ATTACHMENT - A
Emission Rate Potential Tables

INTERIM REMEDIAL MEASURE
152034

FORMER COMPUTER CIRCUITS SUPERFUND SITE

145 Marcus Boulevard
Hauppauge
Suffolk County, New York

Computer Circuits

ERP CALCULATIONS

Maximum allowable emission rate potential within updated 2000 DAR -1 AGC-SGC Tables

Assume 100% mass transfer from soil to gas.

Air Rates: 110 cfm = 3.115 m^3/min = 186.91 m^3/hr

Initial Ratings: 1,1-Dichloroethylene
Carbon tetrachloride

Refer to DAR -1 Appendix A IV.B.1.a for emission rate < 0.1 lb/hr, can consider no control if ambient impact < AGC and SGC.

Appendix B Ambient Air Quality Impact Screening Analyses (1991 Edition):

I. Assume dimensions as follows:

building height, h_b = 18 ft above grade

discharge port, h_s = 20 ft above grade

II. Cavity impacts:

shortest distance to property line, D_{pl} = 62 ft

$D_{pl} > 3h_b$, cavity impacts are confined to on-site receptors, and do not need to be calculated.

ERP CALCULATIONS

III. Point and Area Source Air Quality Impacts

A.1.c - Discharge Buoyancy

84.03 = V, exit velocity [ft/sec]

0.08 = R, stack outlet radius [ft]

0.02 = S, stack outlet area [ft^2]

525 = T, stack exit temp. [Rankine] = F + 460

0.0046 = F, buoyancy flux parameter [m^4/sec^3] = $0.276\ V\ R^2\ (T-510)\ /\ T$

A.1.d - Effective Stack Height

20 = h_e [ft] = h_s, if $h_s/h_b < 1.5$

A.2. - Maximum Actual Annual Impact

Assume uniform influent for initial screening step

= Ca [ug/m^3] = $6\ Qa\ /\ h_e^{2.25}$

A.3. - Maximum Potential Annual Impact

= Cp [ug/m^3] = $52500\ Q\ /\ h_e^{2.25}$

A.4. - Stack Height Reduction of Impacts

1 = f = reduction factor, no reduction for $h_s/h_b < 1.5$

A.5. - Maximum Short-Term Impact

= Cst [ug/m^3] = Cp * f * 65

Computer Circuits

ERP CALCULATIONS

				DAR - 1 Appendix B Screening Analyses								
				A.2.	A.3.	A.4.		AGC	OK?	A.5.	SGC	OK?
Contaminant	Initial Soil Gas Concentration	Initial Annual Emission Rate Q	Qa	Maximum Actual Annual Impact, Ca	Maximum Potential Annual Impact, Cp	Reduced Ca	Reduced Cp	Annual Guideline Concentration		Maximum Short-Term Impact, Cst	Short-term Guideline Concentration	
	(ug/l)	(lb/hr)	(lb/yr)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)	(ug/m^3)		(ug/m^3)	(ug/m^3)	
Acetone	7.60E-02	3.14E-05	2.75E-01	1.95E-03	1.95E-03	1.95E-03	1.95E-03	28000.0	YES	0.13	180000.0	YES
1,2-Dichloroethylene (1,2-DCE)	1.69E+01	6.97E-03	6.11E+01	4.33E-01	4.33E-01	4.33E-01	4.33E-01	1900.0	YES	28.12	- - -	
Tetrachloroethylene (PCE)	3.20E+01	1.32E-02	1.16E+02	8.22E-01	8.21E-01	8.22E-01	8.21E-01	1.0	YES	53.38	1000.0	YES
1,1,1-Trichloroethane (1,1,1-TCA)	2.18E+04	9.01E+00	7.89E+04	5.60E+02	5.59E+02	5.60E+02	5.59E+02	1000.0	YES	36351.75	68000.0	YES
Trichloroethylene (TCE)	1.09E+05	4.50E+01	3.94E+05	2.80E+03	2.79E+03	2.80E+03	2.79E+03	4.50E-01	NO	181661.85	54000.0	NO
Total VOC	1.31E+05	5.41E+01	4.74E+05	3.36E+03								

ATTACHMENT - B
Equipment Specifications

GC Corp.
GENERAL CARBON CORP.

Cleaning the World with Activated Carbon

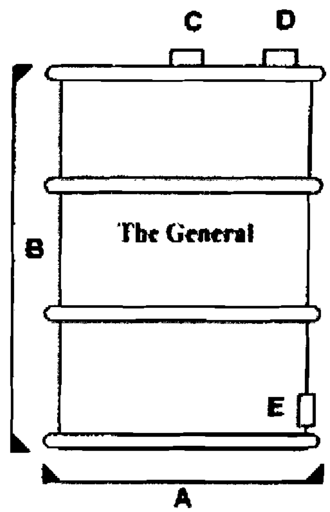
VAPOR FILTRATION
LIQUID FILTRATION
SPENT CARBON
CONTACT INFO
GENERAL INFO IMAGE GALLERY

33 Paterson Street
Paterson, NJ 07501
Tel: 973 523-2223
Fax: 973 523-1494
sales@generalcarbon.com

VAPOR FILTRATION

The General

Air Pollution Control Barrels



The General Air Pollution Control Barrels are ready to use, low cost, self contained air purification units that can treat air flows of up to 250 CFM. **The General** is available in three different sizes to better serve your treatment needs.

Specifications	55 Gallon	85 Gallon	110 Gallon
A-Diameter, Outside:	24"	28"	32"
B-Height, Outside Wall:	35"	39"	43"
Inlet Fitting:	E-2"MPT	C-4"FPT	C-4"FPT
Outlet Fitting:	C-2"MPT	D-4"FPT	D-4"FPT
Drain Fitting:	E-2"MPT	E-l"FPT	E-l"FPT
Carbon Weight, Lbs.:	150	300	400
Max. Recommended Flow Rate, CFM:	100	180	250
Maximum Pressure, psig:	10	7	7
Max. design Temp., Deg F:	140	140	140
Flow Direction:	Upflow	Upflow	Upflow

Activated Carbon - The General vapor adsorbers are filled with virgin, high activity GC C-40 pelletized carbon. Other virgin coal, coconut shell, reactivated or impregnated carbons are available.

Removable Lid - 16 gauge lid with ring & bolt closure and poly-clad cellulose gasket.

Connections - Metal connectors with standard pipe threads insure easy, durable and leakproof hookup to your system. Unions or quick connect fittings are advised to make drum exchange easy. Drains let you remove any accumulated condensate.

Flow Distributors - The 55 gallon barrel uses an air chamber to insure even distribution of the air flow through the carbon. Low pressure drop, slotted Schedule 40 PVC collectors are used in the 85 gallon and 110 gallon drums for proper flow distribution. Stainless Steel internals and drums are available for special applications.

Coatings - The General pollution control barrels are coated on the inside with heat cured phenolic epoxy. The outside coating is industrial enamel. A polyethylene liner is available for extra corrosion resistance for the 55 gallon and 85 gallon units.

Installation & Start Up - The General air pollution control barrel requires no special procedure for start up. Just connect the inlet and outlet to the treatment system and start it up. Multiple units are usually connected in series with testing advised between the units to determine when the first unit needs to be changed out.

Maintenance - Once connected, **The General** requires no maintenance other than the monitoring of the influent and effluent air streams and the operating pressure of the system. Monitoring the air stream into the last Air Pollution Control Barrel in series mode is a recommended safeguard against breakthrough in the final discharge. When the concentration of contaminants in the outflow equals the concentration in the inflow, **The General** has reached its removal capacity and should be removed from the service. The working life of each adsorber is dependent upon the type of contaminant in the air as well as its concentration and the air flow rate. A pressure relief device is advised to prevent damage to the canister in the event of excessive pressure buildup.

Recharging The General - Once the carbon has reached its pollutant removal capacity, the unit should be removed and replaced with a fresh one. To purchase replacement carbon or to arrange for a carbon change out, please contact our office.

Disposal - Dispose of the spent carbon in accordance with Federal, State and Local regulations.

WARNING!

Wet activated carbon removes oxygen from air causing a severe hazard to workers inside carbon vessels. Confined space/low oxygen procedures should be put in place before any entry is made. Such procedures should comply with all applicable local, state and federal guidelines.

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33 Paterson Street • Paterson, NJ 07501 • Tel: 973 523-2223 Fax: 973 523-1494

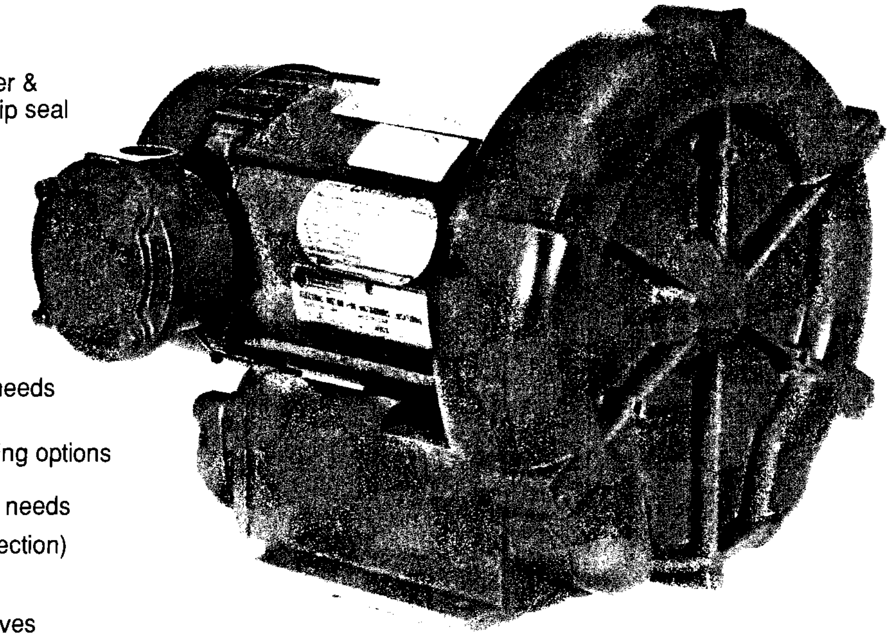
EN 505M & CP 505M
Sealed Regenerative Blower w/Explosion-Proof Motor

FEATURES
- Manufactured in the USA – ISO 9001 compliant
- Maximum flow: 160 SCFM
- Maximum pressure: 62 IWG
- Maximum vacuum: 60 IWG
- Standard motor: 2.0 HP, explosion-proof
- Cast aluminum blower housing, cover, impeller & manifold; cast iron flanges (threaded); teflon lip seal
- UL & CSA approved motor with permanently sealed ball bearings for explosive gas atmospheres Class I Group D minimum
- Sealed blower assembly
- Quiet operation within OSHA standards

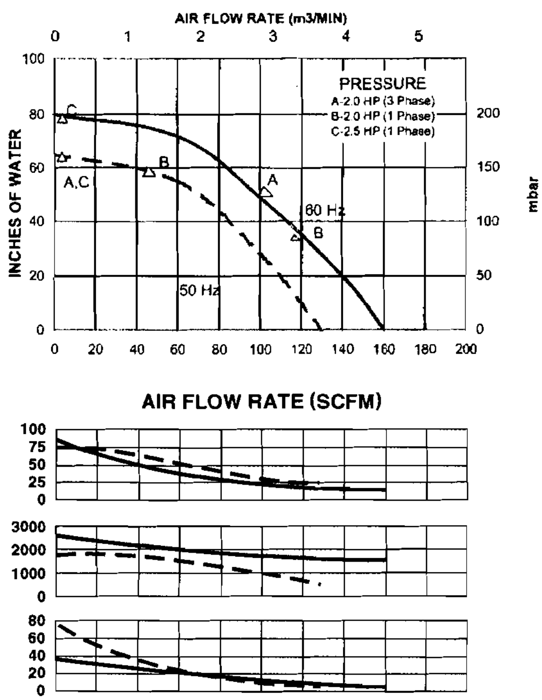
MOTOR OPTIONS
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

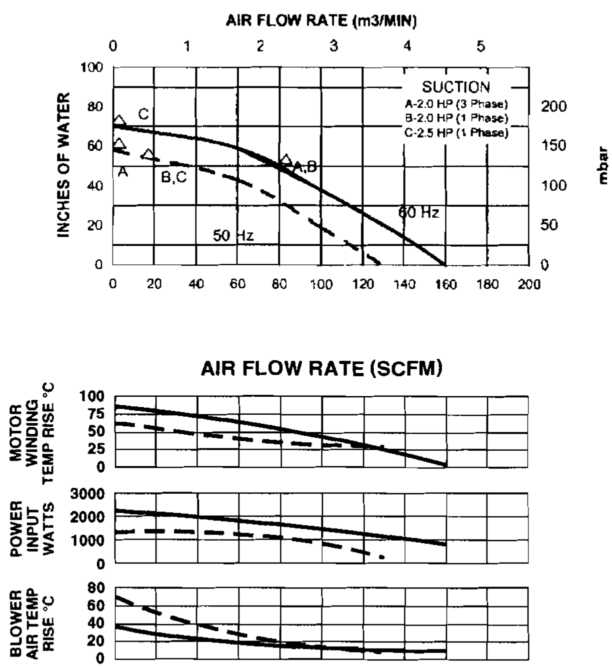
BLOWER OPTIONS
- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

ACCESSORIES (See Catalog Accessory Section)
- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges & relief valves
- Switches – air flow, pressure, vacuum or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package



BLOWER PERFORMANCE AT STANDARD CONDITIONS

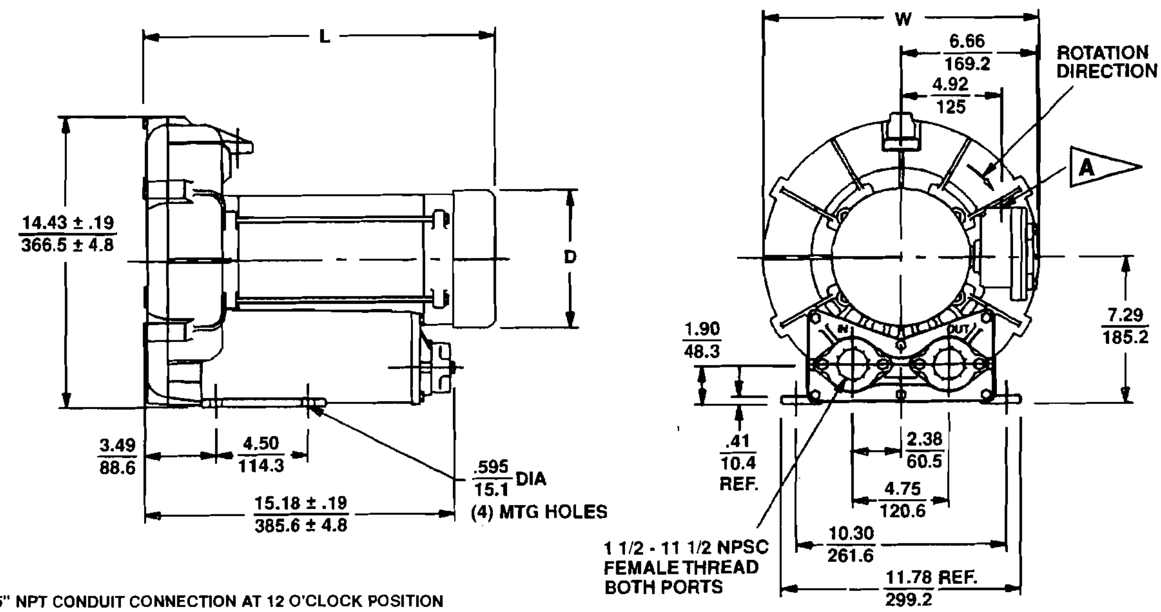




Rev. 2/04

EN 505M & CP 505M
Sealed Regenerative Blower w/Explosion-Proof Motor

Scale CAD drawing available upon request.



A ▷ 0.75" NPT CONDUIT CONNECTION AT 12 O'CLOCK POSITION

DIMENSIONS: IN / MM
TOLERANCES: .XX ± .08 / 2.0
.XXX ± .030 / .800
(UNLESS OTHERWISE NOTED)

MODEL	L (IN) ± .30	L (MM) ± 8	D (IN)	D(MM)	W(IN)	W(MM) ± 5 MM
EN/CP505AX72ML	16.0	405	6.84	173	13.53	344
EN/CP505AX58ML	17.21	437	6.84	173	13.53	344
EN/CP505CJ5ML	18.57	472	7.32	186	13.53	344

SPECIFICATIONS

MODEL	EN505AX58ML		EN505AX72ML		EN505CJ5ML	CP505FS58MLR	CP505FS72MLR
Part No.	038177		038178		038445	080655	038962
Motor Enclosure – Shaft Material	Explosion-proof – **CS**		Explosion-proof – **CS**		Explosion-proof – **CS**	Chem XP – **SS**	Chem XP – **SS**
Horsepower	2.0		2.0		2.5	Same as EN505AX58ML – 038177 except add Chemical Processing (CP) features from catalog inside front cover	Same as EN505AX72ML – 038178 except add Chemical Processing (CP) features from catalog inside front cover
Phase – Frequency [1]	Single - 60 Hz		Three - 60 Hz		Single - 60 Hz		
Voltage [1]	115	230	230	460	230		
Motor Nameplate Amps	17.2	8.6	5.8	2.9	15.5		
Max. Blower Amps [3]	22.0	11.0	6.4	3.2	14.0		
Inrush Amps	112	56	56	28	86		
Starter Size	1	0	0	0	1		
Service Factor	1.0		1.0		1.0		
Thermal Protection [2]	Class B - Pilot Duty		Class B - Pilot Duty		Class B - Pilot Duty		
XP Motor Class – Group	I-D, II-F&G		I-D, II-F&G		I-D, II-F&G		
Shipping Weight	95 lb (43 kg)		87 lb (40 kg)		103 lb (228 kg)		

[1] Rotron motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

[2] Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

[3] Maximum blower amps corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

Specifications subject to change without notice. Please consult your Local Field Sales Engineer for specification updates. Rev. 2/04

ATTACHMENT - C
SVE System Monitoring Form

Former Computer Circuits Site
SVE System Monitoring Form

Date / Time: ____________________
Technician: ____________________

System Operating (Yes / No)

System Parameters

Influent Flow Meter		SCFM
Influent Vacuum		"H2O
Condensate Drum Vac.		"H2O
Blower Vacuum		"H2O
Pre- GAC Pressure		PSI
Mid GAC Pressure		PSI
Post GAC Pressure		PSI
Condensate Level		inches
Condensate Drained		gal.
Bleed valve position		

Sample Ports

	PID (ppm)	Sampled	Analysis / Comments
Pre-GAC			
Mid-GAC			
Post-GAC			

Repairs / Modifications / Comments

ATTACHMENT - D
Standard Operating Procedures

GENERAL AIR SAMPLING GUIDELINES

SOP#: 2008
DATE: 11/16/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) provides guidance in developing and implementing sampling plans to assess the impact of hazardous waste sites on ambient air. It presents the United States Environmental Protection Agency/Environmental Response Team's (U.S. EPA/ERT's) approach to air sampling and monitoring and identifies equipment requirements. It is not within the scope of this SOP to provide a generic air sampling plan. Experience, objectives, site characteristics, and chemical characteristics will dictate sampling strategy. This SOP does not address indoor air sampling.

Two basic approaches can be used to assess ambient air (also referred to as air pathway assessments): modeling and measurements. The modeling approach initially estimates or measures the overall site emission rate(s) and pattern(s). These data are input into an appropriate air dispersion model, which predicts either the maximum or average air concentrations at selected locations or distances during the time period of concern. This overall modeling strategy is presented in the first three volumes of the Air Superfund National Technical Guidance Series on Air Pathway Assessments[1,2,3]. Specific applications of this strategy are presented in several additional Air Superfund Technical Guidance documents[4].

The measurement approach involves actually measuring the air impact at selected locations during specific time periods. These measurements can be used to document actual air impacts during specific time intervals (i.e., during cleanup operations) or to extrapolate the probable "worst case" concentrations at that and similar locations over a longer time period than was sampled.

This SOP addresses issues associated with this second assessment strategy. This SOP also discusses the U.S. EPA/ERT's monitoring instruments, air sampling kits, and approach to air sampling and monitoring at hazardous waste sites.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, depending on site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Air monitoring is defined as the use of direct-reading instruments and other screening or monitoring equipment and techniques that provide instantaneous (real-time) data on the levels of airborne contaminants. The U.S. EPA/ERT maintains numerous monitors for real-time measurements. Examples of air monitoring equipment are hand-held photoionization detectors (PID), flame ionization detectors (FID), oxygen/combustible gas detectors, and remote optical sensors.

Air sampling is defined as those sampling and analytical techniques that require either off- or on-site laboratory analysis and therefore do not provide immediate results. Typically, air sampling occurs after use of real-time air monitoring equipment has narrowed the number of possible contaminants and has provided some qualitative measurement of contaminant concentration. Air sampling techniques are used to more accurately detect, identify and quantify specific chemical compounds relative to the majority of air monitoring technologies.

In the Superfund Removal Program, On-Scene Coordinators (OSCs) may request the U.S. EPA/ERT to conduct air monitoring and sampling during the following situations: emergency responses, site assessments, and removal activities. Each of these activities has a related air monitoring/sampling objective that is used to determine the potential hazards to workers and/or the community.

- Emergency Response

  Emergency responses are immediate responses to a release or threatened release of hazardous substances presenting an imminent danger to public health, welfare, or the environment (i.e., chemical spills, fires, or chemical process failures resulting in a controlled release of hazardous substances). Generally these situations require rapid on-site investigation and response. A major part of this investigation consists of assessing the air impact of these releases.

- Removal Site Assessment

  Removal site assessments (referred to as site assessments) are defined as any of several activities undertaken to determine the extent of contamination at a site and which help to formulate the appropriate response to a release or threatened release of hazardous substances. These activities may include a site inspection, multimedia sampling, and other data collection.

- Removal Actions

  Removal actions clean up or remove hazardous substances released into the environment. Removal actions include any activity conducted to abate, prevent, minimize, stabilize, or eliminate a threat to public health or welfare, or to the environment.

Personal risk from airborne contaminants can be determined by comparing the results of on-site monitoring and sampling to health-based action levels such as the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) and the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). Residential risk can be determined by comparing the results of off-site monitoring or sampling to health-based action levels such as those developed by the Agency for Toxic Substance and Disease Registry (ATSDR).

The extent to which valid inferences can be drawn from air monitoring/sampling depends on the degree to which the monitoring/sampling effort conforms to the objectives of the event. Meeting the project's objectives requires thorough planning of the monitoring/sampling activities, and implementation of the most appropriate monitoring/sampling and analytical procedures. These issues will be discussed in this SOP.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Preservation, containers, handling and storage for air samples are discussed in the specific SOPs for the technique selected. In addition, the analytical method (i.e., U.S. EPA, National Institute for Occupational Safety and Health [NIOSH], and OSHA Methods) may be consulted for storage temperature, holding times and packaging requirements. After sample collection, the sampling media (i.e., cassettes or tubes) are immediately sealed. The samples are then placed into suitable containers (i.e., whirl bags, resealable bagsor culture tubes) which are then placed into a shipping container.

Use bubble wrap or styrofoam peanuts when packing air samples for shipment. DO NOT USE VERMICULITE.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Upwind sources can contribute to sample concentration. Natural sources, such as biological waste, can produce hydrogen sulfide and methane which may contribute to the overall contaminant level. Extraneous anthropogenic contaminants (i.e., burning of fossil fuels; emissions from vehicular traffic, especially diesel; volatile compounds from petrochemical facilities; and effluvium from smoke stacks) may also contribute. Air sampling stations should be strategically placed to identify contributing sources.

Photoreactivity or reaction of the parameters of concern may occur with nonrelated compounds [i.e., nitrogen compounds and polyaromatic hydrocarbons

(PAHs)]. Some sorbent media/samples should not be exposed to light during or after sampling due to photochemical effects (i.e., PAHs).

Various environmental factors, including humidity, temperature and pressure, also impact the air sampling methodology, collection efficiency and detection limit. Since the determination of air contaminants is specifically dependent on the collection parameters and efficiencies, the collection procedure is an integral part of the analytical method.

Detection limits depend on the contaminants being investigated and the particular site situation. It is important to know why the data are needed and how the data will be used. Care should be taken to ensure the detection limits are adequate for the intended use of the final results.

Some equipment may be sensitive to humidity and temperature extremes.

5.0 EQUIPMENT/APPARATUS

5.1 Direct Reading Instruments (Air Monitoring Instruments)

There are two general types of direct reading instruments: portable screening devices and specialized analytical instruments. Generally all these techniques involve acquiring, for a specific location or area, continuous or sequential direct air concentrations in either a real-time or semi-real-time mode. None of these instruments acquires true time-weighted average concentrations. In addition, these instruments are not capable of acquiring simultaneous concentration readings at multiple locations, although several are able to sequentially analyze samples taken remotely from different locations. The document, "Guide to Portable Instruments for Assessing Airborne Pollutants Arising from Hazardous Waste Sites[5]," provides additional information about air sampling and monitoring. The hazard levels for airborne contaminants vary. See the ACGIH TLVs and the OSHA PELs for safe working levels. Common screening devices and analytical instruments are described in Appendix A.

5.2 Air Sampling Equipment and Media/Devices

The U.S. EPA/ERT uses the following analytical methods for sampling: *NIOSH Manual of Analytical Methods*[6], *American Society for Testing and Materials (ASTM) Methods*[7], *U.S. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*[8,9], and *OSHA Methods*[10]. Additional air sampling references include *Industrial Hygiene and Toxicology* (3rd Ed.)[11] and *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*[12]. These methods typically specify equipment requirements for sampling. Since air sampling is such a diverse technology, no single method or reference is best for all applications. Common sampling equipment and media/devices are described in Appendix B.

5.3 Tools/Material and Equipment List

In addition to equipment and materials identified in Appendices A and B, the following equipment and materials may be required to conduct air sampling and monitoring at hazardous waste sites:

- Camera
- Site logbook
- Clipboard
- Chain of custody records
- Custody seals
- Air sampling worksheets
- Sample labels
- Small screwdriver set
- Aluminum foil
- Extension cords
- Glass cracker
- Multiple plug outlet
- Whirl bags or culture tubes
- Teflon tape
- Calibration devices
- Tygon and/or Teflon^{R} tubing
- Surgical gloves
- Lint-free gloves
- Ice
- Sample container

Use the following additional equipment when decontaminating glassware on site:

- Protective equipment (i.e., gloves, splash goggles, etc.)
- Appropriate solvent(s)
- Spray bottles
- Liquinox (soap)
- Paper towels

- Distilled/deionized water
- Five-gallon buckets
- Scrub brushes and bottle brushes

6.0 REAGENTS

Impinger sampling involves using reagents contained in a glass vial to absorb contaminants of concern (for example, NIOSH Method 3500 for formaldehyde uses 1% sodium bisulfite solution). Impinger solutions vary and are method-dependent.

Reagents such as acetone and hexane are required to decontaminate glassware and some air sampling equipment. Decontamination solutions are specified in the Sampling Equipment Decontamination SOP.

7.0 PROCEDURES

7.1 Air Monitoring Design

7.1.1 Initial Surveys

In general, the initial survey is considered to be a relatively rapid screening process for collecting preliminary data at hazardous waste sites. However, initial surveys may require many hours to complete and may consist of more than one entry.

Some information is generally known about the site; therefore, real-time instrumentation for specific compounds (i.e., detector tubes and electrochemical sensors) can be used to identify hot spots. Sufficient data should be obtained with real-time instruments during the initial entry to screen the site for various contaminants. When warranted, intrinsically safe or explosion-proof instruments should be used. An organic vapor analyzer (OVA) is typically used during this survey. These gross measurements may be used on a preliminary basis to (1) determine levels of personal protection, (2) establish site work zones, and (3) map candidate areas for more thorough qualitative and quantitative studies involving air sampling.

In some situations, the information obtained may be sufficient to preclude additional monitoring. Materials detected during the initial survey may call for a more comprehensive evaluation of hazards and analyses for specific compounds. Since site activities and weather conditions change, a continuous program to monitor the ambient atmosphere must be established.

7.1.2 Off-Site Monitoring

Typically, perimeter monitoring with the same instruments employed for on-site monitoring is utilized to determine site boundaries. Because air is a dynamic matrix, physical boundaries like property lines and fences do not necessarily delineate the site boundary or area influenced by a release. Whenever possible, atmospheric hazards in the areas adjacent to the on-site zone should be monitored with direct-reading instruments. Monitoring at the fenceline or at varying locations off site provides useful information regarding pollutant migration. Three to four locations downwind of the source (i.e., plume) at breathing-zone height, provide a basic fingerprint of the plume. Negative instrument readings off site should not be interpreted as the complete absence of airborne toxic substances; rather, they should be considered another piece of information to assist in the preliminary evaluation. The interpretation of negative readings is instrument-dependent. The lack of instrument readings off site should not be interpreted as the complete absence of all airborne toxic substances; rather, it is possible that the particular compound or class of compounds to which the monitoring instrument responds is not present or that the concentration of the compound(s) is below the instrument's detection limit.

7.2 Air Sampling Design

7.2.1 Sampling Plan Design

The goal of air sampling is to accurately assess the impact of a contaminant source(s) on ambient air quality. This impact is expressed in terms of overall average and/or maximum air concentrations for the time period of concern and may be affected by the transport and release of pollutants from both on- and off-site sources. The location of these sources must be taken into account as they impact the selection of sampling locations. Unlike soil and groundwater concentrations, air concentrations at points of interest can easily vary by orders of magnitude over the period of concern. This variability plays a major role in designing an air sampling plan.

Downwind air concentration is determined by the amount of material being released from the site into the air (the emission rate) and by the degree that the contamination is diluted as it is transported. Local meteorology and topography govern downwind dilution. Contaminant emission rates can also be heavily influenced by on-site meteorology and on-site activities. All of these concerns must be incorporated into an air sampling plan.

A sampling strategy can be simple or complex, depending on the sampling program objectives. Programs involving characterization of the pollutant contribution from a single point source tend to be simple, whereas sampling programs investigating fate and transport characteristics of components from diverse sources require a more complex sampling strategy. In addition, resource constraints may affect the complexity of the sampling design.

An optimal sampling strategy accounts for the following site parameters:

- Location of stationary as well as mobile sources
- Analytes of concern
- Analytical detection limit to be achieved
- Rate of release and transport of pollutants from sources
- Availability of space and utilities for operating sampling equipment
- Meteorological monitoring data
- Meteorological conditions in which sampling is to be conducted

The sampling strategy typically requires that the concentration of contaminants at the source or area of concern as well as background contributions be quantified. It is important to establish background levels of contaminants in order to develop a reference point from which to evaluate the source data. Field blanks and lot blanks, as well as various other types of QA/QC samples, can be utilized to determine other sources. The impact of extraneous sources on sampling results can frequently be accounted for by placing samplers upwind, downwind and crosswind from the subject source. The analytical data from these different sampling locations may be compared to determine statistical differences.

7.2.2 Sampling Objectives

The objectives of the sampling must be determined prior to developing the sampling plan. Does the sampling plan verify adequate levels of protection for on-site personnel, or address potential off-site impacts associated with the site or with site activities? In addition, the assumptions associated with the sampling program must be defined. These assumptions include whether the sampling is to take place under "typical," "worst case," or "one-time" conditions. If the conditions present at the time of sampling are different from those assumed during the development of the sampling plan, then quality of the data collected may be affected. The following definitions have been established:

- Typical: routine daily sampling or routine scheduled sampling at pre-established locations.

- Worst case: sampling conducted under the worst meteorological and/or site conditions which would result in elevated ambient concentrations.

- One-time: only one chance is given to collect a sample without regard to time or conditions.

Qualitative data acquired under these conditions are usually applicable only to the time period during which the data were collected and may not provide accurate information to be used in estimating the magnitude of an air impact during other periods or over a long time interval.

The sampling objectives also dictate the detection limits. Sampling methods for airborne contaminants will depend upon the nature and state (solid, liquid or gas) of the contaminant. Gases and vapors may be collected in aqueous media or adsorbents, in molecular sieves, or in suitable containers. Particulates are collected by filters or impactors. The volume of sample to be collected is dependent upon an estimate of the contaminant concentration in the air, the sensitivity of the analytical method, and the standard or desired detection limit. A sufficient amount of sample must be collected to achieve the desired detection limit without interference from other contaminants. In addition, the selected method must be able to detect the target compound(s).

7.2.3 Location and Number of Individual Sampling Points

Choose the number and location of sampling points according to the variability, or sensitivity, of the sampling and analytical methods being utilized, the variability of contaminant concentration over time at the site, the level of precision required and costlimitations. In addition, determine the number of locations and placement of samplers by considering the nature of the response, local terrain, meteorological conditions, location of the site (with respect to other conflicting background sources), size of the site, and the number, size, and relative proximity of separate on-site emission sources and upwind sources. The following are several considerations for sampler placement:

- Location of potential on-site emission sources, as identified from the review of site background information or from preliminary on-site inspections.
- Location of potential off-site emission sources upwind of the sampling location(s). Review local wind patterns to determine the location of off-site sources relative to wind direction.
- Topographic features that affect the dispersion and transport of airborne toxic constituents.

Avoid natural obstructions when choosing air sampling station locations, and account for channelization around those obstructions.

- Large water bodies, which affect atmospheric stability and the dispersion of air contaminants.
- Roadways (dirt or paved), which may generate dust that could mask site contaminants.
- Vegetation, such as trees and shrubs, which stabilizes soil and retards subsurface contaminants from becoming airborne. It also affects air flow and scrubs some contaminants from the air. Sometimes thick vegetation can make an otherwise ideal air monitoring location inaccessible.

Consider the duration of sampling activities when choosing the location and number of samples to be collected. For example, if the sampling period is limited to a few hours, one or two upwind and several downwind samples would typically be adequate, especially around major emission sources.

A short-term monitoring program ranges from several days to a few weeks and generally includes gathering data for site assessments, removal actions, and source determination data (for further modeling). Activities involved in a short-term sampling strategy must make the most of the limited possibilities for data collection. Consider moving upwind/downwind locations daily based on National Oceanic and Atmospheric Administration (NOAA) weather forecasts. Weather monitoring becomes critical where complex terrain and local meteorological effects frequently change wind direction. Often, a number of alternatives can fulfill the same objective.

Prevailing winds running the length of a valley usually require a minimum number of sampler locations; however, a complex valley may require more sampler locations to account for the wide variety of winds. Ocean/lake effects may require a radical plan to collect enough samples to reach a low detection limit. Two sets of samplers may be placed next to each other: one set would be activated during the sea breeze while the other set is turned off, and vice versa when there is no sea breeze. After the sampling event, the respective upwind and downwind samples would be combined. Another alternative for sampling near a large body of water may be to use automatic, wind-vector-operated samplers, which turn the sampler on only when the wind comes from a specified vector. At sites located on hillsides, wind will move down a valley and produce an upward fetch at the same time. Sampling locations may have to ring the site to measure the wind's impact.

Off-site sources may affect on-site monitoring. In this case, on-site meteorological data, concurrent with sampling data, is essential to interpreting the acquired data. Also, additional upwind sampling sites may be needed to fully characterize ambient background contaminant levels. Multiple off-site sources may require several monitoring locations, but if the sources are at a sufficient distance, only one monitoring location is needed.

Topography and weather are not the only factors in sampler location; the sampling sites must be secure from vandals and mishap. Secure all sampling locations to maintain chain of custody, and to prevent tampering with samples or loss of sampling units. High-volume sampling methods often require the use of 110 VAC electric power. When portable generators are used, the power quality may affect sampler operation. Also, be aware that the generators themselves could be a potential pollution source if their placement is not carefully considered.

Air quality dispersion models can be used to place samplers. The models incorporate source information, surrounding topography, and meteorological data to predict the general distance and directions of maximum ambient concentrations. Modeling results should be used to select sampling locations in areas of maximum pollutant concentrations.

7.2.4 Time, Duration and Frequency of Sampling Events

After choosing appropriate sampling or monitoring locations, determine the sampling frequency and the number of samples to be collected. The time of day, duration and frequency of sampling events is governed by:

- The effects of site activities and meteorology on emission rates
- The diurnal effect of the meteorology on downwind dispersion
- The time period(s) of concern as defined by the objective
- The variability in the impact from other non-site-related sources
- If defined, the degree of confidence needed for either the mean or maximum downwind concentrations observed
- The precision requirements for single measurements
- Cost and other logistical considerations

The duration of the removal action and the number of hours per day that site work is conducted determine the time, duration, and frequency of samples. Short-term sampling programs may require daily sampling, while long-term programs may require 24-hour sampling every sixth or twelfth day. If the site will be undergoing removal activities 24 hours a day, continuous air sampling may be warranted. However, if the site activities will be conducted for only eight hours a day, and there are no emissions likely to occur during the remaining 16 hours, then sampling would be appropriate prior to the start of daily activities, would continue during operations, and end at the conclusion of the daily activities. An off-peak sample collection can ensure that emissions are not persisting after the conclusion of daily cleanup activities. For some sites, emissions are still a factor several hours after daily site activities have been completed. Because of the typically decreased downwind dispersion in the evening, higher downwind concentrations than were present during daytime site activities may be detected. For sites where this is possible, the sampling duration needs to be lengthened accordingly.

Sampling duration and flow rate dictate the volume of air collected, and to a major degree, the detection limit. The analytical method selected will provide a reference to flow rate and volume. Flow rates are limited to the capacity of the pumps being employed and the contact time required by the collection media.

The duration or period of air sampling is commonly divided into two categories (1) samples collected over a brief time period are referred to as "instantaneous" or "grab" samples and are usually collected in less than five minutes and (2) average or integrated samples are collected over a significantly longer period of time. Integrated samples provide an average concentration over the entire sampling period. Integrated samples are not suited to determining cyclical releases of contaminants because periodic or cyclical events are averaged out by the proportionally long sampling duration.

Air quality dispersion models can predict the maximum air contaminant concentration expected from a source. The meteorological and site conditions expected to cause the highest concentration are known as worst-case conditions and can be identified by analyzing the modeling results. Depending upon the objective, one may sample when the model predicts worst-case conditions will exist.

7.2.5 Meteorological and Physical/Chemical Considerations

A meteorological monitoring program is an integral part of site monitoring activities. Meteorological data, which define local terrain impacts on air flow paths, are needed to interpret air concentration data. Meteorological data may be available from an existing station located near the site (i.e., at a local airport), otherwise a station should be set up at the site. This data will document the degree that samples actually were downwind and verify whether other worst-case assumptions were met. Meteorological parameters to be monitored are, at a minimum, wind speed, wind direction, and sigma theta (which is the horizontal wind direction standard deviation and an indicator of atmospheric stability). The remaining parameters primarily affect the amount of a contaminant available in the air.

- Wind Speed

  When the contaminant of concern is a particulate, wind speed is critical in determining whether the particulate will become airborne, the quantity of the particulate that becomes airborne, and the distance the particulate will travel from the source. Wind speed also contributes to the volatilization of contaminants from liquid sources.

- Wind Direction

  Wind direction highly influences the path of airborne contaminants. In addition, variations in wind direction increase the dispersion of pollutants from a given source.

- Atmospheric Stability

  Atmospheric stability refers to the degree to which the atmosphere tends to dampen vertical and horizontal motion. Stable atmospheric conditions (i.e., evenings) result in low dispersion, and unstable atmospheric conditions (i.e., hot sunny days) result in higher dispersion.

- Temperature

  Higher temperatures increase the rate of volatilization of organic and some inorganic compounds and affect the initial rise of gaseous or vapor contaminants. Therefore, worst-case emission of volatiles and semivolatiles occurs at the hottest time of day, or on the hottest day.

- Humidity

  High humidity affects water-soluble chemicals and particulates. Humid conditions may dictate the sampling media used to collect the air sample, or limit the volume of air sampled and thereby increase the detection limit.

- Atmospheric Pressure

  Migration of landfill gases through the landfill surface and through surrounding soils are governed by changes in atmospheric pressure. Atmospheric pressure will influence upward migration of gaseous contaminants from shallow aquifers into the basements of overlying structures.

  In many cases, the transport and dispersion of air pollutants is complicated by local meteorology. Normal diurnal variations (i.e., temperature inversions) affect dispersion of airborne contaminants. Terrain features can enhance or create air inversions and can also influence the path and speed of air flow, complicating transport and dispersion patterns.

  The chemical characteristics of a contaminant (i.e., molecular weight, physical state, vapor pressure, aerodynamic size, temperature, reactive compounds, and photodegradation) affects its behavior and can influence the method used to sample and analyze it.

8.0 CALCULATIONS

Volume is obtained by multiplying the sample time in minutes by the flow rate. Sample volume should be indicated on the chain of custody record. Adjustments for temperature and pressure differences may be required.

Results are usually provided in parts per million (ppm), parts per billion (ppb), milligrams per cubic meter (mg/m^3) or micrograms per cubic meter ($\mu g/m^3$).

Refer to the analytical method or regulatory guidelines for other applicable calculations.

9.0 QUALITYASSURANCE/ QUALITY CONTROL

The manufacturer's instructions should be reviewed prior to instrument use. Instruments must be utilized in accordance with manufacturer's instructions. Equipment checkout and calibration activities must occur prior to and after monitoring and sampling and must be documented.

9.1 QA/QC Samples

QA/QC samples provide information on the variability and usability of environmental sample results. Various QA/QC samples may be collected to detect error. QA/QC samples are submitted with the field samples for analysis to aid in identifying the origin of analytical discrepancies; then a determination can be made as to how the analytical results should be used. Collocated samples, background samples, field blanks, and lot blanks are the most commonly collected QA/QC field samples. Performance evaluation (PE) samples and matrix spikes provide additional measures of data QA/QC control. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet site-specific QA or data quality objectives.

9.2 Sample Documentation

All sample and monitoring activities should be documented legibly, in ink. Any corrections or revisions should be made by lining through the incorrect entry and by initialing the error. All samples must be recorded on an Air Sampling Worksheet. A chain of custody record must be maintained from the time a sample is taken to the final deposition of the sample. Custody seals demonstrate that a sample container has not been opened or tampered with during transport or storage of samples.

10.0 DATA VALIDATION

Results for QA/QC samples should be evaluated for contamination. This information should be utilized to qualify the environmental sample results accordingly with data quality objectives.

11.0 HEALTH AND SAFETY

Personal protection equipment (PPE) requirements identified in federal and/or state regulations and 29 Code of Federal Regulations (CFR) 1910.120 for hazardous waste site work must be followed.

The majority of physical precautions involved in air sampling are related to the contaminant sampled. Attention should be given when sampling in potentially explosive, flammable or acidic atmospheres. On rare occasions, the collection media may be hazardous; for example, in the instance where an acidic or basic solution is utilized in an impinger.

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures.

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APPENDIX A

Portable Screening Devices and Specialized Analytical Instruments

PORTABLE SCREENING DEVICES

Where possible, a datalogger should be used to minimize the length of time required for site personnel to be in a potentially contaminated area. Datalogger cable is available from manufacturers for linear output instruments and some nonlinear output instruments. U.S. EPA ERT/REAC has output cables for organic vapor analyzers (i.e., HNU and OVA), toxic gas analyzers (i.e., monitox) and real-time aerosol monitors (i.e., RAM and miniram).

- Total Hydrocarbon Analyzers

  Total hydrocarbon analyzers used to detect a variety of volatile organic compounds (VOCs) at hazardous waste sites principally employ either a photoionization detector (PID) or a flame ionization detector (FID). Compounds are ionized by a flame or an ultraviolet lamp. PIDs depend on the ionization potential of the compounds. PIDs are sensitive to aromatic and olefinic (unsaturated) compounds such as benzene, toluene, styrene, xylenes, and acetylene. Greater selectivity is possible by using low-voltage lamps. The ionization potential of individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. These instruments are not compound-specific and are typically used as screening instruments. FIDs are sensitive to volatile organic vapor compounds such as methane, propanol, benzene and toluene. They respond poorly to organic compounds lacking hydrocarbon characteristics.

- Oxygen and Combustible Gas Indicators

  Combustible Gas Indicators (CGIs) provide efficient and reliable methods to test for potentially explosive atmospheres. CGI meters measure the concentration of a flammable vapor or gas in air and present these measurements as a percentage of the lower explosive limit (LEL).

The measurements are temperature-dependent. The property of the calibration gas determines sensitivity. LELs for individual compounds can be found in the NIOSH Pocket Guide to Chemical Hazards. If readings approach or exceed 10% of the LEL, extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25% LEL, personnel should be withdrawn immediately.

CGIs typically house an electrochemical sensor to determine the oxygen concentration in ambient air. Normally, air contains approximately 20.9% oxygen by volume. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air vapors which could displace ambient air. The meters are calibrated for sea level and may indicate a false negative (i.e, O_2 content) at higher altitudes. Since the air has been displaced by other substances, these oxygen-deficient areas are also prime locations for taking additional organic vapor and combustible gas measurements. Oxygen-enriched atmospheres increase the potential for fires by their ability to contribute to combustion or to chemically react with flammable compounds and promote auto-ignition.

- Toxic Atmosphere Analyzers

  The toxic atmosphere analyzer is a compound-specific instrument, designed and calibrated to identify and quantify a specific compound or class of compounds in either gaseous or vapor form. Cross-sensitivity to air pollutants not of interest may be lead to erroneous results.

  U.S. EPA/ERT has the following toxic atmosphere analyzers: carbon monoxide, phosgene, nitrous oxide, hydrogen cyanide, sulfur dioxide, hydrogen sulfide, and chlorine gas.

- Aerosol/Particulate Monitors

  A Real-Time Aerosol/Particulate Monitor (RAM) displays readings for total particulates. The instrument employs a pulse light emitting diode which generates a narrow band emission in conjunction with a photovoltaic cell to detect light scattered from particulates.

  The U.S. EPA/ERT uses the RAM when the contaminant of concern is associated with particulates, and when responding to fires involving hazardous materials, to identify plume levels. The instrument is very useful in determining the presence of a plume when it is not visible. The U.S. EPA/ERT typically uses RAMs on tripods to obtain particulate concentrations at the breathing zone level. Personal dataloggers are used with the RAMs to document minimum, average and maximum concentrations. This provides real-time data without requiring those in personal protective equipment to be constantly present in the plume.

- Chemical Detector Tubes (Colorimetric Tubes)

  A chemical detector tube is a hollow, tube-shaped, glass body containing one or more layers of chemically impregnated inert material. To use, the fused ends are broken off and a manufacturer-specified volume of air is drawn through the tube with a pump to achieve a given detection limit. The chemicals contained within the packing material undergo a chemical reaction with the airborne pollutant present, producing a color change during the intake of each pump stroke. The concentration of a pollutant is indicated by the length of discoloration on a calibrated scale printed on the detector tube.

- Radiation Meters

  Radiation meters determine the presence and level of radiation. The meters use a gas or solid ion detection media which becomes ionized when radiation is present. The meters are normally calibrated to one probe. Meters that detect alpha, beta, and gamma radiation are available.

- Gold Film (Hydrogen Sulfide and Mercury Vapor) Monitors

  Hydrogen sulfide (H_2S) and Mercury (Hg) monitors operate on the principle that electric resistivity increases across a gold film as a function of H_2S and Hg concentration. The monitors provide rapid and relatively low detection limits for H_2S and Hg in air. After extensive sampling periods or high concentrations of H_2S and Hg, the gold film must be heated to remove contamination and return the monitor to its original sensitivity.

- Infrared Detectors

  Infrared detectors such as the Miniature Infrared Analyzer (MIRAN) use infrared (IR) absorption as a function of specific compounds. MIRAN instruments apply to situations where the contaminants are identified but concentrations are not. MIRAN instruments generally require AC power.

SPECIALIZED ANALYTICAL INSTRUMENTS

The continuous monitors described above provide qualitative measurement of air contaminants. Quantitative measurements in the field can be obtained using more sophisticated instruments, such as portable Gas Chromatographs, to analyze grab samples.

- Direct Air Sampling Portable Gas Chromatographs (GCs)

  Portable GCs use gas chromatography to identify and quantify compounds. The time it takes for a compound to move through a chromatographic column is a function of that specific compound or group of compounds. A trained technician with knowledge of the range of expected concentrations of compounds can utilize a portable GC in the field to analyze grab samples. GCs generally require AC power and shelter to operate. This method is limited by its reliance on a short-term grab sample to be representative of the air quality at a site.

- Remote Optical Sensing

  This technique, also referred to as long-path or open-path monitoring, involves transmitting either an infrared or ultraviolet light beam across a long open path and measuring the absorbance at specific wavelengths. The technique is capable of analyzing any preselected organic or inorganic volatile compound that can be resolved from compounds naturally occurring in ambient air. Current projected removal applications include perimeter monitoring during site cleanups and measurement of emission source strengths during site assessments.

- TAGA Direct Air Sampling Mass Spectrometer/Mass Spectrometer

  The Trace Atmospheric Gas Analyzer (TAGA), which is operated by the U.S. EPA/ERT, is capable of real-time detection of preselected organic compounds at low parts-per-billion concentrations. The instrument has been successfully used by the U.S. EPA/ERT for isolating individual emission plumes and tracking those plumes back to their sources.

APPENDIX B

Air Sampling Equipment and Media/Devices

AIR SAMPLING EQUIPMENT

- High-Volume, Total Suspended Particulate (TSP) Samplers

  High-volume TSP samplers collect all suspended particles by drawing air across an 8- by 10-inch glass-quartz filter. The sample rate is adjusted to 40 cubic feet per minute (CFM), or 1134 liters per minute (L/min), and it is held constant by a flow controller over the sample period. The mass of TSPs can be determined by weighing the filter before and after sampling. The composition of the filter varies according to the analytical method and the detection limit required.

- PM-10 Samplers

  PM-10 samplers collect particulates with a diameter of 10 microns or less from ambient air. Particulates of this size represent the respirable fraction, and thus are of special significance. PM-10 samplers can be high-volume or low-volume. The high-volume sampler operates in the same manner as the TSP sampler at a constant flow rate of 40 CFM; it draws the sample through a special impactor head which collects particulates of 10 microns or less. The particulate is collected on an 8- by 10-inch filter. The low-volume sampler operates at a rate of approximately 17 L/min. The flow must remain constant through the impactor head to maintain the 10-micron cut-off point. The low-volume PM-10 collects the sample on 37-mm Teflon filters.

- High-Volume PS-1 Samplers

  High-volume PS-1 samplers draw a sample through polyurethane foam (PUF) or a combination foam and XAD-2 resin plug, and a glass quartz filter at a rate of 5-10 CFM (144 to 282 L/min). This system is excellent for measuring low concentrations of semivolatiles, PCBs, pesticides, or chlorinated dioxins in ambient air.

- Area Sampling Pumps

  These pumps provide flow-rate ranges of 2-20 L/min and have a telescopic sampling mast with the sampling train. Because of the higher volume, this pump is suitable for sampling low concentrations of airborne contaminants (i.e., asbestos sampling). These pumps are also used for metals, pesticides and PAH sampling which require large sample volumes.

- Personal Sampling Pumps

  Personal sampling pumps are reliable portable sampling devices that draw air samples through a number of sampling media including resin tubes, impingers, and filters. Flow rates are usually adjustable from 0.1 to 4 L/min (or 0.01 to .75 L/min with a restrictive orifice) and can remain constant for up to 8 hours on one battery charge or continuously with an AC charger/converter.

- Canister Samplers

  Evacuated canister sampling systems use the pressure differential between the evacuated canister and ambient pressure to bleed air into the canister. The sample is bled into the canister at a constant rate over the sampling period using a critical orifice, a mechanically compensated regulator, or a mass flow control
  device until the canister is near atmospheric pressure.

  Pressure canister sampling systems use a pump to push air into the canister. To maintain a higher, more controlled flow, the pump typically controls the pressure differential across a critical orifice at the inlet of the canister, resulting in a pressurized canister at the completion of sampling.

AIR SAMPLING MEDIA/DEVICES

If possible, before employing a specific sampling method, consult the laboratory that will conduct the analyses. Many of the methods can be modified to provide better results or a wider range of results.

- Summa[R] Canisters

  Summa canisters are highly polished passivated stainless steel cylinders. The Summa polishing process brings chrome and nickel to the surface of the canisters, which results in an inert surface. This surface restricts adsorption or reactions that occur on the canister's inner surface after collection. At the site, the canister is either placed in a sampler to control sample collection rate, or opened to collect a grab sample. Samples can be collected by allowing air to bleed into or be pumped into the canister. U.S. EPA/ERT uses 6-liter Summa canisters for VOC and permanent gas analysis.

- Passive Dosimeters

  Passive dosimeters are clip-on vapor monitors (samplers) in which the diffused contaminants are absorbed on specially prepared active surfaces. Industrial hygienists commonly use dosimeters to obtain time-weighted averages or concentrations of chemical vapors, as they can trap over 130 organic compounds. Selective dosimeters have also been developed for a number of chemicals including formaldehyde, ethylene oxide, hydrogen sulfide, mercury vapor, nitrogen dioxide, sulfur dioxide, and ozone. Dosimeters must be sent to a laboratory for analysis.

- Polyurethane Foam (PUF)

  PUF is a sorbent used with a glass filter for the collection of semivolatile organic compounds such as pesticides, PCBs, chlorinated dioxins and furans, and PAHs. Fewer artifacts (chemical changes that occur to collected compounds) are produced than with some other solid sorbents. PUF is used with the PS-1 sampler and U.S. EPA Method TO13. PUF can also be used with personal sampling pumps when sampling for PAHs using the Lewis/McCloud method. Breakthrough of the more volatile PCBs and PAHs may occur when using PUF.

- Sampling Bags (Tedlar[R])

  Sampling bags, like canisters, transport air samples to the laboratory for analysis. Samples are generally pumped into the bags, but sometimes a lung system is used, in which a pump creates a vacuum around the bag in a vacuum box. Then the sample flows from a source into the bag. This method is used for VOCs, fixed gases (CO_2, O_2, and N_2) and methane.

- Impingers

  An impinger allows an air sample to be bubbled through a solution, which collects a specific contaminant by either chemical reaction or absorption. For long sampling periods, the impinger may need to be kept in an ice bath to prevent the solution from evaporating during sampling. The sample is drawn through the impinger by using a sampling pump or more elaborate sampling trains with multiple impingers.

- Sorbent Tubes/Cartridges

  A variety of sampling media are available in sorbent tubes, which are used primarily for industrial hygiene. A few examples are carbon cartridges, carbon molecular sieves, Tenax tubes and tube containing the XAD-2 polymer. Depending upon the sorbent material, tubes can be analyzed using either a solvent extraction or thermal desorption. The former technique uses standard laboratory equipment and allows for multiple analyses of the same sample. The latter technique requires special, but readily available, laboratory equipment and allows only one analysis per sample. In addition, thermal desorption typically allows for lower detection limits by two or more orders of magnitude. Whenever sorbent tubes are being used for thermal desorption, they should be certified as "clean" by the laboratory doing the analysis.

Thermally Desorbed Media

During thermal desorption, high-temperature gas streams are used to remove the compounds collected on a sorbent medium. The gas stream is injected and often cryofocused into an analytical instrument, such as a GC, for compound analysis:

- Tenax Tubes

  Tenax tubes are made from commercially available polymer (p-phenylene oxide) packed in glass or stainless steel tubes through which air samples are drawn or sometimes pumped. These tubes are used in U.S. EPA Method TO1 and VOST for volatile nonpolar organic, some polar organic, and some of the more volatile semivolatile organics. Tenax is not appropriate for many of the highly volatile organics (with vapor pressure greater than approximately 200 mm Hg).

- Carbonized Polymers

  The carbonized molecular sieve (CMS), a carbonized polymer, is a commercially available, carbon sorbent packed in stainless-steel sampling tubes through which air samples are drawn or sometimes pumped. These are used in U.S. EPA Method TO2 for highly volatile nonpolar compounds which have low-breakthrough volumes on other sorbents. When high-thermal desorption temperatures are used with CMS, more variability in analysis may occur than with other sorbents.

- Mixed Sorbent Tubes

  Sorbent tubes can contain two type of sorbents. Combining the advantages of each sorbent into one tube increases the possible types of compounds to be sampled. The combination of two sorbents can also reduce the chance that highly volatile compounds will break through the sorbent media. An example of a mixed sorbent tube is the combination of Tenax and charcoal with a carbonized molecular sieve. A potential problem with mixed sorbent tubes is the breakthrough of a compound from an earlier sorbent to a later sorbent from which it cannot be desorbed.

Solvent-Extracted Media

Solvent-extracted media use the principle of chemical extraction to remove compounds collected on a sorbent media. The chemical solvent is injected into an instrument, such as a GC, for analysis of compounds. Examples of solvent-extracted media follow:

- Chemically Treated Silica Gel

  Silica gel is a sorbent which can be treated with various chemicals. The chemically treated silica gel can then be used to sample for specific compounds in air. Examples include the DNPH-coated silica gel cartridge used with U.S. EPA Method TO11.

- XAD-2 Polymers

  XAD-2 polymers usually are placed in tubes, custom-packed sandwich-style with polyurethane foam, and prepared for use with U.S. EPA Method TO13 or the semi-VOST method. The polymers are used for the collection of semivolatile polar and nonpolar organic compounds. The compounds collected on the XAD-2 polymer are chemically extracted for analysis.

- Charcoal Cartridges

  Charcoal cartridges, consisting of primary and backup sections, trap compounds by adsorption. Ambient air is drawn through them so that the backup section verifies that breakthrough of the analytes on the first section did not occur, and the sample collection was therefore quantitative. Quantitative sample collection is evident by the presence of target chemicals on the first charcoal section and the absence on the second section. Next, the adsorbed compounds must be eluted, usually with a solvent extraction, and analyzed by GC with a detector, such as a Mass Spectrometer (MS).

- Tenax Tubes

  Cartridges are used in OSHA and NIOSH methods in a manner similar to charcoal cartridges but typically for less volatile compounds.

Particulate Filters

Particulate filters are used by having a sampling pump pass air through them. The filter collects the particulates present in the air and is then analyzed for particulate mass or chemical or radiological composition. Particulate filters are made from different materials which are described below.

- Mixed Cellulose Ester (MCE)

  MCE is manufactured from mixed esters of cellulose which are a blend of nitro-cellulose and cellulose acetate. MCE filters are used often for particulate sampling.

- Glass Fiber

  Glass fiber is manufactured from glass fibers without a binder. Particulate filters with glass fiber provide high flow rates, wet strength, and high, solid holding capacity. Generally, the filters are used for gravimetric analysis of particulates.

- Polyvinyl Chloride

  Particulate filters with polyvinyl chloride are resistant to concentrated acids and alkalis. Their low moisture pickup and light tare weight make them ideal for gravimetric analysis.

- Teflon

  Teflon is manufactured from polytetrafluorethylene (PTFE). Particulate filters with Teflon are easy to handle and exceptionally durable. Teflon filters are used for metal collection.

- Silver

  Particulate filters manufactured from pure silver have high collection efficiency and uniform pore size. These filters are used for mercury collection and analysis.

- Cellulose

  Particulate filters with cellulose contain less than 0.01% ash. These filters are used to collect particulates.

CHIP, WIPE, AND SWEEP SAMPLING

1.0 SCOPE AND APPLICATION

This standard operating procedure (SOP) outlines the recommended protocol and equipment for collection of representative chip, wipe, and sweep samples to monitor potential surficial contamination.

This method of sampling is appropriate for surfaces contaminated with non-volatile species of analytes (i.e., PCB, PCDD, PCDF, metals, cyanide, etc.) Detection limits are analyte specific. Sample size should be determined based upon the detection limit desired and the amount of sample requested by the analytical laboratory. Typical sample area is one square foot. However, based upon sampling location, the sample size may need modification due to area configuration.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Since surface situations vary widely, no universal sampling method can be recommended. Rather, the method and implements used must be tailored to suit a specific sampling site. The sampling location should be selected based upon the potential for contamination as a result of manufacturing processes or personnel practices.

Chip sampling is appropriate for porous surfaces and is generally accomplished with either a hammer and chisel, or an electric hammer. The sampling device should be laboratory cleaned and wrapped in clean, autoclaved aluminum foil until ready for use. To collect the sample, a measured and marked off area is chipped both horizontally and vertically to an even depth of 1/8 inch. The sample is then transferred to the proper sample container.

Wipe samples are collected from smooth surfaces to indicate surficial contamination; a sample location is measured and marked off. While wearing a new pair of surgical gloves, a sterile gauze pad is opened, and soaked with solvent. The solvent used is dependent on the surface being sampled. This pad is then stroked firmly over the sample surface, first vertically, then horizontally, to ensure complete coverage. The pad is then transferred to the sample container.

Sweep sampling is an effective method for the collection of dust or residue on porous or non-porous surfaces. To collect such a sample, an appropriate area is measured off. Then, while wearing a new pair of disposable surgical gloves, a dedicated brush is used to sweep material into a dedicated dust pan. The sample is then transferred to the proper sample container.

Samples collected by all three methods are then sent to the laboratory for analysis.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples should be stored out of direct sunlight to reduce photodegredation, cooled to 4°C and shipped to the laboratory performing the analysis. Appropriately sized laboratory cleaned, glass sample jars should be used for sample collection. The amount of sample required will be determined in concert with the analytical laboratory.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

This method has few significant interferences or problems. Typical problems result from rough porous surfaces which may be difficult to wipe, chip, or sweep.

5.0 EQUIPMENT

Equipment required for performing chip, wipe, or sweep sampling is as follows:

- Lab clean sample containers of proper size and composition
- Site logbook
- Sample analysis request forms
- Chain of Custody records
- Custody seals
- Field data sheets
- Sample labels
- Disposable surgical gloves
- Sterile wrapped gauze pad (3 in. x 3 in.)
- Appropriate pesticide (HPLC) grade solvent
- Medium sized laboratory cleaned paint brush
- Medium sized laboratory cleaned chisel
- Autoclaved aluminum foil
- Camera
- Hexane (pesticide/HPLC grade)
- Iso-octane
- Distilled/deionized water

6.0 REAGENTS

Reagents are not required for preservation of chip, wipe or sweep samples. However, reagents will be utilized for decontamination of sampling equipment.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or preclean equipment, and ensure that it is in working order.

4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.

5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Mark all sampling locations. If required the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

7.2 Chip Sample Collection

Sampling of porous surfaces is generally accomplished by using a chisel and hammer or electric hammer. The sampling device should be laboratory cleaned or field decontaminated as per the Sampling Equipment Decontamination SOP. It is then wrapped in cleaned, autoclaved aluminum foil. The sampler should remain in this wrapping until it is needed. Each sampling device should be used for only one sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record surface area to be chipped.

3. Don a new pair of disposable surgical gloves.

4. Open a laboratory-cleaned chisel or equivalent sampling device.

5. Chip the sample area horizontally, then vertically to an even depth of approximately 1/8 inch.

6. Place the sample in an appropriately prepared sample container with a Teflon lined cap.

7. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

8. Store samples out of direct sunlight and cool to 4°C.

9. Follow proper decontamination procedures then deliver sample(s) to the laboratory for analysis.

7.3 Wipe Sample Collection

Wipe sampling is accomplished by using a sterile gauze pad, adding a solvent in which the contaminant is most soluble, then wiping a pre-determined, pre-measured area. The sample is packaged in an amber jar to prevent photodegradation and packed in coolers for shipment to the lab. Each gauze pad is used for only one wipe sample.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record surface area to be wiped.

3. Don a new pair of disposable surgical gloves.

4. Open new sterile package of gauze pad.

5. Soak the pad with solvent of choice.

6. Wipe the marked surface area using firm strokes. Wipe vertically, then horizontally to insure complete surface coverage.

7. Place the gauze pad in an appropriately prepared sample container with a Teflon-lined cap.

8. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site logbook and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

9. Store samples out of direct sunlight and cool to 4°C.

10. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

7.4 Sweep Sample Collection

Sweep sampling is appropriate for bulk contamination. This procedure utilizes a dedicated, hand held sweeper brush to acquire a sample from a pre-measured area.

1. Choose appropriate sampling points; measure off the designated area. Photo documentation is optional.

2. Record the surface area to be swept.

3. Don new pair of disposable surgical gloves.

4. Sweep the measured area using a dedicated brush; collect the sample in a dedicated dust pan.

5. Transfer sample from dust pan to sample container.

6. Cap the sample container, attach the label and custody seal, and place in a plastic bag. Record all pertinent data in the site log book and on field data sheets. Complete the sampling analysis request form and chain of custody record before taking the next sample.

7. Store samples out of direct sunlight and cool to 4°C.

8. Leave contaminated sampling device in the sample material, unless decontamination is practical.

9. Follow proper decontamination procedures, then deliver sample(s) to the laboratory for analysis.

8.0 CALCULATIONS

Results are usually provided in mg/g, µg/g, mass per unit area, or other appropriate measurement. Calculations are typically done by the laboratory.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody forms, field data sheets or within the site logbook.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

The following specific quality assurance activities apply to wipe samples:

For wipe samples, a blank should be collected for each sampling event. This consists of a sterile gauze pad, wet with the appropriate solvent, and placed in a prepared sample container. The blank will help identify potential introduction of contaminants via the sampling methods, the pad, solvent or sample container. Spiked wipe samples can also be collected to better assess the data being generated. These are prepared by spiking a piece of foil of known area with a standard of the analyte of choice. The solvent containing the standard is allowed to evaporate, and the foil is wiped in a manner identical to the other wipe samples.

Specific quality assurance activities for chip and sweep samples should be determined on a site specific basis.

10.0 DATA VALIDATION

A review of the quality control samples will be conducted and the data utilized to qualify the environmental results.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow EPA, OSHA and corporate health and safety procedures.

12.0 REFERENCES

U.S. EPA, A Compendium of Superfund Field Operation Methods. EPA/540/5-87/001.

NJDEP Field Sampling Procedures Manual, February, 1988.

SUMMA CANISTER SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe a procedure for sampling of volatile organic compounds (VOCs) in ambient air. The method is based on samples collected as whole air samples in Summa passivated stainless steel canisters. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass-selective detector or multidetector techniques. This method presents procedures for sampling into canisters at final pressures both above and below atmospheric pressure (respectively referred to as pressurized and subatmospheric pressure sampling).

This method is applicable to specific VOCs that have been tested and determined to be stable when stored in pressurized and subatmospheric pressure canisters. The organic compounds that have been successfully collected in pressurized canisters by this method are listed in the Volatile Organic Compound Data Sheet (Appendix A). These compounds have been measured at the parts per billion by volume (ppbv) level.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure or other procedure limitations. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Both subatmospheric pressure and pressurized sampling modes use an initially evacuated canister. Both modes may also use a mass flow controller/vacuum pump arrangement to regulate flow. With the above configuration, a sample of ambient air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into a pre-evacuated Summa passivated canister. Alternatively, subatmospheric pressure sampling may be performed using a fixed orifice, capillary, or adjustable micrometering valve in lieu of the mass flow controller/vacuum pump arrangement for taking grab samples or short duration time-integrated samples. Usually, the alternative types of flow controllers are appropriate only in situations where screening samples are taken to assess for future sampling activities.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

After the air sample is collected, the canister valve is closed, an identification tag is attached to the canister, and the canister is transported to a laboratory for analysis. Upon receipt at the laboratory, the canister tag data is recorded. Sample holding times and expiration should be determined prior to initiating field activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Contamination may occur in the sampling system if canisters are not properly cleaned before use. Additionally, all other sampling equipment (e.g., pump and flow controllers) should be thoroughly cleaned.

5.0 EQUIPMENT/APPARATUS

The following equipment/apparatus (Figure 1, Appendix B) is required:

5.1 Subatmospheric Pressure Sampling Equipment

1. VOC canister sampler - whole air sampler capable of filling an initially evacuated canister by action of the flow controlled pump from vacuum to near atmospheric pressure. (Andersen Samplers Inc., Model 87-100 or equivalent).

2. Sampling inlet line - stainless steel tubing to connect the sampler to the sample inlet.

3. Sample canister - leak-free stainless steel pressure vessels of desired volume with valve and Summa passivated interior surfaces (Scientific Instrumentation Specialist, Inc., ID 83843, Andersen Samplers, Inc., or equivalent).

4. Particulate matter filter - 2-µm sintered stainless steel in-line filter (Nupro Co., Model SS-2F-K4-2, or equivalent).

5. Chromatographic grade stainless steel tubing and fittings - for interconnections (Alltech Associates, Cat. #8125, or equivalent). All materials in contact with sample, analyte, and support gases should be chromatographic grade stainless steel.

6. Fixed orifice, capillary, or adjustable micrometering valve - used in lieu of the electronic flow controller/vacuum pump for grab samples or short duration time-integrated samples.

5.2 Pressurized Sampling Equipment

1. VOC canister sampler - whole air sampler capable of filling an initially evacuated canister by action of the flow controlled pump from vacuum to near atmospheric pressure. (Andersen Samplers Inc., Model 87-100).

2. Sampling inlet line - stainless steel tubing to connect the sampler to the sample inlet.

3. Sample canister - leak-free stainless steel pressure vessels of desired volume with valve and Summa passivated interior surfaces (Scientific Instrumentation Specialist, Inc., ID 83843, Andersen Samplers, Inc., or equivalent).

4. Particulate matter filter - 2-µm sintered stainless steel in-line filter (Nupro Co., Model SS-2F-K4-2, or equivalent).

5. Chromatographic grade stainless steel tubing and fittings - for interconnections (Alltech Associates, Cat. #8125, or equivalent). All materials in contact with sample, analyte, and support gases should be chromatographic grade stainless steel.

6.0 REAGENTS

This section is not applicable to this SOP.

7.0 PROCEDURE

7.1 Subatmospheric Pressure Sampling

7.1.1 Sampling Using a Fixed Orifice, Capillary, or Adjustable Micrometering Valve

1. Prior to sample collection, the appropriate information is completed on the Canister Sampling Field Data Sheet (Appendix C).

2. A canister, which is evacuated to 0.05 mm Hg and fitted with a flow restricting device, is opened to the atmosphere containing the VOCs to be sampled.

3. The pressure differential causes the sample to flow into the canister.

4. This technique may be used to collect grab samples (duration of 10 to 30 seconds) or time-integrated samples (duration of 12 to 24 hours). The sampling duration depends on the degree to which the flow is restricted.

5. A critical orifice flow restrictor will have a decrease in the flow rate as the pressure approaches atmospheric.

6. Upon sample completion at the location, the appropriate information is recorded on the

Canister Sampling Field Data Sheet.

7.1.2 Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Andersen Sampler Model 87-100)

1. Prior to sample collection the appropriate information is completed on the Canister Sampling Field Data Sheet (Appendix C).

2. A canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, is opened to the atmosphere containing the VOCs to be sampled.

3. A whole air sample is drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly.

4. A small portion of this whole air sample is pulled from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.

5. The initially evacuated canister is filled by action of the flow controlled pump to near atmospheric pressure.

6. A digital time-program is used to pre-select sample duration and start and stop times.

7. Upon sample completion at the location, the appropriate information is recorded on the Canister Sampling Field Data Sheet.

7.2 Pressurized Sampling

7.2.1 Sampling Using a Mass Flow Controller/Vacuum Pump Arrangement (Anderson Sampler Model 87-100)

1. Prior to sample commencement at the location, the appropriate information is completed on the Canister Sampling Field Data Sheet.

2. A canister, which is evacuated to 0.05 mm Hg and connected in line with the sampler, is opened to the atmosphere containing the VOCs to be sampled.

3. A whole air sample is drawn into the system through a stainless steel inlet tube by a direct drive blower motor assembly.

4. A small portion of this whole air sample is pulled from the inlet tube by a specially modified inert vacuum pump in conjunction with a mass flow controller.

5. The initially evacuated canister is filled by action of the flow controlled pump to a positive pressure not to exceed 25 psig.

6. A digital time-programmer is used to pre-select sample duration and start and stop times.

7. Upon sample completion at the location, the appropriate information is recorded on the Canister Sampling Field Data Sheet.

8.0 CALCULATIONS

1. A flow control device is chosen to maintain a constant flow into the canister over the desired sample period. This flow rate is determined so the canister is filled to about 88.1 kPa for subatmospheric pressure sampling or to about one atmosphere above ambient pressure for pressurized sampling over the desired sample period. The flow rate can be calculated by:

$$F = \frac{(P)(V)}{(T)(60)}$$

where:

F	=	flow rate (cm^3/min)
P	=	final canister pressure, atmospheres absolute
V	=	volume of the canister (cm^3)
T	=	sample period (hours)

For example, if a 6-L canister is to be filled to 202 kPa (two atmospheres) absolute pressure in 24 hours, the flow rate can be calculated by:

$$F = \frac{(2)(6000)}{(24)(60)} = 8.3cm^3/\text{min}$$

2. If the canister pressure is increased, a dilution factor (DF) is calculated and recorded on the sampling data sheet.

$$DF = \frac{Ya}{Xa}$$

where:

Xa = canister pressure (kPa, psia) absolute before dilution.
Ya = canister pressure (kPa, psia) absolute after dilution.

After sample analysis, detected VOC concentrations are multiplied by the dilution factor to determine concentration in the sampled air.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

The following general quality assurance procedures apply:

1. All data must be documented on standard chain of custody records, field data sheets, or site logbooks.

2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety practices. Specifically, pressurizing of Summa canisters should be performed in a well ventilated room, or preferably under a fume hood. Care must be taken not to exceed 40 psi in the canisters. Canisters are under pressure, albeit only 20-30 psi, and should not be dented or punctured. They should be stored in a cool dry place and always be placed in their plastic shipping boxes during transport and storage.

12.0 REFERENCES

1. Ralph M. Riggin, Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air, EPA-600/4-83-027 U. S. Environmental Protection Agency, Research Triangle Park, NC, 1983.

2. W. A. McClenny, J. D. Pleil, T. A. Lumpkin and K. D. Oliver, "Update on Canister-Based Samplers for VOCs," Proceedings of the 1987 EPA/APCA Symposium on Measurement of Toxic and Related Air Pollutants, May, 1987 APCA Publication VIP-8, EPA 600/9-87-010.

3. J. F. Walling, "The Utility of Distributed Air Volume Sets When Sampling Ambient Air Using Solid Adsorbents," Atmospheric Environ., 18:855-859, 1984.

4. J. F. Walling, J. E. Bumgarner, J. D. Driscoll,C. M. Morris, A. E. Riley, and L. H. Wright, "Apparent Reaction Products Desorbed From Tenax Used to Sample Ambient Air," Atmospheric Environ., 20:51-57, 1986.

5. Portable Instruments User's Manual for Monitoring VOC Sources, EPA-340/1-88-015, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Washington, D.C., June 1986.

6. R. A. Rasmussen and J. E. Lovelock, Atmospheric Measurements Using Canister Technology, J. Geophys. Res., 83: 8369-8378, 1983.

7. R. A. Rasmussen and M. A. K. Khalil, "Atmospheric Halocarbon: Measurements and Analysis of Selected Trace Gases," Proc. NATO ASI on Atmospheric Ozone, BO: 209-231.

8. EPA Method TO-14 "Determination of Volatile Organic Compounds (VOC's) in Ambient Air Using Summa Passivated Canister Sampling and Gas Chromatographic Analysis", May 1988.

APPENDIX A

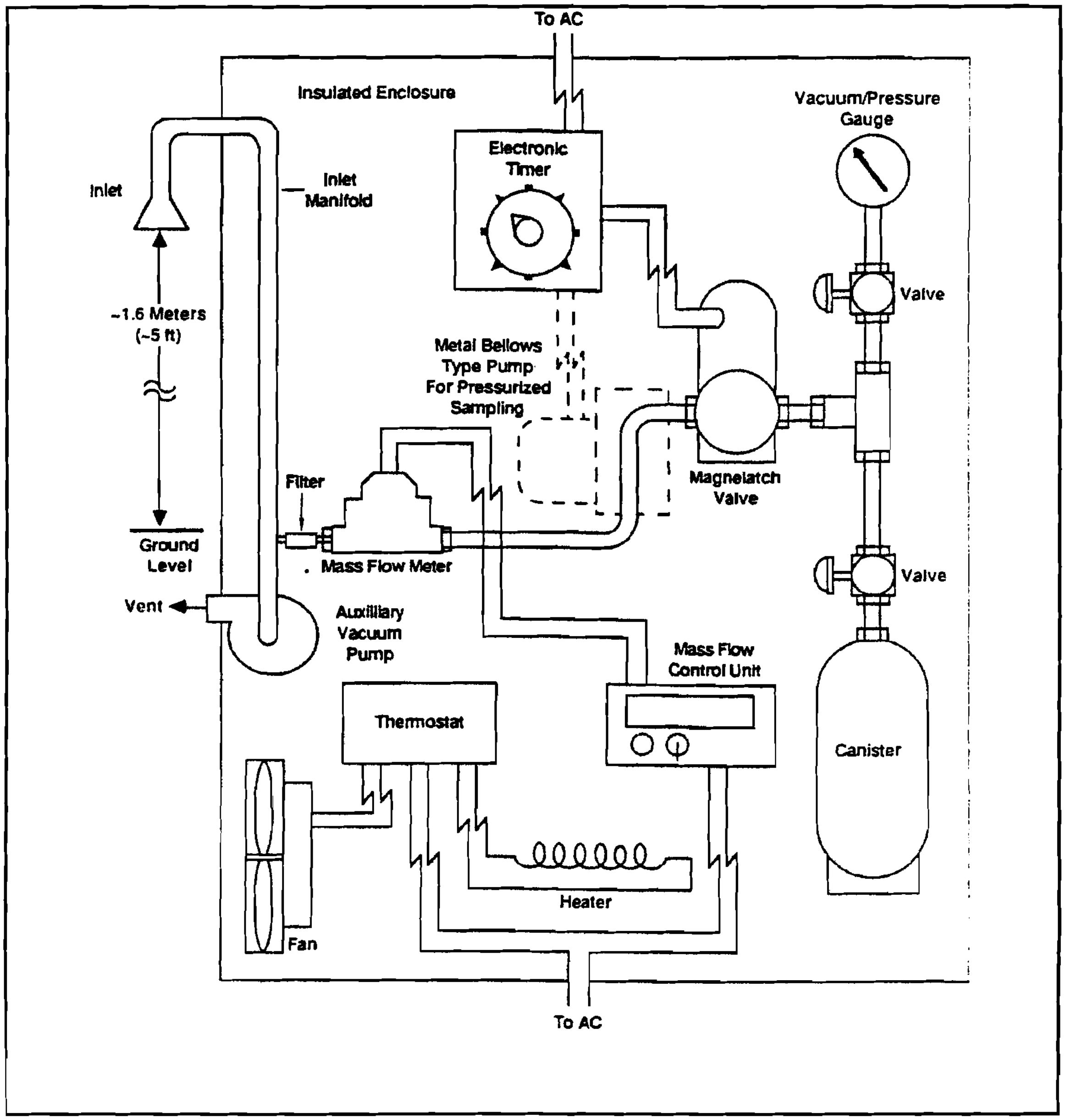
Volatile Organic Compound Data Sheet

TABLE 1. VOLATILE ORGANIC COMPOUND DATA SHEET

COMPOUND (SYNONYM)	FORMULA	MOLECULAR WEIGHT	BOILING POINT (°C)	MELTING POINT (°C)	CAS NUMBER
Freon 12 (Dichlorodifluoromethane)	Cl_2CF_2	120.91	-29.8	-158.0	
Methyl chloride (Chloromethane)	CH_3Cl	50.49	-24.2	-97.1	74-87-3
Freon 114 (1,2-Dichloro-1,1,2,2-tetrafluoroethane)	$ClCF_2CClF_2$	170.93	4.1	-94.0	
Vinyl chloride (Chloroethylene)	CH_2=CHCl	62.50	-13.4	-1538.0	75-01-4
Methyl bromide (Bromomethane)	CH_3Br	94.94	3.6	-93.6	74-83-9
Ethyl chloride (Chloroethane)	CH_3CH_2Cl	64.52	12.3	-136.4	75-00-3
Freon 11 (Trichlorofluoromethane)	CCl_3F	137.38	23.7	-111.0	
Vinylidene chloride (1,1-Dichloroethene)	$C_2H_2Cl_2$	96.95	31.7	-122.5	75-35-4
Dichloromethane (Methylene chloride)	CH_2Cl_2	84.94	39.8	-95.1	75-09-2
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	CF_2ClCCl_2F	187.38	47.7	-36.4	
1,1-Dichloroethane (Ethylidene chloride)	CH_3CHCl_2	98.96	57.3	-97.0	74-34-3
cis-1,2-Dichloroethylene	CHCl=CHCl	96.94	60.3	-80.5	
Chloroform (Trichloromethane)	$CHCl_3$	119.38	61.7	-63.5	67-66-3
1,2-Dichloroethane (Ethylene dichloride)	$ClCH_2CH_2Cl$	98.96	83.5	-35.3	107-06-2
Methyl chloroform (1,1,1-Trichloroethane)	CH_3CCl_3	133.41	74.1	-30.4	71-55-6
Benzene (Cyclohexatriene)	C_6H_6	78.12	80.1	5.5	71-43-2
Carbon tetrachloride (Tetrachloromethane)	CCl_4	153.82	76.5	-23.0	56-23-5
1,2-Dichloropropane (Propylene dichloride)	$CH_3CHClCH_2Cl$	112.99	96.4	-100.4	78-87-5
Trichloroethylene (Trichloroethene)	ClCH=CCl_2	131.29	87	-73.0	79-01-6
cis-1,3-Dichloropropene (cis-1,3-dichloropropylene)	CH_3CCl=CHCl	110.97	76		
trans-1,3-Dichloropropene (cis-1,3-Dichloropropylene)	$ClCH_2CH$=CHCl	110.97	112.0		
1,1,2-Trichloroethane (Vinyl trichloride)	$CH_2ClCHCl_2$	133.41	113.8	-36.5	79-00-5
Toluene (Methyl benzene)	$C_6H_5CH_3$	92.15	110.6	-95.0	108-88-3
1,2-Dibromoethane (Ethylene dibromide)	$BrCH_2CH_2Br$	187.88	131.3	9.8	106-93-4
Tetrachloroethylene (Perchloroethylene)	Cl_2C=CCl_2	165.83	121.1	-19.0	127-18-4
Chlorobenzene (Phenyl chloride)	C_6H_5Cl	112.56	132.0	-45.6	108-90-7
Ethylbenzene	$C_6H_5C_2H_5$	106.17	136.2	-95.0	100-41-4
m-Xylene (1,3-Dimethylbenzene)	1,3-$(CH_3)_2C_6H_4$	106.17	139.1	-47.9	
p-Xylene (1,4-Dimethylxylene)	1,4-$(CH_3)_2C_6H_4$	106.17	138.3	13.3	
Styrene (Vinyl benzene)	C_6H_5CH=CH_2	104.16	145.2	-30.6	100-42-5
1,1,2,2-Tetrachloroethane	$CHCl_2CHCl_2$	167.85	146.2	-36.0	79-34-5
o-Xylene (1,2-Dimethylbenzene)	1,2-$(CH_3)_2C_6H_4$	106.17	144.4	-25.2	
1,3,5-Trimethylbenzene (Mesitylene)	1,3,5-$(CH_3)_3C_6H_6$	120.20	164.7	-44.7	108-67-8
1,2,4-Trimethylbenzene (Pseudocumene)	1,2,4-$(CH_3)_3C_6H_6$	120.20	169.3	-43.8	95-63-6
m-Dichlorobenzene (1,3-Dichlorobenzene)	1,3-$Cl_2C_6H_4$	147.01	173.0	-24.7	541-73-1
Benzyl chloride (α-Chlorotoluene)	$C_6H_5CH_2Cl$	126.59	179.3	-39.0	100-44-7
o-Dichlorobenzene (1,2-Dichlorobenzene)	1,2-$Cl_2C_6H_4$	147.01	180.5	-17.0	95-50-1
p-Dichlorobenzene (1,4-Dichlorobenzene)	1,4-$Cl_2C_6H_4$	147.01	174.0	53.1	106-46-7
1,2,4-Trichlorobenzene	1,2,4-$Cl_3C_6H_3$	181.45	213.5	17.0	120-82-1
Hexachlorobutadiene (1,1,2,3,4,4-Hexachloro-1,3-butadiene)					

APPENDIX B

FIGURE 1. Subatmospheric/Pressurized Sampling Equipment



APPENDIX C

Canister Sampling Field Data Sheet

Page ___ of ___

SUMMA AIR SAMPLING WORK SHEET

Site: ____________________ Site#: ____________________

Samplers: ____________ Work Assignment Manager: ____________________

Date: ____________________ Project Leader: ____________________

Sample #					
Location					
SUMMA ID					
Orifice Used					
Analysis/Method					
Time (Start)					
Time (Stop)					
Total Time					
SUMMA WENT TO AMBIENT	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO
Pressure Gauge					
Pressure Gauge					
Flow Rate (Pre)					
Flow Rate (Post)					
Flow Rate (Average)					

MET Station On-site? Y / N

General Comments:

GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

ATTACHMENT - E
Site Specific Quality Assurance Project Plan
(August 2001)

REVISED FINAL
SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN
FOR
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
FORMER COMPUTER CIRCUITS SUPERFUND SITE
TOWN OF SMITHTOWN
SUFFOLK COUNTY, NEW YORK

AUGUST 2001

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REVISED FINAL
SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN
FOR
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
FORMER COMPUTER CIRCUITS SUPERFUND SITE
TOWN OF SMITHTOWN
SUFFOLK COUNTY, NEW YORK

AUGUST 2001

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ACRONYMS AND ABBREVIATIONS

%R	Percent Recovery
ASP	Analytical Sampling Protocol
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DESA	Division of Environmental Science and Assessment
DI	Deionized
DOT	US Department of Transportation
DQO	Data Quality Objective
FCR	Field Change Request
FID	Flame Ionization Detector
FOL	Field Operations Lead
FSP	Field Sampling Plan
GC	Gas Chromatograph or Gas Chromatography
GIS	Geographic Information System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HSO	Health and Safety Officer
ICP	Inductively Coupled Plasma
ICS	Interference Check Sample
LCS	Laboratory Control Sample
MDL	Method Detection Limit
MRR	Material Received Report
MSDS	Material Safety Data Sheet
N/A	Not Applicable or Not Available.
Non-RAS	Non-Routine Analytical Services
NTU	Nephelometric Turbidity Units
NYSDEC	New York State Department of Environmental Conservation
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PID	Photoionization Detector
PM	Project Manager
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAS	Routine Analytical Services
RI/FS	Remedial Investigation and Feasibility Study
RPD	Relative Percent Difference
RSCC	Regional Sample Control Center
RSD	Relative Standard Deviation
SD	Standard Deviation

SMP	Site Management Plan
SOP	Standard Operating Procedure
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TDEMI	Time-Domain Electromagnetic Induction
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TSS	Total Suspended Solids
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound
VPB	Vertical Profile Boring
WAM	Work Assignment Manager

1.0 INTRODUCTION

Presented herein is the Quality Assurance Project Plan (QAPP) for the Remedial Investigation/Feasibility Study (RI/FS) investigation to be undertaken by P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. at the Computer Circuits Superfund site (the site). This investigation will provide an adequate database to develop a conceptual model of the site, to assess human health and ecological risks associated with the site, and to select a remedy to eliminate, reduce, or control unacceptable risks to human health and the environment, as per the Work Plan, December 2000, for the site.

This QAPP has been prepared to define the quality assurance (QA) and quality control (QC) activities to be implemented, to verify the integrity of the work to be performed at the site, and that the data collected will be of the appropriate type and quality needed for the intended use. This plan has been prepared and reviewed in accordance with the USEPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (External Review Draft Final) - EPA QA/R-5 (USEPA, 1998).

Specifically, this QAPP addresses the following:

- Description of Project
- Organization and Responsibilities of Project Personnel
- Project Objectives, including Quality Assurance Objectives for Data
- Overview of Field Sampling Program and Procedures
- Sample Packaging and Shipping
- Sample Documentation
- Sample Analytical Program
- Quality Assurance/Quality Control Procedures

Related documents referenced in this QAPP and under separate include the: Work Plan; Field Sampling Plan; Site Management Plan; and the Health and Safety Plan.

1.1 SITE LOCATION AND DESCRIPTION

The Computer Circuits site is a 1.7-acre lot in an industrial/commercial area of Hauppauge, Suffolk County, New York. A one-story building is located near the center of the site. The site is bordered by Marcus Boulevard to the west and other commercial businesses to the north, south and east. The site is currently occupied by Algorex Power and Control Electronics, Incorporated. A Site Plan is presented in Figure 1-2 of the Field Sampling Plan.

1.2 SITE HISTORY

The following presents an overview of the Computer Circuits site history. Additional, more detailed information is presented in Sections 1.2.2 and 2.0 of the Work Plan.

From 1969 to 1991 the property was owned by MCS Realty, who leased the property to various companies. MCS Realty sold the property to 145 Marcus Blvd., Corporation in July, 1991. Computer Circuits, which occupied the entire property from 1969 to 1977, manufactured printed circuit boards for both military and commercial applications. Chemicals used in the manufacturing process included ammonia, copper, copper sulfate, fluorides, gold cyanate, hydrochloric acid, lead, lead fluoroborate, nickel, nitric acid, sulfuric acid, tin, and trichloroethene (TCE). Waste liquids were discharged to five cesspools located southeast of the building and to one cesspool located north of the building.

In January 1973, a pipe connection was discovered between the Computer Circuits industrial cesspool on the south side of the building and a storm drain on Marcus Boulevard. The connection was removed in 1974; however, wastewater was subsequently observed flowing over the ground surface into the storm drain system.

Between 1976 and 1977, the Suffolk County Department of Environmental Control collected samples from the cesspools, and determined that copper and lead were consistently detected at levels above the State Pollutant Discharge Elimination System permit limits. An inspection conducted in 1976 revealed that the site was littered with trash, broken barrels, and spilled piles of chemicals and blue/green colored sludge.

Computer Circuits hired a contractor in 1976 to excavate and fill the five cesspools near the southeast corner of the building, and to install two new cesspools which were then also used for industrial waste disposal.

A soil and groundwater investigation was performed at the site in May 1989 by Roux Associates, Inc., as required by the New York State Department of Environmental Conservation (NYSDEC) under an Order on Consent between NYSDEC and MCS Realty. Ten soil borings were drilled throughout the site, and three monitoring wells were installed and sampled. Volatile organic compounds (VOCs), including TCE; and metals, including copper and lead; were detected in the soil and groundwater samples.

In May 1994, a sinkhole was discovered at the site, near the southeast corner of the building. A consultant for the property owner discovered construction debris and a barrel containing a nickel solution. This material was excavated and stockpiled, and then removed from the site in November 1995.

A soil quality investigation was performed from September through November 1995. Five soil borings were drilled, and VOCs and metals were detected in the samples at levels exceeding background concentrations established for the site. Additional stained soil was also removed from the sinkhole area, and the remains of a cesspool were discovered.

NYSDEC conducted a soil vapor survey at the site in February 1996, and detected elevated levels of TCE and 1,1,1-trichloroethane (TCA).

From March through May 1996, the United States Environmental Protection Agency (USEPA) conducted a sampling investigation of the site. Fourteen subsurface soil samples were collected, and VOCs and metals were detected at levels significantly above background. Three additional monitoring wells were installed, and groundwater samples were collected from these three wells and two of the previously installed wells. Copper was detected in the groundwater at levels significantly above background.

2.0 PROJECT ORGANIZATION AND PERSONNEL RESPONSIBILITIES

P.W. Grosser Consulting Engineer & Hydrogeologist, P.C. (PWGC) will be responsible for collecting data in accordance with the associated project plans and preparation of reports after the RI/FS investigation is complete. The USEPA is the lead regulatory agency overseeing the Computer Circuits investigation. An organization structure has been developed to identify the roles and responsibilities of the various parties involved with the project and is discussed in the following paragraphs.

Although QA/QC responsibilities lie principally with the PWGC's Project Director and QA Officer, proper implementation of QA/QC requirements necessitate that the entire project staff be cognizant of all procedures and goals. A field program organization chart is presented as Figure 2-1; the project organization structure is discussed in detail in Section 4.0 of the Work Plan. PWGC project personnel and respective responsibilities are described below.

The **Project Director**, James P. Rhodes, is responsible for the overall quality of the work performed on this project. The responsibilities generally include technical review, resolution of technical issues and client and agency relations. He monitors the progress of each work assignment to ensure that adequate resources are available and that major quality problems are prevented or minimized. The Project Director implements the program standard of quality for work under the contract and ensures that the Project Manager adheres to that standard. The Project Director's review concentrates on the technical quality, schedule, and cost for all work assignments.

Charles B. Sosik will be the **Project Manager** (PM) for the Computer Circuits site. He has primary responsibility for planning and implementation of the RI/FS investigation, including the overall management of the project team. The PM is accountable for ensuring that the investigation is conducted in accordance with applicable plans and guidelines, including the Work Plan, the Field Sampling Plan (FSP), the Site Management Plan (SMP), the QAPP, and the Health and Safety Plan (HASP). In addition, the PM will communicate all technical, QA and administrative matters to the PWGC Project Director. He will ensure that any deviations from the approved Work Plan, FSP, SMP, QAPP, and/or HASP are documented and reviewed/approved. The PM has the responsibility for overseeing the preparation of project deliverables to be submitted by PWGC.

The overall management of the activities to ensure the quality of work associated with the project is the responsibility of Lisa Santoro, the **Quality Assurance/Data Quality Officer**. A site-specific **QA Officer** will be assigned to the project, to hold responsibility for on-site QA activities, including performance of audits and verification of corrective actions. In addition, the QA Officer will coordinate with the PM and other project staff, as applicable, during the reduction, review and reporting of the analytical data.

The **Field Operations Lead** (FOL) will be responsible for the management and supervision of the field investigation program, providing consultation and decision-making on day-to-day issues relating to the sampling activities. The FOL shall monitor the sampling to determine that operations are consistent with plans and procedures, and that the data acquired meets the analytical and data quality needs. When necessary, the FOL will document any deviations from the plans and procedures for approval.

The **Sample Coordinator** is responsible for overseeing the collection, packaging, preservation and shipping procedures for the investigation samples and ensuring that these procedures are performed in accordance with applicable plans and guidelines.

The **Site Geologist/Hydrogeologist** shall be responsible for the geological and hydrogeological field investigation at the site. In addition, the analysis and evaluation of the field data will be the responsibility of the Site Geologist/Hydrogeologist.

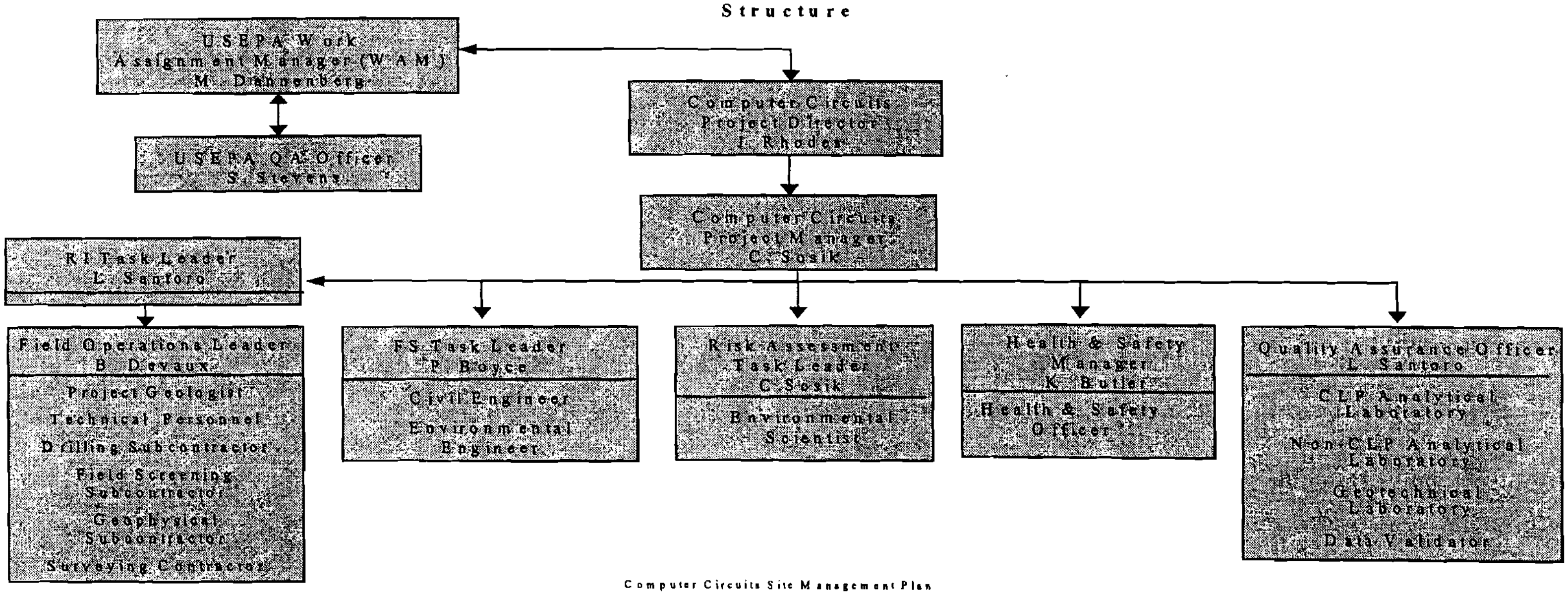
The site-specific **Health and Safety Officer** (HSO) reports to the FOL and PM and is responsible for the implementation of the site-specific HASP. The HSO shall advise the project staff on health and safety issues, conduct health and safety training sessions, and monitor the effectiveness of the health and safety program conducted in the field. The HSO, acting for the safety of all site personnel, has the authority to stop work when unsafe work conditions exist during the field activities.

In addition, other technical sampling team members may provide support to the PM and the FOL on an as-needed basis.

The services of several subcontractors (e.g., drilling, surveying, waste management, and laboratory services) will also be necessary for the performance of the field investigation. The PM, with assistance from the FOL, and the Quality Assurance/Data Quality Officer, will be the liaison between each of the subcontractors.

FIGURE 2-1

Project Organization Structure



3.0 QUALITY ASSURANCE PROJECT OBJECTIVES

The objective of the field investigation for the Computer Circuits site is to obtain sufficient data at a known quality level for the selection of a remedy to eliminate, reduce, or control risks to human health and the environment, through the performance of human health and ecological risk assessments and a feasibility study.

3.1 DATA QUALITY OBJECTIVE PROCESS

Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality of the data required to support decisions during remedial activities. DQOs can be defined as what the end user expects to obtain from the analysis results, and are developed through a seven-step process:

- Step 1 State the problem
- Step 2 Identify the decision
- Step 3 Identify inputs to the decision
- Step 4 Define the study boundaries
- Step 5 Develop a decision rule
- Step 6 Specify limits on decision errors
- Step 7 Optimize the decision for obtaining data

For the site, screening data generated by rapid, less precise methods of analysis will achieve a data use level for site characterization and monitoring (equivalent to Level I in EPA540/G-87/003, March 1987). Sample results via field gas chromatography (GC) will be field screening data with definitive confirmation levels (equivalent to Level II in EPA540/G-87/003, March 1987). Definitive laboratory analytical data generated during the field investigation will achieve a data use level to support a risk assessment (equivalent to Levels III, IV and V in EPA540/G-87/003, March 1987).

Specifically, these data will be used to:

- Characterize the nature and extent of contamination on the site, through the comparison of constituent results to applicable criteria and the development of isoconcentration maps (as applicable);
- Characterize the migration of contaminants and determine the impacts to off-site locations, through the comparison of constituent results to applicable criteria, the development of isoconcentration maps, and the assessment of physical-chemical transport properties for individual constituents and/or contaminant classes;
- Obtain sufficient data (i.e., greater than or equal to 90 percent complete; see Section 3.3) to determine the current and potential future human health and ecological risks at the site; and
- Obtain sufficient data (i.e., greater than or equal to 90 percent complete; see Section 3.3) to determine, through screening and evaluation, the most appropriate remedial alternatives to minimize continued risks to human health and/or the environment.

Known contaminants present in samples collected from the site and the nearby vicinity include chlorinated solvents (e.g., TCE, 1,1,1-trichloroethane); phenolics (e.g., ethanol, 4-nitrophenol); and metals (e.g., copper, lead, nickel, zinc). The principal contaminants of concern at the Computer Circuits site are VOCs, especially TCE, and metals, especially copper and lead.

3.2 DATA QUALITY CATEGORIES

DQOs are composed of written expectations for precision, accuracy, representativeness, completeness and comparability of a data set. These aspects will be further defined in Section 3.3. The DQO process provides a logical basis for linking the QA/QC procedures to the intended use of the data, primarily through the decision maker's acceptable limits on decision error. Two descriptive data categories - screening data and definitive data - will be used for the site.

Screening data are generated by rapid, less precise methods of analysis, and, with the exception of the field gas chromatograph (GC) results, are deemed non-critical to project objectives. Data results obtained during the field GC analysis are deemed critical to project objects, and a percentage of the screening data will be confirmed with definitive data. Portable instruments to be used during this field investigation to collect screening data include:

- Interface probe/water level indicator
- Dissolved oxygen meter
- pH meter
- Specific conductivity meter
- Temperature meter
- Turbidity meter
- Photoionization detector (PID) or Flame ionization detector (FID)
- EM-61 Survey
- Ground penetrating radar system
- Portable field gas chromatograph (GC)

Definitive data are generated using specific analytical methods and guidelines and have satisfied known QA/QC requirements. Analytical data provided by an off-site laboratory shall be definitive data, and are deemed critical to project objectives. QA/QC elements of definitive data include determination and documentation of calibrations, detection limits, method blanks, and matrix spike recoveries. Additional information on analytical QC elements and their acceptance criteria are provided in Section 9.2. For further information on analytical data validation and reporting, see Section 10.0.

3.3 QA/QC CHARACTERISTICS

The overall QA/QC objective for the field investigation is to develop and implement procedures that will provide data of known and documented quality. QA/QC characteristics for data include precision, accuracy, representativeness, completeness, and comparability (PARCC). Data quality objectives for each of these parameters are determined based on the level of data required. Descriptions of these characteristics are provided below, and specific QA objectives for both screening and definitive data are presented on Table 3-1. Analytical matrices and methods are provided on the table; further information on the field investigation procedures and analytical methodologies are presented in Sections 4.0 and 6.0, respectively.

TABLE 3-1 (Sheet 1 of 2)
QA OBJECTIVES FOR FIELD INVESTIGATION DATA

Parameter	*Measurement*	*Matrix*	*Method*	*Units*	*Precision*	*Accuracy*	*CRQL / MDL*	*Completeness (%)*
Water Level	Screening	Aqueous	Direct Field Measurement	feet	± 0.01 feet	N/A	N/A	90
Dissolved Oxygen	Screening	Aqueous	Direct Field Measurement	mgO_2/L	± 3%	N/A	N/A	90
pH	Screening	Aqueous	Direct Field Measurement	Std. Units	± 0.1 units	N/A	N/A	90
Specific Conductivity	Screening	Aqueous	Direct Field Measurement	umhos/cm or mS/cm	± 1% of full scale*	N/A	N/A	90
Temperature	Screening	Aqueous	Direct Field Measurement	°C	± 0.1 °C	N/A	N/A	90
Turbidity	Screening	Aqueous	Direct Field Measurement	NTU	± 2 NTU	N/A	N/A	90
Target VOCs (1)	Screening	Headspace	Direct Field GC Measurement	ug/L	± 50% RPD	75-125% R	25 ug/L	90
TCL VOCs/freon	Definitive	Soil Aqueous	EPA Method 5035 EPA Method 8260B	ug/kg ug/kg	± 25% RPD ± 25% RPD	59-172% R 59-172% R	10 ug/kg (soil) 1-5 ug/L (aq.)	90
TCL Semi-VOCs	Definitive	Soil	EPA Method 8270C	ug/kg	± 25% RPD	59-172% R	330 - 830 ug/kg	90

TABLE 3-1 (Sheet 2 of 2)
QA OBJECTIVES FOR FIELD INVESTIGATION DATA

TAL Metals/cyanide	Definitive	Soil Aqueous	CLP-M	mg/kg	± 20% RPD	75-125%R	0.04-1000 mg/kg (soil) 0.2-5000 ug/L (aq.)	90
Total Organic Carbon	Definitive	Soil	L. Kahn (7/88)	mg/kg	± 25% RPD	N/A	100 mg/kg	90
Grain Size	Definitive	Soil	ASTM D422	%	± 25% RPD	N/A	N/A	90
Con. Water Quality(2)	Definitive	Aqueous	(2)	mg/L	± 25% RPD	N/A	(2)	90

Notes:
Abbreviations include:

%R = Percent Recovery
GC = Gas Chromatography
N/A = Not Applicable
NTU = Nephelometric Turbidity Units
TAL = Target Analyte List
TCL = Target Compound List plus freon
CRQL = Contract Required Quantitation Limit
MDL = Method Detection Limit
VOCs = Volatile Organic Compounds
RPD = Relative Percent Difference

* Precision dependent on meter and scale.

- Target VOCs include trichloroethene, 1,1,1-trichloroethane, and tetrachloroethene.

- Water quality parameters include the following: dissolved oxygen, nitrate, sulfide, sulfate, iron II, redox potential, dissolved organic carbon, carbon dioxide, alkalinity and chloride. Methods and detection limits are provided in Table 6-2.

Precision is the measurement of agreement in repeated tests of the same or identical samples, under prescribed conditions. Analytical precision can be expressed in terms of Standard Deviation (SD), Relative Standard Deviation (RSD) and/or Relative Percent Difference (RPD). The precision of analytical environmental samples has two components - laboratory precision and sampling precision. Laboratory precision is determined by replicate measurements of laboratory duplicates and by analysis of reference materials. The objectives for laboratory precision are specified in the analytical methodologies and are presented on Table 3-1. The precision of the field sampling effort is determined by the analysis of field duplicate samples; see Section 9.1.5. Field duplicate analysis will be performed at a rate of five percent (i.e., one duplicate collected for every 20 samples). Acceptance criteria for duplicates analyzed by field GC shall be an RPD of 50 percent, and acceptance criteria for duplicates analyzed by an off-site laboratory shall be an RPD of 25 percent. The precision limits provided in Table 3-1 for the screening measurements are acceptance criteria for duplicate and calibration analyses of field measurement parameters.

Accuracy is the degree of agreement of a measured sample result or average of results with an accepted reference or true value. It is the quantitative measurement of the bias of a system, and is expressed in terms of percent recovery (%R). Measurements of accuracy for the laboratory include surrogate spike, laboratory control spike, matrix spike and matrix spike duplicate samples. The laboratory must meet or exceed control limit objectives, as stated in Table 3-1 and the applicable methodologies.

Representativeness is the degree to which the results of the analyses accurately and precisely represent a characteristic of a population, a process condition, or an environmental condition. In this case, representativeness is the degree to which the data reflect the contaminants present and their concentration magnitudes in the sampled site areas. Representativeness of data will be ensured through the selection of sampling locations and implementation of approved sampling procedures. Results from environmental field duplicate sample analyses can be used to assess representativeness, in addition to precision.

Completeness is defined as the percentage of samples that meet or exceed all the criteria objective levels for accuracy, precision and detection limits within a defined time period or event. It is the measure of the number of data "points" which are judged to be valid, usable results. The objective for completeness for this field investigation is 90 percent, and will be calculated by dividing the number of usable data results (i.e., all results not considered to be "rejected" and all samples able to be analyzed) by the number of possible data results (i.e., the total number of field samples collected), and then multiplying by 100 percent.

Comparability is the degree of confidence with which results from two or more data sets, or two or more laboratories, may be compared. To achieve comparability, standard environmental methodologies will be employed in the field and in the laboratory. See Table 3-1 and Section 6.0 for analysis methods and detection limits for this field investigation.

3.4 IMPACT OF FAILURE TO MEET DATA QUALITY OBJECTIVES

The QA objectives presented in Table 3-1 represent the data quality necessary to meet the project's technical goals. The QA/QC efforts discussed in this QAPP focus on controlling measurement error, and ultimately providing a database for estimating the uncertainty in the measurement data for the project. QA objectives will be evaluated throughout the field investigation effort to see if the results for the project meet the stated objectives. If these objectives are not being met, the precision and/or accuracy of the sampling data will be decreased, and corrective actions shall be taken, as documented in Section 13.0.

4.0 FIELD INVESTIGATION ACTIVITIES

This section provides an overview of the field investigation and sampling operations by matrix and type of procedures, and includes the following:

- Mobilization and Demobilization
- Site Survey
- Ecological Resources Reconnaissance
- Geophysical Survey
- Test Pit Investigation
- Surface Soil Sampling
- Subsurface Soil Sampling
- Catch Basin Sediment Sampling
- Soil Sample Field Screening
- Hydropunch® Sampling
- Groundwater Field Screening
- Monitoring Well Installation and Development
- Water Level Measurements
- Monitoring Well Sampling
- Aquifer Testing
- Decontamination

4.1 SAMPLING PROGRAM PROCEDURES

The sampling program to be conducted at the former Computer Circuits site will be conducted in accordance with established technical guidelines, methods, policies and Standard Operating Procedures (SOPs). The subsections below present an overview of the sampling program procedures; a more detailed discussion of the sampling program is presented in Section 3.3 of the FSP. A schedule for implementation of the field sampling program is provided in Section 4 of the Work Plan.

4.1.1 Mobilization and Demobilization

The mobilization effort will consist of logistical planning, identification and staking of sampling locations, equipment mobilization to the site, and field personnel orientation. The orientation meeting will familiarize the sampling team with a brief history of the site, health and safety requirements, and field investigation procedures.

Equipment and personnel will be demobilized at the completion of each phase of field activities, as appropriate. Demobilization will consist of site area clean-up, staging and inventory of investigation-derived wastes, decontamination and demobilization of field equipment, and organization of investigation records.

4.1.2 Site Survey

A survey will be conducted by a qualified licensed surveyor to update the existing property, boundary, utility locations and topographic information for the site. Monitoring wells, will be surveyed for horizontal location (nearest 0.1 foot), ground elevation (nearest 0.1 foot), and measuring point elevation (nearest 0.01 foot). The survey will include the elevation of the top of the monitoring well casing, with the well cap removed, for determination of water table elevations. Sampling locations such as soil borings off-site will be horizontally located. The survey will be presented in the New York State Plane coordinate system, using the NAD 1983 horizontal datum and NAVD 1988 elevation datum, and will be provided in AutoCAD Version 2000 electronic format.

4.1.3 Geophysical Survey

A geophysical investigation will be performed to delineate areas possibly utilized for subsurface disposal of industrial wastes. In addition, the geophysical survey may be used to delineate the former cesspool systems and to detect any underground storage tanks or other source areas. Time-domain electromagnetic induction (TDEMI) and ground penetrating radar (GPR) will be used at the site, and the survey will be performed to the north, east and south of the building. Refer to Section 3.3.1.8 of the Work Plan for more detail.

Downhole gamma-ray geophysical logging will be conducted on both the newly installed and existing monitoring wells. The gamma-ray logging can be performed in cased and uncased boreholes, and provides an indication of stratigraphic changes, especially in regard to clayey zones.

4.1.4 Ecological Resources Reconnaissance

An ecological resources reconnaissance of the site will be performed in support of the ecological setting characterization required for the screening-level preliminary exposure estimate and risk calculation for the site. The reconnaissance will include completion of the ecological assessment checklist to assist in making observations and developing a preliminary site evaluation with respect to ecological conditions.

4.1.5 Test Pit Investigation

Test pits may be excavated in place of soil borings at locations of anomalies detected during the geophysical survey to identify the presence of hazardous materials for immediate removal. The test pit program will determine the physical nature and location of anomalies detected during the survey. The test pit program will be conducted concurrently with the start of drilling activities. Test pits will be excavated to a maximum depth of 10 feet bgs, to provide a visual characterization of site contamination. Final test pit depths, lengths, and widths will be determined by the FOL and/or Site Geologist, and will depend on the horizontal and vertical extent of buried waste and/or structures and/or visually contaminated soils. Collection of samples may be performed during the test pit program as necessary and appropriate (e.g., stained soil, elevated FID/PID readings, etc.). The samples would be analyzed for Target Compound List (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), Target Analyte List (TAL) metals cyanide and freon.

The procedures for test pit excavation are detailed in SOP #6 in the Field Sampling Plan.

4.1.6 Air Monitoring

Real-time air monitoring, using a photoionization detector (PID) or flame ionization detector (FID) meter, will be performed during the field investigation to detect VOCs in ambient air for health and safety purposes.

Indoor Ambient Air Sampling

Based on the results of the soil gas study performed by Parsons Engineering Science in 1996, the NYSDOH has determined that ambient air inside the building must be sampled to determine if the building occupants are being exposed to site related VOCs.

Since the building does not have a subsurface basement, air quality samples will be collected from the main floor of the building. Air sampling will be performed in accordance with the NYSDOH Indoor Air Sampling Analysis and Protocol included as Attachment C of the Field Sampling Plan.

Three samples will be collected in total. Two samples will be collected inside of the building in the vicinity of borings P-15 and P-17 as shown in Figure 3-1. Both of these locations are adjacent to areas where the highest soil gas concentrations were reported. The third sample will be collected outside of the building to determine the background ambient air quality.

Samples will be collected using glass sorbent tubes and a calibrated low flow sampler as provided by the laboratory. Analysis will be in accordance with EPA 625R-96 "Compendium of Methods for the Determination of Organic Compounds in Ambient Air", Method TO17, as provided in Attachment C. Since ASP-B procedures are not available for air samples, the samples will be collected and analyzed following QA/QC procedures similar to those detailed under ASP-B. In addition to the three samples detailed above, one field blank and one blind duplicate sample will be prepared and submitted for analysis as part of the QA/QC program. A full discussion of the air sampling procedures, sample analysis and the laboratory QA/QC program is provided in Attachment C of the Field Sampling Plan.

The results of the indoor air sampling will be compared to NYSDOH and USEPA guidelines for indoor air quality.

4.1.7 Subsurface Soil Sampling

PWGC has established a minimum base plan of initial soil sampling points which may be modified with respect to location, or expanded as the investigation proceeds. A total of 19 shallow and 4 deep soil borings will be installed within and around potential source areas as identified by previous investigations, beneath the floor of the building and within the loading dock area drain. The soil borings will be installed to identify potential contaminant source areas, and to determine the vertical and horizontal extent of soil contamination. In addition, borings will be advanced, upgradient and downgradient of the primary source area to establish the lithologic characteristics of the plume migration zone within this cross-sectional area. Figure 3-1 of the workplan shows the proposed location of the initial borings. Pavement surface, if present, will first be cored to provide access to the underlying soil.

PWGC will perform field screening on subsurface soil samples collected from the soil borings. This field screening will consist of analyzing the headspace above an aliquot of the sample in a covered glass jar using a field GC. The field GC will be used to perform analyses for trichloroethene, 1,1,1-trichloroethane and tetrachloroethene. All unknown volatile compounds detected will be quantified relative to trichloroethene. Handheld PID/FID readings will provide an indication of possible ranges on the GC. The results of these screening analyses will be used in conjunction with visual observations of the soil characteristics (e.g., visible staining) and the depth interval to determine which samples will be submitted for confirmatory laboratory analyses. See SOP #9 in the Field Sampling Plan for further details on the use of the field GC.

Deep Borings

To characterize the vertical extent and distribution of soil contamination, 1 deep boring will be advanced in each of the four identified source areas. These vertical profile borings (VPB) will be installed to and below the water table using a rotary drill rig and 3 inch I.D. hollow stem augers. Samples for field screening will be collected using a split-core barrel sampler (spoon) at the following sampling rate: five foot intervals to a depth of 40 feet below surface, and then at approximately 10 foot intervals to the extent of contamination. The deep borings will be advanced until field screening indicates individual VOC concentrations below 20 ppb in three consecutive samples to a maximum depth of 300 feet. A minimum of 10 percent of the samples collected will be submitted for laboratory analysis of TCL VOCs, SVOCs, TAL Metals, cyanide and freon. The selection of samples for laboratory analysis will be based on the field screening results and the interval from which the sample was collected. Additional samples will be submitted for laboratory analysis at the discretion of the FOL.

Shallow Borings

A minimum of 3 borings will be located as shown on Figure 3.1 of the workplan to determine the areal extent of contamination associated with the four identified source areas (if no anomalies are detected). In addition, 6 borings will be installed beneath the building slab to determine if contamination exists beneath the building at two locations which correspond to high soil gas (VOC) readings taken adjacent to the building foundation. The placement of additional soil borings (moving out from the source area) will be determined by field screening for VOCs and visual observation. The shallow borings will be advanced using push-probe equipment to minimize excess soil disposal and to accelerate the sample retrieval process. A minimum of 10 percent of the samples collected will be submitted for laboratory analysis of TCL VOCs, SVOCs, TAL Metals, cyanide and freon. The selection of samples for laboratory analysis will be based on the field screening results and the interval from which the sample was collected. Additional samples will be submitted for laboratory analysis at the discretion of the FOL.

Soil samples will be collected using one or more Geoprobe® sampling tools, including open-tube, piston-stop and dual- tube samplers, depending on site conditions. Samples for field screening will be collected at approximately 5-foot intervals to a depth of 25 feet at all exterior locations. Borings within the building will be advanced with smaller less-powerful push-probe equipment mounted on skids, tracks, an ATV, or a portable rail system. Samples for field screening within the building will be collected at approximately 5-foot intervals to either 25 feet, or the limits of the push-probe unit, whichever comes first.

The sampling interval will be refined in borings P2, P5, P6, P8, P9, P10, P12, P13, P15, P17 and P19 to provide the resolution required to evaluate near-surface contamination. In these borings samples will be collected at 2-foot intervals for the first 10 feet and then at 5-foot intervals for the remainder of the boring.

The decision framework for the shallow borings will be primarily dependant upon the results of the field screening. If soil concentrations are detected above the 20 ppb criteria at a given location, a step-out boring will be advanced at a distance out (away from source area center) from that location. The distance will vary depending on the relative magnitude of the concentration detected. If concentrations are detected above the 20 ppb criteria but less than one order of magnitude, the step-out boring will be placed 10 to 15 feet out from the original location. If the concentration is above one order of magnitude, the distance of the step-out boring will be 20 to 30 feet. Samples collected from the step-out borings will be limited to three samples which attempt to duplicate and "bracket" (5 ft above/below) the sample depth which displayed the highest VOC concentration (GC screening) in the VPB. Additional samples will be collected at the discretion of the FOL. The FOL will use best judgement in the field to account for obstructions and accessability issues.

Lithologic Borings
Borings will be advanced at selected locations to provide lithologic and geochemical information along the contaminant transport zone. Borings will be placed upgradient of the site and along the downgradient vertical profile transect as shown in Figure 3-2 of the work plan. Samples will be collected using a split-barrel sampler in 10- foot intervals beginning 10 feet above the water table and continuing to the extent of the contaminant transport zone as defined by field screening the deep soil borings. Collected samples will be submitted to a geotechnical laboratory for analysis of grain size, effective porosity, total organic carbon (TOC) and fraction of organic carbon (FOC, ASTM D2974).

4.1.8 Surface Soil Sampling
Surface soil samples (0-2 inches) will be collected from each of the source area locations where the surface soils are exposed (i.e., not beneath asphalt). It is estimated that 5 surface soil samples will be collected, and will be analyzed for TCL VOCs, SVOCs, TAL metals cyanide and freon. The procedure for collecting surface soil samples is detailed in SOP #7 of the Field Sampling Plan.

4.1.9 Sediment Sampling

Sediment, if present, will be sampled from the catch basin on Marcus Boulevard, near the southwest corner of 145 Marcus Boulevard. The purpose of this sampling is to determine whether contaminants are still present in the base of the drain. One sediment sample will be collected from the storm drain and will be sent to a laboratory for analysis of TCL VOCs and TAL metals.

4.1.10 Groundwater Sampling

Vertical Profile Sampling

After the soil boring program has sufficiently characterized the extent and distribution of residual source area contamination, a groundwater sampling effort will be initiated to delineate the dissolved phase components. Groundwater sampling points will be located downgradient from the source areas, as identified from the soil boring program, in transects perpendicular to the direction of groundwater flow. The first transect will be located a distance of approximately 300 feet northeast of the identified source areas. Boreholes will be drilled using hollow-stem auger methods and sampled in five foot intervals using a Hydropunch® or equivalent. Collected samples will be screened on-site using a field portable GC for analysis of headspace trichloroethylene (TCE) and other selected VOCs. A minimum of 15 percent of the samples collected will be submitted for laboratory analysis of TCL VOCs, TAL Metals, cyanide and freon. Due to potential limitations in the volume of groundwater that may be collected using Hydropunch® techniques, samples will first be retained for VOCs field screening and laboratory analysis of TCL VOCs and freon. If enough sample remains, duplicate samples (filtered, non-filtered) will be submitted for analysis of TAL metals and cyanide. Field filtering will be in accordance with the method described in SOP# 13A of the Field Sampling Plan. The selection of samples for laboratory analysis will be based on the field screening results and the interval from which the sample was collected.

The decision framework for the vertical profile sampling will be primarily dependant upon the results of the field screening. Prior to drilling, the anticipated vertical position of the dissolved component plume will be calculated for each transect based on areal recharge and aquifer parameters (hydraulic conductivity, porosity, ground water gradient, aquifer thickness).

With the exception of location VP4, the sampling will continue until three consecutive samples, below the calculated depth of the contaminant plume, exhibit individual VOC parameters below 10 ppb, as determined from the field GC analysis. Sampling at location VP4 will continue until three consecutive samples, below the calculated depth of the contaminant plume, exhibit individual VOC parameters below 5 ppb, as determined from the field GC analysis.

At the discretion of the FOL, the VOC decision limit can be raised to 15 ppb based on the location and depth of the sample and on the results from preceding samples and/or background levels. However, if the 15 ppb limit is selected, confirmatory samples for laboratory analysis will be required for each sample at or above 10 ppb, as determined by the field GC. Site background concentrations, as established from upgradient vertical profile location(s), may also be given consideration in establishing the minimum field screening decision limit. Any proposed changes in the limit due to site background VOC levels, will be presented and discussed with EPA and the NYSDEC and approved prior to implementation.

Since the purpose of the vertical profile sampling transect is to define the width and centerline of the plume as well as it's vertical position, additions or adjustments may be required in the drilling locations as the investigation proceeds. If higher concentrations are detected near one end of the transect, the transect may be shifted, at the discretion of the FOL, by adding or relocating a sampling location or in reducing the spacing between locations. The FOL will use best judgement in the field to account for obstructions and accessability issues. The need for additional transects will be evaluated by the FOL, Project Manager and EPA WAM after completing the first transect.

Upgradient Vertical Profile Sampling
To establish background VOC levels and ascertain whether some on-site contaminants originated from an unknown off-site source, vertical profile sampling will be performed at an upgradient location as shown in Figure 3-2. Sampling and analysis will be as described for the vertical profile transects. The final depth of sampling will be based on the 10-15 ppb decision limit, as previously detailed, but may be increased if information is obtained which indicates that deeper contamination associated with an upgradient source may be present. If upgradient VOCs are detected, additional upgradient sampling locations may be selected to evaluate the VOC flux passing onto the Computer Circuits site.

4.1.11 Gas Chromatographic Analysis for Field Screening
Soil, groundwater, and sediment samples will be field screened with a portable GC for three targeted VOC constituents (i.e., TCE, TCA, and PCE). A photoionization detector (PID) will be in-line to capture the column effluent and detect the analytes of interest. Site samples will be placed in a warm water bath (approximately 35°C) for 10 minutes, and then headspace from the sample will be injected into the GC and run to completion with the PID chromatograph being plotted on the integrator. Analytes within the samples will be identified and quantitated against a known, reference standard.

Approximately 10 percent of soil samples and 15 percent of groundwater samples will be shipped for off-site laboratory confirmatory analysis.

4.1.12 Monitoring Well Installation and Development
To provide "permanent" sampling points to track plume migration, some of the vertical profile borings will be completed as monitoring wells. The number, location and design of the monitoring wells will be based on the results of the source area soil screening and the vertical profile sampling. The monitoring wells will be installed using a rotary drill rig and hollow stem augers. For depths greater than 200 ft, a small amount of drilling fluid (mud) will be placed in the lead auger to prevent the infiltration of sediments. If an extensive confining silt or clay layer is encountered, drilling will be stopped and EPA will be contacted to discuss the situation before preceding further. Monitoring wells will be constructed of 2- inch schedule 80 pvc casing and 5-foot of 0.020 inch slotted screen

set to intersect the high concentration interval as determined by field screening with the portable GC. Wells screened at the water table will have 15 feet of 0.020 inch slotted screen set to intersect the water table interface (5 ft above, 10 ft below). A Morie® # 1 filter pack will be placed to two feet above top of the screen followed by a two-foot thick bentonite pellet seal and cement/bentonite grout to ground surface. See SOP # 14A and 14B for details on monitoring well construction and completion.

Monitoring wells will be developed by pumping and/or surging until turbidity has been eliminated or stabilized. See SOP # 14C of the Field Sampling Plan.

The need for monitoring multiple discreet intervals will be evaluated by the FOL, Project Manager and EPA WAM after completing the first transect. If it is decided that "permanent" multi-level sampling points are needed, PWGC will submit a memo to EPA outlining the proposed construction details of a multi-level sampling well.

4.1.13 Monitoring Well Sampling

Two complete rounds of groundwater samples will be collected from the nine existing (7 on-site 2 off-site) and all newly-installed monitoring wells. Sampling of the pre-existing wells is dependent upon the condition of the wells, to be determined during the well survey. Monitoring wells will be purged and sampled in accordance with SOP #18 of the FSP, which complies with the USEPA Region II low stress groundwater purging and sampling procedure (provided as Attachment B to the Work Plan). All groundwater samples will be analyzed for TCL VOCs, freon, SVOCs, TAL metals, cyanide and hexavalent chromium during the first round. The analysis of samples during the second round will include VOCs and TAL metals but may omit, with EPA and DEC approval, SVOCs, freon, cyanide and hexavalent chromium, if these parameters are non-detect during the first sampling round. Selected locations along the plume axis (4 minimum) will be analyzed during the first round for water quality parameters (Dissolved oxygen (DO), nitrate, sulfide, sulfate, iron II, redox potential, dissolved organic carbon (DOC), carbon dioxide, alkalinity and chloride) and data will be supplied in results only format.

4.1.14 Water Level Measurements

Static water level measurements will be collected prior to each round of groundwater sampling from the newly installed monitoring wells and existing monitoring wells. Additional water level measurements may be collected at the discretion of the FOL and/or Site Geologist throughout the field activities. In addition, measurements of water levels in selected monitoring wells will be acquired during the aquifer testing. A water level indicator will be used to collect measurements in the monitoring wells from surveyed measuring points. Readings will be recorded in a field logbook or on applicable field investigation sheets (see Section 5.3) in increments of 0.01 feet, in accordance with SOP #17 in the FSP.

4.1.15 Aquifer Testing

Aquifer testing will consist of instantaneous displacement aquifer tests (slug tests) on selected wells. Data will be recorded using a pressure transducer/data logger and analyzed by Bouwer and Rice (1989) or other suitable method to provide a localized value of hydraulic conductivity.

4.2 DECONTAMINATION PROCEDURES

All non-disposable equipment involved in field sampling activities will be decontaminated prior to and subsequent to sampling. Equipment leaving the site will also be decontaminated.

All drilling equipment will be steam cleaned prior to use and between sample locations. Pressurized steam will be used to remove all visible excess material from augers, rods, drill bits, the back of the drill rig, and other parts of the rig which contact augers, rods, and split-spoons. Steam cleaning will be conducted on a decontamination pad, which will be constructed on-site for the field investigation. Probe rods will be washed with a non-phosphate detergent scrub and distilled water rinse or steam cleaned.

Field instrumentation (such as interface probes, water quality meters, etc.) will be decontaminated between sample locations by rinsing with deionized water. If visible contamination still exists on the equipment after the rinse, an Alconox detergent scrub step will be added, and the probe thoroughly rinsed again.

Decontamination of non-disposable sampling equipment used to collect samples for chemical analyses (e.g., scoops, trowels, bowls, etc.) will be conducted as described below:

1. Alconox detergent and potable water scrub
2. Potable water rinse
3. Rinse with 10 percent nitric acid (ultra pure grade) when sampling for inorganics. Carbon steel split-spoons will be rinsed with a 1 percent nitric acid solution to avoid stripping of metals.
4. Distilled water rinse
5. Air dry
6. Wrap or cover exposed ends of equipment with aluminum foil for transport and handling if not immediately used.

Monitoring wells developed or purged using a non-dedicated pumps will be decontaminated prior to and between each use. The following details the decontamination procedure for pumps:

1. Pre-Rinse: Operate pump in a basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment as well.

2. Wash: Operate pump in a basin containing 8 to 10 gallons of non-phosphate detergent solution, such as Alconox for 5 minutes, and flush other equipment with fresh detergent solution. Use the detergent sparingly.
3. Rinse: Operate pump in a basin of potable water for 5 minutes and flush other equipment with potable water
4. Final Rinse: Operate pump in a basin containing 1 to 2 gallons of distilled/deionized water and flush other equipment as well.

Decontamination of sampling equipment will be kept to a minimum in the field, and wherever possible, dedicated disposable sampling equipment will be used. Decontamination fluids will be stored in US Department of Transportation (DOT)-approved 55-gallon drums or in an on-site storage tank (liquids only) until proper disposal. Personnel directly involved in equipment decontamination will wear protective clothing, as stated in the HASP (Appendix D to the Work Plan).

5.0 SAMPLE CUSTODY AND DOCUMENTATION

Identification and documentation of samples are important in maintaining data quality. Strict custody procedures are necessary to ensure the integrity of the environmental samples. The subsections below address sample identification, packaging, shipping, and documentation.

5.1 SAMPLE IDENTIFICATION SYSTEM

The method of identification of a sample depends on the type of measurement or analysis performed. When field screening measurements (e.g., pH, turbidity) are made, data are recorded directly in logbooks or on field investigation forms (see Section 5.3). Identifying information such as project name, sample location and depth, date and time, name of sampler, field observations, remarks, etc. shall be recorded.

Each sample collected for on-site field GC analysis or for off-site laboratory analysis during the field investigation will be specifically designated by PWGC for unique identification. Samples will be identified using a letter code to indicate sample collection methodology. A letter code (see below) will follow, along with the name and/or number that depicts the specific location and sample depth, when appropriate. Field equipment blanks will be denoted by the letter code "FB" and trip blanks with TB. Sample collection date and time will be recorded in the field logbook/form, chain of custody as well as the sample label.

Letter code prefixes for the field investigation are as follows:

- SB Soil Boring Sample (Geoprobe or split-spoon),
- SF Surface Soil Sample
- MW Monitoring Well Groundwater Sample,
- GW Groundwater Sample Hydropunch®,
- SS Sediment Sample,
- FB Field Blank Sample, and
- TB Trip Blank Sample

At a minimum, all location and identification information for the samples shall be recorded in the field sampling logbook (see Section 5.3.2), and on the appropriate chain of custody record form for shipment (see Section 5.2.1). In addition, sampling location information may be entered into a computerized database during the field investigation (if possible).

5.2 SAMPLE CUSTODY, PACKAGING AND SHIPPING

Sample custody must be strictly maintained and carefully documented each time the sample material is collected, transported, received, prepared, and analyzed. Custody procedures are necessary to ensure the integrity of the samples, and samples collected during the field investigation must be traceable from the time the samples are collected until they are disposed of and/or stored, and their derived data are used in the final report. Sample custody is defined as (1) being in the sampler's possession; (2) being in the sampler's view, after being in the sampler's possession; (3) being locked in a secured container, after being in the sampler's possession; and (4) being placed in a designated secure area. Section 5.2.1 documents the on-site packaging and shipment procedures for sample custody in the field. The analytical laboratories will maintain custody after arrival of the samples through internal logging procedures, as indicated in Section 5.2.2.

5.2.1 Field Custody, Packaging and Shipping Procedures

Field custody procedures shall be implemented for each sample collected. The field sampler shall be responsible for the care and custody of the samples until they are properly transferred or dispatched. To maintain the integrity of the samples, the samples are to be stored in a designated, secure area and/or be custody sealed in the appropriate containers prior to shipment.

Each environmental sample will be properly identified and individually labeled. Labels will be filled out in indelible ink with at least the following information: sample identification (see Section 5.1), type and matrix of sample, date and time of sample acquisition, name of sampler, analysis required, and preservation (as necessary). The sample label will be securely attached to the sample container.

Environmental samples being analyzed by off-site laboratories will be properly packaged and shipped for analysis. Samples are to be packed with sufficient wet ice to cool the samples to 4 °C. Additionally, each cooler will be packed with a cooler temperature blank (see Section 9.1.4). Lastly, the cooler should be filled with adequate cushioning material to minimize the possibility of container breakage. Any modifications to the previous procedures will be documented (see Section 13.0).

A completed chain of custody form will be included with all sample shipments. Figure 5-1 presents a typical PWGC chain of custody form; a laboratory-provided chain of custody may also be utilized.

When the samples are being shipped by an overnight delivery service to the laboratory, the chain of custody form and any other paperwork shall be checked against the sample labels and field documentation, and then placed in a waterproof sealable plastic bag and taped securely to the inside lid of the cooler. The cooler must then be secured, with custody seals affixed over the lid opening in at least two locations, and the cooler wrapped with strapping tape (without obscuring the custody seals). Orientation "this end up" arrows shall be drawn or attached on two sides of the cooler, and a completed overnight delivery service shipping label shall be attached to the top of the cooler.

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CHAIN OF CUSTODY RECORD

Client:	
Address:	
Phone:	FAX:
Person receiving report:	
Sampled by:	
Source:	
Job No.:	

MATRIX (Soil, Water, etc.)	COLLECTED DATE	COLLECTED TIME	SAMPLE IDENTIFICATION	TOTAL NUMBER OF CONTAINERS	TYPE & NUMBER OF CONTAINERS														REMARKS - TESTS REQUIRED, SPECIAL TURNAROUND, SPECIAL Q.C. etc.

Relinquished by: (Signature) / Representing:	DATE/TIME	SEAL INTACT? YES NO NA	Received by: (Signature) / Representing:	Relinquished by: (Signature) / Representing:	DATE/TIME	SEAL INTACT? YES NO NA	Received by: (Signature) / Representing:
Relinquished by: (Signature) / Representing:	DATE/TIME	SEAL INTACT? YES NO NA	Received by: (Signature) / Representing:	Relinquished by: (Signature) / Representing:	DATE/TIME	SEAL INTACT? YES NO NA	Received by: (Signature) / Representing:

Samples to be shipped by an overnight delivery service shall be shipped within 24 hours of sample collection and arrive at the laboratory within 24 hours of sample shipment. A member of the field team will notify the laboratory of a sample shipment.

5.2.2 Laboratory Custody Procedures

The following generally summarizes laboratory custody procedures; more detailed operations are presented in the laboratory's SOPs.

- A designated sample custodian will accept custody of the shipped samples and will verify that the information on the sample labels matches that on the chain of custody record(s),
- The laboratory custodian will use the sample label number or assign a unique laboratory number to each sample label and will assure that all samples are transferred to the proper analyst or stored in the appropriate secure area; and,
- Laboratory personnel are responsible for the care and custody of samples from the time they are received until the sample is exhausted or returned to the custodian or sample storage area. Internal chain of custody records shall be maintained by the laboratory.

The laboratory shall communicate with PWGC personnel by telephone or facsimile, as necessary, throughout the process of sample scheduling, shipment, analysis and data reporting, to ensure that samples are properly processed. If a problem occurs during sample shipment or receipt (e.g., a sample container arrives broken or with insufficient sample volume, a sample was not preserved correctly, a sample was not listed on the chain of custody, etc.), the laboratory shall immediately notify the appropriate person for resolution. Corrective actions shall be documented and approved before implementation; see Section 13.0.

Samples received by the laboratory will be retained until analyses and QA checks are completed. When sample analyses and necessary QA checks have been completed, the unused portion of the sample and the sample container must be disposed of properly by the laboratory. All identifying tags, data sheets, and laboratory records shall be retained as part of the permanent documentation.

5.3 SAMPLE DOCUMENTATION

5.3.1 Sample Logbook

A cumulative sampling log will be maintained by the FOL or his designee as the field program progresses. All of the samples will be referenced by sampling location in this master log and on a detailed site map. The log data will be maintained as the table of contents for the sample logbook. The sample logbook shall be a loose-leaf notebook containing sample log sheets, as shown in Figure 5-2, or pages of a similar data management format, which includes all the necessary information items. A sample log sheet (or equivalent) must be filled out for each sample from the information recorded in the field notebook (see Section 5.3.2).

5.3.2 Site and Field Logbooks

A bound weatherproof master site logbook will be kept by the FOL or an otherwise designated holder. The site logbook is a controlled document that records all major on-site activities during the field investigation. At a minimum, the site logbook shall contain an abbreviated version of the notes listed in the team or individual field logbooks, a summary of sampling identifiers and shipment information, visitor's names and arrival/departure times, community contacts, and other site-specific information determined by the FOL to be noteworthy. In addition, prior to field work each day, the personnel on the site, the proposed activities and the weather shall be recorded in the site logbook. Discussions of program activities, field difficulties/problems, and deviations from the FSP, the QAPP and/or other site plans (with justification) must also be included in the logbook record, along with corresponding times.

FIGURE 5-2
SAMPLE LOG SHEET (TYPICAL)

I. SAMPLE IDENTIFICATION

USEPA WAM: ____________________ PROJECT MANAGER: ____________________
SITE: ____
SAMPLE NAME/NUMBER: ______________ DATE: ________ TIME: ________ HRS
SAMPLING LOCATION/DEPTH: ______________ TYPE: _____ GRAB:___ COMPOSITE
SAMPLE MATRIX: _____ SURFACE WATER ______ GROUNDWATER _____ SEDIMENT
_____ SOIL ______ WASTE
_____OTHER (SPECIFY) ______________________
SAMPLED BY: ____

II. SAMPLE SOURCE

_____ WELL _____ OUTFALL _____ LEACHATE
_____ DRUM _____ BORING _____ RIVER/STREAM
_____ BLDG/STRUCTURES _____ TANK _____ IMPOUNDMENT
_____ TEST PIT/TRENCH _____ OTHER (SPECIFY)__________________

SOURCE DESCRIPTION ____
____

III. FIELD OBSERVATIONS/MEASUREMENTS

APPEARANCE/COLOR: ____
VOLATILE ORGANIC ANALYSIS (VOA): _____ HNU _____ OVA _____ OTHER
VOA READINGS: OFF SAMPLE ______________ RESPIRATORY ZONE ____________
LEL/O_2/H_2S READINGS: ____
RADIOACTIVITY (mR/hr): ____
pH: ___________ CONDUCTIVITY: ___________ TEMPERATURE _____________
SALINITY: ____________________ OTHER: __________________
OBSERVATIONS: ____

IV. SAMPLE DISPOSITION

PRESERVATION: ____
LABORATORY NAME: ____
LABORATORY LOCATION: __________ ON-SITE __________ OFF-SITE
FORWARDED TO LABORATORY: DATE ________________ TIME: __________ HRS
LABORATORY SAMPLE NO.: ____
CHAIN OF CUSTODY NO.: ____________________ FED EX NO.: __________________

V. ADDITIONAL REMARKS

The sampling team or any individual performing a particular field investigation activity shall be required to maintain a field logbook. Each logbook will be controlled and assigned a unique sequential identification (e.g., the second logbook devoted to drilling and soil sampling activities would be designated "Geology Logbook No. 2"). The field logbook shall be a bound weatherproof notebook, and entries to the logbook must be filled out legibly in ink. Pertinent information to be recorded in field logbooks includes all information that is necessary to reconstruct the investigative/sampling operations. Documentation of sample activities in the field logbook shall be completed immediately after sampling at the location of sample collection. Logbook entries shall contain all sample information, including sample number, collection time, location, descriptions, field measurements, and other site- or sample-specific observations. Difficulties with sample recovery and field observations (e.g., staining, visible contamination, etc.) must be noted if encountered.

If photographs are taken as part of the documentation procedure, the name of the photographer, the date, the time, the site name, the site location, and a description of the photo shall be entered sequentially in the field logbook as the photographs are taken. Once developed, the photographic prints shall be numbered in correspondence to the logbook numbers, and the above information shall be placed on the back of the photograph. If an electronic camera is used, photo labels will be attached to the electronic file as well.

Logbook pages (for both the master site logbook and the field logbooks) shall be consecutively numbered, and upon entry of data, the logbook pages require the date and the signature of the responsible project team member at the bottom of each page. Corrections to the logbooks shall consist of a single strike line through the incorrect entry, the new accurate information, the initials of the corrector, and the date of amendment. Any blank spaces/pages in the logbooks shall be crossed out with a single strike mark and signed by the person making the notation.

5.3.3 Field Investigation Forms

In addition to field logbooks, field team members will use appropriate forms applicable to the field activities. Boring logs will be used for each soil boring to document the subsurface conditions and a well installation sheet shall detail the construction of the monitoring wells (Figures 5-3 and 5-4, respectively). During development of monitoring wells, a data sheet (Figure 5-5) shall be filled out for each well and field parameters recorded. During the aquifer test, a data sheet would be used for each of the specific wells designated for data collection. Refer to the FSP for sheets/forms.

FIGURE 5-3
BORING LOG SHEET (TYPICAL)

PROJECT: BORING NUMBER:
PROJECT NO: DATE STARTED:
LOCATION: DATE COMPLETED:
GEOLOGIST: GROUNDWATER DEPTH:
DRILLER: ELEVATION:
DRILLING/SAMPLING METHOD:

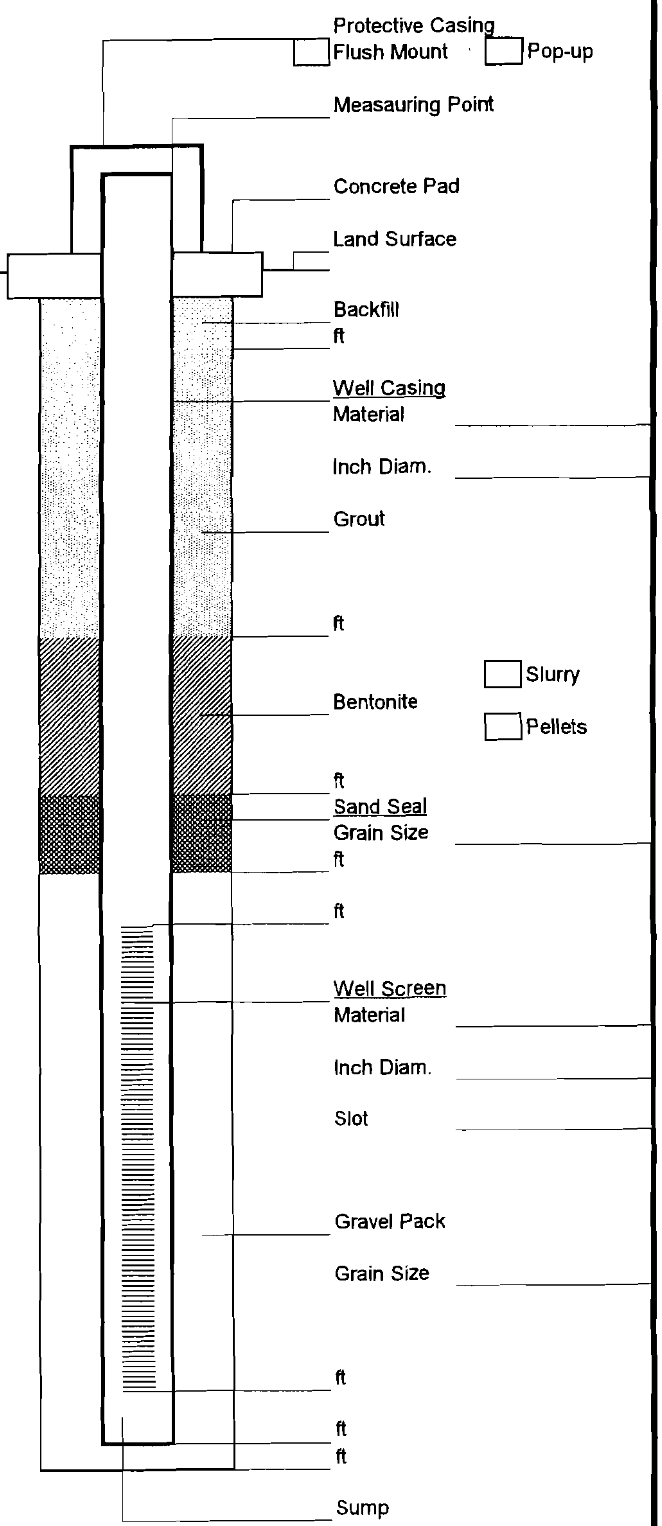
SAMPLE ID	DEPTH (feet)	BLOWS per 6"	RECO-VERY	PRO-FILE	USCS CLASS	MATERIAL DESCRIPTION	COLLECTION		HNu/ OVA (ppm)	COMMENTS
							Time	Date		

NOTES:

PAGE 1 OF

FIGURE 5-4

WELL CONSTRUCTION SHEET (TYPICAL)



Note: Drawing is not to scale.
Depths are given in feet below land surface.

Well No. ______

NYSDEC Permit No. ______

Project ______

Surveyor ______

Land Surface Elevation ______

Measuring Point Elevation ______

BNL Northing ______

BNL Easting ______

Installation Date ______

Drilling Contractor ______

Drilling Method ______

Drilling Fluid ______

Development Technique (s) and Date (s) ______

______

______

______

Fluid Loss During Drilling ______ Gallons

Water Removed During Development ______

Static Depth to Water ______

Pumping Depth to Water ______

Pumping Duration ______

Yield ______ GPM ______ DATE ______

Specific Capacity ______ GPM/Ft

Well Purpose ______

______

______

______

Hydrogeologist ______

Company Name ______

Notes ______

______

FIGURE 5-5
WELL DEVELOPMENT LOG (Typical)

Monitoring Well Designation:

Developed by:

Pump Decontaminated Prior to Development:

Total Depth of Well:

Pump Start Time:

Static Depth to Water:

Total Gallons Removed During Development:

Date	Time	Pump Rate	Gal. Removed	pH	Cond.	Diss. Oxy.	Temp. (C)	Turbidity	Appearance

Chain of custody forms shall be used for all sample shipments. These forms are described in Section 5.2.1, and typical forms are presented as Figures 5-1.

Records of calibration attainment and preventive maintenance shall be kept for all field instrumentation used that require daily calibration. Further information on calibration and maintenance procedures can be found in Section 8.0.

5.3.4 On-Site Screening Analysis Records

Field data for the portable GC results, water level measurements, field FID/PID soil screening, dissolved oxygen measurements, pH measurements, conductivity measurements, temperature measurements, and turbidity measurements (see Table 3-1) will be reported by site personnel in field logbooks and/or on field investigation forms associated with the sampling event (see Sections 5.3.2 and 5.3.3). The portable GC data shall be reported in a field logbook dedicated to the screening investigation, and will include calibration, duplicate, and spike results and all calculations. At the end of the field investigation, the field GC results shall be summarized in tabulated form to be incorporated in the RI/FS report, and all chromatograms associated with the analysis will be placed in the project files.

6.0 ANALYTICAL REQUIREMENTS

The analytical program to be undertaken at the former Computer Circuits site is summarized in Table 6-1. Sample collection and analytical protocol information, which includes the following: sample type, matrix, sampling device, number of samples, analytical parameter, sample container requirements, sample preservation, analytical method, detection limits, and sample holding times, are presented in Table 6-2.

Results from the analyses are to be reported in standard units for the matrix and analysis. For further information on reporting units, see Tables 3-1 and 6-2.

Analytical services will be provided by a NYS Department of Health ELAP approved laboratory. The laboratory will follow NYSDEC Analytical Sampling Protocol (ASP) and provide data with Category B deliverables (ASP-B). Analyses not available using ASP-B will be provided in results only format.

TABLE 6-1
SUMMARY OF ANALYTICAL PROGRAM

Sample Type	Field Screening	TCL VOCs/ Freon	TAL Metals/ Cyanide	SVOCs	TOC / FOC	Grain Size	Water Quality Parameters	Field Meas.
SOILS:								
Shallow Borings	147	15	15	15	--	--	--	--
Deep Borings	80	8	8	8	--	--	--	--
Surface Soil	--	5	5	5	--	--	--	--
Lithologic Borings	--	--	--	--	8	20	--	--
GROUNDWATER:								
Hydropunch	75 - 100	11 - 15	11 - 15	--	--	--	--	--
Round 1	—	13	13	13	--	--	4	13
Round 2	—	13	13	--	--	--	--	13
SEDIMENT:								
Catch Basin	–	1	1	--	--	--	--	--
BLANKS:								
Field	--	5	5	2	--	--	--	--
Trip	--	15	15	--	--	--	--	--
Totals	*302-327*	*86- 90*	*86- 90*	*38*	*8*	*20*	*4*	*26*

Notes:

1. The table does not include field environmental duplicate samples or laboratory QA/QC samples.
2. Target VOCs for field GC screening include: TCE, TCA, and PCE.
3. TCL VOC parameter list (plus freon 11, 12, 113 - assumed first round groundwater samples only), ASP-B.
4. TAL metal parameter list (plus cyanide and hexavalent chromium assumed first round groundwater samples only), ASP-B.
5. Water quality parameters: nitrate, sulfide, sulfate, iron II, dissolved organic carbon (DOC), alkalinity and chloride, data supplied in report only format.
6. Field measurements: dissolved oxygen, pH, conductivity, temperature, and turbidity.
7. QA/QC blanks are estimated on the basis of 1trip blank/day when VOC samples are collected; and at least 1 field blank/decontamination event/type of sampling equipment, not to exceed one per day.

TABLE 6-2 (Sheet 1 of 4)
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	No. of Samples	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDL	Holding Time
Soil Boring (Field Screening)	Headspace	Syringe inserted into VOA vial with sample matrix	227	Target VOCs (1)	Gas tight syringe	NA	Direct Measurement by Field GC	10 ug/L	Analyze immediately
Hydropunch Groundwater (Headspace)	Headspace	Syringe inserted into VOA vial with sample matrix	75 - 100	Target Volatile Organic Compounds (1)	Gas tight syringe	NA	Direct Measurement by Field GC	10 ug/L	Analyze immediately
Subsurface Soil	Soil	Split spoon/Geoprobe	23	TCL VOC plus freon 11,12, 113	(3) 5 g Encore Samplers	Cool to 4°C	EPA Method 5035	10 ug/kg	48 hrs
			23	TAL Metals (no Hg) plus cyanide	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	Element Specific (0.04-1000 mg/kg)	180 days
			23	Tin	1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	5 mg/kg	180 days
			23	Mercury	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 7471a	0.1mg/kg	26 days
			23	TCL SVOCs	(1) 8oz amber glass jar w/teflon lined cap	Cool to 4°C	EPA Method 8270C	Element Specific (330-830 ug/kg)	10 days
			8	Total Organic Carbon	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	L. Kahn Method (7/88)	100 mg/kg	14 days*
			20	Grain Size	(1) 8 oz. glass jar w/Teflon lined cap	NA	ASTM Method D422	NA	NA
Surface Soil	Soil	Encore Sampler	5	TCL VOC plus freon 11, 12, 113	(3) 5 g Encore Samplers	Cool to 4°C	EPA Method 5035	10 ug/kg	48 hrs
		Scoop	5	TAL Metals (no Hg) plus cyanide	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	Element Specific (0.04-1000 mg/kg)	180 days
			5	Tin	1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	5 mg/kg	180 days
			5	Mercury	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 7471a	0.1mg/kg	26 days
			5	TCL SVOCs	(1) 8oz amber glass jar w/teflon lined cap	Cool to 4°C	EPA Method 8270C	Element Specific (330-830 ug/kg)	10 days

TABLE 6-2 (Sheet 2 of 4)
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	No. of Samples	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDL	Holding Time
Sediment (Catch Basin)	Sediment	Encore Sampler	1	TCL Volatile Organic Compounds plus freon 11,12,113	(3) 5 g Encore Samplers	Cool to 4°C	EPA Method 5035	10 ug/kg	48 hrs
		Scoop	1	TAL Metals (no Hg) plus cyanide	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	Element Specific (0.04-1000 mg/kg)	180 days
			1	Mercury	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 7471a	0.1mg/kg	26 days
Groundwater (Hydropunch)	Water	Hydropunch sampler	11 -15	VOCs plus freon 11, 12, 113	(4) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
			11 - 15	TAL Metals (no Hg) plus cyanide	(1) 1 L polyethylene	HNO_3 to pH<2; Cool to 4°C	EPA Method 6010b	Element specific (0.2-5000 ug/L)	6 months
			11 - 15	Mercury	(1) L polyethylenee	HNO_3 to pH<2; Cool to 4°C	EPA Method 7471a	0.2ug/L	26 days
Groundwater (Monitoring Wells)	Water	Low Flow Pump or dedicated bailer	26	pH; conductivity; dissolved oxygen; temp.; turbidity	NA	NA	Field measurement	NA	NA
			26 @	VOCs plus freon 11, 12, 113	(4) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/L)	10 days
			26	TAL Metals (no Hg) plus cyanide	(1) 1 L polyethylene	HNO_3 to pH<2; Cool to 4°C	EPA Method 6010b	Element specific (0.2-5000 ug/L)	6 months
			26	Mercury	(1) L polyethylenee	HNO_3 to pH<2; Cool to 4°C	EPA Method 7471a	0.2ug/L	26 days
			13	Hexavalent Chromium	(1) 200 mL polyethylene	Cool to 4°C	SW846 Method 7197	10 ug/L	24 hours
			13	SVOCs	(1) 1 L Amber Glass	None	EPA Method 8270C	Element Specific (5-20 ug/L)	5 days
			4	Dissolved Organic Carbon	(1) 1 L amber glass	Filter in field w/0.45 um filter; H_2SO_4 to pH<2; Cool to 4°C	MCAWW 415.1	1 mg/L	28 days*

TABLE 6-2 (Sheet 3 of 4)
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	No. of Samples	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDL	Holding Time
			4	Nitrate	(1) 250 ml polyethylene	H_2SO_4 to pH<2; Cool to 4°C	MCAWW 353.2	0.01 mg/L	48 hours*
			4	Chloride	(1) 250 ml polyethylene	Cool to 4°C	MCAWW 325.1	1 mg/L	28 days*
Groundwater (Monitoring Wells)	Water	Low Flow Pump or dedicated bailer	4	Alkalinity	(1) 250 ml polyethylene	Cool to 4°C	MCAWW 310.1	2 mg/L	14 days*
			4	Sulfate	(1) 250 ml polyethylene	Cool to 4°C	MCAWW 375.1	10 mg/L	28 days*
			4	Sulfide	(1) 1 L polyethylene	2 ml zinc acetate, NaOH to pH>9; Cool to 4°C	MCAWW 376.1	1 mg/L	7 days*
			4	Iron II	(1) 1 L polyethylene	5 ml HCl; Cool to 4°C	MCAWW 413.2	0.2 mg/L	28 days*
Field Blank (solids)	Water	Collected Rinsate Passed Over/ Through Sampling equipment	4	TCL VOCs plus freon 11,12, 113	(4) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA method 8260B	10 ug/L	10 days
			4	TAL Metals (no Hg) plus cyanide	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 6010b for ICP Metals	Element Specific (0.04-1000 mg/kg)	180 days
			4	Mercury	(1) 8 oz. glass jar w/Teflon lined cap	Cool to 4°C	EPA Method 7471a	0.1mg/kg	26 days

TABLE 6-2 (Sheet 4 of 4)
SAMPLE COLLECTION AND ANALYSIS PROTOCOLS

Sample Type	Matrix	Sampling Device	No. of Samples	Parameter	Sample Container	Sample Preservation	Analytical Method#	CRQL / MDL	Holding Time
Field Blank (groundwater)	Water	Collected Rinsate Passed Over/ Through Sampling equipment	3	VOCs plus freon 11, 12, 113	(4) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA method 8260B	Compound specific (1-5 ug/l)	10 days
			3	TAL Metals (no Hg) plus cyanide	(1) 1 L polyethylene	HNO_3 to pH<2; Cool to 4°C	EPA Method 6010b	Element specific (0.2-5000 ug/L)	6 months
			3	Mercury	(1) L polyethylenee	HNO_3 to pH<2; Cool to 4°C	EPA Method 7471a	0.2ug/L	26 days
Trip Blank	Water	Direct Fill of Sample Bottles	15	TCL Volatile Organic Compounds	(4) 40 ml VOA vials w/Teflon lined septum	1:1 HCl to pH<2; Cool to 4°C	EPA Method 8260B	Compound specific (1-5 ug/l)	10 days

Notes:

@ Plus freon first round of groundwater samples

\# Preperation methods are included within the analytical methods with the exception of mercury analysis. Preperation method EPA Method 7470a is used for soils and EPA Method 7471a is used for water samples.

All holding times listed are from Verified Time of Sample Receipt (VTSR) unless noted otherwise. * Holding time listed is from time of sample collection.

The number in parentheses in the "Sample Container" column denotes the number of containers needed. All bottles will comply with OSWER Directive 9240.0-05A: "Specifications and Guidance for Obtaining Contaminant - Free Sample Containers", EPA 540/R-93/051, December 1992.

Triple volume required when collected MS/MSD samples

The number of field blanks and trip blanks are estimated.

(1) Targeted volatile organic compounds include trichloroethene, 1,1,1-trichloroethane, and tetrachloroethene.

CRQL / MDL = Contract Required Quantitation Limit / Method Detection Limit.

ASTM = American Society for Testing and Materials.

MCAWW = Methods for Chemical Analysis of Water and Wastes.

SW846 = Test Methods for Evaluating Solid Waste - Physical/Chemical Methods.

NA = Not available or not applicable.

7.0 SUPPLIES AND CONSUMABLES

Supplies and consumables necessary for the field investigation will be obtained through appropriate commercial markets and shall meet any supply-specific requirements outlined in the FSP and/or this QAPP. All supplies and consumables will be inspected by PWGC personnel (e.g., the FOL, the Site Geologist) prior to use. Any supplies/consumables that do not meet requirements will be discarded or returned to the supplier.

Supply-specific requirements include the following:

- Sampling equipment shall be manufactured from the procedural-specific material (e.g., carbon steel split-spoons for soil boring sampling, teflon lined polyethylene tubing for groundwater sampling, etc.).
- Sample bottle containers will be supplied by the analytical laboratory and will meet all guidelines specified in Specification and Guidance for Obtaining Contaminant-Free Sample Containers, EPA 540/R-93/051 and OSWER Directive 9240.0-05A (USEPA, 1992).
- The field QC sample water will be distilled, deionized water that is contaminant-free. Certifications from the supplier will be retained in the project files or by analytical laboratory.
- The drilling subcontractor may be required to provide a potable water supply for equipment decontamination, depending on availability of water at the site. Any necessary permits or testing will be obtained or reviewed/approved by PWGC. Documentation of the potable water source will be retained in the project files.
- Decontamination chemical supplies shall be of ultra pure grade (nitric acid). Certifications from the supplier will be provided and retained in the project files. In addition, MSDS for the chemicals will be maintained at the site.
- Field screening instrumentation supplies shall be of procedural- and/or manufacturer-specific grade.

Supplies and consumables will be stored, as necessary, in a designated area on the site. The storage area shall be protected from adverse conditions (e.g., weather, heat, etc.) to protect the supplies/consumables from possible outside contamination and breakage.

8.0 INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE

8.1 CALIBRATION

This section describes the requirements for control, calibration, and adjustment of instrumentation. Instruments shall be calibrated and adjusted (if warranted) at specified, predetermined intervals using known, recognized standards. All instruments shall be calibrated in accordance with manufacturer's instructions.

8.1.1 Field Instrumentation

The FOL or his designee will be responsible for ensuring that instrumentation are of the proper range, type and accuracy for the measurement/test being performed, and that all of the equipment are calibrated at their required frequencies, according to their specific calibration protocols/procedures.

All field measurement instruments must be calibrated according to the manufacturer's instructions prior to the commencement of the day's activities. Exceptions to this requirement shall be permitted only for instruments that have fixed calibrations pre-set by the equipment manufacturer. QC objectives for field measurement parameters are presented in Table 3-1. Calibration information shall be documented on instrument calibration and maintenance log sheets (see Figure 8-1 for a typical form) or in a designated field logbook. Information to be recorded includes the date, the operator, and the calibration standards (concentration, manufacturer, lot number, expiration date, etc.). All project personnel using measuring equipment or instruments in the field shall be trained in the calibration and usage of the equipment (see Section 12.0), and are personally responsible for ensuring that the equipment has been properly calibrated prior to its use.

In addition, all field instruments must undergo response verification checks at the end of the day's activities and at any other time that the user suspects or detects anomalies in the data being generated. The checks consist of exposing the instrument to a known source of analyte (e.g., the calibration solution), and verifying a response. If an unacceptable instrument response is obtained during the check (i.e., not within specifications; see Table 3-1), the data shall be labeled suspect, the problem documented in the site logbook, and appropriate corrective action taken. See Section 13.0 for further information on corrective action procedures.

FIGURE 8-1
EQUIPMENT CALIBRATION AND MAINTENANCE FORM (TYPICAL)

Instrument (Name / Model No. / Serial No.): ______________________

Manufacturer: ______________________ **Date Purchased or Leased:** __________

CALIBRATION LOGSHEET

Calibration Date	Initial Settings	Standard(s) Used	Procedure	Adjustments Made	Final Settings	Signature of Operator

MAINTENANCE LOGSHEET

Maintenance Date	Reason for Maintenance	Maintenance Performed	Signature of Operator

The geophysical survey equipment will be calibrated by the subcontractor/manufacturer. To ensure the accuracy and repeatability of the geophysical survey equipment, a single geophysical test line will be acquired for each instrument at the beginning and end of each day's activities with each instrument. This test line will consist of a known subsurface object or of an object placed on the ground surface (such as a steel pipe). If results along this test line for an instrument are not comparable, the instrument will be recalibrated or replaced.

The field GC instrument shall be calibrated daily prior to sample screening analysis. Calibration information shall be documented in the dedicated field logbook for the survey. A three to five point initial calibration must be performed to demonstrate the working range and linearity of the GC. Continuing calibrations will be run every 12 hours that the GC is in operation. If the standard responses are not within calibration limits, a new three to five point calibration curve must be generated before sample analysis can proceed.

Any equipment found to be out of calibration shall be recalibrated. When instrumentation is found to be out of calibration or damaged, an evaluation shall be made to ascertain the validity of previous test results since the last calibration check. If it is necessary to ensure the acceptability of suspect items, the originally required tests shall be repeated (if possible), using properly calibrated equipment. Any instrument consistently found to be out of calibration shall be repaired or replaced.

8.1.2 Laboratory Instrumentation

Personnel at the laboratory will be responsible for ensuring that analytical instrumentation are of the proper range, type and accuracy for the test being performed, and that all of the equipment are calibrated at their required frequencies, according to specific protocols/procedures.

Off-site laboratory equipment shall be calibrated using certified/nationally recognized standards and according to the applicable methodologies and the laboratory SOPs. In addition, these methods/procedures specify the appropriate operations to follow during calibration or when any instrument is found to be out of calibration. Information on and frequency for laboratory QC samples are presented in Section 9.2 and/or the specified analytical method procedures.

8.2 PREVENTIVE MAINTENANCE

8.2.1 Field Instrumentation

Field equipment shall be maintained at its proper functional status in accordance to manufacturer manual specifications. A check of the equipment shall be performed before field activities begin, and any potential spare parts (e.g., batteries, connectors, etc.) and maintenance tools will be brought on site, to minimize equipment downtime during the field activities. Visual checks of the equipment will be conducted on a daily basis. Routine preventive maintenance shall be performed to assure proper operation of the equipment. Any maintenance performed on field equipment will be documented on instrument calibration and maintenance sheets or in the designated field logbook, and shall be undertaken only by personnel who have the appropriate skills and/or training in the type of maintenance required (see Section 12.0).

8.2.2 Laboratory Instrumentation

The laboratory is responsible for the maintenance of their analytical equipment, in accordance with manufacturers' specifications. Analytical personnel will be responsible for ensuring that instrumentation is functioning properly and within specific guidelines/specifications prior to starting any analysis. Maintenance, performed by either laboratory personnel or the manufacturer's service personnel, will be conducted according to manufacturer's recommendations and procedures.

9.0 QUALITY ASSURANCE/QUALITY CONTROL SAMPLE REQUIREMENTS

This section will discuss the type and quantities of QA/QC samples to be utilized during implementation of the field programs. The site-specific number and type of QA/QC samples are discussed in Section 6.0.

9.1 FIELD QUALITY CONTROL SAMPLES

The subsections below present general information and guidance on field QC samples, including definition and frequency of QC blanks. Field QC samples will be labeled and shipped according to the procedures outlined in Section 5.0.

9.1.1 Field Blanks

A field blank will be collected to evaluate the potential for contamination of environmental samples from inadequate decontamination of field equipment. Field blanks shall be collected by pouring laboratory supplied distilled/deionized (DI) water over and/or through decontaminated non-disposable equipment (e.g., split-spoons for soil sampling) or disposable equipment, and collecting the rinsate (see Section 4.2 for decontamination procedures). Field blanks will be collected at a frequency of one per decontamination event per type of sampling equipment, not to exceed one per day. Preservation and analysis of field blanks will be identical to that of the associated environmental samples (see Table 6-2).

During the groundwater sampling utilizing the low flow sampling and purging method, the field blank will be collected after sampling from the most contaminated well (as per previous data and/or location estimation). This blank will be collected by pumping DI water through the decontaminated low flow sampling apparatus and collecting the rinsate. If dedicated pumps are used, a field blank will not be collected.

9.1.2 Trip Blanks

A trip blank serves to detect possible cross-contamination of samples resulting from handling, storage and shipment procedures. Trip blanks will accompany VOC glassware in transit through sample collection and shipment to the laboratory. In addition, trip blanks are stored by the laboratory under the same conditions as the environmental samples. A trip blank will accompany each cooler containing samples submitted for VOC analysis, and will be preserved as per the groundwater samples and analyzed identically to the associated environmental samples. VOC samples will be consolidated in one cooler for daily shipment, if possible, to minimize the number of trip blanks required in the field program. It is anticipated that only one trip blank per day will be necessary.

9.1.3 Temperature Blanks

A temperature blank will be sent with each cooler of samples to verify that the cooler temperature has been maintained at 4°C. One non-preserved VOA vial shall be filled with either potable or DI water, and labeled with "USEPA cooler temperature indicator" and the date. If supplied, the laboratory's temperature blank will be used in place of the VOA vial. The laboratory shall record the temperature of the blank water on the chain of custody immediately upon cooler arrival.

9.1.4 Field Environmental Duplicate Samples

Duplicate environmental samples will be analyzed by the field GC and by the off-site laboratories to evaluate the reproducibility of the sampling procedures. Duplicate samples will be collected at a rate of five percent of the total samples for each specific matrix for each type of analysis (i.e., one duplicate for up to every 20 samples). The duplicate samples will be collected from the same location and at the same time as the original environmental sample; however, the duplicated samples will be "coded" in such a manner that the laboratory will not be able to determine of which original field sample they are duplicated (i.e., "blind" duplicates). For example, the duplicate sample of location SS01 may be "coded" as location SS21, as long as there are not more than twenty surface soil locations being sampled (i.e., the coded sample name should not be assigned a legitimate sample location identification). An explanation of the duplicate "coding" must be written in the field logbook. Preservation and analysis of duplicate samples will be identical to those for the environmental samples. Precision of field data will be evaluated based on the calculation of Relative Percent Difference (RPD), with acceptance criteria of 50 percent for the field GC samples and 25 percent for the off-site laboratory samples. Blind duplicate samples will be collected in the same manner as the environmental samples, i.e. VOCs grab and metals composited. Soils analyzed for metals will be homogenized, then the appropriate glassware filled.

9.2 LABORATORY QUALITY CONTROL SAMPLES

General information and guidance on laboratory QC samples are presented in the subsections below. A summary of QC procedures, frequencies, criteria, and corrective actions for the samples, as determined by the applicable method guidelines (see Section 6.0), is provided in Table 9-1.

9.2.1 Method Blanks/Preparation Blanks

A method blank (for organics) or a preparation blank (for inorganics) will be analyzed with every batch of samples to ensure that contamination has not occurred during the analytical process. Method blanks consist of a portion of analyte-free water or solid that is processed through the entire sample procedure the same as an environmental sample.

9.2.2 Matrix Spikes/Matrix Spike Duplicates

Matrix spike/matrix spike duplicate samples (also known as spike/duplicate samples) will be used to assess precision and accuracy of the analytical methods. In this procedure, three aliquots of an actual field sample are collected at a specific location, and two aliquots are "spiked" by the addition of known amounts of an analyte or analytes and these samples are then analyzed identically to the field samples. A comparison of the resulting concentration to the original sample concentration and among the two "spiked" sample concentrations provides information on the ability of the analytical procedure to generate a correct result from the sample. Matrix spike/matrix spike duplicate samples will be collected in the field at a rate of five percent, and will be analyzed on a per batch basis, with up to 20 samples per week constituting a batch. The validity of matrix spike/matrix spike duplicate recovery and relative percent difference values will be determined using the acceptance criteria stated in Table 9-1.

TABLE 9-1 (Sheet 1 of 4)
SUMMARY OF ANALYTICAL QC PROCEDURE CHECKS, FREQUENCIES, ACCEPTANCE CRITERIA, AND CORRECTIVE ACTIONS FOR LABORATORY SAMPLE ANALYSES

Parameter	*Method*	*QC Procedure*	*Frequency*	*Acceptance Criteria*	*Corrective Action*
Target VOCs (headspace)	Direct Measurement by Field GC	Method Blank	1 every 12 hours	no constituent > MDL	suspend analysis until source rectified
		Matrix Spike	1 per ≤ 20 samples	75-125%R	reanalyze
TCL (aqueous)	EPA Method 8260B	Method Blank	1 every 12 hours	no constituent > CRQL	suspend analysis until source rectified
		Surrogate Compounds	all samples	80-120%R	check calculations and instruments, reanalyze affected samples
		Internal Standards	all samples	● 40%R, ± 20 sec retention time shift	check calculations and instruments, reanalyze affected samples
		Laboratory Control Sample	1 per ≤ 20 samples	60-140%R	check calculations and instruments, reanalyze affected samples
TCL VOCs (solid) + freon	EPA Method 5035	Method Blank	1 every 12 hours	no constituent > CRQL *	suspend analysis until source rectified
		Matrix Spike/Matrix Spike Duplicate	1 per ≤ 20 samples	Compound Specific (full range: 59-172%R, ± 24%RPD)	flag outliers
		Surrogate Compounds	all samples	Compound Specific (full range: 59-138%R)	check calculations and instruments, reanalyze affected samples
		Internal Standards	all samples	50-100% of area, ± 30 sec retention time shift	check calculations and instruments, reanalyze affected samples

TABLE 9-1 (Sheet 2 of 4)
SUMMARY OF ANALYTICAL QC PROCEDURE CHECKS, FREQUENCIES, ACCEPTANCE CRITERIA, AND CORRECTIVE ACTIONS FOR LABORATORY SAMPLE ANALYSES

Parameter	Method	QC Procedure	Frequency	Acceptance Criteria	Corrective Action
		Surrogate Compounds	all samples	Compound Specific (full range: 15-140%R)	check calculations and instruments, reanalyze affected samples
		Internal Standards	all samples	-50 to +100 % of area; ● 20 sec retention time shift	check calculations and instruments, reanalyze affected samples
		Laboratory Control Sample	1 per ≤ 20 samples	Compound Specific (full range: 10-120%R)	check calculations and instruments, reanalyze affected samples
TCL SVOCs (solid)	EPA Method 8270C	Method Blank	1/ ≤ 20 samples OR whenever samples extracted	no constituent > CRQL **	suspend analysis until source rectified
		Matrix Spike/Matrix Spike Duplicate	1 per ≤ 20 samples	Compound Specific (full range: 11-142%R, ± 50%RPD)	flag outliers
		Surrogate Compounds	all samples	Compound Specific (full range: 59-138%R)	check calculations and instruments, reanalyze affected samples
TCL SVOCs [cont'd] (solid)		Internal Standards	all samples	-50 to +100% of area, ± 30 sec retention time shift	check calculations and instruments, reanalyze affected samples
TAL Metals (aqueous/solid) + cyanide	TAL Metals (no Hg) EPA Method 6010b	Preparation Blank	1 per ≤ 20 samples	no analyte > CRQL	suspend analysis until source rectified; redigest and reanalyze affected samples
	Hg(in Soil) EPA Method 7471a	Spike/Duplicate	1 per ≤ 20 samples	75-125%R*** ± 20% RPD****	flag outliers

TABLE 9-1 (Sheet 3 of 4)
SUMMARY OF ANALYTICAL QC PROCEDURE CHECKS, FREQUENCIES, ACCEPTANCE CRITERIA, AND CORRECTIVE ACTIONS FOR LABORATORY SAMPLE ANALYSES

Parameter	*Method*	*QC Procedure*	*Frequency*	*Acceptance Criteria*	*Corrective Action*
	Hg (in water) EPA Method 7470a	Interference Check Sample	beginning, end & periodically during run (≥2 X every 8 hrs)	± 20% of true value*****	check calculations and instruments, reanalyze affected samples
		Laboratory Control Sample	1 per ≤ 20 samples	80-120%R (except Ag and Sb) [aqueous] control limits established by USEPA [solid]	suspend analysis until source rectified; redigest and reanalyze affected samples
Hexavalent Chromium (aqueous/solid)	SW846 Method 7197 [Method 1311 for extraction]	Preparation Blank	1 per ≤ 20 samples	no analyte > CRQL	suspend analysis until source rectified; reprepare and reanalyze affected samples
		Spike/Duplicate	1 per ≤ 20 samples	75-125%R ± 20% RPD	flag outliers
		Post-Chelation/Extraction Spike	after analyte fails spike %R	85-115%R	dilute and reanalyze sample
		Laboratory Control Sample	1 per ≤ 20 samples	80-120%R	suspend analysis until source rectified; redigest and reanalyze affected samples
Total Organic Carbon (solid)	L. Kahn (7/88)	Laboratory Duplicate Sample	1 per ≤ 20 samples	± 25% RPD	reanalyze

TABLE 9-1 (Sheet 4 of 4)
SUMMARY OF ANALYTICAL QC PROCEDURE CHECKS, FREQUENCIES, ACCEPTANCE CRITERIA, AND CORRECTIVE ACTIONS FOR LABORATORY SAMPLE ANALYSES

Parameter	*Method*	*QC Procedure*	*Frequency*	*Acceptance Criteria*	*Corrective Action*
Water Quality Parameters(aq.)	MCAWW [see Table 6-2]	Laboratory Duplicate Sample	1 per ≤ 20 samples	± 25% RPD	reanalyze

Notes:

Abbreviations include:

%R = Percent Recovery
GC = Gas Chromatography
SD = Standard Deviation
CRQL = Contract Required Quantitation Limit
TAL = Target Analyte List
SVOCs = Semi-Volatile Organic Compounds
RPD = Relative Percent Difference
TCL = Target Compound List

* with the exception of methylene chloride which can be up to 2.5 times the contract required detection limit (CRQL) and acetone and 2-butanone which can be up to 5 times the CRQL.

** with the exception of phthalates which can be up to 5 times the CRQL.

*** with the exception when the concentration is greater than 4 times the spike concentration.

**** with the exception when the concentration is less than 5 times the CRQL, then ± CRQL.

***** with the exception when the instrument detection limit is greater than the CRQL for As, Pb, Se and Tl.

9.2.3 Laboratory Control Samples

A laboratory control sample (LCS) consists of an analyte-free water or solid phase sample that is spiked with target analytes at a known concentration. The LCS shall be analyzed for every batch of samples (i.e., 1 per 20) to assess the ability of the analytical procedure to generate a correct result without matrix effects/interferences affecting the analysis. The percent recoveries for the LCS compounds will be compared to QC limits stated in the appropriate methods, and are presented in Table 9-1.

9.2.4 Surrogate Compounds

Surrogates (also known as System Monitoring Compounds) are compounds of known concentrations added to every organic analysis sample for analytical chromatography methods at the beginning of the sample preparation to monitor their recovery. Surrogate recoveries will be used to assess potential matrix interferences and to monitor any potential effects of sample preparation and analysis on final analyte concentrations. The recovery values will be compared to values established in the applicable methodologies to determine the validity of the data (see Table 9-1).

9.2.5 Internal Standards

ıternal standards are used to provide instrument correction for variation in instrument performance and injection volumes. Internal standards also establish relative response factors for the analytes.

9.2.6 Interference Check Samples

An interference check sample (ICS), which contains target analytes at known concentrations, verifies the laboratory's interelement and background correction factors. Analysis of ICS samples is unique to metals analysis using the inductively coupled plasma (ICP) method.

10.0 DATA REDUCTION, VALIDATION AND REPORTING

Standard methods and references will be used as guidelines for data handling, reduction, validation, and reporting. All data for the project will be compiled and summarized with an independent verification at each step in the process to prevent transcription/typographical errors. Any computerized entry of data will also undergo verification review.

10.1 DATA REDUCTION

10.1.1 Field Data Reduction

Field instrumentation data will be reported by site personnel in field logbooks and/or on field investigation forms associated with the sampling event (see Section 5.3). Portable GC data shall be reported in a field logbook dedicated to the screening investigation. Screening data from the field GC analysis will undergo a data review, to include review of calibration, method blank and duplicate results and calculations. At the end of the field investigation, the field screening data results shall be summarized in a computerized database and/or in tabulated form, as warranted.

0.1.2 Laboratory Data Reduction

All data generated by the off-site laboratory will be reported in a specified format containing all required elements to perform data validation (see Section 10.3.1). Analytical results shall be presented on standard NYSDEC ASP-B forms or equivalents, and include the dates the samples were received and analyzed, and the actual methodology used. Laboratory QA/QC information required by the method protocols will be compiled, including the application of data QA/QC qualifiers as appropriate. In addition, laboratory worksheets, laboratory notebooks, chains-of-custody, instrument logs, standards records, calibration records, and maintenance records, as applicable, will be provided in the laboratory data packages to determine the validity of data. Specifics on internal laboratory data reduction protocols are identified in the laboratory's SOPs.

10.1.3 Project Data Reduction

Following receipt of the laboratory analytical results by PWGC, the data results will be compiled and presented in an appropriate tabular form. Where appropriate, the impacts of QA/QC qualifiers resulting from laboratory or external validation reviews will be assessed in terms of data usability.

10.1.4 Non-Direct Measurements

If information necessary for the project has not been measured directly in the field, non-direct measurement data may be obtained from literature files, texts, computer databases, etc. References utilized will be acknowledged sources within the specific discipline. An explanation of the rationale behind using the reference and a description of any concern regarding the use of the referenced data (e.g., uncertainty, conflicting literature, etc.) shall be made within the report. Non-direct measurement data, after usage, will be filed within the project files for the length of the project.

10.2 DATA VALIDATION

The data results obtained from the laboratories will be sent to a third party (Data Validation Services, North Creek, NY) to undergo a systematic data validation to provide assurance that the data is adequate for its intended use (i.e., in the performance of human health and ecological risk assessments and a feasibility study). The validation will be performed by personnel who have appropriate training and/or experience in performing data validation for the analyses of interest associated with the project.

'alidation will be performed based on an evaluation of method-specific QC information (such as holding times, calibration records, laboratory and field blanks, duplicate precision, and surrogate and matrix spike recovery; see Section 9.0) and the best professional judgement of the validator. Validation will be performed utilizing guidance from the most current updates of the USEPA Region II validation SOPs for SW846 methodologies, if available, and from the USEPA Region II CLP SOPs, modified for the specific methodology, if not.

Deviation from the USEPA Region II Data Validation SOPs will be documented along with a discussion of the appropriateness of the deviation for EPA approval. Deviation from the USEPA Region II Data Validation SOPs will not compromise State or Federal Applicable or Relevant Appropriate Requirements.Qualifiers (as applicable) will be added to the data result tables by manual computer entry. All keyed entries will be verified and signed off as checked by the QA Officer or his designee.

10.3 DATA REPORTING

10.3.1 Contents of Laboratory Data Reports

The laboratories performing analysis work on this project will submit a hardcopy data package and an electronic deliverable.

The hardcopy laboratory report, and any associated electronic deliverable files, will be sent directly to PWGC, and will contain information such as:

- Title and Location of the Project
- Project Identification Number
- Name of the Report
- Date Report was Prepared
- Name, Address and Telephone Number of the Laboratory
- Case Narrative
- Sample Identification Number
- Name and Location of Sample
- Type of Sample (e.g., water, soil)
- Analysis performed
- Parameter results
- Any special observations, circumstances or comments which may be relevant for interpretation of the data
- Signature of laboratory manager

The laboratory report will include a written case narrative, which will note any problems encountered in receipt or during analysis of the samples, and the corrective actions utilized (including telephone logs, etc.). Each laboratory report will include supporting documentation, such as copies of chromatograms, data system printouts, internal sample tracking documentation, sample preparation and analysis logbooks, and standard preparation data, as appropriate. Each constituent tested will include the name of parameter, the CAS number (if applicable), approved testing procedure references, results of analysis, and the units of the reported results.

Non-ASP data will be supplied in "results only" format. At a minimum, results only data sheets will include:

- Title and Location of the Project
- Project Identification Number
- Name of the Report
- Date Report was Prepared
- Name, Address and Telephone Number of the Laboratory
- Sample Identification Number
- Name and Location of Sample
- Type of Sample (e.g., water, soil)
- Analysis performed
- Parameter results

- Any special observations, circumstances or comments which may be relevant for interpretation of the data

10.3.2 Contents of Summary Reports

A Site Characterization Summary Report, in the form of a Technical Memorandum, will be prepared following completion of the site investigation field activities and data evaluation. The results of the field investigation and analytical testing program will be summarized in this report, and data tables containing the laboratory results, showing all detects and non-detects, detection limits for non-detects, and data qualifiers, will be included. In addition, results of previous investigations will be included in the data table set. Appropriate figures illustrating sample locations will also be included. A qualitative evaluation of the usability of the data, along with justification for excluding any data if warranted, will also be provided in the report.

Risk Assessment Reports (human health and ecological) will be prepared as part of this RI/FS. All usable data, as applicable and appropriate, will be included in the quantitative risk calculations. The risk assessments will determine whether site contaminants pose a current or potential future risk to human health and the environment.

A Remedial Investigation (RI) Report will be prepared following completion of the site investigation field activities and data evaluation. The results of the field investigation and analytical testing program will be summarized in this report, including geologic and hydrogeologic information, nature and extent of contamination, and potential fate and transport of contaminants. Comparison of the acquired site data to existing standards and guidelines (e.g., drinking water standards) will be performed to assist in the evaluation of the extent of contamination. The data will also be presented in potentiometric contour maps and in isoconcentration plume maps within the RI Report.

In addition, the site data results will be utilized in the remedial alternatives screening during the Feasibility Study (FS). A FS Report will be prepared, which shall include detailed analyses of the potential alternatives against evaluation criteria.

The PWGC PM shall review all reports, prior to submission, to ensure compliance with project requirements.

11.0 PERFORMANCE AND SYSTEMS AUDITS

The PWGC PM and/or FOL will conduct a "readiness review" for field activities, prior to the commencement of the investigation. Equipment and supplies will be inventoried, and field instrumentation will be checked to ensure that all are in working order. Any maintenance activities performed during the "readiness review" are to be documented on instrument maintenance sheets or in a designated field logbook.

Internal systems and performance audits will be conducted by the off-site laboratories in accordance with USEPA analytical methodology requirements and the laboratory SOPs. The laboratories shall cooperate with USEPA or other regulatory agency personnel with Agency-requested internal technical systems and/or performance audits.

Surveillance of field program activities will be conducted by the PM and FOL. The QA Officer and/or a member of the QA/QC staff will accompany sampling personnel into the field for one or two days to verify that sampling is being correctly implemented according to the Work Plan, the FSP, and this QAPP. Based on the length of the field effort at the site, one inspection will occur per month and then one inspection will be performed every six months of consecutive activities thereafter. Additional inspections may be warranted to ensure that corrective actions of major deficiencies/problems identified in an initial inspection have been implemented/addressed.

The audit will be documented and uniquely identified for tracking purposes, and all deficiencies noted during the audit shall be identified, with a recommended corrective action for compliance. The Quality Assurance/Data Quality Officer shall evaluate all audit corrective action responses and inform the PM/subcontractor organization of the closure of any or all of the deficiencies noted during the audit. A log of the audits conducted and responses thereto shall be maintained by the Quality Assurance/Data Quality Officer.

12.0 TRAINING OF PROJECT STAFF

PWGC will establish requirements for training and qualification of project personnel to ensure that they are capable of performing all required investigation activities.

Performance-based testing will be provided to all appropriate personnel performing project activities. Performance-based testing involves the review of the personnel's work products by the PM, FOL, Quality Assurance/Data Quality Manager and/or QA Officer, until the monitored individual reaches the desired level of competence in performing his work tasks. Once a person exhibits the required degree of competence, unannounced periodic monitoring is performed to ensure this level is maintained.

12.1 GENERAL PERSONNEL TRAINING

Project staff shall receive general training on the project objectives, the DQOs for the site, the Work Plan, the FSP, the SMP, the QAPP, and the HASP.

12.2 QUALITY ASSURANCE TRAINING

Training will include topics related to Quality Assurance. It will cover, but not be solely limited to:

- QAPP elements, including project-specific QA requirements
- Need for proper documentation and records maintenance
- Responsibilities of project personnel
- Handling and review of field, laboratory and non-direct measurement data
- USEPA Region II QA requirements

12.3 TRAINING RECORDS

PWGC will complete and maintain all training records in the project files. They will include, as appropriate:

- Attendance sheets
- Records of course content, including dates of training and the instructor's name
- Training logs and curricula
- Personnel training record
- Formal qualification/certification records (as applicable)

13.0 CORRECTIVE ACTION

Review and implementation of systems and procedures may result in recommendations for corrective action. Any deviations from the specified procedures within approved project plans due to unexpected site-specific conditions shall warrant corrective action. All errors, deficiencies, or other problems shall be brought to the immediate attention of the PWGC PM, who in turn shall contact the Quality Assurance/Data Quality Manager or his designee (if applicable).

Procedures have been established to ensure that conditions adverse to data quality are promptly investigated, evaluated and corrected. These procedures for review and implementation of a change are as follows:

- Define the problem.
- Investigate the cause of the problem.
- Develop a corrective action to eliminate the problem, in consultation with the personnel who defined the problem and who will implement the change.
- Complete the required form describing the change and its rationale (see below for form requirements).
- Obtain all required written approvals.
- Implement the corrective action.
- Verify that the change has eliminated the problem.

During the field investigation, all changes to the sampling program will be documented in field logs/sheets and the PWGC PM advised.

If any problems occur with the laboratory or analyses, the laboratory must immediately notify PWGC PM, who will consult with other PWGC project staff. All approved corrective actions shall be controlled and documented.

All corrective action documentation shall include an explanation of the problem and a proposed solution which will be maintained in the project file or associated logs. Each report must be approved by the necessary personnel (e.g., the PM) <u>before</u> implementation of the change occurs. The PWGC PM shall be responsible for controlling, tracking, implementing and distributing identified changes.

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USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Low Concentration Water. OLC02.1.

ATTACHMENT - F
Health and Safety Plan (August 2001)

P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST, P.C.

REVISED FINAL

HEALTH AND SAFETY PLAN
FOR THE
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
FORMER COMPUTER CIRCUITS FACILITY
TOWN OF SMITHTOWN
SUFFOLK COUNTY, NEW YORK

AUGUST 2001

NOTICE

THIS DOCUMENT HAS BEEN MODIFIED BY P.W. GROSSER CONSULTING ENGINEER & HYDROGEOLOGIST P.C. (PWGC) FOR USE AT THIS SITE. THE INFORMATION PROVIDED IN THE ORIGINAL VERSION OF THIS DOCUMENT, DATED DECEMBER 1999 WAS FUNDED BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA) UNDER RAC II CONTRACT NO. 68-W-98-214 TO FOSTER WHEELER ENVIRONMENTAL CORPORATION (FOSTER WHEELER ENVIRONMENTAL).

HEALTH AND SAFETY PLAN

Site:	**Former Computer Circuits Facility**
Location:	**Hauppauge, Suffolk County, New York**
Prepared By:	**P.W. GROSSER ENGINEER & HYDROGEOLOGIST, P.C.**
Date Prepared:	**AUGUST 2001**
Version:	**1**
Revision:	**4**
Project Description:	**REMEDIAL INVESTIGATION/FEASIBILITY STUDY**
Waste types:	Solid, Liquid
Characteristics:	Volatile Organic Compounds, Copper and Nickel
Status:	Inactive
Background Review:	Complete
Overall Hazard:	Low to Moderate

P.W. GROSSER ENGINEER & HYDROGEOLOGIST, P.C. (PGWC). PWGC'S SUBCONTRACTORS, AND THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

APPROVALS

By their signature, the undersigned hereby certify that this Health and Safety Plan (HASP) has been reviewed and approved for use at the Former Computer Circuits Facility.

Project Manager Charles B. Sosik	8/8/01 Date
Health and Safety Officer Keith W. Butler	8/8/01 Date

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1.0 INTRODUCTION

1.1 Purpose

This Health and Safety Plan (HASP) addresses the minimum health and safety practices that will be employed by site workers participating in activities at the Former Computer Circuits Facility located in Hauppauge, Suffolk County, New York, see Figure 1-1. The Site is currently listed on the U.S. Environmental Protection Agency's (USEPA) National Priority List which classifies the site as a Superfund Site.

The HASP takes into account the specific hazards inherent to the site and presents the minimum requirements which are to be met by P.W. Grosser Engineer & Hydrogeologist, P.C. (PWGC), its' subcontractors, and other on-site personnel in order to avoid and, if necessary, protect against health and/or safety hazards. PWGC sub-contractors will have the option of adopting this HASP or developing their own site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in this HASP and must be made available to PWGC and EPA.

Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 CFR Parts 1910 and 1926, and the PWGC Corporate Environmental Health and Safety policy. Modifications to the HASP may be made with the approval of the PWGC Health and Safety Manager (HSM) and/or Project Manager (PM).

Refusal to comply with the HASP or violation of any safety procedures by field personnel may result in their immediate removal from the site following consultation with the HSM and the Project Manager.

1.2 Scope

This HASP addresses the potential hazards related to the Site Remedial Investigation (RI). The primary RI activities include the following:

- Site Mobilization/Demobilization;
- Site Survey and Reconnaissance;
- Geophysical Survey;
- Surface, Subsurface Soil Sampling and Soil Sample Field Screening;
- Hydropunch Groundwater Sampling and Field Screening;
- Monitoring Well Installation and Development
- Aquifer Testing; and
- Decontamination.

The potential hazards associated with this scope are listed below and are discussed in more detail in this HASP after the project organization and responsibilities section.

- Chemical Hazards

- Biological Hazards
- Physical Hazards

1.3 Application

The HASP applies to all personnel involved in the above tasks who wish to gain access to active work areas, including but not limited to:

- PWGC employees and subcontractors;
- Client representatives; and
- Federal, state or local representatives.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

This section specifies the PWGC project organization and responsibilities.

2.1 Project Manager Charles B. Sosik

- Participates in major incident investigations;
- Ensures that the HASP has all of the required approvals before site work is conducted; and
- Has the overall project responsibility for project health and safety.

2.2 Field Operations Lead (FOL)/ Health and Safety Officer (HSO) - Bryan A Devaux

- Ensures that the HASP is implemented in conjunction with the Health and Safety Manager (HSM);
- Ensures that field work is scheduled with adequate equipment to complete the job safely;
- Enforces site health and safety rules;
- Ensures that proper personal protective equipment is utilized;
- Ensures that the HSM is informed of project changes which require modifications to the HASP;
- Ensures that the procedure modifications are implemented;
- Investigates incidents;
- Conducts the site safety briefing;
- Reports to HSM to provide summaries of field operations and progress; and
- Acts as Emergency Coordinator.

2.3 PWGC Health and Safety Manager - Keith W. Butler

- Provides for the development of the HASP;
- Serves as the primary contact to review health and safety matters that may arise;
- Approves individuals who are assigned HSO responsibilities;
- Coordinates revisions of this HASP with field personnel; and
- Assists in the investigation of major accidents.

2.4 Site Personnel

- Report any unsafe or potentially hazardous conditions to the FOL/HSO;
- Maintain knowledge of the information, instructions and emergency response actions contained in this HASP; and
- Comply with rules, regulations and procedures as set forth in this HASP and any revisions.

3.0 SITE HISTORY AND PROJECT DESCRIPTION

3.1 Background and Site Description

From 1969 to 1991, the property owned by MCS Realty leased the property to various companies. In July 1991, MCS Realty sold the property to 145 Marcus Boulevard Corporation. Computer Circuits occupied the entire property from 1969 to 1977. The site is currently occupied by Algorex Power and Control Electronics, Incorporated. Computer Circuits was a manufacturer of printed circuit boards for both military and commercial applications. Various chemicals were used in the manufacturing process including copper sulfate, nickel, sulfuric acid, hydrochloric acid, lead fluoroborate, fluorides, copper, trichloroethylene, photography chemicals, gold cyanate, ammonia, lead, nitric acid, and tin. Waste liquids from the manufacturing process were discharged to five cesspools located to the southeast of the building and one cesspool on the north side of the building. In January 1973, a pipe connection was discovered between the Computer Circuits industrial cesspools on the south side of the building and a catch basin on Marcus Boulevard. After the connection was removed in 1974, wastewater was observed flowing over the surface of the ground into the storm drain system. On numerous occasions between 1976 and 1977, the Suffolk County Department of Environmental Control (SCDEC) collected samples from the cesspools, and found that copper and lead were consistently detected at levels above the State Pollutant Discharge Elimination System (SPDES) permit limits. An inspection conducted in 1976 revealed that the site was littered with trash, broken barrels, and spilled piles of chemicals and blue/green colored sludge.

In 1976, in response to requests by the SCDEC, Computer Circuits hired a contractor (Thomas Patterson, Inc.) who excavated and filled the five underground leaching pools located near the southeast corner of the building and installed two new cesspools, which were also used for industrial waste disposal.

The following is a brief chronological summary of the sampling and analytical programs conducted on or in the vicinity of the Computer Circuits site to date. A more detailed discussion of the current understanding of the site-related contaminants is presented in Section 2.0. A map showing the location and posted results of soil and groundwater samples from previous investigations is included as Figure 1-3.

- *1976* - Thomas Patterson, Inc., under contract to the tenant, Computer Circuits, excavated and filled five leaching pools and installed two new leaching pools.

- *1976 and 1977* - SCDEC sampled on-site cesspools and found exceedances for copper and lead.

- *May 3, 1989* - Roux Associates, Inc., under contract to the former property owner (MCS Realty), conducted a soil and groundwater investigation at the site as required by the NYSDEC under an Order on Consent (Number W10061885) between the NYSDEC and the former property owner, MCS Realty. A magnetometer survey was conducted. Ten soil borings were drilled at various locations throughout the site, including west of the building, near the cesspools at the southeast and northwest corners of the building, and the former drum storage area east of the building. Three monitoring wells, MW-1, MW-2 and MW-3 were installed and sampled. VOCs were not detected in the soil above NYSDEC guidance values. Groundwater analysis from the monitoring wells indicated VOCs, including trichloroethene, 1,2-dichloroethene and 1,1,1-trichloroethane present above NYSDEC standards and metals including cadmium, chromium, copper, lead, nickel and zinc present at or below NYSDEC standards. No significant anomalies were detected during the magnetometer survey.

- *May 1994* - PWGC, as consultant for the property owner, investigated a sinkhole at the site, located southeast of the corner of the building. Construction debris and a barrel containing a nickel solution were discovered in the sinkhole area. This material was excavated and stockpiled, and removed from the site in November 1995.

- *September through November 1995* - PWGC, as consultant for the property owner, conducted a soil quality investigation at the request of the NYSDEC. Five soil borings were drilled, one near the sanitary cesspool west of the building, one at the cesspool north of the building, and three around the southeast corner of the building. Groundwater samples were also collected from the three existing monitoring wells at this time. VOCs were not detected in the soil samples above NYSDEC guidance values. Metals including lead, silver, copper, nickel and zinc were detected in the soil samples above the NYSDEC guidance values. Groundwater samples indicated the presense of VOCs, including trichloroethene, 1,2-dichloroethene and 1,1,1-trichloroethane and tetrachloroethene above NYSDEC standards. Metals including zinc were detected slightly above the NYSDEC standards. Additional stained soil was also removed from the sinkhole area and the remains of a cesspool were discovered.

- *February 1996* - NYSDEC conducted a soil vapor survey at the site. The samples were analyzed for TCE, 1,1,1-TCA, and 1,2-DCA. Elevated levels of TCE and 1,1,1-TCA were detected in soil vapor at the site, particularly at the northwest, southeast, and northeast corners of the building.

- *March through May 1996* - USEPA conducted a Hazard Ranking System sampling investigation of the site. Fourteen subsurface soil samples were collected from the cesspool areas, the sinkhole area, and background locations on the property. VOCs were not detected above NYSDEC guidance values. Metals including copper and nickel were detected above

NYSDEC guidance values. In addition, three monitoring wells MW4, MW5 and MW6 were installed at the site. In May, groundwater samples were collected from three of the newly installed wells and two of the previously existing wells. VOCs including trichloroethene, 1,1,1-trichloroethane, tetrachloroethene and 1,2-dichloroethene were detected above NYSDEC standards. Analysis for metals detected detected zinc above NYSDEC standards.

4.0 POTENTIAL HAZARDS OF THE SITE

This section presents an assessment of the chemical, biological, and physical hazards that may be encountered during the tasks specified under Section 1.0. Additional information can be found in Appendix A - Chemical Data Sheets or in Appendix B - Activity Hazard Analyses.

4.1 Chemical Hazards

Review of historical information from the site indicates that the soil and groundwater are contaminated primarily with TCE at low ppm levels. PCE and TCA are also present, but at ppb levels in the groundwater and soil. These compounds may present an occupational exposure hazard during site operations.

The VOCs identified above generally have a depressant effect on the central nervous system, may cause chronic liver and kidney damage, and there is limited evidence of carcinogenicity in humans. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. Specific information on these compounds can be found in Table 4-1 as well as on the Chemical Data Sheets found in Appendix A.

In addition to the chemical hazards existing at the site, additional chemical hazards may be present due to materials being brought to the site, such as acids, and decontamination fluids. Prior to potential exposure to these materials on-site, material safety data sheets (MSDSs) shall be obtained by the HSO and reviewed by affected site personnel. Efforts to minimize exposure/risk from the hazards discussed in the sections will be implemented.

4.2 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects and plants. The Activity Hazard Analyses found in Appendix B will include specific hazards and control measures for each task, if applicable.

4.2.1 Animals

It is not expected to encounter, animals such as dogs, cats, raccoons, skunks, mice and snakes as the Site is located in a predominantly industrial area. However, workers shall use discretion and avoid all contact with animals. If these animals present a problem, efforts will be made to remove these animals from the Site by contacting a licensed pest control technician.

4.2.2 Insects

Insects, such as mosquitoes, ticks, bees and wasps may be present during certain times of the year. Workers will be encouraged to wear repellents (DEET for Ticks) when working in areas where insects are expected to be present. If insects are prevalent, efforts will be made to remove them from the site by contacting a licensed pest control technician.

Table 4-1
Chemical Data

COMPOUND	CAS #	ACGIH TLV	OSHA PEL	ROUTES OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Tetrachloro-ethylene	127-18-4	25 ppm TWA, 100 ppm STEL	100 ppm	Inhalation Skin Absorption Skin Contact Ingestion	Irritates eyes, nose, throat; nausea; flushed face & neck; vertigo, dizziness, incoordination, headache, somnolence; skin erythema; potential human carcinogen	Eyes, skin, resp. system, CNS, liver, kidneys	VP= 14 mm Chloroform like odor, IP= 9.32 eV
1,1,1-trichloroethane	71-55-6	350 ppm TWA, 450 ppm STEL	350 ppm	Inhalation Ingestion Skin Contact	Irritates eyes, skin; headache, lassitude, CNS depression, poor equilibrium; dermatitis; cardiac arrhythmia	Eyes, skin, CNS, CVS, liver	VP= 100 mm Chloroform like odor IP= 11.0 eV
Trichloroethylene	79-01-6	50 ppm	100 ppm	Inhalation Skin Absorption Skin Contact Ingestion	Skin irritation, tremors, nausea, vomiting, dermatitis, insomnia; suspected human carcinogen, potential human carcinogen	Eyes, skin, liver, CNS	VP= 58 chloroform like odor, IP=9.45 eV

Abbreviations

ACGIH = American Conference of Governmental Industrial Hygienists
C = Ceiling limit, not to be exceeded
CNS = Central Nervous System
CVS = Cardiovascular System
eV = Electron volt
IP = Ionization Potential
OSHA = Occupational Safety and Health Administration
ppm = parts per million
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure at approximately 68° F in mm Hg (mercury)

4.2.2.1 Lyme Disease

Since the site is located in the northeast, the potential for coming into contact with deer ticks exists. Lyme disease is caused by an infection from a deer tick, which is about the size of the head of a pin. During the painless tick bite, a microorganism (spirochete) may be transmitted into the bloodstream that may lead to Lyme disease. The effects of the disease vary from person to person, which often makes it difficult to diagnose. Typically, the incubation period ranges from two days to two weeks. In most cases, the infected area will resemble a red bulls-eye with concentric rings. Within the same period, flu-like symptoms may develop. If left untreated, the red ringed area will eventually fade and Lyme disease may further develop into an arthritis-like condition. Employees bitten by deer ticks during the course of employment, will be offered a medical examination. Control measures to prevent Lyme disease include the following:

- Self/Buddy check of neck, hairline, groin and body after working in areas that may contain deer ticks;
- Wear light colored Tyvek® or clothing;
- If a tick is found, remove it by pulling gently at the head with tweezers; and,
- Report any of the above symptoms and all tick bites to the FOL/HSO for evaluation.

4.2.3 Plants

Plants such as poison ivy and poison oak may be prevalent at the site during certain times of the year. Workers will be trained to recognize these plants and to minimize contact with them. Employees may wear PPE in order to reduce the potential for exposure. A pre-exposure topical lotion may be applied prophylactically.

4.3 Physical Hazards

Most safety hazards are discussed in the Activity Hazard Analyses (AHA) in Appendix B for the different phases of the project. In addition to the AHAs, general work rules and other safety procedures are described in Section 10 of this HASP.

4.3.1 Temperature Extremes

Heat Stress

Heat stress is a significant potential hazard, which is greatly exacerbated with the use of PPE in hot environments. The potential hazards of working in hot environments include dehydration, cramps, heat rash, heat exhaustion, and heat stroke.

Cold Stress

At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia as well as slippery surfaces, brittle equipment, and poor judgment.

4.3.2 Steam, Heat and Splashing

Exposure to steam/heat/splashing hazards can occur during steam cleaning activities. Splashing can also occur during groundwater well development and sampling activities. Exposure to steam/heat/splashing can result in scalding/burns, eye injury, and puncture wounds.

4.3.3 Noise

Noise is a potential hazard associated with the operation of heavy equipment, drill rigs, power tools, pumps and engines. Workers will wear hearing protection while in the work zone when machinery such as heavy equipment, Geoprobe units, drill rigs, or generators are operating.

4.3.4 Hand and Power Tool Usage

In order to complete the various tasks for the project, personnel will utilize hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and/or electrocution.

4.3.5 Fire and Explosion

When conducting excavation or drilling activities, the opportunity of encountering fire and explosion hazards may exist from underground utilities and gases. Additionally, the use of a diesel engine on drill rig, could present the possibility of encountering fire and explosion hazards.

4.3.6 Manual Lifting/Material Handling

Manual lifting of heavy objects may be required. Failure to follow proper lifting technique can result in back injuries and strains. Back injuries are a serious concern as they are the most common work place injury, often resulting in lost or restricted work time, and long treatment and recovery periods.

4.3.7 Slips, Trips and Falls

Working in and around the site will pose slip, trip and fall hazards due to slippery surfaces that may be oil covered, or from surfaces that are steep inclines or are wet from rain or ice. Falls may result in twisted ankles, broken bones, head trauma or back injuries.

4.3.8 Heavy Equipment Operation

A backhoe will be used to excavate test pits, and a drill rig will be used to install monitoring wells and to collect subsurface soil samples. Working with or near heavy equipment poses many potential hazards, including electrocution, fire/explosion, being struck by or against, or pinched/caught/ crushed by, and can result in serious physical harm.

4.3.9 Electrocution

Encountering underground utilities, the use of power tools and extension cords may pose electrical hazards to workers. Additionally, overhead electrical lines can be a concern during test pit and drilling operations. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

5.0 ACTIVITY HAZARD ANALYSES

The Activity Hazard Analysis (AHA) is a systematic way of identifying the potential health and safety hazards associated with major phases of work on the project and the methods to avoid, control and mitigate those hazards. The AHAs will be used to train work crews in proper safety procedures during phase preparatory meetings.

AHAs have been developed by PWGC for the following phases of work:

- Site Mobilization/Demobilization;
- Site Survey and Reconnaissance;
- Geophysical Survey;
- Subsurface Soil Sampling and Soil Sample Field Screening;
- Hydropunch Groundwater Sampling and Field Screening;
- Monitoring Well Installation and Development
- Aquifer Testing; and
- Decontamination

Copies of these AHAs are included in Appendix B of this HASP.

6.0 PERSONAL PROTECTIVE EQUIPMENT

The personal protective equipment (PPE) specified in Table 6-1 represents the hazard analysis and PPE selection required by 29 CFR 1910.132. Specific information on known potential hazards can be found under Section 4.0 and Appendix B - Activity Hazard Analyses. For the purposes of PPE selection, the HSM and FOL/HSO are considered competent persons. The signatures on the approval page of the HASP constitute certification of the hazard assessment. For activities not covered by Table 6-1, the FOL/HSO will conduct the hazard assessment, select the PPE, and ndocument changes in the appropriate field logs. PPE selection will be made in consultation with the HSM.

Modifications for initial PPE selection may also be made by the FOL/HSO in consultation with the HSM and changes documented accordingly. If major modifications occur, the HSM will notify the PM.

6.1 PPE Abbreviations

HEAD PROTECTION
HH = Hard Hat

HEARING PROTECTION
EP = ear plugs
EM = ear muffs

HAND PROTECTION
Cot = cotton
But = Butyl
LWG = Leather Work Gloves
Neo = Neoprene
Nit = Nitrile
Sur = Surgical

EYE/FACE PROTECTION
APR = Full Face Air Purifying Respirator
MFS = Mesh Face shield
PFS =Plastic Face shield
SG = ANSI approved safety glasses with side shields

BODY PROTECTION
WC = work clothes
Cot Cov = Cotton Coveralls
Poly = Polyethylene coated Tyvek® coveralls
Saran = Saranex coated coveralls
Tyvek® = Uncoated Tyvek® coveralls

FOOT PROTECTION
Neo = Neoprene
OB = Overboot
Poly = polyethylene coated boot
Rub = rubber slush boots
STB = Leather work boots with steel toe

RESPIRATORY PROTECTION
APR = Full-face air purifying respirator with organic vapor cartridges
ASR = Full face air supplied respirator with escape bottle
SCBA = Self-contained breathing apparatus

6.2 Hazard Assessment for Selection of Personal Protective Equipment

The initial selection of personal protective equipment for each task was done by performing a hazard assessment taking into consideration the following:

- Potential chemical and physical present;
- Work operations to be performed;
- Potential routes of exposure;
- Concentrations of contaminants present; and
- Characteristics, capabilities and limitations of PPE and any hazard that the PPE presents or magnifies.

Table 6-1
Personal Protective Equipment Selection

TASK	HEAD	EYE/FACE	FEET	HANDS	BODY	HEARING	RESPIRATOR
Mobilization/ Demobilization	HH	SG	STB	WG	WC	None	None
Site Survey & Reconnaissance; Geophysical survey	HH	SG	STB	WG	WC	None	None
Subsurface Soil or Groundwater Sampling, (Geoprobe, Drilling or Test Pit Operations	HH	SG	STB, OB as needed	Nit + Sur	WC, Tyvek® as needed	EP or EM	None initially APR if action levels exceeded
Monitoring Well Inst., development or aquifer Testing	HH	SG	STB	WG, Nit + Sur as needed	WC, Tyvek® as needed	None	None initially APR if action levels exceeded
Decontamination	HH	SG	STB	Nit + Sur	WC, Tyvek® as needed	None	None initially APR if action levels exceeded

A review of the analytical data from previous sampling events indicates that volatile organic compounds identified in Table 4-1 are the primary contaminants of concern, particularly TCE; the maximum concentration for these compounds is less than 60 parts per million (ppm). The primary concern is inhalation; skin contact and ingestion are secondary routes of exposure. Chemical protective gloves will be required for all activities that involve sample handling and the likelihood for skin contact. Additionally, the type of respiratory protection will be dependent on real-time air monitoring results. The use of organic vapor cartridges, along with the air monitoring program, will provide adequate respiratory protection to minimize potential exposure via inhalation. The proper use of PPE and strict adherence to decontamination and personal hygiene procedures will effectively minimize skin contact and ingestion as potential routes of exposure.

6.3 Respirator Cartridge Change-Out Schedule

A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. If the use of respirators is necessary, the respirator cartridge change-out schedule for this project will be as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first; and
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short of time period they were used the day before.

The schedule was developed based on the following scientific information and assumptions:

- Analytical data that is available regarding site contaminants;
- Using the Rule of Thumb provided by the AIHA;
- All of the chemicals have boiling points greater than 70°C;
- Total airborne concentration of contaminants is anticipated to be less than 200 ppm;
- The humidity is expected to be less than 85%; and
- Desorption of the contaminants (including those with poor warning properties) after partial use of the chemical cartridge can occur after a short period (hours) without use (eg, overnight) and result in a non-use exposure.

The following is a partial list of factors that may affect the usable cartridge service life and/or the degree of respiratory protection attainable under actual workplace conditions. These factors have been considered when developing the cartridge change-out schedule.

- Type of contaminant(s);
- Contaminant concentration;
- Relative humidity;

- Breathing rate;
- Temperature;
- Changes in contaminant concentration, humidity, breathing rate and temperature;
- Mixtures of contaminants;
- Accuracy in the determination of the conditions;
- The contaminant concentration in the workplace can vary greatly. Consideration must be given to the quality of the estimate of the workplace concentration;
- Storage conditions between multiple uses of the same respirator cartridges. It is recommended that the chemical cartridges be replaced after each work shift. Contaminants adsorbed on a cartridge can migrate through the carbon bed without airflow;
- Age of the cartridge;
- Condition of the cartridge and respirator;
- Respirator and cartridge selection respirator fit;
- Respirator assembly, operation, and maintenance;
- User training, experience and medical fitness;
- Warning properties of the contaminant; and
- The quality of the warning properties should be considered when establishing the chemical cartridge change schedule. Good warning properties may provide a secondary or back-up indication for cartridge change-out.

7.0 AIR MONITORING

The following sections contain information describing the types, frequency and location of real-time, and other monitoring.

7.1 Real-Time Monitoring

This section addresses the real-time monitoring that will be conducted including instrumentation, frequency and location.

7.1.1 Work Area

The following instruments will be used for work area monitoring:

- Photoionization Detector (PID)
- Dust Monitor

Table 7-1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real-time monitoring for the site. Table 7-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas.

7.1.2 Community Air Monitoring Requirements

To establish ambient air background concentrations, air will be monitored at several locations around the site perimeter before construction activities begin. These points will be monitored periodically in series during the site work. Fugitive respirable dust will be monitored using a MiniRam Model PDM-3 aerosol monitor. Air will be monitored for VOCs with a portable Photovac MicroTip photoionization detector (PID), or equivalent. Table 7-1 presents a breakdown of each main activity and provides the instrumentation, frequency and location of the real-time monitoring for the site. Table 7-2 lists the Real-Time Air Monitoring Action Levels to be used in all work areas.

All air monitoring data is documented in a site log book by the designated site safety officer (Appendix H). PWGC's site safety officer or delegate must ensure that air monitoring instruments are calibrated and maintained in accordance with manufacturer's specifications. All instruments will be zeroed daily and checked for accuracy. A daily log will be kept. Monitoring will conform to the NYSDOH guidance included in Appendix F.

If additional monitoring is required, the protocols will be developed and appended to this plan.

7.2 Data Quality Assurance

7.2.1 Calibration

Instrument calibration shall be documented on instrument calibration and maintenance sheets or in the designated field logbook. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

7.2.2 Operations

All instruments shall be operated in accordance with the manufacturer's specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on-site by the FOL/HSO for reference.

Table 7-1
Frequency and Location of Air Monitoring

ACTIVITY	AIR MONITORING INSTRUMENT	FREQUENCY AND LOCATION
Drilling and Test Pit Operations NOTE: Drilling activities include hydropunch, well drilling, and split-spoon sampling.	PID Dust Monitor	Continuous in BZ during intrusive activities or if odors become apparent, screening in the BZ every 30 minutes during non-intrusive activities

Table 7-2

Real-Time Air Monitoring Action Levels

AIR MONITORING INSTRUMENT	MONITORING LOCATION	ACTION LEVEL	SITE ACTION	REASON
PID	Breathing Zone	0-25 ppm, non-transient	None	Exposure below established exposure limits
PID	Breathing Zone	25-100 ppm, non-transient	Don APR	Based on potential exposure to trichloroethylene
PID	Breathing Zone	>100 ppm, non-transient	Don ASR or SCBA, Institute vapor suppression measures, Notify HSM	Increased exposure to site contaminants, potential for vapor release to public areas
PID	Work Area Perimeter	< 5 ppm	None	Exposure below established exposure limits.
PID	Work Area Perimeter	> 5 ppm	Stop work and implement vapor release contingency plan until readings return to acceptable levels, Notify HSM	Increased exposure to site contaminants, potential for vapor release to public areas
Mini Ram	Work Area Perimeter	< 150 $\mu g/m^3$	None	Exposure below established exposure limits.
Mini Ram	Work Area Perimeter	>150 $\mu g/m^3$	Don ASR or SCBA, Institute vapor suppression measures, Notify HSM	Stop work and implement dust suppression techniques until readings return to acceptable levels, Notify HSM

7.2.3 Data Review

The FOL/HSO will interpret all monitoring data based on Table 7-2 and his/her professional judgment. The FOL/HSO shall review the data with the HSM to evaluate the potential for worker exposure, upgrades/downgrades in level of protection, comparison to direct reading instrumentation and changes in the integrated monitoring strategy.

Monitoring and sampling data, along with all sample documentation will be periodically reviewed by the HSM.

7.3 Other Monitoring

Temperature extreme monitoring will be performed by PWGC in accordance with procedures established in Foster Wheeler Environmental's program document EHS 4-6 which is contained in Appendix C.

8.0 ZONES, PROTECTION AND COMMUNICATION

8.1 Site Control

Site zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It shall include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones shall be established on the work site when operations begin. All maps will be posted at the site and used during initial site-specific training.

This project is a hazardous waste remediation project, and any person working in an area where the potential for exposure to site contaminants exists, will only be allowed access after providing the FOL/HSO with proper training and medical documentation.

The zones are based upon current knowledge of proposed site activities. It is possible that the zone configurations may be altered due to work plan revisions. Should this occur, the work zone will be adjusted accordingly, and documented through use of a field-change request form.

The following shall be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone - The SZ is an uncontaminated area (trailers, offices, etc.) that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone.

Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

Contamination Reduction Zone - The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides for an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for EZ entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone - All activities, which may involve exposure to site contaminants, hazardous materials and/or conditions, should be considered an EZ. This zone will be clearly delineated by cones, tapes or other means. The FOL/HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the site HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

8.2 Contamination Control

Decontamination areas will be established for the following activities.

8.2.1 Personnel Decontamination Station

All personnel and portable equipment used in the EZ shall be subject to a thorough decontamination process, as deemed necessary by the FOL/HSO. Sampling equipment shall be decontaminated. As necessary, all boots and gloves will be decontaminated using soap and water solution and scrub brushes or simple removal and disposal. All used respiratory protective equipment will be decontaminated daily and sanitized with appropriate sanitizer solution.

All drums generated as a result of sampling and decontamination activities will be marked and stored at a designated area at the site until the materials can be property disposed of off-site.

All non-expendable sampling equipment will be decontaminated. This usually entails the use of Alconox, solvent and distilled/deionized water rinses to eliminate contaminants.

8.3 Communication

- Each PWGC field team member will have a Nextel cell phone/radio for communication with the PWGC PM, HSO and other team members during field activities.

- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breathe
Grip on a partner's wrist or placement of both hands around a partner's waist.	Leave the area immediately, no debate.
Hands on top of head	Need assistance
Thumbs up	Okay, I'm all right, I understand.
Thumbs down	No, negative.

9.0 MEDICAL SURVEILLANCE PROCEDURES

All contractor and subcontractor personnel performing field work where potential exposure to contaminants exists at the site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f).

9.1 Medical Surveillance Requirements

A physician's medical release for work will be confirmed by the HSM before an employee can work in the exclusion zone. The examination will be taken annually at a minimum and upon termination of hazardous waste site work if the last examination was not taken within the previous six months. Additional medical testing may be required by the HSM in consultation with the Corporate Medical Consultant and the FOL/HSO if an over-exposure or accident occurs, if an employee exhibits symptoms of exposure, or if other site conditions warrant further medical surveillance.

9.2 Medical Data Sheet

A medical data sheet is provided in Appendix D. This medical data sheet is voluntary and should be completed by all on-site personnel and will be maintained at the site. Where possible, this medical data sheet will accompany the personnel needing medical assistance. The medical data sheet will be maintained in a secure location, treated as confidential, and used only on a need-to-know basis.

10.0 SAFETY CONSIDERATIONS

10.1 General Health and Safety Work Practices

A list of general health and safety work practices is included as an included in Appendix E. The work rules will be posted in a conspicuous location at the site.

10.2 The Buddy System

At a minimum, employees shall work in groups of two in such a manner that they can observe each other and maintain line-of-sight for each employee within the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

10.3 Sample Handling

Personnel responsible for the handling of samples should wear the prescribed level of protection. Samples should be identified as to their hazard and packaged as to prevent spillage or breakage. Sample containers shall be decontaminated in the CRZ or EZ before entering a clean Support Zone area. Any unusual sample conditions, odors, or real-time readings should be noted. Laboratory personnel should be advised of sample hazard level and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling, in order to assure that the practices are appropriate for the suspected contaminants in the sample.

10.4 Drill Rigs

When conducting drilling activities, the opportunity of encountering fire and explosion hazards exists from underground utilities and gases. The locations of underground utilities will be verified prior to performing any intrusive activities. Additionally, because of the inherently hazardous nature of drilling operations, safety and accident prevention are crucial when drilling operations are performed. Most drilling accidents occur as a direct result of lack of training and supervision, improper handling of equipment, and unsafe work practices. Hazards include: assembling and disassembling rigs, rotary and auger drilling, and grouting. The drilling safety guidelines are contained in Foster Wheeler Environmental's Drill Rig Safety Program document EHS 6-2 (see Appendix C).

10.5 Excavation and Trenching

Excavation will be conducted in accordance with Foster Wheeler Environmental's, Health and Safety Program for Excavation and Trenching, document EHS 6-3; this program can be found in Appendix C. Excavation and trenching will be performed in accordance with the requirements contained in 29 CFR 1926, Subpart P-Excavations. It provides for the designation of a "Competent Person" and general requirements for safe excavating practices. The program also incorporates company standards for the monitoring of potentially hazardous atmospheres; protection from water hazards; analyzing and maintaining the stability of adjacent structures; daily competent person inspections; soil classification; sloping and benching; protective systems; and training.

The Competent Person will be the Field Operations Lead or other designee with appropriate training and experience. The Competent Person will be assisted in his/her duties by other technical personnel such as the HSM, geologists, structural engineers and soils engineers.

Excavations and trenches 4 feet or greater in depth will require atmospheric monitoring and ladders for safe entry/egress. The Competent Person will determine the need for cave-in protection. If trenches exceed 5 feet in depth and personnel will enter, cave-in protection will be implemented in accordance with 29 CFR 1926, Subpart P.

11.0 DISPOSAL PROCEDURES

All discarded materials, waste materials or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard or causing litter to be left on site.

All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials will be collected and bagged for appropriate disposal as non-hazardous solid waste. Additional waste disposal procedures may be developed as applicable.

12.0 EMERGENCY RESPONSE PLAN

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures which are addressed in the following subsections include communications, local emergency support units, preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures.

12.1 Responsibilities

12.1.1 Health and Safety Manager (HSM)

The HSM oversees and approves the Emergency Response/Contingency Plan and performs audits to determine that the plan is in effect and that all pre-emergency requirements are met. The HSM acts as a liaison to applicable regulatory agencies and notifies OSHA of reportable accidents.

12.1.2 Field Operations Lead/Health and Safety Officer (FOL/HSO)

The FOL/HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The FOL/HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can ensure that OSHA is notified within the required time frame. The HSM will be notified of all OSHA recordable injuries, fires, spills, releases or equipment damage in excess of $500 within 24 hours.

12.1.3 Emergency Coordinator

The Emergency Coordinator for the project is the FOL/HSO.

The Emergency Coordinator shall make contact with Local Emergency Response personnel prior to beginning work on site. In these contacts the emergency coordinator will inform interested parties about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. The emergency coordinator will locate emergency phone numbers and identify hospital routes prior to beginning work on site. The emergency coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator will implement the Emergency Response/Contingency Plan whenever conditions at the site warrant such action.

12.1.4 Site Personnel

Site personnel are responsible for knowing the Emergency Response/Contingency Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency.

12.2 Communication

A variety of communication systems may be utilized during emergency situations. These are discussed in the following sections.

12.2.1 Hand Signals

Downrange field teams will employ hand signals where necessary for communication during emergency situations. Hand signals are found in Section 8.3.

12.2.2 Field Radios and Cell Phones

PWGC field personnel are provided Nextel cellular phones with telephone and two-way radio capabilities for site communication and emergency use.

12.3 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during remedial activities at the site, Table 12-1 will be posted prominently in the field office and in all places where telephone service is available.

A route map from the site to the nearest hospital can be found in Appendix G. This map will be posted adjacent to the above emergency telephone numbers in the field office and in all places where telephone service is available. It should also be placed in all on-site vehicles.

12.4 Pre-Emergency Planning

PWGC will communicate directly with administrative personnel from the emergency room at the hospital to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from exposure to any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

Before the field activities begin, the local emergency response personnel will be notified of the schedule for field activities and about the materials that are thought to exist on the site so that they will be able to respond quickly and effectively in the event of a fire, explosion, or other emergency. Before fieldwork on the site commences, each person who will be working there or observing the operations will complete a medical data sheet. These data sheets will be filled out during site-specific training and will be kept on the site.

In the event of an incident where a team member becomes exposed or suffers from an acute symptom of exposure to site materials and has to be taken to a hospital, a copy of his/her medical data sheet will be presented to the attending physician

Table 12-1

Emergency Telephone Numbers

Contact	Firm or Agency	Telephone Number
Police		911
Fire		911
Hospital	St. Catherine's of Siena Hospital	631-862-3000
Ambulance		911
Project Manager	Charles B. Sosik	631-589-6353
HSM	Keith W. Butler	631-589-6353
EPA Site Contact	Mark Dannenberg	212-637-4251
Poison Control Center		(800) 962-1253
Chemtrec		(800) 424-9300

12.5 Emergency Medical Treatment

The procedures and rules in this HASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the FOL/HSO immediately. First aid equipment will be available on site at the following locations:

First Aid Kit:	Support Zone (or designated by FOL/HSO upon arrival)
Emergency Eye Wash:	Support Zone (or designated by FOL/HSO upon arrival)

During site-specific training, project personnel will be informed of the location of the first aid station(s) that has been set up. Unless they are in immediate danger, severely injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

There will be at least two people with current First Aid and CPR certification on each active work shift. When personnel are transported to the hospital, the FOL/HSO will provide a copy of the Medical Data Sheet to the paramedics and treating physician.

Only in non-emergency situations will an injured person be transported to the hospital by means other than an ambulance. A map and directions to the hospital can be found in Appendix G.

12.6 Emergency Site Evacuation Routes and Procedures

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority will be established. The EC will take charge of all emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The EC will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive. At his/her discretion, the EC also may order the closure of the site for an indefinite period.

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, an air horn will be sounded on the site. The horn will sound continuously for one blast, signaling that immediate evacuation of all personnel is necessary due to an immediate or impending danger. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the evacuation meeting point, which will be determined upon arrival at the site by the FOL/HSO, prior to work beginning. This will then be conveyed to all crew members during the site-specific briefing.

The EC will give directions for implementing whatever actions are necessary. Any project team member may be assigned to be in charge of emergency communications during an emergency. He/she will attend the site telephone specified by the EC from the time the alarm sounds until the emergency has ended.

After sounding the alarm and initiating emergency response procedures, the EC will check and verify that access roads are not obstructed. If traffic control is necessary, as in the event of a fire or explosion, a project team member, who has been trained in these procedures and designated at the site safety meeting, will take over these duties until local police and fire fighters arrive.

The EC will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation. A map showing evacuation routes, meeting places, and location of emergency equipment will be posted in all trailers and used during site-specific training.

12.7 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site (air horn will sound for a single continuous blast), and notification of local fire and police departments. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

12.7.1 Fire Prevention

Adhering to the following precautions will prevent fires:

- Good housekeeping and storage of materials;
- Storage of flammable liquids and gases away from oxidizers;
- No smoking in the exclusion zone or any work area;
- No hot work without a properly executed hot work permit;
- Shutting off engines to refuel;
- Grounding and bonding metal containers during transfer of flammable liquids;
- Use of UL approved flammable storage cans;
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities; and
- Monthly inspections of all fire extinguishers.

12.8 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet or recommended by the Corporate Medical Consultant will be followed, when necessary.

SKIN AND EYE CONTACT: Use copious amounts of soap and water. Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. Skin should also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs.

INHALATION: Move to fresh air. Decontaminate and transport to hospital or local medical provider.

INGESTION: Decontaminate and transport to emergency medical facility.

PUNCTURE WOUND OR LACERATION: Decontaminate and transport to emergency medical facility.

12.9 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medica treatment is required, normal decontamination procedures may need to be abbreviated or postponed. The FOL/HSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on-site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

12.10 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

- PWGC Health and Safety Manager, Keith W. Butler;
- Project Manager, Charles B. Sosik; and
- The employer of any injured worker who is <u>not</u> a PWGC employee.

Written confirmation of verbal reports are to be completed by the FOL/HSO using the Incident Report Form and submitted within 24 hours. The incident report and investigation form is found in Appendix D. If the employee involved is not a employee, his employer will receive a copy of the report.

12.11 Adverse Weather Conditions

In the event of adverse weather conditions, the FOL/HSO will determine if work can continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds);
- Limited visibility (fog);
- Potential for electrical storms;
- Earthquakes; and
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The FOL/HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

12.12 Spill Control and Response

All small hazardous spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. Drains or drainage areas should be blocked. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill. The following seven steps should be taken by the Emergency Coordinator:

- Determine the nature, identity and amounts of major spill components;
- Make sure all unnecessary persons are removed from the spill area;
- Notify appropriate response teams and authorities;
- Use proper PPE in consultation with the FOL/HSO;
- If a flammable liquid, gas or vapor is involved, remove all ignition sources and use nonsparking and/or explosive proof equipment to contain or clean up the spill (diesel only vehicles, air operated pumps, etc.);
- If possible, try to stop the leak with appropriate material; and,
- Remove all surrounding materials that can react or compound with the spill.

12.13 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on-site:

- Industrial first aid kit;
- Burn kit portable eye washes (one per field team);
- 15-minute continuous flow eyewash;
- Fire extinguishers (one per work area); and
- Absorbent material /spill kit.

12.14 Postings

The following information will be posted at various, conspicuous locations throughout the site and notices are contained in Appendix E:

- Emergency telephone numbers;
- Evacuation Routes;
- OSHA Poster; and
- Work Practices.

12.15 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers;
- Refilling medical supplies;
- Recharging eye washes and/or showers; and
- Replenishing spill control supplies.

13.0 TRAINING

13.1 General Health and Safety Training

In accordance with PWGC corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations unless otherwise noted in the above reference. At a minimum, the training shall have consisted of instruction in the topics outlined in the standard.

Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

13.1.1 Three Day Supervised On the Job Training

In addition to the required initial hazardous waste operations training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

13.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 1910.120 requirements and related company programs and procedures.

13.3 Site-Specific Training

Prior to commencement of field activities, all field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the site operations. It will include site and facility layout, hazards and emergency services at the site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

13.4 On-Site Safety Briefings

Project personnel and visitors will be given on-site health and safety briefings daily by the FOL/HSO to assist site personnel in safely conducting their work activities. A copy of the Daily Briefing Sign-In Sheet is contained in Appendix D. The briefings will include information on new operations to be conducted, changes in work practices or changes in the site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. The meetings will also be an opportunity to periodically update the crews on monitoring results. Prior to starting any new activity, a training session using the Activity Hazard Analysis will be held for crew members involved in the activity.

13.5 First Aid and CPR

The HSM will identify those individuals requiring first aid and CPR training to ensure that emergency medical treatment is available during field activities. It is anticipated that a minimum of one field person on-site at any one time will have first aid and CPR training. The training will be consistent with the requirements of the American Red Cross Association or American Heart Association. If none are available on-site, then the HSM shall be notified.

13.6 Hazard Communication

Hazard communication training will be provided in accordance with PWGC's corporate policy.

13.7 Supervisory Training

Supervisors and health and safety personnel shall have completed an additional eight hours of specialized training in accordance with 29 CFR 1910.120.

14.0 LOGS, REPORTS AND RECORDKEEPING

Changes to the HASP will be documented in the Health and Safety log book and as appropriate, the HSM and/or PM will be notified. Daily tailgate meetings will be documented in the H&S log book as well as personnel on-site.

14.1 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training and documentation of three day OJT) and medical clearance for hazardous waste site work and respirator use will be maintained on-site. Records for all subcontractor employees will also be kept on-site.

14.2 Incident Report and Investigation Form

The incident report and investigation form is to be completed for all accidents and incidents, including near misses. The form can be found in Appendix D.

14.3 Health and Safety Logbooks

The FOL/HSO will maintain a logbook during site work. The daily site conditions, personnel, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

14.4 Hazard Communication Program/MSDS

Material Safety Data Sheets (MSDS) will be obtained for applicable substances and included in the site hazard communication file. The hazard communication program will be maintained on-site in accordance with 29 CFR 1910.1200.

15.0 FIELD PERSONNEL REVIEW

This form serves as documentation that field personnel have read, or have been informed of, and understand the provisions of the HASP. It is maintained on site by the FOL/HSO as a project record. Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read, or have been informed of, the Health and Safety Plan and understand the information presented. I will comply with the provisions contained therein.

Name (Print and Sign)	Date
Bryan A. Devaney	11/8/01
Rick Voxey	11-8-01
Bill Lefferts	11/8/01
Robert Gimpel	11/14/01
Tom Kirk	11-14-01
John Onofrio	11-28-01
John Pratt	11-28-01
John Potenza	11-28-01
Zeb Youdsman	12/18/01
Joseph Savellis	12/18/01
Luke Caballero	12/18/01
Doreen Fitzsimmons	1/7/02
Karl Keller	1/8/02
Matt Lyons	1/10/02

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project:
Name: ______________________________ Home Telephone: __________
Address: ____
Age: _______ Height: _______ Weight: _______ Blood Type: __________

Name and Telephone Number of Emergency Contact: ______________________

Drug or Other Allergies: ______________________________________

Particular Sensitivities: ______________________________________

Do You Wear Contacts? ______________________________________

Provide A Check List Of Previous Illnesses: ______________________

What Medications Are You Presently Using?______________________

Do You Have Any Medical Restrictions? ______________________

Name, Address, And Phone Number Of Personal Physician:

ATTACHMENT 1 (Page 1 of 2)

GENERAL HEALTH AND SAFETY WORK PRACTICES

1. All site personnel must attend each day's Daily Briefing and sign the attendance sheet.

2. Any individual taking prescribed drugs shall inform the FOL/HSO of the type of medication. The FOL/HSO will review the matter with the HSM and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the FOL/HSO and/or associated procedures shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. Personnel must follow proper decontamination procedures and shower as soon as possible upon completion of work shift.

6. Eating, drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the HSM to allow fluid intake during heat stress conditions).

7. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

8. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the FOL/HSO.

9. No one shall enter a permit-required confined space without a permit and appropriate training. Confined space entry permits shall be implemented as issued.

10. All personnel must follow Hot Work Permits as issued.

11. All personnel must use the Buddy System in the Exclusion Zone.

ATTACHMENT 1 (Page 2 of 2)

GENERAL HEALTH AND SAFETY WORK PRACTICES

12. All personnel must follow the work-rest regimens and other practices required by the heat stress program.
13. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.
14. No person shall operate equipment unless trained and authorized.
15. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.
16. Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.
17. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.
18. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.
19. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.
20. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out walkways and puddles unless protected and rated for the service.
21. Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.
22. Horseplay of any kind is prohibited.
23. Possession or use of alcoholic beverages, controlled substances, or firearms on any site is forbidden.
24. All incidents, no matter how minor, must be reported immediately to the Supervisor.
25. All personnel shall be familiar with the Site Emergency Response Plan, which is contained in Section 12 of the HASP.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the client, PWGC Supervisors, and the FOL/HSO.

APPENDIX A

CHEMICAL DATA SHEETS

Date: 10/91
Update: 3/97
#11

CHEMICAL DATA SHEET

I. Chemical/CompoundName: Tetrachloroethylene(Tetrachloroethene)
  A. Synonyms: Perchloroethylene, Perk, tetrachlorethylene
  B. CAS #127-18-4
  C. Formula: $Cl_{2}C=CCl_{2}$ Mol. weight: 165.85

II. Physical Characteristics
  A. _X_ Liquid ___ Solid ___ Powder ___ Gas
  B. Color: Colorless
  C. Odor: Ether, Chloroform-like
  D. LEL - Not Combustible Flash Pt. N/A
  E. Boiling Point 250°F Melting Point -2°F
  Ionization Potential - 9.32 eV Vapor Pressure: 14 mm
  F. Other: Detection Level - 5 ppm

III. Recommended Air Purifying Cartridge:
  ___Dusts, Fumes, Mists
  _X_Organic Vapors
  ___HEPA
  ___Ammonia/Amines
  ___Acid Gases
  ___Pesticides
  ___Air Purifying is Inappropriate
  ___Other:

IV. Health Hazards Data
  A. Routes of Entry: _X_ Inhalation _X_ Skin Absorption _X_ Ingestion _X_ Skin/Eye Contact
  B. Human Carcinogen: __ No __ Suspect _X_ Yes
  Classifying Agency: _X_ NIOSH __ACGIH __OSHA
  C. Sensitizer: __ No _X_ No Data __ Suspect __ Yes
  D. Acute Toxicity:
    Eye Contact: Irritant. May cause lacrimation and burning.
    Skin Contact: Mild skin irritation. If exposures are confined or prolonged, may cause dermatitis.
    Inhalation: Nose, throat, upper respiratory irritant. May produce headaches, nausea and vomiting, giddiness, inebriation, sinus inflammation salivation, a metallic taste and narcosis. Massive exposure may cause death by respiratory arrest.
  E. Chronic Toxicity:
    Target Organs: Liver, kidneys, eyes, upper resp. tract, CNS
    Long-Term Effects: Liver and kidney damage. Possibly lung and cervical cancer.

V. Exposure Limits
  A. OSHA PEL: 100 ppm TWA, 200 ppm Ceil, 300 ppm/5 min. 3 hr. peak
  B. ACGIH TLV: 25 ppm TWA
  C. IDLH: 150 ppm
  D. NIOSH REL: lowest feasible limit
  E. STEL: 100 ppm

VI. Other Pertinent Information/Special Precautions:

VII. Reference Section

ACGIH TLVs and BEIs 1996
Code of Federal Regulations 1996
NIOSH Pocket Guide to Chemical Hazards 1994

Update: 3/97
#80

CHEMICAL DATA SHEET

I. Chemical/CompoundName: 1,1,1-Trichloroethane
  A. Synonyms: Methyl chloroform, alpha-trichloroethane, methyl-trichloroethane, chlorothene
  B. CAS #71-55-6

II. Physical Characteristics
  A. _X_ Liquid ___ Solid ___ Powder ___ Gas
  B. Color: Colorless
  C. Odor: Chloroform-like
  D. LEL 7 % Flash Pt. None °F
  E. Boiling Point 165°F Melting Point -23°F
  Ionization Potential 11.0 eV Vapor Pressure: 100mm
  F. Other: Water soluble

III. Recommended Air Purifying Cartridge:
  ___Dusts, Fumes, Mists ___Acid Gases
  _X_Organic Vapors ___Pesticides
  ___HEPA ___Air Purifying is Inappropriate
  ___Ammonia/Amines ___Other:

IV. Health Hazards Data
  A. Routes of Entry: _X_ Inhalation ___Skin Absorption _X_ Ingestion ___ Skin/Eye Contact
  B. Human Carcinogen: _X_ No __ Suspect __ Yes
  Classifying Agency: ___NIOSH ___ACGIH ___OSHA
  C. Sensitizer: __ No __ No Data _X_ Suspect __ Yes
  D. Acute Toxicity:
    Eye Contact: Irritation (at 450 ppm)
    Skin Contact: May cause dermatitis due to de-fatting properties
    Inhalation: High concentrations (>900 ppm) must be encountered before symptoms are exhibited: light-headedness; loss of coordination; stupor; coma and death (20,000 ppm).
  E. Chronic Toxicity:
    Target Organs: Skin, CNS, cardiovascular system, CVS, liver
    Long-Term Effects: Dizziness, mental confusion, slowed response time, possible liver and kidney damage (generally reversible)

V. Exposure Limits
  A. OSHA PEL: 350 ppm, TWA
  B. ACGIH TLV: 350 ppm, TWA
  C. IDLH: 700 ppm
  D. NIOSH REL: 350 ppm, 15-min. ceiling
  E. STEL: 450 ppm

VI. Other Pertinent Information/Special Precautions: A sensitization to epinephrine has been cause of death, following confined-space exposures.

VII. Reference Section

  ACGIH TLVs and BEIs 1996
  Code of Federal Regulations 1995
  NIOSH Pocket Guide to Chemical Hazards 1994

ATTACHMENT B

FWENC TECHNICAL GUIDELINES

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - January 2001
Phase of Work Mobilization/ Demobilization	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Mobilization and demobilization of equipment site tools, personnel	Slips/trips/falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.
2. Set up/remove staging and decontamination areas	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes Program (Appendix C).
	Hand tool usage	• Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; and • Use in accordance with manufacturer instructions.
	Vehicular traffic	• Spotters will be used when backing up trucks and heavy equipment and when moving equipment.
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; • All ground personnel will stay clear of suspended loads; • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and • All overhead hazards will be identified prior to commencing work operations.
	Noise	• Ear plugs or ear muffs shall be worn for operations that exceed 85 decibels.
	Electrocution	• Equipment will be equipped with GFCI; • A licensed electrician will conduct all electrical work; • All equipment will stay a minimum of 15 feet from overhead-energized electrical lines (50 kV). This distance will increase .4 inches for each 1 kV above 50 kV.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - January 2001
Phase of Work Subsurface soil or groundwater sampling (Geoprobe, Drilling or Test Pit Operations)	**Page 1 of 2**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Collect subsurface soil samples using a drill rig or Geoprobe	Chemical hazards	• Wear appropriate PPE per Table 6-1; • Perform air monitoring per Tables 7-1 and 7-2; • Practice contamination avoidance; • Follow proper decontamination procedures; and • Wash hands/face before eating, drinking or smoking.
2. Install hydropunch and groundwater monitoring wells. 3. Conduct downhole geophysics.	Hand and power tool usage	• Equip all electrical equipment with GFCI's; • Inspect all electrical equipment and tools prior to use; • Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; • Use in accordance with manufacturer instructions; and • Tag and remove defective equipment.
4. Dig test pits. 5. Steam clean/ decontaminate equipment.	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes Program (Appendix C).
	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Drill rigs	• Follow FWENC Drill Rig Safety Program (Appendix C).
	Fire/Explosion	• ABC type fire extinguishers shall be readily available; • No smoking in work area.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.
	Heavy equipment	• Ground personnel will stay clear of all suspended loads; • Ground personnel will stay out of the swing radius; • Eye contact with operators will be made before approaching equipment; • Equipment will not be approached on blind sides; • All equipment will be equipped with backup alarms or spotters shall be used.
	Slips/Trips/Falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - March 2001
Phase of Work Subsurface soil or groundwater sampling (Geoprobe, Drilling or and Test Pit Operations)	**Page 2 of 2**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Steam/Heat/Splashing	• Use face shield and safety glasses or goggles; • Stay out of the splash/steam radius; • Do not direct steam at anyone; • Do not hold objects with your foot and steam area near it; • Ensure that the direction of spray minimizes spread of constituents of concern; and • Use shielding as necessary.
	Excavation hazards	• Follow Excavation and Trenching Program, Appendix C.
	Overhead hazards	• Personnel will be required to wear hard hats that meet ANSI Standard Z89.1; • All ground personnel will stay clear of suspended loads; • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects; and • All overhead hazards will be identified prior to commencing work operations.

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - March 2001
Phase of Work Hydrogeological Sampling	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Collect groundwater samples. 2. Collect sediment samples.	Chemical hazards	• Wear appropriate PPE per Table 6-1; • Perform air monitoring per Tables 7-1 and 7-2; • Practice contamination avoidance; • Follow proper decontamination procedures; and • Wash hands/face before eating, drinking or smoking.
3. Conduct aquifer test. 4. Measure surface water and groundwater elevations.	Hand and power tool usage	• Equip all electrical equipment with GFCI's; • Inspect all electrical equipment and tools prior to use; • Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; • Use in accordance with manufacturer instructions; and • Tag and remove defective equipment.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes Program (Appendix C).
	Manual lifting and material handling	• Site personnel will be instructed on proper lifting techniques; mechanical devices should be used to reduce manual handling of materials; team lifting should be utilized if mechanical devices are not available.
	Splashing	• Wear safety glasses; and • Wear safety goggles for operations where splash potential is high.
	Slips/Trips/Falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.
	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Fire/Explosion	• ABC type fire extinguishers shall be readily available; • No smoking in work area.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - March 2001
Phase of Work Site Survey & Reconnaissance; Geophysical Survey	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Conduct various site reconnaissance activities.	Slips/trips/falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; and • Wear footwear with soles that grip.
	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes Program (Appendix C).
	Hand tool usage	• Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; and • Use in accordance with manufacturer instructions.
	Vehicular traffic	• Spotters will be used when backing up trucks and heavy equipment and when moving equipment.
	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Electrocution	• Equipment will be equipped with GFCI; • A licensed electrician will conduct all electrical work; • All equipment will stay a minimum of 15 feet from overhead-energized electrical lines (50 kV). This distance will increase .4 inches for each 1 kV above 50 kV.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

Project Identification Former Computer Circuits Facility	Location Hauppauge, NY	Estimated Dates December 2000 - March 2001
Phase of Work	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Decontamination	Chemical	• Wear appropriate PPE per Table 6-1; • Perform air monitoring per Tables 7-1 and 7-2; • Practice contamination avoidance; • Follow proper decontamination procedures; and • Wash hands/face before eating, drinking or smoking.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes program (Appendix C).
	Vehicular Traffic	• Spotters will be used when backing up trucks and heavy equipment and when moving equipment.
	Noise	• Hearing protection mandatory at or above 85 dBA. • Instruct personnel how to properly wear heating protective devices. • Disposable ear plugs or other hearing protection required when working near noisy equipment.
	Splashing	• Wear safety glasses; and • Wear safety goggles for operations where splash potential is high.
	Manual lifting/ material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Heavy Equipment	• Ground personnel will stay clear of all suspended loads; • Ground personnel will stay out of the swing radius; • Eye contact with operators will be made before approaching equipment; • Equipment will not be approached on blind sides; • All equipment will be equipped with backup alarms or spotters shall be used.
	Biological hazards	· Be alert to the presence of biological hazards; · Wear insect repellent; · Follow procedures in Section 4.2.2 for tick bites; · FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.
	Slips/Trips/Falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.

Project Identification Former Computer Circuits Facility	**Location** Hauppauge, NY	**Estimated Dates** December 2000 - January 2001
Phase of Work Ecological Characterization	**Page 1 of 1**	**Analysis Approved by** Charles B. Sosik, PM
TASKS	**HAZARDS**	**CONTROL MEASURES**
1. Habitat delineation. 2. Wildlife observation and survey.	Slips/trips/falls	• Maintain alertness to slip/trip/fall hazards; • Maintain good housekeeping; • Walk, do not run; • Wear footwear with soles that grip; • Unloading areas should be on even terrain; and • Mark and repair if possible tripping hazards.
3. Identify endangered species.	Manual lifting and material handling	• Instruct personnel on proper lifting techniques; • Use proper lifting techniques; and • Team lifting will be used for heavy loads or use mechanical lifting devices.
	Temperature extremes	• Drink plenty of fluids: • Train personnel of signs/symptoms of heat/cold stress; • Monitor air temperatures when extreme weather conditions are present; • Stay in visual and verbal contact with your buddy; and • Use Temperature Extremes Program (Appendix C).
	Hand tool usage	• Daily inspections will be performed; • Remove broken or damaged tools from service; • Use the tool for its intended purpose; and • Use in accordance with manufacturer instructions.
	Biological hazards	• Be alert to the presence of biological hazards; • Wear insect repellent; • Follow procedures in Section 4.2.2 for tick bites; • FOL/HSO should be aware of on-site personnel with allergic reactions in insect bites and stings.

ATTACHMENT C

USEPA ERT AND REGION II STANDARD OPERATING PROCEDURES

1.0 PURPOSE

The purpose of this program is to prevent heat and cold stress related injuries and illnesses at field operations.

2.0 SCOPE

This program applies to all P.W. Grosser Consulting (PWGC) and subcontractor field personnel that may be exposed to heat or cold stress during the performance of their field work assignments.

3.0 MAINTENANCE

The Director, Environmental Safety and Quality (ESQ) Programs is responsible for updating this procedure. Approval rests with P.W. Grosser's President. Suggestions for revision shall be submitted to both the department responsible for updating the procedure and the Director, Administration and Compliance.

4.0 DEFINITIONS

4.1 Adjusted Temperature

The dry bulb temperature adjusted to account for solar radiation, to be used as a heat stress indicator for personnel in impermeable protective clothing.

4.2 Deep Frostbite

The tissue beneath the skin is solid to the touch; it may involve a full thickness freeze to the bone. This is an extreme emergency and can result in permanent tissue loss.

4.3 Frostbite

Freezing of body tissue.

4.4 Frostnip or Incipient Frostbite

A cold related injury that progresses slowly and is painless while developing. The victim is usually unaware that he/she has frost nip. The skin first becomes reddened, then changes to white; no freezing of tissue occurs.

4.5 Heat Cramp

Painful muscle spasms usually occurring on the arms, legs, and abdomen; caused by excessive loss of body electrolytes from profuse sweating.

4.6 Heat Exhaustion

A form of shock that occurs when the body loses large amounts of water and electrolytes from excessive perspiration after exposure to heat and physical activity; also called heat prostration.

4.7 Heat Rash

Profuse tiny raised red vesicles (blister-like) on affected areas of the skin which cause a prickling sensation during heat exposure.

4.8 Heat Stroke

A life-threatening condition caused by rapidly rising body core temperature that occurs when the body's temperature regulating mechanisms are overwhelmed. Sweating stops and the skin is dry and hot.

4.9 Hyperthermia

A rise in body core temperature above 99.6 C.

4.10 Hypothermia

Decreased body core temperature from prolonged exposure to freezing or near-freezing temperatures. This is the most life-threatening cold injury and affects the entire body with possible localized severe cooling.

4.11 Superficial Frostbite

Frostbite which affects the skin and tissue just beneath the skin. The skin is firm and waxy, tissue beneath is soft and numb. The skin turns purple and may tingle and burn during warming.

4.12 Wet-Bulb Globe Temperature (WBGT)

Method used to measure the environmental factors (e.g.,

4.13 Wind-Chill Factor or Equivalent Chill Temperature (ECT)

An index describing the effect of the cooling power of moving air on exposed flesh. The effect of wind velocity at a certain temperature is expressed as the equivalent cooling effect of a lower temperature with still air.

4.14 Work/Rest Regimen

The ratio of time spent working to time spent resting in an area designed to relieve heat related conditions. This ratio is expressed in one hour periods. Example: A work/rest regimen of 75% work, 25% rest corresponds to 45 minutes work, 15 minutes rest each hour.

5.0 DISCUSSION

5.1 Responsibilities

5.1.1 Field Personnel

All field personnel will be trained in heat and cold stress prevention and treatment. Field personnel will monitor themselves and their workmates for symptoms of heat and cold stress and will inform the Environmental and Safety Supervisor (ESS) or their supervisor immediately should symptoms become apparent.

5.1.2 Line Management

Site Supervisors have the responsibility to:

- Provide resources and facilities necessary to prevent health effects from temperature extremes
- Enforce work rules related to such prevention
- Ensure implementation of the requirements of this program as specified in the Site Environmental, Safety and Health (EHS) plans.

5.1.3 Environmental, Health and Safety Personnel

The Project Environmental and Safety Manager (PESM) will make the initial determination of heat and cold stress prevention requirements as part of the site EHS Plan (see EHS 3-2, EHS Plans) and oversee the implementation of temperature, relative humidity) which impacts the body's physiological responses to heat.

this program on a project basis for all FWENC field programs.

The ESS will assist with implementation of heat and cold stress prevention programs. The ESS will, in most cases, be the person responsible for monitoring heat and cold stress on the job, determining work/rest and work/warm-up schedules where used, and will implement emergency response or corrective action, if needed. The ESS will train site personnel on the effects of temperature extremes and the site prevention program, and will maintain records related to this program.

5.2 General Program Requirements

Adverse weather conditions must be considered when planning site operations. Excessively hot or cold working environments can produce a number of different injuries. Critical to the ability to care for those injuries is a basic understanding of the way in which the body maintains its temperature and how it physiologically adjusts to extremes of heat and cold. Attachment A provides information on the body's physiological responses to heat and cold stress.

Proper care of victims who are suffering from the effects of heat or cold exposure will help to minimize injuries and speed recovery. On the other hand, improper treatment of these emergencies can result in serious injury, disability, or death.

The most effective first aid for any injury is prevention. When acceptable monitoring and prevention programs are followed, there should be no victims.

5.3 Heat Stress

A heat stress prevention program will be implemented when ambient temperatures exceed 70°F for personnel wearing impermeable clothing and for other personnel when the WBGT index exceeds the ACGIH Threshold Limit Values.

5.3.1 Selection of Chemical Protective Clothing

The PESM will review site data and working conditions and select the personal protective equipment ensemble that best protects the employees from site hazards. The risk of heat related illness will be fully considered in balancing the risks and benefits of the PPE. Where contact with a waste material is unlikely; contact is not expected to result in a serious dermal hazard; and significant absorption of the contaminants is not likely to occur, then impermeable clothing should not be required. In this case, the risk of heat related illness may grossly outweigh the benefits provided by such equipment. Even when chemical protective clothing is needed, the PESM should consider the probable exposure scenarios and select protective equipment accordingly. For example, if dermal exposure is likely to be localized, strong consideration should be given to using gloves, boots, gauntlets, leggings, aprons, bibs, face shields, etc., in lieu of full body coveralls and respirators.

5.3.2 Hydration

ENC will supply cool (50°–59°F) potable water or other suitable drinks (e.g., sport electrolyte replacements) for fluid replacement. Employees involved in the heat stress prevention program will be trained and encouraged to drink at a rate of approximately 8 oz. every 20 minutes. Individual cups will be used and kept in closed containers or dispensers.

5.3.3 Cool Rest Areas

Shaded rest areas will be provided. On large remediation projects, air conditioned rest areas should be provided for workers exposed to heat stress conditions.

5.3.4 Other Prevention Program Elements

The PESM, ESS and the Project Manager will incorporate other elements into the heat stress prevention program as necessary. The selected elements will be described in the EHS plans. Engineering controls are preferred. Where their use is not feasible, the program must incorporate administrative/work practice controls, personal protective equipment, or a combination. Examples of other prevention program elements include:

- **Engineering Controls**

Engineering controls may include:

— Air conditioned cabs for heavy equipment and vehicles (Such controls may eliminate the need for other program elements);

— Fans or blowers; and

— Cold water for drenching personnel in impermeable clothing. This can be provided through a garden hose, a garden sprayer filled with ice water, a clean drum full of water for "hard hat dipping" or containers of ice water and clean towels in the rest area to hasten cool down.

- **Administrative and Work Practice Controls**

Administrative controls include:

— Adjusting work schedules to do the bulk of the work during the cooler parts of the day;

— Acclimatizing workers; and

— Implementing work/rest regimens (See Attachment B for Work/Rest Regimen Procedures).

- **Personal Protective Equipment**

Personal cooling devices which may be useful include:

— Ice vests;

— Circulating water vests; and

— Vortex tubes.

Where ice vests and circulating water vests are used, rest periods of approximately 15 minutes should be taken when ice packs or batteries need to be changed. Continuous work over long periods of time with these devices may present an increased musculoskeletal injury risk due to the extra weight. Since the duration of the cooling effectiveness of these devices will vary with heat and work loads, users must be instructed to leave the area to replenish ice or batteries at the first sign of loss of cooling.

- **Monitoring**

A program of environmental and physiological monitoring must be established in order to use work/rest regimens. The monitoring procedures are described in Attachment B.

5.3.5 Training

All site personnel must receive training on the following topics:

- Health effects of hot environments and symptoms of heat related illness;
- Personal risk factors;
- Effect of personal protective equipment on heat stress conditions;
- Preventive measures;
- Fluid replacement;
- Elements of the site Heat Stress Prevention Program; and
- First aid and emergency response.

Records shall be maintained in accordance with EHS 1-9, Recordkeeping.

5.4 Cold Stress

At certain times of the year, workers may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trenchfoot or immersion foot, and hypothermia as well as slippery surfaces, brittle equipment, poor judgement and taking short cuts. The current ACGIH threshold limit values (TLVs) for cold stress will be used as a guideline. ENC will implement the following cold stress prevention program elements when there is a potential for cold related injuries.

5.4.1 Personal Protective Equipment

The following personal protective equipment will be provided as necessary to ENC employees when conditions indicate a potential for cold-related injury. Subcontractors will be expected to supply appropriate equipment to their employees.

- Hard hat liners,
- Gloves or glove liners,
- Rain gear or water impermeable coveralls and gloves for potentially wet operations,
- Fleeced boot liners where rubber steel-toe boots are used, and
- Winter coveralls.

5.4.2 Engineering Controls

A variety of engineering controls shall be evaluated to minimize cold stress. These include:

- General or spot heating should be used to increase temperature at the workplace.
- If fine work is to be performed with bare hands in a cold environment, special provisions should be made to keep the worker's hands warm. Warm air jets, radiant heaters, or contact warm plates can be used.
- The work area should be shielded from winds and drafts that may affect the wind chill factor.
- The air velocity in refrigerated rooms should be minimized as much as possible, and should not exceed 1m/sec in the work zone.
- At temperatures below freezing, metal handles of tools and control bars should be covered with thermal insulating material.
- Unprotected metal chair sets should not be used as they conduct heat away from the body.
- When necessary, equipment and processes should be substituted, isolated, relocated, or redesigned to reduce cold stress at the worksite.
- Power tools, hoists, cranes, or lifting aids should be used to reduce metabolic workload.
- Heated warming shelters such as tents and cabins should be made available if work is performed continuously in an equivalent chill temperature of 20°F or below.
- The ESS may implement a work-rest schedule to reduce

exposure to cold stress.

- Scheduled rest breaks should be enforced.
- Personnel exposed to the cold should be provided the opportunity for frequent intake of warm, sweet, caffeine-free, nonalcoholic liquids or soup.
- Work should be moved to warmer areas whenever possible.
- Extra workers should be assigned to highly demanding tasks.
- Workers should be allowed to pace themselves, taking breaks when needed.
- Workers shall be trained in the prevention, symptoms, and emergency response to cold stress.
- Utilize the "buddy system" to monitor cold stress symptoms among the workers.
- Allow new employees time to adjust or "acclimate" to cold conditions.
- Minimize the need to sit or stand in one place for long periods of time.
- Minimize the amount of work time spent in a cold environment.
- Allow for the weight and bulkiness of protective clothing when estimating work performance goals and tasks.

5.4.3 Warm Rest Areas

ENC will make warm rest areas, e.g., heated trailers, available for rest breaks in cold weather. Employees will be permitted and encouraged to use the heated trailers whenever they experience symptoms of cold stress.

5.4.4 Work/Warm-up Schedule

The work/warm-up schedule found in the ACGIH TLVs for cold stress will be followed. In addition, ENC will make warm-up periods available to employees who need to change into dry clothing to prevent immersion foot or hypothermia.

5.4.5 Training

All ENC employees and subcontractors will be trained in:

- The effects of cold stress, including frostbite, immersion

HEAT AND COLD STRESS INFORMATION

The two most reliable and distinct differences between heat stroke and heat exhaustion are:

Heat Stroke

- Skin flushed (red); may be dry; hot to touch
- Oral temperature above 105°F.

Heat Exhaustion

- Skin pale; wet or clammy; cool to touch
- Oral temperature usually normal.

Cold Stress

Hypothermia is a drop in the core body temperature below 98.6 F. The first symptoms of hypothermia are uncontrollable shivering and the sensation of cold; this is followed by a slowed and sometimes irregular heart beat, a weakened pulse and a drop in blood pressure. Vague or slow slurred speech, memory lapses, apathy, incoherence and drowsiness can occur. Other symptoms may include cool skin, slow, irregular breathing, apparent exhaustion, and fatigue after rest.

Prevention

Hypothermia is caused by prolonged exposure to a cold environment, whether air, water, or snow and ice. Adequate dry clothing with appropriate insulating capacity must be provided to workers to prevent hypothermia, especially if work is performed in air temperatures below 40 F. Wind chill is a critical factor. Work at a slow but steady pace. The job should be a "no sweat" operation.

Unless there are unusual or extenuating circumstances, cold injury to other than the extremities (hands, feet, and head) is not likely to occur without the development of the initial signs of hypothermia. Older workers or workers with circulatory problems require special precautionary protection against hypothermia. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions which should be considered for these workers. The precautionary actions to be taken will depend upon the physical condition of the worker and should be determined with the advice of a physician with knowledge of the cold stress factors and the medical condition of the worker.

Treatment

First aid for mild hypothermia will be performed as follows:

1. End the exposure - get the victim out of the cold and wet.
2. Replace wet clothing with dry or add insulation to clothing.
3. Offer warm, non-alcoholic fluids.

4. Increase exercise.
5. Seek shelter from wind, wet and cold.

ATTACHMENT A (Page 1 of 6)
HEAT AND COLD STRESS INFORMATION

HEAT AND COLD STRESS INFORMATION

HEAT STRESS

Hot weather can cause physical discomfort, loss of efficiency, and personal injury. The human body strives to maintain a constant core temperature of 98.6o. If this temperature is to be maintained, heat loss must equal heat production. This balance is maintained by variations in the blood flow to the outer part of the body. When the core temperature rises, blood vessels beneath the skin dilate, and the blood brings increased heat to the skin, where it is dissipated by radiation and convection. This works only as long as the skin temperature is lower than the temperature of the outside environment. Heat loss by radiation convection is impossible when the temperature of the outside air approaches or exceeds the temperature of the skin. The body will now rely on dissipation through evaporation of sweat. But the sweat mechanism also has limits. The normal adult can sweat only about one liter per hour and can sweat at that rate for only a few hours at a time. In addition, sweating only works if the relative air humidity is low. Sweat evaporation ceases entirely when the relative humidity reaches 75 percent.

Of particular concern in heat stress monitoring is the use of personal protective clothing which decreases natural body ventilation and greatly increases the temperature and humidity to the skin. If precautions are not taken, heat stress will progress into a heat-related injury. Heat-related injuries fall into three major categories: heat cramps, heat exhaustion, and heat stroke.

Heat Cramps

<u>Symptoms</u>

Heat cramps are the least common and least severe of heat injuries. Heat cramps occur when the electrolytic balance in the blood between water, calcium, and sodium (salt) is altered. Low blood salt level, from profuse sweating and inadequate salt consumption, is the usual cause.

Symptoms of heat cramps include:

- Severe muscle cramps and pain, especially of the upper legs, calves, and abdomen, and occasionally in the arms foot and hypothermia;

- Personal risk factors;
- Recognition of the symptoms;
- Methods employees can use to protect themselves; and
- First aid procedures and recognition of medical emergencies.

Records shall be maintained in accordance with EHS 1-9, Recordkeeping.

6.0 REFERENCES

ACGIH (American Conference of Government Industrial Hygienists)
Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, 1994-95.
Environmental Health & Safety Programs EHS 1-9, Recordkeeping
Environmental Health & Safety Programs EHS 3-2, EHS Plans
NIOSH (National Institute for Occupational Safety and Health)
Occupational Exposure to Hot Environments, Revised Criteria 1986.
NIOSH/OSHA/EPA/USCG/EPA
Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. October 1985.
National Safety Council
Fundamentals of Industrial Hygiene. Third Edition, 1988.

7.0 ATTACHMENTS

Attachment A - Heat and Cold Stress Information
Attachment B - Work/Rest Regimens and Monitoring

- Faintness and dizziness
- Possible nausea and vomiting

Treatment

Emergency care will include:

- Remove victim from the hot environment

- Dilute one teaspoon of salt in one quart of water or use a commercial product with a low glucose content; allow victim to sip this solution at the rate of one-half glassful every 15 minutes
- To relieve pain, gently stretch the involved muscle group; gently message cramps as long as it does not increase the pain or discomfort

The victim should avoid exertion of any kind for 12 hours. A victim of heat cramps is prone to recurrence.

Heat Exhaustion

Symptoms

Heat exhaustion is the most common heat injury and usually occurs in an individual who is involved with heavy physical exertion in a hot, humid environment, and is wearing protective clothing. Heat exhaustion is a mild state of physical shock caused by the pooling of blood in the vessels just below the skin, causing blood to flow away from the major organs of the body. Due to prolonged and profuse sweating, the body also loses large amounts of salt and water.

The symptoms of heat exhaustion include:

- Profuse sweating
- Pale, cool, sweaty skin
- Headache and extreme weakness, fatigue
- Nausea and possible vomiting
- Dizziness and faintness
- Collapse and possible brief unconsciousness
- Body core temperature normal, may even be slightly below normal

Treatment

Emergency care will include:

- Remove victim from the hot environment and out of the exclusion zone
- Lie victim down with feet slightly raised
- Remove as much clothing as reasonable (especially personal protective clothing); loosen what cannot be

removed

- Apply cold, wet compresses to the skin; fanning will also aid in cooling
- If the victim is fully alert, allow him/her to drink water or the same solution, at the same rate, that was used for the emergency care of heat cramps
- If the victim vomits, do not give fluids by mouth, transport him/her to a hospital immediately (dehydration is the most critical problem in heat exhaustion victim; intravenous fluids will have to be given)
- Take oral temperature every 10 minutes, if the victim's temperature is above 101° or shows a steady increase, transport to a hospital immediately and start sponging him/her off with cool water.

ATTACHMENT A (Page 5 of 6)
HEAT AND COLD STRESS INFORMATION

CAUTION: If the victim remains cold for a number of hours, chemical changes may have taken place which, on rewarming, may cause major medical problems for the victim and which could result in death. Severely hypothermic victims are best warmed in the hospital under controlled conditions. If a severely hypothermic victim cannot be transported to a hospital within a few hours, rewarming should begin in the field.

Symptoms

Frostbite can occur either before or after the onset of hypothermia when body tissue (usually an extremity) is exposed to freezing temperatures. Frostbite occurs when the fluids surrounding tissue cells freezes. The danger of frostbite increases with increased wind chill and/or reduced temperatures below 32 F. Frostbite can also occur if tissues are in prolonged contact with a frozen material or object. Skin contact with frozen metal, for example, can result in frostbite in a short period of time, even in a warm environment.

There are three degrees of frostbite:

- First degree - freezing without blistering or peeling, "frostnip"
- Second degree - freezing with blistering and/or peeling, and
- Third degree - freezing resulting in the death of skin tissue and possibly the death of underlying tissues as well

Symptoms of frostbite include the following:

- The skin changes color to white or grayish-yellow, progresses to reddish-violet, and finally turns black as the tissue dies
- Pain may be felt at first, but subsides
- Blisters may appear, and
- The affected area is cold and numb

Prevention

Frostbite can be prevented by wearing sufficient protection to prevent skin from coming into prolonged contact with a freezing environment. The following steps can be taken:

1. Wear sufficient clothing. Mittens are better than gloves. Face masks and wool stocking caps are better than hats. Wind and waterproof hoods protect the face and neck.

2. Clothing should be loose enough to prevent constriction of blood vessels. Boots must be roomy enough to permit movement of the toes with no feeling of tightness.

3. Do not contact conductive metals or contact gasoline or other solvents with bare skin as rapid evaporation of solvents may

quickly lead to frozen tissues in a cold environment.

4. Exercise the toes and fingers to maintain circulation.
5. Observe the condition of your partners' face, hands and ears frequently for signs of frostbite.
6. Avoid smoking and drinking alcoholic beverages.

ATTACHMENT A (Page 6 of 6)
HEAT AND COLD STRESS INFORMATION

Treatment

First aid for superficial (first degree) frostbite is as follows:

1. Place a warm body part next to the frozen area, applying firm, steady pressure.
2. DO NOT RUB THE AREA. Rubbing may cause further damage to already injured skin.
3. Protect the area from further freezing.

First aid for deep frostbite (second and third degree) is as follows:

1. KEEP THE FROZEN PART FROZEN!
2. Prevent further injury: avoid rubbing and further freezing of unaffected tissue.
3. If the part has thawed, the part should NOT be allowed to refreeze or bear weight. A victim with thawed feet should be carried out.
4. Give the victim plenty of fluids and evacuate to medical assistance as soon as possible.

Symptoms

This condition may be caused by long, continuous exposure to cold without freezing, combined with persistent dampness or actual immersion in water. Edema (swelling), tingling, itching, and severe pain occur, and may be followed by blistering, death of skin tissue, and ulceration. When other areas of the body are affected besides the feet, the condition is known as chilblains.

Prevention

Trenchfoot and chilblains can be prevented by keeping the body as dry as possible at all times. Waterproof boots should be worn when required, but provisions must be made for preventing excessive perspiration to accumulate inside the boots. Socks should be changed at least twice daily and the boots wiped dry inside with each change of socks. The feet should also be wiped dry and foot powder applied.

Treatment

Affected body parts should not be rubbed or massaged, but bathed in water using plain white soap. Dry thoroughly and elevate the body part, allowing the body part to be exposed at room temperatures. If the feet are affected, do not walk during treatment.

ATTACHMENT B (Page 1 of 5)

WORK/REST REGIMENS AND MONITORING

HEAT STRESS
WORK/REST REGIMES AND MONITORING

Introduction

Establishing a work/rest regimen that allows work to be completed in a timely manner while providing adequate rest time to prevent heat stress requires involvement of the ESS, FOL, and individuals involved. In many cases, particularly when wearing normal field type clothing (i.e., level D), awareness and communication are the key elements to a successful program. Allowing rest periods on an "as needed" basis while ensuring vigilance for initial symptoms of heat stress, encourages this success.

There are times when this approach is not appropriate. When heat stress contributing protective clothing (e.g., respirators, impermeable coveralls) are worn for extended periods, or when "as needed" work/rest regimens adversely impact either the individuals exposed to the heat source or work completion, a more formal work/rest regimen will be established.

Formal work/rest regimens are based either on 1) monitoring ambient conditions (e.g., with a WBGT), estimating work loads and establishing work/rest times, 2) monitoring physiological conditions and adjusting work/rest periods, or 3) using personnel heat stress monitors.

The WBGT, physiological monitors, and personnel heat stress monitors will be used in accordance with manufacturer's instructions. Personnel heat stress monitors will be approved for use by the PESM.

II. WBGT Based Work/Rest Regimens

A. Work/Rest Regimens

When required, the WBGT will be used in conjunction with the work load to determine the appropriate work/rest regimen for personnel wearing regular work clothing or semipermeable disposal coveralls (uncoated Tyvek). Light work examples include sitting or standing or performing light hand or arm work. Moderate work includes

ATTACHMENT B (Page 2 of 5)

WORK/REST REGIMENS AND MONITORING

Table B-1. Examples of Permissible Heat Exposure Threshold Limit Values.

(Values are given in °F WGBT)*

Work - Rest Regimen	Work Load: Light	Moderate	Heavy
Continuous work	86	80	77
75% Work - 25% Rest, each hour	87	82	78
50% Work - 50% Rest, each hour	89	85	82
25% Work - 75% Rest, each hour	90	88	86

* Notes on Table B-1

1) These values are for fully acclimatized workers wearing light weight pants and shirts. For conditions other than this use this table with the correction factors from Table B-2.

2) These values assume that workers drink frequently and have properly increased salting of food prior to exposure.

3) These values are guidelines. Actual levels may be modified based on individual physiological response and actual work and rest conditions.

4) These values assume that the rest location is cool enough to alleviate heat load conditions.

walking about with moderate lifting and pushing. Heavy work corresponds to pick and shovel-type work.

The work/rest regimen using the WBGT procedure will be used as a guideline. Table B-1 outlines the work/rest regimen guidelines based upon WBGT temperature and work load. Table B-2 identifies the correction factors. The WBGT temperature will be determined in accordance with Section B of this attachment.

ATTACHMENT B (Page 3 of 5)

WORK/REST REGIMENS AND MONITORING

Table B-2. Correction Factors for Table B-1 in °F*

Clothing Type	WBGT Correction
Summer work uniform	0
Cotton overalls	-3.5
Winter work uniform	-7
Water barrier, permeable	-11
Condition	**WBGT Correction**
Unacclimatized worker, moderate work load	-4.5

*To use this table, identify the most restrictive applicable clothing type and whether unacclimatized workers are involved. Add the two. Modify Table B-1 temperatures by this amount. For example, the Table B-1 TLV for continuous work, light workload is 86oF. If cotton overalls (-3.5) are work and acclimatized workers are acclimatized (no additional change) the modified limit is 82.5oF.

B. WBGT Determination

If the Wet Bulb Globe Temperature (WBGT) is used to determine if field conditions are conducive to heat stress illnesses, the WBGT is determined through the following equations:

- Outdoors with solar load: (1)

  WBGT=0.7 NWB+0.2GT+0.1DB

- Indoors or outdoors with no solar load: (2)

  WBGT=0.7 NWB+0.3GT

Where:

WGBT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Thermometer Temperature

ATTACHMENT B (Page 4 of 5)

WORK/REST REGIMENS AND MONITORING

The factors involved in the above equations can be measured in the following manner:

- Through the use of a direct-reading heat stress monitor capable of measuring all of the individual factors associated with the WBGT equation. For example, the Reuter-Strokes Wibet No. RSS-214 heat stress monitor.

- By measuring the individual factors manually using the following type of equipment

  Natural Wet-Bulb Temperature Thermometer
  Dry-Bulb Temperature Thermometer
  Globe Temperature Thermometer
  Stand

III. Adjusted Temperature Based Work/Rest Regimens

When wearing impermeable protective clothing, the use of work/rest regimens based on WBGT is not recommended. The WBGT index is designed to account for the effects of evaporative cooling. Vapor barrier clothing impedes the evaporation of sweat and renders the WBGT an inappropriate physiological model. The most important environmental conditions related to heat stress for workers wearing impermeable protective clothing have been suggested to be the ambient dry bulb temperature and the radiant solar heat. These factors are combined into an index called the adjusted temperature using the following formula:

$T°$ adjusted = ambient dry bulb temperature + (13 x % sunshine)

where % sunshine is an estimate of the amount of time the sun is covered by clouds thick enough to produce a shadow. The thermometer bulb should be shielded from radiant heat when taking measurements.

The adjusted temperature values are then used to determine the initial work/rest regimen and physiological monitoring frequency. Table B-3 gives the work period and monitoring frequency. Initially, rest periods will be at least 15 minutes. Physiological monitoring that is normally recommended is pulse rate and body temperature. Procedures for each are described below. Initially, both should be done. Pulse rate monitoring may be discontinued with the approval of the PESM if temperature monitoring proves to be effective.

ATTACHMENT B (Page 5 of 5)

WORK/REST REGIMENS AND MONITORING

A. Pulse Rate Monitoring

Take the pulse immediately at the start of the rest period (P1). Take the pulse again 2 1/2 to 3 minutes into the rest period (P2). If any of the following conditions exist, shorten the next work period by a third:

P1 > 110 beats per minute(bpm)

P2 > 90 bpm

P1 - P2 < 10 bpm.

Pulse rates can be taken with an electronic pulse meter, or manually with a stopwatch for 30 seconds.

B. Oral Temperature

Take the oral temperature immediately at the start of the rest period. If the oral temperature exceeds 99.5o shorten the next work period by a third. Do not return the worker to hot work in semipermeable or impermeable clothing until the oral temperature is less than 99.5oF.

Oral temperatures may be taken with disposable oral thermometers or infrared ear drum scanners, such as the Thermoscan. Note: If a Thermoscan unit is purchased, the Pro Model should be selected. The home model available through drugstores cannot be recalibrated.

C. Removal from Exposure

If an individual requires a shortening of the work period on more than two consecutive monitoring periods, or repeatedly over a few days, they should be removed from exposure to hot environments wearing semipermeable impermeable protective clothing until examined and cleared for such work by the consulting physician.

Table B-3. Initial Work Period and Physiological Monitoring Frequency'

ADJUSTED TEMPERATURES	SCHEDULE -
90°F or above	15 minutes
87.5° - 90°F	30 minutes
82.5° - 87.5°F	60 minutes
77.5° - 82.5°F	90 minutes
70° - 77.5°F	120 minutes

[1] Schedule is for fit and acclimatized workers in impermeable protective clothing.

1.0 PURPOSE

The purpose of this program is to establish drilling safety guidelines.

2.0 SCOPE

The requirements of this program apply to all drillers and drilling subcontractors working on projects. This program contains requirements for drilling, servicing and related operations performed in support of monitoring well installation and geological exploration, and addresses hazards associated with assembling and disassembling rigs, rotary and auger drilling, and grouting.

3.0 MAINTENANCE

The Director, Environmental, Safety and Quality (ESQ) Programs is responsible for updating this procedure. Suggestions for revision shall be submitted to both the department responsible for updating the procedure and the Director, Administration and Compliance.

4.0 DEFINITIONS

4.1 Annular Space

The space surrounding the pipe suspended in the wellbore. The outer wall of the annular space may be an open hole or it may be larger pipe.

4.2 Auger Rig

Drilling method in which a hole is drilled by rotating a corkscrew type hollow stem steel drill.

4.3 Cable Tool Drilling

Drilling method in which hole is drilled by advancing a drive barrel and/or hand tool. As the hole is advanced a steel casing is driven by a cable to prevent collapse.

4.4 Cathead

A spool-shaped extension of the draw works shaft used to lift heavy equipment and to make up or break out drill pipe.

4.5 Cribbing

Logs, 2 X 4s or other non-compressible material used to support an object above the ground/floor.

4.6 Cuttings

Soil or other particles obtained during drilling operations. Cuttings are brought to the surface by circulating mud-laden fluid in rotary drilling or by hollow stem auger drilling. They are bailed out in cable tool drilling.

4.7 Derrick

Any one of a large number of types of load-bearing structures. In drilling work, the standard derrick has four legs standing at the corners of the substructure and reaching to the crown block. The substructure is an assembly of heavy beams used to elevate the derrick above the ground and provide space to install blowout preventers, casing heads, etc. The standard derrick has largely been replaced by the mast for drilling. The mast is lowered and raised without disassembly.

4.8 Mud

The liquid that is circulated through the wellbore during rotary drilling and workover operations. In addition to its function of bringing cuttings to the surface, mud also cools and lubricates the bit and drill string, protects against blowouts by containing subsurface pressures, and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formations. Although it originally was a suspension of earth solids, especially clays, in water, the mud used in modern drilling operations is a somewhat more complex three-phase mixture of liquids, reactive solids, and inert solids. The liquid phase may be fresh water, diesel oil, or crude oil and may contain one or more conditioners.

4.9 Rotary Drilling

The drilling method by which a hole is drilled by a rotating bit to which a downward force (drill collars) is applied. The bit is fastened to and rotated by the drill stem, which also provides a passage for the circulating fluid.

4.10 Sheave

A wheel or disc with a grooved rim, especially one used as a pulley.

5.0 DISCUSSION

5.1 Responsibilities

5.1.1 All Employees and Subcontractor Personnel

All personnel are responsible for understanding and complying with the requirements of this program. They should bring all perceived, potential or actual unsafe site conditions to the attention of the Environmental and Safety Supervisor (ESS) during site safety meetings. Drillers are required to have their own drilling safety plan on-site which shall reference and comply with this procedure.

5.1.2 Line Management

The Project Manager (PM) is responsible for selecting a qualified drilling subcontractor for the project and has overall responsibility for the health and safety of all employees and subcontractor employee on the job site. The PM shall include this procedure and other appropriate health and safety requirements in all drilling specifications.

5.2 Housekeeping

The drilling safety supervisor shall understand and fulfill the responsibility for proper maintenance and good "housekeeping" on and around the drill rig. These requirements include, but are not limited to:

- Provide suitable storage locations for all tools, materials and supplies so that tools, materials and supplies can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials or supplies within or on the mast (derrick) of the drill rig.
- Neatly stack pipe, drill rods, casing augers and similar drilling tools on racks or sills to prevent spreading, rolling or sliding.
- Place penetration or other driving hammers at a safe location on the ground or secure them to prevent movement when not in use.

- Keep work areas, platforms, walkways, scaffolding and other access ways free of materials, debris, and obstructions and substances such as ice, grease or oil that could cause a surface to become slick or otherwise hazardous.

- Keep all controls, control linkages, warning and operation lights and lenses free of oil, grease and/or ice.

- Do not store gasoline in any portable container other than a non-sparking, approved container with a flame arrester in the fill spout and having the word "gasoline" easily visible. A hazard communication label shall also be placed on all gasoline cans. (See EHS 4-2, Hazard Communications, and EHS 3-7, Hazardous Material Storage and Transportation.)

5.3 Maintenance

Proper maintenance will make drilling operations safer. Maintenance should be performed safely. These requirement include, but are not limited to:

- Keep drill rigs and associated equipment in good condition.
- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittings (except repairs or adjustments that can only be made with the engine running). Take precautions to prevent accidental starting of an engine during maintenance by locking, removing or tagging the ignition key (see EHS 6-4 Lockout/Tagout Procedure).
- Always block the wheels or lower the leveling jacks or both and set hand brakes before working under a drill rig.
- When possible and appropriate, release all pressure on the hydraulic systems, the drilling fluid system and the air pressure systems of the drill rig prior to performing maintenance. In other words, reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.
- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.
- Never weld or cut on or near a fuel tank.
- Do not use gasoline or other volatile or flammable liquids as a cleaning agent on or around a drill rig.
- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils and/or coolants.
- Replace all caps, filler plugs, protective guards or panels and high pressure hose clamps and chains or cables that have been removed for maintenance before returning the drill rig to service.
- Check the deadman switch daily. Ensure that its location is known to all drill rig crew personnel.

5.4 Hand Tools

There are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops and more than an equal number of instructions for proper use. "Use the tool for its intended purpose" is the most important rule. The following are a few specific and some general suggestions which apply to safe use of hand tools that are often used on and around drill rigs.

- When a tool becomes damaged, either repair it before using it again or discard it.
- When using a hammer wear safety glasses and require all others around you to wear safety glasses.
- When using a chisel wear safety glasses and require all others around you to wear safety glasses.
- Keep all tools cleaned and neatly stored when not in use.
- Use wrenches on nuts - do <u>not</u> use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut - first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing - check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease which would otherwise build up and cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hook and heel jaws when they become visibly worn.
- When breaking tool joints on the ground or on a drilling platform, position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform, should the wrench slip or the joint suddenly let go.

5.5 Clearing the Work Area

Prior to drilling, perform adequate site clearing and leveling to accommodate the drill rig and supplies and provide a safe working area. Drilling shall not be commenced when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

5.6 Start-up

- Instruct all visitors to "stand clear" of the drill rig immediately prior to and during starting of any an engine.
- Make sure all gear boxes are in neutral, all hoist levers are disengaged, all hydraulic levers are in the correct non-actuating positions and the cathead rope is not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer's manual.

5.7 Safety During Drilling Operations

- Safety requires the attention and cooperation of every worker and site visitor.
- Do not drive the drill rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick), look up to check for overhead obstructions.
- Maintain a minimum of 15 ft clearance from all overhead electric lines. See Army Corps of Engineers, EM 385-1-1, Section 11.E for additional guidance on operations adjacent to overhead lines.
- Before raising the mast (derrick), all drill rig personnel (with the exception of the operator) and visitors shall be cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors shall be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig must first be leveled and stabilized with leveling jacks and/or solid cribbing. The drill rig shall be re-leveled if it settles after initial set up. Lower the mast (derrick) only when the leveling jacks are down and do not raise the leveling jack pads until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
- The operator of a drill rig shall only operate a drill rig from the position of the controls. If the operator of the drill rig must leave the area of the controls, the operator shall shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator shall shut down the drill engine before leaving the vicinity of the drill rig.
- Throwing or dropping tools shall not be permitted. All tools shall be carefully passed by hand between personnel or a hoist line shall be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.
- When encountering a "hot spot" during drilling operations involving volatiles, vacate the immediate area and allow the borehole to vent. Resume work after monitoring instruments indicate an atmosphere in

compliance with the site-specific EHS Plan.

- If it is necessary to drill within an enclosed area, make certain that exhaust gases are vented out of the area. Exhaust gases can be toxic and some cannot be detected by smell.

- Clean mud and grease from your boots before mounting a drill platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.

- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.

- All air and water lines and pumps should be drained when not in use if freezing weather is expected.
- All unattended boreholes must be adequately covered or otherwise protected to prevent drill rig personnel, site visitors or animals from stepping or falling into the hole. All open boreholes shall be covered, protected or backfilled adequately and according to local or state regulations on completion of the drilling project.

- "Horsing around" within the vicinity of the drill rig and tool and supply storage areas is not allowed, even when the drill rig is shut down.

- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

- Use elevated derrick platforms with the following precautions:

  - When working on a derrick platform, use a safety harness and a lifeline. The safety harness shall be at least four inches (100 mm) wide and shall fit snugly but comfortably. The lifeline, when attached to the derrick, shall be less than six feet (2 m) long. The safety harness and lifeline shall be strong enough to withstand the dynamic force of a 250 pound (115 kg) weight (contained within the belt) falling six feet (2 m).

  - When climbing to a derrick platform that is higher than 20 feet (6 m), use a safety climbing device.

  - When a rig worker is on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- When a rig worker first arrives at a derrick platform, inspect the platform for broken members, loose connections and loose tools or other loose materials.
- Attach tools securely to the platform with safety lines. Do not attach a tool to a line attached to your waist or any other part of your body.
- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.
- Do not leave loose tocls and similar items on the derrick platform or on structural members of the derrick.
- A derrick platform over four feet (1.2 m) above ground surface shall be equipped with toe boards and safety railings that are in good condition.
- Workers on the ground or the drilling floor shall avoid working under rig workers on elevated platforms, whenever possible.

• Terminate drilling operations during an electrical storm and move the entire crew away from the drill rig.

5.8 Safe Use of Wire Line Hoists, Wire Rope and Hoisting Hardware

- The use of wire line hoists, wire rope and hoisting hardware shall be as stipulated by 29 CFR 1910, 29 CFR 1926, and the American Iron Steel Institute Wire Rope Users Manual.
- Visually inspect all wire ropes and fittings during use and thoroughly inspect them at least once a week for: abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion and damage to lifting hardware. Replace wire ropes when inspection indicates excessive damage according to the Wire Rope Users Manual. Thoroughly inspect all wire ropes which have not been used for a period of a month or more before returning them to service.
- End fittings and connections consist of spliced eyes and various manufactured devices. Install all manufactured end fittings and connections according to the manufacturer's instructions and follow the manufacturer's load specifications.
- If a ball-bearing type hoisting swivel is used to hoist drill rods, inspect and lubricate the swivel daily to assure that the swivel freely rotates under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 foot (0.3 m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints and do not make up, tighten or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to break the fall of the rods with your hands or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with a single part line. Never increase the number of parts of line without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave - if the rope is too large, the sheave will pinch the wire rope - if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire ropes.
- The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting of tools (except when angle hole drilling). Do not use tool handling hoists to pull objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far away as possible from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope - apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace damaged safety latches on safety hooks before using.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.
- Inspect and test clutches and brakes of hoists periodically.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.

- Never leave a load suspended in the air when the hoist is unattended.

- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up and when the load is being hoisted.

- Never hoist the load over the head, body or feet of any personnel.

- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.

- Replacement wire ropes should conform to the drill rig manufacturer's specifications.

5.9 Safe Use of Cathead and Rope Hoists

The following safety procedures shall be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. Clean the cathead with a wire brush if it becomes rusty.

- Check the cathead periodically, when the engine is not running, for rope wear grooves. Replace the cathead if a rope groove forms to a depth greater than 1/8 inch (3 mm).

- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator shall also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator shall keep careful watch on the suspended tools and shall quickly back away after turning off the engine.

- The rope shall always be protected from contact with all chemicals. Chemicals can cause deterioration of the rope that may not be visibly detectable.

- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg or any other part of your body.

- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope methods. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose unbuttoned or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a load.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must be able to operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

5.10 Safe Use of Augers

The following general procedures shall be used when starting a boring with a continuous flight or hollow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below ground

surface.

- If the auger head slides out of alignment, disengage the clutch or hydraulic rotation control and repeat the hole starting process.

- An auger guide can facilitate the starting of a straight hole through hard ground or pavement.

- The operator and tool handler shall establish a system of responsibility for the various activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing the auger fork. The operator must assure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

- Only use the manufacturer's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench or any other tools during rotation.

- Whenever possible, use tool hoists to handle auger sections.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over other auger sections or other hard surfaces such as the drill rig platform.

- Never allow feet to get under the auger section that is being hoisted.

- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatsoever.

- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.

- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

5.11 Safety During Rotary and Core Drilling

- Rotary drilling tools shall be safety checked prior to drilling:

  - Lubricate and check water swivels and hoisting plugs for "frozen" bearings before use. Use only approved lubrication fluids.

  - Check drill rod chuck jaws periodically and replace when necessary.

- Check the capacities of hoists and sheaves against the anticipated weight to the drill rod string plus other expected hoisting loads.

- Special precautions for safe rotary or core drilling involve chucking, joint break, hoisting and lowering of drill rods:

  - Only the operator of the drill rig shall brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.

  - Do not brake drill rods during lowering into the hole with drill rod chuck jaws..

  - Do not hold or lower drill rods into the hole with pipe wrenches.

  - If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.

  - In the event of a plugged bit or other circulation blockage, relieve or bleed down the high pressure in the piping and hose between the pump and the obstruction before breaking the first tool joint.

  - When drill rods are hoisted from the hole, they shall be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.

  - If work must progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit shall be equipped with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.

  - Do not lean unsecured drill rods against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

5.12 Engines and Pumps

- The following engine and pump stop devices are as follows:

  - For an internal-combustion engine: an ignition or grounding switch.

  - For a diesel engine: a quick-closing valve or equivalent device which will shut off the air to the air-intake manifold of the engine and prevent entry of gas-laden air, or a means of releasing the engine compression which will not produce an open flame or spark.

- For an electric motor: a suitable switch in the motor circuit, or a switch or stop button in the control circuit, approved for the location in which it is installed.

- Mud pumps shall be equipped with a pressure relieving device set to release within the limits of the safe working pressure of the pump. Such devices include direct spring-loaded safety valves, shear-pin safety valves, and rupture disks.
- There shall be no valve between the pump and its pressure-relieving device. The point of discharge from a pressure-relieving device shall be located where employees are not endangered by the discharge of fluids.
- Each pump shall be equipped with bleeder valves.
- All personnel involved in the operation of the rig shall know the exact location of each stop device.

5.13 Safety During Travel

- The individual who transports a drill rig on and off a drilling site shall:
  - Be properly licensed and shall only operate the vehicle according to federal, state and local regulations.
  - Know the traveling height (overhead clearance), width, length and weight of the drill rig with carrier and know the highway and bridge load, width and overhead limits, making sure these limits are not exceeded and allowing an adequate margin of safety.
  - Never move a drill rig unless the vehicle brakes are in sound working order.
  - Allow for mast overhang when cornering or approaching other vehicles or structures.
  - Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
  - Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels or other commercial sites.
  - Never travel on a street, road, highway with the mast (derrick) of the drill rig in the raised or partially raised position.
  - Remove all ignition keys when a drill rig is left unattended.

5.14 Off-Road Movement

- The following safety precautions relating to off-road movement shall be followed:
  - Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts and similar obstacles.
  - Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven or hilly ground.
  - Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts and mountings.

- Discharge all passengers before moving a drill rig on rough or hilly terrain.

- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.

- Use caution when traveling a side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of gravity. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).

- Attempt to cross obstacles such as small logs and small erosion channels or ditches squarely, not at an angle.

- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.

- After the drill rig has been moved to a new drilling site, set all brakes and/or locks and block wheels.

- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

5.15 Tires, Batteries and Fuel

- Tires on the drill rig must be checked daily for safety and during extended travel for loss of air and they must be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be reinflated to normal pressures before movement on firm or hilly ground or on streets, roads and highways. Under inflated tires are not as stable on firm ground as properly inflated tires. Air pressures shall be maintained for travel on streets, roads and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

  - Missing or loose wheel lugs

  - Objects wedged between duals or embedded in the tire casing

  - Damaged or poorly fitting rims or rim flanges

  - Abnormal or uneven wear and cuts, breaks or tears in the casing.

- The repair of truck and off-highway tires shall only be made with required special tools following the recommendations of a tire manufacturer's repair manual. If they are split rim tires, repairs shall be performed using an appropriate tire cage device.

- Batteries contain strong acid. Use extreme caution when servicing batteries.
  - Batteries shall only be serviced in a ventilated area while wearing safety glasses.
  - When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
  - When installing a battery, connect the battery ground clamp last.
  - When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger leads to the battery posts. Loosen cell caps prior to charging to permit the escape of gas.
  - Spilled battery acid can burn your skin and damage your eyes. Spilled battery acid shall be immediately flushed off your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
  - To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels, and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.
- Special precautions must be taken for handling fuel and refueling the drill rig or carrier.
  - Only use the type and quality of fuel recommended by the engine manufacturer.
  - Refuel in a well-ventilated area.
  - Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
  - Do not spill fuel on hot surfaces. Clean any spillage before starting an engine.
  - Wipe up spilled fuel with cotton rags or cloths - do not use wool or metallic cloth.
  - Keep open lights, lighted smoking materials and flames or sparking equipment well away from the fueling area.
  - Turn off heaters in carrier cabs when refueling the carrier or the drill rig.

- To allow for expansion of the fuel during temperature changes, do not fill portable fuel containers completely full.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Fuel containers and hoses shall remain in contact with a metal surface during travel to prevent the buildup of static charge.

5.16 Drill Rig Utilization and Alterations

- Do not attempt to exceed manufacturer's ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes which they are intended and designed.
- Alterations to a drill rig or drilling tools shall only be made by qualified personnel and only after consultation with the manufacturer.

6.0 REFERENCES

American Iron Steel Institute, Wire Rope Users Manual.
Drilling Safety Guide. 3008 Millwood Avenue, Columbia, S.C. 29205.
Environmental, Health & Safety Programs EHS 3-7, Hazardous Material Storage and Transportation
Environmental, Health & Safety Programs EHS 4-2, Hazard Communications
Environmental, Health & Safety Programs EHS 6-4, Lockout/Tagout
National Drilling Federation
OSHA (Occupational Safety and Health Administration)
29 CFR 1910
29 CFR 1926
USACOE (U.S. Army Corps of Engineers), EM 385-1-1, 11.E, Operations Adjacent to Overhead Lines. Safety and Health Requirements Manual.

1.0 PURPOSE

This program provides the requirements for activities involving excavations in accordance with 29 CFR 1926, Subpart P - Excavations.

2.0 SCOPE

These requirements are applicable to all P.W. Grosser Consulting (PWGC) operations

3.0 MAINTENANCE

The Director, Environmental Safety and Quality (ESQ) Programs is responsible for updating this procedure. Approval rests with P.W. Grosser's President. Suggestions for revision shall be submitted to both the department responsible for updating the procedure and the Director, Administration and Compliance.

4.0 DEFINITIONS

4.1 Benching

A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

4.2 Competent Person

A competent person is one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

4.3 Excavation

Any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

4.4 Hazardous Atmosphere

An atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

4.5 Protective Systems

A method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

4.6 Sloping

A method of protecting employees from cave-ins by forming sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

4.7 Support System

A structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

4.8 Trench

A narrow excavation made below the surface of the ground. In general the depth is greater than the width, but the width of a trench measured at the bottom is not greater than 15 feet. If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet or less, the excavation is also considered to be a trench.

5.0 DISCUSSION

5.1 Responsibilities

5.1.1 Competent Person

The competent person(s) shall be responsible for:

- Day-to-day oversight of open excavations and trenches
- Conducting soil classifications
- Selection of protective systems

- Conducting daily inspections of open excavations and trenches; and
- Providing the Environmental and Safety Supervisor (ESS) with all required documentation on a daily basis.

5.1.2 Line Management

The Project Manager (PM) shall be responsible for:

- Ensuring compliance with this procedure
- Providing the necessary resources for compliance with this procedure; and
- Designating competent personnel in consultation with the Project Environmental, Health and Safety Manager (PESM)

5.1.3 Environmental, Health and Safety Personnel

The ESS shall be responsible for:

- Providing oversight on the implementation of the requirements contained in this procedure
- Conducting periodic reviews of open trenches and excavations
- Consulting with the project manager and competent person on excavation issues; and
- Maintaining required records.

5.2 Designation of Competent Personnel

Prior to the start of any excavation work the project manager shall designate a competent person to fulfill the requirements of this procedure.

5.3 General Requirements

The following section provides general requirements governing activities in and around excavation and trenches, as well as the requirements for the selection and use of protective systems.

- Surfaces surrounding open trenches and excavations shall have all surface hazards removed.
- All utilities shall be located and cleared prior to initiating digging. Public or facility utility groups shall be utilized

where possible for this purpose. In the absence of either, the ESS shall specify the procedures to be used to clear utilities in consultation with the project PESM and project manager. When the excavation is open, utilities shall be supported and protected from damage. Clearance and support methods shall be documented on the daily inspection checklist.

- Where structural ramps are used for egress they shall be installed in accordance with 29 CFR 1926.651(c)(1).
- Stairways, ladders, or ramps shall be provided as means of egress in all trenches 4 feet or more in depth. Travel distance shall be no more than 25 feet between means of exit.
- Employees exposed to vehicular traffic shall wear traffic vests.
- No employee shall be permitted under loads being lifted or under loads being unloaded from vehicles.
- When vehicles and machinery are operating adjacent to excavations warning systems such as stop logs or barricades shall be utilized to prevent vehicles from entering the excavation or trench.
- Scaling or barricades shall be used to prevent rock and soils from falling on employees.
- Excavated and loose materials shall be kept at least 3 feet from the edge of excavations.
- Walkways or bridges with standard railing shall be provided at points employees are to cross over excavations or trenches.
- Barriers shall be provided to prevent personnel from inadvertently falling into an excavation.

5.4 Hazardous Atmospheres

Where atmospheres containing less than 19.5 percent oxygen or other types of hazardous atmospheres may exist the following requirements shall be implemented.

- Atmospheric testing shall be done prior to employees entering excavations 4 feet or greater in depth.
- Testing methods shall be listed on the daily inspection checklist and results documented daily in field logs.
- Control measures such as ventilation and personal protective equipment (PPE) shall be used to control employee exposure to hazardous atmospheres below published exposure limits.

- Ventilation shall be used to control flammable and combustible vapors to below 10 percent of their lower explosive limit.
- Testing shall be repeated as often as necessary to ensure safe levels of airborne contaminants.
- Emergency equipment shall be provided and attended when the potential for a hazardous atmosphere exists. This equipment shall include but not be limited to emergency breathing apparatus, harnesses, lifelines, and basket stretchers. Required equipment will be listed on the daily inspection checklist and reviewed daily.

5.5 Protection From Water Hazards

When water has collected or is collected in excavations and trenches the following requirements shall be applied.

- Employees shall not work in excavations in which water has, or is, accumulating without the use of additional protection such as special support systems or water removal.
- Water removal shall be monitored by a competent person.
- Barriers such as ditches and dikes shall be used to divert runoff from excavations and trenches.
- Trenches shall be reinspected prior to re-entry after water accumulation due to heavy rainfall or seepage.

5.6 Stability of Adjacent Structures

When excavating or trenching near an adjacent structure the following practices shall be implemented.

- Support systems such as shoring, bracing, or underpinning shall be provided where the stability of buildings, walls, or other structures is endangered by excavation.
- Excavation bases or footings of foundations shall be prohibited unless support systems are used, the excavation is in stable rock, a professional engineer has determined the structure is sufficiently removed from the site as to not pose a hazard, or the PE determines that the excavation shall not pose a hazard to employees due to the structure.
- Support systems shall be used when it is necessary to undermine sidewalks, pavements, and appurtenant structures.
- Surcharge load sources and adjacent encumbrances shall be listed with their evaluation date on the daily inspection checklist.

5.7 Daily Inspections

Inspections shall be performed daily on all excavations, adjacent areas, and protective systems before personnel enter the trench. The checklist provided in Attachment A or equivalent shall be used.

5.8 Soil Classification

To perform soil classification, the competent person shall use a thumb test, pocket penetrometer, or shear vane to determine the unconfined compressive strength of the soils being excavated. In soils with properties that change (i.e., one soil type mixed with another within a given area) several tests may be necessary. When different soil types are present the overall classification shall be that of the type with the lowest unconfined compressive strength. Classifications shall result in a soil rating of Stable Rock, Type A, Type B, or Type C in accordance with 29 CFR 1926.652, Appendix A. Soil classifications shall be listed on the daily inspection checklist. The soils analysis checklist provided in Attachment B or equivalent shall be used for soil classifications.

5.9 Sloping and Benching

All sloping and benching shall be done in accordance with 29 CFR 1926.652, Appendix B. Selection of the sloping method and evaluation of surface surcharge loads shall be made by a competent person familiar with the requirements contained therein. Sloping and benching methods and specifications shall be listed on the daily inspection checklist.

5.10 Protective Systems

Protective systems are required on all excavations over 5 feet in depth or in excavations less than 5 feet when examination of the ground by a competent person reveals conditions that may result in cave-ins.

Selection and installation of protective systems shall be done in accordance with 29 CFR 1926.652, Appendices C & D, or manufacturers data for shoring and shielding systems. Selection of a protective system shall be made based upon soil classification and job requirements by a competent person. Protective systems and specifications shall be listed on the daily inspection checklist.

5.11 Training

Competent persons shall have an adequate combination of experience and training to classify soil types and select protective systems as outlined in 29 CFR 1926.652. Training and experience pertaining to qualification as a competent person shall be documented and include the following:

- General safety practices related to working in or near open excavations;
- Inspection requirements and techniques;

DAILY EXCAVATION INSPECTION CHECKLIST
To be completed by a "Competent Person"

Site location					
Date		Time		Competent Person	
Soil Type(s)					
Soil Classification(s)		Excavation depth		Excavation width	
Type of protective system used					

Indicate for each item by circling: Y (Yes), N (No), - Address in Comments, Not Applicable (N/A.)

I. General Inspection of Job Site				
A. Surface encumbrances removed or supported	Y	N		
B. Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation	Y	N		
C. Hard hats worn by all employees	Y	N		
D. Spoils, materials, and equipment set back at least 2 feet from the edge of the excavation	Y	N		
E. Barriers provided at all remotely located excavations, wells, pits, shafts, etc.	Y	N		
F. Walkways and bridges over excavations 4 feet or more in depth are equipped with standard guardrails	Y	N		
G. Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic	Y	N		
H. Warning system established and utilized when mobile equipment is operated near the edge of the excavation	Y	N		
I. Employees prohibited from working on the faces of sloped or benched excavations above other employees	Y	N		
II. Utilities				
A. Utility companies contacted and/or utilities located	Y	N	N/	
B. Exact location of utilities marked when approaching the utilities	Y	N	N/	
C. Underground installations protected, supported or removed when excavation is open	Y	N	N/	
III. Means of Access and Egress				
A. Lateral travel to means of egress no greater than 25 feet in excavations 4 feet or more in depth	Y	N	N/A	
B. Ladders used in excavations secured and extended 3 feet above the edge of the trench	Y	N	N/A	
C. Structural ramps used by employees designed by a competent person	Y	N	N/A	
D. Structural ramps used for equipment designed by a registered professional engineer (RPE)	Y	N	N/A	
E. Ramps constructed of materials of uniform thickness, cleated together on the bottom, equipped with a no-slip surface	Y	N	N/A	
F. Employees protected from cave-ins when entering or exiting the excavation	Y	N	N/A	

IV. Wet Conditions

A.	Precautions taken to protect employees from the accumulation of water	Y	N	N/A
B.	Water removal equipment monitored by a competent person	Y	N	N/A
C.	Surface water or runoff diverted or controlled to prevent accumulation in the excavation	Y	N	N/A
D.	Inspections made after every rainstorm or other hazard increasing occurrence	Y	N	N/A

V. Hazardous Atmospheres

A.	Atmosphere within the excavation tested where there is a reasonable possibility of an oxygen deficiency, combustible or other harmful contaminant exposing employees to a hazard	Y	N	N/A
B.	Ventilation	Y	N	N/A
C.	Testing conducted often to ensure that the atmosphere remains safe	Y	N	N/A
D.	Emergency equipment, such as breathing apparatus, safety harness and line, and basket stretcher readily available where hazardous atmospheres could or do exist	Y	N	N/A
E.	Safety harness and life line used and individually attended when entering deep confined excavations	Y	N	N/A

VI. Support Systems

A.	Materials and/or equipment for support systems selected based on soil analysis, trench depth and expected loads	Y	N	N/A
B.	Materials and equipment used for protective systems inspected and in good condition	Y	N	N/A
C.	Materials and equipment not in good condition have been removed from service	Y	N	N/A
D.	Damaged materials and equipment used for protective systems inspected by a RPE after repairs and before being placed back into service	Y	N	N/A
E.	Protective systems installed without exposing employees to the hazards of cave-ins, collapses or from being struck by materials or equipment	Y	N	N/A
F.	Members of support system securely fastened to prevent failure	Y	N	N/A
G.	Support systems provided to insure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.	Y	N	N/A
H.	Excavations below the level of the base or footing approved by an RPE	Y	N	N/A
I.	Removal of support systems progresses from the bottom and members are released slowly as to note any indication of possible failure	Y	N	N/A
J.	Backfilling progresses with removal of support system	Y	N	N/A
K.	Excavation of material to a level no greater than 2 feet below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth	Y	N	N/A
L.	Shield system placed to prevent lateral movement	Y	N	N/A
M.	Employees are prohibited from remaining in shield system during vertical movement	Y	N	N/A

VII. Comments

____

____

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____

- Classification of soils in accordance with 29 CFR 1926.652, Appendix A; and
- Uses, limitations, and specifications of protective systems in accordance with 29 CFR 1926.652.

Training records shall be maintained in accordance with EHS 1-9, Recordkeeping.

6.0 REFERENCES

Environmental, Health & -Safety Programs EHS1-9, Recordkeeping

OSHA (U.S. Department of Labor, Occupational Safety and Health Administration),
29 CFR 1926, Subpart P, Excavations.

7.0 ATTACHMENTS

Attachment A - Daily Excavation Inspection Checklist
Attachment B - Soils Analysis Checklist

ATTACHMENT A

DAILY EXCAVATION INSPECTION CHECKLIST

Dailexc.do

SOILS ANALYSIS CHECKLIST

This checklist must be completed when soil analysis is made to determine the soil type(s) present in the excavati separate analysis must be performed on each layer of soil in excavation walls. A separate analysis must also be per if the excavation (trench) is stretched over a distance where soil type may change.

Site location: ____

Date: ______________ Time: ______________ Competent Person ______________________

Where was the sample taken from? ______________________________

Excavation: Depth: ______________ Width: ______________ Length: ______________

VISUAL TEST

Particle type: ____ Fine Grained (cohesive) ____ Course grained (sand or gravel)

Water conditions: ____ Wet ____ Dry ____ Surface water present ____ Submerged

Previously disturbed soils? ____ Yes ____ No

Underground utilities? ____ Yes ____ No

Layered soils? ____ Yes ____ No

Layered soil dipping into excavation? ____ Yes ____ No

Excavation exposed to vibrations: ____ Yes ____ No

Crack-like openings or spallings observed? ____ Yes ____ No

Conditions that may create a hazardous atmosphere? ____ Yes ____ No

If yes, identify condition and source: ______________________________

Surface encumbrances: ____ Yes ____ No

Work to be performed near public vehicular traffic? ____ Yes ____ No

Possible confined space exposure? ____ Yes ____ No

MANUAL TEST

Plasticity: ____ Cohesive ____ Non-cohesive

Dry Strength: ____ Granular (crumbles easily) ____ Cohesive (broken with difficulty)

ATTACHMENT B

SOILS ANALYSIS CHECKLIST

Soilana.do

NOTE: The following unconfined compressive strength tests should be performed on undisturbed soils.

THUMB TEST (used to estimate unconfined compressive strength of cohesive soil)

Test performed: ____ Yes ____ No

____ Type A (soil indented by thumb with very great effort)

____ Type B (soil indented by thumb with some effort)

____ Type C (soil easily penetrated several inches by thumb with little or no effort). If soil is submerged, seeping water, subjected to surface water, runoff, exposed to wetting.

PENETROMETER OR SHEARVANE (used to estimate unconfined compressive strength of cohesive soil

Test performed: ____ Yes ____ No

____ Type A (soil with unconfined compressive strength of 1.5 tsf or greater)

____ Type B (soil with unconfined compressive strength of 0.5 tsf to 1.5 tsf)

____ Type C (soil with unconfined compressive strength of 1.5 tsf or less). If soil is submerged, seeping wate subjected to surface water, runoff, exposed to wetting.

WET SHAKING TEST (used to determined percentage of granular and cohesive materials). Compare result to soil textural classification chart to determine soil type.

Test performed ____ Yes ____ No

____ Type A (clay, silty clay, sandy clay, clay loam, and in some cases silty clay, loam and sandy clay loam)

____ Type B [angular gravel (similar to crushed rock), silt, silt loam, sandy loam, and in some cases, silty clay loam and sandy clay loam.

____ Type C(granular soil including gravel, sand and loamy sand)

____ % granular ____ % cohesive ____ % silt

NOTE: Type A — no soil is Type "A" if soil is fissured; subject to vibration; previously disturbed; layered dipping into the excavation on a slope of 4H:1V.

SOIL CLASSIFICATION

____ Type A

____ Type B

____ Type C

SELECTION OF PROTECTIVE SYSTEM

____ Sloping, Specify angle:

____ Timber Shoring

____ Aluminum Hydraulic Shoring

NOTE: Although OSHA will accept the above tests in most cases, some states will not. Check your state safety requirements for trenching regulations.

APPENDIX D

HEALTH & SAFETY FORMS

- **Medical Data Sheet**
- **Incident Report Form**
- **Daily Briefing Sign-In Sheet**

MEDICAL DATA SHEET

The brief medical data sheet shall be completed by on-site personnel and will be kept in the Support Zone by the HSO as a project record during the conduct of site operations. It accompanies any personnel when medical assistance is needed or if transport to a hospital is required.

Project:
Name: ______________________________ Home Telephone: __________
Address: ____
Age: _______ Height: ______ Weight: ______ Blood Type: __________

Name and Telephone Number of Emergency Contact: ______________________

Drug or Other Allergies: ______________________________

Particular Sensitivities: ______________________________

Do You Wear Contacts? ______________________________

Provide A Check List Of Previous Illnesses: ______________________________

What Medications Are You Presently Using? ______________________________

Do You Have Any Medical Restrictions? ______________________________

Name, Address, And Phone Number Of Personal Physician:

Name (Print and Sign)	***Date***

CORPORATE ESQ REPORT # ____________

INCIDENT/NEAR MISS REPORT AND INVESTIGATION

TYPE OF INCIDENT - CHECK ALL THAT APPLY

☐ INJURY/ILLNESS ☐ VEHICLE DAMAGE ☐ PROPERTY DAMAGE ☐ FIRE
☐ SPILL/RELEASE ☐ PERMIT EXCEEDENCE ☐ HIGH LOSS POTENTIAL (NEAR MISS) ☐ OTH

GENERAL INFORMATION

PROJECT/OFFICE: REPORT #: DATE OF REPORT:

DATE OF INCIDENT: MILITARY TIME: ____ DAY OF WEEK:

FW SUPERVISOR ON DUTY: AT SCENE OF INCIDENT: ☐ YES ☐ NO

LOCATION OF INCIDENT:

WEATHER CONDITIONS: ADEQUATE LIGHTING AT SCENE: ☐ YES ☐ NO ☐ N

DESCRIBE WHAT HAPPENED (STEP BY STEP - use additional pages if necessary)

AFFECTED EMPLOYEE INFORMATION

NAME: EMPLOYEE: ☐ YES ☐

HOME ADDRESS:

SOCIAL SECURITY #: HOME PHONE #:

JOB CLASSIFICATION: YEARS IN JOB CLASSIFICATION:

HOURS WORKED ON SHIFT PRIOR TO INCIDENT: YEARS WITH FWENC: AGE:

DID INCIDENT RELATE TO ROUTINE TASK FOR JOB CLASSIFICATION: ☐ YES ☐ NO

INJURY/ILLNESS INFORMATION

NATURE OF INJURY OR ILLNESS:

OBJECT/EQUIPMENT/SUBSTANCE CAUSING HARM:

FIRST AID PROVIDED: ☐ YES ☐ NO

IF YES, WHERE WAS IT GIVEN: ☐ ON SITE ☐ OFF SITE

IF YES, WHO PROVIDED FIRST AID:

WILL THE INJURY/ILLNESS RESULT IN: ☐ RESTRICTED DUTY ☐ LOST TIME ☐ UNKNOWN

MEDICAL TREATMENT INFORMATION			
WAS MEDICAL TREATMENT PROVIDED?:	☐ YES	☐ NO	
IF YES, WAS MEDICAL TREATMENT PROVIDED:	☐ ON SITE	☐ DR.'S OFFICE	☐ H
NAME OF PERSON(S) PROVIDING TREATMENT:			
ADDRESS WHERE TREATMENT WAS PROVIDED:			
TYPE OF TREATMENT:			
VEHICLE AND PROPERTY DAMAGE INFORMATION			
VEHICLE/PROPERTY DAMAGED:			
DESCRIPTION OF DAMAGE:			
SPILL AND AIR EMISSIONS INFORMATION			
SUBSTANCE SPILLED OR RELEASED:	FROM WHERE:	TO WHERE:	
ESTIMATED QUANTITY/DURATION:			
CERCLA HAZARDOUS SUBSTANCE? YES ☐ NO ☐	RQ EXCEEDED? YES ☐ NO ☐	SPECIFY: __	
REPORTABLE TO AGENCY? YES ☐ NO ☐	SPECIFY: ________________		
WRITTEN REPORT? YES ☐ NO ☐	TIME FRAME: ________________		
RESPONSE ACTION TAKEN			
PERMIT EXCEEDENCE			
TYPE OF PERMIT:	PERMIT #:		
DATE OF EXCEEDENCE:	DATE FIRST KNOWLEDGE OF EXCEEDENCE:		
PERMITTED LEVEL OR CRITERIA (e.g., Water quality):			
EXCEEDENCE LEVEL OR CRITERIA:	EXCEEDENCE DURATION:		
REPORTABLE TO AGENCY? YES ☐ NO ☐	SPECIFY: ________________		
WRITTEN REPORT? YES ☐ NO ☐	TIME FRAME: ________________		
RESPONSE ACTION TAKEN:			
NOTIFICATIONS			
NAME(S) OF FWENC PERSONNEL NOTIFIED:		DATE/TIME:	
CLIENT NOTIFIED:	DATE/TIME:		
AGENCY NOTIFIED:	DATE/TIME:	☐ NOT REQUIRED	
CONTACT NAME:			
PERSONS PREPARING REPORT			
EMPLOYEE'S NAME: (PRINT)	SIGN:		
EMPLOYEE'S NAME (PRINT)	SIGN:		
SUPERVISOR'S NAME: (PRINT)	SIGN:		

***NOTE:** Supervisor to forward a copy of Incident Report to immediate supervisor, PESM, ESS or ESC, and other personnel as identified in Table 1 of this procedure ASAP, but no later then 24 hours.*

REPORT #:___

INVESTIGATIVE REPORT

DATE OF INCIDENT:________ DATE OF INVESTIGATION REPORT:___

INCIDENT COST: ESTIMATED: $__________ ACTUAL : $_____

OSHA RECORDABLE(S): ☐ YES ☐ NO # RESTRICTED DAYS_____ # DAYS AWAY FROM WO

CAUSE ANALYSIS

IMMEDIATE CAUSES – WHAT ACTIONS AND CONDITIONS CONTRIBUTED TO THIS EVENT? (USE NEXT PAGE)

BASIC CAUSES - WHAT SPECIFIC PERSONAL OR JOB FACTORS CONTRIBUTED TO THIS EVENT? (USE NEXT PAGE)

ACTION PLAN

REMEDIAL ACTIONS - WHAT HAS AND OR SHOULD BE DONE TO CONTROL EACH OF THE CAUSES LISTED? INCLUDE MAN PROGRAMS (SEE ATTACHED LIST) FOR CONTROL OF INCIDENTS IF APPLICABLE.

ACTION	PERSON RESPONSIBLE	TARGET DATE	CO

PERSONS PERFORMING INVESTIGATION

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE

INVESTIGATOR'S NAME: (PRINT) SIGN: DATE

MANAGEMENT REVIEW

PROJECT/OFFICE MANAGER (PRINT) SIGN:

COMMENTS:

PESM or ESC (PRINT) SIGN:

COMMENTS:

NOTE: ***Attach additional information as necessary. Supervisor to forward copy of Investigative Report to the PM or OM or ESC ASAP, but no later then 72 hours after the incident. A copy shall be sent to the Director, Health and Sa Programs within 24 hours of completion of the report.***

EXAMPLES OF IMMEDIATE CAUSES	
SUBSTANDARD ACTIONS	SUBSTANDARD CONDITIC
1. OPERATING EQUIPMENT WITHOUT AUTHORITY	1. GUARDS OR BARRIERS
2. FAILURE TO WARN	2. PROTECTIVE EQUIPMENT
3. FAILURE TO SECURE	3. TOOLS, EQUIPMENT, OR MATERIA
4. OPERATING AT IMPROPER SPEED	4. CONGESTION
5. MAKING SAFETY DEVICES INOPERABLE	5. WARNING SYSTEM
6. REMOVING SAFETY DEVICES	6. FIRE AND EXPLOSION HAZARDS
7. USING DEFECTIVE EQUIPMENT	7. POOR HOUSEKEEPING
8. FAILURE TO USE PPE PROPERLY	8. NOISE EXPOSURE
9. IMPROPER LOADING	9. EXPOSURE TO HAZARDOUS MATEF
10. IMPROPER PLACEMENT	10. EXTREME TEMPERATURE EXPOS
11. IMPROPER LIFTING	11. ILLUMINATION
12. IMPROPER POSITION FOR TASK	12. VENTILATION
13. SERVICING EQUIPMENT IN OPERATION	13. VISIBILITY
14. UNDER INFLUENCE OF ALCOHOL/DRUGS	
15. HORSEPLAY	

EXAMPLES OF BASIC CAUSES	
PERSONAL FACTORS	JOB FACTORS
1. CAPABILITY	1. SUPERVISION
2. KNOWLEDGE	2. ENGINEERING
3. SKILL	3. PURCHASING
4. STRESS	4. MAINTENANCE
5. MOTIVATION	5. TOOLS/EQUIPMENT
	6. WORK STANDARDS
	7. WEAR AND TEAR
	8. ABUSE OR MISUSE

MANAGEMENT PROGRAMS FOR CONTROL OF INCIDENTS	
1. LEADERSHIP AND ADMINISTRATION	10. HEALTH CONTROL
2. MANAGEMENT TRAINING	11. PROGRAM AUDITS
3. PLANNED INSPECTIONS	12. ENGINEERING CONTROLS
4. TASK ANALYSIS AND PROCEDURES	13. PERSONAL COMMUNICATIONS
5. TASK OBSERVATION	14. GROUP MEETINGS
6. EMERGENCY PREPAREDNESS	15. GENERAL PROMOTION
7. ORGANIZATIONAL RULES	16. HIRING AND PLACEMENT
8. ACCIDENT/INCIDENT ANALYSIS	17. PURCHASING CONTROLS
9. PERSONAL PROTECTIVE EQUIPMENT	

NOTIFICATION REMINDER
Fatalities or hospitalization (admittance) of three or more individuals requires notification to OSHA within 8 hours. Contact the Director, Health and Safety Programs or Director, ESQ Programs to make the notification. If unavailable, the senior operations on site should make the notification.

INCIDENT/NEAR MISS REPORT AND INVESTIGATION INSTRUCTIONS

General : The incident report (pages 1 and 2) must be completed within 24 hours. Do not delay the report if any information is unknown. It can be provided later by revising the Report.

Type of Incident: Check all that apply. A High Loss Potential (Near Miss) incident is one that does not result in loss, but under slightly different circumstances, could have resulted in an OSHA Recordable injury, spill, release, permit exceedence, fire, or vehicle/property damage in excess of $500. All High Loss Potential (Near Miss) incidents are to be investigated.

General Information

Project/Office: If the incident occurs on a delivery order contract, give the contract/program name, DO# and location. If the incident occurs on a C&E field project, give the Office location managing the project as well as the project/location.

Report No.: Optional numbering field for offices/projects.

Supervisor: Supervisor responsible for the work effort involving the incident. Do not give a subcontractor supervisor or craft foreman name. If a Supervisor was the Affected Employee, this field should contain the name of his or her supervisor. The Supervisor is the project supervisor if the incident happens on a project, or the administrative supervisor if the incident happens in the office. E.g., a geologist, acting as an FOL gets injured on a job site, or in a motor vehicle in the course of project work. The Supervisor is most likely the Project Manager. If the same geologist gets injured lifting a box in his office, the Supervisor is likely the Office Science Lead.

Location of Incident: The specific location on the project, in the office, or off-site location.

Weather Conditions: Temperature, precipitation, approximate wind speed and direction, cloud cover, relative humidity. This information may be included in the description section, and must be given in detail whenever it is a factor in the cause or impact., e.g., spill, release, heat stress, wind blown material.

Describe What Happened: This section must be completed in sufficient detail to adequately describe the events and conditions leading up to and resulting from the incident. Try to answer the questions who, what, where, when, and how. This information is then used to determine why (cause). ovide details such as work objective, procedure being used, body position, and PPE. Include diagrams or sketches for all incidents involving vehicles/equipment and other incidents where they aid in providing detail or perspective. attaching photographs. Follow the guidelines in Loss Control Leadership, and consider the impact of the following:

P - People
E - Equipment
M – Material
E – Environment

To do an effective job, a visual inspection of the s usually necessary along with private interviews of employees and witnesses.

Where appropriate, use terms indicating the type of c e.g., struck by; struck against; fall from elevation; fall o level; caught in; caught between or under; caught on: with; overstress; equipment failure: environmental r fire.

Affected Employee Information

ENC Employee: Direct hire, whether profes administrative, or craft; full-time or part-time; perman temporary. If the affected employee is not a FV employee, give the name of the employer and bu relationship (e.g., client, subcontractor) in the descr section above.

Hours Worked on Shift Prior to the Incident: Only in the amount of time the employee worked that shift o prior to the incident.

Years with ENC: For ENC employees, give number of years employed with ENC. If the employe worked for ENC for less than a year, do not write Give the answer in fraction of year, or specify the numb months, e.g., 0.1 or 1 month.

Injury/Illness Information

Nature of Injury or Illness: If the incident resulted i injury or illness, give a brief description of the body affected and type of injury or illness, e.g., fractured thu left hand; carpal tunnel syndrome, right hand.

First Aid Provided: First Aid is any treatment that doe have to be provided by a health care professional, even if E.g., a laceration that is cleaned and bandaged in a clinic constitute first aid, if sutures are not given.

Will the Injury Result In:. Do not delay the report if t information is unknown.

Medical Treatment Information

Was Medical Treatment Provided? Medical treatment is that treatment that must be provided by a licensed medical practitioner, e.g., sutures, prescription medication, etc.

Type of Treatment: This information is important in determining OSHA recordability, since some forms of treatment would not constitute a Recordable case (e.g., one-time administration of prescriptions, negative diagnostic exams). Attach a copy of the treating professional's statement/work release.

Vehicle and Property Damage Information

Vehicle/Property Damaged: For vehicles, indicate VIN and whether it is company owned or leased, business trip rental (Avis) or owned by others.

Description of Damage: Be specific as to the identity of damaged part, location and extent.

Spill and Air Emissions Information

Substance Spilled or Released: For pure substances, list materials by common name/chemical. For wastes, indicate waste code. For mixtures or contaminated media, provide contaminant name, CAS No., concentration.

RQ Exceeded? Reportable quantity. Contact your ESQ representative for guidance. Specify the RQ for the material, whether you answer yes or no.

Reportable to Agency? If yes, specify the federal, state or local agency that must be provided with verbal and/or written notification.

Written Report? Answer yes if the release requires a written report to be filed and note the time frame.

Response Action Taken: Describe the mitigation efforts, as well as any reports made, beyond initial notification.

Permit Exceedence

Type of Permit: List name of permit including the agency name where applicable (e.g., NPDES, PSAPCA NOC)

Date of Exceedence: Specify date exceedence occurred (e.g., date discharge in excess of permit limits occurred)

Date First Knowledge of Exceedence: Specify date when first knew there was an exceedence (i.e., date analytical received). This date may be different from the date of the exceedence listed above.

Permitted Level or Criteria: List numerical disch emission limit or narrative criteria specified in t (e.g., 20% opacity limit. Best Management Practic implementation per SWPPP).

Exceedence Level or Criteria: Specify actual discharge/emission limit or narrative criteria whic exceeded (e.g., 22% opacity, failure of BMPs (sil collapse) per SWPPP)

Exceedence Duration: Specify time frame by date and (using military time) during which exceedence occurr

See **"Spill/Release Information"** (above) for descripti remaining questions.

Persons Preparing Report

Employee's Name: The affected employee desc page 1 should review the report and sign here, as well as employees witnessing or involved in the incident.

Supervisor's Name: The ENC Supervisor mus and sign the report indicating agreement. The Supervisor and the Investigator (next page) should same person.

Investigative Report

Report No.: This is the same as the project/office report number from page 1 of the Incident/Near Miss Rep

Date of Investigative Report: This date should be wi hours of the incident. In cases where the investigation is completed until a later date, submit the incomplete r within the 72 hours, and a revised report should be sub when the missing information is obtained .

Incident Cost: For all vehicle/equipment or property d cases, an estimated or actual loss value must be entered estimated value is entered, the report must be revised when actual costs are known.

OSHA Recordables: This section should be completed consultation with the PESM. If it cannot be determined at time of the report, the PESM should consult with the Dir Health and Safety Programs and revise the report whe determination is made.

No. of Restricted Days: This relates to days of <u>rest work activity</u>, not restrictions on motion or physi capability. If the employee is capable of doing his norm the day after the injury and thereafter, there are no rest days, even if the physician indicates a physical restric does not include the day of the injury.

No. of Days Away from Work: The number of days after the day of the injury that the employee was scheduled to work but could not due to an occupational injury. If the treating physician releases an employee to return to work, but the employee chooses not to come to work, do not count those days. In this case the PESM should contact the Director, Health and Safety Programs.

Cause Analysis

Immediate Causes: Determine the immediate causes, using the example on page 4. If one or more of the examples fits the circumstance, use those words in the cause description. This facilitates statistical analysis of the incident database for program evaluation/modification. However, do not confine your cause determination to the guide words. Explain, e.g., Improper Lifting – employee attempted to lift box by bending at the waist and twisting while lifting. Be sure that the incident description on page 1 is sufficiently detailed to support the causal analysis in this section. An assumption of cause (e.g., improper lifting) from the injury (low back pain) is not acceptable.

Basic Causes: Like the Immediate Causes, use the guide words in the attachment whenever appropriate and explain. For example, improper motivation may be because the correct way takes more time or effort; short cutting standard procedure is tolerated or positively reinforced: or the person thinks there is no personal benefit to always doing the job correctly.

Note: The investigator is encouraged to review the Practical Loss Control Leadership chapters on *Causes and Effects of Loss* and *Accident/Incident Investigation* before doing the causal analysis. As a check, the investigator may refer to the S.C.A.T. Chart available from the PESM.

Remedial Actions: Include all actions taken or those that should be taken to prevent recurrence. Be sure that actions address the causes. For example, training (safety meetings) may be a necessary response for lack of knowledge, but may be inadequate for improper motivation. If completion dates exceed the 72 hours reporting period, a revised report must be submitted when all remedial actions are complete.

Persons Performing Investigation: The primary investigator is the FWENC Supervisor in charge of the work where the incident occurred. Others participating in the investigation, such as the Project Manager, ESS, QC, site engineer, foreman, etc. should also sign the report.

Management Review: The Project or Office Manager and the PESM or office ESC must sign the report indicating their satisfaction with thoroughness of the investigation and the report, and their concurrence that the action items address the identified causes. This constitutes the peer review, and the report, particularly the description. should be clear to not familiar with the project or incident.

DAILY BRIEFING SIGN-IN SHEET

Date: ______________________ Project Name/Location: ______________________

Shift/Department: ______________________ Person Conducting Briefing: ______________________

1. AWARENESS (e.g., special EHS concerns, pollution prevention, recent incidents, etc.):

____

____

____

____

2. OTHER ISSUES (EHS Plan changes, attendee comments, etc.):

____

____

____

3. ATTENDEES (Print Name):

1.	21.
2.	22.
3.	23.
4.	24.
5.	25.
6.	26.
7.	27.
8.	28.
9.	29.
10.	30.
11.	31.
12.	32.
13.	33.
14.	34.
15.	35.
16.	36.
17.	37.
18.	38.
19.	39.
20.	40.

APPENDIX E

NOTICES

- **Work Practices**
- **OSHA Poster**

GENERAL HEALTH AND SAFETY WORK PRACTICES RULES

1. All site personnel must attend each day's Daily Briefing and sign the attendance sheet.

2. Any individual taking prescribed drugs shall inform the FOL/HSO of the type of medication. The FOL/HSO will review the matter with the PHSM and the Corporate Medical Consultant (CMC), who will decide if the employee can safely work on-site while taking the medication.

3. The personal protective equipment specified by the FOL/HSO and/or associated procedures shall be worn by all site personnel. This includes hard hats and safety glasses which must be worn at all times in active work areas.

4. Facial hair (beards, long sideburns or mustaches) which may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.

5. Personnel must follow proper decontamination procedure and shower as soon as possible upon completion of work shift.

6. Eating drinking, chewing tobacco or gum, smoking and any other practice that may increase the possibility of hand-to-mouth contact is prohibited in the exclusion zone or the contamination reduction zone. (Exceptions may be permitted by the PHSM to allow fluid intake during heat stress conditions.)

7. All lighters, matches, cigarettes and other forms of tobacco are prohibited in the Exclusion Zone.

8. All signs and demarcations shall be followed. Such signs and demarcation shall not be removed, except as authorized by the FOL/HSO.

9. No one shall enter a permit-required confined space without a permit and appropriate training. Confined space entry permits shall be implemented as issued.

10. All personnel must follow Hot Work Permits as issued.

11. All personnel must use the Buddy System in the Exclusion Zone.

12. All personnel must follow the work-rest regimens and other practices required by the heat stress program.

13. All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.

14. No person shall operate equipment unless trained and authorized.

15. No one may enter an excavation greater than four feet deep unless authorized by the Competent Person. Excavations must be sloped or shored properly. Safe means of access and egress from excavations must be maintained.

16. Ladders and scaffolds shall be solidly constructed, in good working condition, and inspected prior to use. No one may use defective ladders or scaffolds.

17. Fall protection or fall arrest systems must be in place when working at elevations greater than six feet for temporary working surfaces and four feet for fixed platforms.

18. Safety belts, harnesses and lanyards must be selected by the Supervisor. The user must inspect the equipment prior to use. No defective personal fall protection equipment shall be used. Personal fall protection that has been shock loaded must be discarded.

19. Hand and portable power tools must be inspected prior to use. Defective tools and equipment shall not be used.

20. Ground fault interrupters shall be used for cord and plug equipment used outdoors or in damp locations. Electrical cords shall be kept out of walkways and puddles unless protected and rated for the service.

21. Improper use, mishandling, or tampering with health and safety equipment and samples is prohibited.

22. Horseplay of any kind is prohibited.

23. Possession or use of alcoholic beverages, controlled substances, or firearms on any site is forbidden.

24. All incidents, no matter how minor, must be reported immediately to the Supervisor.

25. All personnel shall be familiar with the Site Emergency Response Plan, which is contained in Section 12 of the HASP.

The above Health and Safety Rules are not all inclusive and it is your responsibility to comply with all regulations set forth by OSHA, the client, PWGC Supervisors, and the FOL/HSO.

APPENDIX F

NYSDOH COMMUNITY AIR MONITORING PLAN

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A minimum penalty of $5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 347-3573
Boston, MA	(617) 565-7164
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 391-5858
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 744-6670
Seattle, WA	(206) 553-5930

Washington, DC
1995 (Reprinted)
OSHA 2203

Robert B. Reich, Secretary of Labor

U.S. Department of Labor

Occupational Safety and Health Administration

Washington, DC 1995 (Reprinted) OSHA 2203

This information will be made available to sensory impaired individuals upon request. Voice phone: (202) 219-8615; TDD message referral phone: 1-800-326-2577

Community Air Monitoring Plan
(Ground Intrusive Activities)

Real-time air monitoring, for volatile compounds and particulate levels at the perimeter of the work area is necessary. The plan must include the following:

- Volatile organic compounds must be monitored at the downwind perimeter of the work area on a continuous basis. If total organic vapor levels exceed 5 ppm above background, work activities must be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings must be recorded and be available for State (DEC & DOH) personnel to review.

- Particulates should be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations. If the downwind particulate level is 150 $\mu g/m^3$ greater than the upwind particulate level, then dust suppression techniques must be employed. All readings must be recorded and be available for State (DEC & DOH) personnel to review.

Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- the organic vapor level 200 ft. downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 ppm over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and if the following levels persist for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect:

- if organic vapor levels are approaching 5 ppm above background.

However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

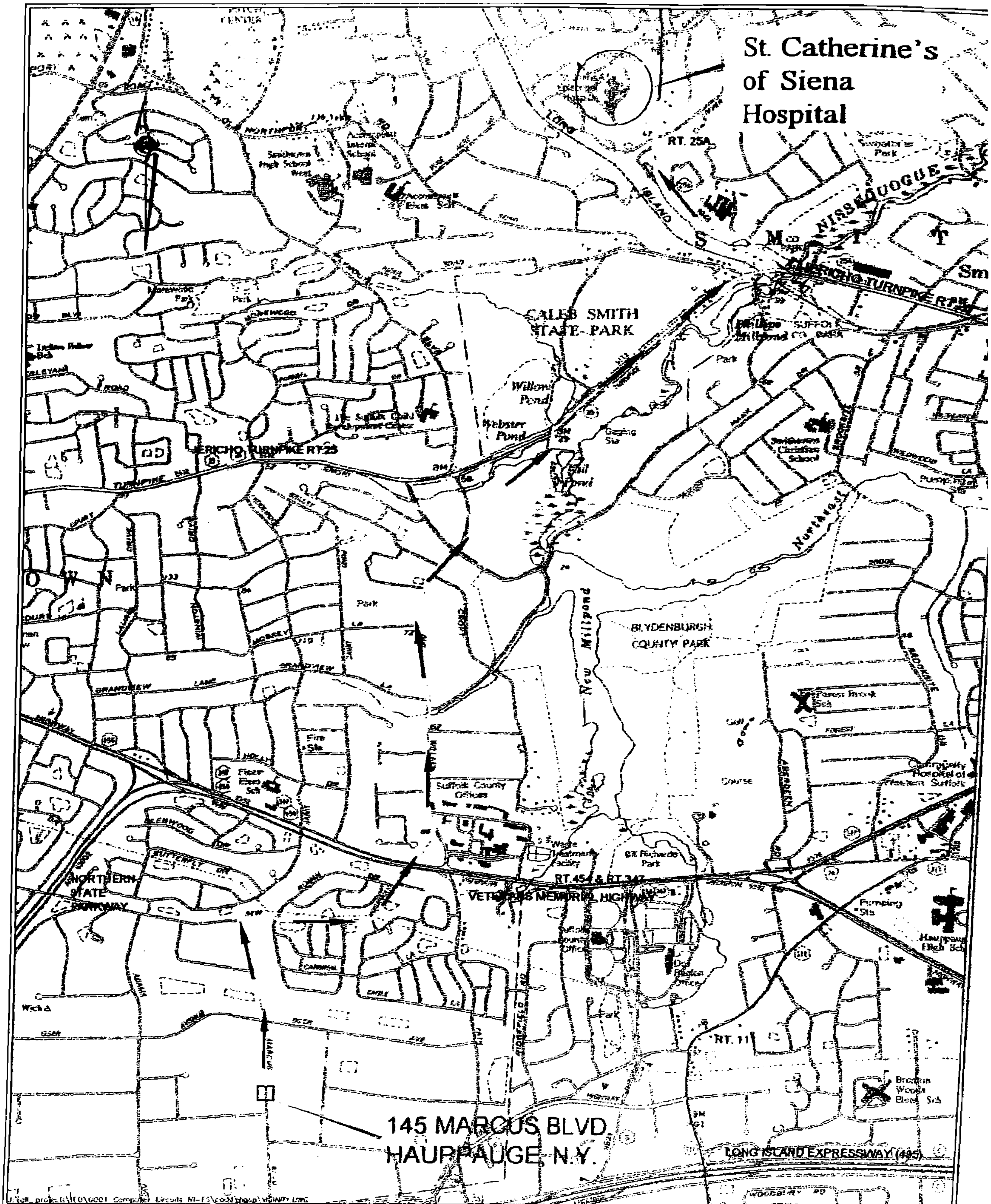
Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts as listed in the Health and Safety Plan of the Work Plan will go into effect.
2. The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30 minutes intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

APPENDIX G

HOSPITAL ROUTE MAP



HOSPITAL ROUTE MAP

FORMER COMPUTER CIRCUITS FACILITY

145 MARCUS BLVD.

HAUPPAUGE, N.Y.

Project	TED0001
	JPR
	LS
	JAK
Date	8/18/00

650 Johnson Ave., Suite 7
Bohemia, N.Y. 11716-2618

ROAD TRIPS Door-to-Door™

145 Marcus Blvd, Hauppauge, NY to Saint Johns Hospital, NY
5.7 Miles ; ~15 Minute(s)

Quickest Route

Driving Directions	Trip Odometer	Drive Time
Start at 145 Marcus Blvd, Hauppauge, NY		
Start on Marcus Boulevard Drive 0.7 miles (~2 mins)	0.7	0:02
Turn right on New Highway Drive 0.7 miles (~2 mins)	1.4	0:04
Turn right on NY 454 (Veterans Memorial Highway) Drive less than 0.1 miles	1.4	0:04
Turn left on Islip Avenue Drive 0.2 miles (~ 1 block)	1.6	0:05
Bear left on Old Willets Path Drive 1.4 miles (~4 mins)	3.1	0:09
Turn right on NY 25 North (Jericho Turnpike) Drive 1.4 miles (~2 mins)	4.5	0:11
Make a sharp left on St Johnland Road Drive 0.9 miles (~3 mins)	5.4	0:14
Make a sharp left Drive 0.3 miles (~ 2 blocks) *Pass by Saint Johns Hospital*	5.7	0:15
End at Saint Johns Hospital, NY	***5.7***	***0:15***

All drive times are approximate.
('~5 mins' indicates you should be on this segment for 'about 5 minutes'.)

This suggested route is based on various data sources and may be incomplete or inaccurate in some cases. The user assumes full liability for any delay, loss, or damage which may occur as a result of its use. Please obey local traffic laws.