SOIL REMOVAL IRM DELINEATION:
STORM WATER CATCH BASIN
WORK PLAN

BROWNFIELD CLEANUP PROGRAM
TOWN AND COUNTRY CLEANERS
2308 AND 2310 MONROE AVENUE
BRIGHTON, NEW YORK
BCP SITE #C828149

Prepared for:	Town and Country Redevelopment LLC 259 LaSalle, Drive Webster, New York
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Project #:	4214S-09
Date	April 2010 (Revised June 18, 2010)

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1.0 INTRODUCTION

DAY Environmental, Inc. (DAY) prepared this Soil Removal IRM Delineation: Storm Water Catch Basin Work Plan (Work Plan) on behalf of Town and Country Redevelopment LLC.

Town and Country Redevelopment LLC has entered the Brownfield Cleanup Program as a Volunteer (Site No.C828149) to evaluate and address environmental conditions on the property located on 2308 and 2310 Monroe Avenue, Town of Brighton, New York (Site). The Site has been operated commercially as a dry cleaning plant and laundry from approximately 1969 to the present, and tetrachloroethene (PCE) is used as a dry cleaning solvent. A project locus map is included as Figure 1.

This Work Plan describes a scope of work intended to delineate and characterize chlorinated solvent impact (i.e., PCE and associated breakdown products) within the subsurface in proximity to the storm water catch basin at the Site (designated herein as Catch Basin #1). It is anticipated that the data generated by this study will provide the necessary information to develop and prepare an Interim Remedial Measure (IRM) work plan for the excavation and off-site disposal of contaminated soil in proximity to Catch Basin #1.

1.1 Background

A sediment sample collected from Catch Basin #1 in April 2009 contained a PCE concentration of 334 parts per million (ppm). A soil sample collected in May 2009 from a depth interval of 4 feet (ft.) to 8 ft. below the ground surface (bgs) in a test boring advanced in proximity of the catch basin contained a PCE concentration of 224 ppm. These concentrations exceed the restricted commercial use soil cleanup objectives (SCO) for PCE of 150 ppm as referenced in 6 NYCRR Subpart 375. The restricted commercial use SCO is judged the most appropriate criteria for the Site. Thus, these findings suggest that PCE may have been discharged into Catch Basin #1 in the past creating a source area of PCE impact to soil, groundwater and potentially soil vapor at the Site.

To date, soil samples have been collected and submitted for analytical laboratory testing from other locations at, and in proximity of the Site. These samples and the analytical laboratory results for these samples are included on Figure 2, and a stratigraphic cross-section showing subsurface conditions encountered in select test borings advanced to date is presented as Figure 3.

2.0 PRELIMINARY CONCEPTUAL MODEL

To date, limited studies have been conducted on the Site and/or adjoining properties. This preliminary Conceptual Site Model describing subsurface conditions, contaminant types, and distribution patterns was developed based upon the limited studies conducted to date.

Overburden Geology

Generally, the ground surface slopes from west to east across the Site and is predominately covered by the building footprint (2,200 square feet) and asphalt pavement that surrounds the building. Heterogeneous fill materials consisting primarily of re-worked sand and gravel extend from the ground surface (i.e., below the asphalt pavement) to depths of approximately 0.5 ft. to 4 ft. bgs. In the area of Catch Basin #1, fill materials extended to a depth of about 5 ft. bgs. A silty sand deposit ranging in thickness from about 1 ft. to 5 ft. underlies the fill materials and overlies an apparently continuous silty clay deposit that was greater than 4 ft. thick in the test borings that have been advanced at the Site. A sandy gravel deposit underlies this silty clay. The thickness of the sandy gravel deposit was not determined.

Bedrock

The test borings advanced during previous studies at and in the vicinity of the Site extended to a maximum depth of 16 ft. bgs and did not encounter bedrock. However, a map produced in 1935 by the Monroe County Regional Planning Board shows bedrock in the area of the Site potentially up to about 30 ft. bgs. The bedrock in the vicinity of the Site is identified as Lockport Dolomite.

Hydrogeology

There are no surface water bodies on or adjoining the Site. In addition, no state- or federally-listed wetlands are located within a ½ mile radius of the Site.

Groundwater was measured at depths of about 3.5 and 6.5 ft. bgs in the monitoring wells currently installed at the Site. Based on previous investigations the regional groundwater flow appears to flow southeast, however, localized groundwater flow at the Site may vary, but it is anticipated to flow predominately to the east.

Contaminants of Concern

The Contaminants of Concern (COC), include PCE and its breakdown products. Specifically, the currently identified COC at the Site include:

- tetrachloroethene (PCE);

- trichloroethene (TCE);
- 1,1-dichlorethene (1,1-DCE);
- trans-1,2-dichlorethene (trans-1,2-DCE);
- cis-1,2-dichloroethene (cis-1,2 DCE); and
- vinyl chloride (VC)

Contaminants of Concern Distribution and Migration

To date, the highest concentrations of COC were measured in samples collected within and in proximity to, the storm water catch basin located in the parking lot northeast of the building at the Site (i.e., Catch Basin #1). Refer to Figure 2 for the location of Catch Basin #1. It is speculated that a waste solvent may have been discharged into this catch basin by some unknown mechanism, and that this catch basin is a source area of the COC detected at the Site.

The silty clay layer encountered approximately 8 ft. to 11 ft. bgs appears to be acting as a confining layer that restricts vertical groundwater flow and COC migration. It appears that the primary route of COC migration is via release into the shallow groundwater within the fill/silty sand above the silty clay layer and migration away from the source area(s) via groundwater flow. Based on the density of the COC, downward vertical migration away from the source area is suspected and higher concentrations of COC are anticipated at the base of the silty sand layer (i.e., above the silty clay). Some preferential flow could also occur along buried utilities and this flow could alter the distribution of COC.

3.0 SCOPE OF WORK

This section presents the proposed scope of work to complete the objectives of this Work Plan. In general, this Work Plan will be completed in accordance with provisions and guidance outlined in the NYSDEC May 2010 document *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10 document).

3.1 COC Delineation Test Borings

To evaluate COC-impact in proximity of Catch Basin #1, DAY will retain the services of a subcontractor to advance test borings using a Geoprobe dual-tube sampling system, or similar. Test borings will be completed in general accordance with the ASTM procedures presented in Appendix A of this document and they will be advanced from the ground surface to the top of the silty clay layer (anticipated to be encountered at a depth of 8 to 12 ft. bgs). In the event evidence of COC-impact [e.g., staining/chemical odors, dense non-aqueous phase liquid (DNAPL) and/or photoionization detector (PID) readings in excess of 2,500 ppm] is measured in soil samples collected above the silty clay layer, the test boring will be terminated as a precautionary measure to preclude contaminant migration through the silty clay layer. If the overlying soil does not contain evidence of COC-impact, the test boring will extend through the silty clay layer and into the top of the sandy gravel unit. It is anticipated that the test borings will be advanced to a maximum depth of 16 ft. bgs; however, if evidence of COC-impact (e.g., staining, elevated PID readings, etc.) is detected at 16 ft bgs, the test borings will be advanced until evidence of COC-impact is not identified or to the extent possible using the sampling techniques described herein to define the vertical extent of impact. It is anticipated that between 10 and 15 test borings will be advanced during this program.

A DAY representative will observe the soil samples recovered from the test borings in order to develop a stratigraphic description of the subsurface conditions and to evaluate the samples for evidence of suspect contamination (e.g., staining, unusual odors, etc.). Portions of the soil samples will be screened with a MiniRae 2000 PID equipped with a 10.6 eV lamp for evidence of volatile organic compound (VOC) impact in accordance with the procedures outlined in Appendix A. The subsurface conditions at each test boring will be documented on test boring logs, which will include:

- Date, boring identification, and project identification;
- Name of individual preparing the log;
- Name of drilling contractor;
- Drill make and model;
- Identification of alternative drilling methods used and justification thereof;
- Depths recorded in feet and fractions thereof referenced to ground surface;
- The length of the sample interval and the percentage of the sample recovered;
- The depth of the first encountered water table referenced to ground surface;
- Drilling and borehole characteristics;
- Sequential stratigraphic boundaries; and
- Field screening results.

Initially, test borings designated D-1 through D-5 will be advanced in the locations depicted on Figure 2. These test borings will be placed at an approximate radius of 10 ft. from Catch Basin #1. Test boring D-5 will be positioned in proximity of the discharge piping that exits Catch Basin #1 to evaluate preferential flow that could be occurring along the piping leading to Catch Basin #2. The samples collected from the initial five test borings will be evaluated in the field for indications of impact (i.e., olfactory, staining, elevated PID measurements, etc). The results of this monitoring will be used to select the location for additional test borings. In the event evidence of field impact is detected in the initial test borings additional test borings will be advanced at an approximate 20 ft. radius from Catch Basin #1 in the direction(s) in which impact was identified. In the event evidence of field impact is detected in these test borings, additional test borings will be advanced at approximate 20 ft. intervals until the Site boundary or other obstruction (e.g., the building located at the Site) is reached, or further evidence of impact is not observed.

Alternatively, if evidence of impact is not identified in the initial test borings, subsequent locations will be selected nearer to the Catch Basin #1 or offset from the initial test borings to evaluate the potential presence of a narrow plume of COC impact.

Cuttings from each test boring will be placed on polyethylene sheeting adjacent to each test boring as they are generated. If no evidence of potential impact is observed during the field screening, the cuttings will be placed in a New York State Department of Transportation (NYSDOT) approved 55-gallon drum, labeled accordingly, and this material will be used as backfill material during the subsequent IRM. If evidence of potential impact is observed during field screening, the drill cuttings will be transferred from the polyethylene sheeting and stored on-site in separate secured and labeled NYSDOT approved 55-gallon drums. Potentially, impacted materials will subsequently be characterized and disposed in accordance with applicable regulations or disposed of in conjunction with the soil removed as part of the IRM excavation. Upon completion, boreholes will be sealed with a bentonite/grout mixture, which will be tremied in place as the down hole equipment is withdrawn.

3.2 Analytical Laboratory Testing Program

Soil samples collected from the test borings will be delivered under chain-of-custody control to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory for possible testing.

For each test boring advanced, the sample containing the greatest evidence of COC impact (i.e., highest PID reading, staining, odor) collected above the silty clay layer will be submitted to the analytical laboratory. If no evidence of impact is observed in the test boring, a sample collected from just above the silty clay layer will be submitted for testing. If the test boring is advanced through the silty clay layer a second sample will be collected from the underlying sand and gravel deposit. If no apparent evidence of impact is determined, a sample collected from the bottom of the test boring (i.e., from a depth of 16 feet bgs) will be submitted to the analytical laboratory, otherwise the sample from the sand and gravel exhibiting the highest level of COC-impact will be submitted for testing.

In test borings containing evidence of COC-impact, select samples from the soil above the COC-impacted soil that does not exhibit evidence of field impact will also be submitted to the analytical laboratory for the purpose of delineating 'clean' soil that can be re-used during IRM activities.

Initially, the "worst case" samples collected from test borings D-1 through D-5 (or samples collected from a position immediately above the silty clay and the bottom of the test borings, if no apparent COC-impact is detected) will be tested for halogenated VOCs via USEPA Method 8260. Other samples collected during this process will be submitted to the analytical laboratory and preserved under "active hold" conditions allowing them to be tested at a later date (but within the 14 day holding time).

In the event evidence of impact is detected within the silty clay layer, a "worst case" sample from the silty clay will also be submitted for analytical laboratory testing.

Following receipt of the analytical laboratory test results (i.e., expected within five business days of submittal to the analytical laboratory), select samples that were placed on active hold may be tested to supplement the test results described above. In addition, two composite samples of COC-impacted samples will be tested for waste characterization purposes. These samples will be tested for halogenated VOCs using USEPA Method 8260 Resource Conservation and Recovery Act (RCRA) metals using USEPA Method 6010; Flashpoint using USEPA Method 1010; and pH using USEPA Method 9040.

The anticipated analytical laboratory testing program is summarized on Table 1 of this document.

3.3 Data Package

DAY will prepare a data package summarizing the findings of the work completed during these delineation studies. This data package will include: a brief summary of the work completed; a figure depicting test boring locations; data tables; analytical laboratory reports; test boring logs; and conclusions and recommendations, as warranted. Additional information associated with vertical and horizontal COC distribution within the subsurface, IRM excavation limits, etc. will be presented in the IRM work plan. To the extent possible, PID measurements will be correlated to halogenated VOC concentrations so that this information can be used during the subsequent IRM as guidance in the determination of the amount of soil requiring removal.

4.0 HEALTH AND SAFETY PLAN

A copy of the Health and Safety Plan (HASP) to be implemented during the work described herein is included in Appendix B. This HASP includes a community air monitoring plan (CAMP), which will comply with the requirements of Appendix 1A of the May 2010 DER-10 document. The CAMP will be implemented during the test boring program.

5.0 QUALITY ASSURANCE

Procedures will be implemented to assure the quality of the samples collected and tested during this evaluation.

Sample Designations

The samples collected will be given unique sample identification. The sample name will include an identifier for the Town and Country Cleaners (TCC) Site, sample location, and sample depth for soil samples. For example, a soil sample collected from a depth of 1.5 feet in test boring D-1 would be given the designation TCC-D1 (1.5').

Sample Handling and Analysis

Samples collected for possible analysis will be placed directly into laboratory-provided sample containers and immediately after collection placed in a cooler to be held at a temperature of approximately 4°C until delivery to the laboratory. Samples will be labeled with the sample designation described above and the initials of the person collecting the sample. Each sample will be tracked by means of a Chain-of-Custody form that will be initiated at the time of sample collection and will be maintained with the sample until delivery to the laboratory.

Quality Assurance/Quality Control Samples

A standard data package will be prepared for the analytical laboratory data generated. Confirmatory field Quality Assurance/Quality Control (QA/QC) samples (i.e., trip blanks, field blanks and duplicate samples) will not be prepared by the laboratory or collected as part of the testing program outlined in this Work Plan.

Field Equipment Procedures and Preventative Maintenance

Prior to the initiation, preventive maintenance and calibration of equipment will be implemented to assure proper operation of field instruments. Members of the field team will be familiar with the maintenance, calibration, and operation of field equipment. The field equipment will be used according to manufacturer instructions.

Equipment Decontamination Procedures

It is anticipated that many of the materials used to assist in obtaining samples will be disposable one-time use materials (e.g., sampling containers, plastic trowels, latex gloves, etc.). However, decontamination of re-useable field equipment will be conducted to ensure that the data collected (i.e., analytical laboratory data and field screening data) is acceptable. When equipment must be re-used (e.g., static water level indicator, macrocore samplers, drilling rods, shovel, etc.), it will be decontaminated by at least one of the following methods:

- Steam clean the equipment; or
- Rough wash in tap water; wash in mixture of tap water and Alconox®-type soap; double rinse with de-ionized or distilled water; and air dry and/or dry with clean paper towel.

In order to reduce the potential for cross-contamination of samples during this project, re-useable field instrumentation, sampling equipment, heavy equipment, drilling equipment, etc. must arrive on-site in clean condition and must also leave the Site in clean condition. Equipment that arrives on-site and is not clean will not be allowed on-site.

Decontamination liquids and disposable equipment and Personal Protective Equipment (PPE) will be containerized, temporarily staged on-site (preferably inside a building). These materials will subsequently be characterized and disposed in accordance with applicable regulations.

6.0 SCHEDULE

It is anticipated that the test borings can be completed within one week of the authorization to proceed (depending upon the availability of drilling subcontractors). A report summarizing the work completed will be submitted within four weeks of the notice to proceed.

TABLES

Table 1

Sampling and Analysis Summary

Soil Removal IRM Delineation: Storm Water Catch Basin Work Plan

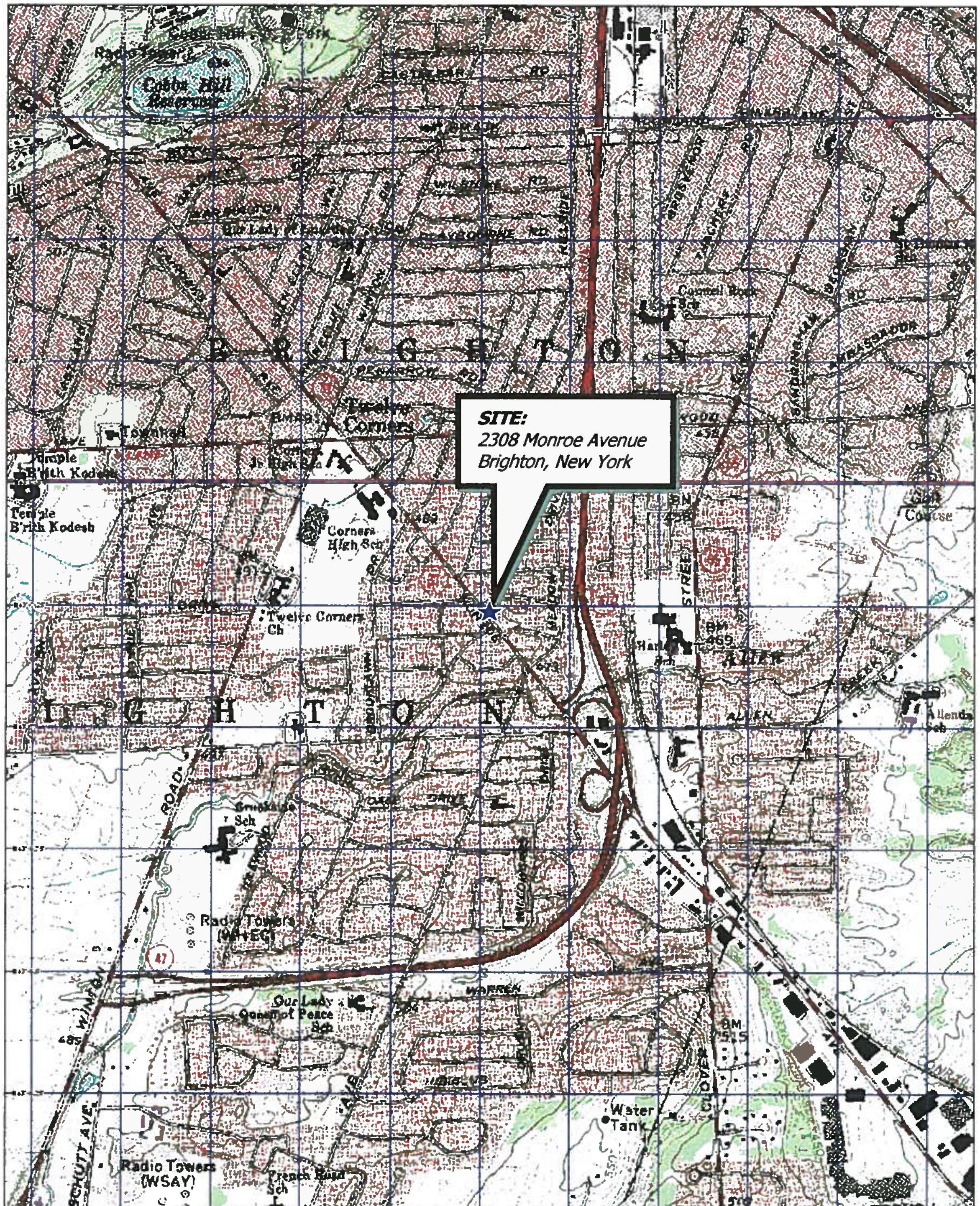
Town and Country Cleaners BCP Site No. C828149

Task	Media	Test Parameter and Method	Sample Type and Number				Total Number of Samples	Data Package
			Test Sample	Trip Blank	Field Blank	MS/MSD		
IRM Delineation Samples "collected above the silty clay layer"	Soil	Halogenated VOCs USEPA 8260	10	0	0	0	10	Standard
IRM Delineation Samples "collected below the silty clay layer"	Soil	Halogenated VOCs USEPA 8260	10	1	1	1	13	Category B
IRM Delineation "silty clay samples"	Soil	Halogenated VOCs USEPA 8260	5	1	1	1	8	Category B
IRM Delineation "suspected clean soil"	Soil	Halogenated VOCs USEPA 8260	4	0	0	0	4	Standard
Waste Characterization	Soil (Composite)	Halogenated VOCs, RCRA Metals Reactivity/Corrosivity	2	0	0	0	2	Category B

Notes:

1.) The number of test samples identified in the above table is based on the assumption that a total of ten test borings will be advanced and that a minimum of two samples will be from each test boring (i.e., one sample above the silty clay layer and one sample below the silty clay layer) will be submitted for analytical laboratory testing.

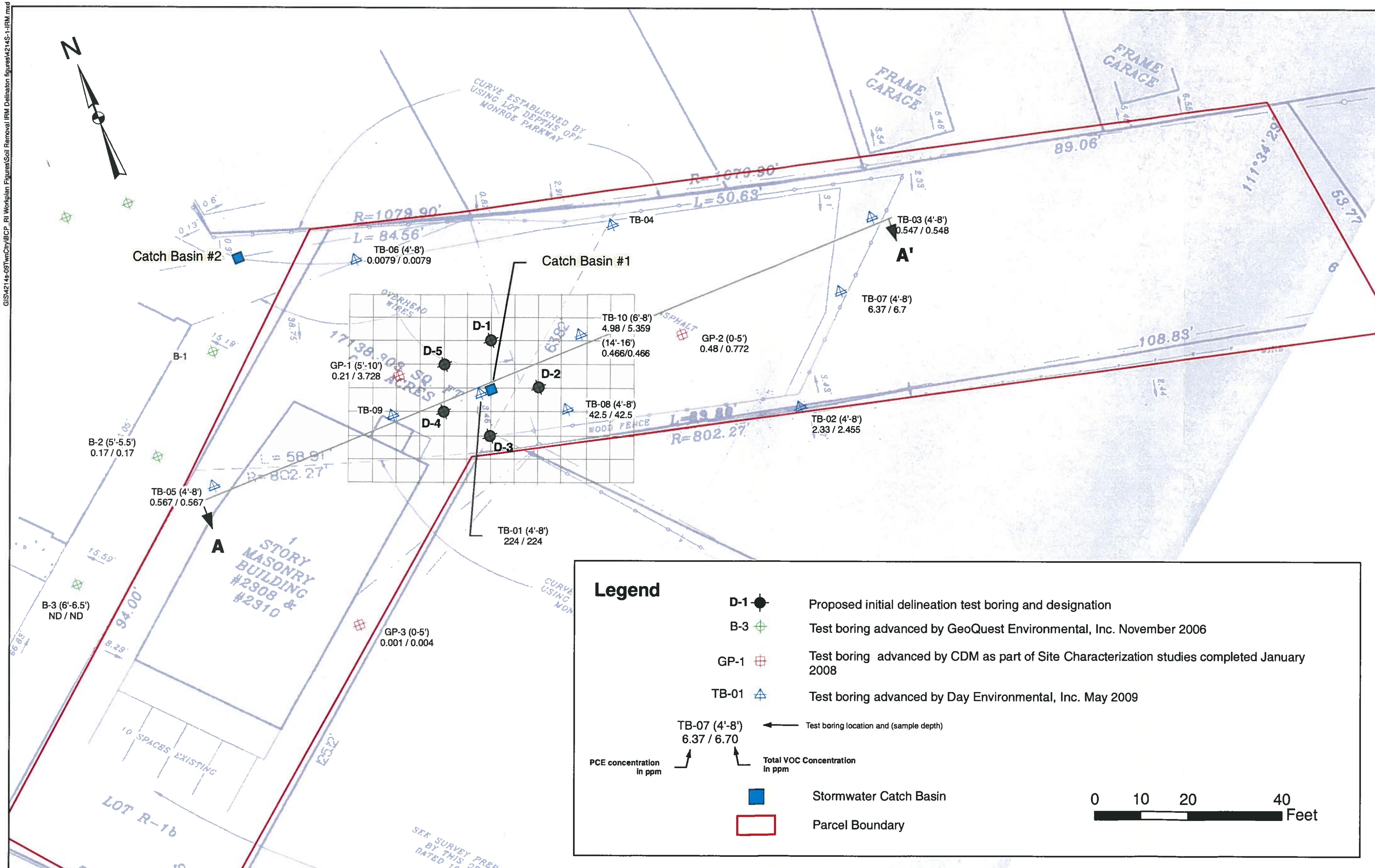
Figures



550 ft Scale: 1 : 19,200 Detail: 14-0 Datum: WGS84

Drawing Produced From: 3-D TopoQuads, DeLorme Map Co., referencing USGS quad maps Pittsford (NY) 1995 and Rochester East (NY) 1995. Site Lat/Long: N43° 7.24' – W77° 33.47'

DATE 4/20/2010 DRAWN BY RJM SCALE 1" = 2000'	**DAY ENVIRONMENTAL, INC.** ENVIRONMENTAL CONSULTANTS ROCHESTER, NEW YORK 14614-1008 NEW YORK, NEW YORK 10165-1617	PROJECT TITLE **2308 MONROE AVENUE BRIGHTON, NEW YORK** **HEALTH AND SAFETY PLAN** DRAWING TITLE **PROJECT LOCUS MAP**	PROJECT NO. **4214S-09** **FIGURE 1**



NOTE:

Test borings and Monitoring Wells were located using a Trimble XH GPS Unit with sub-foot accuracy or by reference to existing Site features.. In addition the data was differentially corrected to increase accuracy. Locations are to be considered approximate.

Site plan overlay obtained from a figure prepared by O'neill - Rodak Land Surveying Associates, P.C., dated January 2, 2002.

Parcel boundary provided by Monroe County, dated 2008.

Date 06-15-2010

Drawn By CPS

Scale AS NOTED

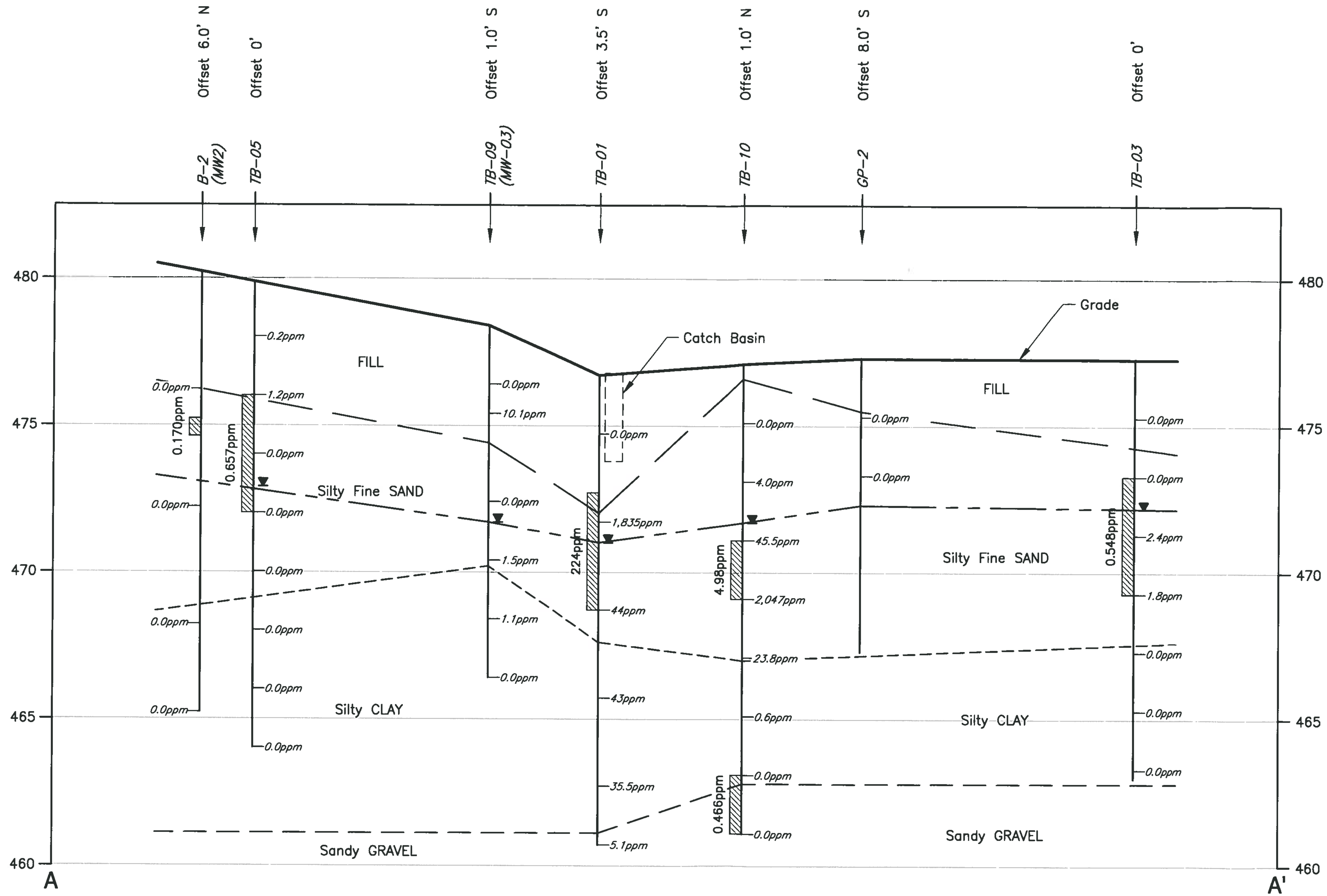
Project Title
2308 AND 2310 MONROE AVENUE
BRIGHTON, NEW YORK
BROWNFIELD CLEANUP PROGRAM REMEDIAL WORK PLAN

Drawing Title
Site Plan / Proposed Delineation Test Borings

day
DAY ENVIRONMENTAL, INC.
Environmental Consultants
Rochester, New York 14614-1008
New York, New York 10165-1617

Project No.
4214S-09

Figure 2



CROSS SECTION A–A'

HORZ. SCALE: 1" = 20'
VERT. SCALE: 1" = 4'

NOTES:

Refer to Figure 2 for Location and Orientation of Cross Section

LEGEND

▼	Approximate Groundwater Elevation Estimated Based Upon Measurements Made By DAY on May 14, 2009 During the Advancement of Test Borings
35.5ppm	Peak Photoionization Detector (PID) Reading Recorded In Part Per Million (ppm)
224ppm	PCE Concentration Recorded In Parts Per Million (ppm) By Analytical Laboratory
▨	Interval Of Sample Analyzed By Laboratory

Ref1: Section A-A.dwg
Ref2:
Ref3:

Xerox432AnsiB-2; 11 x 17
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Pen Setting File: 800psFullcolor.ctb

Time Plotted: Tuesday, June 15, 2010 1:27:53 PM
File Name: U:\McPhee\Drawings\TwnCtry\4214S-09\Cross Section A-A.dwg

FIELD VERIFIED BY: CAH	DATE: 1-2010
DRAWN BY: RJM	DATE DRAWN: 1-8-2010
SCALE: As Noted	DATE ISSUED: 5-7-2010

day
DAY ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTANTS
ROCHESTER, NEW YORK 14614-1008
NEW YORK, NEW YORK 10016-0710

PROJECT TITLE
2308 AND 2310 MONROE AVENUE BRIGHTON, NEW YORK
Brownfield Cleanup Program Remedial Investigation Work Plan

DRAWING TITLE
Cross Section A-A'

PROJECT NO.
4214S-09

FIGURE 3

APPENDIX A

STANDARD OPERATING PROCEDURES, ASTM METHODS AND FIELD/SAMPLING FORMS

DAY STANDARD OPERATING PROCEDURES
(SOPs)

STANDARD OPERATING PROCEDURE
HEADSPACE SCREENING: SOIL SAMPLES

This document provides procedures to be used by Day Environmental, Inc. (DAY) to complete field screening of soil samples using a photoionization detector (PID) or a flame ionization detector (FID).

Field Screening Procedure

1. Perform PID or FID instrument calibration in accordance with the manufacturer's requirements. Record calibration results, including the date/time of calibration, in a bound field book. In the event contaminant types/concentrations change during the field day, the PID/FID malfunction or other such occurrences, the equipment should be re-calibrated and the results summarized in the field book.

2. Use a new self-sealing quart-size polyethylene freezer bag (or a sandwich-size bag depending on the size of sample) for each test. Half-fill the bag with a soil sample to be tested (the volume ratio of sample to air within the bag should be approximately equal), then immediately seal the bag. Manually break up the soil sample within the bag. [Note: The test sample should be placed into the bag immediately after opening the split spoon or direct-push sample liner. Soil samples from test pits or stockpiles should be obtained from freshly exposed surfaces.]

3. Allow the headspace to equilibrate for at least 10 minutes at approximate room or ambient air temperature (if above 32° Fahrenheit). Vigorously shake the bag and break up the soil sample for 15 seconds at the beginning and end of the equilibration period. Release of volatile vapors from soil decreases with temperature. When the air temperature is below 32° Fahrenheit, the sample should be allowed to equilibrate within a heated vehicle or building. Record the date/time of headspace screening in the field book. <u>The headspace analysis should be completed within 20 minutes of sample collection.</u>

4. After the headspace sample has been prepared, introduce the PID or FID probe through a small opening in the bag to the approximate mid-point of the headspace. Keep the probe free of water droplets and soil particles.

5. Record the highest PID or FID meter response on the test boring/test pit log (or within a field book if no log is generated). The maximum response typically occurs within about two seconds. Erratic meter response readings may occur if high organic vapor concentrations or moisture is present. Note any erratic headspace data in the field book, as this information could indicate that the headspace readings are questionable. **Do not collect samples for analytical laboratory testing from the polyethylene bag.**

Standard Operating Procedure for Soil Classification

This document presents the soil classification system to be used by Day Environmental, Inc. (DAY) to describe soil samples collected from test borings and test pits or other appropriate sample collection methodologies.

Classification System

Soil samples are to be described based primarily upon their gradation characteristics and plasticity with additional information provided to describe unique characteristics, such as, evidence of suspect contamination (e.g., unusual odor, staining, etc.) and other physical characteristics of the soil (e.g., moisture content, color, soil structure, etc.).

The first step is to estimate the major constituent of the material and the relative percentages of the lesser soil fractions. [Note: In the description for indigenous soils, the major constituent (or constituents when using "and") is written entirely in capitals, while only the first letter of minor constituents are capitalized.] The relative percentages of the lesser sizes are described by "some", "little" and "trace". If the material being classified is a fill, the first letter of each of the individual components is capitalized and at the end of the description the material is denoted as "FILL".

In this system, it is recognized that it is impossible to determine the gradation of fines (i.e., silt and clay). Thus, no attempt is made to express the relative amount of silt and clay sizes present in the fines. Rather the fine material is classified based upon plasticity to describe the material. The description "silty clay" does not mean 70% clay size particles and 30% silt size particles, but that the fines have a plasticity index which is indicative of silty clay. In this soil classification system, the relative amounts of fine grained soil are described similarly to granular soils. For example, if the material is primarily a silty clay with about 20% fine sand the description would be written "Silty CLAY, little fine Sand". Similarly if the material is primarily a fine sand with about 10 % silty clay the description would be written as " fine SAND, trace Silty Clay".

In addition to the gradation and plasticity characteristics, the description should include pertinent adjectives to define the material. In general, adjectives describing consistency, color and grain size range should precede the soil component name, while further details, such as plasticity, mineralogy, structure, moisture content and contaminant characteristics should follow the main body of the identification.

<u>Example</u>

Medium-dense, red-brown, fine to coarse SAND, little fine Gravel, trace Clayey Silt, wet. Slight overall plasticity, sand subangular, slight petroleum odor.

Guide for the Description of Soils

This guide describes the soil description system to be used by DAY personnel in the field. It is based primarily upon visual observations and field measurements and it can be refined to include additional site-specific data or test results. The format described herein should be used as the basis of the soil description system.

Description of Soils

Samples should be described using the following format and order:

1. Density or Consistency (based upon a standard penetration test or observation)

Density descriptions are used for soils in which the major component is a granular soil (i.e., non-cohesive silt, sand and gravel). The table below is based upon blow counts from the Standard Penetration Test (SPT).

SPT Blows/Foot	Density
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
50+	Very Dense

Consistency descriptions are used to describe fine grained (cohesive) soils. The table below is based upon SPT and physical tests (provided a SPT is not completed).

SPT Blow/Foot	Consistency	Physical Test
0-2	Very Soft	Extrudes between fingers when squeezed
2-4	Soft	Molded by light finger pressure
4-8	Medium Stiff	Molded by strong finger pressure
8-15	Stiff	Indented by thumb with effort
15-30	Very Stiff	Indented by thumb with difficulty
30+	Hard	Knife required to indent

2. Color

Simple color descriptions should be used such as the primary colors, a combination of them or shades (e.g., light, dark). Avoid the use of exotic colors (e.g., purple, chartreuse, etc.) and extensive color descriptions (e.g., light to dark gray-brown, red etc.). Also distinguish between the soil color and staining, since staining implies a secondary reaction such as the introduction of contamination (e.g., red-brown stained black).

3. Grain Size

A granular soil is further defined by its grain size distribution. Generally, these sizes are based upon standard sieve sizes and the range of particle sizes as follows.

Material	Sieve Size
Boulder	Larger than 12 inches
Cobble	3 inches to 12 inches
Gravel – coarse	¾ inch to 3 inches
Gravel – fine	No. 4 to ¾ inch
Sand – coarse	No. 10 to No. 4
Sand – medium	No. 4 to No. 40
Sand – fine	No. 40 to No. 200
Silt and Clay	Less than No. 200

In test boring samples, the maximum size of the material that can be collected is limited. As such, descriptions of the amount of coarse gravel, cobbles and boulders must be take the sample collection procedure into account. The determination of the size and amount of 'larger" granular deposits is best done via test pit explorations.

A fine grained soil is described by its plasticity as follows:

Material	Degree of Plasticity	Smallest Diameter of Threads
SILT	Non-Plastic	None
Clayey SILT	Slight	¼ inch
SILT & CLAY	Low	1/8 inch
CLAY & SILT	Medium	1/16 inch
Silty CLAY	High	1/32 inch
CLAY	Very High	1/64 inch

An organic soil is classified by its soil structure.

Material	Description
TOPSOIL	Surfical soils (or an original layer potentially buried beneath a layer of fill) that supports plant life and, which contains organic matter (e.g., roots)
PEAT `	Deposits of plant remains in which the original plant fibers may be visible

4. Major Soil Type

For indigenous soils, the major soil component (i.e., greater than 50 % by weight) is written with upper case letters for granular soil (e.g., SAND, GRAVEL) and a combination of upper and lower case letters for fine grained soils (e.g., Silty CLAY, Clayey SILT) or all upper case letters if the amount of silt and clay is judged to be approximately the same (e.g., CLAY and SILT).

Fill material is described by its major component(s) and additional significant components. Only the first letter of each fill component is capitalized, but the word "FILL" (all upper case letters) follows the sample description to denote the material was not placed by natural processes.

5. Minor Constituents

Minor constituents follow the major soil type in order of decreasing percentages. These are described by the following:

0 –10 %	trace
10 – 20 %	little
20 – 35 %	some
35 – 50 %	and

Each minor constituent has the first letter capitalized (e.g., trace Gravel).

6. Moisture Content

The moisture content of the soil/fill sample is described by the following:

Damp	Moisture is not apparent, sample appears dusty
Moist	No visible water
Wet	Visible free water

Groundwater level measurements taken in test boring/test pits should include the date and time of measurement as the readings may have been taken before equilibrium has been reached and the level shown may or may not be representative.

7. Special Components

This will include descriptions of soil structure produced by deposition of sediments as shown below.

Stratified	Random soil deposits of varying components or color
Varved	Alternating soil deposits of varying thickness (i.e., clays and silts)

Stratum	Soil deposit >12 inches thick
Layer	Soil deposit 3 inches to 12 inches thick
Seam	Soil deposit 1/8 inch to 3 inches thick
Parting/Lens	Soil deposit <1/8 inch thick

The special components will also include a description of suspect contamination. This discussion should be presented in the following order.

Evidence of staining (e.g., black staining with stained interval defined)

Unusual odors, which should generally be limited to chemical or petroleum odors unless additional information is known to define the type of odor (e.g., diesel fuel, weathered gasoline, etc.). Limit the use of "organic" odor to the description of decaying vegetation and qualify this description as follows: organic odor (decaying vegetation)

The presence of free product should be carefully described and qualified. For example, describe if the free product was observed on the sample device, within the sample and the apparent depth/interval of the product. Also, describe the physical appearance of the product (e.g., globules, streaks within partings, etc.). Care should be exercised when describing the presence of free product on boring logs.

Color changes attributable to contamination should be identified with depth and interval of occurrence. For example, weathered gasoline contamination can change the soil to an olive green and gray soils may suggest anaerobic conditions due to an abundance of microbes reacting to contaminants.

ASTM Methods

Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations[1]

This standard is issued under the fixed designation D 6282; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide addresses direct push soil samplers, which also may be driven into the ground from the surface or through prebored holes. The samplers can be continuous or discrete interval units. Samplers are advanced by a combination of static push, or impacts from hammers, or vibratory methods, or a combination thereof, to the depth of interest. The guide does not cover open chambered samplers operated by hand such as augers, agricultural samplers operated at shallow depths, or side wall samplers. This guide does not address single sampling events in the immediate base of the drill hole using rotary drilling equipment with incremental drill hole excavation. Other sampling standards, such as Test Methods D 1586 and D 1587 and Practice D 3550 apply to rotary drilling activities. This guide does not address advancement of sampler barrel systems with methods that employ cuttings removal as the sampler is advanced. Other drilling and sampling methods may apply for samples needed for engineering and construction applications.

1.2 Guidance on preservation and transport of samples, as given in Guide D 4220, may or may not apply. Samples for chemical analysis often must be subsampled and preserved for chemical analysis using special techniques. Practice D 3694 provides information on some of the special techniques required. Additional information on environmental sample preservation and transportation is available in other references (**1, 2**).[2] Samples for classification may be preserved using procedures similar to Class A. In most cases, a direct push sample is considered as Class B in Practice D 4220 but is protected, representative, and suitable for chemical analysis. The samples taken with this practice do not usually produce Class C and D (with exception of thin wall samples of standard size) samples for testing for engineering properties, such as shear strength and compressibility. Guide D 4700 has some information on mechanical soil sampling devices similar to direct push techniques, however, it does not address most direct push sampling methods. If sampling is for chemical evaluation in the Vadose Zone, consult Guide D 4700 for any special considerations.

1.3 Field methods described in this guide, include the use of discreet and continuous sampling tools, split and solid barrel samplers and thin walled tubes with or without fixed piston style apparatus.

1.4 Insertion methods described include static push, impact, percussion, other vibratory/sonic driving, and combinations of these methods using direct push equipment adapted to drilling rigs, cone penetrometer units, and specially designed percussion/direct push combination machines. Hammers providing the force for insertion include drop style, hydraulically activated, air activated and mechanical lift devices.

1.5 Direct push soil sampling is limited to soils and unconsolidated materials that can be penetrated with the available equipment. The ability to penetrate strata is based on hammer energy, carrying vehicle weight, compactness of soil, and consistency of soil. Penetration may be limited or damage to samplers and conveying devices can occur in certain subsurface conditions, some of which are discussed in 5.5. Successful sample recovery also may be limited by the ability to retrieve tools from the borehole. Sufficient retract force must be available when attempting difficult or deep investigations.

1.6 This guide does not address the installation of any temporary or permanent soil, ground water, vapor monitoring, or remediation devices.

1.7 The practicing of direct push techniques may be controlled by local regulations governing subsurface penetration. Certification, or licensing requirements, or both, may need to be considered in establishing criteria for field activities.

1.8 The values stated in SI units are to be regarded as standard: however, dimensions used in the drilling industry are given in inch-pound units by convention. Inch-pound units are used where necessary in this guide.

1.9 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

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[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigation.

Current edition approved Jan. 1, 2005. Published February 2005. Originally approved in 1998. Last previous edition approved in 1998 as D 6282–98.

[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

1.10 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a projects's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:* [3]

D 653 Terminology Relating to Soil, Rock and Contained Fluids
D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils
D 1587 Practice for Thin-Wall Tube Sampling of Soils
D 2488 Practice for Description and Identification of Soils (Visual-Manual Method)
D 3550 Practice for Ring-Lined Barrel Sampling of Soils
D 3694 Practices for Preparation of Sample Containers and for Preservation of Organic Constituents
D 4220 Practices for Preserving and Transporting Soil Samples
D 4700 Guide for Soil Sampling from the Vadose Zone
D 5088 Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites
D 5092 Practice for Design and Installation of Ground Water Monitoring Wells in Acquifers
D 5299 Guide for Decommisioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
D 5434 Guide for Field Logging of Subsurface Explorations of Soil and Rock
D 6001 Guide for Direct-Push Water Sampling for Geoenvironmental Investigations

3. Terminology

3.1 *Definitions*—General definitions for terminology used in this guide are in accordance with Terminology D 653. Definitions for terms related to direct push water sampling for geoenvironmental investigations are in accordance with Guide D 6001.

3.1.1 *assembly length, n*—length of sampler body and riser pipes.

3.1.2 *borehole, n*—a hole of circular cross-section made in soil or rock.

3.1.3 *casing, n*—pipe furnished in sections with either threaded connections or bevelled edges to be field-welded, which is installed temporarily or permanently to counteract caving, to advance the borehole, or to isolate the interval being monitored, or combination thereof.

3.1.4 *caving/sloughing, n*—the inflow of unconsolidated material into an unsupported borehole that occurs when the borehole walls lose their cohesive strength.

3.1.5 *decontamination, n*—the process of removing undesirable physical or chemical constituents, or both, from equipment to reduce the potential for cross-contamination.

3.1.6 *direct push sampling, n*—sampling devices that are advanced into the soil to be sampled without drilling or borehole excavation.

3.1.7 *extension rod, n*—hollow steel rod, threaded, in various lengths, used to advance and remove samplers and other devices during direct pushing boring. Also known as *drive rod.* In some applications, small diameter solid extension rods are used through hollow drive rods to activate closed samples at depth.

3.1.8 *incremental drilling and sampling, n*—insertion method where rotary drilling and sampling events are alternated for incremental sampling. Incremental drilling often is needed to penetrate harder or deeper formations.

3.1.9 *percussion driving, n*—insertion method where rapid hammer impacts are performed to advance the sampling device. The percussion normally is accompanied with the application of a static down-force.

3.1.10 *push depth, n*—the depth below a ground surface datum to which the lower end, or tip, of the direct-push sampling device is inserted.

3.1.11 *sample interval, n*—defined zone within a subsurface strata from which a sample is gathered.

3.1.12 *sample recovery, n*—the length of material recovered divided by the length of sampler advancement and stated as a percentage.

3.1.13 *soil core, n*—cylindrical shaped specimen of sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter recovered from a soil sampler.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *closed barrel sampler, n*—a sampling device with a piston or other secured device that is held to block the movement of material into the barrel until the blocking device is removed or released. Liners are required in closed barrel samplers. Also may be referred to as a *protected type sampler.*

3.2.2 *impact heads/drive heads, n*—pieces or assemblies that fit to top of the above ground portion of the direct push tool assembly to receive the impact of the hammering device and transfer the impact energy to sampler extensions.

3.2.3 *open barrel sampler, n*—sampling barrel with open end allowing material to enter at any time or depth. Also may be referred to as an *unprotected type sampler.*

3.2.4 *piston lock, n*—device to lock the sampler piston in place to prevent any entry of a foreign substance into the sampler chamber prior to sampling.

3.2.5 *single tube system, n*—a system whereby single extension/drive rods with samplers attached are advanced into the subsurface strata to collect a soil sample.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.2.6 *solid barrel sampler, n*—a soil sampling device consisting of a continuous or segmented tube with a wall thickness sufficient to withstand the forces necessary to penetrate the strata desired and gather a sample. A cutting shoe and a connecting head are attached to the barrel.

3.2.7 *split barrel sampler, n*—a soil sampling device consisting of the two half circle tubes manufactured to matching alignment, held together on one end by a shoe and on the other by a connecting head.

3.2.8 *two tube systems, n*—a system whereby inner and outer tubes are advanced simultaneously into the subsurface strata to collect a soil sample. The outer tube is used for borehole stabilization. The inner tube for sampler recovery and insertion.

4. Summary of Guide

4.1 Direct push soil sampling consists of advancing a sampling device into subsurface soils by applying static pressure, by applying impacts, or by applying vibration, or any combination thereof, to the above ground portion of the sampler extensions until the sampler has been advanced to the desired sampling depth. The sampler is recovered from the borehole and the sample removed from the sampler. The sampler is cleaned and the procedure repeated for the next desired sampling interval. Sampling can be continuous for full depth borehole logging or incremental for specific interval sampling. Samplers used can be protected type for controlled specimen gathering or unprotected for general soil specimen collection.

5. Significance and Use

5.1 Direct push methods of soil sampling are used for geologic investigations, soil chemical composition studies, and water quality investigations. Examples of a few types of investigations in which direct push sampling may be used include site assessments, underground storage tank investigations, and hazardous waste site investigations. Continuous sampling is used to provide a lithological detail of the subsurface strata and to gather samples for classification and index or for chemical testing. These investigations frequently are required in the characterization of hazardous waste sites. Samples, gathered by direct push methods, provide specimens necessary to determine the chemical composition of soils, and in most circumstances, contained pore fluids (**3**).

5.2 Direct push methods can provide accurate information on the characteristics of the soils encountered and of the chemical composition if provisions are made to ensure that discrete samples are collected, that sample recovery is maximized, and that clean decontaminated tools are used in the sample gathering procedure. For purposes of this guide, "soil" shall be defined in accordance with Terminology D 653. Using sealed or protected sampling tools, cased boreholes, and proper advancement techniques can assure good representative samples. Direct push boreholes may be considered as a supplementary part of the overall site investigation or may be used for the full site investigation if site conditions permit. As such, they should be directed by the same procedural review and quality assurance standards that apply to other types of subsurface borings. A general knowledge of subsurface conditions at the site is beneficial.

5.3 Soil strata profiling to shallow depths may be accomplished over large areas in less time than with conventional drilling methods because of the rapid sample gathering potential of the direct push method. More site time is available for actual productive investigation as the time required for ancillary activities, such as decontamination, rig setup, tool handling, borehole backfill, and site clean-up is reduced over conventional drilling techniques. Direct push soil sampling has benefits of smaller size tooling, smaller diameter boreholes, and minimal investigative derived waste.

5.4 The direct push soil sampling method may be used as a site characterization tool for subsurface investigation and for remedial investigation and corrective action. The initial direct push investigation program can provide good soil stratigraphic information depending on the soil density and particle size, determine ground water depth, and provide samples for field screening and for formal laboratory analysis to determine the chemical composition of soil and contained pore fluids. Use of this method, results in minimum site disturbance and no cuttings are generated.

5.5 This guide may not be the correct method for investigations in all cases. As with all drilling methods, subsurface conditions affect the performance of the sample gathering equipment and methods used. Direct push methods are not effective for solid rock and are marginally effective in partially weathered rock or very dense soils. These methods can be utilized to determine the rock surface depth. The presence or absence of ground water can affect the performance of the sampling tools. Compact gravelly tills containing boulders and cobbles, stiff clay, compacted gravel, and cemented soil may cause refusal to penetration. Certain cohesive soils, depending on their water content, can create friction on the sampling tools which can exceed the static delivery force, or the impact energy applied, or both, resulting in penetration refusal. Some or all of these conditions may complicate removal of the sampling tools from the borehole as well. Sufficient retract force should be available to ensure tool recovery. As with all borehole advancement methods, precautions must be taken to prevent cross contamination of aquifers through migration of contaminants up or down the borehole. Regardless of the tool size, the moving of drilling and sampling tools through contaminated strata carries risks. Minimization of this risk should be a controlling factor in selecting sampling methods and drilling procedures. The user should take into account the possible chemical reaction between the sample and the sampling tool itself, sample liners, or other items that may come into contact with the sample (**3, 4**).

5.6 In some cases this guide may combine water sampling, or vapor sampling, or both, with soil sampling in the same investigation. Guides D 6001 and D 4700 can provide additional information on procedures to be used in such combined efforts.

6. Criteria for Selection

6.1 Important criteria to consider when selecting sampling tools include the following:

6.1.1 Size of sample.

6.1.2 Sample quality (Class A,B,C,D) for physical testing. Refer to Practice D 4220.

6.1.3 Sample handling requirements, such as containers, preservation requirements.

6.1.4 Soil conditions anticipated.

6.1.5 Ground water depth anticipated.

6.1.6 Boring depth required.

6.1.7 Chemical composition of soil and contained pore fluids.

6.1.8 Probability of cross contamination.

6.1.9 Available funds.

6.1.10 Estimated cost.

6.1.11 Time constraints.

6.1.12 History of tool performance under anticipated conditions (consult experienced users and manufacturers).

6.2 Important criteria to consider when selecting direct push equipment include the following:

6.2.1 Site accessibility.

6.2.2 Site visibility.

6.2.3 Soil conditions anticipated.

6.2.4 Boring depth required.

6.2.5 Borehole sealing requirements.

6.2.6 Equipment performance history.

6.2.7 Personnel requirements.

6.2.8 Decontamination requirements.

6.2.9 Equipment grouting capability.

6.2.10 Local regulatory requirements.

7. Apparatus

7.1 *General*—A direct push soil sampling system consists of a sample collection tool, hollow extension rods for advancement, retrieval, and transmission of energy to the sampler, and an energy source to force sampler penetration. Auxiliary tools are required to handle, assemble and disassemble, clean, and repair the sample collection tools and impact surfaces. Necessary expendable supplies are sample containers, sample container caps, sample liners, sample retainers, appropriate lubricants, and personal safety gear.

7.2 *Direct Push Tool Systems*:

7.2.1 *Two Tube System*—An outer casing and an inner extension rod with a sampler attached (see Fig. 1) are advanced simultaneously into the soil for the length capacity of the sampler. The sampler is removed from the borehole and a new sampler barrel or plug bit is inserted for each increment of depth. Two-tube sampling systems also may incorporate sample gathering chambers that are fitted into the outer casing shoe. These sample barrels are designed to create a minimum of sample disturbance while gathering high quality specimens (see Fig. 2). Samplers are held in the proper position by different methods, such as extension rods, pneumatic or mechanical packers, spring activated latches, or other devices (see Figs. 1 and 2). Locking devices must be strong enough to hold the sampler while penetrating the sample strata. The outer casing supports the borehole wall. Sample retrieval is expedited by the cased hole and continuous sampling is simplified. Continuous sampling may be a benefit to lithological logging. A cased borehole can be sealed from the bottom up as the casing is extracted (see Section 10). A cased hole may reduce the risk of contamination migration down the borehole and sample cross contamination. The two-tube system is more susceptible to soil friction because of its larger diameter and may require larger direct push energy than single-tube systems. An oversized drive shoe is sometimes used to reduce friction and buckling but may increase the risk of contamination migration down the borehole.

7.2.2 *Single Tube System*—The single tube system (see Fig. 3), uses a hollow extension/drive rod to advance and retrieve the sampler. The sampler is attached to the bottom of the extension/drive rod. A drive cap is added to the top of the extension/drive rod and the sampler is pushed into the soil. Extension/drive rods generally are smaller in diameter than the sampler. The single tube system minimizes effort for discrete interval sampling under many subsurface conditions. Tool connection time per interval is reduced. Time of removal and reinsertion of samplers into the borehole is affected by soil conditions. Repeated movement of the sampler through contaminated subsurface strata may increase the risk of contamination migration down the borehole. Bottom up borehole sealing may require re-entry in soil formations that collapse (see Section 10).

7.3 *Samplers*:

7.3.1 *Split Barrel Samplers*—Split barrel samplers (see Fig. 4) are available for use with direct push drilling methods and are available in various sizes up to 3.0 in. (76.2-mm) inside diameter. The inside tolerance should allow for use of liners. Split barrel sampler shoes used in two tube systems must be of sufficient diameter to prevent the intrusion of soil between the outer diameter of the shoe and the inside wall of the outer tube. Split barrel shoes should be replaced when the leading edge is damaged. Damaged shoes can negatively affect sample recovery. Samplers can be used with or without ball check value fitted split barrel heads. The ball check prevents uphole fluids from flowing down through the sample. Where soil sampling will be performed below the water table, the split barrel head, equipped with a ball check, should be used. The open split barrel is best used with the two tube system because the outer casing protects the borehole against cave-in or sloughing, or in soils in which the borehole wall will not collapse. Split barrel sealing systems are available. Split barrel sections can be joined to create a sampler with a nominal sample length capacity of 48 in. (1.22 m). It is understood that samplers with usable lengths beyond 24 in. (0.61 m) are used to advantage in certain soil types; however, the added weight of the soil sample in the chamber and the added friction within the sampler may prevent loose soils from entering the sampler, affecting sample recovery and representativeness. Split barrel samplers can be fitted with a basket to improve recovery in cohesionless soils. Retainers are available in many styles and materials. Retainers should allow the passage of softer soils. Stiff retainers can reduce specimen recovery in soft soils.

7.3.2 *Solid Barrel Samplers*:

7.3.2.1 *Open Solid Barrel Samplers*—Open solid barrel (see Fig. 5) samplers are used with all types of direct push sampling systems. Solid barrels can have inside diameters ranging up to 3 in. (76.2 mm). Barrel lengths range from 6 in. (152.4 mm) to 5 ft (1.53 m). Solid barrel samplers may be one piece or segmented. Sample liners should be used to facilitate removal

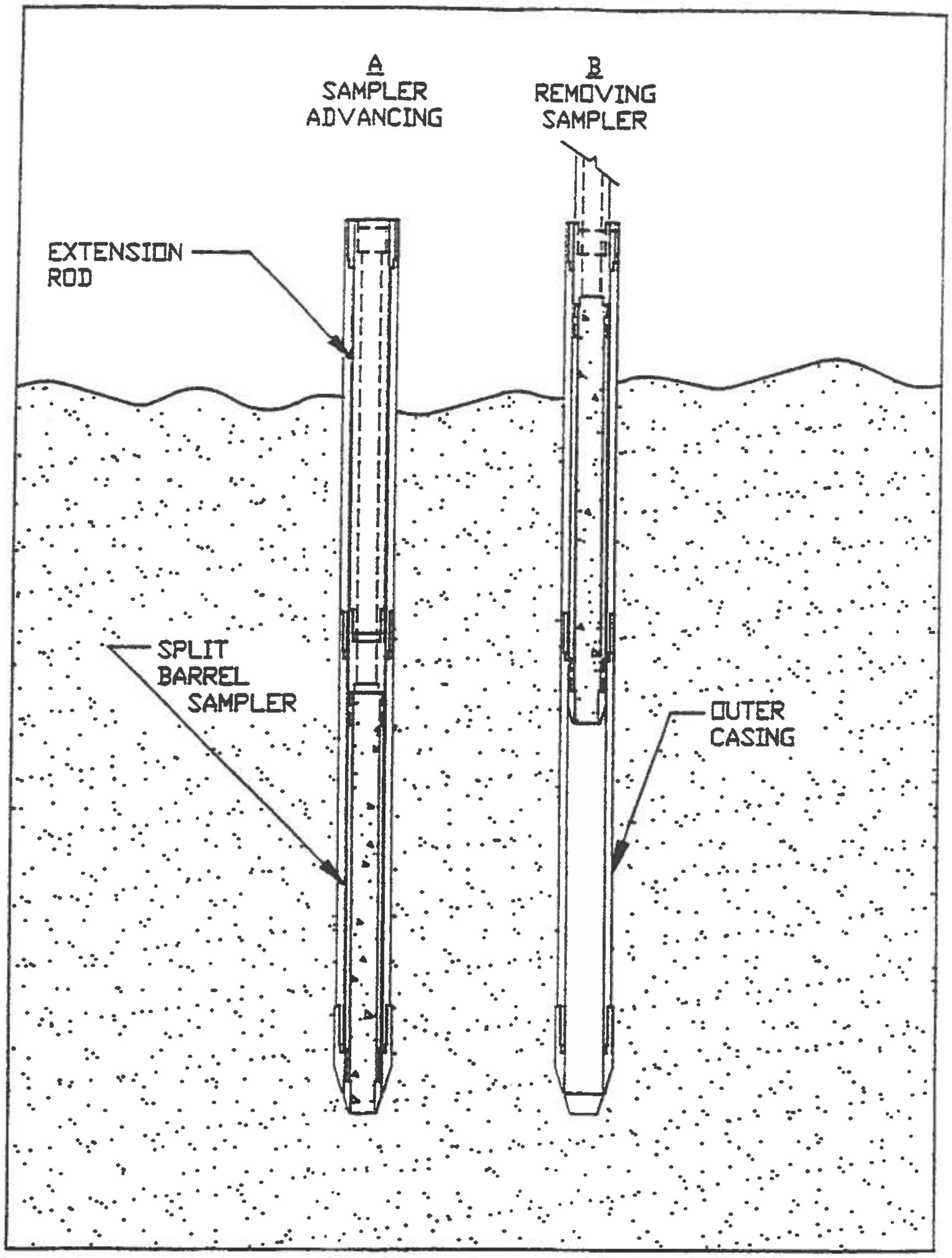

FIG. 1 Split Spoon Sampling, Two Tube System

of the sample from the solid barrel. Without the use of liners, samples are extruded mechanically. Liner lengths should fit sampler barrel lengths. Solid barrel samplers are generally assembled with a removable cutting shoe and a drive head (see Fig. 6). The head provides a backing to hold the liner stationary while the sampler is advanced and serves as a connector to the extension/drive rods. The shoe is manufactured to hold the liner stationary during the soil collection procedure. The liner should be slightly larger than the inner diameter of the cutting shoe. It may be slipped over the cutting shoe (see Fig. 6) or nested inside of the cutting shoe (see Fig. 7). The shoe is manufactured to cut the sample to a slightly undersized diameter allowing it to pass into the sample liner with a minimum of side friction to reduce sample disturbance. The amount of specimen contact with the inside of the shoe should be held to the minimum distance possible to aid in achieving the maximum amount of recovery.

7.3.3 *Closed Barrel Sampler*—Closed barrel samplers (see Figs. 2 and 3, Figs. 5-8) are devices, which remain sealed shut until an action is taken to open the sample receiving chamber. These samplers are used most often for single events (discrete point sampling) where a sealed sampler is required to avoid

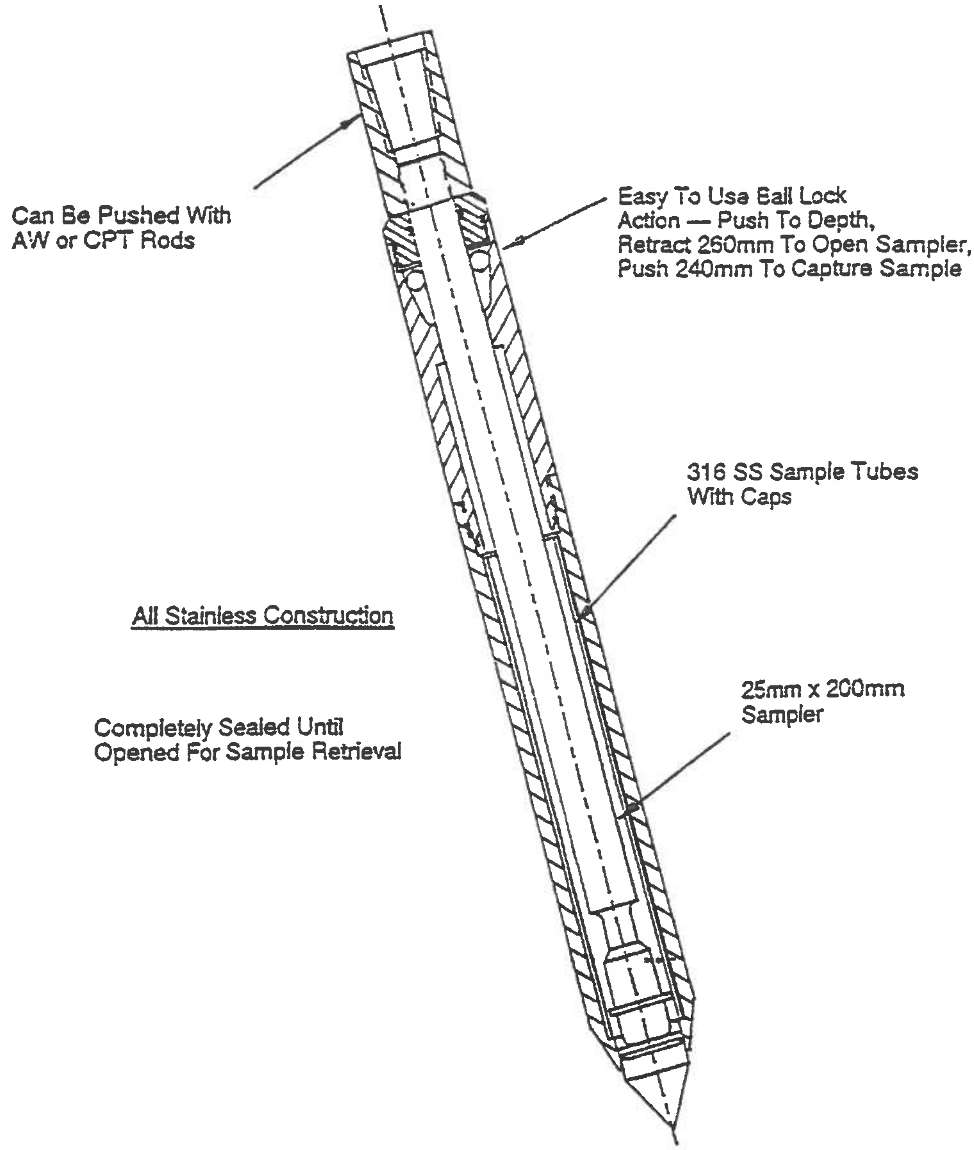

FIG. 2 Sealed Sample Barrel, Single Tube System

cross contamination or in circumstances where borehole wall stability cannot be assured. The shoe sealing device generally is a point designed to allow the continuous flow of soil around and past the sampler until such time as it is removed or released. The piston point can be fitted with seals, such as "O" rings at top and bottom to hold fluid out until sampling the desired interval. The piston rod extends through the sample retaining liner and must be released or removed for the soil to enter (see Fig. 3, Fig. 5, Fig. 7). The piston can be removed manually before sampling or be displaced by the soil entering the sampler chamber. Using the displacement method can result in reduced recovery if sampled soils do not have sufficient strength to displace the piston. Pistons are locked in place by several methods, such as a spring loaded latch. The latch holds several balls (see Fig. 2, Fig. 7, Fig. 8) into a groove in the latch coupling. When the latch is released by lifting up on the latch stem, the balls slip back into the latch chamber allowing the piston to be removed. Another method uses a locking screw. A reverse thread pin (Fig. 3, Fig. 6) is positioned in the sampler head to prevent the piston from being displaced by the soil when advancing the sampler. At the sampling interval, small diameter extension rods are inserted through the sampler extension/drive rods and rotated clockwise to unscrew the locking pin. A third method uses an inflated packer. An inflated packer (see Fig. 9) is attached to the top of the sampler barrel. The sample barrel is lowered into position in the drive casing and the packer inflated. The packer is deflated to release and the sample barrel is recovered after being advanced the sampling interval.

7.3.4 *Thin Wall Tube*—A 1.0-in. (25.4-mm) diameter thin wall tube (see Fig. 10) is available for use with direct push equipment and is manufactured according to Practice D 1587. Thin wall tubes can be effective when used with dual tube direct push systems as the borehole must be kept clear of

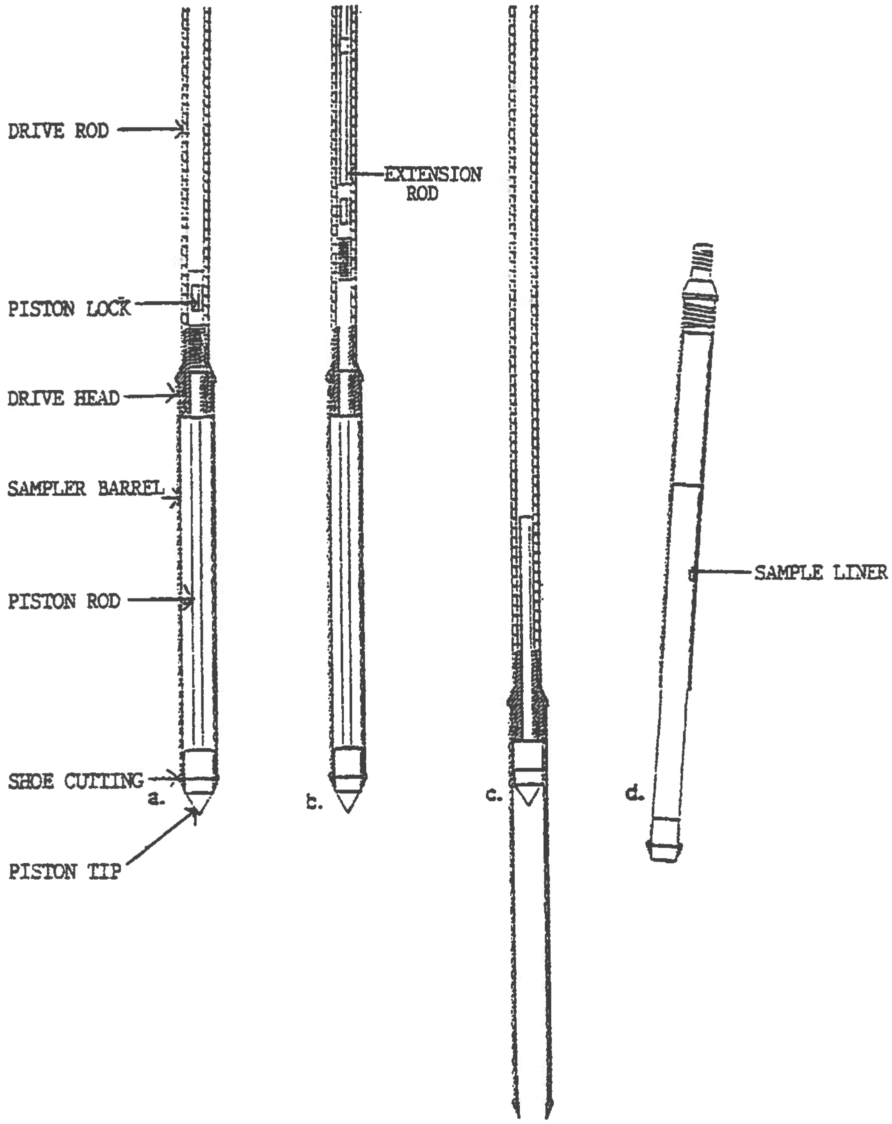

FIG. 3 Driving and Sampling, Single Tube System

(a) Driving the sealed sampler. (b) Removing the stop-pin.
(c) Collecting a sample (d) Recovering sample in liner.

disturbed soil prior to gathering a sample. Thin wall tubes may be effective in cohesive soils with single tube systems when the borehole can be kept clear of disturbed soil. Thin wall tubes must have an outside diameter that will allow passage through the outer casing. The thin wall tube can be operated in accordance with Practice D 1587, or it can be advanced using the percussion hammer of the direct push equipment. The primary use of the thin wall tube is to gather relatively undisturbed samples in cohesive soils. Sealing of thin wall tube ends should be completed in accordance with Practice D 4220. Fixed piston apparatus (see Fig. 10) also is available for use with thin walled tubes. The fixed piston action allows the sampling of very soft formations, which may not be retained in conventional samplers. In certain soil formations, the thin wall tube provides the best method to collect an undisturbed sample.

7.3.5 *Sampler Extension/Drive Rods*—Sampler extension/drive rods are lengths of rod or tube generally constructed of steel to withstand the pushing or percussion forces applied. Extension drive rods are available in various lengths. Rod lengths should be mated with casing and sampling equipment used. Thread types and classes vary between equipment manufacturers. Rod joints can be sealed to prevent fluid intrusion with “O” rings. Teflon™ washers or Teflon™ tape. Because of the percussive effort, joint seals should be checked for each sampling effort. Extension/drive rods should have sufficient inside diameter to accommodate the equipment necessary to perform the desired action.

7.3.6 *Sampler Liners*—Sampler liners are used to collect and store samples for shipment to laboratories, for field index testing of samples and for removing samples from solid barrel

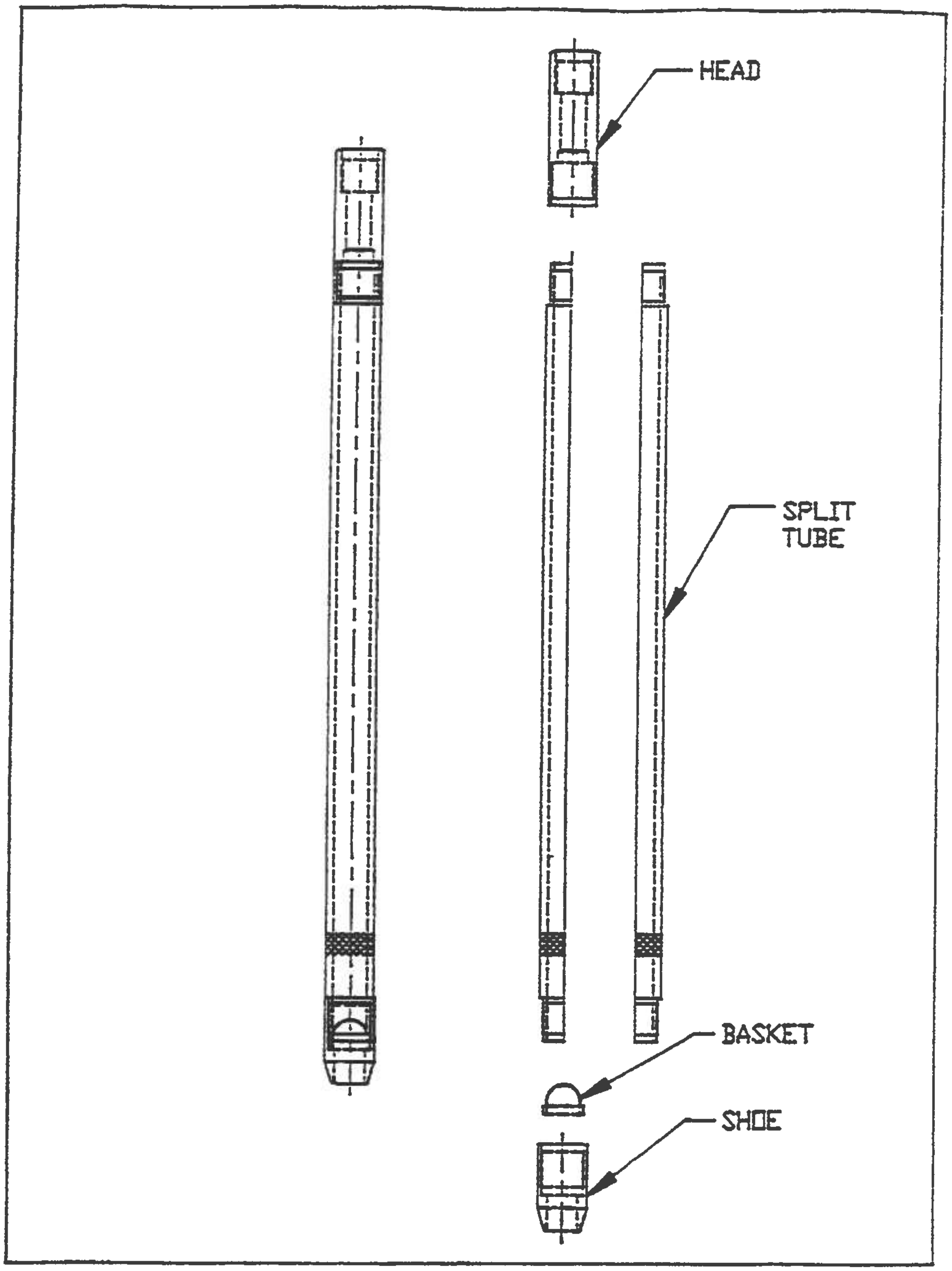

FIG. 4 Split Barrel Sampler, Two Tube System

type samplers. Liners are available in plastics, Teflon®, brass, and stainless steel. Other materials can be used as testing needs dictate. Liners are available in lengths from 6 in. (152.4 mm) to 5.0 ft (1.53 m). Liner material selection often is based on the chemical composition of liner/soil to minimize sample reaction with liner. Most liner use is short term as samples are subsampled and preserved immediately on site. A general rule for liner selection is stainless steel for organic compounds and plastic for metals. Teflon® may be required for mixed wastes and for long time storage. Liners should be sealed in accordance with Practice D 4220 when samples are collected for physical testing. Other appropriate procedures must be used when samples are collected for environmental analysis (see Practices D 3694) (**1, 2**). Liners generally are split in the field for subsampling. Individually split liners are available in some sizes for field use. The liner should have a slightly larger inside diameter than the soil specimen to reduce soil friction and enhance recovery. When a slightly oversized liner is used, the potential for air space exists around the sample. Certain chemical samples may be affected by the enclosed air. Liners having less tolerance may be required and a shortened sampled interval used to reduce friction in the liner. Metal liners can be

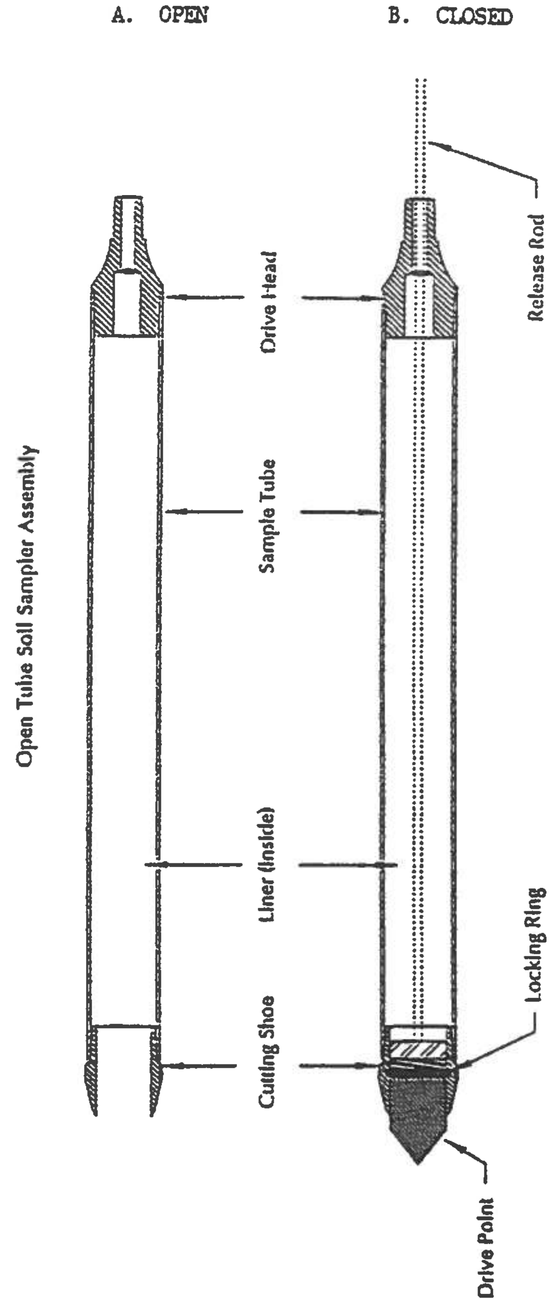

FIG. 5 (A) Open and (B) Closed Piston Sampler Assembly, Single Tube System

reused after proper cleaning and decontamination. Plastic liners should be disposed of properly after use.

7.3.7 *Sample Containers*—Sample containers should be prescribed according to the anticipated use of the sample specimen. Samples taken for chemical testing may require decontaminated containers with specific preservatives. Practice D 3694 provides information on some of the special containers and preservation techniques required (**1, 2**). These containers generally will be decontaminated to specific criteria. Samples for geotechnical testing require certain minimum volumes and specific handling techniques. Practice D 4220 offers guidance for sample handling of samples submitted for physical testing.

7.4 *Direct Push Power Sources*—Soil probing percussion driving systems, penetrometer drive systems, and rotary drilling equipment may be used to drive casings and direct push soil sampling devices. The equipment should be capable of applying sufficient static force, or dynamic force, or both, to advance the sampler to the required depth to gather the desired sample. The system must have adequate retraction force to remove the sampler and extension/drive rods once the selected strata has been penetrated. Rotation of the drill string can be added during insertion, as well as during retraction if the drive system can impart rotation.

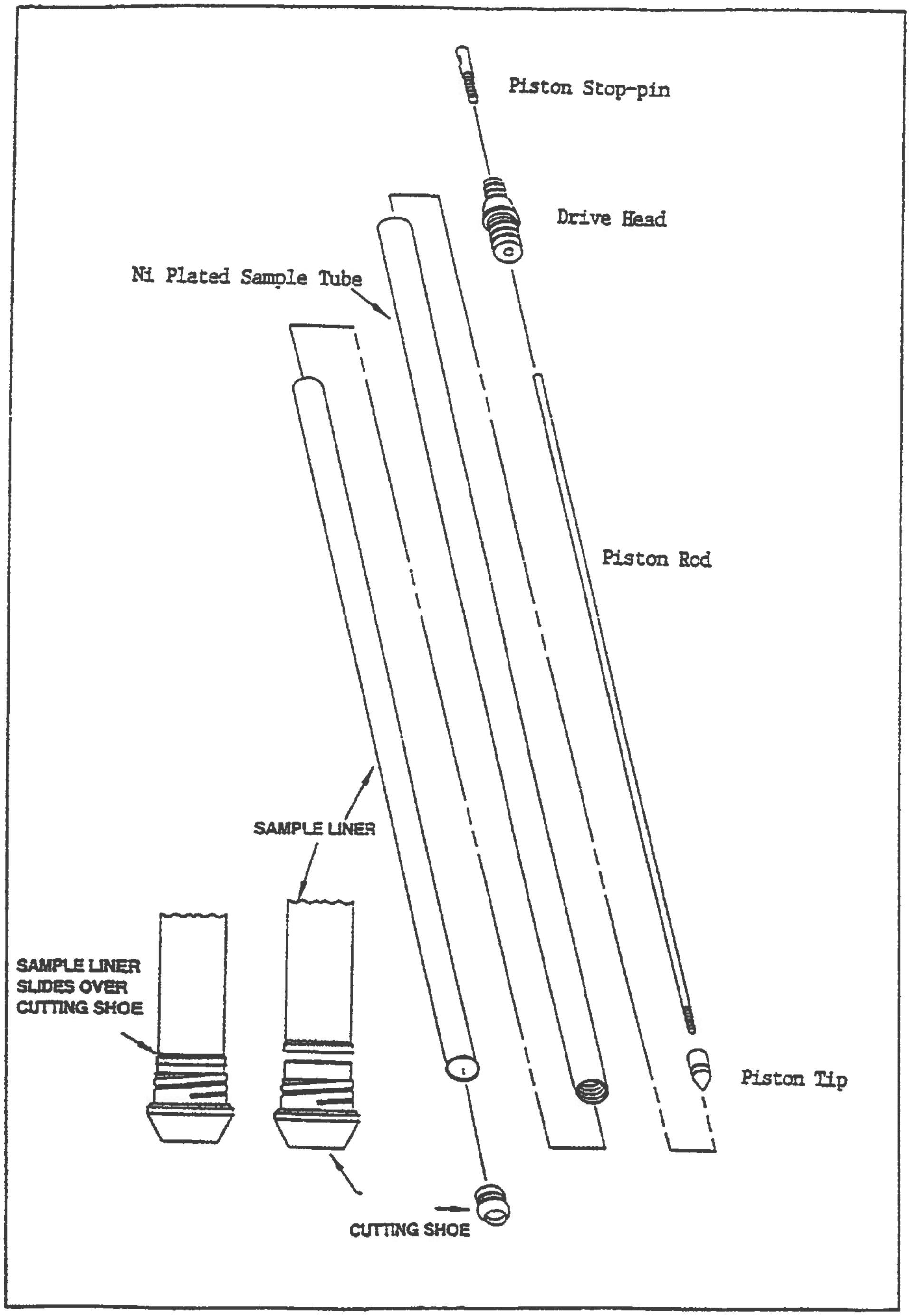

FIG. 6 Sampler Parts, Single Tube System

7.4.1 *Retraction Force*—The retraction force can be applied by direct mechanical pull back using the hydraulic system of the power source; line pull methods using mechanical or hydraulic powered winches, or cathead and rope windlass type devices. Winches used with direct push technology should have a minimum of 2000 lb (907 kg) top layer rating capacity and a line speed of 400 ft (121.96 m)/min to provide effective tool handling. Direct push sampling tools can be retracted by back pounding using weights similar to those of standard penetration testing practices. Backpounding to recover samples can affect recovery and cause disturbances to the sample. Other forms of extraction, such as jacking, that do not cause undue disturbance to the sample, are preferable.

7.4.2 *Percussion Devices*—Percussion devices for use with direct push methods are hydraulically-operated hammers, air-operated hammers, and mechanically-operated hammers. Hydraulically-operated hammers should have sufficient energy to be effective in moving the samplers through the subsurface

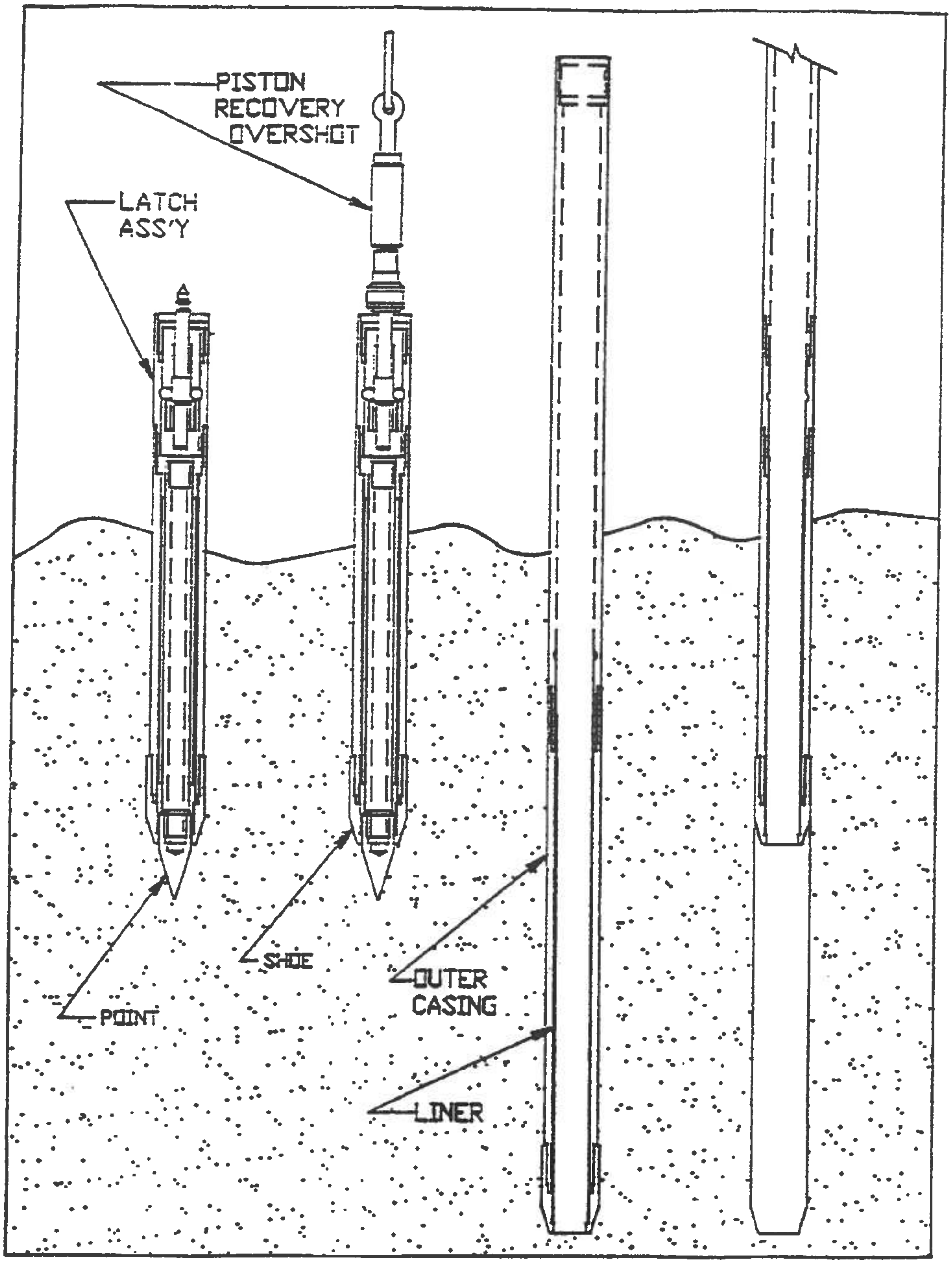

FIG. 7 Closed Solid Barrel Sampler, Single Tube System

strata. The maximum energy application is dependent on the tools used. Hammer energy that exceeds tool tolerance will result in tool damage or loss and will not achieve the goal of collecting high quality samples. Air-operated hammers should be capable of delivering sufficient energy, as well. Hammer systems utilizing hydraulic oil or air should be operated in the range specified by the manufacturer. Manually-operated hammers can be used to advance direct push tools. These hammers can be operated mechanically or manually using cathead and rope. These systems generally involve using 140 lb, standard penetration (see Test Method D 1586) hammers, which can work well for direct push sampling. In operation, these hammers tend to be slower than hydraulic hammers and can cause tool damage if direct push tools are not designed to take the heavy blows associated with these hammers. The hydraulic- and air-operated hammers strike up to 2000 blows/min. In addition to the energy transferred, the rapid hammer action sets up a vibratory effect, which also aids in penetration. This vibratory effect, along with the percussive effort, may disturb some soil samples.

7.4.3 *Static Push Systems*—Cone penetrometer systems are an example of static push systems. They impart energy to the

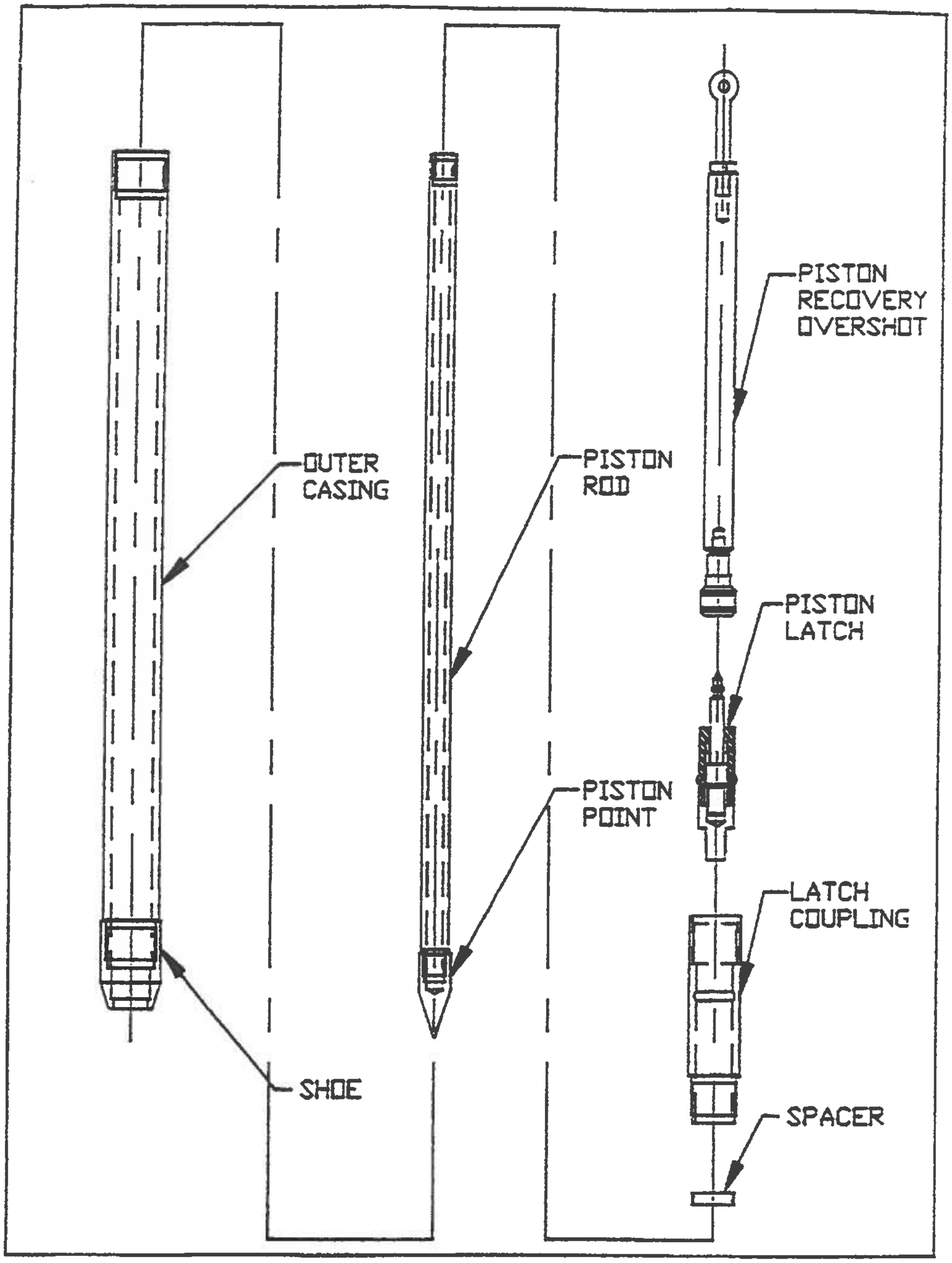

FIG. 8 Closed Solid Barrel Sampler, Single Tube System

sampler and extension rods by using hydraulic rams to apply pressure. The pressure applied is limited to the reactive weight of the drive vehicle. Retraction of the sampler and extension rods is by static pull from the hydraulic rams.

7.4.4 *Vibratory/Sonic Systems*—These systems utilize a vibratory device, which is attached to the top of the sampler extension rods. Reactive pressure and vibratory action are applied to the sampler extensions moving the sampler into the formation. In certain formations, sample recovery and formation penetration is expedited; however, all formations do not react the same to vibratory penetration methods.

7.4.4.1 *Sonic or Resonance Drilling Systems*—These are high powered vibratory systems that can be effective in advancing large diameter single or dual tube systems. They generally have depth capabilities beyond the smaller direct push systems.

7.4.5 *Rotary Drilling Equipment*—Direct push systems are readily adaptable to rotary drill units. The drill units offer a ready hydraulic system to operate percussion hammers, as well as reactive weight for static push. Because most drills are equipped with leveling jacks, better weight application is achieved. Vertical pushing is improved because of the ability to

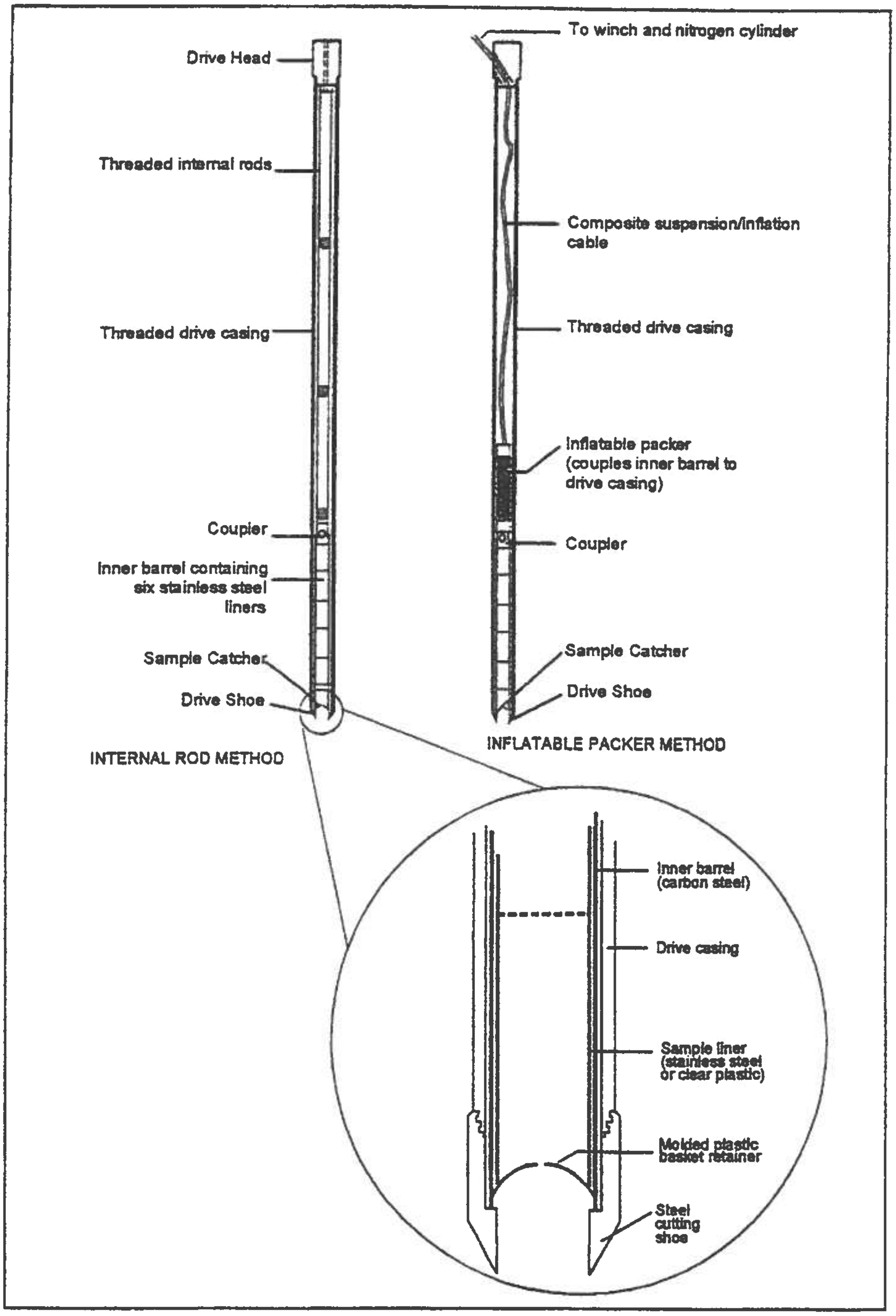

FIG. 9 Sampler Holding Methods, Two Tube System

level the machine. Tool handling is facilitated by high speed winches common to drilling rigs, extended masts for long tool pulls, and longer feed stroke length. Drill units with direct push adaptations also offer drilling techniques should obstacles be encountered while using direct push technology. Large drill units may have reactive weights that can exceed the tool capacity, thereby resulting in damaged tools.

8. Conditioning

8.1 *Decontamination*—Sampling equipment that will contact the soil to be sampled should be cleaned and decontaminated before and after the sampling event. Extension rods should be cleaned prior to each boring to avoid the transfer of contaminants and to ease the connecting of joints. Thread

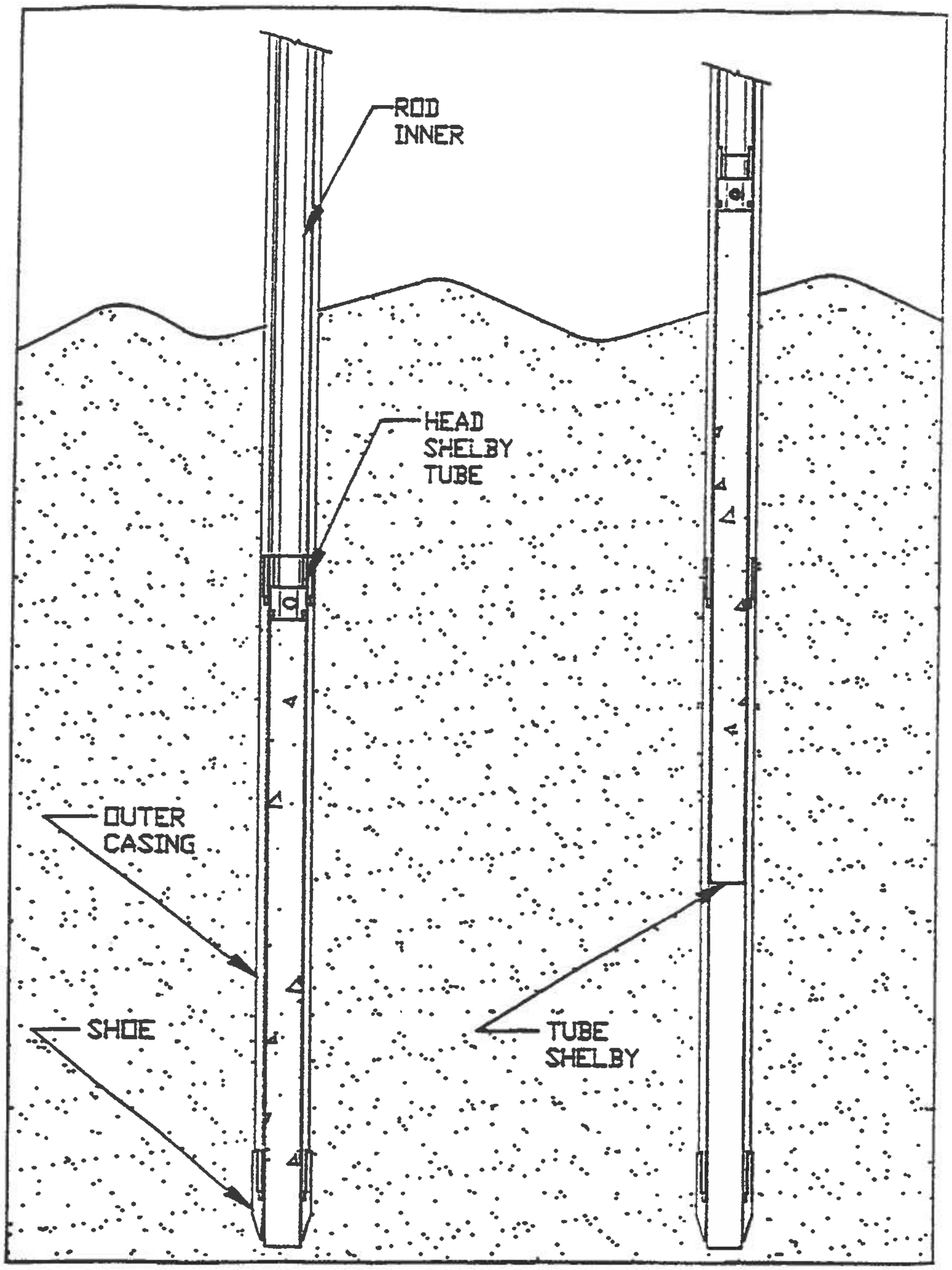

FIG. 10 Thin Wall Tube Sampler, Two Tube System

maintenance is necessary to ensure long service life of the tools. Sample liners should be kept in a sealed or clean environment prior to use. Reusable liners should be decontaminated between each use. All ancillary tools used in the sampling process should be cleaned thoroughly, and if contaminants are encountered, decontaminated before leaving the site. It should not be assumed that new tools are clean. They should be cleaned and decontaminated before use. Decontamination should be performed following procedures outlined in Practice D 5088 along with any site safety plans, sampling protocols, or regulatory requirements.

8.2 *Tool Selection*—Prior to dispatch to the project site an inventory of the necessary sampling tools should be made. Sample liners, containers, sampling tools, and ancillary equipment should be checked to ensure its proper operation for the work program prescribed. Sampling is expedited by having two or more samplers on site. Since samples can be recovered quite fast, a supply of samplers will allow a boring to be completed so other functions can be performed while samples are being processed. A backup tool system adaptable to and within the capabilities of the power source should be available should the original planned method prove unworkable. Materials for proper sealing of boreholes should always be available at the site (5-7).

9. Procedure

9.1 While procedures for direct push soil sampling with two common direct push methods are outlined here, other systems may be available. As long as the basic principles of practice relating to sampler construction and use are followed, other systems may be acceptable.

9.2 *General Set-Up*—Select the boring location and check for underground and overhead utilities and other site obstructions. Establish a reference point on the site for datum measurements, and set the direct push unit over the boring location. Stabilize and level the unit, raise the drill mast or frame into the drilling position, and attach the hammer assembly to the drill head if not permanently attached. Attach the anvil assembly in the prescribed manner, slide the direct push unit into position over the borehole, save a portion of the sliding distance for alignment during tool advancement, and ready the tools for insertion.

9.2.1 *Tool Preparation*—Inspect the direct push tools before using, and clean and decontaminate as necessary. Inspect drive shoes for damaged cutting edges, dents, or thread failures as these conditions can cause loss of sample recovery and slow the advancement rate. Where permissible, lubricate rod joints with appropriate safe products, and check impact surfaces for cracks or other damage that could result in failure during operations. Assemble samples and install where required, install sample retainers where needed, and install and secure sampler pistons to ensure proper operation where needed.

9.2.2 *Sample Processing*—Sample processing should follow a standard procedure to ensure quality control procedures are completed. View sample in the original sampling device, if possible. Open the sampling device with care to keep disturbance to a minimum. When using liners or thin wall tubes, protect ends to prevent samples from falling out or being disturbed by movement within the liner. Measure recovery accurately, containerize as specified in the work plan or applicable ASTM procedures, and label recovered samples with sufficient information for proper identification. When collecting samples for volatile chemical analysis, sample specimens must be contained and preserved as soon as possible to prevent loss of these components. Follow work plan instructions or other appropriate documents (see Practice D 3694) when processing samples collected for chemical analysis.

9.3 *Two Tube System*:

9.3.1 *Split Barrel Sampling (see* Fig. 1*)*—Assemble the outer casing with the drive shoe on the bottom, attach the drive head to the top of the outer casing, and attach the sampler to the extension rods. Connect the drive head to the top of the sampler extension rods, and insert the sampler assembly into the outer casing. The sampler cutting shoe should contact the soil ahead of the outer casing to prevent unnecessary sample disturbance. The split spoon cutting shoe should extend a minimum of 0.25 in. (6.25 mm) ahead of the outer casing. Greater extensions may improve recovery in soft formations. Mark the outer casing to designate the required drive length, position the outer casing and sampler assembly under the drill head, and move the drill head downward to bring pressure on the tool string. If soil conditions allow, advance the sampler/casing assembly into the soil at a steady rate slow enough to allow the soil to be cut by the shoe and move up inside the sample barrel. If advancement is too rapid, it can result in loss of recovery because of soil friction in the shoe. Occasional hammer action during the push may help recovery by agitating the sample surface. If soil conditions prevent smooth static push advancement, activate the hammer to advance the sampler. Apply a continuous pressure while hammering to expedite soil penetration. The pressure required is controlled by subsurface conditions. Applications of excessive down pressure may result in the direct push unit being shifted off the borehole causing misalignment with possible tool damage. Stop the hammer at completion of advancement of the measured sampling barrel length. Release the pressure and move the drill head off the drive head. Attach a pulling device to the extension rods or position the hammer bail and retrieve the sampler from the borehole. At the surface remove the sampler from the extension rods and process. Soil classification is accomplished easily using split barrel samplers as the specimen is available readily for viewing, physical inspection and subsampling when the barrel is opened. Clean, decontaminate, and reassemble the sampler. Reattach the sampler to the extension rod, add the necessary extension rod and outer casing to reach the next sampling interval, and sound the borehole for free water before each sample interval. If water is present, it may be necessary to change sampling tools. Unequal pressure inside the casing may result in blow-in of material disturbing the soil immediately below the casing. Lower the sampler to its proper position, add the drive heads, and repeat the procedure. If it is desired that the pass through certain strata without sampling, install an extension rod point in lieu of the sampler. When the sampling interval is reached, remove the point and install the sampler. Advance the sampler as described. Upon completion of the borehole, remove the outer casing after instrumentation has been set or as the borehole is sealed as described in Section 10 (6).

9.3.2 *Two Tube System—Other Samplers*:

9.3.2.1 *Thin Wall Tubes*—Thin wall tubes (see Fig. 10) can be used with the dual tube system. Attach the tube to the tube head using removable screws. Attach the tube assembly to the extension rods and position at the base of the outer casing shoe protruding a minimum of 0.25 in. (6.25 mm) to contact the soil ahead of the outer casing. Advance the tube, with or without the outer casing, at a steady rate similar to the requirements of Practice D 1587. At completion of the advancement interval, let the tube remain stationary for 1 min. Rotate the tube slowly two revolutions to shear off the sample. Remove the tube from the borehole, measure recovery, and classify soil. The thin wall tube can be field extruded for on-site analysis or sealed in accordance with Practice D 4220 and sent to the laboratory for processing. Samples for environmental testing generally require the subsampling and preservation of samples in controlled containers. Soil samples generally are removed from the sampling device for storage and shipping. Thin wall tubes should be cleaned and decontaminated before and after use.

9.3.2.2 *Thin Wall Tube Piston Sampler (see Fig. 11)*—Check the fixed piston sampling equipment for proper operation of the cone clamping assembly and the condition of the sealing "O" rings. Slide the thin wall tube over the piston, and attach it to the tube head. Position the piston at the sharpened end of the thin wall tube just above the sample relief bend. Attach the sampler assembly to the extension rods, and lower the sampler into position through the outer casing. Install the actuator rods through the extension rod, and attach to the actuator rod in the sampler assembly. Attach a holding ring to the top of the actuator rod string, and hook the winch cable or other hook to the holding ring to hold the actuator rods in a fixed position. Attach the pushing fork to the drill head/probe hammer, and slowly apply downward pressure to the extension rods advancing the thin wall tube over the fixed piston into the

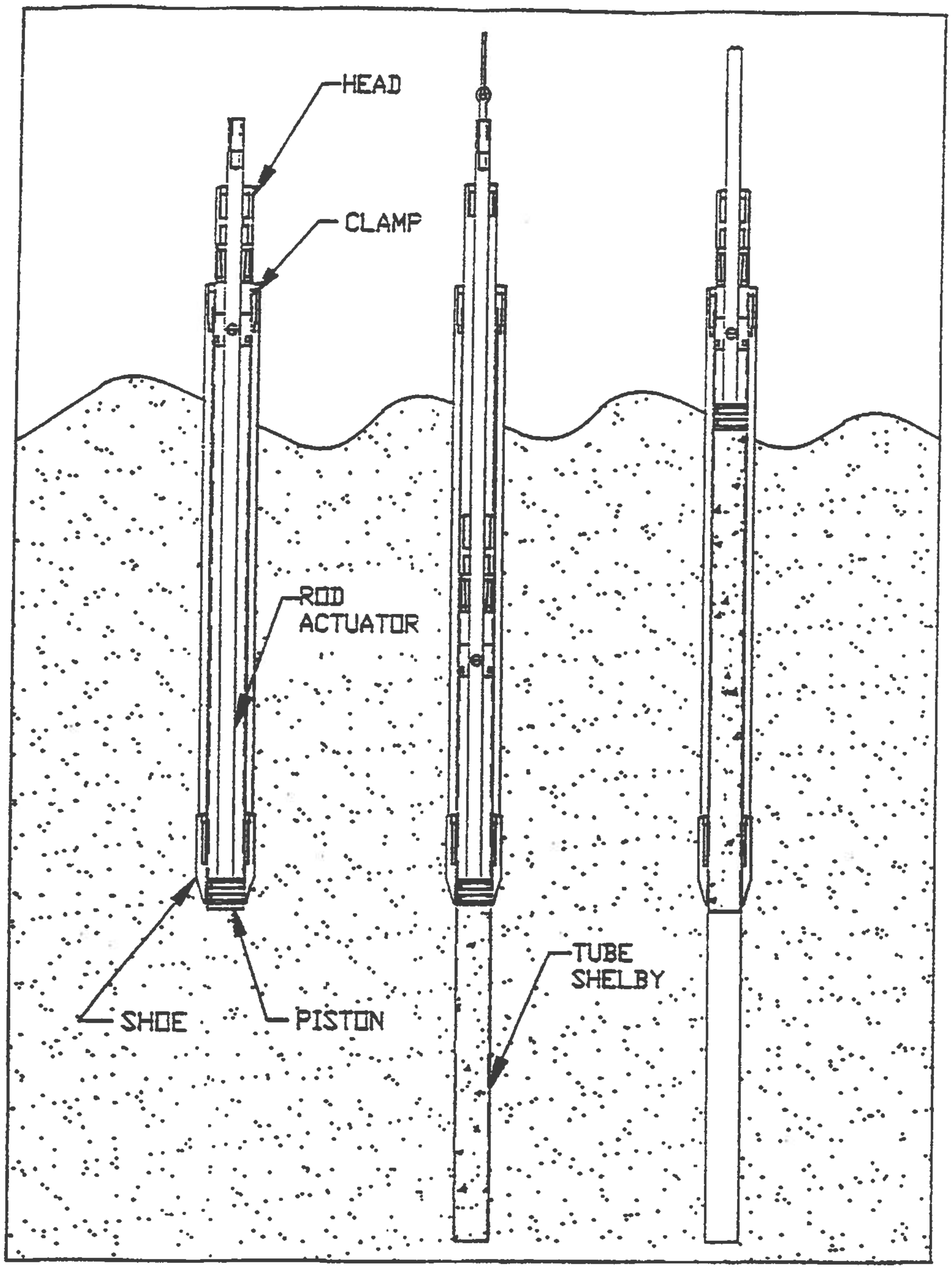

FIG. 11 Fixed Piston Sampler, Two Tube System

soil for the sample increment. Rest sampler 1 min to allow sample to conform to tube. Rotate tube one revolution to shear off sample. Remove sampler assembly from borehole and process sample (**6**).

9.3.2.3 *Open Solid Barrel Samplers*—Use solid barrel samplers in advance of the outer casing where the soil conditions could cause swelling of split barrel samplers, or where friction against the outer casing precludes its advancement and sampling must still be accomplished. The solid, single, or segmented barrel sampler requires the use of liners for removal of the sample. The sampler must be cleaned and decontaminated before use. Use of the sampler follows the procedure described in 9.3.1.

9.4 *Single Tube System*:

9.4.1 *Open Solid Barrel Sampler (see Figs. 5 and 6)*—Attached the required liner to the cutting shoe by insertion into the machined receptacle area or by sliding over the machined tube. Insert the liner and shoe into the solid barrel, and attach the shoe (**6, 8-11**). Attach the sampler head to the sampler barrel providing a backing plate for the liner. Attach the sampler assembly to the drive rod and the drive head to the drive rod. Position the assembly under the hammer anvil and advanced as described in 9.3.1. At completion of the sampling increment, remove the sampler from the borehole. Remove the filled sample liner from the barrel by unscrewing the shoe, cap the liner for laboratory testing or spit open for field processing, and advance the borehole by repeating the procedure. Because the solid barrel cannot be opened for cleaning, it may require more effort for cleaning and decontamination. The open solid barrel sampler is used in soil formations that have sufficient wall strength to maintain a borehole wall without sloughing or cave-in. In soil formations not affording such structure, other sampling methods may be required or the opening sealed. To enhance recovery in some soil strata, it may be necessary to vary the length of the sampling increment. Shorter increments generally improve recovery because of lower sample friction and compression inside the sampler chamber. Sample recovery can be enhanced in some formations by intermittent use of the percussion hammer (**6, 8, 10, 11**).

9.4.2 *Closed Solid Barrel Sampler (see Figs. 5-7,* Fig. *11)*—Insert or attach the sample liner to the shoe, and insert the assembly into the solid barrel sampler. Install sample retaining basket if desired. Attach the latch coupling or sampler head to the sampler barrel, and attach the piston assembly with point and" O" rings if free water is present, to the latching mechanism or holder. Insert the piston or packer into the liner to its proper position so the point leads the sampler shoe. Set latch, charge packer, or install locking pin, and attach assembled sampler to drive rod. Add drive head and position under the hammer anvil. Apply down pressure, hammer if needed, to penetrate soil strata above the sampling zone. When the sampling zone is reached, insert the piston latch release and recovery tool, removing the piston, or insert the locking pin removal/extension rods through the drive rods, turn counterclockwise, and remove the piston locking pin so the piston can float on top of the sample, or release any other piston holding device. Direct push or activate the hammer to advance the sampler the desired increment. Retrieve the sampler from the borehole by withdrawing the extension/drive rods. Remove the shoe, and withdraw the sample liner with sample for processing. Clean and decontaminate the sampler, reload as described, and repeat the procedure. Extreme stress is applied to the piston when driving through dense soils. If the piston releases prematurely, the sample will not be recovered from the correct interval, and a resample attempt must be made. The piston sampler can be used as a re-entry grouting tool for sealing boreholes on completion if it is equipped with a removable piston (**5, 6, 7, 10, 11**).

9.4.3 *Standard Split Barrel Sampler*—Attach the split spoon to an extension rod or drill rod. Using a mechanical or hydraulic hammer drive the sampler into the soil the desired increment, as long as that increment does not exceed the sampler chamber length. Remove the sampler from the borehole, disassemble, and process sample. Standard split barrel samplers can be used, as long as borehole wall integrity can be maintained and the additional friction can be overcome. If caving or sloughing occurs, the sampler tip should be sealed or other sampling tools used (**9**).

9.5 *Quality Control*:

9.5.1 *Quality Control*—Quality control measures are necessary to ensure that sample integrity is maintained and that project data quality objectives are accomplished. By following good engineering principles and applying common sense, reliable site characterizations can be accomplished.

9.5.2 *Water Checks*—Water seeping into the direct push casing or connecting rods from contaminated zones may influence testing results. Periodically check for ground water before inserting samplers into borehole or into outer casings in the two tube system. If water is encountered, it may be necessary to switch to the sealed piston type samplers to protect sample integrity. Sealed piston type samples may not always be water tight. Sealing of rod or casing joints can prevent ground water from entering through the joints.

9.5.3 *Datum Points*—Establishment of a good datum reference is essential to providing reliable sample interval depths and elevators. Select datum reference points that are sufficiently protected from the work effort, and that can be located for future reference. Field measurements should be to 0.1 ft (3.05 mm). Measure extension rods as the bore advances to locate sample depth. Mark rods before driving each sample interval to determine accurate measurement of sample recovery and to accurately log borehole depth.

9.5.4 *Sample Recovery*—Sample recovery should be monitored closely and results documented. Poor recovery could indicate a change in sampling method is needed, that improper sampling practices are being conducted, or that sampling tools are incorrect. Sample recovery involves both volume and condition. Poor sample recovery should cause an immediate review of the sampling program.

9.5.5 *Decontamination*—Follow established decontamination procedures. Taking shortcuts may result in erroneous or suspect data.

10. Completion and Sealing

10.1 *Completion*—For boreholes receiving permanent monitoring devices, completion should be in accordance with Practice D 5092, site work plan, or regulatory requirements.

10.2 *Borehole Sealing*—Seal direct push boreholes to minimize preferential pathways for containment migration. Additional information and guidance on borehole sealing can be found in Guide D 6001 and in Guide D 5299. State or local regulations may control both the method and the materials for borehole sealing. Regulations generally direct bottom up borehole sealing as it is the surest and most permanent method for complete sealing. High pressure grouting is available for use with direct push technology for bottom up borehole sealing.

10.2.1 *Sealing by Slurry, Two Tube System*—Sound the borehole for free water. If water exists in the casing, place the extension rods, open-ended, to the bottom of the outer casing, as a tremie. Mix the slurry to standard specifications prescribed by regulation or work plan. Pump slurry through the extension/drive rod until it appears at the surface of the outer casing. Remove the extension rods. If no free water exists in the borehole, the slurry can be placed by gravity. Top off the outer casing as it is removed from the borehole.

10.2.1.1 *Slurry Mixes*—Slurry mixes used for slurry grouting of direct push boreholes generally are of lower viscosity because of the small diameter tremie pipes required. Usable mixes are 6 to 8 gal (22.7 to 30.28 L) of water/94-lb (42.64-kg) bag of cement with 5 lb (2.27 kg) of bentonite or 24 to 36 gal (90.84 to 136.28 L) of water to 50 lb (22.68 kg) of bentonite.

10.2.2 *Sealing by Gravity—Two Tube System*—Measure the cased hole to ensure it is open to depth. Slowly add bentonite chips or granular bentonite to fill the casing approximately 2 ft. Withdraw the casing 2 ft and recheck depth. Hydrate the bentonite by adding water. Repeat this procedure as the outer casing is withdrawn. The bentonite must be below the bottom of the casing during hydration. Wetness inside the rods may affect the flow of granular bentonite to the bottom of the casing. Fill the top foot of the borehole with material that is the same as exists in that zone.

10.2.3 *Borehole Sealing Single Tube System*:

10.2.3.1 *Gravity Sealing from Surface*—If the soil strata penetrated has sufficient wall strength to maintain an open hole, then it may be possible to add sealing materials from the surface. Dry bentonite chips or granular bentonite can be placed by gravity. The borehole volume should be determined and the borehole sounded every 10 ft (3 m) to ensure bridging has not occurred. The bentonite should be hydrated by adding approximately 1 pt (0.57 L) of water for each 5 ft of filled borehole. Seal the surface with native material.

10.2.3.2 *Wet Grout Mix Tremie Sealing*—Tremie sealing methods can be used with single tube systems when borehole wall strength is sufficient to maintain an open hole or when extension rods with an expendable point are used to reenter the borehole. The grout pipe should be inserted immediately after the direct push tools are withdrawn or through the annulus of the extension rods that have been reinserted down the borehole for grouting. Care must be taken to not plug the end of the grout pipe. Side discharge grout pipes also can be used to prevent plugging.

10.2.4 *Re-Entry Grouting*—If the borehole walls are not stable, the borehole can be re-entered by static pushing grouting tools, such as an expendable point attached to the extension/drive rods to the bottom of the original borehole. Pump a slurry through the rods as they are withdrawn. High pressure grouting equipment may be beneficial in pumping standard slurry mixes through small diameter gravity pipes. Care must be taken to ensure the original borehole is being sealed.

11. Record Keeping

11.1 *Field Report*—The field report may consist of boring log or a report of the sampling event and a description of the sample. Soil samples can be classified in accordance with Practice D 2488 or other methods as required for the investigation (**12**). Prepare the log in accordance with standards set in Guide D 5434 listing the parameters required for the field investigation program. List all contaminants identified, instrument readings taken, and comments on sampler advancement. Record any special field tests performed and sample processing procedures beyond those normally used in the defined investigation. Record borehole sealing procedures, materials used, and mix formulas on the boring log. Survey or otherwise locate the boring site to provide a permanent record of its replacement.

11.2 *Backfilling Record*—Record the method of sealing, materials used, and volume of materials placed in each borehole. This information can be added to the field boring log or recorded on a separate abandonment form.

12. Keywords

12.1 decontamination; direct push; ground water; sealing; soil sampling

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BLANK FORMS AND LOGS

day

DAY ENVIRONMENTAL, INC.

ENVIRONMENTAL CONSULTANTS

AN AFFILIATE OF DAY ENGINEERING, P.C.

Project #: BCP Site #C828149
Project Address: 2308 and 2310 Monroe Ave
Brighton, NY
DAY Representative:
Drilling Contractor:
Sampling Method:

TEST BORING TB-

Page 1 of 1

Ground Elevation: --
Datum: --
Date Started:
Date Ended:
Borehole Depth:
Borehole Diameter:
Completion Method: ☐ Well Installed ☐ Backfilled with Grout ☐ Backfilled with Cuttings
Water Level (Date):

Depth (ft)	Blows per 0.5 ft.	Sample Number	Sample Depth (ft)	% Recovery	N-Value or RQD%	Headspace PID (ppm)	PID Reading (ppm)	Sample Description	Notes
1									-
2									-
3									-
4									-
5									-
6									-
7									-
8									-
9									-
10									-
11									-
12									-
13									-
14									-
15									-
16									-

Notes:
1) Water levels were made at the times and under conditions stated. Fluctuations of groundwater levels may occur due to seasonal factors and other conditions.
2) Stratification lines represent approximate boundaries. Transitions may be gradual.
3) PID readings are referenced to a benzene standard measured in the headspace above the sample using a MiniRae 2000 equipped with a 10.6 eV lamp.
4) NA = Not Available or Not Applicable
5) Headspace PID readings may be influenced by moisture

TEST BORING TB-

CHAIN OF CUSTODY

	REPORT TO:			INVOICE TO:				
	COMPANY:			COMPANY: Same			LAB PROJECT #:	CLIENT PROJECT #:
	ADDRESS:			ADDRESS:				
	CITY:	STATE:	ZIP:	CITY:	STATE:	ZIP:	TURNAROUND TIME: (WORKING DAYS)	
	PHONE:	FAX:		PHONE:	FAX:		1 ☐ 2 ☐ 3 ☐ STD 5 ☐	OTHER ☐
PROJECT NAME/SITE NAME:	ATTN:			ATTN:				
	COMMENTS:						Quotation #	

REQUESTED ANALYSIS

	DATE	TIME	COMPOSITE	GRAB	SAMPLE LOCATION/FIELD ID	MATRIX	NUMBER CONTAINERS										REMARKS	PARADIGM LAB SAMPLE NUMBER
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		

****LAB USE ONLY BELOW THIS LINE****

Sample Condition: Per NELAC/ELAP 210/241/242/243/244

Receipt Parameter	NELAC Compliance	
Container Type: *Comments:*	Y ☐	N ☐
Preservation: *Comments:*	Y ☐	N ☐
Holding Time: *Comments:*	Y ☐	N ☐
Temperature: *Comments:*	Y ☐	N ☐

Sampled By	Date/Time	Total Cost:	
Relinquished By	Date/Time		
Received By	Date/Time	P.I.F.	
Received @ Lab By	Date/Time		

DAY ENVIRONMENTAL, INC.
SITE OBSERVATION REPORT

CLIENT: Town and County LLC	DATE: DAY:
PROJECT: Town and Country Cleaners **BCP Site #C828149**	WEATHER:
LOCATION: 2308 and 2310 Monroe Avenue, Brighton NY	TEMPERATURE: Celsius; ( ) Fahrenheit
CONTRACTOR:	

On Site at: __________ am/pm

COMMENTS:

Off Site at: __________ am/pm

WORK FORCE AND EQUIPMENT:

DAY Representative (print):______________________ DAY Representative (signed):______________________

APPENDIX B

HEALTH AND SAFETY PLAN

APPENDIX B
HEALTH AND SAFETY PLAN

SITE SPECIFIC HEALTH AND SAFETY PLAN
TOWN AND COUNTRY CLEANERS
2308 AND 2310 MONROE AVENUE
BRIGHTON, NEW YORK
NYSDEC BCP SITE #C828149

Prepared For: Town and Country Redevelopment, LLC
259 Lesalle Drive
Webster, New York

Prepared By: Day Environmental, Inc.
40 Commercial Street
Rochester, New York 14614

Day Project: 4214s-09

Date: January, 2010

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1.0 INTRODUCTION

Day Environmental, Inc. (DAY) has prepared this Site Specific Health and Safety Plan (HASP) for work tasks associated with the remedial investigation (RI) at 2308 Monroe Avenue, Rochester, NY (Site) including the Interim Remedial Measure (IRM) to remove soil and groundwater impacted with Volatile Organic Compounds (VOCs). The laboratory analytical results from previous soil and groundwater samples indicate the presence of VOCs, at values greater than NYSDEC standards; these are the primary contaminants of concern (COCs) on the Site.

This plan outlines the health and safety procedures, personal protective equipment (PPE), and field monitoring equipment required for monitoring the performance of health and safety requirements during proposed RI activities. Adherence to the details outlined in the HASP is intended to minimize the potential for injury or exposure to contaminants of concern to DAY employees conducting work on this Site.

1.1 Health and Safety Plan Overview

This HASP has been prepared for DAY personnel for activities conducted during the proposed RI project work. The procedures and personal protective equipment described in this plan were developed after reviewing the Site environmental data from previous investigations conducted by DAY, and from data that was provided to DAY from previous investigations conducted by others. DAY has evaluated the potential hazards that may be encountered during the tasks and project work detailed in the RI Work Plan. The purpose of this HASP is to:

- Establish personnel safety/protection standards that meet or exceed the Occupational Safety and Health Administration (OSHA) Regulations;
- Define responsibilities of different organizations and personnel;
- Establish safe operating procedures relative to the conditions encountered at the project work area;
- Define the project work area;
- Provide for anticipated contingencies that may arise during the course of investigation work; and
- Modify the HASP in response to new environmental data or conditions encountered during implementation of the investigation.

2.0 SITE ACCESS & PERSONNEL

DAY personnel working at the Site must follow this HASP and other appropriate written safe access procedures maintained by DAY.

2.1 Site Access

Site access will be given to DAY personnel, DAY's sub-contractors, and appropriate regulatory agencies involved with the project. DAY and DAY's sub-contractors are responsible for providing a safe work area and securing the project work area during work hours and during non-work hours.

Site Specific Health & Safety Personnel

DAY is responsible for the health and safety of DAY personnel. This responsibility includes:

- Provide overall health and safety oversight for the project;
- Prepare and/or review potential changes to this HASP and edit a task-specific addendum to the HASP, if required; and
- Monitor health and safety performance.

One person may be designated as having the responsibilities of the key personnel listed below for this project. A description of the responsibilities of the key personnel involved in the HASP program is presented below.

Project Manager

The Project Manager (PM) will assist with management of on-Site work tasks. The PM is responsible for:

- Managing the planned work requirements so that work performed adheres to the outlined health and safety procedures;
- Providing guidance so that personnel follow health and safety procedures;
- Reviewing daily work activities and field conditions encountered that may result in potential injury or exposure to contaminants of concerns (COCs) as identified during project work; and
- Providing notification of unsafe conditions noted during fieldwork to Site owner and sub-contractors.

Site Health and Safety Officer

The Site Health and Safety Officer's (SHSO) responsibilities will be implemented by the on-Site representative who will be present during the majority of the field phase of the project. The SHSO will be responsible for the following tasks:

- Implementing the HASP;

- Maintaining a daily record (if relevant to health and safety at the project Site) of personnel activities, monitoring activities and results, exposure incidents, and personnel protection equipment usage;
- Monitoring anticipated hazards and propose modifications (if necessary) for the level of personnel protection and/or work procedures;
- Advising the PM on work activities completed and proposed work tasks or conditions which may impact health and safety requirements;
- Having copies of this HASP available on-Site for review; and
- Recording daily weather conditions (e.g., temperature, wind speed/direction, etc.) if these conditions are relevant to health and safety at the project Site.

The SHSO has the authority to suspend work activities if it is felt that the Site or weather conditions may adversely affect personnel health and safety. The SHSO will notify the PM, sub-contractors, and Site owner of such actions.

On-Site Workers

DAY project personnel involved in the proposed investigation activities are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Taking reasonable precautions to prevent incidents and to report accidents;
- Implementing procedures specified in this HASP, and report deviations to the SHSO; and
- Performing the tasks for which they are trained.

For this project, hard hats, work boots, safety glass, and gloves (Level D) are required for field tasks.

Copies of 40-hour HAZWOPER/8-hour refresher certificates are provided in Appendix A.

Visitors

Non-Site workers and Site visitors are responsible for:

- Reading, understanding, and complying with the requirements of the HASP;
- Having the required personnel protecting equipment (e.g., hard hats, safety glass, and work boots); and
- Taking reasonable precautions to prevent incidents that may result in injury.

3.0 HEALTH & SAFETY RISK ANALYSES

3.1 Site Overview

The Site is located at:

2308 and 2310 Monroe Avenue
Brighton, New York 14618

A sub-contractor will install the test borings, groundwater monitoring wells, and conduct IRM excavation and removal activities proposed in the RI Work Plan. DAY will supervise these subsurface explorations and select soil and groundwater samples for laboratory testing.

3.2 Hazard Analyses

Physical Hazards

Possible physical hazards associated with the proposed work include, but are not limited to the following:

- Hazards associated with injury from vehicles or drilling equipment;
- Hazards associated with excavation activities (i.e., slip or trip into the excavation);
- Underground utilities injury from damage to these utilities (i.e., electric shock, fire, and explosion); and
- Heat and/or cold stress.

Chemical Hazards

The chemicals listed below in Table 3.2A are VOCs that were detected at the Site in environmental samples at concentrations above NYSDEC Subpart 375-6 Unrestricted Remedial Soil Clean-up Objectives and NYSDEC TOGS 1.1.1 groundwater standards or guidance values. This list also presents the permissible exposure limits (PELs) and levels that are considered an immediate danger to life or health (IDLH), if such values are available. A summary of the United States Center for Disease Control (CDC) chemical descriptions and hazards associated with overexposure to these VOCs are also presented below. A National Institute for Occupational Safety and Health (NIOSH) Chemical Hazard Data Sheet for each compound is included in Appendix B.

CONSTITUENT	OSHA PEL	NIOSH REL	ACGIH TLV	IDLH
Acetone	1000 ppm	250 ppm	500 ppm	2500 ppm
1,1-dichloroethene	NL	NL	5 ppm	ND
Cis 1,2-dichloroethene	200 ppm	200 ppm	200 ppm	1000 ppm
Tetrachloroethene	100 ppm	NL	50 ppm	150 ppm
Trichloroethene	100 ppm	NL	25 ppm	1000 ppm
Vinyl Chloride	1 ppm	NL	1 ppm	ND

Notes:

PEL = OSHA Permissible Exposure Limits (Time Weighted Average for 8-hour day)
REL = NIOSH Recommended Exposure Limits (Time Weighted Average for 8-hour day)
TLV = ACGIH Threshold Limit Values (Time Weighted Average for 8-hour day)
NL = None Listed
ND = Not Determined
IDLH = Immediately Dangerous to Life or Health Concentration

Acetone

General Description: A colorless, volatile, extremely flammable liquid, which is widely used as an organic solvent. It is readily soluble in water, ethanol, ether, etc., and itself serves as an important solvent. The most familiar household use of acetone is as the active ingredient in nail polish remover. Acetone is also used to make plastic, fibers, drugs, and other chemicals.

Safety and Health: Swallowing very high levels of acetone can result in unconsciousness and damage to the skin in the mouth. Skin contact can result in irritation and damage to the skin. Kidney, liver, and nerve damage, increased birth defects, and lowered reproduction ability of males (only) occurred in animals exposed long-term. It is not known if these same effects would be exhibited in humans.

1,1-Dichloroethene

General Description: 1, 1-Dichloroethene is an industrial chemical that is not found naturally in the environment. It is a colorless liquid with a mild, sweet smell. It is also called vinylidene chloride. 1, 1-Dichloroethene is used to make certain plastics, such as flexible films like food wrap, and in packaging materials. It is also used to make flame retardant coatings for fiber and carpet backings, and in piping, coating for steel pipes, and in adhesive applications.

Safety and Health: The main effect from breathing high levels of 1,1-dichloroethene is on the central nervous system. Some people lost their breath and fainted after breathing high levels of the chemical. Breathing lower levels of 1,1-dichloroethene in air for a long time may damage your nervous system, liver, and lungs. Workers exposed to 1,1-dichloroethene have reported a loss in liver function, but other chemicals were present.

Cis 1,2-dichloroethene

General Description: 1, 2-Dichloroethene, also called 1, 2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1, 2-dichloroethene in air (about 17 parts of 1, 2-dichloroethene per million parts of air [17 ppm]). There are two forms of 1, 2-dichloroethene; one is called cis-1, 2-dichloroethene and the other is called trans-1,2-di-chloroethene. Sometimes both forms are present as a mixture.

Safety and Health: Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

Tetrachloroethene

General Description: Tetrachloroetheneis a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products. Other names for Tetrachloroetheneinclude perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell Tetrachloroethenewhen it is present in the air at a level of 1 part Tetrachloroetheneper million parts of air (1Â ppm) or more, although some can smell it at even lower levels.

Safety and Health: High concentrations of Tetrachloroethene(particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used Tetrachloroetheneto get a "high." The health effects of breathing in air or drinking water with low levels of Tetrachloroetheneare not known.

Trichloroethene

General Description: Trichloroethene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Trichloroethene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

Safety and Health: Breathing small amounts of Trichloroethene may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating. Breathing large amounts of Trichloroethene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage. Drinking large amounts of Trichloroethene may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Drinking small amounts of Trichloroethene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Vinyl Chloride

General Description: Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, Trichloroethene, and Tetrachloroetheneare broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials. Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

Safety and Health: Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death. Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. The effects of drinking high levels of vinyl chloride are unknown. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

4.0 SITE CONTROL MEASURES

4.1 Site Control

Site control will minimize potential injury and exposure of COCs to workers and observers. Site control measures also enhance response in emergency situations.

It is anticipated that project work under this program will be generally conducted following Level D health and safety protocol. In the event that an upgrade to Level C health and safety protocol is necessary, a meeting will be held to prepare for Level C health and safety issues and revisions to the HASP. Project work areas and locations to support level C field operations will be defined and divided into distinct areas. The actual extent of each area is considered task and location specific and will be determined in the field.

4.1.1 Work Zone

The Work Zone is the area in which the potential for chemical contact/exposure may occur. Workers entering this zone will be required to be protected as defined in Section 7.0 of this HASP. The work zone is intended for OSHA-trained workers. Within this zone, the levels of protection may be changed in accordance with Section 7.3 of this HASP. The work zone will be considered a 20-foot radius around the investigation locations, the excavation area, and the impacted soil staging area.

4.1.2 Decontamination Zone

A decontamination zone will be required in the event that Level C health and safety protocol is necessary. The decontamination zone is the area that is established to facilitate the removal of potential contamination from equipment and personnel protective equipment. A decontamination zone will be set up adjacent to the project work area (work zone) to facilitate decontaminating equipment that is used throughout the remediation project work. The location of the decontamination zone will depend on prevailing wind direction and physical Site features.

4.1.3 Support Zone

A support zone may be set up outside the decontamination zone. The support zone will be used to store equipment and first aid supplies. Administrative and other support function may occur within the support zone such as communication systems. Protective clothing (personnel protection equipment) that is used in the work zone may not be used in the support zone except in emergencies.

4.2 Site Security

The SHSO or designated alternate is responsible for controlling access to the active work zone during daytime hours. The sub-contractor is responsible for securing the excavations during working hours and non-working hours. When necessary to establish a work zone as defined above, the same will be identified by barricades or a barrier fence or tape which will be placed a minimum of 10 feet from the edge of the excavation area. Excavations left open overnight or during non-working hours will be barricaded with orange snow fence or equivalent.

4.3 Buddy System

Field activities in contaminated or otherwise potential hazardous work areas should be conducted, whenever possible, with a buddy who is able to:

- Provide partner with assistance;
- Observe partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of partner's protective clothing; and
- Notify the SHSO or others if emergency help is needed.

4.4 Site Communications

Communications will be conducted through verbal communications. When out of audible range, verbal communications will be communicated using portable telephones or a 2-way radio.

Communications between workers in various zones shall consist of standard hand signals, voice, or radios. A portable telephone will be used to contact appropriate agencies in the event of an emergency.

4.5 Safe Work Practices

Operating procedures consistent with general safety rules should be followed by all workers. Workers will be conscientious of others working around them and check that they are safe, and working in a safe manner.

General safety rules that will be enforced at the project work areas include the following:

- Monitoring excavations from an upwind location and periodically from a downwind location;
- Smoking will be prohibited in the work zone;
- Eating and chewing gum will be prohibited at work zones;
- Field work will be conducted during daylight hours unless adequate light is provided;
- Anyone authorized to enter the Site will sign the daily field log and will also be required to follow all procedures in this HASP;
- Workers must thoroughly wash their hands prior to leaving the work area and decontamination zones and before eating or drinking; and
- Excessive facial hair should be minimized in the event that respiratory equipment is required for Level C project work.

4.6 Visitors

Visitors may be permitted in the immediate area of active operations with the approval from the SHSO. Visitors will not be allowed to enter into the work zone and decontamination zones. Site visitors will be briefed on appropriate sections of the HASP. The presence of visitors will be documented on the daily log maintained by the SHSO or designated alternate during all Site activities. Visitor vehicles will be restricted to Support Zones. Visitors will not be allowed in work areas during Level C project work.

4.7 Nearest Medical Assistance

First Aid supplies will be located near the area of the work zone, support zone, or in a field vehicle. Additional medical assistance can be summoned by dialing "911".

The nearest hospital is Strong Memorial Hospital. The emergency route from the Site to this facility is shown on Figure 1 – Hospital Emergency Route.

Additional information regarding driving directions to medical assistance, evacuation routes, and emergency procedures is contained in Section 9.0 of this HASP.

4.8 Safety Equipment

In addition to the PPE necessary to conduct work activities, the following inventory of safety equipment will be available:

- First aid kit;
- Scissors or knife for emergency equipment removal;
- Emergency eye wash;
- Rope for securing objects and use as a lifeline;
- Electrolyte replacement drink – stored in clean area; and
- Fire extinguisher for Class ABC fires.

4.9 Community Air Monitoring Plan

During the advancement of test borings and the excavation and loading of impacted material from the source area, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. A Community Air Monitoring Plan (CAMP) will be implemented in accordance with Appendix 1A of the DER-10 guidance document. A copy of DER-10 Appendix 1A is included as Appendix C.

5.0 EMPLOYEE TRAINING

5.1 Pre-assigned & Annual Refresher Training

DAY employees and contractor personnel working on this site will be trained in accordance with OSHA 29 CFR Part 1910.120.

6.0 MEDICAL SURVEILLANCE

DAY employees and contractors will follow their respective individual in-house medical surveillance procedures.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The SHSO has reviewed the environmental and historical sampling data that is relevant to the proposed work to determine potential exposure to COCs and physical hazards. This review resulted in designating the work area as a construction zone. Level D PPE has been designated as the primary level of personnel protection that should be used during project work where contact with soil and groundwater is possible. Upgrading to Level C will be executed as required in the monitoring guidelines outlined.

7.1 Personal Protective Equipment Selection Criteria

PPE requirements selected for each project work task are specified in Section 7.3 of this HASP. Equipment selection was based upon the mechanics of the task and the nature of the hazards that are anticipated. The following criteria were used in the selection of PPE equipment:

- Chemical hazards known or suspected to be present;
- Routes of entry trough which the chemicals could enter the body, e.g., inhalation, ingestion, skin contact; and
- Potential for contaminant/worker contact while performing the specific task or activity.

Based on available data, DAY anticipates that most on-Site or near-site work activities will be performed at Level D protection. However, Level C protection will be available in the event an upgrade is required.

7.2 Selected Personal Protective Equipment Ensembles

The following components of Level D PPE will be available and used as appropriate in accordance with the specifications of this HASP:

- Safety glasses
- Hard hat when working with heavy equipment
- Steel-toed or composite-toed work boots
- Protective gloves (e.g., nitrite) during sampling or handling of potentially contaminated media
- Work clothing as prescribed by weather

It is possible that an upgrade to Level C may be required during the tasks identified during the project work. If an inhalation hazard is present or per the guidelines presented in the PPE reassessment program, Level C will consist of the following:

- Air-purifying respirator with appropriate cartridges
- Outer protective wear, such as Tyvek coverall [Tyveks (Sarans) and PVC acid gear will be required when workers have a potential to be exposed to impacted liquids or particulates].
- Hard hat
- Steel-toed or composite-toed work boots
- Nitrile, neoprene, or PVC overboots, if appropriate
- Nitrile, neoprene, or PVC gloves, if appropriate

- Safety glasses
- Face shield (when projectiles or splashes pose a hazard and when using a half-face respirator)

7.2.1 Levels of Protection

The following anticipated levels of protection will be used for specific work activities. Adjustments to these levels may be required given the Site conditions encountered.

- Soil borings and collection of soil samples –Level D
- Groundwater monitoring well installation and collection of water samples – Level D
- Excavation, staging, and load out of impacted soil from the source area - Level D
- Dewatering and containerization of impacted groundwater from the source area - Level D

7.3 Personal Protective Equipment Reassessment Program

Air monitoring will be conducted during the project work when excavation or drilling of COC impacted soils is performed. Such monitoring will be conducted within the work zone utilizing photoionization detection (PID) with a 10.6 eV lamp, or equivalent. Monitoring will consist of determining breathing zone concentrations of total volatile organic vapors. The air monitoring equipment utilized will be calibrated and maintained, in accordance with the manufacturer's instructions. The calibrations and checks will be recorded in the field book. This will be performed by field staff at the beginning each day and more frequently, as the conditions warrant.

Background readings will be obtained in the work zone, upwind, downwind, and support zone prior to excavation of COC impacted soil. Following the establishment of background PID measurement, air monitoring will be conducted in the work zone during the soil excavation activities. Periodic PID measurements will be obtained at downwind locations. The PID measurements will be utilized for evaluating potential upgrade to Level C, if necessary. This may be accomplished by comparing PID measurements to health and safety action levels. The action levels for the PID air-monitoring measurements in the worker's breathing zone are provided below:

- Upgrade from Level D to Level C the following conditions exist:
  - Total Organic Vapor (TOV) is greater or equal to 5 ppm and less than 50 ppm with compensation made for background readings sustained for a period of at least 10 minutes.
- Downgrade from Level C to Level D if both of the following conditions exist: Total Organic Vapor (TOV) is less than 5 ppm, above background sustained for a period of at least 10 minutes, with subsequent approval to downgrade provided by the Project Manager.

Immediate Evacuation of Area:

- Total Organic Vapor (TOV) – sustained readings greater or equal to 50 ppm in the workers' breathing zone.
- Excavation of unknown soil type or containers.

If evacuation of the area becomes necessary, a meeting will be held to address the air monitoring results and air monitoring may be continued until levels are below evacuation criteria so the area can be reentered.

8.0 DECONTAMINATION PROCEDURES

Field decontamination of PPE (e.g., Boots) will consist of washing contaminated PPE with a mixture of Alconox soap and water. Modification to the decontamination protocol for PPE will be made on-Site as needed.

9.0 EMERGENCY RESPONSE

In the event of an emergency the following procedures will apply:

- Fire – the work area will be evacuated and the fire department will be notified. Telephone 911.
- Injury – Contact emergency medical services (Telephone 911). A qualified person will administer first aid. If injury is not a life or death situation, then self-transport to the hospital is acceptable. Directions to the hospital are attached.
- Chemical Overexposure – If possible, move the victim to a safe location and contact 911 for emergency services. Have a qualified person administer first aid. If the person is conscious self-transport to the hospital is acceptable. If the person is unconscious, notify the appropriate emergency medical services at telephone number 911.

9.1 Available Equipment and Emergency Authorities

DAY and/or Day's sub-contractor will have a cellular telephone. If additional emergency equipment is required, the following local agencies can be called upon for advice, supplies, or additional manpower:

AGENCY	TELEPHONE NUMBER
Town of Brighton Fire Department	911
Medical Emergency	911
NYSDEC Project Manager, Gary Bonarski	(585) 266-5328
NYSDOH Project Manager, Gary Litwin	(518) 402-7850

9.2 Driving Directions to Strong Memorial Hospital

1. Head **northwest** on **Monroe Ave** toward **Monroe Pkwy**	0.5 mi
2. Turn **left** at **Co Rd 87/Elmwood Ave** Continue to follow Elmwood Ave	3.0 mi
3. Turn **left** into Hospital access road Strong Memorial Hospital will be on the right	

SIGNATURE PAGE

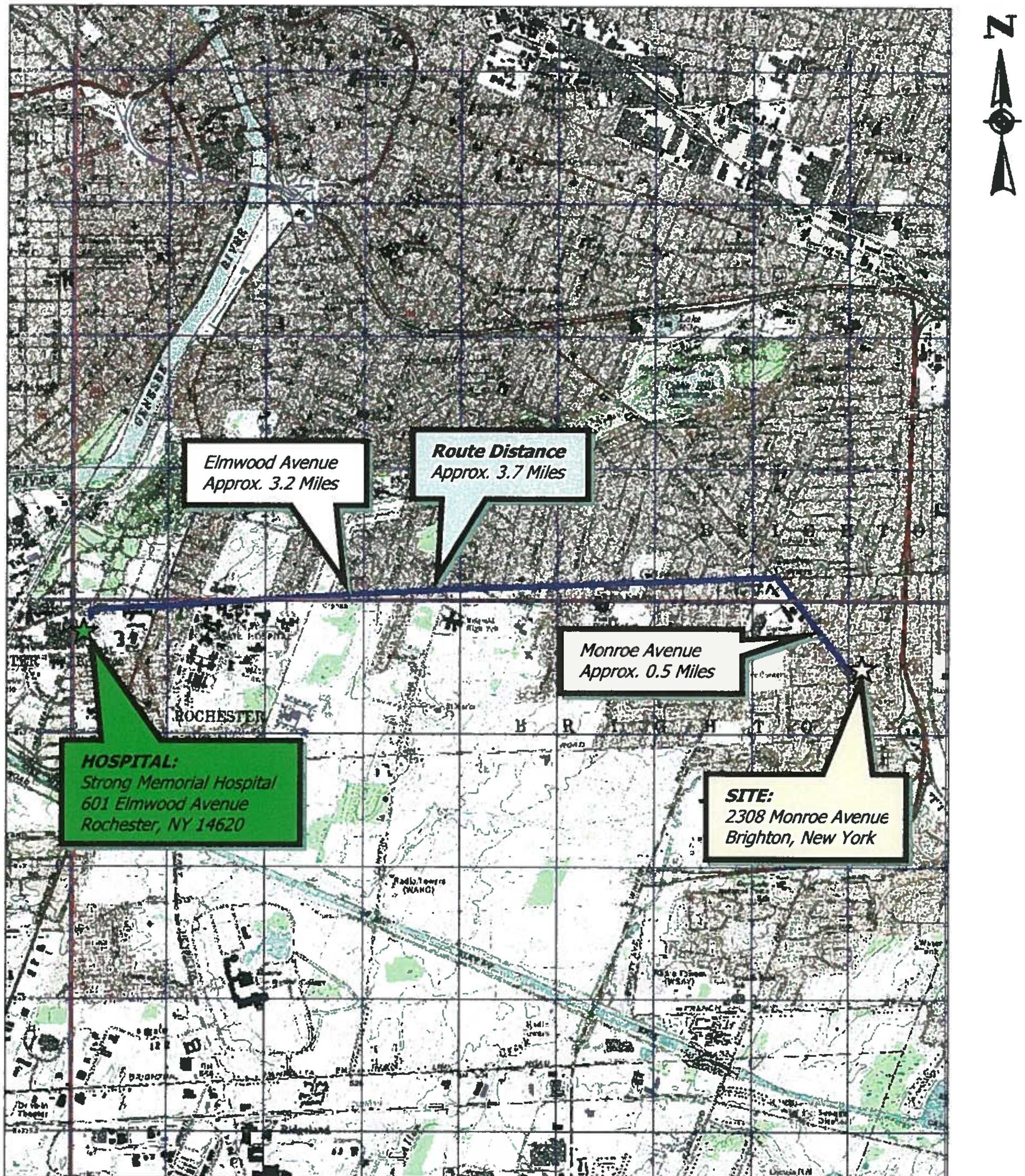
By signing below, I acknowledge that I have been informed of the items covered by this plan.

PRINTED NAME	SIGNATURE

FIGURES

FIGURE 1

HOSPITAL EMERGENCY ROUTE



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096 Source Data: USGS   1000 ft Scale: 1 : 34,375 Detail: 13-0 Datum: WGS84

Drawing Produced From: 3-D TopoQuads, DeLorme Map Co., referencing USGS quad maps Rochester East (NY) 1995 and Pittsford (NY) 1995.

DATE	day DAY ENVIRONMENTAL, INC.	PROJECT TITLE	PROJECT NO.
1-5-2010	ENVIRONMENTAL CONSULTANTS	2308 MONROE AVENUE BRIGHTON, NEW YORK	4214S-09
DRAWN BY RJM	ROCHESTER, NEW YORK 14614-1008	HEALTH AND SAFETY PLAN	
SCALE As Noted		DRAWING TITLE ROUTE FOR EMERGENCY SERVICES	FIGURE 1

APPENDIX A

40- Hour HAZWHOPPER Training Certifications

CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Jeff Danzinger

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

Clark K. Price, P.E.
Project Manager, Industrial Compliance
Day Engineering, P.C.
Rochester, New York 14614
(585) 454-0210

CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

David Day

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Ray Kampff

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Charles Hampton

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Nate Simon

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Christie Sunderrajan

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

Clark K. Price, P.E.
Project Manager, Industrial Compliance
Day Engineering, P.C.
Rochester, New York 14614
(585) 454-0210

CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Glenn Miller

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

Clark K. Price, P.E.
Project Manager, Industrial Compliance
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Rochester, New York 14614
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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Tom Roszak

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

Clark K. Price, P.E.
Project Manager, Industrial Compliance
Day Engineering, P.C.
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CERTIFICATE OF COMPLETION

OSHA 8-HOUR HAZARDOUS WASTE SITE WORKER ANNUAL REFRESHER TRAINING

Kelly Crandall

is hereby certified as having attended and successfully completed eight hours of Hazardous Waste Site Worker Annual Refresher Training complying with the requirements of applicable regulations as published in 29 CFR 1910.120.

Completed October 31, 2009

Clark K. Price, P.E.
Project Manager, Industrial Compliance
Day Engineering, P.C.
Rochester, New York 14614
(585) 454-0210

APPENDIX B

NIOSH Chemical Hazard Data Sheets

NIOSH Publication 2005-149 **September 2005**

NIOSH Pocket Guide to Chemical Hazards

Vinylidene chloride

CAS 75-35-4

$CH_2=CCl_2$

RTECS KV9275000

Synonyms & Trade Names
1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride

DOT ID & Guide
1303 130P (inhibited)

Exposure Limits
NIOSH REL: Ca See Appendix A
OSHA PEL†: none

IDLH Ca [N.D.] See: IDLH INDEX

Conversion

Physical Description
Colorless liquid or gas (above 89F) with a mild, s weet, chloroform-like odor.

MW: 96.9	BP: 89F	FRZ: -189F	Sol: 0.04%
VP: 500 mmHg	IP: 10.00 eV		Sp.Gr: 1.21
Fl.P: -2F	UEL: 15.5%	LEL: 6.5%	

Class IA Flammable Liquid: Fl.P. below 73F and BP below 100F.

Incompatibilities & Reactivities
Aluminum, sunlight, air, copper, heat [Note: Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

Measurement Methods
NIOSH 1015; OSHA 19
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Cancer Site [in animals: liver & kidney tumors]

See also: INTRODUCTION See ICSC CARD: 0083

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Acetone

CAS 67-64-1

$(CH_3)_2CO$

RTECS AL3150000

Synonyms & Trade Names
Dimethyl ketone, Ketone propane, 2-Propanone

DOT ID & Guide
1090 127

Exposure Limits
NIOSH REL: TWA 250 ppm (590 mg/m^3)
OSHA PEL†: TWA 1000 ppm (2400 mg/m^3)

IDLH 2500 ppm [10%LEL] See: 67641

Conversion 1 ppm = 2.38 mg/m^3

Physical Description
Colorless liquid with a fragrant, mint-like odor.

MW: 58.1	BP: 133F	FRZ: -140F	Sol: Miscible
VP: 180 mmHg	IP: 9.69 eV		Sp.Gr: 0.79
Fl.P: 0F	UEL: 12.8%	LEL: 2.5%	

Class IB Flammable Liquid: Fl.P. below 73F and BP at or above 100F.

Incompatibilities & Reactivities
Oxidizers, acids

Measurement Methods
NIOSH 1300, 2555, 3800; OSHA 69
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
Up to 2500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0087 See MEDICAL TESTS: 0002

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

1,2-Dichloroethylene

CAS 540-59-0

ClCH=CHCl

RTECS KV9360000

Synonyms & Trade Names
Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene

DOT ID & Guide
1150 130P

Exposure Limits
NIOSH REL: TWA 200 ppm (790 mg/m^3)
OSHA PEL: TWA 200 ppm (790 mg/m^3)

IDLH 1000 ppm See: 540590

Conversion 1 ppm = 3.97 mg/m^3

Physical Description
Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F	Sol: 0.4%
VP: 180-265 mmHg	IP: 9.65 eV		Sp.Gr(77°F): 1.27
Fl.P: 36-39°F	UEL: 12.8%	LEL: 5.6%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods
NIOSH 1003; OSHA 7
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 1000 ppm:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode£
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£
(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; central nervous system depression

Target Organs Eyes, respiratory system, central nervous system

See also: INTRODUCTION See ICSC CARD: 0436

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Tetrachloroethylene

CAS 127-18-4

$Cl_2C=CCl_2$

RTECS KX3850000

Synonyms & Trade Names
Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

DOT ID & Guide
1897 160

Exposure Limits
NIOSH REL: Ca Minimize workplace exposure concentrations. See Appendix A
OSHA PEL†: †: TWA 100 ppm
C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm

IDLH Ca [150 ppm] See: 127184

Conversion 1 ppm = 6.78 mg/m^3

Physical Description
Colorless liquid with a mild, chloroform-like odor.

MW: 165.8	BP: 250F	FRZ: -2F	Sol: 0.02%
VP: 14 mmHg	IP: 9.32 eV		Sp.Gr: 1.62
Fl.P: NA	UEL: NA	LEL: NA	

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities
Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Measurement Methods
NIOSH 1003; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site [in animals: liver tumors]

See also: INTRODUCTION See ICSC CARD: 0076 See MEDICAL TESTS: 0179

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Trichloroethylene

CAS 79-01-6

$ClCH{=}CCl_2$

RTECS KX4550000

Synonyms & Trade Names
Ethylene trichloride, TCE, Trichloroethene, Trilene

DOT ID & Guide
1710 160

Exposure Limits
NIOSH REL: Ca See Appendix A See Appendix C
OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)

IDLH Ca [1000 ppm] See: 79016

Conversion 1 ppm = 5.37 mg/m^3

Physical Description
Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	BP: 189F	FRZ: -99F	Sol(77F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
Fl.P: ?	UEL(77F): 10.5%	LEL(77F): 8%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods
NIOSH 1022, 3800; OSHA 1001
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures)
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site [in animals: liver & kidney cancer]

See also: INTRODUCTION See ICSC CARD: 0081 See MEDICAL TESTS: 0236

NIOSH Publication 2005-149 September 2005

NIOSH Pocket Guide to Chemical Hazards

Vinyl chloride

CAS 75-01-4

CH_2=CHCl

RTECS KU9625000

Synonyms & Trade Names
Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)

DOT ID & Guide
1086 116P (inhibited)

Exposure Limits
NIOSH REL: Ca See Appendix A
OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute]

IDLH Ca [N.D.] See: IDLH INDEX

Conversion 1 ppm = 2.56 mg/m^3

Physical Description
Colorless gas or liquid (below 7F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

MW: 62.5	BP: 7F	FRZ: -256F	Sol(77F): 0.1%
VP: 3.3 atm	IP: 9.99 eV	RGasD: 2.21	
Fl.P: NA (Gas)	UEL: 33.0%	LEL: 3.6%	
Flammable Gas			

Incompatibilities & Reactivities
Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Measurement Methods
NIOSH 1007; OSHA 4, 75
See: NMAM or OSHA Methods

Personal Protection & Sanitation (See protection codes)
Skin: Frostbite
Eyes: Frostbite
Wash skin: No recommendation
Remove: When wet (flammable)
Change: No recommendation
Provide: Frostbite wash

First Aid (See procedures)
Eye: Frostbite
Skin: Frostbite
Breathing: Respiratory support

Respirator Recommendations (See Appendix E) NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus
Important additional information about respirator selection

Exposure Routes inhalation, skin, and/or eye contact (liquid)

Symptoms Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]

Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system

Cancer Site [liver cancer]

See also: INTRODUCTION See ICSC CARD: 0082 See MEDICAL TESTS: 0241

APPENDIX C

DER-10: Technical Guidance for Site Investigation and Remediation, May 2010
Appendix 1A – New York State Department of Health Generic Community Air Monitoring Plan

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the

work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009