SAMPLING AND ANALYSIS PLAN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

AUGUST 1992
REVISED APRIL 1993
FINAL AUGUST 1993

BLASLAND & BOUCK ENGINEERS, P.C.
6723 TOWPATH ROAD
SYRACUSE, NEW YORK 13214

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The Sampling and Analysis Plan (SAP) is composed of two documents: the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP). This volume presents the QAPP. Volume 2 presents the FSP. These two documents are integrated and as such are cross referenced where applicable to eliminate redundancy. A complete discussion of the scope-of-work is presented in the Remedial Investigation/Feasibility Study (RI/FS) work plan.

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QUALITY ASSURANCE PROJECT PLAN
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SECTION 1 - PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) documents the quality assurance/quality control (QA/QC) procedures necessary to achieve the objectives of the Remedial Investigation/Feasibility Study (RI/FS) at the Chicago Pneumatic Site.

1.2 Objectives

The overall objectives of the RI/FS are to:

1. Characterize and delineate potential source areas to quantify waste and contaminated media (i.e., soil, sediment, surface and ground water, and air);
2. Determine the risk, if any, to public health and environment from the identified chemical constituents present in the environmental media; and
3. Determine whether remedial action is appropriate and feasible at any identified source area for ground water. Evaluation of remedial alternatives will include identification of treatability studies, as appropriate.
4. Identify and develop a detailed analysis of potential remedial alternatives for those areas in which remedial action is determined appropriate.

1.3 Site Description

The Chicago Pneumatic Tool Company is located in the town of Frankfort, Herkimer County, approximately one mile east of the city of Utica, New York. The facility property is situated on a 77-acre lot. The site is in a remote industrial setting, which is bound to the north by Bleecker Street, to the south by a wooded marsh and agricultural land, to the west by a creek that drains the marsh, and to the east by a property fence line bordering Industrial Park Drive. Two east-west trending drainage ditches, originating in the southern portion of the property behind the manufacturing building, converge at an oil/water separator to form one north-south trending ditch along the eastern portion of the property. This drainage ditch joins with an east-west trending drainage ditch located parallel and adjacent to Bleecker Street.

Features on the site include the main office building and manufacturing building located in the center of the site; the foundry building, garage, power plant, storage tanks, and a water tower located south of the manufacturing building (south field); the three buried former oil separation ponds and a former debris landfill located south of the foundry building; and two parking lots, one each on the east and west sides of the manufacturing building.

The topography of the site is relatively flat, sloping gently to the north. The elevational difference from the south to the north portions of the site is approximately 14.5 feet over a distance of approximately 1,050.0 feet.

Additional information on the location and physical setting of the site is provided in Section 2 of the RI/FS Work Plan.

1.4 Site History

During the 1930s and early 1940s, the site was occupied by an amusement park and baseball field. The amusement park was located in an area to the south of the current manufacturing facility. The baseball field was located near the southeast portion of the manufacturing facility, and the flagpole for the former baseball field still stands at the facility. Around 1941, trolley barns were constructed along the western side of the property, where the west side parking lot is presently situated.

The factory was constructed in 1948 and has since been operating as a pneumatic tool manufacturing facility. Historic aerial photographs of the Chicago Pneumatic plant were examined to determine both pre-manufacturing topographic features and post-construction changes in the character of the site. Aerial photographs are provided for reference in Appendix A of the RI/FS Work Plan.

Additional information on the operational and regulatory history is provided in Section 2 of the RI/FS Work Plan.

1.5 RI Work Tasks, Overview, and Rationale

To address the objectives of the RI/FS and the conceptual model of the Chicago Pneumatic Site (as outlined in the RI/FS Work Plan), the RI components consist of the following:

- Site Reconnaissance
- Characterization of Area of Concern
- Background Investigation
- Hydrogeologic Characterization
- Sample Analysis and Validation
- Data Evaluation

The primary RI Work Tasks that will be performed as part of the field investigation include Site Reconnaissance, Characterization of Areas of Concern, a Background Investigation, and the Hydrogeologic Characterization. Some aspects of these tasks require the collection of analytical data. To insure that the objectives and uses of the analytical data are met, data quality objectives (DQOs) are specified. The DQOs are statements that specify the objectives of the activity, the data quality/quantity required, and the appropriate analytical procedures to achieve the required quality. The analytical parameters selected for most samples are the parameters of the Target Compound List (TCL) and Target Analyte List (TAL). The TCL/TAL includes the categories: volatiles, semi-volatiles, polychlorinated Biphenyls (PCB), and inorganics (metals and cyanide). Because the potential chemical constituents that may be present at the site include analytes from all the categories of the TCL/TAL, the TCL/TAL was selected as the analytical mechanism to characterize the nature of the sources as well as the exposure routes. Because this data will be used to determine risk levels and the necessity and applicability of remedial alternatives, New York State Department of Environmental Conservation (NYSDEC) 1991 Analytical Services Protocol (ASP) analytical methods will be followed.

Analyses for Resource Conservation and Recovery Act (RCRA) characteristics (Toxicity Characteristic Leaching Procedures (TCLP) constituents, ignitability, corrosivity, and reactivity) may be performed on source area samples with visual indications of waste or black/oil stained soil. In addition, to further characterize soil in potential source areas, selected samples will be characterized for total organic carbon (TOC), percent moisture, porosity, and particle size distribution (PSD). Selected ground-water samples will be characterized for TOC, total suspended solids (TSS), total dissolved solids (TDS), total volatile solids (TVS),

and hardness. General ground-water quality parameters (i.e., pH, specific conductivity, and temperature) will be measured in the field.

In addition, an on-site mobile field laboratory will be used to perform select analyses on soil and ground-water samples. Analyses will be performed to evaluate concentration of trichloroethene (TCE) and trans-dichloroethene (DCE) by USEPA Method F080.007, "Volatile Organics in Water by Manual Headspace."

SECTION 2 - PROJECT ORGANIZATION AND RESPONSIBILITY

The Chicago Pneumatic Site RI/FS project organization is depicted on Figure 2-1. The duties and responsibilities of the project personnel are summarized below:

Affiliation	Title	Name	Telephone Number
Blasland & Bouck Engineers, P.C.	Project Officer	Tyler E. Gass	315/446-9120
	Project Manager	Vita A. DeMarchi	
	FS, Engineering Services Program Director	David J. Ulm Frederick J. Kirschenheiter	
	Field Program Coordinator	Robert G. Patchett	
	Quality Assurance	Laurie Johnston	
Galson Corp.	Analytical Laboratory Project Manager	Gale Sutton	315/432-0506
Enviroserv	Mobile Laboratory Supervisor	Jeff Tuttle	703/204-3580
Parratt-Wolff, Inc.	Drilling Services Supervisor	Mike Ellingworth	316/437-1429

2.1 Project Officer

1. Overall project direction including both RI and FS activities.
2. Provide approval for RI Report, FS Report, and other key major documents and project deliverables.

2.2 Project Manager

1. Overall project management including both RI and FS activities with an emphasis on adhering to the objectives of the RI/FS.
2. Quality assurance management of all aspects of the project.

3. Reviews RI Report, FS Report, and all documents transmitted to the regulatory agencies.
4. Overall project management of the RI activities.
5. Develops, establishes, and maintains project RI files.
6. Reviews data reductions from the RI activities.
7. Conducts audits of the RI operations concentrating on physical activities.
8. Performs final data review of field data reductions and reports.
9. Prepares audit reports.
10. Issues requests for corrective action.
11. Assures corrective actions are taken for deficiencies cited during RI operations.
12. Overall QA/QC of the RI.

2.3 FS, Engineering Services Program Director

1. Overall project management of the FS activities.
2. Develops, establishes, and maintains project FS files.
3. Reviews data reductions from the FS activities.
4. Performs final data review of data reductions and reports.
5. Assures corrective actions are taken for deficiencies cited during FS activities.
6. Overall QA/QC of the FS.

2.4 Field Program Coordinator

1. Oversees field efforts of the RI.
2. Performs soil vapor survey.

3. Oversees field data reduction.
4. Reviews and approves all field records and logs.
5. Instructs field staff.
6. Coordinates field and laboratory schedules.
7. Reviews the field instrumentation, maintenance, and calibration to obtain quality objectives.
8. Prepares draft assessments and reports.
9. Maintains field files of notebooks and logs, data reductions and calculations, and transmits originals to the Program Director.
10. Performs field procedures set forth in the FSP.
11. Performs field analyses and collects QA samples.
12. Calibrates and maintains equipment.
13. Reduces field data.

2.5 Quality Assurance Officer

1. Supervise technical staff in QA/QC procedures.
2. Conduct audits of laboratory activities and field methods.

2.6 Analytical Laboratory/Galson Corp., East Syracuse, NY

1. Performs all analytical procedures and analytical QA/QC procedures.
2. Supplies sampling containers and shipping cartons.
3. Serve as primary contact for communications between Blasland & Bouck and laboratory staff.

Additional information on the responsibilities of the analytical laboratory is provided in the Analytical Laboratory QAPP.

2.7 Mobile Laboratory and GeoProbes/Enviroserv, Inc.

1. Perform USEPA Method F080.007 analysis for TCE and DCE on soil and ground-water samples.
2. Advance GeoProbe borings.

2.8 Data Validator/OBG Laboratories, Syracuse, NY

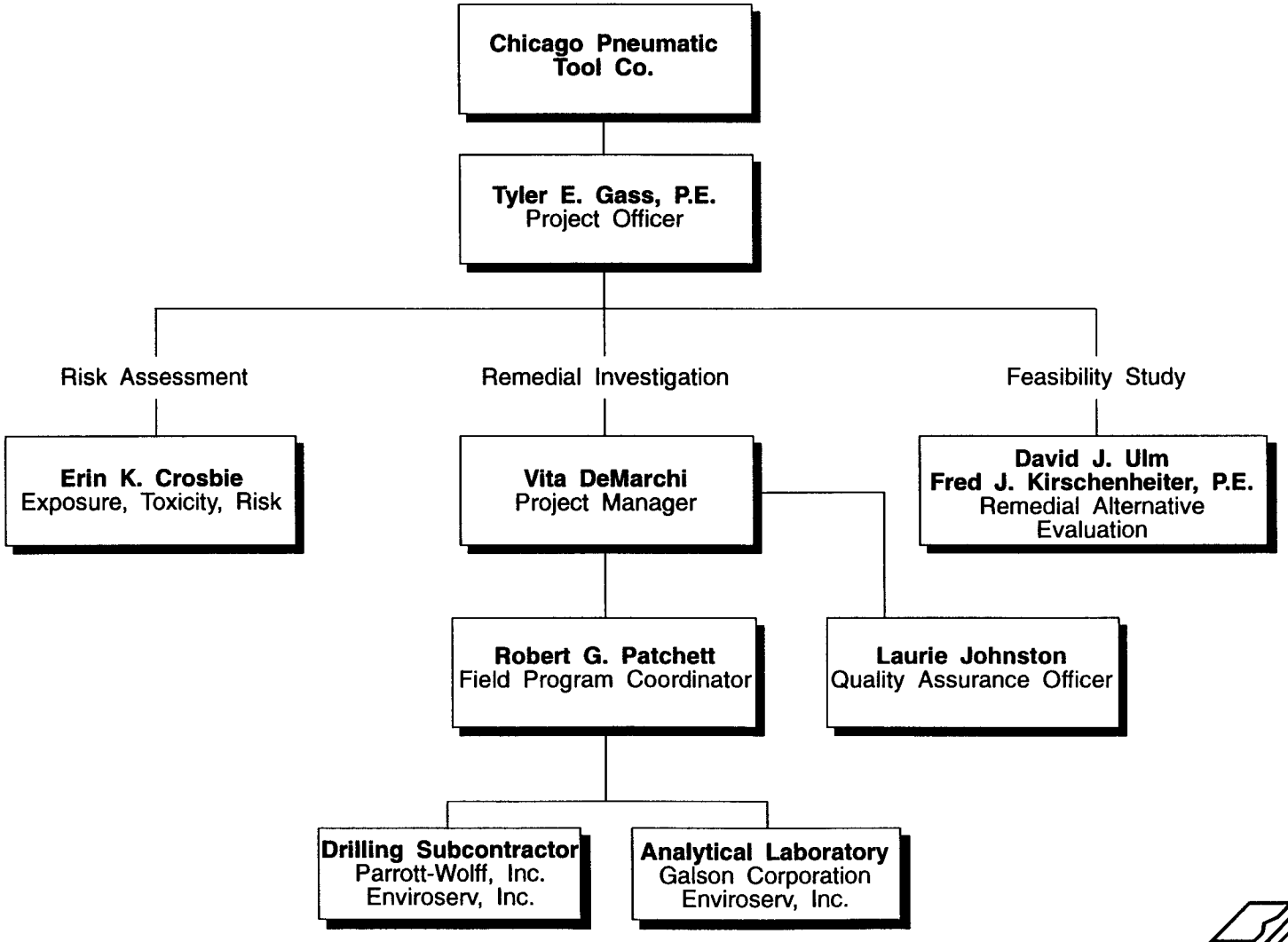
1. Validates analytical data.

2.9 Drilling Services/Parratt-Wolff, Inc., East Syracuse, NY

1. Perform drilling services including test pits/trenches, borings, and monitoring well installation.
2. Decontamination of drilling and sampling equipment.
3. Well development.

FIGURE 2-1

Project Organization Chart
Chicago Pneumatic Site
Frankfort, New York



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ENGINEERS & SCIENTISTS

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SECTION 3 - QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

3.1 Selection of Measurement Parameters, Laboratory and Field Methods

The parameters to be measured were selected based on review of the site history and the results of previous site investigation. The parameters selected for a majority of the samples are the TCL/TAL and RCRA characteristics. Additional parameters for select soil samples include TOC, pH, and PSD. Additional parameters for select ground-water samples include TSS, TDS, TVS, TOC, hardness, and general water quality parameters.

TCL/TAL Parameter	Reference
Volatiles	1991 ASP; 91-4/91-1
Semivolatiles	1991 ASP; 91-2
Pesticide/PCB	1991 ASP; 91-3
Inorganics	1991 ASP; Mod. EPA 200.7
Mercury	1991 ASP; Mod. EPA 245.1
Cyanide	1991 ASP; Mod. EPA 335.2
Additional Parameters	**Reference**
RCRA Characteristics	1987 USEPA SW-846 Test Methods for Evaluation of Solid Waste
TCLP	EPA 1311
Hardness	EPA 130.2
TOC	EPA 415.2
TDS	EPA 160.1
TSS	EPA 160.2
TVS	EPA 160.4
Percent Moisture	EPA 160.3
PSD	ASTM D422/D1140
Porosity	Army Corps of Engineers EM 1110-2-1906
Field Laboratory	**Reference**
TCE, DCE	EPA F080.007

3.2 Quality Assurance Objective

The overall QA objective is to develop and implement procedures for defensible sampling, chain-of-custody, laboratory analysis, and reporting. Specific procedures to be used for sampling, chain-of-custody, calibration, laboratory analysis, reporting, internal quality control, audits, preventive maintenance, and corrective actions are described in other sections of this QAPP.

3.3 Level of QA Effort

This section defines the goals for the level of QA effort in terms of:

1. Representativeness;
2. Comparability of measurement data from all analytical laboratories;
3. Completeness;
4. Precision;
5. Accuracy; and
6. Sensitivity of analyses.

The levels of QA effort for field measurements are also discussed.

Laboratory duplicates, laboratory blanks, standards, matrix spikes and matrix spike duplicates, field duplicates, rinse blanks, and trip blanks will be analyzed by the laboratory to provide a means of assessing the quality of the data resulting from the laboratory and the field. Laboratory duplicate samples and matrix spike duplicate samples are analyzed to check for analytical reproducibility. Field duplicates will be used to assess the variability of chemical constituents in the field and to check on consistency of sampling procedures. Rinse blank samples will be used to evaluate the effectiveness of the cleaning procedures used. Trip blanks provided by the analytical laboratory will be used to check for analytes introduced during shipping and handling of the samples prior to, during, and after sample collection. The specific level of

QA effort itemized by sample media and type of analysis is provided in Table 3-1 for laboratory analytical data.

A duplicate sample will not be performed for the geotechnical services (laboratory porosity and particle size distribution).

3.4 Representativeness

The RI/FS work plan specifies the analysis of surface water, sediment, ground water, and soil. Sampling of each media will provide data that will be used in the assessment of the environmental conditions at the site. The representativeness of the samples collected will be a qualitative goal to be achieved rather than a term that can be defined in a strict quantitative sense. All sampling methods and sampling point strategies follow approved NYSDEC, USEPA, or ASTM protocols used in site characterization to ensure that data gathered is representative of the population group from which it was sampled.

3.5 Comparability

Comparability is the degree of confidence with which a data set can be compared to a previous data set or a data set from another laboratory. The degree of confidence is increased by consistent and diligent adherence to all laboratory and field protocols described in this QAPP and the FSP. The field protocols are consistent with NYSDEC and USEPA procedures. Temporally sensitive field data, such as water level measurements, will be collected within the least amount of time possible to minimize variation.

3.6 Completeness

Completeness is the degree to which environmental concerns are addressed. Completeness in regard to data is defined as the actual quantity of valid data gathered compared to the proposed quantity of data to be collected.

The objective of this study is to provide a complete characterization of the site. This objective is met by the investigation of site physical characteristics;

identification of source(s) and any potential routes of exposure; and characterization of the risk to human health and the environment. The number of samples and the analytes that will be sampled for constitute a reasonably complete characterization of the site. The physical data acquisition program is a series of tests and installations that will allow a thorough representation of site conditions.

3.7 Precision

Precision is the measure of reproducibility of sample results. Precision is maximized by consistently performing measurements in accordance with documented and accepted protocols. All work for this RI/FS will be in adherence to the protocols outlined in this document. The precision objectives for field measurement parameters are provided in Table 3-2. The precision objective goals for the analytical laboratory methods are provided in Table 3-3.

The specific precision checks that will be applied throughout the RI/FS are outlined in Table 3-1 and in Section 9. For analytical samples, precision will be assessed through the calculation of relative percent differences (RPD) from the analysis of laboratory duplicate and matrix spike duplicate samples. One laboratory duplicate or matrix spike duplicate will be analyzed for every 20 samples. In addition, field duplicates, two samples from the same location collected separately, will be used to calculate percent differences which can be used to evaluate the validity of the sampling procedures and the apparatus used to collect the samples. One field duplicate will be obtained and analyzed for every 10 samples per sampling medium.

3.8 Accuracy

Accuracy is the deviation of a sample measurement from a known standard. Accuracy is maintained in the laboratory through the use of reference standards and by the analysis of matrix spiked samples where a known concentration of a compound is introduced into the sample matrix and the percent recovery is

measured. The accuracy objective goals for the laboratory analytical methods are provided in Table 3-3. In the field, accuracy is maintained by calibrating field meters to known standard solutions, gases or other measuring tools according to the manufacturers' instructions.

3.9 Sensitivity

The fundamental QA objective with respect to sensitivity of the laboratory analytical data is to achieve the sensitivity requirements for laboratory analytical methods for the purposes of this RI/FS and the Contract Required Quantitation Limits (CRQL) presented in Table 3-4.

TABLE 3-1

QUALITY CONTROL CHECKS
LABORATORY ANALYTICAL DATA

Media	Field Duplicate	Rinse Blank	Trip Blank*	Background Sample	Laboratory Preparation Blank	Laboratory Duplicate	Laboratory Matrix Spike/ Matrix Spike Duplicate
				TCL/TAL ANALYSES			
Ground Water/ Surface Water	1 per 10 samples	1 per decon event	1 per day or 1 per cooler	Minium of 1 per sampling event	1 per 20 samples	1 per 20 samples	1 per 20 samples
Soil, sediment	1 per 10 samples	N/R	N/R	Minium of 1 per sampling event	1 per 20 samples	1 per 20 samples	1 per 20 samples
				RCRA CHARACTERISTICS			
Waste/Soil	1 per 10 samples	N/R	N/R	N/R	N/R	N/R	N/R
				GENERAL WATER QUALITY PARAMETERS (1)			
Ground Water/ Surface Water	1 per 10 samples	N/R	N/R	N/R	N/R	N/R	N/R
				PHYSICAL ANALYSES (2)			
Ground Water/ Surface Water	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Soil, sediment	N/R	N/R	N/R	N/R	N/R	N/R	N/R
				MOBILE LABORATORY -- TCE & DCE ANALYSIS			
Ground Water/ Soil	1 per 10 samples	N/R	N/R	N/R	daily	1 per 10 samples	1 per 10 samples

Notes:

* = Volatile Organic Analysis only.
N/R = Not required
(1) = pH, temperature specific conductivity
(2) = Only for TOC, TSS, TDS, TVS, hardness, percent moisture, and pH.

TABLE 3-2

QUALITY ASSURANCE OBJECTIVES CHART
FIELD MEASUREMENTS

Measurement Field Parameter	Reference in FSP	Matrix	Precision	Accuracy
Water Level	Appendix H	Ground Water/ Surface Water	±.1'	±.01'
Water Temperature	Appendix G	Ground Water/ Surface Water	±1°	±1° Instrument Capability
pH	Appendix G	Ground Water/ Surface Water	±.1 pH Units	±.1 pH Units Instrument Capability
Specific Conductivity	Appendix G	Ground Water/ Surface Water	±0.010 umhos/cm	± 5% Standard
Concentrations of Total Organic Vapors in Soil Vapor (PID-MicroTIP)	Appendix E	Soil Vapor	± 1%	±0.1 PID Units Instrument Capability

TABLE 3-3

QUALITY ASSURANCE OBJECTIVE GOALS[a] CHART
ANALYTICAL MEASUREMENTS

Media	Method Number	Analytes	Accuracy as % Recovery	Precision %
Ground Water/ Surface Water/ Soil/Sediment	TCL/TAL			
	(91 ASP; 91-4)	Volatiles[b]	75 - 125	±20% RPD*
	(91 ASP; 91-1)	Volatiles	75 - 125	±20% RPD*
	(91 ASP; 91-2)	Semi-Volatiles	75 - 125	±20% RPD*
	(91 ASP; 91-3)	Pesticides/PCBs	75 - 125	±20% RPD*
	(91 ASP; Mod. EPA 200)	Metals	75 - 125	±20% RPD*
	(91 ASP; Mod. EPA 335.2)	Cyanide	75 - 125	±20% RPD*
Ground Water/ Soil	EPA Method F080.007	TCE/DCE		

Notes:

[a] These are the general quality assurance objective goals. Actual control limits will be established by the analytical laboratory and mobile laboratory.

[b] Analytical Method 91-4 will only be used on ground water from monitoring wells.

* ± 20% Relative Percent Differences for values greater than 5 times the detection limit (DL). For values less than 5 times the DL, ± the DL will be used.

TABLE 3-4

QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

Volatiles	Method Number	Contract-Required QuQuantitation Limits (CRQL) Low Water ug/L
Chloromethane	1991, ASP; 91-4	1
Bromomethane	1991, ASP; 91-4	1
Vinyl chloride	1991, ASP; 91-4	1
Chloroethane	1991, ASP; 91-4	1
Methylene chloride	1991, ASP; 91-4	2
Acetone	1991, ASP; 91-4	5
Carbon Disulfide	1991, ASP; 91-4	1
1,1-Dichloroethene	1991, ASP; 91-4	1
1,1-Dichloroethane	1991, ASP; 91-4	1
1,2-Dichloroethene (total)	1991, ASP; 91-4	1
cis-1,2-Dichloroethene	1991, ASP; 91-4	1
trans-1,2-Dichloroethene	1991, ASP; 91-4	1
Chloroform	1991, ASP; 91-4	1
1,2-Dichlorothane	1991, ASP; 91-4	1
2-Butanone	1991, ASP; 91-4	5
Bromochloromethane	1991, ASP; 91-4	1
1,1,1,-Trichloroethane	1991, ASP; 91-4	1
Carbon tetrachloride	1991, ASP; 91-4	1
Vinyl acetate	1991, ASP; 91-4	5
Bromodichloromethane	1991, ASP; 91-4	1
1,1,2,2-Tetrachloroethane	1991, ASP; 91-4	1
1,2-Dichloropropane	1991, ASP; 91-4	1
cis-1,3-Dichloropropene	1991, ASP; 91-4	1
Trichloroethene	1991, ASP; 91-4	1
Dibromochloromethane	1991, ASP; 91-4	1
1,1,2-Trichloroethane	1991, ASP; 91-4	1
Benzene	1991, ASP; 91-4	1
trans-1,3-Dichloropropene	1991, ASP; 91-4	1
cis 1,3-Dichloropropene	1991, ASP; 91-4	1
Bromoform	1991, ASP; 91-4	1
4-Methyl-2-pentanone	1991, ASP; 91-4	5
2-Hexanone	1991, ASP; 91-4	5
Tetrachloroethene	1991, ASP; 91-4	1
1,1,2,2-Tetrachloroethane	1991, ASP; 91-4	1
1,2-Dibromoethane	1991, ASP; 91-4	1
Toluene	1991, ASP; 91-4	1
Chlorobenzene	1991, ASP; 91-4	1
Ethylbenzene	1991, ASP; 91-4	1
Styrene	1991, ASP; 91-4	1
o/p-Xylene	1991, ASP; 91-4	1
m-Xylene	1991, ASP; 91-4	1
Total Xylenes	1991, ASP; 91-4	1
1,3-Dichlorobenzene	1991, ASP; 91-4	1
1,4-Dichlorobenzene	1991, ASP; 91-4	1
1,2-Dichlorobenzene	1991, ASP; 91-4	1
1,2-Dibromo-3-chloropropane	1991, ASP; 91-4	1
Vinyl acetate	1991, ASP; 91-4	1

TABLE 3-4
(Cont'd.)
QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

Volatiles	Method Number	Contract-Required QuQuantitation Limits (CRQL) Low/Soil Sediment(1)(2) ug/Kg
Chloromethane	1991, ASP; 91-1	10
Bromomethane	1991, ASP; 91-1	10
Vinyl chloride	1991, ASP; 91-1	10
Chloroethane	1991, ASP; 91-1	10
Methylene chloride	1991, ASP; 91-1	10
Acetone	1991, ASP; 91-1	10
Carbon Disulfide	1991, ASP; 91-1	10
1,1-Dichloroethene	1991, ASP; 91-1	10
1,1-Dichloroethane	1991, ASP; 91-1	10
1,2-Dichloroethene (total)	1991, ASP; 91-1	10
Chloroform	1991, ASP; 91-1	10
1,2-Dichlorothane	1991, ASP; 91-1	10
2-Butanone	1991, ASP; 91-1	10
1,1,1,-Trichloroethane	1991, ASP; 91-1	10
Carbon tetrachloride	1991, ASP; 91-1	10
Vinyl acetate	1991, ASP; 91-1	10
Bromodichloromethane	1991, ASP; 91-1	10
1,1,2,2-Tetrachloroethane	1991, ASP; 91-1	10
1,2-Dichloropropane	1991, ASP; 91-1	10
Trichloroethene	1991, ASP; 91-1	10
Dibromochloromethane	1991, ASP; 91-1	10
1,1,2-Trichloroethane	1991, ASP; 91-1	10
Benzene	1991, ASP; 91-1	10
trans-1,3-Dichloropropene	1991, ASP; 91-1	10
cis 1,3-Dichloropropene	1991, ASP; 91-1	10
Bromoform	1991, ASP; 91-1	10
4-Methyl-2-pentanone	1991, ASP; 91-1	10
2-Hexanone	1991, ASP; 91-1	10
Tetrachloroethene	1991, ASP; 91-1	10
Toluene	1991, ASP; 91-1	10
Chlorobenzene	1991, ASP; 91-1	10
Ethylbenzene	1991, ASP; 91-1	10
Styrene	1991, ASP; 91-1	10
Total Xylenes	1991, ASP; 91-1	10

Notes:

(1) Medium Soil/Sediment Detection Limit (DL) for Volatile TCL Compounds are 120 times the individual Low Soil/Sediment DL.

(2) Specific method detection limits are hghly matrix dependent. The detection listed herein are provided for guidance and may not always be achievable.

TABLE 3–4
(Cont'd.)
QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

		Contract–Required Quantitation Limits (CRQL)	
Semi–Volatiles	Method Number	Low Water ug/L	Low/Soil Sediment(3)(4) ug/Kg
Phenol	1991, ASP; 91–2	10	330
bis(2–Chloroethyl) ether	1991, ASP; 91–2	10	330
2–Chlorophenol	1991, ASP; 91–2	10	330
1,3–Dichlorobenzene	1991, ASP; 91–2	10	330
1,4–Dichlorobenzene	1991, ASP; 91–2	10	330
1,2–Dichlorobenzene	1991, ASP; 91–2	10	330
4–Methylphenol	1991, ASP; 91–2	10	330
bis(2–Chloroisopropyl) ether	1991, ASP; 91–2	10	330
3–Methylphenol	1991, ASP; 91–2	10	330
N–Nitroso–di–n–propylamine	1991, ASP; 91–2	10	330
Hexachloroethane	1991, ASP; 91–2	10	330
Ntrobenzene	1991, ASP; 91–2	10	330
Isophorone	1991, ASP; 91–2	10	330
2–Nitrophenol	1991, ASP; 91–2	10	330
2–4–Dimethylphenol	1991, ASP; 91–2	10	330
bis(2–Chloroethoxy) methane	1991, ASP; 91–2	10	330
2,4–Dichlorophenol	1991, ASP; 91–2	10	330
1,2,4–Trichlorobenzene	1991, ASP; 91–2	10	330
Naphthalene	1991, ASP; 91–2	10	330
4–Chloroaniline	1991, ASP; 91–2	10	330
Hexachlorobutadiene	1991, ASP; 91–2	10	330
4–Chloro–3–methylphenol (p–Chloro–m–cresol)	1991, ASP; 91–2	10	330
2–Methylnaphthalene	1991, ASP; 91–2	10	330
Hexachlorocyclopentadiene	1991, ASP; 91–2	10	330
2,4,6–Trichlorophenol	1991, ASP; 91–2	10	330
2,4,5–Trichlorophenol	1991, ASP; 91–2	25	800
2–Chloronaphthalene	1991, ASP; 91–2	10	330
2–Nitroaniline	1991, ASP; 91–2	25	800
Dimethylphthalate	1991, ASP; 91–2	10	330
Acenaphthylene	1991, ASP; 91–2	10	330
2,6–Dinitrotoluene	1991, ASP; 91–2	10	330
3–Nitroaniline	1991, ASP; 91–2	25	800
Acenaphthene	1991, ASP; 91–2	10	330
2,4–Dinitrophenol	1991, ASP; 91–2	25	800
4–Nitrophenol	1991, ASP; 91–2	25	800
Dibenzofuran	1991, ASP; 91–2	10	330
2,4–Dinitrotoluene	1991, ASP; 91–2	10	330
Diethylphthalate	1991, ASP; 91–2	10	330
4–Chlorophenyl–phenylether	1991, ASP; 91–2	10	330

TABLE 3-4
(Cont'd.)
QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

Semi-Volatiles	Method Number	Contract-Required Quantitation Limits (CRQL) Low Water ug/L	Low/Soil Sediment(3)(4) ug/Kg
Fluorene	1991, ASP; 91-2	10	330
4-Nitroaniline	1991, ASP; 91-2	25	800
4,6-Dinitro-2-methylphenol	1991, ASP; 91-2	25	800
N-Nitrosodiphenylamine	1991, ASP; 91-2	10	330
4-Bromohpenyl-phenylether	1991, ASP; 91-2	10	330
Hexachlorobenzene	1991, ASP; 91-2	10	330
Pentachlorophenol	1991, ASP; 91-2	25	800
Phenanthrene	1991, ASP; 91-2	10	330
Anthracene	1991, ASP; 91-2	10	330
Carbazole	1991, ASP; 91-2	10	330
Di-n-butyl phthalate	1991, ASP; 91-2	10	330
Fluoranthene	1991, ASP; 91-2	10	330
Pyrene	1991, ASP; 91-2	10	330
Butylbenzylphthalate	1991, ASP; 91-2	10	330
3,3'-Dichlorobenzindine	1991, ASP; 91-2	10	330
Benzo(a)anthracene	1991, ASP; 91-2	10	330
Chrysen	1991, ASP; 91-2	10	330
bis(2-Ethylhexyl) phthalate	1991, ASP; 91-2	10	330
Di-n-octyl phthalate	1991, ASP; 91-2	10	330
Benzo(b)fluoranthene	1991, ASP; 91-2	10	330
Benzo(k)fluoranthene	1991, ASP; 91-2	10	330
Benzo(a)pyrene	1991, ASP; 91-2	10	330
Indeno(1,2,3-cd)anthracene	1991, ASP; 91-2	10	330
Dibenz(a,h)anthracene	1991, ASP; 91-2	10	330
Benzo(g,h,i)perylene	1991, ASP; 91-2	10	330

Notes:

(3) Medium Soil/Sediment CRQL for Semi-Volatile Compounds are 30 times the individual Low Soil/Sediment CRQL.
(4) Specific method detection limits are highly matrix dependent. The quantitation limiits listed herein are provided for guidance and may not always be achievable.

TABLE 3–4
(Cont'd.)
QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

Pesticides/PCBs	Method Number	Contract–Required Quantitation Limits (CRQL) Low Water ug/L	Low/Soil Sediment (5)(6) ug/Kg
alpha–BHC	1991, ASP; 91–3	0.05	1.7
beta–BHC	1991, ASP; 91–3	0.05	1.7
delta–BHC	1991, ASP; 91–3	0.05	1.7
gamma–BHC (Lindane)	1991, ASP; 91–3	0.05	1.7
Heptachlor	1991, ASP; 91–3	0.05	1.7
Aldrin	1991, ASP; 91–3	0.05	1.7
Heptachlor epoxide	1991, ASP; 91–3	0.05	1.7
Endosulfan I	1991, ASP; 91–3	0.05	1.7
Dieldrin	1991, ASP; 91–3	0.10	3.3
4,4'–DDE	1991, ASP; 91–3	0.10	3.3
Endrin	1991, ASP; 91–3	0.10	3.3
Endosulfan II	1991, ASP; 91–3	0.10	3.3
4,4'–DDD	1991, ASP; 91–3	0.10	3.3
Endosulfan sulfate	1991, ASP; 91–3	0.10	3.3
4,4'–DDT	1991, ASP; 91–3	0.10	3.3
Endrin ketone	1991, ASP; 91–3	0.10	3.3
Eldrin aldehyde	1991, ASP; 91–3	0.10	3.3
Methoxychlor	1991, ASP; 91–3	0.5	17.0
alpha–Chlordane	1991, ASP; 91–3	0.05	1.7
gamma–Chlordane	1991, ASP; 91–3	0.05	1.7
Toxaphene	1991, ASP; 91–3	5.0	170.0
Aroclor–1016	1991, ASP; 91–3	0.065	33.0
Aroclor–1221	1991, ASP; 91–3	0.065	67.0
Aroclor–1232	1991, ASP; 91–3	0.065	33.0
Aroclor–1242	1991, ASP; 91–3	0.065	33.0
Aroclor–1248	1991, ASP; 91–3	0.065	33.0
Aroclor–1254	1991, ASP; 91–3	0.065	33.0
Aroclor–1260	1991, ASP; 91–3	0.065	33.0

Notes:

(5) Medium Soil/Sediment Detection Limits (DL) for PCB/Pesicides compounds are 15 times the individual Low Soil/Sediment DL.
(6) Specific detection limits are highly matrix dependent. The detection limitslisted hereinare provided for guidance and may not always be achievable.

TABLE 3-4
(Cont'd.)
QUANTITATION AND DETECTION LIMITS
TARGET COMPOUND LIST (TCL)/TARGET ANALYTE LIST (TAL)

Inorganics	Method Number	Contract-Required Detection Limits (ug/L)
Aluminum	1991, ASP; Mod. EPA 200.7 CLP-M	200
Antimony	1991, ASP; Mod. EPA 200.7 CLP-M	60
Arsenic	1991, ASP; Mod. EPA 200.7 CLP-M	10
Barium	1991, ASP; Mod. EPA 200.7 CLP-M	200
Beryllium	1991, ASP; Mod. EPA 200.7 CLP-M	5
Cadmium	1991, ASP; Mod. EPA 200.7 CLP-M	5
Calcium	1991, ASP; Mod. EPA 200.7 CLP-M	5000
Chromium	1991, ASP; Mod. EPA 200.7 CLP-M	1
Cobalt	1991, ASP; Mod. EPA 200.7 CLP-M	50
Copper	1991, ASP; Mod. EPA 200.7 CLP-M	25
Iron	1991, ASP; Mod. EPA 200.7 CLP-M	100
Lead	1991, ASP; Mod. EPA 200.7 CLP-M	3
Magnesium	1991, ASP; Mod. EPA 200.7 CLP-M	5000
Managanese	1991, ASP; Mod. EPA 200.7 CLP-M	15
Mercury	1991, ASP; Mod. EPA 245.1 CLP-M	0.2
Nickel	1991, ASP; Mod. EPA 200.7 CLP-M	40
Potassium	1991, ASP; Mod. EPA 200.7 CLP-M	5000
Selenium	1991, ASP; Mod. EPA 200.7 CLP-M	5
Silver	1991, ASP; Mod. EPA 200.7 CLP-M	10
Sodium	1991, ASP; Mod. EPA 200.7 CLP-M	5000
Thalliu,	1991, ASP; Mod. EPA 200.7 CLP-M	10
Vanadium	1991, ASP; Mod. EPA 200.7 CLP-M	50
Zinc	1991, ASP; Mod. EPA 200.7 CLP-M	20
Cyanide	1991, ASP; Mod. EPA 335.2 CLP-M	10

SECTION 4 - SAMPLING PROCEDURES

Ground-water, surface water, subsurface soil, and sediment sampling procedures are provided in the FSP. In addition, the FSP contains the procedures to install monitoring wells and Geoprobe boreholes, perform soil borings, and clean equipment.

SECTION 5 - SAMPLE CUSTODY

Any personnel obtaining custody of samples will be responsible for the care and integrity of the samples. The term "custody" is defined below.

A person will have custody of samples when the samples are in: their physical possession; their view after being in their physical possession; their physical possession and secured so they cannot be tampered with; or secured in a restricted area with access to authorized personnel only.

5.1 Field Chain-of-Custody

The field chain-of-custody procedures are included in the FSP (Appendix N). The objective of this procedure is to ensure that the samples remain un-tampered with throughout sampling until transport to the analytical laboratory.

5.2 Laboratory Chain-of-Custody

The chain-of-custody procedures that will be followed in the laboratory are contained in the Analytical Laboratory QAPP.

5.3 Final Evidence File

The chain-of-custody forms and the original laboratory reports will be filed at the Blasland & Bouck office in Syracuse, New York, until the completion of the RI/FS. At such time possession will be transferred to the Chicago Pneumatic Tool Company or archived in Blasland & Bouck's file storage area.

SECTION 6 - CALIBRATION PROCEDURES AND FREQUENCIES

6.1 Field Equipment Calibration Procedures and Frequencies

Field equipment calibration records will be kept for the pH meter, conductivity meter, Photovac MicroTip Photoionization detector (MicroTip), and water level meter. Calibration will be conducted daily for the MicroTip and water quality meters. Table 6-1 lists the field equipment, frequency of calibrations, and the calibration standard replacement frequency. Prior to testing the water or soil samples for specific conductance, pH, and organic vapors, the field equipment will be calibrated at least daily at a field office or in a controlled environment.

Detailed procedures and logs for calibration of the pH meter, conductivity meter, MicroTip meter and the water level meter are provided in the FSP (Appendix F).

6.2 Laboratory Equipment Calibration Procedures and Frequencies

Specific laboratory equipment calibration procedures and calibration frequencies are presented in the Analytical Laboratory QAPP.

TABLE 6-1

FIELD EQUIPMENT CALIBRATION FREQUENCY

Equipment	Calibration Check Frequency	Internal Calibration Frequency	Calibration Standard	Calibration Standard Holding Time Limits
PHotovac MicroTip PID	Daily	Prior to implementing Project or when warranted	Manufacturer supplied non-toxic gas	2 months
pH Meter	Daily	When warranted	4.0 pH buffer 7.0 pH buffer 10.0 pH buffer	1 month
Conductivity Meter	Daily	When warranted	YSI 3160 or YSI 3161 1,000 umhos KCL solution	1 month
Electric Water Level Probe	Prior to implementing field work	Once	100' engineers tape	N/A

SECTION 7 - ANALYTICAL PROCEDURES

7.1 Laboratory Analytical Procedures

The analytical laboratory will analyze all water, soil, and sediment samples in accordance with the analytical procedures outlined in NYSDEC 1991 Analytical Services Protocol.

TCL/TAL Parameter	Reference
Volatiles	1991 ASP; 91-4/91-1
Semivolatiles	1991 ASP; 91-2
Pesticide/PCB	1991 ASP; 91-3
Inorganics	1991 ASP; Mod. EPA 200.7
Mercury	1991 ASP; Mod. EPA 245.1
Cyanide	1991 ASP; Mod. EPA 335.2
Additional Parameters	**Reference**
RCRA Characteristics	1987 USEPA SW-846 Test Methods for Evaluation of Solid Waste
TCLP	EPA 131.1
Hardness	EPA 130.2
TOC	EPA 415.2
TDS	EPA 160.1
TSS	EPA 160.2
TVS	EPA 160.4
Percent Moisture	EPA 160.3
PSD	ASTM D422/D1140
Porosity	Army Corps of Engineers EM 1110-2-1906
Field Laboratory	**Reference**
TCE, DCE	EPA F080.007

7.2 Field Analytical Procedures

7.2.1 Soil Screening for Volatile Organic Compounds

A Photovac MicroTip with 10.2 eV light source or equivalent will be used to screen the soil samples. The MicroTip uses an ultra-violet light source to ionize organic vapors. The ionization is then quantified into a meter response calibrated to a gas standard. The MicroTip is used as a gross indicator for the presence of total volatile organic compounds. The standard procedures for screening soil samples and the forms to record the readings are presented in the FSP (Appendix E). Accuracy will be maintained by daily calibration and calibration checks of the PID meter to a standard gas of known concentration.

7.2.2 Water Quality Field Measurements

Temperature, pH, and specific conductance of ground water and surface water will be measured in the field with portable meters. The specific conductance and pH meters will be calibrated daily prior to measurement. The pH meter will also be calibrated prior to use at each sample location. The specific field measurement protocols are included in the FSP (Appendix G).

SECTION 8 - DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Field Data Reduction, Validation, and Reporting

8.1.1 Field Data Reduction Methods

Reduction of field data involves the processing of field data into useful information. Data reduction will include:

1. Calculation of water elevation by subtracting the depth-to-water data from the surveyed elevation referenced to the National Geodetic Vertical Datum of the measuring point;
2. Hydraulic conductivity calculation from in-situ hydraulic conductivity test data using the Bouwer-Rice method for unconfined conditions and Hvorslev Time-Lag method for confined conditions;
3. Production of hydrogeologic contour maps by contouring lines of equal water elevations using linear interpolation through known elevation points;
4. Calculation of the ground-water velocity using the equations for average linear velocity, $v = Ki/n$ where K is the hydraulic conductivity, i is the gradient (obtained from the ground-water contour map), and n is the porosity (estimated from literature values);
5. Production of contour maps of the analytical data by contouring the lines of equal chemical concentrations using a natural logarithmic interpolation through data points;
6. Preparing logs of the geologic and screening data obtained during the soil boring, and monitoring well installation procedures; and
7. Preparing geologic cross-sections using the soil boring logs and the site plan.

8.1.2 Field Data Validation

Field data calculations and interpretations will be conducted by the on-site geologist and reviewed for accuracy by the Project Manager. The criteria used to validate data integrity during data reduction is summarized in Table 8-1.

Field data records and documents prepared by the on-site geologist will be reviewed by the Field Program Coordinator during site activities. All logs and documents will be checked daily for:

1. General completeness;
2. Readability;
3. Usage of appropriate standard procedures;
4. Calibration completeness;
5. Instrument maintenance;
6. Correct water level measurement points; and
7. Correct ground-water purge volumes.

The Field Program Coordinator will sign or initial all logs and documents.

8.1.3 Field Data Reporting

All field data forms and calculations, where appropriate, will be typed and included in the Appendices to the RI Report. The original field logs, documents, and data reductions will be kept in a locked file cabinet dedicated to the Chicago Pneumatic Site RI/FS at the Blasland & Bouck office in Syracuse, New York.

8.2 Laboratory Data Reduction, Validation, and Reporting

The specific procedures that will be used to reduce, validate, and report laboratory analytical results by the laboratory are presented in the Analytical Laboratory QAPP.

8.3 Laboratory Data Validation

A data validator, independent of the RI/FS field investigation efforts, will review and validate all laboratory analytical data. The data validator is identified in Section 2, Project Organization and Responsibility.

This data validation will consist of a review for completeness, a review for compliance, and the actual validation. An outline of the items considered in the completeness and compliance review is provided in Table 8-2. The data validation will consist of a detailed comparison of the reported data with the raw data. The following guidance documents will be used:

1. SOP No. HW-2 for Inorganic Data Validation, Revision 11, January 1992; and
2. SOP No. HW-6 for Organic Data Validation, Revision 7, February 1990.

Upon completion of the data validation, a report of the findings will be prepared. This report will include:

1. An assessment of the data package;
2. A description of any protocol deviations;
3. Any failures to reconcile reported data with raw data; and
4. An assessment of any compromised data.

The data validation report will be included as an appendix to the RI Report.

TABLE 8-1

DATA VALIDATION CHECK LIST
FIELD DATA

- Check location, date, and time on data record against the Daily Field Log and site map to ensure the proper location is indicated.
- Check personnel qualifications for experience and ability to perform an accurate test.
- Check to see that instrument was calibrated prior to test.
- Check data for completeness.
- Check that data seem reasonable (i.e., for a falling head slug test, the depth to water level field measurements will increase with time and then stabilize; the corresponding water elevation values will decrease with time, then stabilize).
- Check previous data of the specific location (if available) to see if the present data seem comparable to data collected in the past. Check the present value relationships between different locations with those of past (if available).
- Check input values to any computer models, spreadsheets, or equations.
- Check all calculations.
- Check ground-water contour maps; evaluate with respect to general hydrogeologic principles; and eliminate interpolations between unrelated data points.
- Check analytical contour maps to make sure the natural logarithm of the concentration value was used; eliminate interpolations between unrelated data points.
- Compare representations of field data to original field data.
- Compare logs with representations on cross-sections; if one location is used on more than one contour map, check consistency; check distances from site plan.

TABLE 8-2

PRE-VALIDATION CHECK LIST
LABORATORY ANALYTICAL DATA

- Review for Completeness

  1. Chain of custody forms included.
  2. QA/QC summaries included with analytical data.
  3. Calibration data included with analytical data.
  4. Instrument and performance data included.
  5. Documentation of attaining MDLs.
  6. Data report forms for calculating concentrations.
  7. Raw data used in identification and quantification of the analyses required.

- Review for Compliance

  1. Data package complete.
  2. Data meets QAPP requirements.
  3. QA/QC criteria met.
  4. Instrument type and calibration procedures met.
  5. Calibration met.
  6. All flags included, dilutions and clean-ups.

SECTION 9 - FIELD AND LABORATORY QUALITY CONTROL CHECKS

A comprehensive series of QC measures will be followed to ensure that the data are precise and accurate. Specific field QC checks are described below. Laboratory QC procedures are presented in the Analytical Laboratory QAPP.

9.1 Field Quality Control Checks

Quality control checks are also discussed in Section 3.

9.1.1 Rinse Blanks

Rinse blanks are a QC check of the cleanliness of the sampling devices and effectiveness of the cleaning procedures. Rinse blanks will be prepared by running analyte-free water through the cleaned sampling devices, collecting the water in sample containers, and analyzing the sample in the laboratory. A successful rinse blank will be non-detection of all TCL/TAL constituents above background concentrations.

Rinse blanks will be prepared at the site during the ground-water and surface water sampling at a rate of one blank per decon event.

9.1.2 Trip Blanks

Trip blanks are a check of sample exposure to non-site constituents during sample storage and transport. The trip blanks will be prepared in the laboratory with analyte-free water, or in the field using analyte-free water provided by the laboratory. The trip blanks will accompany the sample containers throughout transport to the site, sampling, transport back to the laboratory, and storage at the laboratory.

Trip blanks will consist of one per sample cooler or one per day during ground-water and surface water sampling. Trip blanks will be prepared and analyzed for volatile organic compounds only.

9.1.3 Field Duplicates

Field duplicates are used to assess the reproducibility of the sampling methods and the sampling media. Duplicates are prepared by filling two complete sets of containers from one sampling location. The second set may be given an assumed name designation to reduce analytical bias (blind duplicate).

Field duplicates will be prepared at a rate of one duplicate set for every 10 samples. The field duplicate analytical results will be compared to evaluate field sampling techniques and the variability of the concentrations of chemical constituents in the sampling media.

The field duplicates will be taken at sampling locations where chemical constituents were detected in the past, or are thought to be currently present.

9.1.4 Analyte-Free Water

The requirements for demonstrating that the water is analyte-free are as follows:

1. Volatile Organics < CRQLs in Table 3-4, Section 3
2. Semi-volatile Organics < CRQLs in Table 3-4, Section 3
3. Pesticides/PCBs < CRQLs in Table 3-4, Section 3
4. Inorganics < CRQLs in Table 3-4, Section 3

The analytical laboratory will provide documentation on the analyte-free water supplied for field and equipment blanks.

9.2 Laboratory Quality Control Checks

Laboratory QC checks will include the analysis of matrix spikes, matrix spike duplicates, reference standards, laboratory duplicates, and laboratory method blanks.

The specific laboratory QC procedures are outlined in the Analytical Laboratory QAPP.

SECTION 10 - PERFORMANCE AND SYSTEM AUDITS

Performance and system audits will be performed during the project to ensure that data of high quality are being collected.

A system audit is a qualitative evaluation of all components of field and laboratory QA/QC. The system audit involves comparison of the scheduled QA/QC activities from this document with the QA/QC activities actually performed in the field and laboratory.

The performance audit is a quantitative assessment of precision and accuracy of the data gathered and the laboratory results generated.

10.1 System Audits

10.1.1 Internal Field System Audits

The Site Characterization Program Director or their designee will be present periodically throughout the field work to perform system audits. This Program Director will observe site work to check that the field work is being performed according to the procedures defined in the QAPP and the FSP. The Program Director will implement corrective action if deficiencies are noted.

10.1.2 Internal Laboratory System Audits

The internal laboratory system audits are described in the Analytical Laboratory QAPP.

10.2 Performance Audits

10.2.1 Field Performance Audits

The Project Manager will observe field activities periodically to perform field performance audits. These audits will concentrate on the measurements taken in the field with respect to precision and accuracy. The Project Manager will ensure that field instrumentation is calibrated and

that measurements are taken precisely and accurately. After samples are analyzed, the Project Manager will review the rinse blank and trip blank analyses to define deficiencies in field sampling and cleaning procedures.

10.2.2 Laboratory Performance Audits

The Data Validator will evaluate laboratory precision and accuracy by: knowledge of the identity of the duplicate sample pairs and their analytical results; review of project analytical results to ensure that the proper analytical procedures were followed; and consideration of laboratory QA/QC results (spikes, blanks, and duplicates).

The laboratory performance audits are described in the Analytical Laboratory QAPP.

10.3 Audit Reports

Audit reports will be written by the Project Manager or their designee after gathering and evaluating all available data. Items, activities, and documents determined by them to be in non-compliance shall be identified at interviews conducted with the involved personnel. Non-compliances will be documented and become a part of the Internal Audit Report. These audit findings are directed to the Project Manager or their designee for corrective action in a specified and timely manner.

All audit procedures, audit reports, audit findings, and acceptable resolutions are approved by the Project Manager prior to issue. QA verification of acceptable resolutions may be determined by re-audit for documented surveillance of the item or activity. Upon verification acceptance, the Project Manager will close out the audit report and findings. Copies of all audit reports will be available.

It is the overall responsibility of the Project Manager or their designee to ensure that all corrective actions to resolve audit findings are acted upon promptly and satisfactorily by project personnel.

10.4 External Audits

The NYSDEC or NYSDEC-designated personnel may conduct audits of both the field sampling and laboratory analysis operations.

SECTION 11 - PREVENTIVE MAINTENANCE

11.1 Field Instruments and Equipment

Prior to any sample collection or field measurement activities, all field equipment will be inspected to ensure tools, probes, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturers' recommendations. When appropriate, field equipment will be fully charged or contain a fresh set of batteries prior to use at the site.

It will be the responsibility of the Field Program Coordinator to ensure adherence to the maintenance schedule and to arrange for prompt service of equipment for which they are responsible.

Maintenance logs will be established for key pieces of equipment to record and control maintenance and service procedures and schedules. Entry in the instrument logs shall include the following:

1. Date of entry;
2. Symptoms;
3. Disposition of problem; and
4. Person's name responsible for correcting problem.

These logs will be maintained by the Field Program Coordinator. The Project Manager will periodically audit these logs to ensure full compliance with all recommended procedures and schedules.

11.2 Field Equipment Preventive Maintenance

Preventive maintenance on the temperature/conductivity, pH meters, and MicroTip include a bench check daily prior to field use to ensure that the batteries are charged and that proper calibration is attainable.

The pH meters will be calibrated daily with fresh buffer solutions at two values. The conductivity meters are calibrated daily with a known standard potassium chloride solution. When using the pH and conductivity meters, care will be taken to prevent the electrode from drying out or being scratched.

The MicroTip will also be checked daily prior to use to ensure that the batteries are charged and the instrument is calibrated. The calibration standards and calibration frequencies are discussed in Section 6. Procedures and logs for calibration and maintenance are presented in the FSP (Appendix F).

Appropriate spare parts will be available for each instrument, and a back-up instrument will be set up for next-day delivery if a malfunction is detected.

11.3 Laboratory Instruments and Equipment Preventive Maintenance

Provisions for laboratory equipment preventive maintenance are included in the Analytical Laboratory QAPP.

SECTION 12 - DATA ASSESSMENT PROCEDURES

12.1 Data Precision Assessment Procedures

The assessment of field precision (reproducibility of measurements) is difficult to enumerate because of the temporal and geographic variation in measurable hydrogeologic parameters. Field precision is optimized by performance of testing and measurements by experienced personnel in accordance with accepted procedures with precise and accurate field calibrated equipment.

The precision of laboratory analytical data will be calculated and evaluated using the percent difference of laboratory duplicate sample sets. The relative percent difference (RPD) or standard deviation is calculated by the following equation, where A and B are the analytical results of the duplicate measurements on the same sample:

$$\frac{(A-B)}{\frac{1}{2}(A+B)} \times 100 = RPD$$

The percent differences will be evaluated to assess laboratory precision.

12.2 Data Accuracy Assessment Procedures

The accuracy of field measurements is greatly increased by performance of tests by experienced personnel in consistent adherence to established protocol. The accuracy of field measurements with field equipment will be assessed by review of calibration logs and maintenance logs described in Sections 6 and 11 and provided in the FSP (Appendix F).

The accuracy of laboratory data is calculated as a percent recovery of a spike calculated as:

$$\frac{A-X}{B} \times 100$$

where: A = Value Measured in the spiked sample

X = Value Measured in the un-spiked sample

B = True value of the spike amount added

12.3 Data Completeness Assessment Procedures

The completeness of an individual set of tests or field observations is greatly facilitated by documenting all data on field data sheets that are specific to the particular test or data set. This enables the field personnel to document all observations and measurements that are critical to the particular analysis. Fully completed field data sheets form a complete record of the field activities.

The completeness of either the field or analytical data is calculated by comparing the proposed amount of data collection to the actual valid amount of data collected and is expressed in a percentage as shown below:

$$\frac{\text{Number of Valid Samples Collected}}{\text{Number of Proposed Samples}} \times 100$$

SECTION 13 - CORRECTIVE ACTION

13.1 Field Corrective Action

Corrective action procedures are followed to assure that conditions adverse to quality such as malfunctions, deficiencies, deviations, and errors are promptly investigated, documented, evaluated, and corrected.

When a significant condition adverse to quality is noted, the cause of the condition will be determined and corrective action will be taken to preclude repeating the same condition. Condition identification, cause, and corrective action to be taken will be documented on the Corrective Action Request form, Table 13-1, and reported to the Project Manager. Implementation of corrective action will be verified by documented follow-up action.

All project personnel have the responsibility, as part of their normal work duties, to promptly identify and report conditions adverse to quality.

Corrective actions may be initiated, as a minimum, under the following conditions:

1. When predetermined data acceptance standards are not attained;
2. When procedures are performed incorrectly;
3. When equipment or instrumentation is not in proper calibration or is not functioning correctly;
4. When samples and test results are not completely traceable;
5. When QC requirements have not been met;
6. When designated approvals have been circumvented; and/or
7. As a result of issues discovered during system and performance audits.

Project personnel will monitor on-going work performance continuously in the normal course of daily responsibilities.

13.2 Laboratory Corrective Action

Laboratory corrective action is presented in the Analytical Laboratory QAPP.

TABLE 13-1
Corrective Action Request (CAR)

CAR Number: _____ Date: _____

To: _____ cc: Project Manager

You are hereby requested to take corrective actions indicated below and as otherwise determined by you (A) to resolve the noted condition and (B) to prevent it from reoccurring. Your written response is to be returned to the Project Manger by _____.

_____
Condition

_____
Reference Documents

_____
Recommended Corrective Actions

_____

_____
Originator Date Approval Date P.M. Approval Date

_____
Response

_____
Corrective Action

A. Resolution
B. Pretension
C. Affected Documents

Signature _____ Date _____

_____
Follow-up

Corrective Action Verified: By_____ Date _____

_____

SECTION 14 - QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 Internal Reporting

The Data Validator will submit a report to the Project Manager detailing the accuracy, precision, and completeness of the analytical results. The Project Manager will incorporate this report into a summary report that will be included as a QA/QC appendix to the RI/FS Report. This appendix will include:

1. Assessment of data accuracy, precision, and completeness from field and laboratory checks;
2. Results of the performance and system audits;
3. Significant QA/QC problems, solutions, corrections, and potential consequences; and
4. An analytical data validation report.

ACRONYMS AND ABBREVIATIONS

ASP	Analytical Services Protocol
ASTM	American Society for Testing and Materials
CRQL	Contract Required Quantitative Limits
DCE	trans-Dichloroethene
DQO	Data Quality Objective
FSP	Field Sampling Plan
MicroTip	Photovac MicroTip photoionization detector
NYSDEC	New York State Department of Environmental Conservation
PCBs	Polychlorinated biphenyls
PRP	Potentially Responsible Parties
PSD	Particle Size Distribution
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TVS	Total Volatile Solids
USEPA	United States Environmental Protection Agency

REFERENCES

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APPENDIX A

LABORATORY QUALITY ASSURANCE PLAN

LABORATORY QUALITY ASSURANCE PLAN

Galson
Laboratories

Galson Laboratories
Quality Assurance Plan

Project Organization and Responsibilities

Galson Laboratories employs qualified staff and requires training, either in the form of short courses or formal in-house programs and demonstration of proficiency. This document provides for designated QA personnel to review products and provide guidance on QA matters. Senior technical staff is assigned to project specific QA/QC functions.

Staff Responsibilities

Included is the laboratory organizational chart. Every member of the staff has responsibilities for quality control.

Vice President - The Vice-President coordinates communications between the laboratory and the rest of the corporation. He reviews audit reports from the QA Manager.

Laboratory Director - The Laboratory Director is responsible for laboratory operations. The laboratory director carries out administrative functions and oversees quality control activities within the laboratory.

Quality Assurance Manager - The QA Manager coordinates a;; QA/QC functions. Together with the Quality Assurance Staff, the following functions are carries out:

-Review of reports and data packages
-Evaluation of data quality
-Maintenance of QC records, such as control charts, method detection limits, and SOPs
-Coordination and/or performance of quality control investigations
-Development and implementation of quality control programs, including statistical procedures and techniques
-Approval of SOPs
-Writing and updating of QA/QC manuals
-Performance of system audits

Group Leader - The Group Leader is directly responsibility for data analysis and reporting. Duties include:

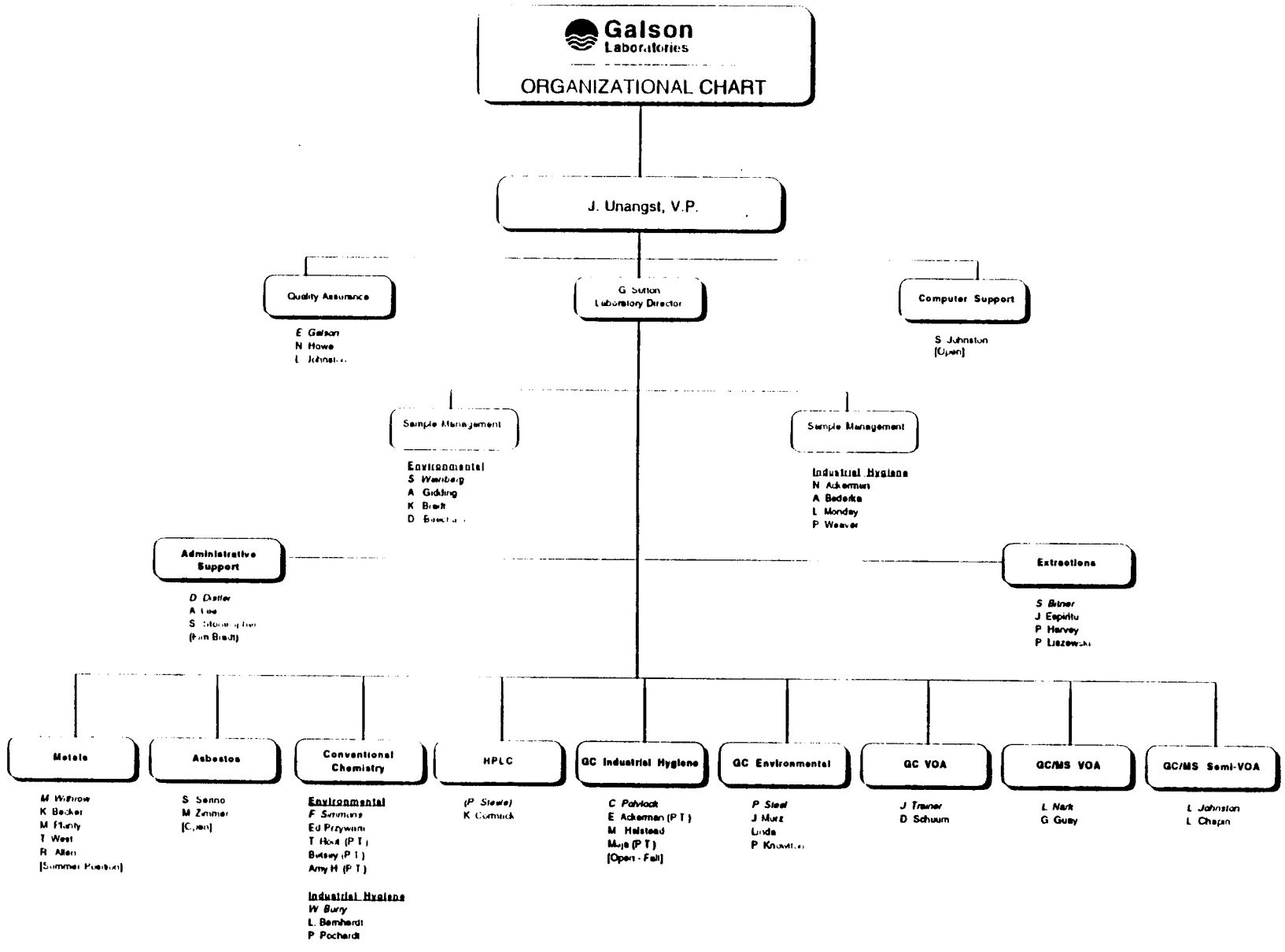
-Scheduling of analysis
-Review of laboratory work and test reports
-Review of QC data
-Tabulation of QC data
-Sample analysis

Analysts - Analysts duties include:

-Sample analysis
-Calibration and routine maintenance of instruments
-Analysis of QC samples on a schedule determined by protocol and/or the QA Manager and Group Leader
-Performing preliminary review of data
-Entering QC data into notebooks
-Entering laboratory data into LIMS

Sample Custodian/Client Services - Responsible for sample and document security, traceability, and disposal. Duties include:

-Receipt and security of samples and paperwork
-Log-in of samples into the laboratory LIMS system
-Labelling of samples with unique identifying numbers
-Initiation and maintenance of internal chain of custody documents
-Resolution of problems and discrepancies relating to client samples



OFFICE 5 19 92

Note: Names in *Italics* represent Section Supervisors

Quality Assurance Objectives

It is the goal of Galson Laboratories quality assurance program to ensure that all data submitted to our clients if of acceptable validity, of known precision and accuracy, and is legally defensible. To achieve that goal Galson employs qualified personnel; utilizes validated methods supplemented with written SOPs; utilizes state of the art equipment maintained and calibrated according to specifications; includes QC samples such as knowns, spikes duplicated and surrogates with analyses when appropriate; subjects data and procedures to reviews and audits; and implements corrective actions when needed.

Sample Containers and Preservation

The following is a summary of the recommended bottle types and preservation for the project. All bottles used are purchased from Eagle Picher pre-cleaned to Level I specifications. Eagle Picher supplies certificates of analysis with each box of bottles received. All bottles are labeled with unique identifying numbers before they are sent out to the field. These numbers are entered into the Level I bottle prep log and cross referenced to the QC lot number supplied by Eagle Picher.

GROUNDWATER

ANALYTE	METHOD	BOTTLE TYPE	PRESERVATION
Volatiles	91-4	40ml glass [1]	cool to 4°C optional: pH <2 with HCl
Semivolatiles	91-2	1 liter amber glass with Teflon lined cap	cool to 4°C
Pesticide/PCBs	91-3	1 liter amber glass with Teflon lined cap	cool to 4°C
Metals	Mod. EPA 200	1 liter plastic	pH <2 with HNO_3
Cyanide	Mod. EPA 335	1 liter plastic	pH >12 with NaOH cool to 4°C

[1] 40ml glass vials with open caps with Teflon lined septa. It is required that sites for volatile analysis be sampled in duplicate.

It is recommended that, when ever possible, all groundwater sampling be done in duplicate.

SOIL

ANALYTE	METHOD	BOTTLE TYPE	PRESERVATION
Volatiles	91-1	125ml glass jar with Teflon lined lid	cool to 4°C
Semivolatiles	91-2	250ml glass jar with Teflon lined lid	cool to 4°C
Pesticide/PCBs	91-3	250ml glass jar with Teflon lined lid	cool to 4°C
Metals	Mod. EPA 200	250ml glass jar with Teflon lined lid	
Cyanide	Mod. EPA 335	250ml glass jar with Teflon lined lid [1]	cool to 4°C

[1] Soils may be sampled into a single 250ml jar for metals and cyanide analyses.

EP TOXICITY (SW-846/1310)
SOIL

ANALYTE	METHOD	BOTTLE TYPE	PRESERVATION
Pesticides	8080	250ml glass jar with Teflon lined lid	cool to 4°C
Herbicides	Mod. 8150	250ml glass jar with Teflon lined lid	cool to 4°C
Metals	6010/7000/7470	250ml glass jar with Teflon lined lid	

Sample and Document Custody

Sample custody begins when a sample is collected and ends when analytical data are delivered to the client. It is important to be able to trace samples from collection to data reporting so that utmost confidence can be placed in the data.

Field Sample Custody

A chain of custody is a mechanism for tracing custody from the time of collection through reporting of results. The chain is initiated by the sampling agent who completes a Chain of Custody form (Figure 1.1). Sample location and sampling date and time are noted, as are sample matrix and parameters of interest. The sampling agent signs the custody form and includes any pertinent remarks about the samples. Any transfer of samples from individual to individual is noted on the custody form.

Sample Labeling

The importance of sample labeling cannot be overstated. Improperly or inadequately labeled samples are of little value in a monitoring program. Improperly labeled samples lead to questions with regard to location, project, sampling station, date sampled, and sampler. All of this information is essential to proper sample handling.

The following information is required on each sample label:

Client	Date Collected
Project	Time Collected
Location	Collected by
Preservative	

Preprinted sample labels (Figure 1.2) are affixed to sample bottles prior to delivery to sampling site.

Sample Packing

Proper packing is essential to assure sample integrity and minimize breakage. The following summarizes the sample packing procedure.

- -If individual sample bottle custody seals are required they are applied across the bottle lid in a manner which prevents the opening of the bottle without breaking the seal.
- -The sample bottles are wrapped in plastic bubble wrap and placed in a plastic cooler which has been lined with cushioning material.
- -Additional bubble wrap is added to cover the samples.
- -Ice is placed around and on top of the sample bottles.
- -Additional packing material is added to minimize sample movement.
- -The Chain of Custody and any other paperwork is placed inside a waterproof plastic bag and taped to the inside lid of the cooler.
- -The cooler lid is secured with tape and sealed with a minimum of two custody seals (Figure 1.3).
- -The shipping label is attached to the sample cooler.

Sample Receipt and Log-in

Upon receipt at the laboratory, the sample custodian inspects the samples for integrity and checks the shipment against the chain of custody. Any discrepancies are documented on the chain of custody form.

The client is contacted by the Sample or Project Manager to resolve discrepancies. When the shipment and the chain of custody are in agreement, the sample custodian initiates an internal chain of custody (Figure 1.4) Volatile samples are stored separately and maintain their own chain of custody (Figure 1.5). The sample preservation is checked and pH entered on the internal chain of custody. If pH adjustments are required, a Preserved Sample pH Record is initiated (Figure 1.6) and pH corrected with the proper preservative.

The samples are logged in to the Laboratory Information Management System (LIMS), which assigns a unique number to each sample. The analyses required are specified by Test Codes which are assigned to the sample at this time. Labels are then generated which contain the sample number, client name, job number and task number (Figure 1.7). One label is attached to each sample bottle and one to the paperwork associated with it.

A work order is created which includes the AD04 sample analysis summary (Figure 1.8) which contains the following information: the sample name, Galson sample ID, sample receipt date, holding time, report due date, required analyses, quality control requirements, and reporting requirements. Also included in the work order is the chain of custody, and relevant correspondence. Copies of the work order are distributed to the appropriate analytical group managers prior to sample analysis.

Sample Storage

After the samples are labeled, they are moved to locked refrigerators where they are maintained at 4°c. Access to the refrigerators is limited to members of the sample management department, with the exception of volatile sample refrigerators which are controlled by the volatile group managers.

When samples are desired, the analyst makes a copy of the internal chain of custody and circles those analytes for which samples is required. The analyst signs and dates the chain of custody copy and gives it to the sample custodian who locates the samples, signs and dates the chain of custody, and gives the samples to the analyst. When the analyst is finished with the sample, he returns the unused portion to the samples custodian. Both the analyst and the sample custodian sign and date the chain of custody and the sample is returned to secure storage. The chain of custody copy becomes an appendage to the original internal chain of custody and part of the permanent case file.

Sample extracts maintain their own chain of custody. Sample extract custody begins with an extraction, digestion or distillation log, as appropriate to the analysis (Figures 1.9, 1.10, 1.11, and 1.12). Upon completion of the preparation, an extract chain of custody form (Figures 1.13, 1.14, and 1.15) is initiated. The extracts are given to the analyst with the time and date noted on the form. The analyst places the extracts in designated secure storage areas. All transfers of the extract into and out of the storage area are noted on the chain of custody.

Sample and extract storage areas are shown in the following table:

Sample Type	Storage Area	Location
Volatile Organics	Refrigerator #1	Sample receiving
Semivolatile Organics	Walk-in #1	Sample receiving
PCB/Pesticides	Walk-in #1	Sample receiving
Inorganic - Metals	Walk=in #1	Sample receiving
Inorganic - Cyanide	Walk-in #1	Sample receiving

Extract Type	Storage Area	Location
Semivolatile Organics	Refrigerator #8	GC/MS Lab
PCB/Pesticides	Refrigerator #6	Sample receiving
Inorganic - Metals	Cabinet M-1,2,3	Metals Lab

Samples and sample extracts are maintained in secure storage until disposal. All samples are held for a minimum of 90 days and extracts for 365 days after data submission. Sample disposal date is noted on the chain of custody by the sample custodian.

Document Custody

The goal of the Document Control Program is to assure that all documents for a specified project will be accounted for when that project is complete.

Document control begins with the initial client contact and continues throughout the project to include all correspondence, faxed information, and phone logs. This information is kept by the Project Manager for the duration of the project. When the project is complete, the information is filed in the project case file by the Document Control Officer.

The original work order, chain of custody, and airbills are kept by the Document Control Officer in the case file.

Internal Chain of Custody forms are maintained by the Sample Custodian until sample disposal. Upon sample disposal, the forms are turned over to the Document Control Officer and placed into the project case file.

Chain of Custody Record

Page _____ of _____

Company Name	Project Manager/Contact
Project No.	Project Name

Galson Laboratories
6601 Kirkville Road East
E. Syracuse, New York 13057
315-432-0506 or 800-950-0506

Special QA/QC Protocol (Circle)
EPA CLP EPA SW 846
NYS DEC NYS DOH
NJ TIER I CALIFORNIA
NJ TIER II OTHER (Specify)

SAMPLE LOCATION / SAMPLE ID	Date	Time	TYPE Comp.	TYPE Grab	Aqueous	Soil	Other	A	B	C	D	E	F	G	H	I	J	K	Laboratory ID Number

PARAMETERS FOR ANALYSIS

Task No.

REMARKS:

SAMPLERS NAME: **SIGNATURE:**

SAMPLES RELINQUISHED BY:

NAME: DATE:
SIGNATURE: TIME:

NAME: DATE:
SIGNATURE: TIME:

NAME: DATE:
SIGNATURE: TIME:

SAMPLES RECEIVED BY:

NAME: DATE:
SIGNATURE: TIME:

NAME: DATE:
SIGNATURE: TIME:

NAME: DATE:
SIGNATURE: TIME:

Received For Laboratory By: DATE:
(Signature) TIME:

Custody Seal Intact?Sample ☐ *Yes* ☐ *No* ☐ *N.A.*

Shipment Complete? ☐ *Yes* ☐ *No*

LabStor. Location A B C D E F G H I J K L

2/85

Figure 1.1

Galson
Laboratories

6601 Kirkville Rd.
E. Syracuse, NY 13057
315-432-0506

Sample ID Number: _____

Sample Location: _____

Date: _____ Time: _____ Matrix: _____

Sampled By: _____

Preservative: HCl HNO_3 H_2SO_4

NONE OTHER _____

Analysis/Comments:

Figure 1.2

Galson
Laboratories

CUSTODY SEAL

_____

Sealed By: _____ Date: _____

6601 Kirkville Rd.
E. Syracuse, NY
13057
315-432-0506

Figure 1.3

Internal Chain of Custody Receipt and Termination Form

Client : _____ Cover Page _____ of _____ Q: D:

Job # : _____ Final Report Date : _____

Task : _____ Disposal Holding Interval : _____ ***

VTSR : _____ (Date/Time)** Request #: _____

Sample #	Client Id	Matrix #	pH	# Contr's Received	Storage Area	Analytes Circle Requests	Hazard Level	Containers Taken / Retn:
								/
								/
								/
								/
								/
								/
								/
								/
								/
								/
					--			/
								/
								/
								/
								/
								/
								/
								/
								/
								/
								/
								/
								/

Total # of Containers For Task: _____

Sample Receipt/Breakdown By: _____ (Sig) _____ (Date/Time)

Sample Storage By: _____ (Sig) _____ (Date/Time)

Sample Disposal By: _____ (Sig) _____ (Date/Time)

Total # Cntr's Taken

Disposal Comments:

* - pH adjustment was required, see attached sheet.

** - VTSR = Validated Time of Sample Receipt

*** - The period of time after final report for which the contract requires the lab tomaintain custody of the samples in question.

NR = Entire sample used: none to return.

Total # Cntr's Ret:

Released To: _____ (Sig) Released By : _____ (Sig) _____ (Date/Time)

Returned By: _____ (Sig) Returned To : _____ (Sig) _____ (Date/Time)

Figure 1.4

GC/MS VOLATILE CHAIN OF CUSTODY

Client: _____ Page # _____ of _____

Task #: _____

Sample Analysis Requested: 8240 624 8911 TCLP 524.2 Other: _____

Protocol: ELAP RCRA SPDES NYS/ASP Other: _____

Relinquished By: _____ Date/Time _____ / _____

Received By: _____ Date/Time _____ / _____

Store In Refrigerator # _____

Sample Removal & Return Tracking

Galson Sample ID	Client Sample ID	Bottle #	Date/Time Out	Removed By	Removed For	Date/Time In	Date/Time Out	Removed By	Removed For	Date/Time In	Date/Time Out	Removed By	Removed For	Date/Time In	Comments

Reasons For Removal

A:Analysis DW:Dry Weight

SS: Sub-Sampling B:Debulking

O:Other (Specify In comments)

Sample Debulking

Relinquished By: _____ Date/Time _____

Received By: _____ Date/Time _____

Sample Disposal

By: _____

Date/Time _____

Figure 1.5

PRESERVED SAMPLE pH RECORD

CLIENT : _____ MEASURED BY : _____

TASK : _____ COMMENTS :

VTSR : _____

JOB # : _____

LOGIN NUMBER	CLIENT ID	ANALYSIS (ES)	INITIAL pH	ACID ADDED		FINAL pH
				TYPE / CONC	ML	

VTSR - VALIDATED TIME OF SAMPLE RECEIPT

Figure 1.6

[illegible] 5199-001
Oct-16-1991 Water FB-1

Figure 1.7

09:34:18 **Gelson Laboratories** 11/05/91

Report Report Generation Sample Login: 5199

Project: STANDARD
Starts:
Ends:
Account: 10624
Bill Ref:

Billing: Accounts Payable
(account) [redacted], [redacted], & Xxx
[redacted] Rd.
Box [redacted]
Syracuse, , NY 13214

Sales 1: MOVE - Plan
Sales 2: - Plan
Alt. Ref:
Terms:
PO#:

Sample No.	Client ID	Key	Dtes COLL	RECV	DUE	HOLD	Matrix	Analyses	SamMan 1	SubCon 2	Prep 3	MS/LC 4	SVO/GC 5	VOA/AB 6	Metals 7	CC/WET 8	Report 9	QC 10
5199-001		F8:1	10/16	10/16	10/28		COMMENTS: Q1DS											
						10/22	Water	EG-89-3			DONE		DONE				SENT	DONE
						10/23	Water	EM-89-1				DONE					SENT	DONE
						10/22	Water	EN 89-2			DONE	DONE					SENT	DONE
						10/28	Water	ET-G/DIGN							DONE		SENT	DONE
						10/28	Water	EI-GFAS.Q1							DONE		SENT	DONE
						10/28	Water	EI-GFPB.Q1							DONE		SENT	DONE
						10/28	Water	EI-GFSB.Q1							DONE		SENT	DONE
						10/28	Water	EI-GFSE.Q1							DONE		SENT	DONE
						10/28	Water	EI-GFTL.Q1							DONE		SENT	DONE
						10/28	Water	EI-HG.Q1							DONE		SENT	DONE
						10/28	Water	EI-I/DIGN							DONE		SENT	DONE
						10/28	Water	EI-ICPAG.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPAL.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPBA.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPBE.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPCA.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPCD.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPCO.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPCR.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPCU.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPFE.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPK.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPMG.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPMN.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPNA.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPNI.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPV.Q1							DONE		SENT	DONE
						10/28	Water	EI-ICPZN.Q1							DONE		SENT	DONE
5199-002	CES-37		10/16	10/16	10/28		COMMENTS: Q1DS											
						10/22	Soil	EG-89-3			DONE		DONE				SENT	DONE
						10/23	Soil	EM-89-1				DONE					SENT	DONE
						10/22	Soil	EN 89-2			DONE	DONE					SENT	DONE
						10/28	Soil	ET-G/DIGN							DONE		SENT	DONE
						10/28	Soil	EI-GFAS.Q1							DONE		SENT	DONE
						10/28	Soil	EI-GFPB.Q1							DONE		SENT	DONE
						10/28	Soil	EI-GFSB.Q1							DONE		SENT	DONE
						10/28	Soil	EI-GFSE.Q1							DONE		SENT	DONE
						10/28	Soil	EI-GFTL.Q1							DONE		SENT	DONE
						10/28	Soil	EI-HG.Q1							DONE		SENT	DONE
						10/28	Soil	EI-I/DIGN							DONE		SENT	DONE
						10/28	Soil	EI-ICPAG.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPAL.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPBA.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPBE.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPCA.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPCD.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPCO.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPCR.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPCU.Q1							DONE		SENT	DONE
						10/28	Soil	EI-ICPFE.Q1							DONE		SENT	DONE

Figure 1.8

GALSON LABORATORIES

GC EXTRACTION LOG

G.C. BATCH # :

	START	FINISH
CONTINUOUS		
SOXHLET		
SEPARATORY FUNNEL SONICATION SHAKER		

EXTRACTION METHOD :

MATRIX

EXTRACTION SOLVENT

FINAL SOLVENT

CLIENT	TASK #	GTS #	INIT. CH	INITIAL WT/VOL	SPK'D (INIT.)	FINAL VOL	CLEANUP DILUTION	FURTHER CLEAN
BLANK								
MS /BS								
MSD / BSD								
CHK. STD/____								

SURROGATE STANDARD # : _____ VOLUME _____

MATRIX SPIKE STANDARD # : _____ VOLUME _____

EXTRACTION	DATE
CONCENTRATION	DATE
CLEANUP	DATE
EXTRACTS REC'D	DATE

Figure 1.9

GALSON LABORATORIES

GC/MS EXTRACTION LOG

Q.C. BATCH # : _____

		START	FINISH
CONTINUOUS	B		
	A		
SOXHLET			
SEPARATORY FUNNEL SONICATION SHAKER			

EXTRACTION METHOD : _____

MATRIX _____

EXTRACTION SOLVENT : _____

CLIENT	TASK #	GTS #	INIT SH	INITIAL WT/VOL	SPIKED (INIT.)	FINAL VOL B/N	FINAL VOL A	pH B	pH A
BLANK									
MS /BS									
MSD / BSD									
CHK. STD. ____									

SURROGATE STANDARD # : _____ VOLUME : _____

MATRIX SPIKE STANDARD # : _____ VOLUME : _____

EXTRACTION	B		DATE :
	A		DATE :
CONCENTRATION	B		DATE :
	A		DATE :
EXTRACTS REC'D	B		DATE :
	A		DATE :

Figure 1.10

GALSON LABORATORIES

CLP WATER DIGESTION LOG

METHOD: (circle one)
CLP FOR WATERS
EPA SW846 3010/3020

CLIENT _____
SDG _____

PAGE _____ A

	GALSON ID	CLIENT ID	COLOR	CLARITY	ICP PREP INITIAL VOL. (mls)	GFAA PREP INITIAL VOL. (mls)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

ICP prep:
ANALYST _____
DATE _____

GFAA prep:
ANALYST _____
DATE _____

CHECKED BY _____
DATE _____

Figure 1.11a

GALSON LABORATORIES

CLP WATER DIGESTION LOG

CONTINUED FROM PREVIOUS PAGE A

	ICP PREP FINAL VOL. (mls)	ICP PREP COLOR	ICP PREP CLARITY	GFAA PREP FINAL VOL. (mls)	GFAA PREP COLOR	GFAA PREP CLARITY
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

ICP prep:

ANALYST _____

DATE _____

GFAA prep:

ANALYST _____

DATE _____

CHECKED BY _____

DATE _____

Figure 1.11b

GALSON LABORATORIES

CLP BULK DIGESTION LOG

CLIENT _____ METHOD (circle one): PAGE _____ A

SDG _____ EPA SW846 3050

CLP FOR SOILS/SEDIMENTS

	GALSON ID	CLIENT ID	COLOR	TEXTURE	ARTIFACTS	ICP PREP WEIGHT (G)	GFAA PREP WEIGHT (G)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							

ICP prep:

ANALYST _____

DATE _____

GFAA prep:

ANALYST _____

DATE _____

CHECKED BY _____

DATE _____

Figure 1.11c

BALSON LABORATORIES CLP BULK DIGESTION LOG

CONTINUED FROM PREVIOUS PAGE A

	ICP PREP FINAL VOL. (mls)	ICP PREP COLOR	ICP PREP CLARITY	GFAA PREP FINAL VOL. (mls)	GFAA PREP COLOR	GFAA PREP CLARITY
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

ICP prep:
ANALYST _____
DATE _____

GFAA prep:
ANALYST _____
DATE _____

CHECKED BY _____
DATE _____

Figure 1.11d

GALSON LABORATORIES

CLP WATER DIGESTION LOG

METHOD: (circle one)
CLP-M 245.1
EPA SW846 7470

CLIENT _____
SDG _____
PAGE _____

GALSON ID	CLIENT ID	INITIAL VOLUME (MLS)	FINAL VOLUME (MLS)	COMMENTS

ANALYST _____
DATE _____

CHECKED BY _____
DATE _____

Figure 1.11e

GALSON LABORATORIES

CLP HG BULK DIGESTION LOG

METHOD: (circle one)
CLP-M 245.5
EPA SW846 7471

CLIENT _____
SDG _____
PAGE _____

GALSON ID	CLIENT ID	WEIGHT (G)	FINAL VOLUME (MLS)	COMMENTS

ANALYST _____
DATE _____

CHECKED BY _____
DATE _____

Figure 1.11f

CYANIDE DISTILLATION LOG

CLIENT(S) _____ PAGE _____

GALSON ID	CLIENT ID	MATRIX	WEIGHT (G)	VOLUME (mls)	COMMENTS

ANALYST _____ CHECKED BY _____
DATE _____ DATE _____

Figure 1.12

EXTRACTABLE CHAIN OF CUSTODY

Page # of

Client:_____ Relinquished by:_____ Date/Time /

Task #:_____ Received by:_____ Date/Time /

Sample Analysis Requested: Pest/PCB's 604/8040 610/8310 310.13 TCLP Air Other:

Protocol: ELAP CLP RCRA SPDES Other:_____ Stored In Refrigerator # 6a QC Batch #_____

#1- ALS vial
#2- 8ml vial
#3- 1ml vial

Sample Removal & Return Tracking

Galson Sample ID		Bottle #	Date/Time Out	Removed By	Removed For	Date/Time In	Date/Time Out	Removed By	Removed For	Date/Time In	Date/Time Out	Removed By	Removed For	Date/Time In	Comments & Date of Disposal

*Reasons For Removal-- A:Analysis IS: Standardizing C:Combining D:Debulking & Reorganizing O:Other (Specify In Comments) 900606.0932

Figure 1.13

GC/MS EXTRACTABLE CHAIN OF CUSTODY

Page#____ of ____

Client: _____

Task #: _____

Relinquished by: _____ Date/Time ____/____

Received by _____ Date/Time ____/____

Sample Analysis Requested: 8270 625 89-2 TCLP Other:_____

Protocol: ELAP RCRA SPDES NYS/ASP Other:_____

Stored in Refrigerator #____ QC Batch ____

Galson Sample ID	Client Sample ID	Bottle#	Fraction	Sample Removal & Return Tracking										
				Date/Time Out	Removed By	For	Date/Time In	Date/Time Out	Removed By	For	Date/Time In	Date/Time Out	Removed By	For	Date/Time In	Comments

Reasons For Removal
A:Analysis IS:Standardizing C:Combining
D:Dilution B:Debulking & Reorganizing
O:Other (Specify in comments)

Extract Debulking
Relinquished By:_____ Date/Time____/____
Received By:_____ Date/Time____/____

Extract Disposal
By _____
Date/Time____/____

Figure ...

CHAIN OF CUSTODY

METALS EXTRACTS

CLIENT	SAMPLE #	MATRIX	PREP. DATE; TECHNICIAN	PLACE STORED	SIGNED OUT BY; TIME, DATE, REASON	SIGNED IN BY; TIME;DATE

Figure 1.15

Calibration Procedures

Calibration of laboratory equipment is as specified in the analytical methods used during the project. Records of calibrations are maintained by the laboratory group managers.

All standards used in the calibration of equipment are traceable, directly or indirectly, to NIST. All standards received are logged into standard receipt logs (Figure 2.1) maintained by the individual analytical groups. Each group maintains a standards log (Figure 2.2) which tracks the preparation of standards used for calibration and QC purposes.

Volatile Organics

Prior to calibration of the GC/MS it is necessary to insure that the hardware tune meets specifications. This is done through the analysis a performance evaluation standard, p-Bromofluorobenzene (BFB). 50ng of BFB is analyzed and the resulting mass spectrum checked against the following criteria.

Mass	Ion Abundance Criteria
50	15.0-40.0 percent of the base peak
75	30.0-60.0 percent of the base peak
95	base peak, 100 percent relative abundance
96	5.0-9,0 percent of the base peak
173	less than 2.0 percent of mass 174
174	50.0-120 percent of mass 95
175	5.0-9.0 percent of mass 174
176	95.0-101.0 percent of mass 174
177	5.0-9.0 percent of mass 176

Once the standard has passed criteria, calibration of the system can begin. A five point calibration is run and the response factors relative to an internal standard calculated for all compounds. If the percent relative standard deviation of the response factors for all compounds are within specified limits, the calibration is considered valid and sample analysis may begin.

A performance evaluation standard must be run at the beginning of each 12 hour analysis sequence. The analysis sequence follows with a continuing calibration check standard. The response factors for the standard are calculated and checked against the calibration curve. If the percent difference between the check standard and the curve are within specified limits, the calibration is considered to valid and sample analysis may begin.

Semivolatile Organics

Prior to calibration of the GC/MS it is necessary to insure that the hardware tune meets specifications. This is done through the analysis a performance evaluation standard, decafluoro-triphenylphosphine (DFTPP). 50ng of DFTPP is analyzed and the resulting mass spectrum checked against the following criteria.

Mass	Ion Abundance Criteria
51	30.0-60.0 percent of mass 198
68	less than 2.0 percent of mass 69
69	present
70	less than 2.0 percent of mass 69
127	40.0-60.0 percent of mass 198
197	less than 1.0 percent of mass 198
198	base peak, 100 percent relative abundance
199	5.0-9.0 percent of mass 198
275	10.0-30.0 percent of mass 198
365	greater than 1.0 percent of mass 198
441	present but less than mass 443
442	40.0-110 percent of mass 198
443	17.0-23.0 percent of mass 442

Once the standard has passed criteria, calibration of the system can begin. A five point calibration is run and the response factors relative to an internal standard calculated for all compounds. If the percent relative standard deviation of the response factors for all compounds are within specified limits, the calibration is considered valid and sample analysis may begin.

A performance evaluation standard must be run at the beginning of each 12 hour analysis sequence. The analysis sequence follows with a continuing calibration check standard. The response factors for the standard are calculated and checked against the calibration curve. If the percent difference between the check standard and the curve are within specified limits, the calibration is considered to valid and sample analysis may begin.

PCB/Pesticides

The gas chromatographs are calibrated by analysis of standard solutions containing target compounds which do not coelute. The specific standards run are:

Performance Evaluation Mix (PEM)	
Individual Standard Mix B	Aroclor 1232
Individual Standard Mix B	Aroclor 1242
Toxaphene	Aroclor 1248
Aroclor 1016	Aroclor 1254
Aroclor 1221	Aroclor 1260

A three point calibration of the individual standard mixes are run, a single point is run for the multicomponent standards. The calibration factors are determined using a peak area versus concentration calculation. If the percent relative standard deviation for the calibration factors is less than 20% for all compounds (30% for surrogates) and the RPD of the true amount and the calculated amount for each single component pesticide and surrogate in the PEM is less then 25%, the curve is considered valid and analysis may begin.

Continuing calibration check standards are run every 12 hours. If the RPD of the true amount and the calculated amount for each single component pesticide and surrogate in the PEM is less than 25% the calibration is considered to be valid and analysis of samples may continue.

Metals

A daily calibration for AA-Furnace consists of four standards and a blank. A linear regression is performed on the standards with a correlation coefficient requirement of >0.997.

AA-Flame is calibrated using two standards and a blank. Two additional standards are then analyzed, one at the detection limit. The result of any standard above the detection limit must be within 5% of the true value.

The Inductively Coupled Plasma (ICP) instruments are calibration using four standards and a blank. The correlation coefficient must be >0.997 for the curve to be valid. Each analyte curve is updated daily before analysis begins. The update consists of a blank and one standard which the slope and intercept of the original curve. A new calibration is required when update corrections are greater than 20%.

Cyanide

Initial calibration of cyanide consists of a five point calibration and a blank. The correlation coefficient of the of >0.997 is required for the curve to be considered valid. The curve is followed by an initial calibration verification standard (ICV) with recovery limits of 85-115%. This standard is followed by an initial calibration blank (ICB). Recoveries in the blank must be less than the lowest calibration standard. Sample analysis begins after successful analysis of the ICB. A continuing calibration verification standard (CCV) is required at the end of sample analysis. Recoveries on this standard must be between 85 and 115 percent for the sample analyses to be valid. Sample analysis may continue under the initial calibration as long as the CCV recoveries are within specified limits.

GC/MS STANDARDS RECEIPT LOG

GALSON TECHNICAL SERVICES

COMPOUND	SUPPLIER	QUANTITY	LOT	DATE REC'D

Figure 2.1

GALSON LABORATORIES

STD#	DESCRIPTION	STOCK #	STOCK CONC.	INITIAL WT/VOL	FINAL VOL.	FINAL CONC.	DATE	PREP BY

Figure 2.2

Analytical Procedures

The samples will be analyzed for any or all of the parameters and analytical method listed below:

Parameter	Matrix	Extraction	Cleanup	Analysis
Volatile organics	water	-	-	91-4[1]
	soil	-	-	91-1[1]
Semivolatile organics	water	continuous	-	91-2[1]
	soil	sonication	GPC	91-2[1]
PCB/Pesticides	water	continuous	1:1 acid	91-3[1]
	soil	soxlet	1:1 acid/GPC	91-3[1]
Metals	water	digestion	-	TAL[2]
	soil	digestion	-	TAL[2]
Cyanide	water	distillation	-	335.2 CLP-M[1]
	soil	distillation	-	335.2 CLP-M[1]

1- Method references are from the 1991 NYS-DEC ASP.
2- TAL - Target Analyte List. The specific methods for each element (from the 1991 NYS-DEC ASP) are shown below.

Element	Method AA-Furnace	Method AA-Flame
Aluminum	202.2 CLP-M	202.1 CLP-M
Antimony	204.2 CLP-M	204.1 CLP-M
Arsenic	206.2 CLP-M	-
Barium	208.2 CLP-M	208.1 CLP-M
Beryllium	210.2 CLP-M	210.1 CLP-M
Cadmium	213.2 CLP-M	213.1 CLP-M
Calcium	-	213.1 CLP-M
Chromium	218.2 CLP-M	218.1 CLP-M
Cobalt	219.2 CLP-M	219.1 CLP-M
Copper	220.2 CLP-M	220.1 CLP-M
Iron	236.2 CLP-M	236.1 CLP-M
Lead	239.2 CLP-M	239.1 CLP-M
Magnesium	-	242.1 CLP-M
Manganese	243.2 CLP-M	243.1 CLP-M
Nickel	249.2 CLP-M	249.1 CLP-M
Potassium	-	258.1 CLP-M
Selenium	270.2 CLP-M	-
Silver	272.2 CLP-M	272.1 CLP-M
Sodium	-	273.1 CLP-M
Thallium	279.2 CLP-M	279.1 CLP-M
Vanadium	286.2 CLP-M	286.1 CLP-M
Zinc	289.2 CLP-M	298.1 CLP-M
Mercury	Cold Vapor Technique - 245.2 CLP-M	

Listed below are the quantitation limits for both the organic and inorganic analytical methods.

Volatile Organics

Compound	Quantitation Limit Water(ug/L)	Soil (ug/kg)*
Chloromethane	1	10
Bromomethane	1	10
Vinyl Chloride	1	10
Chloroethane	1	10
Methylene chloride	2	10
Acetone	5	10
Carbon disulfide	1	10
1,1-Dichloroethene	1	10
1,1-Dichloroethane	1	10
1,2-Dichloroethene	1	10
Chloroform	1	10
1,2-Dichloroethane	1	10
2-Butanone	1	10
1,1,1-Trichloroethane	1	10
Carbon tetrachloride	1	10
Bromodichloromethane	1	10
1,2-Dichloropropane	1	10
cis-1,3-Dichloropropene	1	10
Trichloroethene	1	10
Dibromochloromethane	1	10
1,1,2-Trichloroethane	1	10
Benzene	1	10
trans-1,3-Dichloropropene	1	10
Bromoform	1	10
4-Methyl-2-pentanone	1	10
2-Hexanone	1	10
Tetrachloroethene	1	10
Toluene	1	10
1,1,2,2-Tetrachloroethane	1	10
Chlorobenzene	1	10
Ethylbenzene	1	10
Styrene	1	10
Total Xylenes	1	10

* Medium level limits are 125 times the individual low level soil limits.

* Quantitation limits for soils are based on wet weight. The quantitation limits calculated by the laboratory, calculated on a dry weight basis, will be higher.

Semivolatile Organics

Compound	Quantitation Limit Water(ug/L)	Soil (ug/kg)*
Phenol	10	330
bis(2-Chloroethyl)ether	10	330
2-Chlorophenol	10	330
1,3-Dichlorobenzene	10	330
1,4-Dichlorobenzene	10	330
1,2-Dichlorobenzene	10	330
2-Methylphenol	10	330
2,2'-oxybis(1-chloropropane)	10	330
4-Methylphenol	10	330
N-Nitroso-di-n-propylamine	10	330
Hexachloroethane	10	330
Nitrobenzene	10	330
Isophorone	10	330
2-Nitrophenol	10	330
2,4-Dimethylphenol	10	330
bis(2-Chloroethoxy)methane	10	330
2,4-Dichlorophenol	10	330
1,2,4-Trichlorobenzene	10	330
Naphthalene	10	330
4-Chloroaniline	10	330
Hexachlorobutadiene	10	330
4-Chloro-3-methylphenol	10	330
2-Methylnaphthalene	10	330
Hexachlorocyclopentadiene	10	330
2,4,6-Triclhorophenol	10	330
2,4,5-Trichlorophenol	25	800
2-Chloronaphthalene	10	330
2-Nitroaniline	25	800
Dimethyl phthalate	10	330
Acenaphthalene	10	330
2,6-Dinitrotoluene	10	330
3-Nitroanaline	25	800
Acenaphthene	10	330
2,4-Dinitrophenol	25	800
4-Nitrophenol	25	800
Dibenzofuran	10	330
2,4-Dinitrotoluene	10	330
Diethylphthalate	10	330
4-Chlorophenyl phenyl ether	10	330
Fluorene	10	330
4-Nitroaniline	25	800
4,6-Dinitro-2-methylphenol	25	800
N-Nitrosodiphenylamine	10	330

Semivolatile Organics (cont.)

Compound	Quantitation Limit Water(ug/L)	Soil (ug/kg)*
4-Bromophenyl phenyl ether	10	330
Hexachlorobenzene	10	330
Pentachlorophenol	25	800
Phenanthrene	10	330
Anthracene	10	330
Carbazole	10	330
Di-n-butyl phthalate	10	330
Fluoranthene	10	330
Pyrene	10	330
Butyl benzyl phthalate	10	330
3,3'-Dichlorobenzidine	10	330
Benzo(a)anthracene	10	330
Chrysene	10	330
bis(2-ethylhexyl)phthalate	10	330
Di-n-octyl phthalate	10	330
Benzo(b)fluoranthene	10	330
Benzo(k)fluoranthene	10	330
Benzo(a)pyrene	10	330
Indeno(1,2,3-cd)pyrene	10	330
Dibenzo(a,h)anthracene	10	330
Benzo(g,h,i)perylene	10	330

* Medium level limits are 60 times the individual low level soil limits.

* Quantitation limits for soils are based on wet weight. The quantitation limits calculated by the laboratory, calculated on a dry weight basis, will be higher.

PCB/Pesticides

Compound	Quantitation Limit Water(ug/L)	Soil(ug/Kg)*
alpha-BHC	0.05	1.7
beta-BHC	0.05	1.7
delta-BHC	0.05	1.7
gamma-BHC (Lindane)	0.05	1.7
Heptachlor	0.05	1.7
Aldrin	0.05	1.7
Heptachlor epoxide	0.05	1.7
Endosulfan I	0.05	1.7
Dieldrin	0.10	3.3
4,4'-DDE	0.10	3.3
Endrin	0.10	3.3
Endosulfan II	0.10	3.3
Endosulfan sulfate	0.10	3.3
4,4'-DDT	0.10	3.3
Methoxychlor	0.50	17.0
Endrin ketone	0.10	3.3
Endrin aldehyde	0.10	3.3
alpha-Chlordane	0.05	1.7
gamma-Chlordane	0.05	1.7

PCB/Pesticides (cont.)

Compound	Quantitation Limit Water(ug/L)	Soil(ug/Kg)*
Toxaphene	5.0	170.0
AROCLOR-1016	0.065	33.0
AROCLOR-1221	0.065	67.0
AROCLOR-1232	0.065	33.0
AROCLOR-1242	0.065	33.0
AROCLOR-1248	0.065	33.0
AROCLOR-1254	0.065	33.0
AROCLOR-1260	0.065	33.0

* Medium level limits are 15 times the individual low level soil limits.

* Quantitation limits for soils are based on wet weight. The quantitation limits calculated by the laboratory, calculated on a dry weight basis, will be higher.

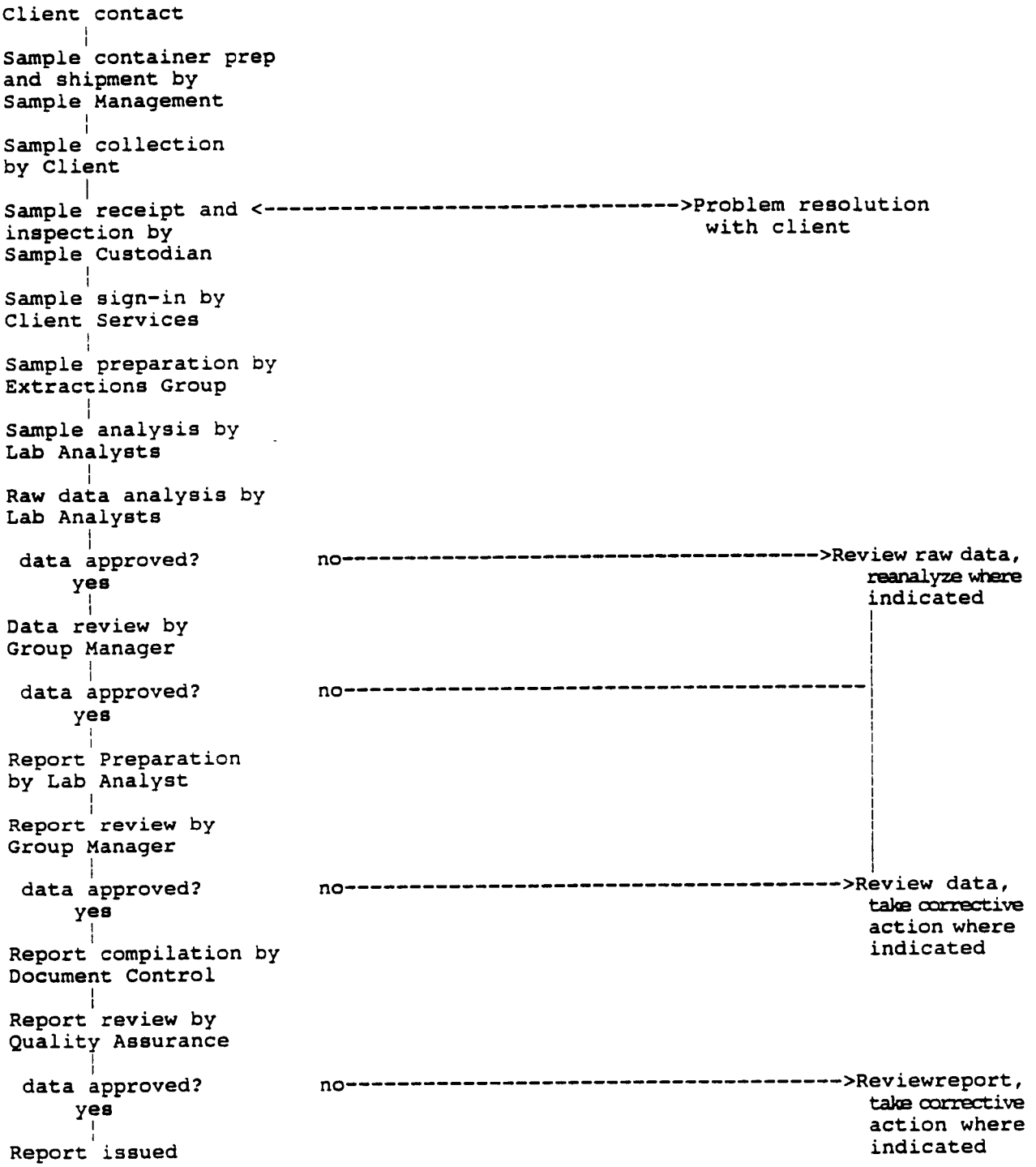
Inorganics

Compound	Quantitation LImiit ug/L
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Thallium	10
Vanadium	50
Zinc	20
Cyanide	10

These limits are the instrument detection limits obtained in pure water. The quantitation limits for samples may be considerably higher depending on the sample matrix.

Data Reduction, Validation and Reporting

The data flow starts with the client contact and follows through from sample collection, shipping, receipt, analysis, data compilation, validation and issuing of the report as shown below.



Data Reduction

Calculations for organic analyses are based on the average response factor of the calibration curve. Quantitation is performed using internal standards. The equations used in these calculations are listed here:

RELATIVE RESPONSE FACTOR (RRF)

$$RRF = \frac{Area_{(compound)} \times Concentration_{(internal\ std)}}{Area_{(internal\ std.)} \times Concentration_{(compound)}}$$

Area = area of the characteristic ion (GC/MS) or area under the peak (GC/FID) for the compound or internal standard to be measured

CONCENTRATION

$$\text{CONCENTRATION ug/l (volatiles)} = \frac{Area_{(comp.)} \times Amt._{(int.\ std)}}{RF \times Area_{(int.\ std.)} \times Vol_p}$$

Area -target	=	area of the characteristic ion for the compound or internal standard to be measured
Area -non-target	=	area under the peak for the compound or internal standard to be measured
$Amt._{(int.std.)}$	=	amount of internal standard added in nanograms (ng)
RF -target	=	relative response factor
RF -non-target	=	1
Vol_p	=	volume of sample purged in milliliters (ml)

$$\text{CONCENTRATION ug/l (semivolatile)} = \frac{\text{Area}_{(\text{comp.})} \times \text{Amt.}_{(\text{int. std})} \times \text{Vol}_t}{\text{RF} \times \text{Area}_{(\text{int. std.})} \times \text{Vol}_o \times \text{Vol}_i}$$

Area - target	=	area of the characteristic ion for the compound or internal standard to be measured
Area -non-target	=	area under the peak for the compound or internal standard to be measured
$\text{Amt.}_{(\text{int.std.})}$	=	amount of internal standard added in nanograms (ng)
RF - target	=	relative response factor
RF - non-target	=	1
Vol_t	=	volume of the total extract in microliters (ul) - 2000ul for combined water extracts with no dilutions
Vol_o	=	volume of water extracted in milliliters (ml)
Vol_i	=	volume of extract injected (ul)

$$\text{CONCENTRATION ug/l (PCP/Pesticides)} = \frac{\text{Area}_{(comp.)} \times \text{Amt.}_{(int.\ std)} \times \text{Vol}_t}{RF \times \text{Area}_{(int.\ std.)} \times \text{Vol}_a \times \text{Vol}_i}$$

Area	=	area under the peak for the compound or internal standard to be measured
$\text{Amt.}_{(int.std.)}$	=	amount of internal standard added in nanograms (ng)
RF	=	relative response factor
Vol_t	=	volume of the total extract in microliters (ul) - 1000ul for combined water extracts with no dilutions
Vol_a	=	volume of water extracted in milliliters (ml)
Vol_i	=	volume of extract injected (ul)

Data acquisition, calculation and report production for GC/MS analyses takes place on a dedicated computerized data system. Data acquisition for GC analyses takes place on its own computerized data system with raw data transferred to the LIMS where calculations and report production take place.

Inorganic analyses are based on regression analysis. Regression analysis is used to fit a curve through the calibration standard data. The samples concentrations are calculated using the resulting regression equations.

Standard data are fitted to an equation in the form:

$$y = a + bx$$

where

y = instrument response
x = concentration of amount of analyte
a = y-intercept
b = slope of the line (sensitivity)

After the regression equation has been computed, the sample concentration (x) can be calculated by rearranging the regression equation to read:

$$x = (y-a) / b$$

Metals data acquisition is performed on a computerized data system. Raw data transfered into a computerized report generation program which calculates concentrations and recoveries and produces a final report.

Cyanide raw data is entered into a personal computer which calculates the regression and concentrations. The data is then manually entered onto the inorganic report forms.

Data Validation

Data validation begins with the analyst. Raw data is examined to assess compliance with quality control guidelines. Surrogate, matrix spike, and quality control check sample recoveries are checked. Samples are checked for possible contamination or interferences. Concentrations are checked to insure the systems are not saturated. If dilutions are necessary, they are performed. Any deviations from the guidelines call for corrective action. Those deviations which are determined to be caused by factors outside the laboratory's control, such as matrix interference, are noted with an explanation in the report narrative.

Data validation continues with the group managers who check the analysts calculations where necessary and check for oversights. Laboratory data validation ends with the Quality Assurance Officer's review of the final data package.

Data Reporting

Data reports are produced by each laboratory group individually by the lab analysts. Reports include all raw data required to recalculate any result. Included in the package are:

-sample target compound results
-tentatively identified compounds (volatile and semivolatile organics only)
-surrogate spike recoveries
-matrix spike/matrix spike duplicate/matrix spike blank recoveries
-QC check sample recoveries
-duplicate sample results (inorganics only)
-blank target compound results
-internal standard area data (organics only)

All sample results on the report forms are corrected for dilutions. All soil samples are reported on a dry weight basis.

Once the analyst has generated the report forms and assembled the data package, it is given to the group manager. The group manager reviews the package looking for any discrepancies, errors or omissions. The group manager produces a preliminary narrative at this time outlining quality control compliance and details specific to the analysis of the samples. The package is next given to the Document Control Officer.

The Document Control Officer assembles the individual packages from each group into an inorganic and an organics data package following the package assembly SOP. Added to the packages at this time are the Laboratory Analytical Request Forms, the Chain of Custodies, air bills, and DEC Forms. The packages are now given to the Quality Assurance Officer for review.

The Quality Assurance Officer reviews the package following the package review checklist found in the package review SOP (Figures 4.1 and 4.2). Once the QA Officer completes the review, the package is returned to the groups managers for corrections. The corrections are made and the package returned to the QA Officer.

The package is returned to the Document Control Officer who paginates the package, creates a Table of Contents and cover, and produces the required number of copies. The package is logged into the Documentation Mailing Log, placed into the appropriate shipping container, and mailed to the client.

GALSON LABORATORIES STANDARD OPERATING PROCEDURE			
SUBJECT ORGANIC DATA PACKAGE REVIEW			
SOP NUMBER: EO-MISC-3	REV NO/DATE: #3 5/92	PAGE NUMBER: 1	APPROVED BY: AUTHOR: LAB DIRECTOR: QA/QC MANAGER:

1. PURPOSE

   To provide a system for the review of organics data packages

2. PERSONS AFFECTED

   Group Managers, QA/QC Staff

3. POLICY

   It is the policy of Galson to insure that all data packages are thoroughly reviewed prior to delivery to the client.

4. DEFINITIONS

   Sample Identification and Analytical Requirement Summary: Form on which those analyses required for each sample received are listed.

   Sample Preparation and Analysis Summary: Form which lists the sample identification, date of receipt, analysis protocol, date and type of preparation, clean-ups, dilution factors, and date of analysis.

   Log-in Number: Unique number assigned to a group of samples received from a client from a given site on a given day.

5. RESPONSIBILITIES

   It is the responsibility of the Group Managers to produce the data packages which are then reviewed by the QA/QC Group. It is the Group Managers responsibility to make any corrections determined to be necessary by the reviewer.

Figure 4.1

6. PROCEDURE

6.1 The data package and data package summary are reviewed as outlined below. All discrepancies are logged by the QA/QC reviewer in a package review logbook. The package page on which the discrepancy occurs is flagged with a yellow sticker.

6.2 Summary Package Review

6.2.1 Are the Following items present?

- -Sample Identification and Analytical Requirement Summary
- -Field Chain of Custody
- -Internal Chain of Custody
- -Shipping Tags
- -Shipping Receipts
- -Sample Preparation and Analysis Summary
  - -Volatile
  - -Semivolatile
  - -Pesticide/PCB

6.2.2 Are the log-in numbers present on all forms listed in 6.2.1? Are the log-in numbers correct and are all log-ins present?

6.2.3 Compare the forms and the LIMS generated work order. Are all sample IDs correct? Check any discrepancies against the client's original Chain of Custody.

6.2.4 Compare the Sample Identification and Analytical Requirement Summary Form to the client analytical request. Are all requests the same? Correct any clerical errors. If an analysis was missed or is incorrect, contact the project manager.

6.2.5 FORM 1 (Organic Analysis Data Sheet)

Is there a Form 1 for each sample listed on the Sample Identification and Analytical Requirement Summary Form?

Is there a FORM 1E (Tentatively Identified Compounds) present for each volatile sample and method blank?

Is there a FORM 1F (Tentatively Identified Compounds) present for each semivolatile sample and method blank?

Do all Form 1s have the same sample ID for each sample?

Check % moisture. Do all moisture values match those on the % moisture determination sheets?

Check the matrix identification. Is it the same for each Form 1 and does it match what is listed on the Sample Preparation and Analysis Summary?

Check the date of receipt against that on the Chain of Custody. Do they match?

Check the date of analysis for the VOA Form 1s. Is it within 7 days of sample receipt?

Check the date of extraction of the Semivolatile and Pesticide/PCB Form 1s. Are they within 5 days of sample receipt? Is the analysis date within 40 days of receipt?

Do all dates on the Form 1s match those on the Sample Preparation and Analysis Summary Forms?

Are results corrected for % moisture?

Are all values requiring a qualifier appropriately flagged?

6.2.6 FORM 2 (Surrogate Recovery)

Is each sample listed on the Form 2?

Is the matrix correct?

Are outliers correctly marked with an asterisk and totalled correctly at the bottom of the form?

Are there one or more VOA surrogate outliers for any sample?
If there were outliers, was the sample reanalyzed?
Is the reanalysis labelled with a 'RE' suffix?

Are there one or more Semivolatile surrogate outliers for any sample?

Are there 2 or more base/neutral or 2 or more acid surrogate outliers or is any one surrogate recovery less than 10%?

If so, was the sample reextracted/reanalyzed?

Is the reextraction/reanalysis labelled with a 'RE' suffix?

Was the reextraction/reanalysis done within holding times?

Are there one or more Semivolatile surrogate outliers for the blank?

Was the blank reanalyzed?

Were the blank and its associated samples reextracted and reanalyzed?

Are there any Pesticide/PCB surrogate recoveries for samples or blanks outside of control limits?

6.2.7 FORM 3 (Matrix Spike/Matrix Spike Duplicate Recovery)

Is there a Form 3 for each VOA level (low and medium) analyzed?

Is there a Form 3 for each Semivolatile level (low and medium) and extraction type (sonication, continuous, and sep. funnel)?

Is there a Form 3 for each Pesticide/PCB level (low and medium) and extraction type (sonication, continuous, soxlet, and sep. funnel)?

Is there one MS/MSD for every 20 samples?

Were the Semivolatile and Pesticide/PCB MS/MSDs extracted within 7 days of all other extractions performed in the package?

Is the sample that was used for the MS/MSD indicated on the form?

Are there any recovery outliers?

Are there any RPD outliers?

6.2.8 FORM 3-BS (Blank Spike Recovery)

Is there a Form 3-BS for each VOA level (low and medium) analyzed?

Is there a Form 3-BS for each Semivolatile level (low and medium) and extraction type (sonication, continuous, and sep. funnel)?

Is there a Form 3-BS for each Pesticide/PCB level (low and medium) and extraction type (sonication, continuous, soxlet, and sep. funnel)?
Is there one BS for every MS/MSD?

Were the Semivolatile and Pesticide/PCB BSs extracted within 7 days of all other extractions performed in the package?

Are there any recovery outliers?

6.2.9 FORM 3-QC (Quality Control Check Standard Recovery)

Is there a Form 3-QC for each VOA level (low and medium) analyzed?

Is there a Form 3-QC for each Semivolatile level (low and medium) and extraction type (sonication, continuous, and sep. funnel)?

Is there a Form 3-QC for each Pesticide/PCB level (low and medium) and extraction type (sonication, continuous, soxlet, and sep. funnel)?

Is there one QC for every 20 samples?

Were the Semivolatile and Pesticide/PCB QCs extracted within 7 days of all other extractions performed in the package?

Are there any recovery outliers?

6.2.10 FORM 4 (Blank Summary Form)

Is there a VOA Form 4 for each day or 12 hour sequence of analysis of samples?

Is there a Semivolatile Form 4 for each day, matrix, level, and type of extraction?

Is there a Pesticide/PCB Form 4 for each day, matrix, level, and type of extraction?

Was a blank analyzed for every 20 samples?

Are all samples accounted for on the Form 4s?

Do any blanks has positive results?
- -Volatile
- -Semivolatile
- -Pesticide/PCB

If there were positive results in any blanks, are matching hits in the samples associated with it flagged with a 'B' qualifier?

6.2.11 FORM 8 (Internal Standard Summary)

Is there a Form 8 for each day Volatile or Semivolatile samples were analyzed?

Do all internal standard areas meet the +100% to -50% criteria?

Were all samples which failed the internal standard area criteria reanalyzed?

6.3 Data Package Review

All items listed in summary review must also be addressed in data package review.

6.3.1 Volatile Data

Are all forms present in the summary package also present in the data package?

Is there a FORM 5 (GC/MS Tuning and Mass Calibration Form) for each day of analysis?

Are all standards, blanks, samples, and spikes accounted for on the Form 5s?

Do the times of analysis for all runs match those found on the Form 5s?

Do the relative ion abundances on the Form 5s match those from the raw data?

Is each sample and method blank Form 1 and 1E followed by a RIC (reconstructed ion chromatogram), quantitation report, and spectra?

Do the positive results listed on the Form 1, those listed on the quantitation report, and the spectra agree?

Is the FORM 6 (Initial Calibration Data Form) present along with the associated standard RICs and quantitation reports?

Is there a separate calibration for low and medium level volatiles?

Do the response factors for each compound meet specified criteria?

Is there a FORM 7 (Continuing Calibration Data Form) for each day of sample analysis?

Is the standard RIC and quantitation report present?

Do the average response factors from the continuing calibration match those from the initial calibration?

Do the response factors for each compound meet specified criteria?

Were the continuing calibration response factors used for quantitation?

Is there a BFB Performance Evaluation Standard bar graph spectrum and mass tabulation present for each day of analysis?

Are there FORM 1s and associated RICs and quantitation reports present for each matrix spike, matrix spike duplicate, matrix spike blank, and QC check standard?

Are the spikes present the same as those listed on the FORM 3s?

Do the concentrations on the FORM 1s match those on the FORM 3s?

Is there a copy of the instrument run log present for each day of analysis?

Is there a soil moisture determination sheet present and is each sample accounted for?

6.3.2 Semivolatile Data

Are all forms present in the summary package also present in the data package?

Is there a FORM 5 (GC/MS Tuning and Mass Calibration Form) for each day of analysis?

Are all standards, blanks, samples, and spikes accounted for on the Form 5s?

Do the times of analysis for all runs match those found on the Form 5s?

Do the relative ion abundances on the Form 5s match those from the raw data?

Is each sample and method blank Form 1 and 1F followed by a RIC (reconstructed ion chromatogram), quantitation report, and spectra?

Do the positive results listed on the Form 1, those listed on the quantitation report, and the spectra agree?

Are GPC chromatograms present?

Is the FORM 6 (Initial Calibration Data Form) present along with the associated standard RICs and quantitation reports?

Do the response factors for each compound meet specified criteria?

Is there a FORM 7 (Continuing Calibration Data Form) for each day of sample analysis?

Is the standard RIC and quantitation report present?

Do the average response factors from the continuing calibration match those from the initial calibration?

Do the response factors for each compound meet specified criteria?

Were the continuing calibration response factors used for quantitation?

Is there a DFTPP Performance Evaluation Standard bar graph spectrum and mass tabulation present for each day of analysis?

Are there FORM 1s and associated RICs and quantitation reports present for each matrix spike, matrix spike duplicate, matrix spike blank, and QC check standard?

Are the spikes present the same as those listed on the FORM 3s?

Do the concentrations on the FORM 1s match those on the FORM 3s?

Is there a copy of the instrument run log present for each day of analysis?

Is there a copy of the extraction log for each batch present in the package?

Is there a soil moisture determination sheet present and is each sample accounted for?

6.3.3 Pesticide/PCB Data

Are all forms present in the summary package also present in the data package?

Is each sample and method blank FORM 1 followed by a chromatogram and GC integration report for both the original and confirmation run?

Do the positive results listed on the FORM 1 and those listed on the integration report agree?

Are all positive hits labelled on the chromatogram?

Are the retention times of sample compounds within the calculated retention time windows?

Are GPC chromatograms present?

If sufficient concentrations of identified compounds were present, was GC/MS confirmation performed?

Are GC/MS spectra present?

Are the Initial Calibration of Single Component Analytes (Form 6 PEST-1 and 6 PEST-2) present for both columns?

Are the Initial Calibration of Multicomponent Analytes (Form 6 PEST-3) present for both columns?

Are the Analyte Resolution Summaries (Form 6 PEST-4) present for both columns?

Are the Calibration Verification (Form 7 PEST-1) present for all PEMs?

Are the Calibration Verification (Form 7 PEST-2) present for all Individual Standard Mixtures A&B and instrument blanks used for calibration verification?

Are all Analytical Sequence (Form 8 PEST) present?

Are Florisil Cartridge Check (Form 9 PEST-1) present for all lots of cartridges used to process samples in the SDG?

Are Pesticide GPC Calibration (Form 9 PEST-2) present for all GPC columns used to process samples in the SDG?

Are there Pesticide Identification Summary for Single Component Analytes (Form 10 PEST-1) present for all samples and blanks with positively identified single component analytes?

Are there Pesticide Identification Summary for Multicomponent Analytes (Form 10 PEST-2) present for all samples and blanks with positively identified multicomponent analytes?

Are chromatograms and quantitation reports present for all standards listed below?

- -Resolution check mixture
- -Performance evaluation mixtures (PEM)
- -Individual standard mixture A, three point initial calibration
- -Individual standard mixture B, three point initial calibration
- -All multicomponent analytes, single point initial calibration
- -All midpoint individual standard mixtures a&B used for calibration verification
- -Florisil cartridge check solution, all lots
- -Pesticide GPC calibration check solution, all calibration relating to samples in the SDG
- -All multicomponent analyte standards analyzed for confirmation

Are there FORM 1s and associated chromatograms and integration reports present for each extraction blank, matrix spike, matrix spike duplicate, matrix spike blank, and QC check standard?

Are the spikes present the same as those listed on the FORM 3s?

Do the concentrations on the FORM 1s match those on the FORM 3s?

Is there a copy of the extraction log for each batch present in the package?

Is there a soil moisture determination sheet present and is each sample accounted for?

GALSON LABORATORIES STANDARD OPERATING PROCEDURE			
SUBJECT INORGANIC DATA PACKAGE REVIEW			
SOP NUMBER: EM-MISC-3	REV NO/DATE: #2 1/92	PAGE NUMBER: 1	APPROVED BY: AUTHOR: LAB DIRECTOR: QA/QC MANAGER:

1. PURPOSE

   To provide a system for the review of inorganic data packages

2. PERSONS AFFECTED

   Group Managers, QA/QC Staff

3. POLICY

   It is the policy of Galson to insure that all data packages are thoroughly reviewed prior to delivery to the client.

4. DEFINITIONS

   Sample Identification and Analytical Requirement Summary: Form on which those analyses required for each sample received are listed.

   Sample Preparation and Analysis Summary: Form which lists the sample identification, date of receipt, analysis protocol, date and type of preparation, clean-ups, dilution factors, and date of analysis.

   Log-in Number: Unique identification number assigned to a samples received from a client from a given site on a given day.

5. RESPONSIBILITIES

   It is the responsibility of the Group Managers to produce the data packages which are then reviewed by the QA/QC Group. It is the Group Managers responsibility to make any corrections determined to be necessary by the reviewer.

Figure 4.2

6. PROCEDURE

6.1 The data package and data package summary are reviewed as outlined below. All discrepancies are logged by the QA/QC reviewer in a package review logbook. The package page on which the discrepancy occurs is flagged with a yellow sticker.

6.2 Summary Package Review

6.2.1 Are the Following items present?

- -Sample Identification and Analytical Requirement Summary
- -Field Chain of Custody
- -Internal Chain of Custody
- -Shipping Tags
- -Shipping Receipts
- -Sample Preparation and Analysis Summary
  - -metals
  - -cyanide
- -Inorganic Data Reporting Qualifiers

6.2.2 Are the log-in numbers present on all forms listed in 6.2.1? Are the log-in numbers correct and are all log-ins present?

6.2.3 Compare the forms and the LIMS generated work order. Are all sample IDs correct? Check any discrepancies against the client's original Chain of Custody.

6.2.4 Compare the Sample Identification and Analytical Requirement Summary Form to the client analytical request. Are all requests the same? Correct any clerical errors. If an analysis was missed or is incorrect, contact the project manager.

6.2.5 FORM 1 (Inorganic Analysis Data Sheet)

Is there a Form 1 for each sample listed on the Sample Identification and Analytical Requirement Summary Form?

Do all Form 1s have the same sample ID for each sample?

Are results for all requested analytes present?

Is the physical description complete?

Are all dilutions reported in the comments section?

Check % solids. Do all solids values match those on the % solids determination sheets?

Check the matrix identification. Is it the same for each Form 1 and does it match what is listed on the Sample Preparation and Analysis Summary?

Check the date of receipt against that on the Chain of Custody. Do they match?

Do all dates on the Form 1s match those on the Sample Preparation and Analysis Summary Forms?

Are results corrected for % solids?

Are all values requiring a qualifier appropriately flagged?

6.2.6 FORM 5 (Spiked Sample Results)

Is there one spiked sample for every 20 samples?

Are all of the headings complete?

Are spike results reported for each requested analyte and matrix?

Are results listed in the appropriate units?

Are recoveries within specified limits?

If a recovery is outside limits, is the analyte flagged with a 'N'?

Are the appropriate FORM 1s flagged with a 'N'?

6.2.7 FORM 6 (Duplicate Sample Results)

Is there one duplicate for every spiked sample?

Are all headings complete?

Are spike results reported for each requested analyte and matrix?

Are results listed in the appropriate units?

Are recoveries within specified limits?

If a recovery is outside limits, is the analyte flagged with an '*'?

Are the appropriate FORM 1s flagged with an '*'?

6.2.8 FORM 7 (Laboratory Control Sample Results)

Is there one QC for each batch of samples digested?

Are all of the headings complete?

Are LCS results reported for each requested analyte and matrix (excluding mercury and cyanide)?

Are results listed in the appropriate units?

Are recoveries within specified limits?

If a recovery is outside limits, were the samples redigested and reanalyzed for that analyte (excluding antimony and silver)?

6.2.9 FORM 3 (Blank Summary Form)

Are all headings complete?

Do all requested analytes have I/CCBs reported

Is there a preparation blank for each reported analyte and matrix?

Are the results reported in the proper units?

Are all analytes in the reported blanks below the CRDL?

If there are analytes above the CRDL, is there a statement explaining the affect on the data?

Are all samples accounted for on the Form 3s?

6.3 Data Package Review

All items listed in summary review must also be addressed in data package review.

6.3.1 Inorganic Data Results

Are all forms present in the summary package also present in the data package?

Are FORM 1s present for all samples?

Are FORM 1s arranged by sample ID in increasing alphanumeric order?

Are concentration units correct?

Are results reported in the correct number of significant figures?

Are results reported on a dry weight basis?

Is the % solids reported to one decimal place?

Does the % solids value match that on the % solids determination sheet?

Are all dilutions reported in the comment section?

6.3.2 Quality Control Data

FORM 2A (Initial and Continuing Calibration Verification)

Are all headings complete?

Do all requested analytes have I/CCVs reported?

Are all recoveries within specified control limits?

If there are recoveries outside limits, is there an explanation of the affect on the data?

FORM 2B (CRDL Standard for AA and Linear Range Analysis for ICP)

Are all headings complete?

Do all requested analytes have results reported?

FORM 3 (Blanks)

Are all headings complete?

Do all requested analytes have I/CCBs reported?

Is there a preparation blank reported for each requested analyte and matrix?

Are the blanks reported in the correct units?

Are all reported blanks below the CRDL?

If there are analytes above the CRDL in the blank, is there an explanation as to the affect on the data?

FORM 4 (ICP Interference Check Sample)

Are the headings complete?

Are results reported for each analyte?

Are all recoveries within the specified control limits?

If recoveries are outside limits, is there an explanation as to the affect on the data?

FORM 5 (Spike Sample Recovery)

Are all headings complete?

Are spike results reported for each requested analyte and matrix?

Are the results reported in the correct units?

Are all recoveries within the specified control limits?

If recoveries are outside limits, is the analyte flagged with a 'N'?

Are the appropriate FORM 1s flagged with a 'N'?

FORM 6 (Duplicates)

Are all headings complete?

Are spike results reported for each requested analyte and matrix?

Are the results reported in the correct units?

Are all recoveries within the specified control limits?

If recoveries are outside limits, is the analyte flagged with an '*'?

Are the appropriate FORM 1s flagged with an '*'?

FORM 7 (Laboratory Control Sample)

Are all the headings complete?

Is there a LCS for each batch of samples digested?

Is an LCS reported for each analyte requested (excluding cyanide and mercury)?

Are the results within control limits?

If the results were outside control limits, were the samples redigested and reanalyzed (excluding antimony and silver)?

FORM 8 (Standard Addition Results)

Are all headings complete?

Are results reported in alphanumeric order per analyte?

Are all correlation coefficients greater than 0.995?

If yes, are the appropriate FORM 1s flagged with a 'S'?

if no:

Are the samples with cc > 0.995 flagged with a 'S'?

Did the samples with cc < 0.995 have an MSA performed twice?

Was the second cc > 0.995?

if no, are the appropriate FORM 1s flagged with a '+'?

if yes, are the appropriate FORM 1s flagged with a 'S'?

FORM 9 (ICP Serial Dilutions)

Are all headings complete?

Is there a serial dilution reported for each requested analyte and matrix with a result over 50 times the IDL, 10x for Q4 (SPDES) and Q5 (RCRA) ?

Are the results within the control limits?

If there are results outside the control limits, is the analyte flagged with an 'E'?

Are the appropriate FORM 1s flagged with an 'E'?

FORM 10 (Instrument Detection Limits)

Are all the headings complete?

Is there an IDL listed for each analyte requested for each instrument used?

Have the IDLs been determined in the last three months?

FORM 11 (ICP Interelement Correction Factors)

Are all the headings complete?

Have all the interelement correction factors used been reported?

Have the interelement correction factors been determined in the last year?

FORM 12 (ICP Linear Ranges)

Are all the headings complete?

Are all the linear ranges for each requested analyte run by ICP reported?

Have the linear ranges been determined in the past three months?

FORM 13 (Preparation Log)

FORM 14 (Analysis Run Log)

6.3.3 Raw Data

Is all ICP raw data present and labelled?

Are all calibration standards present.

Are all initial and continuing blanks and preparation blanks present?

Are all initial and continuing calibration verification standards, interference check samples, ICP serial dilution samples, CRDL standards for ICP, Laboratory Control Samples, And Post Digestion Spikes present?

Are all diluted and undiluted samples and all weights, dilutions and volumes used to obtain the reported values present?

Are all spikes including standard solutions used, final spike concentrations, and volumes involved, present?

Are all duplicates present?

Is the instrument used, any instrument adjustments, and any data corrections or other apparent anomalies on the measurement record notated?

Is the time and date of each analysis indicated?

Is all Flame-AA raw data present and labelled?

Are all calibration standards present?

Are all initial and continuing blanks and preparation blanks present?

Are all initial and continuing calibration verification standards, interference check samples, CRDL standards for AA, Laboratory Control Samples, And Post Digestion Spikes present?

Are all diluted and undiluted samples and all weights, dilutions and volumes used to obtain the reported values present?

Are all duplicates present?

Are all spikes including standard solutions used, final spike concentrations, and volumes involved, present?
Are all diluted and undiluted samples present?

Is the instrument used, any instrument adjustments, and any data corrections or other apparent anomalies on the measurement record notated?

Is the time and date of each analysis indicated?

Is all Graphite Furnace-AA raw data present and labelled?

Are all calibration standards present?

Are all initial and continuing blanks and preparation blanks present?

Are all initial and continuing calibration verification standards, CRDL standards for AA, Laboratory Control Samples, And Post Digestion Spikes present?

Are all diluted and undiluted samples and all weights, dilutions and volumes used to obtain the reported values present?

Are all duplicates present?

Are all spikes including standard solutions used, final spike concentrations, and volumes involved, present?
Are all duplicates present?

Is the instrument used, any instrument adjustments, and any data corrections or other apparent anomalies on the measurement record notated?

Is all information clearly identified on the raw data, including sample number, sample and analytical spike data, percent recovery, coefficient of variation, full MSA data, MSA correlation coefficient, slope and intercepts of linear fit, final sample concentration, and type of background correction.

Were any analytical spike recoveries less than 40%?

If yes, was the sample diluted and reanalyzed?

Was the reanalysis recovery still less than 40%?

if yes, was the data flagged with an 'E'?

Was spike recovery less than 85% or greater than 115%?

If yes and sample concentrations were less than 50% of spike concentration, were results flagged with a 'N'?

If yes and sample concentrations were greater than 50% of spike concentration

Was a MSA performed?

Are the appropriate FORM 1s flagged with a 'S'?

Is the time and date of each analysis indicated?

Is all Mercury raw data present and labelled?

Are all calibration standards present?

Are all initial and continuing blanks and preparation blanks present?

Are all initial and continuing calibration verification standards and Laboratory Control Samples present?

Are all diluted and undiluted samples and all weights, dilutions and volumes used to obtain the reported values present?

Are all duplicates present?

Are all spikes including standard solutions used, final spike concentrations, and volumes involved, present?
Are all duplicates present?

Is the instrument used, any instrument adjustments, and any data corrections or other apparent anomalies on the measurement record notated?

Is the time and date of each analysis indicated?

Is all Cyanide raw data present and labelled?

Are all calibration standards present and labelled to include source and prep date?

Are all initial and continuing blanks and preparation blanks present?

Are all initial and continuing calibration verification standards, Laboratory Control Samples, And Post Digestion Spikes present?

Are all diluted and undiluted samples and all weights, dilutions and volumes used to obtain the reported values present?

Are all duplicates present?

Are all spikes including standard solutions used, final spike concentrations, and volumes involved, present?

Is the instrument used, any instrument adjustments, and any data corrections or other apparent anomalies on the measurement record notated?

Is the time and date of each analysis indicated?

6.3.4 Digestion Logs

Are digestion logs present for:

-ICP
-FAA
-GFAA
-Mercury
-Cyanide Distillation

Do the digestion logs include the date, sample weights and volumes, extraction comments and indication of pH?

Are copies of the standards prep log present for all standards used, including the spiking solution used?

Internal Quality Control Checks

Field Operations

To assess the sample decontamination procedures and the affects of the sample handling process, trip blanks, field blanks, and equipment blanks are recommended. Duplicate and replicate sampling is recommended to measure control within the sample collection system.

The trip blank consists of a set of sample containers filled with analyte-free water. The sample containers are not opened in the field, they simply travel with the sample collector.

The field blank consists of analyte-free water poured into a sample container at the site. Once the field blank is created, it is handled like a sample.

The equipment blank serves as a check on the equipment decontamination process. Analyte-free water is passed through decontaminated sampling equipment, transferred to a sample bottle, and returned to the laboratory.

Field duplicates are two samples collected independently at a sampling location during a single act of sampling.

A replicate sample is a single sample collected then divided in two equal parts.

Laboratory Operations

The following are quantity control activities that are incorporated into the Galson QC program:

Volatile Organics

- -Performance Evaluation Standard (BFB)
  - -at the beginning of each 12 hour analytical sequence
- -Calibration Curve
  - -30% RSD for calibration check compounds (CCC)
  - -35% all other compounds
- -Continuing Calibration Check Standard
  - -25 %D for CCC
  - -35 %D all other compounds
  - -once every 12 hour sequence
- -Method Blank
  - -once every 12 hour sequence
  - -after calibration standard, but before sample analysis
- -must contain no compound over the method quantitation limit
- -MS/MSD/BS
  - -one for every 20 samples (or sample delivery group)
  - -spiking and quality control limits as per method 89-1
- -Quality Control Check Sample
  - -one for every 20 samples (or sample delivery group)
  - -spiked with all compounds at 20ug/L

Semivolatile Organics

-Performance Evaluation Standard (DFTPP)
  -at the beginning of each 12 hour analytical sequence
-Calibration Curve
  -30% RSD for calibration check compounds (CCC)
  -35% all other compounds
-Continuing Calibration Check Standard
  -25 %D for all compounds
  -once every 12 hour sequence
-Extraction Blank
  -one every extraction batch
-should contain no compound over the method quantitation limit
-MS/MSD/BS
  -one for every 20 samples (or sample delivery group)
  -spiking and quality control limits as per method 89-2
-Quality Control Check Sample
  -one for every 20 samples (or sample delivery group)
  -spiked with all compounds

Pesticide/PCBs

-Performance Evaluation Mixture (PEM)
  -at the beginning or end of each 12 hour analytical sequence
-Calibration Curve
  -20% RSD for individual component pesticides
  -30% RSD for surrogates
  -25% RPD for PEM
  -single point for multicomponent compounds
-Continuing Calibration Check Standard
  -25% RPD for PEM
  -once every 12 hour sequence
-Extraction Blank
  -one every extraction batch
  -should contain no compound over the method quantitation limit
-MS/MSD/BS
  -one for every 20 samples (or sample delivery group)
  -spiking and quality control limits as per method 91-3
-Quality Control Check Sample
  -one for every 20 samples (or sample delivery group)
  -spiked with all compounds

Metals

-Calibration Curve
    -0.997 correlation coefficient
-Continuing Calibration Check Standard
    -update corrections less than 20%
-Calibration Blank
    -daily
-Extraction Blank
    -one every extraction batch
-MS/BS
    -one for every 20 samples (or sample delivery group)
    -spiking and quality control limits as per ASP
-Duplicate Sample
    -one per extraction batch
-Quality Control Check Sample
    -one for every 20 samples (or sample delivery group)
    -spiked with all compounds

Cyanide

-Calibration Curve
    -0.997 correlation coefficient
-Initial Calibration Verification Standard
    -after each curve
    -85-115% recovery
-Continuing Calibration Verification Standard
    -after sample analysis
    -85-115% recovery
-Initial Calibration Blank
    -recovery not higher than lowest standard
-Method Blank
    -daily
-MS/BS
    -one for every 20 samples (or sample delivery group)
    -spiking and quality control limits as per ASP
-Duplicate Sample
    -one per extraction batch
-Quality Control Check Sample
    -one for every 20 samples (or sample delivery group)
    -spiked as per ASP

Performance and Systems Audits

Performance Audits

Performance check standards are analyzed on the gas chromatographs to determine column and system performance. A mixture of compounds is injected which evaluates the resolution of closely eluting compounds, and the tendency of the column to degrade or absorb labile compounds. Response factors must not vary by more than 15% form previous analysis.

Quarterly interelement correction standards are run in the inductively coupled plasma spectrometer (ICP) to track changes in element interferences.

For other analyses, the calibration procedure of instruments that give a linear response is used to track changes in performance. Data produced is retained in the laboratory for historical purposes.

System Audits

Internal system audits are conducted quarterly by the Laboratory QA Officer. The audit documents whether written procedures are being followed.

The system audits are conducted to evaluate the following:

- -Sample handling procedures
- -Calibration procedures
- -Analytical procedures
- -QC results
- -Safety procedures
- -Recordkeeping procedures
- -Timeliness of analysis and reporting

Outside Audits

The laboratory participates in the following interlaboratory QC rounds:

- -New York State Department of Health Environmental Laboratory Approval Program (ELAP)
  - Semiannual samples for water, wastewater, solid and hazardous waste, air and emissions, and asbestos
- -New Jersey Department of Environmental Protection (NJDEP)
  - Semiannual analysis of wastewater samples
  - EPA Performance Evaluation Samples are used
- -California Department of Health Services
  - Annual analysis of wastewater samples

The laboratory is certified/accredited by the following programs:

- -NYS Department of Health ELAP Program
- -NYS Department of Environmental Conservation "Technically Acceptable" list
- -New Jersey Department of Environmental Protection
- -California Department of Health Services
- -California Air Resources Board
- -Vermont Health Department
- -Commonwealth of Massachusetts (formaldehyde)
- -American Industrial Hygiene Association

Preventative Maintenance

All instruments and equipment are serviced only by qualified personnel. All repairs, adjustments, and calibrations are documented in the appropriate logbook or data sheet. All instruments have regularly updated maintenance logs.

It is laboratory policy to maintain a sufficient supply of spare parts for all its instruments to minimize downtime. Whenever possible, backup instrumentation is retained.

All GC and GC/MS equipment and their associated computer systems are maintained under a service contract with Hewlett Packard. The contract allows for semi-annual preventative maintenance for all systems as well as system repair on a "as needed" basis. The laboratory has sufficient trained staff to allow for routine day to day maintenance on all equipment.

Inorganic equipment is maintained by in house staff. Spare parts are kept in inventory to minimize instrument downtime. Manufacturers service representatives are readily available to assist in any repairs which are beyond the capabilities of laboratory personnel.

Data Measurement Assessment

Procedures used to assess data precision and accuracy will be in acordance with the appropriate laboratory method.

Precision

Precision is calculated from duplicate measurements. Relative percent difference (RPD) is used as the measure of precision

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2) / 2} \times 100$$

C_1 = larger of two observed values
C_2 = smaller of two observed values

Accuracy

Percent recovery is used as a measure of accuracy

$$\%R = \frac{S - U}{C_{sa}} \times 100$$

%R = percent recovery
S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

Method Detection Limits

MDL is defined as follows for all measurements:

$$MDL = t_{(n-1,1-\alpha=0.99)} \times s$$

MDL = method detection limit
s = standard deviation of replicate analyses
$t_{(n-1,1-\alpha=0.99)}$ = student's t-value for a one-sided 99% confidence level and a standard deviation estimate with n-1 degrees of freedom

Corrective Action

Galson Laboratories uses the immediate closed loop corrective action system. This method can be applied equally to non-conforming data, malfunctioning equipment, discovery of contamination or client complaints. The following actions are taken, as appropriate, to remedy an out-of-control situation.

-define the problem

-investigate and determine the cause of the problem

-Determine corrective action to eliminate the problem

-Implement corrective action

-Verify corrective action has eliminated the problem

-Fill out closed loop corrective action form (Figure 9.1)

-Implement procedures to eliminate the problem in the future

CLOSED LOOP CORRECTIVE ACTION REPORT - QA/QC

ORIGINATOR SIGNATURE	DATE	CLCAR NUMBER	DEPARTMENT	AREA
INDIVIDUAL(S) CONTACTED			AUDIT NUMBER	DATE

COMPLETED BY ORIGINATOR

REQUIREMENTS

FINDING

RECOMMENDED CORRECTIVE ACTION

SCHEDULED RESPONSE DATE	RESPONSIBLE FOR CORRECTIVE ACTION

COMPLETED BY PERSON RESPONSIBLE FOR CORRECTIVE ACTION

CORRECTIVE ACTION

DATE	SUBMITTED BY	MANAGEMENT APPROVAL

COMPLETED BY QUALITY ASSURANCE MANAGER

DATE RESPONSE RECEIVED	RESPONSE ACCEPTABLE YES NO

REASON FOR REJECTION

CLCAR VERIFICATION

DATE VERIFIED	SIGNATURE	DOCUMENT USED FOR CLOSEOUT	CLOSED DATE

Quality Assurance Reports

Quality Assurance reports will be prepared the QA Officer and submitted to the Project Manager, the manager of the audited group, and the project sponsor to ensure that QA/QC objectives are met. Items to be included in the reports will include the results of performance and system audits and, where appropriate:

-an assessment of the precision and accuracy

-significant quality control problems and the status of corrective actions

-any changes to the QAPP

APPENDIX B

USEPA METHODA FO80.007

DRAFT

FASP STANDARD OPERATING GUIDELINE

Volatile Organics in Water by Manual Headspace

Method F080.007

Ecology and Environment, Inc.
Field Investigation Team-Zone II
Contract No. 68-01-7347
July 1990

DRAFT

July 1990

DISCLAIMER

This report has been prepared by Ecology and Environment, Inc. and NUS Corp. under U.S. Environmental Protection Agency (EPA) Contract 68-01-7347 and reviewed and approved for public release by the EPA. Mention of commercial products does not constitute endorsement by the U.S. Government. Editing and technical content of this report are the responsibility of Ecology and Environment, Inc., and do not necessarily reflect the views or policies of EPA.

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1 SCOPE, APPLICATION, AND LIMITATIONS

1.1 PURPOSE

This Field Analytical Support Project (FASP) method is proposed for use in determining the concentrations of various volatile organic compounds (VOCs) in aqueous samples using manual headspace techniques and gas chromatographic (GC) analysis.

1.2 LIST OF COMPOUNDS

Table 1-1 lists the compounds that may be determined by this method and approximate method quantitation limits.

1.3 USER RESTRICTIONS

The method should be used only by trained analysts under the supervision of an experienced Chemist.

1.4 ANALYTES IDENTIFIED

The method yields tentative identification and estimated quantitation of the analytes listed in Table 1-1. Report values are on an "as received" basis.

1.5 VERIFICATION

The primary objective of FASP is to provide analytical data in a timely manner for guidance of ongoing work in the field. Identification of specific target compounds and prior knowledge regarding potential matrix interferences are prerequisites to successful use of FASP. FASP is not equivalent to or a replacement for Contract Laboratory Program (CLP) analyses. Verification of data through the CLP, encompassing the range of sample concentrations, is recommended.

1.6 LIMITATIONS

This FASP headspace technique is intended only for sample screening, due to several assumptions used in the method for volatile compounds. For example, it is assumed that the quantity and number of compounds found in the headspace over the liquid sample directly relate to the actual concentrations of compounds in the water sample. This is often a valid assumption, especially in relatively clean or noncomplex matrices. This assumption begins to break down, however, for the complex matrices often found during environmental investigations. Examples of complex matrices are oily wastes, multiphase samples, and many samples containing high levels of one or several compounds that might prevent the usual partitioning between the liquid and gas/vapor phases in the sample bottle. Synergistic (enhancing) or antagonistic

(masking) effects may either artificially increase or decrease the resulting concentrations of specific compounds in the sample.

This method should be used only to generate screening data that can be used to direct ongoing fieldwork, identify samples that need additional analysis, or determine relative concentrations of the FASP target compounds.

1.7 QUALITY CONTROL

This FASP SOG should be used in conjunction with the FASP SOGs for quality control (QC)--General Quality Control (F030.001), Quality Control-Gas Chromatographic Organic Compound Analyses (F030.002), and Laboratory Safety (F020.001).

Table 1-1

FASP TARGET COMPOUND LIST (FTCL) AND
FASP QUANTITATION LIMITS (FQL)*

Volatile Organic Compound	Case Number	Quantitation Limits Water (µg/l)
1,1-Dichloroethene	75-35-4	5.0
Methylene Chloride	75-09-2	5.0
Trans-1,2-Dichloroethene	540-59-0	5.0
1,1,1-Trichloroethene	71-55-6	20.0
Benzene	71-43-2	5.0
Trichloroethene	79-01-6	5.0
Toluene	108-88-3	5.0
Tetrachloroethene	127-18-4	5.0
Chlorobenzene	108-90-7	5.0
Ethylbenzene	100-41-4	5.0
m,p-Xylenes	1330-20-7	5.0
o,Xylene	1330-20-7	5.0

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

2 SUMMARY OF METHOD

The headspace volume must be constant for all samples and standards since the headspace method assumes the concentration of the compound in the headspace over the aqueous standard directly relates to the actual concentration of the compound in the aqueous phase. The standard and sample containers are sealed and allowed to equilibrate to ambient temperature. A sample is withdrawn from the headspace and injected onto a gas chromatograph (GC) equipped with a packed or megabore capillary column. Volatile organic compounds are detected with a Photoionization Detector (PID). Tentative identification and quantitation are based on comparison of the retention times and relative peak area or heights between the standard and sample.

3 INTERFERENCES

The laboratory where volatile analysis is performed should be completely free of solvents. If the method is used in an open area (i.e., behind the hot line at a site) vehicle exhaust fumes and other possible sources of volatile contamination should be removed or kept away. Henry's Law states that the concentration of the volatile analyte in the headspace above the solution is proportional to the concentration of the analyte in solution. The proportionality, known as Henry's Constant, is temperature and pressure dependent. Henry's Law holds for dilute solutions. Dilute solutions can be defined as solutions with less than 1 percent total dissolved species. In practice, the upper concentration limit is defined by the water solubility of the analyte being measured, which is typically on the order of 100 to 1,000 µg/l. The upper concentration limit can be reduced by diluting the samples that contain concentrations higher than the solubility limit. Caution should be exercised especially if free product is present in the original sample.

4 APPARATUS AND MATERIALS

Listed below is one GC option that meets the requirements of this method. Other GC configurations may be substituted if they also meet the method and QC requirements.

4.1 ANALYTICAL SYSTEMS

1. Gas Chromatograph

A portable GC equipped with a PID and all necessary accessories including the appropriate analytical column (packed or megabore) are required. The GC should have an internal data-handling system capable of retention time labeling and providing relative and absolute peak height and/or peak area measurements. If the GC is not equipped with an internal integrator, an external strip-chart recorder, or integrator can be utilized.

1) Column 1 - 4 foot x 1/8 inch teflon column packed with SE-30 (80/100 mesh) or equivalent.

2) Column 2 - 10 meter (0.53mm) CP Sil 5CB megabore column or equivalent.

3) Oven (Optional) - The portable GC may be equipped with an isothermal oven. The isothermal oven will ensure retention time stability and slightly faster analysis times.

4) Detector - Photoionization detector with a 10.6 eV lamp.

5) Gas Supply - The carrier gas should be ultra-zero grade air.

4.2 OTHER LABORATORY EQUIPMENT

1) Micro Syringes

10µl, 25µl, and larger.

2) Sample Syringes

100µl, 250µl, 500µl, and larger gas-tight syringes.

3) Volumetric Flasks

With ground glass stoppers.

4) Leak Detector

Snoop liquid or equivalent for packed column operations or GOW-MAC gas leak detector or equivalent for megabore capillary operations.

5) Chromatographic Data Stamp

Use to record instrument operating conditions.

4.3 REGION-SPECIFIC INSTRUMENT OPTIONS:

Region-specific instrument options are provided in Appendix A of this method.

5 REAGENTS

5.1 SOLVENTS

Methanol, analytical grade.

5.2 REAGENT WATER

Reagent water is defined as water in which an interferent is not observed at the FASP Quantitation Limit (FQL) of the analyte of interest. Reagent water may be generated using a carbon filter bed containing activated carbon (Calgon Corporation, Filtrasorb-300 or equivalent) or a water purification system (Milli-Q Plus with Organex Q cartridge or equivalent), or purchased from commercial supply houses.

5.3 CARRIER GAS

Ultra-zero grade air.

5.4 STOCK STANDARD SOLUTIONS

Stock standard solutions or neat standards should be purchased as manufacturer certified solutions.

5.5 CALIBRATION STANDARDS

Prepare calibration standards at a minimum of three concentration levels for each analyte of interest. This is done through volumetric dilution of the stock standard in water. The lowest concentration standard should be equal to two times the FQL as listed in Table 1-1. The remaining concentration levels should define the approximate working range of the GC: one standard at the upper linear range and the other midway between it and the lowest standard. All standards must be stored at 4°C in Teflon-sealed glass bottles. Calibration solutions must be replaced after 6 months, or sooner if comparison with check standards indicates a problem.

5.6 CHECK STANDARDS

Check standards are calibration standards independently prepared by a Chemist other than the calibration standard preparer.

5.7 INTERNAL STANDARDS (optional)

The internal standard should be a compound that a) is not expected to be found in the samples, b) has a retention time toward the end of the run (where the greatest retention time shifts occur), and c) is in the middle of the expected concentration range.

In this method, an internal standard can be used with the Photovac 105 Series of GCs to recalibrate retention-time windows that change due to ambient temperature variations. If the Photovac is not equipped with an isothermal oven, it is very susceptible to these temperature variations. If a retention-time shift occurs, the operator can change the internal standard retention-time value in the Photovac's library. the GC will then adjust the retention-time windows for all other compounds in the library and match any peaks in the chromatogram with the new retention-time values. This will alleviate the need to inject a new calibration standard every time there is a change in the ambient temperature.

5.8 MATRIX SPIKE SOLUTIONS

Matrix spike solutions should be prepared by dilution of stock standard solutions so that no more than 250 µl of spike solution is required to provide a final sample spike level within FASP QC limits.

6 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

Samples should be collected, handled, preserved, and shipped maintaining a chain-of-custody following current EPA regulations and recommendations in force at the time of sample collection. The sole exception to this rule is the sample volumes required by the laboratory. Aqueous samples may be preserved with 2 drops of hydrochloric acid (added to the VOA vial before filling with the sample), and shipped on ice in 40ml VOA vials with teflon-lined septa.

The use of Chain-of-Custody Records as described in the U.S. EPA "CLP Users Guide" (9240.0-1), December 1988, is required for sample tracking. The maximum holding time for VOCs in water is 14 days from sampling to analysis if preserved, or 7 days from sampling to analysis if unpreserved.

7 CALIBRATION

7.1 INITIAL CALIBRATION

A standard containing each compound of interest must be injected into the GC during calibration to establish a retention time and response factor for quantitation. Some portable GCs will only do a single-point calibration; however, the PID detector is linear over a wide concentration range. Instrument linearity can be documented by bracketing the expected sample concentration range with standards of known concentrations. The analyst should prepare a mid-concentration standard as the calibration standard. After calibration, the low-concentration and high-concentration standards can be run in the same way as samples. If the instrument is linear, the low and high standards will be quantitated correctly. A correct quantitation is within 10 percent of the true value. Inaccurate quantitation can be the result of a nonlinear working range or inaccurate standards.

After an experienced chromatographer has insured that the entire chromatographic system is functioning properly; that is, conditions exist such that resolution, retention times, response reporting, and interpretation of chromatograms are within acceptable quality control limits, the GC may be calibrated (Section 10). Using at least three calibration standards for each compound prepared as described in Section 5.5, initial calibration curves (response versus standard concentration) are generated for each compound (refer to Section 9 for chromatographic procedures).

The percent relative standard deviation (%RSD) based on each compound's three Calibration Factors (CFs, see Section 10) is computed to determine the acceptability (linearity) of the curve. Unless otherwise specified the %RSD must be $\leq$ 25 percent, or the calibration is invalid and must be repeated. Any time the GC system is altered (e.g., new column, change in gas supply, change in oven temperature, etc.) or shut down, a new initial calibration curve must be established.

7.2 CONTINUING CALIBRATION

The GC system is checked on a regular basis through the continuing calibration. The mid-range initial calibration standard is generally the most appropriate choice for continuing calibration validation. This single-point analysis follows the same analytical procedures used in the initial calibration. Instrument response is used to compute the CF which is then compared to the mean initial calibration factor ($\overline{CF}$) and a relative percent difference (RPD, see Section 10) is calculated. Unless otherwise specified, the RPD must be $\leq$ 25 percent for the continuing calibration to be considered valid, or the calibration must be repeated. If an internal standard is not

used, the continuing calibration standard must be analyzed after each sample that shows a retention time shift, and the sample must be reanalyzed. For the Photovac 10A10 GC without an isothermal oven, it is recommended to analyze the continuing calibration standard every 8-10 injections or every 2 hours whichever is more frequent. For the Photovac 10S50 GC with an isothermal oven, the continuing calibration standard does not need to be reanalyzed as frequently. It is recommended to reanalyze the continuing calibration standard every 4 hours if an isothermal oven is being used. After each continuing calibration standard, a blank must be injected to verify the clean baseline.

The continuing calibration is employed in all target analyte sample concentration calculations (Section 10) for the period over which the calibration has been validated.

7.3 FINAL CALIBRATION

A final calibration must be obtained at the end of each batch of sample analyses. The maximum allowable RPD between the mean initial calibration and final calibration factors for each analyte is $\leq$ 50 percent. A final calibration which achieves $\leq$ 25 percent RPD may be used as an ongoing continuing calibration.

8 SAMPLE PREPARATION

Water samples are collected in the usual manner in 40 ml vials with Teflon-coated septums. After collection, the samples should be stored in a refrigerator at 4°C or packed in ice if not analyzed immediately. Upon analysis, the samples and standards should be allowed to equilibrate to ambient temperature.

Samples are prepared by withdrawing exactly 10 ml of water from the vial using a 10 ml syringe. A vent needle is also placed through the septum so that air can enter the vial to replace the water that is removed. The needles are removed and the vial is shaken for at least one minute. The vial is placed on the counter septum-side down (to prevent potential loss of volatiles) for at least one minute to allow for equilibration of the head-space sample. The sample is then ready for analysis.

9 INSTRUMENTAL ANALYSIS

9.1 INSTRUMENT PARAMETERS

Table 9-1 summarizes two examples of acceptable instrument operating conditions for the gas chromatograph. Other instruments, columns, and/or chromatographic conditions may be employed if FASP Quality Control criteria are met.

Table 9-1

EXAMPLE FASP ISOTHERMAL GC OPERATING CONDITIONS

Instrument 1:	Photovac 10S50 GC equipped with a PID with a 10.6 eV lamp.
Column:	10 meter (0.53mm) CP Sil 5CB megabore column
Carrier Gas:	Ultra-zero grade air.
Column Oven:	30°C, 40°C, or 50°C.
GC Analysis Time:	18 min. (compound specific)
Instrument 2:	Photovac 10530 GC equipped with a PID with a 10.6 eV lamp.
Column:	4' x 1/8" SP-2100 packed column.
Carrier Gas:	Ultra-zero grade air.
GC Analysis Time:	18 min. (compound specific)

9.2 CHROMATOGRAMS

Computer reproductions of chromatograms that are attenuated to insure all peaks are on scale over a 100-fold range are acceptable. However, this can be no greater than a 100-fold range. This is to prevent retention time shifts by column or detector overload. Generally, peak response should be > 25 percent and < 100 percent of full-scale deflection.

The following information must be recorded on each chromatogram:

1) Instrument/detector identification;
2) Column packing/coating, length, and I.D.;
3) Oven temperature; (if applicable)

4) Gases and flow rates;
5) Site name;
6) Sample volume;
7) Gain/attenuation;
8) Sample number;
9) Date and time; and
10) GC Operator initials.

9.3 VOC IDENTIFICATION

Qualitative identification of VOCs is based on both the PID selectivity and relative retention time as compared to known standards.

Generally, individual peak relative retention time windows should be $\leq$ 5 percent for packed columns and $\leq$ 2 percent for megabore capillary columns. It may not be possible or practical to separate all VOCs on a single column (i.e., methylene chloride and 1,1-dichloroethene coelute on some columns). In such cases, these VOCs should be denoted as the appropriate combination of VOCs or the sample can be reanalyzed on a confirmation column.

9.4 REGION-SPECIFIC INSTRUMENT PARAMETERS

Region-specific instrument operating parameters are provided in Appendix B of this method.

9.5 ANALYTICAL SEQUENCE

1. Instrument Blank
2. Initial Calibration
3. Syringe Blank
4. Check standard solution and/or performance evaluation sample (if available)
5. Syringe Blank
6. Sample 1
7. Syringe Blank (if the sample is contaminated)
8. Sample 2
9. Syringe Blank (if the sample is contaminated)
10. Sample 3
11. Continue for samples 4-10
12. Continuing Calibration Standard (Photovac 10A10 - after the 10th injection or 2 hours, whichever is more frequent; Photovac 10S50 with isothermal oven - approximately every 4 hours)
13. Syringe Blank
14. Repeat, beginning at 8
15. Final calibration at end of day

10 CALCULATIONS

10.1 INITIAL CALIBRATION

Analyze each calibration standard, adding the internal standard spiking solution (optional) directly to the sample vial containing the standard before sealing. Tabulate the area response for each target analyte against concentration for each compound and calculate calibration factors (CFs) using the following equation.

$$CF = \frac{\text{Area of Peak}}{\text{Mass Injected (in nanograms)}}$$

Using the CF value calculated above, calculate the percent relative standard deviation (%RSD) for each compound at the three concentration levels using the equation below. The percent relative standard deviation must be $\leq$25 percent.

$$\% \text{ RSD} = \frac{SD}{\bar{X}} \times 100$$

where SD, the Standard Deviation, is given by

$$SD = \sqrt{\sum_{i=1}^{N} \frac{(X_i - \bar{X})^2}{N-1}}$$

where: X_i = individual calibration factor (per compound)

$\bar{X}$ = mean of all initial relative response factors (per compound)

N = number of calibration standards.

10.2 CONTINUING CALIBRATION

Sample quantitation is based on analyte CFs calculated from continuing calibrations. Mid-range standards for all initial calibration analytes must be analyzed as continuing calibration standards at specified intervals ($\leq$ 24 hours).

The maximum allowable relative percent difference (RPD) calculated using the equation below for each analyte must be $\leq$ 25 percent.

$$RPD = \frac{|\overline{CF_I} - CF_C|}{\frac{\overline{CF_I} + CF_C}{2}} \times 100$$

where: $\overline{CF_I}$ = Mean CF from the initial calibration for each compound

CF_C = Measured CF from the continuing calibration for the same compound

10.3 FINAL CALIBRATION

The final calibration is obtained at the end of any batch of samples anlayzed.

The maximum allowable RPD between the mean initial calibration and final calibration factors for each analyte must be $\leq$ 50 percent. A final calibration that achieves $\leq$ 25 percent RPD may be used as an ongoing continuing calibration.

$$RPD = \frac{|\overline{CF_I} - CF_F|}{\frac{\overline{CF_I} + CF_F}{2}} \times 100$$

where: $\overline{CF_I}$ = Mean initial CF for each compound

CF_F = Final CF for the same compound

10.4 SAMPLE QUANTITATION

Calculate the concentration in the sample using the following equations. The relative response can be measured by automated relative peak height or relative peak area measurements from an integrator. The Photovac 10S50 GC will automatically calculate the sample concentration based on the standard listed in the library.

The CF value from the continuing calibration analysis is used to calculate the concentration in the sample. Use the CF as determined in Section 10.1 and the equations below. Corrections must be made for changes in volumes and gain/attenuation between the samples and standards.

$$\text{Concentration } (\mu g/l) = \frac{(A_x)(1000)}{(V)\ \ (CF)}$$

where: A_x = area of the peak for the compound to be measured

V = volume of sample in vial (ml)

CF = the calibration factor for the analyte to be measured

Report results in micrograms per liter (µg/l) <u>without correction</u> for blank or spike recovery.

When identification is questionable, the Chemist may calculate and report a maximum possible concentration (flagged as < the numerical value). This allows the data user to determine if additional (e.g., CLP RAS or SAS analysis) work is required, or if the reported concentration is below action levels and project objectives and DQOs have been met, thus foregoing further analysis.

Coeluted analytes should be quantitated and reported as the combination of the unseparated volatile organic target analytes or reanalyzed on a confirmation column.

Similarly, when sample concentration exceeds the linear range, the analyst may report a probable minimum level (flagged as > the numerical value). This allows the data user to determine if additional (e.g., CLP analyses) work is required, or if the reported concentration is above action levels and project objectives and DQOs have been met, to forego further analysis.

Quality Control (QC) criteria (as described in the FASP QC SOGs) must be met for all analyses. Advisory limits for spike %R and duplicate RPD are presented in Table 10-1.

Table 10-1

FASP MATRIX SPIKE PERCENT RECOVERY (%R) AND DUPLICATE RELATIVE PERCENT DIFFERENCE (RPD) ADVISORY LIMITS
Method F080.007 (Volatile Organics in Water by Manual Headspace)

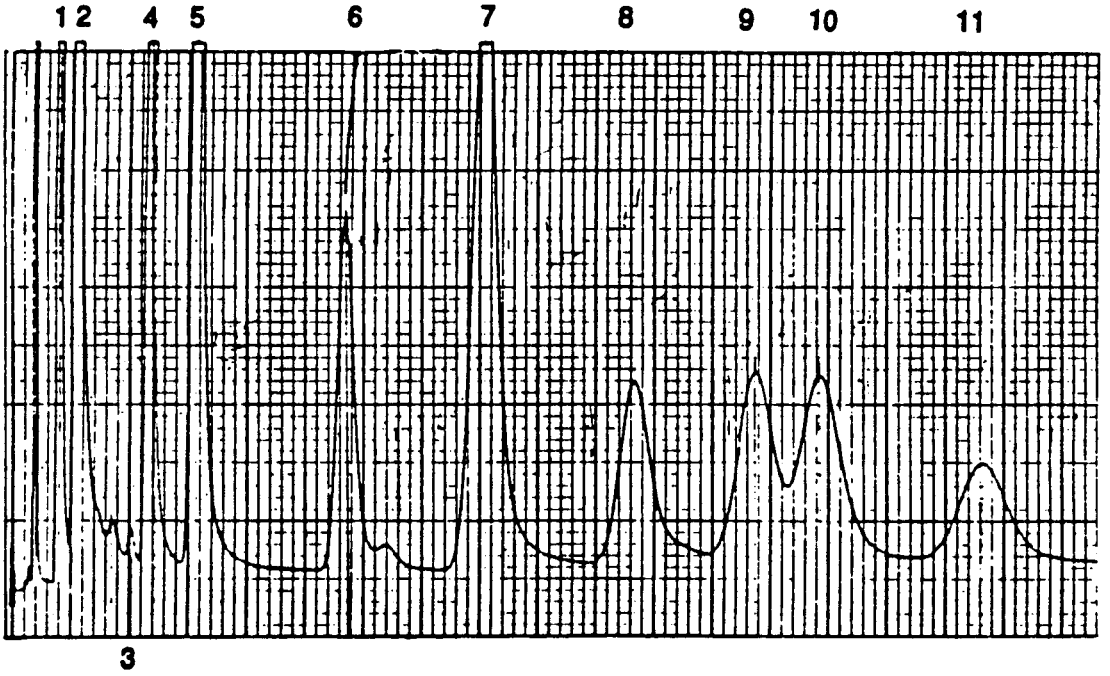
Analyte	FASP Advisory Quality Control Limits	
	Spike %R	Duplicate RPD
1,1-Dichloroethene	30 - 200%	± 100%
trans-1,2-Dichloroethene	30 - 200%	± 100%
Chloroform	30 - 200%	± 100%
Benzene	30 - 200%	± 100%
Trichloroethene	30 - 200%	± 100%
Toluene	30 - 200%	± 100%
Tetrachloroethene	30 - 200%	± 100%
Dibromochloromethane	30 - 200%	± 100%
Chlorobenzene	30 - 200%	± 100%
Ethylbenzene	30 - 200%	± 100%
m,p-Xylenes	30 - 200%	± 100%
o-Xylene	30 - 200%	± 100%

11 METHOD PERFORMANCE

The following is an example of a GC chromatogram for several FTCL analytes.

11.1 GAS CHROMATOGRAM

1. 1,1-DCE
2. Trans 1,2-DCE
3. 1,1,1-Trichloroethylene
4. Benzene
5. Trichloroethene
6. Toluene
7. Tetrachloroethene
8. Chlorobenzene
9. Ethyl Benzene
10. M-Xylene
11. O-Xylene



Instrument: Photovac 10S30

Column: 4' x 1/8" SP-2100

Gas: Ultra-zero grade air at a flow rate of 15 ml/min

Detector: Photoionization Detector (PID) with a 10.6 eV lamp

11.2 METHOD F080.007 EXAMPLES OF SAMPLE QA/QC RESULTS

Spike and duplicate sample results are presented in Tables 11-1 and 11-2 as examples of FASP Method F080.007 empirical data.

Table 11-1

FASP METHOD F080.007
MATRIX SPIKE % RECOVERY
VOLATILE ORGANIC COMPOUNDS IN WATER
(µg/l)

(To be completed as data becomes available.)

Table 11-2

FASP METHOD F080.007
DUPLICATE SAMPLE ANALYSIS
RELATIVE PERCENT DIFFERENCE
VOLATILE ORGANIC COMPOUNDS IN WATER
(µg/l)

(To be completed as data becomes available.)

12 DELIVERABLES

12.1 VERBAL SUMMARIES OF SAMPLE RESULTS

A verbal summary of sample results should be available within 24 hours of sample analysis by the laboratory, or a facsimile type hard copy via telecommunication may be substituted. If computer compatibility can be established, a modem link may be used to transfer data from the laboratory to field personnel.

12.2 FINAL FASP REPORT

A final FASP report should be generated for each project including:

1) A reference to the FASP method used and a note addressing any changes to the method.

2) A hard copy of all data and summary sheets documenting required QA/QC data (available within 14 days of completion of all FASP analyses for a project).

3) A data summary of all reportable results with units, µg/l, clearly specified.

4) All calculations using standard good measurement practices in the use of significant figures. Rounding off will be allowed only for final deliverable values.

5) All sample results reported using two significant figures. QC data will be reported in three significant figures.

6) A statement by analyte, that initial, continuing, and final calibration CFs, %RSDs, and RPDs met FASP quality control criteria.

7) A summary table of the blank, matrix spike, and duplicate results for each target analyte must be provided.

8) A summary of FQLs for each target analyte is also a final deliverable requirement.

9) A comparison of inter-laboratory split sample results, may be submitted as an addendum to the final FASP report.

Again, all results must be annotated (followed by the flag, F) by the laboratory indicating to future data users that FASP techniques were employed in sample analysis.

12.3 EXAMPLE FINAL REPORT

An example of a standard reporting format is provided in Appendix C of this method.

13 SAMPLE AND DATA STORAGE

13.1 DISPOSAL OF SAMPLES

Samples should be disposed of in accordance with established Federal, State, and local regulations and policies after a minimum holding period of 14 days after receipt by the laboratory. Sample extracts may be disposed of 30 days after final FASP report submission.

13.2 RAW AND SUMMARY DATA STORAGE

The laboratory must maintain a hard copy or computer disk storage of all raw (including instrument printouts, and logbooks) and summary data associated with an analytical case for a minimum of 6 months after receipt of the hard copy report by the data user.

13.3 PERMANENT DATA STORAGE

After the 6-month period has elapsed, the laboratory should place all records into permanent storage (TDD/PAN files), including laboratory notebooks.

SAMPLING AND ANALYSIS PLAN

FIELD SAMPLING PLAN
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

AUGUST 1992
REVISED APRIL 1993
FINAL AUGUST 1993

BLASLAND & BOUCK ENGINEERS, P.C.
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CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

SAMPLING AND ANALYSIS PLAN

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

The Sampling and Analysis Plan (SAP) is composed of two documents: the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP). This volume presents the FSP. Volume 1 presents the QAPP. These two documents are integrated and as such are cross-referenced where applicable to eliminate redundancy. A complete discussion of the scope-of-work is presented in the Remedial Investigation/Feasibility Study (RI/FS) work plan.

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APPENDICES

SECTION 1 - INTRODUCTION

1.1 General

The Field Sampling Plan (FSP) contains detailed field investigation procedures including sampling locations and analyses, the sampling designation system, sampling and field procedures, and handling and documentation procedures. This document contains the necessary information from the Remedial Investigation/Feasibility Study (RI/FS) Work Plan and the Quality Assurance Project Plan (QAPP), the first volume of the SAP, such that the field staff can implement the RI work tasks.

1.2 Objectives

The overall objectives of the RI/FS at the Chicago Pneumatic Site are to:

1. Characterize and delineate potential source areas to quantify waste and contaminated media (i.e., soil, sediment, surface and ground water, and air);
2. Determine the risk, if any, to human health and environment from the identified chemical constituents present in the environmental media;
3. Determine whether remedial action is appropriate and feasible at any identified source area and for ground water. Evaluation of remedial alternatives will include identification of treatability studies, as appropriate; and
4. Identify and develop a detailed analysis of potential remedial alternatives for those areas in which remedial action is determined appropriate.

1.3 Overview of RI Field Investigation Work Tasks

The RI field investigation will address the objectives of the RI/FS and the data requirements dictated by the conceptual model. The RI field investigation will consist of:

- A Site Reconnaissance
- Characterization of Areas of Concern
- Background Investigation
- Hydrogeologic Characterization

1.3.1 Site Reconnaissance

The site reconnaissance was performed at the onset of the Work Plan development in order to observe current site conditions and evaluate locations for sampling. A summary of the Site Reconnaissance observations are included in the RI/FS Work Plan.

1.3.2 Characterization of Areas of Concern

The RI field investigation is designed to characterize four areas of concern and as well as background/off-site areas. The areas and their associated migration pathways to be investigated in the RI include:

1. The former debris landfill;
2. The former oil/water separation ponds and East Lot;
3. The former chip chute area and drainage ditches;
4. The foundry sand (West Parking Lot and Western Creek); and
5. The clay discharge pipe and off-site drainage ditch.

Test pits and/or soil borings will be advanced and soil samples obtained in each area investigated. The majority of the soil borings will be advanced with a drill rig and hollow-stem augers and sampled with standard split-spoons. Soil will be continuously sampled and screened with a MicroTip Photoionization Detector (PID) or equivalent to provide a gross evaluation of total volatile organic vapor concentrations. Some soil samples from the former chip chute area will be obtained with the Geoprobe system. Soil samples from the Geoprobe boreholes will be obtained from selected intervals. In general, soil samples will be obtained at

a depth of approximately 5 feet and again at the top of till. A summary of the scope-of-work to be performed in each area is presented in Tables 1-1 through 1-7, and discussed in detail in Section 5 of the work plan.

1.3.3 Background Investigation

The primary purpose of collecting background samples is to provide a means of evaluating concentrations of constituents observed in environmental media on site. Soil samples obtained from the wooded marsh south of the site fence line will be used to provide background levels of constituents, primarily the inorganics, observed on site. A mobile, tripod-mounted drilling apparatus will be used to obtain the samples from this area since access is limited due to the wooded marsh. Soil samples will be selected that are similar in composition to overburden soil described on site. The scope-of-work to be performed is presented in Table 1-6.

1.3.4 Hydrogeologic Characterization

The hydrogeologic characterization activities will provide data that will be used to evaluate migration of constituents from potential areas of concern. The hydrogeologic characterization will include both chemical and physical characterization of the ground-water system. Ground-water samples will be obtained from existing and newly installed monitoring wells, as well as from Geoprobe boreholes. The scope-of-work to be performed is presented in Table 1-7.

FSP
TABLE 1-1
SCOPE-OF-WORK
DEBRIS LANDFILL

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be completed in the debris landfill area include the following:

- Excavation of test pits to identify waste and delineate the horizontal extent of the debris landfill;
- Advancement of two soil borings within the debris landfill area, two borings at the downgradient perimeter of, two borings at the upgradient perimeter of, and one boring between the debris landfill and the separation ponds to delineate both horizontal and vertical extent;
- Collection and analytical characterization of soil, waste, and till samples; and
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.4).

Samples will be selected for physical and chemical characterization in the analytical laboratory. A summary of the analytical scope-of-work to be completed is presented in Table 12. The analytical sample selection in the debris landfill area includes the following:

- Two samples of the fill/soil/waste within the debris landfill area will be collected during test pit/trench excavation for physical and chemical characterization. Each sample will be analyzed for full TCL/TAL parameters, and RCRA characterization (ignitability, corrosivity, reactivity, and TCLP). The sample selection will be based on visual indication of waste such that it represents a worst case evaluation of the material.
- Two samples of the fill/soil material within the debris landfill area will be collected from the samples obtained during continuous sampling in the two borings advanced within the debris landfill area. The samples will be collected from beneath the soil/till interface. The samples will be analyzed for full TCL/TAL parameters.
- One soil sample will be collected from the soil/till interface from one of the two downgradient perimeter borings for chemical characterization. One till sample will be collected from one of the two downgradient perimeter borings if visual indications of waste/oil are observed and/or if a till sample has a PID reading above 0.00 ppm or background. The sample will be analyzed for full TCL/TAL parameters.
- Two soil samples will be collected; one from the two upgradient soil borings, and one from the sidegradient boring for chemical characterization. The samples will be collected from above the overburden till interface and analyzed for full TCL/TAL parameters.

FSP
TABLE 1-1 (Cont.)
SCOPE-OF-WORK
DEBRIS LANDFILL

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

- Two samples from within the debris landfill area will be collected from the soil borings or test pits/trenches which were not selected for chemical characterization and do not visually contain a significant amount of oil. These samples will be submitted to the laboratory for physical characterization. Two samples will be selected from different boring or trench locations and from different depth intervals to provide a more representative evaluation of the material. Physical analyses will include TOC, pH, percent moisture, porosity, and PSD.

FSP
TABLE 1-2
SCOPE-OF-WORK
SEPARATION PONDS AND EAST LOT

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be completed in the area of the separation ponds include the following:

- Excavation of test pits to identify waste and delineate the horizontal extent of these separation ponds, and to identify whether underground piping remains in the subsurface;

- Advancement of three soil borings within the separation ponds, one borings at the downgradient perimeter, one boring at the upgradient perimeter, and one boring at the eastern perimeter to delineate both horizontal and vertical extent;

- Advancement of three soil borings east of the drainage ditches in the East Lot, two in the southeast near well MW-5, and one in the area northeast of the drainage ditch;

- Collection and analytical characterization of soil, waste, and till samples;

- Collection and analytical characterization of two sediment samples at depth from one sampling location within the southern drainage ditch located downgradient of the separation ponds; and

- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.5).

Samples will be selected for physical and chemical characterization in the analytical laboratory in much the same manner as for the debris landfill area. A summary of the analytical scope-of-work to be completed is presented in Table 13. The analytical sample selection in the separation ponds area includes the following:

- Two samples of the fill/soil/waste within the separation pond area will be collected during test pit/trench excavation for physical and chemical characterization. Each sample will be analyzed for full TCL/TAL parameters and RCRA characterization (ignitability, corrosivity, reactivity, and TCLP). The sample selection will be based on either the highest visual indication of waste such that it represents a worst case evaluation of the material.

- Two samples of the fill/soil material within the separation ponds area will be collected from the samples obtained during continuous sampling in the two borings advanced within the area of the first and third separation ponds. The samples will be collected from the soil/till interface. The samples will be analyzed for full TCL/TAL parameters.

- Two soil samples will be collected from the soil/till interface, one from each of the two downgradient perimeter borings for chemical characterization. The sample will be analyzed for full TCL/TAL parameters. One till sample may be collected from one of the two downgradient perimeter borings if visual indications of waste/oil are observed and/or if a till sample has a PID reading above 0.00 ppm.

FSP
TABLE 1-2(Cont.)
SCOPE-OF-WORK
SEPARATION PONDS AND EAST LOT

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

- Two soil samples will be collected, one from the upgradient soil boring, and one from the eastern sidegradient boring for chemical characterization. The samples will be collected from above the overburden/till interface and analyzed for full TCL/TAL parameters.

- Two samples from within the separation ponds area will be collected from the soil borings or test pits/trenches which were not selected for chemical characterization and do not contain a significant amount of oil. These samples will be submitted to the laboratory for physical characterization. The two samples will be selected from different boring locations, or from the test pits, and from different depth intervals to provide a more representative elevation of the material. Physical analysis will include total organic carbon (TOC), pH, percent moisture, porosity, and particle size distribution (PSD).

- Three soil samples will be collected, one from each of the three soil borings advanced near well MW-5 and in the area northeast of the drainage ditch. Samples will be selected based on visual indications of waste or oil stained soil and/or from the interval with the highest PID reading. The samples will be selected such that they represent worst case evaluations. If visual and PID readings do not provide guidance for sample selection, one soil sample will be selected from above the water table and one will be selected from the overburden/till interface. Analyses will include chemical characterization of full TCL/TAL parameters.

- Two sediment samples from the southern drainage ditch will be collected and analyzed for full TCL/TAL chemical parameters and TOC.

FSP
TABLE 1-3
SCOPE-OF-WORK
FORMER CHIP CHUTE AREA AND DRAINAGE DITCHES

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be performed in association with the former chip chute area and drainage ditches include the following:

- Excavation (if physically feasible) of up to two test pits/trenches to determine whether underground piping between the former holding tank and the separation ponds is present in the subsurface.
- Advancement of three soil borings within the area of the former steel holding tank and former chip chute bin;
- Advancement of four or more Geoprobe borings to the top of till and on-site chemical characterization of one soil sample per boring;
- Collection and analytical characterization of four sediment samples at depth from two sampling locations within the drainage ditches;
- Collection of three soil or waste samples from the subsurface borings; and
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.4).

Selected samples will undergo physical and chemical characterization in the analytical laboratory. A summary of the analytical scope-of-work to be completed is presented in Table 14. The analytical sample selection in the chip chute area and drainage ditches includes the following:

- One overburden sample from the borings advanced within the former chip chute area will be obtained from the interval showing visual indication of waste, black/oil staining, and/or relatively elevated PID readings. Analyses will include chemical characterization of full TCL/TAL parameters;
- Two overburden samples will be obtained from the chip chute area borings at the interval directly above the overburden/till interface. Analyses will include chemical characterization of full TCL/TAL parameters;
- Four soil samples will be obtained from directly above the overburden/till interface; one from each Geoprobe location along the loading dock and downgradient of the oil skimmer pond. Analyses will include chemical characterization in the on-site mobile laboratory for the indicator compounds TCE and DCE; and
- Four sediment sample from the drainage ditch will be analyzed for full TCL/TAL chemical parameters and TOC.

FSP
TABLE 1-4
SCOPE-OF-WORK
FOUNDRY SAND - WEST PARKING LOT

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be performed in association with the foundry sand fill beneath the west parking lot include the following:

- Advancement of two soil borings;
- Collection of two foundry sand samples for chemical characterization;
- Collection of one foundry sand sample for physical characterization;
- Collection and analytical characterization of four sediment samples obtained at depth from two sampling locations within the western unnamed creek;
- Collection and analytical characterization of up to six surface soil samples from the southwest corner area of the manufacturing building; and
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.5).

The primary constituents of concern associated with the foundry sand are lead, zinc, and the phenol binders which were used in the sand molds. The foundry sand samples will be screened for total volatile organic vapors using a PID. A summary of the analytical scope-of-work to be completed is presented in Table 15. The analytical sample selection includes the following:

- Two representative foundry sand samples, one from each boring, will be obtained based on visual observation of the material. Analyses will include chemical characterization of TAL parameters and total phenol. If volatile organic vapors are detected with the PID, the sample will also be analyzed for TCL parameters. A PID reading above background concentrations or 0.00 ppm in headspace will be considered a detection of volatile organic vapors.
- One representative foundry sand sample from one of the two borings will be obtained. Analyses will include physical characterization of TOC, PSD, pH, percent moisture, and porosity.
- Four sediment samples will be obtained at depth from two sampling points within the northwestern unnamed creek to provide data on potential off-site chemical transport. Analyses will include chemical characterization of full TCL/TAL parameters and TOC.
- Six surface soil samples will be obtained to provide data on the potential presence of waste cyanide salts that may have been disposed of in this area. Analyses will include chemical characterization of cyanide (total and, if detected, amenable).

FSP
TABLE 1-5
SCOPE-OF-WORK
CLAY PIPE AND OFF-SITE DRAINAGE DITCHES

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be performed in association with the clay drainage pipe and off-site drainage ditches include the following:

- Sampling and analytical characterization of one sample of discharge water from the clay pipe;
- Sampling and analytical characterization of six sediment samples from three sampling locations in the off-site drainage ditch north of Bleecker Street; and
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.5).

A summary of the analytical scope-of-work to be completed is presented in Table 16. The analytical sample selection includes the following:

- One sample of the discharge water from the clay drainage pipe will be collected. Analytical characterization will include the TCL/TAL chemical parameters, TOC, and hardness.
- Up to six sediment and surface water samples will be obtained from the drainage ditch north of Bleecker Street. Analytical characterization will include the TCL/TAL chemical parameters and TOC. Based on the detected compounds in surface water and sediment from previous sampling data, the constituents of concern here consist of the VOCs, primarily TCE and DCE.

FSP
TABLE 1-6
SCOPE-OF-WORK
BACKGROUND INVESTIGAITON

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be completed in evaluation of background and off-site conditions include the following:

- Installation of and soil sampling at background monitoring well MW-14, located in the southeast lot;
- Collection and analytical characterization of two sediment samples from one sampling location within the unnamed creek;
- Collection and analytical characterization of three soil samples obtained from the wooded marsh area south of the fence line; and
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.4).

A summary of the analytical scope-of-work to be completed is presented in Table 17.

Background sample selection includes:

- One representative overburden soil sample obtained from background monitoring well MW-14. The soil sample will be obtained from the unsaturated overburden, approximately two feet above the water table. Analyses will include chemical characterization of full TCL/TAL parameters.
- Three representative overburden background samples obtained from shallow soil borings advanced in the wooded marsh. Analyses will include chemical characterization of one sample for full TCL/TAL parameters and two samples for TAL parameters.
- Two background sediment samples obtained at depth from the unnamed creek in the wooded marsh. Analyses will include chemical characterization of full TCL/TAL parameters and TOC.
- Ground-water and surface water sampling and analytical characterization as specified in the Hydrogeologic Characterization activities (Section 5.3.4).

FSP
TABLE 1-7
SCOPE-OF-WORK
HYDROGEOLOGIC CHARACTERIZATION

CHICAGO PNEUMATIC TOOL COMPANY
FRANKFORT, NEW YORK

The RI activities to be performed in association with the Hydrogeologic Investigation include the following:

1. Installation of two shallow monitoring wells, MW-13 and MW-14;
2. Installation of one shallow replacement monitoring well, MW-6R;
3. Installation of five deep monitoring wells, MW-6D, MW-7D, MW-9D, MW-10D, MW-13D;
4. Decommissioning of two damaged monitoring wells, MW-2 and MW-6;
5. Installation of a minimum of 14 Geoprobe boreholes;
6. Potential installation of one monitoring well (MW-15) based on results of the Geoprobe activities (contingent);
7. Ground-water sampling and chemical and physical characterization of all monitoring wells (17) and Geoprobe boreholes, including in-field chemical analysis;
8. Collection and chemical characterization of one soil sample from well MW-13. Additional soil samples may be obtained from the geoprobe boreholes for analysis in the mobile laboratory;
9. Surface water sampling and chemical characterization at eleven selected drainage ditch locations (including off-site and background locations);
10. In-situ hydraulic conductivity testing (slug testing) at the newly installed wells and selected existing wells;
11. Performance of a site survey at all wells, sampling locations, and other site features to determine elevation;
12. Evaluation of the New York State Department of Health (NYSDOH) database of residential wells in the area surrounding the site; and
13. Evaluation of water quality data obtained from the three SPDES sampling points.

SECTION 2 - SAMPLING LOCATIONS AND ANALYSES

The locations for soil sampling from test pits, soil borings, ground-water sampling from monitoring wells and Geoprobe boreholes, and surface water and sediment sampling from the drainage ditch and unnamed creek are provided on Figures 2A and 2B. The sampling matrices, laboratory and field analyses, and QA requirements for each area being investigated are provided in the QAPP. Summaries of QA requirements for each area of concern can be found in the work plan on Tables 1-1 through 1-7 designated by the following investigation names:

- The former debris landfill;
- The former oil/water separation ponds (separation ponds) and East Lot;
- The former chip chute area and drainage ditches;
- The foundry sand fill (west parking lot) and western creek;
- The clay discharge pipe and off-site drainage ditch;
- Background Investigation; and
- Hydrogeologic Investigation.

APPENDIX O

SURFACE SOIL SAMPLING PROCEDURES

I. Introduction

This appendix presents procedures by which surface soil samples will be collected at the site.

II. Materials

- Health and safety equipment (as required by the Health and Safety Plan
- Decontamination equipment
- Aluminum or stainless steel tray
- Dedicated stainless steel scoops
- Measuring device
- Appropriate sample containers and forms
- Coolers with ice
- Field book
- Shovel
- Photoionization detector (PID)

III. Procedures

The following procedures will be employed to collect surface soil samples:

1. Put on personal protective equipment (as required by the health and Safety Plan.

2. Identify sample locations form sample location plan and note locations in field notebook.

3. If the sample location is a vegetated area, the vegetation should be removed prior to sample collection.

4. Samples will be collected by carefully cutting into the soil to the desired depth with a precleaned stainless steel scoop; cut a large enough area to obtain the required sample volume.

5. Obtain one surface soil sample and place it into an 8-ounce glass jar and screen the headspace with a PID. Record PID reading in field book. Visually characterize the soil and classify according to USCS soil classification procedures.

6. Obtain samples in appropriate containers.

7. Label containers and place in a transportation cooler.

8. At one in every 20 sample locations, a rinse blank and a duplicate sample will be obtained. Obtain duplicate sample by dividing the sample into two sets of containers.

9. Handle, pack, and ship the samples with appropriate chain-of-custody procedures.

10. Record all other appropriate information in the field notebook.

IV. Field Cleaning Procedures

A. Materials

- Health and safety equipment (as required by the Health and Safety Plan)
- Laboratory-supplied analyte-free water or equivalent
- Non-phosphate soap (Alconox[R] or equivalent)
- Tap water
- Appropriate decontamination solvent
- Rinse collection plastic containers
- Brushes
- Aluminum foil
- Garbage bags
- Spray bottles for solvent
- Ziploc[R] type bags

B. Procedures

1. Follow health and safety procedures specified in the Health and Safety Plan.

2. Decontamination of reusable sampling equipment (e.g., trays, spatula, scoops, and core driver) will follow the decontamination procedures presented below:

   a. Alconox[r] and tap water rinse

   b. Tap water rinse

   c. Solvent spray rinse

   d. Analyte-free water rinse

   e. Allow to air dry and wrap in aluminum foil

3. Decontamination will be conducted in plastic containers that will be transported to each sampling location (or group of locations). These containers will also be used to collect all decontamination rinsate that will be transferred to an on-site container.

FIGURE 2A

POWER PLANT

FOUNDRY

W.T.

SW2

OIL TANK

STORAGE TANKS

MW-8

MW-9D

SD3

MW-9

DLSB-1

DLSB-2

DLSB-3

DLSB-4

DLSB-5

DLSB-6

DLSB-7

MW-1

SPSB-1

SPSB-2

SPSB-3

SPSB-4

SPSB-5

SPSB-6

SPSB-7

SEPARATION PONDS

FENCE

DEBRIS LANDFILL

MW-10

MW-10D

Y
8/13/93 DMW 60
3070821R\30708BM4

LEGEND

- EXISTING MONITORING WELL
- TEST PIT (1989)
- PROPOSED SOIL BORING
- PROPOSED MONITORING WELL
- PROPOSED SURFACE WATER SAMPLING LOCATION
- PROPOSED SEDIMENT SAMPLING LOCATION
- TEST PIT AREA (1993)

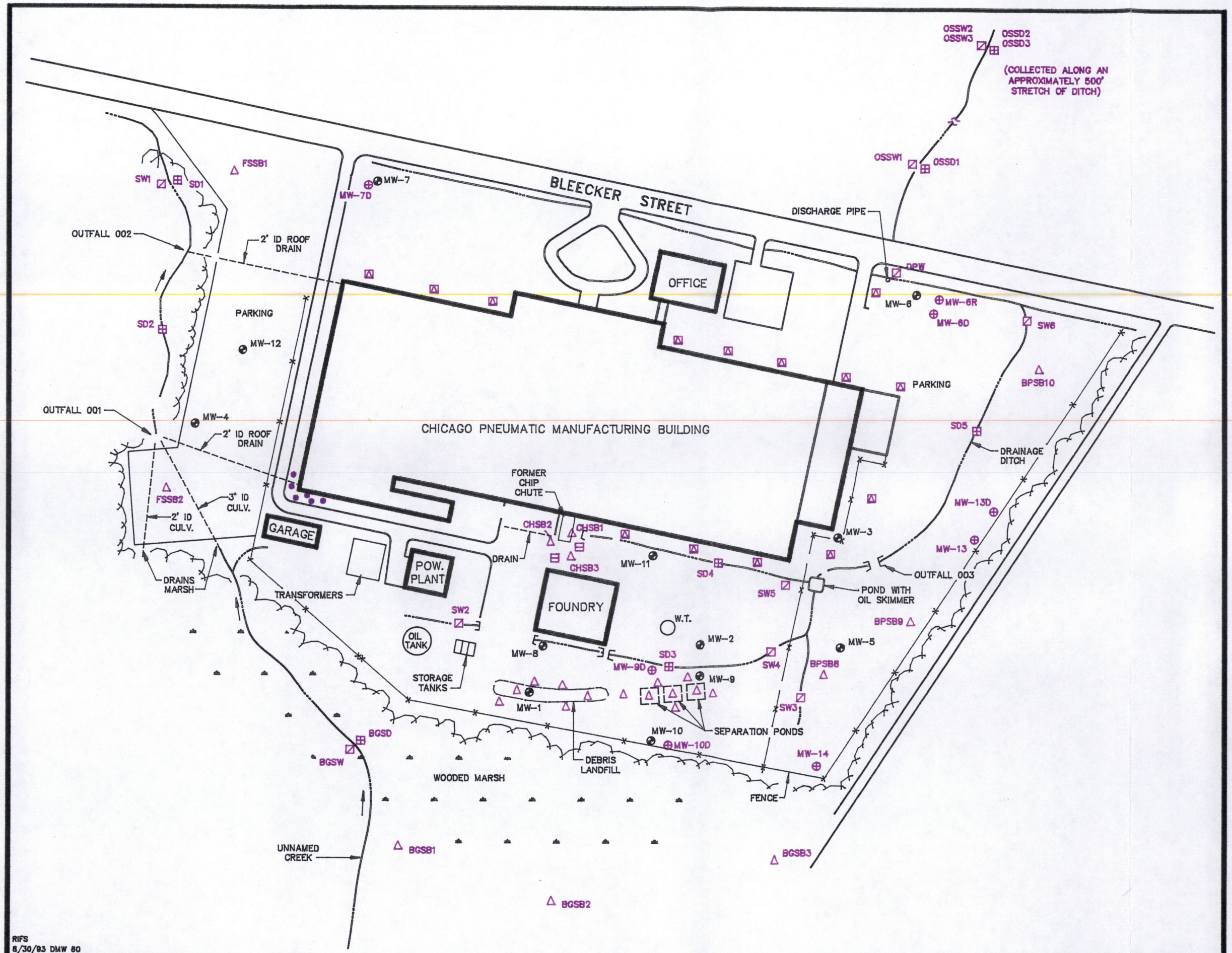
CHICAGO PNEUMATIC TOOL CO.
FRANKFORT, NEW YORK

PROPOSED RI/FS SAMPLING LOCATIONS SOUTH FIELD

SCALE:
50' 0 50'

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

FIGURE 2B



RIFS
8/30/93 DMW 80
3070821R\3070BBM3

LEGEND

- EXISTING MONITORING WELL
- PROPOSED SOIL BORING
- PROPOSED MONITORING WELL
- PROPOSED GEOPROBE SAMPLING LOCATION
- PROPOSED SEDIMENT SAMPLING LOCATION
- PROPOSED SURFACE WATER SAMPLING LOCATION
- PROPOSED TEST PIT
- PROPOSED SURFACE SOIL SAMPLING LOCATION

NOTE: ALL LOCATIONS ARE APPROXIMATE AND WILL BE CONFIRMED IN THE FIELD.

CHICAGO PNEUMATIC TOOL CO.
FRANKFORT, NEW YORK

PROPOSED RI/FS SAMPLING LOCATIONS

SCALE:
200' 0 200'

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

SECTION 3 - SAMPLE DESIGNATION SYSTEM

The sample designation system is a numbering system to provide all samples obtained with a unique number. The borings and associated soil samples will be identified with a name specifically relating it to the area of concern from which it was obtained, media, and depth of collection. When a soil sample is selected for analysis from a particular boring, the depth interval from which it was collected will also be added to the identification name. The general identification names to be assigned to the soil borings and samples from each area will include the first letters of that area, for example: Debris Landfill Soil Boring 1 : DLSB-1(depth of collection).

The same naming logic will apply to each location. The general names of the sampling locations are shown on Figures 2A and 2B. The sample designation names for the Geoprobe borings advanced as part of the hydrogeologic characterization will be HGP-#(depth). When a water sample is obtained from a Geoprobe borehole the designation name will include a "GW" to indicate ground water has been collected, for example, GWHGP-#. Ground-water samples obtained from the monitoring wells will simply have the monitoring well designation. Sediment samples will have the designation SD-#, and surface water samples will have the designation SW-#.

When a sample is designated as a duplicate it will have a "D" following the boring or well number, for example: HGP-#D(2-4) and DLSB-1D(4-6). Trip blanks and equipment blanks will be identified by the word "trip" and "Equip," respectively, followed by the date, for example, Trip9-2-92 and Equip9-2-92.

SECTION 4 - SAMPLING AND FIELD PROCEDURES

For the field investigations of the RI, several standard field procedures will be performed. They include:

1. Soil Boring Installation and Test Pit Excavation;
2. Ground-Water Monitoring Well Installation;
3. Ground-Water Sampling;
4. Surface Water Sampling;
5. Sediment Sampling; and
6. Surface Soil Sampling.

This section describes these procedures and references the appropriate detailed procedures in the Appendices, including ancillary procedures for equipment cleaning, field screening, water level measurement, well development, in-situ hydraulic conductivity tests, field measurements, and calibration and maintenance of field instruments.

4.1 Soil Boring Installation and Test Pit Excavation

The majority of the soil borings advanced in the areas of concern will be drilled with a truck-mount soil boring drill rig using the hollow stem auger method. The hollow stem auger method does not require the use of drilling fluids or additives. The Geoprobe boreholes will be located around the perimeter of the manufacturing building. The Geoprobe boreholes will be advanced with a drilling system that operates using probe rods which are driven into the soil by a hydraulic cylinder/percussion hammer unit mounted in the back of a 4-wheel drive pickup truck. The soil borings will be advanced both through the overburden and into the underlying till. The Geoprobe

boreholes will be advanced to the top of the overburden/till interface. The detailed procedures for drilling soil borings and Geoprobe boreholes are provided in Appendix A. Materials brought to the surface during the drilling of the soil borings will be handled consistent with DEC guidance TAGM 4032. TAGM 4032 indicates that soil cuttings generated from a borehole that is not to be utilized for a monitoring well completion can be used to backfill the boreholes. All soil cuttings generated from drilling a boring will be mixed with the grout and filled back into the borehole. Those borings that extend into till will be backfilled with a cement grout to the soil/till interface, and soil cuttings will be used as backfill with a grout mixture to the surface. This backfilling procedure will eliminate potential vertical movement of constituents into the till. The top of the borings will be covered with the cement/bentonite grout.

The soil cuttings generated during drilling of monitoring wells will be temporarily placed in the debris landfill or the buried ponds area. The cuttings will be covered with six inches of compacted soil, as indicated in TAGM 4032.

Test pit excavation will be conducted as described in Appendix A. While drilling the soil borings, undisturbed soil samples will be obtained from the split-spoon sampler or Geoprobe tube sampler as described in Appendix A. Soil samples will be obtained continuously from the soil borings and at selected intervals from the Geoprobe boreholes for a profile of the subsurface. Representative portions of all split-spoon soil samples will be retained in appropriate containers for 1) screening with the PID, 2) a visual classification by the supervising geologist, 3) physical characterization, and 4) laboratory analyses. All soil samples sent for laboratory analysis will be designated by the code system described in Section 3. Any soil or waste samples will be handled, packaged, and shipped as described in Appendix M using the chain-of-custody procedures provided in Appendix N. The procedures for collecting and screening the soil samples with the PID are provided in Appendix E.

The procedures for calibrating and maintaining the PID are provided in Appendix F. The procedures for collecting and examining soil samples for visual classification are provided in Appendix A. The procedures for collecting soil samples for grain size and laboratory permeameter analyses are provided in Appendix A. The procedures for cleaning the equipment between each soil sample are provided in Appendix L.

4.2 Monitoring Well Installation

A total of eight new monitoring wells will be installed. The locations of the eight monitoring wells are listed below:

1. MW-6R will be installed as a shallow monitoring well. MW-6R will be located approximately 15 feet west of existing monitoring well MW-6. Well MW-6R will replace MW-6 as the downgradient eastern perimeter shallow monitoring well.
2. MW-6D will be installed as a deep monitoring well. MW-6D will be located adjacent to MW-6R as a downgradient eastern perimeter deep monitoring well.
3. MW-7D will be installed as a deep monitoring well. MW-7D will be located adjacent to MW-7 as a downgradient western perimeter deep monitoring well.
4. MW-9D will be installed as a deep monitoring well. MW-9D will be located near existing well MW-9, downgradient of the debris landfill area and separation ponds.
5. MW-10D will be installed as a deep monitoring well. MW-10D will be located hydraulically upgradient of the debris landfill and separation ponds.
6. MW-13 will be installed as a shallow monitoring well. MW-13 will be located in the eastern parking lot, hydraulically sidegradient of potential source areas identified on site.
7. MW-13D will be installed as a deep monitoring well. MW-10D will be located adjacent to MW-13.

8. MW-14 will be installed as a shallow monitoring well. MW-14 will be located in the south lot, hydraulically upgradient of potential source areas identified on site.

Based on the subsurface materials observed during installation of existing monitoring wells, depth to till is anticipated to be encountered between 3 and 12 feet. The shallow wells will be designed such that the screened interval extends to the soil/till interface. The wells will be installed such that the bottom of the screen extends approximately 1 to 2 feet into the top of the till or weathered till surface. A sump will be placed on the bottom of the screen and extend 3 to 5 additional feet into the till. The borehole annuals will be filled with grout from the bottom of the sump to the screen bottom. The sand pack will then extend from the bottom of the screen to 2 feet above the screen. If TCE is present in non-aqueous phase or other dense non-aqueous phase liquids (DNAPLs) are present, this well design will provide a migration pathway for the DNAPL that may be present at the till/overburden interface to enter the well. The shallow wells will be installed with either a 5-foot or 10-foot section of screen, depending on the saturated thickness above till.

The deep wells will be installed at a depth approximately 20 feet below the adjacent shallow well bottom. In general, the deep wells will be installed at a depth of 30 feet below ground surface. The deep well will be constructed with a 10-foot length of screen. The sand filter pack will extend upward 1 to 2 feet above the top of the screen. A one-foot bentonite seal will be placed above the sand pack and completed with grout to the surface. All wells will be constructed of 2-inch-diameter PVC riser, and a 4- for 5-foot section of 0.010-inch diameter slotted screen. The drilling, well construction, well development protocols, and decontamination procedures to be

followed for completion of the well installation activities are detailed in Appendix A, B, and L of the FSP.

The Geoprobe borings will be advanced to the top of till in order to obtain a ground-water sample for in-field chemical characterization. In general, the Geoprobe equipment operates using probe rods which are driven into the soil by a hydraulic cylinder/percussion hammer. Sampling probes consist of a one-foot-long by one-inch-outside diameter tube sampler, which can be adapted to collect soil or ground-water samples. The number of Geoprobe sampling locations may be increased to further delineate the extent of constituents in ground water, based on the field analytical characterization. These data will provide an indication of the spatial trends in ground-water quality. Based on the results of the ground-water quality trends at the Geoprobe locations, an additional monitoring well will be installed.

During the site reconnaissance, two of the existing monitoring wells (MW-2 and MW-6) were observed during the site reconnaissance to be damaged and therefore unusable for the RI program. These wells will be properly abandoned in accordance with procedures set forth in Appendix B.

All monitoring well casing and screen will be cleaned prior to installation using the procedures in Appendix L.

During the drilling and installation of the monitoring wells and after the monitoring wells are completed, water levels will be obtained. The procedures that will be used for obtaining water levels are provided in Appendix H.

Upon completion of each monitoring well, the well will be developed to remove fine grain materials that may have settled in or around the monitoring well during installation, and to insure the monitoring well will properly transmit ground water. The procedures used for developing monitoring wells are provided in Appendix C.

After each monitoring well is developed and the water levels have returned to static conditions, an in-situ hydraulic conductivity test will be performed to evaluate the well or formation performance according to the procedures described in Appendix D.

4.3 Ground-Water Sampling

Ground-water samples will be obtained from monitoring wells in accordance with the procedures in Appendix I. Purge water will be stored in drums on-site until proper disposal occurs. The pre-field cleaning procedures and the cleaning procedures during and after ground-water sampling are provided in Appendix L.

The ground-water samples will be collected in the appropriate sample containers and preserved as described in Section 5 and labeled as described in Section 3. The ground-water samples will be handled, packaged, and shipped as described in Appendix M using the chain of custody procedures provided in Appendix N.

A ground-water sample from each well and Geoprobe borehole will be collected and measured for temperature, conductivity, and pH in the field at the time of collection. The procedures for measuring for these parameters in the field are provided in Appendix G. The temperature/conductivity meter and the pH meter will be calibrated and maintained on a daily basis according to the procedures provided in Appendix F.

4.4 Surface Water Sampling

Surface water samples will be obtained from the drainage ditch and unnamed creek. All samples will be obtained in one sampling event and within the dame day. The surface water sampling procedures are provided in Appendix J. Water levels will be measured following procedures in Appendix H.

The surface water samples will be collected in the appropriate sample containers and preserved as described in Section 5 and labeled as described in Section 3. The

surface water samples will be handled, packaged, and shipped as described in Appendix M using the chain-of-custody procedures provided in Appendix N.

Each surface water sample will be collected and measured for temperature, conductivity, and pH in the field at the time of collection. The procedures for measuring for these parameters in the field are provided in Appendix G. The temperature/conductivity meter and pH meter will be calibrated and maintained on a daily basis according to the procedures in Appendix F.

4.5 Sediment Sampling

Sediment samples will be obtained from the on-site and off-site drainage ditches and unnamed creek as described in Appendix K.

The sediment samples will be collected in the appropriate sample containers and preserved as described in Section 5 and labeled as described in Section 3. The stream sediment samples will be handled, packaged, and shipped as described in Appendix M using the chain-of-custody procedures provided in Appendix N.

4.6 Surface Soil Sampling

Surface soil samples will be obtained from behind the southwest corner of the manufacturing building as described in Appendix O.

The surface soil samples will be collected in the appropriate sample containers and preserved as described in Section 5 and labeled as described in Section 3. The surface soil samples will be handled, packaged, and shipped as described in Appendix M using the chain-of-custody procedures provided in Appendix N.

SECTION 5 - SAMPLE HANDLING AND DOCUMENTATION

5.1 Sample Containers and Preservation

The sample containerization, preservation, handling, and analyses procedures will be performed following the EPA Guidelines outlined in "Test Methods for Evaluating Solid Waste, Publication SW-846, Third Edition, Update 1, December 1987." Sample containers will be selected, cleaned, and quality controlled following the procedures in "Statement of Work for Maintenance of a Quality Controlled Prepared Sample Container Repository, 4/87, Rev. 7/87, 8/87, USEPA."

The appropriate sample containers, preservative method, and holding times for the analytical parameters are provided in Table 5-1.

The methods used to obtain and preserve the samples are implemented to:

1. Retard biological action;
2. Retard hydrolysis of chemical compounds;
3. Reduce volatilization of the compounds; and
4. Reduce alteration of the sample by selection of appropriate sample container materials.

Preservation methods include the addition of parameter-specific chemical preservatives and refrigeration.

The analytical laboratory will supply the appropriate sampling containers, control the quality of the containers, and submit proof of container cleanliness to the NYSDEC. The field sampling crew is responsible for properly collecting, labeling, and preserving samples as well as placing the samples on wet ice in coolers immediately after sample collection. Trip blanks will be prepared and preserved by the laboratory. The samples will be packed and shipped with the Chain-of-Custody forms in accordance with the procedures in Appendix M and Appendix N.

5.2 Packing, Shipping, and Handling Requirements

The sample containers to be used by the sampling team will be supplied by the analytical laboratory in sealed cartons. The labels, custody seals, and packaging materials for filled sample bottles will also be provided by the analytical laboratory.

The cartons of sample containers will be opened at the site. The filled, labeled, and sealed containers will be immediately placed in a cooler and carefully packed to eliminate the possibility of container breakage.

The samples will be packaged by designated personnel and transported as low concentration environmental samples or hazardous materials, dependent on the sample. The packaged samples will be shipped via express overnight carrier (Federal Express or Courier) to the laboratory. When appropriate, the samples may also be hand delivered to the laboratory by sampling personnel.

Trip blanks of analyte-free water will be provided by the laboratory, preserved on-ice, and included in each cooler. Trip blanks will be analyzed to assess quality control throughout the sample preservation and transport procedures, as discussed in the QAPP.

Standard operating procedures for packing, handling, and shipping low concentration environmental samples are included in Appendix M.

5.3 Documentation

Blasland & Bouck field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and chain-of-custody. This documentation forms a record which allows reconstruction of all field events, aiding the review and interpretation process once all of the data is gathered.

All documents, records, and information relating to the performance of the work at the site will be retained in a locked file at Blasland & Bouck's office in Syracuse, New York.

The forms of documentation which will be maintained throughout the RI/FS are briefly outlined below.

5.3.1 Daily Production Documentation

The field notebook will consist of a waterproof, bound, surveyor's-type notebook which will contain an overall record of all activities performed at the site. The specific readings from site testing and sampling will be recorded on the separate documentation sheets.

Separate documentation sheets are used to encourage comprehensive documentation of daily site conditions by field personnel.

A daily drilling summary will be used to track the production of each boring and monitoring well installation.

5.3.2 Subsurface Information

Subsurface soil logs and monitoring well construction details will be completed by the on-site geologist. The subsurface soil logs will provide a record of all information needed to completely describe the subsurface strata, geotechnical characteristics, and ground-water levels observed during drilling. The monitoring well construction details are a record of the dimensions and construction materials of all subsurface installations. The PID screening results will contain the specific PID responses from headspace screening of soil samples from the soil borings. In-situ permeability test records will be used to document the time and water level readings taken during slug testing in the monitoring wells.

5.3.3 Sampling Information

Ground-water and surface water sampling field logs will be filled out at each sampling location and will contain data on water levels, depths, physical

observations of the water, and field meter readings (temperature, pH and specific conductance). Water level readings will be measured to surveyed reference points, i.e., top of outer casing (TOC), top of inner casing (TIC), ground level (GL), or surveyed stake.

Chain-of-Custody sheets will form the record of sample responsibility from collection, transport, submittal to the laboratory, to laboratory analysis. A complete discussion of chain-of-custody procedures is presented in Appendix N. The Chain-of-Custody sheets will be initiated by the laboratory when the clean sample containers are first relinquished to the sampling personnel. The sheets will be filled out at the end of each day of sampling by the geologist. The original Chain-of-Custody form will accompany the samples to the laboratory and copies will be forwarded to the Project Manager.

Sample Analysis Requests will be filled out and will accompany the samples to the laboratory. This will ensure that the proper analyses will be performed on the samples.

5.3.4 Field Equipment Calibration and Maintenance Logs

To maintain field accuracy, all water quality meters and organic vapor meters will be calibrated to known standards. The pH and conductivity meters will be calibrated daily. Before and after calibration readings to known standard solutions will be recorded. The PID MicroTIP will be calibrated daily and checked every 10 samples to a standard gas of a known concentration. Examples of the Calibration forms are included in Appendix F.

5.4 Sample Custody

Any personnel obtaining custody of samples will be responsible for the care and custody of the samples. The term "custody" is defined below.

A person will have custody of samples when the samples are in: their physical possession; their view after being in their physical possession; their physical possession and secured so they cannot be tampered with; or secured in a restricted area with access to authorized personnel only.

The sample chain-of-custody procedures are included in detail in Appendix N.

FIELD SAMPLING PLAN

APPENDICES

TABLE OF CONTENTS

APPENDIX A

DRILLING PROCEDURES FOR SOIL SAMPLES AND TEST PIT EXCAVATIONS

APPENDIX A

DRILLING PROCEDURES FOR SOIL SAMPLES AND TEST PIT EXCAVATIONS

I. Introduction

Soil borings shall be completed using the hollow-stem auger drilling method or driven casing drilling method to a depth specified by the supervising geologist/engineer. Test pit excavations will be performed with a backhoe.

II. Soil Sampling

Samples of the encountered subsurface material shall be collected continuously. The sampling method employed shall be ASTM D-1586/Split- Barrel (spoon) Sampling or ASTM D-1587-83/Thin Walled Tube Sampling, complete references are provided in Attachment 1. The split spoon will be composed of rust-free carbon steel. Upon retrieval of split spoon samples, the soil sample shall be placed in glass sample jars and labeled. Samples will be selected for chemical characterization by the analytical laboratory based on preselected intervals or criteria presented in the Work Plan. Sample selection criteria is Specific to the area of concern being investigated. Volatile organic samples will be collected first, prior to disturbing the core sample. The remainder of the split spoon sample (not including any wash material) will be homogenized by mixing in a stainless steel pan with a cleaned stainless steel scoop. After this homogenization, the remaining sampling containers will be filled. A geologist will be on site during the drilling operations to fully describe each soil sample including: 1) soil type, 2) color, 3) percent recovery; 4) moisture content; 5) texture; 6) grain size and shape; 7) consistency; 8) miscellaneous observations. The descriptions will be recorded on the log in Attachment 2. The supervising geologist will be responsible for retaining a representative portion of each

sample in a one pint glass jar labeled with: 1) site; 2) boring number; 3) interval sample/interval period; 4) date; 5) time of sample collection; and 6) sampling personnel. These samples will be used for particle size analyses and/or stored for future reference. The ASTM procedures for sample particle size analyses are completely referenced in Attachment 3. The particle size analyses will be plotted on the form (Attachment 4, Gradation Curves).

The Drilling Contractor will be responsible for obtaining accurate and representative samples, informing the supervising geologist of changes in drilling pressure and loss of circulation, and keeping a separate general log of soils encountered including blow counts (i.e., the number of blows from a soil sampling drive weight [140 pounds] required to drive the split spoon sampler in 6-inch increments).

Several boreholes will be advanced using the Geoprobe Systems method. The Geoprobes will be installed by EnviroSurv Inc. located in Washington D.D.. Soil samples will be collected from selected zones and monitored for total volatile organic vapors using a photoionization detector (PID) and some samples may be selected for further analytical characterization in the on-site laboratory.

The Geoprobe System operates using probe rods, which are driven into the soil by a hydraulic cylinder/percussion hammer unit mounted in the back of a 4-wheel drive pickup truck. Soil sampling probes consist of a 1-foot long by 1-inch outside diameter tube sampler attached to a steel probe rod. When the piston soil sampler is driven to the top of the desired sampling depth, the piston is released via an extension rod inserted down the probe rod. The probe rod and the tube sampler is driven an additional 8 to 10 inches to collect approximately 100 grams of soil.

Soil material brought to the surface and not utilized for samples during performance of all soil borings will be handled consistent with DEC guidance TAGM 4032, as described in Section 4 of this FSP.

III. Test Pit/Trench Excavation Procedures

APPENDIX A-1

Test Pit/Trench Excavation Procedures

I. Introduction

The test pits/trenches will be excavated using a backhoe equipped with a bucket. If residues are visually observed in the test pit/trenches, the contents will also be sampled.

II. Materials

- Backhoe with bucket
- Shovel
- Plastic sheeting
- Stainless steel hand trowel
- Stainless steel pan
- Appropriate sample containers and packing materials
- Tap water
- Steam cleaning equipment
- Appropriate Health and Safety equipment (Appendix B)
- Photoionization detector (PID), HNu or equivalent
- Camera/videocamera
- Test pit/trench log

III. Procedure

1. Identify the test pit/trench number on the log, (included an Attachment) or in the designated field notebook, along with the temperature, weather, date, time, and personnel at the site.

2. Set up decontamination station and decontaminate the backhoe, bucket, shovel, and other sampling apparatus with a high-pressure steam rinse using a tap water source.

3. Put on appropriate health and safety equipment.

4. Place the plastic sheeting on the ground next to the test pit/trench location.

5. Position backhoe and personnel at upwind (to the extent feasible) locations of the test pit/trench area.

6. Turn on the PID. Measure and record on the test pit/trench log background PID readings on the log or in the field book.

7. Excavate the soil with the backhoe in approximately one-foot increments. At each interval, examine and classify the soils according to the United Soil Classification System (USCS). Record these observations in the test pit/trench log or field book. Also screen the soil samples with a PID. These measurements will also be recorded in the test pit/trench log (or field book).

8. If the contents of the test pit/trench visually appear to consist of site residues, the test pit/trench contents will be sampled. The test pit/trench will be sampled with a shovel if the test pit/trench is less than 3 feet deep. If the test pit/trench is greater than three feet deep, then the test pit/trench will be sampled with the backhoe bucket. The contents of the bucket will then be sampled with a cleaned stainless steel hand trowel.

9. The samples will be collected in the appropriate containers and placed immediately in a cooler of wet ice to maintain a 4°C temperature for preservation. Volatile organic samples will be collected immediately after sample retrieval. Next, a sufficient amount of the remaining soil will be removed from the sampling device and homogenized by mixing thoroughly in a clean stainless steel pan with a clean stainless steel trowel.

Samples will be selected for analytical characterization only if visible residues are present and/or relatively high PID screening readings are measured.

10. The test pit/trench will be terminated when residues are encountered, top of table is reached, or to the maximum reach of the backhoe, whichever occurs first.

11. Soils generated during drilling will be staged on plastic during excavation, monitored for PID readings and visual observations, then placed back into the test pit/trench. Clean fill will be placed at the surface.

12. A labeled stake will be placed at the test pit/trench location.

13. A photograph of each location before, during, and after each test pit/trench is excavated will be taken. During the excavation, videotapes of the operations may be obtained to provide visual documentation.

14. The backhoe, backhoe bucket, and all tools used at the test pit/trench area will be decontaminated using a high-pressure steam rinse using a tap water source. Decontamination water and residual materials associated with decontamination will be contained.

IV. Survey

A field survey control program will be conducted using standard instrument survey techniques to document boring location and elevation.

V. Equipment Cleaning

Equipment cleaning will occur between each separate boring location. All drilling equipment and associated tools including augers, drill rods, sampling equipment, wrenches and any other equipment or tools that may have come in contact with the soils will be cleaned using high pressure steam cleaning equipment using a controlled water source followed by a dilute solvent rinse and

controlled water rinse (Appendix L).

The drilling equipment will be cleaned for each boring in an area designated by the supervising geologist. No equipment will leave a drilling site at any time without first being cleaned as described above unless otherwise specified in the field by the geologist.

APPENDIX A

ATTACHMENT 1

SAMPLING METHOD REFERENCES

APPENDIX A

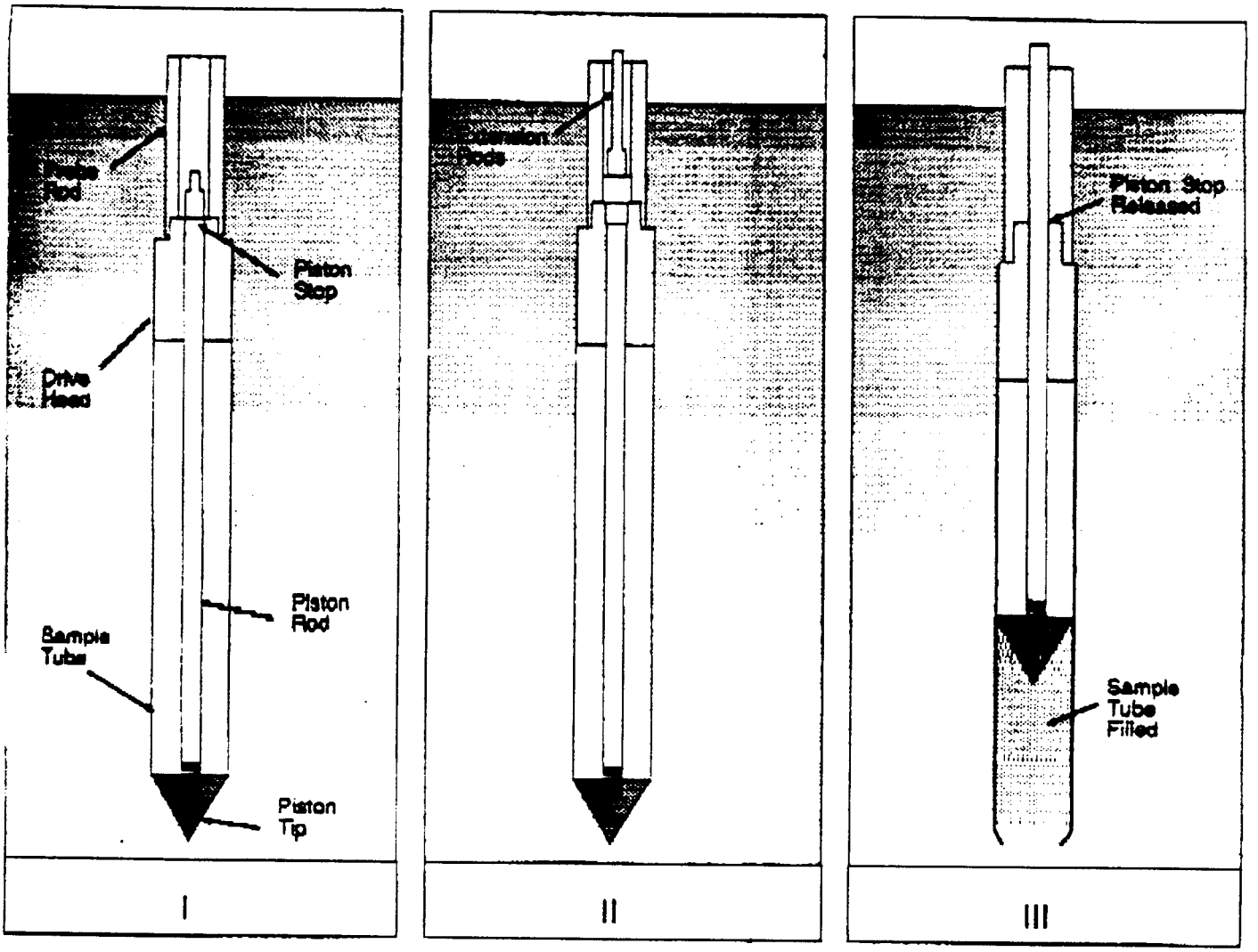
ATTACHMENT 1

SAMPLING METHOD REFERENCES

1. Standard Method for Penetration Test and Split-Barrel Sampling of Soils, ASTM D 1586-84, published in Annual Book of ASTM Standards Volume 04.08.

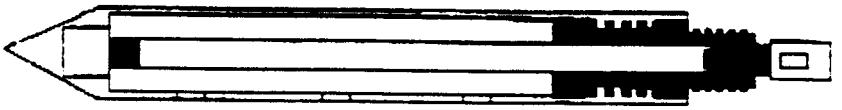
2. Standard Practice for Thin-Walled Tube Sampling of Soils, ASTM D 1587-83, published in Annual Book of ASTM Standards, Volume 04.08.

Geoprobe Systems

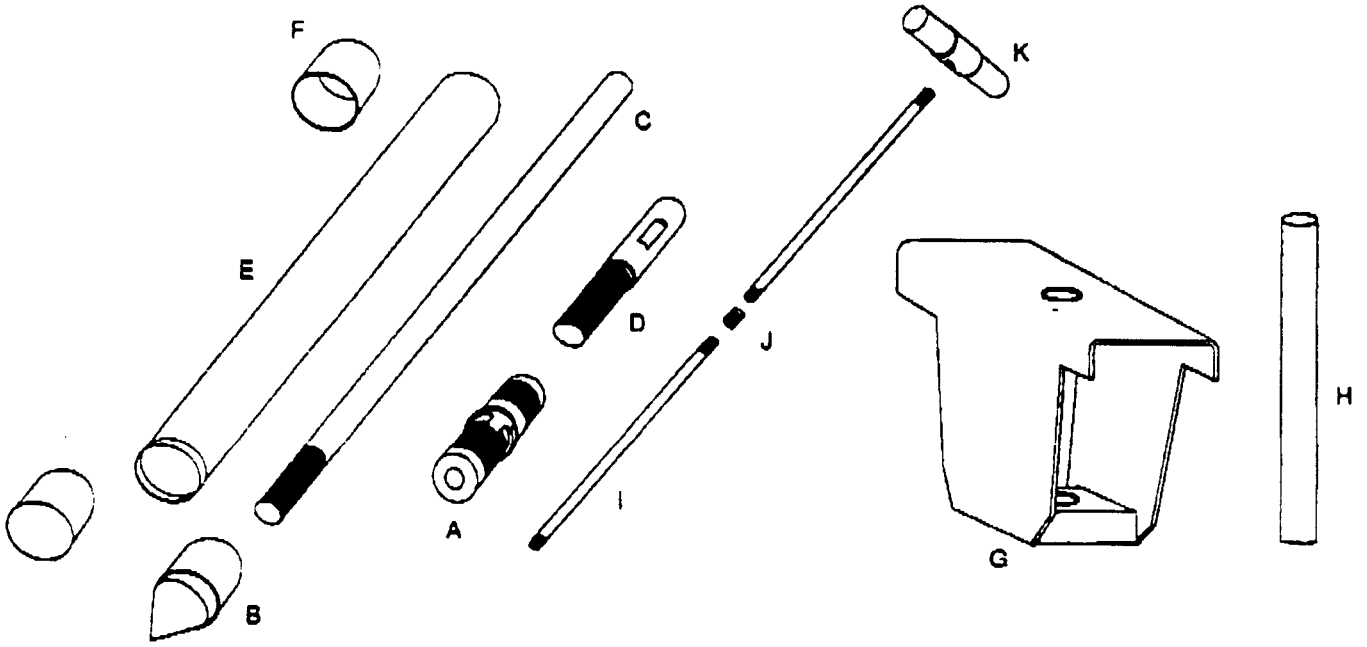


SCHEMATIC OF SOIL SAMPLING PROCEDURES

Probe-Drive Soil Sampler Kit
A sealed soil sampler which is driven to depth and then opened to obtain a soil sample.



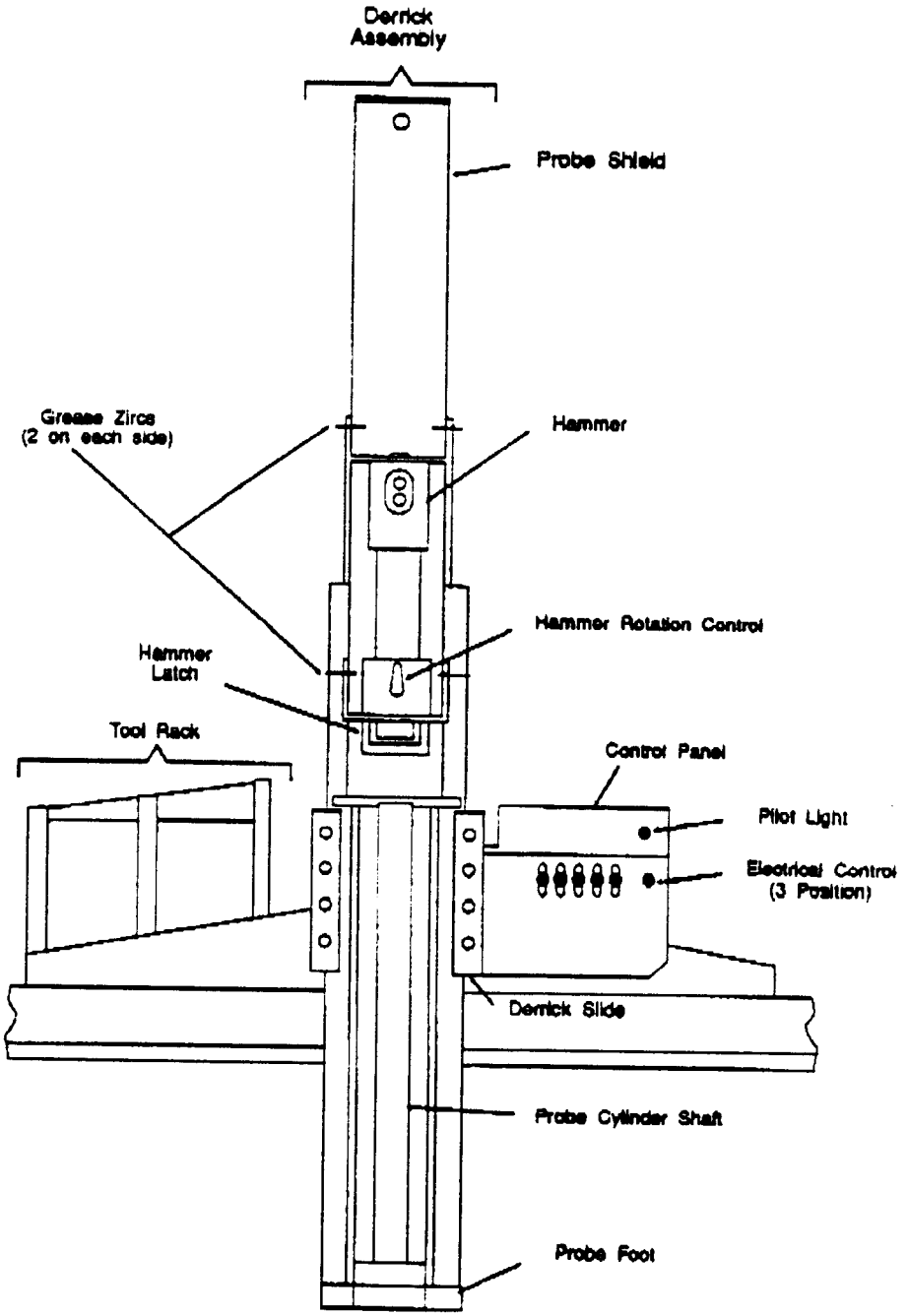
Assembled Probe-Drive Soil Sampler



Probe-Drive Soil Sampler Parts

A. Drive Head
B. Piston Tip
C. Piston Rod
D. Piston Stop
E. Sample Tube (11.5" in. length, recovers 100 gram or larger sample)
F. Vinyl End Caps
G. Sample Extruder
H. Extruder Piston
I. Extension Rod (304 s.s)
J. Extension Rod Coupler
K. Extension Rod Handle

SOIL SAMPLING TOOLS



SCHEMATIC OF HYDRAULIC UNIT
(Front View)

APPENDIX A

ATTACHMENT 2

SUBSURFACE LOG

SUBSURFACE LOG

DEPTH (FT)	SAMPLES	SAMPLE NO	RECOVERY (FEET)	N	HNU	WELL COLUMN	GEOLOGIC COLUMN	DESCRIPTION

SURFACE ELEVATION _____
DATE STARTED _____
DATE COMPLETED _____
CLASSIFIED BY _____

PROJECT _____
PROJECT NO _____
NO. _____
SHEET ____ OF ____

BLASLAND, BOUCK & LEE

APPENDIX A

ATTACHMENT 3

PARTICLE SIZE ANALYSIS METHODS REFERENCES

APPENDIX A

ATTACHMENT 3

PARTICLE SIZE ANALYSIS METHODS REFERENCE

1. Standard Method for Particle Size Analysis of Soils, ASTM D 422-63 (Re-approved 1972) as published in Annual Book of ASTM Standards, November 21, 1963.

APPENDIX A

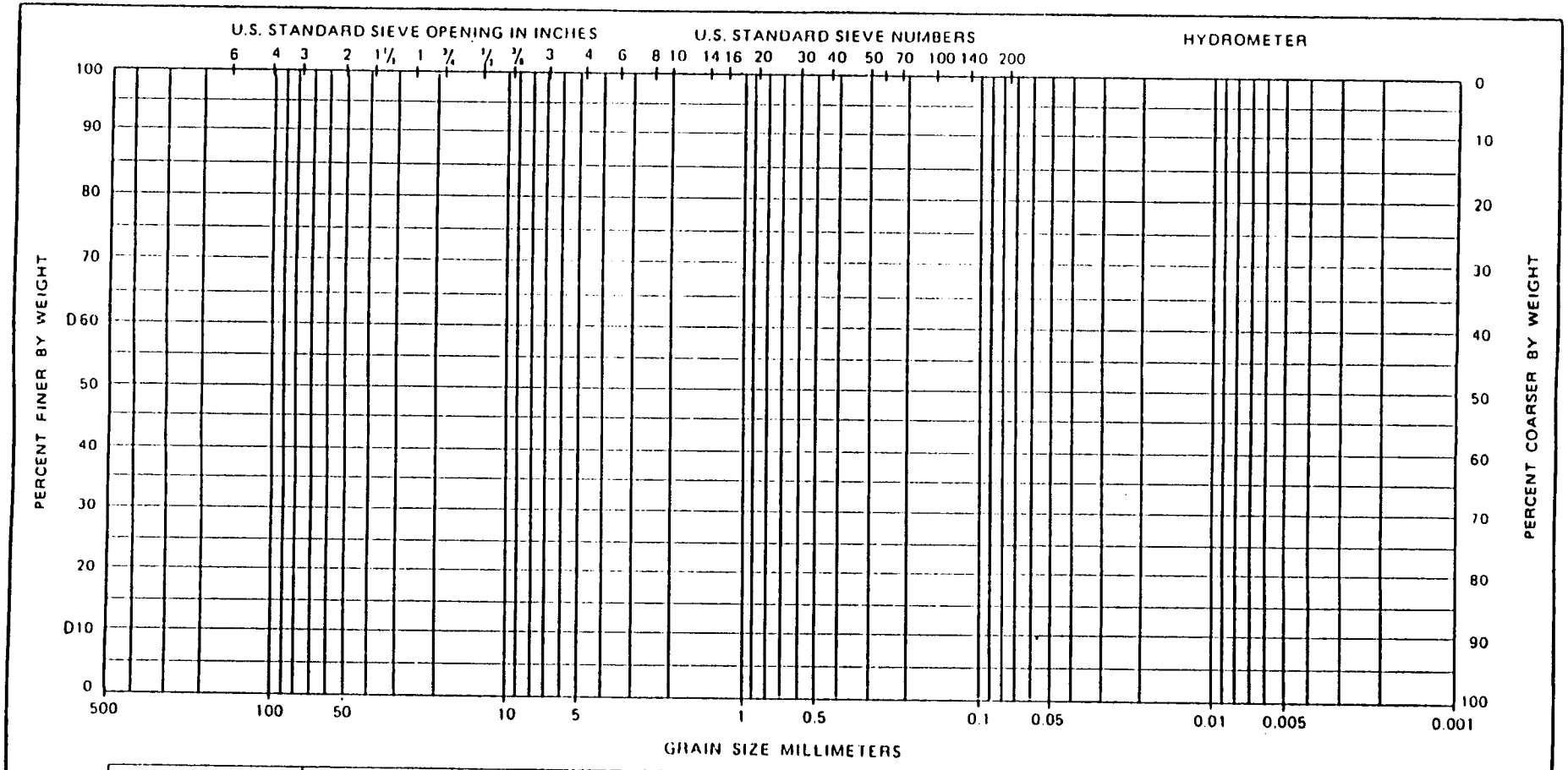
ATTACHMENT 4

GRADATION CURVES

APPENDIX A

ATTACHMENT 4

GRADATION CURVES



SAMPLE NO.	ELEV. OR DEPTH	CLASSIFICATION	D10	D60	UC.

KEY: trace 0-10% some 20%-35% U.C. uniformity coefficient
little 10%-20% and 35%-50%

Wiley-Fisk Form 16-7

BLASLAND & BOUCK ENGINEERS, P.C.

APPENDIX B

DRILLING PROCEDURES FOR MONITORING WELL COMPLETION IN SOIL AND MONITORING WELL ABANDONMENT

APPENDIX B

DRILLING PROCEDURES FOR MONITORING WELL COMPLETION IN SOIL AND MONITORING WELL ABANDONMENT

I. Introduction

Soil borings shall be completed using the hollow-stem auger drilling method specified by the supervising geologist/engineer. No oils or grease will be used on equipment lowered in the boring (eg., drill rod, casing, or sample tools, etc.).

II. Procedures

Well Installation

All monitoring wells will be constructed of PVC, teflon or other material as specified in the work plan or FSP. Each monitoring well will have flush-joint threaded well screen and riser casing that will extend from the screened interval to existing grade. Well screen slot sizes generally will be either .010 or .006 inches in width.

A monitoring well will be installed by placing the screen and casing assembly with bottom cap into the auger string once the screen interval has been selected. At that time, a washed silica sand pack will be placed in the annular space opposite the screen to at least one foot above the top of the screen or approximately 0.5 feet below the till interface (if encountered). Hydrated bentonite pellets will then be added to the annulus between the well casing and the borehole wall for two feet to insure proper sealing. A cement grout will then be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed above the screened interval.

During placement of sand and bentonite, frequent measurements will be made to check the height of the sand pack and thickness of bentonite by a weighted tape measure.

Based on the subsurface materials observed during installation of existing monitoring wells, depth to till is anticipated to be encountered between 3 and 12 feet. The shallow wells will be designed such that the screened interval extends to the soil/till interface. The wells will be installed such that the bottom of the screen extends approximately 1 to 2 feet into the top of the till or weathered till surface. A sump will be placed on the bottom of the screen and extend 3 to 5 additional feet into the till. The borehole annuals will be filled with grout from the bottom of the sump to the screen bottom. The sand pack will then extend from the bottom of the screen to 2 feet above the screen. If TCE is present in non-aqueous phase or other dense non-aqueous phase liquids (DNAPLs) are present, this well design will provide a migration pathway for the DNAPL that may be present at the till/overburden interface to enter the well. The shallow wells will be installed with either a 5-foot or 10-foot section of screen, depending on the saturated thickness above till.

The deep wells will be installed at a depth approximately 20 feet below the adjacent shallow well bottom. In general, the deep wells will be installed at a depth of 30 feet below ground surface. The deep well will be constructed with a 10-foot length of screen. The sand filter pack will extend upward 1 to 2 feet above the top of the screen. A one-foot bentonite seal will be placed above the sand pack and completed with grout to the surface. All wells will be constructed of 2-inch-diameter PVC riser, and a 4- for 5-foot section of 0.010-inch diameter slotted screen. The drilling, well construction, well development protocols, and decontamination procedures to be followed for completion of the

well installation activities are detailed in Appendix A, B, and L of the FSP. A vented locking protective steel casing shall be located over the top of the PVC riser extending 2 feet below grade and 2 feet to 3 feet above grade for wells with stick-up. A flush mounted steel cover will be installed on wells in paved areas. A cement seal shall extend laterally at least one foot in all directions from the protective casing and shall slope gently away to drain water away from the well. A vented 2-inch pressure cap will be locked at the top of the PVC riser pipe.

A typical monitoring well detail is shown as Attachment 1. The supervising geologist/engineer shall specify the monitoring well design to the Drilling Contractor before installation.

The supervising geologist/engineer is responsible for recording the exact well construction details as relayed by the drilling contractor and actual measurements. Both the supervising geologist/engineer and drilling contractor are responsible for tabulating all well materials used such as footage of casing and screen or bags of bentonite, cement and sand.

A field survey control program will be conducted using standard instrument survey techniques to document well location and ground, inner, and outer casing elevations.

Well Abandonment

Any ground-water monitoring wells that are determined to be inadequate sample points will be eliminated to prevent any potential conduits between the surface and subsurface. Abandonment procedures will comply with 6 NYCRR 360-2.11 (8) (vi).

Monitoring well completion logs will be reviewed to determine what depth the initial borehole was advanced. A steel drill rod will be placed inside the well to its full depth to act as a guide while drilling. Hollow stem augers with

an outside diameter equal to or greater than the original borehole diameter will be advanced to the original borehole completion depth. The center guide drill rod will be removed at this time removing all original well material. A roller bit will be advanced to the bottom of the augers to assure all material has been removed. A cement bentonite grout will be pumped via a tremie pipe through the center of the auger as the augers are removed, creating a continuous grout column from the bottom of the borehole to the surface.

III. Survey

A field survey control program will be conducted using standard instrument survey techniques to document well location, ground, inner and outer casing elevations.

IV. Well Development

All monitoring wells will be developed or cleared of fine grain materials that have settled in or around the well during installation (Appendix C).

V. Cleaning

All drilling equipment and associated tools including augers, drill rods, wrenches, and any other equipment or tools that may have come in contact with soil shall be cleaned using a high pressure steam cleaner with potable water. The control water shall be obtained from a source approved by the supervising geologist/engineer. Sampling equipment will be cleaned according to the procedures in Appendix L. The primary choice of a controlled water source will be a municipal supply. A sample should be collected for analytical testing prior to its use.

All well materials will be steam cleaned before emplacement in the

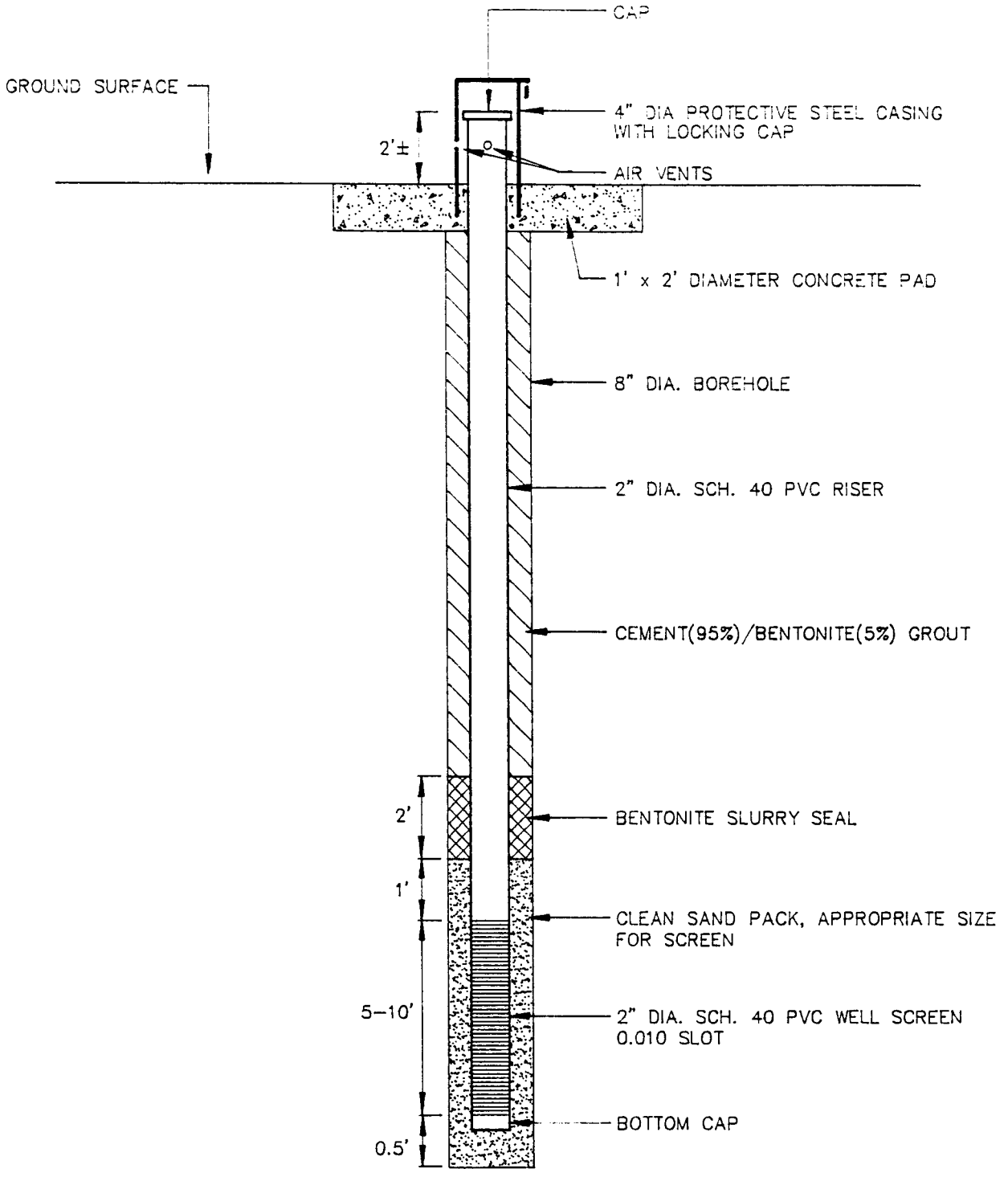
borehole or well.

The drilling equipment will be cleaned for each well in an area designated by the supervising geologist. No equipment will leave a drilling site at any time without first being cleaned as described above, unless otherwise specified in the field by the geologist/engineer.

APPENDIX B

ATTACHMENT 1

TYPICAL SINGLE CASED MONITORING WELL DETAIL



(DRAWING NOT TO SCALE)

BLASLAND & BOUCK ENGINEERS, P.C.
ENGINEERS & GEOSCIENTISTS

CHICAGO PNUEMATIC TOOL CO.
FRANKFORT, NEW YORK

SHALLOW & DEEP MONITORING WELL CONSTRUCTION DETAILS

3/17/93 DMW 60
30708211R\30708L01.DWG

APPENDIX C

WELL DEVELOPMENT PROCEDURES

APPENDIX C

WELL DEVELOPMENT PROCEDURES

I. Introduction

All monitoring wells will be developed (i.e., cleared of fine-grained materials and sediments to ensure the screen is transmitting ground water representative of the surrounding formation waters. Development will be accomplished by surging and evacuating well water by pumping (preferred) or bailing.

When developing a well using the pumping method, clean polypropylene tubing from the pump is extended to the screened portion of the well and will be moved up and down the screened interval until the well yields clear water. A procedure that may be used for well development entails moving ground water through the well screen using a centrifugal pump and/or a submersible pump. The centrifugal pump uses atmospheric pressure to lift water from the well and therefore can only be used where the depth to water is less than twenty-five feet. The submersible pump is attached to the end of the tubing that goes into the well, pushing the water to the surface, and is effective for all wells particularly where ground water is greater than twenty-five feet below land surface. The tubing will be manually lifted and lowered within the screened interval to pull in fine sand and silt. To lift water from the well, the pump will be turned on forcing silty water up through the tubing. Surging will be repeated as many times as necessary within the well screen interval until the ground water is relatively clear. Any tubing will be disposed of between wells; clean, new tubing will be used at each well.

After development, the well will not be sampled for at least 24 to 48 hours.

II. Materials

A. Materials for monitoring well development using a pump include:

- Cotton Coveralls
- Vinyl Gloves
- Safety Glasses
- Polypropylene tubing
- Power source (Generator)
- Field Book
- Graduated Pails
- Pump (centrifugal, submersible, etc.)

B. Materials for monitoring well development using a bailer include:

- Cotton Coveralls
- Vinyl Gloves
- Safety Glasses
- Bottom Loading Bailer
- Polypropylene Rope
- Plastic Sheeting
- Graduated Pails
- Field Book

III. Development Procedures

A detailed procedure for ground-water well development will be as follows:

A. Don appropriate safety equipment.

B. All equipment entering each monitoring well will be cleaned as specified in Appendix L.

C. Open well and monitor for organic vapors with PID.

D. Lower a water level probe into the well and obtain a static water level reading.

E. Attach appropriate pump and lower tubing into well.

F. Turn on pump. If well runs dry then shut off pump and allow to recover.

G. Surging by raising and lowering the tubing in the well will be performed several times to pull in fine grained material.

H. Steps D and E will be repeated until ground water is relatively silt free.

I. The developing equipment will be raised two feet and then Step D through Step E will be repeated.

J. Step F will be repeated until entire well screen has been developed.

The procedure for developing a well using the bailer method is outlined below:

A. Bailers and new rope will be cleaned as specified in Appendix E.

B. Place 5' x 5' plastic sheeting around well.

C. Determine depth of well through examination of drilling log data and measure at least ten feet greater of rope than the total depth of the well.

D. Secure one end of the rope to the well casing, secure the other end of the rope to the bailer. Test the knots and make sure the rope will not loosen. Check bailers to be sure all parts are intact and will not be lost in the well.

E. Open well and monitor for organic vapors with a PID.

F. Lower a water level probe into well and obtain a static water level reading.

G. Lower bailer into well until bailer reaches total depth of the well.

H. Surge by raising and lowering the bailer at two-foot intervals, at least 10 times.

I. Lower bailer back into well and repeat raising and lowering at an interval 2 feet above the previously surged interval.

J. Repeat Step F through Step H until entire screen has been surged.

K. If silt is still in purge water after surging entire screen repeat Step E through Step I.

L. Upon completion of surging of the well, remove bailer and remove the rope from the bailer and the well.

M. Secure lid and lock back on well.

N. Dispose of plastic sheeting and polypropylene rope in plastic garbage bags and clean bailer as specified.

Note:

During well development, when turbidity visually appears to stabilize, temperature, specific conductance, pH, and turbidity will be monitored after each well volume removed. The well will be considered developed when; temperature and conductivity have stabilized to within five percent and pH to within 0.3 units.

A goal of 50 NTUs of clarity will try to be achieved but if the temperature, conductivity, and pH criteria are met and the well does not show a consistent reduction in NTU we will determine the well to be developed.

APPENDIX D

IN-SITU HYDRAULIC CONDUCTIVITY TEST PROCEDURES

APPENDIX D

IN-SITU HYDRAULIC CONDUCTIVITY TEST PROCEDURES

I. Introduction

In-situ hydraulic conductivity tests will be conducted at selected wells. The tests will be used to determine the hydraulic conductivity of the formation screened by the well based on the responsiveness of the well to a change in static water level.

The type of test conducted will be a rising head test accomplished by using a solid cylinder ("slug"), or a bailer that will be submerged below the water table. When the water level returns to initial conditions the bailer or slug will be removed. By monitoring the rate of changing water levels, a hydraulic conductivity value may be calculated.

II. Materials

- Cement weighed PVC slug
- Bailer
- Polypropylene rope
- Water level indicator
- Masking tape
- Waterproof marker
- Engineer's rule
- Distilled water
- Stopwatch
- Laboratory-type Soap
- Cleaning solvent (if necessary)
- In-situ hydraulic conductivity test field log

III. Procedures

1. Identify site and well number on the In-Situ hydraulic conductivity Test Log (Attachment 1) along with date, time personnel and weather conditions. (Two persons will be required to conduct this test.)

2. Record the static water level of the well with a water level recorder.

3. While the water level recorder probe is still at static water level, place masking tape on the water level recorder cable from reference point to 5 feet above the reference point.

4. Using a waterproof pen, mark the masking tape where static water level is reached from the reference point. Label the mark "S" for static water level.

5. Remove the cable and probe from the well and place it in the plastic sheeting.

6. Measure out a length of rope ten feet greater than the depth to static water level.

7. Clean the slug and the rope according to the cleaning protocol (Appendix M) and place on a plastic sheet near the well.

8. Secure one end of the rope to the bailer and the other end to the well casing using a bowline knot.

9. Assign one person responsible for lowering the slug into the well and recording times in the log. Assign another person responsible for lowering the water level probe into the well and finding water levels.

10. Slowly lower the slug or bailer into the well until it is just below the water level. Set the water level probe into the well to monitor the water level until it returns to initial conditions.

11. Set stop watch.

12. When both people are ready, remove the slug or bailer from the water and start the stop watch at the same time.

13. Measure water levels at approximately five second intervals. When the water level is found, mark the tape at the reference point and record the time.

14. After 3 minutes, measure water levels at approximately 15 second intervals for 5 minutes and then at 1 minute intervals for 10 minutes. When readings, start to stabilize, they may be taken at longer time increments until the water level reaches static level.

15. When test is completed, changes in water levels will be measured to the nearest hundredth from the masking tape and recorded with its corresponding change in time reading.

16. Remove the masking tape from the water level probe cable and clean the probe with soapy water, distilled water and/or clean solvent if necessary.

APPENDIX D

ATTACHMENT 1

IN-SITU HYDRAULIC CONDUCTIVITY TEST LOG

IN SITU HYDRAULIC CONDUCTIVITY TEST

DATE STARTED _____
DATE FINISHED _____
SHEET ____ OF ____
PROJECT _____
JOB NO. _____
LOCATION _____

OBSERVATION WELL NO. _____
DATUM _____
FT. ABOVE GROUND LEVEL _____
TEST NO. _____
STATIC WATER LEVEL BEFORE TEST _____

CLOCK TIME	WATER LEVEL READINGS	△	CLOCK TIME	WATER LEVEL READINGS	△	CLOCK TIME	WATER LEVEL READINGS	△

APPENDIX E

PHOTOIONIZATION DETECTOR (PID)

FIELD SCREENING PROCEDURES

APPENDIX E

PHOTOIONIZATION DETECTOR (PID)

FIELD SCREENING PROCEDURES

PHOTOIONIZATION DETECTOR (PID)

I. Introduction

Field screening with the photoionization detectors (PID) MicroTIP, or equivalent, is a procedure to measure relative concentrations of volatile organic and inorganic compounds. Field screening can be conducted on the head space of soil samples (as described below) with the PID. The characteristics of this instrument is found in Attachment 1.

II. Materials

- Photoionization detectors (PID) MicroTIP or equivalent
- Sample jars
- Aluminum foil

III. Procedures

All samples will be field screened upon collection with the PID for a relative measure of the total volatile concentration. Initial PID readings will be recorded on the microtip Soil Sample Field Screening Form (Attachment 2). A fresh representative portion of the sample will be placed in a sample jar and covered with foil for a minimum of 10 minutes or until it can be screened with the PID (not more than one hour).

The MicroTIP PID will be calibrated to isobutylene daily before use according to the operating manual, and the calibration will be checked once for every ten samples according to procedures in Appendix F. In addition, a blank and a field duplicate will be performed every ten samples. Maintenance and calibration records will be kept as part of the field quality assurance program.

APPENDIX E

ATTACHMENT 1

CHARACTERISTICS OF THE PHOTOIONIZATION DETECTOR (PID)

I. Introduction

The PIDs photoionization detectors, are used in the field to detect a variety of compounds in air. The PID instruments can be used to detect leaks of volatile substances in drums and tanks, determine the presence of volatile compounds in soil and water and make ambient air surveys. If personnel are thoroughly trained to operate the instrument and to interpret the data, these PID instruments can be a valuable tool for helping to decide the levels of protection to be worn, assist in determining other safety procedures and determine subsequent monitoring or sampling locations.

II. MicroTIP-PID

The MicroTIP photoionizer detects the concentrations of organic gases as well as a few inorganic gases in the same manner as the HNU. The MicroTIP also operates by detecting gaseous species that are ionized when subjected to ultraviolet radiation.

The MicroTIP is equipped with a 10.6 eV probe which detects more gaseous compounds and is more durable than any other eV probe.

The primary MicroTIP calibration gas is isobutylene, which is equivalent in response to benzene. The MicroTIP memory capabilities allows for calibration of four other gases in addition to isobutylene.

III. General Considerations

This instrument can monitor only certain vapors and gases in air. Many non-volatile liquids, toxic solids, particulates and other toxic gases and vapors

cannot be detected with PIDs. Because the types of compounds that the PIDs can potentially detect are only a fraction of the chemicals possible present at an incident, a zero reading on either instrument does not necessarily signify the absence of air contaminants.

The instruments are generally not specific, and their response to different compounds is relative to the calibration gases. Instrument readings may be higher or lower than the true concentration. This can be an especially serious problem when monitoring for total contaminant concentrations if several different compounds are being detected at once. In addition, the response of these instruments is not linear over the entire detection range. Care must, therefore, be taken when interpreting the data. All identifications should be reported as tentative until they can be confirmed by more precise analysis. Concentrations should be reported in terms of the calibration gas and span potentiometer or gas-select-knob setting.

Since the PIDs are small, portable instruments they cannot be expected to yield results as accurate as laboratory instruments. The PIDs were originally designed for specific industrial applications. They are relatively easy to use and interpret when detecting total concentrations of known contaminants in air, but interpretation becomes more difficult when trying to identify the components of a mixture. Neither instrument can be used as an indicator for combustible gases or oxygen deficiency.

The MicroTIP is not certified by Factory Mutual for use in Class I, Division 2, Groups A, B, C and D.

APPENDIX E

ATTACHMENT 2

MICROTIP SOIL SAMPLE FIELD SCREENING FORM

ORGANIC VAPOR ANALYSIS FIELD SCREENING RECORDS

MICROTIP

ROOM TEMPERATURE ____________

SAMPLE BATH TEMPERATURE ____________

DURATION OF SAMPLE WARMING ____________

PROJECT TITLE ____________

PROJECT NO. ____________

DATE ____________

PERSONNEL ____________

SHEET ____ OF ____

INTERNAL CALIBRATION DATE ____________

DAILY CALIBRATION CHECK ____________

ISOBUTYLENE CALIBRATION GAS ________ PPM

MICROTIP CALIBRATION VALUE ________ PPM

WELL/BORING NO.	INTERVAL	AMBIENT AIR	MICROTIP VALUE	WELL/BORING NO.	INTERVAL	AMBIENT AIR	MICROTIP VALUE

50663

BLASLAND & BOUCK ENGINEERS, P.C.

APPENDIX F

FIELD EQUIPMENT CALIBRATION PROCEDURES

APPENDIX F

CALIBRATION AND MAINTENANCE PROCEDURES

1. MicroTIP Photoionization Detector (PID) Calibration Procedures.
2. pH Meter Calibration Procedures.
3. Temperature/Conductivity Meter Calibration Procedures.
4. Water Level Probe Calibration Procedures.

MICROTIP PHOTOIONIZATION DETECTOR (PID)

CALIBRATION PROCEDURES

I. Introduction

The MicroTIP measures relative total concentrations of organic and inorganic vapors in the field and will be calibrated daily to five standard gases. The MicroTIP does not carry an Intrinsic Safety Rating at this time and will therefore be used to screen soil vapor samples and the head space of soil/water samples in a controlled environment only. The MicroTIP will be calibrated daily prior to use.

II. Materials

- Photovac MicroTIP (PID)
- 100 ppb isobutylene
- Tedlar gas sample bags
- Flow regulator
- MicroTIP calibration log
- Zero span gas (clean outdoor air or zero grade gas)
- Gas bag adaptor nut

III. Procedures

1. If there is any doubt of the air quality, then zero grade gas will be obtained.

2. Connect the regulator to the span gas cylinder. Hand tighten the fittings.

3. Label the gas bag with the compound and concentration of gas that will be contained in that gas bag.

4. Open the valve on the gas bag by turning the valve stem fully counterclockwise.

5. Attach the gas bag adapter nut to the regulator. Hand tighten these fittings.

6. Turn the regulator knob counterclockwise about half a turn to start the gas to flow.

7. Fill gas bag about half full and then close the regulator fully clockwise to turn off the flow of gas.

8. Disconnect the bag from the adaptor and empty it.

9. Repeat one through nine three times to fully purge the gas bag.

10. Repeat one through seven then fill the gas bag.

11. Close the gas bag by turning the valve clockwise.

12. Press "CAL" and expose MicroTIP to zero gas. Press "ENTER" and MicroTIP sets its zero point.

13. MicroTIP then asks for the Span Gas concentration. Enter the known Span Gas concentration and then connect the Span Gas bag adaptor to the inlet.

14. Press "ENTER" and MicroTIP sets its response factor.

15. When MicroTIP's, display reverts to normal, the MicroTIP is calibrated and ready to use. Remove the Span Gas from the inlet.

PH METER CALIBRATION PROCEDURES

I. Introduction

The pH meter will be calibrated daily. Calibration checks will be performed before and after each sample.

II. Materials

- Temperature controlled water bath
- Styrofoam pad
- 10.0, 7.0, 4.0 pH buffer solutions
- Thermometer
- Distilled water
- Spray bottle

III. Procedures

1. Begin pH meter calibration when temperature of bath water and the pH solutions are at 25°C.

2. Place the meter on a dry styrofoam pad one foot away from any electrical sources or metal objects.

3. Remove the 10.0, 7.0 and 4.0 pH buffer solutions from the bath water and open the containers. (Make sure these containers are dry so that no water enters the buffer solution containers.) If water enters the buffer solutions, discard this solution and repeat Steps 4, 5, 17 and 18. (One drop of distilled water will dilute the buffer solutions.)

4. Check the probe electrode for wetness. If the electrode has dried out,

soak it in 7.0 pH solution for one hour. (Do not touch electrode; this may impede pH electrode responsiveness.)

5. Submerse the electrode in the 7.0 pH buffer and adjust the temperature setting on the meter to 25°C each.

6. Turn the instrument to on and gently stir the electrode in the solution. After three minutes, adjust the ADJ pot until the meter reads 7.0 pH.

7. Rinse the electrode with distilled water using a spray bottle. Shake residual water off the electrode and dry off outside of electrode probe. Submerge electrode in the 4.0 pH buffer and stir gently for three minutes.

8. Make the instrument read 4.0 pH by adjusting the SLOPE screw pot with a fine screw driver.

9. Rinse the electrodes with distilled water using a spray bottle. Let electrode dry.

10. Submerge the electrode in the 10.0 pH buffer solution and stir gently for three minutes.

11. Make the instrument read 10.0 pH by adjusting the SLOPE screw pot with a fine screw driver.

12. Put a few drops of distilled water in the protective cap and place the protective cap back on the electrode. Place the meter and electrode in the field carrying case.

13. Discard of the 10.0 pH, 7.0 pH and 4.0 pH buffer solutions in the reservoir supplied with the pH meter field carrying case. Refill the 10.0, 7.0 and 4.0 pH reservoirs with unused fresh buffer solutions.

14. Record calibration procedures on pH meter calibration and maintenance log, Attachment 3.

TEMPERATURE/CONDUCTIVITY METER CALIBRATION PROCEDURES

I. Introduction

The temperature/conductivity meter will be calibrated daily to ensure accurate data is obtained.

II. Materials

- Glass jar capable of submerging the entire probe in a calibration liquid standard
- Calibration liquid standard
- Fine screw driver
- One glass measuring cup
- Temperature controlled water bath

III. Procedures

1. Document date, time and location of calibration in the calibration and maintenance log, Attachment 4. Make note of any observations made during instrument inspection and record on the log.

2. Monitor the temperature of the water bath with the teflon coated thermometer and adjust to 25°C accordingly.

3. When calibration solutions have reached 25°C, calibrate the temperature and conductivity meter (make sure the meter is out of the direct sunlight and at least one foot from any large metal objects).

4. The temperature of the conductivity solution can be determined by using the following formula:

Actual Conductivity of Solution at

T = (Conductivity of solution at 25°C)

X = (A+BT+CT2)

Where T = Temperature of solution

A = .5407

B = .0173

C = .000043

5. To calibrate the temperature-conductivity meter, switch the mode control to off and view the meter needle. Check to see if the meter needle is at zero. If not, adjust screw pot.

6. Plug probe cable into the jack on the conductivity meter. Examine probe for cleanliness. (Do not touch electrode, this may scratch off the platinum coating.)

7. Switch the mode control to Red Line. View the meter needle. If the meter needle does not move, replace batteries with two size "D" cells and check connections. If needle is close to red line, adjust needle screw pot.

8. Place the dip cell temperature/conductivity probe electrode into measuring cup.

9. Open conductivity solution container and pour conductivity standard solution into the measuring cup until probe is completely submersed in the solution. Make sure the measuring cup is one foot from any metal object

or any electrical currents. Move probe up and down in the solution and check electrodes for air bubbles.

10. Switch the mode control to temperature. Check and record the temperature with an ASTM teflon coated ±.2 accurate thermometer. These thermometers should both read 25°C ± .5°C. If the temperatures are greater than ± 2°C the instrument should be sent back to the manufacturer for repair. A replacement instrument will be obtained and calibrated. The new calibration logs will be initiated for the replacement instrument.

11. Switch the mode control to 10X. Check and record calibration solution conductance. If the conductance is greater than ±200 umho/cm send the instrument to the manufacturer's for replating the nickel electrodes.

12. Rinse and store electrode in distilled water. Dispose of the residual rinse water. Rinse the measuring cup with distilled water and also store in the bath water.

WATER LEVEL PROBE CALIBRATION PROCEDURES

I. Introduction

The water level probe cable will be checked to a standard at one foot lengths to insure the meter has been correctly calibrated by the manufacturer.

II. Materials

- Water level probe and cable
- Six-foot engineer's rule
- Maintenance log (Attachment 5)

III. Procedures

1. Each water level probe will be calibrated prior to using.

2. To calibrate, the lengths between each pre-taped five-foot increment marker on the cable will be measured with a six-foot engineer's rule. The cable will be checked for the first 150 feet.

3. If markers are incorrect, the probe will be sent back to the manufacturer.

APPENDIX F

ATTACHMENT 1

PHOTOIONIZATION DETECTOR
Photovac - MicroTIP
CALIBRATION AND MAINTENANCE LOG

Instrument Model Number _____

Instrument Serial Number _____

Project No. _____

Calibration Gas 1 _____ @ _____

Calibration Gas 2 _____ @ _____

Calibration Gas 3 _____ @ _____

Calibration Gas 4 _____ @ _____

Calibration Gas 5 _____ @ _____

Battery Charging			Cleaning		Calibration										Initials
Date/ Time	Time Off	Time On	Lamp	Tubing Casing	Background Value	Calibration Gas Value 1	2	3	4	5	Measured Gas Value 1	2	3	4	5	

APPENDIX F

ATTACHMENT 2

PH METER
CALIBRATION AND MAINTENANCE LOG

Project
Instrument Serial Number

Project No.
Buffer Solution Purchase Date

Date/ Time	Date Last Used	Electrode Checked Clean/Days	Buffer Solution Replaced	4.0 pH Buffer Temp.	4.0 pH Calibration	7.0 pH Buffer Temp.	7.0 pH Calibration	10.0 pH Buffer Temp.	10.0 pH Calibration	Air Temp.	Initials

APPENDIX F

ATTACHMENT 3

TEMPERATURE/CONDUCTIVITY METER CALIBRATION AND MAINTENANCE LOG

Project _____ Project No. _____

Instrument Serial No. _____ Solution Conductivity _____

Solution Expiration Date _____

Date/ D.I. Time	Cell Cleaned	Thermometer Air Calibration Temperature	Conductivity Solution Temperature	Corrected%1 Conductivity of Solution	Conductivity Meter Reading	Corrected%2 Factor	ment	Cell Stored Adjust- Water	In Int.

[1]Corrected conductivity of solution = (conductivity of solution of 25.0%each) x (A + BT + CT%2)

T = temperature

[2]Correction factor = $\frac{\text{Corrected Conductivity of Solution}}{\text{Conductance Meter Reading}}$

A = 0.5407

B = 0.0173

C = 0.000043

APPENDIX F

ATTACHMENT 4

WATER LEVEL PROBE
MAINTENANCE LOG

Instrument Serial Number

Date/ Time	Date Batteries Installed	Date Decontaminated	Check: Sound Indicator	Light Indicator	Case	Six Foot Rule	Weight	Initials

APPENDIX G

TEMPERATURE, CONDUCTIVITY AND PH FIELD MEASUREMENT PROCEDURES

APPENDIX G

TEMPERATURE, CONDUCTIVITY AND PH FIELD MEASUREMENT PROCEDURES

I. Introduction

The temperature of the ground water or surface water will be measured first followed by conductivity and pH. The temperature value will be used to field calibrate the pH meter prior to testing the water.

II. Materials

- Conductivity/Temperature meter with carrying case
- pH meter with a temperature compensated or manual temperature compensated electrodes
- 1,000 umhos/cm KCL calibration solution
- pH Buffer solutions 7.0 pH, 4.01 pH and 10.0 pH
- (2) 4 cup glass measuring cups
- (1) Teflon safety coated ASTM thermometer
- Distilled water
- 500 ml glass flask
- (2) Two gallon graduated pail
- Two spray bottles
- Laboratory-type soap
- Fine screw driver

III. Procedures

The detailed procedure for obtaining the temperature, conductivity and pH of a water sample is outlined below.

1. The temperature and conductivity will be obtained using an

appropriate combination meter. The pH will be obtained using an appropriate temperature-compensated or manual-temperature compensated pH meter. The instruments will be calibrated prior to field use. The pH meter will be field calibrated between sampling stations. The temperature/conductivity meter will only be calibrated each day of use.

2. Set out the temperature-conductivity meter and the pH meter on the plastic sheeting near the well out of direct sunlight. (Do not let the meters get wet.)

3. After filling sample containers, obtain additional water from the well, place in a clean flask. Submerge the conductivity electrode into the flask of ground water. Connect the electrode cable to the meter, switch the temperature conductivity meter control knob to red line and adjust the red line ADJ if necessary.

4. Switch the control knob to temperature. Record the temperature on the Field Log (Attachment 1) and adjust the temperature knob on the conductivity meter and the pH meter to the temperature of the ground water.

5. Switch the control knob to read conductivity and record this measurement on the field log or in the field book.

6. Spray probe and cable clean with distilled water. Store in clean container.

7. Field calibrate the temperature-compensated pH meter using the procedures outlined in Appendix G. (Be sure to shake off as much distilled water from the probe as possible without touching the electrode before using.)

8. If bailing a well or obtaining a surface water sample, go to Steps 12 and 13 skip Steps 14, 15 and 16. If pumping a well, go to Step 14.

9. When bailing a well or sampling surface water, measure the pH directly from the water inside the bailer or sampler. Submerse the probe at least three inches into the sampler and stir the probe for one minute to ensure all air bubbles are off the electrode. Record this measurement and remove the electrode from the sampler.

10. Pour the water from the sampler into a clean glass bowl and remeasure the pH. Record the measurement on the Field Log or in the field book.

11. When pumping a well, place the discharge hose at the bottom of one gallon small mouth jug or flask. Pump two gallons at .5 to 1.0 gallon per minute. (Be sure to contain the overflow.)

12. Continue pumping and submerse the pH electrode into the flask for one minute. Record this value on field log and remove the electrode.

13. Pour the water from the flask into a clean glass bowl and measure the pH. Record this measurement on the Field Log or in the field book.

14. Spray the electrode clean with distilled water and put the protective cap back on the probe.

APPENDIX H

WATER LEVEL MEASUREMENT PROCEDURES

APPENDIX H

WATER LEVEL MEASUREMENT PROCEDURES

I. Introduction

Water levels will be obtained to develop piezometric maps. The water levels will be obtained using an electric well probe, a oil/water interface probe, or chalk and tape.

II. Materials

- Photoionization or flame ionization meter or other appropriate instruments to measure headspace vapors.
- Appropriate protective clothing and gear in compliance with site regulations.
- Water Level Probe and Oil/Water Interface Probe.
- Watch (record time and day).
- Laboratory-type Soap.
- Solvent.
- Handi-wipes.
- Distilled water.
- Two plastic buckets.
- Plastic sheeting.
- Utility knife.
- Hacksaw.

III. Procedures for Water Levels in Wells

A detailed procedure for obtaining water levels will be as follows:

1. Identify site and well number on Water Level Records Log (Attachment 1) along with date, time, personnel and weather conditions.

2. Don safety equipment as specified by the site specific HSP.

3. Set up a cleaning station as in Appendix L and clean the oil-water interface level probe and/or water level probe and cable in accordance to the cleaning protocol.

4. Put clean plastic sheeting on the ground next to the well.

5. Establish a background reading with the organic vapor (photoionization or flame ionization) meter.

6. Unlock and open the well cover while standing up wind from the well. Place the well cap on the plastic sheeting. Sample the air inside the well casing with an organic vapor meter. If the meter reads greater than 5 ppm meter units, move up wind from the well and allow the air inside the casing to vent. Re-sample the air inside the casing with the meter. If the meter still reads 5 ppm or greater, put on a full face respirator with appropriate cartridges and filters.

7. Locate a measuring reference point on the well casing. If one is not found initiate a reference point by notching the inner and outer casings with a hacksaw. All down hole measurements will be taken from the reference points. The acronym TIC will designate the top of inner casing and the acronym TOC will designate top of outer casing. If a well has both inner and outer casings use the top of inner casing as the reference point.

8. Measure to the nearest hundredth of a foot and record the height of the inner and outer casing from reference point to ground level.

9. Measure to the nearest hundredth of a foot and record on the field log the inside diameter of the casings.

10. Lower the water level indicator probe until it indicates the top of water. Measure to the nearest hundredth foot and record the depth to water from the reference point. I fusing an oil/water interface probe and an oil layer or film is detected, measure the top and bottom of the layer from the reference point.

11. Lower the water level recorder to bottom of well. Measure to the nearest hundredth of a foot and record the depth of the well from the reference point. Again, record the reference point used. If weights suspended from the water level probe, record the total length of the weights and add to the total depth.

12. Remove cable or tape and probe from the hole. Clean the instrument.

13. Compare depth of well to previous records.

14. Lock the well when all activities are completed.

IV. Procedures for Water Levels in Ditches and Streams

If a stilling well is utilized to obtain water levels in streams, the procedures will be similar to those described in III above. If the water levels are to be measured from an existing structure or a placed monument, the following procedures will be used:

1. Identify site on Water Level Records Logs (Attachment 1) along with date, time, personnel, and weather conditions.

2. Don safety equipment as specified by the site-specific HSP.

3. Set up a cleaning station as specified in Appendix M and clean the water level probe and cable in accordance with the cleaning protocol.

4. Locate marked point on culvert, survey stake or monument, and/or stage gauge which was surveyed for elevation and location.

5. From that point, lower the water level probe until it indicates the top of the water. Measure to the nearest hundredth foot and record the depth to water from the reference point.

6. Lower the water level probe to the bottom of the stream. Measure to the nearest hundredth foot and record the depth from the reference point.

7. Clean the water level probe and cable.

APPENDIX H

ATTACHMENT 1

WATER LEVEL RECORDS

WATER LEVEL RECORDS

Site _____ **Job Title** _____

Date _____ **Job No.** _____

Sheet ____ **of** _____

Well No.	Stickup	Well Depth	Water Depth	Water Elev.	Time	Comments	By

BLASLAND & BOUCK

APPENDIX I

GROUND-WATER SAMPLING PROCEDURES

APPENDIX I

GROUND-WATER SAMPLING PROCEDURES

I. Introduction

During heavy precipitation events, ground-water sampling will be discontinued until precipitation ceases. No wells will be sampled until well development has been performed.

Ground water will be sampled at selected borehole location and analyzed in the on-site mobile laboratory for TCE and DCE. The ground-water sample will be collected from the sand and silt or fill interval directly above the less permeable till deposit. Soil sampling during borehole advancement will confirm whether the desired sample interval is reached. (Appendix A).

The Geoprobe ground-water sampling equipment consists of a 3-foot long, 0.02-inch mill-slotted stainless steel well point. The well point equipment is placed through the probe rod to the desired monitoring depth. The probe rod is then pulled up to expose the screen section to the aquifer material. The well point will be allowed sufficient time for ground water to infiltrate, prior to sampling. The ground-water sample is retrieved using a Waterra Hydrolift pump, 3/4-inch diameter polypropylene tubing, and bottom check valve. Ground water will be collected directly into two 40-ml glass vials.

Prior to sampling a well for the first time, an aquifer test may be performed to evaluate the well and formation performance. This evaluation will provide the basis for future evaluations of well performance. Aquifer test data will be evaluated using the Bouwer-Rice equation or a similar equation to derive hydraulic conductivity values. Aquifer test procedures are found in Appendix D.

II. Materials

The following materials, as required, shall be available during ground-water sampling:

- Photoionization detector - PID or equivalent
- Disposable gloves, Latex inner gloves, appropriate material outer gloves
- Safety glasses or goggles
- Disposable coveralls, PVC liquid resistant, if appropriate
- Cotton coveralls
- Rubber chemical-resistant boots over steel toe/shank boots
- Full-face respirator with appropriate cartridges and filters (tested to sampling personnel)
- Fire extinguisher
- First aid kit
- Eye wash station
- Plastic sheeting
- Bailer 1-1/2 inch I.D. stainless steel or teflon at least 3 feet long
- Polypropylene rope 1/4" or 1/16" diameter
- 40 micron water filters
- Hand or peristaltic pump
- Clean disposable towels
- Water level well probe
- 6' rule with gradation in tenths or hundredths of a foot
- Wrist watch
- Two 5-gallon graduated pails, two 2-gallon graduated pails
- Conductivity/Temperature meter
- One dip cell conductivity/temperature probe
- Ph meter

- Two temperature compensated Ph electrodes
- Appropriate water sample containers
- Field method blanks
- Insulated transport containers (25-gallon coolers) with frozen blue ice and appropriate packing material
- Tamper-proof tape for sample containers, duct tape, strapping tape, masking tape, and 2-inch wide transparent tape
- Zip-lock type bags/one-quart and one-gallon size
- Large heavy-duty garbage bags
- Spray bottles
- Sample labels
- Bound notebook of ground-water sampling logs, water-proof pages
- Monitoring well evaluation log
- Chain-of-Custody forms
- Custody seals
- Indelible ink pens
- Site map with well locations and ground-water contours maps
- Knife
- Two 18" wrenches
- Hacksaw
- Extra well locks
- Keys to wells
- Camera and film

III. Procedures

1. Review materials check list (Part II) to ensure the appropriate equipment has been acquired.

2. Identify site and well sampled on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment utilized and other pertinent data requested on the logs (Attachment 1, Ground-water Sampling Field Log).

3. Label all sample containers using the procedures outlined in Appendix M or a laboratory supplied label with sample number, date, well number, site, and sampling personnel.

4. Don safety equipment as specified by the HSP.

5. Set up an equipment cleaning station and clean equipment as detailed in Appendix L.

6. Place a new 3' x 6' plastic sheeting adjacent to well to use as a clean work area.

7. Set out on plastic sheeting all sampling equipment that has been cleaned. (This step is used whenever sampling equipment is not dedicated to the well).

8. Establish the background reading with the photoionization detector and record the reading on the field log (Attachment 1).

8a. Remove lock from well and if rusted or broken replace with a new brass keyed-alike lock.

9. Unlock and open the well cover while standing upwind of the well.

Remove well cap and place on the plastic sheeting insert photoionization detector probe approximately 4" to 6" into the casing or the well headspace and cover with gloved hand. If photoionization detector reading is below 5 ppm proceed. If photoionization detector reading is above 5 ppm, move upwind from well 5 minutes to allow the well headspace volatiles to dissipate. Repeat the headspace test. If the reading is still above 5 ppm, put on a full-face air purifying respirator with appropriate cartridges and filters and proceed. Record the photoionization detector reading.

10. Obtain and record on the field log a water level depth and bottom of well depth following the procedures in Appendix H using an electric well probe and record on sampling log sheet. Clean the well probe after each use with a solvent rinse and distilled water rinse.

11. Calculate the number of gallons of water in the well using the length of water column (in feet) multiplying .163 for a 2" diameter well or use the table found on Attachment 2. Record the well volume on the ground-water sampling field log.

12. Field calibrate the pH meter (see Appendix F) and record this calibration on the field log.

13. Remove the required purge volume of water from the well. If a bailer is used to purge, the well will be bailed from the top of the water column. If a pump is used to purge, the cleaned pump or intake tubing will initially be positioned at the top of the water column and lowered as the water level is lowered. All purged water will be measured via a graduated

pail. Three to five well volumes will be removed prior to sampling. Store purge water in labelled container(s) on-site until proper disposal occurs.

14. After the appropriate purge volume of ground water in the well has been removed or if the well has been pumped or bailed dry and allowed to recover, obtain the ground water sample needed for analysis with a cleaned bailer. Wells will be sampled within three hours of purging unless water recovery prohibits. Pour the ground water directly from the sampling device in the appropriate container and tightly screw on the cap. The volatile organic vials will be filled first. The remaining sample containers will be filled and preserved as per Table 5-1 in the following order: semi-volatiles, pesticides, PCBs, cyanide, total metals, and water quality parameters. Preservation will be performed in the field and checked with pH paper.

15. A clean one-quart container will be filled to provide a field-filtered sample for metals. This water will be passed through a .45 micron filter by a hand pump or a peristaltic pump prior to being containerized in the lab supplied bottle.

16. Note the time on the sample label and the ground-water sampling field log. Secure with packing material and store at 4°C on wet ice in an insulated transport container provided by the laboratory. Refrigeration and protection of samples should minimize any chemical alteration of samples prior to analysis. Packaging, shipping, and handling for samples are discussed in Appendix M.

17. After all sampling containers have been filled, remove an additional volume of ground water, to measure and record on the field log physical appearance, pH, temperature, and conductivity using procedures in Appendix G.

18. Replace well cap and lock well.

19. Clean sampling device, purge pump and lines and/or bailer with a solvent rinse followed with a control water rinse as per Appendix L.

20. Place all disposable sampling materials (rope, gloves, plastic sheeting, and plastic suits) in a double plastic bag and leave on-site for disposal at an approved waste storage facility. Record the time sampling procedures were completed on the field logs. Go to next well and repeat Step 1 through Step 20 until all wells are sampled.

21. Complete the procedures for packaging, shipping, and handling (Appendix M) and for chain of custody (Appendix N) after each day of sampling ground water.

APPENDIX I

ATTACHMENT 1

GROUND-WATER SAMPLING FIELD LOG

APPENDIX I

ATTACHMENT 1

EXAMPLE

GROUND-WATER SAMPLING FIELD LOG

Project _____ Project No. _____
Sampling Purpose _____ Site Name _____
Well No. _____ Sampling Personnel _____
Key No. _____ Date/Time ____ In _____ Out ____
HNU Background _____ Well _____ Weather _____

I. Well Information

Reference Point Marked on Casing Y N
Well Diameter _____ ID ____ OD
Well depth _____ TOC, TIC
Water table depth _____ TOC, TIC
Slug test Y N

Length of Inner Casing ____ above grade
Length of Outer Casing ____ above grade
Redevelop Y N

II. Well Water Information

Length of water column _____
Volume of water in well _____
Pumping rate of pump _____
Volume of bailer _____

___ x water volume in well to be removed
Minutes of pumping_____
Number of bails _____

III. Evacuation Information

Volume of water removed from well _____
Did well go dry? Y N

Evacuation method Pump ( )
Bailer ( )
Evacuation rate _____

IV. Well Sampling

Container	Preservative	Time Sampled	Lab Sample No.	Analysis

V. Groundwater Characteristics/After Well Evacuation

Temperature _____
Conductivity _____
pH _____

Film _____
Redline? Y N
_____ 10; ____4; ____7
(calibration standard readings)

VI. Miscellaneous Observations/Problems

VII. Sample Destination

Laboratory Via _____ By _____

_____
Field Program Coordinator

APPENDIX I

ATTACHMENT 2

SAMPLE LABEL

BLASLAND & BOUCK ENGINEERS, P.C.
6723 Towpath Road, Box 66, Syracuse, New York 13214
(315) 446-9120

SAMPLE DESCRIPTION: _____

_____ INITIALS: _____

SAMPLE DATE: _____ SAMPLE TIME: _____

PROJECT NUMBER: _____ LAB NUMBER: _____

DATE RECEIVED: _____ TIME RECEIVED: _____

PRESERVATION: _____

APPENDIX I

ATTACHMENT 3

WELL VOLUME TABLE
WATER VOLUME FOR VARIOUS WELL DIAMETERS

APPENDIX I

WELL VOLUME IN GALLONS PER CASING DIAMETER OF THE WELL AND FEET OF WATER IN THE WELL

Feet of Water	Casing diameter (inches) 1.50	2.00	3.00	4.00	6.00	8.00	10.00	12.00
1	0.09	0.16	0.37	0.65	1.47	2.61	4.08	5.87
2	0.18	0.33	0.73	1.31	2.94	5.22	8.16	11.75
3	0.28	0.49	1.10	1.96	4.41	7.83	12.24	17.62
4	0.37	0.65	1.47	2.61	5.87	10.44	16.32	23.50
5	0.46	0.82	1.84	3.26	7.34	13.06	20.40	29.37
6	0.55	0.98	2.20	3.92	8.81	15.67	24.48	35.25
7	0.64	1.14	2.57	4.57	10.28	18.28	28.56	41.12
8	0.73	1.31	2.94	5.22	11.75	20.89	32.64	47.00
9	0.83	1.47	3.30	5.87	13.22	23.50	36.72	52.87
10	0.92	1.63	3.67	6.53	14.69	26.11	40.80	58.75
11	1.01	1.80	4.04	7.18	16.16	28.72	44.88	64.62
12	1.10	1.96	4.41	7.83	17.62	31.33	48.96	70.50
13	1.19	2.12	4.77	8.49	19.09	33.94	53.04	76.37
14	1.29	2.28	5.14	9.14	20.56	36.55	57.12	82.25
15	1.38	2.45	5.51	9.79	22.03	39.17	61.20	88.12
16	1.47	2.61	5.87	10.44	23.50	41.78	65.28	94.00
17	1.56	2.77	6.24	11.10	24.97	44.39	69.36	99.87
18	1.65	2.94	6.61	11.75	26.44	47.00	73.43	105.75
19	1.74	3.10	6.98	12.40	27.91	49.61	77.51	111.62
20	1.84	3.26	7.34	13.06	29.37	52.22	81.59	117.50
21	1.93	3.43	7.71	13.71	30.84	54.83	85.67	123.37
22	2.02	3.59	8.08	14.36	32.31	57.44	89.75	129.25
23	2.11	3.75	8.44	15.01	33.78	60.05	93.83	135.12
24	2.20	3.92	8.81	15.67	35.25	62.66	97.91	140.99
25	2.29	4.08	9.18	16.32	36.72	65.28	101.99	146.87
26	2.39	4.24	9.55	16.97	38.19	67.89	106.07	152.74
27	2.48	4.41	9.91	17.62	39.65	70.50	110.15	158.62
28	2.57	4.57	10.28	18.28	41.12	73.11	114.23	164.49
29	2.66	4.73	10.65	18.93	42.59	75.72	118.31	170.37
30	2.75	4.90	11.02	19.58	44.06	78.33	122.39	176.24
31	2.85	5.06	11.38	20.24	45.53	80.94	126.47	182.12
32	2.94	5.22	11.75	20.89	47.00	83.55	130.55	187.99
33	3.03	5.39	12.12	21.54	48.47	86.16	134.63	193.87
34	3.12	5.55	12.48	22.19	49.94	88.77	138.71	199.74
35	3.21	5.71	12.85	22.85	51.40	91.39	142.79	205.62
36	3.30	5.87	13.22	23.50	52.87	94.00	146.87	211.49
37	3.40	6.04	13.59	24.15	54.34	96.61	150.95	217.37
38	3.49	6.20	13.95	24.80	55.81	99.22	155.03	223.24
39	3.58	6.36	14.32	25.46	57.28	101.83	159.11	229.12
40	3.67	6.53	14.69	26.11	58.75	104.44	163.19	234.99
41	3.76	6.69	15.05	26.76	60.22	107.05	167.27	240.87
42	3.86	6.85	15.42	27.42	61.69	109.66	171.35	246.74
43	3.95	7.02	15.79	28.07	63.15	112.27	175.43	252.62
44	4.04	7.18	16.16	28.72	64.62	114.88	179.51	258.49
45	4.13	7.34	16.52	29.37	66.09	117.50	183.59	264.37
46	4.22	7.51	16.89	30.03	67.56	120.11	187.67	270.24
47	4.31	7.67	17.26	30.68	69.03	122.72	191.75	276.11
48	4.41	7.83	17.62	31.33	70.50	125.33	195.83	281.99
49	4.50	8.00	17.99	31.98	71.97	127.94	199.91	287.86
50	4.59	8.16	18.36	32.64	73.43	130.55	203.99	293.74

APPENDIX J

SURFACE WATER SAMPLING PROCEDURES

APPENDIX J

SURFACE WATER SAMPLING PROCEDURES

I. Introduction

No sampling will take place during heavy precipitation events.

II. Materials

The following materials, as required, shall be available during surface water sampling.

- Disposable coveralls
- Disposable gloves, inner and outer
- Rubber boots (preferably waders)
- Safety glasses or goggles
- Plastic sheeting
- Distilled water
- Cleaning solvent, appropriate to sampling conditions
- Clean disposable paper towels ("handiwipes")
- Plastic bags
- Two wash basins
- Scrubbing brush
- Laboratory-type soap
- Temperature/Conductivity meter
- pH meter
- Appropriate sampling containers and forms
- Water sampler consisting of:
- 1,000 ml beaker/stainless steel or glass
- Adjustable clamp
- Two or three piece telescoping aluminum tube

- Insulated transport containers with ice or "blue ice"
- Orange flagging
- Surveyor's stakes

III. Procedures

To insure a representative sample of the surface water, it is important to clean all sampling apparatus prior to and between each sampling station.

The sampling procedure is outlined below:

1. Identify sampling location with surveyor's stake and label surface water location on stake and on sampling log sheet (Attachment 1).
2. Put on coveralls, rubber boots, and a new pair of disposable gloves (inner and outer), if necessary.
3. Place plastic sheeting near sampling location to use as a clean work area.
4. Set out clean or new materials for each sampling station, such as appropriate sampling device, field notebook, pH meter, conductivity meter, gloves, coveralls (if necessary), and sampling containers.
5. Assemble the water sampler. Make sure that the sampling beaker and the bolts and nuts that secure the clamp to the pole are tightened properly. If possible, submerge the sample bottle directly in water to obtain sample. (See Attachment 2).
6. Obtain sample by slowly submerging the beaker or sample bottle with minimal surface disturbance (if sampling stream, opening of beaker/sample bottle will be upstream).
7. Retrieve the water sampler from the surface water with minimal disturbance.
8. Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/device edge.

9. Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.

10. Continue delivery of the sample until the bottle is almost completely full. When sampling for volatiles, continue delivery of the sample until the bottle is overflowing so that no air space is present in the sample. *The two* volatile sample vials will be filled first.

11. Preserve the sample, as appropriate, *and check for proper pH with pH paper.*

12. Check that a Teflon liner is present in the cap, if required. Secure the cap tightly.

13. Label all sample containers with date, time, station location number, site, and sampling personnel and store in cooler on ice. Be sure that the temperature in the cooler is maintained at a maximum of 40 degrees Fahrenheit (four degrees Celsius) throughout the sampling and transportation period.

14. After all sampling containers have been filled, obtain one more sample of surface water, measure and record physical appearance, temperature, conductivity, and pH of the water as per Appendix L.

15. Dismantle the sampler; clean beaker and sampling rod according to procedures in Appendix L.

16. Place all remaining disposable sampling materials (gloves, plastic sheeting, and disposable coveralls) in a plastic bag for disposal.

17. Measure location of surface water location to two mapped locations.

18. Pack, ship, and handle samples in accordance to the procedures in Appendix M.

19. Initiate chain-of-custody following guidelines in Appendix N.

20. Deliver samples to laboratory.

APPENDIX J

ATTACHMENT 1

SURFACE WATER SAMPLING FIELD LOG

APPENDIX J

ATTACHMENT 1

Surface Water Sampling Field Log

Client _____ Project No. _____

Site _____ Sampling Personnel _____

Date _____

Time _____

Weather _____

I. Sample Location

Sample depth _____ Approximate flow rate _____

Volume of glass beaker _____

II. Surface Water Sampling Information

Distance from bank sampled _____

Depth below surface of water removed _____

III. Physical Appearance of Sample

Color _____ Suspended Soils _____

Odor _____ Film _____

IV. Container Analysis

V. Surface Water Characteristics

Color _____ Suspended Solids _____

Temperature _____ Film _____

Conductivity _____ Salinity _____

pH _____ Odor _____

APPENDIX J

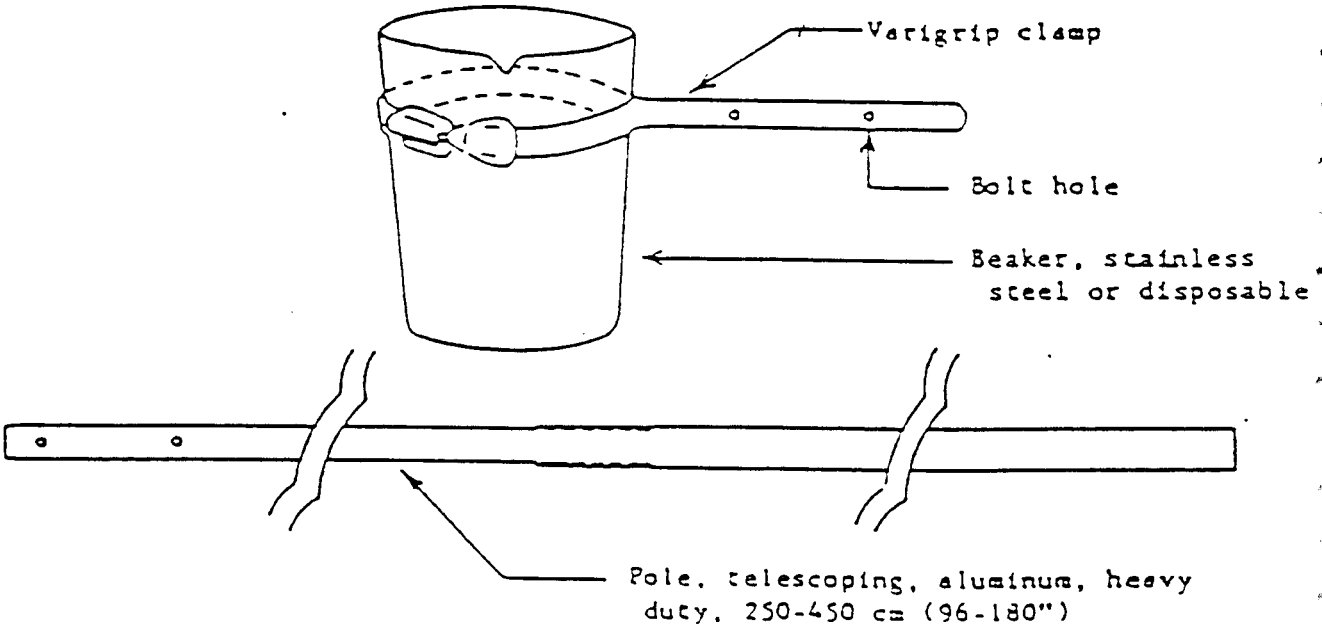
ATTACHMENT 2

SURFACE WATER SAMPLER

APPENDIX J

ATTACHMENT 2

SURFACE WATER SAMPLER



APPENDIX K

Sediment Probing and Sampling Procedures

APPENDIX K

Sediment Probing and Sampling Procedures

I. Introduction

This protocol describes the procedures to collect soil/sediment core samples.

II. Materials

The following materials will be available, as required, during sediment sampling activities.

- Health and safety equipment (as required by the Health and Safety Plan);
- Cleaning equipment (Section V);
- Boat and/or waders;
- Aluminum or stainless steel tray;
- Duct tape;
- Lexan^{R} tubing with end caps;
- Metal rod calibrated for sediment depth measurement;
- Hacksaw;
- Stainless steel core driver;
- Vacuum pump;
- Piston sampler;
- 200-foot measuring tape;
- 6-foot rule or survey rod;
- Flagging;
- Transport container with ice;
- Appropriate sample containers and forms; and
- Field book.

III. Procedures for Probing

1. Identify the site;
2. Don personal protective equipment (as required by the Health and Safety Plan);
3. Begin physically probing for sediments with a metal rod by floating in a boat and/or by wading along the stream. Probe the stream bottom at regular intervals along the side of the stream channel adjacent to the site to identify the location of significant sediment deposits. Soft areas which are penetratable with the rod will be considered sediment deposits. As sediment deposits are located, each will be marked with flagging;
4. Probe the sediment deposit area to determine the approximate average sediment depth;
5. Obtain the approximate dimensions of the sediment deposits to determine surface area; and
6. Record the following information in the field book: approximate location, date, personnel, weather, average sediment depth, length and width of sediment deposit, average water depth cover, stream width, sediment type, type of depositional environment, and any other pertinent comments.

IV. Procedures for Lexan^{R} Tube Sampling

1. Identify the proposed sample location in the field notebook along with other appropriate information collected during soil/sediment sampling activities. Samples locations will be selected based on the following:
    a) areas of potential source residues;
    b) areas receiving or areas that received on-site surface

water runoff;

c) areas of fine grained and/or organic type sediment deposits;

2. Don personal protective equipment (as required by the Health and Safety Plan);
3. At each sample location, lower a section of Lexan^{R} tube until it just reaches the top of sediment. Measure the depth of water;
4. Push the Lexan^{R} tube into the sediment by hand until refusal. Measure the depth of sediment;
5. Drive the tube several more inches using a stainless steel core driver block and measure the distance. This procedure is performed to obtain a "plug" at the bottom of the core and prevent the loose sediment from escaping;
6. Place a vacuum pump on the top end of the Lexan^{R} tube and create a vacuum to prevent the sediments/plug from escaping;
7. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary);
8. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged;
9. Keeping the tube upright, wipe the bottom end dry and seal the cap with duct tape and label. Measure the length of sediment recovered and evaluate the integrity of the core. If the core is not suitably intact, repeat coring procedure within 5 to 10 feet of the first location attempted;
10. While still keeping the core upright, use a hacksaw to make a horizontal cut in the tube approximately one inch above the sediment;

11. Re-cap the cut end of the tube, seal the cap with duct tape, and mark this end as "top";

12. Wipe the tube dry;

13. Record the following information on both the tube and on the cap: 1) sample number; 2) sampling date; and 3) sampling time;

14. Place the core sample upright in a container with ice;

15. Repeat the above procedures until the appropriate number of core samples are collected;

16. Extrude the sediment cores from the Lexan^{R} tubing onto an aluminum or stainless steel tray. Describe and record sample description.

17. Section the cores into the uppermost 6-inch increment based on the ratio of the measured sediment depth to the recovered sediment depth to account for sample compression or expansion during collection. The saw or knife used to section the core should be cleaned (Section V) between each cut. Core sections may be frozen to facilitate sectioning when sediment is extremely loose. Place the sediment into the appropriate laboratory-supplied containers;

18. Label all sample containers and place in the transport container;

19. At one in every 20 sediment sample locations, a rinse blank and a duplicate sample will be obtained. Obtain a duplicate sediment sample by dividing the uppermost 6-inches of the sample into two sets of containers; and

20. Handle, pack, and ship the samples using the chain-of-custody procedures.

V. Field Cleaning Procedures

A. Materials

- Health and safety equipment (as required in the Health and Safety Plan)
- Laboratory-supplied analyte-free water or equivalent
- Non-phosphate soap; (Alconox^{R}, or equivalent)
- Tap water
- Appropriate cleaning solvent (methanol or hexane)
- Rinse collection plastic containers
- Brushes
- Aluminum foil
- Garbage bags
- Spray bottles for solvent
- Ziploc^{R} type bags

B. Procedures

1. Follow health and safety procedures specified in the Health and Safety Plan.
2. Cleaning of reusable sampling equipment (e.g., trays, spatulas, scoops and core driver) will follow the decontamination procedures presented below:
   a. Alconox^{R} and tap water wash;
   b. Tap water rinse;
   c. Solvent spray rinse;
   d. Analyte-free water rinse; and
   e. Allow to air dry and wrap in aluminum foil.
3. Cleaning will be conducted in plastic containers that will be transported to each sampling location (or group of locations). These containers will also be used to collect all

decontamination rinsate that will be transferred to an on-site container.

APPENDIX L

EQUIPMENT CLEANING PROCEDURES

APPENDIX L

EQUIPMENT CLEANING PROCEDURES

I. Introduction/General

The equipment cleaning procedures described herein include pre-field, in the field and post-field sampling equipment cleaning. The sampling equipment consists of soil sampling equipment, well construction materials, ground water, and surface water collection devices, water testing instruments, downhole geophysical instruments, and field vehicles. The non-disposable equipment will be cleaned after completing each sampling event. The cleaning events will be documented in notebooks and will be performed according to safety procedures. All rinse water will be contained and treated on site or sent to an approved disposal facility. Cleaning procedures will be monitored by appropriate quality assurance and control checks through sampling and analyses.

II. Equipment Cleaning Material List

- Deionized water
- Tap water/control water
- Laboratory grade non-phosphate soap (Alquinox or Liquionox)
- Appropriate cleaning solvent (pesticide grade - hexane and methanol)
- Nitric acid solution (10 percent) utilizing reagent-grade nitric acid and deionized water
- Measuring device dedicated to each solvent for measuring volumes of solvent
- Seven dedicated graduated wash basins
- One large diameter one-foot tall basin
- Non-wire wrapped brushes
- Plastic sheeting
- Laboratory grade aluminum foil

- Large heavy duty garbage bags
- Spray bottles
- Ziplock type bags
- Waterproof pens and magic marker
- Handiwipes
- Knife
- Cleaned notebooks
- Disposable gloves (inner vinyl and outer nitrile)
- Rubber over boots
- Safety glasses
- Cotton coveralls
- Duct tape
- Solvent container seal tape

III. Cleaning QA/QC

The proposed rinse water will be analyzed prior to initiating cleaning procedures for the TCL parameters. The water will be used if it meets the following requirements:

Volatile Organics	<CRQL
Semi-volatile Organics	<CRQL
Pesticides/PCBs	<CRQL
Inorganics	<CRQL

where CRQL is the Contract Required Quantitation Limits.

IV. Storage of Equipment

All sampling equipment will be stored in a clean environment and, where appropriate, the equipment will be covered in aluminum foil.

V. Safety Procedures During Equipment Cleaning

1. Personnel will wear the following safety equipment:
   - safety glasses, goggles and/or a splash shield;
   - neoprene or nitrile outer gloves taped to tyvex;
   - vinyl inner gloves;
   - outer tyvex coverall; and
   - inner cotton coveralls.

2. All solvent rinsing will be conducted in an open area and not in a closed room.

3. All solvents transported into the field will be stored and packed in styrofoam and kept at a temperature not to exceed 75°F.

4. Material Safety Data Sheets (MSDS) will accompany the solvents when the solvents are transported into the field.

5. The solvent containers will be closed tightly after each use and sealed with tape.

6. All solvent rinse will be contained and either treated or disposed of at a hazardous waste facility.

VI. Cleaning Procedures

A. Soil and Rock Drilling Rig and Portable Power Auger Equipment Cleaning

Drill rigs and appurtenances will be cleaned prior to mobilizing to the site, after mobilizing to the site, between each boring while on site and prior to leaving site according to the following steps.

1. Wash all large equipment (augers, drill rods, drill bit, wrenches, rock core barrels) with a high pressure steam cleaner using a brush to remove any particulates.

OR

1. Scrub small equipment (split spoons) with soapy (non-phosphate soap) tap water and brush.
2. Rinse equipment with controlled water.
3. Rinse equipment with 10% nitric acid rinse (1% for carbon steel split spoons).
4. Rinse with controlled water.
5. Rinse equipment twice with a solvent (methanol followed by hexane) rinse.
6. Rinse equipment with controlled (analyte-free) water and allow it to air dry.
7. Wrap in aluminum foil (as appropriate).

Sampling equipment such as split spoons, thin-walled samplers, stainless steel homogenization pans, shelby tubes, stainless steel spatulas/scoops, and rock core barrels will also be cleaned between each sample using Steps 1 through 7.

Monitoring well materials will also be cleaned prior to installation by high pressure steam cleaning.

B. Ground Water and Surface Water Sampling Device

The ground water and surface water sampling devices will be cleaned prior to mobilizing to the site, after mobilization, between each sample and prior to leaving site. The cleaning procedures prior to mobilization are detailed in Section VII, B-1. The cleaning procedures at the site, during and after sampling, are detailed in Section VII, B-2.

B-1 Pre-Field Cleaning Procedures

B-1.1

Teflon bailers, teflon bladder pumps, stainless steel bailers, and glass instruments will be pre-field cleaned according to the following steps:

1. Equipment will be washed thoroughly with laboratory detergent (non-phosphate) and hot water using a brush to remove any particulate matter or surface film.
2. The equipment will be rinsed thoroughly with hot tap water.
3. Rinse equipment with at least a ten percent nitric acid solution.
4. Rinse equipment thoroughly with tap water.
5. Rinse equipment thoroughly with deionized water.
6. Rinse equipment twice with solvent (methanol followed by hexane) and allow to air dry.
7. Wrap equipment completely with aluminum foil to prevent contact with other materials during storage and/or transport to the field.
8. Rinse the teflon or glass sampling equipment thoroughly with tap water in the field as soon as possible after use.

B-1.2

Peristaltic pump tubing *(such as polyethylene, polypropylene, and teflon)* will be cleaned according to the following procedures.

1. Flush tubing with hot tap water and phosphate-free laboratory detergent.
2. Rinse tubing thoroughly with hot tap water.
3. Rinse tubing with deionized water.
4. Install tubing in peristaltic pump.
5. Cap both ends of tubing with aluminum foil.

*New pre-cleaned tubing must be used for each automatic sampler set-up.

B-1.3

The pre-field cleaning procedures for new submersible pumps, water level devices, pH measuring devices, conductivity devices, flow meters, and downhole geophysical instruments will be cleaned according to the following steps:

1. Wash with laboratory detergent and tap water.
2. Rinse with tap water.
3. Rinse with deionized water.
4. Equipment should be wrapped with *aluminum foil* to prevent contact with other materials during storage or transit.

B-1.4

The pre-field cleaning procedures for field vehicles will include an exterior wash.

B-2 Field and Post-Field Cleaning Procedures

B-2.1

Teflon bailers, teflon bladder pumps, and glass instruments will be cleaned as follows:

1. Clean with controlled water and laboratory detergent (non-phosphate) using a brush if necessary to remove particulate matter and surface matter.
2. Rinse thoroughly with controlled water.
3. Rinse with 10% nitric acid.
4. Rinse thoroughly with controlled water.
5. Rinse with solvents (methanol followed by hexane).
6. Rinse thoroughly with controlled water (analyte-free) and allow to air day as long as possible.
7. Wrap with aluminum foil, if appropriate, to prevent contact with other materials if equipment is going to be stored or transported.

New bailer cords will be used for each well sampling location. Prior to use, bailer cords will be washed with non-phosphate soapy water and rinsed with controlled analyte-free water.

B-2.2

To clean stainless steel bailers, stainless steel pumps, or any other metal equipment, use the procedures in B-2.1.

B-2.3

Submersible pumps, water level devices, pH measurement devices, conductivity meters, flow meters, and down hole geophysical instruments will be cleaned as follows:

1. Clean with controlled water and laboratory detergent (non-phosphate).
2. Rinse with controlled water.
3. Rinse with controlled analyte-free water.

B-2.4

The field vehicles will be washed before leaving the site.

VIII. Set Up for Cleaning Procedures

1. Establish a cleaning station in the vicinity and downwind of the sampling station.

2. Put on clean protective clothing as necessary, (coveralls, new gloves, chemical resistant over boots, and goggles).

3. Label with a water-proof marker seven buckets as follows: SOAPY, WATER1, NITRIC/WATER, WATER2, SOLVENT1, SOLVENT2, and WATER-F. These buckets will be dedicated for cleaning and will not be used for any other function.

4. Place a clean 3' x 6' sheet of plastic on the ground at the cleaning station and secure with weights if windy. Adjacent to the plastic sheeting place a 4' diameter .5' height basin.

5. Fill the SOAPY bucket with approximately 2 liters of control water and laboratory soap. Fill both WATER buckets and the WATER-F bucket with approximately 2 liters of control water. Fill the SOLVENT buckets with *pure* solvent. Fill the NITRIC/WATER bucket with 0.9 liter control water and 0.1 liter nitric acid. Place a clean rag or handiwipe in each bucket. (Refill buckets as needed during cleaning.)

6. Set all seven buckets in the plastic basin.

7. If equipment to be used has been cleaned and properly stored in aluminum foil and in a clean environment the equipment may be used. If equipment

has just been used or has not been cleaned or a sample event has been completed, go to Step 8.

8. Set out the non-disposable equipment to be used or that has been used in the well near the cleaning station for cleaning. This equipment may include bailers, bladder pumps, submersible pumps, surface water samplers, surface soil samplers, stream sediment samplers, and hydraulic conductivity testing slugs. Set out disposable equipment to be used in the next well for cleaning. The disposable equipment includes polypropylene rope and well development tubing which will be disposed of after used in a well.

9. If residual soil particles are observed on the equipment parts that will come in contact with the inside of well casing or the ground water, use a brush to remove the particles.

10. Begin swabbing the equipment with the soapy water using a long handled brush to clean inside the bailer. Contain all wash water. Rinse with the controlled water, swab the equipment with nitric acid solution, and rinse with controlled water. Begin swabbing the equipment with the solvent soaked rag while holding the equipment over the basin. Make sure all the rinse water is contained in the large basin. The personnel cleaning the equipment will stand up-wind of the SOLVENT buckets.

11. Put handiwipe or rag used for the solvent swabbing back in the SOLVENT buckets if it is still clean. If the rag is soiled, dispose of it in a double-lined garbage bag.

12. Begin swabbing the equipment with the WATER soaked rag while holding the equipment over the basin to contain all swabbing water.

13. After the cleaning process is completed, place cleaned equipment on the clean 3' x 3' plastic sheeting and allow it to air dry.

14. Dispose of water that is in the basin and the buckets after cleaning, into a portable container that is leak proof, into a treatment system or have it transported to hazardous waste facility, as appropriate.

15. Dispose of 3' x 3' plastic sheeting in double-lined plastic garbage bags.

16. Equipment has been or is now cleaned and ready for use or stored in plastic bags.

17. Upon completion of the sampling activity, the equipment will be cleaned according to Step 4 through Step 16.

APPENDIX M

PACKING, HANDLING, AND SHIPPING PROCEDURES

APPENDIX M

PACKING, HANDLING, AND SHIPPING PROCEDURES

I. Packaging

1. Complete all documents, including sample label, sample tag, and chain-of-custody forms, and sign the custody seal evidence tape using indelible ink (Attachments 1, 2, and 3).
2. Ensure that all bottles have the appropriate report labels (Attachment 1). Secure labels by adhering transparent tape over the entire label and around the sample container.
3. Check the caps on the sample containers by gently twisting the cap clockwise until tight.
4. Secure the caps to the sample container and prevent leaks with tamper-proof tape.

II. Handling

1. Secure the drain plug at the bottom of the cooler used for sample transport with duct tape. Use a large plastic trash bag as a liner for the cooler.
2. Seal each sample container in individual zip-lock type plastic bags, and place upright in the lined and cushioned cooler.
3. Repackage sufficient amount of ice and/or blue ice in small zip-lock type plastic bags, to maintain an internal temperature of 4°C inside the cooler during delivery to the laboratory, and place loosely in the cooler. Do not pack ice so tightly that it may break glass bottles or prevent addition of sufficient cushioning material.
4. Place the documents accompanying the samples (chain-of-custody) (Attachment 2) in a large zip-lock type bag and tape the forms to

the inside of the cooler lid. If hand delivery, place copies of the documents in the cooler and hand deliver the originals to be signed.

5. Close the lid of the cooler and fasten the latch.

6. Affix signed custody seal evidence tape (Attachment 3) to both ends of the cooler in such a manner that they must be removed or broken in order to open the cooler.

7. Wrap strapping tape around both ends of the cooler twice, do not tape over any labels.

III. Shipping

1. Mark the cooler on the outside with the following information: name and address of laboratory, return address, "Fragile" labels on the top and one side, and arrows indicating the "This End Up" on all four sides.

2. All samples will be delivered either by the samplers or by an express carrier within one day of the sample collection.

3. When using an express carrier, fill out the carrier's express form for an unrestricted article and for next day delivery. (The express carrier will not be required to sign the chain-of-custody).

4. A bill of lading will be used when samples are shipped by carrier. The bill of lading receipts will be retained by the samplers.

APPENDIX M

ATTACHMENT 1

BLASLAND & BOUCK ENGINEERS, P.C.
5793 Widewaters Parkway Box 66 Syracuse, New York 13214
(315) 446-9120

SAMPLE DESCRIPTION: _____

_____ INITIALS: _____

SAMPLE DATE: _____ SAMPLE TIME: _____

PROJECT NUMBER: _____ LAB NUMBER: _____

DATE RECEIVED: _____ TIME RECEIVED: _____

PRESERVATION: _____

APPENDIX M

ATTACHMENT 2

BLASLAND & BOUCK ENGINEERS, P.C.

CHAIN OF CUSTODY RECORD

PAGE _____ OF _____

FILE NO. _____
PROJECT _____
B & B CONTACT _____

LABORATORY _____
ADDRESS _____
CONTACT _____

B & B SAMPLE NO.	LABORATORY SAMPLE NO.	SAMPLING DATE	SAMPLING TIME	SAMPLE DEPTH	SAMPLE TYPE	ANALYSES: VOA	BNA	METALS	PEST/PCB						NO. OF CONTAINERS

COMMENTS
(SPECIAL INSTRUCTIONS, CAUTIONS, ETC.)

I. SAMPLED AND RELINQUISHED BY
SIGN
PRINT
FIRM
DATE TIME

I. RECEIVED BY
SIGN
PRINT
FIRM
DATE TIME

II. RELINQUISHED BY
SIGN
PRINT
FIRM
DATE TIME

II. RECEIVED BY
SIGN
PRINT
FIRM
DATE TIME

III. RELINQUISHED BY
SIGN
PRINT
FIRM
DATE TIME

III. RECEIVED BY
SIGN
PRINT
FIRM
DATE TIME

IV. RELINQUISHED BY
SIGN
PRINT
FIRM
DATE TIME

IV. RECEIVED BY
SIGN
PRINT
FIRM
DATE TIME

EVIDENCE SAMPLES TAMPERED WITH ☐ NO ☐ YES ☐ N/A
IF YES EXPLAIN IN REMARKS

LIQUID	VOA VIAL														
	GLASS BOTTLE														
	PLASTIC BOTTLE														
	PRESERVATIVE														
	CONTAINER VOLUME														
SOLID	VOA VIAL														
	GLASS JAR														
	PLASTIC JAR														
	PRESERVATIVE														
	CONTAINER VOLUME														

NOTE: SAMPLE BOTTLES SUPPLIED BY LAB, UNLESS INDICATED

PRESERVATION KEY: A - SAMPLE CHILLED, B - FILTERED,
C - ACIDIFIED WITH _____
D - NaOH, E - NaTHIOSULFATE, F - OTHER.

REMARKS: (SAMPLE STORAGE, NONSTANDARD SAMPLE BOTTLES)

APPENDIX M

ATTACHMENT 3

SAMPLE CONTAINER SEAL

SAMPLE

OFFICIAL SAMPLE SEAL	SAMPLE NO.	DATE	SEAL BROKEN BY
	SIGNATURE		
	PRINT NAME AND TITLE		DATE

APPENDIX N

SAMPLING CHAIN-OF-CUSTODY PROCEDURES

APPENDIX N

SAMPLING CHAIN-OF-CUSTODY PROCEDURE

I. Procedures

The sampler's custody and chain-of-custody procedures will be as follows:

1. Remove from storage area the laboratory-supplied glass sample containers which have been delivered in custody-sealed insulated transportation containers to ensure that bottles have not been opened or broken.

2. Review the chain-of-custody form initiated by the laboratory for the recorded number of sample containers and field methods blanks. Compare these records to the sample containers and field method blanks received.

3. Sign and date the chain-of-custody form if the laboratory-supplied sample containers are accounted for. Note on the chain of custody the storage history prior to sampling wells.

4. After completing the sampling procedures, place the sample in the appropriate bottle and log the following information in the field notebook:

   a. Project name and number;

   b. Sample number;

   c. Well volume;

   d. Purged volume;

   e. pH, conductivity and temperature;

   f. Sampling method;

g. Date;

h. Name of sampler(s);

i. Time (military);

j. Location (project);

k. Weather

l. Any comments;

m. Water level; and

n. Depth of well.

5. Fill in sample label with:

a. Project name and number;

b. Sample number(s);

c. Date;

d. Time (military); and

e. Analysis to be performed.

6. Place samples in coolers. Samples are to remain in the custody of the samplers until they are brought to field headquarters.

7. Complete chain-of-custody forms including:

a. Sample number(s);

b. Date;

c. Project name and number;

d. Samplers' name(s);

e. Time (military);

f. Type (grab or composite);

g. Number of samples;

h. Volume of bottles;

i. Analysis requested;

8. Complete the shipping procedures in Appendix M, Packing, Shipping and Handling. Relinquish the sample containers to the delivery person (via express carrier or hand deliver). The chain-of-custody form should be signed, dated and the time noted when transfer occurs if hand delivered. The forms should be included in the cooler if express carried. The express carrier will not be required to sign the chain-of-custody forms.

9. The sampler will log the name of the individual receiving the sample and the time relinquished in the sampler's field notebook.

10. When the samples are received by laboratory, the lab personnel will check the sample identification numbers on the containers to ensure they coordinate with the chain-of-custody Forms and Analysis Request Forms.

11. If hand delivered, the samplers will wait until numbering and sample checking are completed. If delivered by express courier, the laboratory will call the samplers to verify the samples arrival and describe the sample condition.

12. Further chain-of-custody procedures submitted by the subcontracted laboratory.

APPENDIX O

SURFACE SOIL SAMPLING PROCEDURES