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MALCOLM PIRNIE

ARCS II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. 68-W9-0051

LI TUNGSTEN
GLEN COVE, NEW YORK
Work Assignment No. 025-2L4L

RI/FS
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.
104 Corporate Park Drive
White Plains, New York 10602

July 1996

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WORK ASSIGNMENT # 025-2L4L

SITE NAME: **LI TUNGSTEN**
GLEN COVE, NEW YORK

DRAFT FINAL FIELD SAMPING PLAN

JULY 1996

CONTRACTOR QA/QC SIGN-OFF

Malcolm Pirnie, Inc., has reviewed this 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 USEPA, Region II under Work Assignment No. 025-2L4L 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.

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LI TUNGSTEN RI/FS
DRAFT FINAL FIELD SAMPLING PLAN

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	MP FPOA-021 - Sample Preservation

1.0 INTRODUCTION

1.1 GENERAL

This Draft Final Field Sampling Plan (FSP) describes in detail the field procedures for the Remedial Investigation/Feasibility Study (RI/FS) to be conducted at the Li Tungsten Site located in the Town of Glen Cove, Suffolk County, Long Island, New York. The purpose of the FSP is to insure that samples are properly collected, handled and transported to the laboratory, and that sampling and handling procedures are fully documented. This will result in representative samples of the media being sampled, minimum potential for cross-contamination, proper preservation of the samples, and laboratory analysis for the appropriate constituents. The sampling and data collection methods described in this FSP are consistent with the U. S. Environmental Protection Agency (USEPA) guidance documents including: A Compendium of Superfund Field Operations Methods (EPA/540/P-87/001, OSWER Directive 9355.0-14, December 1987), and the USEPA's Region II CERCLA Quality Assurance Manual, Final Copy, Revision 1, October 1989.

Before beginning work at the site, each member of the field team will read this document to understand the procedures to be followed in the field. In addition, each field team member will become familiar with the Site Health and Safety Plan (SHSP) and follow its requirements 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 this FSP. The Malcolm Pirnie Site Quality Assurance Officer will advise the ARCS II PMO Quality Assurance Manager and the Site Manager of any need to change procedures. After the changes have been agreed to, the revised procedures will be fully documented and attached to the FSP as an addendum. Copies of this FSP will be kept at the field office trailer at all times. Addenda to this FSP will be sent to the USEPA Work Assignment Manager (WAM). Any major changes to this FSP will first be discussed and agreed upon with the USEPA WAM prior to being implemented.

1.2 LABORATORY ANALYTICAL PLAN

Since this document was originally prepared, the USEPA's CLP-Special Analytical Services (SAS) Program has been replaced with the non-RAS Program and is no longer part of the CLP Program.

Malcolm Pirnie's non-RAS Draft Implementation Plan (Malcolm Pirnie, 1994d) was submitted to the USEPA on August 17, 1994 and is awaiting USEPA approval.

Based on the changes to the CLP Program, two types of laboratory analytical services are described in this FSP: the CLP-Routine Analytical Services (RAS) Program, and the non-CLP, non-RAS Program. The non-RAS Program encompasses all analytical parameters not included in the CLP-RAS Program (e.g., radiological parameters, pH, TOC, physical properties, and TCLP parameters). Procedures and requirements of the non-RAS Program were outlined in the non-RAS Draft Implementation Plan. Before procuring an analytical laboratory for non-RAS analysis, Malcolm Pirnie will first determine through the USEPA WAM whether the USEPA ESD laboratory or ERT laboratory can perform the analysis. If this is not feasible, the samples will be analyzed through the non-RAS Program under a separate work assignment. To control costs, sampling will begin only after all required laboratory support (CLP-RAS and non-RAS) is booked or procured.

Future modifications to this FSP that may be necessary as a result of changes to the non-RAS Draft Implementation Plan, will be addressed in adherence to Malcolm Pirnie's ARCS II QA Program SOP MP-PMOQA-009 1/92 entitled: Procedures for Requesting Modification in the Working Documents of a Remedial Investigation/ Feasibility Study (RI/FS). A copy of this document is provided in Appendix E of the QAPjP for the Li Tungsten RI/FS.

2.0 SITE BACKGROUND

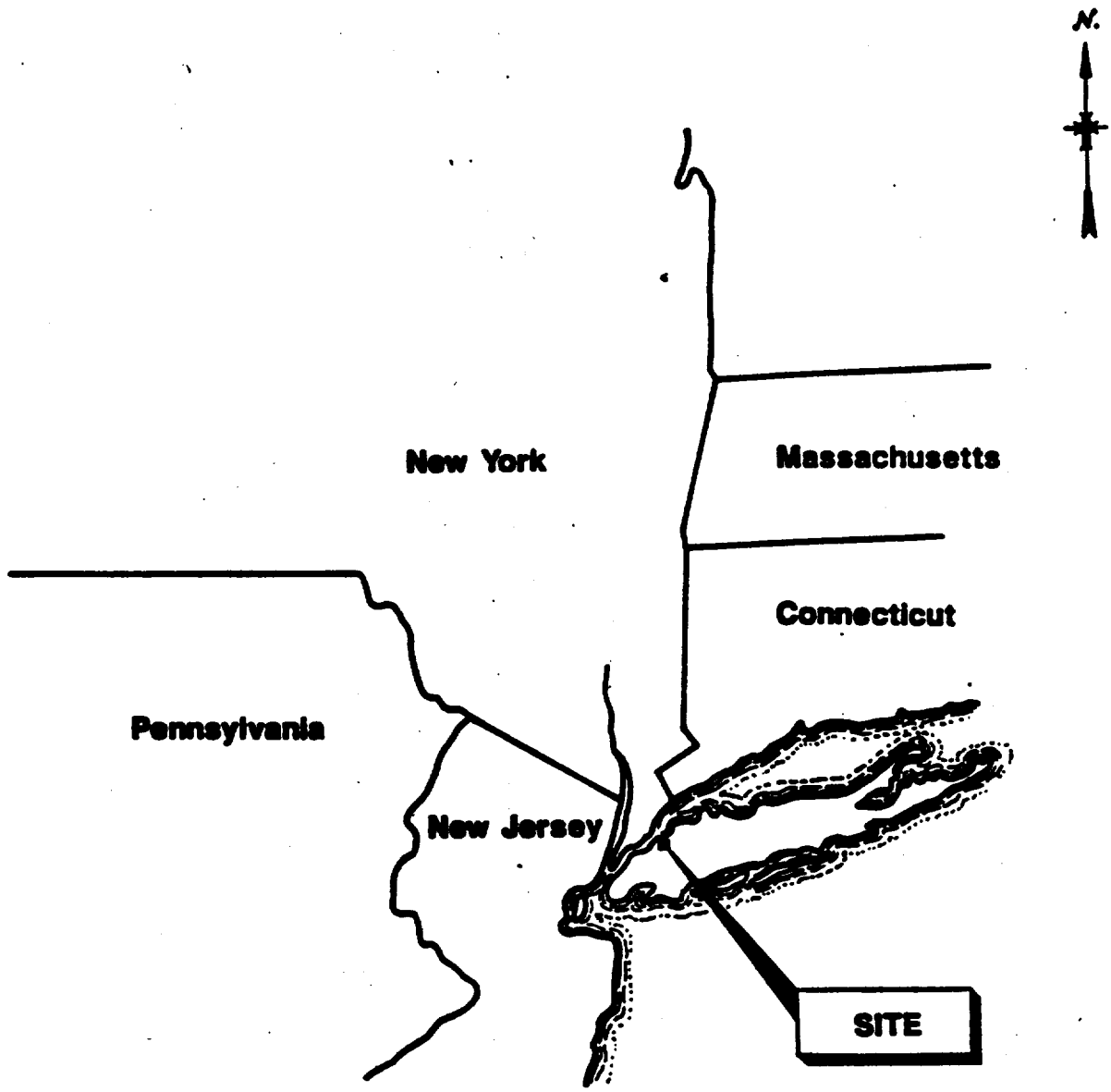
A comprehensive review of background information used to design the field investigation is presented in the Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Malcolm Pirnie, 1993). A summary of the important aspects of that background research is presented below.

2.1 SITE DESCRIPTION

The Li Tungsten Site is located at 63 Herb Hill Road in the City of Glen Cove, Nassau County, Long Island, New York. A regional map, a site location map, and a site plan are provided in Figures 2-1, 2-2, and 2-3, respectively. The Mattiace Petrochemical Site, which is on the National Priorities List (NPL) and was the subject of a recently completed RI/FS by the USEPA (EBASCO, 1991), is located adjacent to the Li Tungsten Site and is also shown on Figure 2-2. From the early 1940's until approximately 1985, tungsten ores and concentrates, imported primarily from mainland China, South America and Canada, were smelted at the Li Tungsten facility for the production of tungsten carbide powder, tungsten wire, and welding rods. In 1985, the company filed for bankruptcy and the facility ceased operation.

The Site, which is situated on approximately 26 acres, consists of three (3) separate parcels designated A, B, C (including C'). For the purpose of the field investigation, the study area is defined as the entire 26 acres. Parcel A is approximately seven acres and served as the main operations center when the Site was active. It contains the majority of buildings, structures (e.g., tanks, two surface impoundments) and drums/crates of tungsten ore. It is bounded by Herb Hill Road on the north, Garvies Point Road on the west, an adjoining property on the east, and Glen Cove Creek on the south. Parcel B is the smallest of the three parcels, approximately five acres, and is located north of Parcel A. Parcel B is bounded by Herb Hill Road on the south, Dickson Lane on the west, The Place on the north, and an adjoining commercial property on the east. The area south of the pond on Parcel B was used primarily as a parking lot when the plant was active; however, disposal activities are believed to have taken place in an area north of the pond. Although this disposal area has been referred to as a "landfill" in previous reports, insufficient information is available to confirm that actual landfilling operations took place. In this document, this area is referred to as the Parcel B Disposal Area. Parcel C is the largest of the three parcels (10 acres); however, not all of this parcel was part of the Li Tungsten property during active Site operations. The Glen Cove Development Corporation (GCDC) acquired approximately four acres of undeveloped property, designated Parcel C', sometime after

FIGURE 2-1



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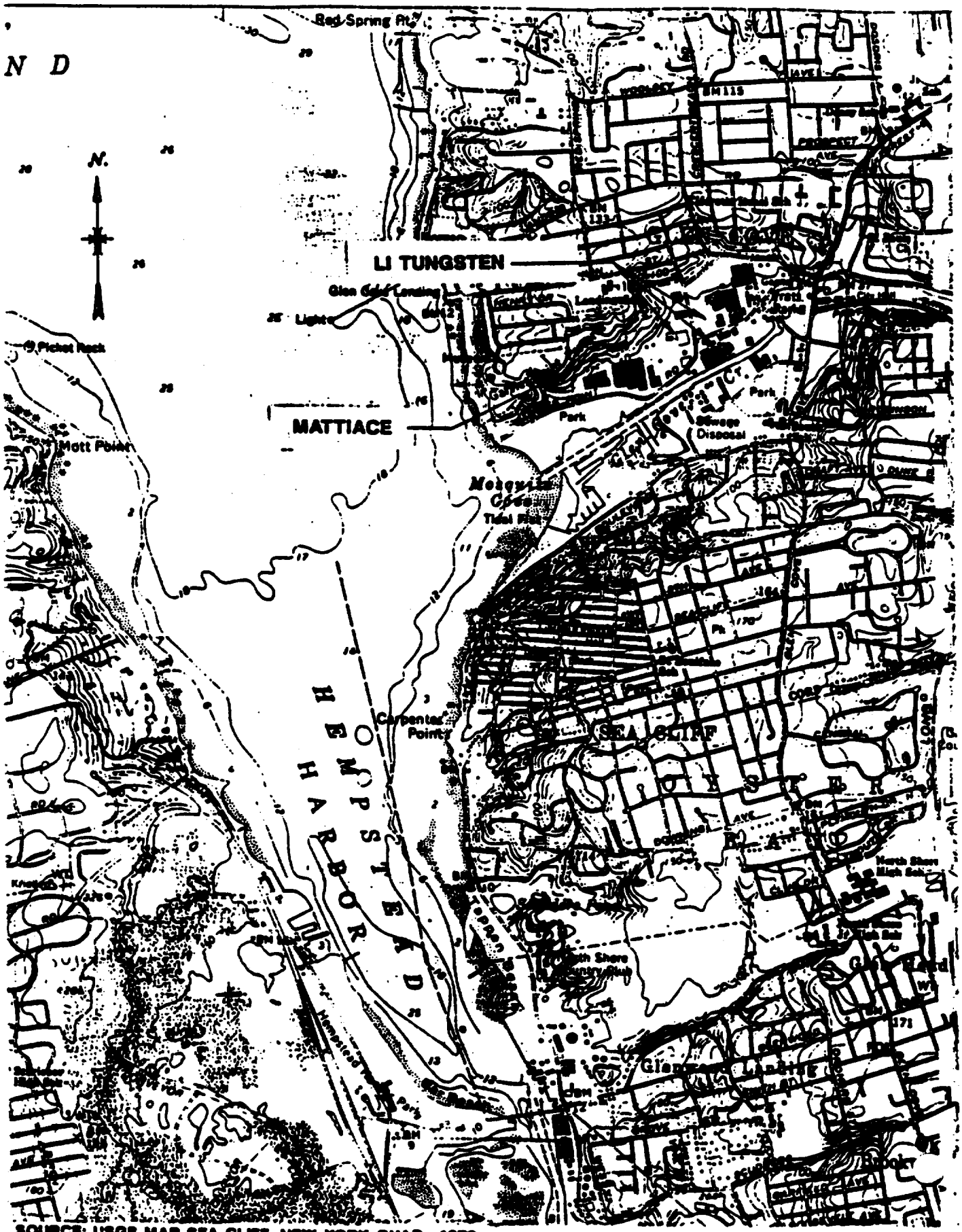
LI TUNGSTEN
GLEN COVE, NEW YORK
REGIONAL LOCATION MAP

FIGURE



SOURCE: USGS MAP SEA CLIFF, NEW YORK QUAD., 1979

LI TUNGSTEN
GLEN COVE, NEW YOR
SITE LOCATION M

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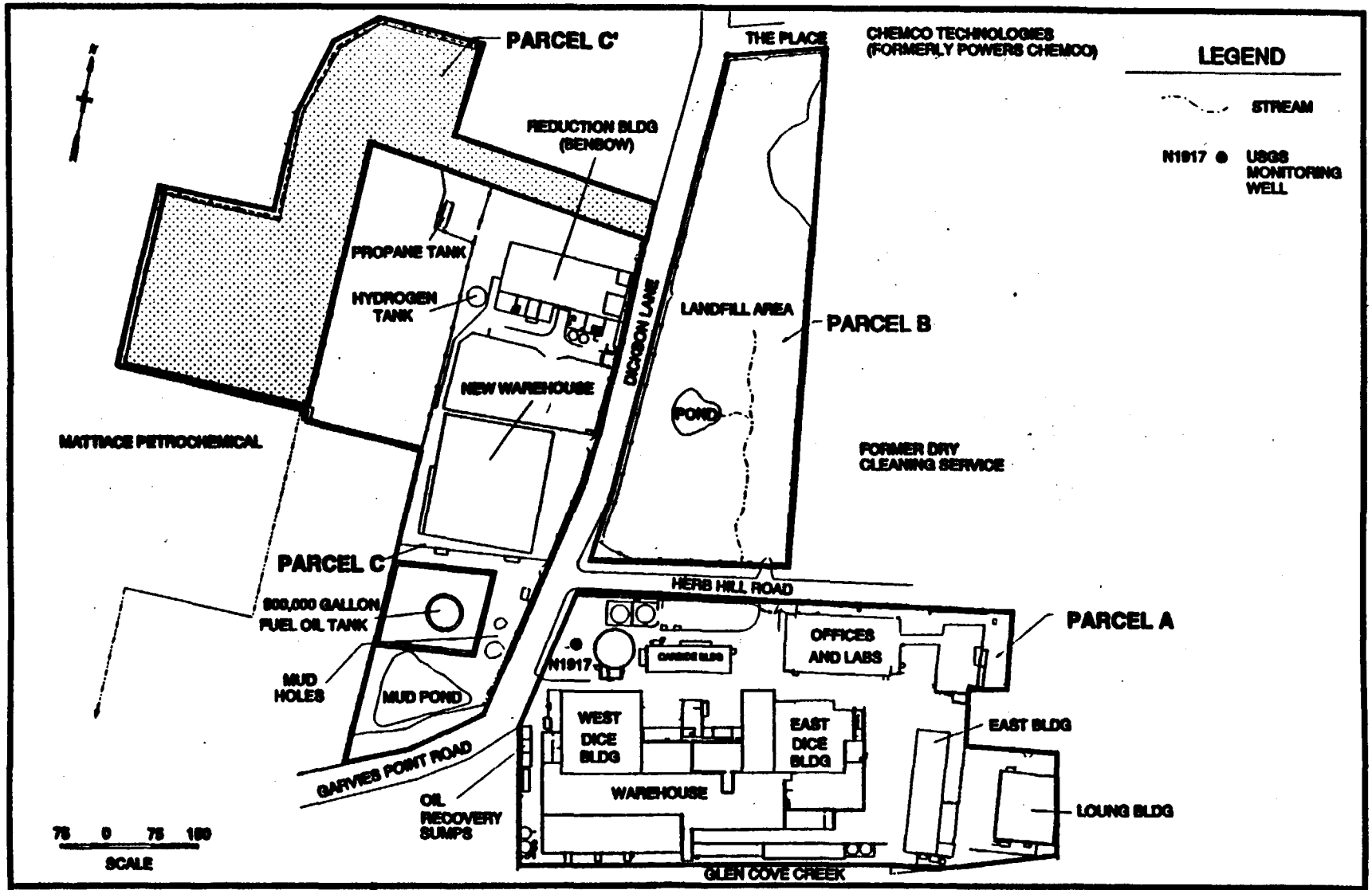

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LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

SITE PLAN

MALCOLM PIRNIE, INC

FIGURE 2-3

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1984. Parcel C contains several buildings, a 500,000 gallon aboveground fuel oil storage tank, and three surface impoundments (i.e., Mud Pond and two Mud Holes) used to dispose of process waste water. The location of Parcels A, B, and C (including C') and the significant features on each parcel are shown on the site plan provided in Figure 2-3.

2.2 GEOLOGIC AND HYDROGEOLOGIC SETTING

2.2.1 Regional Geology

Long Island is the northern most extension of the Atlantic Coastal Plain. The Island is composed of terrestrial deposits of Cretaceous age and Quaternary deposits primarily of glacial origin (Pleistocene). These deposits form a southeastward thickening wedge of sediments which overlie Paleozoic and Precambrian crystalline bedrock. The bedrock surface and the overlying strata generally dip to the southeast, with the unconsolidated strata thickening in the down-dip direction. In the Glen Cove region, the unconsolidated sediments are 400 to 600 feet thick. The stratigraphic column underlying the northern part of the Town of Oyster Bay, Long Island, which includes the Glen Cove region is presented in Table 2-1.

The Li Tungsten Site is located about four miles north of the Harbor Hill terminal moraine, a series of coalescing irregular hills (kames) which form a pronounced ridge trending north-northeast across Long Island. This moraine marks the terminal position of the most recent Pleistocene (late Wisconsin) ice sheet to reach Long Island. The deposits which formed during the glacial recession include outwash sand and gravel deposits, till or ground moraine (a heterogenous mixture of clay, silt, sand and boulders) interlayered with gray clay lenses and delta deposits. Earlier glacial deposits associated with the Ronkonkoma glaciation underlie the Harbor Hill drift. These deposits are collectively designated as the upper Pleistocene deposits.

The predominant surficial deposit in the Glen Cove region is a veneer of Harbor Hill ground moraine, which is a heterogeneous mixture of clay, silt, sand and boulders typically 5 to 10 feet thick although locally, the thickness is as much as 40 feet. Beneath the ground moraine lies another sequence of older (Ronkonkoma) drift containing interlayered glacial till and outwash deposits. The glacial sediments range in thickness from less than 10 to over 200 feet in the northern part of Long Island.

On most of Long Island, the glacial deposits lie unconformably on the Mattawan Group (Magothy Formation - undifferentiated), a Cretaceous age sedimentary sequence of sand, gravel and discontinuous clay lenses. In the Glen Cove region, however, the Magothy Formation is missing.

Table 2-1
Summary of Geology and Water-Bearing Properties of Deposits Underlying the Northern Part of Town of Oyster Bay, Nassau County, New York

Series	Geologic Unit	Hydrogeologic Unit	Approximate Range in Thickness (ft)	Character of deposits forming geologic unit *(modified from Swarzenski, 1963, and Isbister, 1966)	Water Bearing Properties
QUATERNARY					
Holocene	Undifferentiated artificial fill, salt-marsh and swamp deposits, stream alluvium, and shore deposits	Upper Glacial Aquifer	0 to 50	Sand, gravel, silt, and clay; organic mud, peat, loam, and shells. Colors are gray, green, black, and brown.	Permeable zones near the shore and in stream valleys may yield small quantities of fresh or brackish water at shallow depths. Clay and silt beneath the north-shore harbors retard saltwater encroachment and confine underlying aquifers.
Pleistocene	Upper Pleistocene deposits		10 to 380	Till, composed of unsorted clay, sand, gravel, and boulders. Outwash deposits of stratified brown sand and gravel. May also contains some lacustrine and marine deposits consisting of clay, silt, and sand; locally fossiliferous.	Till, relatively impermeable, may cause local conditions of perched water and impede downward percolation of precipitation. Outwash deposits of sand and gravel are highly permeable. Wells screened in glacial outwash deposits yield as much as 1,750 gal/min. Specific capacities of large-capacity wells range from 14 to 175 (gal/min)/ft of drawdown. Water is generally fresh and unconfined but may locally contain saltwater near shores
CRETACEOUS - QUATERNARY					
Upper Cretaceous, Pleistocene, and Holocene	Deposits of Holocene and Pleistocene age, undifferentiated. May locally include eroded remnants of the clay member of the Raritan Formation	Port Washington Confining Unit	0 to 360	Clay, solid and silty, gray, gray-green, white, red, mottled, and brown, containing lenses or layers of sand or sand and gravel. May locally contain lignite, shells, foraminifera, and other microfossils.	Relatively impermeable throughout much of the area. May be moderately to highly permeable in areas adjacent to inferred limit of Magothy aquifer where sand and sand and gravel content may be large. Confines water in underlying Port Washington and Lloyd aquifers but does not prevent movement of water between upper glacial aquifer and Port Washington aquifer. Lenses of sand and sand and gravel provide sources of water with adjacent formations. One large capacity well had a reported yield of 2,000 gal/min with a specific capacity of 43 (gal/min)/ft of drawdown. Coarser deposits may locally contain saltwater near shores.
	Deposits of Pleistocene age, undifferentiated, and/or local erosial remnants of the Lloyd sand member of the Raritan Formation	Port Washington Aquifer	0 to 170	Sand, fine to coarse, white, yellow, gray, and brown, or gray and gravel with interbedded clay, silt and sandy clay	Moderately to highly permeable. One large capacity well had a reported yield of 1,100 gal/min with a specific capacity of 11 (gal/min)/ft of drawdown. Water is confined under artesian pressure. Generally contains freshwater but may have high iron content.
CRETACEOUS					
Upper Cretaceous	Matawan Group Magothy Formation Undifferentiated	Magothy Aquifer	0 to 610	Clay, silt, sand, and sand, fine to medium, clayey, white, gray, yellow, pink, and multicolored, in lenticular beds. May contain lenticular beds of coarse sand and gravel in lower part of unit. Lignite, pyrite and iron oxide concretions may occur throughout the unit.	Moderately to highly permeable. Wells screened in lower part of aquifer yield as much as 1,400 gal/min. Specific capacities of large capacity wells commonly range from 10 to 50 (gal/min)/ft of drawdown but may be as high as 80 (gal/min)/ft. Aquifer is principal source for public supply. Water is generally of excellent quality. Degree of confinement under artesian pressure is variable, however, artesian conditions increase with depth. Hydraulic continuity may exist between the Magothy aquifer and continuous Pleistocene aquifers
	Clay Member (Raritan Formation)	Raritan Clay Confining Unit	0 to 185	Clay, solid and silty, gray, white, red and mottled. May contain lenses or layers of fine to medium sand which may locally contain gravel. Sand layers frequently occur near top of unit. Lignite and pyrite are common	Relatively impermeable. Confines water in underlying Lloyd aquifer but does not prevent movement of water between Magothy and Lloyd aquifers.
	Lloyd Sand Member (Raritan Formation)	Lloyd Aquifer	0 to 195	Sand, fine to coarse, white, yellow, or gray, and gravel, commonly in a clayey matrix. Contains lenses and layers of solid or silty clay. Beds are usually lenticular and frequently show great lateral changes in composition.	Moderately permeable. Large-capacity wells may yield as much as 1,600 gal/min; specific capacities commonly range from 10 to 19 (gal/min)/ft of drawdown. Water is confined under artesian pressure; some wells flow. Water is generally of excellent quality but may have high iron content.
	Crystalline Rocks	Bedrock	Not Known	Metamorphic and igneous rocks; manahatta-biotite schist, gneiss, and granite. May have weathered zone at top.	Relatively impermeable. Contains some water in fractures but impracticable to develop owing to low permeability.

The absence of the Magothy is attributed to channel cutting during a pre-Wisconsin stage of the Pleistocene epoch. Post Cretaceous erosion was the major contributing factor in producing more than 400 feet of relief on the Cretaceous surface along the north shore of Long Island.

In the Glen Cove region, where the Magothy Formation is missing, the upper Pleistocene deposits are underlain by an extensive unit comprised of clay, silt and a few layers of sand. This unit is believed by some researchers to be equivalent to the Gardiners Clay, which is a shallow marine sequence deposited during an intergiacial period. A more recent publication refers to this stratum as the Port Washington Confining Unit and identifies it as Pleistocene and Holocene age.

In the Glen Cove region, this sequence rests unconformably on the unnamed clay member of the Raritan Formation. The surface of the clay member is about 200 feet below sea level. The clay member and the Pleistocene clay deposits are in direct contact and differentiation between the two is sometimes difficult. Together these strata comprise a contiguous unit approximately 75 feet thick in the Glen Cove region. The lower unit of the Raritan Formation is the Lloyd Sand Member which is approximately 125 feet thick in the Glen Cove region. The Lloyd Sand Member rests on bedrock at depths of approximately 400 to 500 feet below mean sea level (MSL).

2.2.2 Site Geology

Hydrogeologic investigations conducted at and near the Li Tungsten Site indicate the presence of unsorted surficial deposits of sand, silt, clay and gravel interbedded with lenses of moderately-to-well sorted sand, silt and clay beneath the Site. This lithology is consistent with published sources that describe the site area as underlain by interlayered Pleistocene deposits of till, outwash and lacustrine sediments. Little information is available regarding deeper Site geology. Only three of the on-site monitoring wells were drilled to a depth greater than 20 feet, and only one well to more than 25 feet. As a result, a geologic log of a water supply well (N1917) drilled on the Site property provides the only information on the deep subsurface geology at the Site (Table 2-2). This well was drilled to a depth of 311 feet and terminated in the Lloyd Sand Member. The log of supply well N1917 shows a sequence of clay beds from 8 to 57 feet and from 103 to 215 feet below land surface. The deeper clays may be the clay member of the Raritan Formation, however, from the descriptions in the boring log, the deeper clay cannot be differentiated from the younger Port Washington Confining Unit with any confidence.

2.2.3 Regional Hydrogeology

There are two discrete aquifers in the Glen Cove region. These are designated as the Upper Glacial and the Lloyd Aquifers. In addition to these aquifers, bodies of perched groundwater are found in the Glen Cove region. Perched groundwater occurs where the downward migration of water in the vadose zone is impeded by a layer of relatively low permeability which results in a local zone of saturation above and unrelated to the main water table. In the Glen Cove region, perched water occurs close to the land surface in depressions that are underlain by clayey till and clay. Perched groundwater is prevalent in the area of ground moraine north of the Harbor Hill terminal moraine (which includes the Glen Cove region).

The Upper Glacial Aquifer consists of permeable upper Pleistocene deposits that occur below the water table. The water table occurs from MSL to about 60 feet above MSL in the Glen Cove region. Recharge is entirely from precipitation occurring mostly during the late fall and winter when plant growth is dormant. Under natural conditions, shallow groundwater discharges to streams, springs and Long Island Sound and its harbors, and migrates vertically by downward leakage to the underlying aquifer. Previous investigations have indicated that groundwater movement in the Upper Glacial Aquifer is generally to the south in the vicinity of the Site, with shallow discharge to Glen Cove Creek. Groundwater movement in the deeper aquifers may pass under the creek. In the Glen Cove region, discontinuous beds of low permeability sediments limit the amount of water which can be pumped from the Upper Glacial Aquifer.

The clay member of the Raritan Formation is a confining unit that overlies the Lloyd Aquifer. The Port Washington Confining Unit occurs above, and is contiguous with, the clay member in many places. Together, these strata form an effective confining unit separating the Lloyd Aquifer from the Upper Glacial Aquifer in the Glen Cove region. The thickness of the confining unit is about 112 feet at the Li Tungsten Site, based on the boring log of well N1917 (Table 2-2). In places where the Cretaceous deposits have been completely eroded, the Port Washington Confining Unit lies on a sequence of deposits of Pleistocene and (or) Late Cretaceous Age called the Port Washington Aquifer. It is not known if the Port Washington Aquifer extends onto the Site.

The lower limit of the Lloyd Aquifer and the Port Washington Aquifer is the Precambrian bedrock surface; the upper limit is the clay member of the Raritan Formation or the Port Washington Confining Unit. The Lloyd Aquifer is a confined water bearing unit, as demonstrated by minimal interference effects between pumping wells tapping the different aquifers. Hydraulic heads in the Lloyd Aquifer are generally lower than those in the Upper Glacial Aquifer, resulting in downward leakage of water through the clay unit. The Lloyd Aquifer is replenished entirely by downward

TABLE 2-2
GEOLOGIC LOG OF WATER SUPPLY WELL N1917
WAH CHANG TRADING CORPORATION
GLEN COVE, NEW YORK

Geologic Material Encountered	Thickness (feet)	Depth (feet)
Fill	2	2
Gravel, sand, and clay, brownish-gray	6	8
Clay, gray, plastic, with pebbles	49	57
Gravel, light yellow, clean	14	71
Sand, coarse, and gravel, light yellow, clean	2	73
Gravel, silt, sand and clay	22	95
Gravel, fine and coarse sand	8	103
Clay, gray	47	150
Clay, gray, with some gravel	15	165
Silt, almost a sand, clean, light brick red	25	190
Clay, dark gray, plastic, very little silt	25	215
Sand, fine, and silt, light gray	77	292
Sand, medium to fine, white, some clay	3	295
Sand, coarse, and gravel, white, clean	16	311
Casing: 8 inch to 6 inch.		
Screen: 10 feet of 6 inch. with bottom at 306 feet.		

NOTES:

1. Supply Well #1917. Wah Chang Trading Corp., 63 Herb Hill Road, Glen Cove (6 E, 1.8 N, 2.9 W). Drilled by C. W. Lauman and Company, Inc., May 1943. Altitude about 10 feet above sea level. Log begins at land surface. Log based on examination of samples by W. deLaguna.

2. NYSDEC Water Power and Control Commission, Record of Wells in Nassau County, New York, Supplement 1. Prepared by the USGS in cooperation with the Water Power and control Commission, and the Nassau County Department of Public Works. Bulletin GW-10, Albany, 1946, page 145.

percolation of water from the overlying aquifers through the more permeable zones of the confining unit and, directly but slowly, through the clay itself. The primary recharge area of the Lloyd Aquifer is in eastern Nassau County. Groundwater movement in the Lloyd Aquifer is generally westward, away from the recharge area. Groundwater moves laterally into the Port Washington Aquifer from the Lloyd Aquifer where the two units are contiguous. Water discharges by submarine leakage and through pumping wells.

2.2.4 Site Hydrogeology

The uppermost hydrostratigraphic unit on the Li Tungsten Site is the Upper Glacial Aquifer which is comprised of outwash and lacustrine deposits of Quaternary Age. Immediately beneath this aquifer lies an areally continuous clay sequence. Available data indicate that this clay represents both the clay member of the Raritan Formation and the younger Port Washington Confining Unit. This clay layer impedes downward groundwater movement, thereby inhibiting contaminant migration from the Upper Glacial Aquifer to the underlying Lloyd Aquifer. For this reason, hydrogeologic investigations of industrial sites in the area, including the Li Tungsten Site, have focused almost exclusively on shallow groundwater in the Upper Glacial Aquifer. Consequently, little information is available on the deeper glacial sediments and Cretaceous strata (Raritan Formation) at the Site. It should be noted that water supply well N1917 is not currently in use and the condition of this well in unknown. If the casing leaks or if the well head is intermittently flooded, the well could potentially serve as a conduit for contaminants to reach the Lloyd Aquifer.

Groundwater elevation data collected on the Site indicate the presence of a steep hydraulic gradient in the Upper Glacial Aquifer. High hydraulic heads in the northern portion of the Site and low heads in the southern portion suggest that groundwater flow is generally from north to south across the Site with groundwater discharge to Glen Cove Creek. The relatively high hydraulic heads in the northern portion of the Site and in several wells in the southern portion of the Site may be a consequence of perched groundwater in these areas. Although this interpretation is consistent with the USGS description of the regional hydrogeology, Site specific geologic information does not appear to support this assessment because the on-site areas of high hydraulic head do not correlate with low permeability layers (e.g., silt or clay lenses). One reason for this discrepancy might be that when the borings were drilled on the Site, soil sampling was intermittent rather than continuous and changes in lithology may not have been recognized. Another possibility is that because the wells were installed in the uppermost groundwater zone, low permeability materials occurring below the boring completion depths were undetected. A more complete geological characterization of the deeper glacial materials

is needed to determine whether the large hydraulic head differences are due to perched groundwater or some other factor, and to determine the effects the different strata have on groundwater flow direction and velocity.

2.3 SITE HISTORY

The Li Tungsten Site has a complex history of name and ownership changes, and has been the subject of several environmental site assessments, investigations and removal actions. Specific details pertaining to the operational history of the facility are discussed in Section 2 of the RI/FS Work Plan (Malcolm Pirnie, 1993). A chronological history of Site ownership, operations, and investigations is summarized in Table 2-3 and can be found at the end of this section.

2.4 CURRENT CONDITIONS

The Li Tungsten Site ceased operations in June 1985 and has been inactive since. The Site is fenced and a security guard is present 24 hours a day. Observations made during Site visits have indicated that trespassing has occurred in the past and continues despite the continuous security. As a result many of the salvageable fixtures (e.g., copper wiring and piping) have been removed. There is also a considerable amount of general debris (e.g., scrap lumber, asphalt roof shingles, washing machines, mattresses) on the property.

Large quantities of ore concentrates still exist on the Site in various processed and unprocessed forms. The ore, which is present in drums, wooden crates and piles both inside and outside the buildings, contains heavy metals and radioactive isotopes of uranium, thorium, and radium. Many of the drums and crates located outside are weathered and corroded to a point where the contents have spilled on the ground. In other areas, the drums have been overstacked and have become very unstable as the drums deteriorated and corroded. Many of the empty drums may be radioactive and may represent both a health and physical safety hazard. In addition, several buildings have deteriorated to a point where portions of some walls and roofs have collapsed. Although it was determined during development of the Interim Remedial Action (IRA) Work Plan that building demolition is not necessary at that time, the Benbow Building on Parcel C and portions of the Dice Building on Parcel A are not considered safe to enter (Malcolm Pirnie, 1994c). Finally, friable and non-friable asbestos is present as pipe wrap, tank insulation, siding shingles, and roof tiles.

2.5 SUMMARY OF SOURCES AND DISTRIBUTION OF CONTAMINATION

2.5.1 Sources of Contamination

The primary sources of contamination on the Li Tungsten Site include processed and partially processed tungsten ore present in drums, wooden crates, and piles located both inside and outside the buildings. Interim on-site storage of these source materials will be completed as part of the IRA (Malcolm Pirnie, 1994c) prior to initiating the RI field investigation. Other potential sources include; the Mud Pond and two Mud Holes which were used for disposal of wastewater; the disposal area located on Parcel B; unconfirmed disposal areas in the northern portions of Parcel C that are devoid of vegetation; underground storage tanks (whose locations and contents are unknown); and a 500,000 gallon aboveground fuel oil tank. In addition, asbestos containing materials (ACM) have been found on the Site in siding shingles, roof tiles, tank covers and pipe insulation. ACM has also been found on the ground at the Site. Removal of asbestos in areas affected by RI/FS field activities will be performed as part of Interim Remedial Actions before the RI field investigation is initiated. Secondary sources of contamination include the on-site soil; off-site groundwater from the Mattiace property, the Konica property (formerly Powers-Chemco), and a former dry cleaner; and the storm and process drains on-site and off-site.

2.5.2 Characteristics of Contamination

Characteristics of chemical and radiological contamination on the Site stem from activities associated with the production of tungsten carbide powder, tungsten wire and welding rods. To produce these products, monazite sand and tungsten ore or concentrates were smelted between 1942 and 1985. The treatment processes used to extract tungsten metal from these materials generated a residual slag (waste ore) which tended to concentrate radioactive isotopes of uranium, thorium and radium, and other heavy metal impurities. The slag, as well as some processed and unprocessed, ore was stored on the Site in wooden crates, piles, and drums. Much of this material either still remains on Site or is believed to have been disposed of on Parcels B and C.

Small quantities of contaminants that could potentially remain on the Site include commercially prepared strong acids, strong bases, organic solvents, aqueous ammonia, inorganic metals and cyanide which were used in the treatment processes. The acids were used for leaching of impurities out of the tungsten where mechanical separation was not effective. An on-site laboratory also existed where the tungsten product was analyzed for impurities and either sent for reprocessing or identified as a finished product. Laboratory chemicals, drums of liquid chemicals (e.g., acids, bases and solvents),

and aqueous ammonia were removed from the Site as part of the Time Critical Removal Action completed in 1990 (HART, 1990). Other organics used on the Site included PCBs in transformers (PCB oils from these transformers were collected for off-site disposal as part of the Time Critical Removal Action), and fuel oil which was stored in several tanks, including one 500,000 gallon aboveground storage tank.

2.5.3 Distribution of Chemical Contamination

Chemical contamination is distributed throughout the groundwater, surface water, soils and sediments at the Site. Volatile organics in the groundwater may originate from off-site sources, including a former dry cleaning establishment to the east of Parcel B and the Mattiace Site. No on-site source of volatile organic contaminants has been identified. The predominant contamination attributable to on-site sources is metals contamination. Metals are found at the majority of the groundwater sampling locations. Metals have also been identified in the on-site surface waters and sediments, including Mud Pond, the Mud Holes, the pond and associated drainage stream on Parcel B, the standing water in the building, and open tanks.

2.5.4 Characteristics of Radiological Contamination

A survey of radioactive materials and radiation exposure rates was performed for the GCDC in 1989. This investigation included a gridded surface emission rate survey, surface alpha particle survey of equipment and miscellaneous debris, limited indoor radon and thoron measurements, and uranium and thorium series radionuclide characterization of groundwater, pond sediment, ore, processed materials, and soils.

Radionuclide concentrations in the materials currently on site range from the tens of pCi/g to approximately 1000 pCi/g. Ambient radiation exposure rates on the Site typically range from 10-30 μR/h; however, emission rates up to 1 mR/h have been measured along the surface of some of the waste piles.

Some radioactive materials have been removed from the Site or moved indoors (Dice Building). In general, these materials were among the most highly contaminated materials discovered during the 1989 radiological survey. In addition to the piles of process materials and ore currently present at the Site, four areas with thorium contamination remain. These are a heavily vegetated area in Parcel C (behind the Dickson Warehouse) with exposure rates from 3-5 mR/h, a mound of tungsten slag (previously described as "rocks") on the north end of Parcel C with exposure rates from 1-3 mR/h, a mound of tungsten slag (previously described as "rocks") on the northern perimeter of Parcel

A with exposure rates from 1-3 mR/h, and an area along the Parcel A north fence where buried waste results in an exposure rate of 300 μR/h. With the exception of some tanks, Site structures and building components/equipment (e.g., floors, walls, etc.) did not indicate contamination with radionuclides.

The potential for exposure to the public was determined to be low. There are two areas along Herb Hill Road (north of Parcel A) where the exposure rates are elevated (100-300 μR/h) above the natural background rate (8-10 μR/h). However, the levels drop off to background within a few feet of the fence. In addition, the Nassau County Department of Health (NCDOH) and the New York State Department of Health (NYSDOH) took soil samples from seven locations along the Site perimeter in June, 1989, for analysis of thorium, radium, and uranium. They did not find any elevated radionuclide concentrations and concluded it unlikely that radionuclides are migrating from the Site. In November, 1989, fish, clam, and sediment samples were collected and were also found not to contain elevated radionuclide concentrations.

TABLE 2-3
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
1940	National Reconditioning Corporation was formed by K. C. Li with the express purpose of building the Glen Cove facility.
1942	Facility becomes operational. Operation consisted of processing raw ore and scrap tungsten concentrates to produce ammonium paratungstate (APT) and subsequently formulating APT to metal tungsten powder and tungsten carbide powder. Other specialty products including tungsten carbide powder plus cobalt and other material for plasma spraying; tungsten titanium carbide powder; tantalum carbide powder; tungsten spray powder; crystalline tungsten powder; and molybdenum spray powder were also produced.
1948	National Reconditioning Corporation changes its name to Wah Chang Smelting and Refining Corporation (WCSRC).
1948 - 1964	Site operated by WCSRC.
1964	WCSRC leases equipment/property to the Wah Chang Corporation (WCC) which continued to operate the facility.
April 1967 - 1972	Teledyne acquired the stock of WCC and the two companies merged. Operations at the site continued by Teledyne-Wah Chang Corporation.
1972	WCSRC formed a wholly owned subsidiary (Li Tungsten Corporation) which operated the facility until filing for bankruptcy in 1985.
1984	Property acquired by the Glen Cove Development Company (GCDC). GCDC is a general partnership duly organized and existing under the laws of the State of New York and is owned by the Old Court Holdings Company and the Old Court Joint Ventures, Inc., both of which, in turn, are wholly-owned subsidiaries of Old Court Savings and Loan, Inc., (in Receivership) located in Maryland.

TABLE 2-3 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
1984	GCDC continues to lease the site to Li Tungsten Corporation. Market for tungsten in decline.
June 1985	Li Tungsten Corporation files for bankruptcy. Manufacturing operations at the facility cease.
May 1988	RTP Environmental Associates, Inc., (Westbury, NY) completes Site Investigation Report for Campon Reality Corporation (RTP, 1988). Site investigation undertaken to evaluate environmental conditions prior to residential development. Geraghty and Miller was subcontracted to perform the hydrogeology investigation.
March 29, 1989	New York State Department of Environmental Conservation (NYSDEC) performs site inspection.
April 14-16, 1989	USEPA assumes lead enforcement role on response actions at the site. USEPA FIT2 contractor (NUS) initiates Preliminary Assessment.
July 21, 1989	Administrative Order On Consent (ACO) issued by USEPA to Glen Cove Development Corporation which specified nine (9) interim remedial actions.
September 18, 1989	USEPA FIT2 contractor (NUS) issues Preliminary Assessment Report (NUS, 1989).
April 4, 1990	Time Critical Removal Action completed and final report submitted (HART, 1990).
September 28, 1990	USEPA FIT2 contractor (NUS) issues Site Inspection Report (NUS, 1990).
July 1991	Li Tungsten site proposed for inclusion on the National Priorities List (NPL).
February 12, 1992	Special Notice letters were sent by USEPA to five PRPs (Teledyne, Inc.; Li Tungsten Inc.; the Glen Cove Development Corporation; and Mr. John Li (son of Mr. K. C. Li). These letters gave the PRPs until

TABLE 2-3 (continued)
CHRONOLOGY OF EVENTS AND SITE INVESTIGATIONS
Li Tungsten Site
Glen Cove, New York

DATE	EVENT
	April 14, 1992 to submit a good faith proposal to finance or undertake an RI/FS. A good faith proposal was received, but subsequent negotiations have not resulted in a settlement.
August 26, 1992	Malcolm Pirnie receives work assignment to prepare RI/FS Work Plan.
October 5, 1992	Malcolm Pirnie submits Draft Work Plan for RI/FS.
October 1992	Li Tungsten site is added to the National Priorities List (NPL).
April 28, 1993	Revised RI/FS Work Plan (Malcolm Pirnie, 1993) approved by USEPA.
May 24, 1994	Malcolm Pirnie submits Draft Field Sampling Plan (Malcolm Pirnie, 1994a) and Draft Quality Assurance Project Plan (Malcolm Pirnie, 1994b).
December 7, 1994	Malcolm Pirnie submits revised Interim Remedial Action Work Plan (Malcolm Pirnie, 1994c).

3.0 SAMPLING OBJECTIVES

The analytical data associated with previous investigations conducted at the Li Tungsten Site provide some insight into the sources and distribution of contamination within the Li Tungsten Study Area. Available data indicate that chemical contamination is distributed throughout the groundwater, surface water, soils, and sediments at the Site. Volatile organics detected in the groundwater may originate from off-site sources, including a former dry cleaning establishment to the east of Parcel B and the Mattiace Site. The predominant contamination attributable to on-site sources is metals contamination. Metals are found at the majority of the groundwater sampling locations. Metals have also been identified in the on-site surface water and sediment samples, including those collected from the Mud Pond, the Mud Holes, the pond and drainage channel on Parcel B, standing water in some of the buildings, and open tanks. In addition, residual radiological contamination also exists on the Site property. Although the information previously obtained provides a general understanding of Site conditions and migration pathways, several concerns at the Site have not been fully addressed and are outlined below:

- Previous Site investigations have focused primarily on the geology/ hydrogeology and groundwater contamination in the Upper Glacial Aquifer. As a result, there is little information regarding deeper on-site geology and the Lloyd Sand Aquifer which exists beneath the Site.

- Information regarding subsurface features including underground storage tanks, buried drums, waste disposal areas, and the storm sewer system is presently incomplete.

- Although radiological sampling has been conducted at the Li Tungsten Site, sampling data for environmental media, equipment, tank residues and structural components of buildings is incomplete. In addition, removal of certain radiological materials from on-site areas is anticipated prior to the initiation of RI field activities. As a result, a re-evaluation of these areas will be necessary to assess post removal residual contamination in these areas.

As a result of the data gaps described above, the sources, distribution, and migration pathways of the various on-site contaminants cannot be fully determined. The objectives of the field activities associated with the Li Tungsten RI/FS are to obtain the additional analytical data necessary to fill these data gaps so that a more detailed characterization of on-site contamination sources and migration pathways can be made. To meet these objectives, additional waste source characterization, a hydrogeologic investigation, and a groundwater and surface water/sediment sampling and analysis

program are proposed. A brief description of the field sampling activities that will be implemented to meet the objectives of the Li Tungsten RI/FS are outlined below. A more detailed description of field sampling tasks are provided in Section 5 of this FSP.

- Hydrogeologic Investigation - New monitoring wells will be installed across the Site, groundwater samples will be collected and analyzed to characterize the groundwater at the Site. Groundwater and surface water levels will be measured to determine ground water flow directions and if the surface water bodies are recharge or discharge points for ground water. A pumping test will be conducted to measure aquifer parameters and determine hydraulic connection with potential off-site contaminant sources.

- Topographic Mapping - Will be performed to enable accurate determination of ground water elevation and flow direction.

- Soils Investigation - Will consist of soil borings in potential source areas, along the alignment of the storm sewers, and for site-specific information on stratigraphy (e.g., presence and depth to clay layer). Selected soil samples will be collected and analyzed for chemical, radiological, and physical parameters.

- Geophysical Survey - A limited magnetometer survey will be conducted to provide information on the potential for buried drums in the Parcel B Disposal Area and in determining the location of underground storage tanks.

- Test Pits - A series of shallow test pits will be dug around the perimeter of the Parcel B Disposal Area to delineate the extent of waste and to physically and chemically characterize the waste and surrounding soil.

- Soil Gas Survey - A soil gas survey will be conducted to further delineate the extent and migration pattern of VOCs in the groundwater previously reported (NUS, 1990) on Parcels A, B and C.

- Surface Water and Sediment - Surface water and sediment samples will be collected from both natural and manmade surface water bodies on the Site (e.g., the unnamed pond and drainage channel on Parcel C, Mud Pond, and the oil recovery sumps and wastewater retention tank on Parcel A).

- Radiological Survey - Will be conducted in two phases. Phase I will consist of a gamma exposure rate survey after the processed and unprocessed tungsten ore and residual byproducts are removed, and short-term radon/thoron measurements. Based on the results of the Phase I survey, Phase II activities will consist of surface alpha measurements, gamma logging of soil borings, gamma surveys of buildings, analysis of soil, surface water, and groundwater samples for radionuclides.

- Air Monitoring - Real time air monitoring for organic vapors will be conducted during the field investigation using portable field equipment, and a particulate monitor will be used to assess the presence of other airborne contaminants.

- Environmental Assessment - An environmental assessment will be conducted to characterize and inventory potentially sensitive receptors as well as surface water resources.

- Cultural Resources - A Stage 1A cultural resources survey will be conducted in the general vicinity of the Site. A Stage 1B cultural resources survey/investigation will be performed if the Stage 1A cultural resources survey indicates important cultural resources in the vicinity of the Site.

The results of these investigations will be used to assess the potential risks 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.

4.0 SAMPLE LOCATIONS, FREQUENCY AND DESIGNATION

4.1 INTRODUCTION

Field sampling activities are proposed at the Li Tungsten Site to better define the nature and extent of the contamination on the site. Soil and sediment samples will be collected for both chemical and radiological and physical analyses; groundwater and surface water samples will be collected for chemical and radiological analyses. This section identifies the location and number of samples to be collected for laboratory analysis, and specifies the laboratory analytical parameters. A summary of the number of samples to be submitted for laboratory analysis by environmental media and sample location is presented in Tables 4-1 and 4-2. Lastly, this section also describes each type of quality assurance/quality control (QA/QC) sample, the number of QA/QC samples to be collected, and the numbering system to be used to identify each sample.

It should be noted that although the RI/FS Work Plan (Malcolm Pirnie, 1993) states that tungsten would be included as an analytical parameter, it was decided, after further consideration and consultation with the USEPA WAM for this project, to eliminate this parameter from the required analyses. The reasons for this decision are as follows:

* Analysis of other indicator analytes (i.e., radiological parameters) that will be performed will provide adequate information regarding the location and extent of residual contamination resulting from processed and unprocessed tungsten ores.

* Information available at this time indicates that there is limited use of analytical data for tungsten in performing a health-based risk assessment for the Li Tungsten Site.

* Given that tungsten is an infrequent analyte, it was difficult to obtain an adequate analytical method for soil, sediment and aqueous media.

Table 4-1 summarizes the number of environmental samples to be collected, analytical parameters, data quality objectives (DQOs), and data uses in association with each environmental media that will be investigated. QA/QC samples will also be collected for each matrix to assure the data meet the necessary DQOs. Detailed sampling procedures are provided in Section 5.0.

Subsurface soil samples will be collected from exploratory soil borings (i.e., source area borings, storm sewer borings, and radiological borings), new monitoring well borings, and test pits. A total of 109 samples will be analyzed for the chemical parameters listed in Table 4-2; 149 samples will be analyzed for the radiological parameters listed in Table 4-2; 26 samples will be analyzed for physical

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TABLE 4-1
OVERALL SUMMARY OF PROPOSED RI SAMPLING PROGRAM

MEDIA	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	Data Quality Level	PROPOSED ANALYSES	Est. No. of Samples/ Measurements
Soil	Soil Gas Survey	• Downgradient from dry cleaner (Parcels A, B) • .500,000 AGST • Oil Recovery Sump • Northern portion of Parcel C	Locate monitoring wells	II	Selected VOCs	30
	Subsurface Soil Sampling (Soil Borings and Test Pits)	· Source Area Borings · Storm Sewer Borings · Monitoring Well Borings · Radiological Soil Borings · Parcel B Disposal Area Test Pits	Site Characterization Risk Assessment Alternative Evaluation	IV,V V V V	TCL/TAL, Total Cyanide TOC, pH, Physical Properties TCLP ^{232}Th,^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U	100 26 7 149
	Surface Soil Sampling	· Parcels A, B, & C	Assess dermal/ Inhalation hazard	IV, V	TCL/TAL, Total Cyanide, ^{232}Th,^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U	15
	Borehole Logging (Phase II)	Based on results of Phase I Gamma Exposure Rate Survey	Site Characterization Risk Assessment Alternative Evaluation	I	Gamma Radiation	600
Ground Water	Monitoring Well Sampling	· New and existing monitoring/supply wells · Pumping Test · Parcel B Geoprobe	Same as above	IV, V	TCL/TAL Total and Dissolved Metals, Total Cyanide, TDS, ^{232}Th, ^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U TCL/TAL Total and Dissolved Metals, Total Cyanide	68 1
Surface Water	Surface Water Sampling	· Mud Pond, Mud Holes, & Parcel B Pond · Pond Drainage Channel & Parcel C Stream · Oil Recovery Sump · Wastewater Retention Tank	Same as above	IV, V	TCL/TAL, Total Cyanide, ^{232}Th,^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U	9
Sediment	Sediment Sampling	· Mud Pond, Mud Holes, & Parcel B Pond · Parcel C Stream · Oil Recovery Sump · Storm Drains	Same as above	IV, V V	TCL/TAL, Total Cyanide, TOC, pH, ^{232}Th,^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U Grain-size distribution,	18 8
Misc.	Phase I Indoor Radon/ Thoron Measurements	· Interior of Buildings	Same as above	I	Radon/Thoron Gas	Field Determined
	Phase II Surface Alpha Measurement	· Exterior areas (Tanks & Asphalt) · Interior Surfaces	Same as above	I	Alpha Particles	Field Determined
	Bldg./Tank Material Samples	Same as above	Same as above	V	^{232}Th, ^{226}Ra	Field Determined
Residue	Tank Residue Sampling	· Tanks	Same as above	V	^{232}Th,^{230}Th, ^{226}Ra, ^{228}Ra, ^{238}U	Field Determined

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TABLE 4-2
DETAILED SUMMARY OF RI SAMPLING PROGRAM AND ANALYTICAL PARAMETERS

DESCRIPTION	NO. OF LOC	TCL VOLS	TCL SEMI-VOLS	TCL PEST/PCBs	TAL METALS		TOTAL CYANIDE	TOC	pH	ALPHA EMITTERS (1)	BETA EMITTERS (2)	TCLP	PHYS PROP	TDS
					Disolv	Total								
SUBSURFACE SOIL SAMPLES														
1. SOURCE AREA BORINGS														
a. PARCEL A AOCs	8	16	16	16	0	16	16	16	16	16	16	1	3	0
b. PARCEL B DISP AREA	12	24	24	24	0	24	24	24	24	24	24	1	3	0
c. PARCEL C SCARRED VEG.	3	6	6	6	0	6	6	6	6	6	6	1	1	0
d. PARCEL C AGST	5	10	10	10	0	10	10	10	10	10	10	1	3	0
2. STORM SEWER BORINGS	15	15	15	15	0	15	15	15	15	15	15	1	0	0
3. RADIOLOGICAL SOIL BORINGS	20	0	0	0	0	0	0	0	0	40	40		0	0
4. MONITORING WELL BORINGS	16	32	32	32	0	32	32	32	32	32	32	0	16	0
5. TEST PITS	6	6	6	6	0	6	6	6	6	6	6	2	0	0
SUBTOTAL		109	109	109	0	109	109	109	109	149	149	7	26	0
SURFACE SOIL SAMPLES														
1. PARCEL A	3	3	3	3	0	3	3	0	0	3	3	0	0	0
2. PARCEL B	4	4	4	4	0	4	4	0	0	4	4	0	0	0
3. PARCEL C	5	5	5	5	0	5	5	0	0	5	5	0	0	0
4. PARCEL C'	3	3	3	3	0	3	3	0	0	3	3	0	0	0
SUBTOTAL		15	15	15	0	15	15	0	0	15	15	0	0	0

TABLE 4-2
DETAILED SUMMARY OF RI SAMPLING PROGRAM AND ANALYTICAL PARAMETERS

DESCRIPTION	NO. OF LOC	TCL VOLS	TCL SEMI-VOLS	TCL PEST/PCBs	TAL METALS		TOTAL CYANIDE	TOC	pH	ALPHA EMITTERS	BETA EMITTERS	TCLP	PHYS PROP	TDS
					Disolv	Total				(1)	(2)			
SEDIMENT SAMPLES														
1. SURFACE LOCATIONS	8	8	8	8	0	8	8	8	8	8	8	0	8	0
2. STORM DRAINS	10	10	10	10	0	10	10	10	10	10	10	0	0	0
SUBTOTAL		18	18	18	0	18	18	18	18	18	18	0	8	0
GROUNDWATER SAMPLES (2 ROUNDS)														
1. EXISTING WELLS	14	28	28	28	28	28	28	0	0	28	28	0	0	28
2. ON-SITE SUPPLY WELL	1	2	2	2	2	2	2	0	0	2	2	0	0	2
3. NEW WELLS	16	32	32	32	32	32	32	0	0	32	32	0	0	32
4. GEOPROBE	1	1	0	0	1	1	1	0	0	0	0	0	0	0
5. PUMP TEST	6	6	6	6	6	6	6	0	0	6	6	0	0	6
SUBTOTAL		69	68	68	69	69	69	0	0	68	68	0	0	68
SURFACE WATER SAMPLES														
1. PARCEL A	2	2	2	2	0	2	2	0	0	2	2	0	0	0
2. PARCEL B	2	2	2	2	0	2	2	0	0	2	2	0	0	0
3. PARCEL C	5	5	5	5	0	5	5	0	0	5	5	0	0	0
SUBTOTAL		9	9	9	0	9	9	0	0	9	9	0	0	0

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TABLE 4-2
DETAILED SUMMARY OF RI SAMPLING PROGRAM AND ANALYTICAL PARAMETERS

DESCRIPTION	NO. OF LOC	TCL VOLS	TCL SEMI-VOLS	TCL PEST/PCBs	TAL METALS		TOTAL CYANIDE	TOC	pH	ALPHA EMITTERS	BETA EMITTERS	TCLP	PHYS PROP	TDS
					Disolv	Total				(1)	(2)			
BUILDING/TANK SAMPLES														
1. BUILDING MATERIALS	TBD (3)	0	0	0	0	0	0	0	0	TBD (3)	TBD (3)	0	0	0
2. TANK RESIDUES	TBD	0	0	0	0	0	0	0	0	TBD	TBD	0	0	0
3. TANK MATERIALS	TBD	0	0	0	0	0	0	0	0	TBD	TBD	0	0	0
SUBTOTAL		0	0	0	0	0	0	0	0	0	0	0	0	0

NOTES:

1. ALPHA EMITTERS INCLUDE TH-230, TH-232, RA-226, U-238.

2. BETA EMITTERS INCLUDE RA-228.

3. TDB - TO BE DETERMINED IN THE FIELD.

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properties; seven samples for TCLP parameters (TCLP volatiles, TCLP semi-volatiles, TCLP metals, and TCLP mercury). A total of 69 groundwater samples will be collected. Sixty-nine samples will be collected from sixteen new monitoring wells and 15 existing on-site wells in two sampling events. One groundwater sample will be collected from the geoprobe location in the Parcel B Disposal Area. Finally, six groundwater samples will be collected during pump test activities.

Additional samples to be collected include 15 surface soil samples, nine surface water samples, 18 sediment samples, and an undetermined number of radon/thoron samples, surface wipe samples, building/tank material samples, and tank residue samples.

4.2 SAMPLE LOCATIONS AND FREQUENCY

4.2.1 Soil Gas Survey

Soil gas data (equivalent to analytical USEPA level II) are intended to tentatively identify constituents at the part per million vapor (ppmv) level. In identifying the soil gas survey as a screening tool, the following elements are considered: an overview of the survey; the methodology; and the approach that has been developed for soil gas sampling.

4.2.1.1 Overview

A soil gas survey is an effective screening tool for locating subsurface contamination, as indicated by the presence of VOCs in the soil gas. Soil gas sampling provides appropriate and useful data by yielding immediate (real time) data for evaluation, which permits the adjustment of sampling points to define sources and migration, if present, and allows sampling points to remain in place for further sampling. The soil gas survey will be conducted by a subcontractor to further delineate the extent and migration pattern of VOCs in the groundwater reported previously (NUS, 1990) on Parcels A, B, and C. If the results of the soil gas survey indicate that additional soil borings and shallow monitoring wells are warranted, this recommendation will be made to the USEPA WAM for consideration and approval.

4.2.1.2 Soil Gas System

VOCs, whether adsorbed onto the soil matrix or dissolved in the groundwater, tend to volatilize into the interstitial spaces between soil particles in the vadose zone. The vapor contained in the interstitial spaces (i.e., soil gas) can be sampled to determine quickly and inexpensively whether subsurface contamination is present.

The concentration of VOCs in soil gas is a complex function that depends upon various factors: (1) the concentration and quantity of contaminants in the soil and groundwater; (2) the rates of chemical

and biochemical transformations, (3) the solubility and vapor pressure of the contaminants, (4) the partition coefficients of the contaminants between the soil, water, and gas phases, and (5) the characteristics of the soil, including the permeability, porosity, and degree of saturation throughout the aquifer and soil column.

The ability of a soil gas survey to estimate subsurface contamination is highly dependent on site-specific conditions, including hydrogeology, soils, and climate. Soil gas above a contaminated aquifer may not contain detectable levels of contaminants because of the variability of factors such as the contaminant concentration, the location of the contaminant with respect to water, the depth of the water table, soil types and other factors. Soil gas surveys are least effective where there are barriers to gaseous flow and diffusion, (e.g., clayey soils) and in water saturated soils. Temperature, recent rainfall, and barometric pressure also directly affect concentrations of contaminants in soil gas.

4.2.1.3 Soil Gas Sampling

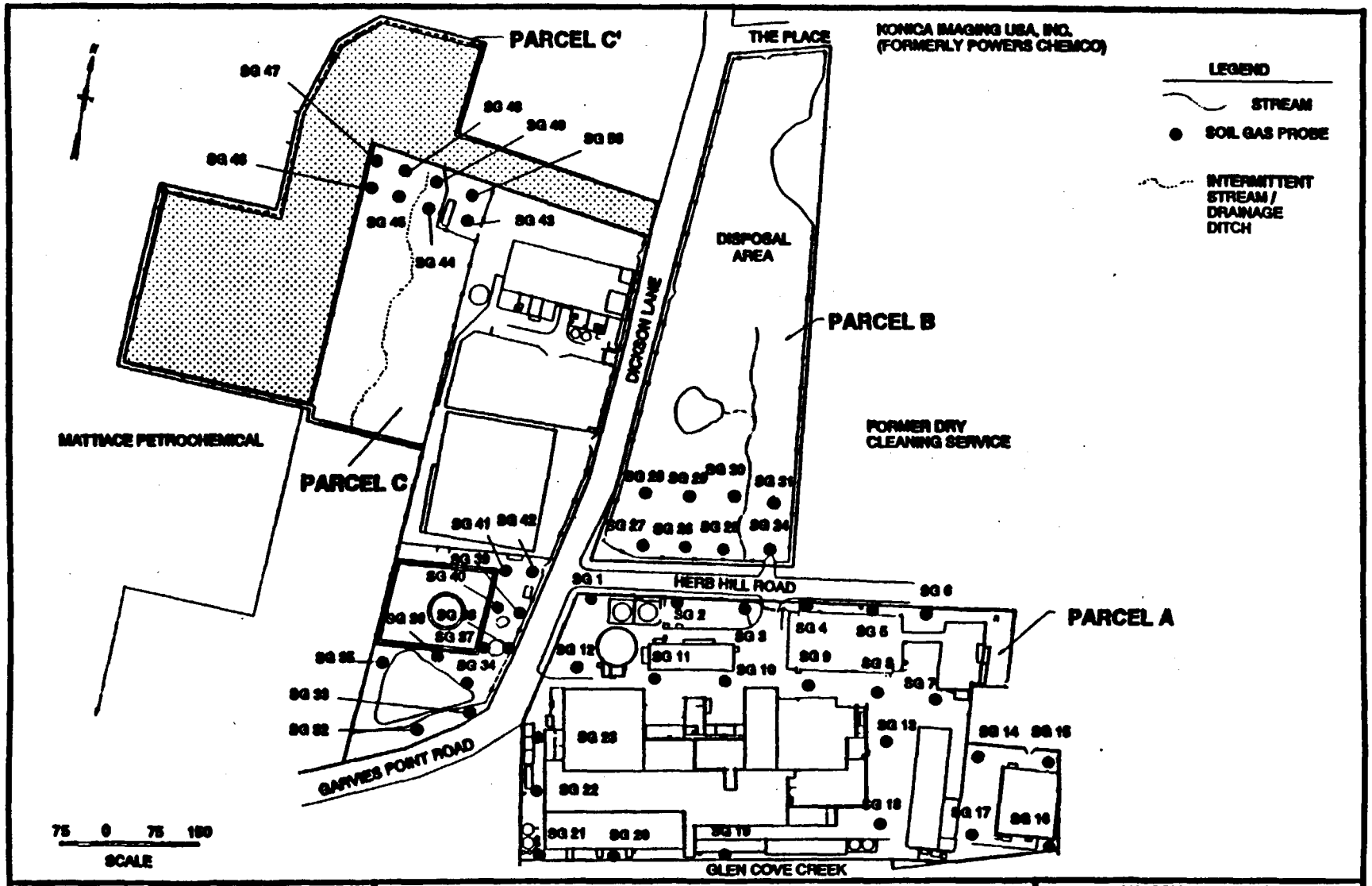
The soil gas survey will use an active sampling method. A soil gas survey will be conducted at 50 locations using the techniques described in Section 5.5 of this FSP on Parcels A, B and C, as shown on Figure 4-1. Each soil gas sample will be collected in a syringe and analyzed in the field by a gas chromatograph for the parameters outlined in Section 4.3.2. Real time screening analysis of the soil gas samples will allow confirmation of the previously reported (NUS, 1990) VOC groundwater plumes, so that a decision can be finalized on the need (if any) for additional soil borings or monitoring wells.

4.2.2 Soil Borings

4.2.2.1 Overview

To address the additional data needs in the vadose zone, a soil boring program consisting of 63 exploratory soil borings (i.e., source area borings, storm sewer borings, and radiological borings) and ten monitoring well borings will be drilled using the hollow stem auger technique. The three objectives of the soil boring program include:

- Provide detailed information on the vertical limits of buried waste on the site (e.g., Parcel B Disposal Area)
- Assess the presence, nature and extent of contamination in the vadose zone
- Characterize site stratigraphy.



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LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

SOIL GAS SURVEY LOCATION MAP

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FIGURE 4-1

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The collection of soil boring samples will be accomplished using the split spoon sampling technique outlined in Section 5.6 of this FSP. The following provides a detailed description of the proposed soil boring locations, the number of samples to be collected, and the physical, chemical and radiological analytical parameters.

4.2.2.2 Exploratory Soil Borings

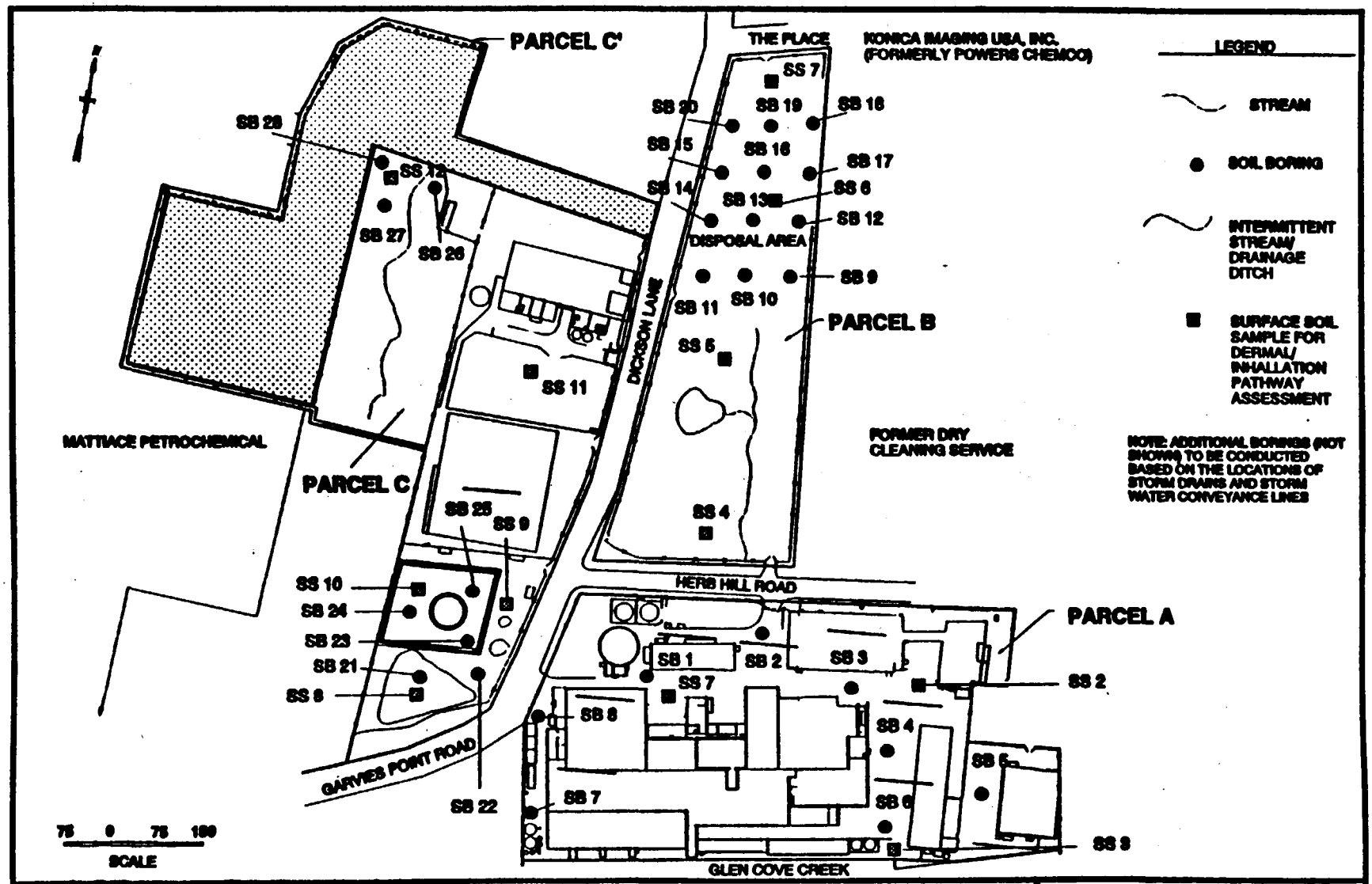
Exploratory soil borings consist of source area borings, storm sewer borings, and radiological borings. A total of 28 source area borings will be drilled near four areas of concern that have been identified on Parcel A, Parcel B, and Parcel C. Another 15 soil borings will be drilled adjacent to the existing storm sewer drains, and up to 20 radiological soil borings will be drilled at biased sample locations that exhibit high levels of gamma radiation activity.

4.2.2.2.1 Source Area Soil Borings

Eight source area soil borings are proposed on Parcel A beneath the paved areas. Twelve source area soil borings are proposed in the Parcel B disposal area. Three source area soil borings are proposed in the northwest corner of Parcel C in the area of scarred vegetation. Finally, five source area soil borings are proposed in the southern portion of Parcel C around the 500,000 gallon storage tank. Proposed soil boring locations are shown on Figure 4-2.

At each source area soil boring location, continuous split-spoon soil samples will be collected at two foot intervals from the ground surface to the water table. A minimum of two samples per soil boring location will be selected for laboratory analysis. All split spoon samples will be screened for volatile organic compounds in the field with a photoionization detector and for radioactivity with a Geiger Mueller (GM) pancake detector. Based upon the results of this field screening and/or visual identification of wastes, soil samples will be collected at depths where contamination is suspected. An additional soil sample will be collected in natural unsaturated material beneath any waste encountered to a maximum depth of six to 12 inches above the water table. If the field screening procedure does not show evidence of contamination, then one sample will be collected from six to 12 inches below the ground surface and one sample will be collected from six to 12 inches above the water table.

Source area soil boring samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.3.1 of this FSP and listed in Tables 4-1 and 4-2. Ten source area soil boring samples will also be sent to a non-RAS laboratory for analysis of the physical parameters outlined in Section 4.3.3.2 of this FSP and listed in Tables 4-1 and 4-2. Samples sent for analysis of physical parameters will be selected to be representative of the different lithologies encountered and will be selected so that their spatial arrangement provides adequate coverage



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LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

SOURCE AREA BORING & SURFACE SOIL SAMPLE LOCATION MAP

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FIGURE 4-2

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across the site. Finally, four source area soil boring samples will also be collected and sent to a non-RAS laboratory for TCLP parameters (Table 4-1; 4-2). The soil sample(s) exhibiting the highest photoionization detector and/or GM pancake detector reading(s) of all of the soil borings collected from each of the four source areas will be sent for TCLP parameter analysis. If the same sample has the highest reading for organic volatile compounds and radiation, then only one sample will be sent from that area. If different waste types are encountered in the soil borings of any particular source area, a sample of each waste type will be sent for analysis.

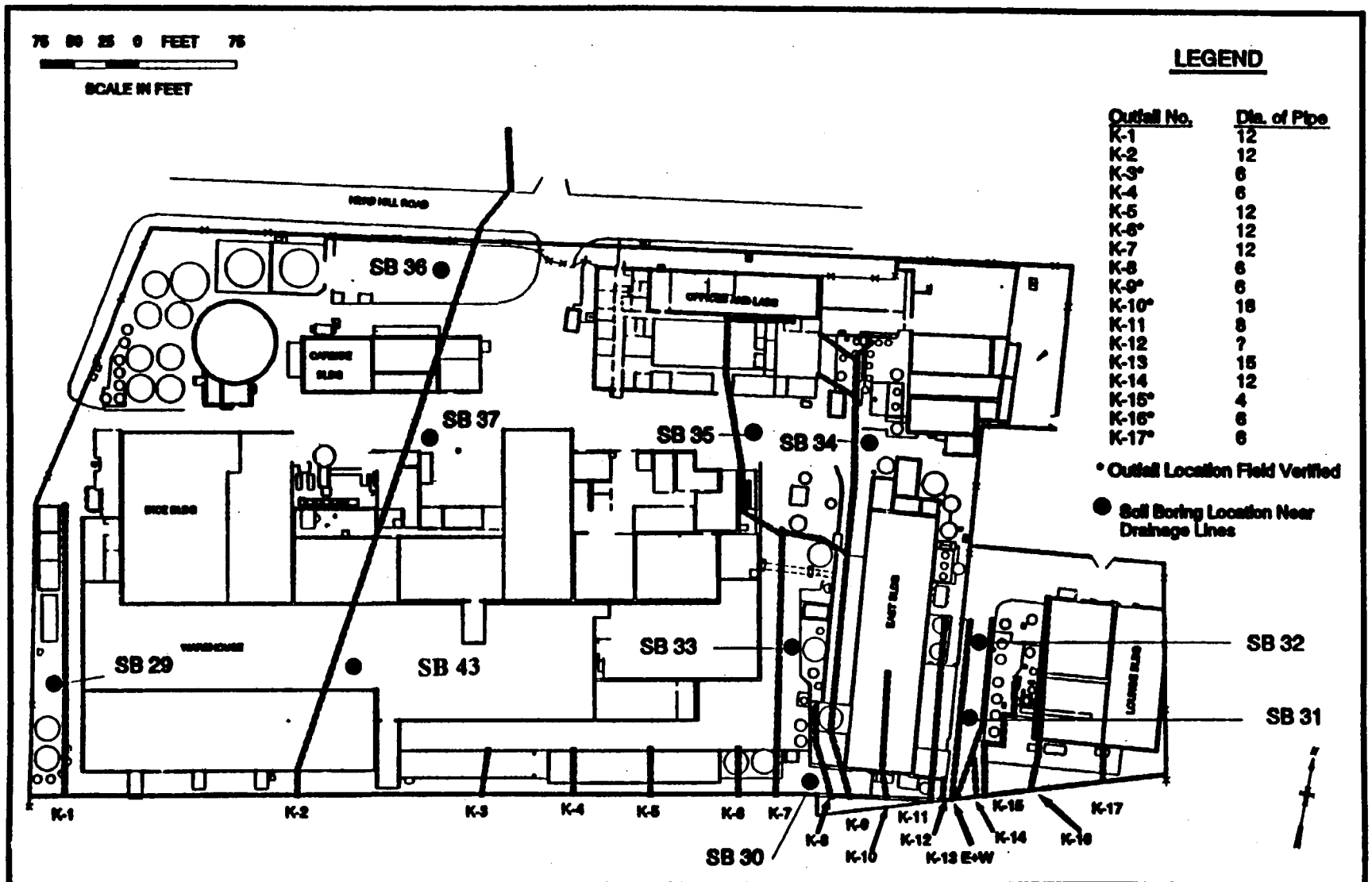
4.2.2.2.2 Storm Sewer Soil Borings

Exploratory soil borings will also be drilled adjacent to the existing storm sewer to determine the extent to which it functions as migration pathway and contaminant source to the groundwater and Glen Cove Creek. The location and elevation of the storm sewer system and storm drains will be obtained from records of previous storm water discharge permits, the Nassau County Department of Public Works and field reconnaissance. The number of borings to be drilled will depend on the location and areal extent of the storm sewer system; however, it is estimated that 15 soil borings will be necessary. Figures 4-3 and 4-4 show the location of the existing drainage and discharge pipes and the proposed borings associated with the drainage pipe network. Soil borings will be drilled to the invert elevations of the drainage pipes. Split-spoon soil samples will be collected one-foot below the invert elevation at each soil boring location and will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.3.1 of this FSP and listed in Tables 4-1 and 4-2.

One additional soil sample from a storm sewer soil boring will also be collected and sent for TCLP parameter analysis. The soil sample exhibiting the highest photoionization detector and/or GM pancake detector reading(s) will be sent to a non-RAS laboratory for TCLP parameter analysis. If the same sample has the highest reading for organic volatile compounds and radiation, then only one sample will be sent for analysis. Finally, sediment samples will also be collected from within the drains of the storm sewer system as described in Section 4.2.6.3 of this FSP.

4.2.2.2.3 Radiological Soil Borings

To better define the extent (i.e., depth and volume) of radiological contamination on the Li Tungsten Site, soil borings will be drilled for the purposes of soil sample collection and downhole gamma logging. Borehole locations will be selected to coincide with areas exhibiting elevated gamma exposure rates. If elevated exposure rates are observed through a building floor, drilling and soil sample collection will also be done inside of buildings. Boreholes will be drilled to 15 feet using either the air rotary or the hollow stem auger method. Soil samples will be collected continuously with two-inch



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LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY
STORM SEWER SOIL BORING LOCATIONS
PARCEL A

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FIGURE 4-3

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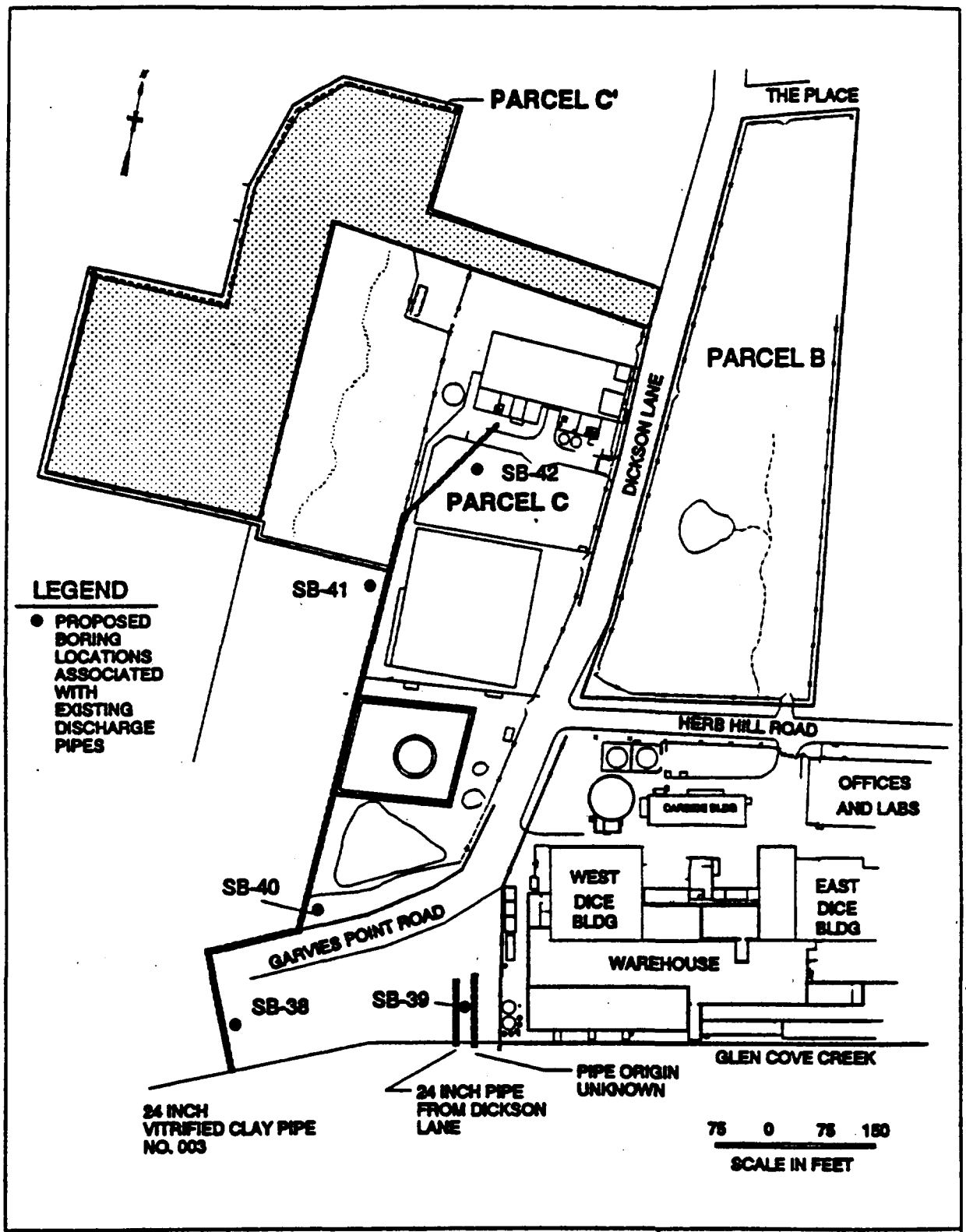

MALCOLM PIRNIE	LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY STORM SEWER SOIL BORING LOCATIONS PARCEL C	MALCOLM PIRNIE, INC. FIGURE 4-4

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diameter split spoons. The contents of each spoon will be scanned with a GM pancake detector to identify segments exhibiting enhanced radioactivity. Samples will be collected of the soil exhibiting elevated radioactivity as well as of the soil located directly beneath the contaminated material. In this way, the soil sample data will reveal both the extent and depth of radionuclide concentration. Twenty boreholes will be drilled at biased locations. Radiological soil boring samples will be sent to a non-RAS laboratory for analysis of the radiological parameters outlined in Section 4.3.3.1 of this FSP and listed in Tables 4-1 and 4-2.

Following sample collection, a 2.5-inch diameter hollow PVC pipe, which is capped at one end, will be installed into the open borehole. Starting at the ground surface, a NaI detector coupled to a r-atemeter/scaler will be inserted into the pipe and 30 second count rate readings will be taken at six-inch increments.

It is possible that much of the contaminated material in the vegetated portions of the site (i.e., Parcel B and C) reside in the upper few feet of soil. If necessary, additional downhole gamma logging will be conducted to a depth of five feet. Hollow steel tubes, up to five feet in length will be driven into the ground with a jackhammer at "hot spots" and at suspected boundaries of the contaminated materials. Downhole gamma logging measurements will be taken with a NaI scintillation detector (3/8" x 3/8" x ½" crystal) coupled to a portable ratemeter/scaler.

4.2.2.3 Monitoring Well Borings

In addition to the soil sampling program associated with the exploratory soil borings described above, continuous split-spoon samples will also be collected during the installation of each new monitoring well. Sixteen new monitoring wells (nine shallow, seven deep) will be installed at eight locations (six single well locations, two shallow/deep well clusters) shown on Figure 4-5. Borings for the installation of monitoring wells will be drilled using the hollow stem auger technique. If the hollow-stem auger technique proves to be unsuitable, a rotary method (air or mud) may be necessary. Split-spoon soil samples will be collected continuously in each boring. When cluster wells are being installed, soil samples will be collected only in the deeper boring of the cluster. A minimum of two samples per well location will be selected for laboratory analysis. All split spoon samples will be screened in the field with a photoionization detector and a GM pancake detector. Samples which show the greatest evidence of contamination will be sent to the laboratory for analysis. If the field screening procedure does not show evidence of contamination, then one sample will be collected from six to 12 inches below the ground surface and one from six to 12 inches above the water table. If clay beds thicker than two feet are encountered during split spoon sampling, the next deeper soil sample will be collected with a Shelby tube that will be sent to a non-RAS laboratory for measurement of vertical hydraulic conductivity.

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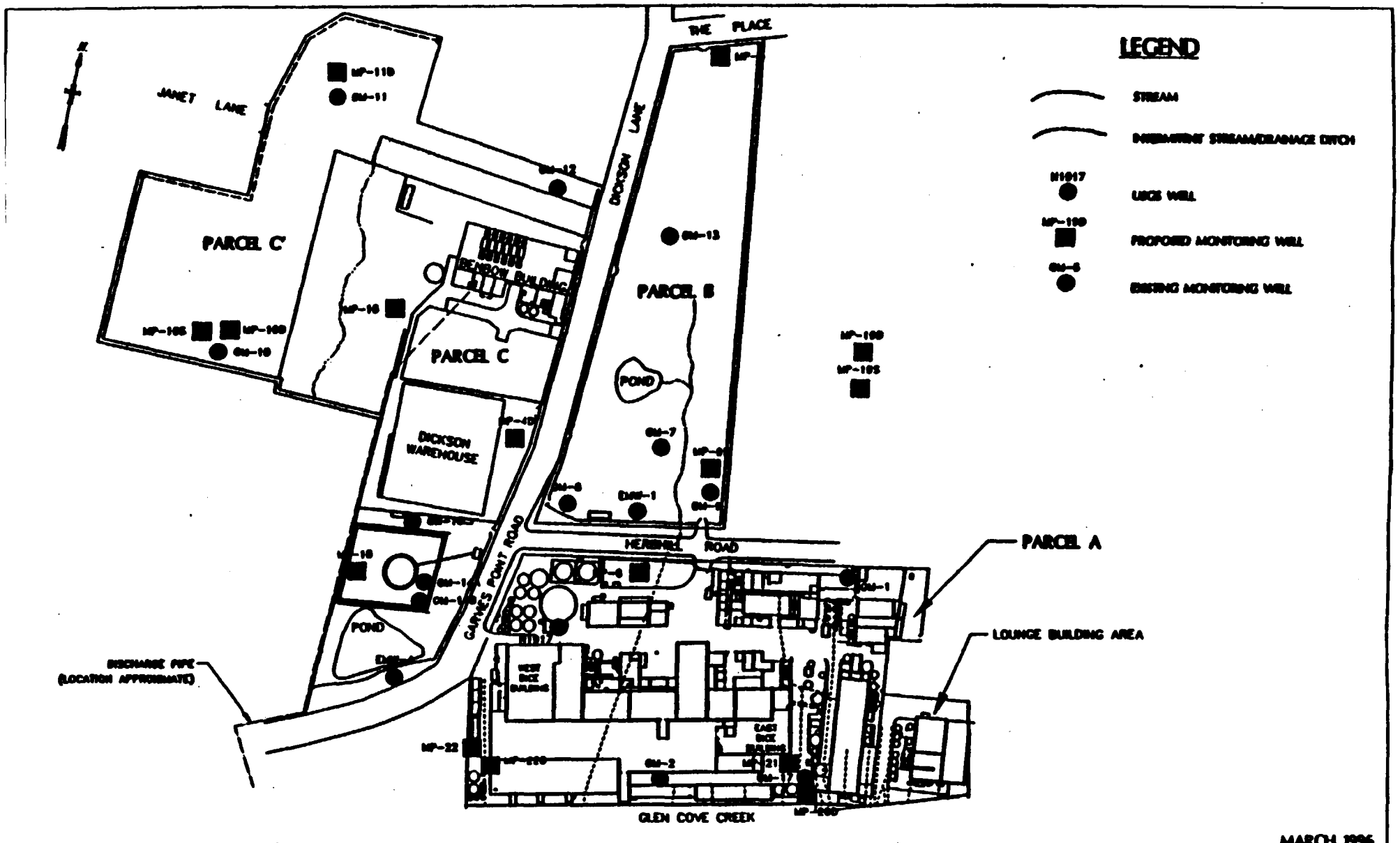

SOURCE: FRED C. HART ASSOCIATES, INC. (AUGUST 1989)

MARCH 1996

MALCOLM PIRNIE

LI TUNGSTEN – RI/FS
GLEN COVE, NEW YORK

MONITORING WELL LOCATIONS

MALCOLM PIRNIE, INC.

FIGURE 4-5

Monitoring well boring samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.3.1 of this FSP and listed in Tables 4-1 and 4-2. In addition, sixteen monitoring well boring samples will be sent to a non-RAS laboratory for analysis of the physical properties outlined in Section 4.3.3.2 of this FSP and listed in Tables 4-1 and 4-2. Samples sent for analysis of physical parameters will be selected to be representative of the different lithologies encountered and will be selected so that their spatial arrangement provides adequate coverage across the site.

4.2.3 Test Pit Excavation

4.2.3.1 Overview

Test pits will be excavated to investigate the subsurface extent of the disposal area located on Parcel B and will supplement the information gathered during the source area soil boring investigation. Soil samples will be collected during test pit excavation to determine if soils are contaminated and represent a potential source of groundwater contamination.

4.2.3.2 Test Pit Sampling

Six test pits will be excavated around the disposal area to assess the subsurface extent and to collect samples of soil and buried waste. The tentative location of six test pits are shown on Figure 4-5; however, final test pit locations and the number of pits will be dependent upon the results of the soil boring program. In general, the test pits will be located around the perimeter of the disposal area.

Soil samples will be collected from each bucket of material excavated at each test pit location. These samples will be screened in the field with a photoionization detector and a GM pancake detector. Samples that exhibit the greatest response on the field instruments or show visible evidence of contamination will be selected for laboratory analyses. The remaining samples will be archived for future reference. A minimum of one sample per test pit will be collected for analyses; however, the actual number of samples may increase based on field conditions. The test pit samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.4 of this FSP and listed in Tables 4-1 and 4-2.

In addition to the discreet grab samples described above, composite samples of each type of waste encountered in the test pits will be collected and sent to a non-RAS laboratory for TCLP parameter analysis to classify the buried waste. It is estimated that two composite samples will be collected for TCLP parameter analysis. Additional sampling and analysis (both discreet grabs and composites) may be required pending the TCLP results.

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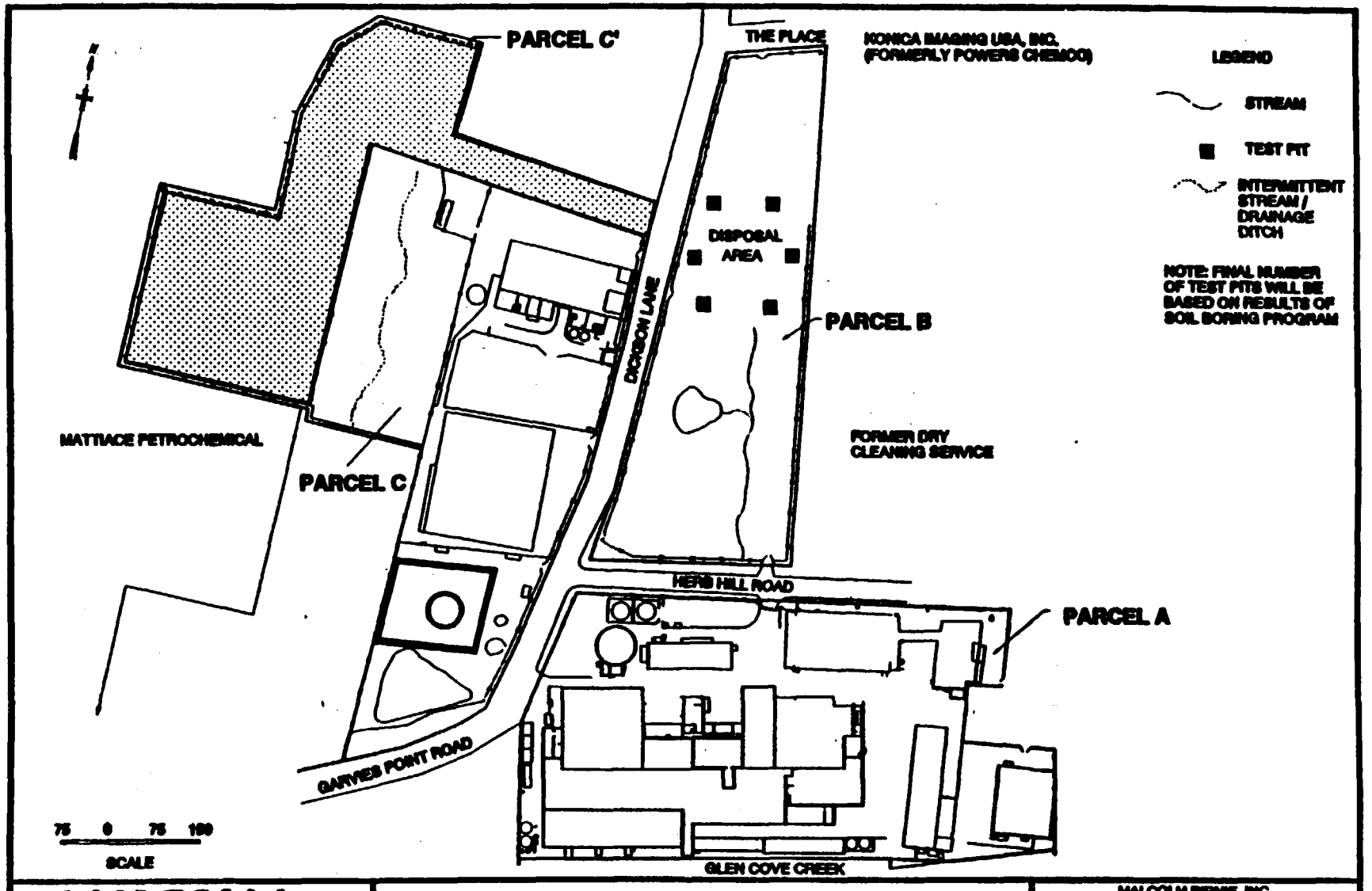

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LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

TEST PIT LOCATION MAP

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FIGURE 4-6

4.2.4 Surface Soil Sampling

Twelve surface soil samples will be collected to assess the potential for dermal/inhalation pathways associated with surface soil contaminants. The proposed surface soil sample locations are shown on Figure 4-2. Surface soil samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.5 of this FSP and listed in Tables 4-1 and 4-2.

4.2.5 Groundwater Sampling

4.2.5.1 Overview

There are 14 existing and functional monitoring wells on the Li Tungsten Site, all of which are screened in the shallow overburden aquifer. Data on well construction, construction date, screen length, construction material, well diameter, total depth, and top of casing elevation are presented on Table 5-1 of the RI/FS Work Plan (Malcolm Pirnie, 1993). One additional on-site well, water supply well N1917, intersects the deeper Lloyd aquifer. Sixteen new monitoring wells (nine shallow and seven deep) will be installed and developed in conjunction with the RI/FS field activities. The location of the existing on-site wells and proposed locations for new monitoring wells are shown in Figure 4-6.

Two rounds of groundwater samples will be collected from both new and existing on-site monitoring wells, and supply well N1917 (if this well can be located and is in good condition). Groundwater samples will be analyzed to obtain data on groundwater quality. Additional groundwater samples will be collected from a temporary well installed in one of the source area soil borings drilled in the Parcel B Disposal Area, and during pump test activities.

4.2.5.2 Monitoring Well Sampling

A total of 69 groundwater samples will be collected from 30 monitoring wells (16 new and 14 existing), and one water supply well (Well N1917) during two rounds of sampling. One sampling event will take place in the summer when groundwater levels are typically depressed; the second sampling event will occur during the wetter months when groundwater levels are generally high. Two separate sampling events will provide a check for possible seasonal variations in contaminant concentrations. Samples will be collected a minimum of two weeks after the wells are installed and developed to allow for stabilization. Groundwater samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.6 of this FSP and listed in Tables 4-1 and 4-2. The pH, conductivity, and temperature of the groundwater samples will be measured in the field.

4.2.5.3 Geoprobe Sampling

After completion of the source area soil boring program in the Parcel B Disposal Area, one drilling location with the most visible evidence of soil contamination will be selected for installation of a geoprobe (or hydropunch). The geoprobe will be installed in accordance with the procedures described in Section 5.9.6 of this FSP.

A groundwater sample will be collected from this location and sent to a non-RAS laboratory for analysis of the chemical parameters outlined in Section 4.3.6 of this FSP and listed in Tables 4-1 and 4-2. This sample will be analyzed on a quick-turnaround basis (24 to 48 hours). The pH, conductivity, and temperature of the groundwater will be measured in the field. The results of the analysis will be used, in consultation with the WAM, to determine whether a permanent monitoring well will be installed at this location.

4.2.5.4 Pump Test Groundwater Sampling

In association with the hydrogeologic investigation, a pump test will be conducted in the Upper Glacial aquifer to further define the groundwater hydrology and as an aid in evaluating contaminant fate and transport. Location of the pumping well and the type of test to be conducted will be determined following evaluation of the monitoring well survey and the slug test data. A minumum of three monitoring wells located near the pumping well will be selected as observation wells for the collection of water level data throughout the pumping test. A constant-rate pumping test will be conducted for up to 72-hours with periodic monitoring of the water level in the pumping well and the observation wells during pumping and recovery. During the pump test, pH, conductivity and temperature will be measured continuously using a YSI Model 3600 flow-through meter. In addition, one groundwater sample will be collected every 12-hours during the pump test and will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.6 of this FSP and listed in Tables 4-1 and 4-2. The results will be used to assess the contaminants in groundwater and are needed to evaluate groundwater treatment.

4.2.6 Surface Water and Sediment Sampling

4.2.6.1 Overview

The nearest natural surface water body to the site is Glen Cove Creek, which is located along the southern boundary of the site. Glen Cove Creek is a tidal estuary and therefore, flow and water quality are influenced by the tides. The site has limited topographic relief and the pattern of surface water flow to Glen Cove Creek has not been identified. It is believed that most on-site surface water flow is collected in a system of storm drains that discharge to Glen Cove Creek through a series of outfalls. Two

on-site surface water ponds exist: Mud Pond and one unnamed pond on the southwestern portion of Parcel B. In addition, a previously unmapped and unsampled intermittent stream or drainage ditch was identified on Parcel C during the February 1993 site visit. This feature appears to receive surface water flow draining off the area of scarred vegetation and other areas on Parcel C at higher elevations. Surface water and sediment samples will be collected from each of these surface water bodies during the RI/FS field activities. At present, no surface water or sediment sampling of Glen Cove Creek is proposed as requested by USEPA.

4.2.6.2 Surface Water Sampling

Surface water samples previously collected indicated the presence of metals and non-metal inorganic compounds. Seven surface water samples will be collected from areas on Parcel A, B and C that were previously sampled (NUS, 1990). In addition, two surface water samples will be collected along the intermittent stream or drainage ditch on Parcel C that has not been previously sampled. Proposed surface water sampling locations are shown in Figure 4-7. Surface water samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological parameters outlined in Section 4.3.7 of this FSP and listed in Tables 4-1 and 4-2. Field parameters, including temperature, pH, and specific conductance of surface water samples will be measured at the time of collection.

If a significant increase in the surface water contamination is identified compared to previous investigations, a more in depth sampling program, including biota and sampling of the outfalls to the Glen Cove Creek during precipitation events, will be necessary.

4.2.6.3 Sediment Sampling

Sediment samples previously collected and analyzed indicated PCB contamination in the Mud Pond and two Mud Holes. In addition, elevated concentrations of numerous metals were also detected in the majority of the previously collected sediment samples. Six sediment samples will be collected from areas that were previously sampled. Two sediment samples will also be collected along the intermittent stream or drainage ditch on Parcel C. Proposed sediment sampling locations are shown in Figure 4-8. In addition, approximately ten sediment samples will be collected from the drain pipes of the storm sewer system. Sediment samples will be sent to both CLP and non-RAS laboratories for analysis of the chemical and radiological and physical parameters outlined in Sections 4.3.8.1 and 4.3.8.2 of this FSP, respectively and listed in Tables 4-1 and 4-2. Based upon the results of the sediment analyses, additional sampling may be required to delineate the vertical and horizontal extent of PCB contamination.

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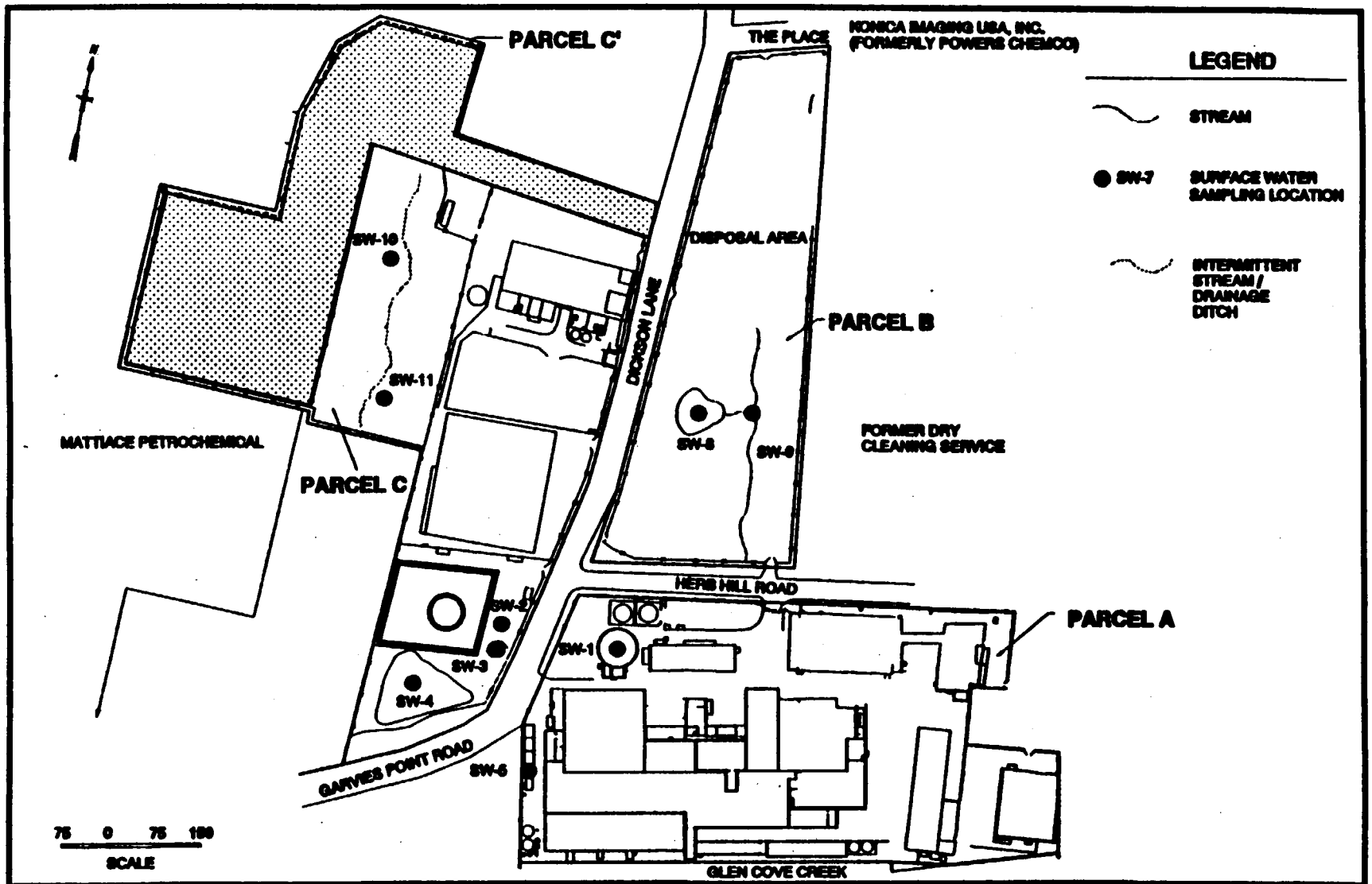

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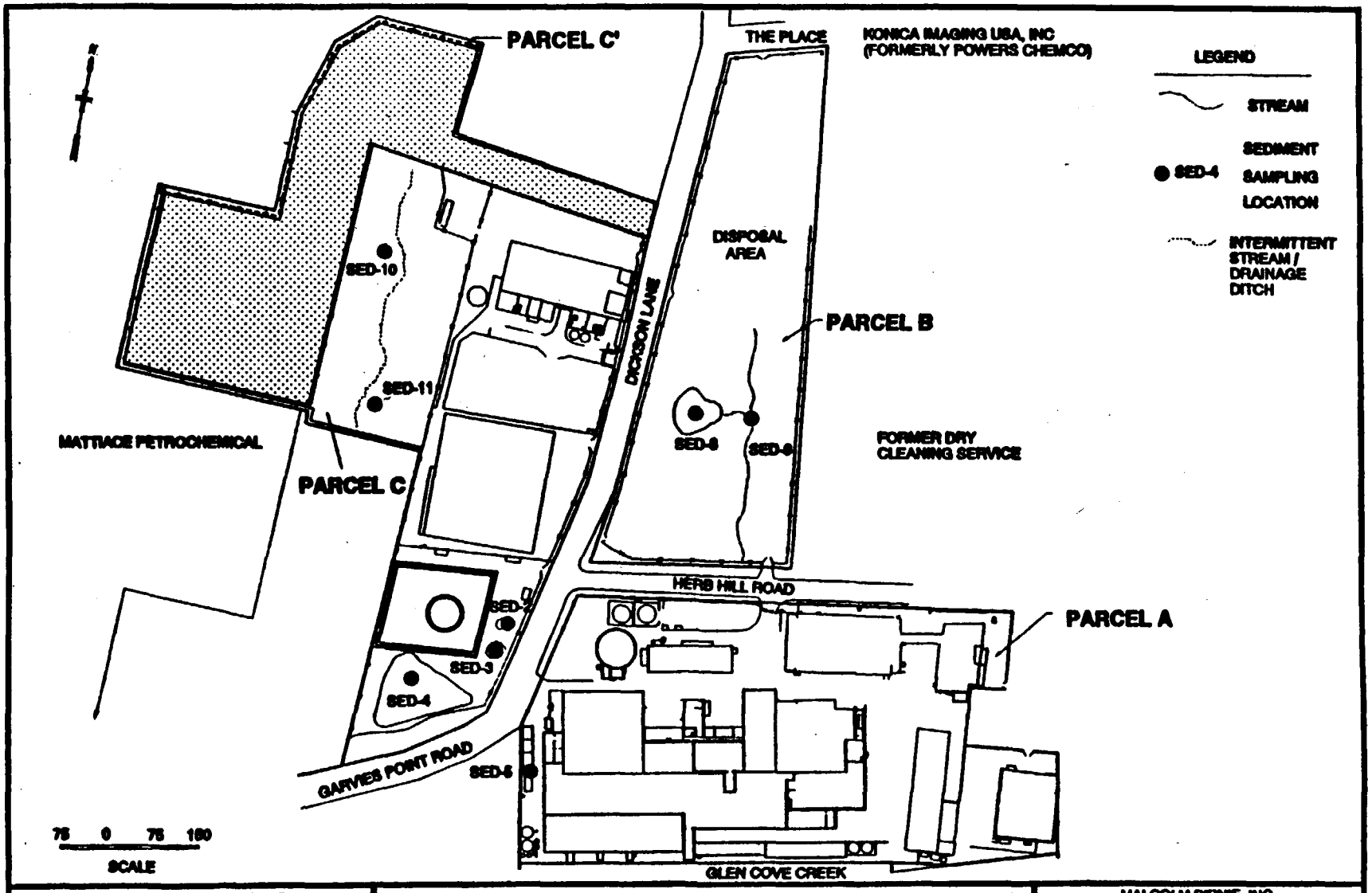
LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

SURFACE WATER SAMPLING LOCATION MAP

MALCOLM PIRNIE, INC

FIGURE 4-7



MALCOLM PIRNIE

LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

SEDIMENT SAMPLING LOCATION MAP

MALCOLM PIRNIE, INC

FIGURE 4-8

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4.2.7 Building Materials and Tank Sampling

4.2.7.1 Overview

Building material, tank residue, and tank material samples will be collected to identify and determine the concentration of radioactive contaminants in materials which appear to be sources of elevated gamma radiation exposure rates and/or surface radioactivity.

4.2.7.2 Building Materials Sampling

The numbers and locations of building materials samples to be collected will be determined in the field and will be based upon the results of gamma radiation exposure rate surveys and/or surface radioactivity surveys. In general, however, materials which exhibit elevated levels of radioactivity will be sampled and sent to a non-RAS laboratory for analysis of the radiological parameters outlined in Section 4.3.9.1 of this FSP.

4.2.7.3 Tank Residue Sampling

The numbers and locations of tank residue samples to be collected will be determined in the field and will be based upon the results of gamma radiation exposure rate surveys and/or surface radioactivity surveys. In general, however, the contents of all tanks which exhibit elevated levels of radioactivity will be sampled and sent to a non-RAS laboratory for analysis of the radiological parameters outlined in Section 4.3.9.2 of this FSP.

4.2.7.4 Tank Material Sampling

The numbers and locations of tank material samples to be collected will be determined in the field and will be based upon the number of tank residue samples collected. In general, tank material samples will be collected from all tanks from which residue samples were collected. Tank material samples will be sent to a non-RAS laboratory for analysis of the radiological parameters outlined in Section 4.3.9.1 of this FSP.

4.3 ANALYTICAL PARAMETERS

4.3.1 Analytical Methods

The analytical methods to be used for the chemical and radiological parameters and physical

properties described in this section of the FSP include the following:

PARAMETER	ANALYTICAL METHOD
TCL Volatiles TCL Semi-Volatiles TCL Pesticides/PCBs	USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM01.2 with revisions through OLM01.9.
TAL Metals Mercury Cyanide	USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0
Total Dissolved Solids	USEPA 160.2. Methods for Chemical Analysis of Water and Wastes, (EPA 600/479-020).
Total Organic Carbon (TOC)	USEPA-II. Lloyd Kahn Method, Determination of Total Organic Carbon in Sediment, USEPA Region II, July 27, 1988.
pH	USEPA-9045A. Test Methods for Evaluating Solid Waste, Vol 1C, Laboratory Manual Physical/Chemical Methods SW-846, 3rd Edition, Revision No. 1, July 1992.
Hydraulic Conductivity	ASTM D5084-90. ASTM, Standards for Construction, Volume 4.08, 1992.
Atterberg Limits	ASTM D4318-84. ASTM, Standards for Construction, Volume 4.08, 1992.
Moisture Content	ASTM D2216-92. ASTM, Standards for Construction, Volume 4.08, 1992.
Bulk Density Maximum Index Minimum Index	 ASTM D4253-94. ASTM, Standards for Construction, Volume 4.08, 1992. ASTM D4254-91. ASTM, Standards for Construction, Volume 4.08, 1992.
Grain Size	ASTM-D 422-63. ASTM, Standards for Construction, Volume 4.08, 1992.
^{238}U, ^{230}Th, ^{232}Th	HASL-300. EML Procedures Manual, U.S. Department of Energy, 27th Edition, Volume 1, February 1992.
^{226}Ra, ^{228}Ra	HASL-300. EML Procedures Manual, U.S. Department of Energy, 27th Edition, Volume 1, February 1992.
TCLP Parameters (TCLP volatiles, TCLP semi-volatiles, TCLP metals, and TCLP mercury)	USEPA 1311. Multi-Client Headquarters 7954-Q-01 & 02 Special Analytical Services Report

4.3.2 Soil Gas Survey Sampling

All soil gas samples will be analyzed in the field using a gas chromatograph for specific target compounds. The target compounds were selected based on previous analytical data (NUS, 1990).

Samples collected from subsequent soil borings and monitoring wells will be analyzed for VOCs by a CLP-RAS laboratory. These analyses will provide sufficient confirmation of the soil gas results, therefore, no additional laboratory confirmation is proposed for soil gas samples.

The largest of the four areas to be investigated using the soil gas technique includes the southern portion of Parcel B and the northern and eastern portions of Parcel A (stations SG-1 through SG-18; SG-24 through SG-31). Target compounds include: tetrachloroethene, trichloroethene and trans 1,2-dichloroethene. The second area to be investigated is located in the western portion of Parcel A (stations SG-19 through SG-23). Target compounds include: benzene, ethylbenzene, toluene, xylene and trichloroethene. The third area includes the 500,000-gallon aboveground storage tank and surrounding area (stations SG-32 through SG-42). Target compounds include: benzene, ethylbenzene, toluene and xylene. The fourth and final area to be investigated using the soil gas methodology is in the northern portion of Parcel C (stations SG-43 through SG-50). Although previous sampling efforts in this general area of the Site did not detect VOCs in the soil or groundwater, the soils in the immediate area have been disturbed and, therefore, warrant VOC screening. Target compounds for this area were developed from all target VOCs in the three other areas and include: trichloroethene, tetrachloroethene, trans 1,2-dichloroethene, benzene, ethyl benzene, toluene and xylene.

4.3.3 Soil Boring Split Spoon Sampling

4.3.3.1 Chemical and Radiological Analyses

All source area soil boring, storm sewer soil boring, and monitoring well soil boring samples will be analyzed by a CLP laboratory for the Routine Analytical Services (RAS) parameters (TCL organic compounds, TAL inorganic metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (TOC, pH, radiological constituents) described in Tables 4-3 and 4-4, respectively. In addition, a minimum of one split-spoon sample from each of the four source areas and the storm sewer borings will be sent to a non-RAS laboratory for TCLP parameter analysis.

Radiological soil borings will only be analyzed for the radiological constituents (^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{238}U) described in Table 4-4.

4.3.3.2 Physical Properties

All soil boring samples will be will be visually described and classified in the field by a geologist according to the modified Burmister System. Standard penetration tests (SPT) consistent with ASTM D-1586 will also be an integral part of the soil boring program. SPT will be used to estimate the in-situ consistency of the soils encountered and will be conducted at each borehole location. A total of 20 soil boring samples (ten source area borings and ten monitoring well borings) will also undergo testing by

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

LI TUNGSTEN RI/FS

TCL	CRQL	
Semivolatiles (Continued)	Water (ug/l)	Low Soil/Sediments[2] (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
Butyl Benzyl Phthalate	10	330
3,3'-Dichlorobenzidine	10	330
Benzo(a)anthracene	10	330
Chrysene	10	330
bis(2-ethylhexyl)phthalate	10	330
Di-n-octyl Phthalate	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]

LI TUNGSTEN RI/FS

TCL	CRQL	
Semivolatiles	Water (ug/l)	Low Soil/Sediment[2] (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-Chloroethyoxy) methane	10	330
2,4-Dichlorophenol	10	800
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
Acenapthylene	10	800

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

LI TUNGSTEN RI/FS

TCL	CRQL	
Volatiles	Water (ug/l)	Low Soil/Sediment[2] (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
Vinyl Acetate	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]

LI TUNGSTEN RI/FS

TCL	CRQL	
Pesticides/PCBs	Water (ug/l)	Low Soil/Sediment[2] (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	
Aroclor-1016	1.0	170.0
Aroclor-1221	2.0	33.0
Aroclor-1232	1.0	67.0
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/TARGET ANALYTE LIST
CONTRACT REQUIRED DETECTION LIMITS (CRDL)[1]

LI TUNGSTEN RI/FS

TAL	CRDL
Inorganics	Contract Required[3] 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

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

LI TUNGSTEN RI/FS

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) 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
NON-RAS ANALYTICAL PARAMETERS
LI TUNGSTEN RI/FS

CHEMICAL PARAMETERS

Water[1]	Total Dissolved Solids
Soil/Sediment[1]	Total Organic Carbon
	pH
	Atterberg Limits
	Moisture Content
	Bulk Density
	Grain Size
	Hydraulic Conductivity [2]

RADIOLOGICAL PARAMETERS

Matrix	Radionuclides	Minimum Detectable Activity (MDA)
Water[1]	^{230}Th, ^{232}Th	≤ 1 pCi/L
	^{226}Ra, ^{228}Ra	≤ 1 pCi/L
	^{238}U	≤ 1 pCi/L
Soil/Sediment Tank Residue Building Materials [1]	^{230}Th, ^{232}Th	≤ 0.3 pCi/g
	^{226}Ra	≤ 0.3 pCi/g
	^{228}Ra	≤ 0.3 pCi/g
	^{238}U	≤ 0.3pCi/g

NOTES:

(1) Not all samples will be analyzed for all of the parameters listed. Please refer to the text in Section 4.3 and Tables 4-1 and 4-2 to determine the analyses required for each type of sample collected.

(2) If Shelby tubes are collected.

a non-RAS laboratory for physical properties including Atterburg limits, grain size, moisture content, and bulk density.

4.3.4 Test Pit Soil Sampling

All test pit soil samples will be analyzed by a CLP laboratory for the RAS parameters (TCL organic compounds, TAL inorganic metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (TOC, pH, radiological constituents) described in Tables 4-2 and 4-4, respectively. In addition, two composite samples of each type of waste encountered in the test pits will be collected and sent to a non-RAS laboratory for TCLP parameter analysis.

4.3.5 Surface Soil Sampling

All surface soil samples will be analyzed by a CLP laboratory for the RAS parameters (TCL organic compounds, TAL inorganic metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (radiological constituents) described in Tables 4-3 and 4-4, respectively.

4.3.6 Groundwater Sampling

All groundwater samples (including pump test samples but excluding the temporary well sample) will be analyzed by a CLP laboratory for the RAS parameters (TCL organic compounds, TAL inorganic total and dissolved metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (TDS, radiological constituents) described in Tables 4-3 and 4-4, respectively. The groundwater sample collected from the Parcel B geoprobe location will be analyzed by a non-RAS laboratory for TCL volatiles, TAL inorganic total and dissolved metals, and total cyanide as described in Table 4-4.

4.3.7 Surface Water Sampling

All surface water samples will be analyzed by a CLP laboratory for the RAS parameters (TCL organic compounds, TAL inorganic metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (radiological constituents) described in Tables 4-3 and 4-4, respectively.

4.3.8 Sediment Sampling

4.3.8.1 Chemical and Radiological Analyses

All sediment samples will be analyzed by a CLP laboratory for the RAS parameters (TCL organic compounds, TAL inorganic metals, total cyanide) and a non-RAS laboratory for the non-RAS parameters (TOC, pH, radiological constituents) described in Tables 4-3 and 4-4.

4.3.8.2 Physical Properties

In addition to the chemical analyses described in Section 4.3.7.1 above, sediment samples will also be analyzed by a non-RAS laboratory for grain-size distribution.

4.3.9 Building Materials and Tank Sampling

4.3.9.1 Building and Tank Materials Sampling

All building and tank material samples will be analyzed by a non-RAS laboratory for the radiological parameters (^{232}Th and ^{226}Ra) described in Table 4-4.

4.3.9.2 Tank Residue Sampling

All tank residue samples will be analyzed by a non-RAS laboratory for the radiological parameters (^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra and ^{238}U) described in Table 4-4.

4.4 QUALITY CONTROL SAMPLES

Quality control procedures will be employed to check that sampling, transportation and laboratory activities do not bias sample chemical quality. Trip blanks, field blanks, duplicate samples, matrix spike samples and matrix spike duplicate samples will provide a quantitative basis for validating the analytical data. A summary of the anticipated QA/QC samples for each of the media is included in Table 4-5.

4.4.1 Blank Water

Blank water used in this project will be demonstrated analyte-free prior to the start of sample collection through the performance of analytical testing. The blank water will be purchased from a laboratory that can provide analytical results for each lot of water demonstrating that the water meets USEPA Region II requirements. The blank water will be obtained in certified clean containers and will be stored in a location separate from sources of potential 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 be also 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

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TABLE 4-5
QC SAMPLE SUMMARY
LI TUNGSTEN RI/FS

MATRIX	ANALYSIS	ESTIMATED NUMBER OF SAMPLES	NUMBER OF FIELD DUPLICATES	NUMBER OF FIELD BLANKS (1)	NUMBER OF TRIP BLANKS (2)	NUMBER OF MS/MSD or MS/MD SAMPLES (3) (4)
Monitoring Well Sampling	TCL Volatiles	69	4	7	14	4
	TCL Semi-Volatiles	68	4	7	N/A	4
	TCL Pesticides/PCBs	68	4	7	N/A	4
	TAL Metals (Total)	69	4	7	N/A	4
	TAL Metals (Dissolved)	69	4	7	N/A	4
	Cyanide	68	4	7	N/A	4
	Radionuclides	68	4	7	N/A	4
	TDS	68	4	N/A	N/A	N/A
Subsurface Soils	TCL Volatiles	109	6	20	N/A	6
	TCL Semi-Volatiles	109	6	20	N/A	6
	TCL Pesticides/PCBs	109	6	20	N/A	6
	TAL Metals	109	6	20	N/A	6
	Cyanide	109	6	20	N/A	6
	Total Organic Carbon	109	6	N/A	N/A	6
	pH	109	6	N/A	N/A	6
	Radionuclides	149	8	20	N/A	8
	Grain Size	26	2	N/A	N/A	N/A
	Moisture Content	26	2	N/A	N/A	N/A
	Bulk Density	26	2	N/A	N/A	N/A
	Atterberg Limits	26	2	N/A	N/A	N/A
	Hydraulic Conductivity	26	2	N/A	N/A	N/A
	TCLP Parameters	7	1	6	N/A	1

TABLE 4-5
QC SAMPLE SUMMARY
LI TUNGSTEN RI/FS

MATRIX	ANALYSIS	ESTIMATED NUMBER OF SAMPLES	NUMBER OF FIELD DUPLICATES	NUMBER OF FIELD BLANKS (1)	NUMBER OF TRIP BLANKS (2)	NUMBER OF MS/MSD or MS/MD SAMPLES (3) (4)
Surface Soils	TCL Volatiles	15	1	2	N/A	1
	TCL Semi-Volatiles	15	1	2	N/A	1
	TCL Pesticides/PCBs	15	1	2	N/A	1
	TAL Metals	15	1	2	N/A	1
	Cyanide	15	1	2	N/A	1
	Radionuclides	15	1	2	N/A	1
Surface Water	TCL Volatiles	9	1	N/A	1	1
	TCL Semi-Volatiles	9	1	N/A	N/A	1
	TCL Pesticides/PCBs	9	1	N/A	N/A	1
	TAL Metals	9	1	N/A	N/A	1
	Cyanide	9	1	N/A	N/A	1
	Radionuclides	9	1	N/A	N/A	1
Sediments	TCL Volatiles	18	1	4	N/A	1
	TCL Semi-Volatiles	18	1	4	N/A	1
	TCL Pesticides/PCBs	18	1	4	N/A	1
	TAL Metals	18	1	4	N/A	1
	Cyanide	18	1	4	N/A	1
	Total Organic Carbon	18	1	N/A	N/A	N/A
	pH	18	1	N/A	N/A	N/A
	Grain Size Distribution	8	1	N/A	N/A	N/A
	Radionuclides	18	1	4	N/A	1

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TABLE 4-5
QC SAMPLE SUMMARY
LI TUNGSTEN RI/FS

MATRIX	ANALYSIS	ESTIMATED NUMBER OF SAMPLES	NUMBER OF FIELD DUPLICATES	NUMBER OF FIELD BLANKS (1)	NUMBER OF TRIP BLANKS (2)	NUMBER OF MS/MSD or MS/MD SAMPLES (3) (4)
Surface Alpha	Alpha Particles	(5)	2	N/A	N/A	N/A
Building/Tank Materials	Radionuclides	(5)	2	2	N/A	N/A
Soil Gas Samples	Selected VOCs	50	3	N/A	N/A	N/A

FOOTNOTES:

(1) Number is estimated - actual number of QA/QC samples will depend on the field conditions, equipment availability and program schedule.
(2) Number is estimated - trip blanks are analyzed for VOAs only.
(3) MS/MSD - triple volume is required for one field aqueous sample per 20. No extra volume is required for soil samples.
(4) MS/MD - double volume is required for one field aqueous sample per 20. No extra volume is required for soil samples.
(5) The number of field samples will depend on the field conditions
N/A - Not Applicable

PCBs	<CRQL
Inorganics	<CRDL

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

Common Laboratory Contaminants

Methylene Chloride

Acetone

Toluene

2-Butanone

Phthalates

4.4.2 Trip Blanks

Trip blanks will be taken for each aqueous medium being sampled for volatile analysis at a minimum frequency of one per day. 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 placed in each cooler returned to the lab each day aqueous volatile samples are scheduled for analysis. The trip blank will be analyzed for volatile organic compounds to detect possible contamination during shipment. Trip blanks will be preserved in accordance with the procedures described in SOP, MP-FPQA-021, in Appendix E.

4.4.3 Field Rinsate Blanks

A field rinsate blank is prepared by starting with an empty set of certified demonstrated analyte-free sample containers. 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. Equipment rinsates blanks will be collected at a frequency of once each day a decontamination event takes place for each type of equipment used, not to exceed one per day. 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 rinsate blank will be collected for each piece of equipment associated to a particular sample matrix which will be analyzed for volatile organics.

The field rinsate 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. Field rinsate blanks will be preserved in accordance with the procedures described in SOP, MP-FPQA-021, in Appendix E.

4.4.4 Matrix Spike/Matrix Spike Duplicate Samples and Matrix Spike/Matrix Duplicate Samples

Matrix spike and matrix spike duplicate (MS/MSD; MS/MD for inorganics) sample pairs are analyzed by the laboratory to provide a quantitative measure of the laboratory's precision and accuracy. The limits on a sample delivery group (SDG) are the following:

- Each case of field samples or
- Each 20 field samples within a case, or
- 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), whichever comes first.

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 analysis. MS/MSD or MS/MD samples are selected in the field by the Field Operations Leader. No additional volume of sample is needed for MS/MSD or MS/MD samples for soil or sediment.

4.4.5 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 4.5. 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.

4.4.6 Soil Gas Samples

The soil gas survey will be performed by a subcontractor that will be procured at a future date. Depending upon the subcontractor selected and equipment that will be used, the QC samples listed below may require some modification, however the program outlined below will serve as a guide. Any changes

in the type or number of QC samples to be collected will be documented in a Field Variance Report. The actual frequency will depend upon the number of samples analyzed each day and the length of time of the survey.

Quality Control Samples - Soil Gas Survey

SAMPLE TYPE	FREQUENCY
Ambient Air Samples	1 per sampling location
Analytical Method Blanks	1 per day
Continuing Calibration Check	20% (1 every 5 samples)
Field System Blank	1 per day
Reagent Blank	1 per set of working standards
Replicate Blanks	10% of all samples

The ambient air samples are collected prior to sampling each probe by sampling the air onsite and immediately injecting it into the GC. Analytical method blanks are taken to demonstrate that the analytical instrumentation is not contaminated. These are performed by injecting a carrier gas (nitrogen) into the GC with the sampling syringe. Continuing calibration checks are analyzed to verify the detector response for the target VOCs. If the response changes by more than 25 percent, the GC will be recalibrated and new response factors will be calculated.

Field system blanks will be analyzed to check for contamination of the sampling apparatus (e.g., probe and sampling syringe). A sample will be collected using standard sampling procedures, but without putting the probe into the ground. The results will be compared to those obtained from a concurrently analyzed ambient air sample. If field system blanks detect target compounds at concentrations that indicate equipment contamination or concentrations that exceed normal background levels (ambient air analysis), corrective actions will be taken. If the problem cannot be corrected, an out-of-control event will be documented in the field log book. Field system blanks will be performed after any probe decontamination event.

A reagent blank will be performed to ensure that the solvent used to dilute the stock standards is not contaminated. Analytical instruments will be calibrated daily using fresh working standards made from National Institute of Sciences and Technology traceable standards and reagents blanked solvents.

Quantitative precision will be assured by replicating analysis of 10 percent of the samples. Replicate analysis will be performed by subsampling vapors from the same sampling syringe.

The injector port septa through which samples will be injected into the GC will be replaced daily to prevent possible gas leaks from the chromatographic column. All sampling and subsampling syringes will be decontaminated after each use and will not be reused until they have been decontaminated by washing in anionic detergent and baked at 90°C.

4.4.7 Background Radiological Samples

Radiological contamination at the Li Tungsten Site consists of naturally occurring radioactive materials (NORM). Members of the thorium and uranium series have been found in the soil and residual slag at the site. Samples collected as part of the remedial investigation will be analyzed at a non-RAS laboratory for several radionuclides, all of which are found in the environment as components of natural background radiation. These radionuclides include isotopes of uranium, thorium, and radium. Since the radionuclides are not anthropogenic, matrix-specific background concentrations must be established to determine the magnitude of contamination and for risk assessment calculations.

A minimum of five soil samples will be collected from on-site areas (e.g., boundary areas in Parcel B and Parcel C) which do not exhibit elevated exposure rates or at off-site locations to determine the background concentrations. Two groundwater and up to two surface water background samples will be collected. Background sample results will be compared to published literature values to confirm that they were collected in areas free of contamination. If another surface water body cannot be located in the vicinity of the site, surface water sample results from the Parcel B pond will be compared to available data in the literature.

Background concentrations of radionuclides will be used to evaluate the ingestion and inhalation exposure pathways in the risk assessment. External gamma radiation is another exposure pathway that will be evaluated in the risk assessment. Background exposure rate will be determined by making a series of measurements at locations near, but not part of, the Li Tungsten Site.

4.5 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 designation which identifies the project site. For this project, the two letter designation will be LT.

- Sample Type: The second component, which identifies the sample type or event, will consist of a two or three letter code as follows:

  SG- Soil Gas Samples

  SB - Subsurface Soil Samples

  SS- Surface Soil Samples

  GW - Groundwater Samples

  SW- Surface Water Samples

  SED- Sediment Samples

  BM- Building Material Samples

  TR- Tank Residue Samples

  TM- Tank Material Samples

  RT- Radon/Thoron Samples

- Sample Location: The third component either identifies the sample location or identifies the sample as a trip blank or field blank. The monitoring well numbers, soil boring numbers, and test pit numbers will be used to identify groundwater, and subsurface soil 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 blank.

- Sample Identification: The fourth component will be used for split spoon samples, test pit samples, trip blanks, and field blanks as described below:

  Split Spoon/Test Pit Samples: A two-digit number will be used to indicate the interval (feet below ground) from which the sample was collected.

  Trip Blanks and Field 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:

LT - SB - MP19D-8:	Split spoon soil sample collected from monitoring well location MP19-D, at a depth 8 feet below grade.
LT - SB - TP2 - 4:	Test pit soil sample collected from test pit TP-2 at a depth of four feet.
LT - GW - FB-02:	The second field blank collected during the groundwater 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 will be followed by the field team to achieve the necessary data quality objectives.

5.2 MOBILIZATION AND DEMOBILIZATION

5.2.1 Overview

This subtask will consist of field personnel orientation, equipment mobilization, on and off-site 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 facilities in areas subject to intrusive sampling will be marked by the concerned utilities. Notification of the utilities may be accomplished by notifying the Underground Location Service by phone at 1-516-661-6000 prior to implementation of intrusive field work.

5.2.2 Equipment Mobilization

Equipment mobilization will entail securing all sampling equipment needed for the field investigation. Equipment not available at any of Malcolm Pirnie's facilities will be ordered, purchased, and if necessary, fabricated. A check of available equipment at the ARCS equipment facility will be conducted prior to initiating field activities. Any equipment that is needed but not available in the ARCS inventory will be secured after notification to and approval by the USEPA WAM. Equipment mobilization may include (but will not be limited to) sampling equipment, drilling subcontractor equipment, health and safety decontamination equipment, and field office trailer utility hookups.

5.2.3 Field Reconnaissance

5.2.3.1 Health & Safety Survey

To determine if a chemical hazard exists on the site, a survey will be conducted using an HNu or OVA (organic vapors), and a Miniram (respirable dust meter). 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 mark and number the location, (by driving a numbered stake in the ground or spray painting asphalt/concrete surfaces), record the stake number, and record the reading in the field book. If the initial survey determines that there may be a hazard, the USEPA WAM will be notified immediately.

5.2.3.2 Stage Ia Archaeological Survey

A Stage Ia Archaeological Survey was completed in February 1995 (Malcolm Pirnie, 1995) principally to evaluate the potential architectural significance of site buildings that could be affected by site activities during the Interim Remedial Actions (IRA). Secondary considerations included identification of potential archeological resources at the site and to recommend further investigations, if necessary, prior to the initiation of IRA and RI/FS field activities.

Based on the results of the Stage Ia survey, it is unlikely that any activities related to the IRAs or the RI/FS will disturb or destroy possibly significant archeological or architectural resources. Potential archeological and architectural resources were identified, however, that may warrant further investigation prior to remedial construction activities if large scale ground disturbance or building demolition is planned.

5.2.3.3 Human Population and Land Use

A field reconnaissance will be conducted within the limits of the site, and in the general site area to ascertain the proximity to, and likely human contact with contaminated media. In addition, local demographic and land use data will be compiled from previous studies and available data bases for the purpose of the site health risk assessment. Information on the size, location, and characteristics of the human population living within a one-half to three-mile radius of the site will be collected from U.S. Census Bureau reports and/or Nassau County Planning Board computer files and reports.

5.2.4 Location of Sampling Points

Preliminary locations for the surface soil samples, sediment samples, exploratory and monitoring well soil borings, test pits, soil gas survey, and new groundwater monitoring wells will

be staked. These locations will be measured from existing landmarks and provisions will be made to accommodate activities currently in progress. Proposed sampling locations are presented in Figures 4-1 through 4-8. The locations will be modified as required should subsequent information show that staked areas are unsuitable.

5.2.5 Support Facilities

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

- Field office trailer with necessary utility hookups
- Temporary decontamination pad
- Staging area for equipment, supplies, and drums of investigation derived waste materials
- Portable Wind Vane/Anemometer - A portable wind vane/anemometer will be set up on-site during the intrusive phases of the RI to determine the prevailing wind direction and speed.

The location of the above listed facilities will be reviewed with the USEPA WAM prior to mobilization.

5.2.6 Demobilization

5.2.6.1 Equipment Demobilization

Equipment will be demobilized at the completion of each phase of field activities as necessary. Equipment to be demobilized 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.

5.2.6.2 Groundwater Disposal

Groundwater extracted during the well development and purging may be disposed of by several methods. The selected method will depend on the anticipated yield of the wells, which will be estimated based on the results of the slug tests performed on each well, and the water quality, which will be based upon at least one round of groundwater sampling. The groundwater may be

pumped into tankers for characterization and transport to an appropriate disposal facility. For each type of waste (e.g., hazardous, non-hazardous, radioactive) scheduled for disposal, the appropriate disposal facility will be contacted to determine waste characterization requirements for compliance with the license of that facility.

A temporary SPDES permit may be obtained from the NYSDEC to discharge the pumped water directly to the ground or into a surface water body. Some treatment prior to discharge may be recommended depending on the chemical and radiological quality of the groundwater. Information gained from treatment during well development and purging could provide valuable information for screening alternatives during the FS.

5.2.6.3 Waste Disposal

The disposal of drummed drill cuttings, decontamination liquids, and health and safety equipment will be completed by a subcontractor. The subcontractor will also be responsible for the off-site disposal of any hazardous wastes generated during the RI. For each type of waste (e.g., hazardous, non-hazardous, radioactive) scheduled for disposal, the appropriate disposal facility will be contacted to determine waste characterization requirements for compliance with the license of that facility. Appendix A provides USEPA's guidance document, which will be followed, on the Management of Investigation - Derived Wastes (IDW).

5.3 AIR MONITORING

5.3.1 Monitoring Objectives

Air monitoring will be conducted during field operations to measure levels of volatile organic vapors, combustible gases, respirable dust, and radiation. The purpose of the air monitoring is to evaluate contaminant levels in the breathing zone to select appropriate personal protective equipment, and to measure any exposure of workers to radiation, as described in the Site Health and Safety Plan (SHSP).

5.3.2 Required Equipment

- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)

- MSA Model 261 Combustible Gas Meter
- Ludlum micro-R detector
- MIE, Inc., Miniram Model PDM-3 (Miniram)
- Field notebook and pen

In addition, a portable wind vane/anemometer will be set up during intrusive sampling phases of the RI to provide data on the wind direction and speed.

A baseline emission estimate of volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs) will also be performed, and the estimates will be input into the USEPA screening atmospheric dispersion model (SCREEN) to determine the maximum anticipated contaminant concentrations. These data will then be used for comparison with the chemical specific ARAR's for the contaminants.

5.3.3 Monitoring Procedures

During field activities, air monitoring will be conducted in the workers' breathing zone and at the sampling locations. An HNu or OVA will be used to measure levels of volatile organic vapors, the combustible gas meter will be used to measure explosive gases, and the Miniram will be used to measure dust during drilling operations. The direction of wind movement will be recorded by observing the wind vane located on the site. For each measurement, the date, time, location, instrument readings, and wind direction will be recorded in a field notebook.

Should the level of organic vapors, or dust reach the action level for upgrade of personal protective equipment, the Site Health and Safety Officer will order the upgrade or bring activities to an immediate halt. Further detail regarding health and safety issues may be found in the Site Health and Safety Plan (SHSP).

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

5.4 SURFACE AND SUBSURFACE FEATURES INVESTIGATION

5.4.1 Surface Features Investigation

5.4.1.1 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. Particular attention will be given to features that identify potential contaminant sources (e.g., buildings, underground storage tank vent pipes, and other structures), the migration routes of contaminants, and the location of potentially affected receptors. An assessment of surface cover and associated areas will also be made. Access to monitoring wells, test pit locations, and exploratory soil boring locations will also be investigated. A topographic map will be prepared which will show the location and elevations of the surface features (including monitoring wells).

5.4.1.2 Required Equipment

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

- 300-foot tape measure
- 35mm camera
- Field notebook and pen
- Site base map
- Sighting compass
- Flagging tape

5.4.1.3 Investigation Procedures

Personnel will examine areas adjacent to the site for potentially affected receptors such as surface water bodies, residences, and recreation areas. Personnel will photograph notable features and mark them in the field on appropriately scaled maps (using a compass and tape measure) and/or flagging them for subsequent surveying.

All existing monitoring wells will be surveyed (at a permanently marked reference point on the inner well casing) to verify previous survey data. All new monitoring wells installed during the RI will also be surveyed and this information will be incorporated on an updated topographic base map of the site.

5.4.2 Subsurface Features Investigation

In addition to the surface features investigation discussed above, a subsurface features investigation is proposed for all four parcels of the site. Field activities associated with the subsurface features investigation include a magnetometer survey, an electromagnetic (EM) survey, and a storm sewer inventory.

5.4.2.2 Required Equipment

The following equipment will be required to perform the subsurface features investigation:

- Brunton compass
- Surveying stakes
- Permanent markers
- Flagging tape
- 100-foot tape measure
- Field notebook and pen
- EG&G Model G-856 Proton Precession Magnetometer
- Site map showing potential storm drain locations
- Geonics EM 34-3 or equivalent

5.4.2.3 Magnetometer and EM Survey Procedures

A magnetometer and EM survey will be conducted on each the four parcels. Since portions of the site are inaccessible due to existing structures, a field determination will be made regarding where the survey can be conducted. Once the survey areas are selected, a determination will be made regarding where the magnetometer survey and EM survey will be performed. The magnetometer survey will be conducted in areas of the site that do not have interfering structures (e.g., buildings, steel tanks, drums, reinforced concrete slabs). Procedures detailing the use of the EG&G Model G-856 Proton Precession Magnetometer are outlined in SOP-20 found in Appendix C. The EM survey will be conducted at locations that may not be suitable for magnetometry. Both surveys will be conducted by establishing grids in each of the areas selected for surveying. The grids will be established on two baselines, one oriented north-south and the other oriented east-west. The endpoints of the baselines will be marked by driving wooden stakes nearly to grade. Markers will be placed at 10-foot intervals along the baselines. A 100-foot tape measure will be oriented north-south from the baseline, creating a traverse line. Data will be collected along the traverse lines at 10-foot intervals.

The magnetometer and EM surveys will be conducted by a field team member who is free of any magnetically detectable material. The operator of the magnetometer and EM will walk along the north-south traverse lines, collecting data at the marked 10-foot intervals. The instrument will be

placed at each grid location with the sensor oriented properly to the north, and an instrument reading will be collected. The instrument data will be transferred to a floppy disk in a format compatible with an IBM PC.

To identify potential magnetic drift, a base (background) station will be established at a convenient location that will not be influenced by nearby magnetic anomalies. A reading on both instruments will be collected at the base station three times a day. This information will be used to apply a drift correction to the data. Interference from surface metal, fences, power lines, and other background sources will be noted in the field notebook, and taken into consideration during data reduction and interpretation. The data generated from both instruments will be reduced, corrected for diurnal variations (if necessary), plotted on a site map, and contoured. The contour map will be interpreted by a geologist and a map will be generated showing the location of target areas.

5.4.2.4 Storm Sewer System Inventory

An inventory of mapped or visible storm sewer drains, including building drains, will be conducted throughout the site. The location and elevation of the storm sewer system and drains will be obtained from available records of previous storm water discharge permits and from Nassau County Department of Public Work records. A field reconnaissance will then be conducted to verify this information, and to confirm active discharges from the identified outfalls. This inventory will be used to identify potential contaminant routes to the Glen Cove Creek and to identify cracked or disconnected pipes which may represent a potential contaminant source to groundwater. The approximate storm sewer outfall locations are shown on Figures 4-3 and 4-4.

5.5 SOIL GAS SURVEY

5.5.1 Objectives

A soil gas survey will be conducted at fifty on-site locations. This survey will be conducted to further delineate the extent, and the migration pattern of the VOC groundwater plumes previously identified (NUS, 1990) on Parcels A, B, and C. Based on the findings of the soil gas survey, additional soil borings and shallow monitoring wells may be required. The proposed soil gas survey locations are shown on Figure 4-1.

5.5.2 Sampling Equipment

The following equipment (or equivalent) will be needed to conduct the soil gas survey:

- Field notebook and pen
- 35mm camera
- Carrier vehicle with percussion hammer and hydraulics
- Field portable gas chromatograph equipped with an electrolytic conductivity detector (ELCD) or electron capture detector (ECD) and computing integrator (or equivalent)
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp or equivalent
- Foxboro Organic Vapor Analyzer (OVA 128) or equivalent
- Site map
- 100-foot tape measure
- Rotary hammer to drill through asphalt/concrete
- Slam bar
- Stainless steel soil gas probes with detachable drive tips
- Sample syringes
- Clear teflon tubing
- Tubing fasteners (stainless steel or teflon)
- Vacuum pump
- Chain-of-Custody forms
- Personal protective equipment
- Miscellaneous hand tools

5.5.3 Procedures

The soil gas survey will be performed by a subcontractor. Procedures outlined in this FSP are consistent with industry standards, however, they may be modified based on the selected subcontractor and the specific equipment they have available. Deviations, if any, from the procedures outlined in this FSP will be described using the Field Variance Report. Each soil gas survey location will first be located and labeled with the correct identification number. All components of the soil gas system (e.g., probe, tubing, fasteners) that come into contact with the sample shall be made of an inert material (e.g., stainless steel or teflon). At each soil sampling point, the soil gas probes will be driven into the soil using a truck-mounted hydraulic ram, a hand-held percussion hammer, or a slam bar. The probes will be installed to an approximate depth of three to five feet below ground surface. The aboveground end of each probe will be fitted with a reducer (manifold) and a length of polyethylene tubing leading to a vacuum pump. Once set-up has been completed, probe purging and sample volume calibrations will be performed. Optimal purge volumes are assessed by performing time-series sampling of at least one probe to evaluate trends in soil gas concentrations as a function of purge volume.

Soil gas samples will be analyzed in the field immediately after collection by direct gas injection into a laboratory-grade, field-operable gas chromatograph equipped with an electrolytic conductivity detector (ELCD) or electron capture detector (ECD), a photoionization detector (PID), and a flame-ionization detector (FID). Target compounds that will be used as indicators of general volatile contamination are listed in Section 4.3.2. Retention times of observed peaks will be compared to the retention times of calibrated standards. Compounds will be identified and quantified on the basis of this comparison. Compounds that are not identified will be designated unknowns and reported according to the response of benzene. A discussion of the soil gas sampling quality assurance/quality control procedures is presented in the QAPjP.

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

- Name and location of job
- Sample identification number
- Weather conditions
- Date of sample collection
- Description of sampling location

5.6 SOIL BORING AND SPLIT-SPOON SAMPLING PROCEDURES

5.6.1 Overview

A total of 79 soil borings will be drilled at various locations throughout the site. Sixty-three of the soil borings will be exploratory and will include: 28 source area soil borings, 20 radiological soil borings, and approximately 15 storm sewer soil borings. The exact number of storm sewer borings may vary, however, the final number of storm sewer soil borings will be determined during the storm sewer inventory. The remaining ten soil borings will be drilled during the installation of the new monitoring wells.

Of the 28 source area soil borings, eight will be located on Parcel A, twelve will be located in the Parcel B Disposal Area, three will be located in the northwest corner of Parcel C, and five will be located in the southern portion of Parcel C. These borings will be used to assess the presence, nature and extent of contamination in the vadose zone, to further characterize site stratigraphy, and to collect split-spoon samples for chemical, radiological and physical properties analysis. The borings on Parcel B will also be used to provide detailed information on the vertical limits of the buried waste.

The 20 radiological soil borings will be drilled at locations that exhibit elevated gamma readings. These borings will be used to determine the depth and extent of radiological contamination in the on-site soil. Approximately 15 storm sewer borings will be drilled adjacent to the storm drain

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system. These borings will be used to determine if the storm sewer system functions as a migration pathway and contaminant source to the groundwater and Glen Cove Creek.

The sixteen monitoring well borings will be used for the installation of monitoring wells, for assessing the presence, nature and extent of contamination in the vadose zone, to characterize site stratigraphy, and to collect split-spoon samples for chemical, radiological and physical property analysis. When cluster wells are being installed, soil samples will only be collected from the deeper boring.

5.6.2 Required Equipment

The following equipment is needed to drill soil borings and to collect split spoon soil samples for analysis:

- Truck-mounted hollow stem auger drilling rig
- Decontaminated three-inch diameter, two foot long stainless steel split-spoons
- Decontaminated stainless steel trowels, scoops and bowls
- Sample containers (see Table 6-2)
- Coolers and ice
- HNu Systems, Inc., PI-101 photoionization detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)
- Geiger Mueller (GM) pancake detector and ratemeter
- Personnel protection equipment
- Field notebook and pen
- Camera
- Roll of polyethylene sheeting
- Glass jars for archiving samples

5.6.3 General Procedures

Prior to drilling the soil borings, each location will first be located and labeled with a soil boring identification number. A truck mounted drill rig with hollow stem augers will be used to drill the borings. The drilling platform, augers, drill rods, and any other drilling equipment that will enter the hole will be decontaminated by steam cleaning before drilling each borehole. Decontamination water will be collected in a polyethylene lined area and pumped into DOT approved 55-gallon drums or to a tanker for temporary on-site storage. All sampling equipment such as split-spoons, trowels, scoops and bowls will be decontaminated as described in Appendix D.

Split-spoon soil samples will be collected in accordance with ASTM Standard D 1586-84, and will be used to estimate the in-situ consistency of the soils. A two-inch diameter stainless steel split-

spoon sampler will be driven by dropping a 140-lb hammer from a height of 30 inches. If necessary, a 300 pound hammer and three-inch O.D. stainless steel split-spoon sampler will be used for better soil penetration and soil volume recovery. The number of blows required to advance the sampler each six inches will be recorded.

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 or borehole.

5.6.3.1 Source Area Soil Boring and Monitoring Well Boring Sampling Procedures

Continuous split-spoon soil samples will be collected at two foot intervals from the ground surface to the water table. As each split-spoon is retrieved, it will be opened and laid on a piece of clean polyethylene sheeting dedicated to each split-spoon. Field personnel will screen the sample for organic vapors by passing the HNu or OVA probe over the length of the sample. Field personnel will also screen the sample for radiation by passing a GM pancake detector and ratemeter over the length of the sample. An aliquot from all split-spoon soil samples will be collected immediately (prior to homogenization), placed in two 40-ml VOA vials, and placed in a cooler at 4°C and held for possible laboratory analysis. Remaining 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 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 of the HNu or OVA. The samples to be sent for laboratory analysis will be selected based upon headspace readings, radiation readings, and/or visible evidence of staining. The samples exhibiting the greatest evidence of contamination will be sent to the laboratory for analysis. A minimum of two samples will be collected from each boring; however, the actual number of samples may increase based upon field conditions. If no evidence of contamination is present, one sample collected from six to 12 inches below ground surface, and one sample collected from six to 12 inches above the water table will be sent for laboratory analysis. All non-volatile soil samples selected for laboratory analyses will be homogenized using the technique described in SOP MP-FPQA-004 contained in Appendix C, and will be placed in coolers and packed with ice and be maintained at 4- C.

All soil sample fractions will be collected in the following order:

- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- TOC
- pH
- Radionuclides

Soil samples which are not submitted for laboratory analysis will be archived and kept on-site. Excess soils will be placed in DOT-approved 55-gallon drums along with other drill cuttings and will be held in a staging area for eventual disposal. Photographs will be taken of the soil samples. Each photograph will include a card showing the site name, sample identification number, date, and a reference scale.

5.6.3.2 Storm Sewer Soil Boring Sampling Procedures

One soil sample will be collected from each of the borings drilled adjacent to the storm sewer system. The sample will be collected at a depth of one foot below the invert elevation of the storm sewer pipes. Since very little information is available regarding the storm sewer system, a full inventory of the system will be conducted prior to sampling. This information will be used to determine sample locations and to determine the expected depth of the boring. Procedures identical to those described in section 5.6.3.1 will be used to preserve, collect and determine which samples will be sent for analyses. All non-volatile soil samples selected for laboratory analyses will be homogenized using the technique described in SOP, MP-FPQA-004 contained in Appendix C, and will be placed in coolers and packed with ice and be maintained at 4° C.

All soil sample fractions will be collected in the following order:

- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- TOC
- pH
- Radionuclides

Soil samples which are not submitted for laboratory analysis will be archived and kept on-site. Excess soils will be placed in DOT-approved 55-gallon drums along with other drill cuttings and will be held in a staging area for eventual disposal. Photographs will be taken of the soil samples. Each photograph will include a card showing the site name, sample identification number, date, and scale for comparison.

5.6.3.3 Radiological Soil Boring Sampling Procedures

Continuous split-spoon soil samples will be collected at two foot intervals from the ground surface to 15 feet below grade. As each split-spoon is retrieved, it will be opened and laid on a piece of clean polyethylene sheeting dedicated to each split-spoon. Field personnel will screen the sample for radiation by passing a GM pancake detector over the length of the sample. The samples exhibiting evidence of elevated radioactivity will be sent to the laboratory for analysis. In addition, a sample will be collected from the split-spoon retrieved immediately after a split-spoon which showed evidence of elevated radioactivity, and sent to the laboratory for analysis. Samples collected from these borings will be only be analyzed for radionuclides. All soil samples selected for radiological analyses will be homogenized using the technique described in SOP, MP-FPQA-004 contained in Appendix C, and will be placed in coolers and packed with ice and be maintained at 4°C.

Soil samples which are not submitted for laboratory analysis will be archived and kept on-site. Excess soils will be placed in DOT-approved 55-gallon drums along with other drill cuttings and will be held in a staging area for proper disposal. Photographs will be taken of the soil samples. Each photograph will include a card showing the site name, sample identification number, date, and scale for comparison.

5.6.3.4 Physical Properties Sampling Procedures

Twenty-six soil samples representing each of the lithologies encountered will be collected from various soil borings across the site and tested for physical properties at an approved laboratory. Ten samples will be collected from the source area soil borings. Sixteen additional samples will be collected from the monitoring well borings. If clay beds thicker than two feet are encountered, undisturbed samples will be collected from the next deeper sample for laboratory analysis of vertical hydraulic conductivity using a Shelby tube sampler. All soil samples selected for physical properties analysis (except vertical hydraulic conductivity), will be homogenized using the technique described in SOP, MP-FPQA-004 contained in Appendix C, and will be placed in coolers and packed with ice and be maintained at 4°C. Laboratory testing will augment the visual classification of the soil and characterize the material according to the following physical properties:

- Grain size distribution
- Moisture content
- Bulk density
- Atterberg limits
- Hydraulic conductivity (if Shelby tubes are collected)

5.6.3.5 TCLP Parameters Sampling Procedures

Additional soil samples from the source area soil borings and the storm sewer borings will also be collected and sent for TCLP parameters analysis. Field personnel should follow the sample collection and preservation procedures described in Section 5.6.3.1 while collecting the samples for TCLP parameter analyses. The source area soil borings are located in four distinct areas (i.e., the Parcel B disposal area, the northwest corner of Parcel C, the southern portion of Parcel C, and Parcel A). The storm sewer borings are all located adjacent to the storm sewer system. The soil sample(s) exhibiting the highest HNu or OVA and/or GM pancake detector reading of all soil borings in each source area and of all storm sewer borings will be sent for TCLP analysis. If the same sample has the highest reading for both volatile organic compounds and radiation, then only one sample will be collected for TCLP analysis from that area. If different waste types are encountered in the exploratory soil borings in any of the source areas, a sample of each waste type will be sent for analysis. If none of the samples in a source area soil boring exhibits evidence of contamination, the sampler will choose the sample to be sent for analysis. The TCLP VOA sample will be collected immediately from the center of the bucket, and placed in two 40-ml VOA vials. Soil samples selected for non-volatile TCLP laboratory analyses will be homogenized using the technique described in SOP, MP-FPQA-004 contained in Appendix C, and will be placed in coolers and packed with ice and be maintained at 4 C.

5.7 TEST PIT SAMPLING PROCEDURES

5.7.1 Objectives

Six test pits will be excavated around the disposal area on Parcel B to provide detailed information on the vertical limits of the buried waste in the disposal area and to collect soil samples for chemical and radiological analysis. Proposed test pit locations are shown in Figure 4-6.

5.7.2 Required Equipment

The following equipment is needed to excavate test pits and to collect soil samples for analysis:

- Backhoe
- Decontaminated stainless steel trowels, scoops and bowls
- Sample containers (see Table 6-2)
- Coolers and ice

- HNu Systems, Inc., PI-101 photoionization detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)
- Geiger Mueller (GM) pancake detector and ratemeter
- Personnel protection equipment
- Field notebook and pen
- Camera
- Roll of polyethylene sheeting
- Glass jars for archiving samples

5.7.3 Sampling Procedures

Each location will first be located and labeled with the test pit identification number. At each test pit location, a subsurface features investigation will have previously been conducted. If the magnetometer or EM survey indicates the presence of buried ferrous material, the test pits will be located to avoid this material. A backhoe will be used to excavate the test pit. The backhoe bucket and any other equipment that will enter the hole will be decontaminated by steam cleaning prior to excavation and between test pits. Sampling equipment such as stainless steel trowels, scoops, and bowls will be decontaminated as described in Appendix D. The backhoe will excavate the test pit in one foot lifts of approximately two feet wide by ten feet long. The length of the trench will be excavated by collecting not more than one bucket of soil per lift. Each bucket will be screened for visible evidence of soil staining, for VOCs with an HNu or OVA, and for radiological contamination with a GM pancake detector and ratemeter prior to being deposited on polyethylene sheeting dedicated to each bucket. A VOA sample will be collected immediately from the center of the bucket and placed in two 40-ml VOA vials. The vials will be placed in a cooler at 4°C and held for possible laboratory analysis. A sufficient volume of sample will also be collected from the bucket and placed into a stainless steel bowl for headspace screening and subsequent CLP and non-RAS analysis prior to depositing the soil onto polyethylene sheeting. The stainless steel bowl will be sealed with aluminum foil, taped, and allowed to stand for one-half hour 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 of the HNu or OVA. The samples to be selected for laboratory analysis will be based on the headspace reading, the radiation reading, and/or evidence of staining once the samples for analysis have been selected. The procedure for homogenization of non-volatile samples as described in SOP MP-FPQA-004 (Appendix C) will be used. A minimum of one sample will be collected from each test pit for analysis; however, the actual number of samples may increase based on field conditions. If no evidence of contamination is apparent, one sample will be collected from the test pit at a depth determined by the sampler. Soil

samples that are not submitted for laboratory analysis will be archived and kept on-site. All soil sample fractions will be collected in the following order:

- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- TOC
- pH
- Radionuclides

Two composite soil samples will also be sent for TCLP analysis. The samples will be composited from visually similar waste/strata encountered in the test pits. For example, if visually similar waste is encountered in three of the test pits, a sample will be collected from each of these three pits, and the three grab samples composited to form one sample. To minimize the potential of off-gassing, each test pit sample will be collected and held in sealed containers with zero headspace, placed in a cooler, and maintained at 4°C, until all three samples are collected. Then an aliquot of each sample will taken to form one sample. This is being done to control analytical costs. If similar waste is encountered in all six of the test pits, one composite sample will be formed from samples from three of the pits, and the second composite sample be formed from samples from the remaining three pits. If similar material is not encountered in the pits, the number of composite samples may increase.

Prior to excavating each subsequent one foot layer, a geologist will log the test pit wall, look for visual evidence of contamination, and screen the test pit for the presence of organic vapors and radiation. Should organic vapors, radiation, or contamination be detected in a shallow (less than four feet) test pit, the sampler may take the sample directly from the test pit using a decontaminated stainless steel towel. Direct sampling will not be conducted more than four feet below the ground surface because personnel are not permitted to enter an unshored trench greater than four feet deep. As necessary, the length of each successive layer excavated will be tapered to provide trench stability and reduce the amount of soil excavated. The following parameters will be used to determine the final depth of each test pit:

- Once a soil layer one foot below the bottom of deposited waste has been exposed and sampled, the test pit will be completed.

- Test pits will not be excavated below the water table. Once the water table has been reached, the test pit will be completed.

- The soil borings in the Parcel B disposal area will be utilized to obtain information regarding the depth of the waste. Once this depth is reached without encountering waste, the test pit will be completed.

At each sample location, the following information will be recorded in the field book:

- Name and location of job.
- Sample identification numbers.
- Date of sampling.
- Method of sample acquisition.
- Soil description.
- Photograph numbers.

Photographs will be taken of all soil samples. Each photograph will include a card showing the site name, sample identification number, date of collection and a reference scale for comparison. Before backfilling, all significant features exposed by the test pit will also be photographed. These photographs will also include the site name, test pit number, depth, description of feature, date and a reference scale.

Four foot high temporary fences will be installed around all excavation areas to prevent accidental entry if the hole should remain open overnight. All test pit excavations will be backfilled prior to a weekend or extended holiday.

5.8 COLLECTION OF SURFACE SOIL SAMPLES

5.8.1 Sampling Objectives

Fifteen surface soil samples will be collected to assess the potential for dermal/inhalation pathways associated with surface soil contaminants. Three surface soil samples will be collected on Parcel A, four surface soil samples will be collected on Parcel B, five surface soil samples will be collected on Parcel C, and three surface soil samples will be collected from Parcel C'. The proposed surface soil sampling locations are shown in Figure 4-2.

5.8.2 Sampling Equipment

The following equipment will be needed to collect surface soil samples for analysis:

- Decontaminated stainless steel trowels, scoops, and bowls
- Sample containers (See Table 6-1)
- Coolers and ice
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp

- Foxboro Organic Vapor Analyzer (OVA 128)
- Geiger Mueller (GM) pancake detector and ratemeter
- Personnel protective equipment
- Polyethylene sheeting
- Field notebook, sampling logs and pen
- Ruler

5.8.3 Surface Soil Sampling Procedures

The surface soil samples will be collected employing the methods described in SOP-4 presented in Appendix C, as appropriate. The sample fractions will be collected in the following order:

- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- Radionuclides

The sample bottles will be placed into coolers with ice and will be sent to the laboratory for analysis. Sample handling procedures are detailed in Section 6. Data to be recorded in the field logbook will include the following:

- Name and location of job
- Sample identification number
- Method of sample collection
- Weather conditions
- Date of sample collection
- Organic vapor levels
- Radiation levels
- Type of analysis
- Description of sampling location

5.9 MONITORING WELL INSTALLATION AND DEVELOPMENT PROCEDURES

5.9.1 Objectives

Monitoring wells will be installed for the purpose of collecting groundwater samples for chemical and radiological analysis, measuring groundwater elevation to supplement existing data on groundwater movement, to conduct aquifer testing to estimate the upper glacial aquifer hydraulic characteristics, and to delineate the top of the clay confining unit. Three well clusters (two upgradient of the site and one downgradient of the site) are proposed and each will consist of a shallow and deep well. In addition, four deep wells are proposed at various locations throughout the site to further

define the depths and extent of the clay unit beneath the site. Finally, one shallow well (upgradient of the site and downgradient of the Mattiace property) will be installed. Additional shallow monitoring wells may be required as a result of the soil gas survey. Proposed monitoring well locations are shown on Figure 4-5. All monitoring wells will be drilled using a truck-mounted hollow stem auger drilling rig.

5.9.2 Required Equipment

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

- Truck-mounted hollow stem auger drilling rig
- Four-inch diameter Schedule 40 PVC flush-joint casing pipe, with threaded cap.
- Four-inch diameter, 10-foot long Schedule 40 PVC screen with bottom cap.
- Clean, Morie No. 0, No. 1, and No. 2 sand, filter pack material
- Bentonite pellets
- Bentonite-cement grout
- Eight-inch diameter protective steel casing with locking cap
- HNu Systems, Inc., PI-101 photoionization detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)
- Geiger Mueller (GM) pancake detector and ratemeter
- Personnel protection equipment
- Surge block and/or submersible pump
- Portable Turbidimeter
- pH meter (Orion SA 250)
- Temperature/conductivity meter (YSI Model 33)
- Field notebook and pen
- Camera
- Roll of polyethylene sheeting
- Glass jars for archiving samples

5.9.3 General Procedure

A geologist will be in the immediate vicinity of drilling operations when drilling is being performed. The site-specific procedures for the installation of the deep and shallow wells are detailed in Section 5.9.4 and 5.9.5, respectively.

Monitoring well locations will first be staked and labeled with their respective identification number. A truck mounted rig equipped for hollow stem auger drilling will be used to drill the borings. Conditions encountered in the field may necessitate changes in the proposed drilling methods. The drilling rig platform, auger flights, drill rods and any other drilling equipment that will enter the borehole will be decontaminated by steam cleaning before drilling the first borehole and in between each succeeding borehole. Decontamination water will be collected in a polyethylene-lined

depression and pumped into 55-gallon drums or a tanker for temporary storage on-site. Sampling equipment, such as split-spoons, trowels, scoops and bowls will be decontaminated as described in Appendix D.

The monitoring wells will be fitted with locking, steel protective casings (flush-mount or stick-up type), set in concrete well aprons, with a surveyor's pin embedded in them. Following installation, a survey will be performed to determine the elevations of the tops of well casings, caps, and surveyor's pins relative to Mean Sea Level (MSL) datum. The locations of the new wells will also be surveyed and tied to the USGS datum using a bench mark located in the vicinity of the site.

5.9.4 Deep Monitoring Well

The deep monitoring wells will be drilled to the top of the clay unit. The estimated depth to the clay unit across the site ranges from 50-100 feet below ground surface. An 8-inch diameter boring will be drilled from the ground surface to approximately five feet into the clay unit. The borehole into the clay will be backfilled with bentonite pellets to the top of the clay unit. Approximately one foot of clean silica sand filter pack will then be placed at the bottom of the borehole before installing the well. The well will be constructed of four-inch I.D. PVC flush-joint casing with a 10-foot long PVC screen. [Note: PVC well screens have been selected in preference to stainless steel for two technical reasons and one economic reason: 1) the principal contaminants of concern are metals and radionuclides which are compatible with PVC, 2) all existing on-site monitoring wells are constructed of PVC, therefore, groundwater data collected from the existing and proposed wells will be compatible with one another, and 3) cost savings.] Screen slot size will be determined in the field by the geologist based upon visual inspection of the grain size of the interval to be screened.

The well casing and screen material will be decontaminated by steam cleaning before installation in the borehole following the procedure outlined in Appendix D. The filter pack will be completed to a level of not less than one and no more than two feet above the screen. A two-foot thick bentonite pellet seal will be placed above the filter pack. Subsequently, a cement/bentonite grout slurry will be placed by tremie pipe above the bentonite seal to the level of the frost line and the remaining annular space will be sealed with expanding cement. There will be a 1/4-inch diameter hole drilled in the protective steel casing near the ground surface. A sloped concrete well apron will be formed around the casing. The PVC riser pipe will be completed with a threaded, flanged, or compression seal well cap and a 1/4-inch vent hole. A surveyor's mark will be placed at the top of the inner casing for use as a water level measuring point. Construction details for the deep monitoring well are shown in Figure 5-1.

5.9.5 Shallow Monitoring Well

An eight-inch diameter boring will be drilled for shallow monitoring well installation. The boring will be drilled to a depth (estimated at 15-25 feet below ground surface) so that the well screen will bridge the water table with four feet of the well screen set above the water table, and six feet of the well screen set below the water table. The well will be constructed as an overburden style well since it will not penetrate a confining layer. Well construction details are shown in Figure 5-1.

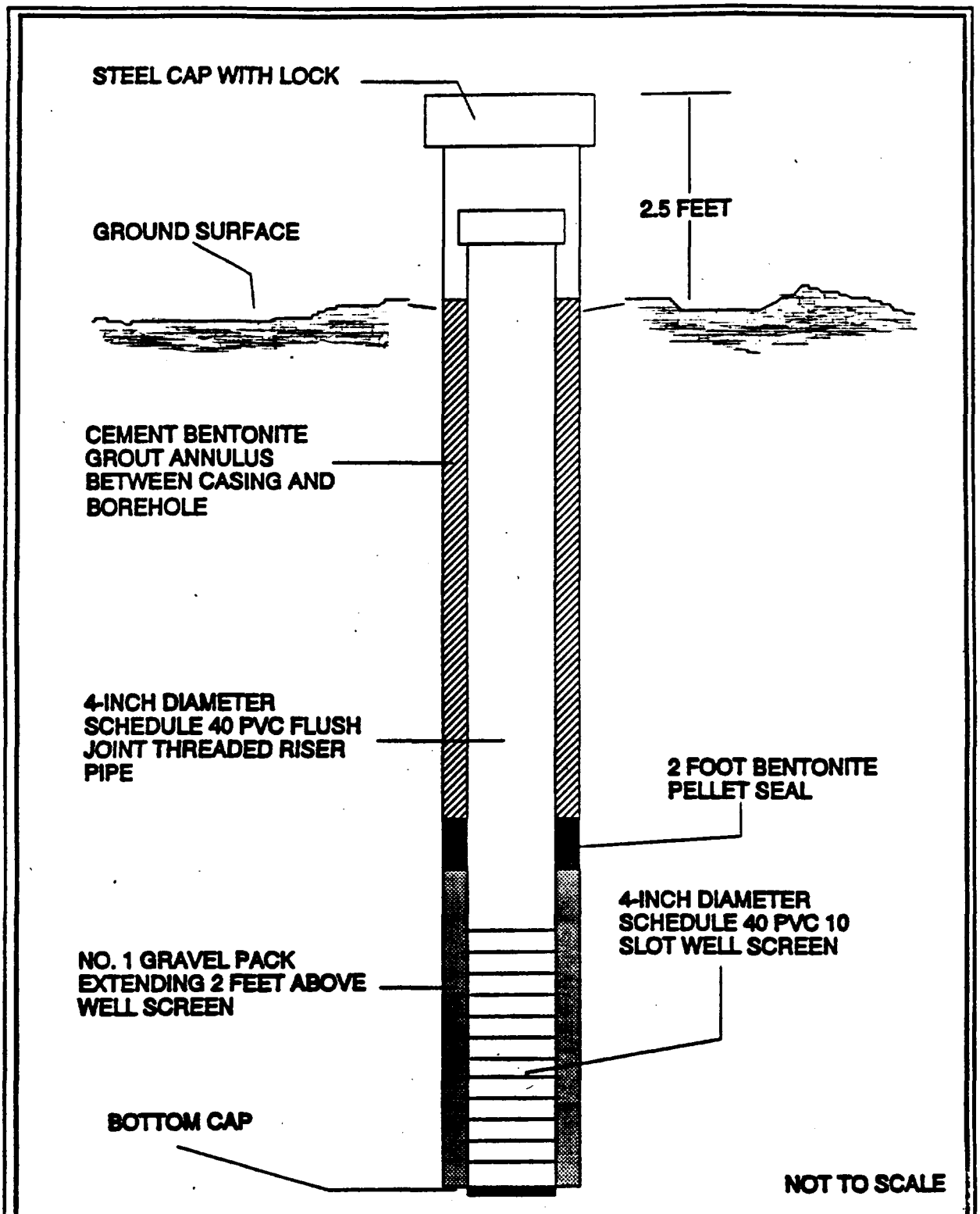
5.9.6 Geoprobe Location

One of the exploratory soil borings in the Parcel B Disposal Area will be selected for installation of one geoprobe. Selection of the geoprobe location will be based on the soil boring samples that exhibit the greatest evidence of contamination (e.g., HNu or OVA readings, radiation readings, or evidence of staining). If no evidence of contamination is present, one of the easternmost (i.e., closest to a potential offsite source of VOCs) borehole locations will be selected.

The equipment and methodology for installation of a geoprobe is similar to soil gas sampling, however, the probe is driven deeper to intersect the water table. A small-diameter probe and hollow tube will be driven into the soil using a truck-mounted hydraulic ram, a hand-held percussion hammer, or a slam bar. The probe will be installed to a depth of approximately three to five feet below the water table. Groundwater samples will be collected by lowering a small diameter bailer. The groundwater sample will be analyzed on a quick turnaround basis by a non-RAS laboratory for the parameters described in Section 4.3.6 of this FSP. Based on the analytical results of the groundwater sample and consultation with the USEPA WAM, the geoprobe location will either be converted into a permanent groundwater monitoring well, or the geoprobe will be removed and the borehole grouted.

5.9.7 Well Development

Well development improves the hydraulic connection between the well and the saturated zone and removes fine sediment from the well. Wells will be developed using the surge block and/or pumping techniques. The pump inlet will be located within the screened interval. All equipment placed into the well during development will be decontaminated before use following the procedures outlined in Appendix D. Development will continue for a minimum of one hour or until the discharge water has a concentration of 50 nephelometric turbidity units (NTUs) or less and the pH, temperature, and conductivity have stabilized to within 10% variation between measurements. 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 and less



MALCOLM PIRNIE

LI TUNGSTEN, GLEN COVE, LONG ISLAND, NY

TYPICAL MONITORING WELL CONSTRUCTION DETAIL

MALCOLM PIRNIE, INC

FIGURE 5-1

than 10 percent variation in specific conductivity, pH, and temperature measurements. These measurements will be monitored and recorded at approximately every half a well volume 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.

5.9.8 Disposition of Material Generated During Drilling

All decontamination solutions, drill cuttings, recirculation water and well development purge water resulting from the installation and development of monitoring wells, will be stored in DOT-approved 55-gallon drums or an on-site tanker. Cuttings and water will be stored in separate drums. Drums containing cuttings or water will be permanently numbered and labeled with the project site name, date and contents, and will be separated by boring location. The contents of the drums will be sampled prior to eventual disposal. The area for temporary storage will be determined before drilling begins. An approved subcontractor will complete the work necessary for the appropriate disposal of all investigation derived wastes (e.g., drummed water, drill cuttings and PPE). The method of disposal will be determined after soil and groundwater analytical results have been obtained. Additional soil analyses for TCLP may be required for disposal options. Appendix A provides USEPA's guidance document, which will be followed, on the management of Investigation - Derived Wastes (IDW).

5.10 WATER LEVEL MEASUREMENTS

5.10.1 Objectives

Synoptic water levels will be measured in the new monitoring wells, existing monitoring wells, selected off-site wells, and selected on-site surface water bodies (i.e., Mud Pond and the pond on Parcel B). As a result, staff gauges will be installed on the two on-site surface water bodies. The water level measurements will be collected to determine the direction of groundwater movement, vertical hydraulic gradient, seasonal or temporal fluctuation, and to evaluate the hydraulic connection between the groundwater and the surface water bodies. Synoptic water levels will be measured twice each month during field activities. This frequency should permit collection of sufficient data to determine seasonal average flow direction. Water levels will be measured with an electronic water level meter to an accuracy of 0.01 feet.

5.10.2 Required Equipment

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

- Electronic water level meter
- Wooden tape measure
- Field notebook and pen
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp or,
- Foxboro Organic Vapor Analyzer (OVA 128)
- Personal protective equipment

5.10.3 Measurement Procedures

5.10.3.1 Water Level Measurements in Wells

At each 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 or OVA and the reading recorded in the field notebook. The electronic water level meter probe will be slowly lowered into the well. When the probe enters the water a buzzer goes off. The depth to the water will be determined to the nearest 0.01 foot from a surveyed mark at the top of the inner PVC well casing.

The date, time, well number and depth to water will be recorded in the field notebook. The cable and probe of the water level indicator will be decontaminated between use at each well by washing with Alconox and tap water, followed by a deionized water rinse.

5.10.3.2 Water Level Measurements at Staff Gauges

One staff gauge will be installed in Mud Pond and one staff gauge will be installed in the pond on Parcel B. At each staff gauge, the distance from the surveyed mark at the top of the staff to the top of the surface water will be recorded, to the nearest 0.01 feet. The date, time, staff gauge number and depth to water will be recorded.

5.11 EVALUATION OF EXISTING ON-SITE WELLS

5.11.1 Objectives

The existing on-site monitoring wells will be inspected to evaluate their condition for collecting groundwater level and chemical data. In addition, a water supply well is present on the site

property. This well, which intersects the Lloyd aquifer, will also be visually inspected to evaluate its condition for collecting groundwater level and chemical data. This data can be used to supplement the data from the shallow monitoring wells. Existing on-site well locations are shown in Figure 4-5.

5.11.2 Required Equipment

The following equipment will be used to evaluate the monitoring wells:

- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp or,
- Foxboro Organic Vapor Analyzer (OVA 128)
- Personal protective equipment
- Field notebook and pen
- Camera
- Sounding equipment

5.11.3 General Procedures

Prior to sampling, all existing on-site monitoring wells and the on-site water supply well will be visually inspected and evaluated. The reported construction of each well will be compared to the construction specifications for the new monitoring wells. Each well will be sounded to confirm the depth of the well and to detect possible accumulation of sediment in the bottom of the well screen. The cement collar around each well will be checked for cracks and settling. If the condition of a well indicates that it is unsuitable for water level measurements and/or sampling, the USEPA WAM will be notified and a decision will be made regarding abandonment and the need to replace the well.

5.12 COLLECTION OF GROUNDWATER SAMPLES

5.12.1 Sampling Objectives

Two sampling rounds of the new and existing monitoring wells are proposed for the groundwater investigation. In addition, the on-site water supply well will also be sampled during these two sampling rounds if it is accessible. The first sampling round will be conducted at least two weeks after the new monitoring wells are installed and developed. Analyses of these samples will be used to characterize the nature and extent of groundwater contamination. The second sampling round will take place approximately six months after the first sampling round. Analytical data from the second round will be used to check for temporal variations in groundwater quality. Procedures for purging and sampling groundwater are described in SOP, MP-FPQA-003 contained in Appendix C.

5.12.2 Sampling Equipment

The following equipment will be needed to collect groundwater samples for analysis:

- Electronic water level indicator (Solinst Model 101)
- Stainless steel submersible pump (Grundfos Redi-Flo)
- Centrifugal pump and check valve
- Polyethylene tubing (ASTM Drinking Water Grade)
- Decontaminated teflon bailer
- Decontaminated teflon-coated leader cord
- Nylon bailer cord
- Sample containers (See Table 6-1)
- Coolers and ice
- Roll of polyethylene sheeting
- pH meter (Orion SA250)
- Temperature, and specific conductivity meter (YSI Model 33)
- Filtering Equipment
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)
- Personnel protective equipment
- Field notebook,
- Sampling logs and pen

5.12.3 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 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 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:

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

where:

V	=	standing water volume (gallons)
23.50	=	π (3.14) x 7.48 gallons/cu.ft.
r	=	well casing radius (feet)
h	=	height of water column (feet)

The type of pump used will depend upon the depth to water. If the depth to water is greater than 20 feet, a submersible pump with clean, new polyethylene tubing will be used to purge the well. During evacuation, the pump intake will not be set greater than six feet below the dynamic water level. This requires that the pump be lowered as purging continues and the water level drops. If the depth to water is less than 20 feet, either a centrifugal pump with clean, new polyethylene tubing with a check valve, or a peristaltic pump will be used. During purging, the tubing intake will not be set greater than six feet below the dynamic water level. This requires that the tubing be lowered as purging continues and the water level drops. The submersible pump will be decontaminated between sampling locations as described in Appendix D. The polyethylene tubing and check valves used on the centrifugal pump will be changed between sampling locations to prevent cross-contamination.

Each well will be purged until a minimum of three well volumes is evacuated or until the well is near dryness. If low yielding wells are problematic, the submersible pump will operate at a low pumping rate in an attempt to prevent dewatering of the well. If the well is still dewatered, the well will be allowed to recover for 15 minutes before restarting the pump. In low yielding wells, only two borehole volumes will be purged. The volume of water removed from each productive well is dependent upon field measurements of pH, temperature and specific conductivity. When each of these parameters has stabilized (i.e., not more than 10 percent variation in two consecutive readings), the volume of water removed will be recorded and the well will be sampled. If the parameters do not stabilize, purging will continue until five volumes of water are removed. The purge water will be collected in DOT-approved drums or a tanker and stored on-site. Purging procedures are described in detail in SOP, MP-FPQA-003 contained in Appendix C.

5.12.4 Groundwater Sampling Procedures

Sampling will be conducted within two hours after the well has been purged unless a well has been evacuated to near dryness. In such cases, the water level in the well will be monitored and samples collected when the water level is sufficient for samples to be taken. Wells evacuated dry will be sampled within three hours of evacuation. All sampling equipment that will come in contact with, or will potentially come in contact with the groundwater (i.e., bailers & leaders), will be decontaminated according to the procedures outlined in Appendix D. New bailer cords will be used at each sampling location.

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. The groundwater sample will be collected by gently lowering a teflon bailer into the well. Teflon-coated cord will be used for

bailer cord which contacts the groundwater. The bailer will be retrieved and the sample will be transferred to the appropriate sample containers. The two 40-ml vials provided for volatile organics will be filled first, leaving no head space or air bubbles. All other sample bottles will be filled to the shoulder. Those samples requiring preservation will be tested and appropriately preserved in the field. Sample collection procedures are described in SOP, MP-FPQA-003 contained in Appendix C; sample preservation procedures are described in SOP, MP-FPQA-021 contained in Appendix E.

Sample fractions will be collected in the following order:

- Field measurements: temperature, pH, specific conductance
- Volatile organics
- Extractable organics
- Total metals
- Dissolved metals
- Cyanide
- Total Dissolved Solids (TDS)
- Radionuclides

The bottles will be placed into coolers with ice and sent to both CLP and non-RAS laboratories for analysis. Sample handling procedures are detailed in Section 6. The bailer and any other equipment entering the well will be handled with phthalate-free (natural rubber or neoprene) gloves to prevent phthalate contamination. Finally, the polyethylene tubing used on the centrifugal pump, bailers, gloves and polyethylene sheeting will be changed between sampling locations to prevent cross contamination. Detailed procedures for the purging and sampling of monitoring wells are presented in SOP, MP-FPQA-003 in Appendix C.

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

- Name and location of job
- Well and sample identification numbers
- Date of sample collection
- Method of purging and sample acquisition
- Depth to water
- Volume of water removed during purging
- pH, temperature and specific conductivity measurements
- Organic vapor levels
- Type of analysis

5.12.5 Geoprobe Sampling Procedures

A groundwater sample will be collected from the geoprobe using the procedures outlined in sections 5.12.3 and 5.12.4. The sample fractions will be collected in the following order:

- Field measurements: temperature, pH, specific conductance
- Volatile organics

- Extractable organics
- Total metals
- Dissolved metals
- Cyanide

This sample be will analyzed by a non-RAS laboratory on a quick (24 to 48 hour) turnaround basis. The results of the analysis will be discussed with the WAM to determine if a permanent monitoring well should be installed at this location.

5.13 HYDRAULIC CONDUCTIVITY TESTING

5.13.1 Testing Objectives

The monitoring wells installed as part of this RI, as well as existing wells, will undergo in-situ hydraulic conductivity testing using both rising and falling head slug tests and pumping tests. The slug test data will be used to obtain an order-of-magnitude estimate of the hydraulic conductivity of the water bearing material around the screened interval and will be used in conjunction with pumping test data and published information. The pumping test data will be used in conjunction with the synoptic water level measurements to perform an analysis of the aquifer transmissivity, storage coefficient and the area influenced by pumping.

5.13.2 Slug Testing Equipment

For the in-situ hydraulic conductivity tests the following equipment will be necessary:

- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp or OVA
- Electric water level indicator (Solinst Model 101)
- Electronic data logger and pressure transducer
- PVC slug of known volume
- New, clean nylon rope
- Stop watch

5.13.3 Slug Testing Procedures

Only rising head tests are planned in the shallow wells since the well screens will be placed to bridge the water table, leaving part of the screened zone above the water table. While this screen placement is advantageous for chemical quality sampling, it will not provide accurate data if a falling head test is conducted. Rising head slug tests will be performed in the shallow wells using a slug that is 3.5-inch O.D. by three feet long constructed of Schedule 40 PVC pipe filled with clean silica sand.

Both rising and falling head tests will be conducted in the deep wells using slugs that are 1.5-inch O.D. by three feet long also constructed of Schedule 40 PVC pipe filled with clean silica sand. Procedures for conducting the slug tests are presented in Appendix C SOP, MP-FPQA-022.

The water level versus time data collected by the data logger will be downloaded into a PC and input into a slug test analysis program, SLUGIX, which calculates the hydraulic conductivity using established methods (Bouwer and Rice, 1976; Cooper et. al., 1967; Hvorslev, 1951). The method selected to analyze the slug test data will be determined after the wells are installed and will be based on the best match between the well characteristics and the set of assumptions for each method.

5.13.4 Pumping Test Equipment

The pumping test equipment list will accompany a memorandum to the USEPA WAM recommending which deep well to use for the pumping test. The list will be dependent upon the number of monitoring wells to be used as observation wells. This information will be obtained after the monitoring well drilling program is complete.

5.13.5 Pumping Test Procedures

The pumping test procedures will also accompany the memorandum to the USEPA WAM recommending the deep pumping well. The procedure will be dependent upon the geologic and hydrogeologic characteristics of the aquifer to be tested. This information will be collected after the monitoring well drilling program and field hydraulic conductivity testing are completed.

5.14 COLLECTION OF SURFACE WATER AND SEDIMENT SAMPLES

5.14.1 Sampling Objectives

Nine surface water and eight sediment samples will be collected from the on-site surface water bodies to assess the presence and nature of contamination present. Sediment samples will also be collected from the storm sewer system. Prior to the start of sampling, a storm sewer inventory will be completed. The results of this inventory will determine the number of sediment samples to be collected from the storm sewer system. The proposed surface water and sediment sampling locations are presented in Figures 4-3, 4-4, 4-7 and 4-8.

5.14.2 Sampling Equipment

The following equipment will be needed to collect surface water and sediment samples for analysis:

- Decontaminated stainless steel trowels, scoops, bowls, and beakers
- Sample containers (See Table 6-1)
- Extension pole
- Coolers and ice
- pH meter (Orion SA250)
- Temperature, and specific conductivity meter (YSI Model 33)
- HNu Systems, Inc., PI-101 Photoionization Detector (HNu) with 10.2 eV lamp
- Foxboro Organic Vapor Analyzer (OVA 128)
- Geiger Mueller (GM) pancake detector and ratemeter
- Personnel protective equipment
- Field notebook, sampling logs and pen
- Ruler

5.14.3 Surface Water Sampling Procedures

The surface water samples will be collected from near the bank of the stream or pond employing the methods described in SOP, MP-FPQA-002 in Appendix C, as appropriate. The sample fractions will be collected in the following order:

- Field measurements: temperature, pH, specific conductance
- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- Radionuclides

Those samples requiring preservation will be tested and appropriately preserved in the field. The specific preservation techniques to be used are described in SOP, MP-FPQA-021 contained in Appendix E. The sample bottles will then be placed into coolers with ice and will be sent to the laboratory for analysis. Sample handling procedures are detailed in Section 6. The meters 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
- Sample identification number
- Method of sample collection
- Weather conditions
- Date of sample collection
- Organic vapor levels
- Type of analysis
- Description of sampling location including pond and/or stream depth
- pH, temperature, and specific conductivity measurements

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5.14.4 Sediment Sampling Procedures

The sediment samples from the on-site surface water bodies will be collected with a stainless steel trowel, hand auger, or dredge, employing the methods described in SOP, MP-FPQA-005 in Appendix C, as appropriate. The sediment samples from the storm sewer system will be collected with an extension pole with a beaker attached to the end. The extension pole will be lowered into the storm drain, and the beaker will be used to collect the sample. Field personnel will screen the sediment samples for radiation by passing a GM pancake detector and ratemeter over the sample. Sampling instruments will be decontaminated before use following the procedures outlined in Appendix D. The sample fractions will be collected in the following order:

- Volatile organics
- Extractable organics
- Total metals
- Cyanide
- TOC
- pH
- Grain size distribution
- Radionuclides

The sample bottles will be placed into coolers with ice and will be sent to the laboratory for analysis. Sample handling procedures are detailed in Section 6. Data to be recorded in the field logbook will include the following:

- Name and location of job
- Sample identification number
- Method of sample collection
- Weather conditions
- Organic vapor levels
- Type of analysis
- Date of sample collection
- Description of sampling location

5.15 ECOLOGICAL ASSESSMENT

5.15.1 Objectives

An ecological investigation of the site and adjacent properties will be conducted to characterize existing on-site conditions relative to vegetation community structure, wildlife utilization and sensitive resources such as surface waters and wetlands. This investigation will identify discernable contaminant pathways, and biological and ecological related ARARs. This information,

together with surface and groundwater data, will be used to assess the ecological effects or impacts of proposed remedial alternatives.

5.15.2 Equipment

The following equipment will required to perform the ecological assessment:

- HNu Systems, Inc., PI-101 Photoionization Detector (HNu)
- Foxboro Organic Vapor Analyzer (OVA 128)
- Soil auger and spade
- Sighting compass
- Field logbook and pen
- 35mm camera
- Tape measure
- Field data forms
- Clip board
- Munsell soil color chart
- Aerial photograph or base map
- Federal interagency plant list
- Flagging tape
- Flags
- Black marker pens
- Corps of Engineers Wetlands Delineation Manual

5.15.3 Procedures

Wetlands, if present, will be delineated by the field team to identify the on-site limits of any wetland systems. The wetlands will be delineated using the Corps of Engineers Wetlands Delineation Manual (January 1987). Areas that meet the wetland criteria for vegetation, soils and hydrology will be delineated using the methodology outlined below:

- Review available USGS topographic mapping, National Wetland Inventory mapping, Soil Conservation Service mapping for Nassau County, aerial photographs, and site base maps.

- Apply the criteria in the U.S. Army Corps of Engineers 1987 Wetlands Delineation Manual to identify wetland areas.

- Identify and flag wetland and nonwetland boundaries. Flag locations will be surveyed and plotted on a site base map. In addition, the location of soil borings and vegetation community sampling will also be keyed to a site base map. A photographic log will be prepared to document the delineated boundaries of each identified wetland.

5.15.3.1 Assessment of Wetland Functional Value

While the field team is conducting the wetland delineation, they will collect information that will be used to assess wetland functional values. The assessment will include a description of the effects of the proposed remedial actions on the wetlands and a delineation of measures to minimize potential harm to wetlands. Should proposed remediation alternative impact delineated wetlands, 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 (WET) Version 2.0. Data generated by the WET program will be used to prepared a restoration/mitigation plan, if necessary, that will attempt to create a wetland system with functional values equal to, or greater than, the existing wetland values identified by the WET program.

5.15.3.2 Flora and Fauna Inventory

Additional data that will be collected during the wetland delineations 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, species utilization of vegetation stratum (i.e., open field, shrub, scrub, wooded) and observed activity (i.e., foraging, nesting, migratory stopper). Emphasis will be placed on observing and recording wildlife utilization of on-site surface water bodies and wetlands. The resulting data will be used to compare species utilization of similar off-site habitats within a one-mile radius of the site. Vegetation communities will be recorded and observation of the vigor and growth patterns of on-site vegetation will be assessed and compared to similar vegetation communities off-site.

5.16 GAMMA EXPOSURE RATE SCAN/SURVEY

5.16.1 Objectives

A gamma exposure rate scan/survey will be conducted to characterize the level of gamma radiation and the spatial distribution with respect to a reproducible grid system. Significant portions of the site have been surveyed during previous investigations; data collected during this remedial investigation will supplement the existing data.

5.16.2 Equipment

The following equipment will required to perform the gamma exposure rate scan/survey:

- Ludlum Model 44-2 1" x 1" sodium iodide (NaI) detector
- Ludlum Model 12 ratemeter
- Ludlum Model 44-9 Geiger Mueller (GM) pancake detector
- Gamma check source
- Eberline Pic 6-A Pressurized Ion Chamber (PIC), or equivalent
- Field logbook and pen
- 35mm camera
- Tape measures

5.16.3 Procedures

A gamma scan will be conducted over the entire floor and accessible wall surfaces of the buildings with the NaI detector. Measurements shall be taken in such a manner that no portion of the surveyor's body is placed between the sensitive portion of the detector and the potential source of radiation.

A preliminary surface level exposure rate scan will be conducted inside the buildings to identify areas with elevated exposure rates. The range of readings will be documented. If exposure rates in excess of twice background are measured, a ten-foot gridded survey will follow. Readings will be taken at the surface and at a one-meter height at the grid line intersections. The areas within the sample points will be surveyed and exposure rate maxima and their coordinates will be recorded. While performing this gamma scan, structural features such as floor materials (i.e., concrete, wood, dirt) which may influence the readings will be noted. For quality control purposes, readings will also be taken with a Pressurized Ion Chamber (PIC). PIC data will be used to perform an "in-field" calibration of the NaI detectors utilized in the gamma surveys. The survey data will be gathered as follows:

- Perform source check, battery check, and background check. Record data on the Daily Check Source Form shown in Figure 5-2.

- Establish a reference grid system over the general areas of interest. Each grid will consist of a system of intersecting lines referenced to a fixed site location or benchmark at ten-foot intervals.

- Perform grid-point measurements at the nodes with the NaI detector at one meter height and at the surface. Record the location coordinates and measurement data on the Exposure Rate Survey Form shown in Figure 5-3.

  Walk over each grid square at a speed of about 1 foot per second, with the NaI detector moving back and forth along the ground surface in a serpentine motion.

METER : _____ DETECTOR: _____

SERIAL NUMBER: _____ SERIAL NUMBER: _____

DATE	TIME	HV SET	SOURCE			BACKGROUND	SOURCE	OK	INITIALS
			TYPE	SERIAL NO.	ACTIVITY	COUNTS/MINUTE	COUNTS/MINUTE		

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DAILY CHECK SOURCE FORM

Malcolm Pirnie, Inc.

FIGURE 5-2

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SITE: ____________________ DATE : ____________

INVESTIGATOR: ________________ TIME : ____________

COORDINATES		cpm	cpm
X	Y	surface	1 meter

COORDINATES		cpm	cpm
X	Y	surface	1 meter

COORDINATES		cpm	cpm
X	Y	surface	1 meter

EQUIPMENT	MODEL #	SERIAL #
RATEMETER		
DETECTOR		

BKG (cpm):

CONVERSION FACTOR
cpm per uR/h

COMMENTS : ____

____

____

____

SIGNATURE ____________________ QC CHECK ____________________

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LI TUNGSTEN CORPORATION

EXPOSURE RATE SURVEY FORM

Malcolm Pirnie, Inc.

FIGURE 3

Record the exposure rates at "hot spots" on the exposure rate survey form and mark the location for potential future soil sampling.

5.17 SHORT-TERM RADON/THORON MEASUREMENTS

5.17.1 Objectives

At the onset of field activities, indoor short-term radon and thoron measurements will be made using an Electret-Passive Environmental Radon Monitor (E-PERM) system for worker health and safety purposes.

5.17.2 Equipment

The following equipment will required to perform the radon/thoron measurements:

- Electrets and Ion Chambers
- Voltage Meter
- Field notebook and pen

5.17.3 Procedures

Radon and thoron sampling will be conducted inside enclosed buildings which will be occupied by workers during the remedial investigation. Two or three E-PERMs will be placed inside each building for a three day duration. They will either be hung from the ceiling or placed flat on a surface such as a table top at least 30-inches above the floor and at least four-inches from other objects (including exterior walls).

Prior to deployment and following retrieval, electret voltage will be measured with the voltage meter. The drop in voltage during the measurement period is proportional to the concentration of radon or thoron gas. The algorithm for determining the concentration of the gases is supplied by the vendor and therefore the results may be generated immediately following the completion of the measurement. All data will be recorded on the E-PERM Data Sheet shown in Figure 5-4.

5.18 SURFACE CONTAMINATION SURVEYS

5.18.1 Objectives

Surface contamination surveys will be made on portions of tanks (including the inside of tanks which were not previously accessible) and any equipment found to be the source of elevated gamma radiation. These measurements will be made to determine the levels of total and removable surface

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ELECTRET SERIAL #	LOCATION	PRE-DEPLOYMENT		POST-EXPOSURE		ANALYSIS		RN / TH CONC. (pCi/L)	NOTES
		DATE/TIME	VOLTAGE	DATE/TIME	VOLTAGE	DELTA T DAYS	DELTA A VOLTS		

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E-PERM DATA SHEET

Malcolm Pirnie, Inc.

FIGURE 5-4

radioactivity on these objects. These data are necessary to determine if the materials are suitable for unrestricted use.

The surface activity survey consists of several types of radiation measurements. First, a surface will be scanned with a gamma scintillation detector to identify areas exhibiting elevated exposure rates for further surface activity surveying. Surfaces in these areas will then be scanned with a GM detector and/or alpha scintillation detector. These measurements provide levels of total surface radioactivity (i.e., both fixed and removable contamination). If significant total surface radioactivity is detected, wipe tests (for removable surface radioactivity) will be conducted on paper filters and counted in an alpha sample counter. Residue found in the interior of tanks may also be wipe tested, as deemed appropriate.

5.18.2 Equipment

The following equipment will required to perform the surface contamination surveys:

- Ludlum Model 43-5 alpha scintillation detector
- Ludlum Model 44-2 NaI detector
- Ludlum Model 44-9 GM detector
- Ludlum Model 12 ratemeter
- Ludlum Model 43-10 alpha sample counter
- Ludlum Model 2221 portable ratemeter/scaler
- Decon swipes/paper filters
- Th-230 alpha check source
- CS-137 gamma check source

5.18.3 Procedures

Several precautions will be taken by personnel during surface radioactivity surveys. The spread of contamination will be minimized during the survey by changing gloves after handling contaminated surfaces and wrapping instruments in plastic wrap or other suitable material, if necessary. Surface contamination surveys will be conducted as follows:

- Perform source check, battery check, and background check on all instruments. Record data on the Surface Radioactivity Survey Form shown in Figure 5-5.

- Scan the surface of the equipment, tank, etc. with a NaI detector, keeping the detector as close as possible to the surface. Identify areas with elevated exposure rates (greater than twice background) for surface activity surveying.

- Replace the NaI detector with the GM or alpha scintillation detector and scan the previously identified surfaces slowly (approximately one detector width per second, holding the detector within two centimeters of the surface).

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MALCOLM PIRNIE, INC.
SURFACE RADIOACTIVITY SURVEY FORM

SITE NAME _____

SAMPLE #	SURFACE EXP. RATE (mR/h)	GM PANCAKE CAP ON (CPM)	TOTAL ALPHA		REMOVABLE ALPHA		REQUIRED LAB ANALYSES	COMMENTS
			(CPM)	(DPM/100 sq cm)	(CPM)	(DPM/100 sq cm)		

DESCRIPTION OF EQUIPMENT/SURFACES SURVEYED: _____

COLLECTED BY _____
DATE _____
TOTAL NO. SAMPLES _____

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SURFACE RADIO' ~TIVITY SURVEY FORM

Malcolm Pirnie, Inc.

FIGURE 5

- Prepare a map of the equipment being surveyed and record data, noting the range of results and count rate maxima. If the direct scan indicated elevated surface activity (greater than twice the background count rate), collect wipe samples as described below.

- Using moderate pressure, wipe an area approximately 100 cm^2 with a decon swipe. Record each sample on the Surface Radioactivity Survey Form, shown in Figure 5-5.

- Following at least 24 hours, count each sample in the alpha sample counter for the determination of removable gross alpha radioactivity.

The Minimum Detectable Activity (MDA) for surface activity measurements will be calculated according to the following equation:

$$MDA = 2.71 + \frac{4.65[(Rb/Tb)]^{1/2}}{E}$$

where:

Rb = Background Count Rate (counts per minute)
Tb = Background Count Time (minutes)
E = Detector Efficiency (counts per disintegration)

The data are expressed in disintegrations per minute per 100 square centimeters.

5.19 BUILDING MATERIALS SAMPLING

5.19.1 Objectives

Building materials samples will be collected to identify and determine the concentration of radioactive contaminants in materials which appear to be sources of elevated gamma radiation exposure rates and/or surface radioactivity.

5.19.2 Equipment

The following equipment will required to perform the building materials sampling:

- Decontamination equipment
- Concrete saw
- Chisel
- Jackhammer
- Sample jars, bags and labels
- Coolers

5.19.3 Procedures

During the gamma radiation exposure rate and surface contamination surveys, building materials exhibiting elevated levels of radioactivity will be noted as potential locations for building material sampling. Samples will be obtained from a representative number of such locations by chipping off pieces of the material using a concrete saw, chisel, or other appropriate device. The samples will be collected in sample jars or bags and packaged for transport to a radioanalytical laboratory. Prior to laboratory analysis, samples will be pulverized and homogenized. Sample collection will be recorded on the Building Materials Sample Collection Forms as shown in Figure 5-6.

5.20 DOWNHOLE GAMMA LOGGING

5.20.1 Objectives

Downhole gamma logging of the 20 boreholes drilled in areas with elevated exposure rates will be conducted to quantify the volume of subsurface radiological contamination.

5.20.2 Equipment

The following equipment will required to perform downhole gamma logging:

- PVC or stainless steel casing
- Ludlum Model 2221 ratemeter/scaler
- Ludlum Model 44-10 2" x 2" NaI detector
- Field logbook
- Gamma check source

5.20.3 Procedures

- Perform source check, battery check, and background check on NaI detector. Record data on the Daily Check Source Form shown in Figure 5-2.

- After the borehole is drilled, insert a 2.5 inch diameter PVC pipe into borehole to prevent collapse.

- Lower the NaI detector down the borehole and record the number of counts in a 0.5 minute count time, from the ground surface to the total depth of the boring at six-inch intervals. Record the data on a Subsurface Gamma-Ray Radiation Logging Form as shown in Figure 5-7.

- Remove the pipe from the borehole and decontaminate the pipe before proceeding to the next borehole.

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SAMPLE IDENTIFICATION	GRID COORDINATES	COLL. DATE	REQUIRED ANALYSES	COMMENTS

COLLECTED BY _____

DATE _____

TOTAL NO. SAMPLES _____

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MALCOLM PIRNIE

LI TUNGSTEN CORPORATION

BUILDING MATERIALS SAMPLE COLLECTION FORM

Malcolm Pirnie, Inc.

FIGURE 5-6

SURVEYORS: _____

COUNT TIME (min):

DEPTH UNITS:

DATE:

INSTRUMENT:

	COORDINATES (X,Y)						
	HOLE #	HOLE #	HOLE #	HOLE #	HOLE #	HOLE #	HOLE #
DEPTH	—	—	—	—	—	—	—

DETECTOR MODEL #: SERIAL #:

SCALER MODEL #: SERIAL #:

COMMENTS:

MALCOLM PIRNIE	LI TUNGSTEN CORPORATION SUBSURFACE GAMMA-RAY RADIATION LOG	Malcolm Pirnie, Inc FIGURE 5-7

300119

It is possible that a significant portion of thorium contaminated waste (especially in Parcels B and C in heavily vegetated areas) may be found to exist within a few feet of the surface. Identifying the waste and quantifying the volume may be accomplished via additional downhole gamma logging, to a depth of 5 feet subsurface. The procedure will be similar to that described above, although the boreholes will be driven with a jackhammer. Gamma logging measurements will be taken with a smaller NaI detector (either 3/8" x 3/8" or ½" x ½"). Gamma logging locations will be selected based on surface exposure rate surveys. Areas exhibiting greater than twice background will be surrounded by several boreholes in an effort to define the boundaries of deposits of subsurface contaminated materials.

5.21 TANK RESIDUE SAMPLING

The contents of all tanks which exhibit elevated levels of radioactivity will be sampled. Pieces of the tank will also be collected for sample analysis, if appropriate. These samples will be used to determine whether each tank will require disposal as a radioactive waste and to evaluate the possibility of decontaminating the interior tank surfaces. The tank residue sampling procedures and required equipment list will be sent in a memorandum to the USEPA WAM. The sampling procedure will be dependent upon the construction of the tanks and the accessibility of the tanks. This information will be collected in the field. After the information is obtained, a determination will be made regarding sampling alternatives.

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 assure that sampling data 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 for CLP-RAS analysis will be labeled, packaged and preserved according to CLP procedures which are described in the "Users Guide to the Contract Laboratory Program", EPA/540/P-91/002, January 1991. All samples collected for non-RAS analysis will be packaged and preserved according to the procedures described in the non-RAS Draft Implementation Plan submitted to the USEPA on August 17, 1994.

6.2 PROCUREMENT AND PREPARATION OF SAMPLE CONTAINERS

Malcolm Pirnie will purchase certified clean, approved sample containers in compliance with OSWER Directive #9240.05A "Specification and Guidance for Obtaining Contaminant-Free Sample Containers". 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 RAS laboratory will be identified with EPA CLP numbers which are provided by the CLP-RAS laboratory.

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All samples labels and tags will contain the following information:

1. Project Number
2. Field ID or sample station number
3. Date and time of collection
4. Designation of sample as grab or composite
5. Sample matrix
6. Sample preservation notes
7. Analytical parameters
8. 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 Section 4.5.

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 4-3 and 4-4. The samples will be analyzed by following USEPA CLP-RAS and non-RAS methodologies. Preservation of samples will be conducted 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, and SOP, MP-FPQA-021 contained in Appendix E. Information on sample containers, preservation techniques, and holding time limits is presented in Tables 6-1 and 6-2.

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 non-RAS Packing List will be initiated at the time of sample collection in the field and copies are shipped with the samples.

Table 6-1
LI TUNGSTEN RI/FS
AQUEOUS MEDIA PARAMETER TABLE

GROUNDWATER SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Ground-water	69 [2]	TCL Volatiles [3]	CLP[4]	1:1 HCL to pH<2 Cool to 4°C	10 days, preserved	2-40 ml. glass vials with tef-lon-lined septa
	68	TCL Semi-Volatiles[3]	CLP [4]	Cool to 4°C	5 days [5] 40 days [6]	2 L amber glass
	68	TCLPesticides/ PCB's[3]	CLP [4]	Cool to 4°C	5 days [5] 40 days [6]	2 L amber glass
	69 [2]	TAL Metals (filtered and unfiltered) [7]	CLP [8]	Concentrated HNO_3 to pH<2 Cool to 4°C	180 days	1 L HDPE
		Mercury (filtered and unfiltered)[7]		Concentrated HNO^3 to pH<2 Cool to 4°C	26 days	
		Cyanide [7]		NaOH to pH>12 Cool to 4°C [9]	12 days	1 L HDPE
	68	Total Dissolved Solids	EPA 160.2 [10]	Cool to 4°C	7 days	1 L HDPE
	68	^{230}U, ^{230}Th, ^{232}Th	EPA 907.0 [11]	1N HNO_3 to pH~2	16 hours	1 L glass
	68	^{226}Ra	EPA 903.0 or 903.1 [11]	1N HNO^3 to pH~2	16 hours	1 L glass
	68	^{228}Ra	EPA 904.0 [11]	1N HNO_3 to pH~2	16 hours	1 L glass

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.
(2) Included in this number of samples is one groundwater sample to be collected from the Parcel B Disposal Area geoprobe location. This sample will be analyzed on a quick turn-around basis (24-48 hours) using the non-RAS program.
(3) Triple volumes will be collected for the aqueous organic fraction samples designated for MS/MSD analysis (volatiles, semi-volatiles, and pesticide/PCBs).
(4) USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM01.2 with revisions through OLM01.9.
(5) From VTSR to distillation or extraction (whichever is applicable).
(6) From extraction to analysis.
(7) Double volumes will be collected for the aqueous inorganic fraction samples designated for MS analysis (TAL Metals, Cyanide).
(8) USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0.
(9) The sample will be tested in the field for the presence of sulfides and oxidizing agents according to SOP MP FPQA-021.
(10) Methods for Chemical Analysis of Water and Wastes (EPA 600/479-020).
(11) Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA-600-4-80-032).

Table 6-1
LI TUNGSTEN RI/FS
AQUEOUS MEDIA PARAMETER TABLE

SURFACE WATER SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Surface Water	9	TCL Volatiles [3]	CLP[4]	1:1 HCL to pH<2 Cool to 4°C	10 days, preserved	2-40 ml. glass vials with teflon-lined septa
	9	TCL Semi-Volatiles[3]	CLP [4]	Cool to 4°C	5 days [5] 40 days [6]	2 L amber glass
	9	TCL Pesticides/PCB's[3]	CLP [4]	Cool to 4°C	5 days [5] 40 days [6]	2 L amber glass
	9	TAL Metals (unfiltered) [7] Mercury (unfiltered)[7] Cyanide [7]	CLP [8]	Concentrated HNO_3 to pH<2 Cool to 4°C Concentrated HNO_3 to pH<2 Cool to 4°C NaOH to pH>12 Cool to 4°C [9]	180 days 26 days 12 days	1 L HDPE 1 L HDPE
	68	^{238}U, ^{230}Th, ^{232}Th	EPA 907.0 [11]	1N HNO_3 to pH~2	16 hours	1 L glass
	68	^{226}Ra	EPA 903.0 or 903.1 [11]	1N HNO^3 to pH~2	16 hours	1 L glass
	68	^{228}Ra	EPA 904.0 [11]	1N HNO_3 to pH~2	16 hours	1 L glass

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.
(2) Included in this number of samples is one groundwater sample to be collected from the Parcel B Disposal Area geoprobe location. This sample will be analyzed on a quick turn-around basis (24-48 hours) using the non-RAS Program.
(3) Triple volumes will be collected for the aqueous organic fraction samples designated for MS/MSD analysis (volatiles, semi-volatiles, and pesticide/PCBs).
(4) USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM01.2 with revisions through OLM01.9.
(5) From VTSR to distillation or extraction (whichever is applicable).
(6) From extraction to analysis.
(7) Double volumes will be collected for the aqueous inorganic fraction samples designated for MS analysis (TAL Metals, Cyanide).
(8) USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0.
(9) The sample will be tested in the field for the presence of sulfides and oxidizing agents according to SOP MP FPQA-021.
(10) Methods for Chemical Analysis of Water and Wastes (EPA 600/479-020).
(11) Prescribed Procedures for Measurement of Radioactivity in Drinking Water (EPA-600-4-80-032).

Table 6-2
LI TUNGSTEN RI/FS
NON-AQUEOUS MEDIA PARAMETER TABLES

SUBSURFACE SOIL SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Sub-Surface Soils	109	TCL Volatiles	CLP[2]	Cool to 4°C	10 days	2-40 ml. glass vials with teflon-lined septa
	109	TCL Semi-Volatiles	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	1-8 oz. wide mouth glass
	109	TCL Pesticides/PCBs	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	
	109	TAL Metals Mercury Cyanide	CLP[2]	Cool to 4°C	180 days 26 days 12 days	1-8 oz. wide mouth glass
	109	Total Organic Carbon (TOC)	USEPA-II[5]	Cool to 4°C	14 days	1-8 oz. wide mouth glass
	109	pH	USEPA-9045A [7]	Cool to 4°C	[8]	1-8 oz. wide mouth glass
	Field Determined	Hydraulic Conductivity	ASTM D 5084-90 [9]	N/A	N/A	Thin walled tube sampler
	26	Atterberg Limits	ASTM D 4318-84[9]	N/A	N/A	2-8 oz. wide mouth glass
	26	Moisture Content	ASTM D 2216-92[9]	N/A	N/A	2-8 oz. wide mouth glass
	26	Bulk Density: Maximum Index Minimum Index	ASTM D 4253-94[9] ASTM D 4254-91[9]	N/A	N/A	2-8 oz. wide mouth glass
	26	Grain Size	ASTM D 422-63[9]	N/A	N/A	2-8 oz. wide mouth glass
	149	^{238}U, ^{230}Th, ^{232}Th	HASL-300 [10]	None Required	None Required	1-32 oz. wide mouth glass
	149	^{226}Ra, ^{228}Ra	HASL-300 [11]	None Required	None Required	1-32 oz. wide mouth glass

Table 6-2
LI TUNGSTEN RI/FS
NON-AQUEOUS MEDIA PARAMETER TABLES

SUBSURFACE SOIL SAMPLING (CONT'D)

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
	7	TCLP Volatiles	USEPA - 1311 [7]	None Required	Collect. to Extr. 14 days Extr. to Analy. - 14 days	2-8 oz. wide mouth glass with teflon-lined septa
		TCLP Extractables			Collect. to Extr. - 14 days Extr. to Sample Prep. - 7 days Extr. to Analy. - 40 days	2-8 oz. wide mouth glass
		TCLP Metals (except Hg)			Collect. to Extr. - 180 days Extr. to Analy. - 180 days	2- 8 oz. wide mouth glass
		Mercury			Collect. to Extr. - 28 days Extr. to Analy. - 28 days	

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.
(2) USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLMC1.2 with revisions through OLM01.9.
(3) From VTSR or distillation to extraction (whichever is applicable).
(4) From extraction to analysis.
(5) USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0.
(6) Lloyd Kahn Method, Determination of Total Organic Carbon in Sediment, USEPA Region II, July 27, 1988.
(7) "Test Methods for Evaluating Solid Waste", Volume 1C; Laboratory Manual Physical/Chemical Methods SW-846, Third Edition, USEPA, Revision No. 1, July 1992.
(8) The analytical method states that pH must be measured as soon as possible by the laboratory.
(9) American Society for Testing and Materials, Standards Section for Construction, Volume 4.08, 1992.
(10) Analyzed via alpha spectroscopy, according to methods described in the Environmental Measurements Laboratory (EML) Procedures Manual, U.S. Department of Energy, 27th Edition, Volume 1, February 1992.
(11) Analyzed via gamma spectroscopy (^{228}Ra via ^{228}Ac gamma).

Table 6-2
LI TUNGSTEN RI/FS
NON-AQUEOUS MEDIA PARAMETER TABLES

SURFACE SOIL SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Surface Soils	15	TCL Volatiles	CLP[2]	Cool to 4°C	10 days	2-40 ml. glass vials with teflon-lined septa
	15	TCL Semi-Volatiles	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	1-8 oz. wide mouth glass
	15	TCL Pesticides/PCBs	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	
	15	TAL Metals Mercury Cyanide	CLP[5]	Cool to 4°C	180 days 26 days 12 days	1-8 oz. wide mouth glass
	15	^{238}U, ^{230}Th, ^{232}Th	HASL-300 [6]	None Required	None Required	1-32 oz. wide mouth glass
	15	^{226}Ra, ^{228}Ra	HASL-300 [7]	None Required	None Required	1-32 oz. wide mouth glass

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.
(2) USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM01.2 with revisions through OLM01.9.
(3) From VTSR or distillation to extraction (whichever is applicable).
(4) From extraction to analysis.
(5) USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0.
(6) Analyzed via alpha spectroscopy, according to methods described in the Environmental Measurements Laboratory (EML) Procedures Manual, U.S. Department of Energy, 27th Edition, Volume 1, February 1992.
(7) Analyzed via gamma spectroscopy (^{228}Ra via ^{228}Ac gamma.)

Table 6-2
LI TUNGSTEN RI/FS
NON-AQUEOUS MEDIA PARAMETER TABLES

SEDIMENT SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Sediment	18	TCL Volatiles	CLP[2]	Cool to 4°C	10 days	2-40 ml. glass vials with tef-lon-lined septa
	18	TCL Semi-Volatiles	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	1-8 oz. wide mouth glass
	18	TCL Pesticides/PCBs	CLP[2]	Cool to 4°C	10 days [3] 40 days [4]	
	18	TAL Metals Mercury Cyanide	CLP[5]	Cool to 4°C	180 days 26 days 12 days	1-8 oz. wide mouth glass
	18	Total Organic Car-bon (TOC)	USEPA-II[6]	Cool to 4°C	14 days	1-8 oz. wide mouth glass
	18	pH	USEPA-9045A [7]	Cool to 4°C	[8]	1-8 oz. wide mouth glass
	8	Grain Size	ASTM D 422-63[9]	N/A	N/A	2-8 oz. wide mouth glass
	18 [10]	^{238}U, ^{230}Th, ^{232}Th	HASL-300 [11]	None Required	None Required	1-32 oz. wide mouth glass
	18 [10]	^{226}Ra, ^{228}Ra	HASL-300 [12]	None Required	None Required	1-32 oz. wide mouth glass

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.
(2) USEPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM01.2 with revisions through OLM01.9.
(3) From VTSR or distillation to extraction (whichever is applicable).
(4) From extraction to analysis.
(5) USEPA CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM03.0.
(6) Lloyd Kahn Method, Determination of Total Organic Carbon in Sediment, USEPA Region II, July 27, 1988.
(7) "Test Methods for Evaluating Solid Waste", Volume 1C; Laboratory Manual Physical/Chemical Methods SW-846, Third Edition, USEPA, Revision No. 1, July 1992.
(8) The analytical method states that pH must be measured as soon as possible by the laboratory.
(9) American Society for Testing and Materials, Standards Section for Construction, Volume 4.08, 1992.
(10) Sediment samples will be analyzed for radiological parameters if surface exposure rates exceed two times background.
(11) Analyzed via alpha spectroscopy, according to methods described in the Environmental Measurements Laboratory (EML) Procedures Manual, U.S. Department of Energy, 27th Edition, Volume 1, February 1992.
(12) Analyze via gamma spectroscopy (^{228}Ra via ^{228}Ac gamma).

Table 6-2
LI TUNGSTEN RI/FS
NON-AQUEOUS MEDIA PARAMETER TABLES

BUILDING MATERIALS/TANK SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Solid	Field Determined	^{232}Th	HASL-300 [2]	None Required	None Required	1-32 oz. wide mouth glass
	Field Determined	^{226}Ra	HASL-300 [2]	None Required	None Required	1-32 oz. wide mouth glass

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.

(2) Analyze via gamma spectroscopy (^{232}Th via ^{228}Ac gamma).

SOIL GAS SURVEY SAMPLING

Matrix	No. of Environmental Samples	Parameter	Analytical Method	Sample Preservation	Holding Time[1]	Container
Soil Gas	50	Selected VOCs	CLP [2]	None Required	Not Applicable	Syringe

NOTES:

(1) Holding Time is determined from the Validated Time of Sample Receipt (VTSR) for RAS parameters and the date/time of sample collection for non-RAS parameters.

(2) USEPA Contract Laboratory Program Statement of Work for Analysis of Ambient Air, Draft SOW 7/91, Revision IAIR 01.2 or latest revision

Copies of these forms are provided in the Procedure for Conducting Sample Management, SOP, MP-FPQA-016 in Appendix E.

After sampling has been completed, the sample containers will be cleaned, sample tags and custody seals will be attached to each sample container and cap. The sample containers will be placed into coolers. Sufficient ice packs will be placed in the coolers to keep the samples at a temperature of 4C. 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 coolers will be secured with either nylon or fiber strapping tape.

The samples will either be transported to the CLP-RAS or non-RAS laboratory under custody of Malcolm Pirnie personnel or shipped by an overnight carrier within 24 hours of sample collection. If the samples are shipped by an overnight carrier, 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 via overnight carrier, two or more custody seals will be signed, dated and placed on each shipping container. The custody seals will be located in a manner that would indicate if the container were opened in transit. After each sample shipment to the appropriate laboratories, the Sample Management Officer (SMO) will be immediately notified by phone.

Samples may contain low levels of naturally-occurring radioactive materials; therefore, the sample coolers will be labeled to comply with U. S. Department of Transportation (DOT) criteria, if applicable (when there may be greater that 2000 pCi/gram total radioactivity in a cooler). The inside of the cooler will be marked "Radioactive". In addition, the following statement will be included in the cooler: "This package conforms to conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN2910." No other labeling requirements would apply assuming that the external surfaces of the package does not exhibit exposure rates that exceed 0.5 mrem/hour or removable surface contamination that exceeds 22 dpm/cm^2 for gamma and beta, and 2.2 dpm/cm^2 alpha.

All samples will be shipped to 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). Field personnel not familiar with proper sample handling procedures should refer to the Procedure for Conducting Sample Management SOP, MP-FPQA-016, in Appendix E.

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MALCOLM PIRNIE

A

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APPENDIX A

MANAGEMENT OF INVESTIGATION-DERIVED WASTES DURING SITE INVESTIGATIONS

EPA/540/G-91/009
OERR Directive 9345.3-02
May 1991

Management of Investigation-Derived Wastes During Site Inspections

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

Printed on Recycled Paper

NOTICE

The policies and procedures set forth here are intended as guidance to Agency and other government employees. They do not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. EPA officials may decide to follow the guidance provided in this directive, or to act at variance with the guidance, based on analysis of specific site circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

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EXECUTIVE SUMMARY

This guidance presents a general regulatory background and options for management of investigation-derived wastes (IDW) generated during Superfund site inspections (SIs). These wastes include soil cuttings, drilling muds, purged ground water, decontamination fluids (water and other fluids), disposable sampling equipment (DE), and disposable personal protective equipment (PPE). The National Contingency Plan (NCP) requires that management of IDW generated during SIs complies with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. In addition, other legal and practical considerations may affect the handling of IDW. Therefore, site inspection managers and other involved parties should be familiar with this guidance, as well as the requirements of the NCP, ARARs, and EPA's interpretation of these requirements.

IDW from SIs may contain hazardous substances as defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Some CERCLA hazardous substances are hazardous wastes under Subtitle C of the Resource Conservation and Recovery Act (RCRA), while other substances are regulated by other federal laws such as the Safe Drinking Water Act (SDWA), Clean Air Act (CAA), Toxic Substances Control Act (TSCA), and the Clean Water Act (CWA). EPA estimates that RCRA hazardous IDW have been generated at fewer than 15 percent of CERCLA sites. However, RCRA regulations, and in particular the RCRA Land Disposal Restrictions (LDRs), are very important as potential ARARs since they regulate treatment, storage, and disposal of many of the most toxic and hazardous materials.

EPA's strategy for managing RCRA hazardous IDW presented in this guidance is based on:

- The NCP directive that SIs comply with ARARs to the extent practicable.
- The Area of Contamination (AOC) unit concept.

The most important elements of the IDW management approach are as follows:

- Leaving a site in no worse condition than existed prior to the investigation.
- Removing those wastes that pose an immediate threat to human health or the environment.
- Leaving on-site wastes that do not require off-site disposal or extended above-ground containerization.
- Complying with federal ARARs, to the extent practicable.
- Complying with state ARARs, as practicable.
- Careful planning and coordination for IDW management.
- Minimizing the quantity of generated wastes.

The specific elements of the approach are as follows:

- Characterizing IDW through the use of existing information (manifests, Material Safety Data Sheets, previous test results, knowledge of the waste generation process, and other relevant records) and best professional judgment.
- Delineating an AOC unit for leaving RCRA hazardous soil cuttings within the unit.

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- Containerizing and disposing of RCRA hazardous ground water, decontamination fluids, and PPE and DE (if generated in excess of 100 kg/month) at RCRA Subtitle C facilities.

- Leaving on-site RCRA nonhazardous soil cuttings, ground water, and decontamination fluids preferably without containerization and testing.

EPA does not recommend removal of wastes from all sites and, in particular, from those sites where IDW do not pose any immediate threat to human health or the environment. Removing wastes from all sites would not benefit human health and the environment and would result in spending a significant portion of the total funds available for the site assessment program, thus impairing EPA's ability to successfully meet the goals of the program.

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1.0 INTRODUCTION

In the process of collecting environmental samples during Superfund site inspections (SIs), site investigators generate many different types of potentially contaminated investigation-derived wastes (IDW) that include soil, ground water, used personal protective equipment (PPE), decontamination fluids, and disposable sampling equipment (DE). The National Contingency Plan (NCP)[1] requires that managing (handling) of IDW attains all applicable or relevant and appropriate requirements (ARARs) to the extent practicable considering the exigencies of the situation. To comply with ARARs, site managers need to be familiar with these requirements and how the Environmental Protection Agency interprets them.

1.1 PURPOSE

This document provides guidance on determining and interpreting ARARs, and highlights EPA's recommended approach to handling IDW in compliance with these requirements. The guidance is intended to assist site inspection managers (SM), EPA regional project officers (RPOs), EPA Site Assessment Managers (SAMs), state environmental agencies, potentially responsible parties (PRPs), and others involved in Superfund site assessment work. The approach presented reflects EPA's goal to protect human health and the environment, addresses the most typical scenarios that the SM may encounter, and describes cost-efficient methods of handling both hazardous and non-hazardous IDW.

1.2 ORGANIZATION OF THE GUIDANCE

This guidance consists of seven sections:

- Section 1 - Introduction.
- Section 2 describes regulatory requirements and policy concerns, with emphasis on Resource Conservation and Recovery Act (RCRA)[2] regulations.
- Section 3 discusses the distinction between IDW containing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances and RCRA hazardous wastes based on their regulatory definitions.
- Section 4 stresses planning for IDW generation and management as the most important factor of the comprehensive approach to handling IDW. This section also presents the IDW disposal decision tree intended as a quick reference for site inspection managers.
- Section 5 describes the implementation of the IDW management plan.
- Section 6 discusses costs involved in both on-site and off-site IDW handling.
- Section 7 briefly describes available subcontracting procedures for IDW transportation and disposal.

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2.0 REGULATORY REQUIREMENTS AND POLICY CONCERNS

A variety of IDW are generated during CERCLA SIs. Many of these wastes contain substances considered hazardous under CERCLA or regulated under various federal statutes such as the Toxic Substances Control Act (TSCA), Clean Water Act (CWA), Safe Drinking Water Act (SDWA), Clean Air Act (CAA), and RCRA. Even though all of these statutes can be ARARs for CERCLA actions, the application of these laws to handling IDW generated during the SI can be difficult and confusing, since none specifically addresses the management of IDW generated during the SI.

The National Contingency Plan (NCP)[1] and the proposed amendment to the NCP[2] ("Procedures for Planning and Implementing Off-Site Response Actions") codifying the CERCLA off-site policy[4], present EPA's interpretation of how these laws apply to response action investigations such as SIs.

2.1 REQUIREMENTS OF CERCLA AND THE NCP

CERCLA authorizes EPA to respond to releases or threats of releases of hazardous substances into the environment. CERCLA response actions include removal actions, remedial investigations, and other response actions financed by Superfund. CERCLA Section 101 (23) defines "removal" to include actions that may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances. Thus, CERCLA studies, site assessments, and field investigations are considered removal actions. The NCP directs that removal actions attain ARARs "to the extent practicable considering the exigencies of the situation" (unless the ARAR is waived) (see Section 300.415 (i) of the NCP). Practicability is assessed by examining factors such as the urgency of the situation and the scope of the removal action to be conducted. Section 2.2 of this guidance discusses procedures for CERCLA off-site actions.

The preamble to the NCP clarifies the extent to which ARARs apply to removal actions:

> "[Because] the purpose of removal actions generally is to respond to a release or threat of release of hazardous substances, pollutants, or contaminants so as to prevent, minimize, or mitigate harm to human health and the environment... [and] removals are distinct from remedial actions in that they may mitigate or stabilize the threat rather than comprehensively address all threats at a site... removal actions cannot be expected to attain all ARARs...Indeed, the imposition by Congress of limits on the amount of time and Fund money that may be spent conducting a removal action often precludes comprehensive remedies by removal actions alone" (55 FR 8695, March 8, 1990) (emphasis added).

Because investigative activities are categorized as removal actions, the preamble to the NCP sets out the following IDW management approach:

> "... the field investigation team should, when handling, treating or disposing of investigation-derived waste on-site, conduct such activities in compliance with ARARs to the extent practicable, considering the exigencies of the situation. Investigation-derived waste that is transported off-site (e.g., for treatability studies or disposal) must comply with applicable requirements of the CERCLA off-site policy" (55 FR 8756, March 8, 1990) (emphasis added).

In determining what is "practicable" in the context of an SI, the Agency may take into account the very limited scope and purpose of the activity, and in particular the fact that it is not intended to address contamination at the site (other than to gather information about it). This means that, as a general matter, actions taken at the SI that leave conditions essentially unchanged (such as returning soil cuttings to the location from which they were taken) should not require a detailed analysis of ARARs or assurance that conditions at the site after the action is taken will comply with ARARs. At the same time, site personnel should ensure that their handling of IDW does not create

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additional hazards at the site. (For example, leaving highly contaminated soil cuttings on the surface could create an additional risk of direct exposure.)

Potential ARARs include (but are not limited to) RCRA[2], TSCA, CWA, CAA, and state legally enforceable regulations. The most important ARARs for managing IDW are RCRA and TSCA (addressed in Sections 2.4 and 2.5 of this guidance). The preamble to the NCP discusses when CERCLA actions (including activities during SIs) constitute "land disposal," which triggers several significant requirements, including RCRA land disposal restrictions (LDRs)[3] (55 FR 8759-8762).

Section 300.400(g) (4) of the NCP defines state ARARs as "those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent than federal requirements." Section 2.7 of this guidance discusses the issue of state ARARs.

Before ARARs can be determined, it is necessary to determine what contaminants, if any, are present in the IDW. Section 3.0 of this guidance discusses the process of identifying contaminants. In general, such identification should be done based on available information about the site and professional judgment rather than testing.

In brief, compliance with the NCP can generally be assured by:

(1) Identifying contaminants, if any, present in IDW based on existing information and best professional judgment; testing is not required in most circumstances.

(2) Determining ARARs (particularly RCRA and state laws), and the extent to which it is practicable to comply with them.

(3) Delineating an area of contamination (AOC) unit based on existing information and visual observation if soil cuttings are RCRA hazardous (see Section 2.4.2).

(4) Burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created. Containerization and testing are not required.

(5) Containerizing RCRA hazardous ground water and other RCRA hazardous IDW such as PPE, DE, and decontamination fluids for off-site disposal.

The following sections of this guidance provide guidelines for determining ARARs and identifying IDW.

2.2 OFF-SITE RESPONSE ACTIONS POLICY

CERCLA Section 121 (d) (3) requires that hazardous substances, pollutants, or contaminants that are transferred off-site for treatment, storage, or disposal during CERCLA response actions must be sent to facilities operating in compliance with RCRA and other applicable laws or regulations. In 1987, EPA issued a more detailed policy (the "off-site policy" – OSWER Directive No. 9834.11, November 13, 1987[4]) that describes procedures that must be followed when a response action under CERCLA involves off-site management of CERCLA wastes. This policy applies to all IDW that are transported to an off-site disposal facility, but does not itself require that all RCRA hazardous wastes and CERCLA hazardous substances be disposed off-site. Sections 2.4.3, 2.4.4, 2.5 and 2.6 of this guidance present the criteria that RCRA Subtitle C facilities, RCRA Subtitle D facilities, TSCA and CWA-regulated facilities must meet. The off-site policy is complex, and questions that arise should be referred to the appropriate EPA Office of Regional Counsel.

The off-site policy provides acceptability criteria for facilities that receive wastes from CERCLA-authorized or -funded response actions, including RCRA land disposal, treatment, storage, and permit-by-rule facilities, and for

non-RCRA Subtitle C facilities (such as facilities permitted to receive waste under TSCA) that receive non-RCRA wastes. Section 2.4.3 of this guidance discusses requirements for RCRA facilities that receive such wastes. In addition, the off-site policy lists procedures for implementing off-site response actions, incorporates the SARA requirements, and provides detailed procedures for issuing and reviewing unacceptability determinations. Off-site actions must comply with applicable requirements of this policy.

The off-site policy also establishes criteria for selecting an appropriate disposal facility. The policy requires that all RCRA hazardous wastes and CERCLA hazardous substances (which include RCRA hazardous wastes as a subset) generated during CERCLA response actions that are transferred off-site be managed in facilities that are not only in compliance with RCRA and other federal and state requirements, but also meet the compliance and release criteria outlined in the policy.

EPA has proposed an off-site rule (Part 300.440 of the NCP) that would codify the requirements of CERCLA Sections 121 (d) (3) and the off-site policy, and prevent CERCLA response actions from contributing to present or future environmental problems "by directing these wastes to management units determined to be environmentally sound" (53 FR 48218, November 29, 1988[29]). Once the rule is issued in final form, it will supersede the policy. Note that the proposed off-site rule contains provisions regarding materials sent to laboratories for testing and analysis. These provisions do not relate to the types of IDW discussed in this guidance.

2.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs must be identified on a site-specific basis, and the site manager must determine whether a requirement is applicable and, if not, whether the requirement is relevant and appropriate. A requirement under environmental laws may be either "applicable" or "relevant and appropriate," but not both.

For dealing with IDW, the most important federal ARAR is RCRA because it specifically regulates all aspects of transportation, treatment, storage, and disposal of hazardous wastes. Other major federal ARARs of concern include CWA, CAA, SDWA, and TSCA. State ARARs should be attained where they are promulgated and legally enforceable (see Section 2.7 of this guidance).

Much of what is discussed in this guidance is directly applicable; however, there are instances where requirements may not be legally applicable, but are nethertheless relevant (addressing a similar situation or problem) and appropriate (being well-suited to a particular site). Relevant and appropriate requirements should be considered in the same way as those that are directly applicable. For instance, such situations might include circumstances where a highly toxic waste constituent is suspected, a large volume of waste may be generated or the nature of the property (e.g. residential or proximity to public facilities) is of concern. Section 4.6 of this guidance discusses factors identified for off-site disposal of IDW and management options when an ARAR has been determined.

2.4 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

The Resource Conservation and Recovery Act (RCRA) of 1976, an amendment to the Solid Waste Disposal Act (SWDA) of 1965, was passed to protect human health and the environment, to conserve energy and natural resources, and to quickly reduce or eliminate the generation of hazardous wastes. RCRA currently has 10 discrete sections (Subtitles) that address specific waste management activities. Two of these Subtitles, and their implementing regulations, may be ARARs for IDW handling: Subtitle C (Hazardous Waste Management) and Subtitle D (Solid Waste Management).

The RCRA Hazardous and Solid Waste Amendments (HSWA) of 1984 established land disposal restrictions (LDRs) for RCRA hazardous wastes and mixtures of RCRA hazardous wastes with other substances, including those regulated under TSCA. Under RCRA regulations, restricted RCRA wastes may only be land disposed after treatment to specified levels. RCRA may be an ARAR for IDW handling if the IDW generated during the SI contain RCRA hazardous wastes. In that case, the SM should evaluate compliance (to the extent practicable) with LDRs.

2.4.1 LAND DISPOSAL RESTRICTIONS

Land disposal, as defined by RCRA Section 3004 (k), includes any placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, or underground mine or cave. For LDR purposes, the Agency commonly uses "land disposal" and "placement" as synonymous terms.

For the purpose of the LDRs, HSWA divides RCRA hazardous wastes into several groups (e.g., First Third, Second Third, California list wastes) and specifies dates, referred to as the statutory deadlines, by which treatment standards for each group must be established. The final statutory deadline for wastes listed or identified before November 8, 1984 was May 8, 1990. For wastes identified after November 8, 1984, EPA must determine whether these wastes will be prohibited from land disposal within 6 months of listing or identification. If EPA fails to promulgate treatment standards within 6 months for newly identified wastes, the wastes can be land disposed without restriction until the appropriate treatment standards are promulgated. After the statutory deadline for wastes identified before November 8, 1984, the wastes are "restricted" or "prohibited" and cannot be disposed in land unless:

- The wastes are treated to meet promulgated treatment standards.
- It can be demonstrated that hazardous constituents will not migrate from the land disposal unit as long as the wastes remain hazardous.
- The wastes are subject to treatment standard variances.
- The specific waste has received a national capacity variance.

It should be noted that the NCP establishes a presumption that treatment to best demonstrated available technology (BDAT) standards is inappropriate as a standard for soil removed from CERCLA sites, and that a treatability variance is appropriate in such circumstances (see 55 FR 8760-8762).

To determine if LDRs are applicable to IDW management, the SM must evaluate whether:

(1) The IDW are RCRA hazardous waste.

(2) The RCRA hazardous waste is regulated under the LDRs.

(3) The anticipated approach to IDW management constitutes "placement" (land disposal) of the generated wastes. (For the purpose of the LDRs, EPA considers itself a waste generator when the response action involves treatment, storage, or disposal of RCRA hazardous wastes. If the SI does not involve RCRA hazardous IDW disposal, RCRA regulations are not triggered.)

LDRs apply only if the answer to all three questions is "yes." In some cases, as discussed in section 2.3, LDRs may be "relevant and appropriate" even if not strictly applicable.

2.4.2 AREA OF CONTAMINATION CONCEPT AND ITS IMPLICATIONS

An important consideration in determining whether LDRs apply is whether land disposal of IDW has occurred. If IDW are merely being moved within the same "area of contamination" (AOC), EPA does not consider "land disposal" to have occurred, so that LDRs are not triggered, even if IDW contain RCRA hazardous material. Therefore, if IDW are being moved only within an AOC, it is unnecessary to determine whether they are subject to LDRs.

EPA has not promulgated a regulatory definition of an AOC. However, the preamble to the NCP (55 FR 8760) states that "EPA generally equates the CERCLA area of contamination with a single RCRA land-based unit, usually a landfill." EPA noted that under RCRA, the term " 'landfill' could include a non-discrete land area on or in which there is generally dispersed contamination." The contamination in an AOC may vary in concentration and type of contaminant. Further guidance on the AOC concept is provided in 55 FR 8760 (March 8, 1990), 53 FR 51444 (December 21, 1988), and in Superfund LDR Guide #5 (OSWER Directive 9347.3-05, July 1989).

The AOC concept applies only to contaminated soil (and sediments) from the impacted site. The AOC concept does not affect the approach for managing IDW that did not come from the AOC, such as PPE, DE, decontamination fluids, and ground water. The latter materials, if RCRA hazardous, must be containerized and disposed off-site.

Examples of AOCs include: a waste source such as waste pit, landfill, waste pile along with the surrounding contaminated soil, or the sediments in a contaminated stream. Depending on site characteristics, one or more AOCs may be delineated. CERCLA sites often consist of several AOCs. To determine if separate AOCs can be delineated within the site, and if RCRA regulated wastes are present within the AOCs, the site manager should collect sufficient information about the site as early as possible, preferably prior to starting field work. Determining AOCs may prove difficult if there is little available information or no visual contamination. In such cases, site managers may use their best professional judgment to delineate AOCs (e.g., a small area immediately adjacent to a borehole may be part of an AOC if the area is covered with surface soil similar to soil from the borehole).

Once the AOC units are determined, the site manager must evaluate whether an anticipated IDW handling approach constitutes land disposal. In general, land disposal does not occur when wastes are:

- Moved within the unit.
- Capped in place.
- Treated in situ (without placing the waste in another unit for treatment).
- Processed within the AOC to improve structural stability (without placing the waste into another unit for processing).

Superfund LDR Guide #5, "Determining when Land Disposal Restrictions (LDRs) are Applicable to CERCLA Response Actions,"[5] states that land disposal occurs when:

- Wastes from different AOCs are consolidated into one AOC.
- Wastes are moved outside of an AOC (for treatment and storage) and returned to the same or a different AOC.
- Wastes are excavated from an AOC, transferred to a separate unit such as a tank, surface impoundment, or incinerator that is within the AOC, and then redeposited into the AOC.

In addition, land disposal occurs if wastes removed from an AOC are stored (e.g., placed in drums outside the AOC) prior to being returned to the AOC.

Thus, under the NCP, the AOC unit concept means that:

- Land disposal does not occur when wastes are left in place, or moved or stored within a single AOC unit.
- Leaving RCRA hazardous soil on-site within the AOC unit does not constitute disposal and does not

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trigger RCRA regulations, unless the SM determines that the wastes would significantly increase risks to human health and the environment (e.g., fire or explosion) and must be disposed of off-site.

- RCRA hazardous ground water, decontamination fluids, PPE, and DE should be containerized and disposed off-site.

- Moving RCRA hazardous soil cuttings from one AOC to another AOC triggers the LDRs.

If IDW cannot be deposited within the delineated AOC, the site manager must comply with all LDRs to the extent practicable. This means that the IDW should be transferred to an off-site RCRA Subtitle C hazardous waste treatment, storage, or disposal facility that complies with the off-site policy.

2.4.3 REQUIREMENTS FOR RCRA SUBTITLE C TREATMENT, STORAGE, AND DISPOSAL FACILITIES

The RCRA Subtitle C standards[2] cover hazardous waste treatment, storage, and disposal (TSD) facilities. The specific standards govern installation, operation, inspection, and closure of containers, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, and other units.

Off-site TSD facilities receiving IDW must have RCRA permits to operate. Facilities that are permitted under another statute to receive hazardous wastes are eligible for RCRA permits without filing RCRA permit applications. These facilities, referred to as "permit-by-rule," include ocean disposal barges or vessels, injection wells, and publicly-owned treatment works (POTWs). The NCP exempts EPA from the RCRA permitting requirement while conducting CERCLA actions on-site. However, EPA should attempt to consider RCRA storage regulations as relevant and appropriate when containerizing and storing wastes on-site, even though a permit application will not be filed.

Generally, the RCRA storage regulations require a generator to: (1) place the waste in containers or tanks; (2) satisfy the standards for containers or tanks; (3) clearly indicate the waste accumulation date on the containers; (4) mark the containers and tanks as "hazardous waste"; and (5) comply with the requirements for owners and operators of hazardous waste TSD facilities. In addition, LDRs prohibit the storage of RCRA restricted waste unless the storage is to accumulate sufficient quantities of the waste to promote proper disposal, treatment, or recovery. When storing hazardous waste for more than 90 days, the SM should consider the storage requirements of 40 CFR Parts 262 and 264 as relevant and appropriate and comply with them to the extent practicable unless the site falls within one of the following categories of waste generators:

1. Conditionally exempt small quantity generators (producing no more than 100 kilograms of hazardous waste in a calendar month), and

2. Small quantity generators producing between 100 kg and 1,000 kg of hazardous waste in a calendar month.

In the cases listed above, the SM will have to comply with the guidelines provided in 40 CFR Part 261.5(g)(2) and 40 CFR Part 262.34.

Any facility receiving IDW containing hazardous wastes must comply with all RCRA Subtitle C design, operation, and closure requirements. In addition, the off-site policy presents additional criteria for selecting an appropriate disposal facility. The most important criteria[6] that a RCRA Subtitle C facility must meet if it receives RCRA hazardous IDW are:

- There must be no record of any relevant violations at or affecting the receiving unit.

- There must be no releases at receiving units of land disposal, treatment, or storage facilities. Note that

a land disposal facility may consist of one or more land disposal units, including landfills, surface impoundments, land treatment units, and piles.

- There must be no significant releases (as determined by EPA) from non-receiving units at treatment and storage facilities that are not controlled by corrective action.

- Waste cannot be disposed of at any unit of a land disposal facility, if any one unit at the facility has releases that are not controlled by corrective action.

- The land disposal facility must demonstrate compliance with the minimum technology requirements of RCRA Section 3004 (o).

The off-site policy also applies to RCRA permit-by-rule facilities receiving RCRA hazardous waste. These facilities are subject to the same requirements as other RCRA Subtitle C facilities and must be inspected for compliance with the applicable RCRA requirements, as well as be inspected by the appropriate authorities for compliance with other applicable laws. Permit-by-rule facilities that receive only nonhazardous materials do not need RCRA permits but must be inspected by local agencies for compliance with applicable laws.

2.4.4 APPLICATION OF RCRA REQUIREMENTS TO IDW MANAGEMENT

RCRA requirements apply to management of IDW during SIs in the following manner: if IDW is stored or disposed off-site, then the SM must comply with all RCRA and ARAR storage requirements; if IDW are stored on-site, then the SM must comply with RCRA to the extent practicable.

Off-site management of RCRA hazardous IDW may also involve treatment, storage, and disposal of RCRA hazardous wastes in accordance with all applicable guidelines. For TSD facilities constructed solely as part of a CERCLA response action, RCRA operating permits are not required.

IDW generated during the SI may require on-site storage in containers while awaiting off-site disposal. Although CERCLA exempts response actions conducted entirely on-site from permit requirements (see CERCLA Section 121 (e) (1)), EPA's policy is to follow the storage regulation practices required for RCRA generators who wish to avoid obtaining permits (40 CFR Parts 240-280). These requirements are applicable if the site manager determines that the containerized IDW are RCRA hazardous waste. RCRA hazardous IDW containerized and stored on-site must be properly disposed within a regulatory timeframe. There are cases where this may not be possible and storage does not require a permit, although EPA should try to expedite removal as much as possible. Note that accumulation of IDW, even on-site, in units other than containers or tanks may result in creation of RCRA units that are subject to various RCRA requirements such as closure, permitting, and ground water monitoring.

2.4.5 CRITERIA FOR RCRA SUBTITLE D FACILITIES

RCRA Subtitle D[22] regulates disposal of nonhazardous wastes in facilities such as municipal landfills. RCRA nonhazardous IDW, such as personal protection equipment (PPE) and disposable equipment (DE), may be disposed of in a Subtitle D facility. Other RCRA nonhazardous IDW (e.g., soil cuttings or ground water) should go to a Subtitle D facility only in very rare circumstances (these wastes should be disposed on-site). The off-site policy establishes requirements for selecting an appropriate RCRA Subtitle D facility for IDW disposal:

- The facility must have a compliance inspection prior to receiving CERCLA IDW and this inspection must not identify any noncompliance with relevant federal and state regulations at or affecting the receiving unit.

- Environmentally significant releases (as determined by EPA) of hazardous substances must be controlled by corrective action.

2.5 TOXIC SUBSTANCES CONTROL ACT

RCRA nonhazardous IDW containing PCBs or asbestos must, in certain circumstances, be disposed of at facilities regulated under the Toxic Substances Control Act (TSCA). While asbestos is not a common contaminant at CERCLA sites, PCBs can be found at about 17 percent of CERCLA sites. Regulations governing the management of IDW containing PCBs, which are generally based on PCB concentrations in waste, are found at 40 CFR 761.60.

TSCA requirements for handling PCBs[8] call for incineration of PCB-contaminated liquid material with concentrations greater than 500 ppm. For liquid material with PCB concentrations between 50 and 500 ppm, the principal alternative to incineration is disposal in a TSCA chemical waste landfill. Any receiving unit must meet the compliance and release criteria for non-RCRA units as set out in the off-site policy, in order to be acceptable. These PCBs may also be destroyed by using a TSCA-approved method that provides a level of performance equivalent to incineration. Nonliquid PCBs at concentrations greater than or equal to 50 ppm may be incinerated, treated by a equivalent TSCA-approved method, or disposed in a TSCA chemical landfill. PCB-contaminated material with concentrations less than 50 ppm are generally not regulated under TSCA, and may be disposed in acceptable Subtitle D facilities.

Even though IDW containing PCBs alone are not RCRA hazardous wastes, IDW containing PCBs mixed with RCRA hazardous wastes are regulated under RCRA LDRs as part of the California list wastes[4,5]. Since PCBs can be governed by RCRA and TSCA, the SM must determine whether RCRA (in the case of PCBs mixed with RCRA wastes) or TSCA regulations, or both, are applicable.

2.6 CLEAN WATER ACT

The Clean Water Act (CWA) addresses site-specific pollutant discharge limitations and performance standards for specified industries to protect surface water quality. At the SI, the most likely situation involves indirect discharge of IDW water, regulated under CWA, to POTWs for treatment and disposal. A less likely situation may involve direct discharge, either on-site or off-site, to surface water.

RCRA hazardous wastewater can be disposed of at POTWs that have a RCRA permit-by-rule and that meet the off-site policy criteria for a facility receiving RCRA hazardous waste. Disposal at a POTW of nonhazardous wastewaters from CERCLA sites is an option[7,8] if the POTW is acceptable under the off-site policy (Appendix C). EPA regulations cover general and specific prohibitions on discharges[9] to POTWs.

The following criteria [10] should be used in selecting an appropriate POTW facility:

- Compliance with all applicable laws.
- The quantity and quality of the CERCLA IDW must be compatible with the POTW.
- The POTW must have no unpermitted "releases."
- The concentration of any hazardous substance must meet applicable pretreatment standards (CERCLA IDW cannot upset the facility's operation and violate the permit).
- The POTW must be in compliance with its National Pollutant Discharge Elimination System (NPDES) permit.
- The transport of IDW to the POTW and its placement in an impoundment must not create a potential for ground water contamination.

2.7 STATE REQUIREMENTS

State ARARs present an array of specific problems for CERCLA sites because their goals and methods often differ from federal environmental laws. CERCLA Section 121 and Section 300.400 (g) of the NCP provide that only those state standards that are promulgated, identified by the state in a timely manner, and more stringent than federal requirements may generally be ARARs. To be considered "promulgated," a standard must be legally enforceable and of general applicability. A waiver is available if the state standard is applied only to CERCLA sites[1]. When dealing with IDW, SMs must comply (to the extent practicable) with state promulgated and enforceable requirements that are more stringent than federal requirements.

State hazardous waste regulations are among the most important environmental laws that may differ, in some states, from federal law. EPA has authorized some states to administer and enforce RCRA hazardous waste management programs. Regulations in these states may be more stringent or have a greater scope of coverage than the federal RCRA requirements. If the CERCLA site is in a state with an authorized RCRA program, the RCRA requirements promulgated by the state will replace the federal requirements as potential ARARs.

In addition to state RCRA regulations, other state legally enforceable standards may govern the handling of wastes. However, the SM should be aware that ARAR waivers are generally available for state requirements specifically aimed at CERCLA sites (see CERCLA section 121(d)(4)(E); 40 CFR 300.430(f)(1)(ii)(C)(5).

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3.0 IDENTIFICATION OF INVESTIGATION-DERIVED WASTES

To properly deal with IDW from SIs, the SM must know whether IDW contain CERCLA hazardous substances, and whether these hazardous substances constitute either RCRA hazardous wastes or contaminants regulated under other statutes. This section is intended to help the SM ascertain the types of IDW generated during the SI and, in particular, to determine whether IDW are either RCRA listed or characteristic hazardous waste.

There are several types of IDW generated during the SI. Examples include the following: (1) soil cuttings and drill mud from soil boring or monitoring well installations; (2) purge water removed from wells before ground water samples are collected; (3) water, solvents, or other fluids used to decontaminate field equipment and PPE; and, (4) PPE and DE. These IDW can be contaminated with various CERCLA hazardous substances. To handle IDW in compliance with regulations, reasonable efforts should be made to characterize the wastes.

3.1 EXTENT OF EFFORTS TO CHARACTERIZE WASTES

The efforts made to characterize IDW should be consistent with the limited scope and purpose of the SI. In most cases, the limited scope of an SI makes it impracticable to characterize wastes to the same extent that might be done in a remedial investigation/feasibility study (RI/FS). In particular, Contract Laboratory Program (CLP) testing would not be warranted in most cases; instead, the nature of the wastes should be assessed by applying best professional judgment, using readily available information about the site (such as manifests, storage records, preliminary assessments, and results of earlier studies that may have been conducted and are available to the Agency, as well as direct observation of the IDW for discoloration, odor, or other indicators of contamination). The Agency has specifically indicated that IDW may be assumed not to be "listed" wastes under RCRA unless available information about the site suggests otherwise (53 FR 51444, December 21, 1988). Similarly, RCRA procedures for determining whether a waste exhibits RCRA hazardous characteristics do not require testing if the decision can be made by "applying knowledge of the hazard characteristic in light of the materials or process used" (40 CFR 262.11(c)). The level of such knowledge required to make a determination with respect to IDW may take into account considerations of practicability and should reflect the limited scope of the activity. In most instances, a determination may be possible based on available information and professional judgment.

The fact that extensive resources need not be used in characterizing IDW does not mean that IDW can be assumed to be nonhazardous unless clearly proven otherwise. Rather, the question is whether, given the limited information that is likely to be available, the SM considers it more likely than not that the wastes are hazardous.

It should be noted that characterizing IDW is only the first step. For example, once it has been determined that a RCRA hazardous waste is involved, the guidelines discussed in Section 2.4 for determining the extent to which RCRA requirements must be complied with should be considered. Furthermore, the degree of certainty with which IDW are characterized during site inspections will be less than during remedial actions. Therefore, even if the waste is deemed not to be RCRA hazardous, RCRA requirements may be considered relevant and appropriate under the specific circumstances at the site (see section 3.2.1).

3.2 RCRA HAZARDOUS WASTES AND CERCLA HAZARDOUS SUBSTANCES

Some CERCLA hazardous substances are RCRA hazardous wastes. Another category of CERCLA hazardous substances are PCBs, which are fairly common at CERCLA sites. Identification of RCRA hazardous wastes and PCB-contaminated IDW is important for making appropriate management decisions (see Sections 2.5, 3.2.1, and 3.2.2 of this guidance). The SM must know the difference between RCRA hazardous wastes and other CERCLA hazardous substances because the presence of RCRA hazardous IDW invokes special technical considerations and

management decisions due to RCRA regulations (particularly the LDRs). EPA recommends using knowledge of IDW rather than testing the wastes to characterize them.

The SM should not assume that all IDW contaminated with CERCLA hazardous substances are RCRA hazardous wastes, in the absence of positive evidence (e.g., manifests, records, knowledge of generation processes) to support such an assumption. At the same time, however, the SM should determine whether IDW are RCRA hazardous wastes, to the extent practicable, as discussed above.

The most important characterization decision is whether IDW contain "hazardous waste" under RCRA. This is relevant to the ARAR status of LDRs and other RCRA requirements, and whether waste disposed of off-site must be disposed of in a Subtitle C or Subtitle D facility. A solid waste is a RCRA hazardous waste[2] if it contains a listed waste or exhibits any of the hazardous characteristics and is not excluded from regulation as a hazardous waste. (For purposes of the RCRA Subtitle C regulations, a solid waste is any discarded material (solid, sludge, liquid, and compressed gas) that is not excluded under SWDA.) IDW generated during the SI may either exhibit a RCRA characteristic or contain RCRA listed waste.

Under EPA regulations, soil and ground water may be considered contaminated environmental media. If they contain listed hazardous waste, they must be managed as RCRA hazardous wastes as long as they "contain" the listed waste. If IDW exhibit RCRA characteristics, they also have to be managed as RCRA hazardous wastes.

To properly handle IDW, the SM must make a reasonable effort to ascertain if they are RCRA hazardous. When the SM determines that IDW do not fall in any listed waste category and does not display RCRA characteristics, the wastes are not RCRA hazardous. Sections 3.2.1 and 3.2.2 help determine if IDW are RCRA characteristic wastes or if they contain RCRA hazardous listed wastes.

Even if the IDW do not contain RCRA "hazardous waste," the SM should determine whether they contain other CERCLA hazardous substances. CERCLA hazardous substances include, in addition to RCRA hazardous wastes, substances, elements, compounds, solutions, or mixtures designated as hazardous or toxic under CERCLA itself or under the authority of other laws such as TSCA, CWA, CAA, and SDWA. Therefore, even where RCRA is not applicable, one of these statutes may be an ARAR. EPA presents a list of these hazardous substances in 40 CFR Part 302.4, Table 302.4.

3.2.1 RCRA CHARACTERISTIC WASTES

A solid waste is a RCRA characteristic hazardous waste if it exhibits the characteristic of ignitability, corrosivity, reactivity (as defined in 40 CFR Part 261, Subpart C), or toxicity (toxicity characteristic leaching procedure, TCLP, as described in 55 FR 11796-11877, March 29, 1990[11]).

IDW exhibit <u>ignitability</u> if:

- They are a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume, and have a flash point lower than 60°C (140°F).
- They are not a liquid and are capable, under standard temperature and pressure, of causing fire and, when ignited, create a hazard.
- They are an ignitable compressed gas as defined in 49 CFR 173.300.
- They are an oxidizer as defined in 49 CFR 173.151.

IDW exhibit corrosivity if:

- They are aqueous and have a pH less than or equal to 2 or greater than or equal to 12.5.
- They are a liquid and corrode steel at a rate greater than 6.35 mm (0.25 inch) per year at a test temperature of 55°C (130°F).

IDW exhibit reactivity if:

- They are normally unstable and readily undergo violent change without detonating.
- They react violently with water.
- They form potentially explosive mixtures with water.
- When mixed with water, they generate toxic gases, vapors or fumes that pose a danger to human health or the environment.
- They are a cyanide- or sulfide-bearing waste capable of (at the pH range of 2 to 12.5) generating toxic gases that can present a danger to human health or the environment.
- They are capable of detonation or explosive decomposition.
- They are a forbidden explosive as defined in 49 CFR 173.51.

IDW exhibit TCLP-toxicity when its leachate contains certain contaminants at levels exceeding their regulatory thresholds[10]. The TCLP has replaced the EP-toxicity test for identifying RCRA characteristic wastes. The new procedure expands the number of chemicals regulated as hazardous wastes by adding 25 organic constituents to the previous RCRA list of toxic chemicals, and by establishing regulatory levels for these chemicals (Appendix C). The TCLP is designed to determine the mobility of both organic and inorganic contaminants present in liquid, solid, and multiphasic wastes. A water containing less than 0.5 percent dry solid material, filtered through a 0.6 to 0.8-um glass fiber filter, is defined as the TCLP extract. If this extract contains a regulated compound above its threshold level, then the water is hazardous by TCLP characteristic. If the filtered extract from the solid phase contains a regulated compound above its threshold level, then the solid material is RCRA hazardous.

To identify RCRA characteristic waste[1], the SM may rely on knowledge of the properties of the substances from, for example, the Material Safety Data Sheets (MSDS) prepared by manufacturers, or on the results of tests described in 40 CFR 261.21 - 261.24. EPA recommends using knowledge of the properties of materials instead of testing since most CERCLA wastes do not exhibit these RCRA characteristics. Therefore, the SM should not test IDW, particularly if they are a soil of known RCRA characteristics, the AOC concept is applicable, and the wastes will be buried on-site.

3.2.2 RCRA LISTED HAZARDOUS WASTES

Any type of IDW that contains listed hazardous wastes should be considered a RCRA hazardous waste. EPA has developed four lists of RCRA hazardous wastes according to the sources of their origin and toxicity (40 CFR Part 261, Subpart D). These lists contain:

- Wastes from nonspecific sources (F wastes). Examples include spent halogenated solvents (tetrachloroethylene, methylene chloride), nonhalogenated solvents (xylene, acetone, ethyl ether), still bottoms from the recovery of these spent solvents, and some wastewater treatment sludges.

- Wastes from specific sources (K wastes). Examples include wastewater treatment sludges from the production of zinc yellow and chrome green pigments, and still bottoms from the distillation of benzyl chloride.

- Discarded commercial chemical products, manufacturing intermediates, off-specification (off-spec) chemicals (which, if they met specifications, would be listed), and container and spill residues that are "acutely hazardous" (P-wastes). Examples include aldrin and phosgene.

- Discarded commercial chemical products, manufacturing chemical intermediates, or off-spec commercial chemical products that are "toxic" (U-wastes). Examples include chlorobenzene and mercury.

To ascertain whether IDW constitute RCRA listed hazardous waste, the SM must first determine if the IDW contain a component that may be a listed hazardous waste, and then decide whether that component meets the regulatory description of that listed waste.

For example, to determine if solvents contaminating IDW are RCRA spent solvent F001-F005 wastes, the SM must know if:

- The solvents are spent and cannot be reused without reclamation or cleaning.

- The solvents were used exclusively for their solvent properties.

- The solvents are spent mixtures and blends that contained, before use, a total of 10 percent or more (by volume) of the solvents listed in F001, F002, F004, and F005.

If the solvents contained in the IDW are RCRA listed wastes, the IDW are RCRA hazardous waste. When the SM does not have guidance information on the use of the solvents and their characteristics before use, the IDW cannot be classified as containing a listed spent solvent. When the solvents are not listed and IDW are not a characteristic waste, the IDW should be declared nonhazardous.

For other F and K wastes, the SM must know the generation process information (about each waste contained in the RCRA waste) described in the listing. For example, for IDW to be identified as containing K001 wastes that are described as "bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol," the SM must know the manufacturing process that generated the wastes (treatment of wastewaters from wood preserving process), feedstocks used in the process (creosote and pentachlorophenol), and the process identification of the wastes (bottom sediment sludge).

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-spec products. Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA IDW contains a P or U waste, the SM must have direct evidence of product use. In particular, the SM should ascertain, if possible, whether the chemicals are:

- Discarded (as described in 40 CFR 261.2(a) (2)).

- Either off-spec commercial products or a commercially sold grade.

- Not used (soil contaminated with spilled unused wastes is a P or U waste).

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- The sole active ingredient in a formulation.

Identification of a listed waste requires a great deal of care on the part of the SM, particularly if the IDW have to be disposed off-site. For instance, depending on its source and prior use benzene may be an F waste, U waste, or not a RCRA hazardous waste at all. The waste identification process requires access to manifests, storage records, records of waste sources and their prior use, and other information that is reasonably ascertainable during the SI. Visual inspection of the site or the waste generating process will sometimes be sufficient.

IDW from many SIs will not fit the definition of RCRA hazardous listed waste due to limited information. If there is a probability that investigation-derived soil cuttings contain a RCRA listed waste, and a site manager intends to leave them on-site within the AOC unit, a thorough evaluation of the waste is not necessary.

4.0 PLANNING FOR IDW GENERATION AND MANAGEMENT

The most important phase of IDW management is planning for waste generation and handling before field activity starts. In the planning phase of work, the SM must decide if IDW can be left on-site or must be disposed off-site. Since some sites may have both RCRA hazardous and RCRA nonhazardous IDW, the SM must be familiar with the NCP, and appropriate sections of RCRA, TSCA, CWA, and other relevant statutes.

Handling of RCRA hazardous IDW and IDW with high PCB concentrations (greater than 50 ppm) may involve either moving the IDW within an AOC unit, or containerization, storage, testing, treatment, and off-site disposal. Handling of RCRA nonhazardous IDW usually involves various methods of on-site disposal. EPA prefers to leave both RCRA hazardous and nonhazardous IDW on-site whenever it complies with regulations and does not pose any immediate threat to human health and the environment. This approach speeds up the site assessment process while avoiding high costs of off-site disposal, particularly when off-site disposal does not result in any benefits to human health and the environment.

The approach to IDW generating and handling must be described in the SI work plan which is subject to EPA approval. The SM must base the approach on available information and best professional judgment. The work plan should describe the logic behind the proposed approach to IDW handling, and in particular:

- Methods of waste quantity minimization.
- Types of waste.
- Quantity of waste.
- ARARs of concern, and limits of practicability in light of the scope of the SI.
- On-site and off-site handling methods, where necessary.
- Delineated AOCs for RCRA waste to be handled on-site.
- Containerization, storage, testing, and pick-up methods for wastes to be disposed off-site.

The description of the approach to IDW handling must be as detailed as possible, so the inspection team can execute the work plan without any major problems in the field. If the SI results in generating any IDW off-site, they should be handled the same way as if they were generated on-site.

4.1 AUTHORITY TO MANAGE IDW

EPA views IDW management as an inherent part of the site investigation process authorized under CERCLA Section 104 (e) (4). Should a site owner refuse to provide access, EPA has the authority to issue an administrative order, or seek a court order, to gain site access for environmental sampling. Non-compliance with such an order may result in imposing the sanctions authorized under CERCLA Section 104 (e) (5), including penalties.

EPA believes the approach contained in this guidance to be reasonable and protective of human health and the environment. The limited scope and purpose of the SI activity is not intended to address contamination at a particular site (other than to gather information about it). Generally, SI activities that leave conditions essentially unchanged (e.g., returning soil cuttings to the location from which they were taken) will comply with ARARs. The SM should seek to obtain the appropriate management approach for IDW outlined in this guidance when negotiating site access agreements.

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Note, however, that some site circumstances may warrant exceptions to the IDW management approach outlined in this guidance. The SM should use professional judgment in recognizing situations where special steps are required to avoid creating additional threats to human health and the environment. When substantial doubt exists regarding the scope of EPA's authority to carry out the proposed plan for IDW management, the SM should consult legal counsel.

4.2 WASTE MINIMIZATION

The SM should select investigation methods that minimize the generation of IDW, particularly RCRA hazardous wastes. The SI team should limit contact with contaminants, and use drilling and decontamination methods (such as steam cleaning) that minimize PPE, DE, decontamination fluids, and soil cuttings. In particular, the inspection team should minimize the amounts of solvents used for decontamination or eliminate solvents. Minimizing the amount of wastes generated reduces the number of IDW handling problems and costs of disposal. The waste minimization approach should be addressed in the SI workplan.

4.3 TYPES, HAZARDS, AND QUANTITIES OF IDW

To handle IDW properly, the SM must determine the types (such as soil cuttings, ground water, decon fluids, PPE or DE), characteristics (whether RCRA hazardous or containing other CERCLA hazardous substances), and quantities of anticipated wastes. As discussed in Section 3.1, testing will generally not be required to characterize waste to the extent appropriate for an SI. In addition to direct observation of the IDW for evidence of contamination, the SM should review and analyze all available information about the site such as:

- Results of previous EPA preliminary assessments or site investigations.
- Environmental permits.
- Results of inspections by state, local, or federal agencies, or private parties.
- Records from community relations interviews.
- Any other helpful data such as tax records or aerial photography.

Upon ascertaining the types of anticipated IDW, the SM should determine IDW characteristics, in particular whether the anticipated waste is RCRA hazardous (see Section 3.2 of this guidance) or contains high concentrations of PCBs. For RCRA hazardous IDW, the SM should determine whether the IDW poses an increased hazard to human health and the environment relative to conditions that existed prior to the SI. Whenever field analytical screening instruments are used during the SI, the SM may plan to evaluate the analytical results as helpful indicators of IDW characteristics. However, the SM must remember that most of these tests are not RCRA tests, and that the test results usually do not identify RCRA hazardous wastes. The SM must also determine the exact properties of RCRA nonhazardous IDW to select an appropriate disposal facility (e.g., POTW) when the circumstances require off-site disposal.

Upon determining the types and characteristics of IDW to be generated, the SM must assess the anticipated quantities which vary depending on the size of a site and the scope of the SI. As a point of reference, a typical SI may result in generating a range of 1 to 3 drums of PPE and DE, 50 to 1,500 gallons of decontamination water, 1 to 3 pints of other decontamination fluids (e.g., organic solvents) and, depending on the number of wells installed or sampled, 0 to 13 drums of soil cuttings and 0 to 200 gallons of well purge water. The SM should calculate the quantity of the anticipated soil cuttings and ground water from the dimensions of wells and the depth to the ground water table. The SM should use experience to assess the amount of decontamination fluids (decontamination water and organics), PPE, and DE.

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4.4 DECISION TREE

Upon designating IDW either RCRA hazardous or RCRA nonhazardous, the SM should determine the appropriate handling approach. The SM should use the decision tree (Figures 1, 2, and 3) which, combined with the SM's best professional judgment, will help select the best approach for IDW management and the steps that are involved in executing the approach. The decision tree indicates when and how IDW should be handled on-site or disposed off-site.

The decision tree summarizes basic elements of planning for IDW handling such as waste minimization, characterization, and management. It shows the steps that must be followed in the process. For example, the "Plan for Waste Management According to IDW Characteristic" branch (Figure 1) indicates that the SM has two options: either to handle IDW on-site or to dispose of it off-site. If the SM's decision is to leave IDW on-site, then the "On-Site Handling" branch (Figure 2) indicates what choices and steps can be involved in this approach depending on the type of IDW. The "Off-Site Disposal" branch (Figure 3) of the decision tree presents options available for handling IDW off-site and steps involved in executing these options. The SM should select one of the available options for a given type of IDW.

For example, when IDW from the same site are expected to encompass ground water, PPE, DE, decontamination fluids, and soil cuttings that are RCRA hazardous (or contaminated with PCBs) wastes, the decision tree (Figures 1, 2) calls for either handling the cuttings on-site in an AOC unit, or in the site's existing treatment or disposal unit (TDU), or disposing of them off-site. EPA prefers to handle most IDW on-site, but if circumstances require, the off-site option is also available. If PPE and DE can be decontaminated and, according to the SM's best professional judgment, rendered nonhazardous, the decision tree indicates (Figure 3) that these wastes should be double-bagged, and deposited either in an industrial dumpster (on-site or at the EPA warehouse), or in a municipal landfill (RCRA Subtitle D facility). If the SM anticipates that PPE and DE cannot be rendered RCRA nonhazardous after decontamination and the total quantity of IDW generated exceeds 100 kg at an individual site, the decision tree indicates (Figures 1,2) that the wastes should be drummed and disposed off-site at an appropriate facility by a subcontractor, and the SM should start the subcontracting process before field activity begins. If the total quantity of RCRA hazardous PPE and DE is less than 100 kg and this quantity represents the entire amount of IDW generated during the SI, the small quantity waste generator exemption applies and the wastes can be disposed of in a municipal landfill with state approval. However, EPA prefers to send even small quantities of RCRA hazardous PPE and DE to RCRA hazardous waste facilities.

The decision tree points out that when the ground water is RCRA nonhazardous (the most common situation), the water may be managed on-site (Figure 2) using one of a few simple techniques. If decontamination fluids are RCRA nonhazardous, they should be handled similarly. The decision tree indicates (Figure 3) that RCRA hazardous organic decontamination fluids should be handled off-site.

Sections 4.5 and 4.6 of this guidance present the details of EPA-preferred approaches to IDW management.

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5.0 IMPLEMENTING THE IDW MANAGEMENT PLAN

The work plan describing the anticipated approach and procedures for IDW management should be clear, detailed, and concise to allow the field team to follow without problems. The plan should also be flexible enough to allow slight modifications due to unexpected and unforeseen field conditions. The SM should document implementation of the work plan in the field log book and describe the appearance of IDW as well as any modifications to the original handling approach. The SM must also ensure that IDW is handled in a fashion that does not generate public concerns.

5.1 ON-SITE IDW MANAGEMENT

If ground water or decontamination fluids are to be collected during the SI, adequate numbers and types of containers must be delivered to the site before the SI starts. The SM must check if the containers are clean and measure the pH of containerized waters even if these waters were originally determined to be RCRA nonhazardous. When the work plan calls for ground water to be poured onto the ground next to the well, then the SM must verify the original determination (e.g., pH testing) before allowing the water to infiltrate the ground.

If the SM, using best professional judgment, renders PPE and DE RCRA nonhazardous after decontamination, the materials are to be double-bagged and the SI team should take them to either the on-site or EPA warehouse dumpster, or to a municipal landfill. The location of PPE and DE disposal should be described in the field log book.

If the work plan calls for on-site management of RCRA hazardous soil cuttings, a shallow pit should be made close to the borings within a delineated AOC unit. IDW should then be buried in this pit and covered with surficial soil. The SM may decide to have more than one IDW burial pit within an AOC unit. The appearance of the generated IDW, and the size and location of the pit, must be described in the field log book.

If the work plan indicates that both RCRA hazardous and nonhazardous IDW are to be disposed in an operating treatment and disposal unit located on the same property as the IDW sources (but outside the AOC), then the SM must verify that the unit complies with the requirements of the off-site policy at the time of disposal.

5.2 OFF-SITE DISPOSAL OF IDW

Off-site disposal of RCRA hazardous and nonhazardous IDW involves the following common elements:

- Coordinating IDW handling.
- Identifying and verifying an acceptable disposal facility before the SI.
- Finalizing the subcontract.
- Containerizing IDW.
- Labeling containers.
- Storing containers.
- Sampling and testing of IDW.
- Transporting IDW off-site.

- Disposing at a disposal facility.

- Documenting the process.

Coordination of IDW handling is important because it affects the schedule and costs of the SI. Most coordination must be done before field activity starts. Before starting the field work, a subcontractor should be selected so the SM can coordinate field work and IDW generation with the subcontractor's sampling, testing, pick-up, and disposal activities. Before containerizing IDW, the SM should check the containers to ensure they are clean and do not contain any residues from past use. All filled containers should be dated and labeled as either RCRA hazardous or RCRA nonhazardous and stored in a safe manner in compliance with relevant regulations. The SM should also obtain an EPA ID number for a RCRA hazardous waste from the RPO.

If a temporary storage facility must be constructed, the SM should have all construction materials, such as chain-link fencing, posts, and other needed materials, delivered to a location agreed upon with the site owner before the SI. The SM should ensure that the storage time is short and never exceeds the regulatory 90 days for RCRA hazardous waste even if the small quantity generator exemption applies.

The SM should check that the subcontractor collects IDW analytical samples for the disposal facility "profile analysis" using EPA-recommended methods described in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" - SW 846. One composite sample should be collected from each large container or from a group of drums. Small samples of soil cuttings or drilling mud should be taken from several locations and depths of the handling containers, homogenized in a decontaminated bucket, and placed in sampling jars. Sampling of PPE and DE should be avoided. The SM should also ensure that the chain-of-custody form for shipping IDW samples is used. When the subcontractor's analysis confirms that IDW is a RCRA restricted hazardous waste, the SM should check that the subcontractor:

- Treats the IDW to meet the treatment standards (if needed) before land disposal.

- Complies with the LDR notification requirements of 40 CFR Part 268.

Containerized and tested RCRA hazardous IDW must be accompanied by a Hazardous Waste Manifest (and other forms required by state laws) if hauled off-site. RCRA nonhazardous IDW should have a bill of lading if transported off-site. The SM must obtain all required forms, fill them out clearly and completely, and have the forms signed by the RPO. The SM, if authorized, may sign the forms on behalf of EPA. Before transporting IDW to the selected facility, the SM must verify the facility's compliance with the off-site policy at the time of disposal. If the facility's status has changed since the award of the contract, (due to receiving citations or fines), the SM is responsible for finding a replacement facility without delay. The SM must receive a copy of the IDW analytical results and a confirmation of disposal from the subcontractor.

6.0 IDW HANDLING COSTS AND SUBCONTRACTING

This section presents and compares the costs of both on-site and off-site IDW management with emphasis on the costs of off-site disposal. The costs presented here are for general reference.

The costs of off-site IDW disposal have been increasing for several years and this trend is expected to continue in the future. Off-site IDW handling involves the use of a subcontractor to haul and dispose IDW in an appropriate facility that complies with the off-site policy. Most wastes generated during the SI and designated for off-site disposal are liquids, either RCRA hazardous or nonhazardous, which go to either RCRA wastewater treatment plants or POTWs. Solid IDW usually go to land disposal facilities.

On-site IDW handling, the EPA-preferred approach, involves the use of a variety of simple techniques for leaving the IDW in existing waste areas. These techniques include pouring RCRA nonhazardous decontamination fluids and ground water onto the ground, and burying soil cuttings in a shallow pit in the investigation area.

6.1 ON-SITE IDW MANAGEMENT

On-site IDW handling generally incurs no costs and does not delay the SI. Drums may be needed for collecting water. However, these drums will be recovered and reused on other SIs, so the cost of purchasing drums, distributed over several SIs, is negligible. The cost of digging shallow pits can be covered under the drilling subcontract. Spreading soil cuttings around the boring, or pouring ground water onto the ground, incurs no costs.

6.2 OFF-SITE DISPOSAL OF IDW

Handling IDW off-site involves hiring a subcontractor to provide transportation, testing, and disposal services. This approach allows the waste generator to select the most technically advanced and economically suitable disposal facility that complies with regulations. However, off-site management has several disadvantages including: (1) increasing costs of the services; (2) loss of control over the fate of IDW while still being liable for the waste; (3) potential for accidental spills during transportation; (4) difficulty in finding a suitable disposal facility; and (5) the reluctance of states to accept out-of-state wastes for disposal.

The costs of off-site IDW handling consist of the following elements: (1) containerization; (2) testing; (3) transportation; and (4) disposal. The costs of containers (usually 55-gallon drums) used to collect waste is about $50/drum. These containers may be purchased by either EPA or the subcontractor. The cost of containers purchased by subcontractors is usually higher, therefore, the SM may decide to purchase all necessary containers.

The cost of the "profile analysis," performed by the subcontractor to verify the waste hazard prior to transport is between $40 and $300/sample. The total cost of the analysis depends on the number of samples and the parameters analyzed. The cost of transportation varies depending on factors such as the distance between the site and the disposal facility, the number of drums (the price per drum is lower when more drums are transported), and whether the pickup service is set for an individual generator or for several waste generators which is less expensive. In 1990, the estimated price range for waste transportation (regardless of whether IDW are hazardous) was between $35 to $600/drum.

The costs of disposal depend on the waste hazard, matrix, and amount. The ranges of costs per drum are presented below:

- RCRA nonhazardous liquid: $12.50 - 345/drum
- RCRA hazardous liquid: $155 - 550/drum
- RCRA nonhazardous solid: $66 - 135/drum
- RCRA hazardous solid: $145 - 615/drum

Additional costs of handling IDW off-site include:

- Storage.
- Field trips (to assist in waste sampling and pickup).
- Procurement expenses.

If IDW on-site storage is not available before pickup, a chain-link fence can be built at an average cost of $600 ($300 for the materials and $300 for labor). The cost of procurement is estimated at about $300 per site. The cost of the field trips depends on the coordination of waste generation, testing, and pickup.

The site manager must select a subcontractor before field work is completed, so the subcontractor can collect IDW samples for the "profile analysis" while the IDW is still on-site. This approach reduces only one more field trip to assist in the waste pickup. If two additional trips are needed (one for collecting IDW samples and one for IDW pickup), the costs of IDW disposal increase significantly. For example, if there are two drums to dispose of, the transportation, testing, and disposal cost is $700, and one field trip costs $500, the total cost of IDW handling is $1,200. An additional field trip would result in a total cost of $1,700, a 42 percent increase.

The approximate cost ranges of managing one drum of IDW off-site, depending on the waste hazard, are presented below:

WASTE	CONTAINER ($)	TEST ($)	TRANSPORTATION ($)	DISPOSAL ($)	STORAGE PROCUREMENT AND FIELD TRIPS ($)	TOTAL* ($)
RCRA Hazardous Solid	50	20-150	35-600	145-615	233	500-1650
RCRA Non-Hazardous Solid	50	20-150	35-600	66-135	233	400-1200
RCRA Hazardous Liquid	50	20-150	35-600	155-550	233	500-1600
RCRA Non-Hazardous Liquid	50	20-150	35-600	12.50-345	233	350-1400

* Based on the following assumptions: (1) 6 drums/site, (2) 1 sample/2 drums and, (3) only one field trip required for waste pickup at a cost of $500/6 drums ($83/drum).

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The role of the SM in coordinating field activities, the subcontracting process, and IDW management is crucial to reducing the costs of IDW management. Disposing IDW off-site always results in high costs regardless of the waste hazard because there is no significant difference between the costs of disposal of hazardous and nonhazardous wastes. The SM should apply the most efficient management techniques to lower the costs of IDW handling whenever possible, and when such practices do not threaten human health and the environment.

6.3 SUBCONTRACTING

To implement subcontracting services for off-site disposal of IDW, the SM should refer to Federal guidelines. These guidelines are available from the Federal Aquisition Regulations (FAR). Federal Superfund contractors generally follow these guidelines.

Names of these subcontractors are available from either a local telephone directory, a state environmental agency list (in some states), or from the Hazardous Materials Control Directory (published annually by the Hazardous Materials Control Research Institute. Waste management facilities of all prospective bidders must be in compliance with the off-site policy during the bidding process and when the IDW are transported and disposed of. The SM and EPA are responsible for verifying the subcontractor's facility compliance with the policy. If the selected facility's status changes before the date of transport and disposal, the subcontract should be immediately awarded to the next lowest bidder if this bidder is able to meet the regulatory storage time limits.

REFERENCES

1. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan, Final Rule, 55 FR 8666-8865, March 8, 1990 (see Appendix A - Relevant Parts of the NCP).

2. 40 CFR Parts 240-280, Solid Waste Regulations, 1988.

3. 40 CFR Part 300.440, Amendment to the National Oil and Hazardous Substances Pollution Contingency Plan; Procedures for Planning and Implementing Off-Site Response Actions; Proposed Rule, 53 FR 48218-48234, November 29, 1988.

4. OSWER Directive 9834.11, November 13, 1987 - "EPA Off-Site Policy."

5. OSWER Directive 9347.3-05 FS, July 1989 - Superfund LDR Guide #5 (see Appendix B).

6. 40 CFR 761.60 - 761.79 - TSCA Regulations, 1988.

7. OSWER Directive 9330.2-4, April 15, 1986 - "Discharge of Wastewater from CERCLA Sites into POTWs" (see Appendix C).

8. "CERCLA Site Discharges to POTWs" - Guidance Manual (EPA/540/G-90/005, August 1990).

9. 40 CFR 403.5 CWA Regulations, 1988.

10. "CERCLA Compliance with Other Laws Manual" (Part I - EPA/540/G-89/006, Part II - EPA/540/G-89/009, 1989).

11. 40 CFR Part 261 et al., Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Toxicity Characteristics Revisions; Final Rule 1990 (see Appendix D - TCLP Constituents Table).

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federal register

Thursday
March 8, 1990

Part II

Environmental Protection Agency

40 CFR Part 300

National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule

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300.420(c)(5) describes the information contained in a lead-agency report following completion of a remedial site investigation, including documentation as well as sampling data and potential risks to humans and the environment.

Response to comments: A commenter asked that the NCP state that reasonable efforts will be made during the site investigation phase to identify PRPs and provide them copies of the preliminary assessment/site investigation (PA/SI) report and an opportunity to comment.

The removal and remedial processes as currently outlined in the NCP provide PRPs with a reasonable opportunity to review and comment on lead agency actions at a site when the proposed plan is made available. Before this time, documents placed in the administrative record, including the PA/SI, are available for public inspection. In addition, PRPs that are interested in more extensive involvement in the investigation process may agree to undertake removal or remedial actions through a settlement agreement with EPA. They may be granted substantially more site involvement than non-settling PRPs.

Extending the formal review and comment period to PRPs as far back in the removal and remedial process as the PA/SI stage would unnecessarily slow down preliminary fact-gathering at a site. In cases where removal actions are considered emergency or time-critical, such review and comment time would unjustifiably delay response to a dangerous situation. Also, in most cases, the PRP search has not been completed or even started in a comprehensive manner at the time of the PA/SI. Accordingly, specifying formal procedures for PRP involvement at that time is not practical.

Final rule: EPA is promulgating §§ 300.410(c)(2) and 300.420(c)(5) as proposed.

Name: Section 300.410(g). Notification of natural resource trustee.

Final rule: Section 300.410(g) is revised as follows (see preamble discussion on § 300.515):

> If natural resources are or may be injured by the release, the OSC or lead agency shall ensure that state and federal trustees of the affected natural resources are promptly notified in order that the trustees may initiate appropriate actions, including those identified in subpart G of this part. The OSC or lead agency shall seek to coordinate necessary assessments, evaluations, investigations, and planning with such state and federal trustees.

Name: Sections 300.415(b)(4) and 300.420(c)(4). Sampling and analysis plans.

Proposed rule: Proposed § 300.415 did not describe sampling requirements. Proposed § 300.420(c)(4) described the procedures necessary for preparing a site-specific sampling plan for a remedial site inspection.

Response to comments: One commenter stated that EPA should revise § 300.420(c)(4) to specify review of the sampling plan to ensure that appropriate sampling and quality control procedures are followed. In response, EPA is revising the description of the site-specific sampling plan in proposed § 300.420(c)(4) to conform with the purpose of the quality assurance project plan (QAPP) defined in § 300.5 and the QAPP and sampling and analysis plan described in § 300.430(b)(8), which states that such plans will be approved by EPA. This change emphasizes the similarity of these activities in the site evaluation and remedial investigation parts of the program. In addition, EPA believes that, when samples will be taken, it is appropriate to describe sampling requirements for non-time-critical removal actions to ensure that data of sufficient quality and quantity will be collected for this type of action.

EPA also notes that portions of the QAPP may incorporate by reference non-site-specific standardized portions of already-approved QAPPs, especially those portions addressing policy and organization, or describing general functional activities to be conducted at a site to ensure adequate data. This eliminates the necessity to reproduce non-site-specific quality assurance procedures for every site.

Final rule: Proposed §§ 300.415(b)(4) and 300.420(c)(4) are revised as follows:

1. In § 300.415(b)(4), a requirement has been added for developing a sampling and analysis plan, when samples will be taken.

2. Section 300.420(c)(4) is revised to better describe the required contents of the sampling and analysis plan.

Section 300.415. Removal Action.

Name: Section 300.415(b)(5)(ii). Removal action statutory exemption.

Proposed rule: CERCLA section 104(c)(1)(C) provides a new exemption to the statutory limits on Fund-financed removal actions of $2 million and 12 months. This exemption, stated in the NCP in § 300.415(b)(5)(ii), is applicable when continued response is otherwise appropriate and consistent with the remedial action to be taken. EPA expects to use the exemption primarily for proposed and final NPL sites, and only rarely for non-NPL sites (see 53 FR 51409).

Response to comments: One commenter supported EPA's proposal to allow waiver of the limits on Fund-financed removal payments if such an exemption is consistent with remedial actions.

One commenter stated that the decision to engage in a removal action should be based on site conditions and their impact on health and the environment, not cost or time; that once EPA concludes that a removal action is appropriate, the various alternatives should be analyzed at both likely NPL and non-NPL sites equally. The commenter felt that EPA should use the consistency exemption more liberally where time, rather than money, was the complicating factor.

In response, Congress has made the determination that cost and time are relevant factors in deciding how extensive a Fund-financed removal action may be; thus, contrary to the commenter's remark, EPA will continue to consider such factors. Further, Congress did not differentiate between time and dollar limits in setting the exemptions; EPA notes that exceeding the time limit will often also increase the cost of a removal action, even though it does not necessarily raise the cost to over $2 million. Thus, EPA does not believe it should set different criteria for their use.

The new exemption from the time and dollar limits applies to any Fund-financed removal and thus encompasses state-lead as well as EPA-lead responses. Actions where EPA has the lead, but is to be reimbursed by private parties or other federal agencies, are still subject to the statutory limits and provisions for exemption.

Because the exemption requires consistency with the remedial action to be taken, its use is well suited to proposed or final NPL sites where remedial action is likely to be taken. It may also be appropriate to use this exemption at some non-NPL sites where justified on a case-by-case basis.

Final rule: EPA is promulgating the rule as proposed.

Name: Section 300.415(i). Removal action compliance with other laws.

Existing rule: The current NCP in § 300.65(f) requires that Fund-financed removal actions and removal actions pursuant to CERCLA section 106 attain or exceed, to the greatest extent practicable considering the exigencies of the circumstances, applicable or relevant and appropriate federal public health and environmental requirements. Other federal criteria, advisories, and guidance and state standards are to be

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considered, as appropriate, in formulating a removal action.

Proposed rule: Proposed § 300.415(j) (renumbered as 300.415(i) in the final rule) required that removal actions attain, to the extent practicable considering the exigencies of the situation, all state as well as federal applicable or relevant and appropriate requirements (ARARs).[6] Other federal and state criteria, advisories, and guidance shall, as appropriate, be considered in formulating the removal action. The proposed revisions also note that statutory waivers from attaining ARARs may be used for removal actions. In addition, the preamble to the proposed revisions provided guidance clarifying three factors to be considered in determining the "practicability" of complying with ARARs: The exigencies of the situation, the scope of the removal action to be taken, and the effect of ARAR attainment on the removal statutory limits for duration and cost (53 FR 51410–11).

Response to comments: Several commenters supported the proposed revision to the NCP requiring that both federal and state ARARs be complied with when conducting removal actions. One commenter asked what documentation is required to show that ARARs have been identified and requested that EPA develop guidance providing hypothetical conditions describing the extent to which ARAR analysis should be performed. Another commenter stated that non-Fund-financed removal actions conducted at federal facilities also should be required to comply with ARARs.

In opposition to the proposal, a number of commenters pointed out that Congress did not intend that removal actions be required to comply with ARARs. The commenters suggested that, based on the legislative history, Congress intended that only remedial actions be subject to compliance with ARARs. According to one commenter, the legislative history states that ARARs do not apply during removal actions because removal actions are short-term, relatively low-cost activities of great urgency that should be free of the delays that may arise if it is necessary to identify and attain ARARs.

Other commenters suggested that attainment of ARARs should not be required during removal actions because removal actions are not intended to completely clean up a site, but rather to quickly eliminate or control an immediate threat. The commenters argued that compliance with ARARs is based on what remains on site after an entire remedy is completed, not after a particular problem is controlled. In addition, several commenters argued that the main purpose of the removal program is quick mitigation of threats, and that requiring ARARs to be complied with during removal actions undermines this purpose by slowing down the cleanup process. The commenters suggested that such procedural delays as identification of ARARs will hinder the removal program's ability to respond to emergencies swiftly.

Several additional commenters suggested that requiring attainment of ARARs discourages PRPs from undertaking removal actions. Fund-financed removals can use the statutory limits to limit attainment of ARARs; those limits do not apply to PRP actions.

One commenter opposed the provision that requires OSCs to justify why they are not attaining ARARs during a specific removal action. The commenter argued that the prospect of an OSC being required to justify why he or she is not attaining all ARARs is inconsistent with removal program objectives.

Other commenters believed that the current policy concerning compliance with ARARs during removal actions should be replaced with a more discretionary policy. They suggested that OSCs should only be required to comply with ARARs that are most crucial to the proper stabilization of the site and protection of public health and the environment.

In response, EPA has carefully reviewed this issue in light of the public comments, and believes a number of clarifying points need to be made. First, as a threshold matter, EPA agrees that Congress did not, in the 1986 amendments to CERCLA, "require" EPA to meet ARARs during removal actions. However, it has been EPA's policy since 1985, established in the NCP, to attain ARARs during removals to the extent practicable, considering the exigencies of the situation. EPA believes that this is still a sound policy. Reference to requirements under other laws (i.e., ARARs) help to guide EPA in determining the appropriate manner in which to take a removal action at many sites.

If, for example, a component of the removal action is to discharge treated waste to a nearby river or stream, effluent limitations based on federal or state water quality criteria will be useful in determining the extent of such treatment. Today's policy is consistent with section 105 of CERCLA which directs that the NCP include methods and criteria for determining the appropriate extent of removals. Thus, EPA is maintaining the policy described in the preamble to the proposed NCP, although EPA has modified the factors to be considered in determining practicability.

A number of other comments questioned the extent to which removals should attempt to attain ARARs. In responding to such comments, it is important to note that the policy that removals comply with ARARs to the extent practicable is defined in large part by the purpose of removal actions.

The purpose of removal actions generally is to respond to a release or threat of release of hazardous substances, pollutants, or contaminants so as to prevent, minimize, or mitigate harm to human health and the environment. Although all removals must be protective of human health and the environment within their defined objectives, removals are distinct from remedial actions in that they may mitigate or stabilize the threat rather than comprehensively address all threats at a site. Consequently, removal actions cannot be expected to attain all ARARs. Remedial actions, in contrast, must comply with all ARARs (or invoke a waiver). Indeed, the imposition by Congress of limits on the amount of time and Fund money that may be spent conducting a removal action often precludes comprehensive remedies by removal actions alone. Removal authority is mainly used to respond to emergency and time-critical situations where long deliberation prior to response is not feasible. All of these factors—limits on funding, planning time, and duration, as well as the more narrow purpose of removal actions—combine to circumscribe the practicability of compliance with ARARs during individual removal actions. Indeed, the vast majority of removals involve activities where consideration of ARARs is not even necessary, e.g., off-site disposal, provision of alternate water supply, and construction of fences, dikes and trenches.

Further, it should be noted that requirements are ARARs only when they pertain to the specific action being conducted. If, for example, a site has leaking drums, widespread soil contamination, and significant ground-water contamination, the removal action at the site might only involve actions necessary to reduce the near-term threats, such as direct contact and further deterioration of the ground

[6] Note that proposed § 300.415(e) has been deleted (see preamble section above on "Listing sites in CERCLIS," and the remaining sections in § 300.415 have been renumbered.

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water; thus, the removal action might be limited to removal of the drums and surface debris and excavation of highly contaminated soil. Requirements pertaining to the cleanup of ground-water contamination would not be ARARs for that action because the removal action is not intended to address ground water; rather, requirements pertaining to the drums, surface debris, or contaminated soil may be ARARs for the specific removal action. Once the lead agency makes the determination that the requirements are ARARs for a removal, then it must determine whether compliance is practicable.

It will generally be practicable for removal actions to comply with ARARs that are consistent with the goals and focus of the removal. However, as stated above, removals are intended to be responses to near-term threats, with the ability to respond quickly when necessary; thus, ARARs that would delay rapid response when it is necessary, or cause the response to exceed removal goals, may be determined to be impracticable. Of course, even where compliance with specific ARARs is not deemed practicable, the lead agency for a removal must use its best judgment to ensure that the action taken is protective of human health and the environment within the defined objectives of the removal action.

In order to better explain how a lead agency can determine when compliance with an ARAR is practicable, the preamble to the proposed NCP included three factors for consideration: Exigencies of the situation, scope of the removal action and the statutory limits (53 FR 51410–11). Upon consideration of comments, EPA has decided to enumerate in the rule only two of those three factors as important for determining practicability: Urgency (simply renaming exigencies) of the situation, and scope of the removal action. EPA believes that statutory limits, because they relate to the authority to conduct removal actions, are easier to consider within, rather than apart from, the factor of scope of the removal action when determining whether compliance with an ARAR is practicable.

The factor of urgency of the situation relates to the need for a prompt response. In many cases, appropriate response activities must be identified and implemented quickly in order to ensure the protection of human health and the environment. For example, if leaking drums pose a danger of fire or explosion in a residential area, the drums must be addressed immediately, and it will generally be impracticable to identify and comply with all potential ARARs.

The second factor, the scope of the removal action relates to the special nature of removals in that they may be used to minimize and mitigate potential harm rather than totally eliminate it. Removals are further limited in the amount of time and Fund money that may be expended at any particular site in the absence of a statutory exemption. Again, using the example above, even though standards requiring cleanup of the lower level soil contamination would be an ARAR to that medium, they would be outside the scope of the removal action when such cleanup is not necessary for the stabilization of the site, or when it would cause an exceedance of the statutory limits and no exemption applied. Hence, such soil standards, while ARARs, would not be practicable to attain considering the exigencies of the situation. Of course, such standards may be ARARs for any remedial action that is subsequently taken at the site.

EPA disagrees with the comment that requiring PRPs to comply with ARARs to the extent practicable discourages PRPs from conducting removals because the statutory limits do not apply to non-Fund-financed actions. Although the limits apply by law to Fund-financed actions only, EPA has the discretion under CERCLA section 104(c)(1) to take removal actions that exceed those limits, in emergency situations or where the action is otherwise appropriate and consistent with the remedial action that may be taken at the site. EPA will select the appropriate remedy, even where an extensive removal action is warranted, regardless of whether the site is Fund-lead or PRP-based. The only difference is that if the site is Fund-lead, an exemption must first be invoked in order to proceed with the action. Thus, the time and dollar limitations generally will not result in PRPs performing a more extensive removal than EPA itself would conduct. That is, EPA's selection of a removal action, including what ARARs will be attained, will not be based on who will be conducting the removal.

Finally, as stated in the preamble to the proposed NCP (53 FR 51411), even if attainment of an ARAR is practicable under the factors described above, the lead agency may also consider whether one of the statutory waivers from compliance with ARARs is available for a removal action. EPA is developing guidance on the process of complying with ARARs during removal actions. EPA generally will only require documentation of ARARs for which compliance is determined to be practicable, in order not to burden OSCs with substantial paperwork requirements.

Final rule: Proposed § 300.415(j) (renumbered as final § 300.415(i)) is revised as follows:

1. The following has been added to identify factors that are appropriate for consideration in determining the practicability of complying with ARARs:

In determining whether compliance with ARARs is practicable, the lead agency may consider appropriate factors, including the following:

(1) The urgency of the situation; and

(2) The scope of the removal action to be conducted.

2. The reference to advisories, criteria or guidance has been modified (see preamble section below on TBCs).

3. The description of ARARs has been reworded (see preamble section below on the definition of "applicable.")

Name: Sections 300.5, 300.415(g) and (h), 300.500(a), 300.505 and 300.525(a). State involvement in removal actions.

Existing rule: Sections 300.61 and 300.62 of the current NCP encourage states to undertake actions authorized under subpart F. Such actions include removal and remedial actions pursuant to CERCLA section 104(a)(1). The regulation notes further that CERCLA section 104(d)(1) authorizes the federal government to enter into contracts or cooperative agreements with the state to take Fund-financed response actions authorized under CERCLA, when the federal government determines that the state has the capability to undertake such actions.

Proposed rule: Proposed § 300.415(h) and (i) (renumbered as final § 300.415(g) and (h)) and § 300.525(a) would codify EPA's existing policy of entering into cooperative agreements with states to undertake Fund-financed removal actions, provided that states follow all the provisions of the NCP removal authorities. The preamble to the proposed rule suggested that non-time-critical actions are the most likely candidates for state-lead removals (53 FR 51410). Proposed § 300.510(b) provided further that facilities operated by a state or political subdivision require a minimum cost share of 50 percent of the total response costs if a remedial action is taken. Section 300.505 describes what EPA and a state may agree to in a Superfund Memorandum of Agreement (SMOA) regarding the nature and extent of interaction on EPA-lead and state-lead response. The preamble clarified that, where practicable, a SMOA may include general provisions

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responses and responses conducted by RPs (emergency and time-critical removals are not covered by this policy). This notification should specify the type and quantity of waste involved, the name and location of the receiving facility and the expected schedule for the transfer of the CERCLA waste. Such notification will enable the recipient state to obtain from its permitted facilities any other information it may need in order to support the out-of-state action. Although this notification is neither mandated by CERCLA nor required by this regulation, EPA believes that adherence to this procedure will help to ensure that these waste transfers occur in a safe and expedient manner. The policy is explained in more detail in OSWER Directive No. 9330.2-07 (September 14, 1989).

Because CERCLA actions may be carried out under a number of mechanisms and by a number of parties (e.g., lead state agencies, other federal agencies, PRPs), EPA plans to issue additional guidance or regulations, if appropriate, to implement this notification policy.

Final rule: There is no rule language on this issue.

Applicable or Relevant and Appropriate Requirements

Introduction. The November 20, 1985 revisions to the NCP required that, for all remedial actions, the selected remedy must attain or exceed the federal applicable or relevant and appropriate requirements (ARARs) in environmental and public health laws. It also required removal actions to attain ARARs to the greatest extent practicable, considering the exigencies of the circumstances. The preamble to the 1985 revisions to the NCP stated that ARARs could be determined only on a site-by-site basis, and it included from EPA's October 2, 1985 Compliance Policy a list of potentially applicable or relevant and appropriate requirements. The preamble also provided a list of federal non-promulgated criteria, advisories and guidance, and state standards "to be considered," called TBCs. EPA also provided five limited circumstances in which ARARs could be waived.

On October 17, 1986, CERCLA was reauthorized with additional new requirements. Section 121 of CERCLA requires that, for any hazardous substance that will remain on-site, remedial actions must attain requirements under federal environmental or state environmental or facility siting laws that are applicable or relevant and appropriate under the circumstances of the release or threatened release at the completion of the remedial action. The statute also retained most of the waivers, with a few additions.

Although section 121(d)(2) basically codified EPA's 1985 policy regarding compliance with other laws, the section also requires that state standards are also potential ARARs for CERCLA remedial actions when they are promulgated, more stringent than federal standards, and identified by the state in a timely manner.

Furthermore, the CERCLA amendments provide that federal water quality criteria established under the Clean Water Act (CWA) and maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act, must be attained when they are relevant and appropriate under the circumstances of the release.

Today's revision to the NCP continues the basic concept of compliance with ARARs for any remedy selected (unless a waiver is justified). ARARs will be determined based upon an analysis of which requirements are applicable or relevant and appropriate to the distinctive set of circumstances and actions contemplated at a specific site. Unlike the 1985 revisions to the NCP, where alternatives were developed based on their relative attainment of ARARs, in today's rule recognition is given to the fact that ARARs may differ depending on the specific actions and objectives of each alternative being considered (for more discussion of this point, see preamble of proposal at 53 FR 51438, section 9).

In today's rule, EPA retains its policy established in the 1985 NCP of requiring attainment of ARARs during the implementation of the remedial action (where an ARAR is pertinent to the action itself), as well as at the completion of the action, and when carrying out removal actions "to the extent practicable considering the exigencies of the situation."

For ease of identification, EPA divides ARARs into three categories: chemical-specific, location-specific, and action-specific, depending on whether the requirement is triggered by the presence or emission of a chemical, by a vulnerable or protected location, or by a particular action. (More discussion of these types can be found in the preamble of the proposal at 53 FR 51437, section 6).

Response to comments: EPA received a few comments on general ARARs policies. One commenter argued that the remedial action should not necessarily have to attain the most stringent applicable or relevant and appropriate requirement if a less stringent requirement provides adequate protection of human health and the environment.

EPA disagrees. CERCLA requires that remedial actions comply with all requirements that are applicable or relevant and appropriate. Therefore, a remedial action has to comply with the most stringent requirement that is ARAR to ensure that all ARARs are attained. In addition, CERCLA requires that the remedies selected be protective of human health and the environment *and* attain ARARs. A requirement does not have to be determined to be necessary to be protective in order to be an ARAR. Conversely, the degree of stringency of a requirement is not relevant to the determination of whether it is an ARAR at a site and must be attained (except for state ARARs).

Another commenter asked for confirmation that variance or exemption provisions in a regulation can be potential ARARs as well as the basic standards. EPA agrees that meeting the conditions and requirements associated with a variance or exemption provision can be a means of compliance with an ARAR. For example, EPA expects that CERCLA sites will frequently be complying with the terms of the treatability variance under the RCRA land disposal restrictions (LDR) for soil and debris when LDR is an ARAR.

Limitations in a regulation, such as the quantity limitations that define small quantity generators under RCRA and affect what requirements a generator must comply with, will also affect what requirements are applicable at a CERCLA site. However, it is possible that a requirement could be relevant and appropriate even though the requirement is not applicable because of a limitation in the regulation.

Indian tribe commenters contended that ARARs should not be defined as promulgated laws, regulations, or requirements because some Indian tribe laws, which could apply to a Superfund cleanup, may not be promulgated in the same fashion as state or federal laws. CERCLA section 126 directs EPA to afford Indian tribes substantially the same treatment as states for certain specified subsections of CERCLA sections 103, 104 and 105; EPA believes, as a matter of policy, that it is similarly appropriate to treat Indian tribes as states for the purpose of identifying ARARs under section 121(d)(2). EPA realizes that tribal methods for promulgating laws may vary, so any evaluation of tribal ARARs will have to

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be made on a case-by-case basis. Tribal requirements, however, are still subject to the same eligibility criteria as states, as described in § 300.400(g)(4).

Another commenter disagreed with EPA's position that environmental laws do not apply to a CERCLA response action unless incorporated by CERCLA section 121(d). This commenter argued that EPA has confused the ARARs concept with one of preemption of state law.

In response, SARA established a process, in CERCLA sections 121(d)(2) and (d)(4), for how federal and state environmental laws should apply to on-site CERCLA remedial actions, i.e., the ARARs process. Based on these provisions, CERCLA remedies will incorporate (or waive) state standards, as appropriate under CERCLA. Thus, although other environmental laws do not independently apply to CERCLA response actions, the substantive requirements of such laws will be applied to such actions, consistent with section 121(d) and NCP § 300.400(g).

EPA's interpretation that CERCLA response actions are required to meet state (and other federal) environmental law standards only to the limited degree set out in CERCLA is also necessary to comply with the special mandates in CERCLA to respond quickly to emergencies, and to perform Fund-balancing. The position that on-site CERCLA response actions are not independently subject to other federal or state environmental laws is a long-standing one, based on a theory of implied repeal or pre-emption. See, e.g., 50 FR 47912, 47917–18 (Nov. 20, 1985); 50 FR 5862, 5865 (Feb. 12, 1985); "CERCLA Compliance With Other Environmental Laws" Opinion Memorandum, Francis S. Blake, General Counsel, to Lee M. Thomas, Administrator, Nov. 22, 1985.

Following are summaries of major comments and EPA's responses on specific sections of the ARARs policy.

Name: Sections 300.5 and 300.400(g)(1). Definition of "applicable."

Proposed rule: "Applicable requirements" means those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. The preamble to the proposed rule pointed out that there is generally little discretion in determining whether the circumstances at a site match those specified in a requirement (53 FR 51435–37).

Response to comments: One commenter suggested that language used in § 300.400(g)(4) of the proposed NCP which provides that "only those state standards that are promulgated and more stringent than federal requirements may be applicable or relevant and appropriate" be added to the definition of ARARs found in § 300.5.

In response, EPA notes that the definition it proposed already includes the condition that standards, whether federal or state, must be promulgated in order to be potential ARARs. EPA accepts this comment on stringency and has revised both §§ 300.5 and 300.400(g) to specify that in order to be considered ARARs, state requirements must be more stringent than federal requirements. EPA notes that, in general, state regulations under federally authorized programs are considered federal requirements.

A commenter supported the discussion of ARARs in the preamble to the proposed NCP, but remarked that the definitions of ARARs do not adequately reflect many of the important aspects mentioned in the preamble. EPA believes that the definitions stated in the rule are sufficiently comprehensive and that the information contained in the preamble to the proposed and final rules will help the public in applying the definitions.

One commenter asked why EPA had deleted rule language that applicable requirements are those requirements that would be legally applicable if the response action were not undertaken pursuant to CERCLA. In working with this definition, EPA found the previous definition confusing because it was stated in the conditional, i.e., requirements that would apply if the action were not under CERCLA. EPA revised the definition to explain more specifically what it means by applicable requirements to avoid any confusion. However, the 1985 wording is still a correct statement of the applicability concept. EPA is modifying the definition, however, to make it clear that the standards, etc. do not have to be promulgated specifically to address CERCLA sites.

Final rule: The proposed definition of "applicable" in §§ 300.5 and 300.400(g)(1) are revised as follows:

1. Consistent with the language in CERCLA section 121(d)(2), the description of federal and state laws in § 300.5 is revised to read:
"* * * requirements, criteria or limitations promulgated under federal *environmental* or state *environmental or facility siting law* * * *."
[Comparable changes are made in §§ 300.415(i), 300.430(e)(2)(i)(A), 300.430(e)(9)(iii)(B) and 300.430(f)(1)(ii)(C).]

2. The following sentence is added to § 300.5: "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

3. In §§ 300.5 and 300.400(g)(1), the word "found" is added before "at a CERCLA site."

Name: Sections 300.5 and 300.400(g)(2). Definition of "relevant and appropriate."

Proposed rule: "Relevant and appropriate requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Section 300.400(g)(2) identified criteria that must be considered, where pertinent, to determine whether a requirement addresses problems or situations that are sufficiently similar to the circumstances of the release or remedial action that it is relevant and appropriate. The preamble to the proposed rule emphasized that a requirement must be both relevant and appropriate; this determination is based on best professional judgment. Also, the preamble stated that with respect to some statutes or regulations, only some of the requirements may be relevant and appropriate to a particular site, while others may not be (53 FR 51436–37).

Response to comments: 1. *General.* Several commenters expressed support in general for the revised definition of relevant and appropriate requirements and for the approach described in the proposal to identifying such requirements. Commenters in particular supported statements that a requirement must be both relevant, in that the problem addressed by a requirement is similar to that at the site, and appropriate, or well-suited to the circumstances of the release and the site, to be considered a relevant and appropriate requirement.

A few commenters recommended changes to the definition of relevant and appropriate requirements. One commenter suggested adding to the proposed definition that a relevant and appropriate requirement must be

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"generally pertinent," a phrase used in the preamble of the proposed NCP in discussing the analysis of the relevance of a requirement, while another suggested adding "pertinent" to the circumstances of the site, expressing concern that "generally pertinent" was overly broad. EPA believes that the concept of "pertinence" is adequately considered as part of the evaluation of what is relevant and appropriate (see discussion of factors for determining relevant and appropriate requirements, below). EPA does not believe that the suggested changes should be made in the definition itself.

Another commenter suggested revising the definition to emphasize the jurisdictional prerequisites of a potentially relevant and appropriate requirement, recommending that a relevant and appropriate requirement be defined as one that, "while not applicable, sufficiently satisfies the jurisdictional prerequisites for legal enforceability." EPA disagrees, because the jurisdictional prerequisites, while key in the applicability determination, are not the basis for relevance and appropriateness. Rather, the evaluation focuses on the purpose of the requirement, the physical characteristics of the site and the waste, and other environmentally- or technically-related factors.

Another commenter objected to the policy that some portions of a regulation could be found relevant and appropriate, while other portions would not be. The commenter believed that this policy would lead to confusion and inconsistency, although the commenter agreed that the application of this policy to RCRA closure requirements, described in the proposal, was useful. EPA believes that this policy is appropriate and reflects its experience in evaluating RCRA closure requirements and other requirements as relevant and appropriate. Finding some parts of a regulation relevant and appropriate, and others not, allows EPA to draw on those standards that contribute to and are suited for the remedy and the site, even though all components of a regulation are not appropriate.

This approach has been particularly valuable as applied to RCRA closure, where the two applicable regulations, clean closure and landfill closure, address only the two poles of a potential continuum of closure responses. When RCRA closure is relevant and appropriate, Superfund may use a combination of these two regulations, known as hybrid closure, to fashion an appropriate remedy for a site that is protective of both ground water and direct contact (for more discussion of hybrid closure, see preamble to the proposed NCP at 53 FR 51446).

2. *Factors for determining relevant and appropriate requirements.* One commenter suggested referencing the criteria described in § 300.400(g)(2) in the definition. EPA believes this is not appropriate because it could lead to confusion about the role of the criteria and result in greater emphasis on rigidly applying the criteria than is warranted.

Based on this latter comment and others about specific criteria in the proposal, EPA wants to clarify the role of the factors. (Note that the rule now refers to "factors" rather than "criteria.") EPA intends that the factors in § 300.400(g)(2) should be considered in identifying relevant and appropriate requirements, but does not want to imply that the requirement and site situation must be similar with respect to each factor for a requirement to be relevant and appropriate. At the same time, similarity on one factor alone is not necessarily sufficient to make a requirement relevant and appropriate. Rather, the importance of a particular factor depends on the nature of the requirement and the site or problem being addressed and will vary from site to site. While the factors are useful in identifying relevant and appropriate requirements, the final decision is based on professional judgment about the situation at the site and the requirement as a whole.

In addition, as EPA discussed in the proposal, a requirement must be both "relevant," in that it addresses similar situations or problems, and "appropriate," which focuses on whether the requirement is well-suited to the particular site. Consideration of only the similarity of certain aspects of the requirement and the site situation constitutes only half of the analysis of whether a requirement is relevant and appropriate.

After review of comments it received, EPA has revised the language in § 300.400(g)(2) because it is concerned that it was misleading. Some commenters viewed the analysis required by this section as requiring consideration only of the similarity of the requirement and the problems or situation at the CERCLA site. While non-substantive for the most part, the changes to § 300.400(g)(2) make clearer that a requirement and a site situation must be compared, based on pertinent factors, to determine both the relevance and appropriateness of the requirement. The rule also now uses the term "factors," rather than "criteria," a change instituted to avoid confusion with the nine criteria for remedy selection in § 300.430.

One commenter suggested that factors be developed for use in evaluating whether a requirement is "appropriate." EPA does not believe this is necessary. Decisions about the appropriateness of a requirement are based on site-specific judgments using the same set of factors already identified. In the abstract it is very difficult to separate out those factors to be considered for relevance and those to be considered for appropriateness. In specific cases it would be possible to say, for example, that a requirement is relevant in terms of the substances but not appropriate in terms of the facility covered.

Several commenters questioned whether certain factors could legitimately be considered in identifying relevant and appropriate requirements. These and other comments on individual factors are discussed below; a brief description of each factor as described in the proposed NCP is given after the name of the factor.

(i): Purpose of the requirement. This factor compared the purpose of a requirement to the specific objectives of the CERCLA action. One commenter was concerned that the "objectives for the CERCLA action" could include the implementability of the remedy, its cost, and even the acceptability of the action to the community. This is not what EPA meant by "objectives." Rather, EPA intended that this factor consider the technical, or health and environmental purpose of the requirement compared to what the CERCLA action is trying to achieve. For example, MCLs are promulgated to protect the quality of drinking water; this is similar in purpose to a CERCLA action to restore ground water aquifers to drinkable quality. To avoid confusion, EPA has simplified the factor, which now states, "the purpose of the requirement and the purpose of the CERCLA action."

(ii): The medium regulated by the requirement. This factor compared the medium addressed by a requirement to the medium contaminated or affected at a CERCLA site. No comments were received on this factor, and the final rule is essentially unchanged from the proposal.

(iii): The substances regulated by the requirement. This factor compared the substances addressed by a requirement to the substances found at a CERCLA site. Several commenters argued that RCRA requirements for hazardous waste should not be potentially relevant and appropriate to wastes "similar" but not identical to a hazardous waste, and

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that this criterion should be dropped. EPA disagrees and has discussed this issue in the section of this preamble on RCRA ARARs.

(iv): The entities or interests affected or protected by the requirement. This factor compared the entities or interests addressed by a requirement and those affected by a CERCLA site. Two commenters expressed concern about this factor. One commenter was concerned that it could be used to disqualify standards from being relevant and appropriate simply because the requirement regulated entities different from those at a CERCLA site. In contrast, another commenter was concerned that EPA would broadly apply requirements to entities that were never intended to be subject to the requirement. EPA agrees that this factor is confusing. EPA believes that the characteristics intended to be addressed by this factor are adequately covered under other factors, such as purpose and type of facility. Therefore, this factor has been eliminated.

(v): The actions or activities regulated by the requirement. This factor compared the actions or activities addressed by a requirement to those undertaken in the remedial action at a CERCLA site. No comments were received on this factor, and the final rule is essentially unchanged from the proposal.

(vi): Any variances, waivers, or exemptions of the requirement. This factor considered the availability of variances, waivers, or exemptions from a requirement that might be available for the CERCLA site or action. One commenter asked for clarification on this factor and expressed his view that the CERCLA waiver provisions for ARARs were the only waivers allowable. However, EPA believes that it is reasonable to consider the existence of waivers, exemptions, and variances under other laws because generally there are environmental or technical reasons for such provisions. These provisions are generally incorporated into national regulations because there are specific circumstances where compliance with a requirement may be inappropriate for technical reasons or unnecessary to protect human health and the environment. Again, this factor is only one that should be considered: even if a waiver provision in a requirement matches the circumstances at the CERCLA site, there may be other reasons why the requirement is still relevant and appropriate.

(vii): The type and size of structure or facility regulated by the requirement. This factor compared the characteristics of the structure or facility addressed by a requirement to that affected by or contemplated by the remedial action. One commenter argued that regulations routinely contain cut-offs based on type or size of the structure or facility for administrative or enforcement convenience. EPA agrees that cut-offs based solely on administrative reasons may not be critical in determining whether a requirement is relevant and appropriate. However, EPA believes that it is necessary and appropriate to consider the physical type or size of structure regulated because requirements may be neither relevant nor appropriate to structures or facilities that are dissimilar to those that the requirement was intended to regulate. In many cases, this factor is a very basic one: in identifying requirements relevant to landfills, one would turn to standards for landfills, not for tanks.

(viii): Consideration of use or potential use of affected resources in the requirement. This factor compared the resource use envisioned in a requirement to the use or potential use at a CERCLA site. One commenter objected to this factor based primarily on opposition to EPA's proposed ground water policy, which, along with the comments EPA has received on this issue, is discussed in the section on ground-water policy in the preamble discussion of § 300.430. EPA believes it is appropriate to compare the resource use considerations in a requirement with similar considerations at a CERCLA site.

Final rule: 1. The following sentence is added to the proposed definition of "relevant and appropriate" in § 300.5 (see preamble discussion above on "applicable"): "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate."

2. Proposed § 300.400(g)(2) is revised as follows:

(2) If, based upon paragraph (g)(1) of this section, it is determined that a requirement is not applicable to a specific release, the requirement may still be relevant and appropriate to the circumstances of the release. In evaluating relevance and appropriateness, the factors in paragraphs (g)(2)(i) through (viii) shall be examined, where pertinent, to determine whether a requirement addresses problems or situations sufficiently similar to the circumstances of the release or remedial action contemplated, and whether the requirement is well-suited to the site, and therefore is both relevant and appropriate. The pertinence of each of the following factors will depend, in part, on whether a requirement addresses a chemical, location, or action. The following comparisons shall be made, where pertinent, to determine relevance and appropriateness:

(i) The purpose of requirement and the purpose of the CERCLA action;

(ii) The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site;

(iii) The substances regulated by the requirement and the substances found at the CERCLA site;

(iv) The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site;

(v) Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;

(vi) The type of place regulated and the type of place affected by the release or CERCLA action;

(vii) The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action;

(viii) Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site.

Name: Section 300.400(g)(3). Use of other advisories, criteria or guidance to-be-considered (TBC).

Proposed rule: The preamble to the proposed rule provided that advisories, criteria or guidance to-be-considered (TBC) that do not meet the definition of ARAR may be necessary to determine what is protective or may be useful in developing Superfund remedies (53 FR 51436). The ARARs preamble described three types of TBCs: health effects information with a high degree of credibility, technical information on how to perform or evaluate site investigations or remedial actions, and policy.

For example, proposed § 300.400(g)(3) stated that other advisories, criteria, and guidance to be considered (TBCs) shall be identified, as appropriate, because they may be useful in developing CERCLA remedies. Proposed § 300.415(j)(§ 300.415(i) in the final rule) stated that other federal and state criteria, advisories, and guidance shall, as appropriate, be considered in formulating the removal action. Proposed § 300.430(b) stated that during project scoping the lead agency shall initiate a dialogue with the support agency on potential ARARs and TBCs. Proposed § 300.430(e)(2) provided that other pertinent information may be used to develop remediation goals. Proposed § 300.430(e)(8) provided that the lead agency shall notify the support agency of the alternatives to be analyzed to facilitate the identification of ARARs and TBCs. Proposed § 300.430(f) on selecting a remedy, however, referred to compliance with ARARs only, not TBCs. Proposed subpart F required that the

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Final rule: References to TBCs will be changed in the following sections to make it clear that their use is discretionary rather than mandatory: §§ 300.400(g)(3), 300.415(i), 300.430(b)(9), 300.430(d)(3), 300.430(e) (8) and (9), 300.505(d)(2)(iii), 300.515(d) and (d) (1) and (2), and 300.515(h)(2).

Name: Sections 300.400 (g)(4) and (g)(5). ARARs under state laws.

Proposed rule: Section 300.400(g) specified that only promulgated state standards may be considered potential ARARs. A promulgated state standard must be legally enforceable and of general applicability. The term "legally enforceable," according to the preamble to the proposed NCP, means that state laws or standards which are considered potential ARARs must be issued in accordance with state procedural requirements and contain specific enforcement provisions or be otherwise enforceable under state law. The preamble also explained that "of general applicability" means that potential state ARARs must be applicable to all remedial situations described in the requirement, not just CERCLA sites (53 FR 51437–38).

The preamble also discussed a dispute resolution process to be followed if there is disagreement about the identification of ARARs, as well as policies to be followed if a state insists that a remedy attain a requirement not determined to be ARAR (see 53 FR 51437 and 51457).

Response to comments: Commenters on this subject called for EPA to establish a formal procedure to be followed by states to demonstrate that proposed state ARARs are legally enforceable and of generally applicability. Commenters suggested that states be required to provide legal citations from appropriate sections of state laws, as well as appropriate citations to legal authority for issuing compliance orders, obtaining injunctions, or imposing civil or criminal penalties in the event of noncompliance. These citations, according to commenters, would demonstrate that proposed ARARs are legally enforceable.

Commenters suggested that general applicability could be demonstrated by requiring states to identify the chemicals, locations, and cleanup actions to which a proposed ARAR would apply.

The proposed NCP did not prescribe a specific procedure to be used in evaluating state standards as potential ARARs. A formal process for demonstrating that state requirements are promulgated is not required by CERCLA. EPA believes that the imposition of a formal procedure on states would be a large administrative burden and could impede the cleanup process.

EPA expects, however, that states will substantiate submissions of potential ARARs by providing basic evidence of promulgation, such as a citation to a statute or regulation and, where pertinent, a date of enactment, effective date, or description of scope. Because a citation is the minimum needed to positively identify a requirement, EPA has added regulatory language requiring both lead and support agencies to provide citations when identifying their ARARs.

Section 300.400(g)(4) specifies that only promulgated state standards that are more stringent than federal requirements and are identified by the state in a timely manner may be considered potential ARARs. If a question is raised as to whether a requirement identified by a state conforms to the requirements for being a potential state ARAR, or is challenged on the basis that it does not conform to the definition, the state would have the burden of providing additional evidence to EPA to demonstrate that the requirement is of general applicability, is legally enforceable, and meets the other prerequisites for being a potential ARAR. If EPA does not agree that a state standard identified by a state is an ARAR, EPA will explain the basis for this decision.

Furthermore, the language of CERCLA section 121(d)(2)(A) makes clear, and program expediency necessitates, that the specific requirements that are applicable or relevant and appropriate to a particular site be identified. It is not sufficient to provide a general "laundry" list of statutes and regulations that might be ARARs for a particular site. The state, and EPA if it is the support agency, must instead provide a list of requirements with specific citations to the section of law identified as a potential ARAR, and a brief explanation of why that requirement is considered to be applicable or relevant and appropriate to the site.

Other comments on this section raised objections to EPA's acceptance of general goals as potential ARARs. One commenter questioned whether such general goals were implementable and satisfied the requirements of a promulgated standard, requirement, criteria, or limitation contained in CERCLA section 121(d). Another commenter argued that attempts to interpret compliance with a general goal will lead to confusion and delay. Several commenters requested clarification of the status of state nondegradation goals and whether such goals qualified as potential ARARs.

In response, it is necessary to examine the nature of a general goal in order to determine whether it may be an ARAR. General goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs. EPA believes, however, that general goals, such as nondegradation laws, can be potential ARARs if they are promulgated, and therefore legally enforceable, and if they are directive in intent. The more specific regulations that implement a general goal are usually key in identifying what compliance with the goal means.

For example, in the preamble to the proposed NCP, EPA cited the example of a state antidegradation statute that prohibits the degradation of surface water below a level of quality necessary to protect certain uses of the water body (53 FR 51438). If promulgated, such a requirement is clearly directive in nature and intent. State regulations that designate uses of a given water body and state water quality standards that establish maximum in-stream concentrations to protect those uses define how the antidegradation law will be implemented are, if promulgated, also potential ARARs.

Even if a state has not promulgated implementing regulations, a general goal can be an ARAR if it meets the eligibility criteria for state ARARs. However, EPA would have considerable latitude in determining how to comply with the goal in the absence of implementing regulations. EPA may consider guidelines the state has developed related to the provision, as well as state practices in applying the goal, but such guidance or documents would be TBCs, not ARARs.

Final rule: 1. EPA has revised § 300.400(g)(4) as follows:

(4) Only those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent than federal requirements may be applicable or relevant and appropriate. For purposes of identification and notification of promulgated state standards, the term "promulgated" means that the standards are of general applicability and are legally enforceable.

2. Also, language has been added to § 300.400(g)(5) requiring that specific requirements for a particular site be identified as ARARs, and that citations be provided.

Name: Section 300.515(d)(1). Timely identification of state ARARs.

Proposed rule: Section 300.515(d)(1) stated that the lead and support agencies shall identify their respective

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case of "applicable" requirements. However, the determination of whether a requirement is relevant and appropriate is not based on its stringency; rather, other criteria are used, as discussed in the section on relevance and appropriateness, and the remedy must comply with the most stringent requirement determined to be ARAR. EPA also believes that, in some situations, the availability of certain requirements that more fully match the circumstances of the site may result in a decision that another requirement is not relevant and appropriate. EPA believes that one such situation is when an MCL or non-zero MCLG and an FWQC for human health are available for the same contaminant when a current or potential source of drinking water is of concern, and there are no impacts to aquatic organisms.

As discussed in this preamble, EPA believes that an MCL or non-zero MCLG is generally the relevant and appropriate requirement for ground water that is a current or potential source of drinking water. EPA also believes that an MCL or non-zero MCLG, promulgated specifically to protect drinking water, generally is the appropriate standard for ground water even if an FWQC for human health is also available for the contaminant, for the following reasons.

CERCLA section 121(d)(2)(B)(i) lists, among other factors, the purpose for which the criteria were developed and the designated or potential use of the water as factors in determining whether FWQC are relevant and appropriate. Since FWQC for human health are promulgated for exposures that include drinking water and consuming fish, on the one hand, and consuming fish only, on the other, it is not directly the purpose of such criteria to provide drinking water standards per se, although levels that protect such a use can be mathematically derived from these two values. Furthermore, such derived values for drinking water will not reflect the contribution of other sources (through an apportionment factor), as MCLs and MCLGs do. Finally, for carcinogens FWQC are recommended at zero, although values corresponding to risks of 10^{-6}, 10^{-5}, and 10^{-7} are also given. For the reasons given in the discussion of MCLs and MCLGs above, the zero value is not considered relevant and appropriate under CERCLA; MCLs, however, represent a level determined to be both protective of human health for drinking water and attainable by treatment.

For the same reasons, EPA believes that MCLs or non-zero MCLGs generally will be the relevant and appropriate standards for surface water designated as a drinking water supply, unless the state has promulgated water quality standards (WQS) for the water body that reflect the specific conditions of the water body. However, surface water bodies may be designated for uses other than drinking water supply, and therefore an FWQC intended to be protective of such uses, such as the FWQC for consumption of fish or for protection of aquatic life, may very well be relevant and appropriate in such cases. Also, where a contaminant does not have an MCL or MCLG, FWQC adjusted to reflect drinking water use may be used as relevant and appropriate requirements.

Final rule: EPA is including in the final rule at § 300.430(e)(2)(i)(E) language stating that FWQC are to be attained where relevant and appropriate under the circumstances of the release or threatened release.

Name: Section 300.435(b)(2). Compliance with applicable or relevant and appropriate requirements (ARARs) *during* the remedial action.

Proposed rule: CERCLA section 121 requires that, at the completion of a remedial action, a level or standard of control required by an ARAR will be attained for wastes that remain on-site. However, consistent with the 1985 NCP (§ 300.68(i), § 300.435(b)) of the proposed NCP also required compliance with ARARs during implementation of the action, stating that *during the course of the remedial design/remedial action (RD/RA)*, the lead agency shall be responsible for ensuring that all federal and state ARARs identified for the action are being met, unless a waiver is invoked. Examples of such requirements given in the preamble to the proposed rule included RCRA treatment, storage, and disposal requirements, Clean Air Act national ambient air quality standards, and Clean Water Act effluent discharge limitations (53 FR 51440).

Response to comments: EPA received a number of comments that the NCP should not require compliance with ARARs during the remedial action. Commenters argued that this policy is inconsistent with the statute, which requires compliance with ARARs only at the completion of the remedial action, and questioned EPA's authority to require compliance with ARARs during remedial design/remedial action.

Several commenters pointed out that CERCLA section 121(d)(1) states that remedial actions must be protective and "must be relevant and appropriate under the circumstances," and argued that this standard should govern how the action itself is carried out. Design and operation of the remedial action should be based on best professional judgment and undertaken in a manner that is protective. Other commenters suggested requiring compliance only with those ARARs that "can reasonably be achieved," or listing specific types of ARARs that must be met during RD/RA.

Commenters were particularly concerned about problems created by requiring compliance with RCRA requirements and the land disposal restrictions in particular for remedial actions.

EPA disagrees with these commenters. EPA believes that it is appropriate to require that remedial activities comply with the substantive requirements of other laws that apply or are relevant and appropriate to those activities. The reasons for complying with such laws during the conduct of the remediation are basically the same as the reasons for applying ARARs as remediation objectives: the laws help define how the activity can be carried out safely and with proper safeguards to protect human health and the environment. EPA is concerned that, if the narrowest possible interpretation were applied to ARARs compliance, compliance with laws critical to protection of health and the environment would become subject to debate, laws such as those that govern surface water discharges or air emissions, or that set operational standards for incineration of hazardous waste.

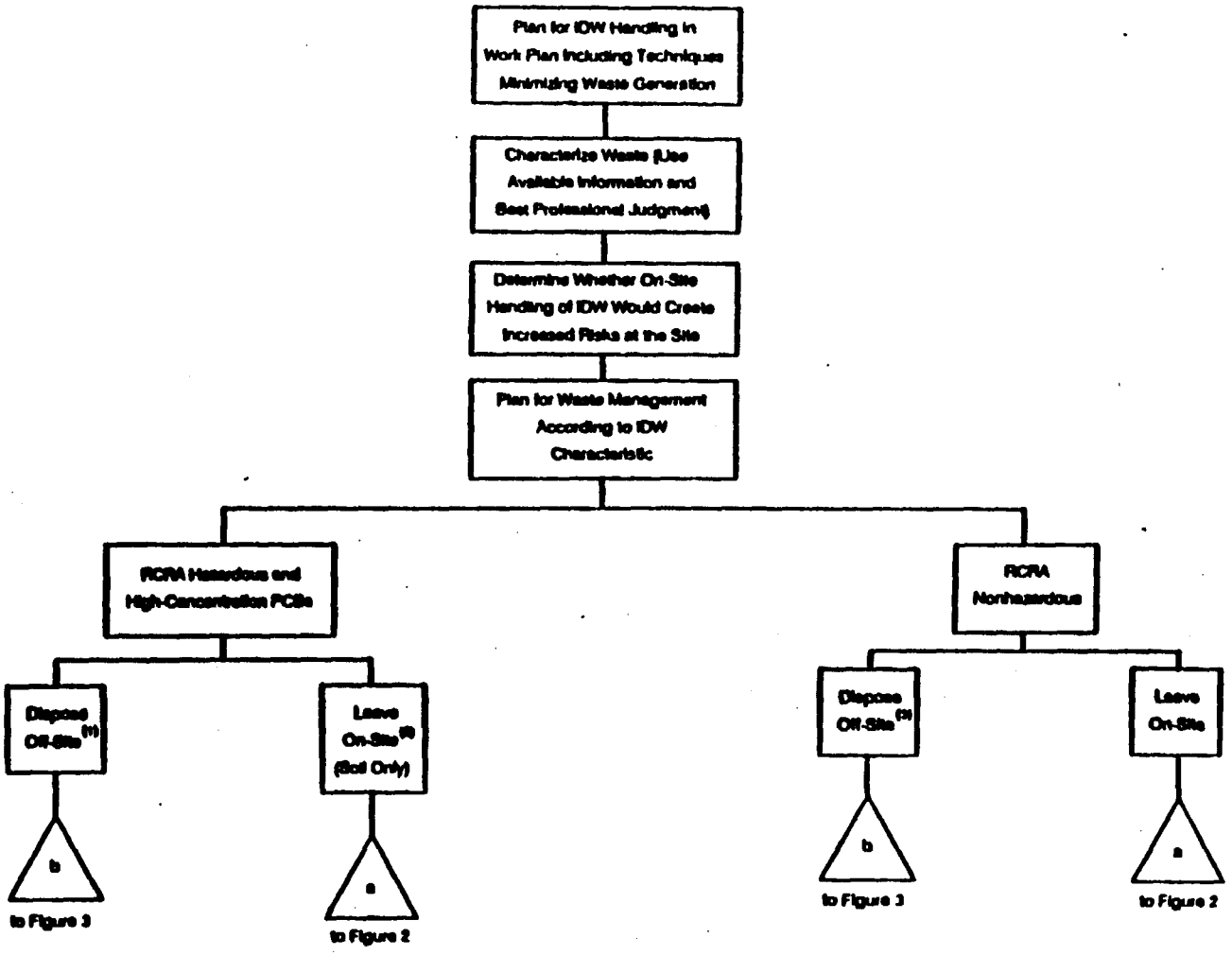
Several commenters also stated that chemical-specific ARARs used as remediation goals, such as MCLs as ARARs for ground water remediation, cannot be attained during implementation. EPA wants to clarify that it recognizes that ARARs that are used to determine final remediation levels apply only at the completion of the action.

It is worthwhile to point out, in the context of this policy on complying with ARARs pertaining to the remedial activity itself, that CERCLA provides a waiver from ARARs for interim actions, provided the final action will attain the waived standard. If there is doubt about whether an ARAR represents a final remediation goal or an interim standard, and it cannot be met during the activity, this waiver could be invoked.

Comments were also received on EPA's discussion of compliance with ARARs during remedial investigations in the preamble to the proposed NCP (53 FR 51442–43). In that discussion, EPA stated that on-site handling, treatment or disposal of investigation-derived waste must satisfy ARARs and that the

Figure 1

IDW Management Decision Tree



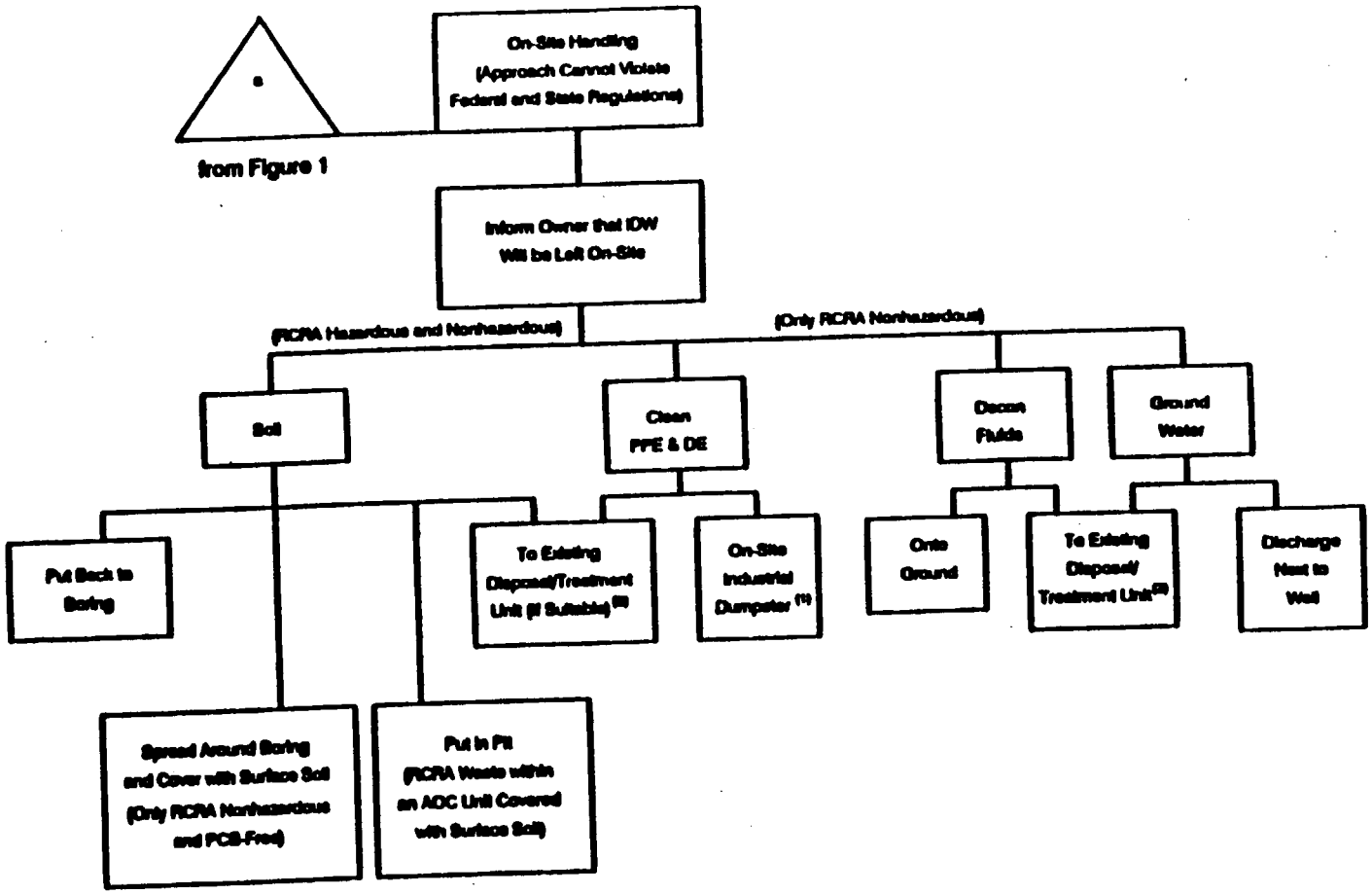
(1) Soil cuttings, ground water, and decontamination fluids creating increased hazards at the site should be disposed off-site. Before and after the SI, determine anticipated waste quantity and applicable regulations for waste generators.

(2) If not prohibited by other legally enforceable requirements such as state ARARs.

(3) Justified only in rare circumstances when a RCRA nonhazardous waste is a state hazardous waste and state legally enforceable requirements call for waste removal, or if leaving the waste on-site would significantly affect human health and the environment.

Figure 2

IDW Management Decision Tree



(1) Clean PPE and DE may also go to the nearest landfill or to an EPA warehouse dumpster.

(2) If the receiving unit meets the off-site policy acceptability criteria.

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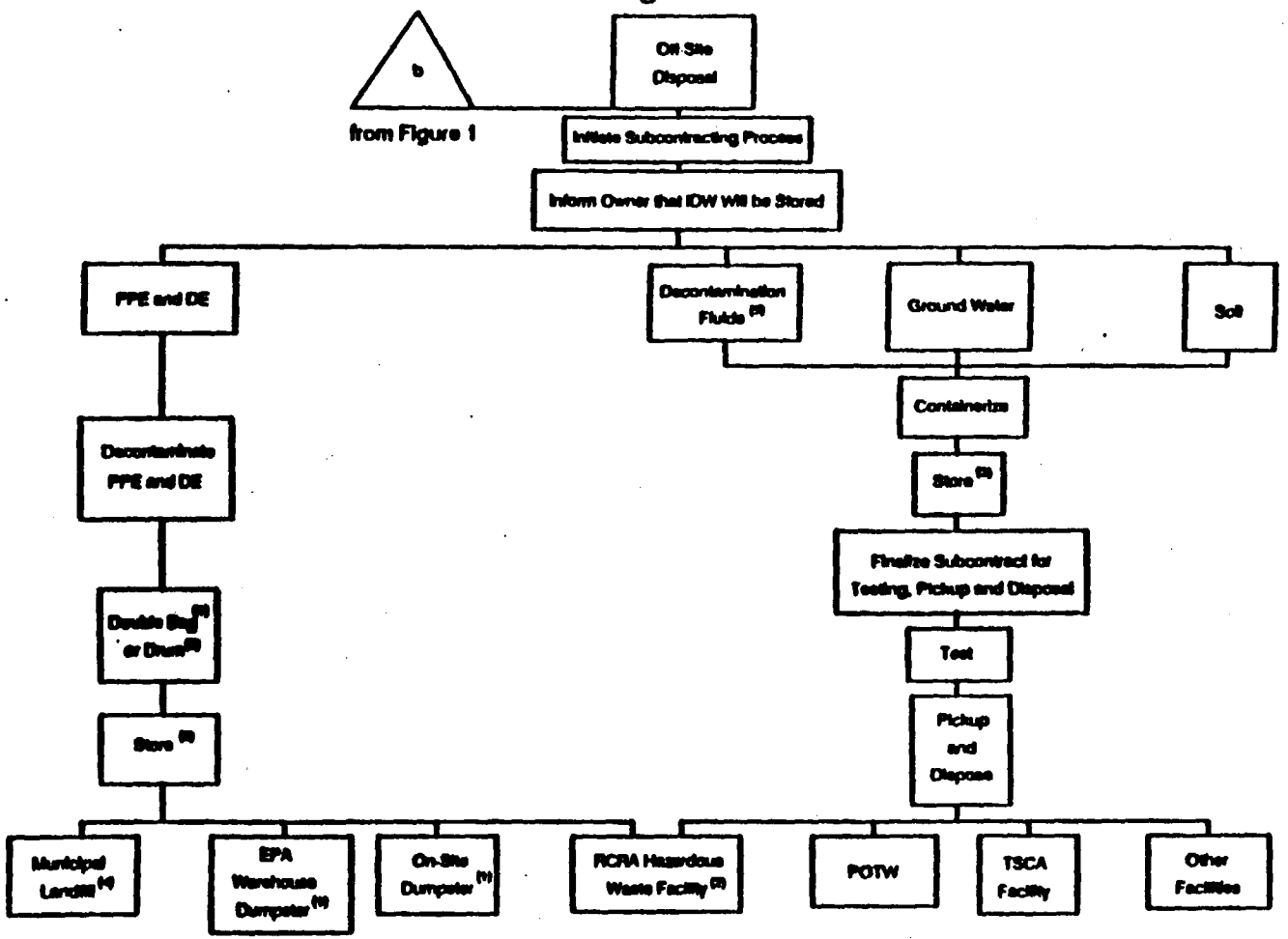
Figure 3

IDW Management Decision Tree



(1) Only RCRA nonhazardous waste.

(2) Only RCRA hazardous waste generated in quantities greater than 100 kg/month when sent off-site.

(3) In accordance with accumulation requirements for RCRA hazardous wastes.

(4) Only if the conditionally exempt small quantity generator exception applies.

(5) If the conditionally exempt small quantity generator exception applies, off-site disposal of decon fluids may not require subcontracting.

4.5 ON-SITE IDW HANDLING AND MANAGEMENT OPTIONS

If IDW are RCRA nonhazardous soil or water, they should be left on-site unless other circumstances, such as a state ARAR or a high probability of serious community concerns, require off-site disposal. RCRA hazardous soil also may be left on-site within an AOC unit. The SM must determine procedures for handling IDW on-site and notify the site owner in the site access agreement form that IDW such as soil cuttings and water will be left on-site. If the SM intends to leave IDW on-site, the waste should not be containerized and tested.

The on-site handling options available to the SM when IDW are RCRA nonhazardous are listed below.

- For soil cuttings:

  1. Spread around the well
  2. Put back to the boring
  3. Put into a pit within an AOC
  4. Dispose of at the site's operating TDU.

- For ground water:

  1. Pour onto ground next to the well to allow infiltration
  2. Dispose of at the site's TDU.

- For decontamination fluids:

  1. Pour onto ground (from containers) to allow infiltration
  2. Dispose of at the site's TDU.

- For decontaminated PPE and DE:

  1. Double bag and deposit in the site or EPA dumpster, or in any municipal landfill
  2. Dispose of at the site's TDU.

If IDW are considered RCRA nonhazardous due to lack of information on the waste hazard, the inspection team should have an alternative plan for handling IDW if field conditions indicate that these wastes are hazardous. In such a case, the minimum requirement is to have an adequate number of containers available for collecting ground water, decontamination water, or soil cuttings.

If IDW consist of RCRA hazardous soils that pose no immediate threat to human health and the environment, the SM should plan on leaving it on-site within a delineated AOC unit. However, before deciding to leave RCRA hazardous soil on-site, the SM must consider the proximity of residents and workers in the surrounding area. The SM must always use best professional judgment to make such decisions. Planning for leaving RCRA hazardous soil on-site involves:

- Delineating the AOC unit.

- Determining pit locations close to the borings within the AOC unit for waste burial.

- Covering hazardous IDW in the pits with surficial soil.

- Not containerizing and testing wastes designated to be left on-site.

Another alternative for handling RCRA hazardous soil is disposal in a TDU located on the same property as the AOC under investigation. If the TDU is outside the AOC, it must comply with the off-site policy. If any organic decon fluids are generated (which are RCRA hazardous wastes), they should be disposed of off-site in compliance with the off-site policy or in compliance with the conditionally exempt small quantity generator exemption. Small quantities (i.e., no more than 100 kg/month) of organic decon fluids may be containerized off-site prior to delivery to a hazardous waste facility.

4.6 OFF-SITE DISPOSAL OF IDW AND MANAGEMENT OPTIONS

IDW should be disposed off-site in the following situations:

- They are RCRA hazardous water.
- They are RCRA hazardous soil that may pose a substantial risk if left at the site.
- They are RCRA hazardous PPE and DE.
- If leaving them on-site would create increased risks at the site.

CRA nonhazardous wastes could be disposed of off-site at appropriate RCRA nonhazardous facilities that are in ompliance with CERCLA section 121(d)(3) and the off-site policy when it is necessary to comply with legally enforceable requirements such as state ARARs that preclude onsite disposal. IDW designated for off-site disposal ust be properly containerized, tested, and stored before pick-up and disposal. Decontaminated PPE and DE should double-bagged if sent to an off-site dumpster or a municipal landfill.

P ing for off-site disposal should include the following EPA guidelines:

- Incorporating a provision in the site access agreement form to inform the site owner that containerized IDW may be temporarily stored on-site while awaiting pickup for off-site disposal. The agreement should also request the owner's cooperation.
- Initiating the bidding process for IDW testing, pick-up, and disposal. If there are any subcontracting needs in planning for off-site disposal, EPA should specify what means of disposal will be needed (i.e. various types of treatment, landfilling, etc.). Since RCRA hazardous IDW must go to RCRA hazardous waste disposal facilities that comply with the off-site policy, the SM should obtain a list of available facilities from the RPO. Each EPA region maintains a list of RCRA hazardous TSD facilities that meet the conditions of the off-site policy. The recent addition of 25 new toxicity characteristic constituents to the list of toxic chemicals subject to RCRA hazardous waste regulations may result in fewer facilities available to handle IDW in the future. The SM must also check the selected facility's compliance before IDW pick-up. If IDW are RCRA nonhazardous, the SM must also check if the receiving RCRA nonhazardous waste facility complies with the off-site policy.
- Coordinating IDW generation with testing and pick-up. IDW samples should be collected in accordance with the "Test Methods for Evaluating Solid Waste" guidance manual (SW 846), and shipped for RCRA tests (and other tests, if necessary) as early as possible during the SI. This approach shortens the storage time and reduces the number of site visits to pick up waste. IDW need not be analyzed by a CLP laboratory. The SM should use the laboratory services of the pickup and disposal subcontractor, obtain an EPA ID number and manifest form for RCRA hazardous IDW, and a bill of lading for RCRA nonhazardous IDW.

- Preparing adequate numbers and types of containers. Drums should be used for collecting small amounts of IDW. Larger amounts of soil and water can be contained in Baker tanks, poly tanks, and bins. PPE and DE should be double-bagged for disposal at a municipal landfill or collected in drums for disposal at a hazardous waste facility.

- Designating a storage area (either within the site's existing storage facility, existing fenced area, or within a temporary fence constructed for the SI). No humans, children in particular, may have access to the storage area. If a temporary storage facility is to be constructed, its location and size must be agreed upon with the site owner, and all construction materials should be delivered to the site before or on the first day of the SI.

EPA expects that complying with this guidance will limit on-site storage to, at most, the time required to complete any testing (usually less than 6 weeks) required by subcontractors in order to arrange for transportation. In most cases, this will not result in exceeding the regulatory 90 day storage time for quantities greater than 1,000 kg/month regardless of the quantity of IDW. In cases where the regulatory 90 day storage time for quantities greater than 1,000 kg/month is exceeded, the SM must initiate a subcontract bidding process to remove IDW wastes off-site and a permit is not required.

All IDW shipped off-site, whether RCRA hazardous or not, must go to facilities that comply with the off-site policy, and the SM must check that subcontractors operate in accordance with this policy.

investigation teams should use best professional judgment in determining n such wastes contain hazardous substances. One commenter recommended that investigation-derived samples be required to be handled, treated, and disposed in accordance with applicable RCRA requirements.

In response, EPA wishes to clarify the discussion in the preamble to the proposed NCP. CERCLA section 101(23) defines "removal" to include "such actions as may be necessary to monitor, assess, and evaluate the release or threat of release of hazardous substances * * * [including] action taken under section 104(b) of [CERCLA]." EPA has stated, therefore, that studies and investigations undertaken pursuant to CERCLA section 104(b), such as activities conducted during the RI/FS, are considered removal actions (54 FR 13298, March 31, 1989). EPA's policy, explained elsewhere in today's preamble, is that removal actions will comply with ARARs to the extent practicable, considering the exigencies of the circumstances. Thus, the field investigation team should, when handling, treating or disposing of investigation-derived waste on-site, conduct such activities in compliance h ARARs to the extent practicable, considering the exigencies of the uation. Investigation-derived waste that is transported off-site (e.g., for treatability studies or disposal) must comply with applicable requirements of the CERCLA off-site policy (OSWER Directive No. 9834.11 (November 13, 1987)) and § 300.440 when finalized (see 53 FR 48218, November 29, 1988).[88] EPA notes that CERCLA section 104(c)(1) provides that the statutory limits on removals do not apply to investigations, monitoring, surveying, testing and other information-gathering performed under CERCLA section 104(b).

Final rule: EPA is promulgating the rule as proposed except for minor editing revisions.

Name: 300.5. Distinction between substantive and administrative requirements.

Proposed rule: The proposed definitions of "applicable" and "relevant and appropriate" stated that they are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria or limitations. The preamble to the proposed rule explained that requirements that do not in and of themselves define a level or standard of control are considered administrative (53 FR 51443). Administrative requirements include the approval of, or consultation with, administrative bodies, issuance of permits, documentation, and reporting and recordkeeping. Response actions under CERCLA are required to comply with ARARs, which are defined not to include administrative requirements.

Response to comments: Many comments were received on EPA's differentiation between substantive and administrative requirements. Some commenters supported the distinction between substantive and administrative requirements. Other commenters disagreed with EPA's interpretation for various reasons.

Several commenters argued that Superfund actions should not be exempt from consultation requirements. One commenter argued that consultation with a state may be necessary to determine how state ARARs apply to the remedy. A commenter contended that it is virtually impossible to meet substantive requirements without consultation. One commenter asserted that state procedures or methodology necessary to determine permit levels should be considered state ARARs. Another argued that not requiring consultation runs opposite to the spirit of cooperation with states. One commenter suggested narrowing the exemption to allow for consultation through existing Superfund mechanisms such as consent orders, SMOAs, and cooperative agreements.

Commenters also objected to the exemption from reporting and recordkeeping requirements. One contended that EPA had no legal authority for such exemption. Others argued that reporting and recordkeeping are necessary to ensure proper control of hazardous substances that will remain on-site and are also necessary for activities with local impacts: Long-term water diversions and air or surface water releases. Commenters asserted that the lead agency must meet reporting requirements to avoid gaps in a state's environmental data. One commenter noted that there are a number of federal and state programs that require the maintenance of complete databases and that the NCP's approach is inconsistent with such programs. Under these programs, a state needs all discharge information in order to evaluate surface water toxicity impacts in a stream or to establish total maximum daily loads.

The concern was also raised that maintaining reporting and recordkeeping procedures on a site-by-site basis would undermine a state's standardized reporting requirements, e.g., ground-water monitoring report forms, NPDES forms, etc. Also, unique site approaches to reporting and recordkeeping may result in problems not detected by a state. Further, these commenters stated that they were not aware of Superfund recordkeeping and reporting requirements. One commenter stated that reporting requirements and compliance mechanisms during remedy implementation and O&M periods should be specified through Superfund mechanisms, as appropriate. One commenter contended that if Superfund insists on this distinction, a determination whether a requirement is substantive or administrative must be documented.

EPA has reviewed these comments, but concludes, as stated in the preamble to the proposed NCP (53 FR 51443), that CERCLA response actions should be subject only to substantive, not administrative, requirements. EPA believes that this interpretation is most consistent with the terms of CERCLA and with the goals of the statute. Section 121(d)(2) provides that remedial actions should require "a level or standard of control" which attains ARARs: only substantive standards set levels or standards of control. Moreover, Congress made clear in sections 121 (d)(2) and (d)(4) that the "standards" or "requirements" of other laws that are ARARs should be applied to actions conducted on-site, and specifically provided in section 121(e)(1) that federal and state permits would not be required for such on-site response actions. These subsections reflect Congress' judgment that CERCLA actions should not be delayed by time-consuming and duplicative administrative requirements such as permitting, although the remedies should achieve the substantive standards of applicable or relevant and appropriate laws. Indeed, CERCLA has its own comparable procedures for remedy selection and state and community involvement. EPA's approach is wholly consistent with the overall goal of the Superfund program, to achieve expeditious cleanups, and reflects an understanding of the uniqueness of the CERCLA program, which directly impacts more than one medium (and thus overlaps with a number of other regulatory and statutory programs). Accordingly, it would be inappropriate to formally subject CERCLA response actions to the multitude of administrative requirements of other federal and state offices and agencies.

[88] The CERCLA off-site policy requires that receiving facilities are in compliance with "applicable laws." Note that many treatability study wastes are exempt from the permitting requirement under RCRA (see 40 CFR 261.4(e) and (f)).

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requirements. Rather, given the need to ensure finality of remedy selection in order to achieve expeditious cleanup of sites, and given the length of time often required to design, negotiate, and implement remedial actions, EPA believes that this is the most reasonable interpretation of the statute.

As EPA discusses elsewhere in this preamble, one variation to this policy occurs when a component of the remedy was not identified when the ROD is signed. In that situation, EPA will comply with ARARs in effect when that component is identified (e.g., during remedial design), which could include requirements promulgated both before and after the ROD was signed. EPA notes that newly promulgated or modified requirements may directly apply or be more relevant and appropriate to certain locations, actions or contaminants than existing standards and, thus, may be potential ARARs for future responses.

It is important to note that a policy of freezing ARARs at the time of the ROD signing will not sacrifice protection of human health and the environment, because the remedy will be reviewed for protectiveness every five years, considering new or modified requirements at that point, or more frequently, if there is reason to believe that the remedy is no longer protective of health and environment.

In response to the specific comments received, EPA notes that under this policy, EPA does not intend that a remedy must be modified solely to attain a newly promulgated or modified requirement. Rather, a remedy must be modified if necessary to protect human health and the environment; newly promulgated or modified requirements contribute to that evaluation of protectiveness. For example, a new requirement for a chemical at a site may indicate that the cleanup level selected for the chemical corresponds to a cancer risk of 10^{-5} rather than 10^{-6}, as originally thought. The original remedy would then have to be modified because it would result in exposures outside the acceptable risk range that generally defines what is protective.

This policy that newly promulgated or modified requirements should be considered during protectiveness reviews of the remedy, but should not require a reopening of the ROD during implementation every time a new state or federal standard is promulgated or modified, was discussed in the preamble to the proposed rule (53 FR at 51440) but not in the rule section itself. For the reasons outlined above, EPA believes that this concept is critical to the expeditious and cost-effective accomplishment of remedies duly selected under CERCLA and the NCP, and thus is appropriate for inclusion in § 300.430(f)(1)(ii)(B) of the final NCP. This will afford both the public and implementing agencies greater clarity as to when and how requirements must be considered during CERCLA responses, and thus will allow the CERCLA program to carry out selected remedies with greater certainty and efficiency. Of course, off-site CERCLA remedial actions are subject to the substantive and procedural requirements of applicable federal, state, and local laws at the time of off-site treatment, storage or disposal.

Final rule: EPA is adding the following language to the rule at § 300.430(f)(1)(ii)(B):

(B) On-site remedial actions selected in a ROD must attain those ARARs that are identified at the time of ROD signature or provide grounds for invoking a waiver under § 300.430(f)(1)(ii)(C)(*3*).

(*1*) Requirements that are promulgated or modified after ROD signature must be attained (or waived) only when determined to be applicable or relevant and appropriate and necessary to ensure that the remedy is protective of human health and the environment.

(*2*) Components of the remedy not described in the ROD must attain (or waive) requirements that are identified as applicable or relevant and appropriate at the time the amendment to the ROD or the explanation of significant differences describing the component is signed.

Name: Applicability of RCRA requirements.

Proposed rule: The preamble to the proposed rule discussed when RCRA subtitle C requirements will be applicable for site cleanups (53 FR 51443). It described the prerequisites for "applicability" at length, which are that: (1) The waste must be a listed or characteristic RCRA hazardous waste and (2) treatment, storage or disposal occurred after the effective date of the RCRA requirements under consideration (for example, because the activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA).

The preamble explained how EPA will determine when a waste at a CERCLA site is a listed RCRA hazardous waste. It noted that it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste.

The preamble discussed how EPA will determine that a waste is a characteristic hazardous waste under RCRA. It stated that EPA can test to determine whether a waste exhibits a characteristic or can use best professional judgment to determine whether testing is necessary, "applying knowledge of the hazard characteristic in light of the materials or process used."

The preamble also discussed when a CERCLA action constitutes "land disposal," defined as placement into a land disposal unit under section 3004(k) of RCRA, which triggers several significant requirements, including RCRA land disposal restrictions (LDRs) and closure requirements (when a unit is closed). It equated an area of contamination (AOC), consisting of continuous contamination of varying amounts and types at a CERCLA site, to a single RCRA land disposal unit, and stated that movement within the unit does not constitute placement. It also stated that placement occurs when waste is redeposited after treatment in a separate unit (e.g., incinerator or tank), or when waste is moved from one AOC to another. Placement does not occur when waste is consolidated within an AOC, when it is treated in situ, or when it is left in place.

Response to comments: EPA received many comments on its discussion of when RCRA requirements can be applicable to CERCLA response actions. On the issue of compliance with RCRA in general, most of these commenters argued that RCRA requirements are not intended for site cleanup actions, that such compliance will result in delays and that RCRA requirements are often unnecessary to protect human health and the environment at CERCLA sites. Other commenters argued, however, that EPA is trying to avoid compliance with RCRA requirements. Most of the comments, however, focused on when LDRs are applicable to CERCLA actions and on EPA's discussion of what actions associated with remediation trigger LDRs.

Some commenters opposed EPA's interpretation of "land disposal" or "placement" as too lenient, believing that EPA is trying to avoid compliance with RCRA laws, particularly LDRs. These commenters argued that LDRs should be applicable when hazardous wastes are managed, excavated, or moved in any way. One argued that ARARs waivers are available to address situations when the LDR levels cannot be achieved and should be used as necessary, rather than trying to narrowly define the universe of ARARs to avoid waivers. This commenter was also concerned with EPA's use of the term "unit," calling it an inappropriate concept for Superfund sites because it

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will allow the excavation and redeposition of waste within very large areas without ever meeting RCRA design and operating standards and LDR. One commenter asserted that EPA concerns on LDRs stem from an unjustifiable belief that LDR cleanup levels cannot be achieved.

Other commenters believed that the definition of "placement" should provide more flexibility. One asserted that replacement of treated residuals in the proximate area should not constitute placement. The commenter argued that Congress intended to address, preventively or prospectively, the original act of disposal, and that an innocent government or public entity should not be required to assume the entire environmental responsibility of the original disposers. The commenter also argued that establishing that replacement of treated waste triggers LDRs will be a serious disincentive to treating wastes. Some commenters argued that LDRs should not be relevant and appropriate where the CERCLA waste to be disposed on land is merely similar in composition to RCRA banned waste.

Other commenters argued that LDRs are inappropriate for CERCLA remedial actions. They noted an inherent conflict between LDRs, which require treatment to BDAT levels, and the CERCLA process, and claimed that LDRs will supplant CERCLA's "carefully articulated and balanced approach to remedy selection." Commenters asserted that compliance with LDRs will create technical problems because of differences between CERCLA wastes and those evaluated for LDRs. The solutions recommended by these commenters primarily focused on narrowing or eliminating RCRA applicability, but included suggestions for creating treatability groups for CERCLA-type waste and seeking legislative waivers from LDRs, e.g., a waiver from LDRs for Superfund actions at NPL sites.

One commenter believed that the concept of "unit" is not readily transferable to CERCLA sites due to the age and former uses of many of the sites undergoing remediation. Given the ramifications of LDRs, the commenter argued, it may be more reasonable to create a presumption of treating the entire site as one "unit," even if remediation includes a series of operable units.

Some comments were received on EPA's statements on consolidating waste. One stated that consolidation of small amounts of waste across units should not be considered placement, because that will lead to less environmentally sound and less cost-effective solutions, particularly if LDRs are triggered. Another recommended that EPA should allow consolidation of small volumes of waste anywhere on-site, for purposes of storage or treatment, without triggering otherwise applicable RCRA standards. Another commenter requested clarification that consolidation within a unit included normal earthmoving and grading operations.

1. *Actions constituting land disposal.* EPA disagrees with commenters who considered EPA's interpretation of the definition of "land disposal" under RCRA section 3004(k) to be too narrow. These commenters argued that any movement of waste should be considered "placement" of waste, and thus "land disposal" under RCRA section 3004(k).

The definition of "land disposal" is central to determining whether the RCRA LDRs are applicable to a hazardous waste which is being managed as part of a CERCLA response action, or RCRA closure or corrective action. The term "land disposal" is defined under RCRA section 3004(k) as including, but not limited to, "any placement of such hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave." The terms "landfill", "surface impoundment," and the others, refer to specific types of units defined under RCRA regulations. Thus, Congress generally defined the scope of the LDR program as the placement of hazardous waste in a land disposal unit, as those units are defined under RCRA regulations.

EPA has consistently interpreted the phrase "placement * * * in" one of these land disposal units to mean the placement of hazardous wastes into one of these units, not the movement of waste within a unit. See e.g., 51 FR 40577 (Nov. 7, 1986) and 54 FR 41566–67 (October 10, 1989)(supplemental proposal of possible alternative interpretations of "land disposal"). EPA believes that its interpretation that the "placement * * * in" language refers to a transfer of waste into a unit (rather than simply any movement of waste) is not only consistent with a straightforward reading of section 3004(k), but also with the Congressional purpose behind the LDRs. The central concern of Congress in establishing the LDR program was to reduce or eliminate the practice of disposing of untreated hazardous waste at RCRA hazardous waste facilities. The primary aim of Congress was prospective rather than directed at already-disposed waste within a land disposal unit. See 51 FR 40577 (Nov. 7, 1986). Moreover, interpreting section 3004(k) to require application of the LDRs to any movement of waste could be difficult to implement and could interfere with necessary operations at an operating RCRA facility. For instance, when hazardous waste is disposed of in a land disposal unit at an operating RCRA facility, there may well be some "movement" of the waste already in the unit. Under the commenters' approach, such movement without pretreatment of the moved waste could be in violation of the LDRs. Thus, under the commenters' interpretation, virtually no operational activities could occur at any RCRA land disposal unit containing hazardous waste without pretreatment of any waste disturbed by the operation: clearly an infeasible approach.

EPA also believes that this interpretation of section 3004(k) is supported by the legislative history for this provision (see 129 Cong. Rec. H8139 (Oct. 6, 1983)(statement of Rep. Breaux)), and by the Congressional choice to define "land disposal" more narrowly for purposes of application of the LDRs than the already-existing term "disposal", which has a much broader meaning under RCRA. Under RCRA section 1004(3), the term "disposal" is very broadly defined and includes any "discharge, deposit, injection, dumping, spilling, leaking, or placing" of waste into or on any land or water. Thus, "disposal" (in a statutory, rather than the regulatory subtitle C meaning of the term) would include virtually any movement of waste, whether within a unit or across a unit boundary. In fact, the RCRA definition of "disposal" has been interpreted by numerous courts to include passive leaking, where no active management is involved (see, e.g., *U.S. v. Waste Industries, Inc.*, 734 F.2d 159 (4th Cir. 1984)). However, Congress did not use the term "disposal" as its trigger for the RCRA land disposal restrictions, but instead specifically defined the new, and more narrow, term "land disposal" in section 3004(k). The broader "disposal" language continues to be applicable to RCRA provisions other than those in subtitle C, such as section 7003. Thus, for the reasons outlined above, EPA believes that the existing interpretation, that movement of waste within a unit does not constitute "land disposal" for purposes of application of the RCRA LDRs, is reasonable.

With respect to the commenter who asked whether normal earthmoving and grading operations within a land disposal unit constitute "placement into

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the unit", under EPA's interpretation of RCRA section 3004(k), such activity would not be "placement into the unit" and thus the RCRA LDRs and other subtitle C disposal requirements would not be applicable (nor would the requirement to obtain a permit under RCRA or minimum technology requirements in RCRA section 3004(o) apply).

Given this interpretation of section 3004(k), EPA does not believe that it is necessary to invoke ARAR waivers of LDRs for any movement of waste within a unit, which was the alternative suggested by the commenters. Nor does EPA believe that the widespread use of such waivers would be practical or desirable. 54 FR 41568–69 (October 10, 1989).

EPA also does not fully agree with the commenters who argued that the RCRA concept of "unit" does not apply to CERCLA sites. The commenters who criticized the application of the RCRA "unit" to the CERCLA area of contamination for purposes of section 3004(k) believed it to be either too broad, allowing large areas to escape the LDRs, or too narrow, not allowing entire CERCLA sites to be considered a single "unit". In contrast to hazardous waste management units at a RCRA facility, CERCLA sites often do not involve discrete waste management units, but rather involve land areas on or in which there can be widespread areas of generally dispersed contamination. Thus, determining the boundaries of the RCRA land disposal "unit," for which section 3004(k) would require application of the LDRs at these sites, is not always self-evident.

EPA generally equates the CERCLA area of contamination with a single RCRA land-based unit, usually a landfill. 54 FR 41444 (December 21, 1988). The reason for this is that the RCRA regulatory definition of "landfill" is generally defined to mean a land disposal unit which does not meet the definition of any other land disposal unit, and thus is a general "catchall" regulatory definition for land disposal units. As a result, a RCRA "landfill" could include a non-discrete land area on or in which there is generally dispersed contamination. Thus, EPA believes that it is appropriate generally to consider CERCLA areas of contamination as a single RCRA land-based unit, or "landfill". However, since the definition of "landfill" would not include discrete, widely separated areas of contamination, the RCRA "unit" would not always encompass an entire CERCLA site.

Waste consolidation from different units or AOCs at a CERCLA site are subject to any applicable RCRA requirements regardless of the volume of the waste or the purpose of the consolidation. Thus, EPA disagrees with those commenters that asserted that small volumes of hazardous waste at a CERCLA site can be consolidated anywhere on-site for storage or treatment purposes without consideration of any applicable RCRA requirements. Such requirements may, however, be subject to ARAR waivers in appropriate circumstances.

The remaining comments received with respect to EPA's interpretation of section 3004(k) discussed the achievability of LDR cleanup levels, questioned the appropriateness of applying the LDRs to remedial actions, and requested more flexibility regarding the LDRs. These comments were the basis for EPA's supplemental notice and proposed reinterpretation of section 3004(k), which is discussed below.

In light of the numerous comments received on the interpretation of "land disposal" in RCRA section 3004(k), as it relates to removal, treatment, and redeposition of hazardous wastes generated by CERCLA and RCRA remedial and other activities, and in view of the important policy decisions that RCRA LDRs pose for the CERCLA and RCRA programs, EPA decided to separately and more fully discuss the issue, the interpretation outlined in the proposed NCP, and possible alternative interpretations of "land disposal". In a supplemental notice to the proposed NCP (54 FR 41566 (Oct. 10, 1989)), EPA outlined several technical, policy, and legal issues concerning LDR applicability to removal, treatment, and redeposition of hazardous wastes, and requested comment on two alternative interpretations of "land disposal". The first alternative would allow the excavation and replacement of previously disposed hazardous wastes in the same unit or area of contamination: since the same wastes would remain in the same unit, this activity would not constitute "land disposal". Under the second alternative, hazardous wastes could be excavated and redeposited either within the original unit or area of contamination, or elsewhere at the site in a new or existing unit. These interpretations would allow greater flexibility in remedial decision-making, in the context of both CERCLA actions and RCRA corrective actions and closures.

On November 6 and 7, 1989, EPA held a forum on contaminated soil and groundwater ("Contaminated Media Forum") to provide an opportunity for interested groups to further address these issues. The Contaminated Media Forum was attended by representatives from EPA, states, environmental groups, Congress, and the regulated community. A summary of the concerns raised and suggested solutions appears in the public docket for this rulemaking.

2. *Selection of LDR treatment standards.* Upon further examination, EPA believes that many of the problems discussed in the supplemental notice, and raised by commenters, result from treatment standards developed pursuant to the RCRA LDR program that are generally inappropriate or infeasible when applied to contaminated soil and debris. As discussed in the October 1989 notice, EPA's experience under CERCLA has been that treatment of large quantities of soil and debris containing relatively low levels of contamination using LDR "best demonstrated available technology" (BDAT) is often inappropriate. 54 FR 41567, 41568 (October 10, 1989). EPA noted that:

> Experience with the CERCLA program has shown that many sites will have large quantities—in some cases, many thousands of cubic meters—of soils that are contaminated with relatively low concentrations of hazardous wastes. These soils often should be treated, but treatment with the types of technologies that would meet the standard of BDAT may yield little if any environmental benefit over other treatment based remedial options.

54 FR 41568 (October 10, 1989). Examples of these and other situations reflecting EPA's experience concerning the inappropriateness of incinerating contaminated soil and debris are included in the record for this rule. In addition, as discussed below, EPA has experienced problems in achieving the current noncombustion LDRs for contaminated soil and debris. Based on EPA's experience to date and the virtually unanimous comments supporting this conclusion, EPA has determined that, until specific standards for soils and debris are developed, current BDAT standards are generally inappropriate or unachievable for soil and debris from CERCLA response actions and RCRA corrective actions and closures. Instead, EPA presumes that, because contaminated soil and debris is significantly different from the wastes evaluated in establishing the BDAT standards, it cannot be treated in accordance with those standards and thus qualifies for a treatability variance from those standards under 40 CFR 268.44.

Accordingly, persons seeking a treatability variance from LDR treatment standards for contaminated soil and debris do not need to demonstrate on a case-by-case basis

believes that it is unnecessary for petitioners (or the lead Agency in CERCLA response actions) to make site-specific demonstrations that BDAT standards are inappropriate for contaminated soil and debris. The numerous comments and Agency experience supporting a presumption that the BDAT standards are inappropriate or not achievable is clearly warranted at this time because the criteria in 40 CFR 268.44 for treatability variances are generally met for soil and debris. As a result, under EPA's established treatability variance procedures (40 CFR 268.44), variance applications for contaminated soil and debris do not need to demonstrate that the physical and chemical properties differ significantly from wastes analyzed in developing the treatment standard and that, therefore, the waste cannot be treated to specified levels or by specified methods. Petitions need only focus on justifying the proposed alternative levels of performance, using existing interim guidance containing suggested treatment levels for soil and debris (Superfund LDR Guidance #6A, "Obtaining a Soil and Debris Treatability Variance for Remedial Actions", EPA OSWER Directive 9347.3-06FS, July 1989) as a benchmark.

Although the presumption is that BDAT standards are not appropriate for soil and debris, there may be special circumstances where EPA determines that the existing BDAT standards are appropriate for contaminated soils and debris at a particular site, such as where high levels of combustible organics in soil are present. In these circumstances, the Agency would make a determination that treatment to the BDAT standards was appropriate and would require such treatment.

EPA regulations provide that treatability variances may be issued on a site-specific basis. 40 CFR 268.44(h).[22] Thus, they may be approved simultaneously with the issuance of a RCRA permit, the approval of a RCRA closure plan, or the selection of a remedy in a CERCLA response action in the ROD. In the case of an on-site CERCLA response action, the procedural requirements of the variance process do not apply. See CERCLA sections 121(e)(1) and 121(d)(2). The variance decision will be made as part of EPA's remedy selection process, during which data justifying alternative treatment levels will be included in the administrative record files, and public participation opportunities and Agency response to comment will be afforded as appropriate under this rule.

In EPA's view, the Agency's determination that the BDAT standards are generally inappropriate for contaminated soil and debris addresses many of the practical concerns raised by commenters in the supplemental notice on the Agency's interpretation of the term "land disposal". For this reason, and because EPA has had insufficient time to review and evaluate the many lengthy and complex issues raised by commenters on the supplemental notice, EPA is deferring any final decision to modify that interpretation. (EPA will respond to comments on the alternatives in the supplemental notice when the Agency makes a final decision on the proposed reinterpretation of land disposal.) Until a final decision is made, the interpretation announced in the preamble to the proposed NCP and discussed in section 1 above will remain in effect.

Final rule: There is no rule language on this issue.

Name: Determination of whether a waste is a hazardous waste.

Proposed rule: The preamble to the proposed rule discussed how to determine whether hazardous waste regulated under RCRA Subtitle C was present at a site (53 FR 51444).

Response to comments: Some commenters raised questions about EPA's discussion about determining whether a waste exhibits a hazardous characteristic. One argued that EPA cannot assume a waste is not a characteristic waste in the absence of testing and should therefore adopt a liberal and inclusive approach to determining whether RCRA applies to avoid expensive and time-consuming testing. Another commenter asked for clarification on who was responsible for applying "process knowledge" to determine whether a waste was a hazardous waste in the absence of testing. The commenter asserted that, under RCRA, EPA exercises prosecutorial discretion if a generator, acting in good faith, decides incorrectly that his waste is not hazardous. EPA notes that when it determines that there is a violation there will normally be some kind of enforcement action taken; the level and type of prosecutorial response will depend on a number of factors, for example, the size of the company, the significance of the violation, the intent, etc.

Under RCRA rules, a generator is not required to test, but may use knowledge of the waste and its constituents to judge whether the waste exhibits a characteristic. (See 40 CFR 262.11(c).) EPA believes this should also apply if the lead agency or PRP at a CERCLA site is the "generator." EPA wants to make clear, however, that a decision that a waste is not characteristic in the absence of testing may not be arbitrary, but must be based on site-specific information and data collected on the constituents and their concentrations during investigations of the site. Based on site data, it will be very clear in some cases that a waste cannot be characteristic: for example, if a waste does not contain a constituent regulated as EP toxic, a decision that the waste does not exhibit this characteristic can reliably be made without testing for EP toxicity. EPA does not expect to undertake testing when it can otherwise be determined with reasonable certainty whether or not the waste will exhibit a characteristic.

In response to the second concern, the determination whether a waste is a hazardous waste may be made by EPA, the state, or a PRP, depending on the nature of the action. EPA will take any necessary or appropriate action if decisions about the hazardous nature of the waste are in error or are made without proper basis.

Several commenters discussed the question of whether RCRA requirements can be applicable to RCRA hazardous waste disposed of before the RCRA requirements went into effect in 1980. One commenter argued that they could not be, unless the waste exhibited a characteristic at the time of the CERCLA action. However, as one commenter noted, EPA has consistently maintained in enforcement actions that RCRA requirements apply to any waste

[22] In light of today's determination, the application of this rule requires clarification in two respects. First, although EPA is today establishing a general presumption that BDAT standards are inappropriate or not achievable for treating soil and debris, the Agency does not believe that this presumption triggers the rulemaking variance procedures in 40 CFR 268.44(a). Even with the presumption, treatment levels will be determined on a case-by-case basis, and commenters may submit information contending that the presumption is not applicable in a particular case. Thus, it is EPA's view that the site-specific, non-rulemaking procedures in 40 CFR 268.44(h) are entirely appropriate. See 53 FR 31199–31200 (August 17, 1988).

Second, EPA does not interpret its site specific variance procedures as invariably requiring applicants to demonstrate that they cannot meet applicable treatment levels or methods. The first sentence of 40 CFR 268.44(h) makes it clear that an applicant may make one of two demonstrations to qualify for a variance: he may show either that he cannot meet a treatment standard, or that a treatment method (or the method underlying the standard is inappropriate for his waste. The final sentence of § 268.44(h), identifying the showing an applicant must include in his variance application, on its terms applies only to applications submitted under the first criterion. EPA's presumption, however, applies to soil and debris regardless of which of the two types of variances apply.

United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Superfund Publication: 9347.3-05FS
July 1989

EPA

Superfund LDR Guide #5

Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions

CERCLA Section 121(d)(2) specifies that on-site Superfund remedial actions shall attain "other Federal standards, requirements, criteria, limitations, or more stringent State requirements that are determined to be legally applicable or relevant and appropriate (ARAR) to the specified circumstances at the site." In addition, the National Contingency Plan (NCP) requires that on-site removal actions attain ARARs to the extent practicable. Off-site removal and remedial actions must comply with legally applicable requirements. This guide outlines the process used to determine whether the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs) established under the Hazardous and Solid Waste Amendments (HSWA) are "applicable" to a CERCLA response action. More detailed guidance on Superfund compliance with the LDRs is being prepared by the Office of Solid Waste and Emergency Response (OSWER).

For the LDRs to be applicable to a CERCLA response, the action must constitute placement of a restricted RCRA hazardous waste. Therefore, site managers (OSCs, RPMs) must answer three separate questions to determine if the LDRs are applicable:

(1) Does the response action constitute placement?

(2) Is the CERCLA substance being placed also a RCRA hazardous waste? and if so

(3) Is the RCRA waste restricted under the LDRs?

Site managers also must determine if the CERCLA substances are California list wastes, which are a distinct category of RCRA hazardous wastes restricted under the LDRs (see Superfund LDR Guide #2).

(1) DOES THE RESPONSE CONSTITUTE PLACEMENT?

The LDRs place specific restrictions (e.g., treatment of waste to concentration levels) on RCRA hazardous wastes prior to their placement in land disposal units. Therefore, a key determination is whether the response action will constitute placement of wastes into a land disposal unit. As defined by RCRA, land disposal units include landfills, surface impoundments, waste piles, injection wells, land treatment facilities, salt dome formations, underground mines or caves, and concrete bunkers or vaults. If a CERCLA response includes disposal of wastes in any of these types of off-site land disposal units, placement will occur. However, uncontrolled hazardous waste sites often have widespread and dispersed contamination, making the concept of a RCRA unit less useful for actions involving on-site disposal of wastes. Therefore, to assist in defining when "placement" does and does not occur for CERCLA actions involving on-site disposal of wastes, EPA uses the concept of "areas of contamination" (AOCs), which may be viewed as equivalent to RCRA units, for the purposes of LDR applicability determinations.

An AOC is delineated by the areal extent (or boundary) of contiguous contamination. Such contamination must be continuous, but may contain varying types and concentrations of hazardous substances. Depending on site characteristics, one or more AOCs may be delineated. Highlight 1 provides some examples of AOCs.

Highlight 1: EXAMPLES OF AREAS OF CONTAMINATION (AOCs)

- A waste source (e.g., waste pit, landfill, waste pile) and the surrounding contaminated soil.
- A waste source, and the sediments in a stream contaminated by the source, where the contamination is continuous from the source to the sediments.*
- Several lagoons separated only by dikes, where the dikes are contaminated and the lagoons share a common liner.

* The AOC does not include any contaminated surface or ground water that may be associated with the land-based waste source.

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For on-site disposal, placement occurs when wastes are moved from one AOC (or unit) into another AOC (or unit). Placement does not occur when wastes are left in place, or moved within a single AOC. Highlight 2 provides scenarios of when placement does and does not occur, as defined in the proposed NCP. The Agency is current reevaluating the definition of placement prior to the promulgation of the final NCP, and therefore, these scenarios are subject to change.

Highlight 2: PLACEMENT

Placement does occur when wastes are:

- Consolidated from different AOCs into a single AOC;
- Moved outside of an AOC (for treatment or storage, for example) and returned to the same or a different AOC; or
- Excavated from an AOC, placed in a separate unit, such as an incinerator or tank that is within the AOC, and redeposited into the same AOC.

Placement does not occur when wastes are:

- Treated in situ;
- Capped in place;
- Consolidated within the AOC; or
- Processed within the AOC (but not in a separate unit, such as a tank) to improve its structural stability (e.g., for capping or to support heavy machinery).

In summary, if placement on-site or off-site does not occur, the LDRs are not applicable to the Superfund action.

(2) IS THE CERCLA SUBSTANCE A RCRA HAZARDOUS WASTE?

Because a CERCLA response must constitute placement of a restricted RCRA hazardous waste for the LDRs to be applicable, site managers must evaluate whether the contaminants at the CERCLA site are RCRA hazardous wastes. Highlight 3 briefly describes the two types of RCRA hazardous wastes --listed and characteristic wastes.

Highlight 3: RCRA HAZARDOUS WASTES

A RCRA solid waste* is hazardous if it is listed or exhibits a hazardous characteristic.

Listed RCRA Hazardous Wastes

Any waste listed in Subpart D of 40 CFR 261, including:

- F waste codes (Part 261.31)
- K waste codes (Part 261.32)
- P waste codes (Part 261.33(e))
- U waste codes (Part 261.33(f))

Characteristic RCRA Hazardous Wastes

Any waste exhibiting one of the following characteristics, as defined in 40 CFR 261:

- Ignitability
- Corrosivity
- Reactivity
- Extraction Procedure (EP) Toxicity

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* A solid waste is any material that is discarded or disposed of (i.e., abandoned, recycled in certain ways, or considered inherently waste-like). The waste may be solid, semi-solid, liquid, or a contained gaseous material. Exclusions from the definition (e.g., domestic sewage sludge) appear in 40 CFR 261.4(a). Exemptions (e.g., household wastes) are found in 40 CFR 261.4(b).

Site managers are not required to presume that a CERCLA hazardous substance is a RCRA hazardous waste unless there is affirmative evidence to support such a finding. Site managers, therefore, should use "reasonable efforts" to determine whether a substance is a RCRA listed or characteristic waste. (Current data collection efforts during CERCLA removal and

remedial site investigations should be sufficient for this purpose.) For listed hazardous wastes, if manifests or labels are not available, this evaluation likely will require fairly specific information about the waste (e.g., source, prior use, process type) that is "reasonably ascertainable" within the scope of a Superfund investigation. Such information may be obtained from facility business records or from an examination of the processes used at the facility. For characteristic wastes, site managers may rely on the results of the tests described in 40 CFR 261.21 - 261.24 for each characteristic or on knowledge of the properties of the substance. Site managers should work with Regional RCRA staff, Regional Counsel, State RCRA staff, and Superfund enforcement personnel, as appropriate, in making these determinations.

In addition to understanding the two categories of RCRA hazardous wastes, site managers will also need to understand the derived-from rule, the mixture rule, and the contained-in interpretation to identify correctly whether a CERCLA substance is a RCRA hazardous waste. These three principles, as well as an introduction to the RCRA delisting process, are described below.

Derived-from Rule (40 CFR 261.3(c)(2))

The derived-from rule states that any solid waste derived from the treatment, storage, or disposal of a listed RCRA hazardous waste is itself a listed hazardous waste (regardless of the concentration of hazardous constituents). For example, ash and scrubber water from the incineration of a listed waste are hazardous wastes on the basis of the derived-from rule. Solid wastes derived from a characteristic hazardous waste are hazardous wastes only if they exhibit a characteristic.

Mixture Rule (40 CFR 261.3(a)(2))

Under the mixture rule, when any solid waste and a listed hazardous waste are mixed, the entire mixture is a listed hazardous waste. For example, if a generator mixes a drum of listed F006 electroplating waste with a non-hazardous wastewater (wastewaters are solid wastes - see Highlight 3), the entire mixture of the F006 and wastewater is a listed hazardous waste. Mixtures of solid wastes and characteristic hazardous wastes are hazardous only if the mixture exhibits a characteristic.

Contained-in Interpretation (OSW Memorandum dated November 13, 1986)

The contained-in interpretation states that any mixture of a non-solid waste and a RCRA listed hazardous waste must be managed as a hazardous waste as long as the material contains (i.e., is above health-based levels) the listed hazardous waste. For example, if soil or ground water (i.e., both non-solid wastes) contain an F001 spent solvent, that soil or ground water must be managed as a RCRA hazardous waste, as long as it "contains" the F001 spent solvent.

Delisting (40 CFR 260.20 and .22)

To be exempted from the RCRA hazardous waste "system," a listed hazardous waste, a mixture of a listed and solid waste, or a derived-from waste must be delisted (according to 40 CFR 260.20 and .22). Characteristic hazardous wastes never need to be delisted, but can be treated to no longer exhibit the characteristic. A contained-in waste also does not have to be delisted; it only has to "no longer contain" the hazardous waste.

If site managers determine that the hazardous substance(s) at the site is a RCRA hazardous waste(s), they should also determine whether that RCRA waste is a California list waste. California list wastes are a distinct category of RCRA wastes restricted under the LDRs (see Superfund LDR Guide #2).

(3) IS THE RCRA WASTE RESTRICTED UNDER THE LDRs?

If a site manager determines that a CERCLA waste is a RCRA hazardous waste, this waste also must be restricted for the LDRs to be an applicable requirement. A RCRA hazardous waste becomes a restricted waste on its HSWA statutory deadline or sooner if the Agency promulgates a standard before the deadline. Because the LDRs are being phased in over a period of time (see Highlight 4), site managers may need to determine what type of restriction is in

Highlight 4: LDR STATUTORY DEADLINES

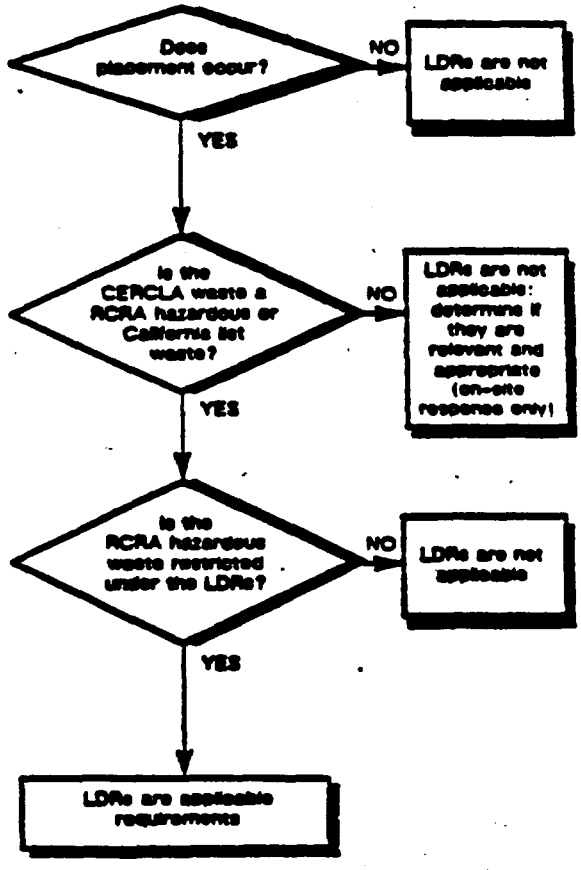
Waste	Statutory Deadline
Spent Solvent and Dioxin-Containing Wastes	November 8, 1986
California List Wastes	July 8, 1987
First Third Wastes	August 8, 1988
Spent Solvent, Dioxin-Containing, and California List Soil and Debris From CERCLA/RCRA Corrective Actions	November 8, 1988
Second Third Wastes	June 8, 1989
Third Third Wastes	May 8, 1990
Newly Identified Wastes	Within 6 months of identification as a hazardous waste

effect at the time placement is to occur. For example, if the RCRA hazardous wastes at a site are currently under a national capacity extension when the CERCLA decision document is signed, site managers should evaluate whether the response action will be completed before the extension expires. If these wastes are disposed of in surface impoundments or landfills prior to the expiration of the extension, the receiving unit would have to meet minimum technology requirements, but the wastes would not have to be treated to meet the LDR treatment standards.

APPLICABILITY DETERMINATIONS

If the site manager determines that the LDRs are applicable to the CERCLA response based on the previous three questions, the site manager must: (1) comply with the LDR restriction in effect, (2) comply with the LDRs by choosing one of the LDR compliance options (e.g., Treatability Variance, No Migration Petition), or (3) invoke an ARAR waiver (available only for on-site actions). If the LDRs are determined not to be applicable, then, for on-site actions only, the site manager should determine if the LDRs are relevant and appropriate. The process for determining whether the LDRs are applicable to a CERCLA action is summarized in Highlight 5.

Highlight 5 - DETERMINING WHEN LDRS ARE APPLICABLE REQUIREMENTS



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 15 1986

OSWER Directive 9330.2-4

MEMORANDUM

SUBJECT: Discharge of Wastewater from CERCLA Sites into POTWS

FROM: Henry L. Longest II, Director
Office of Emergency and Remedial Response

Rebecca Hanmer, Director
Office of Water Enforcement and Permits

Gene A. Lucero, Director
Office of Waste Programs Enforcement

TO: Waste Management Division Directors
Regions I - X

Water Management Division Directors
Regions I - X

A number of emergency removals and remedial cleanup actions under CERCLA will involve consideration of publicly owned treatment works (POTWs) for discharge of wastewater. The current off-site policy (issued on May 6, 1985) does not address the set of concerns and issues unique to POTWs that must be evaluated during the Remedial Investigation and Feasibility Study (RI/FS) for discharge of CERCLA wastewater to POTWs.

Recently, we have had meetings with representatives of the Association of Metropolitan Sewerage Authorities (AMSA) to discuss technical and policy concerns related to the POTW/CERCLA issue. This memorandum is to highlight some of the major points under consideration which were shared with AMSA at their recent Winter Technical Conference. The Agency intends to develop policy on the use and selection of POTWs for CERCLA wastewater. Your comments are sought on the proposed criteria set forth herein. These criteria may be useful in evaluation of POTWs for response actions (fund financed or responsible party financed) to be taken in the interim.

Our position is that no CERCLA discharges to a POTW should occur unless handled in a manner demonstrated to be protective of human health and the environment. Full compliance with all applicable requirements of the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and any other relevant or appropriate environmental statutes will be necessary.

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The national pretreatment program, under the Clean Water Act, requires an analysis to determine whether the discharge of an industrial user of a POTW may pass through the POTW to cause receiving water quality problems or may interfere with POTW operations (including sludge disposal). If the analysis suggests that limits on the industrial user's discharge are needed to prevent pass through or interference, local limits or other safeguards, as necessary, must be established by the POTW and/or the NPDES permitting authority. The national pretreatment program requirements apply to the introduction of all non-domestic wastewater into any POTW, and include, among other things, the following elements:

- Prohibited discharge standards - prohibit the introduction of pollutants to the POTW which are ignitable, corrosive, excessively high in temperature, or which may cause interference or pass through at the POTW.

- Categorical discharge standards - include specific pretreatment standards which are established by EPA for the purpose of regulating industrial discharges in specific industrial categories.

- Local limits - where no categorical standards have been promulgated or where more stringent controls are necessary.

POTWs under consideration as potential receptors of CERCLA wastewaters may include those POTWs either with or without an approved pretreatment program. POTWs <u>with</u> an approved pretreatment program are required to have the mechanisms necessary to ensure compliance by industrial users with applicable pretreatment standards and requirements.* POTWs <u>without</u> an approved pretreatment program must be evaluated to determine whether sufficient mechanisms exist to allow the POTW to meet the requirements of the national pretreatment program in accepting CERCLA wastewaters. As noted above, pass through and interference are always prohibited, regardless of whether a POTW has an approved pretreatment program. POTWs without an approved pretreatment program must therefore have mechanisms which are adequate to apply the requirements of the national pretreatment program to specific situations.

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*POTWs with approved pretreatment programs must, among other things, establish procedures to notify industrial users (IUs) of applicable pretreatment standards and requirements, receive and analyze self-monitoring reports from IUs, sample and analyze industrial effluents, investigate noncompliance, and comply with public participation requirements.

Determination of a POTW's ability to accept CERCLA wastewater as an alternative to on-site treatment and direct discharge to receiving waters must be made during the Remedial Investigation/ Feasibility Study (RI/FS) process. During the remedial alternatives analysis, the appropriateness of using a POTW must be carefully evaluated. Water Division officials and their state counterparts should participate in the evaluation of any remedial alternatives recommending the use of a POTW, and should concur on the selection of the POTW.

If an alternative considers the discharge of wastewater from a CERCLA site into a POTW, the following points should be evaluated in the RI/FS prior to the selection of the remedy for the site:

- The quantity and quality of the CERCLA wastewater and its compatibility with the POTW (The constituents in the CERCLA wastewater must not cause pass through or interference, including unacceptable sludge contamination or a hazard to employees at the POTW; in some cases, control equipment at the CERCLA site may be appropriate in order to pretreat the CERCLA discharge prior to introduction to the POTW).

- The ability (i.e., legal authority, enforceable mechanisms, etc.) of the POTW to ensure compliance with applicable pretreatment standards and requirements, including monitoring and reporting requirements.

- The POTW's record of compliance with its NPDES permit and pretreatment program requirements to determine if the POTW is a suitable disposal site for the CERCLA wastewater.

- The potential for volatilization of the wastewater at the CERCLA site and POTW and its impact upon air quality.

- The potential for groundwater contamination from transport of CERCLA wastewater or impoundment at the POTW, and the need for groundwater monitoring.

- The potential effect of the CERCLA wastewaters upon the POTW's discharge as evaluated by maintenance of water quality standards in the POTW's receiving waters, including the narrative standard of "no toxics in toxic amounts".

- The POTW's knowledge of and compliance with any applicable RCRA requirements or requirements of other environmental statutes (RCRA permit-by-rule requirements may be triggered if the POTW receives CERCLA wastewaters that are classified as "hazardous wastes" without prior mixing with domestic sewage, i.e., direct delivery to the POTW by truck, rail, or dedicated pipe; CERCLA wastewaters are not all necessarily considered hazardous wastes; case by case determinations have to be made).

- The various costs of managing CERCLA wastewater, including all risks, liabilities, permit fees, etc. (It may be appropriate to reflect these costs in the POTW's connection fees and user charge system).

Based upon consideration of the above elements, the discharge of CERCLA wastewater to a POTW should be deemed inappropriate if the evaluation indicates that:

- The constituents in the CERCLA discharge are not compatible with the POTW and will cause pass through, interference, toxic pollutants in toxic amounts in the POTW's receiving waters, unacceptable sludge contamination, or a hazard to employees of the POTW.

- The impact of the transport mechanism and/or discharging of CERCLA wastewater into a POTW would result in unacceptable impacts upon any environmental media.

- The POTW is determined to be an unacceptable receptor of CERCLA wastewaters based upon a review of the POTW's compliance history.

- The use of the POTW is not cost-effective.

If consideration of the various elements indicates that the discharge of CERCLA wastewater to a POTW is deemed appropriate:

- There should be early public involvement, including contact with POTW officials and users, in accordance with the CERCLA community relations plan and public participation requirements.

- The NPDES permit and fact sheet may need to be modified to reflect the conditions of acceptance of CERCLA wastewaters; permit modification may be necessitated by the need to incorporate specific pretreatment requirements, local limits, monitoring requirements and/or limitations on additional pollutants of concern in the POTW's discharge or other factors.

Policy to be developed in the future will apply to all removal, remedial, and enforcement actions taken pursuant to CERCLA and Section 7003 of RCRA. We would appreciate your feedback on this memorandum and any experience in the use of POTWs for CERCLA removal or remedial actions that you have to offer.

If you have any comments or questions on this issue, please submit written comments to the workgroup co-chairs: Shirley Ross (FTS-382-5755) from the Office of Emergency and Remedial Response, or Victoria Price (FTS-382-5681) from the Office of Water.

cc: Ed Johnson
Russ Wyer
Tim Fields
Steve Lingle

TOXICITY CHARACTERISTIC CONSTITUENTS AND REGULATORY LEVELS

Constituent	Regulatory level (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlorodane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-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 (and its hydroxide)	0.008
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachlorethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0

TOXICITY CHARACTERISTIC CONSTITUENTS AND REGULATORY LEVELS

Constituent	Regulatory level (mg/L)
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichlorethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	2.0

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GLOSSARY OF TERMS

AOC - Area of Contamination

ARARs - Applicable or Relevant and Appropriate Requirements

BDAT - Best Demonstrated Available Technology

BOA - Basic Ordering Agreement

CAA - Clean Air Act

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CLP - Contract Laboratory Program

CWA - Clean Water Act

DE - Disposable Equipment

FIT - Field Investigation Team

HSWA - Hazardous and Solid Waste Amendments

IDW - Investigation - Derived Wastes

LDRs - Land Disposal Restrictions

NCP - National Contingency Plan

PCB - Polychlorinated Biphenyls

PPE - Personal Protective Equipment

POTW - Publicly Owned Treatment Works

PRPs - Potentially Responsible Parties

RCRA - Resource Conservation and Recovery Act

RI/FS - Remedial Investigation/Feasibility Study

RPO - Regional Project Officer

SDWA - Safe Drinking Water Act

SI - Site Inspection

SM - Site Inspection Manager

SWDA - Solid Waste Disposal Act

TSD - Treatment, Storage, and Disposal

TCLP - Toxicity Characteristic Leaching Procedure

TSCA - Toxic Substances Control Act

*U.S. Government Printing Office: 1991 — [illegible]

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APPENDIX

300202

300203

APPENDIX B

EQUIPMENT CALIBRATION AND MAINTENANCE PROCEDURES

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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
- MSA Model 261 Combustible Gas and Oxygen Alarm
- Miniram Model PDM-3 Respirable Dust Meter
- Radiation Alert Monitor 4 Radiation Meter
- Hach Model 16800 Portable Turbidimeter
- Orion Model SA250 pH Meter
- 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
- Model GA-52B Magnetic Locator
- Model G-856 Magnetometer

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.

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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 Manger.

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,

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

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 know 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 know 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 THE COMBUSTIBLE GAS INDICATOR

Accuracy

The calibrated accuracy of the Mine Safety Appliances (MSA) Combustible Gas and Oxygen Alarm, Model 261, is ±0.3% oxygen at constant temperature and pressure; and ±% LEL (lower explosive limit) up to 50% of full scale, and ±5% LEL up to 100% of full scale for combustible gas. Measurement ranges are 0 to 25% oxygen, and 0 to 100% LEL, with operating temperature ranging from 0°F to 104°F. However, below 32°F, response time is longer.

Calibration

Combustible System Calibration Check - Before the calibration of the combustible gas indicator can be checked, the Model 261 must be in operating condition. Calibration check adjustment is made as follows:

1) Check and zero the instrument.

2) Attach the flow control to the recommended calibration gas tank.

3) Connect the adapter-hose to the flow control.

4) Open flow control valve.

5) Connect the adapter-hose fitting to the inlet of the instrument. After approximately 15 seconds, the LEL meter pointer should be stable and within the range specified on the calibration sheet accompanying the calibration equipment. If the meter pointer is not in the correct range, stop the flow and remove the right hand side (speaker) panel. Turn on the flow and adjust the "S" control with a small screwdriver to obtain the reading specified on the calibration sheet.

6) Disconnect the adapter-hose fitting from the instrument.

7) Close the flow control valve.

8) Remove the adapter-hose from the flow control.

9) Remove the flow control from the calibration gas tank.

10) Replace the side panel on the Model 261.

Oxygen System Calibration Check - Make an oxygen system calibration check each time a combustible gas check is made.

Note: More detailed instructions are contained in the operating manual.

Maintenance

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1) Battery Pack Charging - The primary maintenance item of the Model 261 is the rechargeable, 4.0-volt lead-acid battery. Using the appropriate batter charger (120 VAC, Part No. 631664, or 240 VAC, Part No. 631712) insert charger plug into charge jack.

   The POWER ON lamp indicates that the charger is receiving power from the 120 or 240 VAC line. The FAST CHARGE lamp indicates that the battery voltage is low and that the charger has automatically switched to the higher charge rate. When the battery is approximately 95% charged, the charger will change to the trickle charge rate and the FAST CHARGE lamp will be extinguished.

   Caution: Use only the chargers specified above to charge the instrument; otherwise, damage to the battery pack and/or the instrument circuitry may result.

   Recommended charging time is 14 hours. The battery pack may be left on charge for longer periods without damage.

   Warning: Do not charge the battery pack in areas that may contain a flammable mixture of combustible gases, vapors, or dust and air; otherwise, an explosion may occur since a source of ignition exists during charging.

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2) Extended Operation - An external Charging Adapter (Part No. 477153) can be used to charge a depleted battery while it is removed from the instrument. Use of this adapter permits extended operation by enabling the user to install a second, back-up battery into the instrument while externally charging the depleted battery.

The batter pack may not supply full power capacity after repeated partial use between chargings; therefore, it is recommended that the battery pack be "exercised" at least once per month by operating the Model 261 for 8 to 19 hours and then recharging. The battery pack should be charged after each day of use (or prior to use if the instrument has not been operated for 30 days).

3) Battery Pack Replacement - When the rechargeable, 4.0-volt lead-acid battery pack no longer responds to recharging or no longer "holds" a charge, the pack should be replaced according to the following procedure:

a) Loosen the knurled screws holding the handle and remove the handle.

b) Looking at the front panel of the instrument, remove the right (audible alarm side) panel by unscrewing the four side panel screws.

c) Gently pull the side panel loose and tilt the instrument to help slide out the battery case. Disconnect the molded nylon plug from the battery case. (NOTE: Do not disconnect the alarm speaker.)

d) Install the new battery by reversing steps 1 through 3 above.

4) Sample Inlet Filter/Filter Element - The sample inlet filter should be examined each time the Model 261 is recharged. If the filter element appears to be coated with dust or dirt, it should be washed, dried and re-inserted or a new element substituted. If a new element is installed, also install a new filter O-ring. Make sure the inlet seal O-ring in the inlet filter cap is properly seated. If the O-ring is damaged or missing, replace it before using the Model 261 with any sampling accessories.

5) Printed Circuit Board Adjustments - The printed circuit board contains five adjustment pots, identified as follows:

<u>Oxygen Sensor Adjustment</u>

O_2H: The Oxygen High Alarm Point Adjustment (factory-set at 23%).

O_2L: The Oxygen Low Alarm Point Adjustment (factor-set at 19.5% oxygen).

O_2 OFFSET: The Oxygen Offset controls the zero reading of the oxygen meter. The leads to the oxygen cell must be disconnected and shorted together, and the front panel CALIBRATE O_2 knob turned fully clockwise. The % oxygen meter should indicate zero; adjust OFFSET if necessary.

Combustible Gas Sensor Adjustment

CGA: The combustible Gas Alarm Point Adjustment (factor-set at 25% LEL).

S: After zeroing, the Span is adjusted by sampling calibration check gas and adjusting the readout accordingly.

Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The standard 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 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/m^3) 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 RADIATION METER

General Operation

The Radiation Alert Monitor 4 detector contains a Geiger-Muller (GM) detector which is capable of detecting gamma, beta, and alpha radiation. The units are small and lightweight and can be easily carried by one member of the field team. The following operating procedures describe the use of these detectors:

1. Turn power on by moving the know on the right of the housing to the "Audio" position. Note the response of the instrument in background, or uncontaminated areas.

2. Check that the battery is functioning by moving the knob on the left to "BATT." The needle should deflect to the portion of the scale with the word "BATTERY" written in the centerline. If it doesn't change, change the battery.

3. Turn the knob on the left to the x1 scale.

4. While performing the survey, hold unit so the back is pointed in the direction of the area being measured. Listen for changes in the count rate.

5. If the needle deflects offscale, the exposure rate has exceeded 0.5 mR/hour. Set meter to the x10 scale and observe the exposure rate as you move away from the contaminated area. Record the location(s) and magnitude(s) of the elevated readings in the field notebook.

Maintenance

The only maintenance required is battery replacement. Battery replacement is indicated when the meter's needle does not deflect to "BATTERY" portion of the scale when the knob is moved to "BATT".

Replace batteries every six months to reduce the danger of corrosion due to leaky batteries.

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 change is built into the 16800 meter. Readings are repeatable to within ±1% of full scale.

Calibration and Operation

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

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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.

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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 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.

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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.

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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 is used for calibrations:

1. Connect electrode(s) to meter. Slide the mode switch to pH.1 4.01.

2. Place electrode(s) into pH, 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 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 ±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.

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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 ±5°C of actual sample temperature. Temperature which can also be measured with this instrument, has an accuracy of ±0.7°C over the full scale temperature range of -5°C to +45°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 O_2 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 walking 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.

Cleaning and Maintenance

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 with alconox 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.

<u>To replace battery inside reel:</u>

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.

<u>To replace probe battery:</u>

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.

CALIBRATION AND MAINTENANCE OF THE GA-52B MAGNETIC LOCATOR

General Operation

The Model GA-52B Magnetic Locator detects the magnetic field of a ferromagnetic object. It responds to the difference in magnetic field between the two sensors spaced about 20 inches apart in the wand. The response consists of a change in the frequency of a signal that is emitted by a loudspeaker.

Turn on the Model GA-52B and adjust the volume level by rotating the ON-OFF/VOLUME control in a clockwise direction until the idling tone reaches the level desired. Position the SENSITIVITY (range) control approximately halfway between the high range and low range for what is referred to as NORMAL RANGE.

Unwanted background signals due to nearby magnetic objects may require that the range of the locator be reduced. To reduce the range, turn the sensitivity know in a counterclockwise direction.

NOTES:

1. A burbling sound indicates the presence of an energized power line. The burbling is due to the alternating magnetic field associated with the electrical current.

2. The instrument will not detect nonmagnetic materials such as gold, silver, copper, brass, aluminum, snow, water, ice, etc.

3. Normally, telephone lines cannot be detected.

Maintenance

Normally, the only maintenance required is replacement of the batteries. If the locator malfunctions, refer to the trouble-shooting guide located on page 12 of the operation manual. Low voltage from weak batteries may cause the speaker to emit an uncontrollable loud signal.

The GA-52B is powered by four C-cell batteries carried in a battery holder. Access to the batteries is obtained by removing the two knurled nuts, and sliding off the cover.

The four batteries are connected in series. The proper polarities for the batteries are shown on the battery holder. Batteries must be removed and installed in the order as shown on page 11 of the instruction manual.

CALIBRATION AND MAINTENANCE OF THE G-856 MAGNETOMETER

General Operation

The G-856 is a portable and a "base station" magnetometer. It features push button operation and a built-in digital memory which stores over 1,000 readings. The following procedure is to check the magnetometer's operation. Note that the magnetometer will produce incorrect readings indoors or where magnetic interference (from buildings, power lines, vehicles, etc.) is present.

1. Unfold the staff and twist each section together.
2. Mount the sensor (the white cylindrical object) on the staff by screwing the staff into the threaded sensor mount, either on its end or horizontally.
3. Using the signal cable, connect the sensor to the magnetometer.
4. Depress READ. The displays will light, turn off, then light again for five seconds. If the displays did not light, see the maintenance and troubleshooting section in Chapter 4 of the operation manual.

Calibration

The magnetometer needs to be tuned to achieve the best signal strength. Tuning requires matching the circuits response to the intensity of the actual field value. Very precise tuning can be achieved by locating your position on the world magnetic map on page iii of the instruments operating manual. The map will provide the approximate field for your location; one or two digit accuracy is sufficient.

The magnetometer may be tuned to 3-digit resolution (e.g., 57.4 kilogammas) but internally it selects from 256 possible steps. This allows you to tune the magnetometer very precisely which will result in less scatter and more accurate readings. In order to tune the magnetometer you will need to be outdoors, away from power lines and large metal objects.

Maintenance

1. If any of the following conditions occur, consult the troubleshooting guide provided in the instruction manual.

   a. Low signal amplitude (Display indicates less than 6 volts).

   b. Field displays shows truncated digits (poor signal to noise ratio).

   c. Erratic readout.

   d. Displays don't light.

   e. No reading on STATION/DAY display.

   f. Low battery voltage indication.

   g. Display reads "ERROR".

   h. Display reads "data Err".

   i. Display reads FULL.

   j. Console will not tune.

   k. Partial numeric display.

2. Batteries

There are two kinds of batteries in the G-856 Memory Mag magnetometer. Basic operation is powered by eight D-cell batteries, and the clock and memory are powered by lithium battery installed on the digital circuit board when the main batteries are disconnected or removed.

D-cell batteries should be replaced when the voltage indicator reads 7.5 volts. The lithium batteries should be changed about every 10 years. It's soldered into and underneath the top circuit board and should be replaced according to the operating manual instructions. Be sure all data is removed from memory and recorded before the lithium battery is unsoldered from the circuit board.

3. Instrument Storage

Disconnect the sensor cable from the magnetometer and store all the components in the shipping container to prevent magnetic contamination. If the magnetometer system will be stored for a long time, remove the batteries to prevent electrolytic leakage or corrosion of the contacts. DO NOT REMOVE THE LITHIUM BATTERY which is soldered into the circuit board.

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APPENDIX

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11. The preferred order of sample collection (continued):

    11. Cyanide
    12. Sulfate and Chloride
    13. Turbidity
    14. Nitrate and Ammonia
    15. Radionuclides

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.

1. Clean the stainless steel measuring tape and Popper according to established decontamination procedures. Refer to the SOP for Decontamination #MP-FPQA-008.

2. Open the well cap and measure the height of the stick-up.

3. 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.

4. 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.

5. 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.

1. 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. Refer to the SOP for Decontamination #MP-FPQA-008.

2. Open the well cap and measure the height of the stick-up.

3. 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.

4. 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 evacuate from the monitoring 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 18 ft. water column would require purging 26.4 gallons of water to evacuate 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 evacuate the well.

Procedure to Evacuate Monitoring Wells

Methods used to evacuate 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 evacuated using submersible pumps, or hand-bailed.

Procedure to Confirm Proper Evacuation 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 evacuation, the evacuation procedure should be confirmed with pH and conductivity readings of three consecutive additional well volumes. The following procedure may be employed to confirm proper evacuation of a monitoring well.

Note: If the well is pumped dry, and obviously evacuation is confirmed, pH and conductivity readings for this purpose are not necessary and the following procedure will not apply.

1. Using a 250 ml beaker, collect a sample of the well volume being evacuated from the monitoring well.

2. Determine the pH and conductivity of the sample.

3. Record the pH and conductivity of the initial well volume.

4. Collect samples from the second and third consecutive volumes purged from the monitoring well. Measure and record the pH and conductivity.

5. If the three consecutive well volumes are representative of the groundwater in the aquifer, all pH readings will be within pH ± 0.5 units and all conductivity reading will be within conductivity ± 3 percent ± 1 digit.

6. If the three pH and conductivity measurements are stable, sufficient quantity of standing water has been removed from the monitoring well to ensure collection of a representative groundwater sample.

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.

1. Clean all down-hole equipment according to all established decontamination procedures.

2. Measure the depth to groundwater from the top of the stick-up using a steel tape with weight attached.

3. Measure the diameter of the well; determine the radius.

4. 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.

5. Determine the volume of standing water in the well using the following equation:

   $V = r^2 L_w$ (7.48 gallons/ft^3)
   V = volume of the well
   = 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)
   7.48 gallons of liquid per cubic foot

6. 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.

After the proper evacuation of a monitoring well, groundwater samples may be collected using the following procedures.

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.

1. Clean the stainless steel bailer according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination #MP-FPQA-008.

2. Attach a 3 ft stainless steel wire leader to the top of the sampler using 5/8-inch stainless steel U-bolts.

3. Attach a solid braided 3mm (1.8 inch) nylon guy line to the stainless steel teflon coated leader.

4. Securely fasten the guy line to a stable immovable object.

5. 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.

6. 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.

7. Immediately collect and preserve the VOA fraction (refer to the SOP for Sample Preservation #MP-FPQA-021 .

8. Continue delivery of the remaining non-VOA sample fractions until each sample container is almost completely filled, making sure to leave adequate headspace to allow for sample expansion and sample preservation. Preserve each sample fraction following the SOP for Sample Preservation #MP-FPQA-021.

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination #MP-FPQA-008.

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 the present 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:

1. 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 and 6 of this SOP).

2. 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.

3. Measure pumping rate frequently. A calibrated container and stopwatch are most commonly used.

4. 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.

5. 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.

6. 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.

V. References

ASTM D4448. Standard guide for sampling groundwater monitoring wells. American Society for Testing and Materials, Philadelphia, Pennsylvania. October 1985.

ASTM D4750. Stand test method for determining subsurface liquid levels in a borehole or monitoring well. American Society for Testing and Materials, Philadelphia, Pennsylvania. November 27, 1987.

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Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedure
Standard Operating Procedure

Procedure #MP-FPQA-004-10/94
Date: October 1994
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Soil Sampling (Surface, Subsurface and Soil Boring)

I. Introduction

This guideline is to provide general reference information on soil sampling.

II. Limitations

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

III. Definitions

The following terminology is applicable to soil sampling activities.

Soil Samples. Environmental samples of potentially contaminated soil, where soil is defined as a layer of weathered, unconsolidated material; often defined as containing organic matter and being capable of supporting plant growth.

Environmental Samples. Samples with mid - or low-concentration contamination, such as samples collected from stained soils or samples collected along contaminant migration routes, that are collected at some distance from direct sources of contaminants.

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

Composite Sample. A nondiscrete soil sample composed of more than one specific aliquot collected at various locations.

Transfer Device. Any instrument or vessel that contacts the sample during collection or transport (eg. stainless steel trowel).

Soil Trier. A typical sampling trier consists of a long stainless steel tube with a slot that extends almost its entire length. The tip and edges of the tube slot are sharpened to allow the trier to cut a core of the soil to be sampled when rotated after insertion into the ground.

Auger. An auger consists of a T-handle attached to a stainless steel bucket (generally in 3-to 4-inch diameters) with an attached cutting edge that is twisted downward into the soil. The stainless steel bucket allows for collection of subsurface soils during augering.

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 drill rod. The sampler is then driven 18 to 24 inches into the ground to collect the sample in accordance with a standard penetration test (ASTM D1586).

IV. Guidelines

Soil types at a hazardous waste site can vary considerably, both at the site surface and in the underlying strata. Soil variations affect the rate of contaminant migration via surface runoff and windblown transport of particulates, and affect the rate of contaminant migration downward through the soil. Sampling of the soil horizons above the ground water table can detect contaminants before they have migrated into the water table, and can help to quantify the amount of contaminants sorbed within the aquifer that have the potential to contribute to ground water contamination.

The physical properties of soil, its grain size, cohesiveness, associated moisture content, and such factors as depth to the water table limit the depth from which soil samples can be collected and dictate the required methods for sample collection. In order to predetermine the suitability of a chosen sampling method to soil conditions, information pertaining to regional soil properties should be obtained from either the U.S. Department of Agriculture, Soil Conservation Service or from published soil surveys by the U.S. Geological Survey (USGS). One of several applicable soil sampling techniques should then be selected to collect on-site samples.

Most of the methods employed for soil sampling at hazardous waste sites are adaptations of techniques long employed by foundation engineers and geologists. Collection of samples from near the soil surface can be accomplished by using a simple trowel, or by using a thin-walled tube sampler or soil trier. Shallow subsurface soils can be sampled using hand augers. However, the collection of soil samples from the deeper subsurface strata normally requires heavy equipment, such as a truck-mounted auger employing split-spoon sampling.

The following considerations should be taken into account during soil sampling activities.:

- The preferred order of sample collection is as follows:

    1. In-situ measurements (i.e., temperature, pH and specific conductance)
    2. Volatile Organics (VOA)
    3. Purgeable Organic Carbon (POC)
    4. Purgeable Organic Halogens (POX)
    5. Total Organic Halogens (TOX)
    6. Total Organic Carbon (TOC)
    7. Extractable Organics
    8. Total Metals
    9. Dissolved Metals
    10. Phenols
    11. Cyanide
    12. Sulfate and Chloride
    13. Turbidity
    14. Nitrate and Ammonia
    15. Radionuclides

The following procedures may be employed for the collection of soil samples at hazardous waste sites: (1) collection of soil samples using a stainless steel trowel and/or scoop/scoopula; (2) collection of soil samples using a thin-walled tube sampler; (3) collection of soil samples using a soil trier; (4) collection of soil samples using a hand auger; and (5) collection of soil samples using a split spoon, shelby tube or similar device.

Homogenization Procedure For the Collection of Non-VOA Surface Soil Samples

Note: This procedure should be followed for all types of soil sampling (i.e., grab and composite).

1. Thoroughly mix the sample using the same stainless steel trowel or scoop, used during the sample collection. The soil in the bowl should be scraped from the sides, corner and bottom, rolled to the middle of the bowl and initially mixed.

2. The sample should be quartered and separated.

3. Each quarter should be mixed individually and then rolled to the center of the bowl.

4. Mix the entire sample again.

Procedure For Surface Soil Grab Sampling Using A Stainless Steel Trowel and/or Scoop/Scoopula.

1. For VOA samples, insert the scoopula into the soil at a depth of 0 - 2 inches. Avoid collection of surface vegetation, debris or large stones. Fill the VOA sample container to zero headspace.

2. For non-VOA sample fractions, insert the stainless steel trowel or scoop into the soil at a depth of 0 - 2 inches and remove the sample, avoiding the collection of surface vegetation, debris and large stones. Place the sample volume collected in a stainless steel bowl, then follow the procedure for homogenization (refer to page 3 of this SOP).

3. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

4. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

5. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure For Surface Soil Composite Sampling Using A Stainless Steel Trowel and/or Scoop/Scoopula.

1. For VOA samples, insert the scoopula into the soil at a depth of 0 - 2 inches. Avoid collection of surface vegetation, debris or large stones. Fill the VOA sample container to zero headspace.

2. For non-VOA sample fractions, insert the stainless steel trowel or scoop into the soil at a depth of 0 - 2 inches and remove the sample, avoiding the collection of surface vegetation, debris and large stones. Place the sample volume collected in a stainless steel bowl, follow this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable).

3. Composite the non-VOA soil sample aliquots in the stainless steel bowl. Then follow the procedure for homogenization (refer to page 3 of this SOP).

4. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

5. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

6. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure for Surface or Subsurface Soil Sampling Using a Thin-Walled Tube Sampler

Figure 1 (left) depicts a thin-walled tube sampler. Thin-walled tube samplers are ideal for the collection of undisturbed samples from moist soils, especially sandy soils and sandy loams. Procedures for use of the thin-walled tube sampler are as follows.

1. Clean the stainless steel thin-walled tube sampler according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination, #MP-FPQA-008.

2. Force the thin-walled tube sampler into the soil with a single smooth motion until the top of the soil tube is even with the soil surface.

3. Twist the thin-walled tube sampler in the soil, then carefully withdraw the sampler to collect the undisturbed soil sample.

4. First collect the VOA fraction of the soil sample from the sample tube by lightly tapping the tube with a stainless steel spatula. Fill the VOA sample containers to zero headspace.

5. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

6. If this is a composite sample, follow steps 2 and 3 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

   If this is a grab sample follow the procedure for homogenization (refer to page 3 of this SOP).

7. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

8. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure for Surface or Subsurface Soil Sampling Using A Soil Trier

Figure 1 (right) depicts a soil trier sampler. Trier samplers are ideal for the collection of undisturbed samples from cohesive soils, especially silts and clays. Procedures for use of the soil trier sampler are as follows.

1. Clean the stainless steel soil trier according to the requirements for the analytical parameters being measured. (Refer to SOP for Decontamination, #MP-FPQA-008).

2. Force the soil trier into the soil with a single smooth motion until the top of the trier tube is even with the soil surface.

3. Rotate the trier once or twice to cut a core of the soil, then carefully withdraw the trier to collect the undisturbed soil sample.

4. First collect the VOA fraction of the soil sample from the trier by pushing the soil core out of the trier tube using a stainless steel spatula. Fill the VOA sample containers to zero headspace.

5. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

6. If this is a composite sample, follow steps 2 and 3 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

   If this is a grab sample follow steps 2 and 3 of this procedure until sufficient sample quantity has been collected. Follow the procedure for homogenization (refer to page 3 of this SOP).

7. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

8. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure for Sub-Surface Soil Sampling Using A Hand Auger

Figure 1 (left) depicts a hand auger. Hand augers are ideal for collecting shallow subsurface soils in cohesive soils such as silts and clays. In cohesive soils, a hand auger can be used to collect samples generally up to a depth of 3 ft. However, in rocky soils auger refusal is experienced almost immediately, as small stones will block and jam the cutting edge on the auger bucket. Procedures for use of the hand auger are as follows.

1. Clean the stainless steel hand auger according to the requirements for the analytical parameters being measured. (Refer to the Decontamination Procedure, #MP-FPQA-008).

2. Clear the area to be sampled, removing any surface vegetation, debris, or large stones prior to augering.

3. Begin augering. When the auger bucket is filled, carefully withdraw the auger from the borehole and remove the soil from the auger by lightly tapping the side of the bucket with a stainless steel trowel.

4. Continue augering following the above procedure, until you have reached the desired sampling depth.

5. At the desired sampling depth, carefully withdraw the auger from the borehole and immediately collect the soil VOA fraction from the auger bucket using a stainless steel trowel or scoopula. Fill the VOA sample containers to zero headspace.

APPENDIX C

FIELD SAMPLING STANDARD OPERATING PROCEDURES

SOP MP FPQA-002 - Surface Water Sampling

SOP MP PFQA-003 - Groundwater Sampling

SOP MP FPQA-004 - Surface Soil Sampling

SOP MP FPQA-005 - Sediment Sampling

SOP MP FPQA-017 - Split-Spoon Sampling

SOP MP FPQA-020 - Magnetometer Surveys

SOP MP FPQA-022 - Slug Testing

SOP 25 - Ground-Water Monitoring Well Installation

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-002-10/94
Date: October 1994
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Surface Water sampling

I. Introduction

This guideline is to provide general reference information on surface water sampling.

II. Limitations

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

III. 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.

In-situ Measurements. Measurements made on samples in their environment (i.e., temperature , pH and specific conductance).

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.

IV. 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.:

- 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.
- Avoid turbulence when filling sample bottles.
- Collect downstream samples before upstream samples.
- Collect the surface water sample before the sediment sample if both media are to be sampled at the same location.
- When sampling static surface water, consider thermal stratification which retards mixing and could possibly concentrate contamination at specific depths.
- Do not stand upstream of where the surface water sample is being collected.

o The preferred order of sample collection is as follows:

1. Insitu measurements (i.e., temperature, pH and specific conductance)
2. Volatile Organics (VOA)
3. Purgeable Organic Carbon (POC)
4. Purgeable Organic Halogens (POX)
5. Total Organic Halogens (TOX)
6. Total Organic Carbon (TOC)
7. Extractable Organics
8. Total Metals
9. Dissolved Metals
10. Phenols
11. Cyanide
12. Sulfate and Chloride
13. Turbidity
14. Nitrate and Ammonia
15. Radionuclides

The following procedures may be employed for the collection of surface water samples at hazardous waste sites: (1) in-situ sample measurements; (2) grab surface water sampling; (3) sampling surface water using a dipper or other transfer device; and (4) collection of surface water samples from depth with a Kemmerer type sampler.

Procedure For In-Situ Surface Water Sampling - Refer to Standard Operating Procedure (SOP) for pH and Conductivity Measurements, #MP-FPQA-013-10/94.

Procedure For Grab Surface Water Sampling

1. For the VOA fraction, 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, leaving zero headspace. Preserve the sample following the SOP for Sampling Preservation, #MP-FPQA-021.

2. For the non-VOA fractions, submerge the sealed sample container. For flowing waters, position the sample container so that the mouth faces upstream. Remove the cap from the sample bottle while allowing the mouth to remain submerged.

3. Continue delivery of the remaining non-VOA sample fractions until each sample container is almost completely filled, making sure to leave adequate head space to allow for sample expansion and sample preservation. Preserve each sample fraction following the SOP for Sampling Preservation, #MP-FPQA-021.

4. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination , #MP-FPQA-008.

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

1. Submerge a precleaned stainless steel dipper or other suitable transfer device with minimal surface disturbance. (Refer to the SOP for Decontamination #MP-FPQA-008).

2. Allow the device to fill slowly and continuously.

3. Retrieve the dipper/transfer device from the surface water with minimal disturbance.

4. For VOA samples, remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/transfer device edge. Fill the sample container until there is zero headspace and preserve the sample following the SOP for Sampling Preservation, #MP-FPQA-021.

5. Continue delivery of the remaining non-VOA sample fractions until each sample container is almost completely filled, making sure to leave adequate head space to allow for sample expansion and sample preservation. Preserve each sample fraction following the SOP for Sampling Preservation, #MP-FPQA-021.

Procedure For Collection Of Water Samples Using A Kemmerer Sampler

Figure 1 presents a schematic of the Kemmerer sampler. Procedures for use of the Kemmerer sampler are as follows:

1. Inspect the Kemmerer sampler for thorough cleaning and ensure that the drain valve is closed. (Refer to SOP for Decontamination #MP-FPQA-008).

2. Measure and then mark the sampler guy line at the desired sampling depth.

3. Securely fasten the guy line to a stable, immovable object.

4. Open sampler by lifting upper stopper-trip head assembly.

5. Gradually lower sampler until the desired sampling depth is reached.

6. Place messenger on sample line and release.

7. Retrieve sampler; hold sampler by center rod to prevent accidental opening of the bottom stopper.

8. Rinse off the exterior of the sampler body with de-ionized water.

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedure
Standard Operating Procedure

Procedure #MP-FPQA-004-10/94
Date: October 1994
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Soil Sampling (Surface, Subsurface and Soil Boring)

I. Introduction

This guideline is to provide general reference information on soil sampling.

II. Limitations

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

III. Definitions

The following terminology is applicable to soil sampling activities.

Soil Samples. Environmental samples of potentially contaminated soil, where soil is defined as a layer of weathered, unconsolidated material; often defined as containing organic matter and being capable of supporting plant growth.

Environmental Samples. Samples with mid - or low-concentration contamination, such as samples collected from stained soils or samples collected along contaminant migration routes, that are collected at some distance from direct sources of contaminants.

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

Composite Sample. A nondiscrete soil sample composed of more than one specific aliquot collected at various locations.

Transfer Device. Any instrument or vessel that contacts the sample during collection or transport (eg. stainless steel trowel).

Soil Trier. A typical sampling trier consists of a long stainless steel tube with a slot that extends almost its entire length. The tip and edges of the tube slot are sharpened to allow the trier to cut a core of the soil to be sampled when rotated after insertion into the ground.

Auger. An auger consists of a T-handle attached to a stainless steel bucket (generally in 3-to 4-inch diameters) with an attached cutting edge that is twisted downward into the soil. The stainless steel bucket allows for collection of subsurface soils during augering.

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 drill rod. The sampler is then driven 18 to 24 inches into the ground to collect the sample in accordance with a standard penetration test (ASTM D1586).

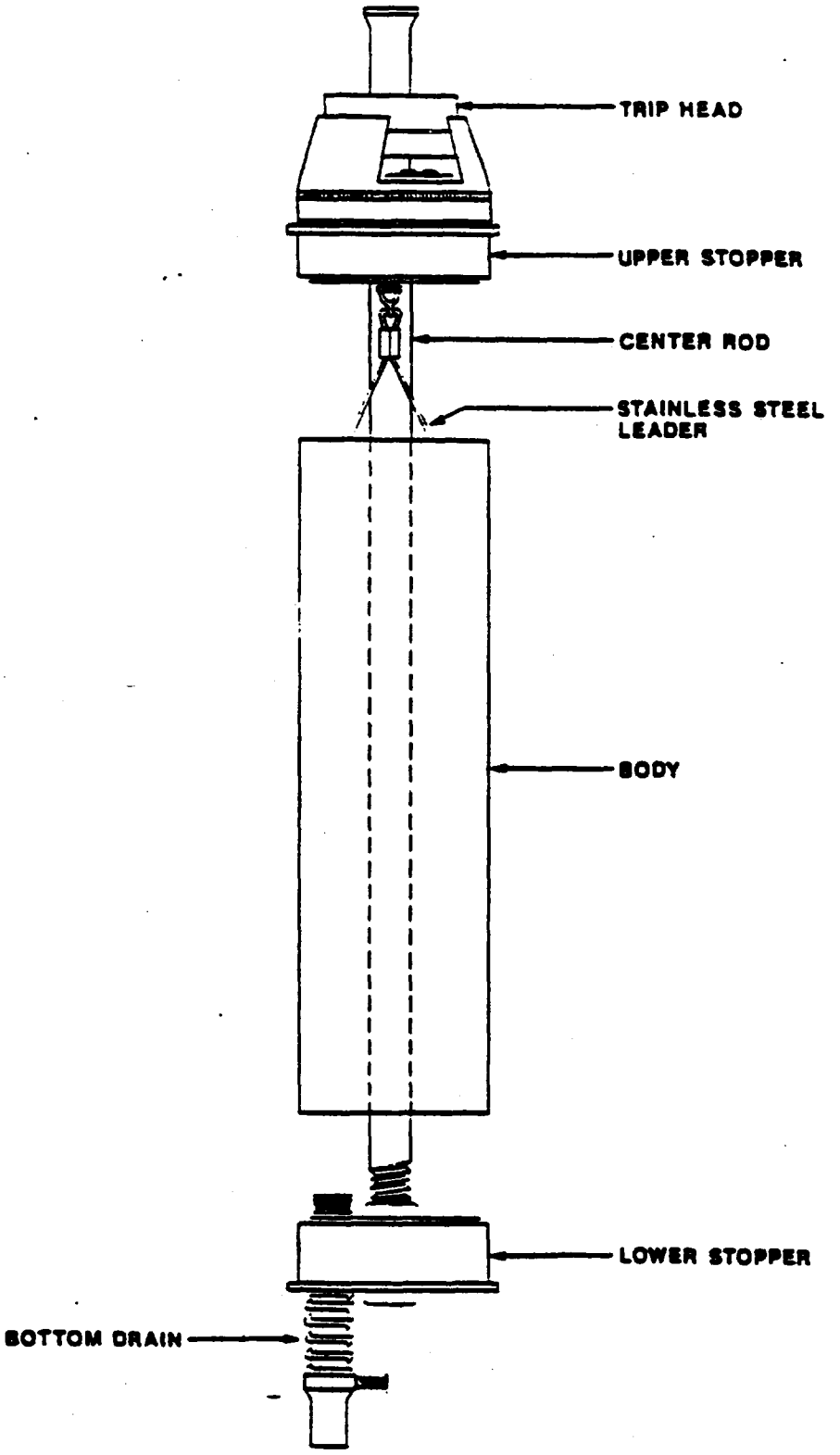

FIGURE 1. SCHEMATIC OF THE KEMMERER SAMPLER

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5. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

6. If this is a composite sample, follow steps 2 and 3 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

   If this is a grab sample follow the procedure for homogenization (refer to page 3 of this SOP).

7. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

8. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure for Surface or Subsurface Soil Sampling Using A Soil Trier

Figure 1 (right) depicts a soil trier sampler. Trier samplers are ideal for the collection of undisturbed samples from cohesive soils, especially silts and clays. Procedures for use of the soil trier sampler are as follows.

1. Clean the stainless steel soil trier according to the requirements for the analytical parameters being measured. (Refer to SOP for Decontamination, #MP-FPQA-008).

2. Force the soil trier into the soil with a single smooth motion until the top of the trier tube is even with the soil surface.

3. Rotate the trier once or twice to cut a core of the soil, then carefully withdraw the trier to collect the undisturbed soil sample.

4. First collect the VOA fraction of the soil sample from the trier by pushing the soil core out of the trier tube using a stainless steel spatula. Fill the VOA sample containers to zero headspace.

5. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

exceeds 3 hours, groundwater samples should be collected in order of their volatility, with the VOA fraction collected with 3 hours of evacuation. 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.

1. All equipment entering the well should be cleaned with appropriate decontamination solutions and should be kept clean by staging the equipment on 0.5-mil polyethylene plastic.

2. Plastic sheeting should be placed around the monitoring well to prevent sampling equipment from coming into contact with the ground.

3. All down-hole equipment must be constructed of Teflon, stainless steel, or polypropylene.

4. 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.

5. Do not allow bailers or pumps to drop freely into the well.

6. Do not allow the bailer to rest against the outside well casing or scrape along the interior of the well.

7. Outer gloves should be decontaminated or changed before sampling or handling clean equipment.

8. Attempt to sample the mid-screen area of the well.

9. Be cognizant of the water level in the well. Draw down in the well may slow the pump discharge rate. Overpumping the well will aerate the groundwater.

10. Be sure the well cap is closed after sampling.

11. The preferred order of sample collection is as follows:

    1. Insitu measurements (i.e., temperature, pH and specific conductance)
    2. Volatile Organics (VOA)
    3. Purgeable Organic Carbon (POC)
    4. Purgeable Organic Halogens (POX)
    5. Total Organic Halogens (TOX)
    6. Total Organic Carbon (TOC)
    7. Extractable Organics
    8. Total Metals
    9. Dissolved Metals
    10. Phenols

6. If this is a grab sample, collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected. Follow the procedure for homogenization (refer to page 3 of this SOP).

   If this is a composite sample, follow steps 3 and 4 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

7. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

8. Restore the void created by sample collection prior to leaving the sampling location (if necessary commercially available potting soil or top soil may be used to fill the void).

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

Procedure for Soil Boring Sampling Using A Split-Spoon Sampler

The collection of split-spoon samples normally requires the services of a drilling subcontractor. When a boring is advanced to the sampling point, drill tools are removed and a 2-inch I.D. steel split-spoon sampler is lowered into the borehole on the bottom of the drill rods. The split-spoon sampler is then driven 18 inches into the ground in accordance with the Standard Penetration Test (ASTM D1586). The effort taken to drive the sampler the last 12 inches is recorded at 6-inch intervals, with the density of the sampled material determined by counting the blows per foot as the split-spoon sampler is driven downward by a 140-lb hammer falling 30 inches. The sampler is then withdrawn from the borehole, dismantled, and given to the field geologist for sampling and analysis.

Figure 2 shows a schematic of the split-spoon sampler. Procedures for opening and sampling from a split-spoon sampler are as follows.

1. Place the filled split-spoon sample on a clear sheet of 0.5-mil polyethylene, with the cutting shoe oriented toward the right.

2. 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.

3. Remove the head and carefully open the halves of the split-spoon. Log the soil core using Unified Soil Classification System procedures.

4. Collect samples of the soil core in 6-inch increments using a stainless steel trowel or spatula.

5. Immediately collect the soil VOA fraction, filling the VOA sample containers to zero headspace. (To determine which portion of the core to collect, consult the site specific FSP and QAPjP.)

6. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

7. If this is a composite sample, follow steps 1 through 4 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

   If this is a grab sample follow the procedure for homogenization (refer to page 3 of this SOP).

8. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

V. References

ASTM D1452. Standard practice method for soil investigation and sampling by auger borings. American Society for Testing and Materials, Philadelphia, Pennsylvania. June 12, 1980.

ASTM D1586. Standard method for penetration test and split-barrel sampling of soils American Society for Testing and Materials, Philadelphia, Pennsylvania. September 11, 1984.

V. References (continued)

EPA, 1984 Characterization of hazardous waste site -- A methods manual, Volume 11, Available sampling methods, Second edition, Section 2.2, Soils, pp. 2-2 to 2-3. Section 2.2.1, Method II-1: Soil sampling with a spade and scoop, p. 2-4. Section 2.2.2, Method 11-2: Subsurface solid sampling with auger and thin-walled tube sampler, pp. 2-5 to 2-7. Section 2.4.1, Method II-7: Sampling of bulk material with a scoop or trier, pp. 2-19 to 2-21. 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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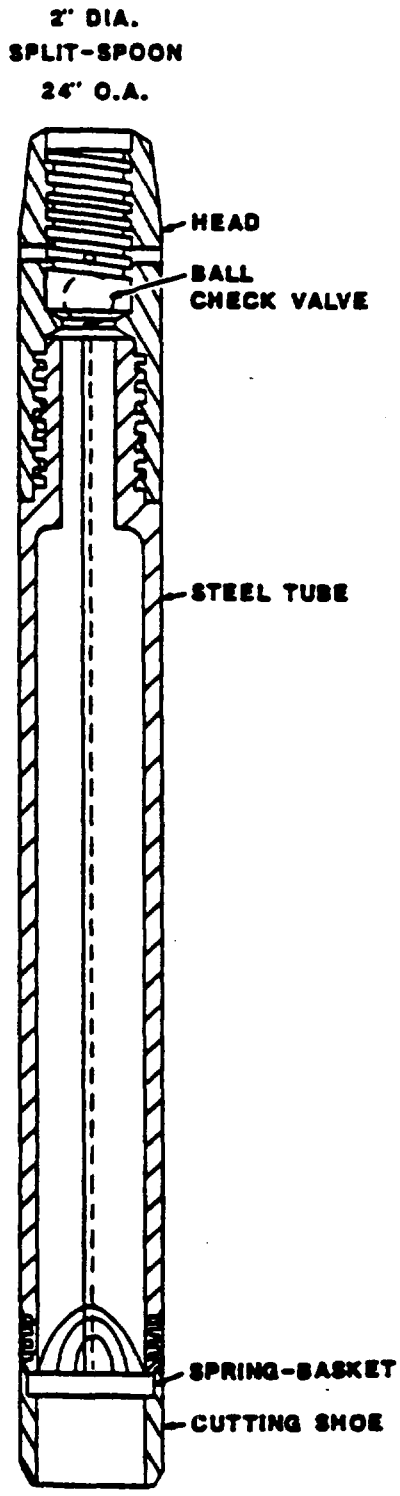

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FIGURE 2. SCHEMATIC OF THE SPLIT-SPOON SAMPLER

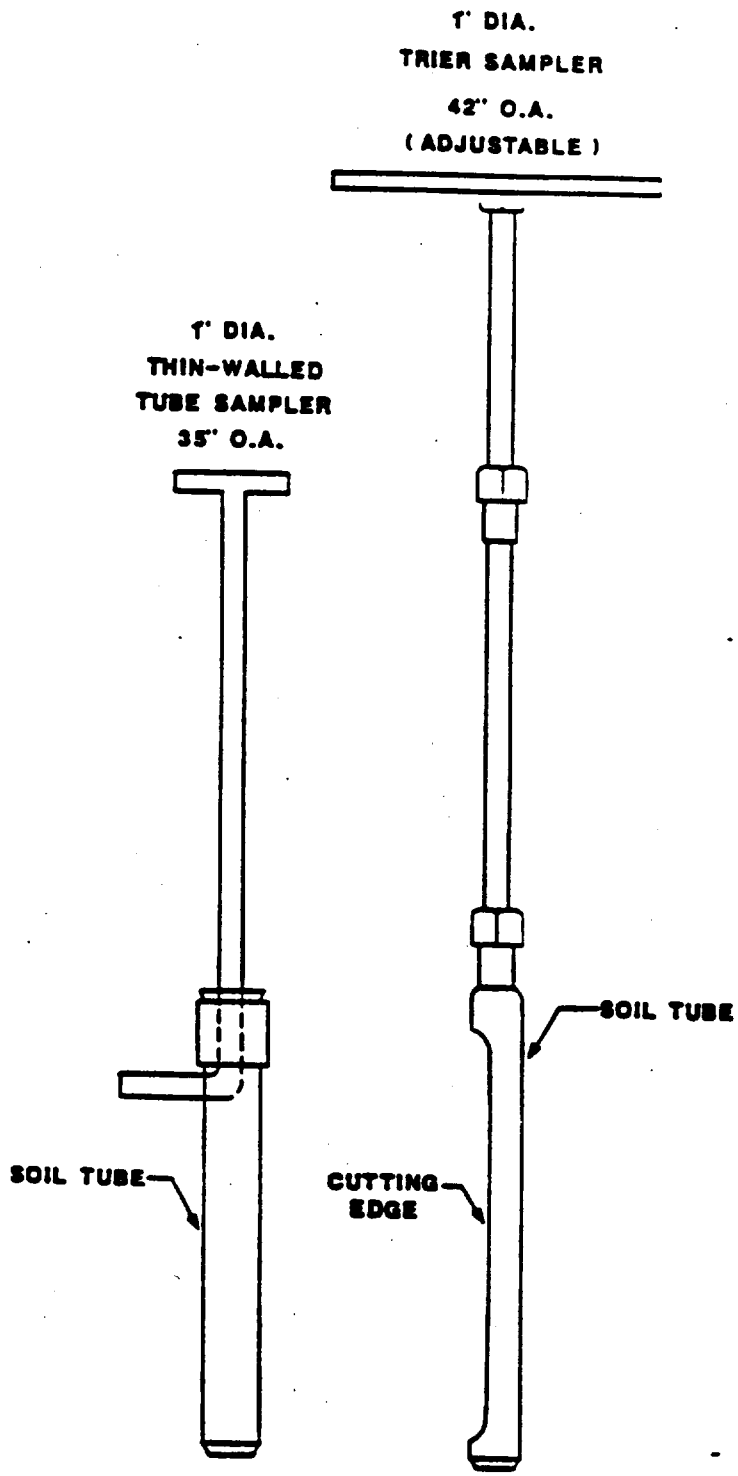

FIGURE 1. SOIL CORING DEVICES

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedure
Standard Operating Procedure

Procedure #MP-FPQA-005-01/95
Date: January 1995
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Sediment Sampling

I. Introduction

This guideline is to provide general reference information on sediment sampling.

II. Limitations

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

III. 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.

IV. 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.

- Collect the sediment sample after the surface water sample if both media are to be sampled at the same location.
- Collect downstream sediment samples before upstream samples.
- Do not stand in the sediment deposits being sampled.
- 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 homogenization and filling of the sample containers.
- The preferred order of sample collection is as follows:

    1. In-situ measurements (i.e., temperature, pH and specific conductance)
    2. Volatile Organics (VOA)
    3. Purgeable Organic Carbon (POC)
    4. Purgeable Organic Halogens (POX)
    5. Total Organic Halogens (TOX)
    6. Total Organic Carbon (TOC)
    7. Extractable Organics
    8. Total Metals
    9. Dissolved Metals

- The preferred order of sample collection (continued):

    10. Phenols
    11. Cyanide
    12. Sulfate and Chloride
    13. Turbidity
    14. Nitrate and Ammonia
    15. Radionuclides

The following procedures may be employed for the collection of sediment samples at hazardous waste sites: (1) collection of sediment samples using a stainless steel trowel or scoop/scoopula: (2) collection of sediment samples using an Eckman dredge; (3) collection of sediment samples using a Ponar dredge; (4) collection of sediment samples using a hand corer; and (5) collection of sediment samples using a gravity corer.

Homogenization Procedure For The Collection Of Non-VOA Sediment Samples

Note: This procedure should be followed for all types of collection of sediment samples (i.e., grab and composite). SEDIMENT SAMPLES FOR VOA ANALYSIS SHOULD NOT BE HOMOGENIZED.

1. Rocks, twigs, leaves and other debris should be removed if they are not considered part of the sample.

2. The sediment is then removed from the sampling device and placed in a stainless steel bowl.

3. Thoroughly mix the sample volume collected, using the same stainless steel trowel or scoop, as used during the sample collection. The sediment in the bowl should be scraped from the sides, corner and bottom, rolled to the middle of the bowl and initially mixed.

4. The sample should be quartered and separated.

5. Each quarter should be mixed individually and then rolled to the center of the bowl.

6. Mix the entire sample again.

7. Fill sample containers in the order specified by the site specific FSP/QAPP or as described in this SOP.

Procedure For Sediment Sampling Using A Stainless Steel Trowel or Scoop/Scoopula.

1. Collect the VOA fraction by inserting the scoop/scoopula into the sediment, avoiding the collection of rocks, twigs, leaves and other debris. Fill the VOA sample containers to zero headspace.

2. For non-VOA sample fractions, insert the stainless steel trowel or scoop into the sediment and remove the sample, avoiding the collection of rocks, twigs, leaves and other debris. Place the sample volume collected into a stainless steel bowl, then follow the procedure for homogenization (refer to page 3 of this SOP).

3. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

4. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

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.

1. Clean the stainless steel Eckman dredge according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination, #MP-FPQA-008.

2. 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.

3. Slip the messenger onto the guy line and securely fasten the guy line to a stable immovable object.

4. Open the sampler jaws one at a time and attach the stainless steel clamshell leader to the trip head.

5. Lower the Eckman dredge to the top layer of the sediment deposit to be sampled.

6. 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.

7. Slowly raise the Eckman dredge clear of the surface.

8. Place the dredge in a stainless steel mixing bowl.

9. Open the top lids of the Eckman dredge to collect the sample.

10. Collect the sample from the center of the dredge to avoid potential cross-contamination of the sediments with the sides of the dredge.

11. Immediately collect the sediment VOA fraction directly from the dredge using a stainless steel scoop/scoopula.

12. Repeat the sampling procedure above until sufficient sample quantity has been collected for the non-VOA fractions.

13. Homogenize the non-VOA fractions following the procedure on page 3 of this SOP.

14. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

15. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

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.

1. Clean the stainless steel Ponar dredge according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination, #MP-FPQA-008.

2. 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.

3. Measure and mark the distance to the top of the sediment deposit on the guy line.

4. Securely fasten the guy line to a stable immovable object.

5. Remove the safety locking pin.

6. 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.

   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.

7. 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.

8. Allow the guy line to slacken to close the jaws of the dredge.

9. Slowly raise the Ponar dredge clear of the surface.

10. Place the dredge in a stainless steel bowl and open the clamshell jaws to remove the sediment sample.

11. Immediately collect the sediment VOA fraction directly from the dredge using a stainless steel scoop/scoopula.

12. Repeat the sampling procedure above until sufficient sample quantity has been collected for the non-VOA fractions.

13. Homogenize the non-VOA fractions following the procedure on page 3 of this SOP.

14. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

15. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

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.

1. Clean the Hand Corer according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination, #MP-FPQA-008.

2. Force Corer into the sediment with a smooth continuous motion.

3. Twist the Corer, then withdraw it in a single smooth motion.

4. Remove the nosepiece and immediately collect the sediment VOA fraction directly from the Hand Corer using a stainless steel scoop/scoopula.

5. For non-VOA fractions, remove the nosepiece and empty the sample fraction into a stainless steel bowl.

6. Repeat the sampling procedure above until sufficient sample quantity has been collected for the non-VOA fractions.

7. Homogenize the non-VOA fractions following the procedure on page 3 of this SOP.

8. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

9. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

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.

1. Clean the Gravity Corer according to the requirements for the analytical parameters to be measured. Refer to the SOP for Decontamination, #MP-FPQA-008.

2. 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.

3. Secure the free end of the line to a fixed support to prevent accidental loss of the Corer.

4. Allow the Corer to free fall through liquid to the bottom.

5. Retrieve the Corer with a smooth, continuous lifting motion. Do not bump Corer as this may result in some sample loss.

6. Remove the nosepiece from the Corer and immediately collect the sediment VOA fraction using a stainless steel scoop/scoopula.

7. For non-VOA fractions, remove the nosepiece from the Corer and slide the sample out of Corer into a stainless steel bowl.

8. Repeat the sampling procedure above until sufficient sample quantity has been collected for the non-VOA fractions.

9. Homogenize the non-VOA fractions following the procedure on page 3 of this SOP.

10. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

11. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

V. 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.

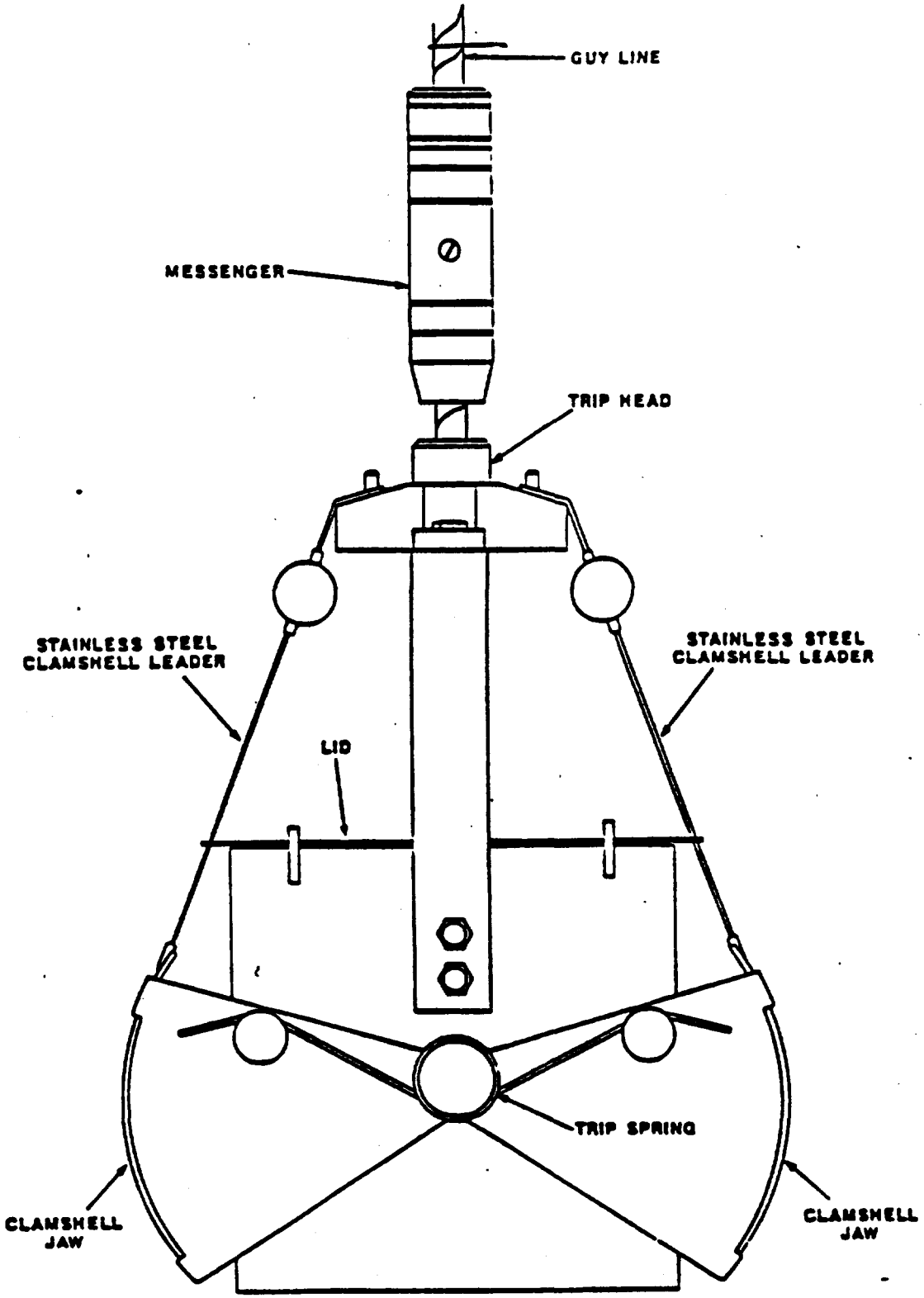

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FIGURE # 1 : SCHEMATIC OF THE ECKMAN DREDGE

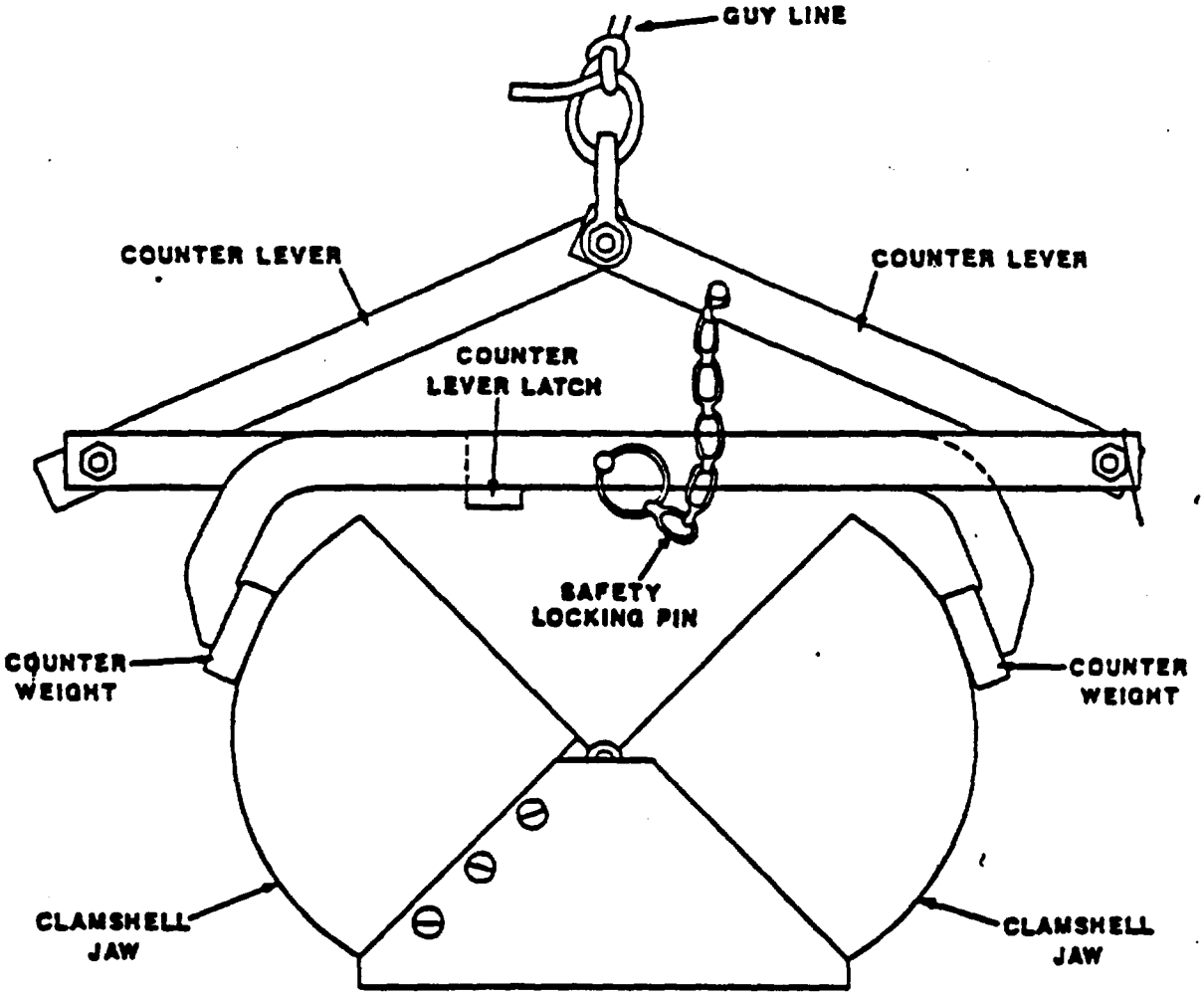

FIGURE # 2 : SCHEMATIC OF THE PONAR DREDGE

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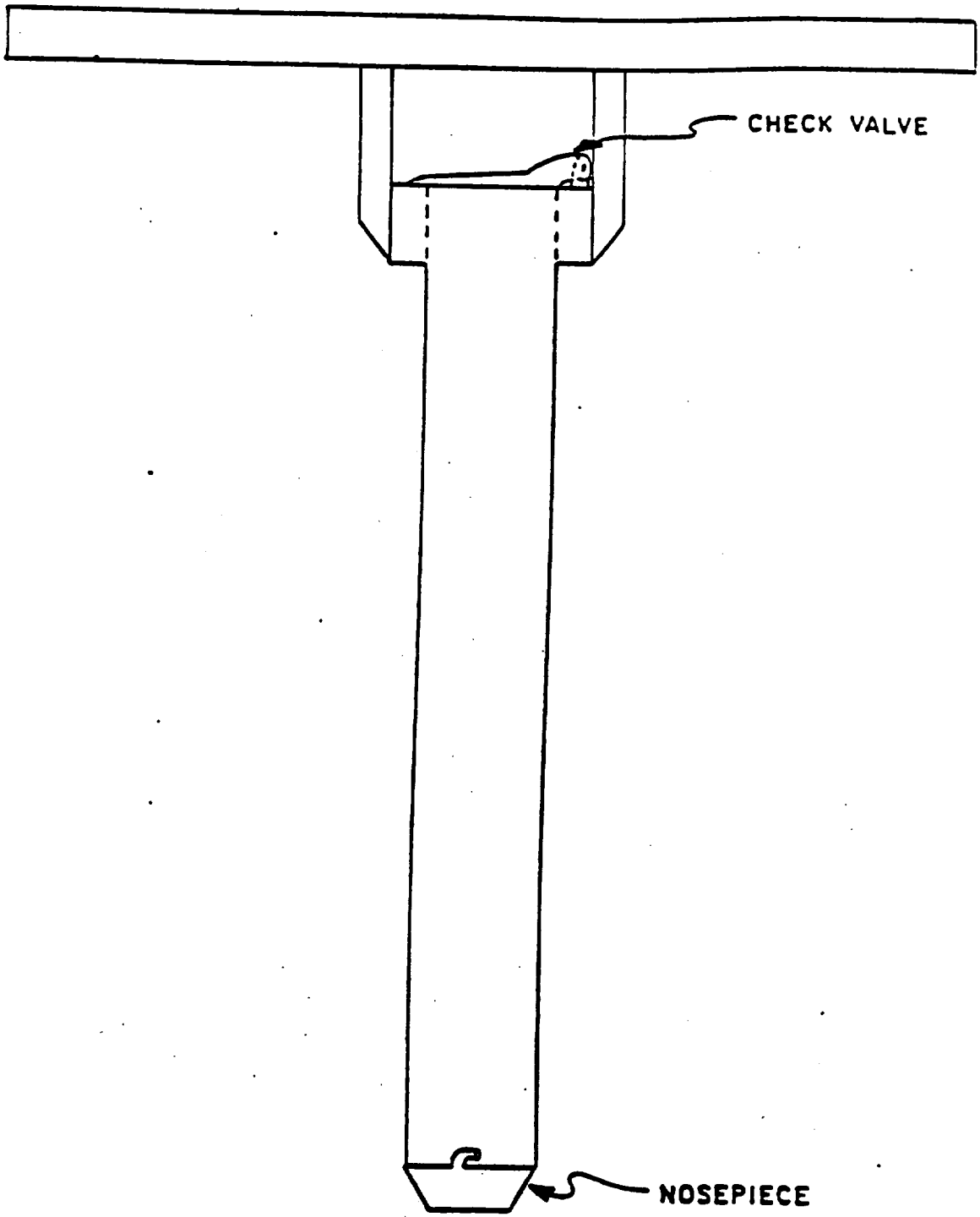

FIGURE # 3 : SCHEMATIC OF A HAND CORER

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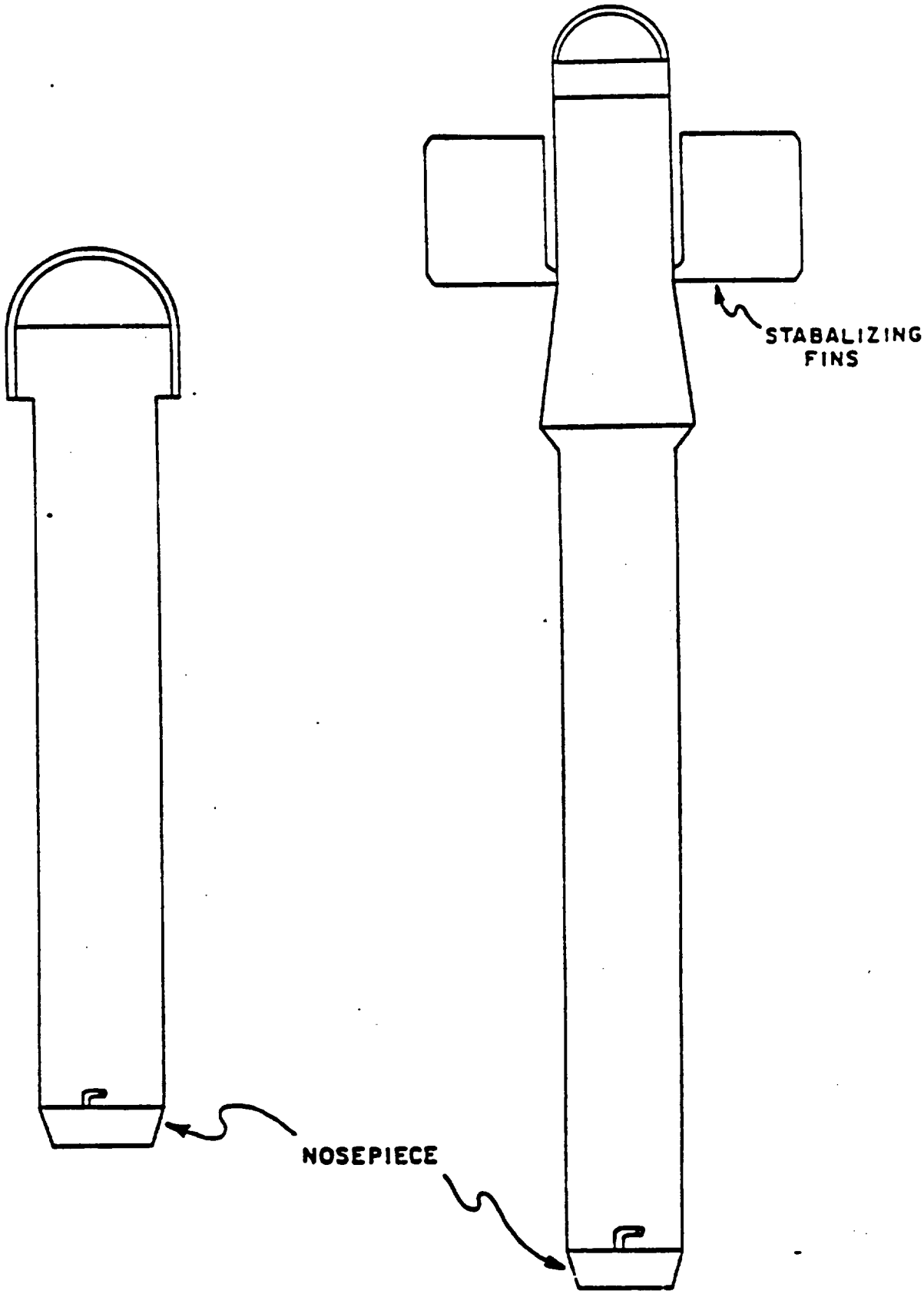

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FIGURE # 4 : SCHEMATIC OF A GRAVITY CORER

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-017-01/95
Date: January 1995
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Split Spoon Sampling

I. Introduction

This guideline is to provide general reference information on the aspects of split spoon sampling.

II. Limitations

These limitations apply to all split spoon sampling operations excepting requirements of project-specific plans for split spoon sampling.

III. 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.

IV. 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:

1. 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).

2. 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.

3. Attach the drive head and hammer the top of the drill rods without the weight resting on the rods.

4. 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.

5. 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.

6. 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.

7. Place the split-spoon sampler on a clean sheet of 0.5 mil polyethylene, with the cutting shoe oriented toward the right.

8. 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.

9. Remove the head and carefully open the halves of the split-spoon.

10. Log the soil core using Unified Soil Classification System procedures.

11. Collect samples of the soil core in 6 inch increments using a stainless steel trowel or spatula.

12. Immediately collect the soil VOA, and moisture content samples. Composite the remaining sample in a stainless steel mixing bowl.

13. Place VOA and moisture content samples in the appropriate containers and label those containers. Fill the VOA sample bottles to zero headspace.

14. Collect the remaining non-VOA fractions in a stainless steel mixing bowl. Repeat the sampling procedure until sufficient sample quantity has been collected.

15. If this is a <u>composite</u> sample, follow steps 1 through 4 of this procedure for each aliquot collected at the various locations or at different points in time (whichever is applicable). Then place the sample volume collected in a stainless steel bowl. Follow the procedure for homogenization (refer to page 3 of this SOP).

    If this is a <u>grab</u> sample follow the procedure for homogenization (refer to page 3 of this SOP).

16. Transfer the homogenized non-VOA fraction into the appropriate sample containers using the same stainless steel trowel or scoop used throughout this entire procedure.

17. Decontaminate the exterior of the sample container. Refer to the SOP for Decontamination, #MP-FPQA-008.

18. Document all properties and sample locations in a Project Field Book.

Homogenization Procedure For the Collection of Non-VOA Surface Soil Samples

Note: This procedure should be followed for all types of soil sampling (i.e., grab and composite).

1. Thoroughly mix the sample using the same stainless steel trowel or scoop, as used during the sample collection. The soil in the bowl should be scraped from the sides, corner and bottom, rolled to the middle of the bowl and initially mixed.

2. The sample should be quartered and separated.

3. Each quarter should be mixed individually and then rolled to the center of the bowl.

4. Mix the entire sample again.

V. 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.

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Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedure
Standard Operating Procedure

Procedure #MP-FPQA-020-01/95
Date: January 1995
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Magnetometer Surveys

I. Introduction

This guideline is to provide general reference information on the aspects of performing a magnetometer survey.

II. Limitations

These limitations apply to all magnetometer surveys excepting requirements of project-specific plans for magnetometer surveys.

III. Materials and Equipment

The following will be needed to perform a magnetometer survey:

1. Brunton compass
2. Survey stakes
3. Permanent markers
4. Flagging materials
5. 100-foot tape measure
6. Schonstedt Model GA-52B Magnetic Locator
7. EG&G Model G-856 Proton Precession Magnetometer

The proton precession magnetometer consists of a coil wound around a bottle of proton-rich fluid, such as water or a hydrocarbon fluid. Sufficient current is introduced through the coil to induce within the fluid an external magnetic field about 100 times stronger than the earth's magnetic field. As a result, the magnetic moment of the protons will cause them to align themselves with the new field. When the external field is removed, the magnetic moment of the protons returns, by precession, to its original orientation with the earth's field. The precessional oscillation will induce a voltage in a second coil wound around the bottle, and the total field strength is determined by measuring the frequency of the induced voltage. Typical sensitivity for this type of magnetometer is one gamma or better.

IV. Discussion

Magnetometer surveys are used to identify areas of anomalous magnetic field strength. Although natural conditions may cause anomalies, shallow-buried ferrous metal objects (i.e., drums or other waste-related metal) exhibit strong anomalies that are rarely confused with natural sources.

Applicability

The magnetic methods described in this section are applicable to locating buried drums and other buried ferrous metal objects; locating waste pits that contain metal; locating underground utilities such as pipelines, cables, tanks and abandoned well casings; clearing drilling sites; and identifying geologic features that exhibit sufficient magnetic contrast.

Metal location and depth of burial can be inferred from the shape and width of the anomaly. The location of metal using magnetometry facilitates safe excavation without puncturing metal containers. Underground utilities, which are traceable with magnetics, often lie within loosely filled trenches that may provide permeable pathways for groundwater flow. Magnetrometry is used in clearing drilling sites to select locations that are free of drums, detectable underground utilities, and other ferrous obstructions.

Under certain conditions where sufficient contrasts in magnetic susceptibilities between geologic units exist, magnetic methods may be useful in identifying geologic structures such as folding, faulting, buried drainage channels, bedrock topography, and igneous intrusions. The magnetic susceptibilities of some rock materials are presented in Table 1.

V. Procedures

A field operations guide adapted from the "Model G-856 Proton Precession Magnetometer Operator's Manual" and the "Instruction Manual Model GA-52B Magnetic Locator" for the Schonstedt instrument appear in Appendix A. The following will provide general considerations and precautions necessary to facilitate a proper magnetometer survey. Appendix A will supplement this procedure in all of the technical aspects encountered during field operations.

Preliminary Considerations

Before conducting a magnetometer survey at a hazardous waste site, the following task should be conducted:

1. Review historical waste disposal practices to identify target and non-target buried ferrous objects.

2. Establish the minimum size target of interest.

3. Conduct on-site reconnaissance to evaluate the suitability of the method, possible interferences, and terrain features.

4. Review site geology to determine if any natural anomalies might exist.

5. Estimate anticipated anomaly intensities.

TABLE 1

Magnetic Susceptibilities of Rock Materials

Material	Magnetic Susceptibility ($K10^6$, CGS Units)
Magnetite	300,000 - 800,000
Pyrrhotite	125,000
Ilmenite	135,000
Franklinite	36,000
Dolomite	14
Sandstone	17
Serpentine	14,000
Granite	28-2, 700
Diorite	46
Gabbro	68-2, 370
Porphyry	47
Diabase	78-1, 050
Basalt	680
Olivine-Diabase	2,000
Peridotite	12,500

For clearing drilling sites, utility maps should always be consulted. On-site reconnaissance is conducted to identify possible interferences and to evaluate accessibility of the areas to be surveyed. Interferences may result from surface metal, fences, buildings, and powerlines.

Metal near the sensor may produce an anomaly great enough to mask an anomaly produced by a buried object below it, depending on the relative anomaly strengths.

The presence of variable geologic conditions, such as mafic intrusions and local magnetite sand accumulations, may give rise to natural interferences. Geologic features that produce anomalies often lie below the depth of burial of the target objects and thus may not affect detection of the targets significantly.

The following components of a magnetometer survey:

1. Establishing a survey grid over the study area.

2. Establishing a base station.

3. Collecting magnetometer measurements at each station.

Survey Design

Magnetic measurements are usually taken either at equally spaced stations located across a rectangular grid or at spaced stations located across a rectangular grid or at equal intervals along several profile lines. The spacing of the stations depends on the target size. In general, the spacing between stations should be approximately one-fourth of the lateral extent of the target. For a single 55-gallon drum, the maximum distance at which the station can be detected is typically 10 to 15 feet, and the grid spacing can be designed accordingly. The closer the stations are spaced, the better the resolution becomes and the better the probability of detecting anomalies. More stations are required to cover the same area, however, and the time required to conduct the survey increases correspondingly.

It is helpful to lay out the survey grid so that the lines are oriented perpendicular to the strike of the target. if this orientation is not known, then north-south grid lines are preferable.

An accuracy of ±5 percent is generally adequate for station locations for a magnetometer survey; hence, a Brunton compass and tape measure are sufficient to survey the station locations. Wooden stakes or other nonmetallic station markers should be used.

Magnetic Measurements

Magnetic measurements are taken by placing the magnetometer at a station, orienting the sensor properly, and taking the reading in accordance with the operating instructions for the particular instrument used. The instrument operator should be free of any magnetic material such as keys, belt buckles, steel-toed shoes, metal rim glasses, and so forth. To avoid effects of rocks that may be naturally magnetic and to avoid the effects of topography,

it is important to hold the magnetometer sensor above the ground while taking measurements. The sensor should be held at the same height above the ground for each measurement.

Interferences

Interferences from surface metals, fences, powerlines, and other aboveground sources, which generally lie closer to the magnetometer sensor than buried targets, may mask the targets and sometimes cannot be corrected for. In some cases, data obtained near such interferences must be excluded. Corrections for interferences from geologic conditions and surface objects that have small magnetic moments in comparison to the target may be possible. Some instruments have filters that eliminate powerline interferences.

Total Field Versus Vertical Gradient

Two types of magnetic measurements are generally used: total field and vertical gradient. The total magnetic field intensity is a scalar measurement, or simply the magnitude of the earth's field vector independent of its direction. The magnetic field gradient is a measurement of the difference in the total magnetic field between two sensors having a fixed distance between them. The gradient equals the change in total magnetic field over distance (sensor spacing). For vertical gradient measurements, the sensors are separated vertically. Gradient measurements mav be made by using a gradiometer, which is a magnetometer with two sensors built in, or by using a normal total field magnetometer and taking two separate readings at different heights. The gradiometer takes measurements at the two sensors simultaneously, whereas measurements using a total field magnetometer have a small time separation. The sensitivity of vertical gradient measurements is variable and depends in part on the vertical separation of the two sensor positions. Commonly, vertical separations of one-half, 1 and 2 meters are used.

Vertical gradient measurements include several advantages over total field measurements:

- The measurements give finer resolution of complex anomalies.
- The measurements require no corrections for diurnal variation, micropulsations, and magnetic storms. Measurements at the two sensors are made simultaneously or nearly so; these temporal variations affect both readings essentially equally and are, therefore, removed on the differential.
- The regional magnetic field affects measurements at both sensors equally, and these variations are removed on the differential.
- Gradient measurements provide vector direction as well as magnitude and can be used for more quantitative determination of anomaly location, depth, shape, and magnetic moment.

The following are disadvantages of the gradiometer and reasons why total field measurements may be preferred:

- Gradiometers have a smaller radius of detection and thus require closer spacing of measurement points to achieve their potential for finer resolution of anomalies. Finer grid spacing requires more time. In some cases, targets at depth may be beyond the radius of detection for a gradiometer, but not for a total field magnetometer.

- Gradient readings using a total field magnetometer take longer to do than a simpler field measurement.

- Calculations that are based on vector properties of gradient measurements to precisely determine source location may be very complex and time consuming.

In summary, total field measurements are suitable for reconnaissance surveys because they enable coverage of a larger area in a shorter amount of time than do vertical gradient measurements; they also provide good information on the location, depth, shape, and magnetic moment of buried ferrous objects. Vertical gradient measurements are best for detailed studies over small anomalies where more detailed characterization of buried ferrous objects may be required. Vertical gradient measurements were taken at the same grid spacing as total field measurements, but the finer resolution of the vertical gradient data is evident.

VI. References

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APPENDIX A

FIELD OPERATION

This chapter will discuss the features and performance of the Memory-Mag magnetometer in regard to actual survey use. Included here is information on sensor attachment and a discussion of sensor orientation and positioning in relation to the repeatability of the instrument's readings. Discussed also are testing for magnetic noise and some particular features concerning the use of the magnetometer as both a base station and also a survey unit.

Sensor Attachment

Inside the sensor case are coils of wire submerged in a hydrocarbon fluid, in this case decane.[1] The following section presents proper mounting procedures for the sensor.

1. Check for sensor fluid volume by shaking and listening for a "sloshing" sound. The fluid should sound like its about 1 cm. from the top of the sensor. If you need to add fluid:

   A. Remove the blue cap plug on the sensor.

   B. Fill with Decane to within 1 cm. from the top.

   C. Replace plug.

2. Attach the signal cable to the sensor. The short one is for backpack use, the longer cable for use with the staff.

3. Attach the sensor to the staff and assemble the sections, or place the sensor in the backpack and attach it to the carrying harness.

Sensor Orientation

The sensor is marked with an arrow and the letter "N". During operation this arrow should be roughly pointed either north or south. Aligning the sensor this way will place the coil axis perpendicular to the earth's field and produce an optimum signal.

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[1]Decane is available from chemical supply houses, oil refineries, petroleum products distributors, or Geometrics. Decane is flammable, but unlike gasoline is not explosive, so it may be carried on airplanes.

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As surveys approach low magnetic latitudes where the field trip dip is less than 40° and the field value generally below 40,000 gammas, (such as near the magnetic equator where the field is close to horizontal) the sensor should be mounted horizontally (saddlemount) on the staff. In this manner the sensor coils will be properly oriented for maximum signal.

Sensor Position/Repeatability

Sensor position, in this case meaning the exact and consistent placing of the sensor, is very important to the repeatability of the system. Repeatability means getting the same count for several readings taken consecutively when the sensor is not moved. This relationship between sensor position and repeatability becomes more and more critical as portable magnetometers increase in sensitivity. The following are occurrences during which 0.1 gamma magnetometer may not repeat as consistently as a 1 gamma unit. To illustrate, consider the following comparisons:

High Gradients - In an area of 1 sq. meter where the magnetic field varies by several tenths of a gamma every 15 centimeters, 1 gamma magnetometer will not be affected by moving the sensor slightly, or even moving it as much as 30 or 40 cm.

However, given those same conditions, the repeatability of a 0.1 gamma magnetometer will be affected, and possibly quite noticeable by moving the sensor as little as a few centimeters.

Rapid Diurnal Changes - Consider also that even if the sensor is held perfectly still, a 0.1 gamma magnetometer will pick up subtle changes in the diurnal field that a 1 gamma magnetometer would never detect. This is of particular concern during high sunspot activity.

Magnetic Dust - Added to this is the possibility that the sensor itself may be magnetically contaminated due to an inclusion or surface adherence. This may affect data greatly if the sensor is rotated or the orientation continually changed.

As a note to the above, there may be other complications to repeatability. One is electrical noise in the system that may produce variations on the order of 0.1 gamma. Another possibility is the random count of protons by the system. Again, a comparison between a 1.0 gamma magnetometer and a 0.1 gamma magnetometer is needed to make the point.

To explain further, the G-856 operates by counting the frequency of spinning protons in the sensor. The length of, or the amount of time involved in this count affects repeatability in a very subtle way. For instance, in a 1 gamma magnetometer, given a normal 3 second cycle time, a certain number of protons will be available for the count. As an example, 53795.2. The 1 gamma magnetometer will round that count to 53795. In a 0.1 gamma magnetometer, however, that count will be more accurate; the magnetometer reports the counts as 53795.2 and 53795.3 respectively. Of course, this accuracy lessens the repeatability.

Truncating Digits on the Display

In areas of very high gradients, often times the environment does not permit the magnetometer to capture an accurate count. This happens because the sensor signal collapses, or dies, before the count time has ended, creating an inaccurate picture of the field. The operator will recognize the symptoms of high gradients by noting truncated digits on the display. When the signal has collapsed too soon, the magnetometer will drop the least significant digit and leave an incomplete reading on the display.

Depending on the resolution you need, this is most likely not a problem. If the cause is high gradients, there is no need for 0.1 gamma resolution. A similar effect may be observed in a very low fields. You can usually improve the signal strength by lengthening the polarization time and/or shortening the count time.

Magnetic Environment

In surveying, it's important that magnetic field readings be as true as possible and not be affected by articles of clothing and personal accessories. Jewelry, keys, watches, belt buckles, pocket knives, zippers, etc. can affect the total magnetic field reading. Objects suspected to be magnetic may be checked in the following manner:

1. Mount the sensor on the staff, place the suspected article far away from the sensor, and take several readings. Each reading should repeat to ±1 gamma. (For details see Sensor Position/Repeatability on the previous page.)

2. Place the suspected article fairly close to the sensor, and again note the readings.

3. Remove the article and again take several readings to check for a diurnal shift in the earth's field. If a shift is present, repeat the test.

4. If no diurnal shift is present, you can assume that the article is magnetic if the first group and the second group of readings varied by more than 1 gamma.

If the article is highly magnetic, or if the sensor is inside or near a building or vehicle, the proton precession signal will be lost, giving completely erratic readings.

The magnetometer can not reliably be operated in areas that are known sources of radio frequency energy, where power line noise (transformers) is present, in buildings, or near highly magnetic objects. The sensor should always be placed on the staff above the ground, or in the "backpack". The sensor will NOT operate properly when placed directly on the ground.

SURVEY OPERATIONS

Magnetic Surveys

During survey operation and after the instrument is tuned to the local field intensity, the operator need only depress the READ key to observe the reading, and if the reading is acceptable, the STORE key. If the reading is in question, for example a sudden shift of several hundred gammas, another reading should be taken.

The sensor is normally mounted on the staff or may be mounted in the backpack for surveys requiring lower mapping accuracy, rapid operation, or in rugged terrain. Because of the magnetic properties of most D-cell batteries, however, only the cardboard or plastic jacketed batteries should be used in the console for this application.

Use of the Line Number in Surveying

The memory feature of the G-856 offers some unique methods for logging a survey. The Memory-Mag magnetometer obviously eliminates the need to write down each magnetic field reading, but it also can eliminate other kinds of notes usually taken during a survey. The use of the line number marker (the three digit number set by depressing TIME, SHIFT, the numbers, and ENTER) is efficient in two ways:

1. It can be changed every time a new survey line is begun, thereby eliminating the need to count stations in a line, and

2. When anomalies show up, and the points on a line previously surveyed need to be filled in, the line number marker can be used as a coded notation.

As an example, presented here is a hypothetical study of a section of ground suspected to have a linear magnetic anomaly such as fault, a dike or a buried stream channel. As in all such surveys, you would start with a map of the area. You would mark survey lines on the map either in a grid or along some natural topographic features. Actually, locating your survey point geographically is one of the most difficult aspects of magnetic surveys, but a detailed analysis is not necessary for this illustration. The six lines have been labeled as shown from 100 to 600.

In the field, you would locate yourself at the Southwest corner at the bottom of line 100. If you are using a base station, you would check the clock on the G-856. The Julian Day will label your data as occurring on this date, but assume that you are conducting six similar surveys and that this is the third one today. You could mark your field logs with the time of day you started, but instead label this job number 3 by setting the Julian to 3. Depress AUTO, TIME, SHIFT, 3, and ENTER. There are of course, three digits available, so other information could be recorded.

Tune the magnetometer and take a few readings (but don't store any) and establish that the horizontal gradient is small and your best interval between readings is 25 meters. Now you are ready to start the survey. You will label the data by setting the Line Number to 125 (line 100, interval 25 meters). Press TIME, SHIFT, 1, 2, 5, ENTER. That information will be recorded with each reading stored in the memory and you will use it later. The coding scheme should also be recorded in your field notes, along with the date and exact time the survey was started. Since you have already done two other surveys, log the battery voltage and the first station number to be used (press READ to see the numbers) and signal strength (press TUNE).

Now that you are ready, conducting the survey is easy. Stand at the beginning of line 100, press READ, wait for the answer, visually check it, and press STORE. Walk up the line 25 meters and take another reading. Continue on in this same manner.

Now suppose that you reached point X on the map and noticed that the last two readings were unusually different than the previous ones. Of course you can review your data at any time by pressing RECALL a few times, and confirm that the last two readings are different than several of the preceding ones.

You conclude that you may be in the area you're looking for, and that you really want to take readings much closer together, starting back two stations. You are standing still all this time, so you are physically at the last point. You will erase that record while you stand there by pressing READ (to make sure you're at the top of the data), RECALL (do not store the last reading), ERASE, ERASE. Now, you walk back to the previous station. Press RECALL, ERASE, ERASE. Continue until you have relocated yourself at the last station where you have good data.

Now change to five meter intervals to get a more precise profile of the anomaly. Press TIME, SHIFT, 1, 0, 5, ENTER, which sets your Line Number to 105, coding the line and the interval. You would now continue your survey by walking up the line five meters, storing the data, and continuing thus until you notice that at point Y the field again becomes constant.

Now reset the line number to 125. Depress TIME, SHIFT, 1, 2, 5, ENTER, and walk up the line 25 meters. Take and store a reading and continue to the end of the line. At the end of line 100, you should record the ending station number and any other remarks relevant to the survey--but its just insurance. Everything regarding the data is in the memory.

Now move to the north end of line 200 and, as an example, suppose that you decide to tighten up the survey a little by changing to 20 meter intervals. Record 220 as the line number. Depress TIME, SHIFT, 2, 2, 0, ENTER. Start surveying south. Again, if anomalies show up, edit, change the intervals, and label the record as before. Continue for
the rest of the lines and note in your field book that you walked north on the odd numbered lines and south on the even numbered lines. Record your ending time, signal strength, and battery voltage.

1.0 OBJECTIVE

The objective of these guidelines is to provide general reference information and technical guidance on the installation of groundwater monitoring wells.

2.0 LIMITATIONS

These guidelines give overall technical guidance only and could be modified by specified requirements of project-specific plans for monitoring well installation.

In most states there are regulations related to the construction of wells. These regulations must be accounted for during the monitoring well design.

Groundwater monitoring wells are limited by their expense. The initial well installation and the laboratory analyses of samples require large expenditures. The number of points where data can be obtained will have to be limited; however, the proper design, and extent of monitoring installations must be sufficient to characterize the site in accordance with project requirements.

3.0 DEFINITIONS

None.

4.0 GUIDELINES

A monitoring well network is used to define the hydrogeologic regimen, groundwater quality and movement and to accomplish specific study objectives such as

- Define the geologic frame work of the site
- Identify on and off-site soils
- Measure groundwater elevations
- Determine groundwater flow direction and velocities
- Monitor pollutant concentrations

- Provide the means for detecting the vertical and horizontal migration of the contaminant plume including the front, size, shape direction and velocity of migration
- Determine the extent of interaquifer movement of pollutants
- Determine aquifer characteristics, such as hydraulic conductivity, head distribution, transmissive, etc.
- Develope a data base for evaluation and design of remedial measures
- Determine effects of remedial measures
- Assist in performing remedial work, such as functioning as recovery wells or injection wells

The objectives for the well installation and its intended use must be clearly defined and integrated before the monitoring system is designed. Within the system, each monitoring well installation is unique, and the design must be based on the specific situation presented.

The location, depth, and construction details of monitoring wells are important considerations when planning a water quality monitoring program. These parameters are equally important when observation wells are installed, since there is often a need to sample wells that were originally designed for measuring water levels. Because hydrogeologic information must be evaluated prior to well placement, it is recommended that a phased approach, or a flexible schedule for monitoring well installation be implemented.

During all phases of the well design, attention must be given to clearly document the basis for design decisions, details of well construction, and the materials to be used.

4.1 LOCATION AND DEPTH

Siting the monitoring wells should be performed after a preliminary estimation of the hydraulic gradients. In most cases the sites can be determined by reviewing geologic data and the site terrain. In addition, production wells or other monitoring wells in the area may be used to determine the flow direction. If these methods cannot be used, piezometers may have to be installed to determine the gradient. This requires a minimum of at least three piezometers. More complex monitoring systems may be required to obtain statistically valid information in areas of multiple sources of contamination and bedrock contamination.

When monitoring for specific objectives, the location of the well and depth of the screen are determined from the purpose of the system. For example, at a new site where the objective is early warning, the wells should be located as close as possible to the source; alternatively, where contamination is discovered, determining the extent of contamination is the objective and the wells may be needed to define the flow potential, the area involved, and the vertical distribution of water quality.

The depth interval covered by the well screen is important for determining not only the vertical distribution of hydraulic heads, but also the levels at which contaminants are present. The quality of the groundwater may vary with the depth due to several factors; density of the contaminant water solution, lenses or layers of varying permeability, and geologic features that may form barriers diverting the flow. A well that is screened for the entire depth of the aquifer may only determine the presence or probable absence of contamination. Therefore, a fully penetrating well cannot be used to quantify or vertically locate a contamination plume. If the vertical distribution of hydraulic heads or contaminant levels is desired, multilevel sampling wells or several wells, screened at different depths, in the same location, may have to be constructed.

4.2 MATERIALS

Well materials are specified by diameter, type of material, and thickness of pipe. Well screens require an additional specification of slot size. Thickness of pipe is referred to as "schedule" for polyvinyl chloride (PVC) casing and is usually Schedule 40 or 80. Steel casing thickness is often referred to as "Strength" and Standard Strength is usually adequate for monitoring well purposes. Obviously, the larger the diameter of the casing, the thicker the casing may need to be to maintain adequate strength.

The selection of the type of well construction materials depends on the method of drilling, the type of contamination expected, and natural water quality and depth. The cost and the level of accuracy required are also important selection factors. The materials generally available are Teflon, stainless steel, PVC, galvanized steel, and mild steel. Each has advantages and limitations. The two most commonly used materials are PVC and steel. Table 25-1 compares these two. When expense is not limited and trace-metals or organic sampling is required, stainless steel may be preferred. Teflon materials are extremely expensive, but considered inert. PVC has many advantages, including low cost, excellent availability, light weight, and ease of manipulation; however, there are also some questions about organic chemical absorption and leaching that are being researched. Indications currently are that these problems are minimal. The crushing strength of PVC may limit the depth of installation, but Schedule 80 materials may overcome some of the problems associated with depth. An added factor to consider when using PVC pipe is that Schedule 80 PVC pipe has an inner diameter slightly smaller than that of Schedule 40 pipe, due to the greater thickness of Schedule 80 pipe. This may be an important factor when considering the size of bailers or pumps to be used for sampling or testing. Screens and casing of mild steel, when properly cleaned, can be very good for organic chemical

determinations. Cleaning is required because oil-based preservatives and oil used during thread cutting may contaminate samples. Metal pipe, however, may corrode and release metal ions or chemically react with organic constituents. This is considered by some to be less of a problem than that of PVC material. Galvanized steel is not recommended for metal analyses, as zinc and cadmium levels may be elevated from the zinc coating. Table 25-2 presents compatibility of several plastics with contaminants.

Where compatibility of well construction materials and suspected contaminants is questionable, field-blank wells could be constructed upgradient in an uncontaminated area and directly downgradient in the contaminated zone. Two wells of different material such as PVC and stainless steel would be installed next to each other at each location. Analytical results would be compared to determine the influence of construction materials.

4.3 WELL DESIGN

Many factors influence the design of a sampling well. The design of the well depends mainly on the application. In determining well diameter, the following needs must be considered:

- Adequate water volume for sampling
- Installation method
- Type of sampling device to be used
- Costs

The volume required for organic an inorganic analysis is approximately 1-1/2 to 2 gallons, plus a split sample (often requested by state or owner). A total of four gallons of water is the minimal volume for a typical sampling program. The standing water in the monitoring well prior to purging is indicative of the volume of water which will be available for sampling after complete recharge has occurred.

Casing Inside Diameter, in.	Standing Water Depth to obtain 1 gal Water, ft	Standing Water Depth to Obtain 4 gal Water, ft
2	6.13	25
4	1.53	6
6	0.68	3

For most monitoring programs, either a two-inch or four-inch diameter well is preferred. The volume of stagnant water in the well is minimized, the costs are reduced, and the water table stabilizes more readily, while providing good representative samples. Pumping tests for determining aquifer characteristics may require large-diameter wells; however, in situ permeability tests can be performed during drilling or after well installation in small-diameter wells. Table 25-3 presents advantages and disadvantages to various monitoring wells.

Multilevel monitoring can be accomplished by installing conventional screen and riser pipe wells in either separate boreholes or a single, large diameter borehole.

Gas lift sampling devices have proven advantageous as alternatives to conventional monitoring wells. These devices are essentially screened samplers installed in a borehole with only one or two small diameter tubes extending to the surface. Manufacturers of these types of samplers claim that four samplers can be installed in a three-inch diameter borehole. This reduces drilling costs, decreases the volume of stagnant water to be purged, and provides a sampling system that minimizes cross contamination from sampling equipment. These samplers also perform well when the water table is below 25 feet (the typical range of suction pumps). Two manufacturers of these samplers are Timco Manufacturing Company, Inc., of Prairie du San, Wisconsin, and BARCAD Systems, Inc., of Concord, Massachusetts. Each offers various construction materials.

Two additional types of multilevel sampling systems have been developed. Both employ individual screened openings through a small-diameter casing. One of these systems (marketed by Westbay Instruments Ltd. of Vancouver, British Columbia, Canada) uses a screened port and a sampling probe to obtain samples and head measurements or perform permeability tests. This system allows sampling ports at intervals as close as five feet, if desired, in boreholes from three to 4.8-inches in diameter.

The other system, developed at the University of Waterloo at Waterloo, Ontario, Canada, requires field assembly of the individual sampling ports and tubes that actuate a simple piston pump and force the samples to the surface. Where the depth to groundwater is less than 25 feet, the piston pumps are not required. The assembly is made of easily obtained materials; however, the cost of labor to assemble these monitoring systems may not be cost-effective.

4.4 INSTALLATION

A typical monitoring well set in unconsolidated materials consists of a slotted or perforated section of pipe designed to allow the inflow of water while supporting the earth materials surrounding this screen. Attached to the screen is casing or riser pipe that extends to the surface. A protective steel casing is generally used with PVC pipe. The protective pipe or casing is fitted with a lockable and ventilated cap to prevent damage and vandalism to the well. Bedrock wells are usually open holes drilled into the rock with a casing set into the bedrock surface to maintain the hole through the overburden and seal out upper groundwater bearing zones from the well. Figure 25-1 shows cross sections of typical monitoring wells.

If an aquifer to be sampled lies below a contaminated zone, proper well installation techniques must be applied to avoid cross contamination between aquifers. Under most conditions, this can be accomplished by installing double-cased wells. This is accomplished by drilling a large diameter boring through the contaminated aquifer, into the underlying compiling layer, and

setting and grouting an outer casing into the confining layer. A smaller diameter boring should then be drilled through the confining layer, into the aquifer to be sampled, for installation of the monitoring well. A proper seal is required between aquifers in order to obtain representative hydrogeologic information.

The installation of the screen and riser pipe is usually accomplished by assembling and lowering the well screen and riser pipe within an open hole or in a cased hole. Casing, mud, or hollow-stem augers are commonly used to keep the hole open in unconsolidated materials. The slotted screen is installed to monitor a specific horizon or zone. The decision concerning placement and slot size is based on the following information:

- Aquifer thickness
- Head distribution and estimated flow in the aquifer
- Permeability and physical characteristics of the formation, such as grain size, thickness and uniformity
- Specific yield of existing wells
- Anticipated depth and thickness of contaminant plume
- Physical and chemical characteristics of pollutants
- Purposes and objectives of installation
- Fluctuation in groundwater level
- Volatile organic scan of soil samples
- Borehole geophysical logs

In common situations, depending on the purpose of the well and the site conditions, screen lengths are often 5 to 10 feet. The slot size selected will govern the quantity of water and natural materials or gravel pack materials entering the well. The screen should pass no more than ten percent of the pack material, or in situ aquifer material. The assembled well should be placed in the borehole and suspended several inches off the bottom of the boring to ensure that the well casing is not bowed during installation. After the screen and riser pipe are in place, a sand or gravel well pack is placed around and three feet along the screen, or the natural materials are allowed to collapse as the casing, two feet above screen, is pulled out of the hole. A centralizer could be used on the riser to ensure the well is centered in the borehole.

A bentonite seal must be place above the top of the screen (on top of the gravel pack) to maintain a discrete sampling interval. It is important to seal the annulus to prevent water flow along a higher permeability zone in this space. this flow could alter the measured contamination or allow cross contamination of aquifers. Typically, seals are constructed of bentonite pellets or a bentonite slurry. (Bentonite is a clay of volcanic origin that has swelling properties and, therefore, a very low permeability.) The seal may extend to the ground surface, or a suitable backfill may be used around the riser pipe above the seal. Installing sand or gravel packs and seals is difficult and must be performed in holes with adequate space between the casing and the screen and riser pipe. The temporary casing or borehole should be as lease 4 in. larger in diameter than the screen an riser pipe. A flush-jointed, threaded riser pipe facilitates the replacement of these materials. A tremie pipe could also be utilized under certain circumstances to prevent bridging and ensure a competent grout seal.

As backfill materials (gravel pack, bentonite pellets, grout, etc.) are being placed in the annular space around the monitoring well, the drilling casing or augers in the hole should be simultaneously withdrawn, to prevent backfill materials from becoming jammed (bridged) between the well casing and drilling tools. If these backfill materials become wedged between the casings, the well may be pulled out of the hole along with the drilling tools. Also, the depths of backfill materials should be checked at frequent intervals with a weighted tape or similar device to ensure that gravel packs, seals, etc. are placed to the proper depths and are the proper thicknesses. All details of well drilling and installation should be carefully documented for later reference.

Flowing wells should be equipped with a pressure gauge and tap for sampling. The well casing should be sealed to prevent water from flowing from such wells.

Protection for the well is generally provided by a large diameter steel pipe with a locking cap, extending below the surface and set into a concrete collar. The protective pipe restricts access to the well, and the concrete seal is designed to route water due to precipitation away from the well. Additional protection is often needed in areas of high traffic. In some instances, the use of manholes or depressed boxes with covers instead of pipes projecting above the ground may be required.

After the monitoring system is completed, a survey should be performed. The elevation of the top of the well casing and the horizontal coordinates of each well must be determined. Surveyors are usually asked to plot the location of each well on a site and to provide elevations of both the top of casing and the ground surface. The location on the well which is surveyed in should be marked. A permanent identification number should be placed on each monitoring well.

4.5 WELL DEVELOPMENT

Well development is one of the most important steps in the procedure of well installation. Every type of drilling operation reduces the permeability of the water-bearing zone in the vicinity of the borehole. The purpose of well development is to increase the permeability of the formation after drilling operations and to stabilize the sand formation around the well screen. Well development can be accomplished by any of several methods. The selection of the well development method to be used should be made by a hydrogeologist and is based on the drilling methods, well construction and installation details, and the characteristics of the formation that the well is screened in. The primary methods of well development are summarized below.

Overpumping and Backwashing This method of development consists of alternately pumping or bailing the well at a high rate to draw the water level down and then "backwashing", reversing the flow direction so that water is passing from the well into the formation. This back and forth movement of water through the well screen and gravel pack serves to remove fines from the formation while preventing bridging (wedging) of sand grains. Backwashing and then bailing can be accomplished by starting and stopping a pump intermittently to change water levels (rawhiding), or backwashing under pressure, which consists of alternately pumping or bailing the well and then forcing water into the well under pressure, through a water tight fitting. Care should be taken when backwashing under pressure not to apply too much pressure, which could damage or destroy the well screen.

Surging with a Surge Plunger A Surge Plunger is essentially a plunger nearly the same diameter as the well casing which is moved up and down inside the well casing to agitate the water, causing it to move in and out of the screens. This movement of water pulls fines into the well, where they may be removed by any of several methods, and prevents bridging of sand particles in the gravel pack. There are two basic types of surge plungers; solid and valved surge plungers. In formations with relatively high water yields, a solid plunger is most effective, as the surging action is greater. In formations with low yields, a valved surge plunger may be preferred, as solid plungers tend to force water out of the well at a greater rate than it will flow back in. Valved plungers are designed to produce a greater inrush than outrush of water during surging.

4.6 DOCUMENTATION

The driller and the Project Manager must collect the pertinent information regarding the installation of the monitoring wells. A form should be used which allows the data of each installation to be the same, and a quick glance will show if some information has not been gathered or reported. Included should be: geologic boring log, well depth, length and type of screen, type of riser, depth and type of all backfill material. Such information also includes weather, times, problems encountered, and procedures used during the installation process. The documentation is very important to prevent problems involving questionable sample validity. This form is shown in Figure 25-9.

Other procedures can be contrived to use the Julian Day and Line Number for record labeling purposes. This example is only one of many possible combinations. Once a procedure is adopted, an attempt should be made at consistency. if the previous procedure is above the skill level of your operators, try the following alternatives.

Set the clock and Julian Date at the base camp. Go to the start of line 100 and tune the magnetometer to the field reading. Push READ, STORE, and RECALL. Write the station number displayed during RECALL on the map. Continue the sequence, surveying along line 100 and writing the station number on the map at each location. The operator might as well also write the field number on the map, which at first glance would seem to defeat the purpose of the memory, but this does provide a check against transcription errors.

A more likely procedure is to write the station number on the map at locations of specific interest including the start and finish of each traverse, physical landmarks, any point where the interval changes, and areas with interesting anomalies. The unrecorded station numbers can be filled in later by manual or computerized interpolation.

Now suppose that your survey is complete and you are ready to list the data on your printer. At the base camp you would plug in your optional RS-232 adaptor cable to a printer, and list the information from just this survey. The log book would tell you that the first station is 372, so you want to start your list from a little before that one. Press: OUTPUT, SHIFT, 3, 7, 0, ENTER. The display starts flashing OUT and the station numbers and the printer start listing a column of data like this:

825	2	131527	370	512498
825	2	131545	371	512511
125	3	140511	372	498733
125	3	140622	374	498710
125	3	140651	375	498725
125	3	140705	376	498735
105	3	141211	377	498744
105	3	141225	378	498772
105	3	141245	379	49879
105	3	141303	380	49882
105	3	141325	381	498833
105	3	141241	382	498841
105	3	141359	383	498845
125	3	141429	384	498853
125	3	141455	385	498874
125	3	141507	386	498882
220	3	141902	387	498557
220	3	141922	388	498551
220	3	141945	389	498542

At this point, you press CLEAR which stops the printer. The first column is the line number and interval spacing. The second column is the Julian Date, which you used instead to label the survey area. The third column is time of day (24 hour clock), the fourth column is the station number, and the last is the magnetic field to six digits.

You would then attempt to construct your survey from the data. Looking at column 2, notice that the first two readings are from a different survey so you can ignore them. The time difference between the readings at stations 371 and 372 is further verification. The third line, column one, tells you that the reading is from line 100 with a 25 meter interval between stations as per our adopted convention in survey area 3, and you started at 2:05 in the afternoon. The readings proceed up (north) on line 100 until station number 377. Notice here that the interval expressed in column one changed to 5 meters (377 is 5 meters from 376) and notice the extra time consumed between readings while you backtracked and erased. The readings at stations 379 and 380 have only five digits, which tell you that the signal is weak, probably because of a high local magnetic gradient from a buried magnetic object. At reading 384, you resumed a 25 meter interval for the balance of line 100. Reading 387 is of course the first reading headed south on line 200 and 20 meter intervals. The time between reading 386 and 387 is about right for a line change.

The above example is intended to show that by using a standard operating convention and some common sense you can reconstruct the field activities with a minimum of notetaking. It is prudent to examine the data while you memory is still fresh as that you can account for long time gaps and strange information.

Summary

This chapter has discussed field operation in general, and has included information on sensor attachment and orientation, sensor positioning with respect to repeatability, magnetic noise, and survey techniques.

If further information is needed, consult the "Model G-856 Proton Precession Magnetometer Operator's Manual" (see reference section).

Instruction Manual

Model GA-52B Magnetic Locator

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Printed May 1989

300291

PREFACE

The Model GA-52B Magnetic Locator is a product of thirty-five years of experience in producing the world's finest flux-gate magnetometers and magnetic detectors for aerospace, military and civilian applications. The GA-52B incorporates the knowledge gleaned from manufacturing under the most rigid quality control standards.

The heart of the GA-52B is its patented Schonstedt HeliFlux® magnetic field sensors. These sensors, acknowledged to be the world's finest, make possible the unequalled performance of the locator.

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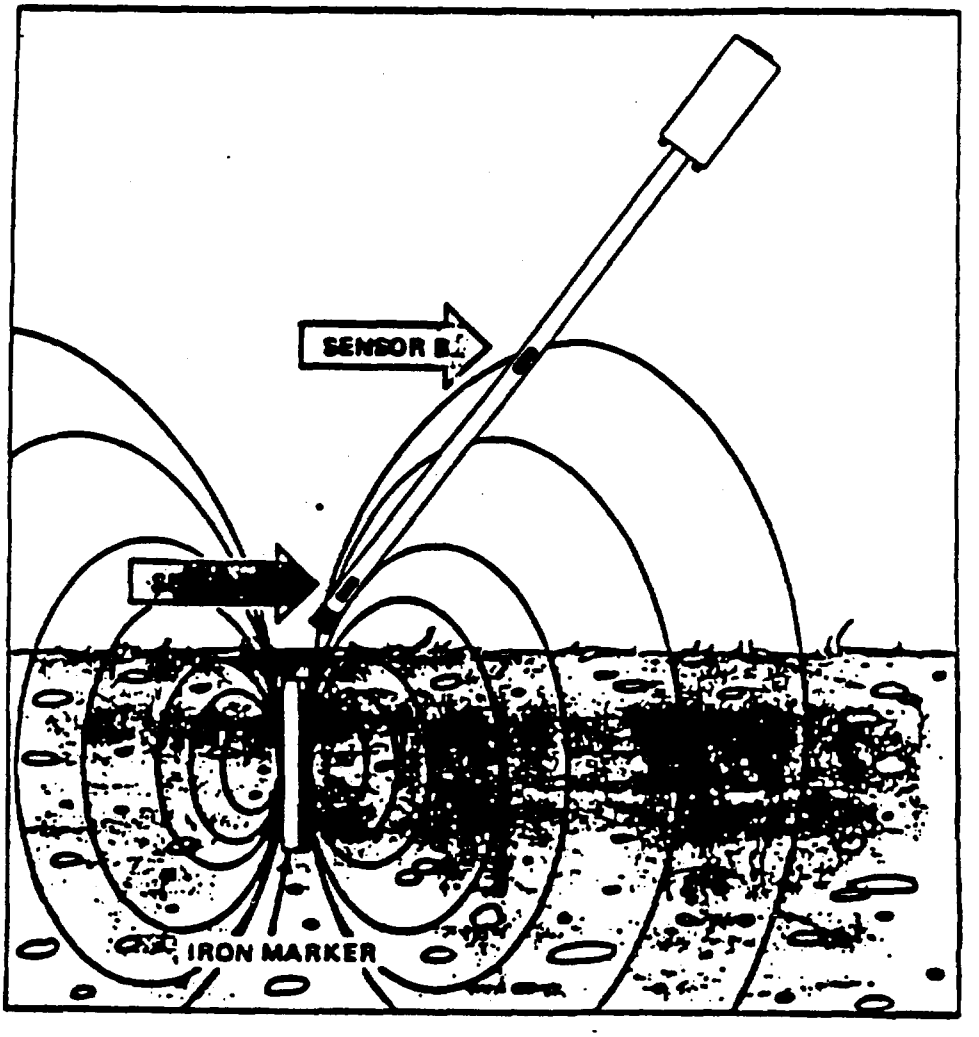
Operation

INTRODUCTION

The Model GA-52B Magnetic Locator detects the magnetic field of a ferromagnetic object. It responds to the difference in magnetic field between two sensors spaced about 20 inches apart. The response consists of a change in the frequency of a signal that is emitted by a loudspeaker.

The figure below illustrates an application of the locator in which it is used to detect an iron marker for a property corner. In the illustration, the magnetic field of the iron marker is stronger at sensor A than it is at sensor B. As a result, the frequency of the signal on the loudspeaker is higher than the idling frequency, 40 Hz, which exists when the field is the same at both sensors.

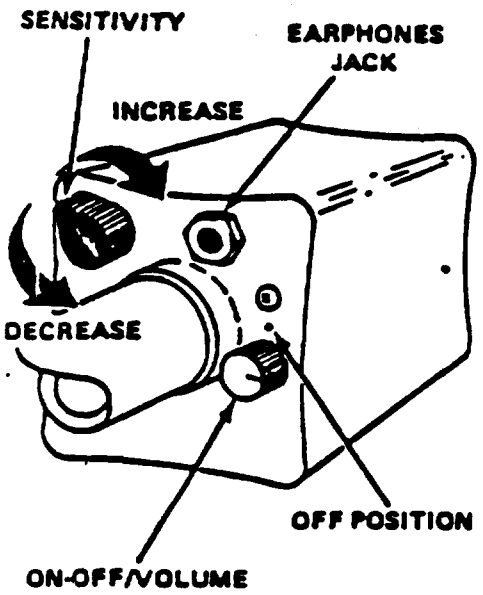


Magnetic field of an iron marker.

300293

Operation (cont.)

TURN-ON, VOLUME AND SENSITIVITY SETTINGS

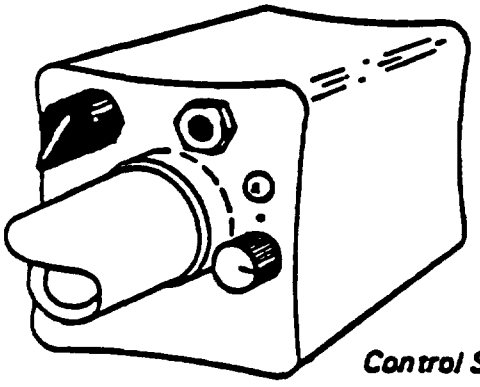


Controls (Normal Settings)

Turn on the Model GA-52B and adjust the volume level by rotating the ON-OFF/VOLUME control in a clockwise direction until the idling tone reaches the level desired. Position the SENSITIVITY (range) control as shown in the figure. With the knob in this position, the sensitivity is set for what is referred to as NORMAL RANGE. The locator can be oriented in any direction without producing a significant change in frequency of the tone from its idling rate.

When headphones are used, *no* variation in sound volume is provided by turning the VOLUME Control.

LOW SENSITIVITY

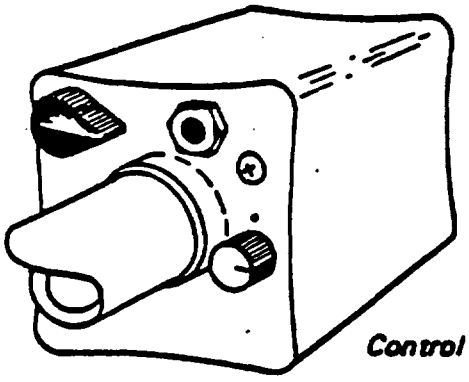


Unwanted background signals due to nearby magnetic objects may require that the range of the locator be reduced. To reduce the range, turn the sensitivity knob in a counterclockwise direction. Reduced range is useful in pinpointing the location of a strongly magnetized marker.

Control Setting for Low Sensitivity

Operation (cont.)

HIGH SENSITIVITY



The sensitivity of the locator is increased by turning the sensitivity knob in a clockwise direction. A high sensitivity setting imposes some constraint on operating methods. The locator tone will vary in frequency depending on the instrument's orientation in the earth's magnetic field.

Control Setting for High Sensitivity

SEARCH

Set the sensitivity control for normal operation and grasp the locator just below the large end as illustrated. Because the upper sensor is located near where the locator is usually held, wrist watches may produce unwanted tone frequency changes. To avoid such problems either remove the wrist watch or use the other hand. Also, avoid bringing the locator close to your shoes, since they might contain magnetic material.

To obtain maximum area coverage, the locator should be swept from side to side with the small end of the instrument kept close to the ground. A higher frequency tone will be heard from the loudspeaker when the locator is within range of an iron marker.

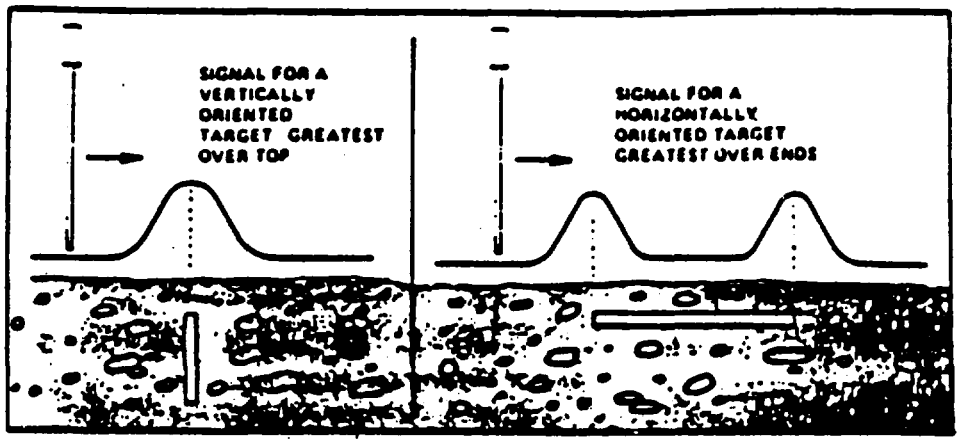
When searching using extended range, avoid turning the locator about its long axis as this may produce signal variations arising from misalignment of the sensors.

The presence of a ferromagnetic object will be indicated by a change in tone frequency.

Searching With the Locator

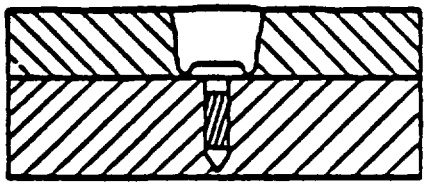
Application Notes

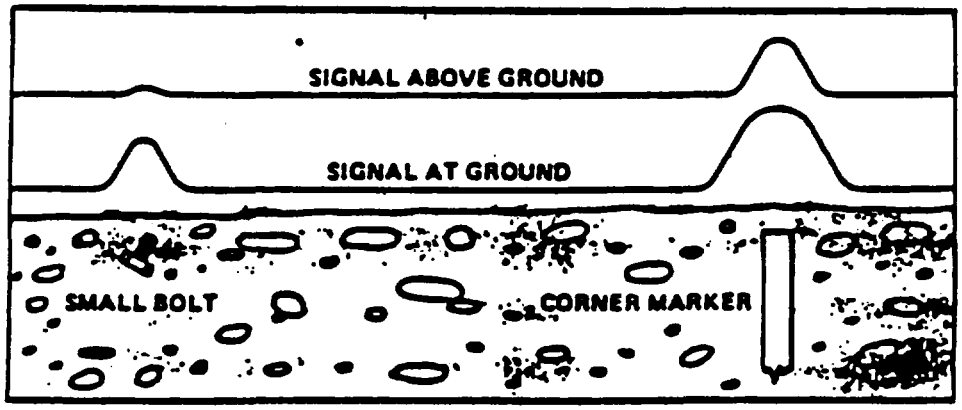
BASIC SEARCH PATTERNS



After you have detected a signal, you can precisely locate the target to save digging over a wide area. Simply hold the locator vertically while moving it in an "X" pattern. The peak signal occurs directly over a vertical target, and over the ends of a horizontal target.

Using the "X" pattern allows precise location of small objects. A 1-1/4" P-K nail marker can be located at depths from 4" to 8". It can be uncovered by using a 1/2" star drill.





A trick that helps if you find more than one signal, when you should find only one, is to raise the locator a few inches. Any signal that disappears is probably not the one you are looking for. The signal from a rusty bolt or other small item will drop much faster with distance than the signal from a larger target such as a corner marker. An 18-inch length of 3/4 inch pipe can be located up to 7 feet.

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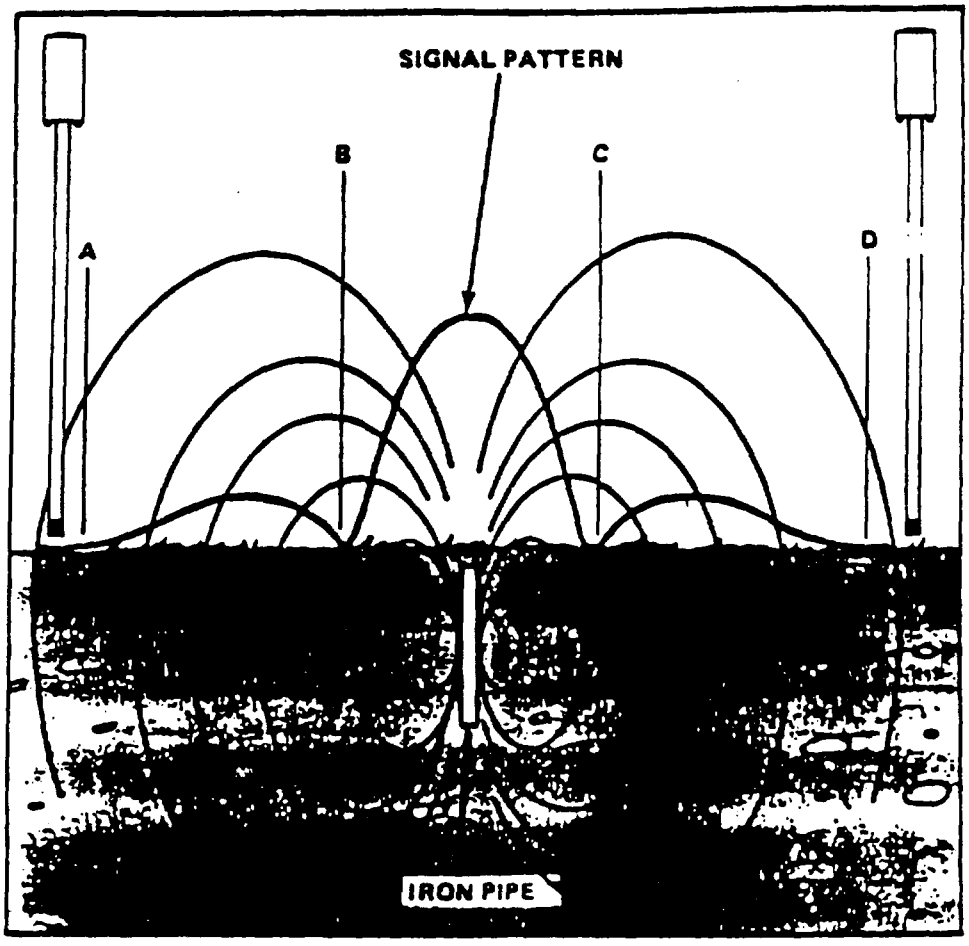
Application Notes (cont.)

STRONGLY MAGNETIZED MARKERS

Strongly magnetized markers at or near the surface may give misleading information as to the location of the markers. The magnetic field of such a marker is illustrated below.



The heavy line in the figure represents the variation in tone frequency obtained when passing the locator over the marker. In moving the instrument from A to B, the tone frequency increases and then suddenly decreases at B. From just beyond B the tone frequency increases sharply, becomes very high over the marker and decreases just before reaching C. From C to D, the pattern is the reverse of that from A to B. It is obvious that the locator must enter the B-C region. Otherwise the marker might be assumed to be between A and B or C and D.

The phenomenon is explained by the fact that the locator is sensitive to the magnetic field components parallel to its long axis. At points B and C, the field is perpendicular to the locator so no high frequency is produced at these points.

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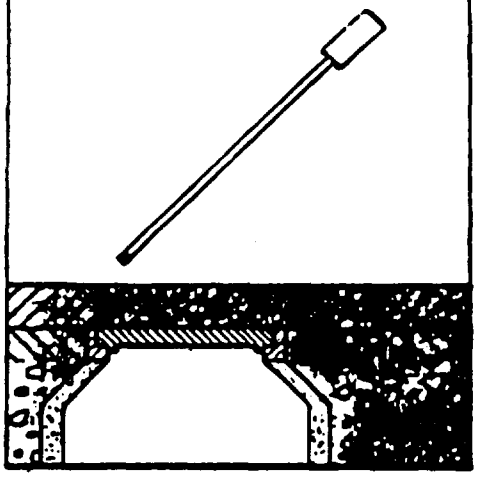
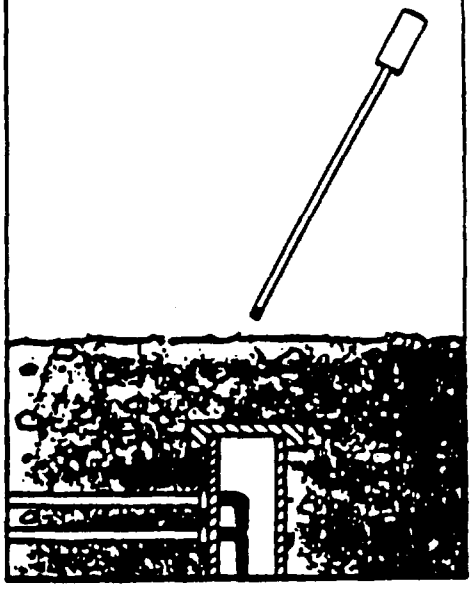
Application Notes (cont.)

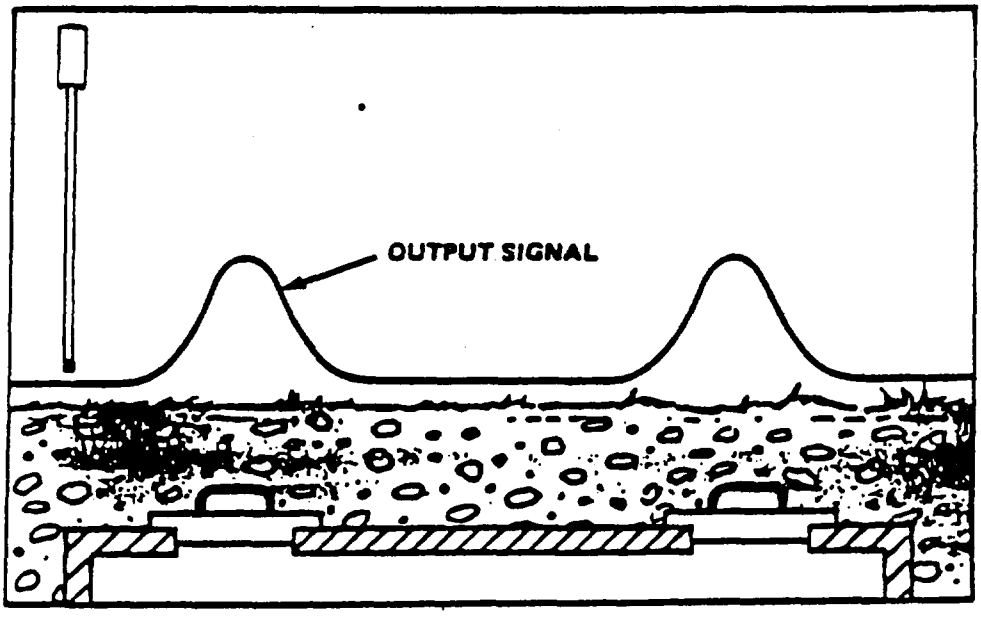
MANHOLES, SEPTIC TANKS, WELLS

The magnetic field is strongest at the edges of a shallow manhole cover. Turn the sensitivity down all the way and you can easily trace the edges of covers near the surface. Locating depth ranges up to 8 feet.



The great length of a well casing provides a strong field at the surface that permits easy locating of casings buried up to 15 feet.



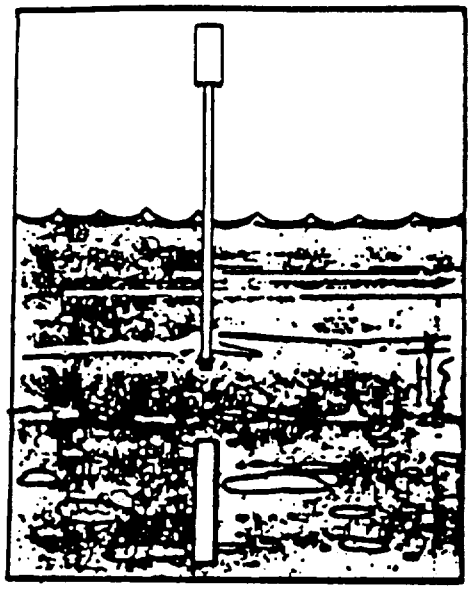


The locator can be used to precisely locate the metal handles or reinforcing bars on septic tank covers buried up to 4 feet.

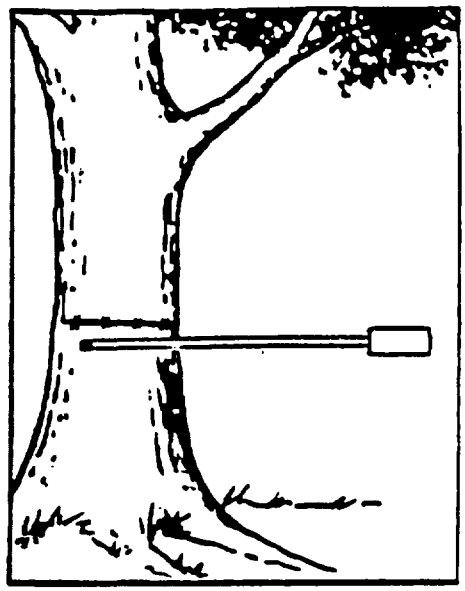
300298

Application Notes (cont.)

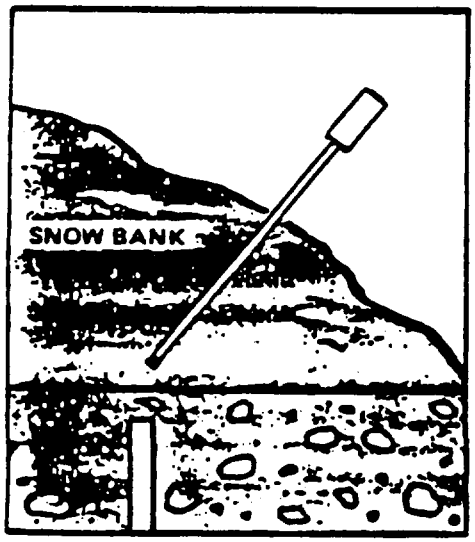
BARBED-WIRE, WATER, SNOW



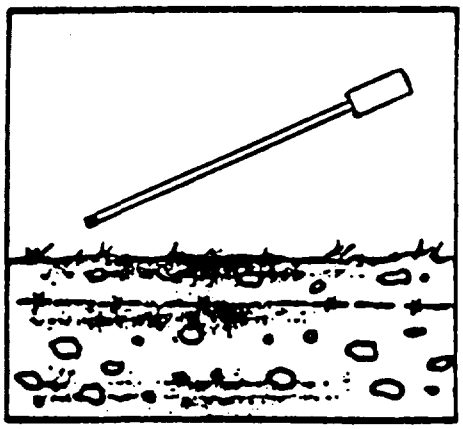
You may use the locator in flooded areas — just keep the electronic unit out of the water.



Examine trees for bench marks and embedded barbed wire of old fence lines. Hold the locator parallel with the direction of the wire.



Snow poses no problem — just thrust the locator into the snow as deeply as necessary to locate the target.

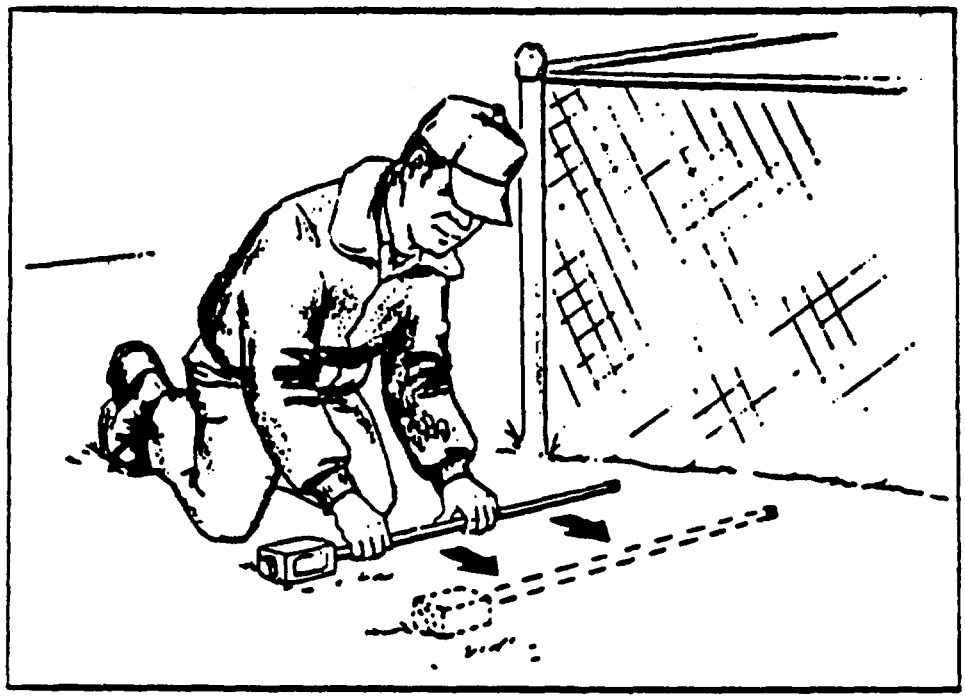


You can often trace barbed-wire (of old fence lines) beneath the surface. Even if the wire is only a trail of rust, it can be detected near the surface. Tip the locator a little lower than usual — but not parallel with the ground.

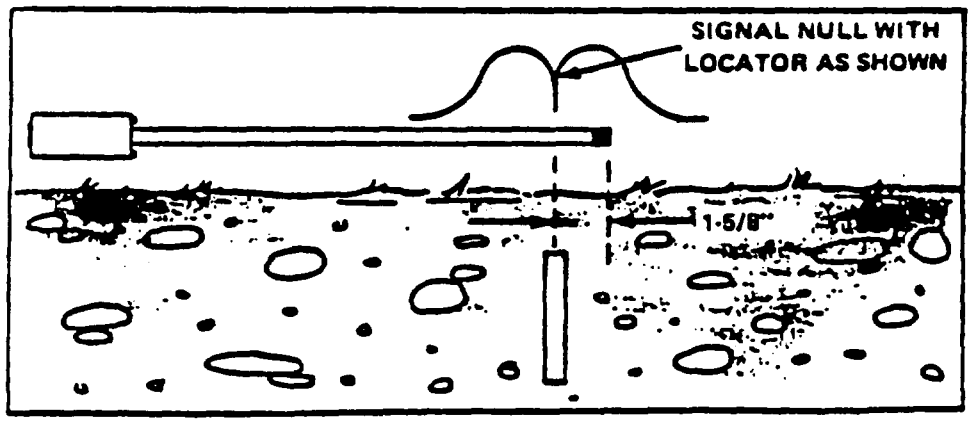
Application Notes (cont.)

ALONG FENCES

Search in the vicinity of an iron-wire fence requires not only a reduced sensitivity setting but also some control over the orientation of the locator. Position the locator substantially horizontal with its long axis approximately perpendicular to the fence. This orientation assures that the upper sensor is kept away from the fence.



Search by moving the locator along the fence, keeping the end a constant distance from the fence. When a point 1-5/8" from the end of the locator is directly over the stake, the signal will drop abruptly as shown below. Any variation in position will produce an abrupt rise in the frequency of the tone.



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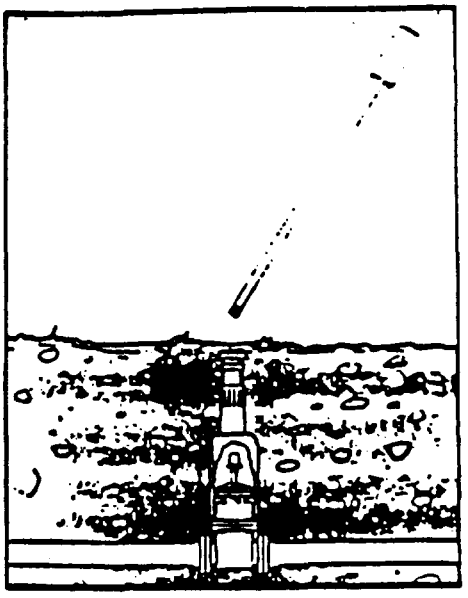
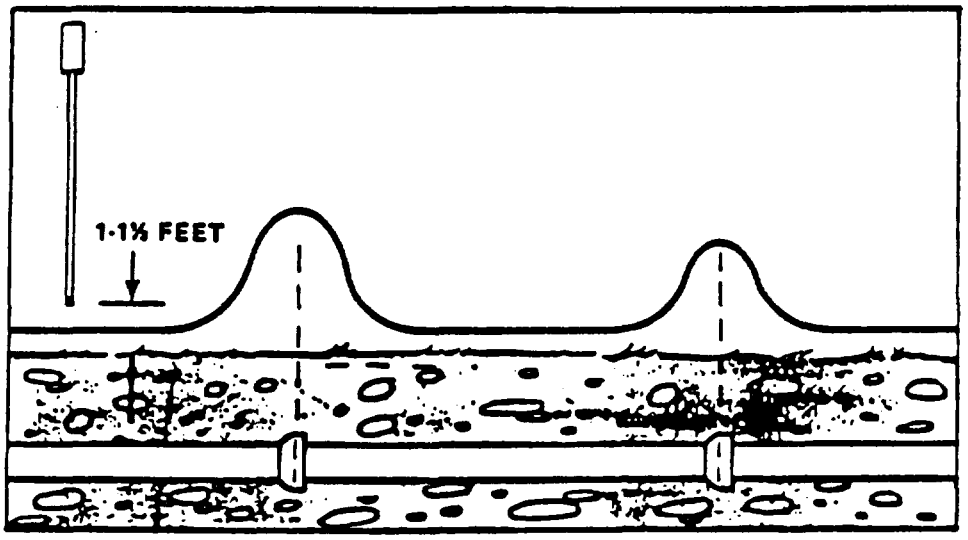
VALVE BOXES

Both the valve and its casing, when iron, provide strong magnetic fields which make them easy to locate. Plastic enclosures containing magnets are easily located at depths of 6 feet or more.



CAST IRON PIPES



Cast iron pipes produce the strongest magnetic signals at their joints. Initial search is best done as follows:

1. Turn sensitivity to maximum.
2. Hold locator vertical approximately 1-1-1/2 feet above the surface.
3. Walk without turning or tilting the locator.
4. Mark the approximate locations of signal maximums.
5. Return to the marked area and probe near the surface for signal maximums. To do so it may be necessary to reduce the sensitivity of the locator. Four-inch pipe can be located at depths up to 8 feet.

The exact location of pipe joints may be displaced slightly from the point of maximum signal — particularly on pipes oriented east-west.

OTHER NOTES

1. A burbling sound indicates the presence of an energized power line. The burbling is due to the alternating magnetic field associated with the electrical current.
2. The instrument will not detect nonmagnetic materials such as gold, silver, copper, brass, aluminum, snow, water, ice, etc.
3. Normally, telephone lines cannot be detected.

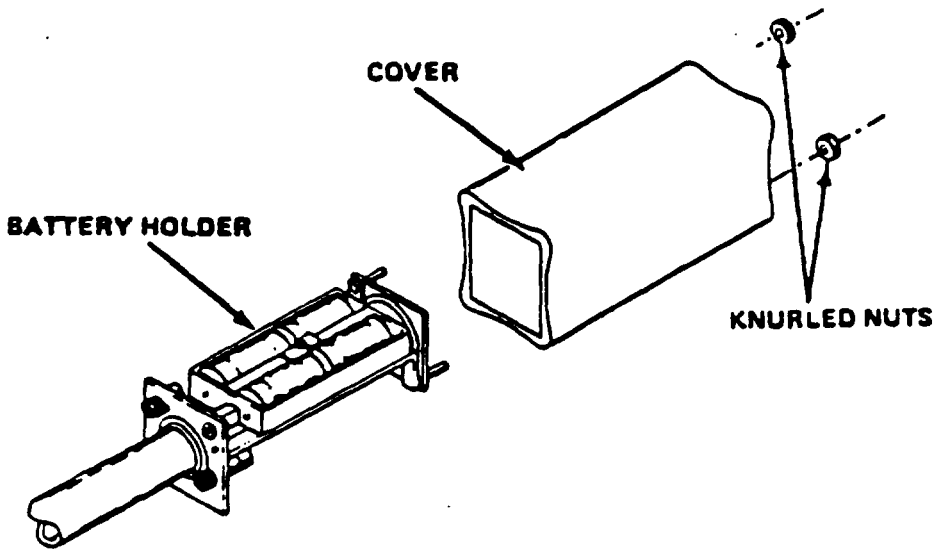
Maintenance

REPLACEMENT OF BATTERIES

The GA-52B is designed and built to give trouble free operation. Normally, maintenance is limited to occasional replacement of the batteries. In the event that your locator does malfunction, we ask that you refer to the trouble-shooting guide located on page 12. This lists a few possible problems that can generally be corrected in the field so that you will be able to continue using the locator without interruption. As indicated, low voltage from weak batteries may cause the speaker to emit an uncontrollable loud signal.

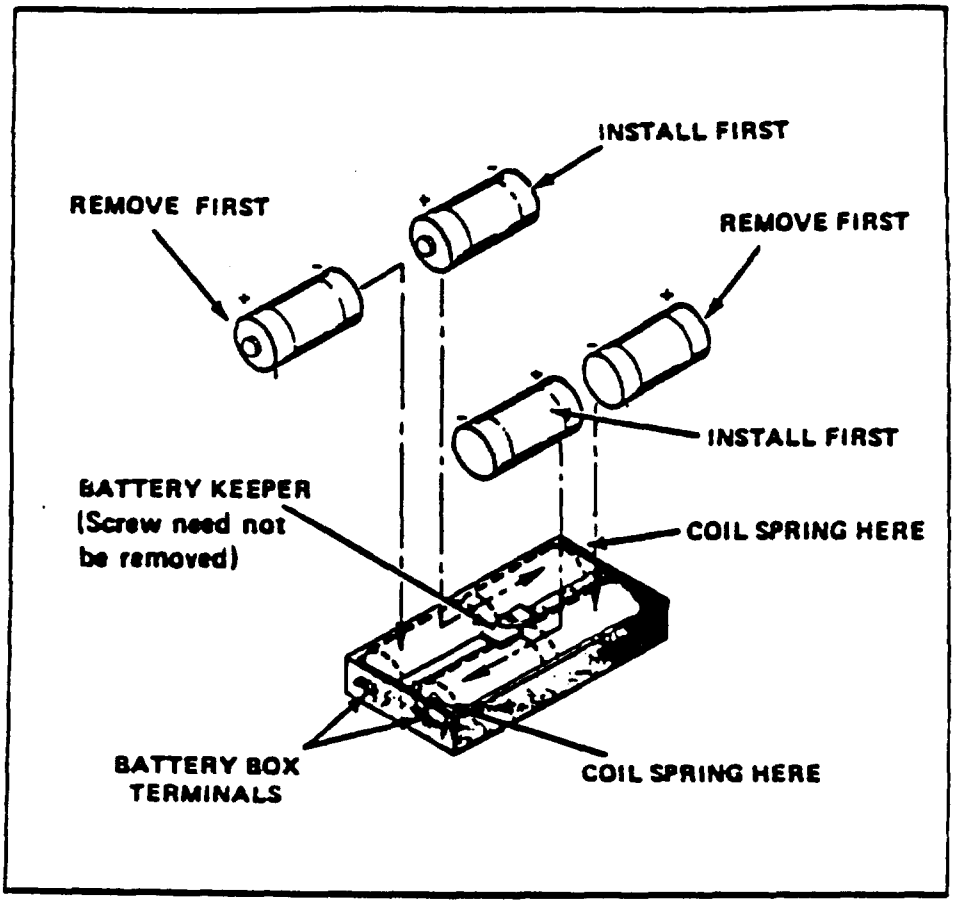
The GA-52B is powered by four C-cell batteries carried in a battery holder illustrated in the exploded view of the electronic assembly below. Access to the batteries is obtained by removing the two knurled nuts, and sliding off the cover.

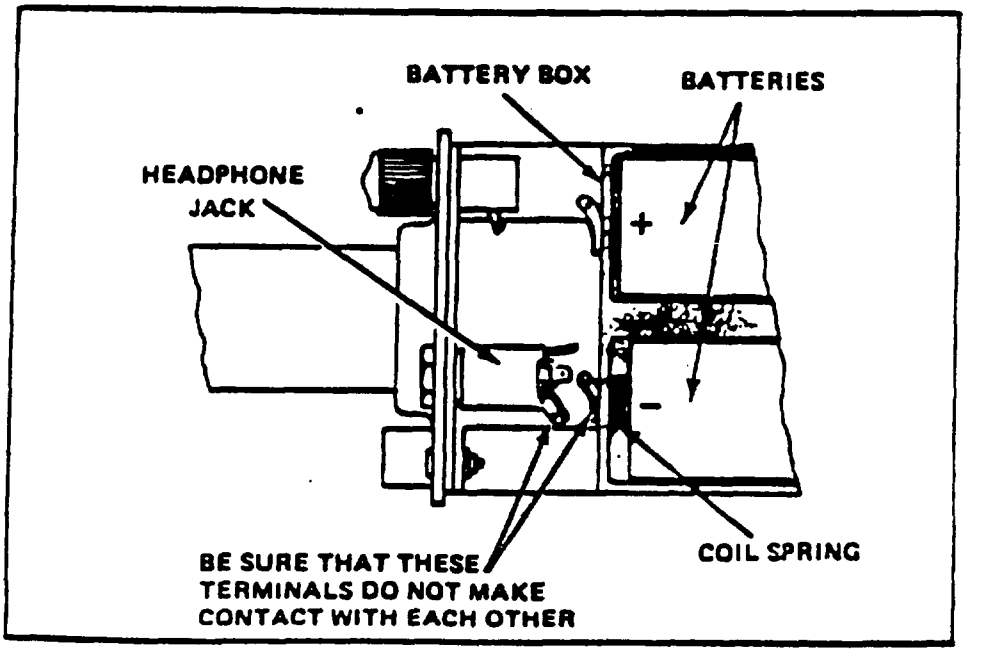
The four batteries are connected in series. The proper polarities for the batteries are shown on the battery holder. **Batteries must be removed and installed in the order as shown in the illustration on the next page.**



Exploded View of the Electronic Unit Cover

Maintenance (cont.)





300303

GA-52B TROUBLE SHOOTING GUIDE

Symptom	Possible Cause	How to Check	How to Fix
Dead	Dead batteries.	Replace.	——
	Batteries not making contact.	Check for contact corrosion.	Clean contacts.
	Broken wires.	Visually inspect.	Resolder.
Intermittent	Batteries not making good contact.	Check for corrosion.	Clean contacts.
No sound	Speaker terminals shorted to cover.	Visual.	Bend terminals.
Uncontrollable screaming	Weak batteries.	Replace.	——

SERVICE INFORMATION

If your locator needs service, please return it to the factory along with the following information: Name, Address, Where Purchased, Date, and Description of Trouble(s). See shipping information on page 14.

Specifications

(Specifications subject to change without notice.)

Input Power: Supplied by four C-cell batteries (1-1/2 V each).

Battery Life: 50 hours (Intermittant usage.)

Output: Approximate 40 Hz idle tone in speaker. Tone frequency increases (or decreases) with gradient-field intensity.

Weight: Approximately 3 lbs. (1.36 kg.).

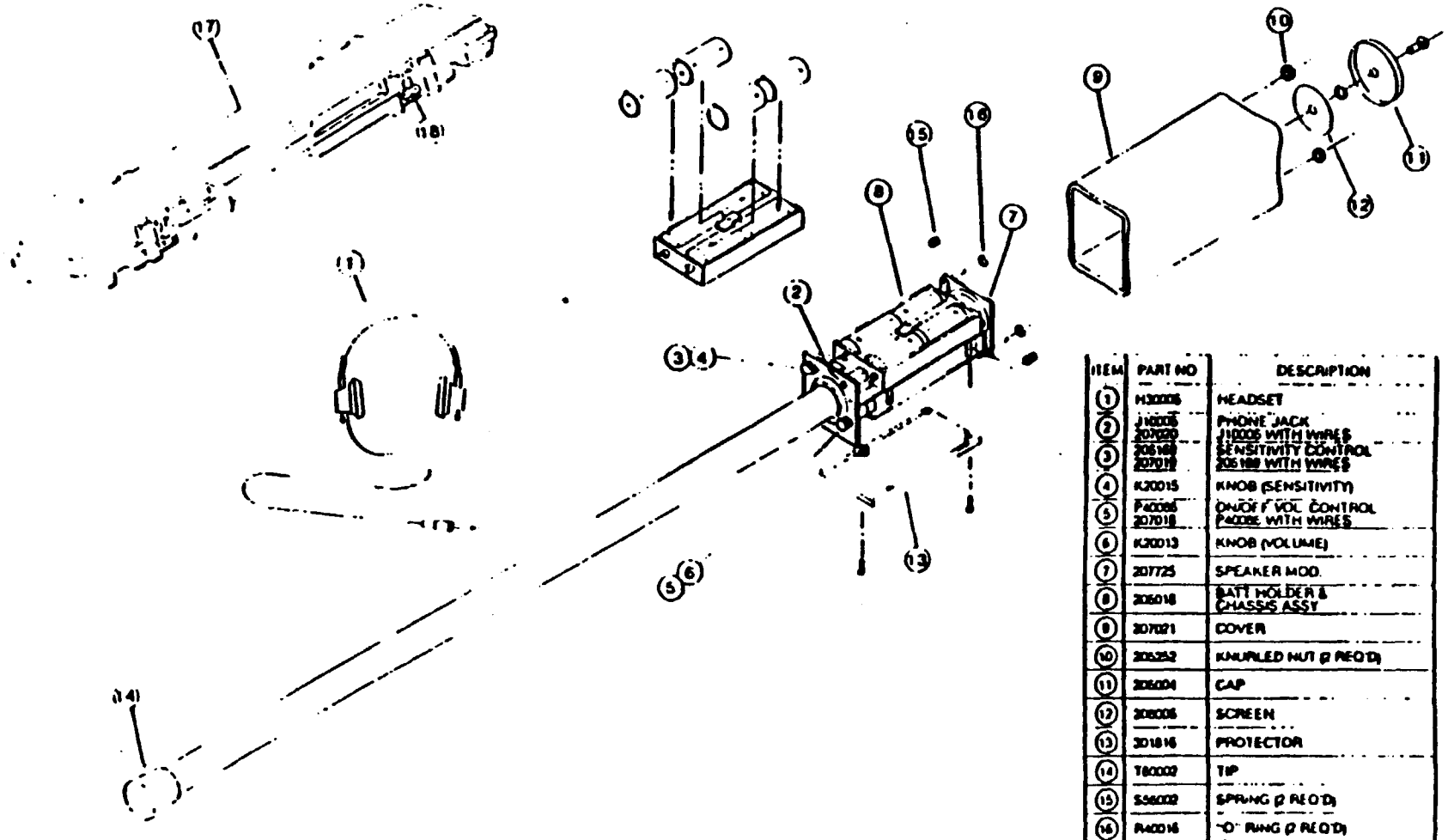
Operating Temperature: 0°F to 120°F (-18°C to 49°C)

Overall Length: 42-5/16 in. (107.4 cm.)
Waterproof Length: 34-1/2 in. (87.6 cm.)
Nominal Sensor Spacing: 20 in. (50.8 cm.)

Construction: Rugged, all solid state.

PATENTS

Manufactured under the following Patents: United States: 2,916,696; 2,981,885; 3,894,283; 3,909,704; 3,961,245; 3,977,072; 4,110,689; 4,161,568; 4,163,877; 4,258,320; 4,388,592 and Design 255552. Canada: 637,963; 673,375; 1,006,915; 1,037,121; 1,141,003 and 1,177,891. Great Britain: 1,446,741; 1,446,742; 1,494,865 and 2,012,4308. France: 2,205,671 and 81 12295. Germany: 25 51 968.0-09; 23 55 630; and 29 01 163. Japan: 1,595,127 and 1,413,844. Other patents pending.



ITEM	PART NO	DESCRIPTION
1	H30006	HEADSET
2	J10006 207000	PHONE JACK J10006 WITH WIRES
3	206168 207018	SENSITIVITY CONTROL 206168 WITH WIRES
4	K20015	KNOB (SENSITIVITY)
5	P40086 207018	ON/OFF VOL. CONTROL P40086 WITH WIRES
6	K20013	KNOB (VOLUME)
7	207725	SPEAKER MOD.
8	206018	BATT HOLDER & CHASSIS ASSY
9	207021	COVER
10	206252	KNURLED NUT (2 REQ'D)
11	206004	CAP
12	206006	SCREEN
13	301816	PROTECTOR
14	T80002	TIP
15	S56002	SPRING (2 REQ'D)
16	R40016	"O" RING (2 REQ'D)
17	208038	INSTRUMENT CASE
18	L56002 1 L56002 2	LATCH LATCH KEEPER

GA-52B REPAIR PARTS

LIMITED WARRANTY

The Schonstedt Instrument Company (Schonstedt) warrants each product of its manufacture to be free from defects in material and workmanship subject to the following terms and conditions. The warranty is effective for one year after shipment by Schonstedt to the original purchaser.

Our obligation under the warranty is limited to servicing or adjusting any product returned to the factory for this purpose and to replacing any defective part thereof. Such product must be returned by the original purchaser, transportation charges prepaid, with proof in writing, to our satisfaction, of the defect. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at cost. Prior to repair in this instance, a cost estimate will be submitted. Service or shipping information will be furnished upon notification of the difficulty encountered. Model and serial numbers must be supplied by user. Batteries are specifically excluded under the warranty.

Schonstedt shall not be liable for any injury to persons or property or for any other special or sequential damages sustained or expenses incurred by reason of the use of any Schonstedt product.

FOR SERVICE OR REPAIR

Please ship locator (in its case to):

Schonstedt Instrument Company
1775 Wiehle Avenue
Reston, VA 22090

1Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-022-05/950
Date: May 1995
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Slug Testing

I. Introduction

This guideline is to provide general reference information on slug testing.

II. Limitations

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

IV. Guidelines

1. Use a slug which displaces over two (2) feet of water in the well.

2. Clean the Hermit data logger transducer and cable, the water level indicator probe and cable, and the slug and line following the standard decontamination procedures. Refer to SOP for Decontamination #MP-FPQA-008.

3. Measure the static water level and depth to the bottom to calculate the water column and compare to the well construction log to determine if the screen is fully saturated. If the screen is fully saturated, both the falling and rising head test data can be interpreted. If the screen is partially saturated, only the rising head test data can be interpreted (Bouwer and Rice, 1989).

4. Record all appropriate data in the field notebook and/or the Slug Test Data Reduction Tracking Sheet.

5. Input the necessary test parameters into the data logger: test number, sampling rate, number of inputs, and type of input. Once set, only the test number is changed for each additional test.

6. Lower the Hermit transducer to a position just above the bottom of the hole. Allow time for the water level to equilibrate.

7. Attach the transducer to the Hermit and check the water level.

8. Input the necessary transducer parameters into the data logger: reference scale, offset, and display. Once set, only the reference is changed for each additional set.

9. Set the slug in the well to a position just above the static water level.

10. Start data logger, wait one (1) second, the quickly lower slug until the top of the slug is below the static water level. Avoid hitting the transducer and cable with the slug.

11. Continue the falling head test until the water level recovers to at least 90% of the initial level.

12. Step the previous test, pull the slug up until it is completely out of the water.

13. Continue the rising head test until the water level recovers to at last 90% of the initial level.

14. Stop the data acquisition program, disassemble and clean the testing equipment.

MALCOLM PIRNIE

D

D

APPENDIX

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APPENDIX D

EQUIPMENT DECONTAMINATION PROCEDURES

SOP MP FPQA-008 Field Decontamination Procedures

300312

Malcolm Pirnie, Inc.
ARCS II QA/QA Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-008-01/95
Date: July 1996
Revision No. 1
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Field Decontamination Procedures

I. Introduction

This guideline is to provide general reference information on field decontamination.

II. Limitations

These limitations apply to all field decontamination activities excepting requirements of project-specific plans for field decontamination.

III. Definitions

The following terminology is applicable to field decontamination.

Decontamination. The process of neutralization, washing, rinsing, and removing contamination from exposed surfaces of equipment to minimize the potential for contaminant migration.

Cross-Contamination. The transfer of contaminants from their known or suspected location into a noncontaminated location.

IV. Guidelines

Effective decontamination procedures are implemented to minimize the potential for cross-contamination and to minimize the potential for off-site contaminant migration (i.e., the transfer of contaminants to areas outside the exclusion zone, usually via improperly decontaminated equipment).

The generalized sequence of routine decontamination procedures for sampling equipment consists of a detergent wash (i.e., high-phosphate Alconox detergent), followed by a nitric acid rinse to remove inorganic contaminants, followed by solvent rinses to remove organic contaminants (i.e., methanol, hexane). If muddy conditions prevail, it is recommended that the equipment be rinsed with tap water into a separate tub prior to the detergent wash. Heavy equipment, such as drill rigs and drilling equipment, are normally steam-cleaned.

Nonroutine decontamination procedures are employed when sampling equipment is visibly contaminated with oily wastes, or when samples are collected for dioxin analyses. When organic oily wastes are suspected on site, it becomes necessary to implement a decontamination procedure that will adequately solubilize and remove the oily waste from contaminated sampling equipment. Consequently, the selection of decontamination solutions is based upon the miscibility of the decontamination solution with the oily contaminants. Finally, nonroutine decontamination procedures are required for all sampling equipment associated

with the collection of samples for dioxin analyses. Whereas the action levels associated with dioxin contamination are very low, extreme care must be taken during the decontamination process to eliminate potential cross-contamination of both the sampling equipment and the samples.

Routine Decontamination Procedures for Sampling Equipment

The following decontamination procedure is applicable for all equipment used to collect routine samples for Target Compound List (TCL) analyses, and when equipment is visibly contaminated with organic oily wastes.

1. Wash and scrub equipment with detergent.
   Alconox and water are generally used.*

2. Rinse with tap water.

3. Rinse with 10 percent nitric acid (HNO_3 redistilled).**

4. Rinse with tap water.

5. Rinse with methanol (pesticide-grade).

6. Rinse with hexane (pesticide-grade).

7. Rinse with analyte-free deionized water.

8. Air-dry.

9. Wrap in aluminum foil, shiny side out, for transport.

* If equipment is muddy, it should first be rinsed with water in a separate tub prior to the detergent and water scrub.

If the equipment is visibly oily, then it is rinsed with methanol, hexane, and methanol again, prior to the detergent and water scrub.

** 1 percent nitric acid must be used when decontaminating equipment composed of carbon steel.

Note: If metals analysis is not required, steps 3 and 4, the nitric acid rinse followed by tap water, may be omitted.

If organics analysis is not required, steps 5 and 6, the first methanol and hexane rinse, may be omitted.

Figure 1 is a flowchart for the above decontamination procedure.

Decontamination Procedures for Equipment Used for Dioxin Sampling

The following decontamination procedure is applicable for all equipment used to collect samples for dioxin analyses or for all equipment used to collect samples for dioxin plus Target Compound List (TCL) analyses.

1. Rigorously scrub equipment with detergent. Alconox and water are generally used. The blenders used for sample homogenization will be filled (one-quarter to one-half full) with Alconox and water and agitated for 30 seconds. If necessary, the blender will be scrubbed with a brush until all visible contamination is removed.

2. Rinse with tap water.

3. Rinse with 10 percent nitric acid (HNO_3 redistilled).*

4. Rinse with tap water.

5. Rinse with methanol (pesticide-grade).

6. Rinse with hexane (pesticide-grade).

7. Rinse with trichloroethane (TCE).

8. Rinse with analyte-free deionized water.

9. Air-dry.

10. Wrap in aluminum foil, shiny side out, for transport.

* 1 percent nitric acid must be used when decontaminating equipment composed of carbon steel.

Note: If metals analysis is not required, steps 3 and 4 can be omitted.

All brushes used during the cleaning process will be rinsed with Alconox and water followed by a water rinse, and drummed with the solid wastes generated during site activities.

Figure 2 is a flowchart for the above decontamination procedure.

Decontamination Procedure of a Pump if Used to Evacuate a Well

The pump must be decontaminated according to the following procedure prior to each use:

1. Alconox soap and water wash.

2. Tap (or potable) water rinse.

3. Pump a minimum of 20 gallons of tap water through the pump.

5. Distilled/deionized water rinse.

Procedure for Decontaminating the Exterior of Sample Containers After Sample Collection

1. Alconox soap and water wash.

2. Tap (or potable) water rinse.

3. Air dry or dry with a paper towel.

V. References

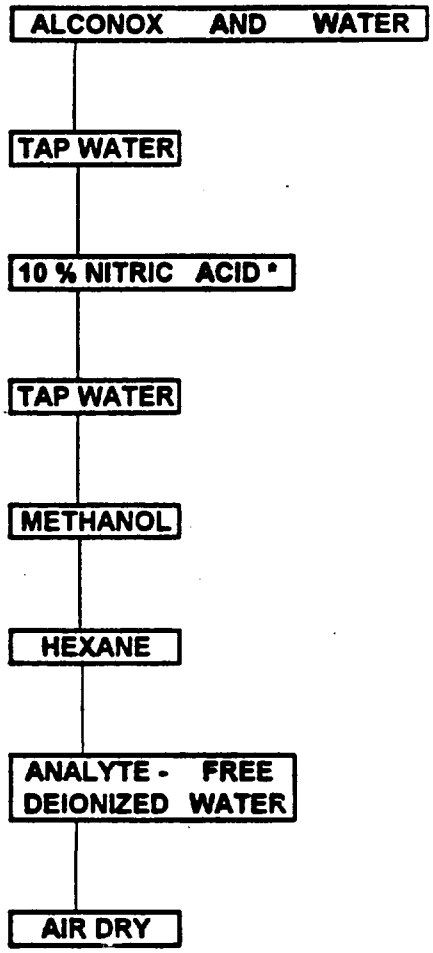
EPA, 1984. Characterization of Hazardous Waste Sites--A Methods Manual, Volume II, Available Sampling Methods. Second Edition. Appendix E: Decontamination Procedures Environmental Monitoring Systems Laboratory, Office of Research and Development. U.S. Environmental Protection Agency, Las Vegas, Nevada. EPA-600/4-84-076 December 1984.

EPA, 1987. A compendium of Superfund Field Operations Methods. Section 3.4: Decontamination, pp 3-19 to 3-21. 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.

U.S. EPA Region II CERCLA Quality Assurance Manual. Part II, Quality Control Handbook for CERCLA Sampling and Analysis, Sections V and VI. October 1989, Revision 1.

FIGURE 1

DECONTAMINATION PROCEDURES FOR SAMPLING EQUIPMENT FOR TCL AND TAL SAMPLING



* For sampling equipment made of carbon steel, 1 percent nitric acid must be used instead of 10 percent nitric acid.

Notes:

If the equipment is muddy, it should be rinsed with water in a separate tub prior to the Alconox and water scrub.

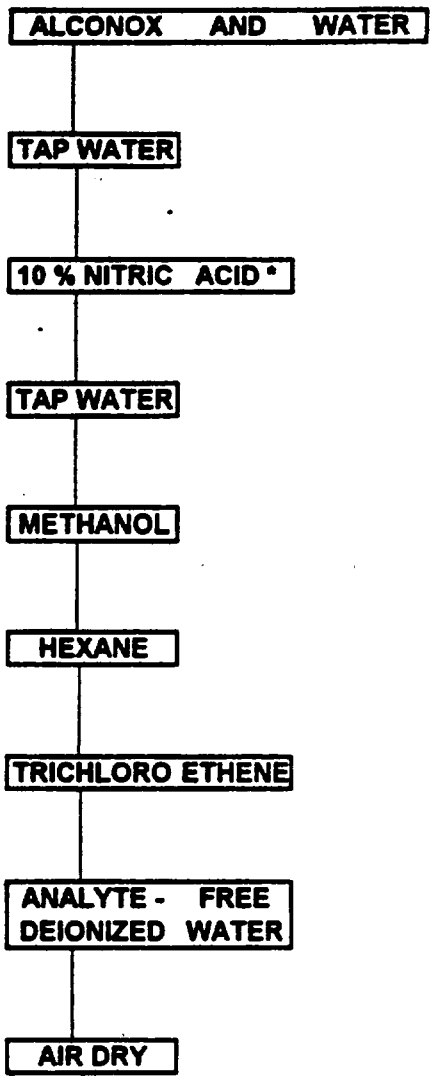
If the equipment is visibly oily, it should be rinsed with methanol, hexane, and methanol again, prior to the detergent and water scrub.

If metals analysis is not required, the nitric acid rinse followed by tap water may be omitted.

If organics analysis is not required, the methanol and hexane rinses may be omitted.

FIGURE 2

DECONTAMINATION PROCEDURES
FOR SAMPLING EQUIPMENT FOR
DIOXIN SAMPLING



* For sampling equipment made of carbon steel, 1 percent nitric acid must be used instead of 10 percent nitric acid.

Notes:

For Blenders: Fill the blender one-quarter to one-half full with Alconox and water, agitate for thirty seconds. If necessary, scrub with a brush to remove visible contaminants.

All brushes used during the cleaning process will be rinsed with Alconox and water followed by a water rinse, and drummed with the solid wastes generated during site activities.

If metals analysis is not required, the nitric acid rinse followed by tap water may be omitted.

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APPENDIX

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CYCLED PAPER

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-016-01/95
Date: July 1996
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure to Conduct Sample Management for RAS and non-RAS Sampling

I. Introduction

This guideline is to provide general reference information on sample management procedures.

II. Limitations

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

III. 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 125 organic compounds. The list is broken into three subdivisions: volatiles, semi-volatiles and pesticide/PCBs.

Target Analyte List (TAL). It is a list of chemical substances consisting of 23 inorganic compounds and cyanide.

Routine Analytical Services (RAS). Laboratory analysis for substances or parameters shown on the TCL and TAL in solid and aqueous samples.

Delivery of non-RAS. Laboratory analysis for substances or parameters not shown on the TCL and TAL. 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 environmental samples 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 organic TCL compounds are added to environmental samples prior to extraction. The sample is split into duplicates and analyzed. The analysis is used to evaluate the matrix effect of the sample upon the analytical methodology. Triple volume of aqueous samples for MS/MSD analysis is collected in the field, at a frequency of at least 5 percent per matrix/concentration. No extra volume is required for the soil samples.

Matrix Spike/Matrix Duplicates (MS/MD). The spike analysis is the process by which standard mixes of various inorganic TAL compounds are added to environmental samples prior to digestion. The analysis is used to evaluate the matrix effect of the sample upon the analytical methodology. The duplicate analysis in the process where the assigned sample is split in two and analyzed at the laboratory. The analysis is an indicator of a laboratories analytical precision based on each sample matrix. Double volume of aqueous samples for MS/MD analysis is collected in the field, at a frequency of at least 5 percent per matrix/concentration. No extra volume is required for soil samples.

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.

IV. 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 Delivery of non-RAS)

Non-RAS sampling requests include substances or parameters not shown on the TCL and TAL. All non-RAS requests should be approved and solicited through the ARCS II Operations Manager in White Plains.

Request for Routine Analytical Services (RAS)

RAS sampling requests include low- and medium-concentration aqueous and soil/sediment samples for TCL and TAL analysis.

RAS CLP analytical programs are defined below:

- Inorganic analysis - Total Metals, Cyanide, or both (35 day turnaround)
- Organic analysis - Volatile Organics (VOA), Base/Neutral/Acid Extractables (BNAs), Pesticide/PCBs, or any combination of these (35 day turnaround)
- Inorganic analysis - Total Metals, Cyanide, or both - fast turnaround (14 days)
- Organic analysis - Volatile Organics (VOA), Base/Neutral/Acid Extractables (BNAs), Pesticide/PCBs, or any combination of these - fast turnaround (14 days)

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 unique Case Number for each sampling project occurring at one site over a specific scheduled time period.

RAS Sampling Requests

In anticipation of a sampling episode, RAS sampling requests are to be made using a CLP Data Management Request Sheet (see Attachment A), or by contacting the Malcolm Pirnie, Inc., Regional Sample Control Center (MPI-RSCC) Coordinator, located in the Central New Jersey (CNJ) Office, by 4 pm the Monday prior to the week of the scheduled sampling event.

The MPI-RSCC Coordinator will fill in a Laboratory Booking Job Tracking (LBJT) form (see Attachment A) and forward, via FAX, to the EPA Management Monitoring Branch (MMB) contact, who will send this request out for laboratory solicitation. When laboratories are solicited, a Case Number is assigned. The Case Number and Laboratory names assigned are sent to the MPI-RSCC Coordinator, who will then forward them to the person who initiated the RAS request.

Note: At times, the EPA-ESD Laboratory will choose to perform all or part of the analysis requested. If the EPA-ESD laboratory is procured, in addition to following this SOP, the special instructions under the Documentation section of this SOP must be followed.

At the time of the RAS request the MPI RSCC Coordinator will also assign CLP Sample Numbers (one to each sample being analyzed for TCL and/or one for TAL) and provide you with all the necessary paperwork. Bottle labels and sample tags may also be generated on the computer, by the MPI-RSCC Coordinator, if requested.

Sample Containers

- All sample containers must be cleaned and prepared in accordance with OSWER Directive #9240.05A, December 1992, "Specifications and Guidance for obtaining Contaminant Free Sample Containers."

- Malcolm Pirnie will purchase certified clean, certified sample containers from an approved supplier. Copies of these certifications will be brought to the site while sampling and then kept in site files for future reference.

- Each bottle used to collect a sample must be identified by a supplier and lot number, to ensure that it is permanently associated with the sample collected in that particular container. The Bottle Lot Number form must be filled out and accompany the bottle certification sheets (see Attachment A). This procedure also applies to 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 certification paperwork 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 Container Preparation

Prior to commencement of a sampling episode the proper containers, labels, and samples (environmental and QA/QC) must be prepared. The types of samples to be collected will be the basis for determining the method of sample preparation.

Sample Labels

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

1. Sample number: This is the MPI-designated sample number. It is associated with the sample source location on a site map.
2. The assigned CLP Number.
3. Date: Indicate the month, day, and year the sample was collected.
4. The type of analysis requested.
5. The type of preservation performed in the field.

All information recorded should be printed on labels using indelible (waterproof) ink. Clear, acetate tape must be applied over all labeling to maintain label integrity during decontamination procedures.

Sample Tags

A sample tag must accompany each sample container. Information provided on the sample tag must include the following:

1. Project Code
2. Sample Number (Station No.): This is the MPI-designated sample number. It is associated with the sample source location on a site map.
3. Date: Indicate the month, day, and year the sample was collected.
4. Type of Sample: Grab/Composite; Water, soil or sediment.
5. Station Location (optional) - more detailed description of the sample location.
6. Samplers Signature
7. The type of analysis requested.
8. The type of preservation performed in the field.
9. The Case Number
10. The organic or inorganic CLP Number assigned, whichever is applicable.
11. A sample Tag Number (this is preprinted on each tag).

Note: The sample containers can be labeled and much of the sample tag information can be filled out prior to the sampling event, saving time during the actual field event.

QA/QC Samples

Trip Blanks

- One trip blank is required for each day that aqueous environmental samples are collected for volatile analysis.
- Trip blanks are only necessary for aqueous environmental samples. If rinsates are the only aqueous samples collected, then a trip blank is not necessary.
- Trip blanks consist of two 40 mL septum vials into which 4-5 drops of 1:1 hydrochloric acid (HCl) is introduced prior to filling them with demonstrated analyte-free water.
- Trip blanks are prepared in, and carried to, the field where aqueous sampling occurs.
- Trip blanks are treated as separate aqueous samples and the appropriate paperwork must be completed. The trip blank is described as No. 4 "Rinsate" in Column A of the Organic Traffic Report/Chain-of-Custody (OTR/COC) and the words "trip blank" should appear in Column K (see Attachment A - OTR/COC).
- The trip blank must be stored away from solvents and must be preserved, packaged, cooled to 4-6°C and shipped to the laboratory with the other aqueous samples.

Rinsate Blanks

- 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.

- 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.

- 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) containers.

- The rinsate blank is described as No. 4 "Rinsate" in Column A or the Organic and Inorganic Traffic Report/Chain-of-Custody (OTR/COC and ITR/COC). The type of equipment that is rinsed is written in Column K on both the OTR/COC and ITR/COC (see Attachment A - ITR/COC).

- Rinsate blanks are preserved, packaged, and shipped in the same manner as low concentration aqueous environmental samples.

Environmental Duplicates

- Samples for duplicate analysis are collected in the field, for each matrix sampled at a frequency of a minimum of 1 in 20 samples per matrix.

- 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.

- The volatile organic fraction is collected first for the aqueous environmental sample and then the duplicate sample, next the extractable organic fraction is collected in the same order, followed by the inorganic fraction, then the Cyanide fraction (if applicable).

  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 homogenized prior to collecting the fraction for extractable organic analysis and then the fraction for inorganic analysis (including cyanide if applicable). Separate bowls should be used to collect the environmental sample and the environmental duplicate.

- The collected samples are preserved, packaged and shipped to the lab as separate samples for analysis. The word "Duplicate" should be written in Column K of the OTR/COC and ITR/COC.

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

- 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.

- Additional volume must be collected from the same sample location for the aqueous samples. No extra volume is required for the soil samples. The additional volume is shipped to the lab using the same CLP numbers.

  Three times the total volume is necessary for collection of aqueous MS/MSD organic samples. Two times the total volume is necessary for collection of aqueous inorganic MS/MD samples. The sample containers are filled in the following order: VOA vials, BNA/Pest./PCB bottles, total metals and Cyanide (if applicable). No extra volume is needed for soil samples.

- The MS/MSD and/or MS/MD samples are noted on the OTR/COC and ITR/COC in Column K and also in a box labeled "Sample used for a spike and/or duplicate".

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 (RAS and non-RAS)

1. Decontaminate and air or towel dry the outside of the sample containers (Alconox and tap water rinse). Make sure the caps are tightly sealed prior to decontamination.

2. Preserve the samples according to the SOP for Sample Preservation #MP-FPQA-021.

3. Apply one custody seal (Attachment A) around the circumference of the container or over the cap and onto the sides of the container. The custody seal must applied to sample containers in such a manner as to reveal if the container was opened during transit.

   Note: Septum vials should not be covered over the top.

4. Place each container in its own ziplock bag. The two 40 ml vials may be placed in one bag with extra air space eliminated.

5. Place the associated sample tag into the ziplock bag and seal.

6. Segregate organic and inorganic fractions of samples. Do not split samples, other than separating organic and inorganic fractions, into separate coolers.

7. Put 1-2 inches of vermiculite in the bottom of the coolers, then place the samples into the cooler.

8. Surround the sample bottles with bags of ice or packets of "blue ice" to ensure that the proper temperature (4-6°C) is achieved and maintained during transport. It is not acceptable to place bags of ice only around the necks of the bottles, or to use only a few bags of ice or packets of "blue ice" since this technique does not ensure the attainment of the proper temperature.

9. 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.

10. 1-10 samples may be written on each Traffic Report/Chain of Custody (TR/COC). Many times these forms can be partially completed in the office. If more than one TR/COC form is necessary than number them 1 of 2, 2 of 2 etc. Complete all the TR/COC's.

11. 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 that has the airbill attached to it. Retain the remaining paperwork to send to the MPI-RSCC Coordinator.

12. When all paper work is filled out and the samples packed in their respective coolers, recheck documentation with the site manager.

13. Fill the cooler with vermiculite and secure the containers from movement within the coolers. Use strapping tape on each side of the cooler to seal the container for shipping.

14. 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. 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 applied to coolers in such a manner as to reveal if the container was opened during transit.

15. If more than one cooler is being sent to one destination, label each cooler 1 of 2, 2 of 2, etc.

16. Fill out RAS Sample Shipping Call-In Form (Attachment A). Call or FAX the shipping information to the MPI-RSCC Coordinator (609-860-0100, FAX# 609-860-0250), by 4:30 pm or by 9:00 am the following morning.

    Note: If the MPI-RSCC Coordinator cannot be reached by 9 am the following morning, the samples can be called in directly to Dynacorp - CLASS at (703) 519-1471.

17. Send all remaining paperwork to MPI-RSCC Coordinator for proper distribution.

    Note: 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 (TR/COC)

Traffic Reports (TR's)

The Sample Management Office provides preprinted traffic reports (TR's) to track the shipment of samples through the CLP. For RAS, multisample traffic reports are used. Multisample TR's reference CLP analytical fractions, not sample containers and volumes, and may be used to document the shipment of 1 to 10 samples under one Case Number.

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, one surface water sample to be analyzed for full TCL/TAL 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 CLP sample numbers are assigned for each sample by the MPI-RSCC Coordinator, at the time of the RAS Request. 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 begin with the letters "MB", then are assigned two more letters and two numbers.

- Sample number for organic analysis for Region 2 begin with the letter "B", then are assigned two more letters and two number.

Note: These sample numbers must never apply to more than one sample being sent for organic and inorganic analysis. Unused portions of labels must be destroyed and not reused.

Chain-of-Custody (COC)

Custody of a sample is defined by the following:

- It is in your possession, or

- It is in your view, after being in your possession, or

- It was in your possession, and you locked it up, or

- It is in a designated secure area.

Each person involved with the sample must know COC 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, COC procedures are followed.

The COC records must be prepared as the sample containers are being packaged for shipping. 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 COC record used by Region 2 is part of the Traffic Report (TR) and is serialized.

Note: Explicit instructions for filling out the TR/COC's are located on the reverse side of each form.

Special Instructions

EPA-ESD Laboratory

If the EPA-ESD Laboratory is performing the analysis, the TR/COC will act only as a COC. A Field Data Sheet must accompany each sample along with the COC paperwork (see Attachment A).

The "Lab Number" on the Field Data Sheet must appear on the TR/COC, next to the assigned CLP Number.

The Gold (or bottom copy) of the field data sheet is kept by the field Sample Management Officer (SMO) and the rest of the copies are to be sent to the EPA-ESD Laboratory along with the samples.

Distribution of Documentation

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

Laboratory

- Bottom 2 copies of TR/COC's

Site Manager for Project File

- 1 xerox copy of all the TR/COC's
- The original airbill receipts
- Bottle Lot Number Form and Bottle Certifications
- The original copy of the Sampling Trip Report (refer to the SOP for Preparation of the Sampling Trip Report #MP-FPQA-012).

MPI-RSCC Coordinator

- Top 2 copies of the TR/COC
- Two copies of the Sampling Trip Report
- Any extra unused CLP labels and paperwork
- A copy of the Bottle Lot Number Form

MPI-RSCC to Distribute To:

RSCC/ESAT Lockheed Environmental Systems

- 2nd page of all the Organic and Inorganic TR/COC's

Dynacorp. - CLASS

- Top copy of the Inorganic and Organic TR/COC
- A copy of the Sampling Trip Report

MPI-RSCC Files

- Sample Trip Report
- Copy of all TR/COC's
- Extra Labels and Paperwork
- Bottle Lot Number Form

V. 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. OLM01.2, Revision OLM01.9 December 1993.

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. ILM03.0, December 1993.

ATTACHMENT A

300333

ARCS Contract# 68-W9-0051

CONTRACT LABORATORY PROGRAM DATA MANAGEMENT REQUEST SHEET

(Shaded Areas for MPI-RSCC Use Only)

Site Name: _____
Site Location: _____
Job Number: _____
CERCLIS #: _____ SSID# _____
Date Requested: _____
Proposed Sampling Date(s): _____
Proposed Shipping Date: _____

Actual Start Date: _____
Actual Completion Date: _____

SM/FTL: _____ _____

Turnaround Time:
Routine _____ Fast _____ # of days _____

Case Number: _____

SAS Number: _____

Laboratories:

Organic: _____

Inorganic: _____

SAS/Other: _____
_____
_____

ROUTINE ANALYTICAL SERVICES (RAS)

SAMPLE TYPE		ORGANICS						INORGANICS					
		Full TCL Organics		VOA Only		Other		TAL Only		TAL + Cyanide		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: _____

U.S. EPA REGION II RSCC
LABORATORY BOOKING AND JOB TRACKING

DATE: _____ RSCC Task Monitor: _____ CASE: _____
SAS CLIENT REQ.#: _____ Philip Guarraia
SENT TO SMO: _____ SAS: _____
SENT TO CONTRACTOR: _____
CANCELLED: _____ LAB: _____

SITE: _____ PROPOSED SAMPLING PERIOD: _____

CONTRACTOR: _____ CONTRACTOR CODE: _____

SITE SPILL #: _____ PHASE: _____ LOCATION: _____

SITE MGR./PHONE #: _____

CERCLIS ID #: _____ RCRA CASE? Y/N _____

UNIQUE ID	#	MATRIX	ANALYSIS	LABORATORY	

ACTUAL SAMPLING & LAST SHIP DATES: _____

DATA ENTRY 1: _____

PAPERWORK RECEIVED: _____

DATA PACKAGE REC'D: (1) _____ (2) _____ (3) _____ FROM LABORATORY

NUMBER CT1 CT2 MATRIX

_____ ROC PREP'D: _____

_____ SENT TO DCR: _____

_____ DATA ENTRY 2: _____

DATA PACKAGE REC'D: _____ FOLLOWING REVIEW

PHOTOCOPY/HIGHLIGHT: _____ _____

2-WAY TRANSMITTAL: _____ _____

TEAM MANAGER (or designee): _____
FINAL APPROVAL

BOX NO.: _____ DATA ENTRY 3: _____

_____

300334

300335

BOTTLE LOT NUMBER FORM

SITE NAME _____ DATE _____

PROJECTED SAMPLING DATE _____

PROJECT JOB # _____ SIGNATURE _____

ARCS Contract# 68-W9-0051

Sample Number	# of 8 oz. jars	Supplier/ Lot #	# of 40 mL vials	Supplier/ Lot #	# of 80 oz. bottles	Supplier/ Lot #	# of 1L Poly bottles	Supplier/ Lot #	Specify other/ Lot #

RINSATE WATER LOT No(s).: _____

DECON LOT No(s).: _____

circle one:

[illegible]-I-[illegible]M EP= [illegible]GLE [illegible]ICH[illegible] OTHE[illegible]

APPENDIX E

SAMPLE HANDLING PROCEDURES

SOP MP FPQA-016 - Sample Management

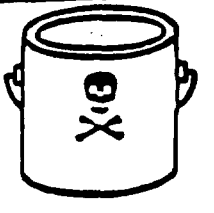
SOP MP FPQA-021 - Sample Preservation

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*)	1 GALLON	4 x 32-OZ. WIDE-MOUTH GLASS JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL*)	80 ML	2 x 40-ML GLASS VIALS

SOIL/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 JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL*)	240 ML	2 x 120-ML WIDE-MOUTH GLASS VIALS

*ALL 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	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
CYANIDE (CN^-) ANALYSIS (LOW LEVEL)	1 LITER	1 x 1-LITER POLYETHYLENE BOTTLE OR 2 x 500 ML POLYETHYLENE BOTTLE
CYANIDE (CN^-) ANALYSIS (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

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

300338

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY OFFICIAL SAMPLE SEAL	SAMPLE NO.	DATE	SEAL BROKEN BY	DATE
	SIGNATURE			
	PRINT NAME AND TITLE *(Inspector, Analyst or Technician)*			

EPA FORM 7560-2 (R7-75)

Designate	Grab	Type ☐ Water ☐ Soil ☐ Sed	Preservation
	Comp.	Samplers (Signatures)	ANALYSES
Time			BOD
			Solids (TSS) (TDS) (SS)
			COD,TOC, Nutrients
			Full TAL
			Metals
			Mercury
Month/Day/Year			Cyanide
			Cyanide Amenable
			Full TCL
		Station Location	Volatile Organics
			BNA
Station No.			Pesticides/PCBs
			Remarks:
			Case No:
			SAS No:
Project Code			CLP Sample No:
		Tag No. 05378	Lab Sample No.

300339

300340

EPA

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

Inor[illegible]c Traffic Report & Chain of Custody Record

(For Inorganic CLP Analysis)

SAS No. (if applicable)

Case No.

1. Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier

Regional Information

Sampler (Name)

Airbill Number

Non-Superfund Program

Sampler Signature

5. Ship To

Site Name

City, State.

Site Spill ID

3. Type of Activity

Lead		Pre-Remedial		Remedial		Removal	
SF	☐			RIFS	☐	CLEM	☐
PRP	☐	PA	☐	RD	☐	REMA	☐
ST	☐	SSI	☐	RA	☐	REM	☐
FED	☐	LSI	☐	O&M	☐	OIL	☐
				NPLD	☐	UST	☐

ATTN:

6. Preservative (Enter in Column D)
1. HCl
2. HNO3
3. NaOH
4. H_2SO_4
5. $K_2CR_2O_7$
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. Rinsate
5. Soil/Sediment
6. Oil (High only)
7. Waste (High only)
8. Other (Specify)

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: Metals: Total	Metals: Dissolved	Cyanide	Low Conc. only: Nitrate/Nitrite	Low Conc. only: Fluoride	High only: pH	High only: Conductivity	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 (R = Blank S = Spike D = Duplicate PE = Perform. Eval. — = Not a QC Sample)

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

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	

Split Samples ☐ Accepted (Signature)
☐ Declined

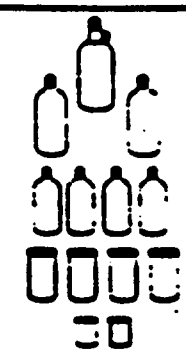
EPA Form 9110-1 (Rev. 5-91) Replaces EPA Form (2075-9), previous edition which may be used

DISTRIBUTION

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 Analytes (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 Analytes (Medium Level*)	1 Gallon	32-oz. Wide-Mouth Glass Jar
Volatile Analytes (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

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

*Vial VOA Vials under study, subject to change, check to ensure proper sizing.

HIGH CONCENTRATION SAMPLE COLLECTION REQUIREMENTS

Liquid or Solid Samples	Required Volume	Container Type
Extractable and Volatile Analytes	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

300342

EPA

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

(anic Traffic Report & Chain of Custody Record

(For Organic CLP Analysis)

SAS No. (if applicable)

Case N

1. Project Code	Account Code	2. Region No.	Sampling Co.	4. Date Shipped	Carrier
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			ATTN:	

3. Type of Activity

Lead		Pre-Remedial		Remedial		Removal	
SF	☐			RIFS	☐	CLEM	☐
PRP	☐	PA	☐	RD	☐	REMA	☐
ST	☐	SSI	☐	RA	☐	REM	☐
FED	☐	LSI	☐	O&M	☐	OIL	☐
				NPLD	☐	UST	☐

6. Preservative (Enter in Column D)
1. HCl
2. HNO3
3. $NaHSO_4$
4. H_2SO_4
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)

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 VOA	BNA	Pest/PCB	High only ARO/TOX	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 = Spike D = Duplicate PE = Perform. Eval. — = Not a QC Sample)

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

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	

Split Samples ☐ Accepted (Signature)
☐ Declined

EPA Form 9110-2 (Rev. 5-91) Replaces EPA Form (2075-7), previous edition which may be used

DISTRI[illegible]N:
Blu[illegible] Pink [illegible] Cop[illegible] White - [illegible] Copy [illegible] Return [illegible] - Lab

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 Jar

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 HNO_3 to pH ≤ 2.
Dissolved metals	Preserve with HNO_3 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

  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

300344

EPA

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
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				

3. Type of Activity

Lead		Pre-Remedial		Remedial		Removal	
SF				RIFS		CLEM	
PRP		PA		RD		REMA	
ST		SSI		RA		REM	
FED		LSI		O&M		OIL	
				NPLD		UST	

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_2SO_4
5. NaOH
6. Other (Specify)
7. Ice only
N. Not preserved

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

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	

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

NOTIFICATION OF SAMPLE SHIPMENT

Site Name: _____

Case No. _____ Caller's Name V. Smith Phone # (609) 860-0100

SAS No. _____ Date of Call / / Region USEPA Region II

Lab Name	Type of Analysis	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 V. Smith Phone # (609) 860-0100

SAS No. _____ Date of Call / / Region USEPA Region II

Lab Name	Type of Analysis	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: _____

FACSIMILE TRANSMITTAL	Number of pages: 1
To:	From:
Co.:	Co.:
Phone #	Phone #
Fax #	Fax #

300346

FIELD DATA SHEET

ENVIRONMENTAL PROTECTION AGENCY - Region II. Edison. New Jersey

ENVIRONMENTAL SERVICES DIVISION

Project Name _____

Collector(s) _____ Affiliation _____

SAMPLING METHOD (Circle)

Kemmerer Dredge Ponar Manual
Niskin Net Seine Trawl Bucket
Trowel Cream Dipper
Automatic
Other _____

LDMS CODE _____

DATA BASE CODE _____

STA. TYPE CODE _____

SUBSTRATE TYPE (Circle) Aqueous Sediment Sludge Oil Biological
Solvent Extract Other ( )

BOD — Seed Supplied ☐ Yes ☐ No Source:

Sample Preparation (Circle)		Sample Source Type (Circle)	
Container	Cleaning Procedure	Landfill	Industrial
Glass Jar	Detergent Wash	Leachate	Effluent
Plastic Jar	Water Rinse	Drum	Process Stream
Metal	Acid Rinse	Test Well	Holding Pond
POA Vial	Solvent Rinse:	Depth:	Drum
Cubitainer	Acetone	Other: _____	Waste Pile
Acetate Core	Hexane		Municipal Treatment
Paper Cap	Methylene Chloride	Storage Tank	Influent
Teflon Cap	Other (Specify):	Top	Effluent-Cl
Foil Cap		Middle	Effluent-Non Cl
Other _____		Bottom	Sludge
		Truck	Ambient
Preservation		Drum	Lake
Acid _____		Tank	Stream
Solvent _____		Other _____	Pond
Chemical _____			Ocean
Wet Ice		Wells	Estuary
Dry Ice		Monitoring	
Ambient		Production	
Other _____		Drinking	
		Private	

Sample Location Description:

Remarks:

Samples to:

Bact	Bio	Chem	Other

Station No.

Sample Depth (Ft.)/Fac. Loc. Code

Lab Number

096863

Type of Sample

Grab	Composite	
	Time	Space

Collection (Ending) Date

Yr	Mo	Day

Ending Time (24 Hr)

Beginning Date

Yr	Mo	Day

Beginning Time (24 Hr)

pH

Sample Temp. (°C)

DO (mg/l)

Cond. (uMHOS/CM)

Salinity(‰)

Sample Split

☐ Yes ☐ No

If Yes With Whom?

Receipt ☐ Yes ☐ No

Form: FTS RPD-11-83-2

300347

Malcolm Pirnie, Inc.
ARCS II QA/QC Field Procedures
Standard Operating Procedure

Procedure #MP-FPQA-021-01/95
Date: January 1995
Revision No. 0
Prepared by: Valerie Smith
Approved by: Alan Greenlaw

Title: Procedure for Sample Preservation

I. Introduction

This guideline is to provide general reference information on the accepted methods of sample preservation.

II. Limitations

The scope of these guidelines applies to all routine methods of sample preservation. Project-specific plans may contain specific requirements for sample preservation.

III. Materials

Preservatives:

a. 1:1 HCl - (Hydrochloric Acid/Deionized Water)
b. HNO_3 - full strength (Nitric Acid)
c. NaOH - 10 N (Sodium Hydroxide)
d. H_2SO_4 - 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. Clear wide mouth glass jar for water pipette
f. Paper towels
g. Lead acetate paper
h. Cadmium nitrate or cadmium carbonate (if using lead acetate paper)
i. Potassium iodide - starch test paper (KI-starch paper)
j. Ascorbic Acid (if using KI starch paper)
k. Filter paper
l. Filter funnels (disposable or decontaminated)
m. Filter vessel with hand pump
n. pH paper

Safety Materials:

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

IV. 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.

V. Guidelines

The following procedures have been developed for preserving aqueous samples for volatile organic and inorganic analyses.:

Volatile Organic Analysis (VOA) Preservation

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

1. One 40-mL VOA vial containing 1:1 HCl.

   The 1:1 HCl should be transferred on site from a 1-liter plastic-coated glass bottle to one properly labeled 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.

2. 40-mL VOA test vial for each aqueous sample to be collected.
3. Plastic ziplock bag containing pH indicator strips for each sampling location.
4. Latex gloves
5. Eye protection
6. Plastic ziplock bag for disposal of used pH indicator strips and latex gloves.

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 <u>not</u> 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 Sample Management Officer (SMO) must be informed which samples are collected without acidification. The field SMO must document the samples as "N" (not preserved) in Column D 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 document as "N" (not preserved), "pH < 2" in Column D 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 1:1 HCl from the 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.:

- Effervescing
- Color development
- Precipitative reactions
- 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 1:1 HCl a few drops at a time (keeping count) 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 1:1 HCl a few drops at a time (keeping count) until the pH falls below 2.0. Proceed to the next step.

6. Note the amount of 1:1 HCl added to the test vial. Add this amount of 1:1 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 1:1 HCl added to each sample. These samples are then packaged and cooled to 4°C prior to shipping to the CLP laboratory.

4. Store the samples at 4°C until the time of analysis.

NOTE: This procedure must be performed at each sample location.

Inorganic Preservation

For low level inorganic aqueous 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 aqueous 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 aqueous samples.

Metals (total (unfiltered) and filtered) Preservation

1. For "total" metals analysis ("Total" meaning inclusion of particulate and dissolved (filtered) fractions) add HNO^3 using a pipet, next recap the sample bottle and turn it gently upside down to mix the contents.

   For dissolved (filtered) metals analysis, the sample is filtered in the field, then HNO^3 is added using a pipet, next recap the sample bottle and turn it gently upside down to mix the contents.

2. Check the pH of the sample bottle by pouring an aliquot of the sample over the pH paper and not by dipping pH paper directly into the sample. The pH of the sample should be < 2.

   Note: If the sample contains a significant particulate fraction, acidification without filtration could result in deceptively high metal values for the aqueous sample. Varying amounts of particulate matter can also give large differences in metal values for duplicate acidified aqueous samples. Observation, therefore, should be made and recorded in the field logbook and also inserted in the Sampling Trip Report. If an obvious change is observed during sample preservation, which may bias the results, the SQAO should be consulted.

3. If the pH is still > 2, repeat steps 1 and 2 until the pH is < 2.

4. Store the samples at 4°C until the time of analysis.

The following procedure has been developed for preserving aqueous samples for cyanide analysis.:

Cyanide Preservation

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 Sulfide. If Sulfide 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 approximately 2 mL of NaOH per liter of sample to a pH > 12, for stabilization, follow steps 1 through 3 of the Metals preservation (refer to pp. 4 and 5 of this SOP) using NaOH instead of HNO_3.

3. Store the samples at 4°C until the time of analysis.

No chemical preservation is required for medium level aqueous 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 aqueous 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.

The following procedure has been developed for preserving aqueous samples using sulfuric acid (H_2SO_4).:

Using H_2SO_4

1. Follow the Metals Preservation procedure (refer to pp. 4 and 5 of this SOP) using H_2SO_4 instaed of HNO_3.

The following procedure has been developed for preserving aqueous samples for Semi-Volatile and Pesticide/PCB analysis.:

Semi-Volatiles and Pesticide/PCBs

1. Semi-Volatiles (BNAE's) and Pesticide/PCB samples must be cooled to 4°C. Ice must be placed in double ziplock backs 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

Measurements	Min. Vol. Req. (mL)	Containers[1]	Preservatives	Holding Time[2]
Physical Properties				
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.
Dissolved	200	P,G	Filter on site HNO_3 to pH <2	6 mos.
Suspended	200	P,G	Filter on site	6 mos.
Total	100	P,G	HNO_3 to pH < 2	6 mos.
Chromium^{+6}	200	P,G	Cool, 4°C	24 hrs.

(1) P = plastic; G = glass
(2) Holding time is from the date of sample collection

Recommendation for Sampling and Preservation of Samples According to Measurement

Measurements	Min. Vol. Req. (mL)	Containers[1]	Preservatives	Holding Time[2]
Mercury dissolved	100	P,G	Filter HNO_3 to pH < 2	28 days
Total	100	P,G	HNO_3 to pH < 2	28 days
Inorganics, Non Metallics				
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	14 days
Fluoride	300	P,G	None Req.	28 days
Iodide	100	P,G	Cool, 4°C	24 hrs.
Ammonia Nitrogen	400	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Kjeldahl, Total	500	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Nitrate plus Nitrite	100	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Nitrate	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
Winkler	300	G bottle/top	Fix on site and store in dark	8 hrs.

(1) P = plastic; G = glass
(2) Holding time is from the date of sample collection

Recommendation for Sampling and Preservation of Samples According to Measurement

Measurements	Min. Vol. Req. (mL)	Containers[1]	Preservatives	Holding Time[2]
Phosphorus				
Ortho-phosphate, Dissolved	50	P,G	Filter on Site, Cool, 4°C	48 hrs.
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Total	50	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Total, Dissolved	50	P,G	Filter on Site Cool, 4°C H_2SO_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
Organics				
BOD	1000	P,G	Cool, 4°C	48 hrs.
COD	50	P,G	Cool, 4°C H_2SO_4 to pH < 2	28 days
Oil and Grease	1000	G only	Cool, 4°C H_2SO_4 to pH < 2	28 days
Organic Carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH < 2	28 days
Phenolics	500	G only	Cool, 4°C H_2SO_4 to pH < 2	28 days
MBAS	250	P,G	Cool, 4°C	48 hrs.
NTA	50	P,G	Cool, 4°C	24 hrs.

(1) P = plastic; G = glass
(2) Holding time is from the date of sample collection