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PREPARED FOR

I. SHULMAN and SON INC.
ELMIRA, NEW YORK

MODIFIED WORK PLAN

REMEDIAL INVESTIGATION/ FEASIBILTY STUDY

AFI
ENVIRONMENTAL

6103 Robinson Road
Lockport, New York 14094
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WORK PLAN

FOR

REMEDIAL INVESTIGATIONS/ FEASIBILITY STUDY

I. SHULMAN & SON INC.
Elmira, New York

FEBRUARY 1990

AFI ENVIRONMENTAL
6103 Robinson Road
Lockport, New York 14094

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1.0 INTRODUCTION

1.1 PURPOSE OF REMEDIAL INVESTIGATION WORK PLAN AND CONCEPTUAL FEASIBILITY STUDY

The purpose of this Remedial Investigation Work Plan and Conceptual Feasibility Study is to present a cost effective approach based primarily on existing data to identify the following:

a. The site specific remedial response objectives,
b. Applicable remedial technologies, and
c. The procedures needed to collect sufficient data to adequately evaluate the remedial action alternatives.

This approach leads to concurrent performances of the RI and FS portions of the report so that the FS data can be continuously evaluated and, if required, the RI activities modified accordingly.

1.2 EXPECTED RI/FS RESULTS

The results of the RI/FS will be the selection of a preferred remedial action alternative which will achieve the cleanup criteria established and be cost effective. The information contained in the RI/FS should be in sufficient enough detail that a conceptual design of the preferred remedial action alternative can be prepared.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

2.1 SITE LOCATION AND HISTORY

I. Shulman and Son, Inc. (Shulman) owns and operates a ferrous and non-ferrous metal salvaging facility comprising 24 acres located at One Shulman Plaza in the City of Elmira, Chemung County, New York (Figure 2-1).

Metal salvaging operations have been performed on the site for approximately twenty years. In 1982, a shipment of drained transformers were received by Shulman for processing. The transformers were dismantled on-site and sold as scrap. It is suspected by the New York State Department of Environmental Conservation (NYSDEC) that these transformers were contaminated with PCB oil which was spilled onto the surface of the site during the dismantling operations. Consequently, the NYSDEC and Shulman entered into a Consent Agreement on September 16, 1986 which has resulted in the performance of a series of site investigations.

2.2 SITE DESCRIPTION

The Shulman site is located in the northeast portion of the town of Elmira, New York. The area is heavily industrialized and the site is bordered by the Clemens Central Parkway on the east, Industrial Service Corporation to the west, Consolidated Rail Corporation to the north and Washington Avenue to the south (Figure 2-1). The site is generally flat with surface water being drained to the center of the property where it empties into a storm drain which is tied into a 48-inch concrete sewer pipe, known as the reformatory line. The reformatory line travels through the center of the western portion of the property. The site has four permanent buildings located on it along with a weigh scale and scale house trailer. The facility take in previously wrecked cars. Cars are dismantled and crushed and sold as scrap metal.

SCALE in feet

0 1000 2000

A-F-I

SITE LOCATION MAP

FEBRUARY [illegible]

FIGURE 2-1

2.3 REGIONAL AND SITE HYDROGEOLOGICAL CHARACTERISTICS

2.3.1 Regional Geology

The Elmira area lies in a disected plateau underlain by nearly flat-lying limestone, shale, siltstone, and fine-grained sandstone. Glacial deposits overlie bedrock everywhere except on steep hillsides where ice scoured the slopes creating truncated spurs.

2.3.2 Soil Characterization

The soils of the area on which the Shulman site is located are generally of the Howard-Chenango association (Figure 2-2). This association consists of nearly level to gently rolling or sloping soils on outwash plains, alluvial fans, stream terraces and floodplains. It principally occupies the large valley that extends from Big Flats to Horseheads and Elmira. This association covers about 13 percent of the county.

Howard soils are deep, well-drained to somewhat excessively drained, medium-textured and gravelly. They formed in glacial outwash material consisting of stratified sands and gravels. They occupy outwash terraces and are mainly nearly level to gently sloping.

Chenango soils formed in channery material (thin, flat course fragments of limestone or sandstone) deposited as old alluvial fans where side streams enter the main valleys. They aare well-drained to somewhat excessively drained, deep soils that are nearly level to gently sloping. They occur around the edges of Howard soils.

Examination of the soils encountered during sampling of the test pits to a depth of two feet from the surface revealed brown to black gravelly sand with significant amounts of small scrap metal pieces, gray cinders, demolition debris and decaying railroad ties.

2.3.3 Regional Hydrogeology

The Elmira aquifer occupies a valley floor that is bordered by steep bedrock hills. The triangular valley system is separated by a nine-square-mile bedrock hill, known as West Hill (see Figure 2-2).

1-LORDSTOWN-VOLUSIA-MARDIN ASSOCIATION

2-HOWARD-CHENANGO ASSOCIATION

3-TIOGA-UNADILLA-HOWARD ASSOCIATION

A-F-I

SOILS ASSOCIATION MAP

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FIGURE 2-2

AFI MAP OF ALLUVIAL FAN NEAR SITE

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FIGURE 2-3

The northern reach of the aquifer occupies a preglacial valley now filled with sediment. The eastern reach from Elmira to Horseheads, and the northwestern reach from Horseheads to Big Flats, are fairly wide and in most places range from 1.5 to 2.5 miles in width. The reach along the Chemung River between Big Flats and Elmira, however, thins locally to less than 0.25 mile in width where the river passes through a bedrock gorge. The southern part of the aquifer is drained by the Chemung River, which is tributary to the Susquehanna River.

In downtown Elmira and south of Elmira, bedrock is 70-100 feet below land surface and is relatively flat. Aquifer material consists of sediments ranging from very fine sand to coarse gravel. The aquifer thickness (i.e. the saturated thickness from the water table to the top of the first relatively impermeable unit) in downtown Elmira and South Elmira suggests a thick outwash deposit containing 40-50 feet of saturated material, thus placing the water table at approximately 20 to 50 feet below land surface. This aquifer is overlain with soils of moderate to high permeability. Soils on adjacent hill sides are less permeable and allow large amounts of runoff to flow onto the valley floor, where infiltration and recharge occur.

Ground water in this aquifer system (which underlies the Shulman site) is presumed to move predominantly with the surface topography (soughtward). Ground water discharges to the streambeds and recharges an underflow that leaves the area south of Elmira. Recharge is derived from precipitation, from streams and from bedrock adjacent to and beneath the aquifer. Chemung County Department of Health representatives in the Elmira area stated that there are no drinking water wells located between the Shulman site and the Chemung River to the south or Newton Creek to the east. The closest producing well is northwest of the site.

2.3.4 Site Hydrogeology

The Shulman site is situated at the western edge of the valley floor of Newton Creek in the City of Elmira. The western boundary of the site corresponds to the eastern edge of an alluvial fan which occupies the former valley of Heller Creek

(Figure 2-3). The edge of the fan is represented by the distinct rise in topography at the western property boundary.

Based on boring logs, there appear to be two hydrogeologic zones beneath the site; an upper shallow water table zone and a lower semi-confined ground water zone.

The upper zone consists of the following units:

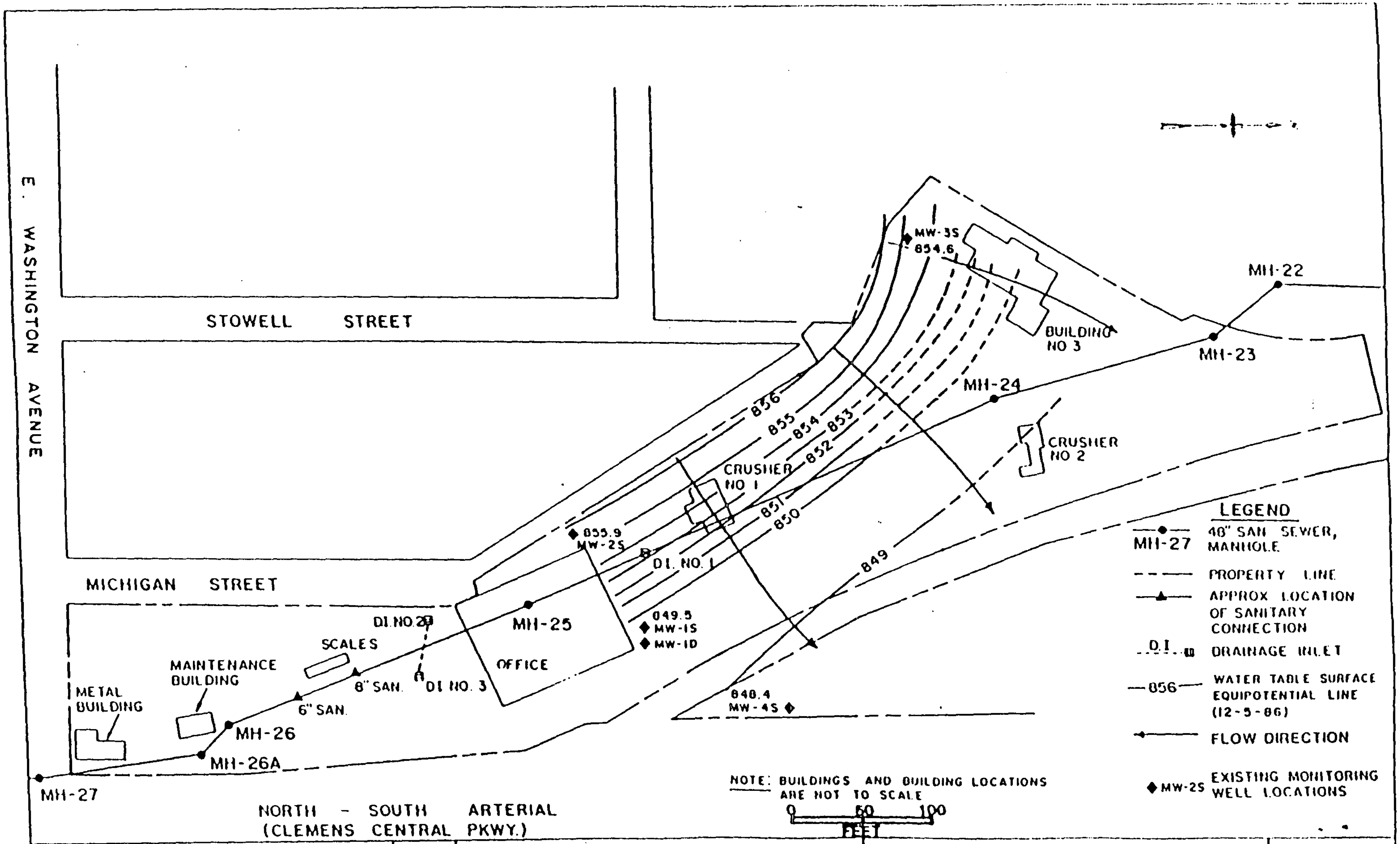
- Surficial fill consisting of a variety of materials, such as dense brown sand, some gravel and dry fill.
- Recent alluvial fan materials at the western edge of the property, as encountered in boring MW-2S.
- Mixed deposit including peat underlain by glaciolacustrine silty clays and glacial lodgement till. The significant points regarding these lower glacial deposits are their fine-grained nature and their low hydraulic conductivity relative to underlying glacial outwash deposits. These deposits, by virture of their physical characteristics, serve as a semi-confining layer in restricting the rate of infiltration from the shallow ground water zone.

The lower ground water zone consists of glaciofluvial outwash sand and gravel deposits which comprise a major aquifer within the valley. The upper limit of the zone is formed by the fine-grained glacial deposits described above.

The configuration of the water table within the upper ground water zone is presented on Figure 2-4. The direction of shallow ground water flow towards the center of the valley to the east is controlled primarily by topography. The steep hydraulic gradient in the western portion of the site is due to shallow ground water discharging from the sloping alluvial fan deposits into the flat-lying fill, peat and glacial deposits on the valley floor. The water table gradient (Figure 2-4) decreases between MW-1 and MW-4 towards the valley center and away from the edge of the alluvial fan.

Slug tests conducted on three shallow monitoring wells resulted in an average horizontal saturated hydraulic conductivity of 6 x 10^{-4} cm/sec in the upper water table zone. In order to estimate horizontal seepage velocities in the water table zone, and effective porosity of 0.1 was assumed. The seepage velocity was calculated for the western portion of the site under a horizontal hydraulic gradient of about 0.03 and in the eastern portion of the site under a gradient of about 0.006. The horizontal seepage velocities were calculated to be: 120 ft/yr and 25 ft/yr for the western and eastern portions of the site, respectively.

Ground water elevations in MW-1S and MW-1D showed the downward hydraulic gradient between the upper and lower ground water zones to be approximately 0.16 ft/ft.



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CONFIGURATION OF THE WATER TABLE SURFACE

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FIGURE 2-4

3.0 INITIAL EVALUATION

3.1 INVESTIGATION RESULTS - 1984

In 1984, the initial field investigation activities were undertaken which consisted of soil sampling in fourteen shallow test pits, sampling sediment from a surface drainage inlet (no water present) and sampling a pool of oil. All samples were analyzed for PCBs, cadmium, chromium, copper, lead, iron, nickel, selenium and zinc. One sediment sample was analyzed for all priority pollutant compounds except for asbestos, acrolein and acrylonitrile.

The analytical results showed test pit samples 1, 2, 3, and 4 and Drainage Inlet Sample (DI) No. 1 and PCB concentrations over the 50 ppm level established by USEPA as being PCB contaminated. This area is the area between the office building and Crusher No. 1. Test pits 5, 6, 7, 8 and 10 had PCB concentrations in the 2 to less than 50 ppm range. This latter area could also require remediation according to the USEPA guidelines for soils which contain greater than 10 ppm of PCBs.

Heavy metals found in the test pit soil and DI No. 1 sediment samples, included high concentrations of iron, lead, copper and zinc, and lower concentrations of cadmium, chromium and nickel.

Other priority pollutants found in the drain sediment included chrysene, phenanthrene, pyrene, total cyanide and phenols.

The results of the 1984 investigation concluded with a conceptual remedial action program which called for soils containing greater than 50 ppm of PCBs to be removed and the remaining areas paved over with asphalt to cap the site and prevent further contact with the contaminants.

3.2 INVESTIGATION RESULTS - 1986

The results of the 1984 investigation identified other potential contaminant migration pathways such as vertical migration through the subsurface soils into the ground water and off-site migration of contaminated sediments through the storm drains and connecting sewer. The supplemental field investigation in 1986 was designed to establish the presence or absence of contaminants in those areas. To accomplish these objectives a sewer investigation was conducted, two additional test pits were dug and sampled, an oil pit sample was taken from Area C, and four shallow and one deep monitoring well were installed and sampled in November of 1986.

The results of the supplemental investigation showed test pits 15 and 16 to be below the 10 ppm PCB cleanup levels established by USEPA. The resampling of the oil showed it to contain less than 50 ppm of PCBs. The ground water sampling results showed PCBs to be detected at monitoring well MW-3S. analysis of the ground water for volatile organics revealed the presence of several chlorinated hydrocarbons at monitoring well MW-2S. These concentrations exceeded NYSDEC Class GA guidance levels or standards. In addition, one standard was exceeded at well MW-1S while several other volatile organics were detected at levels below their respective guidance levels at both well MW-1S and well MW-3S. 'A trace amount of toluene was detected at well MW-1D. Analytical results for heavy metals showed several of the shallow wells to have concentrations of arsenic, cadmium and lead in excess of the New York State Class GA ground water standards. The cadmium, lead and copper concentrations tend to increase in the downgradient direction, while arsenic is highest in the upgradient direction.

Results of the hydrogeological investigation showed the general direction of flow in the shallow aquifer to be to the east-northeast. A clay layer was also found on the site which is thought to form a confining layer between the water table aquifer and the deeper outwash aquifer.

3.3 IDENTIFICATION OF CONTAMINANTS

Table 3-1 lists, by media, (i.e. groundwater, soil, etc.) the contaminants found at the site based on the analytical test results of the two investigations and analytical test results obtained from the NYSDEC.

TABLE 3-1

CONTAMINANTS MATRIX

(MAXIMUM CONCENTRATION FOUND)

PARAMETER	SOIL (mg/kg)	SEDIMENT (mg/kg)	GROUNDWATER (ug/l)
1,1-Dichloroethene	NA[3]	NA	520
t-1,2-Dichloroethene	NA	NA	160
1,1,1-Trichloroethane	NA	NA	10,000
Trichloroethene	NA	NA	7,400
Toluene	NA	NA	7
PCBs (Total)	120	72	4.1
Arsenic	NA	LT 0.5	26
Beryllium	NA	LT 0.5	7
Cadmium	2 7	14	22
Chromium	148	121	103
Copper	19,900	1530	413
Mercury	NA	0.7	0.9
Nickel	200	111	384
Lead	4.050	1620	400
Antimony	NA	1.4	600
Selenium	LT 0.6	LT 0.5	LT 50
Thallium	NA	3.5	LT 300
Silver	NA	3.5	LT 300
Zinc	8830	2250	1,090

NA - Not analyzed for.

3.4 POTENTIAL CONTAMINANT MIGRATION ROUTES, EXPOSURE PATHWAYS AND RECEPTORS

Prior to identifying migration and exposure routes and potential receptors, it is necessary to identify the sources of contamination. The primary source of contamination appears to be spills of PCB oil and possibly other materials onto the surrounding land surface. This condition has in turn created secondary sources of contaminants in the underlying soil.

3.4.1 Possible Contaminant Migration Routes

Possible contaminant migration routes at the site include:

- Infiltration of precipatation into underlying soil and ultimately into the shallow ground water.
- Surface water runoff (i.e. precipitation and sediment) entering the sewer and being carried off-site.
- Sewer line bedding material providing a porous conduit for routing contaminants off site.
- Fugitive dust emissions from truck traffic and related operations at the site in dry periods of the year.

3.4.2 Potential Exposure Routes

Possible exposure routes would include dermal contact with contaminated soils and surface water, inhalation of fugitive dust emissions and ingestion of contaminated ground water.

3.4.3 Potential Receptorsd

Potential receptors would include Shulman employees, people making scrap deliveries and pickups at the facility, people using the ground water as a portable water supply, unauthorized personnel entering the property, and off-site people exposed to contaminated dust.

3.5 PRELIMINARY REMEDIAL RESPONSE OBJECTIVES

Based on previous site investigation activities, the following remedial response objectives have been identified.

- Further define the nature of contamination (i.e. principal contaminants, media, horizontal and vertical extent).
- Identify the possible population at risk and potential exposure levels.
- Identify applicable or relevant and appropriate requirements (AAARs).
- Establish and screen response actions consistent with results of baseline risk assessment.
- Select remedial action alternatives based on existing data and select a recommended alternative or combination of alternatives to meet site clean-up criteria, based on waste characterization sampling.

3.6 PRELIMINARY REMEDIAL ACTION ALTERNATIVES

3.6.1 Response Actions

Prior to the development of remedial action alternatives, general response actions must be identified for the site. Response actions are actions where the source of contamination is controlled to levels of acceptable risk. Source control response actions remove threats or detoxify the contaminants and are the preferred response actions. Site contaminant response actions consist of activities that will immobilize the contaminant source in a controlled situation. The type of response action needed is driven by site specific conditions. Once the response actions are identified, remedial action alternatives can be devised. The following is a list of response actions identified for the Shulman site:

- No action/institutional actions
- Continued monitoring only
- Source control-excavation/removal/treatment and/or disposal of contaminated soil
- Containment - collection/treatment and disposal of contaminated ground water

3.6.2 Remedial Action Alternaties

The following is a list of preliminary remedial action alternatives that may be applicable for the Shulman site:

Alternatives to Remediate Soil

- Complete removal of PCB-contaminated soil (above 10 ppm), off-site treatment/disposal.
- Removal of PCB-contaminated soil (above 50 ppm), cap the remaining areas, treat or dispose of soil.
- Capping of all areas high than 10 ppm with no removal.
- No action.

Alternatives to Remediate Shallow Ground Water

- Collect/treat as necessary for PCBs, VOCs and heavy metals and discharge to existing site sewers.
- Collect/treat to state drinking water quality standards and reinject to aquifer.
- No action.

Alternatives to Remediate Surface Water Sewer Line

- Regrade site to divert surface water from sewer to private treatment, remove sediment from inverts, treat or dispose of sediment off-site, decontaminate existing line and seal it to prevent infiltration of contaminated ground water.
- Install surface water runoff controls, remove old sewer line and sediment with off-site disposal, reroute line through non-contaminated area.
- No action.

3.7 Costs associated with remedial action alternatives.

3.7.1 After identifying the actual remedial action alternatives, the costs for each alternative will be estimated and listed in table form.

4.0 WORK PLAN RATIONALE

The work plan rationale is intended to identify the most cost effective remedial action alternatives based on existing data and also identify new data needs, the quality of the data required and what steps will be taken to satisfy the data requirements for the risk assessment and evaluation of the alternatives.

4.1 DATA QUALITY OBJECTIVES

The following Data Quality Objectives (DQO) have been defined for the remedial response objectives.

4.1.1 Data Needs

4.1.1.1 Nature of Contamination

The previous site investigation activities were aimed at trying to identify areas of PCB contamination. The data required to define the nature of contamination include the following areas:

- Identify the type of contaminants present in each media (soil, ground water, etc.).
- Define both the horizontal and vertical extent of contamination in both the soil and ground water.
- Identify contaminants in the storm water runoff and sediment in the sewar.
- Define the direction and rate of ground water flow in both the shallow ground water zone and outwash aquifer.
- Characterize the permeability, thickness and a real extent of the clays which underlie the site.
- Characterize any volatile and particulate air emissions from site.
- Characterize contaminated soil for disposal at TSDF or secure sanitary landfill.

4.1.1.2 Populations at Risk and Allowable Exposure Levels

The data required to access this response action will require a population count of the area within a 1/2 mile radius of the site to determine the numbers of human receptors present. Allowable exposure levels need to be defined to help identify potential receptors.

4.1.1.3 ARARs

The following regulations need to be reviewed to determine if they are applicable to the site: federal and state air and water quality standards, OSHA exposure levels and RCRA trigger levels.

4.1.1.4 Screening of Alternatives

The following types of data are needed to screen the remedial action alternatives: proven technologies for treatment and/or disposal of PCBs, current cost data, estimated quantities of contaminants to be remediated, pilot or treatability study results.

4.1.2 Data Quality Requirements

The quality requirements for each type of data needed in the RI/FS is summarized in Table 4-1.

The remaining parts of this work plan will present the specific procedures defining how the data will be collected and how they will be used.

TABLE 4-1

DATA QUALITY REQUIREMENTS

Data Needed	Data Quality Required
Contaminant identification/ concentration levels for sediment, soil, tround water, surface water and air	TCL-CLP for ground water, surface water and sediment. PCBs, RECRA Characterization and Land Ban analysis for soil.
Water level	±0.01 foot
Population information	Most recent census and field verification
ARAR's	Existing and proposed regulatory levels
Acceptable risk clean-up criteria	ARAR's when available if ARAR's are not available: - non-carcinogens - no appreciable risk of significant adverse effect - carcinogens - 10^{-4} to 10^{-7} lifetime excess cancer risk
Treatment technology evaluation	Actual remedial action data
Estimated quantities of contaminated media	±20% of actual volume.
Unit costs	Vendor quotations and actual costs from similar projects preferred Compendium costs adjusted to current dollars
Cost estimates	+50% - 30% all in current year dollars

5.0 PROJECT MANAGEMENT

Proper management of the RI/FS project is important for several reasons. First, the interactive nature of the RI and the FS makes it necessary to have one project team performing the work to ensure continuity in the work products. Second, proper management is required to enable integration of regulatory input at critical times during both portions of the project.

5.1 PROJECT ORGANIZATION

The Table of Organization proposed for this project is shown on Figure 5-1. The following sections are brief descriptions of the duties and responsibilities, key positions, and personnel responsible for that position.

5.1.1 Project Manager - William L. Heitzenrater

Mr. Heitzenrater will have overall project management responsibilities. His duties will include keeping the project on-schedule and on-budget and to serve as regulatory liaison.

5.1.2 Technical Review Team - Robert Napieralski, Bill Goodman, Richard Gahagan, William Heitzenrater

The technical review team is responsible for providing quality assurance review for various parts of the project. William Heitzenrater, in his position of Project Officer, and Robert Napieralski will be responsible for the overall review of the RI/FS report. Mr. Gahagan will be responsible for final techical review of the baseline risk assessment. Bill Goodman will review the hydrogeological data during the field investigation activities and also during the report preparation.

5.1.3 Project Leader - Richard W. Gahagan

Mr. Gahagan will manage the day-to-day project activities of the two project teams. He will also manage the activities of the subcontractors.

5.1.4 Project Team Members

Two teams have been proposed: a remedial investigation team and a feasibility study team. The remedial investigation team will be responsible for the field investigation activities, analytical data validation and baseline risk assessments. The feasibility study team will consist of individuals specialized in developing remedial action alternatives, preparing cost estimates and conducting environmental/health assessments of the screened alternatives.

5.2 SUBCONTRACTOR MANAGEMENT

5.2.1 Drilling Subcontractor

We propose to utilize Advanced Drilling Investigations (ADI), Lockport, New York for drilling test borings and installing monitoring wells at the site. Representatives from Advanced Drilling Investigations (ADI) have the required health and safety training for working at hazardous waste sites.

I. SHULMAN AND SON. INC. RI/FS

Table of Organization

I. Shulman and Son

Project Officer

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Subcontractors

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Cost Estimating

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Env. Health Assessment

R. Gahagan
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FIGURE 5-1

5.2.2 Analytical Subcontractor

The analytical subcontractor will be selected from a list of laboratories that are qualified for performing the required analyses and are on the NYSDEC list of technically acceptable laboratories.

5.2.3 Survey Subcontractor

A licensed surveyor will be subcontracted for performance of the required surveying on site.

5.2.4 Excavation Contractor

A construction contractor with the required 40 hour OSHA training will be subcontracted to perform excavation work on the site.

5.3 COMMUNITY RELATIONS

I. Shulman & Son, Inc. acknowledges that the information contained in the RI/FS will become public information upon its submittal to the NYSDEC. If, in the course of complying with the consent agreement terms and conditions, it becomes necessary for public hearings and meetings to be held regarding the disposition of what remedial action will be taken to clean up the site, representatives of I. Shulman & Son, Inc., including AFI, will participate to the extent required.

6.0 REMEDIAL INVESTIGATION PLAN

6.1 INTRODUCTION

The remedial investigation (RI) plan is designed to utilize existing data and provide sufficient field data to enable a baseline risk assessment and feasibility study to be carried out that will meet the remedial response objectives.

The remedial investigation is broken down into the following tasks:

- Identify areas where remedial activities will occur
- Soil excavation
- Establishment of staging areas
- Field investigation
- Sample analysis
- Data evaluation and validation
- Baseline risk assessment
- Refine remedial action goals

At the completion of the eight tasks a draft remedial investigation report will be prepared and submitted to NYSDEC for review and comment. An interim investigation report will be submitted upon receipt and evaluation of analytical reports from the sampling programs.

6.2 FIELD INVESTIGATION

6.2.1 Preliminary Activities

Prior to any field activities being conducted, the following documents must be prepared and approved:

- Site specific health and safety plan
- Quality assurance project plan

Drafts of these documents are included as Appendix A and B, respectively.

6.2.2 Proposed Soil Boring and Monitoring Well Installation Program

Drilling of additional test borings and installation of additional monitoring wells are necessary in order to:

- Provide enough data to make an improved determination regarding the presence or absence of a continuous clay layer beneath the site.

- Provide data for mapping the configuration of the water table aquifer and the deeper glacial outwash aquifer in the vicinity of the site.
- Determine the magnitude of the effect of the sewer on shallow ground water flow.
- Provide shallow and deep ground water sampling points in locations downgradient of wells where contaminants have been detected at contravening levels.
- Provide sampling points to determine if downward vertical migration of contaminants has occurred from the shallow aquifer across the clay layer to the outwash aquifer.

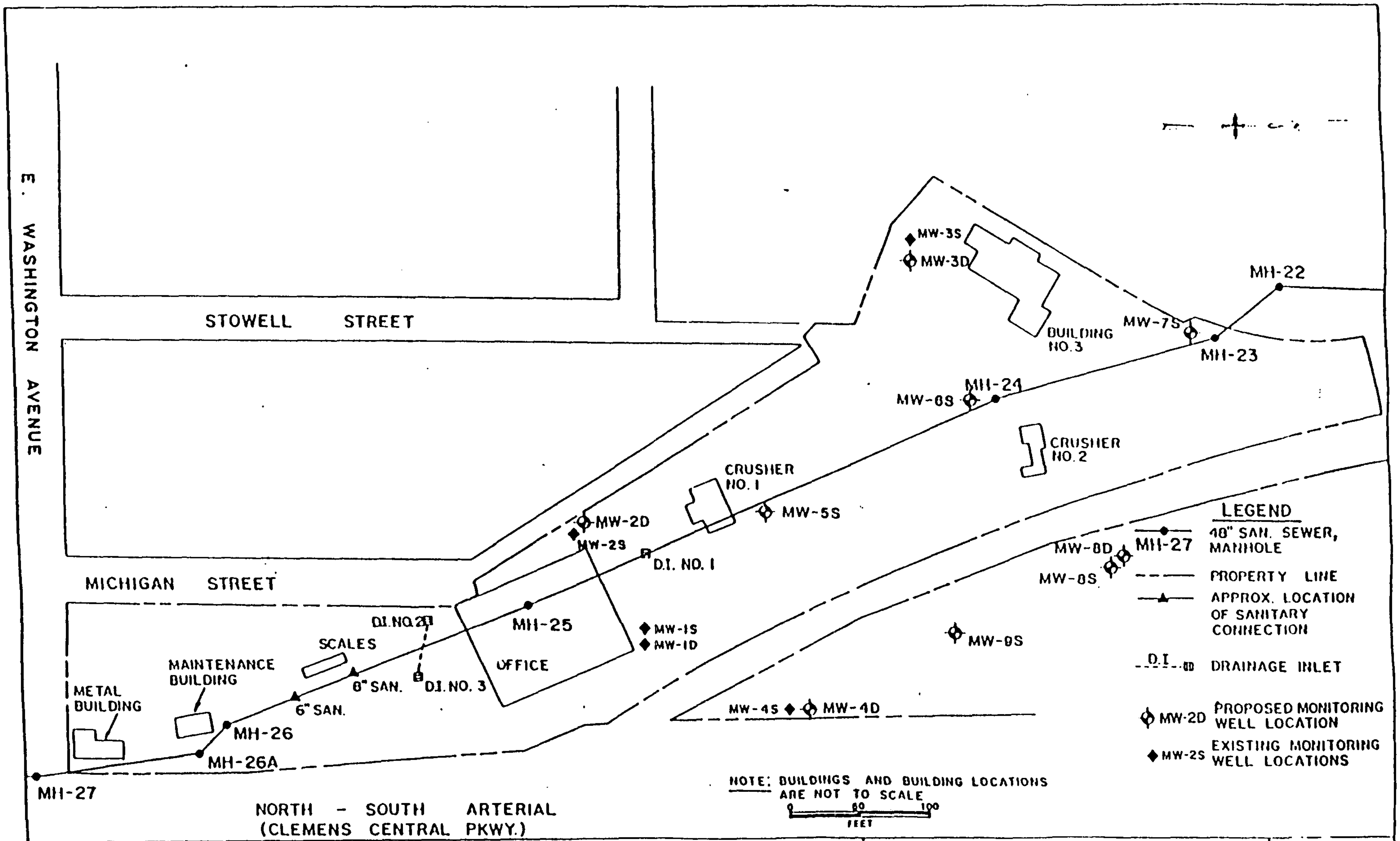
To facilitate collection of the required information, it is proposed that nine new monitoring wells be installed in the vicinity of the site. The proposed locations for the wells are shown on Figure 6-1.

6.2.2.1 Rationale for New Monitoring Wells

Monitoring wells MW-2D and MW-3D are intended to provide sampling points in the upper outwash aquifer, thereby enabling an assessment of downward vertical contaminant migration in those locations.

Monitoring wells MW-4D, MW-8S, MW-8D and MW-9S provide downgradient ground water sampling points. Wells MW-4D and MW-8D will monitor the upper portion of the outwash aquifer, while MW-8S and MW-9S will be used to monitor the shallow ground water zone.

Monitoring wells MW-5S, MW-6S, and MW-7S will be used to monitor the water table in the vicinity of the sewer to determine the sewer's impact on the shallow ground water regime. Analytical results of ground water samples collected from these wells will provide information on ground water quality in these areas. Additional boreholes and/or monitoring wells may be necessary in the vicinity of the MW-5S, MW-6S and MW-7S locations depending on the occurrence of the confining clay layer relative to the depth of the sewer and its associated backfill. For example, if the clay layer is present but appears to have been penetrated during the excavation of the trench for the sewer, it may be necessary to install additional deeper wells for an assessment of water quality with depth. If the clay layer is absent in any of these locations, additional deeper wells may be



I. SHULMAN & SON, INC.
ELMIRA, NEW YORK

PROPOSED MONITORING
WELL LOCATIONS

FEBRUARY 1988

FIGURE 6-1

required for the water quality-with-depth determination. However, if the clay layer is encountered at a depth that is below the influence of any sewer trench excavation activity (based on sewer invert elevations and drilling information) then the boreholes will be discontinued at the top of the clay layer. The AFI Environmental hydrogologist, in conjunction with the on-site NYSDEC representative, will be responsible for making the decision on the need for additional monitoring wells in these areas.

Information collected during the drilling of the boreholes for all of the wells will be used to delineate subsurface geologic units. The presence or absence of a continuous clay layer beneath the site will thereby be determined.

Additional soil boring/monitoring wells may also be needed depending on the results of the groundwater analyses. Identification of contaminants of concern at contravening levels in the deep or shallow downgradient monitoring wells would require the installation of additional monitoring points to determine the extent of ground water contamination. In the event that contravening levels of contaminants are suspected to have migrated off-site an addendum to this portion of the work plan will be submitted to the NYSDEC for review and approval.

One additional soil boring/monitoring well installation will be needed to replace well MW-1S which has been damaged and will not allow the passage of a bailer into the well for sampling purposes.

6.2.2.2 Drilling Methods and Monitoring Well Installation Procedures

The drilling methods and monitoring well installation procedures utilized during the last phase of work at the site will essentially be followed for installation of the proposed shallow wells (MW-5S, MW-6S, MW-7S, MW-8S and MW-9S). However, modifications in the procedures utilized will be made to allow for the screening of split-spoon samples for volatile organics content by head space analysis.

Assuming that the clay layer is continuous beneath the site, the drilling methods and well construction techniques will require modification for installation of the deep wells. The modifications will ensure that there is no hydraulic communication from the upper to the lower aquifer across the clay layer via the borehole.

Only potable water will be utilized during drilling procedures, and will be obtained from the I. Shulman and Sons water supply.

A 6 5/8-inch I.D. flight of hollow stem augers will be used to drill and split-spoon sample to the top of the clay layer. Split-spoon samples will be collected continuously at standard two (2) foot intervals. The split-spoon samples will be collected, described and classified by the AFI Environmental hydrogeologist on-site according to the procedures described in Appendix B. Portions of each split-spoon sample will be tested for the presence of volatile organics utilizing the method in Appendix B. Representative samples from each different unit penetrated during the drilling process will be submitted to a soils laboratory for grain size distribution analysis and/or for a determination of the soil's Atterberg limits, depending on the physical make-up of the soil. Portions of the samples from each different unit penetrated will also be subjected to a dry combustion process to determine the amount of total organic matter present in the soil.

Predominantly granular, noncohesive soils will be subjected to mechanical sieving and a sedimentation method to determine the distribution of the soil particle size distribution. Predominantly fine-grained, cohesive soils will be subjected to 'plasticity tests' to determine their Atterberg limits. The predominantly fine-grained soils may also be subjected to mechanical tests to determine their grain size distribution.

The determination of the total organic matter content will be accomplished according to ASTM D-2974.

After the top of the clay layer has been confirmed via split-spoon, a socket will be augered to receive the six (6) inch casing. Non-shrink grout will be pumped into the socket and a six (6) inch steel casing will be installed prior to removal of the augers. The remaining annulus of the six (6) inch casing will then be grouted. This method will prevent the borehole from collapsing, and will insure that the grout forms a seal within the casing and in the annulus between the casing and the borehole to secure the pipe and effectively seal the clay layer.

Revised Text
AFI Revision #3 5/2/90

After the grout has hardened for a period of 24 hours, a 5-7/8" roller cone will be utilized to drill through the grout to the clay layer. A Shelby-tube sample will be obtained from the upper part of the clay layer in the deep borings. Permeability tests will be performed on the undisturbed samples to determine the saturated vertical hydraulic conductivity ($\underline{K_v}$) of the clay layer. Additional samples of the clay layer may be obtained, depending on the thickness of the unit, for a laboratory determination of ion exchange capacity. Continuous split-spoon samples will be collected through the remainder of the clay layer, and into the underlying outwash aquifer. A four (4) inch diameter casing will be driven intermittently to the bottom of the borehole, utilizing a 140 pound hammer, as the hole is advanced by the split-spoon sampler. After the four (4) inch casing is cleaned out with a roller bit, the two (2) inch well will be installed inside the four (4) inch casing, and the casing will be retracted as the well materials are being emplaced.

If the clay layer is of insufficient thickness to permit sampling of the unit for determination of the K_v via Shelby tube sampling and the ion exchange capacity, then the ion exchange capacity sample will not be collected. A determination of the K_v for this layer is deemed to be more important than the determination of the ion exchange capacity for the unit.

6.2.2.3 Drilling Equipment Decontamination Procedures

To prevent the possibility of any cross-contamination between boreholes, the drilling rig and all drilling accessories will be thoroughly decontaminated before arriving on site and between drilling sites. A pressurized steam cleaner will be utilized for purposes of decontamination of the rig and accessories. All split-spoon samplers will be decontaminated with either the steam cleaner or by using a detergent, followed by a tap water rinse, followed by another rinse using a pesticide grade methanol or hexane, and finally three rinses of de-ionized water.

6.2.2.4 Monitoring Well Construction

Upon completion of the drilling at each location, each of the above referenced boreholes will be converted to a ground water monitoring well to enable sampling of ground water and to permit measurement of ground water elevations at that location.

It is anticipated that each monitoring well will have the following characteristics. Figures 6-2 and 6-3 illustrate the typical monitoring well construction for a shallow and deep well, respectively.

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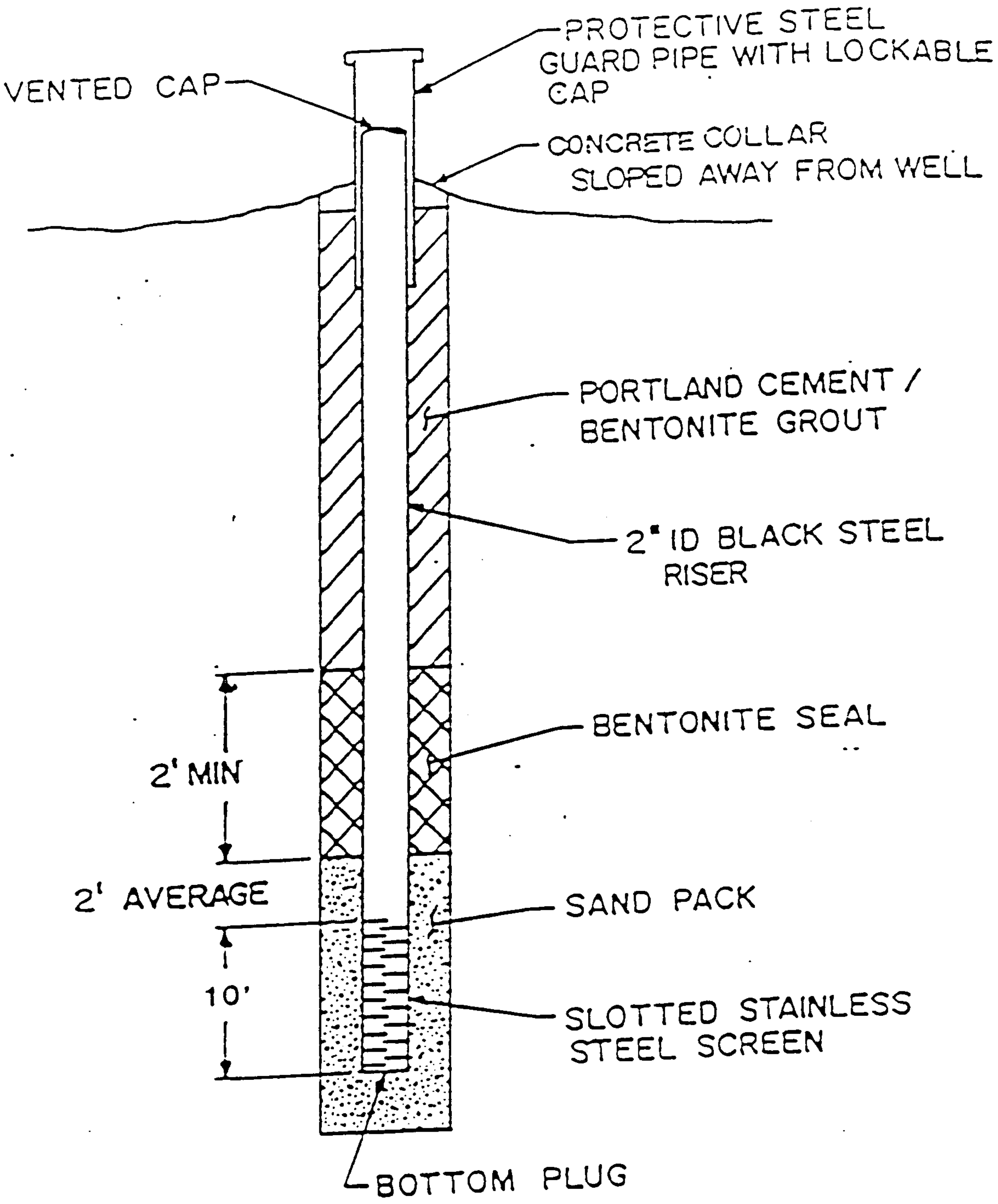
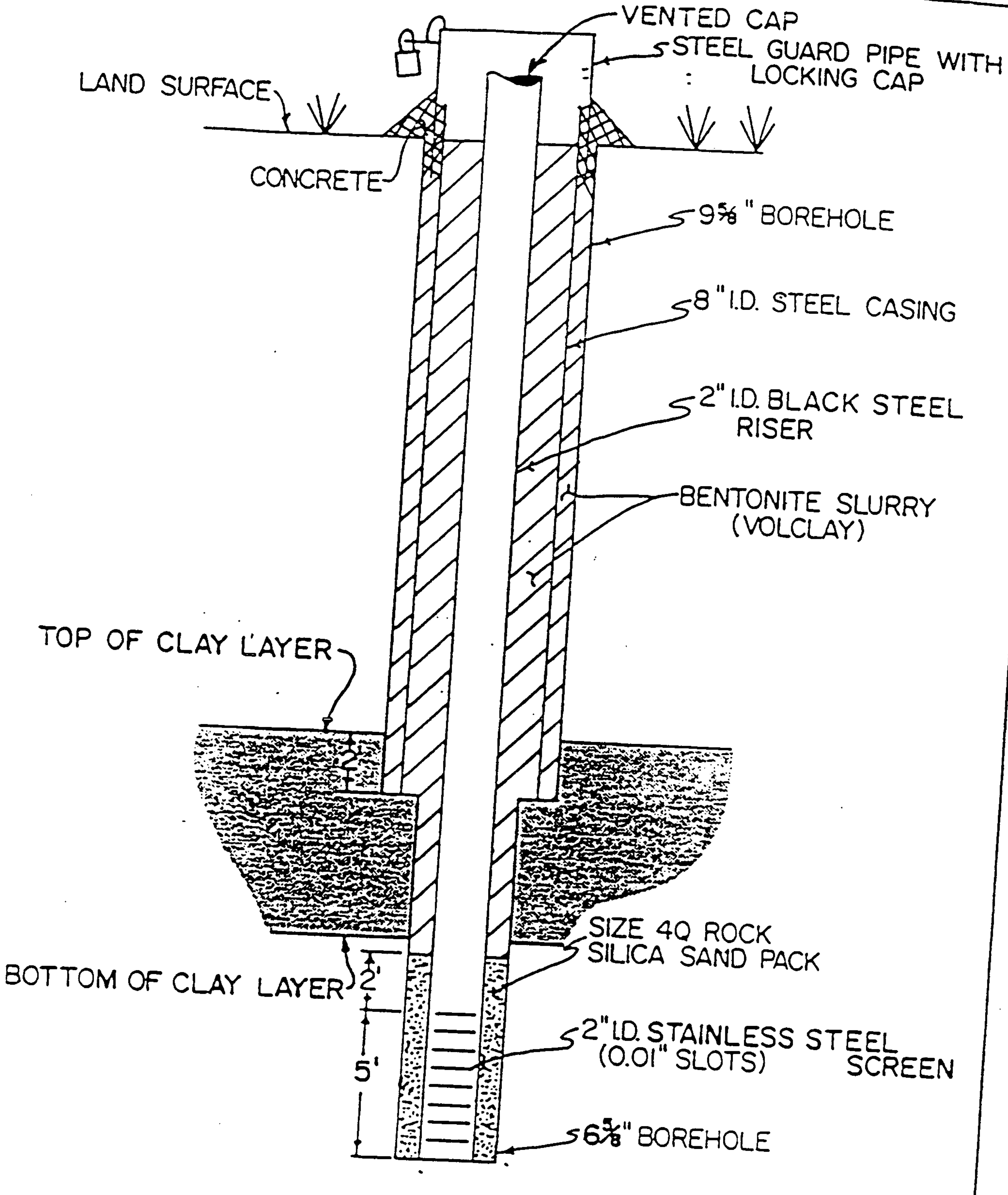
AFI Revision #4 5/11/90



NOT TO SCALE

TYPICAL SHALLOW MONITORING WELL

FIGURE 6-2



NOT TO SCALE

A-F-I

TYPICAL DOUBLE-CASED MONITORING WELL

FIGURE 6-3

- Ten foot well screens will be utilized in shallow wells to provide a sufficient volume for sampling. Based on grain size distrubution analysis performed on soil samples collected from the screened interval in shallow wells MW-1S, MW-3S and MW-4S, 0.006 inch slots will be used for the shallow wells. Screens with 0.01 inch slots will be used for the deep wells.
- Two-inch I.D. black steel riser pipe will extend rom the screened interval to the top of the well.
- Select sand (size 1Q ROK for shallow wells and size 2Q ROK for the deep wells) will be packed in the annular space between the well and the borehole to approximately two feet above the top of the screened interval.
- For the shallow wells, a bentonite seal at least two feet in thickness will be placed above each sand pack. In the deep borehole annulus, which penetrates the confining clay layer, the bentonite slurry seal will extend two (2) feet above the top of the sand pack.
- Portland cement/bentonite grout (3 to 5 pounds of bentonite per 94-pound bag of cement plus approximately 6.5 gallons of potable water, depending on field consistency) will be used to fill the remaining annulus to land surface. The onsite Geologist will record the quantities of water and bentonite entering the grout mixture in the field log.
- A four-inch I.D. protective steel guard pipe with a lockable cap will be lowered over the well casing and cemented into place. The concrete collar will be sloped away from the well toward the land surface.

As each well installation is completed, the well will be developed by bailing until: 1.) all drilling cuttings are removed; 2.) any drilling fluids that were added are removed; and, 3.) if possible, to a turbidity level of less than 50 NTU. However, development of wells to 50 NTU may not be possible if the wells are screened in a formation that is comprised of predominantly very fine-grained unconsolidated soils. The decision to terminate development will be by mutual agreement between AFI Environmental and the NYSDEC representative.

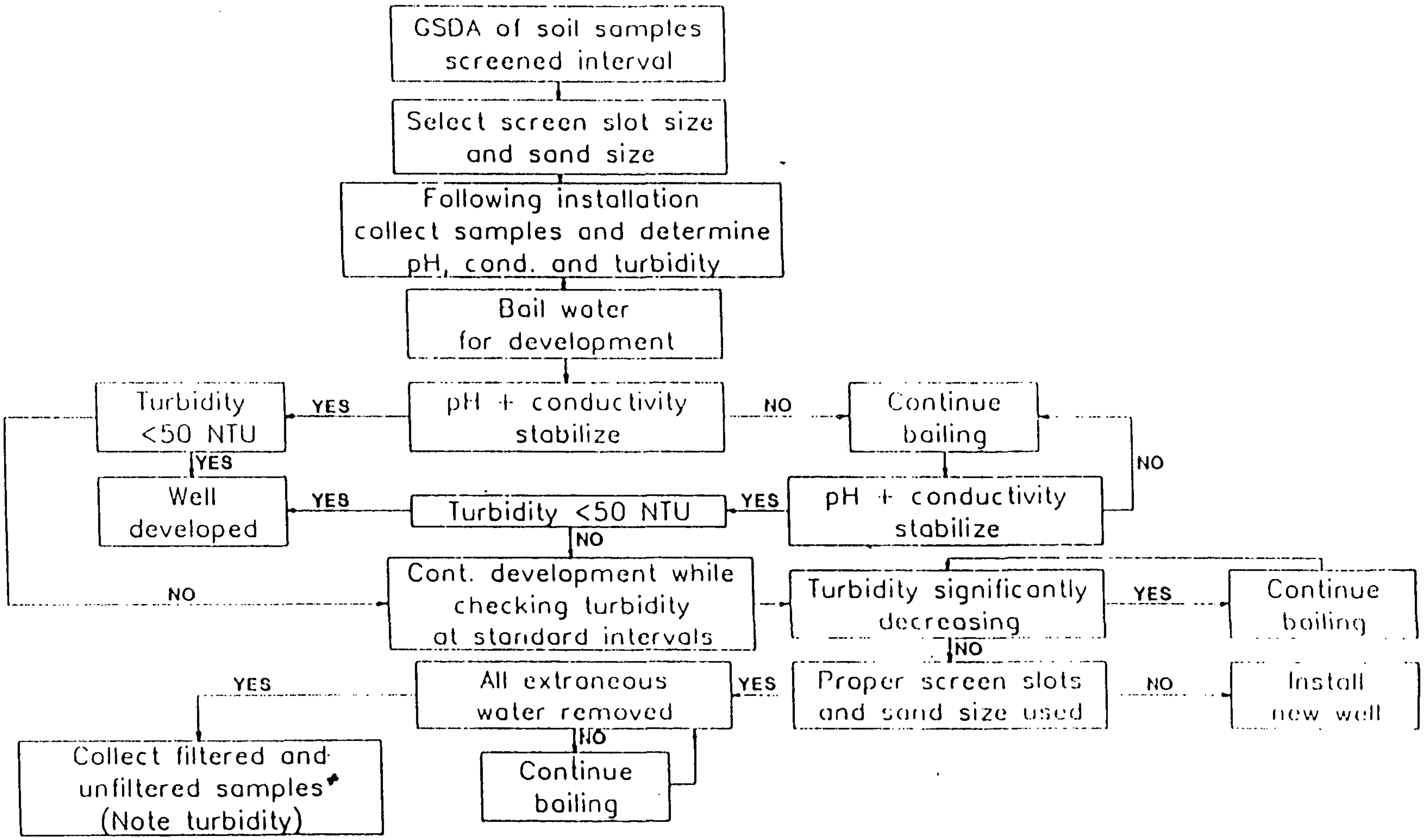
Turbidity measurements will be taken and recorded intermittently during development and purging. Provisions have been made for containerizing all purge water in DOT drums. However, due to the suspected groundwater contamination at the site, dedicated bailers will be utilized for development/purging to eliminate the possibility of cross-contamination.

Written procedures for the field calibration of the turbidity meter have been added to the QAPP.

The decision flow chart shown on Figure 6-4 will be used to determine what steps should be taken during well development. The NYSDEC on-site representative will have significant input into all well

FIGURE 6-4

DECISION FLOW CHART:
WELL INSTALLATION AND DEVELOPMENT



* ANALYZE UNFILTERED SAMPLE FIRST : IF THE UNFILTERED SAMPLE EXCEEDS A R A R's ANALYZE THE FILTERED SAMPLE
IF THE UNFILTERED SAMPLE MEETS A R A R's DO NOT ANALYZE THE FILTERED SAMPLE.

development procedures. Should the newly installed wells fail to meet proper installation guidelines, the NYSDEC can request the installation of replacement wells. In addition, AFI will make every effort to redevelop the existing wells to the 50 NTU target level. However, based on available grain size distribution analyses, and knowledge of the slot sizes used for well construction (0.01 inch), the 50 NTU level may not be attainable. In this case, the development process will be thoroughly documented and forwarded to the NYSDEC.

6.2.2.5 Disposition of Drill Cuttings and Development/Purge Water

In accordance with the proposed NYSDEC Technical and Administrative Guidance Memorandum on the disposal of drill cuttings (Appendix C), all drill cuttings will be disposed of within 20 feet of their respective boreholes. All development and purge water will also be disposed of near the wells.

6.2.2.6 Water Level Measurements

Subsequent to well development, water levels in the shallow and deep wells will be measured and recorded on a monthly basis for a period of at least six months. These data will be used to map the configuration of the water table and the potentiometric surface of the deeper aquifer.

6.2.2.7 Well Surveying

The land surface and the top of the well casing elevations for each well will be surveyed by a licensed surveyor. All surveyed elevations will be tied to a USGS datum. The wells will be surveyed to enable correlation of water levels and subsurface units.

6.2.2.8 Permeability Tests

Falling- or rising-head permeability tests (slug tests) will be performed at each monitoring well to permit calculation of the saturated horizontal hydraulic conductivity of the soils in the vicinity of the screened interval. The procedure for this type of test is provided the QAPP (Appendix B).

6.2.3 Sewer Line Investigation

In the 1984 site investigation, sediment taken from the grating above DI No. 1 contained high levels of PCBs and selected VOCs. For this reason, it was deemed necessary to conduct further investigation activities into the impact of the sewer line and off-site migration of contaminants.

6.2.3.1 Manhole and Storm Drain Inlet Inspection

Starting with manhole 27 and working north, each of the six manholes (27-23) and the three surface water drainage inlets will be opened and inspected. The following physical information will be collected:

- Location of manhole.
- Size and description of sewer and any cross connections.
- Depth from the top of the manhole or surface drain to the bottom of the sewer.
- Estimated amount of sediment present in the bottom.
- Note the presence of oil or other unusual conditions.

6.2.3.2 Dye Testing Surface Water Drainage Inlets

Beginning with DI No. 3, followed by DI No. 2 and DI No. 1, each drainage inlet will be dye tested and tracked downstream through each manhole until it reaches manhole 27.

The arrival time of the dye as it reaches each manhole will be recorded. This process will be repeated for the 6 and 8 inch sanitary sewer lines if the source can be located.

6.2.3.3 Infiltration Survey (Optional)

A comparison of the sewer line bottom elevations with the elevation of water table (during a seasonally wet and a seasonally dry period) will be made across the site. If it is found that the sewer line elevation is partially or completely below ground water, an infiltration survey will be conducted by running a sewer line television camera through the sewer line to identify if ground water is infiltrating the sewer line. If it is found that the sewer line elevation is not below the ground water elevations, no infiltration survey will be performed.

6.2.4 Environmental Sampling

Based on the response objectives defined in Section 1, the following media have been identified as requiring sampling and analysis in order to meet the data requirements.

- Ground water
- Soil
- Surface water runoff
- Sewer line sediments
- Air

The following sections describe in general the sampling programs that will be conducted. Specific sampling procedures can be found in the QAPP (Appendix B).

6.2.4.1 Ground Water Sampling

A total of fourteen groundwater samples will be collected, one from each newly installed and existing well. Each well will be purged of 4 to 10 well volumes (or to dryness) by hand bailing and the samples will be obtained, also by bailers. Dedicated PVC bailers will be used at each well. Quality control samples for the ground water samples will include 1 trip blank/day (VOCs only), 1 field duplicate, 1 matrix spike sample, and 1 matrix spike duplicate. The list of parameters will be the TCL list established by NYSDEC along with hexavalent chromium. Analysis of ground water samples will be in accordance with CLP protocols. Based on the results of the first round of sampling, a second round of ground water samples may be obtained at the wells.

Analytical parameters to be analyzed in the second sampling event will be based on the results of the initial sampling. An analytical parameter list will be submitted to the NYSDEC for approval prior to performing any second-round sampling, should this sampling event be necessary. Section 2 of the QAPP provides detailed information regarding sampling and analysis requirements.

6.2.4.2 Phase 1 – Revised Soil Sampling

The site will be divided into five sections as presented in Figure 6-5. Section 1, located to the north of the Office Building, is about 4.43 acres in size and contains Crusher No. 1. Section 2, located north of Section 1, is about 4.92 acres in size and contains Crusher No. 2 and Building No. 3. Section 3, located to the east of Sections 1 and 2, is about 1.72 acres in size. Section 4 is located to the north of Section 3 and is about 1.60 acres in size. Section 5 is located to the north of Section 4 and is about 3.06 acres in size.

Sections 1, 2 and 4 have shown the presence of PCBs during previous sampling. No previous contamination has been documented in Sections 3 and 5. Therefore, different methods will be utilized to identify the remedial action alternatives. In Sections 1, 2 and 4 contaminated soils will be excavated and samples will be collected from soil piles. In Section 3 and 5 no further samples will be taken.

Areas With Documented Soil Contamination

Results from previous sampling have indicated the presence of PCB-contaminated soil in Sections 1, 2 and 4. The purpose of the proposed soil sampling strategy in these sections is to use previous analytical results and field screening results for PCBs to segregate contaminated soils into staging areas. Staging areas will be segregated according to previously documented levels for PCBs.

Representative composite samples will then be collected from soil piles established in each staging area. Future analytical data will be evaluated in conjunction with the existing analytical data to determine the most cost effective and acceptable remedial action for the soil in each staging area. Table 6-1 identifies anticipated costs associated with proposed disposal alternatives. (This table is presented for comparison purposes only, actual costs may vary).

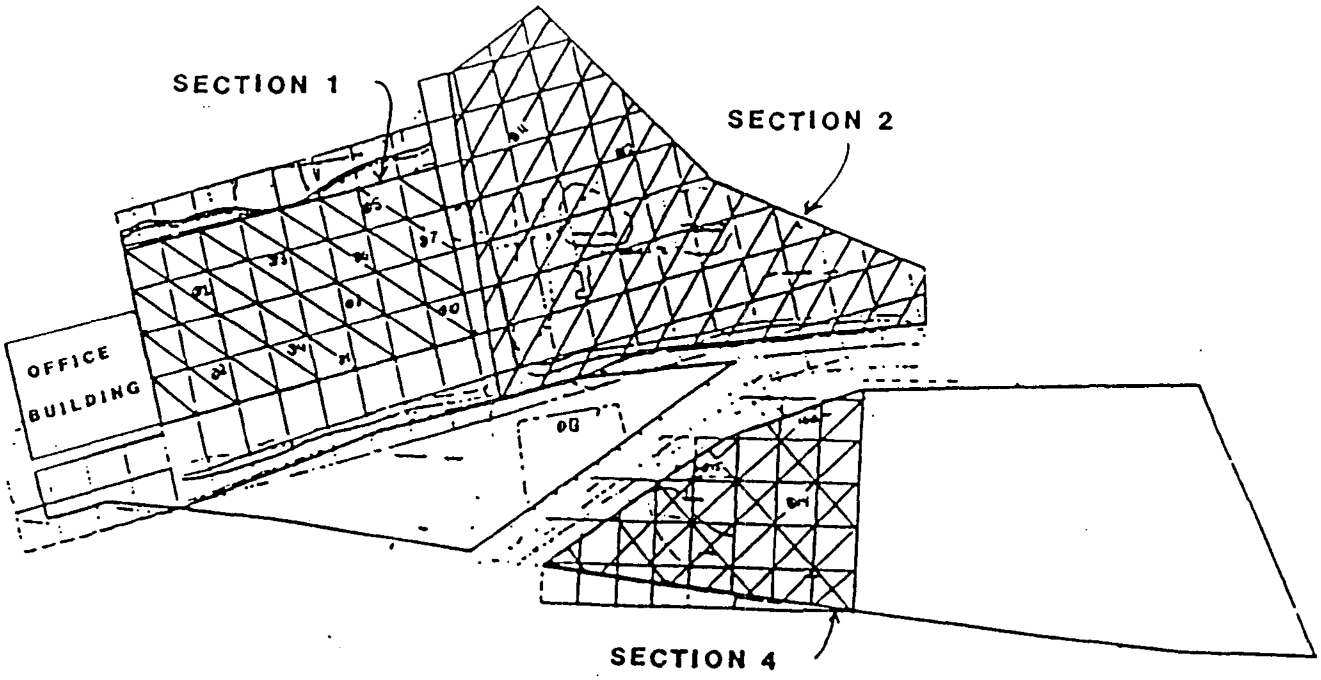
FIGURE 6—5

LEGEND

▧ AREA OF SECTION 1

▨ AREA OF SECTION 2

▩ AREA OF SECTION 4



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I. SHULMAN & SON, INC.
ELMIRA, NEW YORK

SITE INVESTIGATION

PROPOSED AREAS OF
REMEDIATION ACTIVITY

APRIL 26,
1990

TABLE 6-1

Cost Estimates for Remedial Action Alternatives

Remedial Alternatives	Section 1 (2.96 acres) Approximately = 7,174.08 Tons *	Section 2 (4.92 acres) Approximately = 11,906.4 Tons *	Section 4 (1.60 acres) Approximately = 3,872 Ton
Asphalt	$133,200	$221,400	$72,000
Landfilling at Secured Sanitary Landfill Hauling	$430,444 $179,352	$714,384 $297,660	$232,320 $96,800
Landfilling at Treatment Storage and Disposal Facility (TSDF) Hauling	$2,106,453 $187,892	$3,495,957 $311,834	$1,136,819 $101,409
Incineration at Treatment Storage and Disposal Facility (TSDF) Hauling	$14,348,160 $512,434	$23,812,800 $850,457	$7,744,000 $276,571
Remediation on Site	Treatability Study Needed		

* Estimations based on soil removal to a depth of one foot over entire area of section.

In the revised AFI Environmental February 1989 work plan, it was proposed that 16 soil samples be collected from each 200x200 foot grid area. Soil samples were to be obtained from test pits. It is now proposed that staging areas for segregating contaminated soils be established. Soil will be excavated in 6 inch intervals and segregated according to levels of contamination found in previous test pitting investigations and field screening. The following staging areas will be established in each section.

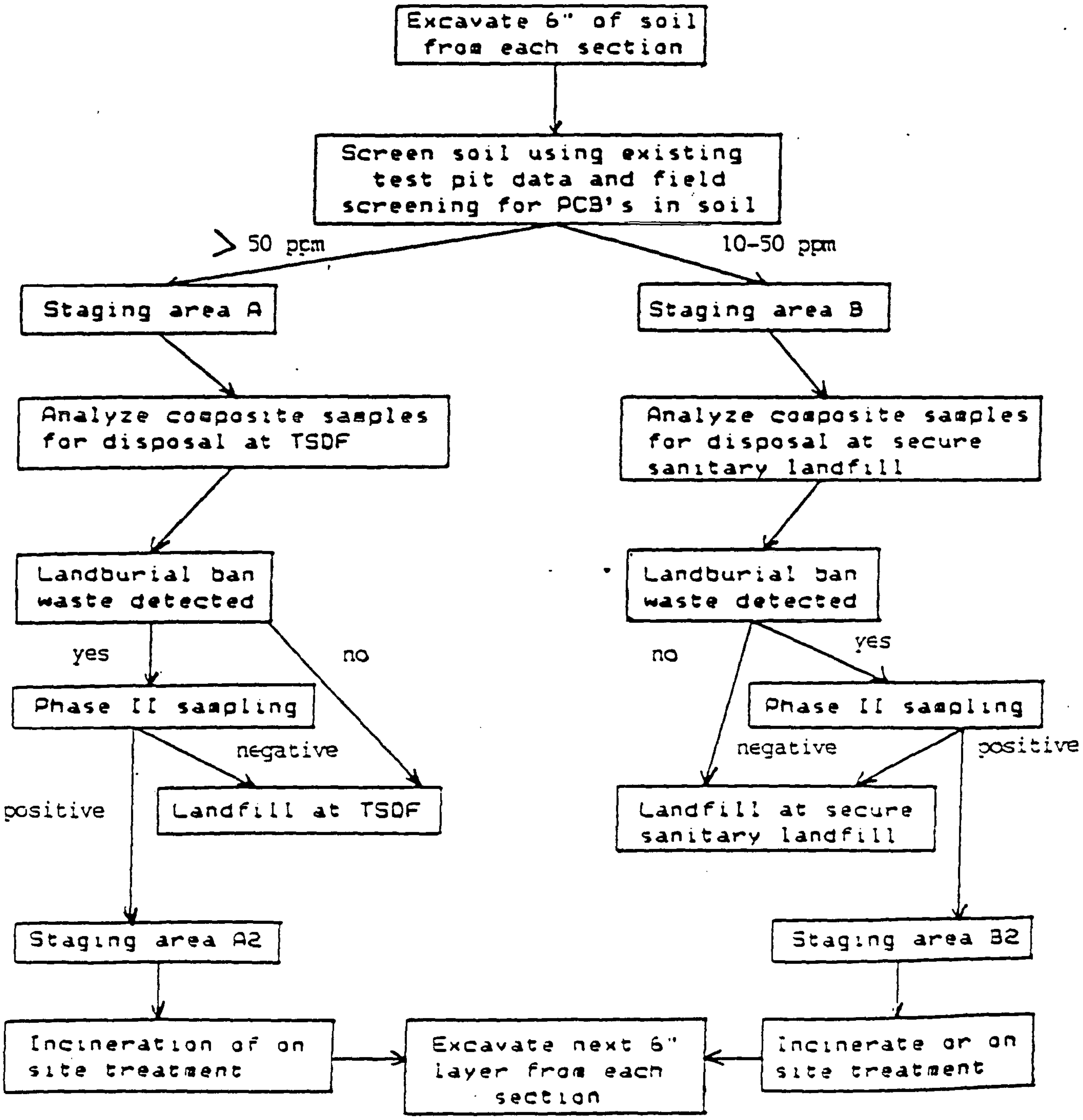
	PCB Concentrations
Staging Area A	> 50 ppm
Staging Area B	10 - 50 ppm
	< 10 ppm to remain in place

After segregation representative composite soil samples will be assembled from each soil pile and the newly exposed soil surface. Equal amounts of soil will be collected from randomly selected sample locations and depths as the soil piles are being established. After sample collection soil will be loaded into roll-off containers for storage awaiting analytical results from testing. Excavation will be discontinued when forty roll-offs have been filled and staged; operations will resume after proper disposal of the soil in the roll-offs is completed.

The shaded areas on Figure 6-5 depict the area where excavation will take place. Samples collected from staging area A in each section will be submitted for analysis to characterize the waste for disposal at a permitted hazardous waste treatment, storage and disposal facility. Samples collected from staging area B in each section will be submitted for analysis to characterize the waste for disposal at a permitted secure sanitary landfill. After proper disposal of the soil from each staging area the process (excavating, segregating, staging and sampling) will be repeated until the desired target level of 10 ppm PCBs is reached for each section. Soil levels of PCBs will be compared to the current PCB spill cleanup standards as given in 40 CFR 761 subpart G (PCB spill cleanup policy). In order to meet these standards it is anticipated that excavations will be required to continue to depths of 18-24" in each section. After excavation to the required depth is completed grid samples will be collected from each section to verify cleanup standards. This will be done in accordance with the EPA recommended sampling scheme as presented in "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup," as shown in section 2-5 of the QAPP.

NEW FIGURE 6-6

Sections 1,2,4



Areas With No Documented Soil Contamination

Previous limited sampling failed to demonstrated any contamination in Sections 3 and 5. No further sampling will be conducted and no action will be taken to remediate these areas.

6.2.4.3 Data Interpretation and Phase 2 Soil Sampling

Sections 1, 2, 4

Once the soil analysis has been completed and the analytical data are available, the data will be compared with historical data for these areas of the site to determine consistency. If the historical data can be correlated with the newly obtained data, all available data will be used to select remedial action alternatives or combinations of alternatives for each section. A second round of sampling may be required if the results from first round sampling indicate contamination from any chemical waste restricted from land disposal. A second round sampling plan and parameter list would be forwarded to the NYSDEC for approval prior to sample collection. Those soils found to be restricted from land disposal by second round sampling will either be incinerated or treated on site.

6.2.4.4 Additional Soil Sampling During Excavation

Soil samples will be collected during the excavation process and submitted to a soils laboratory for a determination of the soil porosity. The soil samples will be collected by digging a few inches into the sides or bottom of the excavation to obtain as undisturbed a sample as possible. The soil samples will be collected in areas where PCB contamination has been documented in the past, e.g. near monitoring well MW-3S, near Crusher #1 and in the Section 1 area near former test pits. It is estimated that four soil samples will be collected for submission, however, additional samples may be submitted depending on the variability of the materials encountered in the excavation.

The results of the porosity tests will be used to estimate the effective porosity of the soil and, ultimately, will be used to estimate the potential for PCB migration through the unsaturated zone to the water table when coupled with additional data such as the estimated total organic carbon content, The Army Corps of Engineer test EM1110-2-1906, which is available in

Appendix 2 of the Engineer Manual, will be followed to arrive at the porosity as well as other closely associated parameters.

6.2.4.5 Surface Water Sampling

Surface water runoff from the site is collected by three storm drains known as DI No. 1, DI No. 2 and DI No. 3 (Figure 6-1). The runoff water may be a potential source of contamination to the sanitary sewer because of coming in contact with metal scrap on site and by picking up soil as it travels to one of the drainage inlets. In order to determine if the surface water runoff from the site is contaminated, the following sampling program will be implemented.

A composite sample will be collected from each of the three drainage inlets during a major precipitation event while the field investigation activities are being conducted. A major precipitation event is defined as one that will result in the continual flow of water to the drainage inlets for a minimum of one hour. The composite sample for each drainage inlet will be collected by taking a series of four grap samples, one every 15 minutes for an hour. Sampling should begin as soon as the water reaches the drainage inlet, if possible. (See Appendix B for sampling procedures). Surface water runoff samples will be analyzed for the TCL list of parameters using CLP protocol. The following quality control samples will be collected: 1 trip blank (VOCs only), 1 duplicate and one field blank sample.

If the analytical test results indicate the presence of significant levels of contaminants, a second round of samples may be proposed.

6.2.4.6 Sewer Sediment Sampling

The sewer sediment sampling will be carried out in two phases. The first phase will be to contact the operators of the POTW and determine if they have had a history of PCBs in the plant's sewage sludge. The next step will be to acquire maps of the sewer line between the Shulman site and the POTW. The drawings will be reviewed to locate areas where sediment sludge may accumulate. Once these areas have been identified. Phase 2 will be performed. Phase 2 consists of going on-site and collecting sediment that may be present at each of the on-site drainage inlets. The next step is to go off-site and physically locate those areas suspected of having built up an accumulation of sediment sludge.

Off-site sediment sampling will only take place where it is physically possible to collect the samples from the surface. No AFI Environmental personnel will be allowed to enter the sewer system to collect samples.

Each drain inlet and sewer line location will be inspected for the presence or absence of sediment ant, if found, a grab sample will be collected with either an Eckman dredge, Ponar dredge or other sediment sampling device. The number of samples will vary from a minimum of 3 to possibly 10.

Each sample will be analyzed for the TCL list of parameters using CLP protocol. Based on the analytical test results, a second round of sampling and analysis may be proposed if significant levels of contaminants potentially originating at the Shulman site are found.

6.2.4.7 Air Monitoring and Sampling

Concern has been raised regarding the potential for PCB contaminated dusts being released from the site via wind-borne fugitive dust. There has also been concern regarding PCBs volatizing from the site. In response to these concerns an air monitoring program for PCBs will be conducted. In order to provide the necessary detection limit NYSDOH air sampling method 311-1 will be utilized. This method utilizes a modified high volume sampler with glas fiber filter and solid absorbent. PCBs are recovered from the samples by soxhlet extraction with hexane. Sampling would be conducted concurrently at 3 or 4 locations at the site perimeter during normal conditions and then during test pit excavations. Monitoring would be performed at both upwind and downwind locations. Air samples will be monitored for total PCB's. Individual PCB aroclors will be identified and quantified where found.

Fugitive dusts will be minimized during excavation and remediation activities by implementing dust suppression measures.

Revised Text
AFI Revision #2 4/24/90

6.2.4.8 Oil Pit Samples

Previous investigations have shown detectable levels of PCB's in oil samples from the oil pit behind building Number 3. Two sediment samples will be obtained from this pit and submitted to the laboratory for analysis for PCB's and oil and grease. One sample of the oil will also be analyzed for PCB's. Individual PCB arochlors will be identified and quantified where found.

6.2.5 Sample Analysis And Validation

6.2.5.1 Sample Analysis

Chemical testing of samples taken from the Shulman site will be described below and in Section 2 of the QAPP. The laboratory, which will be on the NYSDEC's list of Technically Acceptable Laboratories, will analyze for the CLP organic and inorganic analyses found in the New York State Contract Laboratory Program protocol (NYSDEC CLP, November 1987, Volume I, Exhibit C, Sections I and II). The laboratory will follow the analytical methodologies found in the NYSDEC CLP, Volume I Exhibit D, Parts I through V. This testing will include the contaminants on the TCL list and all GC/MS peaks greater than 10 percent of the nearest calibrating standard. The TCL parameter list and the required quantitation limits are shown in Section 2 of the QAPP for this project. Testing of any samples from second sampling events, if necessary, will be for selected parameters of concern identified as a result of the first sampling event. All soil samples will be analyzed for PCBs, ignitability, corrosivity, reactivity, EP Toxicity, aromatics, halogenated organics, nitrogenated organics, and low molecular weight organics. Methods of organic analysis will conform with the NYSDEC. "Approved Analytical Procedures For Determining The Content Of Constituents Banned From Landburial", dated January 1985. Oil pit sediments will be analyzed for total PCBs and oil and grease. Analytical medthodologies and detection limits are provided in Section 2 of the QAPP. The laboratory selected for non-CLP testing will be on the NYSDEC's list of Technically Acceptable Laboratories for the scans involved. The laboratory will be required to fill out the NYSDEC analytical summary forms.

6.2.5.2 Data Validation of Analytical Data

Data validation is a process by which analytical data are compared against criteria that have been established as being technically and legally acceptable. There are two areas that must be evaluated in order for the analytical test results to be considered valid. The first is validation that the sampling protocols were properly adhered to and the second is a review of the laboratories data package for the sample results to confirm the results are within the acceptable limits of the DQOs. AFI Environmental will contract an individual who is independent of the analytical laboratory and consistent with the NYSDEC qualifications and guidelines for a data validator. The data validation review documentation, along with conclusions, will be included in the RI report.

Field Data Validation

The validation of field data will take into account the verification that the following areas have been carried out in accordance with the QAPP standard operating procedures:

- review of field notes to see that proper field information was collected (i.e. times of sample collection, field instrumentation calibration checks)
- conduct audits of sampling personnel
- review trip and field blank samples to see if sample contamination has occurred
- compare duplicate sample results

If, after a review of the data, the results are satisfactory the field sampling procedures will be considered acceptable for use.

Laboratory Validation

Validation of laboratory data is an exhaustive process when utilizing CLP methods. In this case the validation of laboratory data is a two-stage process. The laboratory is the first to validate its own data in accordance with its state approved quality assurance plan.

Once the laboratory certifies the results, AFI Environmental personnel will review the data packages in accordance with the following guidelines: "Functional Guidelines for Evaluating Organic Analyses", TDD No. HQ-8410-01, USEPA 1985 and "Evaluation of Metals Data for the Hazardous Waste Site Program", SOP No. HW-2, USEPA 1985. Data Validation will be performed for 100% of the samples analyzed for the complete TCL and consistent with the 1987 NYSDEC CLP requirements. For those sample results that are not performed under CLP protocols the following areas will be screened:

- Method of sample preparation
- Method for sample clean-up (if used)
- Calibration data (initial and continuing)
- Matrix spike/Matrix spike duplicate
- Definition of surrogates
- Recovery of surrogates
- Instrument blank
- Method blank
- Retention time windows
- Raw data (chromatograms and integration files)
- Corrective action taken

This level of evaluation will ensure the analytical data is correct and an accurate representation of the site conditions.

6.2.6 Data Evaluation

Once the data have been validated as to their accuracy and precision, the data must be reduced and tabulated into a manageable format. The next step will be to evaluate the data to determine if they are sufficient to allow the remedial response objectives to be met by incorporating the data into one of the following activities.

- Ground water quality assessment
- Modeling of the fate of contaminants or contaminant transport in soil and/or ground water.
- Identification of potential wastewater treatment technologies capable of successfully treating known contaminants.
- Identification of additional air monitoring.
- Incorporation of data into a geostatistical analysis to define the horizontal and vertical extent of contamination in soil.
- Determining what risks are associated with the site contaminant concentration levels in the baseline risk assessment.

Once these activities are completed the results will either identify data gaps which will require further investigative work to be performed or conclude that the data are sufficient to achieve the remedial response and data quality objectives.

6.3 BASELINE RISK ASSESSMENT

6.3.1 Purpose and Objectives of Risk Assessment

The purpose of the risk assessment is to provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action and is intended to provide sufficient justification as to whether or not remedial actions need to be performed.

The objectives of the baseline risk assessment are to characterize the following:

- Toxicity and quantity of hazardous substances present in the respective media
- Identify environmental fate and transport mechanisms of contaminants
- Identify potential exposure pathways
- Identify potential exposure pathways
- Identify potential human and or environmental receptors
- Determine likelihood of impact or threat occurring
- Define acceptable levels of risk

The following is a brief overview of each component:

Contaminant Characterization

This component is concerned with the development of the analytical data to define the nature and concentration of site contaminants in the various environmental media (soil, surface water, ground water). The development of these data (e.g., contaminant content of the soil and ground water, contaminant migration) will be completed as described above.

Hazard Identification

This component deals with the review of the known site contaminants and the adverse health and environmental effects that result from both chronic and/or acute exposure. During this step, a review is conducted or water quality criteria, human health and toxicoloty data and similar information from a variety of sources. Only published (peer-reviewed) data are utilized.

Exposure Assessment

The third component of the risk assessment is an evaluation of what exposures are occurring or could be anticipated to occur under existing and realistic future conditions. consideration is given to identification of physical and biological modes of contaminant migration, identification of exposure methods (e.g. direct contact, ingestion, inhalation), identification of target population and target receptors, and evaluation of target-receptor probability and frequency of exposure.

Risk Evaluation

The final component involves an evaluation of the hazards identified when coupled with the exposure potentials. Also factored in is other relevant information (e.g. seasonal effects on potential exposures).

6.4 REFINEMENT OF REMEDIAL ACTION OBJECTIVE

During the process of preparing the Remedial Investigation Report the limitation of the data collected will be assessed to see if additional work is required to adequately address the remedial action objectives. If the data are sufficient, than the remedial action objectives will be reviewed to see if changes are required based on the new data and their interpretation.

Examples of changes would be in the form of better defining the extent of contamination, elimination of particular preliminary remedial actions because site conditions are not conclusive to a particular technology, eliminating particular exposure pathways or identifying clean-up levels which would provide adequate protection to human health and the environment, but are higher than State or Federal standards. Once these refinements are made they can be incorporated into the feasibility study plan and report.

7.0 CONCEPTUAL FEASIBILITY STUDY PLAN

7.1 TECHNICAL APPROACH

The primary objective of the feasibility study plan (FSP) is to present a methodology to develop alternatives that will achieve the remedial response objectives established for the site.

As part of this work plan, remedial action alternatives were developed based on the available data in order for the RI portion of the work plan to be interactive with the FS portion.

The feasibility study will be performed in three tasks:

- development of alternatives
- screening of alternatives
- conducting detailed analysis of the remaining alternatives.

7.2 DEVELOPMENT OF REMEDIAL ACTION ALTERNATIVES

Alternatives for remediation will be developed by assembling combinations of technologies for each identified contaminated media that singularly or in combination will address the extent of contamination on a site-wide basis.

The development of the alternatives will encompass the following process:

- Develop general response actions for each media by defining: containment, treatment, removal, collection and disposal actions that singularly or in combination will achieve the remedial response objectives
- Identify volumes and/or areas of media to which general response actions might be applied.
- Identify and screen technologies applicable to each general response action and begin elimination of those technologies that cannot technically be implemented at the site.
- Identify and evaluate technology process options to select a representative process for each technology.
- Assemble the selected representative technologies into alternatives.

The results of this process will yield a group of alternatives that conceptually would be able to achieve the remedial action objectives.

Upon completion of the draft RI report, the remedial action objectives will be reevaluated and updated as required to reflect new data obtained in the field investigation activities and baseline risk assessment.

7.3 SCREENING OF REMEDIAL ALTERNATIVES

The screening of remedial alternatives will be conducted in three steps. Step one consists of refining the alternatives by quantifying areas and volumes of the media of interest, along with the size and capacities of process options that make up each alternative on a general basis as to its effectiveness, implementability and cost. Step 3 is to decide, based on general evaluation, which alternative(s) should be retained for detailed analysis. The objective of screening the alternatives is to eliminate those alternatives which:

- Cannot accomplish the remedial action objectives on the basis of effectiveness.
- Cannot be reasonably implemented.
- Are cost prohibitive (other technologies can achieve the same results at less cost).

At a minimum, five remedial action alternatives will be retained for detailed analysis. The remedial action alternatives fall into the following categories as specified in 40 CFR 300.68.

- No action.
- Alternatives for treatment or disposal at an off-site facility.
- Alternatives which achieve ARARs.
- Alternatives which exceed ARARs.

- Alternatives that do not attain ARARs, but will reduce the likelihood of present or future threat from hazardous substances and that provide significant protection to the public health and welfare and the environment.

7.4 DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

The detailed analysis of alternatives includes the analysis and presentation of relevant information needed to allow decision makers to select a site remedy. During the detailed analysis, each alternative will be assessed against nine criteria:

- Short-term effectiveness
- Long-term effectiveness
- Reduction of toxicity, mobility and volume
- Implementability
- Cost
- Compliance with ARARs
- Overall protection of human health and the environment
- State acceptance
- Community acceptance

The results of this nine-criteria assessment will allow for a comparative analysis to be made and key traeoffs identified among the alternatives. Once the analysis is completed, the results (the selected remedial alternative) will be able to address the following CERCLA requirements:

- Be protective of human health and environment
- Attain ARARs
- Be cost-effective
- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent possible.
- Satisfy the preference for treatment that reduces toxicity, mobility and volume as a principal element.

7.4.1 Alternative Definition

If any treatability study data and/or additional field investigation data are generated after the draft RI report is prepared, the alternative(s) left from the screening process will need to be more fully refined prior to performing the detaled analysis.

7.4.2 Nine Point Criteria Analysis

The following are specific items that will be evaluated in each of the criteria:

7.4.2.1 Short-term Effectiveness

Under this criterion, the alternatives will be evaluated with respect to their effectiveness in protecting human health and the environment during the construction and implementation phase until the response objectives are met. Areas of concern that will be addressed for each alternative include protection of workers (both Shulman and clean-up contractors) and the surrounding community, potential adverse environmental impacts, and the time required to achieve response objectives.

7.4.2.2 Long-Term Effectiveness and Permanence

The components of this criterion will evaluate the magnitude of risk remaining after the response objectives have been achieved, and the adequacy of controls to contain contaminants and ensure the system is sufficient to maintain designed protection levels. An example of this might be, "How effective would a site cap be if the scrapyard operations were continued on top of that cap?"

7.4.2.3 Reduction of Toxicity, Mobility and Volume

CERCLA legislation provides a statutory preference to selecting remedial actions which employ treatment technologies that permanently reduce toxicity, mobility or volume of hazardous substances as their principal element. The evaluation will focus on the following factors:

- Treatment processes and the materials they treat.

- The amount of hazardous materials destroyed or treated and how principal threats will be addressed.
- Degree of expected reduction in toxicity mobility or volume.
- Irreversibility of the process.
- Type and quantity of residual material remaining after treatment.

7.4.2.4 Implementability

this criterion will be assessed based on technical feasibility, administrative feasibility, and availability of services and materials required for implementation of each alternative. The technical feasibility analysis will consist of an evaluation of the difficulty and unknowns associated with construction and operation of each technology (the ability to meet specified process efficiencies or performance goals), the ease of undertaking additional remedial action and the ability of monitor the effectiveness of a remedy. Administrative feasibility will consist of an evaluation of the ability and time required to obtain approvals and permits for the remedial action. Availability of services and materials includes availability of materials of construction, necessary equipment and specialists, timing of availability and ability to procure the necessary materials and services.

7.4.2.5 Cost

Disposal and Transportation Costs

The costs associated with each remedial action alternative are listed in Table 6-1. Actual remediation costs will be some combination of those listed. For example, some of the contaminated soil excavated in section 1 (see Fig. 6-5) may require incineration; the remainder may be allowed to go into a sanitary landfill. Cost estimations are based on vendor quotations April, 1990, actual cost may vary. Costs identified are for disposal and transportation only. These costs should be used for relative cost comparison purposes only.

Additional cost criterion will be evaluated in four areas:

- Capital Costs - construction, equipment, land-development, indirect costs (e.e. engineering fees, permitting and contingency allowance).
- Annual Operation and Maintenance Costs - labor, power, administrative contingency.
- Present Worth Analysis - apply a discount rate of 5 percent for the anticipated length of the remediation not to exceed 30 years.

- Sensitivity Analysis - identify areas of uncertainty (i.e. effective life, duration of cleanup, sizing of treatment system, etc.) and evaluate how they would impact the total cost of the alternatives.

7.4.2.6 Compliance with ARARs

This criterion will be used to determine how each alternative complies with applicable or relevant and appropriate State and Federal requirements as defined in CERCLA Section 121. The three categories of ARARs to be evaluated include chemical, location and action-specific. The detailed analysis will summarize which requirements are applicable or relavant to each alternative.

7.4.2.7 Overall Protection of Human Health and the Environment

The overall assessment of the degree of protection provided will be based on a composite of factors assessed under the other criteria, especially, long-term effectiveness, short-term effectiveness and compliance with ARARs. The primary focus of this analysis will be the extent to which leachate generation and migration is controlled by the various alternatives.

7.4.2.8 State Acceptance

This criterion is applicable to State-lead sites and evaluates how the alternatives address the formal technical and administrative comments and concerns NYSDEC may have raised during the review of the draft RI report or the interim report describing the alternatives screening.

7.4.2.9 Community Acceptance

This analysis will address public comments received by the NYSDEC or other agencies during preparation of RI/FS documents.

7.4.3 Comparative Analyses of Alternatives

Once each of the alternatives have been individually assessed against the nine criteria, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion. The purpose of the comparative analysis is to identify the advantages and disadvantages relative to one another and will be presented in a narrative format that describes the above analysis. Things which will be considered would include variations in the key uncertainties and how it impacts the alternative's performance. Whenever possible, quantative information that was used to assess the alternatives and will be included in these discussions.

8.0 PROJECT SCHEDULE AND DELIVERABLES

8.1 PROJECT SCHEDULE

Figure 8-1 depicts the proposed project schedule and selected project milestones. It is anticipated that it will take approximately 12 months to successfully complete the RI/FS report.

8.2.1 Interim Investigation Report

Following the receipt and evaluation of all site sampling and analysis data, an interim report containing this data will be submitted to the NYSDEC.

8.2.2 Draft Remedial Investigation Report

A draft Remedial Investigation report will be prepared and submitted to the NYSDEC for review and comment. Included in this report will be the following:

- Discussion of field investigation activities
- Presentation of analytical tests for all media tested
- QA/QC evaluation of analytical data
- Description of the extent of contamination
- Baseline risk assessment results (i.e. identified receptors, risks associated with the site and ARARs)
- Identification of any further data requirements

8.2.3 Interim Remedial Action Alternatives Screening Report

At the end of the alternatives screening process, an interim report describing the screening process, evaluation of the alternatives and the basis for selection of the alternatives will be prepared and submitted to the NYSDEC for review and comment.

I SHULMAN AND SON

PROPOSED PROJECT SCHEDULE

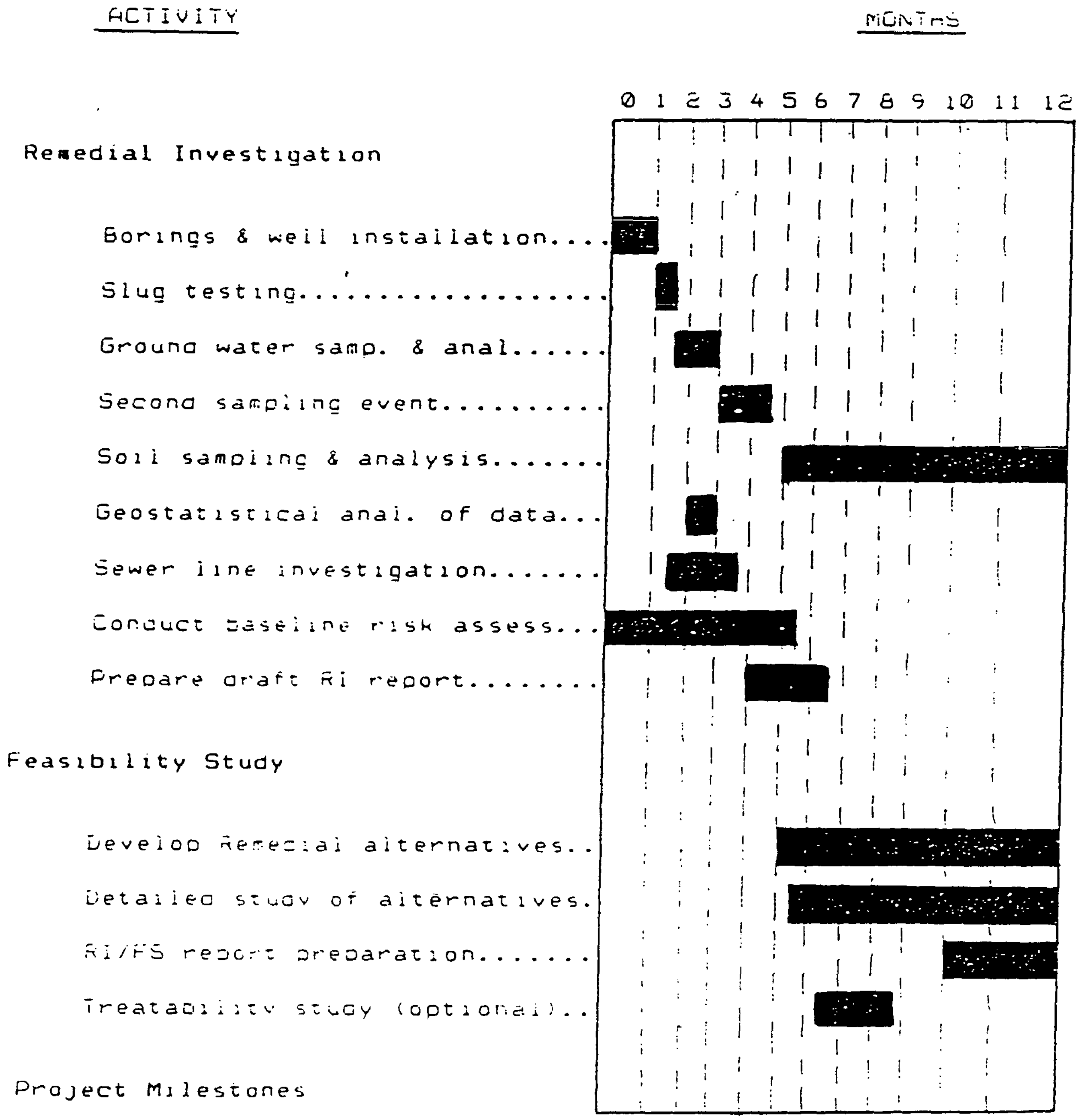


FIGURE 8-1

8.2.4 Final RI/FS Report

Upon completion of the detailed analysis of the remaining remedial action alternatives and selection of a preferred remedial alternative, a final report will be prepared which will address any comments and concerns the NYSDEC had in both the draft remedial investigation report and the interim remedial action alternative screening report. The final report will be submitted to the NYSDEC for the review and comment.

8.2.5 Monthly Reports

Monthly status reports of the progress of the project will be sent to the client with copies to the NYSDEC. The status report will be in a one page memo format with the following headings:

- Report Month
- Work Accomplished During the Report Period
- Problems Encountered and Corrective Actions Taken
- Items Which Need Regulatory Attention
- Percentage of Project Complete

8.2.6 Certification

Upon completion of the final RI/FS report, the consultant will certify that all work on this project was completed in substantial accordance with the work plan and written revisions thereof.

APPENDIX A

SITE SAFETY PLAN

HEALTH and SAFETY PLAN

For

I. SHULMAN SITE
Elmira, New York

AFI
6103 Robinson Road
Lockport, New York 14094

I. SHULMAN & SONS

ELMIRA, NEW YORK

1. GENERAL

This document presents a safety and health plan to be adopted for remedial work activities at I. Shulman and Sons, Elmira, New York. Basic requirements to be addressed by the Contractor's health and safety plan/accident prevention program meet the requirements of the specifications and all governmental regulations. It will provide for a safe and minimal risk working environment for on-site personnel. It also provides for emergency response procedures necessary to minimize the potential of the adverse impact of work activities on the general public. All site personnel will be required to comply with provisions of this health and safety plan and accident prevention program.

2. BASIS

The Occupational Safety and Health Act (OSHA) and its regulations provide the basis for the safety and health program. Additional specifications within this section are in addition to the OSHA regulations and reflect the positions of the United States Environmental Protection Agency (EPA), the National Institute for Occupational Safety and Health (NIOSH), American Conference of Governmental Industrial Hygienists (ACGIH), and U.S. Army Corps of Engineers (USACOE) regarding procedures required to insure safe operations. In addition, work will be completed in accordance with all other applicable federal, state, municipality and local laws, ordinances, codes and other regulations. Where any of these are in conflict, the more stringent requirement will take precedence.

3. SITE DESCRIPTION

I. Shulman and Son Company, Inc. owns and operates a ferrous and non-ferrous metal salvaging facility comprising 24 acres located at One Shulman Plaza in the City of Elmira, Chemung County, New York.

Metal salvaging operations have been performed on the site for approximately 20 years. In 1982 a shipment of drained transformers was received by Shulman for processing. The transformers were dismantled on site and sold as scrap. It is suspected by the New York State Department of Environmental Conservation (NYSDEC) that these transformers were contaminated with PCB oil which was spilled onto the surface of the site during the dismantling operations. Consequently, the NYSDEC and Shulman entered into a consent agreement which resulted in the performance of a series of site investigations.

The investigations conducted at the Shulman Site have identified the presence of PCB's (Aroclor 1242, Aroclor 1248, Aroclor 1254, and Aroclor 1260) and metals (iron and lead). PCB's, metals, and volatile organics (1,1,1-trichloroethane and trichloroethene) have been detected in the ground water.

4. PERSONNEL RESPONSIBLE for SITE SAFETY and HEALTH

The following personnel are responsible for the administration and operation of the site safety and health plan:

(a) **William Heitzenrater - Project Manager**

His duties include:

1) Ensuring the availability of appropriate protective equipment and its proper use by all personnel.

2) Ensuring personnel health and safety awareness by providing proper training and familiarity with health and safety procedures and contingency plans.

3) Ensuring all personnel are apprised of potential hazards associated with the site conditions and operations.

4) Supervising and monitoring compliance with the Plan and the performance of good work practices of all personnel.

5) Correcting any work practices or conditions that would expose personnel to possible injury or hazardous conditions.

6) Implementation of all AFI's required health and safety procedures and contingency plans.

(b) **R. GAHAGAN** - Project Director

His duties include:

1) Overall responsibility for implementation and enforcement of this plan.

2) Present site specific training.

3) Responsibility to stop work when activity is not being done in compliance with this plan.

(c) **M. HUNT** - Site Safety and Health Officer

His duties are:

1) Assist in the implementation, enforcement, and monitoring of the health and safety plan.

2) Ensure that personnel have participated in the medical surveillance program.

3) Assist in the pre-construction training program.

4) Establish and maintain the various work zones.

5) Administer the personal protective equipment.

6) Conduct air monitoring program.

7) Responsibility to stop work when activity is not being done in compliance with this plan.

8) Establish work/rest regimen in regard to heat stress monitoring.

9) Continuously monitor site safety and health conditions.

10) Maintain site safety field logs and forms.

5. SAFETY and HEALTH RISK ASSESSMENT (Hazard Analysis)

The project activities represent the potential for exposure to polychlorinated biphenyls (PCB), lead, and trichloroethane.

In the development of a risk assessment and the resultant control program to protect the workers, public, and environment, one must take into account not only the chemicals present but also their toxicity, physical and chemical characteristics, the available monitoring and analytical methods, and those which have a potential for migration or displacement from the site perimeter. These compounds have been selected based on the above criteria and will serve as indicator compounds for both the hazards involved and the effectiveness of the control program for those hazards.

Polychlorinated biphenyls (PCB) are a group of organic chemicals. They are irritants and cause the skin disease chloracne. They have been implicated in liver cancer. PCB's have the ability to be absorbed through the skin. Their current OSHA limit depends upon the percentage of chlorine. PCB with 42% chlorine has a limit of 1 mg/m^3 and with 54% chlorine has a limit of 0.5 mg/m^3.

Lead is a metal which affects the blood, kidneys, nervous, reproductive and gastrointestinal systems. Its current limit is 50 ug/m^3.

Trichloroethane is a volatile organic chemical which has been used as an industrial degreaser. It affects the liver, kidneys, and skin. Its current exposure limit is 350 ppm.

Chemical information sheets which contain information on the toxicity, routes of exposure, physical state, flammability, corrosivity, reactivity, explosive levels, incompatibilities, vapor pressure and health effects can be found in Appendix A.

The following is a summary of the work that is to be accomplished during this project:

A. Test borings and monitoring well installations.
B. Excavate test pits.
C. Sampling and analysis of soils, ground water, surface water and sediment.

A complete set of hazard analyses can be found in Appendix B. These will be reviewed prior to the start of the specific operation and any modifications to the proposed control techniques will be submitted in writing to the Engineer for his approval.

6. LEVELS OF PROTECTION

Initial work activities will be conducted using the levels of protection as specified in this plan. As air monitoring and other data such as the potential for contact with contaminated material by the various job categories become available, the levels of protection may be upgraded or downgraded to reflect the actual job site conditions. In this way a control program can be devised that will protect the worker and also gain worker acceptance and cooperation, because it is realistic and reflects the hazards to which they are exposed. All requests or changes in the initial levels of protection will be submitted in writing to the Engineer for his approval.

All subcontractors on this project will work under the conditions set forth by this plan. AFI will monitor and enforce subcontractor compliance with this plan.

The initial levels of protection will be:

A. Install borings and monitoring wells - Level C.
B. Develop wells - Level C.
C. Sample wells - Level C.

D. Excavate test pits - Level C.
E. Sample soil - Level C.
F. Sample surface water and sediment - Modified Level D.
G. Air monitoring - Modified Level D.

7. SAFE WORK PRACTICES and ENGINEERING

The primary control method to protect workers against the health effects of the hazards will be the use of personal protective equipment. However, the use of safe work practices and engineering controls as means of protection will be used when such are available, feasible, and provide a degree of protection equal to that of personal protective equipment.

8. ENVIRONMENTAL and PERSONNEL AIR MONITORING

As work progresses, AFI will conduct:

(a) Real time air monitoring in and around the active work area.

(b) Perimeter (fence line) monitoring (real-time and time weighted average).

This sampling will be conducted on a regular basis and as dictated by the work conditions and AFI's safety personnel. All monitoring data will be recorded and become part of the overall site record. These results will be transmitted to the Engineer daily. Real time air monitoring results that are in excess of background levels at the site perimeter locations or those in excess of the designated action levels for personal protective equipment upgrade will be reported to the Engineer when they occur.

A. Area Monitoring

On-site real-time monitoring will be conducted during the following operations:

(a) Installation of monitoring wells and borings.
(b) Well development.
(c) Well sampling.
(d) Excavation of test pits.
(e) Sampling soil.
(f) Sampling surface water and sediment.

The air monitoring equipment will consist of:

(a) Organic vapor monitors - HNU model PI-101 equipped with 10.2 eV lamps (photo-ionization detector).
(b) Digital dust counter - Sibata P5-H2.
(c) Combustible gas/O_2 meter - Niotronics Model 50.

Measurements will be taken in all directions from the specified work areas. Measurements will be taken upwind, downwind, and crosswind of the specified work areas.

All changes of work site status (vapor and/or particulate levels) will be immediately reported by the site safety officer to AFI's Project Manager or his designee.

B. Perimeter Monitoring

One upwind and downwind perimeter monitoring station will be established. Sampling will be conducted for PCB according to NIOSH method 5503. This air monitoring will be conducted during test pit excavation. PCB concentrations greater than 1 ug/m^3 will dictate the need for corrective measures. Corrective measures will be discussed with the NYSDEC and the New York State Department of Health prior to implementation.

C. Action Levels

Based on the real time monitoring results the following action levels will be established:

1. Personnel exposure
    - A) Organic vapor (unknown)
        - 1) Background - Level D.
        - 2) 0-5 ppm above background - Level C.
        - 3) > 5 ppm above background - Level B.
    - B) Particulate
        - 1) Background - Level D.
        - 2) Above background to 150 ug/m^3 - Level C.
        - 3) > 150 ug/m^3 above background - Level B.
    - C) Combustible gas/O_2 - >20% LEL - Stop work.

2. Perimeter
    - A) Organic vapor (unknown)
        - 1) >1 ppm above background - stop work and vapor control techniques instituted.
    - B) Particulate
        - 1) >150 ug/m^3 above background - stop work and dust control techniques instituted.
    - C) Combustible gas/O_2 - >20% LEL - Stop work.

10. PERSONAL PROTECTIVE EQUIPMENT

AFI will provide its personnel with all personal protective equipment. AFI will ensure that all safety equipment and protective clothing is properly used, kept clean, and well maintained.

The following levels of protection will be utilized during this project:

1. Level D
   - a) Hard hat
   - b) Safety glasses or goggles
   - c) Proper Foot Protection
   - d) Work clothes
   - e) Hearing protection if necessary

2. Modified Level D
   - a) Same as 1 (a-e) (Level D)
   - b) Disposable Tyvek
   - c) Full or half face piece air purifying respirator equipped with a combination acid gas/organic vapor/ HEPA cartridge will be carried.

3. Level C
   - a) Same as 1 (a-e) (Level D)
   - b) Disposable Tyvek Polyethylene (PE) Coveralls
   - c) Neoprene overboots
   - d) Nitrile outer gloves
   - e) Disposable latex or cotton inner gloves
   - f) Full or half face piece air purifying respirator equipped with a combination acid gas/organic vapor/ HEPA cartridge.

4. Level B
   - a) Same as 3 (a-f) (Level C)
   - b) Pressure demand supplied air or self contained breathing apparatus.

Respiratory Protection

On-site personnel who are unable to pass a qualitative respirator fit test will not be permitted to enter or work in areas where Level C protection is required to be worn or is required to be carried as a contingency. Each respirator will be individually assigned and will not be interchanged among employees without cleaning and sanitizing. Respirators will be cleaned and sanitized daily. Cartridges and filters will be changed upon breakthrough.

11. PERSONAL HYGIENE

AFI will ensure that all on-site personnel entering the Exclusion Zone or Contaminant Reduction Zone, who are exposed or subject to exposure to hazardous chemical vapors, liquids, or contaminated solids will observe and adhere to the following personal hygiene related provisions. The Health and Safety Officer will be responsible for the enforcement of these rules, and on-site employees found to be continually disregarding these rules will be barred from this site.

These provisions are:

a) On-site personnel will wear personal protective equipment such as coveralls, gloves, and outer footwear as specified in Paragraph 10: **PERSONAL PROTECTIVE EQUIPMENT** at all times whenever entering the Exclusion Zone or the Contaminant Reduction Zone.

b) Used disposable outerwear will not be re-used and will be placed inside designated disposal containers provided for that purpose in the Contaminant Reduction Zone.

c) Disposable outerwear and any other materials placed in containers, together with the containers, will be disposed of in accordance with applicable EPA regulations.

d) Smoking and chewing will be prohibited except in designated smoking areas outside the Exclusion Zone and Contaminant Reduction Zone.

e) Eating and drinking will be prohibited except in a designated lunch or break area outside the Exclusion Zone and Contaminant Reduction Zone.

f) Drinking of replacement fluids will be permitted in a designated area of the Contaminant Reduction Zone. Personnel will, as a minimum, remove outer and inner gloves, respirator and coverall top, and wash hands prior to drinking replacement fluids.

12. CONTAMINANT CONTROL AND EQUIPMENT DECONTAMINATION

Decontamination will take place within the decontamination zone. Personnel decontamination will consist of washing the outer rubber boots and outer gloves with a brush using detergent and water and disposing of the used Tyvek suit.

Non-disposable sampling equipment will be decontaminated with a detergent-water-pesticide grade hexane wash between uses. The backhoe, drilling rig and all drilling accessories will be decontaminated using a pressurized steam cleaner between excavation pits or wells and prior to exiting the site.

Contaminated disposable materials, along with all decontamination solutions, will be collected and drummed in preparation for appropriate disposal.

13. SITE ZONES (Work Zones)

AFI will clearly lay out and identify the various work zones in the field and will limit equipment, operators, and personnel in these zones in compliance with OSHA 29CFR 1910.120 and this health and safety plan.

This work zones are:

a) Exclusion Zone - this zone includes all areas where potentially contaminated materials are exposed, excavated, or handled and all areas where contaminated equipment or personnel may travel. The level of personnel protection will be determined by the Safety Officer in accordance with this plan after monitoring and on-site inspection. The initial level of protection has been specified in Section six (6) of this plan and may be modified depending upon monitoring results and site conditions.

b) Contaminant Reduction Zone - this zone provides for the transfer of construction materials from off-site equipment to site-contaminated equipment, the decontamination of vehicles prior to re-entering the Support Zone, the decontamination of personnel and clothing (including containerization of disposable outerwear), and for the physical segregation of the Support and Exclusion Zones.

c) Support Zone - this zone provides a location for temporary site facilities, personnel decontamination facilities, and an entry and exit area for personnel, material, and equipment to and from the project site.

The following procedures will be used to exit the Exclusion Zone:

a) Drop equipment on plastic sheeting
b) Wash and rinse outer boots and outer gloves at boot wash station
c) Remove tape
d) Remove outer boots
e) Remove outer gloves and dispose in provided container
f) Remove protective suit taking care not to come into contact with outer surfaces of suit and dispose in provided container.
g) Remove respirator face piece.
h) Remove inner gloves and dispose in provided container.

Steps a and b are completed in the Exclusion Zone and the rest are completed in the Contaminant Reduction Zone.

When entering the Exclusion Zone the following steps will be followed:

a) Inspect personal protective equipment.
b) Place legs into protective suit and gather suit around the waist.
c) Put on boots.
d) Tape leg cuffs of suit over boots.
e) Put on respirator and perform positive and negative pressure fit tests.
f) Put on inner gloves.
g) Finish donning the suit.
h) Put on outer gloves and tape to arm cuffs of suit.
i) Enter into Exclusion Zone.

14. EMERGENCY RESPONSE AND CONTINGENCY PLANNING

The following procedures will be followed should an on-site emergency occur:

a) In the event of injury to on-site personnel or contact with hazardous materials, the following protocol will be followed:

  i) in the event of injury, notify the Health and Safety Officer,
  ii) phone designated emergency care facility (St. Joseph's Hospital),
  iii) decontaminate personnel and administer appropriate first aid, and
  iv) transport personnel to the hospital along the designated route.

b) In the event of excessive gases (>20% LEL) or vapors at the work area, the following actions will be taken:

  i) Remove all workers from the area, and

  ii) monitor contaminant concentrations to determine the type of respiratory protective device that will be sufficient before workers re-enter the area to determine the cause(s) of the emergency and the proper method to correct the situation.

c) In the event of a fire, earth moving equipment shall be used to quickly backfill and smother the fire.

d) In the highly unlikely event of a major leak of toxic gas, such as might occur if a compressed gas cylinder were encountered and ruptured during excavation, all on-site personnel shall be evacuated to a safe distance.

After the personnel have been evacuated from the work area, the following course of action will be undertaken:

1) The Engineer will be notified.
2) The situation will be evaluated based on the available information.
3) If necessary, aid will be requested from outside sources.
4) Personnel and equipment allocated for response.
5) If necessary, evacuate the public.
6) Contain or extinguish hazard.
7) Replace damaged or exhausted equipment.
8) Document incident.
9) Review and revise site safety and contingency plans.

The Health and Safety Officer is responsible for initiating all emergency responses. Specific notification requirements will be determined after the results of the background air monitoring are obtained. These requirements will be given in writing to the Engineer.

AFI's Health and Safety Officer will provide a report to the Engineer describing the following:

- The incident (including date and time) that necessitated the notification and the basis for that decision.

- Date, time, and names of all persons/agencies notified and their response.

- Resolution of the incident (including duration) and the method/corrective action involved.

This report will be submitted within five working days of the resolution of the event. In all cases the Engineer will be notified as soon as possible, but after the necessary actions have been taken to protect worker safety and site security. If the Engineer cannot be immediately contacted and in the opinion of the site safety officers an emergency exists, all contractors working on the site will be notified by the Safety and Health Officer of the proper course of action to be followed.

The following phone numbers will be posted at all project telephones:

a)	Fire Department	734-0911
b)	Local police	734-5121
c)	Hospital	737-7806
d)	Ambulance service	734-9161

St. Joseph's Hospital has been designated as the emergency medical care facility for this project. The staff of this facility will be advised of potential medical emergencies including the possibility of contamination of skin and clothing. A route map to the emergency medical route will be completed before mobilization to the Site.

AFI will provide adequate first aid supplies and equipment, eyewash stations, emergency deluge showers, and potable water for all on-site work. At least one industrial first aid kit and stretcher will be provided and maintained fully stocked at a manned location in the active Contaminant Reduction Zones. Should active site work areas be so isolated or separated as to make a single first aid location inadequate, then additional first aid stations will be established in close proximity to the work, but not within active work areas.

First aid kit locations will be specially marked and provided with adequate water and other supplies necessary to cleanse and decontaminate burns, wounds, or lesions. First aid stations will be supplied with buffer solutions for treating acid and caustic burns. Each first aid kit location will be marked.

Emergency deluge showers and eyewash stations will be provided for immediate use and will be protected from contamination in areas where activities involve handling of materials that may be hazardous to the eyes or other exposed portions of the body.

15. MEDICAL SURVEILLANCE

All on-site employees involved in the hazardous phase (work inside the Exclusion and/or Contaminant Reduction Zones) of this project participate in AFI's medical surveillance program which complies with OSHA standard 1910.120.

16. EDUCATION AND TRAINING

Prior to assignment at the site, employees and management who work within the contamination reduction zone and exclusion zone will have completed the 40 hour OSHA mandated training or have been previously certified on the basis of their work experience.

Personnel responsible for training site personnel will have a higher level of training in the areas in which they are providing instruction.

An initial, pre-work site safety meeting will be conducted by the Project Director and Health and Safety Officer for all employees which will include, but not be limited to, the following:

a. Acute and chronic health effects of the toxic chemicals identified at the site.
b. Physical health and safety hazards identified at the site.

c. Personal hygiene and personnel decontamination requirements and procedures.
d. The selection, use, and limitations of available safety equipment, and procedures required for personnel protection.
e. Proper selection, use, maintenance, and fitting of respirators, including drills in using emergency escape units.
f. Work zones established at the site.
g. Prohibitions in contaminated areas.
h. Explanation of the buddy system.
i. Emergency preparedness procedures (emergency egress routes, emergency signals, personnel rescue methods, etc.).
j. Site safety requirements and Health and Safety Plan review.
k. Use of fire extinguishers.
l. Special training for drum opening and sampling techniques, tank demolition, etc.
m. Decontamination procedures for equipment.
n. Review of standard operating procedures.
o. Review of team member responsibilities.
p. Review of Worker's Rights under the OSHA Hazard Communication Standard.
q. Evacuation drills and procedures.

The Safety and Health Officer will conduct weekly safety meetings. These meetings will inform employees of the week's activities and individual responsibilities, inherent hazards, any changes in levels of protection, evacuation routes and emergency procedures for each work area, and approved changes to the Health and Safety Plan. Opportunity will be provided for employees to voice safety-related concerns.

Training Logs will be completed and submitted in accordance with Paragraph 17: LOGS, REPORTS, AND RECORD KEEPING.

17. LOGS, REPORTS, AND RECORD KEEPING:

AFI will maintain logs and reports covering the implementation of the Health and Safety Plan. The logs include Training Logs, Daily Safety Logs, Air Monitoring Results Reports, Weekly Safety Reports and a Close-out Safety Report. These logs and reports will be considered the property of the Department. One copy of the logs and reports will be submitted to the Engineer and another copy will be retained by AFI. A copy of the forms to be used can be found in Appendix C.

Training Logs will be completed by the Industrial Hygienist and submitted to the Engineer prior to allowing personnel on site. These logs will include:

a. Employee's name and attendance record.
b. Time allocation in the training session.
c. Topics covered.
d. Materials used.
e. Equipment demonstrated.
f. Equipment practice for each employee.
g. Prohibitions covered.
h. Explanation of the buddy system.
i. Fit-testing performed and results.
j. Signature of trainer.
k. Other pertinent information.

Daily Safety Logs shall be completed by the Safety and Health Officer and submitted to the Engineer on a daily basis. These logs include:

a. Date.
b. Work area(s) checked.

c. Employees present in work areas.
d. Equipment being utilized by employees.
e. Protective clothing being worn by employees.
f. Protective devices being used by employees.
g. Accidents or breaches of procedure.

Accident Reports will be completed by the Safety Officer and submitted to the Engineer within three working days.

Air Monitoring Reports will be completed by the Safety and Health Officer and submitted to the Engineer on a daily basis. These reports will include:

a. Date of Report.
b. Equipment utilized for air monitoring.
c. Real-Time air monitoring results from each work location.
d. Time-Weighted-Average of personnel sampling, date of actual sampling, and personnel sampled.

Chemical Fact Sheet* Version 3

LEAD (Metallic and Inorganic Compounds)

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Lead, CAS 7439-92-1; lead carbonate, CAS 598-63-0; lead chloride, CAS 7758-95-4; lead monoxide, CAS 1317-36-8; lead sulfide, CAS 1314-87-0; and others.

Trade Names: C.I. Pigment Metal 4, C.I. 77575, Lead flake, Whole lead, Litharge and others.

Uses: Tank linings, piping and other chemical reaction equipment; petroleum refining; manufacture of gasoline additives; pigments for paint; storage batteries, solder and fusible alloys; radiation shielding and others.

PHYSICAL INFORMATION

Appearance: Bluish white to silvery grey solid (lead metal).

Odor: None.

Behavior in Water: Insoluble.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure -- 0.05 mg/m^3 (lead).

NIOSH Recommended Limit: Average 10 hour day or 40 hour week exposure -- 0.1 mg/m^3 (lead).

ACGIH Recommended Limit: Average 8 hour exposure -- 0.15 mg/m^3 (lead).

NOTE: Blood-lead level is a good indicator of total lead exposure. Current OSHA regulations require that if an individual has a blood-lead level greater than or equal to .050 mg lead per 100 ml. blood, he or she must be removed from all exposures to lead and cannot return to the exposure environment until the blood level falls to .040 mg lead per 100 ml. blood or less.

Short Term Exposure:

Note: Lead is a cumulative poison. Increasing amounts can build up in the body eventually reaching a point where symptoms and disability occur. Lead dust carried home on contaminated clothing can result in exposure and symptoms in other family members. Standards only protect for inhalation exposure. Extra precautions should be taken if skin exposure also occurs.

Inhalation: The effects of exposure to fumes and dusts of inorganic lead may not develop quickly. Symptoms may include decreased physical fitness, fatigue, sleep disturbance, headache, aching bones, and muscles, constipation, abdominal pains and decreased appetite. These effects are reported to be reversible if exposure ceases. Inhalation of large amounts of lead may lead to seizures, coma and death.

Skin: May cause irritation.

Eyes: May cause irritation.

Ingestion: See effects listed for inhalation. Ingestion of large amounts of lead may lead to seizures, coma and death.

Long Term Exposure:

Lead can accumulate in the body over a period of time. Therefore, long term exposures to lower levels can result in a build up of lead in the body and more severe symptoms. These may include anemia, pale skin, a blue line at the gum margin, decreased hand-grip strength, abdominal pain, severe constipation, nausea, vomiting, and paralysis of the wrist joint. Prolonged exposure may also result in kidney damage. If the nervous system is affected, usually due to very high exposures, the resulting effects include severe headache, convulsions, coma, delirium and death. In non-fatal cases, recovery is slow and not always complete. Alcohol ingestion and physical exertion may bring on symptoms. Continuous exposure can result in decreased fertility. Elevated lead exposure of either parent before pregnancy can increase the chances of miscarriage or birth defects. Exposure of the mother during pregnancy can cause birth defects.

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*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic is Toxic" available from the New York State Department of Health.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air. Give artificial respiraton as needed. Get medical attention immediately.

Skin: Wash area with plenty of soap and water. Remove any contaminated clothing.

Eyes: Rinse eyes with plenty of water for 15 minutes. Seek medical attention, if necessary.

Ingestion: If person is conscious, give water. Seek medical attention.

Note to Physician: Whole blood lead levels, circulating plasma/erythrocyte lead concentration ratio, urine ALA, and erythrocyte protoporphyrin fluorescent microscopy may all be useful in monitoring or assessing lead exposure. Chelating agents such as edetate disodium calcium and penicillamine are generally useful in the therapy of acute lead intoxification.

FIRE AND EXPLOSION INFORMATION

General: Not combustible. If exposed to fire, may release toxic fumes or sulfur and lead oxides.

Extinguisher: Use extinguisher appropriate to burning material. When fighting fire, wear a self-contained breathing apparatus with a full facepiece and operated in positive pressure mode.

REACTIVITY

Materials to Avoid: Reacts violently with potassium.

Conditions to Avoid: Excessive heat.

PROTECTIVE MEASURES

Storage and Handling: Store in an area away from heat and keep separate from potassium.

Engineering Controls: Adequate ventilation, sinks, showers and eyewash stations should be provided.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Full body work clothing should be worn including bump caps or hard hats, rubber gloves, and eye protection. Employees should routinely wash their skin thoroughly and change clothing at the end of each work shift.

Protective Equipment: For levels up to 0.5 mg/m^3 use a supplied-air respirator, a self-contained breathing apparatus or an air-purifying respirator with high-efficiency particulate filter. For levels up to 1.25 mg/m^3 use a supplied-air respirator operated in continuous flow mode or a powered air-purifying respirator with high efficiency particulate filters. For levels up to 2.5 mg/m^3 use any of the above with a full facepiece. For levels up to 50 mg/m^3 use a Type C supplied-air respirator operated in a positive pressure mode. For levels up to 100 mg/m^3 use a Type C supplied-air respirator with a full facepiece operated in a positive pressure mode. For levels greater than 100 mg/m^3 or in areas of unknown concentrations use a self-contained breathing apparatus with full facepiece operated in a positive-pressure mode or a combination Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. For escape from a contaminated area use a respirator with high-efficiency particulate filters or an escape self-contained breathing apparatus.

Miscellaneous: No eating, drinking, or smoking in areas where the dusts or fumes of lead or its compounds are present.

PROCEDURES FOR SPILLS AND LEAKS

Get all workers out of spill area. Put on necessary protective equipment including respirators. If spill is a solution cover with absorbent and shovel into suitable container. If spill is in powder form, vacuum whenever possible to avoid raising dust by sweeping or blowing. Place in suitable container. For final disposal contact your regional office of the New York State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air. Give artificial respiration or oxygen a required. Seek medical attention if necessary.

Skin: Remove soaked clothing. Wash affected areas with soap and water. Seek medical attention as required.

Eyes: Flush with water for at least 15 minutes. Seek medical attention immediately.

Ingestion: Seek medical attention immediately.

Note to Physician: Expired air analysis may be useful in monitoring exposure.

FIRE AND EXPLOSION INFORMATION

General: Non-flammable.

REACTIVITY

Materials to Avoid: Reacts violently with nitrites, oxygen, sodium and sodium hydroxide. Corrosive to aluminum.

Conditions to Avoid: Hot metals or ultraviolet radiation will decompose 1,1,1-trichloroethane to form irritating and poisonous gases.

PROTECTIVE MEASURES

Storage and Handling: Store in a cool, dark, dry place. Do not store in aluminum containers.

Engineering Controls: Provide adequate ventilation. Sinks, showers and eyewas stations should be readily available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Gloves and apron of polyvinyl alcohol, neoprene (do not use natural rubber) or leather, and splash-proof goggles should be wor if contact with trichloroethane is likely.

Protective Equipment: For levels up to 1000 ppm use a supplied-air respirator or a self-contained breathing apparatus. For levels above 1000 ppm or use in areas of unknown concentrations use a self-contained breathing apparatu with a full facepiece operated in a positive pressure mode or a combinatio Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. For escape from a contaminated area use a gas mask with an organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Keep workers out of spill area. Use sand or other absorbent to absorb material. Shovel into suitable container. Wash spill area with soap and water. For final disposal, contact your regional office of the New York State Department of Environmental Conservation.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air and get medical attention if symptoms continue.

Skin: Remove contaminated clothing immediately. Blot excess with paper towels. Wash affected area thoroughly with soap and water for at least 15 minutes.

Eyes: Rinse eyes with water for at least 15 minutes. A drop of vegetable oil may be added to relieve irritation. Seek medical attention if necessary.

Ingestion: Get immediate medical attention.

Note to Physician: Serum SGOT, SGPT and triglyceride levels have been used to monitor liver damage.

FIRE AND EXPLOSION INFORMATION

General: Non-flammable.

REACTIVITY

Conditions to Avoid: High heat and electrical discharge may produce the highly poisonous substances phosgene, hydrochloric acid and chlorinated dibenzofurans.

PROTECTIVE MEASURES

Storage and Handling: Store in a tightly closed container with proper EPA labelling. Storage for more than 30 days must be in an EPA approved facility.

Engineering Controls: Provide local exhaust ventilation system. Sinks, showers and eyewash stations should be readily available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Wear gloves and aprons made of neoprene, viton or polyethylene, safety glasses with side shields and impervious shoes.

Protective Equipment: For any detectable levels use a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a supplied-air respirator with a full facepiece and an auxiliary self-contained breathing apparatus both operated in positive pressure mode. For escape from a contaminated area wear a gas mask with an organic vapor canister and a high-efficiency particulate filter or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Get workers out of spill area. Wearing protective clothing and equipment, ventilate area to reduce vapor levels. Absorb on nonreactive material such as sand or vermiculite. In the event of a spill and for disposal information, contact your regional office of the New York State Department of Environmental Conservation and the U.S. Environmental Protection Agency.

For more information:
Contact the Industrial Hygienist or Safety Officer at your worksite or the New York State Department of Health, Bureau of Toxic Substance Assessment, 2 University Place, Albany, New York 12203.

Chemical Fact Sheet* Version 2

PCBs

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Polychlorinated biphenyls.

Trade Names: Aroclor, Arochlor, Kaneclor, Clophen, Phenoclor, Pyralene, Askarel, Asbestol, Inerteen, Pyranol, Santotherm, Clorextol, Saf-Ti-Kuhl, No-Flamol, Chemko and others.

Uses: As an insulating, non-flammable, thermally conductive, fluid in electrical capacitors and transformers.

PHYSICAL INFORMATION

Appearance: May be a clear, colorless oily liquid, light to dark yellow resin or wax, or white to yellow powder.

Odor: Aromatic, acrid.

Evaporation: Very slow.

Behavior In Water: Does not mix; sinks.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure -- 1.0 mg/m^3 (42% chlorine).
Average 8 hour exposure -- 0.5 mg/m^3 (54% chlorine).

NIOSH Recommended Limit: Average 10 hour day/40 hour week -- 0.001 mg/m^3.

ACGIH Recommended Limit: Average 8 hour exposure -- 1.0 mg/m^3 (42% chlorine).
Average 8 hour exposure -- 0.5 mg/m^3 (54% chlorine).

Short Term Exposure:

Inhalation: May produce irritation to nose, throat and lungs. Levels above 10 mg/m^3 are reported to be unbearable. Inhalation may contribute significantly to all symptoms of long term exposure.

Skin: Absorption moderate. Contributes significantly to all symptoms of long term exposure. Sensitized individuals may develop a rash after 2 days exposure by contact or inhalation.

Eyes: May produce irritation. Levels of 10 mg/m^3 are severely irritating.

Ingestion: Absorption in digestive system contributes significantly to all symptoms of long term exposure. There are no reported deaths of humans due to a single ingestion. However, experiments in animals suggest that ingestion of 6 to 10 fluid ounces would cause death to a healthy 150 pound adult.

Long Term Exposure:

PCBs are readily absorbed into the body by all routes of exposure. They may persist in tissues for years after exposure stops. The symptoms below may be due to PCBs or to chemical contaminants.

High levels of PCB vapor, 1 to 10 mg/m^3, may produce burning feeling in eyes, nose and face; dry throat; lung and throat irritant; nausea; dizziness and aggravation of acne. These may be felt immediately or be delayed weeks or months.

Chemical acne, black heads, dark patches on skin, and unusual eye discharge have been reported by all routes of exposure. Although some sensitive individuals have reported these effects after two days, onset may not occur for months. These effects may last for months. Liver damage and digestive disturbance have been reproted in some individuals. PCBs may impair the functioning of the immune system.

PCBs at high levels have been shown to produce cancer and birth defects in laboratory animals. Whether PCBs produce these effects in humans is not known.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic Is Toxic", available from the New York State Department of Health.

Chemical Fact Sheet* Version 1

1,1,1-TRICHLOROETHANE

The information in this sheet applies to workplace exposure resulting from processing, manufacturing, storing or handling and is not designed for the population at large. Any generalization beyond occupational exposures should not be made. The best industrial hygiene practice is to maintain concentrations of all chemicals at levels as low as is practical.

Chemical Names: Chloroethane, methyl chloroform, alpha-trichloroethane, methyl trichloroethane; CAS 71-55-6.

Trade Names: Inhibisol, Chlorten, Chlorothene NU, Chlorothene VG, Chlorothene, Alpha-T, Aerothene TT and others.

Uses: Cleaning of plastics, molds and cold type metal, dry cleaning and degreasing.

PHYSICAL INFORMATION

Appearance: Colorless liquid.

Odor: Sweetish, like chloroform. Minimum Detectable By Odor: 400 ppm.

Evaporation: Rapid.

Behavior In Water: Not soluble, sinks.

HEALTH HAZARD INFORMATION

OSHA Standard: Average 8 hour exposure -- 350 ppm.

NIOSH Recommended Limit: 350 ppm.

ACGIH Recommended Limit: Average 8 hour exposure -- 350 ppm.

Short Term Exposure:

Inhalation: Levels above 900 ppm can cause dizziness, mental confusion, drowsiness, loss of coordination and unconsciousness. Death may result.

Skin: Can cause irritation and rash. Absorption is moderate; may contribute significantly to health hazard.

Eyes: Has caused irritation at levels of 450 ppm.

Ingestion: May cause symptoms similar to inhalation. In addition, may cause mouth, throat and stomach irritation.

Long Term Exposure:

Repeated or prolonged contact at levels of 450 ppm or above may result in irritation and dry, scaley, fractured skin. Dizziness, mental confusion, slowed response time and generally reversible liver and kidney damage may result from prolonged inhalation.

*Prepared by the Bureau of Toxic Substance Assessment, New York State Department of Health. For an explanation of the terms and abbreviations used, see "Toxic Substances: How Toxic Is Toxic", available from the New York State Department of Health.

1,1,1-Trichloroethane

EMERGENCY AND FIRST AID INSTRUCTIONS

Inhalation: Move person to fresh air. Give artificial respiration or oxygen a required. Seek medical attention if necessary.

Skin: Remove soaked clothing. Wash affected areas with soap and water. Seek medical attention as required.

Eyes: Flush with water for at least 15 minutes. Seek medical attention immediately.

Ingestion: Seek medical attention immediately.

Note to Physician: Expired air analysis may be useful in monitoring exposure.

FIRE AND EXPLOSION INFORMATION

General: Non-flammable.

REACTIVITY

Materials to Avoid: Reacts violently with nitrites, oxygen, sodium and sodium hydroxide. Corrosive to aluminum.

Conditions to Avoid: Hot metals or ultraviolet radiation will decompose 1,1,1-trichloroethane to form irritating and poisonous gases.

PROTECTIVE MEASURES

Storage and Handling: Store in a cool, dark, dry place. Do not store in aluminum containers.

Engineering Controls: Provide adequate ventilation. Sinks, showers and eyewas stations should be readily available.

Protective Clothing (Should not be substituted for proper handling and engineering controls): Gloves and apron of polyvinyl alcohol, neoprene (do not use natural rubber) or leather, and splash-proof goggles should be wor if contact with trichloroethane is likely.

Protective Equipment: For levels up to 1000 ppm use a supplied-air respirator or a self-contained breathing apparatus. For levels above 1000 ppm or use in areas of unknown concentrations use a self-contained breathing apparatu with a full facepiece operated in a positive pressure mode or a combinatio Type C supplied-air respirator with an auxiliary self-contained breathing apparatus, both with a full facepiece and operated in a positive pressure mode. For escape from a contaminated area use a gas mask with an organic vapor canister or an escape self-contained breathing apparatus.

PROCEDURES FOR SPILLS AND LEAKS

Keep workers out of spill area. Use sand or other absorbent to absorb material. Shovel into suitable container. Wash spill area with soap and water. For final disposal, contact your regional office of the New York State Department of Environmental Conservation.

For more information:

Contact the Industrial Hygienist or Safety Officer at your worksite or the
New York State Department of Health, Bureau of Toxic Substance Assessment,
2 University Place, Albany, New York 12203.

SAFETY and HEALTH HAZARD ANALYSIS

TASK	HAZARD(s)	CONTROL(s)
1) TEST BORINGS and MONITORING WELL INSTALLATION AND DEVELOPMENT	a) Possible exposure to air contaminants b) Possible exposure to noise c) Possible exposure to moving mechanical parts	a) Personal protective equipment a) Air Monitoring b) Hearing protection worn c) Moving parts of mechanical equipment equipped with proper guards or distance from employee a-c) Employee training and safety meetings
2) EXCAVATE TEST PITS	a) Moving Equipment b) Possible exposure to noise c) Possible exposure to air contaminants	a) Trained, experienced operators used a) Equipment checked daily for defects a) Damaged equipment removed from service a) Foot traffic restricted in areas of operation a) No riding on equipment unless a seat is provided a) Established set of hand signals for laborers assisting in the operation of equipment b) Hearing protection worn c) Personal protective equipment c) Air monitoring a-c) Employee training and safety meetings

SAFETY and HEALTH HAZARD ANALYSIS

TASK	HAZARD(s)	CONTROL(s)
3) SAMPLING AND ANALYSIS OF SOILS, GROUND WATER, SURFACE WATER AND SEDIMENT	1) Possible exposure to contaminated material	a) Personal protective equipment a) Air monitoring a) Employee training and safety meetings

HEALTH HAZARD ANALYSIS

CONTAMINANT	EFFECTS	INHALATION	INGESTION	ABSORPTION	LIMITS
(1) PCB's	Chloracne, liver, kidney, suspect liver carcinogen	YES	YES	YES	1.0 mg/m^3 (42% chlorine) 0.5 mg/m^3 (54% chlorine)
(2) LEAD (inorganic)	Blood damage, liver and kidney, nervous system, gastro-intestinal	YES	YES	NO	50 ug/m^3
(3) 1,1,1-TRICHLOROETHANE	Upper respiratory tract irritant, skin irritant, central nervous system, liver	YES	YES	NO	350 ppm

DAILY SAFETY LOG

Date: ______________________

Work Period Covered: ______________________

Weather Conditions: ______________________

Summary of Day's Work Activity: ______________________

____

____

Equipment Utilized by Safety Monitors ______________________

____

____

Protective Clothing and Equipment Being Used by Task: ______________________

____

____

Physical Condition of Workers (any heat or cold stress or other medical problems): ______________________

____

____

Accidents or Breach of Procedures: ______________________

____

____

Description of Monitoring and Air Samples Taken: ______________________

____

____

____

Miscellaneous: ______________________

____

____

______________________ ______________________
Name Title

Signature: ______________________

DAILY FIELD MONITORING RESULTS

DATE: ____________________

HNU DATA				SIBATA PARTICULATE DATA			
TIME	AREA	READING	COMMENTS	TIME	AREA	READING	COMMENTS

COMMENTS:

TRAINING LOG

Date: ____________________

Employees in Attendance:

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

Description of Training Activity/Topics Covered: ____________________

Equipment Demonstrated: ____________________

Special Training and Other Comments: ____________________

____________________ Name of Person Conducting Training

____________________ Title

Signature ____________________

DAILY CALIBRATION DATA

DATE ____

HYGIENIST ____

HNU

SPAN GAS CONCENTRATION	SPAN ADJUSTMENT	COMMENTS

OXYGEN METER/EXPLOSIMETER ____

SIBATA ____

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

I. Shulman & Son

Remedial Investigation/
Feasibility Study

WILLIAM L. HEITZENRATER
PROJECT MANAGER

MARK HUNT
QUALITY ASSURANCE MANAGER

PROJECT NUMBER: C-1089
VERSION: 1.00
MAY 1990

PREPARED BY:

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1.0 INTRODUCTION

1.1 GENERAL

This Quality Assurance Project Plan (QAPP) has been developed for the Remedial Investigation (RI) and Feasibility Study (FS) to be conducted at the I. Shulman & Son (Shulman) site in Elmira, New York. The RI/FS is being conducted to further evaluate contamination found on the site during a Phase II Investigation, and to characterize contaminated soil for selection of appropriate remedial action alternatives.

Specific information regarding the site location and history is provided in the RI/FS workplan.

1.2 PROJECT ORGANIZATION AND MANAGEMENT

The sections below identify the key personnel on this project that have quality assurance responsibilities. Additional information regarding these personnel is provided below.

1.2.1 Project Director

William L. Heitzenrater will serve as the Project Director for the Shulman RI/FS. Mr. Klippel has considerable experience overseeing large scale projects and has been responsible for the conduct of numerous investigative studies at inactive hazardous waste sites.

1.2.2 Quality Assurance Manager

Mark Hunt will serve as the Quality Assurance Manager on this project. The Quality Assurance Manager's responsibilities will be to insure that all of the appropriate procedures in this QAPP are followed and that the proper documentation is maintained. The Quality Assurance Manager is also responsible for overseeing the review and analysis of analytical data and insuring that all chemical testing is performed in accordance with previously agreed upon procedures.

1.2.3 Sampling and Equipment Coordinator

Tom Moore will serve as the AFI Environmental coordinator for all sampling services needed as part of the RI/FS. Mr. Moore will be responsible for insuring that the proper procedures, containers, and preservatives are utilized. In addition, he will be responsible for insuring that all field equipment is in operable condition and calibrated and that all chain-of-custody and other recordkeeping requirements are completed.

1.2.4 Boring Program Coordinator

Mark Seiler will be the in-field coordinator for the boring program and test pit excavations. Mr. Seiler will coordinate all activities with the drilling subcontractor and will arrange for all geotechnical soil testing.

1.2.5 Analytical Report Review

Kathy Fregelette will be responsible for reviewing the quality control data presented with laboratory analytical reports.

1.3 QAPP ORGANIZATION

Section 2 of this QAPP discusses the data quality objectives and analytical requirements for the Shulman RI/FS. Section 3 describes standardized sampling procedures for various environmental media. Section 4 describes field monitoring procedures. Section 5 contains the requirements for maintaining sample integrity. Field instrument calibration and maintenance is covered in Section 6.

2.0 QUALITY ASSURANCE OBJECTIVES

2.1 INTRODUCTION

This section discusses the quality assurance objectives (QAO) that have been established for the I. Shulman & Son RI/FS. Quality Assurance objectives are the requirements specifying the quality of the environmental data needed to support the decision-making process. Established of QAO's identifies the target levels of measurement for various laboratory and field activities and also serves to identify the uncertainty that will be inherent in these measurements. One of the goals of the site investigation is to keep the uncertainty to levels that will allow the resultant data to be utilized.

Various procedures will be utilized to monitor the precision, accuracy and representativeness. Section 2.2 discusses the data quality requirements for the Shulman project. Section 2.3 discusses the sampling and analysis planned for the RI/FS. Section 2.4 discusses the quality assurance samples.

2.2 DATA QUALITY REQUIREMENTS

Table 2-1 identifies the data quality requirements (DQR) for the Shulman RI/FS. Several of these items are discussed further below:

- Sample analysis - Analytical testing of samples will be conducted for ground water, soil, surface water, sediment and air samples obtained at the Shulman site. The quality of the data needed is determined by the intended end use in the feasibility study portion of this project. Ground water quality will be monitored in both existing and new wells (to be installed during te RI/FS). Since this information is being utilized to further refine the determination of the impact of the Shulman site on the ground water in the area, testing will be to determine what

TABLE 2-1

DATA QUALITY REQUIREMENTS

Data Needed	Data Quality Required
Contaminant identification/ concentration levels for sediment, soil, ground water, surface water and air	TCL-CLP for ground water, surface water and sediment. RECRA characterization and landburial ban analysis for soil.
Water level	±0.01 foot
Population information	Most recent census and field verification
ARARs	Existing and proposed regulatory levels
Acceptable risk clean-up criteria	ARAR's when available. If ARAR's are not available: - non-carcinogens - no appreciable risk of significant adverse effect - carcinogens - 10^{-4} to 10^{-7} lifetime excess cancer risk
Treatment technology evaluation	Actual remedial action data
Estimated quantities of contaminated media	±20% of actual volume.
Unit costs	Vendor quotations and actual costs from similar projects preferred Compendium costs adjusted to current dollars
Cost estimates	±50% - 30% all in current year dollars

contaminants may be present. Testing of soil is being conducted to properly characterize the soil for disposal and to determine what areas of the site need to be remediated to a target level of 10 ppm PCB's. The sewer investigation will involve a study of what contaminants are contained in surface water runoff to the sewer and what contaminants may be in the sewer sediment. Air sampling is being conducted to monitor any off-site migration of PCB- contaminated particulates. Further information regarding parameters, analytical methodologies, and detection limits is provided in section 2.3 of this QAPP.

- Water levels - Water level readings will be conducted on a monthly basis (for six months) in all monitoring wells. This data will be needed to develop the rate and direction of ground water flow at the Shulman site. Water levels will be measured to the nearest 0.01 foot. Surveying of measuring points (i.e., top of the well casing) will be conducted by a New York State licensed surveyor.
- Population information - Data regarding the number of residents and workers in the ara surrounding the site is needed to develop exposure potentials during the baseline risk assessment. The data will be from the most recent census data available, and will be verified to within a two block radius of the site. The verification will involve a door-to-door canvass to determine names and numbers of occupants per address.
- ARAR's - Development of applicable or relevant and appropriate requirements (ARAR's) is needed to evaluate the impact of the site on the environmental media in the area. Standards used will include the USEPA and New York State drinking water and ambient water quality standards, and NYSDEC class GA ground water standards. Since there are no ambient air standards for PCB's, the OSHA exposure requirements will serve as guidance for the air evaluation. Soil levels of PCB's will be compared to the current PCB

spill cleanup standards as given in 40 CFR 761, Subpart G (PCB Spill Cleanup Policy). There are currently no other Federal or State standards for contaminant levels in soil.

- Acceptable Risk Clean-up Criteria - During the development and analysis of alternatives, the risks associated with potential alternatives will be evaluated based on a reasonable maximum exposure scenario. Evaluation of acceptable risks will be based on the current USEPA guidelines as follows. ARAR's will be used if available. For noncarcinogenic chemicals for which an ARAR is not available, acceptable risk is when exposures are such that no appreciable risk of significant adverse effects to individuals over a lifetime of exposure exist. For carcinogens, health-based ARAR's will be used when available. When an ARAR is not available, remedies will be selected that result in cumulative risks that fall within a range of 10^{-4} to 10^{-7} individual lifetime excess cancer risk (ref.: 53 FR 51394-51520, 12/21/88).
- Estimated quantities of contaminated media that will need to be cleaned up will be used in determining remedial activities and for cost estimates for those activities. The estimates used will be ±20 percent of actual quantity.
- Cost estimates - Estimates of the total cost for various alternative actions will be needed during the FS process to properly evaluate and select the appropriate remedy. Cost estimates in the range of +50 percent to 30 percent of actual cost (in current year dollars) will be utilized.

2.3 ANALYTICAL REQUIREMENTS

The following sections discussed the analytical requirements for samples being taken during the RI/FS at the Shulman site. Table 2-2 identifies the type and number of samples along with

TABLE 2-2
SAMPLING AND ANALYSIS MATRIX
I. SHULMAN & SON RI/FS

MEDIA	NO. OF SAMPLES	DUPLICATES	TRIP BLANKS	OTHER QA/QC	PARAMETER LIST	DATA VALIDATION REQUIRED
GROUND WATER						100%
Event 1	14	1	1	1 MS, 1 MSD	TCL; CLP protocol + Cr(hex)	
Event 2	14	1	1*		To be determined	
SOIL						
Composite	10-20	1	1*	1MS, 1MSD	PCB's, RECRA HAZARDOUS WASTE CHARACTERIZATION AND LAND BURIAL BAN	10%
SURFACE WATER						
Event 1	5	1		1 Field blank	TCL; CLP protocol	100%
SEWER SEDIMENT						
Event 1	3-10	1		1MS, 1MSD	TCL; CLP protocol	100%
AIR						
Event 1	6-8				PCB's	10%
OIL PIT SAMPLES						NONE
Sediment	2				PCB's, oil & grease	
Oil	1				PCB's	

* = VOC's only MS = Matrix spike MSD = Matrix spike duplicate

the required analytical requirements.

2.3.1 Ground Water

Two sampling events are planned for the Shulman RI. During the first event, all new and existing wells will be samples. Samples will be submitted for analysis of the organic and inorganic analytes found in the New York State Department of Environmental Conservation Contract Laboratory Program protocol (NYSDEC CLP, November 1987, Volume I, Exhibit C, Sections I and II). The parameter list will include the contaminants on the Target Coumpound List (TCL) and up to 30 additional tentatively identified compounds from GC/MS peaks greater than 10 percent of the nearest calibrating standard. Table 2-3 identifies the parameter on the TCL list along with the target detection limits. Samples of all wells will also be analyzed for hexavalent chromium in accordance with USEPA Method 218.4.

The second sampling event, if necessary, will be for selected parameters found in the first sampling. Analytical methodologies will be determined based on the testing required.

2.3.2 Soil

Soil testing will be for PCBs, ignitability, corrosivity, reactivity, EP Toxicity metals, aromatics, halogenated organics, nitrogenated organics and low molecular weight organics. Table 2-3A identifies the preceding parameters along with the detection limits and methods.

2.3.3 Surface Water

Samples of surface water will be obtained during precipitation events that result in significant runoff. Samples will be submitted for analysis of the organic and inorganic analytes found in the New York State Department of Environmental Conservation Contract Laboratory Program protocol (NYSDEC CLP, November 1987, Volume I, Exhibit C, Section I and II). The parameter list will include the contaminants on the Target Compound List (TCL) and all GC/MS peaks greater than 10 percent of the nearest calibrating standard. Table 2-3 identifies the parameters on the TCL list along with the target detection limits.

After discussions with the analytical laboratory, General Testing, AFI Environmental has determined that the proposed method for composition of surface water samples could be a problem for volatiles and semi-volatiles. Therefore, samples of surface water will be obtained during a precipitation event that results in significant runoff. Sample sets consisting of 3 grab samples will be collected such that one sample is collected from each drainage inlet at various times during the precipitation event. The most representative sample set will be selected and submitted for analysis for volatiles and semi-volatiles and all other constituants for organic and inorganic analytes found in the New York State Department of Environmental Conservation Contract Laboratory Program Protocol (NYSDEC CIP, November 1987, Volume I, Exhibit C, Sections I and II). The parameter list will include the contaminants in the Target Compound List (TCL), and all GC/MS peak greater than 10 percent of the nearest calibration standard. Table 2-3 identifies the parameter on the TCL list along with the target detection limits.

Revised Text
AFI Revision #2 4/24/90

TABLE 2-3

Superfund Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Page 1 of 6

	Volatiles	CAS Number	Quantitation Limits** Low Water µg/L	Quantitation Limits** Low Soil/Sediment µg/Kg
1.	Chloromethane	74-87-3	10	10
2.	Bromomethane	74-83-9	10	10
3.	Vinyl chloride	75-01-4	10	10
4.	Chloroethane	75-00-3	10	10
5.	Methylene chloride	75-09-2	5	5
6.	Acetone	67-64-1	10	10
7.	Carbon Disulfide	75-15-0	5	5
8.	1,1-Dichloroethylene	75-35-4	5	5
9.	1,1-Dichloroethane	75-35-3	5	5
10.	1,2-Dichloroethylene (total)	540-59-0	5	5
11.	Chloroform	67-66-3	5	5
12.	1,2-Dichloroethane	107-06-2	5	5
13.	2-Butanone	78-93-3	10	10
14.	1,1,1-Trichloroethane	71-55-6	5	5
15.	Carbon tetrachloride	56-23-5	5	5
16.	Vinyl acetate	108-05-4	10	10
17.	Bromodichloromethane	75-27-4	5	5
18.	1,1,2,2-Tetrachloroethane	79-34-5	5	5
19.	1,2-Dichloropropane	78-87-5	5	5
20.	cis-1,3-Dichloropropene	10061-01-5	5	5
21.	Trichloroethene	79-01-6	5	5
22.	Dibromochloromethane	124-48-1	5	5
23.	1,1,2-Trichloroethane	79-00-5	5	5
24.	Benzene	71-43-2	5	5
25.	trans-1,3-Dichloropropene	10061-02-6	5	5
26.	Bromoform	75-25-2	5	5
27.	2-Hexanone	591-78-6	10	10
28.	4-Methyl-2-pentanone	108-10-1	10	10
29.	Tetrachloroethylene	127-18-4	5	5
30.	Toluene	108-88-3	5	5
31.	Chlorobenzene	108-90-7	5	5
32.	Ethyl Benzene	100-41-4	5	5
33.	Styrene	100-42-5	5	5
34.	Total Xylenes	1330-20-7	5	5

*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**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 protocol, will be higher.

TABLE 2-3
Superfund Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*
Page 2 of 6

	Semivolatiles	CAS Number	Quantitation Limits** Low Water µg/L	 Low Soil/Sediment µg/Kg
35.	Phenol	108-95-2	10	330
36.	bis(2-Chloroethyl) ether	111-44-4	10	330
37.	2-Chlorophenol	95-57-8	10	330
38.	1,3-Dichlorobenzene	541-73-1	10	330
39.	1,4-Dichlorobenzene	106-46-7	10	330
40.	Benzyl alcohol	100-51-6	10	330
41.	1,2-Dichlorobenzene	95-50-1	10	330
42.	2-Methylphenol	95-48-7	10	330
43.	bis(2-Chloroisopropyl) ether	108-60-1	10	330
44.	4-Methylphenol	106-44-5	10	330
45.	N-Nitroso-dipropylamine	621-64-7	10	330
46.	Hexachloroethane	67-72-1	10	330
47.	Nitrobenzene	98-95-3	10	330
48.	Isophorone	78-59-1	10	330
49.	2-Nitrophenol	88-75-5	10	330
50.	2,4-Dimethylphenol	105-67-9	10	330
51.	Benzoic acid	65-85-0	50	1600
52.	bis(2-Chloroethoxy) methane	111-91-1	10	330
53.	2,4-Dichlorophenol	120-83-2	10	330
54.	1,2,4-Trichlorobenzene	120-82-1	10	330
55.	Naphthalene	91-20-3	10	330
56.	4-Chloroaniline	106-47-8	10	330
57.	Hexachlorobutadiene	87-68-3	10	330
58.	4-Chloro-3-methylphenol (p-chloro-m-cresol)	59-50-7	10	330
59.	2-Methylnaphthalene	91-57-6	10	330
60.	Hexachlorocyclopentadiene	77-47-4	10	330
61.	2,4,6-Trichlorophenol	88-06-2	10	330
62.	2,4,5-Trichlorophenol	95-95-4	50	1600
63.	2-Chloronaphthalene	91-58-7	10	330
64.	2-Nitroaniline	88-74-4	50	1600
65.	Dimethyl phthalate	131-11-3	10	330
66.	Acenaphthylene	208-96-8	10	330
67.	2,6-Dinitrotoluene	606-20-2	10	330
68.	3-Nitroaniline	99-09-2	50	1600
69.	Acenaphthene	83-32-9	10	330
70.	2,4-Dinitrophenol	51-28-5	50	1600
71.	4-Nitrophenol	100-02-7	50	1600
72.	Dibenzofuran	132-64-9	10	330

TABLE 2-3
Superfund Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Semivolatiles (cont.)	CAS Number	Quantitation Limits** Low Water ug/L	Low Soil/Sediment^b ug/Kg
73. 2,4-Dinitrotoluene	121-14-2	10	330
74. Diethylphthalate	84-66-2	10	330
75. 4-Chlorophenyl phenyl ether	7005-72-3	10	330
76. Fluorene	86-73-7	10	330
77. 4-Nitroaniline	100-01-6	50	1600
78. 4,6-Dinitro-2-methylphenol	534-52-1	50	1600
79. N-nitrosodiphenylamine	86-30-6	10	330
80. 4-Bromophenyl phenyl ether	101-55-3	10	330
81. Hexachlorobenzene	118-74-1	10	330
82. Pentachlorophenol	87-86-5	50	1600
83. Phenanthrene	85-01-8	10	330
84. Anthracene	120-12-7	10	330
85. Di-n-butyl phthalate	84-74-2	10	330
86. Fluoranthene	206-44-0	10	330
87. Pyrene	129-00-0	10	330
88. Butyl benzyl phthalate	85-68-7	10	330
89. 3,3'-Dichlorobenzidine	91-94-1	20	660
90. Benz(a)anthracene	56-55-3	10	330
91. Chrysene	218-01-9	10	330
92. bis(2-ethylhexyl)phthalate	117-81-7	10	330
93. Di-n-octyl phthalate	117-84-0	10	330
94. Benzo(b)fluoranthene	205-99-2	10	330
95. Benzo(k)fluoranthene	207-08-9	10	330
96. Benzo(a)pyrene	50-32-8	10	330
97. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
98. Dibenz(a,h)anthracene	53-70-3	10	330
99. Benzo(g,h,i)perylene	191-24-2	10	330

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*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**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.

TABLE 2-3

Superfund Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL)*

Page 4 of 6

	Pesticides/PCBs	CAS Number	Quantitation Limits** Low Water ug/L	 Low Soil/Sediment ug/Kg
100.	alpha-BHC	319-84-6	0.05	8.0
101.	beta-BHC	319-85-7	0.05	8.0
102.	delta-BHC	319-86-8	0.05	8.0
103.	gamma-BHC (Lindane)	58-89-9	0.05	8.0
104.	Heptachlor	76-44-8	0.05	8.0
105.	Aldrin	309-00-2	0.05	8.0
106.	Heptachlor epoxide	1024-57-3	0.05	8.0
107.	Endosulfan I	959-98-8	0.05	8.0
108.	Dieldrin	60-57-1	0.10	16.
109.	4,4'-DDE	72-55-9	0.10	16.
110.	Endrin	72-20-8	0.10	16.
111.	Endosulfan II	33213-65-9	0.10	16.
112.	4,4'-DDD	72-54-8	0.10	16.
113.	Endosulfan sulfate	1031-07-8	0.10	16.
114.	4,4'-DDT	50-29-3	0.10	16.
115.	Endrin ketone	53494-70-5	0.10	16.
116.	Methoxychlor	72-43-5	0.5	80.
117.	alpha-Chlordane	5103-71-9	0.5	80.
118.	gamma-Chlordane	5103-74-2	0.5	80.
119.	Toxaphene	8001-35-2	1.0	160.
120.	AROCLOR-1016	12674-11-2	0.5	80.
121.	AROCLOR-1221	11104-28-2	0.5	80.
122.	AROCLOR-1232	11141-16-5	0.5	80.
123.	AROCLOR-1242	53469-21-9	0.5	80.
124.	AROCLOR-1248	12672-29-6	0.5	80.
125.	AROCLOR-1254	11097-69-1	1.0	160.
126.	AROCLOR-1260	11096-82-5	1.0	160.

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*Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

**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 protocol, will be higher.

Superfund Target Compound List (TCL) and Contract Required Quantitation Limit

	Quantitation Level [1] [2]	
Parameter	Low water (ug/L)	Low soil/sediment (mg/kg)
1. Aluminum	200	40
2. Antimony	60	12
3. Arsenic	10	2
4. Barium	200	40
5. Beryllium	5	1
6. Cadmium	5	1
7. Calcium	5000	1000
8. Chromium	10	2
9. Cobalt	50	10
10. Copper	25	5
11. Iron	100	20
12. Lead	5	1
13. Magnesium	5000	1000
14. Manganese	15	3
15. Mercury	0.2	0.2
16. Nickel	40	8
17. Potassium	5000	1000
18. Selenium	5	1
19. Silver	10	2
20. Sodium	5000	1000
21. Thallium	10	2
22. Vanadium	50	10
23. Zinc	20	4
24. Cyanide	10	2
25. Hexavalent Chromium	20	4

TABLE 2-3

Page 6 of 6

1: Any analytical method specified in Exhibit D, CLP-Inorganics may be utilized as long as the documented instrument or method detection limits meet the Contract Required Quantitation Level (CRQL) requirements. Higher quantitation levels may <u>only</u> be used in the following circumstance:

If the sample concentration exceeds two times the quantitation limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the contract required quantitation level. This is illustrated in the example below:

For lead:
Method in use = ICP
Instrument Detection Limit (IDL) = 40
Sample concentration = 85
Contract Required Quantitation Level (CRQL) = 5

The value of 85 may be reported even though instrument detection limit is greater than Contract Required Quantitation Limit. The instrument or method detection limit must be documented as described in Exhibit E.

2: These CRQL are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E. The quantitation limits for samples may be considerably higher depending on the sample matrix.

TABLE 2 - 3A

METHOD 8080 / 608

Chlorinated Pesticides / PCBs

Parameter	Soil (ug / kg) PQL
Alpha - BHC	2.0
Beta - BHC	2.0
Gamma - BHC (Lindane)	2.0
Heptachlor	2.0
Delta - BHC	2.0
Aldrin	2.0
Heptachlor epoxide	2.0
Alpha - Endosulfan	2.0
4,4' -DDE	2.0
Dieldrin	2.0
Endrin	2.0
Beta - Endosulfan	4.0
4,4 -DDT	4.0
Endrin Aldehyde	4.0
Endosulfan Sulfate	4.0
Mirex	8.0
Methoxychlor	8.0
Endrin Ketone	8.0
Chlordane	8.0
Toxaphene	40.0
PCB 1016	20.0
PCB 1221	20.0
PCB 1232	20.0
PCB 1242	20.0
PCB 1248	20.0
PCB 1254	20.0
PCB 1260	20.0
Chlorobenzilate	20.0

TABLE 2-3A

PARAMETERS	METHOD	MDL
PCBs	SW 846 #8080	See Attached
Ignilability	Open Cup - ASTM 92-57 Closed Cup - SW846 #1010 - ASTM D93-62	"
Corrosivity	SW 846 #1110	"
Reactivity		
Cyanide	SW 846 7.3.3.2	0.3-0.4 ppm
Sulfide	SW 846 7.3.4.2	6 - 7 ppm
EP Tox Metals	SW 846 #1310	
Arsenic	#7060	0.020 ppm
Barium	#7080	1.00 ppm
Cadmium	#7030	0.10 ppm
Chromium	#7190	0.50 ppm
Lead	#7420	0.50 ppm
Mercury	#7470	0.0020 ppm
Selenium	#7740	0.020 ppm
Silver	#7760	0.10 ppm
Land Burial	NYSDEC Procedure	
TOX	App A	2.0 %
Aromatic Organics	App B	2.0 %
Total Organic Nitrogen	App C	2.0 %
Low Molecular Wt Organics	App D	2.0 % by/wt.

The second sampling event, if necessary, will be for selected parameters found in the first sampling. Analytical methodologies will be determined based on the testing required.

2.3.4 Sewer Sediment

Sediment samples obtained during the sewer investigation will be submitted for analysis of the organic and inorganic analytes found in the New York State Department of Environmental Conservation Contract Laboratory Program protocol (NYSDEC CLP, November 1987, Volume I, Exhibit C, Sections I and II). The parameter list will include the contaminants on the Target Compound List (TCL) and all GC/MS peaks greater than 10 percent of the nearest calibrating standard. Table 2-3 identifies the parameters on the TCL list along with the target detection limits.

The second sampling event, if necessary, will be for selected parameters found in the first sampling. Analytical methodologies will be determined based on the testing required.

2.3.5 Air Samples

Analysis of high-volume filter samples obtained during the air monitoring program will be in accordance with DOH method 311-1. The detection limit, which is a function of the analytical detection limit and the volume of air drawn through the filter. Analysis is being done for total PCB's. Individual arochlors will be identifed and quantified where found.

2.3.6 Oil Pit Samples

Samples of sediment from the oil pit area will be analyzed for PCBs and oil and grease. PCB analysis will be in accordance with USEPA Method 8080 with a detection limit of 0.72 ppm total PCBs. Oil and grease analysis will be in accordance with USEPA Method 9071. Analysis is being done for total PCBs. Individual arochlors will be identified and quantified where found.

2.3.7 Detection Limits

Detection limits given in the preceding subsections are based on conducting the testing in accordance with the stated analytical methodology in the absence of matrix interferences and high levels of target and non-target analytes. Analytical clean-ups will be performed for matrix interference where required according to the methods and protocols designated in the 2/12/90 letter from General Testing to AFI. If the laboratory is unable to meet the stated detection limits (after appropriate cleanup) due to matrix interferences, the will contact AFI Environmental prior to proceeding further with the analytical work. AFI Environmental will discuss the situation with the laboratory to determine what, if anything, can be done for improvement. AFI Environmental will then discuss this with the NYSDEC prior to deciding on a course of action.

2.3.8 Analytical Report Deliverables

The NYSDEC will be provided with the CLP reporting and deliverables, and data validation for samples, according to the following categories as summarized in Table 2-2.

Category 1 - Sediment and water samples analyzed for the complete TCL and consistent with the reporting and deliverables in the 1987 NYSDEC CLP for VOAs, SVAs, Pesticides/PCBs and inorganics. Data validation will be performed for 100% of these samples.

Category 2 - Groundwater samples analyzed for the complete TCL plus hexavalent chromium and consistent with the reporting and deliverables in the 1987 NYSDEC CLP for VOAs, SVAs, Pesticides/PCBs and inorganics. Data validation will be performed for 100% of these samples.

Category 3 - Soil samples analyzed for PCBs, ignitability, corrosivity, reactivity, EP Toxicity metals, aromatics, halogenated organics, nitrogenated organics and low molecular weight organics. The laboratory will supply the following documentation for 10% of these samples.

- Method of sample preparation
- Method for sample clean-up (if used)
- Calibration data (initial/continuing)
- Matrix spike/matrix spike duplicate
- Definition of surrogates
- Recovery of surrogates
- Instrument Blank
- Method Blank
- Retention time windows

- Raw data(chromatograms and integration files)
- Corrective action taken

Selection of the samples which will be included in this 10% will remain a field decision based on consultation with the on-site NYSDEC representative.

The remaining 90% of these samples will be presented in summary form only. The NYSDEC will be provided with full validation on the 10% of the samples requiring full reporting and deliverables , and shall retain the option to require full reporting of samples.

Category 4 - Analysis of oil pit samples of sediment, oil and grease will not be validated. The data will be presented to the NYSDEC in a summary form.

2.4 QUALITY ASSURANCE SAMPLES

Table 2-2 identifies the quality assurance samples that will be obtained for each type of sampling being conducted during this RI/FS. Duplicate samples will be taken for approximately 10 percent of each type of sample taken. Trip blanks will be utilized for water analyses for volatile organics. Since dedicated bailers will be utilized, field blanks for ground water samples will not be taken. Field blanks will be taken for the surface water and sewer sediment sampling. One matrix spike (MS) and the matrix spike duplicate (MSD) will be taken for the sewer sediment samples, along with the first event samples of ground water, as required by the CLP. Location of the duplicates, MS, and MSD will be determined in the field upon consideration of such factors as sample size, well recovery rates, etc.

2.5 GRID SAMPLING TO VERIFY CLEANUP

After excavation, sampling and disposal of contaminated soil grid samples will be collected from sections 1, 2, and 4 as shown in Figure 2-1, 2-2, and 2-3. Samples will be composited 4-1 and analyzed for PCBs. Data will be reviewed to ensure the target level of 10 ppm PCBs has been met for each section.

SHULMAN AND SONS

SECTION 1 SAMPLE LOCATIONS

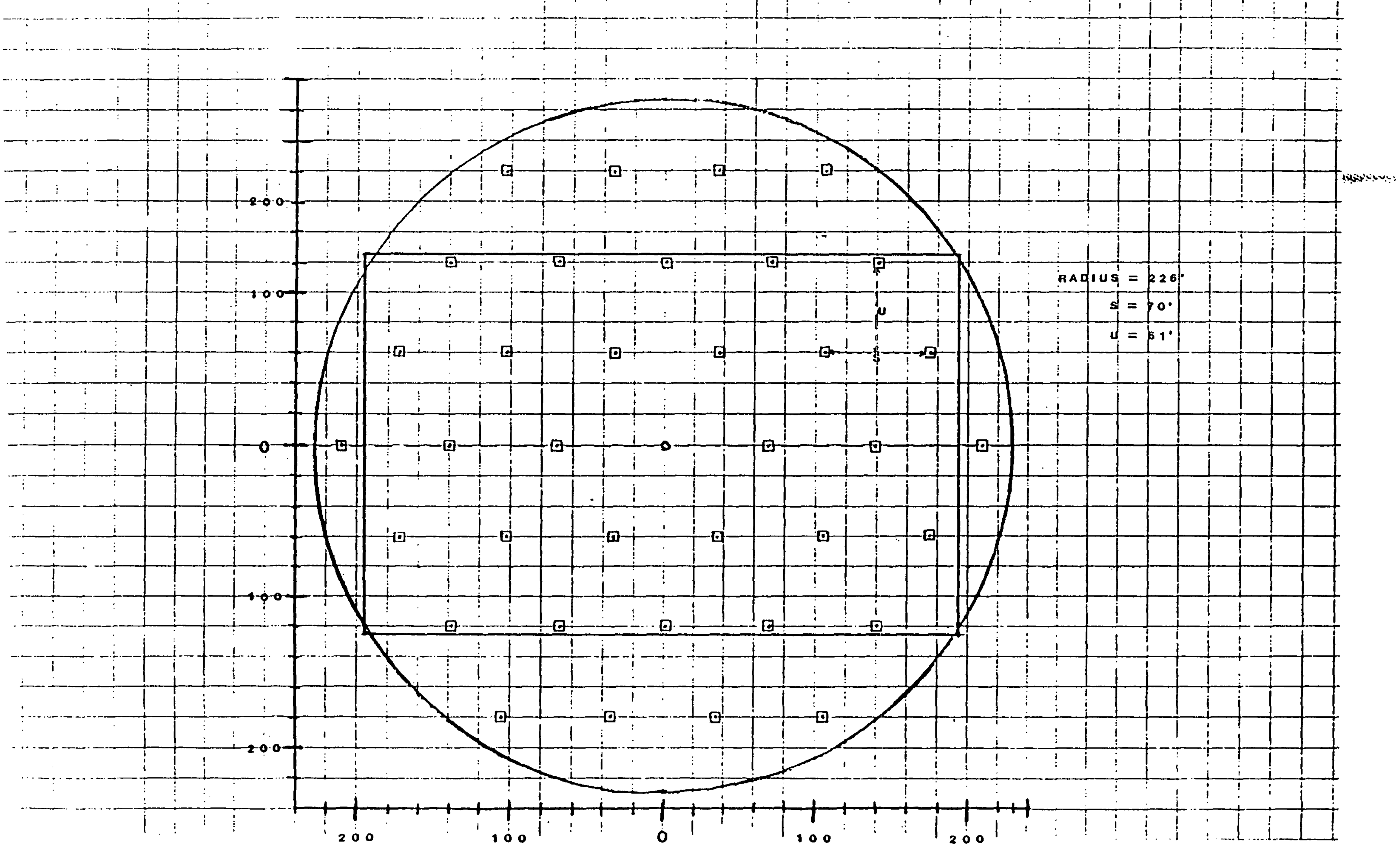


FIGURE 2–1

SHULMAN AND SONS
SECTION 2 SAMPLE LOCATIONS

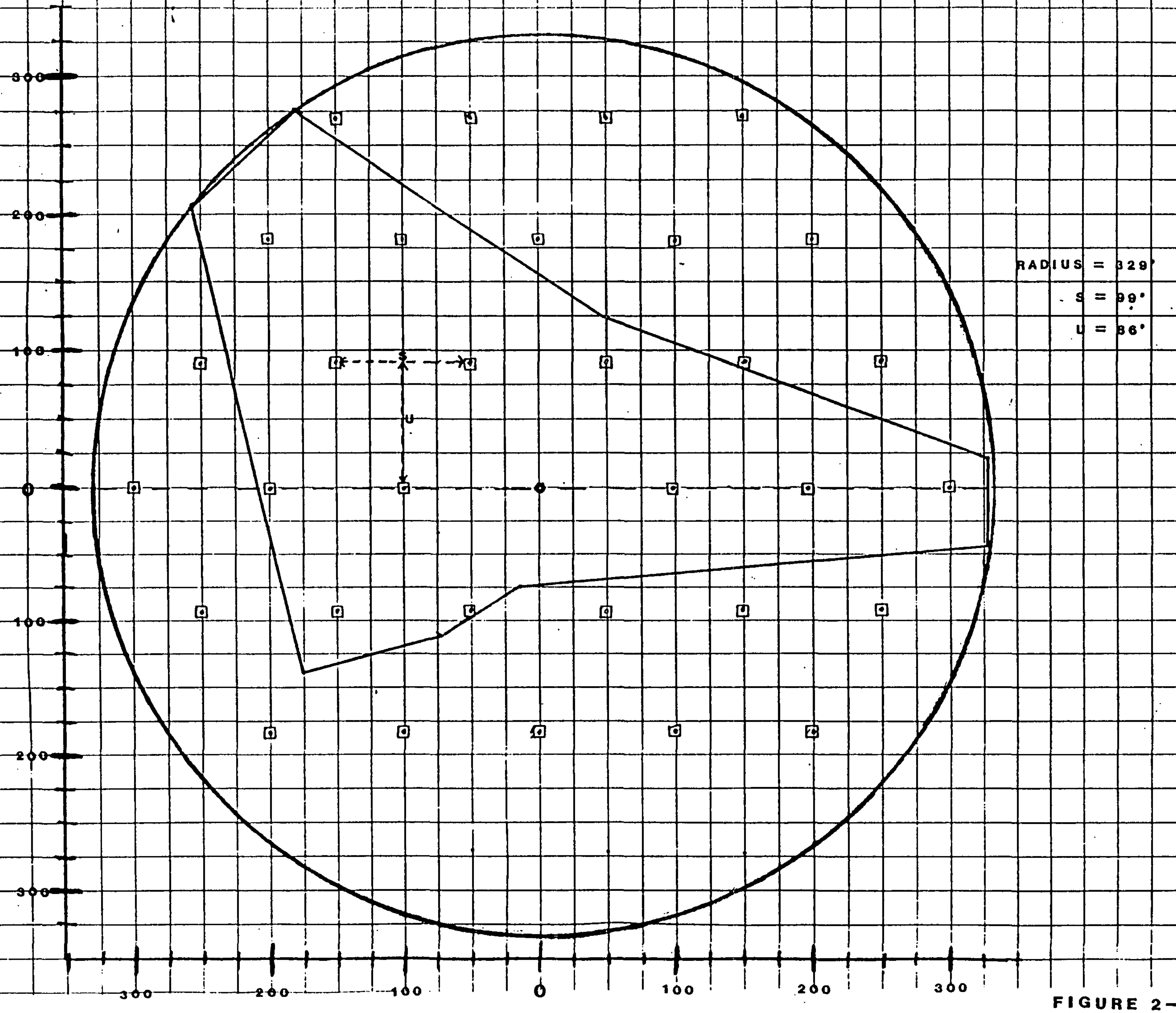
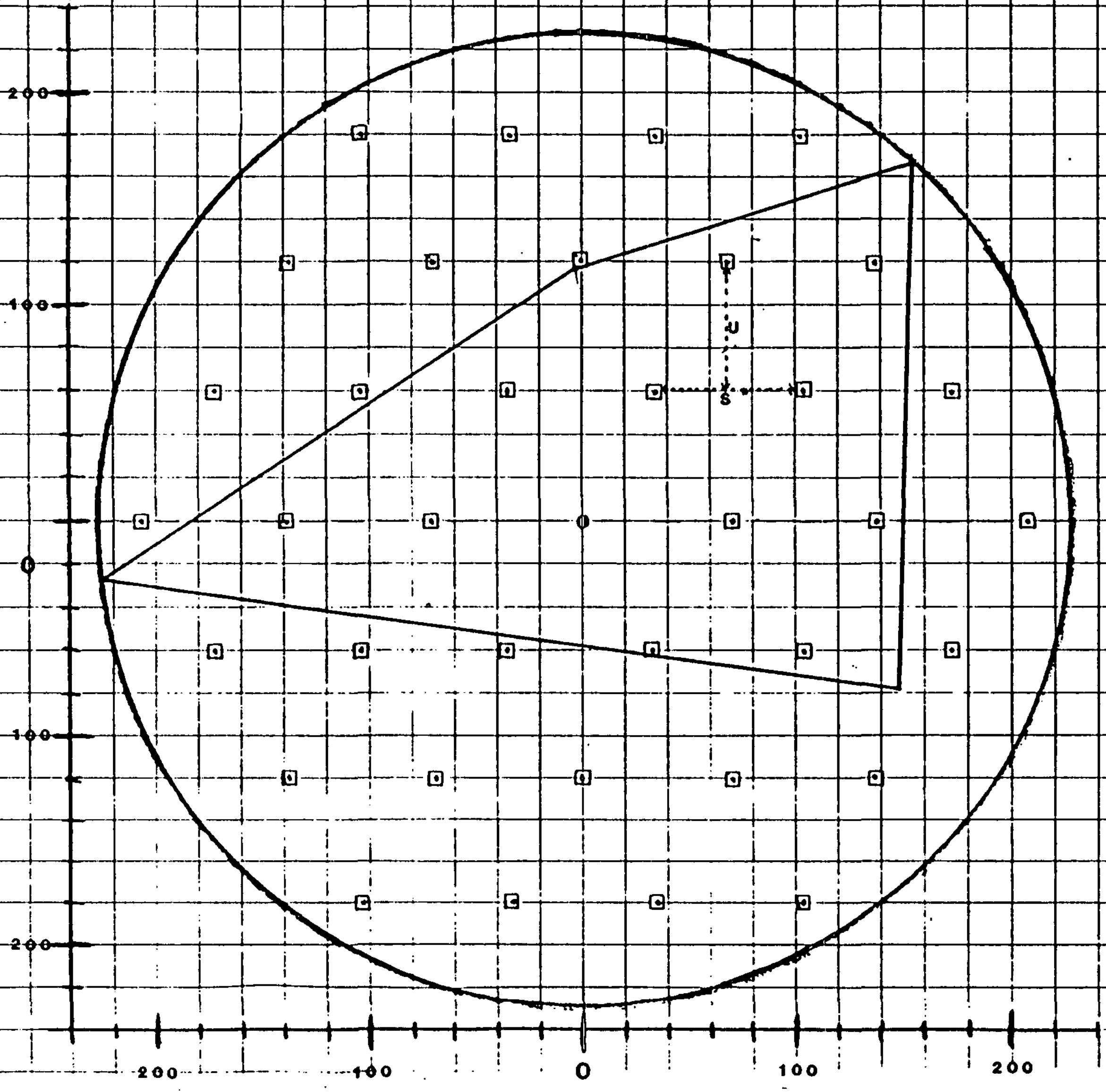


FIGURE 2-2

SHULMAN AND SONS

SECTION 4 SAMPLE LOCATIONS



RADIUS = 226'

S = 68'

U = 69'

FIGURE 2-3

3.0 SAMPLING PROCEDURES

3.1 GROUND WATER

3.1.1 Introduction

In order to assess the impact of the site waste materials on ground water quality, the behavior of pollutants in the subsurface environment and the processes governing this behavior must be evaluated. The fundamental objective of monitoring land disposal sites is to serve as a check on potential ground water contamination by leachate. The subsurface environment, however, is an extremely complex system, subject to extensive physical, chemical and biological changes within small vertical and horizontal distances. Samples from a monitoring well represent a small part of an aquifer horizontally and in many cases, vertically. Special precautions must be taken to ensure that the sample taken from a given well is representative of the ground water at that location and that the sample is neither altered nor contaminated by the sampling and handling procedure.

The following subsections detail the basic procedures followed by AFI Environmental field crews in monitoring ground water at disposal facilities. These procedures are based on USEPA manuals and other ground water monitoring manuals.

3.1.2 Representative Sample Collection

During any ground water sampling program, it must be understood that the composition of the water within the well casing and in close proximity to the well is probably not representative of the overall ground water quality at that sampling site. This is due to the possible presence of drilling contaminants near the well and because important environmental conditions such as pH and oxidation-reduction potential may differ drastically near the well from the conditions in the surrounding water-bearing materials. In addition, stagnation as well as stratification of water can take place within the well.

To safeguard against collecting non-representative water in a sample, it is highly desirable that a well be pumped or bailed until the well is thoroughly flushed of standing water and contains fresh water from the aquifer. The recommended length of time required to pump or bail prior to sampling is dependent on many factors including the characteristics of the well, the hydrogeological nature of the aquifer, the type of sampling equipment being used, and the parameters of interest.

The generally accepted procedure is to bail between three and ten well volumes prior to sampling. In those situations where the well is bailed to dryness, the amount bailed prior to sampling will be less. Note also that non-representative samples can result from excessive pre-pumping of the monitoring well. Stratification of the leachate concentrations in the ground water formation may occur, and excessive bailing can dilute or increase the contaminant concentrations from what is representative of the sampling point of interest.

Determination of the quantity of water in one well volume is calculated from the following formula:

$V = 5.875 I^2 \cdot (D-W)$

WHERE V = one well volume (gallons)
I = inside diameter of well casing (feet)
D = well depth (feet)
W = Depth to water from top of casing (feet)

For a 2-inch ID well, 6 feet of water is approximately one gallon. In most cases, monitoring of temperature, pH and conductivity during bailing will indicate when the well is adequately purged. When these parameters stabilize, it is probable that little or no water from casing storage is left in the well.

3.1.3 Water Level Elevations

Valuable hydrogeologic data can be obtained from the periodic monitoring of water level elevations in the ground water monitoring system at a facility. This information is necessary for the determination of the flow and direction of ground water and to monitor seasonal changes in the ground water elevation in the area. Frequency of these measurements should be determined by the Project Engineer and Hydrogeologist, but at a minimum, they should be taken at each sampling occurrence.

Water level measurements are made using an electronic water level indicator. Depths are measured from the top of the well casing to the water surface. These measurements are converted to elevations (above mean sea level) using a survey elevation of the well. Measurements should be accurate to ±0.01 foot.

3.1.4 Soil Pore Water Sampling

Since few soils or sediments are chemically inert, movement of leachate through the unsaturated zone frequently will result in chemical changes to the leachate. Samples of soil pore water in the unsaturated zone are collected using vacuum/pressure lysimeters. The lysimeters work by creating a vacuum within the sampling vessel; pore water moves toward the sampler and enters the lysimeter through a porous cup. Pressure is then placed on the lysimeter and the sample is forced to the surface.

It should be noted that there are a number of inherent limitation involved with the use of vacuum/pressure lysimeters. These include the uncertainty of the degree to which the collected sample represents the surrounding pore water, the disruption of normal drainage patterns caused by suction induced sampling, clogging of the lysimeter itself, and the potential sample contamination from materials used in lysimeter construction. In addition, their use may be limited by the nature of the site soils.

3.1.5 Collection of Ground Water Samples - Equipment

AFI Environmental utilizes a variety of sampling equipment to bail wells and obtain samples. Selection of the type of equipment used is based on depth of well, recovery rate, accessibility, parameters of interest and cost. The following sections describe the equipment and techniques normally used.

- Bailers

Use of bailers is one of the oldest and simplest methods of sampling ground water wells. AFI Environmental normally utilizes PVC bailers with a PVC check valve on the bottom, but Teflon or stainless steel bailers are also used for certain projects. The PVC bailers are 1.66" OD and will fit in a 2 inch well. The low cost of the PVC bailers allows them to be dedicated to individual wells as a means of minimizing cross contamination. In addition, there is no need for external power.

Bailing and sampling techniques are dictated by the recovery rate of the well. However, for most situations, the bailer is lowered to the bottom of the well and retrieved. In the case of wells that have historically had high recovery rates, the first well volume is retrieved from the top of the water column. Fresh water entering from the bottom insures that the water within the well is fresh and representative of the aquifer of concern.

- Air Lift Sampler

The air'lift system uses air under pressure that is fed down the well and forces water up and out of the well. This system is comprised of threaded PVC pipe sections that are connected together as the screened section is lowered into the well. When the sampler is in place, it is capped off with a top seciton of PVC which allows for the introduction of pressurized air or gas. This forces a check valve closed and the well water up out of the sampler.

The air lift sampler, which can be used as either a portable or permanently installed system, is not suitable for pH sensitive parameters such as metals. Gas stripping of volatile organics may occur, and if air or oxygen is used, oxidation may be a problem. For this reason, the airlift system is normally used only for bailing of the well and samples are collected by other methods.

- Bladder Pumps (Gas Pressure Displacement Pumps)

Bladder pumps (also referred to as gas squeeze pumps) consist of a flexible tube enclosed in a rigid plastic or stainless steel housing. Water enters the housing through a screen and check valve at the bottom of the pump. Air pressure inflates the bladder and forces the water to the surface (Note: In a similar design, the water enters the bladder and the air pressure introduced into the housing compresses the bladder and forces water to the surface). Upon release of the pressure, an upper check valve prevents water from flowing back into the pump. An automated control system from flowing back into the pump. an automated control system regulates gas flow rates and pressurization cycles to produce nearly continuous flow.

The bladder pump has several advantages including a wide range of pumping rates, no contact between air and well water and the unit is faily portable. In addition, once the unit is set up and in operation, constant operator attendance is not needed during bailing operations.

Because of the time involved in disassembly, cleaning and reassembly between uses, AFI Environmental recommends that, where used, bladder pumps should be permanently installed.

- Handpump

A hand operated pump that pumps over 2.5 gallons per minute and fits inside a 2-inch well can sample down to 50 feet or further with extensions. The high flow volume provides for rapid bailing of wells with a high well volume.

- Suction Lift Pumps

While not normally used for monitoring well sampling, both automatic and manual suction lift pumps can be used in a special situations. These pumps (both peristaltic and vacuum) are relatively protable, but sampling is limited to ground water that is within 20 feet of the surface. Use of these pumps may result in degassing and loss of volatile compounds.

Use of thse pumps is generally restricted to monitoring installations such as shallow wells and seepage galleries that are not feasibly sampled by the above described techniques.

3.1.6 Collection of Ground water Samples - Procedures

The following subsections describe procedures used for sampling ground water monitoring wells. The procedures are adapted from various USEPA guidance manuals (see references in Appendix A).

Prior to the use of these procedures, the following steps should be completed.

a. Put on the necessary personal protective equipment and a new pair of disposable gloves.

b. Insure that all sampling and montoring equipment has been properly decontaminated prior to use.

c. Place a square sheet of plastic, with a slit in the middle, over the well to cover the working area around the well.

d. Unlock the well and remove the inner protective cap. Place this in a location that will not contribute contamination tot he well when it is replaced.

e. Using the pre-cleaned electric well depth probe, measure the depth to the water surface in the well (to 0.01 foot) from the top of the internal well casing. Record this information on the log sheet.

It should be noted that all down-hole and potentially wetted surfaces must also be non-contaminating/non-contributing. This includes power cables, suspension cables or rope, compressed gas lines, and sample tubing.

3.1.6.1 Purging With a Peristaltic Pump

Discussion

The peristaltic pump as described in subsection 2.5 can be implemented for the presample purging of ground water montoring wells.

Uses

The use of a peristaltic pump for well purging is particularly advatageous since in many instances, the same system can later be used for sample collection. The application, however, is limited to wells with a depth of less than apporoximately 8 meters, due to the limited lift capabilities of peristaltic action. In addition, certain parameters particularly volitile organics, can be affected by this sampling process.

Procedures For Use

1. Based on well depth and water elevation, determine well volume of water in well.
2. Lower intake into the well to a short distance below the water surface and begin water removal. Collect or dispose of purged water in an acceptable manner. Lower suction intake, as required, to maintain submergence.
3. Measure rate of discharge frequently. A bucket and stopwatch are most commonly used.
4. Purge a minimum of three casing volumes or until the well is dry or until discharge pH, temperature, or conductivity stabilize.

3.1.6.2. Purging With a Gas Pressure Displacement System

Discussion

A pressure displacement system consists of a chamber equipped with a gas inlet line, a water discharge line and two check valves. When the chamber is lowered into the casing, water floods in from the bottom through the check valve. Once full, a gas (i.e., nitrogen or air) is forced into the top of the chamber at a pressure sufficient to result in the upward displacement of the water out of the discharge tube. The check valve in the bottom prevents water from being forced back into the casing, and the upper check valve prevents water from flowing back into the chamber whent eh gas pressure is released. This cycle can be repeated as necessary until purging is complete.

Uses

The pressure lift system is particularly useful when the well depth is beyond the capability of a peristaltic pump. The water is displaced up the discharge tube by the increased gas pressure. The potential for increased gas diffusion into the water makes this system suitable when sampling for volatile organic and most pH critical parameters.

Procedures For Use

1. Based on well depth and water level elevation, determine the well volume of water in the well.

2. Lower displacement chamber until top is just below water level.

3. Attach gas supply line to pressure adjustment valve on cap.

4. Gradually increased gas pressure to maintain discharge flow rate.

5. Measure rate of discharge, pH and temperature frequently. A bucket and stopwatch are usually sufficient for flow measurement.

6. Purge a minimum of three casin volumes or until discharge characteristics stabilize unless the well becomes dry first.

3.1.6.3. Purging With a Bailer

Discussion

Bailers are long narrow tubes equipped with a check valve on the bottom. This valve allows water to enter from the bottom as the bailer is lowered, then prevents its release as the bailer is raised. Top filling bailers are also available and are useful for bailing wells, but they should not be used form sampling unless the purpose is to sample the water surface for floating materials.

Uses

Bailers are not generally practical for bailing wells since the procedure is labor intensive. In particular, deep or large diameter wells with large well volumes require long bailing times. The primary advantage of bailers are low cost and easy decontamination.

Proceedures For Use

1. Based on the well depth and water level elevation, determine the volume of water in the well.

2. Attach a new piece of rope to the pre-cleaned bailer and lower it to just fill the bailer. Withdraw the bailer and note the pH and appearance of the water on the log sheet, along with the time.

3. Continue to bail until at least three complete well volumes have been removed, or the pH or other characteristics stabilize or the well becomes dry.

3.1.6.4 Sampling Monitoring Wells With a Bailer

- Discussion

  As mentioned above, bailers are tall narrow tubes equipped with a check valve on the bottom. This valve allows water to enter from the bottom as the bailer is lowered, then prevents its release as the bailer is raised. Top filling bailers are not recommended for sample acquisition except for specific application.

- Uses

  This device is particularly useful when samples must be recovered from depths greater than the range (or capability) of suction lift pumps, when volatile stripping is of concern, or when well casing diameters are too narrow to accept submersible pumps. It is the method of choice for the collection of samples which are susceptible to volatile component stripping or degradation due to the aeration associated with most other recovery systems. Samples can be recovered with a minimum of aeration if care is taken to gradually lower the bailer until it contacts the water surface and is then allowed to sink as it fills. Teflon is generally the most acceptable construction material but other materials (PVC, stainless steel, etc.) are acceptable if compatible with designated sample analysis. The primary disadvantage of bailers are their limited sample volume and inability to collect discrete sample from a depth below the water surface. In some cases, expecially where analyses for trace contaminants are desired, it may be prudent to use a separate bailer for each well, thus avoiding cross-contamination between wells.

- Procedures For Use

1. Attach precleaned bailer to a new line for lowering.
2. Lower bailer slowly until it contacts water surface.
3. Allow bailer to sink and fill with a minimum of surface disturbance.
4. Slowly raise bailer to surface. Do not allow bailer line to contact ground.
5. Tip bailer to allow slow discharge from top to flow gently down the side of the sample bottle with minimum entry turbulence.
6. Repeat steps 2-5 as needed to acquire sufficient sample volume.
7. Select sample bottles and preserve the sample, if necessary, according to the guidelines in Section 5.
8. Check that a Teflon-liner is present in cap if required. Secure the cap tightly. In the case of vials for volatile organic analyses, insure that no air bubbles are present.
9. Label the sample bottle with an appropriate label and complete all chain-of-custody documents.
10. If non-dedicated bailers are being used, thoroughly decontaminate the bailer and add clean rope after each use according to the guidelines in Section 5.

3.1.6.5 Sampling Monitoring Wells With a Peristaltic Pump

- Discussion

A pump system is considered advantageous when analytical requirements demand sample volumes in excess of several liters. The major drawback of a pump system is the potential for increased volatile component stripping as a result of the required lift vacuum. Samples for volatile organic analysis should be collected with a bailer as described in Section 3.1.6.4 and should precede any sample collection which may further disturb the well by contact.

- Uses

The peristaltic pump system can be used for monitoring well sampling whenever the lift requirements do not exceed 8 meters. It becomes particularly important to use a heavy wall tubing in this application in forder to preven tubing collapse under the high vacuums needed for lifting from depth.

- Procedures For Use

1. Install clean medical grade silicon tubing in the peristaltic pump head.
2. Attach the pump to the required length of precleaned suction line and lower the end of the line to the midpoint of the well screen.
3. Consider the first liter of liquid collected as a system purge/rinse. Note: If well yield is insufficient for required analysis, this purge volume may be suitable for some less critical analysis.
4. Fill necessary sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulence. Cap each bottle as filled.
5. Select sample bottles and preserve the sample, if necessary, as per guidelines in Section 5.
6. Check that a Teflon-liner is present in cap if required. Secure the cap tightly.

7. Label the sample bottle with the appropriate label. Complete the chain-of-custody documents.

8. Allow system to drain then disassemble. Return tubing to lab for decontamination.

3.1.6.6 Sampling Monitoring Wells With a Submersible Pump

- Discussion

Several types of submersible pumps are available for ground water monitoring and offer considerable advantages over other systems. They are able to operate from depths beyond the capabilities of peristaltic pumps and save significant time and effort relative to hand bailing. Further, if constructed of suitable materials and peoperly used, they can both purge and adequately sample the well.

- Uses

Submersible pumps generally use one of two types of power supplies, either electric or compressed gas. Electric powered pumps generally run off a 12 VDC rechargeable batter from an automotive electrical syste. Those units powered by compressed gas normally use a small electric compressor which also needs 12 VDC power. They may also utilize compressed gas from bottles or even high performance hand pumps.

These pumps are generally constructed of "more or less" noncontaminating materials "suitable for Priority Pollutant Sampling". They often contain plastics, rubber or metal parts which may contribute or otherwise effect the analysis of samples for certain trace components. Such pumps may not be suitable when samples are collected for analyses of a wide range of trace contaminants. They may, however, be useful for initial purging of such wells. In any case, when doubt remains, bailers are the best choice for actual sample acquisition.

- Procedures For Use
  1. Lower the precleaned pump to just below the water level and begin pumping. consider the first liter of water as a system purge/rinse. Lower the pump as required to maintain submergence.
  2. Fill necessary sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulence. Cap each bottle as filled.
  3. Select appropriate sample bottles and preserve the sample if necessary as per guidelines in Section 5.
  4. Check that a Teflon-liner is present in cap if required. Secure the cap tightly.
  5. Label the sample bottle with an appropriate label. Complete chain-of-custody documents.
  6. Allow system to drain then disassemble. Return tubing to lab for decontamination.

3.2 SURFACE WATER

3.2.1 Considerations in Determining Representative Sample Locations

The collection of surface water samples is performed for the purpose of assessing the general water quality of a particular body of water and/or to measure the impact of point or non-point source discharges on that body. To properly meet the objective of the sampling, consideration must be given to mixing zones, stratification areas, stream hydraulics, flow status (high flow vs. low flow), and any other conditions which influence the character of the water being sampled.

When monitoring the general quality of a body of surface water, a determination must be made as to the homogeneity of the water both vertically and horizontally. This can be accomplished by either researching historical data on the water body and surrounding land use patterns, by preliminary random sampling, or by in-situ measurement (usually by probe) of certain water quality parameter (such as pH, temperature, dissolved oxygen or specific conductance) prior to sampling.

If the water is known to be homogeneous, a representative sample can be collected at any reasonable location. If the homogeneity of the water cannot be determined, or if it is known to be heterogeneous, the monitoring program must be structured to take into account all sources of variability. At AFI Environmental, this is usually accomplished by theoretically dividing the water body into approximately equal sized sections and taking a representative sample from each section. These samples can be analyzed separately, or composited into one or more representative samples. Stratification of the water column is accounted for by taking samples at more than one depth. These samples can also be composited if desired.

In addition to the above considerations, samples collected to assess the impact of a particular discharge on a body of water must be defined in terms of the discharge conditions which they represent. Initially, the discharge location(s) must be pin-pointed so that representative samples can be collected both upstream and downstream of the site. The extent of the mixing zone should be defined so that well-mixed or unmixed samples can be collected, depending on the objectives of the study. Turbulence or aeration at the discharge point is an important consideration when sampling for volatile compounds because these mechanisms may cause the compounds to dissipate. For a worst case analysis of the impact of a particular discharge, samples should be collected when the receiving water is at low flow; this is usually during the summer months.

3.2.2 Sampling Methods

A variety of surface water sampling procedures can be utilized depending on the water body to be sampled and parameters of concern. The following subsections describe the four basic methods utilized by AFI Environmental.

3.2.2.1 Sampling Surface Waters Using a Dipper or Other Transfer Device

- Discussion

A dipper or other container constructed of inert material, such as glass, stainless steel or Teflon, can be used to transfer liquid wastes from their source to a sample bottle. This prevents unnecessary contamination of the outer surface of the sample bottle that would otherwise result from direct immersion in the liquid. Use of this device also prevents the technician from having to physically contact the water stream. Depending upon the sampling application, the transfer vessel can be either disposed of or reused. If reused, the vessel should be thoroughly rinsed and/or decontaminated prior to sampling a different source.

- Uses

A transfer device can be utilized 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.

- Procedures For Use

1. Submerge a precleaned stainless steel dipper or other suitable device with minimal surface disturbances.
2. Allow the device to fill slowly and continuously.
3. Retrieve the dipper/device from the surface water with minimal disturbance.
4. Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/device edge.
5. Empty the dipper/device slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.
6. Continue delivery of the sample until the bottle is almost completely filled.
7. Select appropriate bottles and preserve the sample if necessary as per guidelines in Section 5.

8. Check that a Teflon liner is present in the cap if required. Secure the cap tightly.
9. Label the sample bottle with an appropriate label and complete the chain-of-custody form.
10. Properly clean and decontaminate the equipment prior to reuse or storage (Section 5).

3.2.2.2 Use of Pond Sampler For the Collection of Surface Water Samples

- Discussion

The pond sampler consists of bottle or similar container attached to the end of a two - or three - piece telescoping tube that serves as the handle.

- Uses

The pond sampler is used to collect surface water samples from near shore and liquid waste samples from disposal ponds, pits, lagoons, and similar reservoirs. The handle may bow when sampling very viscous liquids if sampling is not done slowly.

- Procedures For Use

1. Assemble the pond sampler. Make sure that the sampling container and the bolts and nuts that secure the clamp to the pole are tightened properly.
2. Take grab samples by slowly submerging the precleaned container with minimal surface disturbance.
3. Retrieve the pond sampler from the surface water with minimal disturbance.
4. Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/device edge.
5. Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.
6. Continue delivery of the sample until the bottle is almost completely filled.
7. Select appropriate sample bottles and preserve the sample if necessary as per guidelines in Section 5.

8. Check that a Teflon liner is present in the cap if required. Secure the cap tightly.
9. Properly label the sample bottle and complete the chain-of-custody documents.
10. Properly clean and decontaminate the equipment prior to reuse or storage using recommended guielines of Section 5.

3.2.2.3 Peristaltic Pump For Sampling Surface Water Bodies

- Discussion

This collection system consists of a peristaltic pump capable of achieving a pump rate of 1 to 3 liter per minute, and an assortment of tubing for extending the suction intake. A battery operated pump is preferable as it eliminates the need for DC generators or AC inverters.

- Uses

The system is highly verstile since it is portable and the sample collection is conducted through essentially chemically nonreactive material. It is practical for a wide range of applications including streams, ponds, and containers. This procedure can both extend the lateral reach of the sampler and allow sampling from depth. Likewise, it can function both as a well purge and a surface water sample collection system. The chief disadvantage of this method is the limited lift capacity of the pump, approximately 8 meter.

- Procedures For Use

1. Install clean, medical-grade silicone tubing in the pump head, as per the manufacturer's instructions. Allow sufficient tubing on the discharge side to facilitate convenient dispensation of liquid into sample bottles and only enough on the suction end for attachment to the intake line. This practice will minimize sample contact with the silicone pump tubing.
2. Select the length of suction intake tubing necessary to reach the required sample depth and attach to intake side of pump tubing. Heavy-wall Teflon, of a diameter equal to the required pump tubing, suits most

applications. (Heavier wall will allow for a slightly greater lateral reach.) Tygon or equivalent tubing may be applicable depending on the parameters of concern.

3. If possible, allow several liters of sample to pass through the system, before actual sample collection. Collect this purge volume and then return to source after the sample aliquot has been withdrawn.
4. Fill necessary sample bottles by allowing pump discharge to flow gently down the side of bottle with minimal entry turbulance. Cap each bottle as filled.
5. Select appropriate bottles and preserve the sample, if necessary, as per guidelines in Section 5.
6. Check that a Teflon liner is present in the cap if required. Secure the cap tightly.
7. Label the sample bottle with an appropriate label and complete the chain-of-custody documents.
8. Allow the system to drain, then disassemble. Return tubing to lab for decontamination (if feasible). See Section 5 for general decontamination procedures.

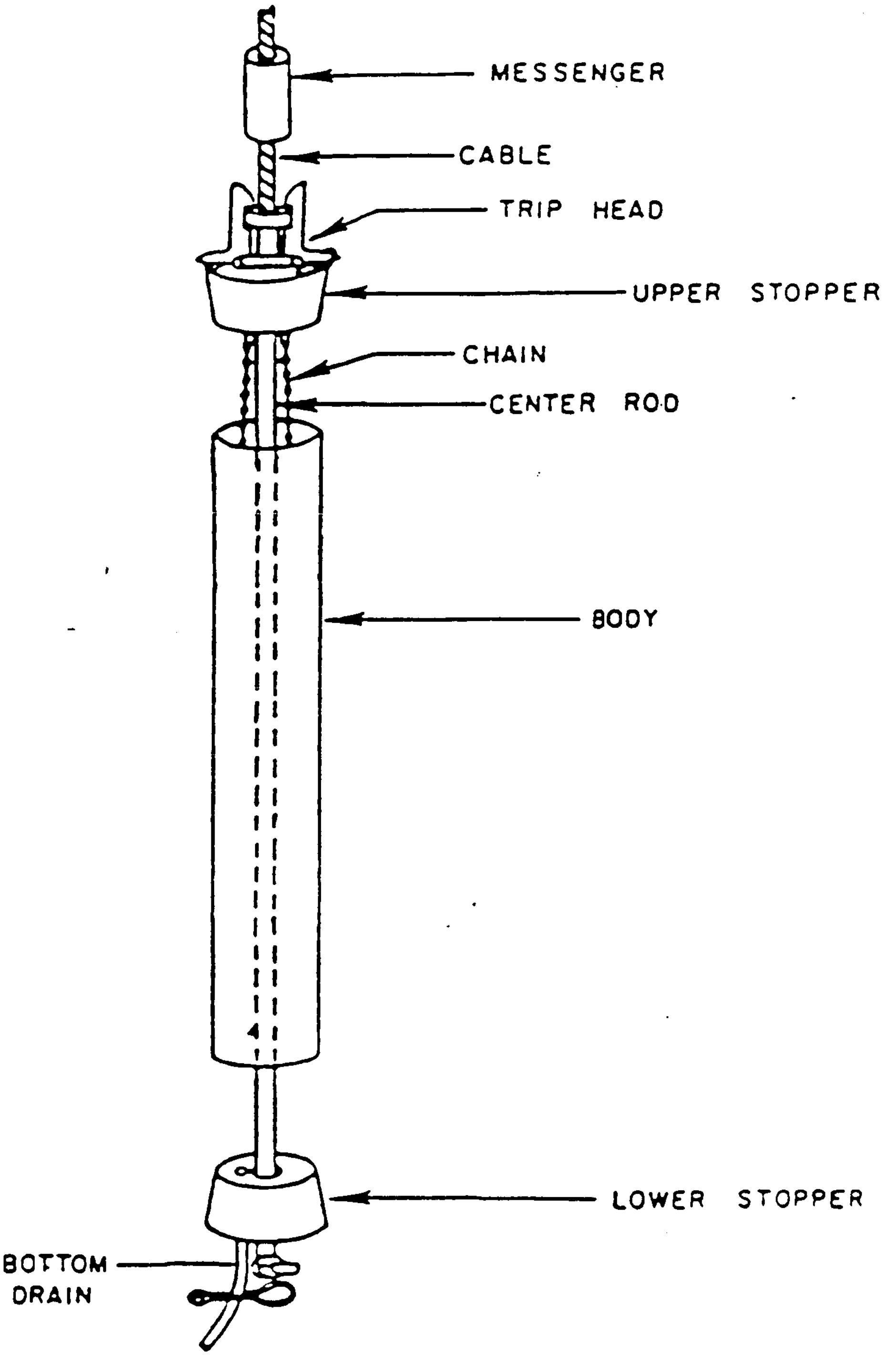
3.2.2.4 Collection of Water Samples From Depth With a Kemmerer Bottle

- <u>Discussion</u>

The Kemmerer bottle is a messenger-activated water sampling device (see Figure 3-1). In the open position, water flows easily through the device. Once lowered to the desired depth, a messenger is dropped down the sample 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 and can be retrieved.

- <u>Uses</u>

The Kemmerer bottle is currently the most practical method of collecting discrete, at-depth samples from surface waters or vessels where the collection depth exceeds the lift capacity of pumps. The application is limited however



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MODIFIED KEMMERER SAMPLER

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FIGURE 3-1

by the incompatability of various construction materials with some analytical techniques. Proper selection, i.e., all metal assemblies for organic analysis or all plastic assemblies for trace element analysis, will overcome this deficiency.

- Procedures For Use

1. Inspect kemmerer bottle for thorough cleaning and insure that sample drain valve is closed (if bottle is so equipped).
2. Measure and then mark sample line at desired sampling depth.
3. Open bottle by lifting top stopper-trip head assembly.
4. Gradually lower bottle until desired level is reached (predesignated mark from Step 2).
5. Place messenger on sample line and release.
6. Retrieve sampler; hold sampler by center stem to prevent accidental opening of bottom stopper.
7. Rinse or wipe off exterior of sampler body (wear proper gloves and protective clothing, if required).
8. Recover sample by grasping lower stopper and sampler body with one hand (gloved), and transfer sample by either (a) lifting top stopper with other hand and carefully pouring contents into sample bottles, or (b) holding drain valve (if present) over sample bottle and opening valve.
9. Allow sample to flow slowly down side of sample bottle with minimal disturbance.
10. Select sample bottles and preserve the sampe if necessary as per guidelines in Section 5.
11. Check that a Teflon liner is present in the cap if required. Secure the cap tightly.
12. Label the sample bottle with an appropriate label and complete all chain-of-custody records.
13. Decontaminate sampler and messenger or place in plastic bag for return to lab. See Section 5 for general decontamination procedures.

3.3 SOIL, SLUDGE, & SEDIMENT

3.3.1 Introduction

The sampling of solid or semi-solid materials such as soils, sludges and sediments is complicated by the structural properties of the materials and the fact that the material to be samples can be below the soil or water surface. In addition, solids may not have uniform characteristics with respect to depth and areal distance.

Soil sampling is an important factor in site investigations, especially in conjunction with ground water investigation. Acquisition of samples can be limited by such factors as grain size, cohesiveness, associated moisture, depth to bedrock and depth to water table. Shallow sampling of soils is accomplished by AFI Environmental through the use of trowels, hand auger-type tools, and thin wall tube samplers. Sampling at greater depth is usually accomplished in conjunction with a boring/monitoring well installation program. Soil samples at depth are collected in accordance with ASTM D1586, "Standard Method for Penetration Test and Split-Barrel Sampling of Soils" (see Appendix B). The actual sampling is conducted by a drilling subcontractor with supervision by AFI Environmental personnel.

Sludges (semi-dry materials ranging from dewatered solids to high viscosity liquids) and sediments (deposited material underlying a body of waste) require somewhat different procedures and equipment due to their physical nature. Sludge sampling methods can vary from the use of a peristaltic pump, to the use of thin-tube samplers. Sediment sampling is similar except that factors such as inflows and discharges may cause significant variations in sediment composition. In addition, the presence of moving and/or deep waste complicates sampling.

3.3.2 Soil Sampling Methods

The following subsections describe several soil sampling procedures utilized by AFI Environmental personnel. They have been adapted from the USEPA (Reference 1).

3.3.2.1 Soil Sampling With a Spade and Scoop

- Discussion

The simplest, most direct method of collecting soil samples for subsequent analysis is with the use of a spade and scoop. A normal lawn or garden spade can be utilized to remove the top cover of soil to the required depth and then a smaller stainless steel scoop can be used to collect the sample.

- Uses

This method can be used in most soil types but is limited to sampling the near surface. Gathering of samples from depths greater than 20 feet becomes extremely labor intensive in most soil types. Very accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the technician. The use of a flat, pointed mason trowel to cut a block of the desired soil will be of aid when undisturbed profiles are required. A stainless steel scoop or lab spoon will suffice in most other applications. Care should be exercised to avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

- Procedures For Use

1. Carefully remove the top layer of soil to the desired sample depth with a precleaned spade.
2. Using a precleaned stainless steel scoop or trowel, remove and discard a thin layer of soil from the area which comes in contact with the shovel.
3. Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.
4. Check that a Teflon liner is present in the cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.

5. Label the sample bottle. Complete all chain-of-custody documents.
6. Decontaminate equipment after use and between sample locations. For specific decontamination guidelines, consult Section 5.

3.3.2.2 Subsurface Soil Sampling With Auger and Thin-Wall Tube Sampler

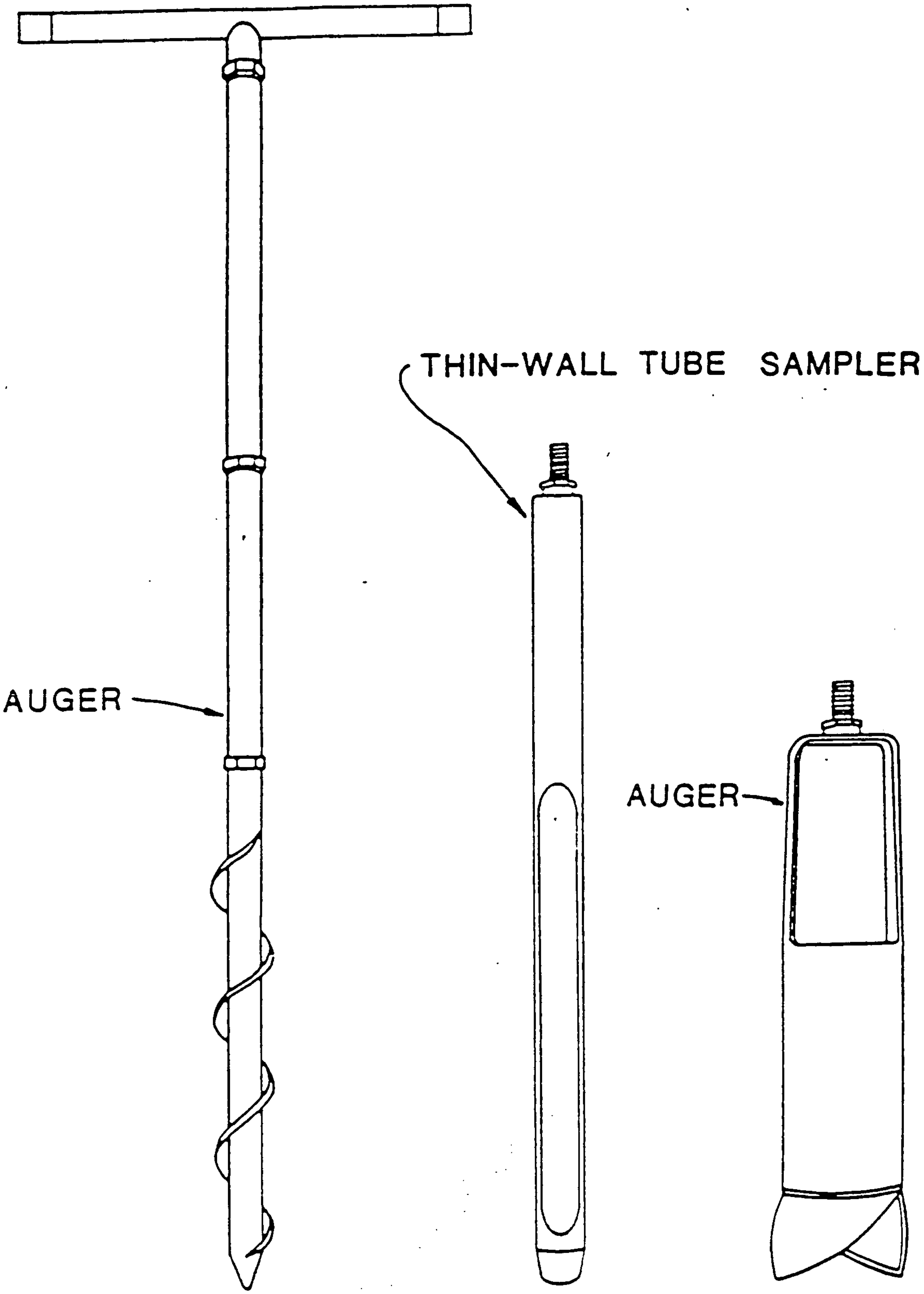
- Discussion

This system consists of an auger bit, a series of drill rods, a "T" handle, and thin-wall tube corer (see Figure 3-2). The auger bit is used to bore a hole to the desired sampling depth and then withdrawn. The auger tip is then replaced with the tube corer, lowered down the borehole, and forced into the soil at the completion depth. The corer is then withdrawn and the sample collected.

Alternately, the sample can be recovered directly from the auger. This technique however, does not provide an "undisturbed" sample as would be collected with a thin tube sampler. In situations where the soil is rocky, it may not be possible to force a thin tube sampler through the soil or possible to force a thin tube sampler through the soil or sample recovery may be poor. Sampling directly from the auger may be the only viable method. In soils where the borehole will not remain open when the tool is removed, a temporary casing can be used until the desired sampling depth is reached.

- Uses

This system can be used in a wide variety of soil conditions. It can be used to sample both from the surface, by simply driving the corer without preliminary boring, or to depths in excess of 6 meters. The presence of rock layers and the collaps of the borehole, however, usually prohibit sampling at depths in excess of 6-7 feet. Interchangeable cutting tips on the corer reduce the disturbance to the soil during sampling and aid in maintaining the core in the device during removal from the borehole.



A-F-I AUGERS and THIN-WALL TUBE SAMPLER

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FIGURE 3-2

- Procedures For Use
  1. Attach the auger bit to a drill rod extension and further attach the "T" handle to the drill rod.
  2. Clear the area to be sampled of any surface debris (twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.
  3. Begin drilling, periodically removing accumulated soils. This prevents accidentally brushing loose material back down the borehole when removing the auger or adding drill rods.
  4. After reaching desired depth, slowly and carefully remove auger from boring. (Note: When sampling directly from auger, collect sample after auger is removed from boring and proceed to Step 10).
  5. Remove auger tip from drill rods and replace with a precleaned thin-wall tube sampler. Install proper cutting tip.
  6. Carefully lower corer down borehole. Gradually force corer into soil. Care should be taken to avoid scraping the borehole sides. Hammering of the drill rods to facilitate coring should be avoided as the vibrations may cause boring walls to collapse.
  7. Remove corer and unscrew drill rods.
  8. Remove cutting tip and remove core from device.
  9. Discard top of core (approximately 1 inch), which represents any material collected by the corer before penetration of the layer in question. Place remaining core into sample container.
  10. Check that a teflon liner is present in the cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemental by a minimal holding time.

11. Label the sample bottle. Complete all chain-of-custody documents.
12. Decontaminate sampling equipment after use and between sampling locations. Refer to Section 5 for decontamination requirements.

3.3.3 Sludge and Sediment Sampling

The following subsections describe several methods for obtaining representative sludge and sediment samples. These have been adapted from USEPA methods (Reference 1).

3.3.3.1 Collection of Sludge or Sediment Samples With a Scoop

- Discussion

Sludge and sediment samples are collected using the simple laboratory scoop or garden type trowel specified in Subsection 3.3.2.1. This method is more applicable to sludges but it can be used for sediments provided the water depth is very shallow (a few inches). It should be noted, however, that this method can be disruptive to the water/sediment interface and might cause substantial alterations in sample integrity if extreme care is not exercised. The stainless steel laboratory scoop is generally recommended due to its noncorrosive nature. Single grab samples may be collected or, if the area in question is large, it can be divided into grids and multiple samples can be collected and composited.

- Uses

This method provides for a simple, quick, and easy means of collecting a disturbed sample of a sludge or sediment.

- Procedure For Use

1. Sketch the sample area or not recognizable features for future reference. If practical, place a numbered stake at the sample site.
2. Insert scoop or trowel into material and remove sample. In the case of sludges exposed to air, it may be

desirable to remove the first 1/2 to 1 inch of material prior to collecting sample.

3. If compositing a series of grab samples, use a stainless steel mixing bowl, Teflon tray, or a hard surface covered with aluminum foil for mixing.
4. Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.
5. Check that a Teflon liner is present in cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.
6. Label the sample bottle and complete all chain-of-custody documents.
7. Decontaminate sampling equipment after use and between sample locations according to the guidelines presented in Section 5.

3.3.3.2 <u>Sampling Sludge or Sediments With a Hand Corer</u>

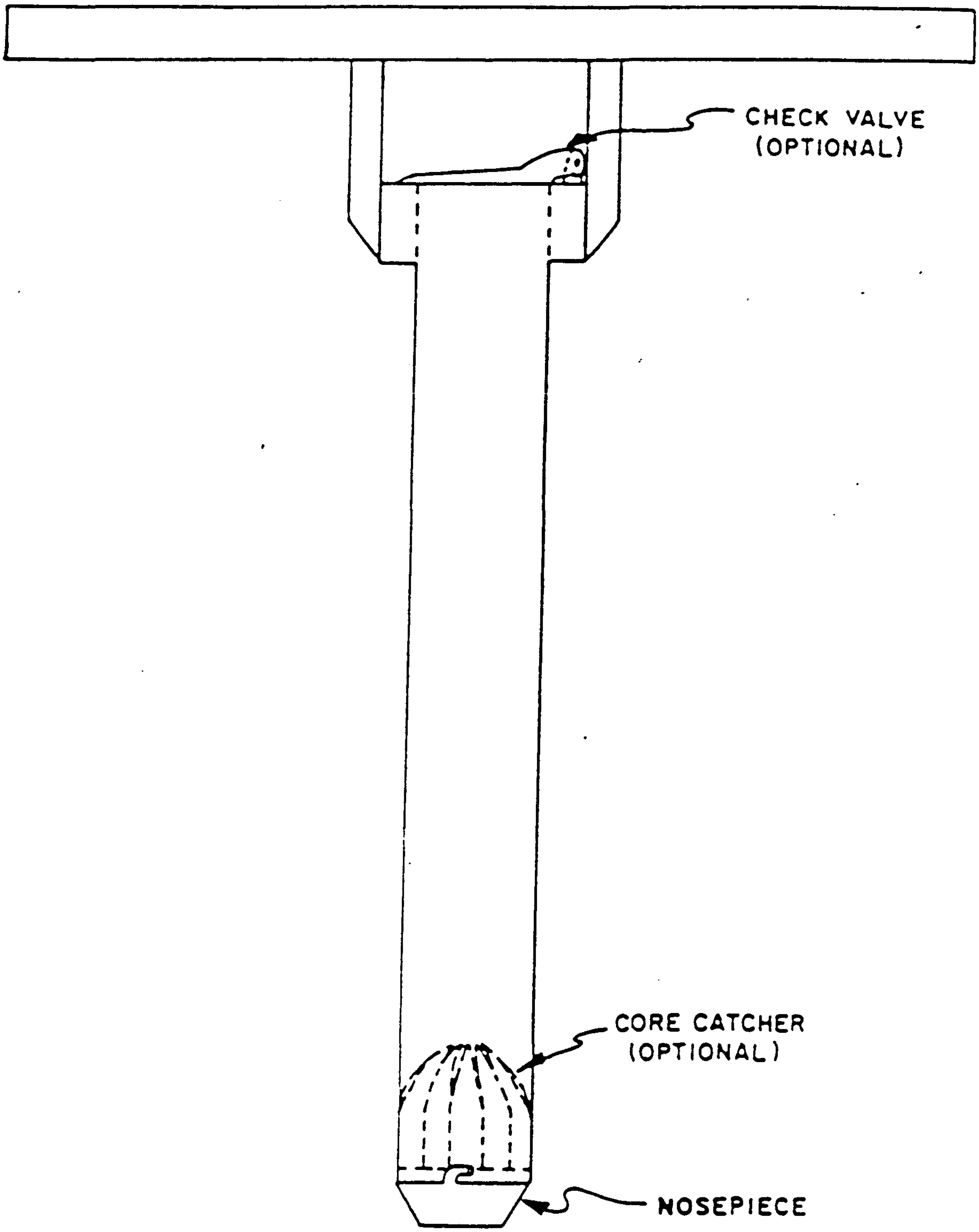
- <u>Discussion</u>

This device is essentially the same type of thin-wall corer described for collecting soil samples (Subsection 3.3.2.2). It is modified by the addition of a handle to facilitate driving the corer (see Figure 3.3) and a check valve on top to prevent washout during retrieval through an overlying water layer.

- <u>Uses</u>

Hand corers are applicable to the same situations and materials as the scoop described in Subsection 3.3.3.1. It has the advantage of collecting an undisturbed sample which can profile any stratification in the sample as a result of changes in the deposition.

Some hand corers can be fitted with extension handles which will allow the collection of samples underlying a shallow layer of liquid. Most corers can also be adapted to



A-F-I

HAND CORER

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FIGURE 3-3

hold liners generally available in brass, polycarbonate plastic or Teflon. Care should be taken to choose a material which will not compromise the intended analytical procedures.

- Procedures For Use

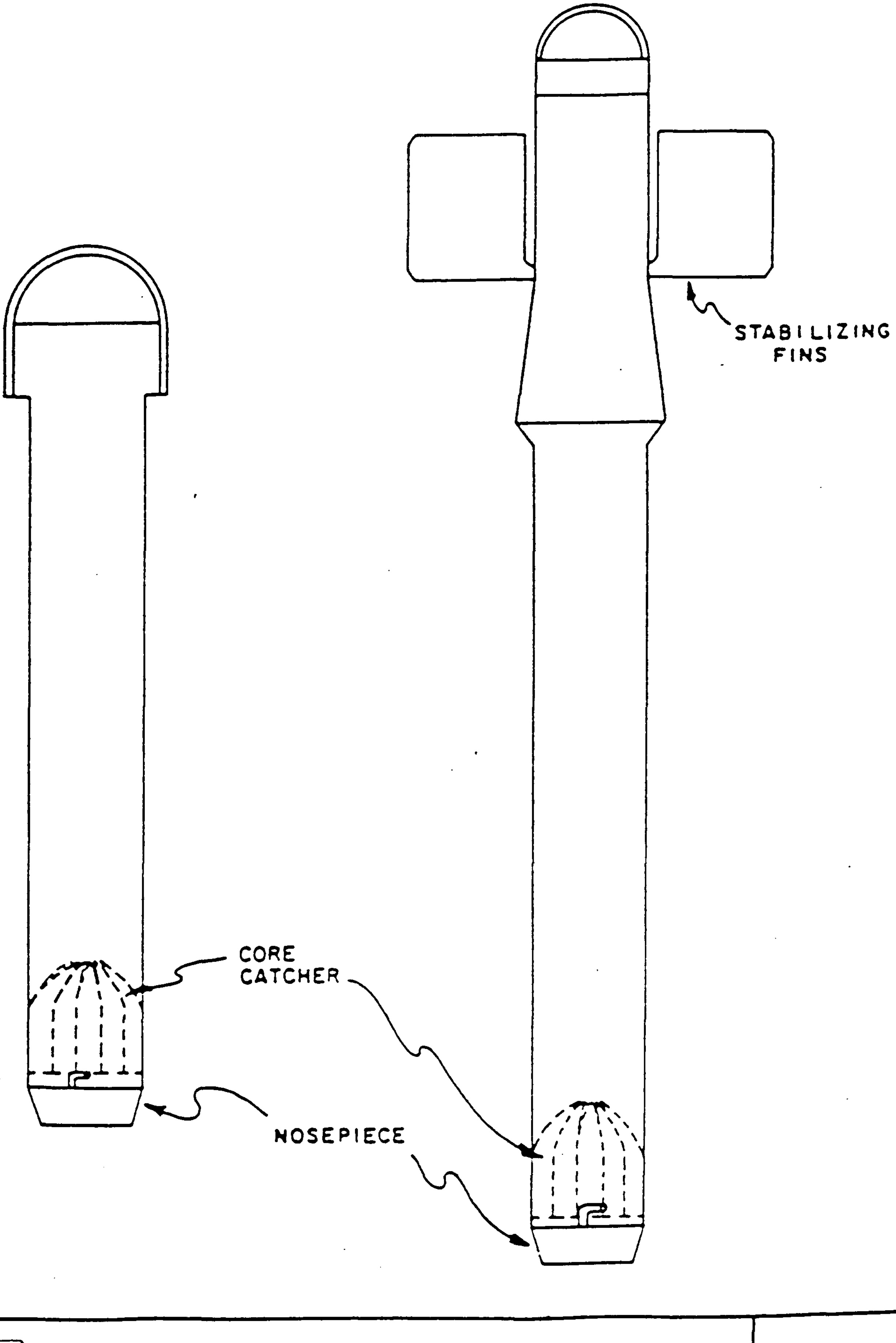
1. Inspect the corer for proper precleaning, and select sample location.
2. Force corer in with smooth continuous motion.
3. Twist corer then withdraw in a single smooth motion.
4. Remove nosepiece and withdraw sample into a stainless steel or Teflon tray, or a tray covered with aluminum foil.
5. Transfer sample into an appropriate sample bottle with a stainless steel lab spoon or equivalent.
6. Check that a Teflon liner is present in cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.
7. Label the sample bottle and complete all chain-of-custody documents.
8. Decontaminate sampling equipment after use and between sample locations as required by procedures in Section 5.

3.3.3.3 Sampling Bottom Sludges or Sediments With a Gravity Corer

- Discussion

A gravity corer is a metal tube with a replacement tapered nosepiece on the bottom and an optional ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents a washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration.

Most corers are constructed of brass or steel and many can accept plastic liners and additional weights (see Figure 3-4).


STABILIZING FINS
CORE CATCHER
NOSEPIECE

- Uses

  Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples which represent the profile of strata which may develop in sediments and sludges during variation in the deposition process. Depending on the density of the substrate and weight of the corer, penetration to depths of 30 inches can be attained.

  Care should be exercised when using gravity corers in vessels or lagoons that have liners because penetration depths could exceed that of the subsurface and result in damage to the liner material.

- Procedures For Use
  1. 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.
  2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
  3. Allow corer to free fall through liquid to bottom.
  4. Retrieve corer with a smooth, continuous lifting motion. Do not bump corer as this may result in some sample loss.
  5. Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan, or a hard surface lined with aluminum foil.
  6. Transfer sample into appropriate sample bottle with a stainless steel lab spoon or equivalent.
  7. Check that Teflon liner is present in cap if required. Secure the cap tightly. The chemical preservation of solids is generally not recommended. Refrigeration is usually the best approach supplemented by a minimal holding time.
  8. Label the sample bottle. Complete all chain-of-custody documents.

9. Consult Section 5 for decontamination requirements and decontaminate sampling equipment after use and between sampling locations.

3.3.3.4 Sampling Bottom Sludges or Sediments With a Ponar Grab

- Discussion

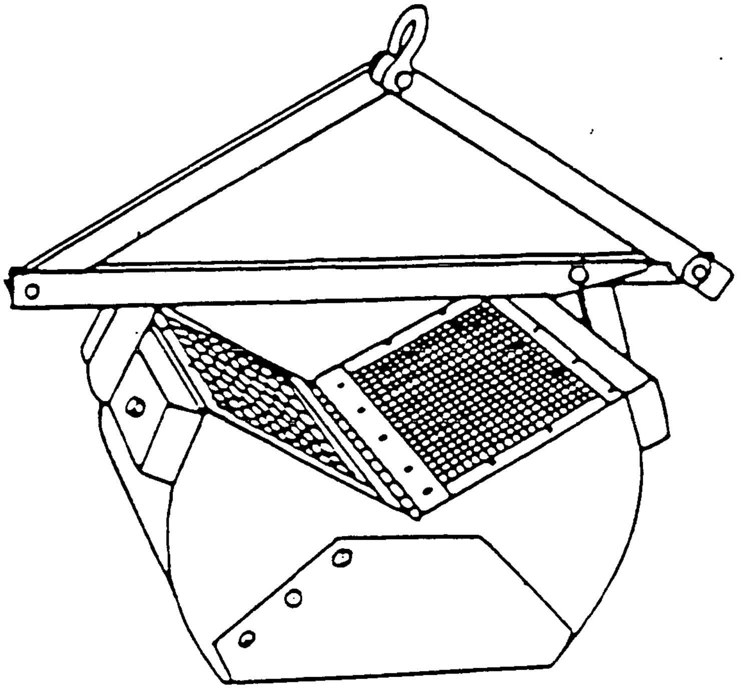
The Ponar grab is a clamshell type scoop activated by a counter lever system. The shell is opened and latched in place and slowly lowered to the bottom. when tension is released on the lowering cable the latch releases and the lifting action of the cable on the lever system closes the clamshell (see Figure 3-5).

- Uses

Ponars are capable of sampling most types of sludges and sediments from silts to granular materials. They are available to a "Petite" version with a 36 square inch sample area that is light enough to be operated without a winch or crane. Penetration depths will usually not exceed 2-3 inches. Grab samplers, unlike the corers described in Subsection 3.3.3.3 are not capable of collecting undisturbed samples. As a result, material in the first inch of sludge cannot be separated from material at lower depths. The sampling action of these devices causes agitation currents which may temporarily resuspend some settled solids. This disturbance can be minimized by slowly lowering the sampler the last one to two feet and allowing a very slow contact with the bottom. It is advisable, however, to only collect sludge or sediment samples after all overlying water samples have been obtained.

- Procedures For Use

1. Attach a precleaned Ponar to the necessary length of sample line. Solid braided 3/16 inch nylon line is usually of sufficient strength; however, 3/4 inch or greater nylon line allows for easier hand hoisting.



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PONAR GRAB

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2. Measure and mark the distance to bottom on the sample line. A secondary mark, 1 1/2 foot shallower, will indicate proximity so that lowering rate can be reduced, thus preventing unnecessary bottom disturbance.
3. Open sampler jaws until latched. From this point on, support sampler by its lift line or the sampler will be tripped and the jaws will close.
4. Tie free end of sample line to fixed support to prevent accidental loss of sampler.
5. Begin lowering the sampler until the proximity mark is reached.
6. Slow rate of descent through last 1 1/2 foot until contact is felt.
7. Allow sample line to slack several inches. In strong currents more slack may be necessary to release mechanism.
8. Slowly raise dredge clear of water surface.
9. Place Ponar into a stainless steel, Teflon or aluminum foil lined tray and open. Lift Ponar clear of the tray.
10. Collect a suitable aliquot with a stainless steel lab spoon or equivalent and place sample into appropriate sample bottle.
11. Check for a Teflon liner in cap if required and secure cap tightly. The chemical preservation of solids is best approach supplemented by a minimal holding time.
12. Label the sample bottle with the appropriate label. Complete all chain-of-custody documents.
13. Consult Section 5 Decontamination, for appropriate decontamination procedures to be used on sampling equipment after use and between sampling locations.

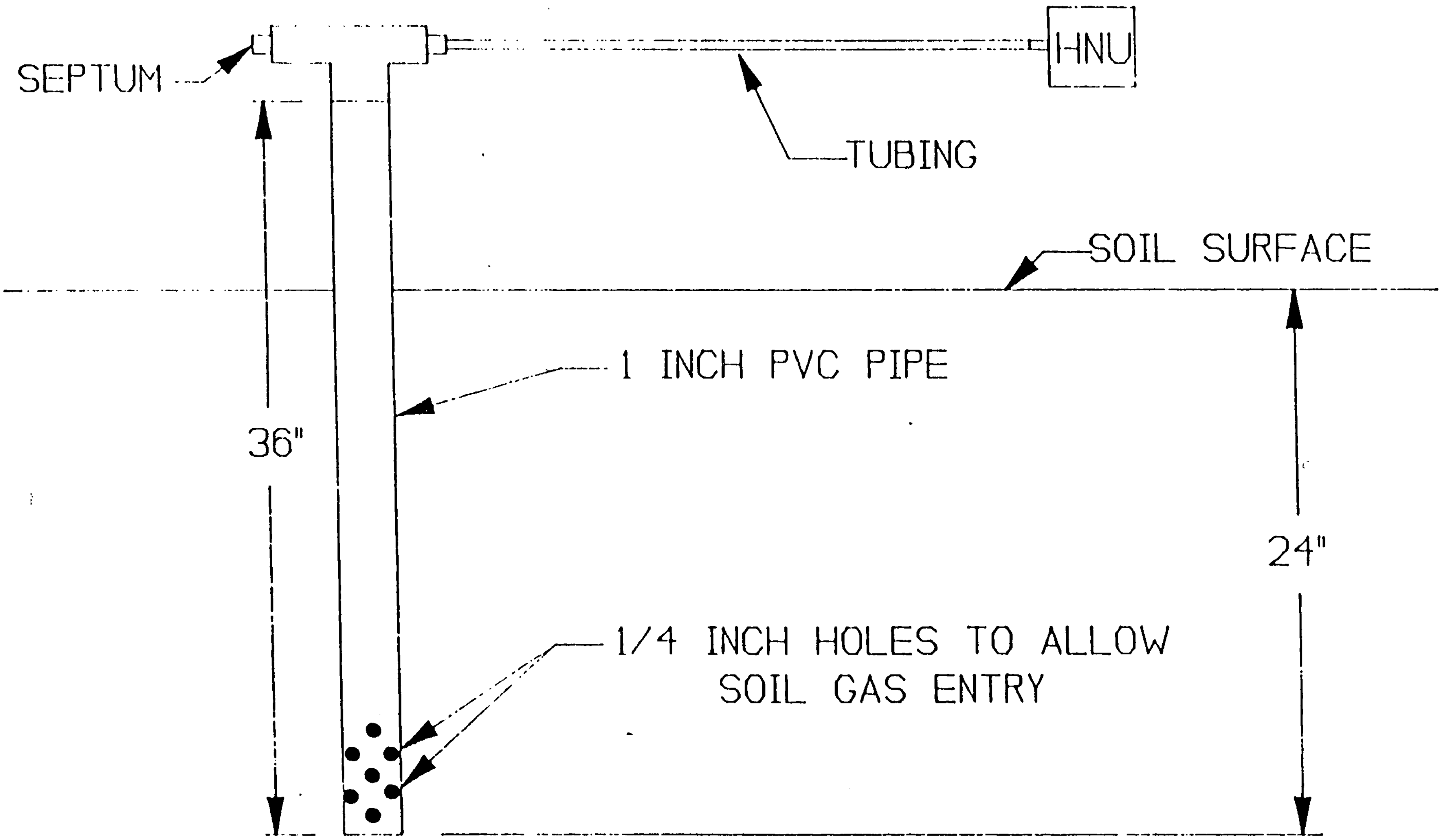
3.4 SOIL GAS

Since soil gas survey results can be affected by weather conditions, surveys will be conducted when both soil temperature and ambient temperature exceed 40 degrees F. Other factors which can affect the outcome of the survey are: the chemical and physical properties of the organic compounds being monitored, properties of the unsaturated zone, hydrogeologic properties, and size and concentration of the contaminant plume. All of these factors will have been considered when planning the soil gas survey described in the work plan.

The following procedure will be used at the site to conduct the soil gas survey described in the work plan. Two inch diameter borings will be drilled to a depth of 24 inches below the land surface (or 24 inches below the bottom of any cap material). The boring will be drilled with a hand or power auger, depending on soil conditions. The soil gas probe (see Figure 3-6) will be inserted into the boring and the probe will be sealed off at the soil surface by compressing the natural soil around the PVC pipe. The probe will be left in place at least 24 hours to allow the area to come to equilibrium.

An HNU PI101 organic vapor analyzer will be connected to the probe as shown in Figure 3-6 and soil gas will be drawn into the unit and two readings will be taken and recorded. The first is the maximum reading noted during the screening of soil gas. The second reading is the level at which the HNU stabilizes after the peak reading.

Depending upon the requirements of the work plan, further on-site characterization of the soil gas may be performed utilizing a portable gas chromatograph (GC). Soil gas for GC analysis will be collected using a gas-tight syringe. The syringe will be inserted through the septum on the probe filled with the proper volume, and then injected into the GC. Minimum detection limits will be as required for the particular parameters being analyzed; these detection limits are spelled out in the work plan.



A-F-I

SOIL GAS PROBE SCHEMATIC

FIGURE 3-6
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3.5 AIR SAMPLING

3.5.1 General

Air monitoring for the purpose of conducting site investigations can be useful for indicating potential health and safety concerns for both on-site workers and off-site residents. The data is necessary in some cases for evaluating the extent of contamination, the need for remediation and also for conducting the risk assessment. This subsection describes various methodologies that that can be used during site investigations to develop the needed information. Since air monitoring procedures are generally determined by the parameters to be monitored, this section provides general information regarding the types of monitoring commonly conducted. Specifics regarding the sampling and analysis of air samples are provided in the workplan and in section 2 of subsection 3.4 of the QAPP. Air monitoring requirements for protection of workers and the community are provided in the site Health & Safety Plan. Procedures for screening soil samples for volatile organics are provided in subsection 4.1.

3.5.2 Volatile Organics in Ambient Air

Monitoring of volatile organics in air is conducted utilizing an HNU PI 101 photoionization instrument. The HNU is capable of detecting a wide variety of organic chemicals. Detection levels are as low as 0.2 ppm depending on the specific parameter being monitored. One drawback with the HNU is the inability to quantitate specific parameters when one or more organics are present.

When lower detection limits are needed or specific parameters need to be identified and quantified, gas chromatography (GC) is needed. The GC can be either a portable model that is brought to the site or it can be in the laboratory and samples are then collected at the site and can be introduced into the GC by direct injection (gas-tight syringe) or through a gas sampling loop.

3.5.3 Combustible Gases in Air

Combustible gases in air are monitored with a Neotronix Ecotox Model 40. This instrument reports the level of combustible gases in air as a percentage of the Lower Explosive Limit (LEL). The combustible gas meter provides indication of the presence of high levels of volatile organics. The instrument does not provide information for trace levels of volatiles in air.

3.5.4 Detector Tubes

A variety of detector tubes are available for monitoring a specific compound or classes of compounds in air. AFI Environmental utilizes a Drager hand pump for site monitoring. Selection of tubes is based on the parameters of concern and the detection level needed. A major advantage of detector tubes is the ability to obtain compound-specific, real-time information. The tubes are easily used by personnel with a minimum amount of training. The tubes are generally adequate for verifying the presence or absence of non-trace levels of numerous organic and inorganic compounds. They may not be adequate for off-site or non-work zone ambient air monitoring due to the low sample volume analyzed.

3.5.5 Particulates in Ambient Air

Particulate sampling of ambient air, mainly off-site or at the property line, is conducted with a high-volume (hi-vol) sampler. Basically this involves the use of a high-volume blower to draw air through one of more filters. The mass concentration in air of particulate samples of a given size is determined from the weight of particles collected and the volume of air pulled through the filter. Specific filters can be utilized depending on the nature of the particulates being monitored and whether chemical analysis of the particulates is needed.

4.0 FIELD MONITORING PROCEDURES

4.1.1 General

During drilling activities, a total hydrocarbon vapor analyzer (HNU P1101) can be used to monitor the borehole and split-spoon samples upon opening of each sampler. The monitoring results will provide a vertical profile of possible soil contamination by volatile organic substances.

Generally, the hydrocarbon vapor analyzer is a portable trace gas analyzer that can be used to measure the concentration of a wide variety or organic vapors. The instrument relies upon the fact that an ultraviolet (UV) light source at a given intensity will emit photons particularly organics, but not high enough to ionize the major components of air, (O_2, N_2, CO, CO_2) or H_2O.

Although the analyzer can be used to detect the presence of a single, pre-specified species, results should be taken as indicative rather than absolute. For precise results, a detailed lab analysis should be performed.

4.1.2 Procedure For Soil Screening

The following procedures shall be incorporated when testing for volatile organic vapors.

- Upon opening each split-spoon sampler, a subsample of the soil will be placed into a precleaned glass VOA vial, sealed with a teflon-lined spetum cap, labeled, and placed immediately on ice in an ice chest. The remainder of the sample will be placed in a comparable labeled wide-mouth glass jar and sealed with aluminum foil and a screw top cap. All samples of the latter type will be staged at a single location and maintained at a temperature that will be as near as possible to 70°F. (Note that a VOA Vial sample is not needed if screening will not be followed by laboratory analysis for volatile organics).

After a minimum of 15 minutes, and before the end of the work day, a head-space analysis of any organic vapor present in each sample bottle will be performed by inserting the sample probe of the total organic vapor analyzer through the aluminum foil seal.

4.1.3 Field Recording Procedure

Field records will be maintained during all field activities. Data and information which will be recorded during soil screening for hydrocarbon vapor detection will include:

- Date
- Time
- Location
- Sampler Name
- Weather
- General Observations/Remarks
- Sample Description and Identification
- Sample Handling Method
- Equipment Used
- Instrument Reading

4.2 SOIL BORING LOG DESCRIPTION PROCEDURES

4.2.1 General

This procedure is presented as a means for insuring proper field identification and description of soils collected from a split barrel sampler according to American Standard Testing Method (ASTM) D 1586, "Penetration Test and Split Barrel Sampling of Soils". The lithology and moisture content of each soil sample can be visually and physically characterized according to either the Burmister Soil Classification System or the Unified Soil Classification System. Both of these methods of soil classification describe soil types on the basis of grain size and liquid and plastic limits and include moisture content.

4.2.2 Data Recording Forms

Enter all data pertaining to the soil description on the Field Borehole Log. Write the ominant particle size in capital letters. Record additional notes such as water loss or gain, drill chatter, odor, etc.

Maintain a daily drilling report indicating the day's drilling activities. This later report will include all drilling starting and ending times, footage drilled, consumables, and any other important notes about the day's drilling process.

4.2.3 Soil Boring Sampling and Borehole Log Descriptions

1. Maintain a daily drilling report describing the day's activities in addition to the field borehole log.
2. With the split-spoon sample barrel resting on the bottom of the borehole, the entire length of the sampler (24 inches) is driven into the sub-soil by a 140 lb. weight free falling from a height of 30 inches.
3. Record the number of blows necessary to drive the sampler 6 inches on the borehole log sheet as below counts. If the sampler is not driven the 6 inch interval after 100 blows are delivered, measure the penetration distance for that interval.
4. After the split-spoon is pried open with a screwdriver, measure and record the length of the sample, the upper 2 to 3 inches of the sample should be neglected since this material will consist of cuttings and sludge.
5. Shave a thin layer off the entire length of the sample to prevent descriptive errors that may result from smearing of the outer sample surface while the sample barrel is being driven.
6. After the sample has been described, place a representative portion of the sample in the pre-cleaned jars and tightly seal with a screw-on cap. Label the jar with the number of blow counts, sample interval, borehole number, and date and store at a safe location.

4.2.4 Descriptive Terms For Soil Characteristics

Use the following terms to identify major characteristics of the soils:

1. Color: Describe soil color utilizing a single color descriptor preceded by a modifier to denote variations in shade or color mixtures. Soil color should be described while the sample is still moist.
2. Density: Classify the relative density of a soil according to the number of blow counts from the standard penetration test while sampling:

Designation	Blows per Foot
Very loose	0 to 4
Loose	5 to 10
Med. dense	11 to 30
Dense	31 to 50
Very Dense	Over 50

3. Particle Size: Base particle size classification upon the grain sizes in the Burmister and Unifies Soil Classification Systems (See Tables 4-1 and 4-2).
4. Soil Descriptors: Describe the relative weight proportions of each soil sample using terms as: and, some, little or trace. Each term represents a range of percentage by weight. See the Burmister Classification System for further details (Table 4-1).
5. Moisture Content: Estimate moisture content according to four categories: dry, moist, wet and saturated. In dry soil, there appears to be little or no water. Saturated samples contain more water than can hole. Moist and wet are used to describe samples that containe more or less water than these two extremes. The application of these terms is subjective, but if consistency is used throughout the drilling project, they will prove to be adequate.

KEY TO SOILS IDENTIFICATION
Burmister Classification

Granular Soils - Particle Size Classification

Material		Fractions	Passing	Retaines On
BOULDERS	Material retained on the 9 in. sieve			9 in.
COBBLES	Material passing the 9 in. sieve and retained on the 3 in. sieve		9 in.	3 in.
GRAVEL	Material passing the 3 in. sieve and retained on the No. 10 sieve	coarse (c)	3 in.	1 in.
		medium (m)	1 in.	3/8 in.
		fine (f)	3/8 in.	No. 10
SAND	Material passing the No. 10 sieve and retained on the No. 200 sieve	coarse (c)	No. 10	No. 30
		medium (m)	No. 30	No. 60
		fine (f)	No. 60	No. 200
SILT	Material passing the No. 200 sieve that is nonplastic in character and exhibits little or no strength when air-dried		No. 200	

Clay Soils - Plasticity Cla: ification

Material*	Degree of Over-all Plasticity	Overal Index Clay	Plasticity and - Silt - Components
Clayey SILT	Slight		1 to 5
SILT & CLAY	Low		5 to 10
CLAY & SILT	Medium		10 to 20
Silty CLAY	High		20 to 40
CLAY	Very High		40 and greater

*Soils passing the No. 200 sieve which can be made to exhibit plasticity and clay qualities within a certain range of moisture content, and which exhibits considerable strength when air-dried.

Penetration Resistance and Soil Properties on Basis of the Standard Penetration Test (After Peck, Hanson and Thornburg, 1974)

Sands (Fairly Reliable)		Clays (Rather Unreliable)	
Number of Blows per ft. N	Relative Density	Number of Blows per ft. N	Consistency
		Below 2	Very Soft
0-4	Very Loose	2-4	Soft
4-10	Loose	4-8	Medium
10-30	Medium	8-15	Stiff
30-50	Dense	15-30	Very Stiff
Over 50	Very Dense	Over 30	Hard

Terms Identifying Composition of Soil

Written*	Defining Range of Percentage by Weight
and	35 to 50
some	20 to 35
little	10 to 20
trace	0 to 10

*Plus (+) or minus (-) sign used after identifying term denotes extremes of range, e.g., "some (-) Gravel" indicates 20 to 24 percent Gravel; "some (+) Gravel" indicates 31 to 35 percent Grave.

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TABLE 4-2
SOIL TERMS

UNIFIED SOIL CLASSIFICATION (USCS)

COARSE GRAINED SOILS

More than half of material is LARGER than No. 200 sieve size

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)			GROUP SYMBOLS	TYPICAL NAMES
50%(1) > 1/4"	CLEAN GRAVELS Low % fines	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel-sand mixtures, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
	GRAVELS W/FINES High % fines	Non-plastic fines (for identification procedures see ML)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures
		Plastic fines (for identification procedures see CL)	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
50% (1) < 1/4"	CLEAN SANDS Low % fines	Wide range in grain size and substantial amounts of all intermediate particle sizes	SW	Well graded sand, gravelly sands, little or no fines
		Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands, little or no fines
	SANDS W/FINES High % fines	Non-plastic fines (for identification procedures see ML)	SM	Silty sands, poorly graded sand-silt mixtures
		Plastic fines (for identification procedures see CL)	SC	Clayey sands, poorly graded sand-clay mixtures

FINE GRAINED SOILS

More than half of material is SMALLER than No. 200 sieve size

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3" & basing fractions on estimated weights)				GROUP SYMBOLS	TYPICAL NAMES
Identification procedures on fraction smaller than No. 40 sieve size					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY (Reaction to Shaking)	TOUGHNESS (Consistency Near Plastic Limit)		
SILTS & CLAYS Liquid limit < 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity
	Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity
SILTS & CLAYS Liquid limit > 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays
	Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS	Readily identified by color, odor, spongy feel and frequently by fibrous texture			Pt	Peat and other organic soils

Boundary classifications-Soils possessing characteristics of two groups are designated by combining group symbols. For example GW-GC, well graded gravel sand mixture with clay binder.
All sieve sizes on this chart are U.S. standard.

DENSITY OF GRANULAR SOILS

DESIGNATION	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT
Very loose	0 - 4
Loose	5 - 10
Medium dense	11 - 30
Dense	31 - 50
Very dense	Over 50

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	UNC. COMPRESSIVE STR. TONS /SQ. FT.	STANDARD PENETRATION RESISTANCE - BLOWS/FOOT	FIELD IDENTIFICATION METHODS
Very soft	Less than 0.25	0 to 2	Easily penetrated several inches by fist
Soft	0.25 to 0.50	2 to 4	Easily penetrated several inches by thumb
Medium stiff	0.50 to 1.0	4 to 8	Can be penetrated several inches by thumb
Stiff	1.0 to 2.0	8 to 15	Readily indented by thumb
Very stiff	2.0 to 4.0	15 to 30	Readily indented by thumbnail
Hard	More than 4.0	Over 30	Indented with difficulty by thumbnail

ROCK TERMS

ROCK HARDNESS (FROM CORE SAMPLES)

DESCRIPTIVE TERMS	SCREWDRIVER OR KNIFE EFFECTS	HAMMER EFFECTS
Soft	Easily gouged	Crushes when pressed with hammer
Medium soft	Can be gouged	Breaks (one blow) Crumbly edges
Medium hard	Can be scratched	Breaks (one blow) Sharp edges
Hard	Cannot be scratched	Breaks conchoidally (several blows) Sharp edges

ROCK BROKENNESS

DESCRIPTIVE TERMS	ABBREVIATION	SPACING
Very broken	(V. Br.)	0 - 2"
Broken	(Br.)	2" - 1'
Blocky	(Bl.)	1' - 3'
Massive	(M.)	3' - 10'

LEGEND

SOIL SAMPLES - TYPES

S - 2" O.D. Split Barrel Sample
ST - 3" O.D. Undisturbed Sample

ROCK SAMPLES - TYPES

X - NX (Conventional) Core (~ 2-1/8" O.D.)
Q - NQ (Wireline) Core ~1-7/8" O.D.)
[illegible]

WATER LEVELS

12/10
▽ 12.6' Initial Level w/Date & Depth
12/11

4.3 HYDRAULIC CONDUCTIVITY DATA COLLECTION

4.3.1 General

This procedure is presented for calculating the hydraulic conductivity of an aquifer from the rate of rise or fall of the water level in a monitoring well after a certain volume of water is removed or added.

4.3.2 Data Collection Procedures

1. Obtain the static ground water surface elevation by measuring the distance from the ground water surface to a stable reference point (viz., top of well riser) with an electronic water level indicator. The top of the protective steel casing should not be used as a reference point since the elevation may be altered by physical disturbance (i.e., heaving due to other heavy equipment bumping into protective casings, etc.)
2. Remove or add a known volume of water (slug).
3. Quickly measure the water level with the electronic water level indicator and note the time corresponding to that reading. Simultaneously read and record the water level and time every 15 seconds for the first 2 to 3 minutes. The frequency of subsequent water level and time recording are based upon the rate of well recovery and are generally taken every few minutes. Record all readings in the field notebook.

4.3.3 Calculation of Hydraulic Conductivity

A slug-test procedure applicable to fully or partially penetrating wells in unconfined aquifers was developed by Bouwer and Rice (1976). The procedure is based on the Thiem equation (1) and assumes negligible drawdown of the water table around the well and no flow above the water table.

$$Q = \frac{2\ (3.1416) KD (h_2 - h_1)}{\ln\ (r_2/r_1)} \qquad (1)$$

The term h_2-h_1 in Eq. 1 then represents the distance y of the water level in the well below the water table (Figure 4-1).

The rate of rise dy/dt of the water level after removal of water is expressed as

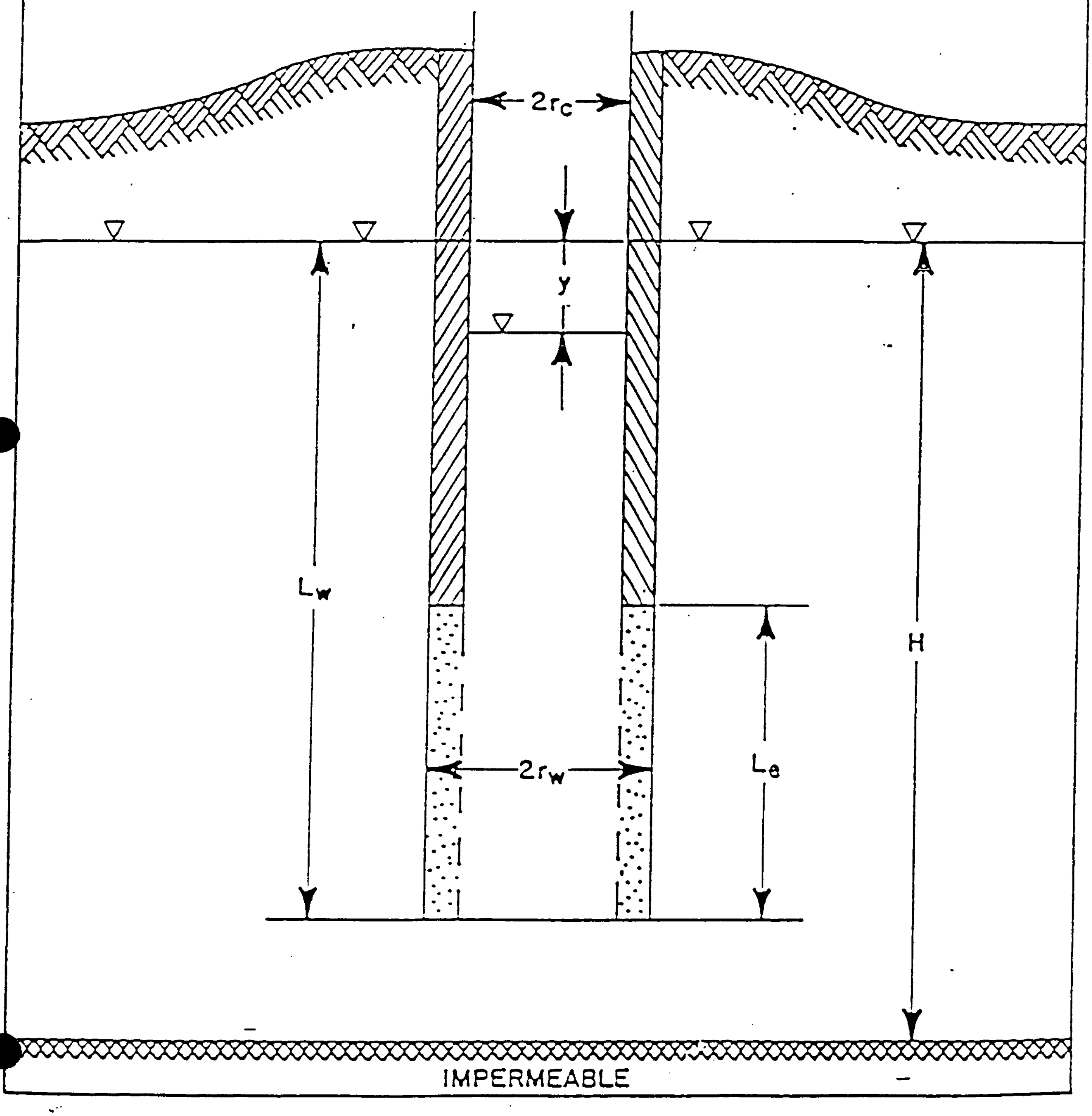
$$\frac{dy}{dt} = - \frac{Q}{(3.1416) r_c^2} \qquad (2)$$

where r_c is the radius of the well section where the water level is rising and Q is the flow of ground water into the well. The minus sign in Eq. (2) is introduced because y decreases with increasing t, so that integrating, and solving for K yields

$$K = \frac{r_c^2 \ln\ (R_e/r_w)}{2L_e} \frac{1}{t} \frac{\ln y_o}{y_t} \qquad (3)$$

where R_e = effective radial distance over which the head difference y is dissipated

r_w = radial distance between well center and undisturbed aquifer (r_c plus thickness of gravel envelope or developed zone outside casing)



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GEOMETRY & SYMBOLS OF MONITORING WELL

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FIGURE 4-1

L_e = height of perforated, screened, uncased, or otherwise open section of well through which ground water enters

y_0 = y at time zero

y_t = y at time t

t = time since y_0

The effective radius R_e is essentially the effective value of r_2 to be used in Eq. (1) so that it gives the correct value of Q (the Thiem equation was developed for horizontal flow only and as such cannot be used to calculate Q for the system of Figure 4-1). Values of R_e were experimentally determined with a resistance network analog for different values r_w, L_e, L_w and H (see Figure 4-1 for meaning of symbols). The following empirical equation was then developed to relate R_e to the geometry and boundary conditions of the system

$$\ln \frac{Re}{rw} = \frac{1}{\dfrac{1.1}{\ln(L_w/r_w)} + \dfrac{A + B \ln [(H-L_w)/r_w]}{(L_e/r_w)}}$$

where A and B are dimensionless parameters shown in Figure 2 in relation to L_e/r_w. If H is much larger than L_w, a further increase in H has little effect on the flow system and, hence, on R_e. The analog analyses indicated that the effective upper limit of $\ln[(H - L_w)/r_w]$ is 6. Thus, if $H - L_w$ is so large that $\ln[(H - L_w)/r_w]$ is greater than 6, a value of 6 should still be used for this term in Eq (4) including the theoretical case of H = . If $H = L_w$ (well penetrating to bottom of aquifer), the term $\ln [(H - L_w)/r_w]$ in Eq. (4) cannot be used. For this situation, the equation for $\ln (R_e/r_w)$ is:

$$\ln \frac{R_e}{r_w} = \frac{1}{\dfrac{1.1}{\ln(L_w/r_w} + \dfrac{C}{(L_e/r_w)}} \qquad (5)$$

where C is a demensionless coefficeint shown in Figure 4-2 as a function of L_e/r_w. The value of ln (R_e/r_w) calculated with Eqs. (4) and (5) is within 10 percent of the analog value if L_e is greater than $0.4L_w$ and within 25 percent if L_e is less than $0.2L_w$.

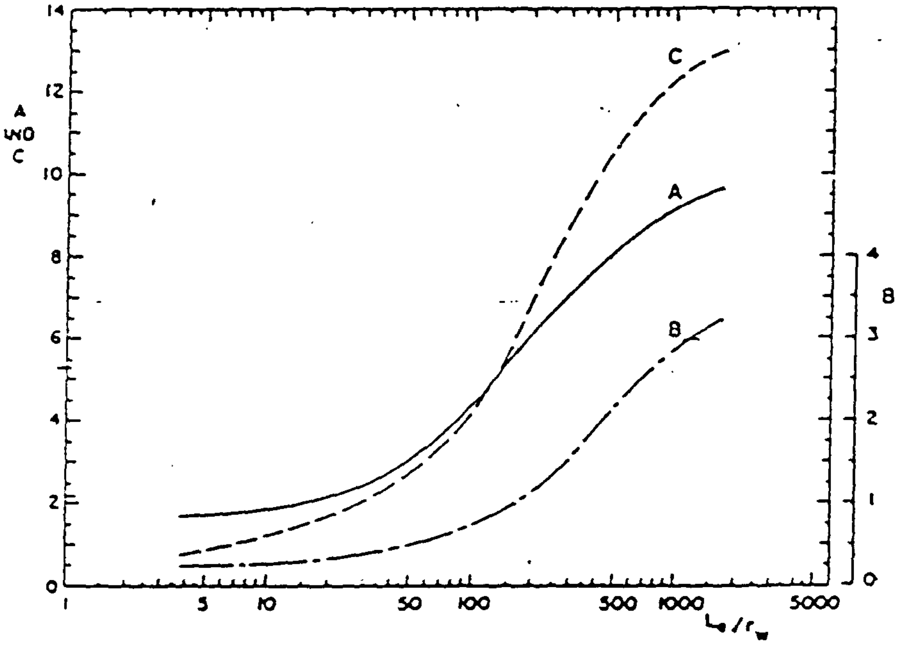

Figure 4-2. Curves relating to coefficients A, B, and C to L_e/r_w.

Since K, r_c, R_e, r_w, and L_e are constant for a given well, 1/t ln (y_0/y_t) must also be constant, as indicated by Eq. (3). Thus, when the observed values of y are plotted against t on semilograithmic paper (y on the log scale), the data points should form a straight line.

QAPP

APPENDIX A

REFERENCES

5.0 SAMPLE INTEGRITY

5.1 EQUIPMENT CLEANING

Contamination of samples is precluded by proper cleaning of sampling equipment and containers prior to their use in the field, or by the utilization of dedicated equipment. The actual cleaning process is the utilization of dedicated equipment. The actual cleaning process is dictated by the analytical procedures designated for the sample, but usually includes the following steps:

1. detergent washing
2. rinse with tap water
3. rinse with a dilute hydrochloric acid solution (inorganics only)
4. one or more rinses with distilled water
5. rinse with hexane
6. rinse with organic-free water

Steps 5 and 6 are generally performed only when samples are to be analyzed for organic compounds.

The cleaning is performed prior to going out in the field. When discrete samples are to be collected at multiple locations, additional cleaning between samples is performed on-site to prevent carry-over of contaminants. Also, in the case of surface water sampling, the sample jars are usually rinsed in the field with sample water prior to filling. During sampling, equipment is not allowed to come in contact with the ground, other equipment, or potential sources of contamination.

The use of dedicated equipment is optimal for projects where a long-term monitoring program is in place, or where protection from contamination is not adequate through the use of normal cleaning procedures. AFI Environmental frequently uses dedicated equipment for extended ground water monitoring programs. In this application, well bailer and pumps are used in only one well and are stored in the well between samplings.

5.2 CONTAINERS, PRESERVATIVES AND HOLDING TIMES

Sample integrity is preserved through the use of proper sample containers, addition of the correct preservatives to the samples and meeting designated holding times (the time from sample collection to sample analysis). Containers, preservatives and holding times used by AFI Environmental are taken from 40 CFR Part 136 and are shown in Table 5-1. Note that preservation techniques, other than cooling to 4°C, and holding times have not been promulgated for soil samples. Holding time for samples submitted for volatile organic analysis will be seven days from the day the sample is taken. This requirement applies to all sample matrices.

5.3 QUALITY CONTROL SAMPLES

5.3.1 Trip Blanks

Field blanks are prepared prior to going on-site. Clean sample bottles are filled with distilled or organic-free water, depending on the analyses to be performed. These blanks are taken to the site, kept with the samples collected there, and submitted to the laboratory for the same analyses that the samples will receive. Results of the analysis will be indicative of quality control on container cleanliness, external contamination and the analytical methods. Trip blanks are only utilized for water samples.

5.3.2 Field Blanks

Field blanks are prepared in the field. Distilled or organic-free water is placed in or through the sampling equipment in the same manner that a sample would be collected, placed in a clean sample container, and preserved like other samples. Analysis of the field blank will indicate potential contamination from sampling equipment, sample preservation and external site conditions. Field blanks are not used for dedicated well bailers if no preservative is utilized. Field blanks are only used for water samples.

5.3.3 Duplicate and Split Samples

Duplicate samples are multiple samples collected at the same time, from the same location, and using the same procedure and containers.

TABLE 5-1
REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
Page 1 of 2

Parameter No./name	Container[1]	Preservation[2,3]	Maximum holding time[4]
Table IA—Bacterial Tests:			
1–4. Coliform, fecal and total	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	6 hours
5. Fecal streptococci	P, G	do	Do.
Table IB—Inorganic Tests:			
1. Acidity	P, G	Cool, 4°C	14 days.
2. Alkalinity	P, G	do	Do.
4. Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
9. Biochemical oxygen demand	P, G	Cool, 4°C	48 hours.
11. Bromide	P, G	None required	28 days.
14. Biochemical oxygen demand, carbonaceous.	P, G	Cool, 4°C	48 hours.
15. Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
16. Chloride	P, G	None required	Do.
17. Chlorine, total residual	P, G	do	Analyze immediately.
21. Color	P, G	Cool, 4°C	48 hours.
23–24. Cyanide, total and amenable to chlorination.	P, G	Cool, 4°C, NaOH to pH > 12, 0.6g ascorbic acid[5].	14 days.[6]
25. Fluoride	P	None required	28 days.
27. Hardness	P, G	HNO_3 to pH < 2, H_2SO_4 to pH < 2.	6 months.
28. Hydrogen ion (pH)	P, G	None required	Analyze immediately.
31, 43. Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
Metals:[7]			
18. Chromium VI	P, G	Cool, 4°C	24 hours.
35. Mercury	P, G	HNO_3 to pH < 2	28 days.
3, 5–8, 10, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except chromium VI and mercury.	P, G	do	6 months.
38. Nitrate	P, G	Cool, 4°C	48 hours.
39. Nitrate-nitrite	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
40. Nitrite	P, G	Cool, 4°C	48 hours.
41. Oil and grease	G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
42. Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH < 2.	Do.
44. Orthophosphate	P, G	Filter immediately, Cool, 4°C	48 hours.
46. Oxygen, Dissolved Probe	G Bottle and top.	None required	Analyze immediately
47. Winkler	do	Fix on site and store in dark	8 hours.
48. Phenols	G only	Cool, 4°C, H_2SO_4 to pH < 2.	28 days.
49. Phosphorus (elemental)	G	Cool, 4°C	48 hours.
50. Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH < 2	28 days.
53. Residue, total	P, G	Cool, 4°C	7 days.
54. Residue, Filterable	P, G	do	7 days.
55. Residue, Nonfilterable (TSS)	P, G	do	7 days.
56. Residue, Settleable	P, G	do	48 hours.
57. Residue, volatile	P, G	do	7 days.
61. Silica	P	do	28 days.
64. Specific conductance	P, G	do	Do.
65. Sulfate	P, G	do	Do
66. Sulfide	P, G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH > 9.	7 days.
67. Sulfite	P, G	None required	Analyze immediately
68. Surfactants	P, G	Cool, 4°C	48 hours
69. Temperature	P, G	None required	Analyze.
73. Turbidity	P, G	Cool, 4°C	48 hours.
Table IC—Organic Tests:[8]			
13, 18–20, 22, 24–28, 34–37, 39–43, 45–47, 56, 66, 88, 89, 92–95, 97. Purgeable Halocarbons.	G, Teflon-lined septum.	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	7 days
6, 57, 90. Purgeable aromatic hydrocarbons	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5], HCl to pH2[9].	Do
3, 4. Acrolein and acrylonitrile	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]; Adjust pH to 4–5[10].	Do
23, 30, 44, 49, 53, 67, 70, 71, 83, 85, 96. Phenols[11].	G, Teflon-lined cap.	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	7 days until extraction, 40 days after extraction.
7, 38. Benzidines[11]	do	do	7 days until extraction[13]
14, 17, 48, 50–52. Phthalate esters[11]	do	Cool, 4°C	7 days until extraction; 40 days after extraction
72–74. Nitrosamines[11,14]	do	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$[5].	Do.
76–82. PCBs[11] acrylonitrile	do	Cool, 4°C	Do.
54, 55, 65, 69. Nitroaromatics and isophorone[11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5] store in dark.	Do.
1, 2, 5, 8–12, 32, 33, 58, 59, 64, 68, 84, 86. Polynuclear aromatic hydrocarbons.[11].	do	do	Do
15, 16, 21, 31, 75. Haloethers[11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	Do.
29, 35–37, 60–63, 91. Chlorinated hydrocarbons[11].	do	Cool, 4°C	Do.
87. TCDD[11]	do	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	Do.
Table ID—Pesticides Tests:			
1–70. Pesticides[11]	do	Cool, 4°C, pH 5–9[15]	Do.
Table IE—Radiological Tests:			
1–5. Alpha, beta and radium	P, G	HNO_3 to pH < 2	6 months

TABLE 5-1
REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES.
Page 2 of 2

[1] Polyethylene (P) or Glass (G).

[2] Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[3] When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide ($NaOH$) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

[4] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See § 136.3(e) for details.

[5] Should only be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12

[7] Samples should be filtered immediately on-site before adding preservative for dissolved metals.

[8] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[9] Sample receiving no pH adjustment must be analyzed within seven days of sampling.

[10] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[11] When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6–9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 12, 13 (re the analysis of benzidine).

[12] 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

[13] Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[14] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[15] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

These samples provide a check on any variability introduced during the sampling process. Split samples are one sample that is divided into two or more aliquots. The aliquots may then be sent to separate laboratories as a check on analytical results or one of the aliquots may be assigned a fictitious number and submitted to the same laboratory as a "blind split". This "blind split". This "blind split" is a check on the analytical variability within the laboratory.

Unless otherwise specified, a field blank and trip blank are used by AFI Environmental for each day of sampling. Duplicate or split samples are collected at a rate of approximately 5% (1 in 20) for each type of sample.

5.3.4 Matrix Spike Samples

Matrix spikes and matrix spike duplicates are collected, when required by the work plan, in the same manner as duplicate samples (see Section 5.3.3) The extra sample volume is used by the analytical laboratory to prepare sample aliquotes to which they add known concentrations of sample constituents. Recovery rates of the spike compounds provide quality control data on the sample extraction/digestion procedures and also indicate sample matrix effects.

5.4 CHAIN-OF-CUSTODY

An important part of quality control is proper documentation of all aspects of the sampling program. This includes careful labeling of the sample containers, the use of field logs to record pertinent data on-site during sampling events, and the use of chain-of-custody sheets which accompany the sample from collection through analysis. AFI Environmental uses pre-gummed labels with spaces to record client name, sample location, date and time of sampling, sampler's name, filtered or not, preservatives added, and sample ID number. The chain-of-custody sheets used by AFI Environmental includes all information on the label, and in addition: sample type, sampling method, number and type of containers, name, date and time of delivering and receiving the sample at the laboratory, and the date, method and person performing each sampling. Custody sheets used specifically for well-monitoring include information on the type of well, size of well, well depth, depth to water, number of volumes pumped, total volume and pH, temperature, color and appearance of the sample. Standard documents used by AFI Environmental are included in Appendix C of this report. Care should be taken to avoid the use of inks that run when wetted.

6.0 FIELD INSTRUMENT CALIBRATION AND MAINTENANCE

6.1 INTRODUCTION

Calibration and maintenance procedures for the field instruments identified below are presented in the following sections.

6.2 PORTABLE FIELD pH METER

6.2.1 Accuracy

The calibrated accuracy of the pH meter will be 0.1 pH unit, over the temperature range of -2_0C to 40_0C.

6.2.2 Calibration

The pH meter will be calibrated by immersing the sensing probe in a container of certified pH buffer solution traceable to the National Bureau of Standards. The meter reading will be compared to the known value of the buffer solution, which is stirred. The meter will be two-point calibrated in the field at the beginning and end of each group of measurements. Precalibration at the office will be performed by local jobs.

6.2.3 Maintenance

1. When not in use or between measurements, the pH probe will be kept immersed in or moist with buffer solution.
2. The meter batteries will be checked at the end of each day and replaced when needed.
3. The pH probe will be replaced any time that the meter response time becomes greater than two minutes or the metering system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.
4. If replacement of the pH probe fails to resolve instrument response time and stability problems, the instrument will be sent to the manufacturer for maintenance and repair.

5. A maintenance log will be kept for each pH monitoring instrument. All maintenance performed on the instrument will be recorded on this log with date and name of the organization performing the maintenance.

6.2.4 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 the data validation, but also to establish maintenance schedules and component replacement.

6.3 PORTABLE FIELD CONDUCTIVITY METER

6.3.1 Accuracy

The calibrated accuracy of the specific-conductance meter will be within three percent of full-scale over the temperature range of -2°C to 40°C.

6.3.2 Calibration

The specific-conductance meter will be calibrated by immersing the sensor in a container of potassium-chloride standard solution and comparing the meter reading with the known value of the standard solution. The potassium-chloride solution will be prepared in accordance with Standard Methods for the Examination of Water and Wastewater, sixteenth edition, 1985, Part 205, or a purchased standard solution will be used.

6.3.3 Maintenance

1. The meter batteries will be checked at the end of each day and replaced when needed.
2. The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than 2 minutes and the meter must be recalibrated more than once per day, the instrument will be sent to the manufacturer for maintenance and repair.

3. A maintenance log will be kept for each specific-conductance meter. All maintenance performed on the instrument will be recorded on this log with date and name of the organization performing the maintenance.

6.3.4 Data Validation

All instrument calibrations will be documented, indicating the meter readings before and after the meter has been adjusted. The standard solution used to calibrate the meter will also be documented.

6.4 HNU PHOTOIONIZATION ANALYZER

6.4.1 Accuracy

The HNU PI101 is temperature compensated to that a 20°C 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 if from 0.2 to 2000 ppm. Response time is less than three seconds to 90 percent of full-scale.

6.4.2 Calibration

The meter will be calibrated using a cylinder of pressurized gas certified by a reputable supplier. The calibration gas will be in the same matrix in which the measurements will be taken. The span pot will be adjusted so the instrument will read the exact value of the calibration gas. For a HNU factory-calibrated by benzene, the calibration will be made using bottle "span gas" supplied by HNU.

6.4.3 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, sent the instrument to the manufacturer for repair and maintenance.

2. The light source window will be cleaned every four weeks during periods of continued use.
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.

6.4.4 Data Validation

All instrument calibrations will be documented, indicating meter readings and the standard gas mixture utilized.

REFERENCES

1. USEPA, Characterization of Hazardous Waste Sites - A Methods Manual: Volume II, Available Sampling Methods, Second Edition, EPA-600/4-84-076, December 1984.
2. USEPA, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1, September 1986.
3. USEPA, Soil Sampling Quality Assurance User's Guide EPA-600/4-84-043, May 1984.
4. USEPA, Procedures Manual For Ground Water Monitoring At Solid Waste Disposal Facilities, SW-611, December 1980.
5. USEPA, Practical Guide For Ground-Water Sampling, EPA/600/2-85/104, September 1985.
6. USEPA, Sediment Sampling Quality Assurance User's Guide, EPA/600/4-85/048, July 1985.
7. USEPA, Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW846, third edition, September 1986.
8. 40 CFR 136.3, Table II - Required Containers, Preservation Techniques, and Holding Times.
9. USEPA, Soil Sensing For Detection and Mapping of Volatile Organics, EPA/600/8-87/036, August 1987.
10. USEPA, Field Manual For Grid Sampling Of PCB Spill Sites To Verify Cleanup, EPA-560/5-86-017, May 1986.

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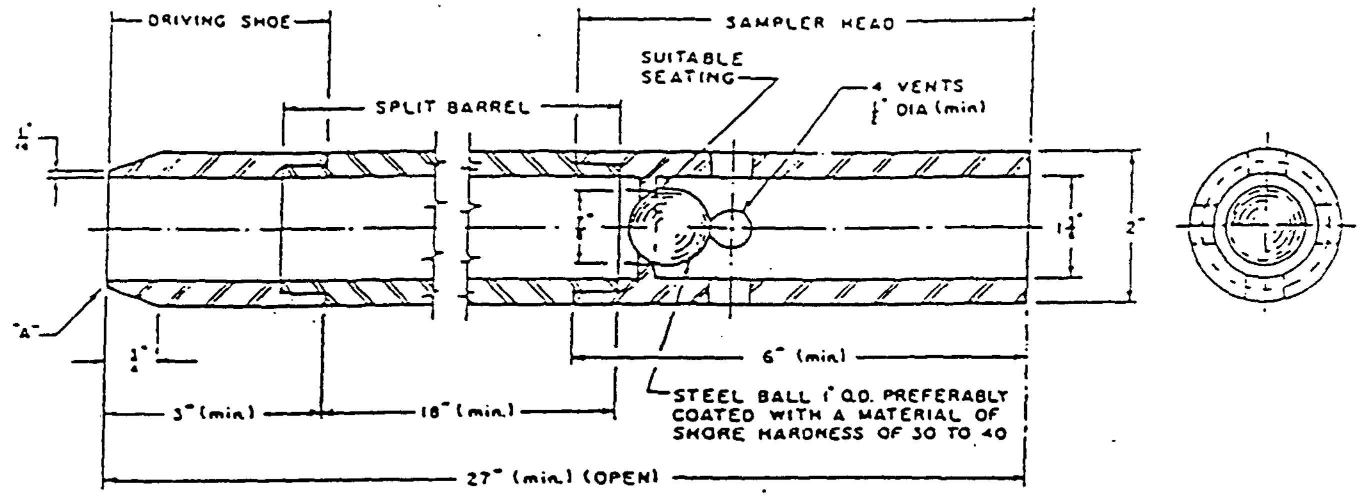
APPENDIX B

ASTM METHOD D-1586



NOTE 1—Split barrel may be 1½ in. inside diameter provided it contains a liner of 16-gage wall thickness.
NOTE 2—Core retainers in the driving shoe to prevent loss of sample are permitted.
NOTE 3—The corners at *A* may be slightly rounded.

Metric Equivalents

in.	mm	in.	mm
1/16 (16 gage)	1.5	2	50.8
½	12.7	3	76.2
¾	19.0	6	152.4
⅞	22.2	18	457.2
1⅜	34.9	27	685.8
1½	38.1		

FIG. 1 Standard Split Barrel Sampler Assembly.

desired depth is reached shall not be permitted. Where casing is used, it may not be driven below sampling elevation. Record any loss of circulation or excess pressure in drilling fluid during advancing of holes.

3.3 With the sampler resting on the bottom of the hole, drive the sampler with blows from the 140-lb (63.5-kg) hammer falling 30 in. (0.76 m) until either 18 in. (0.45 m) have been penetrated or 100 blows have been applied.

3.4 Repeat this operation at intervals not longer than 5 ft (1.5 m) in homogeneous strata and at every change of strata.

3.5 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fractions thereof. The first 6 in. (0.15 m) is considered to be a seating drive. The number of blows required for the second and third 6 in. (0.15 m) of penetration added is termed the penetration resistance, *N*. If the sampler is driven less than 18 in. (0.45 m), the penetration resistance is that for the last 1 ft (0.30 m) of penetration (if less than 1 ft (0.30 m) is penetrated, the logs shall state the number of blows and the fraction of 1 ft (0.30 m) penetrated).

3.6 Bring the sampler to the surface and open. Describe carefully typical samples of soils recovered as to composition, structure, consistency, color, and condition; then put into jars without ramming. Seal them with wax or hermetically seal to prevent evaporation of the soil moisture. Affix labels to the jar or make notations on the covers (or both) bearing job designation, boring number, sample number, depth penetration record, and length of recovery. Protect samples against extreme temperature changes.

4. Report

4.1 Data obtained in borings shall be recorded in the field and shall include the following:

4.1.1 Name and location of job,

4.1.2 Date of boring—start, finish,

4.1.3 Boring number and coordinate, if available,

4.1.4 Surface elevation, if available,

4.1.5 Sample number and depth,

4.1.6 Method of advancing sampler, penetration and recovery lengths,

4.1.7 Type and size of sampler,

4.1.8 Description of soil,

4.1.9 Thickness of layer,

4.1.10 Depth to water surface; to loss of water; to artesian head; time at which reading was made,

4.1.11 Type and make of machine,

4.1.12 Size of casing, depth of cased hole,

4.1.13 Number of blows per 6 in. (0.15 m),

4.1.14 Names of crewmen, and

4.1.15 Weather; remarks.

Designation: D 1586 – 67 (Reapproved 1974)

Standard Method for
PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS[1]

This standard is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This method has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This method describes a procedure for using a split-barrel sampler to obtain representative samples of soil for identification purposes and other laboratory tests, and to obtain a measure of the resistance of the soil to penetration of the sampler.

2. Apparatus

2.1 *Drilling Equipment*—Any drilling equipment shall be acceptable that provides a reasonably clean hold before insertion of the sampler to ensure that the penetration test is performed on undisturbed soil, and that will permit the driving of the sampler to obtain the sample and penetration record in accordance with the procedure described in Section 3. To avoid "whips" under the blows of the hammer, it is recommended that the drill rod have a stiffness equal to or greater than the A-rod. An "A" rod is a hollow drill rod or "steel" having an outside diameter of 1⅝ in. (41.2 mm) and an inside diameter of 1⅛ in. (28.5 mm), through which the rotary motion of drilling is transferred from the drilling motor to the cutting bit. A stiffer drill rod is suggested for holes deeper than 50 ft (15 m). The hole shall be limited in diameter to between 2¼ and 6 in. (57.2 and 152 mm).[2]

2.2 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 1. The drive shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted.

mm) (minimum diameter) vent ports and shall contain a ball check valve. If sizes other than the 2-in. (50.8-mm) sampler are permitted, the size shall be conspicuously noted on all penetration records.

2.3 *Drive Weight Assembly*—The assembly shall consist of a 140-lb (63.5-kg) weight, a driving head, and a guide permitting a free fall of 30 in. (0.76 m). Special precautions shall be taken to ensure that the energy of the falling weight is not reduced by friction between the drive weight and the guides.

2.4 *Accessory Equipment*—Labels, data sheets, sample jars, paraffin, and other necessary supplies should accompany the sampling equipment.

3. Procedure

3.1 Clear out the hole to sampling elevation using equipment that will ensure that the material to be sampled is not disturbed by the operation. In saturated sands and silts withdraw the drill bit slowly to prevent loosening of the soil around the hole. Maintain the water level in the hole at or above ground water level.

3.2 In no case shall a bottom-discharge bit be permitted. (Side-discharge bits are permissible.) The process of jetting through an open-tube sampler and then sampling when the

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[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock.

Current edition approved Oct. 20, 1967. Originally issued 1958. Replaces D 1586 – 64 T.

[2] Hvorslev, M. J., *Surface Exploration and Sampling of Soils for Civil Engineering Purposes*, The Engineering

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APPENDIX C

CHAIN OF CUSTODY FORMS

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CHAIN OF CUSTODY FORMS

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CHAIN OF CUSTODY
SUMMARY FORM

CLIENT/LOCATION					**PROJECT NO.**	**ANALYSIS**										**PRESERVATION**
SAMPLE I.D.	**DATE SAMPLED**	**TIME SAMPLED**	**CONTAINERS**		**DATE ANALYSIS NEEDED**											
			NO.	**SIZE/TYPE**												

RELINQUISHED BY:	**DATE/TIME**	**RECEIVED BY:**	**DATE/TIME**	**NOTES:**
RELINQUISHED BY:	**DATE/TIME**	**RECEIVED FOR LAB. BY:**	**DATE/TIME**	

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MONITORING WELL SAMPLE CHARACTERIZATION & FIELD DATA SHEET

JOB NO. ____________________

SOURCE

CLIENT ____________________ WELL NO. ____________________

LOCATION ____________________ WELL TYPE/SIZE ____________________

EVACUATION

DATE ____________________

WELL DEPTH ____________________

DEPTH TO WATER ____________________

WELL VOLUME ____________________

METHOD ____________________

NO. OF VOLUMES ____________________

TOTAL VOLUME ____________________

ITEM	START	FINISH
TIME		
pH		
TEMP.		
DEPTH		
COLOR		
APPEAR.		

GAL./FT. 1-1/4": 0.077 2" : 0.16 3" 0.37 1-1/2": 0.10 2-1/2" 0.24 3-1/2" 0.50 4" 0.64 6" 1.46

SAMPLING

DATE ____________________ pH ____________________

TIME ____________________ TEMP ____________________

METHOD ____________________ COLOR ____________________

CONTAINER ____________________ APPEAR. ____________________

SAMPLED BY ____________________ Eh ____________________

RESERVATION

DATE ____________________

FILTERED: YES ______ NO ______ TIME ____________ BY ____________________

PRESERVED: YES ______ NO ______ TIME ____________ BY ____________________

PRESERVATIVE: ☐ H_2SO_4 ☐ HNO_3 ☐ NaOH ☐ $H_3PO_4+CuSO_4$ ☐ $Zn(C_2H_3O_2)_2$

☐ COOLED TO 4°C ☐ OTHER ____________________

ELD NOTES

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SAMPLE CHARACTERIZATION & CHAIN OF CUSTODY SHEET

B SAMPLE LOG No.

SOURCE

CLIENT JOB No.

AMPLE I.D. LOCATION DESCRIPTION

SAMPLING

SAMPLE TYPE SAMPLING METHOD

ONTAINERS: No. TYPE

COMPOSITE: DATE SET TIME BY

DATE PICKED-UP TIME BY

GRAB: DATE TIME BY

IOTES:

PRESERVATION

TE

LTERED: YES NO TIME BY

RESERVED: YES NO TIME BY

RESERVATIVE: ☐ H_2SO_4 ☐ HNO_3 ☐ NaOH ☐ $H_3PO_4 \cdot CuSO_4$ ☐ $Zn(C_2H_3O_2)_2$

☐ COOLED TO 4°C ☐ OTHER

OTES:

CUSTODY

ELIVERED BY

ATE TIME

ECEIVED BY

ATE TIME

CUSTODY

LABORATORY SUBCONTRACTOR

NAME OF LAB

ADDRESS

DELIVERED BY

DATE TIME

RECEIVED BY

DATE TIME

IELD NOTES

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OBSERVATION WELL READINGS

ROJECT ______________________ LOCATION ______________________

ETHOD OF READING ______________________

FERENCE POINT ______________________

ATE __________ TIME (START) __________ TIME (END) __________ INITIALS __________

EATHER CONDITIONS ______________________

WELL NO.	DEPTH TO WATER	REF. ELEV.	ELEV.	WELL NO.	DEPTH TO WATER	REF. ELEV.	ELEV.

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HNU Air Monitoring Data

Site Sketch

Site Name ____________

Client Name ____________

Project No. ____________

Sampler's Name ____________

Weather & Notes ____________

Date	Time	Wind Direction	Wind Speed	Location	Span Setting	Concen-tration

APPENDIX C

TECHNICAL ADMINISTRATIVE GUIDANCE MEMORANDUM ON THE DISPOSAL OF DRILLING CUTTINGS

Regional Solid and Hazardous Waste Engineers, Bureau Directors
and Section Chiefs
Mifchael J. O'Toole, Jr., Directors, Div. of Hazardous Waste
Remediation PROPOSED DIVISION TECHNICAL AND ADMINISTRATIVE
GUIDANCE MEMORANDUM TAGM - DISPOSAL OF DRILL CUTTINGS

Purpose

This document presents disposal alternatives for drilling cuttings and spoils from the installation of monitoring wells or soil borings at Class 2 sites.

Introduction

This document specifically addresses the handling of drill cuttings derived from Class 2 sites. These cuttings generally come under the derivative rule [Part 371.1 (d)(3) and (4)] which defines any constituent derived from a Class 2 hazardous waste site as a hazardous substance and requires handling of these materials as hazardous wastes.

Disposal Alternatives

Disposal of monitoring well drill cuttings can be accomplished by one of two methods: on-site disposal or off site disposal.

1. On-site disposal to ground surface

   Drill cuttings may be disposed of on the ground surface provided the following conditions are met:

   a. The drill cuttings are disposed of within 20 feet of the well or bore hole.

   b. The drill cuttings are disposed of in such a manner that surface runoff does not move the cuttings or cause contaminants from the cuttings to migrate to a surface water body or a receiving stream.

   c. The drill cuttings are disposed of in such a manner so that infiltrate which comes in contact with the cuttings will migrate to the aquifer in contact with the area the cuttings came from. This is consistent with returning the contaminants to the aquifer of withdrawal.

   d. Drill cuttings do not pose an imminent threat to health and environment during disposal. Drill cuttings will be tested by field analytical techniques such as pH, conductivity, organic vapor levels, physical appearance or other Department approved field analytical methods to ascertain the threat to health and environment. This testing will be consistent with the Health and Safety Plan for the site. Drill cuttings which pose an imminent health threat will be handled on a case-by-case basis according to the determined risk.

e. Drill cuttings may be collected and disposed of at a specific central on-site location which provides the same protection as paragraphs (b) and (d) above.

2. <u>Off site disposal</u>

Drill cuttings may be disposed of off site provided the following conditions are met:

a. The drill cuttings are accompanied by a 6 NYCRR Part 372 manifest and a 6 NYCRR Part 364 Transporter Permit.

b. The drill cuttings are disposed of at facilities that are permitted to operate a hazardous waste disposal facility under 6 NYCRR Part 373 or a waiver of this regulation has been obtained.

c. In the case where drill cuttings have been determined not to be hazardous wastes, they can be disposed of at a permitted Part 360 disposal site.

APPENDIX D

STATISTICAL METHOD FOR ARRIVING AT THE NUMBERS OF SAMPLES TO BE COLLECTED IN SECTIONS 3 AND 5

SAMPLING METHODOLOGY

The sampling approach is an application of a standard statistical technique for estimating populations or contaminated areas. The proportion of the population is defined as a contaminated circular hot spot and the population is all the soil within the boundaries of the grid to be sampled. It is not necessary to define the contamination area as circular to use this approach. The design requires the selection of a confidence level for detecting the constituents of concern within the hot spot and the selection of the hot spot size.

Historically, The Agency for Toxic Substances and Disease Registry (ATSDR) has required in prior USEPA and New York State Department of Environmental Conservation (NYSDEC) studies a 95 percent confidence level for detection of contaminated hot spots. To achieve the ATSDR requirements, the hot spot size should be the minimum area of soil contamination for each interval that statistically can be detected based on review of the historical sampling at the site. The size of this hot spot was determined to be the minimum area of soil contamination for each depth that statistically can be detected and defined based review of the historical sampling. The hot spot size will ensure that the soil samples collected will be spatially representative. With a confidence level and hot spot size selected, the following formula is used to calculate the required sample size:

$$n = \frac{z^2 pq}{d^2}$$

Notes:

d = antilog of -0.9626 long n + 0.250
n = number of samples
z = constant obtained from a normal distribution table for a 95 percent confidence
p = estimated population proportion or percentage of hot spot to grid area
q = 1 - p
d = antilog of -0.9626 log n + 0.250

Because "d", which is equivalent to (reliability coefficient) times (standard error), is a function of the sample number "n" the formula is iterative. Several iterations are required to arrive the percent spot size to grid area.