**New York State Department of
Environmental Conservation**

Feasibility Study Report

Former Munsey Cleaners (OU2) and
Plaza Cleaners Sites
Port Washington, New York
Site # 130081 and 130108
Work Assignment # D-004439-18.1
and D-004439-14.1

February 2012

ARCADIS

Feasibility Study Report

Former Munsey Cleaners (OU2)
and Plaza Cleaners Sites

Port Washington, New York
Site # 130081 and 130108

Prepared for:
New York State Department of
Environmental Conservation

Prepared by:
ARCADIS U.S., Inc.
855 Route 146
Suite 210
Clifton Park
New York 12065
Tel 518 250 7300
Fax 518 250 7301

Our Ref.:
00266380.0000

Date:
February 2012

Figures

Tables

Appendices

List of Acronyms

1,1,1-TCA	1,1,1-Trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-Dichloroethene
bgs	Below Ground Surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
C&D	Construction and Demolition
CCl4	Carbon Tetrachloride
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
CO2	Carbon Dioxide
COC	Chemical Compounds of Concern
CVOCs	Chlorinated Volatile Organic Compounds
DER	Division of Environmental Remediation
DHE	Dehalococcoides ethanogenes
DO	Dissolved Oxygen
DW	Dry Well
Earth Tech	Earth Tech, Inc.
ESI	Expanded Site Investigation
ESTCP	Environmental Security Technology Certification Program
ETI	Environmental Technology, Inc.
GRAs	General Response Actions
GSA	General Services Administration
ISCO	In-situ chemical oxidation
KMnO4	Potassium permanganate
MCLs	Maximum Contaminant Levels
MNA	Monitored Natural Attenuation

MnO2	Manganese dioxide
MTBE	Methyl tertiary-butyl ether
MW	Monitoring Well
NaMnO4	Sodium permanganate
NAPLs	Non-aqueous Phase Liquids
NOM	Natural Organic Matter
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O & M	Operation and Maintenance
PAHs	Polycyclic aromatic hydrocarbons
PCE	Tetrachloroethene
ppm	part-per-million
PRBs	Permeable Reactive Barriers
PSA	Preliminary Site Assessment
RAGS	Risk Assessment Guidance for Superfund
RAOs	Remedial Action Objectives
$\mathrm{S2O8}^{2-}$	Persulfate anion
SAT	Site Assessment Team
SCG	Standards, Criteria, and Guidance
$\mathrm{SO4}^{2-\bullet}$	Sulfate free radical
SSD	Sub-Slab Depressurization
SVE	Soil Vapor Extraction
TCE	Trichloroethene
TDS	Total Dissolved Solids
USEPA	United States Environmental Protection Agency
UV	Ultraviolet

VC	Vinyl Chloride
VOCs	Volatile Organic Compound

1. Introduction

This Feasibility Study Report has been developed to screen and evaluate remedial measure alternatives for contaminants in groundwater downgradient of the former Munsey and Plaza Cleaners sites in Port Washington, New York (Figure 1). The purpose of this report is to:

- Identify potentially feasible groundwater remedial technologies;
- Evaluate these technologies based on seven evaluation criteria; and
- Compare remedial measure alternatives that could be implemented to meet Remedial Action Objectives (RAOs) and provide site-specific information on performance of the remedial technology.

The remedy for the groundwater downgradient of the former Munsey and Plaza Cleaners sites will not be selected until this evaluation, and subsequent NYSDEC assessments, have been thoroughly reviewed and presented to the public. The goals of this remedy are discussed in Section 2.1. This FS was completed in accordance with NYSDEC Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10), NYSDEC DER program policy for Presumptive/Proven Remedial Technologies (DER-15), and other appropriate NYSDEC guidance.

1.1 Site History

The former Munsey and Plaza Cleaners sites are located in an urban area of Nassau County, NY and is approximately 5 miles north of the Long Island Expressway in Port Washington. The former Munsey Cleaners site is located near the intersection of Main Street and Port Washington Blvd. The site consists of a one-story retail shopping plaza. The commercial building located at the Munsey Cleaners site was constructed in 1947 and used for dry cleaning operations until 1994. Tetrachloroethene (PCE) was used during dry cleaning operations. Spent solvents appear to have been disposed of in the basement.

The former Plaza Cleaners building is located approximately 250 feet southwest of the former Munsey Cleaners building. The Plaza Cleaners site is an active dry cleaners consisting of a one story concrete building located at the corner of Port Washington

Boulevard and Maple Street. The property is approximately 0.25 acres in size and is located in a mixed commercial setting.

1.2 Site Description

The former Munsey and Plaza Cleaners sites are located in an urban area in the Hamlet of Port Washington, Nassau County, Long Island, New York (Figures 1 and 2). Port Washington is located on the approximately 13.5 square-mile, Manhasset Neck peninsula. The Manhasset Neck is surrounded by the Long Island Sound towards the north, Manhasset Harbor to the east and Hempstead Harbor to the west.

The former Munsey Cleaners site is located at the southeastern corner of Port Washington Boulevard and Main Street. The former Plaza Cleaners site, located at the junction of Port Washington Boulevard and Maple Street, is approximately 250 feet southwest of the former Munsey Cleaners site. The Munsey Cleaners Operable Unit 1 (OU-1) consists of the property boundary of the site. The Munsey Cleaners Operable Unit 2 (OU-2) represents the off-site groundwater and potential indoor air impacts. For the purposes of this FS, the Munsey and Plaza Cleaners sites refer to the properties on which these two businesses formerly operated while the Munsey and Plaza Cleaners investigation area encompasses the area of groundwater contamination, which extends off-site from the former Munsey and Plaza Cleaners sites to the west and northwest (Figure 2).

Dissolved-phase VOC plumes primarily containing tetrachloroethene (PCE) and trichloroethene (TCE) extend off-site from the former Munsey and Plaza Cleaners sites approximately three quarters of a mile to the north and northwest. Concentrations of PCE detected in groundwater sampled at the former Munsey Cleaners site (OU-1) ranged from 43 micrograms-per-liter (µg/L) to 1,900 µg/L, while TCE concentrations ranged from not detected to 60 µg/L. In groundwater sampled at the former Plaza Cleaners site in 2003, PCE concentrations ranged from 3 to 809 µg/L.

1.2.1 Physical Setting

Land use is mixed-use commercial and residential in the vicinity of the Munsey and Plaza Cleaners sites. Most businesses are on Port Washington Boulevard and Main Street. Residential areas are generally north of Main Street, and in the Village of Baxter Estates (Figure 1).

The former Munsey and Plaza Cleaners properties are situated at an elevation of approximately 125 feet above mean sea level (AMSL) on the Manhasset Neck in northern Nassau County (Figure 1). Regional topography consists of irregular inland highlands that slope toward the water bodies, with a gentle slope toward the west and steeper slopes toward the east. The topography of the investigation area generally slopes irregularly downward from the former Munsey and Plaza Cleaners properties towards the north and west and upward towards the east. The topography consists of small hummocks (< 5 to 10 feet), kame moraines, and glacial meltwater-incised valleys.

1.2.2 Hydrogeology

Baxter Brook (Swarzenski, 1963), originating west of Port Washington Boulevard, approximately 100 feet north of its intersection with Delaware Avenue courses to the west and runs along Central Drive before flowing into Baxter Pond. A second creek (presumably named Stannards Brook), originates at the southern end of Madison Street and flows through Stannards Brook County Park to the north of Charles Street. Neither of these creeks have been classified by NYSDEC.

The Upper Glacial aquifer present beneath the former Munsey and Plaza Cleaners sites is a shallow, unconsolidated aquifer of variable thickness. The water table occurs at varying depths in this area because of the irregular inland topography, and ranges in elevation from approximately 10 to 150 feet AMSL (Stumm, et. al. 2002). The Upper Glacial Aquifer is underlain by the North Shore confining unit (NScu). The upper surface elevation of the NScu ranges from approximately 35 to 150 feet below mean sea level (BMSL) across the Manhasset Neck (Stumm, et. al. 2002).

Mean annual groundwater pumping from the Upper Glacial Aquifer was 365.6 million gallons through 1992-1996 (Data from the Albertson, Manhasset-Lakeville, Port Washington and Roslyn Water Districts; Sands Point Water Department, and New York State Department of Environmental Conservation, in Stumm et al., 2002). The Manhasset Neck is heavily developed with residential and commercial properties. As such, surface run-off is controlled by pavement and stormwater drainage systems.

In the vicinity of the former Munsey and Plaza Cleaners sites, treated groundwater is used as a local potable water source. The Port Washington Water District (PWWD) receives a portion of its water from two supply wells (N-06087 & N-04860) located approximately 3,700 and 4,100 feet from the former Munsey and Plaza sites, respectively. These wells are in the Sandy Hollow well field, which is downgradient of the former Munsey and Plaza Cleaners sites, and are screened in the Upper Glacial Aquifer. An additional potable water supply well from the PWWD is present at the east end of Bar Beach Road, which is approximately 0.5 miles southeast of the former Munsey and Plaza Cleaners sites. The PWWD serves an area of approximately six square miles that includes the communities of Port Washington, Manorhaven, Port Washington North, Baxter Estates and parts of Flower Hill and Plandome Manor. The PWWD website indicates they serve an average of 9,250 customers with approximately 1.3 billion gallons of water annually.

1.3 Previous Investigations and Remediation Activities

Numerous investigation and remediation activities have been conducted at the former Munsey and Plaza Cleaners sites. Contaminated soil was excavated and removed from both the former Munsey and Plaza Cleaners sites. A soil vapor extraction (SVE) and sub-slab depressurization (SSD) system are currently operating at the former Munsey Cleaners site. A SVE system has been installed at the former Plaza Cleaners site but is not in operation. These activities are summarized below.

1.3.1 Former Munsey Cleaners Site

A Preliminary Site Assessment (PSA) was conducted at the Munsey Cleaners (OU-1) site in 1996 and included soil sampling in the basement area and groundwater sampling. During the PSA, PCE concentrations in soil were found to be as high as 12,000 parts per million (ppm) in the vicinity of the basement floor drain. In 1996, approximately 30 tons of contaminated soil were removed from the Munsey Cleaners site as part of Interim Remedial Measures (IRMs) completed at OU-1. Following the soil excavation, a SVE system was installed and operated until July 1998 when soil samples indicated that contamination levels were reduced to less than NYSDEC standards, criteria and guidance (SCG) levels.

Samples collected during the PSA indicated that PCE was present in groundwater in the vicinity of the Munsey Cleaners site at a concentration greater than the NYSDEC Class GA groundwater standard. Groundwater samples from wells located both on-site and off-site that were installed during a RI completed in 2001 demonstrated VOC contamination levels consistent with those found during the PSA. Currently groundwater samples are periodically collected in OU-1. Results from these sampling events indicate a significant decrease in PCE levels except for the most downgradient well. The decrease in PCE levels within OU-1 may be attributable to the operation of the SVE system installed during the 1996 IRM.

A soil vapor survey was conducted in August 2002 at the Munsey Cleaners site. Results from the survey indicated on-site concentrations of PCE ranging from 59,600 to 201,000 micrograms per cubic meter (µg/m^3). In 2003, the SVE system was restarted to address soil vapor intrusion. Quarterly sampling showed a significant decrease in VOC concentrations in indoor air. In 2004, the SVE system was again shut down and a SSD system was installed to address soil vapor intrusion. Based on the effectiveness of IRMs implemented at the Munsey Cleaners site, a No Further Action Record of Decision (ROD) was made for Munsey Cleaners OU-1 in November 2005. The selected remedy for the Munsey Cleaners site included operation of SVE and SSD systems at the site, monitoring, maintenance, and sampling.

The results from the February 2007 indoor air sampling event indicated that on-site PCE concentrations were lower; however, the levels still exceeded the New York State Department of Health (NYSDOH) *2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*.

1.3.2 Former Plaza Cleaners Site

The 0.25-acre former Plaza Cleaners site includes a one-story concrete building in the southwestern corner of the lot and is currently being used as an active dry cleaner business. The remaining portion of the property is covered with asphalt. This property has operated as a dry cleaner since 1964. Recognized environmental conditions, associated with an on-site underground storage tank (UST) and the long-term operation of a dry cleaner, were identified in a 1998 Phase I Environmental Site Assessment. PCE was subsequently identified in a floor drain within the building and in sub-slab soils during a Phase II Environmental Audit. In 1998 and 1999, under the oversight of the Nassau County Department of Health, approximately 941 tons of contaminated soil was excavated and disposed of off-site at a permitted disposal facility. An Order on Consent was negotiated between NYSDEC and the responsible party in March 2001. During a 2003 Phase II subsurface soil and groundwater investigation conducted under NYSDEC oversight, PCE was detected in on-site groundwater samples at concentrations ranging from 3 to 809 µg/L. Residual PCE was detected in on-site soil ranging from non-detect to 1.01 ppm. A RI/FS was initiated by the responsible party and, in February 2007, a Remedial Action Plan/Feasibility Study (RAP/FS) plan was submitted to NYSDEC; however, in May 2007, the Consent Order was terminated by NYSDEC. In fall 2007, the Plaza Cleaners site was listed as a Class 2 site and the completion of the RI/FS was referred to the State Superfund. An SVE system was installed at the Plaza Cleaners site by the responsible party but was never operated.

1.3.3 Sandy Hollow Well Field

The Sandy Hollow well field is located to the south of Sandy Hollow Road on the northern edge of the Village of Baxter Estates. Treated groundwater from this well field is used as a local potable water source, which is supplied by the Port Washington Water District. This well field consists of three wells screened in the Upper Glacial aquifer, two of which are currently in use. Supply wells N-06087 and N-04860 (also referred to as PWSH-2 and PWSH-1, respectively) are located approximately 3,700 and 4,100 feet, respectively, downgradient of the Munsey and Plaza Cleaners sites. In accordance with NYSDOH drinking water quality requirements, the Port Washington Water District utilizes a granular activated carbon (GAC) system to remove VOCs from water pumped at the Sandy Hollow well field. It is unknown if an evaluation was conducted on behalf of the PWWD to determine the source of these VOCs. ARCADIS U.S., Inc., on behalf of NYSDEC, collected groundwater samples from PWSH-1 and PWSH-2 in 2008 and 2010. No site related VOCs were detected in these samples.

1.4 Conceptual Site Model

Information obtained during the RI and previous investigations was used to develop a conceptual site model, which summarizes the site-specific geology, the depth and flow of groundwater, and the potential CVOC sources. This model is used herein to facilitate the evaluation of potential CVOC source areas and migration pathways and provide an organizational structure for data collected during multiple investigations. These data include site-specific information on CVOCs in soil, groundwater, soil gas, sub-slab vapor, indoor and outdoor air and the geologic and hydrogeologic characteristics that affect the distribution, fate, and migration of the CVOCs. A summary of the analytical results from samples collected from 2008 through 2011 is provided in Appendix A.

The uppermost portion of the water-table (Upper Glacial) aquifer consists predominantly of sand with some gravel and silt (kame and outwash deposits) with discontinuous and intermittent silt and clay lenses. Low permeability zones of clay were encountered sporadically across the investigation area. It is unlikely that these clay zones are continuous across the investigation area because VOCs have been detected stratigraphically below the bottom of the clays. The thickest clay units appear in borings in the vicinity of Baxter Brook, which flows from east to west across the investigation area. Based on information from cross sections in Stumm et al. 2002, bedrock elevation (biotite-garnet schist of the Hartland Formation) varies from approximately 150 to 400 feet BMSL.

Groundwater generally flows from the site to the northwest toward Baxter Estates and the Sandy Hollow municipal well field (Figure 3). The depth to groundwater varies considerably depending upon location within the hummocky kame and outwash deposits. At MC-11, which is approximately 100 feet AMSL in Baxter Estates, groundwater was at a depth of 75 feet bgs. At MC-7, which is approximately 120 feet AMSL along South Bayles Avenue, groundwater occurs at a depth of approximately 30 feet bgs. The water table is influenced by shallow groundwater discharge to Baxter Brook, which flows generally from east to west across the study area. Baxter Brook flows into Baxter Pond, which discharges to Manhasset Bay (Figure 1). The hydraulic gradient is predominantly horizontal throughout the study area, but steepens in the western portion of the study area where it is influenced by the incised Baxter Brook, and potentially influenced by pumping at the Sandy Hollow municipal well field.

Analytical data indicate that groundwater in the water-table aquifer contains CVOCs, primarily PCE and TCE (Figure 3) and that the dissolved-phase CVOC plume is migrating from the sites and to the north and west. The dissolved-phase VOC plume consists primarily of PCE, TCE, and cis-1,2 DCE. MTBE was detected at concentrations greater than the NYSDEC standard at several locations, however, this compound is not characteristic of activities associated with dry cleaners. Total VOC concentrations in groundwater have been detected as high as 1,520 µg/L in the sample collected from MC-B-04 in January 2008. The PCE concentration in this sample was 1,500 µg/L. PCE concentrations in groundwater sampled in 2008 and 2010 from multiple depths from monitoring wells (MC-7-A/B/C) installed near MC-B-04 ranged from 240 to 870 µg/L. Degradation products of PCE include TCE, cis-1,2 DCE, and vinyl chloride (VC). TCE and cis-1,2 DCE were detected at relatively lower concentrations in groundwater and VC was not detected, indicating that little natural attenuation of PCE is occurring within the aquifer. VOCs were detected in intermediate- and deep-zone groundwater in the northwestern section of Baxter Estates at PC-1B/C. This indicates that the VOCs within the plume have not only migrated laterally from the Munsey and Plaza Cleaners sites, but also migrated vertically downwards.

Analysis of surface water collected at four locations from Baxter Brook northwest of the Munsey and Plaza Cleaners sites indicates that the surface water quality may be affected by the dissolved-phase VOC plume. The stream has likely been a discharge point for VOCs within the upper portion of the water table across the investigation area. Given the distance from the presumed release points to Baxter Brook (approximately 4,000 – 7,500 feet) the VOCs are likely well dispersed vertically as the plume reaches Baxter Brook.

Sub-slab vapor and indoor air sampling results indicate that CVOC vapors have migrated upward through the vadose zone overlying the dissolved-phase CVOC plume. Consistent with groundwater quality, PCE and TCE were the primary CVOCs present in the sub-slab vapor and indoor air samples. PCE, the primary VOC present in the sub-slab vapor and indoor air samples, was detected in off-site sub-slab vapor samples at concentrations as high as 61,098 µg/m^3. The PCE concentration in sub-slab vapor was greater than 1,000 µg/m^3 at 14 of the 52 off-site properties where indoor air and/or sub-slab vapor samples were collected. The highest concentrations of PCE were found in sub-slab vapor samples collected from Main Street properties located between Port Washington Boulevard and North Bayles Avenue. This area of Main Street is located west of the former Munsey and Plaza Cleaners sites. Based on a review of the relevant information and analytical data from the 52 residences and businesses where samples were collected, the NYSDEC and NYSDOH recommended mitigation (installation of a sub-slab depressurization system) at approximately nine properties, which are each located over the dissolved-phase VOC plume.

Given the commercial and urban land use in the vicinity of the Munsey and Plaza Cleaners sites, multiple sources of contamination cannot be ruled out. However, analytical data indicate decreasing concentrations in the downgradient direction from the former Munsey and Plaza Cleaners sites to MC-9B and MC-9C. A series of investigation activities have been conducted at the former Munsey and Plaza Cleaners sites to identify source areas and characterize the overall distribution of contaminants. Based on available information with regard to previous releases and attempted remediation thereof, releases of PCE-containing solvents at two locations within and upgradient of former Munsey Cleaners OU-2 have been documented. The data suggest that disposal occurred at both the former Munsey and former Plaza Cleaners sites. Based on the proximity of the former Plaza Cleaners site to the former Munsey Cleaners site, the direction of local groundwater flow, and the results of analytical data, it is likely the two dissolved-phase VOC plumes have partially combined.

2. Identification of RAOs, SCGs, and GRAs

This section outlines the Remedial Action Objectives (RAOs) proposed for the final Munsey and Plaza Cleaners off-site (OU-2) remedies. In addition, this section summarizes the standards, criteria, and guidance (SCGs) and general response actions (GRAs) to be considered in addressing the RAOs. GRAs are medium-specific actions that could be taken to address the RAOs.

2.1 Remedial Action Objectives

RAOs are goals set for environmental media, such as soil, groundwater, sediment, surface water, soil vapor, and indoor air, which are intended to provide protection for human health and the environment. RAOs form the basis for the FS by providing overall goals for site remediation. The RAOs are considered during the identification of appropriate remedial technologies and formulation of alternatives for each site, and later during the evaluation of remedial alternatives. RAOs are based on engineering judgment, and potentially applicable or relevant and appropriate SCGs. For the purposes of this feasibility study, and based on the results of previous site investigations, the RAOs for the Munsey and Plaza Cleaners investigation area are to:

- Eliminate, to the extent practicable, exposures to VOCs in groundwater, surface water, and indoor air;
- Reduce, to the extent practicable, the concentration of site-related contaminants [e.g., PCE, TCE, *cis*-1,2-DCE] in groundwater downgradient of the Munsey and Plaza Cleaners sites to less than NYSDEC Class GA Ambient Water Quality Criteria or guidance values; and
- Reduce, to the extent practicable, VOC concentrations in surface water downgradient of the Munsey and Plaza Cleaners sites that exceed NYSDEC Class C Ambient Water Quality Criteria or guidance values.

2.2 Standards, Criteria, and Guidance

6 NYSCRR Part 375 requires that SCGs are identified and that remedial actions conform with SCGs unless “good cause exists why conformity should be dispensed with.” Standards and Criteria are cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant,

contaminant, remedial action, or location. Guidance includes non-promulgated criteria and guidelines that are not legal requirements; however each site's remedial program should be designed with consideration given to guidance that, based on professional judgment, is determined to be applicable to the site.

The principle SCGs for the Munsey and Plaza Cleaners investigation area are listed below:

General:

- 6 NYCRR Part 375 – Environmental Remediation Programs, including the Inactive Hazardous Waste Disposal Site Remedial Program
- 6 NYCRR Part 371 – Identification and Listing of Hazardous Wastes

Water:

- 6 NYCRR Part 700-705, Water Quality Regulations for Surface Water and Groundwater
- NYSDEC Division of Water TOGS 1.1.1 – Ambient Water Quality Standards and Groundwater Effluent Limitations

Air:

- NYSDEC Division of Air Resources Policy DAR-1 – Guidelines for Control of Toxic Ambient Air Contaminants
- NYSDOH October 2006 Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York

There are three types of SCGs: chemical-, location-, and action-specific SCGs. Chemical-specific SCGs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to the ambient environment. Location-specific SCGs set restrictions on activities based on the characteristics of the site or immediate environs. Action-specific SCGs set controls or restrictions on particular types of remedial actions once the remedial actions have been identified as part of a remedial alternative. The identification of potential SCGs is documented in Table 1.

2.3 General Response Actions

NYSDEC Program Policy DER-15: *Presumptive /Proven Remedial Technologies*, provides generally accepted presumptive remedies for various site media which comply with 6 NYCRR section 375-1.8. Presumptive remedies for VOC contaminated site media are presented in Section 4 of the DER-15 Guidance document. The purpose of the presumptive remedy approach is to streamline the remedy selection process by providing remedies that have been proven to be both feasible and cost-effective for specific site types and/or contaminants. In accordance with Section 4.2(a)3 of the NYSDEC Program Policy Draft DER-10: Technical Guidance for Site Investigation and Remediation, the use of presumptive remedies eliminates the need to screen the selected technologies and to proceed directly to the evaluation of the presumptive alternatives.

In accordance with DER#10 Section 4.2(a)3, general response actions (GRAs) have been identified which may be effective remedies for the remediation of soil vapor, groundwater, and/or surface water at the site. The GRAs identified include:

No Action - A no action response, required by the DER for the Feasibility Study (FS) process, provides a baseline for comparison with other alternatives.

Institutional Controls - Institutional controls are applied when active remedial measures do not achieve cleanup limits. Potential human exposure is reduced by limiting public access to site contaminants. Institutional controls such as environmental easements can also apply through an extended remediation period, or to sites where cleanups are completed up to feasible levels but still leave residual contamination greater than background levels.

Monitored Natural Attenuation (MNA) - MNA, also known as intrinsic remediation, bioattenuation, or intrinsic bioremediation, refers to the use of natural processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, as part of overall site remediation. MNA is a non-engineered remedial technique, which involves the degradation of the VOCs in the groundwater by naturally occurring processes (i.e., biodegradation). Such degradation is monitored over time under a long-term monitoring program.

In-situ Treatment - In-situ treatment for groundwater uses various technologies including biological, thermal, and reactive materials. In-situ treatment is effective in treating source areas of contamination but can be prohibitively expensive for treatment of large areas of groundwater contamination.

Removal Measures - Removal measures provide for the removal of contaminants or contaminated materials from their existing location for treatment (on-site or off-site) or disposal. Groundwater extraction systems are typically used to remove groundwater and are combined with various ex-situ treatment technologies including UV oxidation, air stripping, and granular activated carbon. The effluent treated water is often returned to the subsurface through injection wells, released to surface water bodies, or released to the local Publicly-Owned Treatment Works (POTW).

Containment/Barrier - Containment of groundwater includes remedial measures that contain or isolate contaminants on-site. Containment prevents migration of contaminants from the site or to downgradient areas and attempts to prevent direct human and ecological exposure to contaminated media. Examples of containment technologies are grout slurry walls, sheet piling, hydraulic control by pumping, and reactive barriers. Containment technologies are often combined with other treatment technologies to remove contamination.

3. Identification and Screening of Technologies

In this section selected technologies are described in general and are screened for their implementability and applicability to the site. Based on this screening, remedial technologies are retained or not retained for further consideration.

Technology types include such general categories as treatment or containment, whereas process options are specific processes within the general technology types (e.g., treatment via chemical oxidation, or containment using a treatment barrier). This section develops a list of potential technology types and process options for treatment and/or containment of groundwater and surface water impacted by VOCs at the sites. The retained technologies and process options are subsequently evaluated based on the evaluation criteria discussed in Section 4.2.

Remedial strategies/technologies identified for screening include:

- No Further Action
- Monitored Natural Attenuation
- In-situ Chemical Oxidation
- In-Situ Bioremediation
- Permeable Reactive Barriers
- Air Sparging/Soil Vapor Extraction
- Groundwater Extraction
- In-well Air Stripping
- Phytoremediation

Descriptions, evaluations, and screening of each of these potential remedial strategies/technologies are provided below.

3.1 No Further Action

The “no further action” option, by definition, involves no further institutional controls, environmental monitoring, or remedial action, and, therefore, includes no technological barriers. The no further action option does not include groundwater or air monitoring to evaluate the effects of any natural attenuation processes at the site. Although the no further action option would be unable to meet the RAO, it will be retained to provide a basis for comparison to other remedial alternatives.

3.2 Monitored Natural Attenuation (MNA)

MNA, also known as intrinsic remediation, bioattenuation, or intrinsic bioremediation, refers specifically to the use of natural processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, as part of overall site remediation. MNA is a non-engineered remedial technique, which involves the degradation of the VOCs in the groundwater by naturally occurring processes (i.e., biodegradation). Such degradation is monitored over time under a long-term monitoring program.

Consideration of this option usually requires evaluating contaminant degradation rates and pathways and predicting contaminant concentrations at downgradient receptor points. The primary objective of this evaluation would be to demonstrate that natural processes of contaminant degradation will reduce contaminant concentrations below regulatory standards or risk-based levels before potential exposure pathways are completed. Long term monitoring should be conducted throughout the process to confirm that degradation is proceeding at rates consistent with meeting cleanup objectives. A select group of existing monitoring wells would be monitored quarterly for the first year followed by annual sampling as needed.

Natural attenuation is not the same as no further action, although it often is perceived as such. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires evaluation of a no further action alternative but does not require evaluation of natural attenuation. Natural attenuation is considered on a case-by-case basis. In all cases where natural attenuation is being considered, extensive site characterization and monitoring would be required, both before and after any potential implementation of this remedial alternative.

Compared with other remedial technologies, natural attenuation has the following advantages:

- Less generation or transfer of remediation wastes;
- Less intrusive;
- May be applied to all or part of a given site, depending on site conditions and cleanup objectives;
- May be used in conjunction with, or as a follow-up to, other (active) remedial measures; and
- Overall cost will likely be lower than active remediation.

Potential disadvantages of MNA include:

- Data used as input parameters for modeling need to be collected;
- Intermediate degradation products may be more mobile and more toxic than the original contaminant;
- Natural attenuation is not appropriate where imminent site risks are present;
- Contaminants may migrate before they are degraded;
- Institutional controls may be required, and the site may not be available for its highest reuse potential until contaminant levels are reduced;
- It is not meant to address source areas of relatively high contamination;
- There are long term monitoring costs associated with this alternative; and
- Longer time frames would be required to achieve remedial objectives, compared to active remediation.

Analytical data indicates that natural biological degradation of the groundwater contamination in the Munsey and Plaza Cleaners investigation area is minimal. Because of this and the long time frame associated with natural attenuation processes, MNA will be not considered further. However, long-term groundwater monitoring may be considered as a component of a remedial alternative.

3.3 In-situ Chemical Oxidation

In-situ chemical oxidation (ISCO) has been used since the early 1990s to treat environmental contaminants in groundwater, soil, and sediment. Many of these projects have focused on the treatment of chlorinated solvents (e.g., TCE and PCE), although several projects have also used the process to treat petroleum compounds [(i.e., benzene, toluene, ethylbenzene, and xylene (BTEX) and methyl tertiary-butyl ether (MTBE)] and semi-volatile organic compounds such as polycyclic aromatic hydrocarbons (PAHs) and pesticides (USEPA, 1998 and Siegrist, 2001).

ISCO is defined as the delivery and distribution of oxidants and other amendments into the subsurface to transform contaminants of concern into innocuous end products such as carbon dioxide (CO_2), water, and inorganic compounds. A chemical oxidant is injected in areas where a reduction in groundwater contaminant concentration is desired. Injection locations can be either permanently installed wells or temporary injection points installed using direct-push methods. When oxidants come in contact with chlorinated VOCs they are broken down into non-toxic components. However, contact between the oxidant and contaminant required to facilitate the reaction is the most important technical limitation of this technology, as it can be difficult to accomplish.

Accordingly, this remedial approach generally includes several injections over time accompanied by groundwater sampling and analysis. Numerous injections are typically required to remediate the treatment area. Given this and depending on the final contaminant concentration desired, the overall costs are typically medium to high relative to other technologies. Since the reaction with the contaminant and the chemical oxidant generally occurs over a relatively short period, treatment can be more rapid than other in-situ technologies. This technology does not generate large volumes of residual waste material that must be treated and/or disposed.

ISCO can be used to treat localized source areas and dissolved-phase plumes since it is capable of treating high concentrations of contaminants by adding more oxidants. ISCO typically becomes prohibitively expensive for large areas requiring treatment to low concentration endpoints.

Advantages of ISCO typically include:

- Relatively short remediation times in areas where groundwater flow does not introduce additional contaminants with time (typically one to two years);

- Limited long-term operation, maintenance, and monitoring (OM&M) costs in such settings;
- Treats both dissolved and sorbed contaminants concurrently;
- Treats compounds that are not readily biodegradable; and
- Breakdown of chlorinated VOCs without the generation of potentially more toxic degradation products (although not all chlorinated VOC mass may break down).

Disadvantages of ISCO include:

- Its application to areas with only the highest contaminant concentrations is typically most cost effective;
- The need to inject large volumes of oxidant (especially in areas where groundwater flow introduces additional contaminants over a long period of time from upgradient directions);
- The need for multiple injections;
- The difficulty of contacting oxidants with groundwater contaminants intended for destruction when injecting into low permeability or heterogeneous formations;
- Health and safety issues pertaining to field personnel associated with the handling and injection of oxidants and reagents;
- Relatively high costs per volume treated; and
- Naturally occurring carbon sources increase the oxidant demand in the treatment zone. The presence of carbonates can also add to the oxidant demand for certain ISCO chemicals.

The most common oxidants utilized for ISCO are hydrogen peroxide (Fenton’s reagent), potassium and sodium permanganate, and sodium persulfate. A general summary of each of these oxidants is presented below.

3.3.1 Fenton’s Reagent (Hydrogen Peroxide)

Hydrogen peroxide-based in-situ chemical oxidation is driven by the formation of a hydroxyl free radical in the presence of a metal catalyst. This reaction, known as the Haber-Weiss mechanism, was first utilized for the treatment of organic compounds in wastewater in the 1890s by H.J.H Fenton using an iron catalyst (Fenton’s reagent). The hydroxyl free radical is a powerful oxidizer of organic compounds, thus many organic compounds in the subsurface that contact the chemical oxidant are readily degraded to innocuous compounds (e.g., water and carbon dioxide). Any residual hydrogen peroxide remaining after the reaction decomposes to water and oxygen. Soluble iron (ferrous iron), the transition metal catalyst added to the subsurface during injection of the oxidant mixture, is precipitated out of solution during conversion to ferric iron.

Typical hydrogen peroxide concentrations utilized for treatment with Fenton’s reagent range from five to 50 percent by weight, however, concentrations less than 15 percent are utilized at a majority of sites. The hydrogen peroxide concentration used in the injection fluid is based on contaminant concentrations, subsurface characteristics, and treatment volume. Acids are also typically added to the injection solution to lower the pH of the contaminated zone if the natural pH is not low enough to promote the Fenton’s reaction.

Compared to other oxidants, Fenton’s reagent has a relatively short life once injected into the subsurface. Therefore, a larger number of Fenton’s reagent injections would be required to sustain the oxidant in the subsurface compared to injections of other oxidants. For this reason, Fenton’s reagent will not be retained for further consideration.

3.3.2 Sodium and Potassium Permanganate

Permanganate is an oxidizing agent with a unique affinity for oxidizing organic compounds with carbon-carbon double bonds (e.g., TCE and PCE), aldehyde groups or hydroxyl groups (alcohols). There are two forms of permanganate that are used for ISCO, potassium permanganate ($KMnO_4$) and sodium permanganate ($NaMnO_4$). Potassium permanganate has been used in drinking water and wastewater treatment for several decades to oxidize raw water contaminants, typically for odor control. Potassium permanganate is available as a dry crystalline material, while sodium permanganate is a liquid. Permanganate turns bright purple when dissolved in water;

this purple color is an indicator of unreacted chemical. Reacted permanganate is black or brown, indicating the presence of a manganese dioxide (MnO_2) byproduct.

Sodium permanganate has a much higher solubility in water than potassium permanganate, allowing it to be used for ISCO at higher concentrations, compared to two to five percent for potassium permanganate. Since it is supplied in liquid form, the use of sodium permanganate commonly requires no on-site mixing. Permangenate injections as a form of ISCO will be considered further.

3.3.3 Sodium Persulfate

Sodium persulfate is a strong oxidant that derives its oxidizing potential through the persulfate anion ($S_2O_8^{2-}$). The persulfate anion is capable of oxidizing a wide range of contaminants, including chlorinated ethenes, BTEX, phenols, MTBE, and low molecular weight PAHs. However, when catalyzed in the presence of heat (thermal catalyzation) or transition metals ions (i.e., ferrous iron), the persulfate ion is converted to the sulfate free radical ($SO_4^{2-}\bullet$), which is second only to Fenton's reagent in oxidizing potential. Sodium persulfate is supplied in an aqueous solution at concentrations up to 50 percent by weight. Sodium persulfate injections as a form of ISCO will be considered further.

3.3.4 RegenOx®

RegenOx® is a proprietary mixture of oxidants used to treat VOCs in groundwater. A RegenOx® application will remove significant amounts of contamination from the subsurface and is typically applied using direct-injection techniques. The application process enables the two part product to be combined, then pressure injected into the zone of contamination and moved out into the aquifer media. Once in the subsurface, RegenOx® produces a cascade of efficient oxidation reactions via a number of mechanisms including: surface mediated oxidation, direct oxidation and free radical oxidation. These reactions eliminate contaminants and can be propagated in the presence of RegenOx® for periods of up to 30 days on a single injection. RegenOx® produces minimal heat and is highly compatible with follow-on enhanced bioremediation applications.

ISCO will not be retained for evaluation as a barrier or plume-wide remedial alternative because of the high cost and large number of injections that would be required to sustain a treatment wall/barrier or treat a large area. Because of the relatively high hydraulic conductivity and gradient downgradient of the Munsey and Plaza Cleaners sites, implementing ISCO as a barrier technology is infeasible because of the frequent ISCO injections required to maintain an effective barrier. ISCO will be retained for an evaluation of reducing groundwater CVOC concentrations in targeted portions of the dissolved-phase CVOC plume.

3.4 Enhanced In-situ Bioremediation

Bioremediation (or enhanced biodegradation) is the controlled management of microbial processes in the subsurface. This differs from monitoring of bioremediation processes under monitored natural attenuation (MNA) by being an active, designed, and managed process. Some microorganisms, such as Dehalococcoides (DHC), break down VOCs to the end products ethane and ethene. Therefore, bioremediation can often be enhanced through biostimulation (substrates injected in-situ to promote microbial activity) or bioaugmentation (increasing of bioremediation by adding microbial cultures). Biostimulation is used to set the proper conditions for increased microbial activity and may be all that is needed for satisfactory remediation. Biostimulation is often focused in areas where microbial populations are marginal and/or under conditions that are insufficient to support practical biodegradation rates. Carbon sources used at anaerobic sites include molasses, edible oils, lactic acid, sodium benzoate, methane, and yeast extract.

The presence of Dehalococcoides bacteria can be quantified to evaluate if bioaugmentation with Dehalococcoides would be necessary to further facilitate chlorinated VOC degradation. If bacteria counts are low, additional cultures can be added to the subsurface to increase populations. However, where dechlorination end products (such as ethene) are already present in groundwater, it is likely that sufficient reductive dechlorinators are already present and bioaugmentation may not be necessary.

Favorable in-situ conditions must be present to ensure successful bioremediation. Subsurface heterogeneity can complicate the distribution of biostimulants. Chemically, bioremediation of chlorinated compounds works best under highly reducing conditions, with methanogenic conditions being the most favorable. Under sulfate-reducing conditions biodegradation commonly stalls at cis-DCE. Dechlorinators are also limited if the pH is outside the normal range (greater than 8 or less than 5).

Enhanced bioremediation vendors agree that this technology can effectively treat CVOCs, including PCE, TCE, 1,1,1-TCA, and 1,1-DCE. Despite this, in-situ bioremediation pilot studies are often conducted to evaluate the applicability, effectiveness, and cost of this remedial technology. Pilot studies provide data to better evaluate remedial alternatives, support the remedial design of a selected alternative, and reduce full-scale implementation cost and performance uncertainties.

A form of in-situ bioremediation is a biological barrier which acts as a passive control to dissolved-phase CVOC plume flow when microorganisms break down VOCs that pass by them in groundwater. Biological barriers have recently been installed using emulsified edible oil inserted into the soil with the help of chase water and an emulsifying agent (to reduce viscosity). This type of biological barrier does not require excavation; it can be installed by injecting the oil, chase water, and emulsifying agent into the subsurface through temporary injection points or permanent injection wells.

A disadvantage of a biological barrier is the possible increase of DCE and vinyl chloride (VC) downgradient of the treatment area. This is due to the PCE and TCE byproduct's (DCE and vinyl chloride) slower reduction rates. Heterogeneity in the soil can disrupt continuity of the wall resulting in gaps that can transmit contaminated water. Increased biofouling can also reduce the permeability of the barrier, potentially causing water to flow around the treatment zone. Additional byproducts of bioremediation may include increased methane and increased concentration of dissolved iron and manganese and occasionally other metals if the local pH is significantly lowered through biological activity.

In the right conditions, chlorinated ethenes can be degraded under anaerobic conditions through reductive dechlorination. Reductive dechlorination is a reaction catalyzed by microorganisms in which a hydrogen atom replaces the chlorine atom on CVOCs such as TCE. The resulting hydrogen is then used by reductive dehalogenators to strip the solvent molecules of their chlorine atoms which allows for further degradation. Though this can occur naturally, it may not happen within an adequate time frame to meet remedial goals. The injection of hydrogen-releasing compounds can be used to enhance dechlorination processes. Anaerobic conditions can be created through the introduction of large amounts of carbon sources, and monitored by measuring dissolved oxygen (DO) to determine if anaerobic conditions have been achieved.

Advantages of anaerobic degradation typically include:

- It can effectively reduce CVOC concentrations under the right conditions;

- CVOCs are degraded in-situ; and

- It is generally less expensive than other remedial technologies.

Disadvantages of anaerobic degradation typically include:

- The presence of DO at levels greater than 1 part-per-million (ppm) limit anaerobic degradation and would require the introduction of a carbon source to reduce DO levels.
- Depending on soil type, degree of heterogeneity, and groundwater depth, this technology may require closely spaced injection sites and can be cost prohibitive.
- Bioaugmentation may be necessary if microbial populations are shown to be insufficient.

There is little evidence that natural degradation of CVOCs is occurring in groundwater in the Munsey and Plaza Cleaners investigation area. Degradation products of TCE, 1,1,1-TCA, and 1,1-DCE are not present in groundwater. Field measurements of dissolved oxygen and reduction oxidation potential indicate that the water-table aquifer is under aerobic conditions (contains oxygen). Under these aerobic conditions, CVOCs degrade at a much slower rate than under anaerobic conditions. Because these conditions could be altered through injection of amendments, bioremediation will be retained for further consideration in targeted portions of the dissolved-phase CVOC plume.

3.5 Permeable Reactive Barrier

Permeable Reactive Barriers (PRBs) are vertical zones of material (typically zero-valent iron, mulch, or some other reducing agent) that are installed in the subsurface to passively intercept groundwater flow. PRBs are installed in or down gradient of a dissolved-phase contaminant plume by excavating a trench across the path of a migrating dissolved-phase VOC plume and filling it with the appropriate reactive material (such as a mixture of sand and iron particles), or by injecting the reactive material into the ground as a mobile slurry using direct push technology or injection wells. Groundwater flowing passively under a hydraulic gradient through the PRB is treated as the contaminants in the dissolved-phase plume are broken down into byproducts or immobilized by precipitation or sorption after reacting with the substrate inside the PRB. Although PRBs are a remedial technology that requires no pumping, the rate of groundwater treatment can be accelerated by groundwater withdrawal or injection in the vicinity of the PRB. Groundwater monitoring systems are typically installed to monitor the effectiveness of a PRB (or other remedial technology) over the long term.

PRB systems have been used successfully to treat chlorinated organic compounds, including PCE and TCE at numerous full-scale applications. PRBs intended for groundwater containing VOCs are commonly constructed with zero-valent iron. Such PRBs can be constructed as a wall beneath the ground surface either by open trenching or with minimal disturbance to above-ground structures and property using trenchless injection technology. Another emerging PRB method utilizes an electrolysis process to break apart the VOC constituents. Probes are installed into the ground, which generate a current in the subsurface that degrades the VOC constituents. Both methods, in addition to mulch and chitin barriers, are discussed below.

3.5.1 Zero-valent Iron

The most common PRB technology utilizes zero-valent iron particles, typically in granular (macro-scale) form, to completely degrade chlorinated VOCs via abiotic reductive dehalogenation. As the iron is oxidized, a chlorine atom is removed from the compound using electrons supplied by the oxidation of iron. As the groundwater containing CVOCs flows through the reactive material, a number of reactions occur that indirectly or directly lead to the reduction of the chlorinated solvents. One mechanism is the reaction of iron filings with oxygen and water, which produces hydroxyl radicals. The hydroxyl radicals in turn oxidize the contaminants. During this process, the chloride in the compound is replaced by hydrogen, resulting in the complete transformation of CVOCs to byproducts (ethene, ethane, and chloride ions). Since degradation rates using the process are several orders of magnitude greater than under natural conditions, any intermediate degradation byproducts formed during treatment (e.g., VC) are also reduced to byproducts in a properly designed treatment zone. The use of zero-valent iron to treat CVOCs has been well documented, and is covered under several patents, depending on the installation method.

PRB longevity using zero-valent iron is dependent on contaminant concentration, groundwater flow velocity, and the geochemical makeup of the groundwater. The oldest full-scale PRB was installed in February 1995 at a site in Sunnyvale, California. This PRB has successfully reduced the concentrations of TCE, DCE, VC, and Freon through 11 years of operation (ETI, 2006). Since the age of the oldest PRB is only approximately 16 years, bench scale studies using reactive iron columns (from both cores obtained from emplaced reactive walls and from virgin reactive iron) have been conducted to evaluate long-term PRB longevity. These tests have shown that, although the reactivity of the iron declines with long-term exposure to groundwater, conditions promoting the dehalogenation of chlorinated solvents are maintained over the long term. Based on these studies, the expected life of a typical reactive wall (where life is defined as the period over which the reactivity of the iron declines by a factor of two) is approximately 30 years (ESTCP, 2003). However, these studies also indicated that groundwater geochemistry, specifically the concentration and resulting flux of natural organic matter (NOM), total dissolved solids (TDS), and carbonate, along with the distribution of VOC concentrations, greatly influences the lifetime of the reactive iron and should be considered in the reactive wall design process (Klausen et al., 2003).

Zero-valent iron PRBs can be installed by direct-injection of iron or iron substrate into a series of injection wells or boreholes along the barrier alignment. The iron particles are injected into the subsurface to form a continuous barrier between the wells/boreholes. During injection, the barrier geometry can be monitored in real-time to ensure fracture coalescence or overlap using resistivity sensors in the subsurface. Once installed, the hydraulic continuity of the PRB can also be verified using hydraulic pulse interference testing. This test involves a cyclic injection of fluid into a source well on one side of the PRB and high precision measurement of the pressure pulse using a receiver transducer in an observation well on the other side of the PRB. The time delay and attenuation of the hydraulic pulse is used to evaluate the hydraulic effectiveness and continuity of the wall. PRBs have been installed to depths exceeding 100 feet below grade and barrier lengths exceeding 1,000 feet. This trenchless method generates almost no waste that would require disposal or treatment.

In contrast, PRB installation using trenching installation technologies are typically physically limited to approximately 60 feet below grade, although a trenched PRB is rarely installed to a depth of more than 30 feet below grade. Also, trenching results in larger volumes of waste in the form of soil that must be disposed of or otherwise treated. Also, trenching technology can create significant disruption to surrounding communities and infrastructure, and is generally limited to areas where underground utilities are not present or, if present, can be disturbed.

Advantages of zero-valent iron PRBs typically include:

- The zero-valent iron PRB is a passive method of treatment and long-term OM&M costs will remain low as long as no adjustments need to be made to the barrier;

- Because it is a barrier technology, PRBs can be an effective method of dissolved-phase plume control; and

- PRB installation using direct injection technology is not constrained by utilities and is typically a relatively low-impact method for PRB installation.

Disadvantages of zero-valent iron PRBs typically include:

- Emplacement of a PRB using conventional trenching methods can be complicated if underground utilities are present;

- Once emplaced the PRB is expensive to adjust, re-locate or remove;

- A high groundwater flow rate would decrease the contact time between CVOCs and zero-valent iron, thereby reducing the PRB effectiveness;

- Changes in groundwater direction or velocity, though unlikely, can reduce the PRB effectiveness; and

- Relatively high capital costs.

Because of the deep depth to groundwater containing CVOCs and space constraints related to the highly populated area above the dissolved-phase CVOC plume, the installation of the PRB using ZVI will not be considered further.

3.5.2 Mulch and Chitin Barriers

A form of in-situ bioremediation is a biological barrier which acts as a passive control to dissolved-phase plume flow when microorganisms break down VOCs that pass by them in groundwater. A biological barrier treats VOC containing groundwater biologically, which is different than most PRB technologies where a chemically reactive treatment barrier is utilized. As with chemical barriers, care must be taken to ensure the wall is constructed to the correct thickness so that the dissolved-phase contaminant plume has enough time to biodegrade. Biological barriers can be constructed with a variety of materials including mulch and chitin (though inexpensive, mulch and chitin are limited in the depth to which they can be emplaced) and food waste products such as cheese whey. A mulch or chitin barrier cannot be installed without excavation. Mulch can be used to turn aquifers anaerobic and provide a source of electron donors for reductive dechlorination of CVOCs. Mulch is inexpensive, long-lasting, and is naturally present in the environment. A mulch/chitin barrier will not be considered further for treatment of the dissolved-phase CVOC plume because of the inability to trench down to or deliver the mulch to the required depths.

3.5.3 Electrically-induced Redox Barrier

Application of this technology involves the insertion of closely spaced permeable electrodes through the groundwater plume. A low voltage direct current drives the oxidation of CVOCs. An electrically-induced redox barrier is an effective method for reduction of CVOCs in groundwater.

Advantages of an electrically-induced redox barrier typically include:

- Like other passive technologies, an electrically induced barrier has low long-term OM&M costs, mostly relating to power usage; and
- The electronic barrier has the potential to control mineral accumulation common on other barriers by periodic reversal of electrode potentials, thereby minimizing potential problems related to decreasing permeability.

Disadvantages of an electrically-induced redox barrier typically include:

- This is a relatively new concept with only limited field testing (conducted by Environmental Security Technology Certification Program and Colorado State University at F.E. Warren Air Force Base);
- A trench and fill system is the only way to initially emplace the barrier making it impractical in deep aquifers or urban/suburban areas; and
- The barrier needs to equilibrate with the dissolved-phase contaminant plume for a few months before implementing the charge.

Although an electrically-induced redox barrier may be feasible for site treatment, it will not be retained for future consideration. This technology is an unproven technology that has had limited field testing at F.E. Warren Air Force Base and would be difficult to implement due to the depth to groundwater.

3.6 Air Sparging/Soil Vapor Extraction

Air sparging with soil vapor extraction involves injecting air into groundwater to volatilize contaminants and enhance aerobic biodegradation. A series of injection wells are installed into the saturated zone and soil vapor extraction wells are installed into the vadose zone. After air is injected, air rises in channels through pores in sand and silt with the lowest air-entry pressure (usually the coarser materials) and the contaminants are removed (stripped) from the groundwater and are carried up into the unsaturated zone. A soil vapor extraction system is usually installed to remove vapors from the unsaturated zone.

The system would be designed so that the area of influence of the systems overlap, ensuring that all areas are treated. Pilot tests are often performed to evaluate the most effective distance between injection wells. An injection pump and vacuum extractor would be located above ground. The extracted soil vapor may be treated on-site prior to release to the atmosphere.

Advantages of air sparging with soil vapor extraction typically include:

- Can be installed relatively easily with readily available equipment;
- Can be installed at a relatively low cost.

Disadvantages of air sparging with soil vapor extraction typically include:

- Heterogeneities or stratified soils would cause air flow to not flow uniformly through the subsurface causing some zones to be less treated;
- Ex-situ vapor treatment is commonly required, resulting in the need to properly manage vapor-phase granular activated carbon;
- Surface treatment, vapor extraction, manifold, piping, and injection structures are needed;
- Effective vapor extraction is needed to prevent fugitive vapors; and
- Cannot be used for treating confined aquifers.

Air sparging with soil vapor extraction will not be retained for further evaluation because of the space constraints related to the highly populated area above the dissolved-phase CVOC plume and extensive above ground infrastructure and operations and maintenance required.

3.7 Groundwater Extraction and Treatment

Groundwater extraction and treatment, also referred to as pump and treat, would involve the removal of contaminant-containing groundwater through the use of pumping wells. The extracted water would be treated and returned to the subsurface, a surface water body, or sewer system. Groundwater pumping systems can also be used to control dissolved-phase plume migration.

Site characteristics, such as hydraulic conductivity, will determine the range of groundwater extraction remedial options possible. Chemical properties of the site and dissolved-phase plume need to be evaluated to characterize transport of the contaminant and evaluate the feasibility of groundwater pumping. To assess if groundwater extraction is appropriate for the Munsey and Plaza Cleaners investigation area, the following information is needed to design an effective groundwater pumping strategy:

- Properties of the subsurface; and
- The biological and chemical characteristics of the groundwater.

The advantages of groundwater extraction include:

- Pump and treat is an established and widely proven technique for controlling a large volume of contaminated groundwater;
- Using pumping wells to control groundwater flow and slow or reverse the spread of contaminants can be useful in managing large areas of groundwater contamination;
- Groundwater pumping can create a hydraulic barrier to control the spread of a dissolved-phase plume; and
- The extracted groundwater can be treated with relative ease once it is at the surface.

The following factors may limit the applicability and effectiveness of groundwater pumping as a remedial process and should be evaluated prior to implementation:

- It is possible that a long time may be necessary to achieve the remediation goal;
- Residual saturation of the contaminant in the soil pores cannot be removed by groundwater pumping. Contaminants tend to be sorbed in the soil or rock matrix. Groundwater pumping is not applicable to contaminants with high residual saturation, contaminants with high sorption capabilities, and aquifers with hydraulic conductivity less than 10^{-5} centimeters per second (cm/sec);
- Bio-fouling of the extraction wells, and associated treatment stream, is a common problem which can severely affect system performance;
- Hydraulic control systems require frequent, long-term maintenance;
- The cost of procuring and operating treatment systems can be high. Additional cost may also be attributed to the disposal of spent carbon and the handling of other treatment residual and wastes;
- Pumping is typically not effective at reducing low contaminant concentrations in the subsurface due to tailing effects; and
- The cost-effectiveness of a groundwater pumping system typically decreases as the concentration in the groundwater decreases.

Surfactant-enhanced recovery may also be used to improve the effectiveness for contaminated sites with LNAPLs and DNAPLs. The following factors may limit the applicability and effectiveness of surfactant-enhanced recovery:

- Subsurface heterogeneities, as with most groundwater remediation technologies, present challenges to the successful implementation of this technology; and
- Off-site migration of contaminants due to the increased solubility achieved with surfactant injection.

Extracted groundwater is generally treated by granular activated carbon, air stripping, or ultraviolet (UV) oxidation. Extracted vapors may also need to be treated. A description of several ex-situ treatments is provided below:

3.7.1 Advanced Oxidation Process

Advanced oxidation processes are similar to in-situ chemical oxidation in that oxidants are used to degrade contaminants to carbon dioxide, water, and simple organic and inorganic compounds. The process typically uses ozone, hydrogen peroxide, and ultraviolet light (UV) in some combination to form hydroxyl radicals (OH^-). Hydroxyl radicals have the highest oxidation potential and readily breakdown contaminants such as TCE.

Advanced oxidation processes are available in many forms and are generally used in treatment systems for groundwater that contain higher concentrations of VOCs. The most widely used products are systems using hydrogen peroxide/UV, ozone/UV, and hydrogen peroxide/ozone. For evaluation purposes, the hydrogen peroxide/ozone system has been selected. This system is effective in treating VOCs and is not significantly affected by turbidity as are processes using UV due to the need to keep UV lamps clean. Ozone is readily mixed with groundwater in the controlled environment of the treatment piping. Oxidation is effective at treating a wide variety of compounds but typically has high costs relative to granular activated carbon and air stripping.

3.7.2 Air Stripping/Aeration

Air stripping is a form of aeration, which is a widely used technology used for environmental remediation and in the wastewater treatment industry. Aeration promotes volatilization and biological degradation by increasing the contact between contaminated media and air. Aeration can promote biodegradation in systems where the oxygen-rich air has time to nourish bacteria. Aeration methods include activated sludge, rotating biological contactors, trickling filters, air stripping, air sparging, bioventing, packed towers, diffused aeration, tray aeration, venturi aeration, and spray aeration.

Air stripping involves the mass transfer of VOCs from water to air. In the air stripping process, VOCs are partitioned from extracted groundwater by increasing the surface area of the water containing VOCs exposed to air. Air stripping is most appropriate for

VOCs that are easily evaporated from water. Compounds which are highly soluble, such as alcohols and ketones, are difficult to remove with air stripping.

For groundwater remediation, the most widely used air stripping process typically involves use of a packed tower or tray aeration. The typical packed tower air stripper includes a spray nozzle at the top of the tower to distribute water containing VOCs over the packing in the column, a fan to force air countercurrent to the water flow, and a sump at the bottom of the tower to collect treated water. Packed tower air strippers can be installed as either permanent structures on concrete pads or as temporary structures on a skid or trailer, mainly depending on the volume of water treated. Low-profile air strippers, or tray aerators, include a number of trays in a very small chamber to maximize air-water contact. These systems are easier to install and operate than other air strippers, but have a somewhat larger footprint.

The off-gases may need to be treated if the aerated water contains high concentrations of VOCs. Air strippers commonly use vapor-phase activated carbon systems to capture VOCs in off-gases, especially in early stages of remediation when VOC concentrations are higher. Off-gas treatment is not feasible in some applications of this technology, such as spray irrigation. The effect of, and potential exposures related to, transferring VOCs from water to air must be assessed prior to implementing this technology. Air quality may need to be monitored if this treatment option is implemented.

3.7.3 Carbon Adsorption

Carbon adsorption is most appropriate for low concentrations and/or low flow rates of contaminated water. Liquid-phase carbon adsorption typically involves pumping groundwater through one or more vessels in series containing activated carbon to which dissolved VOCs adsorb. When the concentration of contaminants in the effluent from the treatment vessel exceeds a certain level, the carbon is typically removed and regenerated off site or disposed. The most common reactor configuration for carbon adsorption systems involving groundwater is the fixed bed approach with two vessels in series. The fixed-bed configuration is the most widely used for adsorption from liquids. The duration of operation and maintenance (O&M) is dependent upon the contaminant type, concentration, mass treated, other organics or metals that occupy adsorption sites, and the clean-up requirements. It should be noted that several compounds, including vinyl chloride, 1,1,1-TCA, DCA, chloroform, methylene chloride, and alcohols, have a poor affinity for carbon absorption.

Despite the potential drawbacks related to installation, operation, and maintenance, groundwater extraction with ex-situ treatment has the potential to quickly control dissolved-phase plume migration. Although it is effective at treating a wide variety of compounds, oxidation will not be considered further because of its high costs relative to granular activated carbon and air stripping. Groundwater extraction in areas of high VOC groundwater concentration and treatment using granular activated carbon, air stripping, or aeration will be retained for further consideration. Following treatment, the water would be re-injected into the subsurface or discharged to a surface water body in accordance with SPDES requirements.

The Port Washington Water District (PWWD) uses groundwater extraction and treatment at public water supply wells at the Sandy Hollow municipal well field. The PWWD routinely monitors water quality within its district, including VOC analysis, and treats its water with chlorine, sodium hydroxide, and GAC. These water treatment capabilities have been established, among other reasons, to remove VOCs from drinking water at this facility.

Groundwater extraction and treatment outside of the influence of the Sandy Hollow municipal well field will not be considered further because of the space constraints related to the highly populated area above the dissolved-phase CVOC plume and extensive above ground infrastructure and operations and maintenance required.

3.8 In-well Air Stripping (a.k.a. Groundwater Recirculation)

An in-well air stripping system uses a series of groundwater circulation wells to recapture and re-circulate groundwater within an aquifer. The groundwater circulation well system creates in-situ vertical groundwater circulation cells by drawing groundwater from the aquifer through the lower screen of a double-screened well and discharging it through the upper screen section. No groundwater is removed from the ground. Air is injected into the well, releasing bubbles into the contaminated groundwater, which aerate the water and form an air-lift pumping system (due to an imparted density gradient) that causes groundwater to flow upward in the well.

As the bubbles rise, VOC contamination in the groundwater is transferred from the dissolved state to the vapor state through an air stripping process. The air/water mixture rises in the well until it encounters the dividing device within the inner casing, which is designed to maximize volatilization. The air/water mixture flows from the inner casing to the outer casing through the upper screen. A vacuum is applied to the outer casing, and contaminated vapors are drawn upward through the annular space between the two casings. The partially treated groundwater re-enters the subsurface through the upper screen and infiltrates back to the aquifer and the zone of contamination where it is eventually cycled back through the well, thus allowing groundwater to undergo sequential treatment cycles until the remedial objectives are met. Off gas from the stripping system is collected and treated, typically using granular activated carbon. Pilot testing and field measurements are generally required to determine the exact well and piping configuration.

In-well air stripping has been demonstrated to be effective and has been used or selected as a remedy at numerous sites, particularly in coarse media with little silt or clay lenses. As of January 2006, over 1,300 wells have been installed in more than 75 sites, including federal sites, in 24 states (NYSDEC DER-15). Only a limited number of vendors are available to design and construct an in-well air stripping system.

In general, in-well air strippers are most effective at sites containing high concentrations of dissolved contaminants. The effectiveness of in-well air stripping systems may be limited in shallow aquifers. These systems are typically more cost-effective for remediating groundwater at sites with deep water tables because the groundwater does not need to be brought to the surface. To prevent smearing the contaminants in the area immediately above the water table, this technology should not be used at sites containing non-aqueous phase liquids (NAPLs).

In-well air stripping will not be retained for further evaluation because subsurface heterogeneities can interfere with uniform flow in the aquifer around the well causing incomplete treatment and it would not be as effective as at sites with higher groundwater concentrations. In addition, there would also be significant space constraints related to the highly populated area above the dissolved-phase CVOC plume and extensive above ground infrastructure and operations and maintenance required.

3.9 Phytoremediation

Phytoremediation is a bioremediation process that uses plants to remove, transfer, stabilize, and/or destroy contaminants in the soil and groundwater. Phytoremediation is used for the remediation of metals, radionuclides, pesticides, explosives, fuels, VOCs and semi-volatile organic compounds (SVOCs). Phytoremediation mechanisms include:

- *Rhizosphere biodegradation* - Natural substances are released through the plant's roots, supplying nutrients to microorganisms in the soil, which enhances biological degradation.

- *Phyto-accumulation* (also called phyto-extraction) - Phyto-accumulation is used primarily for remediation of soil and groundwater containing metals. Contaminant mass is absorbed through the plant roots and stored in the plant's shoots and leaves, which are harvested and either smelted for potential metal recycling/recovery or are disposed of as a hazardous waste.

- *Hydroponic Systems for Treating Water Streams (Rhizofiltration)* - Rhizofiltration is similar to phyto-accumulation, but the plants are grown in greenhouses with their roots in water. This system can be used for ex-situ treatment, where groundwater is pumped to the surface to irrigate these plants. The plants are harvested and disposed of after they become saturated with contaminants.

- *Phyto-stabilization* - Chemical compounds produced by the plant immobilize contaminants, rather than degrade them.

- *Phyto-degradation*. In this process, plants metabolize and destroy contaminants within plant tissues.

- *Phyto-volatilization*. A process where plants absorb contaminants and release them into the atmosphere through their leaves.

- *Hydraulic Control*. In this process, trees indirectly assist with remediation of groundwater by controlling groundwater movement by uptaking water and lowering the water table.

The advantages of phytoremediation include:

- Lower cost than many traditional remedial technologies;

- Vegetation can be easily monitored;

- Potential recovery and re-use of valuable metals ("phytomining"); and

- Uses naturally occurring organisms/vegetation and preserves the natural state of the environment.

The following factors may limit the applicability and effectiveness of phytoremediation:

- The area and depth of the treatment zone is dictated by plant root spread and depth. In most cases, it is limited to shallow soils, streams, and groundwater although deeper groundwater can be treated by pumping it to the surface to irrigate plantations of trees;
- Phytoremediation is generally limited to treatment of lower contaminant concentrations and contamination in shallow soils, streams, and groundwater;
- Climatic factors influence the effectiveness of phytoremediation and its success may be seasonal, depending on location;
- The success of remediation depends in establishing the selected plant community, which may require several seasons of irrigation, potentially increasing the mobilization of contaminants in the soil and groundwater;
- Requires a long-term commitment because of slow growth and low biomass;
- Plant survival is affected by the toxicity and concentrations of the contaminants and the general condition of the soil.
- Plants may not be able to live if contaminant concentrations are too high;
- Phytoremediation may transfer contamination across media (e.g., from soil to air);
- Phytoremediation is not effective for strongly sorbed contaminants such as polychlorinated biphenyls (PCBs); and
- Phytoremediation requires large areas of land.

The following should be considered prior to selecting phytoremediation as a remedy:

- The toxicity and bioavailability of biodegradation products is not always known;

- Degradation by-products may be mobilized in groundwater or bio-accumulated in animals;

- It is unclear whether contaminants that collect in the leaves and wood of trees are released when the leaves fall in the autumn or when the tree is used for firewood or mulch;

- Contaminants may bio-accumulate in plants which then pass into the food chain;

- Plants may contain high levels of heavy metals, making disposal of harvested plants problematic; and

- The ecological impact of introducing new plant species should be evaluated prior to implementation and monitored following implementation.

A phytoremediation system often includes the use of plants suited to conditions at the site to degrade and/or remove contaminants. Vegetation may not need to be imported as native vegetation may be sufficient. The previously existing ecosystem could be altered into a phytoremediation system (such as a constructed wetland) or enhanced to provide the desired treatment design.

To be effective, phytoremediation systems must be properly designed, constructed, operated, and maintained. Once completed, a phytoremediation system requires regular monitoring to ensure proper operation. As with any remedial technology these systems may require enhancements or modifications in addition to routine management to maintain optimum performance.

Because of the depth to groundwater and the uncertainties regarding its effectiveness at the Munsey and Plaza Cleaners investigation area, phytoremediation will not be retained for further evaluations.

4. Remedial Alternatives Overview

Medium-specific remedial alternatives for the protection of human health and the environment were developed based a comparison of the results of the RI to SCGs. Potential remedial alternatives, which are discussed in Section 5, were identified by:

- Developing remedial action objectives that specify the contaminants and media of interest, potential exposure pathways, and remediation goals. The objectives developed were based on contaminant-specific cleanup criteria and SCGs;
- Developing general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the Munsey and Plaza Cleaners investigation area;
- Identifying volumes or areas of media to which general response actions might be applied, taking into account the requirements for protectiveness as identified in the remedial action objectives and the chemical and geological characterization of the Munsey and Plaza Cleaners investigation area;
- Identifying and screening the technologies applicable to each medium of interest to eliminate those technologies that cannot be implemented technically at the Munsey and Plaza Cleaners investigation area; and,
- Assembling the selected representative technologies into appropriate alternatives.

Remedial actions have been completed or are ongoing at the former Munsey Cleaners OU-1 site and the No Further Action remedy for this site included operation of SVE and SSD systems at the site, monitoring, maintenance, and sampling. An air sparge/SVE system has been installed at the former Plaza Cleaners site but this system has not been operated. As such, the remedial alternatives evaluated in this FS do not include remediation of groundwater within the property boundaries of the former Munsey or Plaza Cleaners sites.

Alternatives have been developed for remediation in areas of the dissolved-phase CVOC plume with the highest CVOC concentrations. These remedial alternatives are evaluated in Section 5 with the goal of achieving the RAOs discussed in Section 2.1.

So as not to impact the public water supply, no active groundwater remediation will be conducted immediately upgradient of the Sandy Hollow Well Field. The size of the dissolved-phase CVOC plume makes plume-wide remediation costly and difficult to implement. However, a plume-wide remedial alternative (discussed in Section 5) was developed to compare restoring the Munsey and Plaza Cleaners investigation area to pre-disposal conditions versus other remedial alternatives.

As CVOC concentrations in groundwater decrease, the CVOC concentrations in surface water and soil vapor will likely decrease. As such, remedial alternatives have been developed to address CVOCs in groundwater, not surface water. Soil vapor intrusion in the vicinity of the dissolved-phase CVOC plume has been addressed by the installation of sub-slab depressurization systems. As such, soil vapor intrusion remedial technologies are not screened or evaluated in this FS. The concentrations of VOCs in soil vapor would be addressed through the implementation of the selected remedial alternative, which would reduce groundwater CVOC concentrations and the mass flux of VOCs into soil vapor.

4.1 Common Components of Remedial Alternatives

A Site Management Plan, institutional controls, and a Soil Vapor Intrusion Action Plan are common elements of the alternatives being evaluated for the Munsey and Plaza Cleaners investigation area and are not discussed in the summary and evaluation of each alternative.

4.1.1 Site Management Plan

A Site Management Plan would guide future activities at the Munsey and Plaza Cleaners sites by addressing property and groundwater use restrictions and by developing requirements for periodic site management reviews. The periodic site management reviews would focus on evaluating the sites with regard to the continuing protection of human health and the environment as provided by information such as indoor air, soil vapor, sub-slab vapor, and groundwater monitoring results and documentation of field inspections. The site management plan could mandate the ongoing monitoring of groundwater quality and/or the operation and maintenance of engineered mitigation systems, as well as prohibit the use of groundwater. In addition, a site management plan could preclude excavation and construction activities that would expose workers without proper protective equipment to affected groundwater.

4.1.2 Institutional Controls

Building/property use and groundwater use restrictions could be placed on the Former Munsey and Plaza Cleaners properties and/or properties located above the dissolved-phase CVOC plume that would require compliance with the approved site management plan. No institutional controls, such as environmental easements or deed restrictions, are proposed for off-site properties. However, NYSDEC or the NYSDOH will periodically confirm that water treatment infrastructure is in place at the Sandy Hollow well field and verify that the water supply is treated if VOC concentrations exceed SCGs. Costs for implementing institutional controls are not included in the remedial alternative cost estimates.

4.1.3 Soil Vapor Intrusion

A Soil Vapor Intrusion Action Plan would be developed to address requirements for monitoring, maintaining, and further evaluating the effectiveness of the nine sub-slab depressurization systems located above the dissolved-phase CVOC plume that were installed by NYSDEC.

4.2 Evaluation Criteria

The remedial alternatives developed in this Feasibility Study were evaluated based on the following eight criteria, as outlined DER#10 Section 4.2:

- Overall Protection of Human Health and the Environment;
- Compliance with Standards, Criteria, and Guidance (SCGs);
- Long-term Effectiveness and Permanence;
- Reduction of Toxicity, Mobility, and Volume;
- Short-term Impact and Effectiveness;
- Implementability;
- Cost; and
- Land Use

4.2.1 Overall Protection of Human Health and the Environment

This criterion serves as a final check to assess whether each alternative meets the requirements that are protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria; especially long-term effectiveness and performance, short-term effectiveness, and compliance with SCGs. This evaluation focuses on how a specific alternative achieves protection over time and how site risks and human exposures are reduced. The analysis includes how each source of contamination is to be eliminated, reduced or controlled for each alternative.

4.2.2 Compliance with SCGs

This evaluation criterion determines how each alternative complies with SCGs, as discussed and identified in Sections 3 and 4 of this Report. The actual determination of which requirements are applicable or relevant and appropriate is made by NYSDEC and in consultation with NYSDOH. If a SCG is not met, the basis for one of the four waivers allowed under 6 NYCRR Part 375-1.10(c)(i) is discussed. If an alternative does not meet the SCGs and a waiver is not appropriate or justifiable, such an alternative should not be considered further.

4.2.3 Short-term Effectiveness

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase. Alternatives are evaluated with respect to the effects on human health and the environment during implementation of the remedial action. The aspects evaluated include: protection of the community and workers during remedial actions, environmental impacts as a result of remedial actions, and time until the remedial response objectives are achieved.

4.2.4 Long-term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the waste or residual remaining at the site and operating system necessary for the remedy to remain effective. The factors being evaluated include the permanence of the remedial alternative, magnitude of the remaining environmental risks and potential human exposure, adequacy of controls used to manage residual waste, and reliability of controls used to manage residual waste.

4.2.5 Reduction of Toxicity, Mobility, and Volume

This evaluation criterion assesses the remedial alternative’s use of the technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous wastes as their principal element. The NYSDEC’s policy is to give preference to alternatives that eliminate any significant threats at the site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in the contaminants mobility, or reduction of the total volume of contaminated media. This evaluation includes: the amount of the hazardous materials that would be destroyed or treated, the degree of expected reduction in toxicity, mobility, or volume measured as a percentage, the degree in which the treatment would be irreversible, and the type and quantity of treatment residuals that would remain following treatment.

4.2.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services, technology, and materials required during its implementation. The evaluation includes:

- Feasibility of construction and operation;
- Ease of undertaking additional remedial action;
- Monitoring considerations;
- Technical aspects of construction, operation, and monitoring;
- Reliability of technology;
- Activities related to coordinating with other offices or agencies and obtaining necessary approvals from government agencies;
- Availability of equipment, services, and materials, including the availability of specialists and the ability to obtain competitive bids; and

- Availability of adequate off-site treatment, storage, and disposal services, if needed.

4.2.7 Cost

Cost estimates are prepared and evaluated for each alternative. The cost estimates include capital, OM&M, and future capital costs. A cost analysis is performed which includes the following factors: the effective life of the remedial action, the OM&M costs, the duration of the cleanup, the volume of contaminated material, other design parameters, and the discount rate. Cost estimates developed at the detailed analysis of alternatives phase of a feasibility study generally have an expected accuracy range of –30 to +50 percent (USEPA, 2000).

4.2.8 Land Use

This criterion is an evaluation of the current, intended and reasonably anticipated future use of the site and its surroundings, as it relates to an alternative or remedy, when unrestricted levels would not be achieved.

5. Detailed Analysis of Alternatives

The selection and development of the remedial alternatives was conducted in accordance with New York State NYSDEC Division of Environmental Remediation (DER) policy, DER-15: Presumptive/Proven Remedial Technologies. The presumptive remedy approach is to select remedies that have already been proven to be both feasible and cost effective so as to make the remedy selection quicker. In accordance with Section 1 of DER-15 and with the concurrence of NYSDEC, no further action and plume management monitoring alternatives are evaluated in this section along with select presumptive remedies for groundwater contaminated with VOCs.

Based on the screening of remedial technologies in Section 3, the groundwater remedial alternatives to be evaluated are:

- No Further Action with Monitoring;
- Targeted ISCO;
- Targeted Enhanced In-situ Bioremediation; and
- Restoration to Achieve Pre-Disposal Conditions.

The targeted ISCO and targeted enhanced in-situ bioremediation alternatives include active treatment of CVOC-containing groundwater within approximately 1000 feet downgradient of the Munsey and Plaza Cleaners sites. This treatment area was selected because some of the highest CVOC groundwater concentrations in the dissolved-phase CVOC plume have been detected at MC-3, MC-6, MC-7, and PC-7. So as not to interfere with operations at or water quality at the Sandy Hollow Well Field, no active remediation to the north of Baxter Brook is included in the targeted ISCO and targeted enhanced in-situ bioremediation alternatives. The opinion of probable costs for these remedial alternatives, with an expected accuracy range of –30 to +50 percent, is presented in Appendix B. The remedial alternatives are described and evaluated below.

5.1 No Further Action with Monitoring

A no further action with monitoring alternative would involve no active remediation in the former Munsey and Plaza OU-2 area, but would monitor the effectiveness of active remediation systems, which are currently operating at the former Munsey Cleaners site and are installed and planned to be operated at the former Plaza Cleaners site. If this alternative is selected for implementation, the dissolved-phase CVOC plume would not be remediated other than with natural processes (i.e. dilution, dispersion, natural attenuation, etc.). For this reason, this alterative alone would not be in compliance with SCGs, effective in the short-term, or protective of human health and the environment. The no further action with monitoring alternative would not reduce the toxicity, mobility or volume of the dissolved-phase CVOC plume, would require no effort to implement, and would have minimal costs. No further action with monitoring is comparatively effective regardless of whether a remedy has been implemented at the former Plaza Cleaners site. Under the no further action with monitoring alternative, off-site contamination would not be actively remediated, but will be monitored periodically.

The no further action with monitoring alternative would include each of the common remedial actions described in Section 4.1. This alternative would rely on a long-term monitoring program to ensure plume stability and the natural reduction of the CVOC contamination over time. Groundwater samples would be collected semi-annually for 30 years (unless altered based on five-year reviews) from PC-10-B, PC-10-C, and select wells within the plume. Samples would be analyzed for VOCs to verify decreasing VOC concentrations and to assess if groundwater containing site-related compounds is migrating to the Sandy Hollow well field.

Overall Protection of Human Health and the Environment

Although the no further action with monitoring alternative does not include groundwater treatment, it would be protective of human health and the environment because groundwater containing site-related CVOCs is not being used as a water supply and exposures relating to soil vapor intrusion would be addressed.

Compliance with SCGs

Because there is no active groundwater remediation included in this alternative, it would not be in compliance with SCGs.

Short-term Effectiveness and Long-term Effectiveness and Permanence

Because there is no active groundwater remediation included in this alternative, it would not be effective in the short-term. Long-term effectiveness of this remedy would be similar to other remedies given the widespread nature of the plume and the likelihood that under any feasible remedy, residual concentrations of site-related constituents would remain in the groundwater.

Reduction of Toxicity, Mobility, and Volume

The no further action with monitoring alternative would not reduce the toxicity, mobility or volume of the dissolved-phase CVOC plume other than with natural processes (i.e. dilution, dispersion, natural attenuation, etc.).

Implementability

The components of this alternative are readily implementable and would require minimal effort.

Cost

The no further action with monitoring alternative would have significantly lower capital and operation, maintenance, and monitoring (OM&M) costs than the remedial alternatives that include active treatment of the dissolved-phase CVOC plume. Costs are based on the routine, long-term groundwater quality monitoring, and operation and maintenance of the nine NYSDEC installed mitigation systems.

The opinion of probable cost for this remedial alternative, with an expected accuracy range of –30 to +50 percent, is presented in Table B-1. The cost opinion is based on collecting 20 groundwater samples per year for 30 years. Capital costs including the first year of OM&M would be approximately $37,000. Annual OM&M costs are estimated to be $23,000 including two groundwater sampling events and laboratory analysis. The total present value of this alternative based on a 2.3% discount rate over a 30-year period is approximately $538,000.

Land Use

The implementation of this remedy would have little to no impact on the current and future use of the Munsey and Plaza Cleaners sites or the properties located above the dissolved-phase CVOC plume.

5.2 Targeted In-situ Chemical Oxidation

Sodium permanganate and sodium persulfate will be considered in the following alternative. Implementation of a targeted ISCO treatment program would include the following:

- Bench-scale laboratory testing to evaluate the effectiveness of ISCO treatment and the amount of oxidant required for treatment.
- Implementation and evaluation of a field pilot test to evaluate oxidant distribution and persistence in the subsurface.
- Injection of oxidant into either temporary direct-push injection points or permanent injection wells into the subsurface.
- Post-injection groundwater monitoring to evaluate treatment effectiveness.

The oxidant would be injected into the subsurface within a localized treatment zone. Groundwater monitoring upgradient, downgradient, and within the treatment area would be required to evaluate the effectiveness of the ISCO injections at reducing contaminant concentrations. ISCO injections would treat the plume as the affected groundwater flows through the treatment area. However, areas of the plume downgradient of the treatment area would continue to migrate toward the Sandy Hollow well field.

Since ISCO relies on direct contact between the oxidant solution and the contaminant, the success of the ISCO treatment would be highly dependent on the ability to effectively distribute the oxidant through the treatment area. If such distribution can be achieved, it is anticipated that the ISCO treatment is capable of meeting the RAOs for targeted areas within the Munsey and Plaza Cleaners investigation area. Multiple injections are required to sustain the oxidants in the subsurface, commonly 3 to 6 months apart. An ISCO pilot study would be conducted to evaluate the implementability, effectiveness, and feasibility of this technology at the Munsey and Plaza Cleaners investigation area.

As discussed in Section 4.1, development and implementation of Site Management and Soil Vapor Intrusion Action Plans as well as potential institutional controls would be included in this alterative. Building/property use restrictions and groundwater use restrictions could be placed on the former Munsey and Plaza Cleaners site properties that would require compliance with the approved Site Management Plan. The Site Management Plan could mandate the operation and maintenance of engineered mitigation systems, as well as prohibit the use of groundwater. Performance monitoring would be implemented as a secondary component of this alternative and would involve periodic sampling and analysis of groundwater. An example program for monitoring the effectiveness of ISCO treatment would involve collecting groundwater samples from one existing upgradient monitoring well and two existing downgradient monitoring wells for each injection location semi-annually for one year. Subsequent performance monitoring would be based on these results but would likely include annual monitoring with reviews every five years. For costing purposes, it is assumed that 25 groundwater samples would be collected semi-annually for 30 years.

Overall Protection of Human Health and the Environment

The implementation of the ISCO alternative would be protective of human health by reducing concentrations of VOCs in groundwater, although it would only treat a small percentage of the total volume of the dissolved-phase CVOC plume. However, groundwater containing site-related CVOCs is not being used as a water supply and exposures relating to soil vapor intrusion would be addressed.

Compliance with SCGs

The implementation of ISCO as a remedy would be in compliance with SCGs within the treatment area. Groundwater downgradient of the treatment area would also decrease through dilution and contaminant flux.

Short-term Effectiveness

ISCO would be effective in the short-term since ISCO treatment oxidizes VOCs almost immediately upon contact. However, ISCO is ineffective at treating groundwater upgradient and downgradient of the ISCO injection locations. Implementation and initial operation of this alternative is not expected to pose significant risk to the community. Risks to workers, which include potential exposure to oxidants and to contaminated soils and groundwater during well and equipment installation, are readily controlled using standard work practices and engineering controls.

Long-term Effectiveness and Permanence

ISCO is considered to be effective in the long-term because further migration of the dissolved phase plume could be minimized and the groundwater VOC concentrations in the treatment area would be reduced. The limiting factor to the long-term effectiveness of ISCO is the number of injections necessary to maintain the oxidant in the subsurface and treating a sufficient volume of contaminated groundwater, including the source area.

Reduction of Toxicity, Mobility, and Volume

ISCO is considered to be effective at reducing the toxicity, mobility, or volume of the plume because ISCO can convert the VOCs to non-toxic byproducts if sufficient contact can be achieved.

Implementability

ISCO treatment could be implemented using readily available technologies and is considered easy to implement. However, the success of the treatment would be dependent on the degree to which the oxidant solution is able to come into contact with the contaminants and the number of injections required. There would be minimal disruption to site activities during ISCO injection events because no surface structures are needed, other than injection wells. ISCO injections do not generate significant waste, so treatment and disposal considerations are negligible. Utility clearance confirmation is necessary prior to conducting any subsurface drilling.

Cost

The cost for this remedial alternative, with an expected accuracy range of –30 to +50 percent, is presented in Table B-2. The estimated capital cost including the first year of O&M is approximately $618,000. Annual O&M cost are estimated to be approximately $36,000. The total present value of this alternative based on a 2.3% discount rate over a 30-year period is approximately $1.39 million. One injection event would be conducted during the first year with 30 years of semi-annual groundwater monitoring. These costs assume that shallow, intermediate, and deep injections wells will be installed in five well clusters. These costs also assume that 10% pore volume of oxidant would be injected through a 10-foot screen to a distance of 20 feet from the well.

Land Use

The implementation of this remedy would have no little to no impact on the current and future use of the Munsey and Plaza Cleaners sites or the properties located above the dissolved-phase CVOC plume. Potential negative land use impacts if this alternative is implemented include institutional controls such as restrictions on groundwater use.

5.3 Targeted Enhanced In-situ Bioremediation

Implementation of a targeted enhanced in-situ bioremediation treatment program would include the following:

- Bench-scale laboratory testing to evaluate the effectiveness of in-situ bioremediation treatment and the amount of biostimulant or bacteria required for treatment.

- Implementation and evaluation of a field pilot test to evaluate injection efficacy, distribution, and persistence in the subsurface.

- Injection of biostimulant or bacteria into either temporary direct-push injection points or permanent injection wells.

- Post-injection groundwater monitoring to evaluate treatment effectiveness.

Since in-situ bioremediation relies on direct contact between bacteria and the contaminant, the success of the in-situ bioremediation treatment would be highly dependent on the ability to effectively distribute the biostimulant or bacteria through the treatment area. If such distribution can be achieved, it is anticipated that in-situ bioremediation is capable of meeting the RAO. Biostimulants are typically emulsified oils, lactate, or molasses.

In-situ bioremediation would treat the dissolved-phase CVOC plume as the affected groundwater flows through the treatment area, which would limit migration of the dissolved-phase CVOC plume from the area of highest groundwater CVOC concentrations. There would also be limited downgradient treatment because the bioremediation amendments would flow with groundwater downgradient. However, areas of the dissolved-phase CVOC plume downgradient and crossgradient of the treatment area would continue to migrate to the northwest toward the Sandy Hollow Well Field. An enhanced in-situ bioremediation pilot study would be conducted to evaluate the implementability, effectiveness, and feasibility of this technology at the Munsey and Plaza Cleaners investigation area.

Multiple injections, commonly one to two years apart for emulsified oils or lactate and up to monthly for molasses, are required to sustain anaerobic conditions and microbial populations in the subsurface.

As discussed in Section 4.1, development and implementation of Site Management and Soil Vapor Intrusion Action Plans as well as potential institutional controls would be included in this alterative. Building/property use restrictions and groundwater use restrictions could be placed on the former Munsey and Plaza Cleaners site properties that would require compliance with the approved Site Management Plan. The Site Management Plan could mandate the operation and maintenance of engineered mitigation systems, as well as prohibit the use of groundwater at the Munsey and Plaza Cleaners sites.

Performance monitoring would be implemented as a secondary component of this alternative and would involve periodic sampling and analysis of groundwater. Groundwater monitoring both upgradient and downgradient from the treatment area would be required to evaluate the effectiveness of the in-situ bioremediation injections at reducing contaminant concentrations and protecting downgradient areas from further dissolved-phase CVOC plume migration. Groundwater samples from one existing upgradient monitoring well and two existing downgradient monitoring wells for each injection location would be collected for VOC analysis semi-annually for one year following implementation of this alternative. Subsequent performance monitoring would be based on these results but would likely include annual monitoring with reviews every five years. For costing purposes, it is assumed that 25 groundwater samples would be collected semi-annually for 30 years.

Overall Protection of Human Health and the Environment

The implementation of the enhanced in-situ bioremediation alternative would be protective of human health by reducing concentrations of VOCs in groundwater. This alternative would help reduce contaminant concentrations in the vicinity of the injection points but would only treat a small percentage of the total volume of the dissolved-phase CVOC plume. That being said, groundwater containing site-related CVOCs is not being used as a water supply and exposures relating to soil vapor intrusion would be addressed. The nine sub-slab depressurization systems that were installed by the

NYSDEC to address exposures relating to soil vapor intrusion would continue to be maintained.

Compliance with SCGs

If distribution of the biostimulant or bacteria can be achieved, in-situ bioremediation can be used to effectively reduce contaminant concentrations within the treatment area, thus achieving SCGs in limited areas of OU-2.

Short-term Effectiveness

This alternative is not as effective in the short-term as other active alternatives because it can take years for bioremediation to reduce contaminant concentrations. The community is not expected to be exposed to site-related contamination during the implementation of this alternative. Risks to workers, which include potential exposure to contaminated soils and groundwater during well and equipment installation, are readily controlled using standard work practices and engineering controls.

Long-term Effectiveness and Permanence

If distribution of the biostimulant or bacteria can be achieved, in-situ bioremediation is considered to be effective in the long-term because groundwater VOC concentrations would be reduced within the treatment area as long as subsurface conditions amenable to bioremediation are maintained. In-situ bioremediation is expected to be effective for at least six months and potentially more than one year before additional injections are required if emulsified oils or lactate are the biostimulant injected.

There is a potential for incomplete degradation of contaminants if the aquifer is not conducive to anaerobic adjustment or the injection frequency and concentration is not sufficient. The potential for incomplete contaminant degradation would be evaluated using available data, including those from pilot studies.

Reduction of Toxicity, Mobility, and Volume

In-situ bioremediation is considered to be effective at reducing the toxicity, mobility, or volume of the dissolved-phase CVOC plume because bacteria that are stimulated or added can convert the contaminants to non-toxic byproducts if sufficient distribution can be achieved. Contaminated groundwater downgradient of the proposed injection locations would be addressed with plume management monitoring.

Implementability

Enhanced in-situ bioremediation could be implemented using readily available technologies. In-situ bioremediation is expected to be effective for at least six months and potentially more than one year before additional injections are required if emulsified oils or lactate are the biostimulant injected. There does not appear to be any significant obstacles to implementing this technology at the site, however, consideration must be given to minimize the potential for reduced water quality at the Sandy Hollow well field. If in-situ bioremediation were chosen as a selected remedy, injection locations would be upgradient of the Sandy Hollow well field. Currently, the well field has the capacity to treat CVOC at concentrations detected in groundwater.

As the proposed location for the in-situ bioremediation injections is not owned by the State, town permits would need to be obtained to allow for drilling and in-situ bioremediation injections. In-situ bioremediation injections do not generate significant waste, so treatment and disposal considerations are negligible.

Cost

The opinion of probable cost for this remedial alternative, with an expected accuracy range of –30 to +50 percent, is presented in Table B-3. Capital costs including the first year of OM&M would be approximately $500,000. Annual OM&M costs are estimated to be $36,000 including semi-annual post injection groundwater monitoring and laboratory analysis. The total present value of this alternative based on a 2.3% discount rate over a 30-year period is approximately $1.27 million. These costs assume that shallow, intermediate, and deep injections wells will be installed in five well clusters. These costs also assume that 10% pore volume of amendment would be injected through a 10-foot screen to a distance of 20 feet from the well.

Land Use

The implementation of this remedy would have little to no impact on the current and future use of the Munsey and Plaza Cleaners sites or the properties located above the dissolved-phase CVOC plume. Potential negative land use impacts if this alternative is implemented include institutional controls such as restrictions on groundwater use.

5.4 Restoration to Pre-disposal Conditions

ISCO could be employed to restore the Munsey and Plaza Cleaners investigation area to pre-disposal conditions by reducing groundwater contaminant concentrations so as to be in compliance with SCGs. Oxidants would be injected over an approximately 2,000,000 square foot area. A series of directionally drilled injection wells could be installed from two locations above the dissolved-phase CVOC plume. Because ISCO injections would be needed directly upgradient of the Sandy Hollow well field, these public water supply wells may need to be deactivated because of the likelihood of reduced water quality at these wells. Given the limited availability of onsite space to stage equipment and materials necessary for ISCO injection wells, access would need to be granted by adjacent landowners. Because most of the contaminated soils in the vicinity of the former Munsey Cleaners site have been removed, ISCO injection wells would likely be focused on the plume emanating from the former Plaza Cleaners site and other areas of relatively high VOC concentrations. Directionally-drilled injection wells would need to be placed down gradient of existing contamination, with injection depths targeted at the intervals with the known highest concentration of contaminants. Based on results of groundwater sampling conducted during the RI, the directionally-drilled wells would extend an approximate lateral distance of 300 feet to an approximate depth ranging from 60 to 120 feet bgs. Vertical piezometric heads within the offsite plume would likely drive oxidants to the depth of deepest contaminants, however, injections depths would likely take place at shallow, intermediate and deep intervals. It is likely that multiple injection events would be needed to prevent rebound of CVOC groundwater concentrations.

As discussed in Section 4.1, development and implementation of Site Management and Soil Vapor Intrusion Action Plans as well as potential institutional controls would be included in this alterative. Building/property use restrictions and groundwater use restrictions could be placed on the former Munsey and Plaza Cleaners site properties that would require compliance with the approved Site Management Plan. The Site Management Plan could mandate the operation and maintenance of engineered mitigation systems, as well as prohibit the use of groundwater. Performance monitoring would be implemented as a secondary component of this alternative and would involve periodic sampling and analysis of groundwater. For costing purposes, it is assumed that 10 groundwater samples would be collected semi-annually for 30 years.

Overall Protection of Human Health and the Environment

This alternative would be protective of the public health and the environment because the contamination related to the Munsey and Plaza Cleaners sites would be removed or treated.

Compliance with SCGs

Implementation of this alternative would result in a reduction of VOC concentrations within the treatment area to less than SCGs.

Short-term Effectiveness

This alternative would be effective in the short-term because ISCO treatment oxidizes VOCs almost immediately upon contact. Implementation and initial operation of this alternative is not expected to pose significant risk to the community. Risks to workers, which include potential exposure to contaminated soils and groundwater during well and equipment installation, are readily controlled using work practices and engineering controls. Air emissions during implementation are also monitored and can be controlled within acceptable levels with standard work practices and engineering controls.

Long-term Effectiveness and Permanence

This alternative would be effective in the long-term and permanent because groundwater contaminant concentrations on and downgradient of the Munsey and Plaza Cleaners sites would be reduced, including within the source area.

Reduction of Toxicity, Mobility, and Volume

The toxicity, mobility, and volume of contaminants in the treatment area would be reduced if this alternative is implemented.

Implementability

Although each component of this alternative could be implemented using readily available technologies that are easy to implement, the alternative as a whole would be difficult to implement because of the size of the treatment area. ISCO is commonly used as a remedial technology. However, the success of the treatment would be dependent on the degree to which the oxidant solution is able to come into contact with the contaminants and the number of injections required. There would be minimal disruption to site and community activities during ISCO injection events because no surface structures are needed, other than injection wells. ISCO injections do not generate significant waste, so treatment and disposal considerations are negligible. Utility clearance confirmation is necessary prior to conducing any subsurface drilling.

Another prohibitive factor is that injections of oxidants upgradient of drinking water supply wells may adversely affect water quality within the well field. The reduction of drinking water quality may require the deactivation of the Sandy Hollow well field, where treatment capabilities are already in place to reduce CVOC concentrations in groundwater. Deactivation of the Sandy Hollow well field would require the identification of an alternate water supply source, significant capital and broad, long-term water resource management plans for the Village of Port Washington and other communities served by the Sandy Hollow well field. This alternative should not be considered further because groundwater withdrawn from the Sandy Hollow well field is currently treated to remove CVOC, making the substantial investment in time and resources to identify alternative sources of drinking water unnecessary.

Cost

The estimated cost for this remedial alternative, with an expected accuracy range of –30 to +50 percent, is presented in Table B-4. Capital costs include ISCO injections over an approximately 2,000,000 square foot area through a series of directionally drilled injection wells. The capital cost for this alternative is approximately $6.3 million. Annual O&M costs are estimated to be approximately $23,000. The total present value of this alternative based on a 2.3% discount rate over a 30-year period is approximately $6.8 million. This cost does not include deactivating and relocating the Sandy Hollow Well Field municipal water supply, which would like cost millions of dollars.

Land Use

The implementation of this remedy would have little to no impact on the current and future use of the Munsey and Plaza Cleaners sites or the properties located above the dissolved-phase CVOC plume. Potential negative land use impacts if this alternative is implemented include institutional controls such as restrictions on groundwater use.

6. Comparative Evaluation of Alternatives

The following four remedial alternatives are evaluated below relative to each other and the criteria summarized in Section 4.2.

- No Further Action with Monitoring;
- Targeted ISCO;
- Targeted Enhanced In-situ Bioremediation; and
- Restoration to Achieve Pre-Disposal Conditions.

As part of each remedial alternative, groundwater will be sampled from locations both upgradient and downgradient of the treatment area to monitor the effectiveness of the remedial alternative at reducing contaminant concentrations and protecting downgradient areas from further plume migration.

At least one known source area (at the former Plaza Cleaners site) still exists in the area of investigation. As this source area remains uncontrolled or not remediated, implementation of any remedy for the former Munsey and Plaza Cleaners OU-2 area would be problematic. In the event that this source area is controlled or remediated, the no further action with monitoring alternative would be feasible to implement. This alternative would require minimal costs, would be similarly effective in the long-term to other remedies, but would not be in compliance with SCGs, effective in the short-term, or reduce the toxicity, mobility or volume of the dissolved-phase CVOC plume. The targeted ISCO and enhanced bioremediation alternatives could be used to enhance or accelerate the decrease in concentrations downgradient of the suspected source areas, but would be limited to only localized areas within the widespread plume.

In contrast, the pre-disposal conditions alternative would have significantly higher costs, and could involve the temporary or indefinite deactivation of an active public water supply. This alternative is therefore deemed infeasible relative to other alternatives and is not evaluated further in this section. A comparison of each remedial alternative relative to each evaluation criteria is provided below and in Table 2.

6.1 Overall Protection of Human Health and the Environment

The ISCO and bioremediation alternatives would be effective at minimizing groundwater CVOC concentrations by chemically degrading VOCs to non-toxic byproducts (e.g., ethane, ethane, and/or chloride ions). As the RAOs would be met, these remedial alternatives would be protective of human health and the environment. However, the ISCO and bioremediation alternatives would be minimally more protective of human health and the environment relative to the no action with monitoring alternative because they would treat only a portion of the total volume of the dissolved-phase CVOC plume. These alternatives would not affect distal portions of the dissolved-phase CVOC plume and portions of the plume immediately upgradient of the Sandy Hollow well field. The no further action with monitoring alternative is less protective of human health and the environment than the ISCO and bioremediation because it does not include active groundwater remediation. That being said, groundwater containing site-related CVOCs is not being used as a water supply and exposures relating to soil vapor intrusion would be addressed. If groundwater used by the PWWD at the Sandy Hollow well field showed the presence of site-related VOCs, the existing carbon treatment system would be sufficient to treat groundwater to less than applicable drinking water standards.

6.2 Compliance with SCGs

The ISCO and bioremediation alternatives would treat contaminated groundwater in the vicinity of the injection wells. However, these alternatives would treat only a portion of the total volume of the dissolved-phase CVOC plume, leaving some of the dissolved-phase CVOC plume out of compliance with SCGs. The ISCO alternative would be more effective than the bioremediation alternative at complying with SCGs because ISCO would more quickly degrade the CVOCs to non-toxic compounds. The no further action with monitoring alternative would not actively treat the dissolved-phase CVOC plume and would take significantly longer (decades) to be in compliance with SCGs.

6.3 Short-Term Effectiveness

Once the ISCO and bioremediation alternatives are implemented, contaminant concentrations will begin to be reduced within the treatment area. The bioremediation alternative would not be as effective in the short-term as the ISCO alternatives because contaminant degradation using enhanced bioremediation is a slower process than by chemical oxidation. The ISCO alternative would be effective in the short-term assuming sufficient distribution of injected material and uniform treatment is achieved. The short-term effectiveness of each remedial alternative would be assessed using standard groundwater monitoring wells to evaluate upgradient and downgradient (treated) groundwater adjacent to the treatment area.

Implementation and operation of these alternatives are not expected to pose significant risk to the community. Risks to workers, which include potential exposure to oxidants and to contaminated soils and groundwater during well and equipment installation, are readily controlled using standard work practices and engineering controls. Air emissions, which could impact the community, during implementation are also monitored and can be controlled within acceptable levels with standard work practices and engineering controls.

6.4 Long-Term Effectiveness and Permanence

Each of the groundwater treatment remedial alternatives are considered to be effective in the long-term because VOC concentrations in groundwater would be reduced within the treatment area. No further action with monitoring alternative would be effective in the long term if source area remediation and control are maintained (former Munsey Cleaners site) or implemented (former Plaza Cleaners site).

The ISCO alternatives would effectively reduce groundwater VOC concentrations quickly. However, additional injection events may be necessary if there is incomplete treatment or to treat upgradient groundwater that flows into the treatment area. If distribution of the biostimulant or bacteria can be achieved, in-situ bioremediation is considered to be effective in the long-term because groundwater VOC concentrations would be reduced within the treatment area as long as subsurface conditions amenable to bioremediation are maintained. To maintain these conditions, multiple injection events would likely be needed. Remedy performance monitoring would be used to evaluate the frequency of injections if an injection technology is selected as the remedy for groundwater.

The spacing of the injection wells would need to be designed so as to achieve uniform treatment across the width of the dissolved-phase CVOC plume. The potential for incomplete contaminant degradation would be evaluated using available data, including those from pilot studies.

6.5 Reduction of Toxicity, Mobility, or Volume

The no further action with monitoring alternative would not reduce the toxicity, mobility, or volume of the dissolved-phase CVOC plume other than with natural processes (i.e. dilution, dispersion, natural attenuation, etc.). In contrast, the groundwater treatment remedial alternatives would reduce the mobility of the plume by treating the groundwater within the treatment area. These alternatives would limit plume migration and reduce contaminant concentrations in the treatment area, thereby reducing the toxicity, mobility, and volume of the plume. The toxicity, mobility, and volume of the dissolved-phase CVOC plume outside of the treatment area would be reduced at a slow rate as a result of natural processes.

If one of the active treatment alternatives are implemented, VOCs would be chemically or biologically degraded to non-toxic byproducts (e.g., ethane, ethane, and/or chloride ions), which do not pose significant risk to human health or the environment. The amount of reduction of the toxicity, mobility, or volume of the plume is dependent on the degree to which uniform treatment is achieved within the treatment area, which is primarily related to the area of influence and spacing of the injection wells. Each of the remedial alternatives has uncertainties related to the ability to achieve uniform treatment.

6.6 Implementability

It is expected that it would take approximately one year to design and implement each of the alternatives that include active remediation. The remedial alternatives are all technically feasible and may be affected differently by site-specific geologic and hydrogeologic characteristics. As such, pre-design studies and/or pilot tests are recommended prior to remedy implementation to evaluate the feasibility of the selected remedial alternative and to finalize design of the remedy.

The ISCO and enhanced bioremediation injection alternatives are capable of reducing groundwater VOC concentrations while eliminating the need for ex-situ treatment facilities and minimizing disposal issues. These alternatives do not generate significant waste, so ex-situ treatment and disposal considerations are negligible.

It is anticipated that the necessary equipment, personnel, and materials would be available to meet an appropriate schedule for implementation of each of the remedial alternatives using readily available technologies. There does not appear to be significant obstacles to implementing these remedial technologies, although obtaining permits and access will be necessary for the groundwater treatment alternatives. Drilling and installing injection or monitoring wells in the road right-of-ways is feasible but would be logistically challenging as the streets located above the dissolved-phase CVOC plume are busy and narrow. Utility clearance confirmation is necessary prior to conducting any subsurface drilling. There would be minimal disruptions to Munsey and Plaza Cleaners site activities during implementation of these alternatives because no surface structures, other than possibly injection wells, are needed.

6.7 Cost

A summary of opinion of probable costs for each remedial alternative is provided in Tables B-5 and B-6. A graph of the probable present value of each of the alternatives is included in Appendix B. The relative order of probable present value for the six alternatives over a 30-year period are, from least to most expensive:

- No further action with monitoring;
- In-situ enhanced bioremediation;
- ISCO;
- Restoration to pre-disposal conditions.

The no further action with monitoring alternative would cost significantly less than any of the alternatives that include active groundwater remediation. Restoration to pre-disposal conditions would be prohibitively expensive.

6.8 Land Use

The implementation of any of the remedial alternatives would have little to no impact on the current and future use of the Munsey and Plaza Cleaners sites or the properties located above the dissolved-phase CVOC plume. Potential negative land use impacts if these alternatives are implemented include institutional controls such as restrictions on groundwater use at these sites.

6.9 Remedial Alternative Advantages and Disadvantages

A list of select advantages and disadvantages for the no further action with monitoring, targeted ISCO, and targeted enhanced in-situ bioremediation alternatives is below:

No further action with monitoring alternative advantages:

- Low cost;
- Minimally intrusive;
- Can be easily and quickly implemented.

No further action with monitoring alternative disadvantages:

- Includes no active groundwater remediation;
- Groundwater VOC concentrations would not be reduced, other than with natural processes;
- SCGs would not be attained in a reasonable time frame.

Targeted ISCO alternative advantages:

- Limited long-term OM&M costs;
- No above-ground structures needed;
- Treats both dissolved and sorbed contaminants concurrently;
- Treats compounds that are not readily biodegradable;
- Breakdown of chlorinated VOCs without the generation of potentially more toxic degradation products
- Can convert VOCs to non-toxic byproducts if sufficient contact can be achieved;
- Flexible injection strategy, as the results of initial injections may be used to guide, focus, and/or modify subsequent injections;
- More likely than bioremediation to quickly meet the RAOs because ISCO treatment oxidizes VOCs almost immediately upon contact.

Targeted ISCO alternative disadvantages:

- ISCO treatment success is highly dependent on the ability to effectively distribute the oxidant through the treatment area;
- Multiple injections are required to sustain the oxidants in the subsurface, commonly 3 to 6 months apart;
- Subsurface conditions may dictate the need for closely spaced injection wells;
- Relatively high costs per volume treated;
- Subsurface conditions (i.e. soil type, degree of heterogeneity, and groundwater depth) may dictate the need for closely spaced injection wells;
- Well drilling and injection logistics are complicated by space constraints as a result of the highly populated area above the dissolved-phase CVOC plume;
- Potential for impacting water quality at the Sandy Hollow Well Field;
- Oxidants must be handled with care.

In-situ bioremediation alternative advantages:

- Limited long-term OM&M costs;
- No above-ground structures needed;
- Flexible injection strategy, as the results of initial injections may be used to guide, focus, and/or modify subsequent injections.

In-situ bioremediation alternative disadvantages:

- Requires multiple injections to maintain the treatment zone;
- Subsurface conditions (i.e. soil type, degree of heterogeneity, and groundwater depth) may dictate the need for closely spaced injection wells;

- Well drilling and injection logistics are complicated by space constraints as a result of the highly populated area above the dissolved-phase CVOC plume;
- Anaerobic degradation could be limited if elevated DO levels are present;
- A carbon source will be required to create anaerobic conditions;
- Bioaugmentation may be necessary if microbial populations are shown to be insufficient;
- Toxic byproducts could be produced if incomplete degradation occurs;
- Potential for impacting water quality at the Sandy Hollow Well Field.

6.10 Remedial Alternatives Summary

There are several complicating factors in implementing an alternative with active remediation of VOCs in groundwater in the Munsey and Plaza Cleaners investigation area. Well drilling and injection logistics are complicated by space constraints as a result of the highly populated area with crowded, busy, and narrow streets above the dissolved-phase CVOC plume. The likely inability to obtain access to drill on private property or provide access for the drilling rig on some side streets reduces the potential for installing injection wells in desired locations.

Public water supply water quality issues, including aesthetics and CVOC contamination, are a concern if active remediation of the dissolved-phase CVOC plume is selected. Permanganate turns bright purple when dissolved in water; this purple color acts as a built-in indicator for unreacted chemical. Reacted permanganate is black or brown, indicating the presence of a manganese dioxide (MnO2) byproduct. A disadvantage of enhanced in-situ bioremediation is the possible increase of DCE and vinyl chloride downgradient of the treatment area. This is due to the PCE and TCE byproduct's (DCE and vinyl chloride) slower reduction rates. Additional byproducts of bioremediation may include increased methane and increased concentration of dissolved iron and manganese and occasionally other metals if the local pH is significantly lowered through biological activity. Large amounts of carbon sources and electron donors would need to be introduced to the subsurface to create anaerobic conditions and promote reductive degradation. For these reasons, active remediation to the north of Baxter Brook would be problematic under the targeted ISCO or bioremediation alternatives because of the potential to impact operations or water quality at the Sandy Hollow well field.

Furthermore, targeted remediation of groundwater containing VOCs should not occur if upgradient sources of the VOCs would re-contaminate groundwater in the treatment area. Therefore, the Plaza Cleaners OU-1 remedy should be implemented prior to implementation of any of the active remedial alternatives discussed in this FS. Prior to source area remedy implementation at Plaza, no further action with monitoring would be more effective than any of the other alternatives. Surface water concentrations are likely to decrease with decreasing shallow groundwater concentrations.

The no further action with monitoring alternative is the least expensive and easiest to implement but does not include active groundwater treatment. Although groundwater CVOC concentrations would not be in compliance with SCGs under this alternative, groundwater containing site-related CVOCs is not being used as a water supply and soil vapor intrusion pathways are addressed through mitigation. The RAOs would not be achieved in a reasonable time period if the no further action with monitoring alternatives is implemented, unless contaminant source areas are remediated.

The targeted ISCO and bioremediation alternatives would be effective at minimizing groundwater CVOC concentrations in the portions of the dissolved-phase CVOC plume with the highest concentrations. These alternatives would each be protective of human health and the environment, would be in compliance with SCGs in the treatment areas, and would reduce the toxicity, mobility, and volume of the plume. Assuming uniform treatment of the dissolved phase plume can be achieved, the targeted ISCO and bioremediation alternatives would be effective in the long- and short-term, although multiple injection events may be required.

The targeted bioremediation alternative can be relatively easily implemented but can be costly as injections may be required multiple times to distribute and sustain biostimulant or sufficient microorganism populations in the subsurface. ISCO is most effective when treating a source area or area of relatively high concentrations. The costs associated with ISCO injections throughout the widespread dissolved-phase CVOC plume make this alternative infeasible because of space constraints, the need for multiple injection events, and the costs associated with sustaining the oxidant in the subsurface.

The restoration to pre-disposal conditions alternative would be the most effective, most protective of human health and the environment, and most likely to produce uniform plume treatment but its high capital cost and logistical constraints make this alternative infeasible.

None of the remedial alternatives require above-ground structures and extensive O&M efforts. The implementation of the targeted ISCO and bioremediation alternatives would require pre-design studies to finalize the design of the remedy. A pilot test would be performed to evaluate the feasibility of the selected remedial alternative at the Munsey and Plaza Cleaners investigation area and to design the remedy.

The public's comments, concerns and overall perception of the proposed remedial alternative will be evaluated by NYSDEC following issuance of a Proposed Remedial Action Plan (PRAP) in a format that responds to all questions that are raised. Community acceptance of the proposed remedy for the Munsey and Plaza Cleaners Sites would be evaluated after the public comments have been received.

7. References

Cadwell, D.H. and others, 1989. Surficial Deposits Map of New York State – Lower Hudson Sheet. New York State Museum, Albany, New York.

New York State Department of Environmental Conservation, 2009. Plaza Cleaners (Site No.130108) Remedial Investigation Work Plan. Albany, New York p. 147.

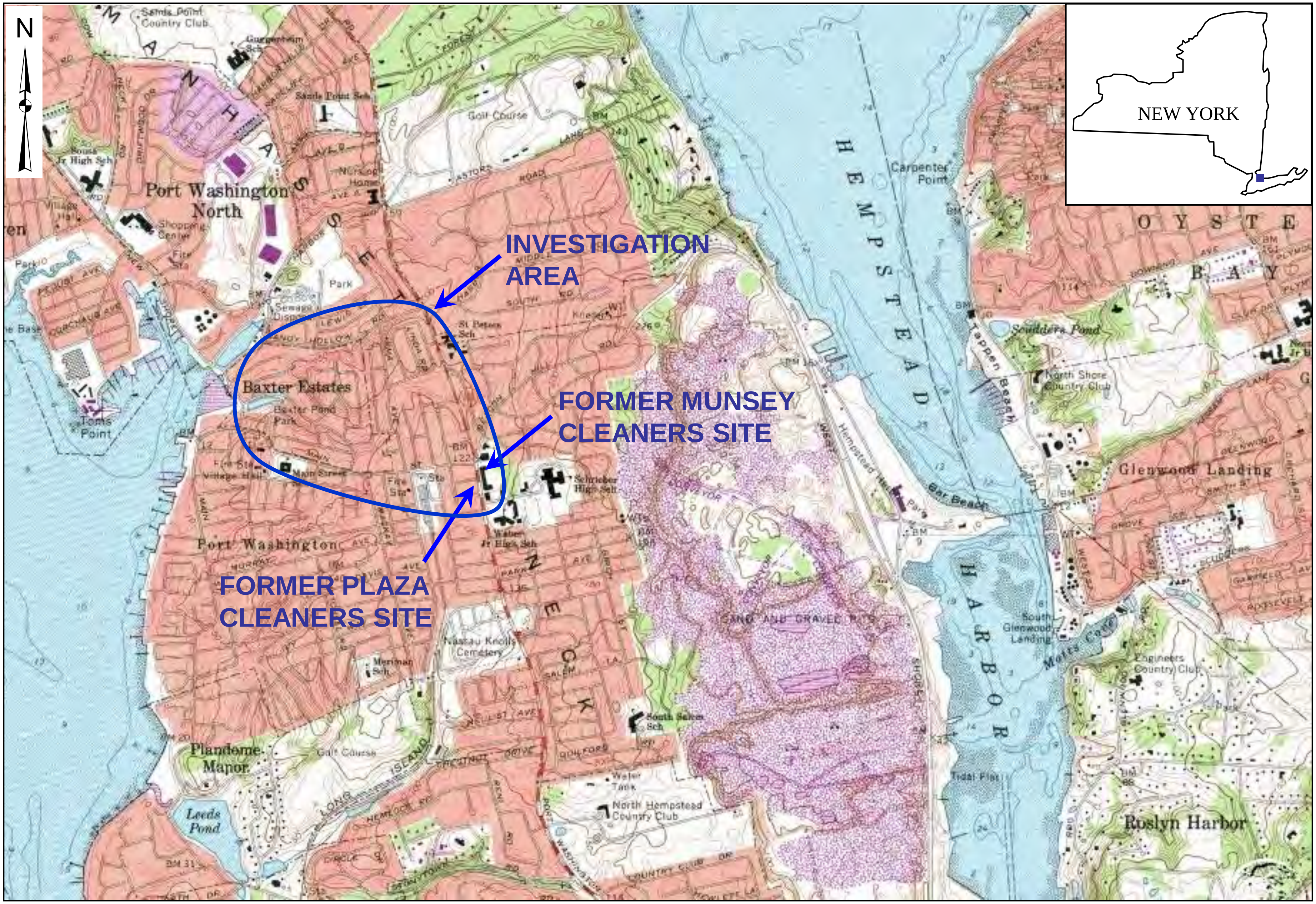
New York State Department of Health, 2006. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. Troy, New York p. 92.

Stumm, Frederick, Lange, Andrew D., and Jennifer Candela, 2002. Hydrogeology and Extent of Saltwater Intrusion on Manhasset Neck, Nassau County, New York: U.S. Geological Survey – Water Resources Investigations Report 00-4193, p. 42.

Swarzenski, Wolfgang V., 1963. Hydrogeology of Northwestern Nassau and Northeastern Queens Counties Long Island, New York. Geological Survey Water-Supply Paper 1657, p. 90.

.

Figures



MAP SOURCE: USGS 7.5 MINUTE TOPOGRAPHIC SERIES, SEA CLIFF QUADRANGLE (PHOTOREVISED 1979)

APPROXIMATE SCALE: 1" = 1500'

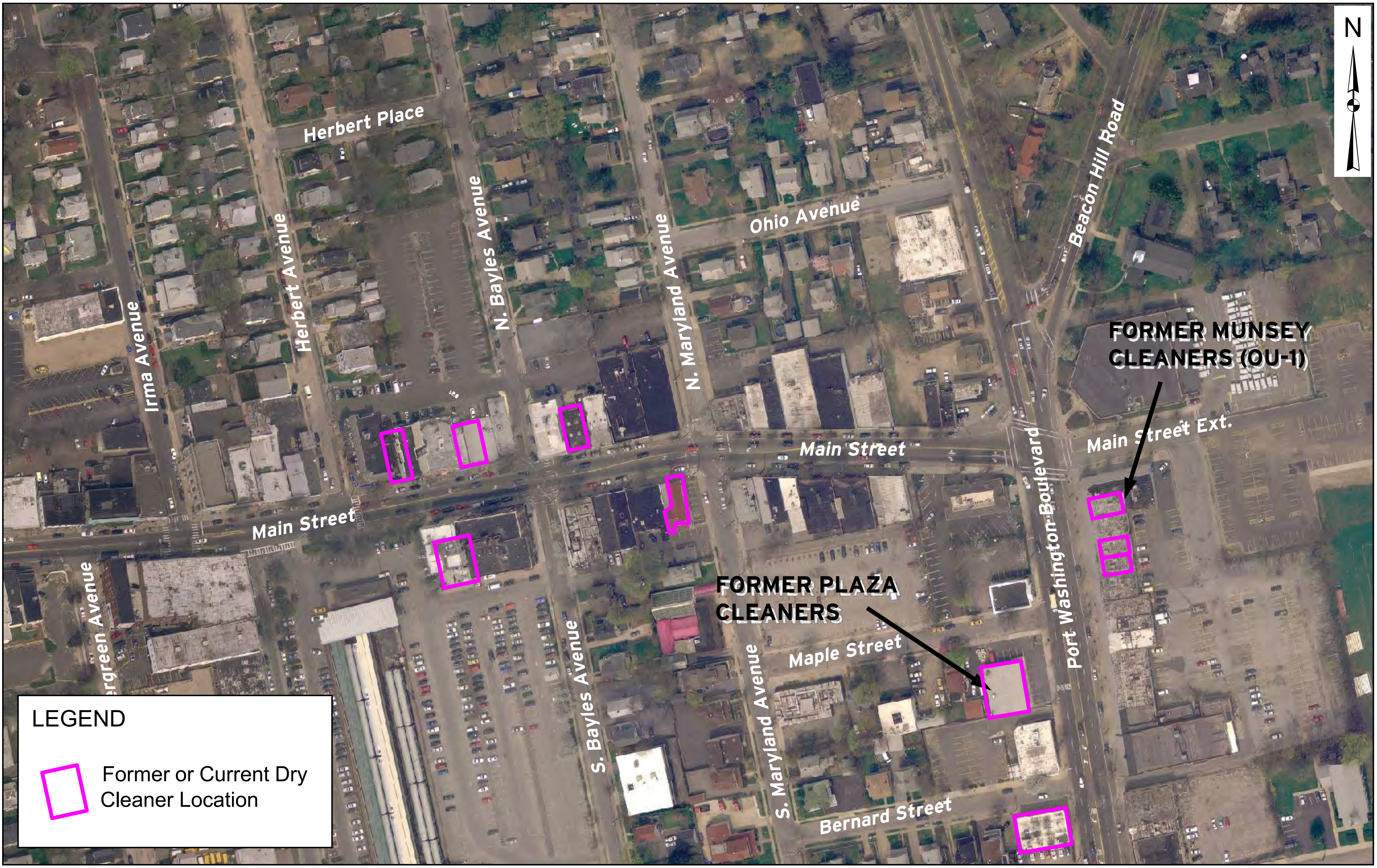
ARCADIS
Infrastructure · Water · Environment · Buildings

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
MUNSEY AND PLAZA CLEANERS SITES
TOWN OF NORTH HEMPSTEAD, NEW YORK

SITE LOCATION

DECEMBER 2011

FIGURE 1



SOURCE: NYSDOP 2-FT Resolution Natural Color Orthoimagery, 2004; New York State GIS Clearinghouse.

0 100 200 400

APPROXIMATE SCALE IN FEET

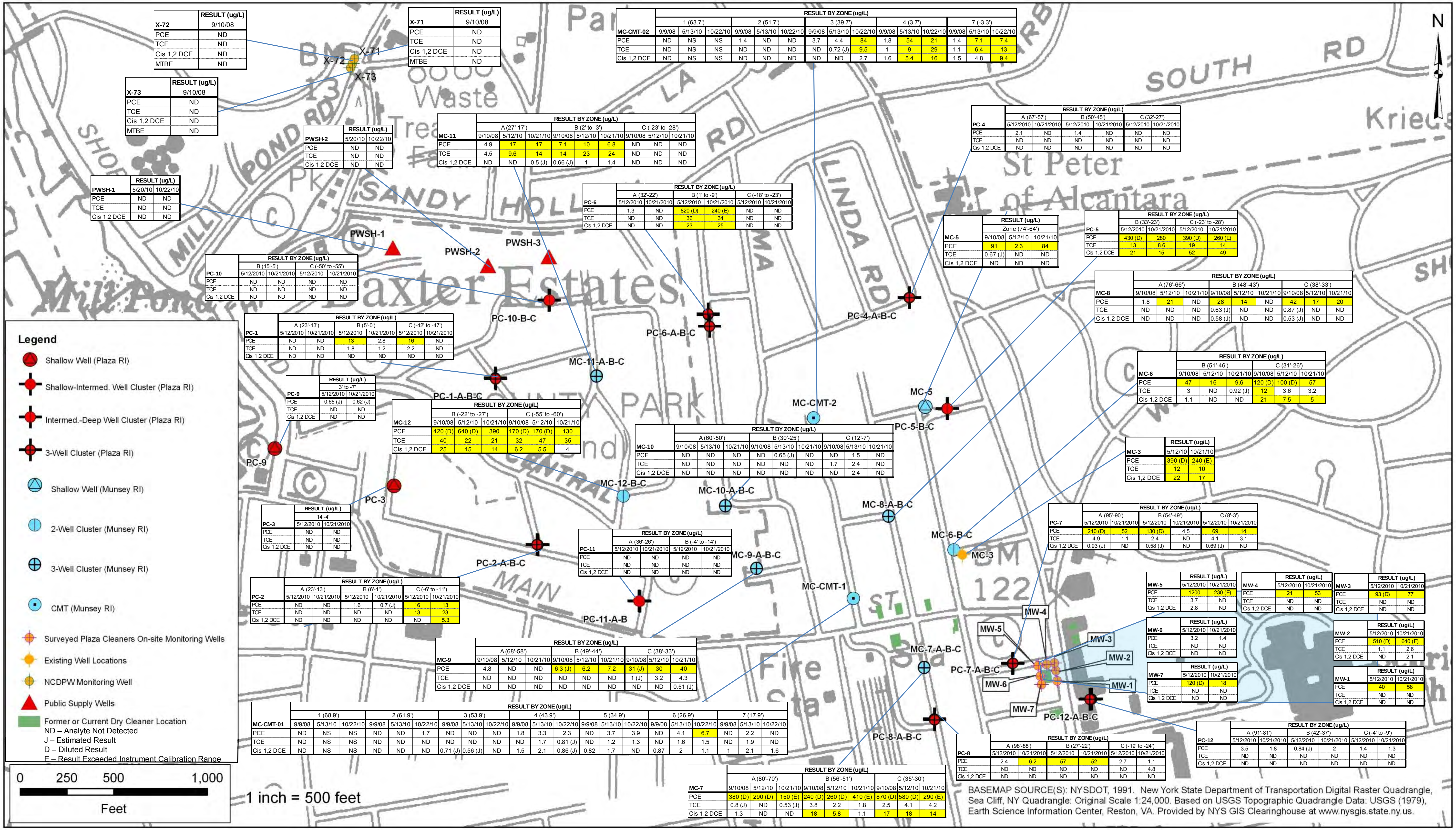
ARCADIS
Infrastructure · Water · Environment · Buildings

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
MUNSEY AND PLAZA CLEANERS SITES
TOWN OF NORTH HEMPSTEAD, NEW YORK

AERIAL PHOTOGRAPH

DECEMBER 2011

FIGURE 2



ND – Analyte Not Detected
J – Estimated Result
D – Diluted Result
E – Result Exceeded Instrument Calibration Range

1 inch = 500 feet

X-72	RESULT (ug/L) 9/10/08
PCE	ND
TCE	ND
Cis 1,2 DCE	ND
MTBE	ND

X-71	RESULT (ug/L) 9/10/08
PCE	ND
TCE	ND
Cis 1,2 DCE	ND
MTBE	ND

X-73	RESULT (ug/L) 9/10/08
PCE	ND
TCE	ND
Cis 1,2 DCE	ND
MTBE	ND

	RESULT (ug/L)	
PWSH-2	5/20/10	10/22/10
PCE	ND	ND
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT (ug/L)	
PWSH-1	5/20/10	10/22/10
PCE	ND	ND
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT BY ZONE (ug/L)														
	1 (63.7')			2 (51.7')			3 (39.7')			4 (3.7')			7 (-3.3')		
MC-CMT-02	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10
PCE	ND	NS	NS	1.4	ND	ND	3.7	4.4	84	1.8	54	21	1.4	7.1	7.4
TCE	ND	NS	NS	ND	ND	ND	ND	0.72 (J)	9.5	1	9	29	1.1	6.4	13
Cis 1,2 DCE	ND	NS	NS	ND	ND	ND	ND	ND	2.7	1.6	5.4	16	1.5	4.8	9.4

	RESULT BY ZONE (ug/L)								
	A (27'-17')			B (2' to -3')			C (-23' to -28')		
MC-11	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	4.9	17	17	7.1	10	6.8	ND	ND	ND
TCE	4.5	9.6	14	14	23	24	ND	ND	ND
Cis 1,2 DCE	ND	ND	0.5 (J)	0.66 (J)	1	1.4	ND	ND	ND

	RESULT BY ZONE (ug/L)					
	A (32'-22')		B (1' to -9')		C (-18' to -23')	
PC-6	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	1.3	ND	820 (D)	240 (E)	ND	ND
TCE	ND	ND	36	34	ND	ND
Cis 1,2 DCE	ND	ND	23	25	ND	ND

	RESULT BY ZONE (ug/L)					
	A (67'-57')		B (50'-45')		C (32'-27')	
PC-4	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	2.1	ND	1.4	ND	ND	ND
TCE	ND	ND	ND	ND	ND	ND
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND

	RESULT (ug/L)		
	Zone (74'-64')		
MC-5	9/10/08	5/12/10	10/21/10
PCE	91	2.3	84
TCE	0.67 (J)	ND	ND
Cis 1,2 DCE	ND	ND	ND

	RESULT BY ZONE (ug/L)			
	B (33'-23')		C (-23' to -28')	
PC-5	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	430 (D)	280	390 (D)	260 (E)
TCE	13	8.6	19	14
Cis 1,2 DCE	21	15	52	49

	RESULT BY ZONE (ug/L)								
	A (76'-66')			B (48'-43')			C (38'-33')		
MC-8	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	1.8	21	ND	28	14	ND	42	17	20
TCE	ND	ND	ND	0.63 (J)	ND	ND	0.87 (J)	ND	ND
Cis 1,2 DCE	ND	ND	ND	0.58 (J)	ND	ND	0.53 (J)	ND	ND

	RESULT BY ZONE (ug/L)			
	B (15'-5')		C (-50' to -55')	
PC-10	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	ND	ND	ND	ND
TCE	ND	ND	ND	ND
Cis 1,2 DCE	ND	ND	ND	ND

	RESULT BY ZONE (ug/L)					
	A (23'-13')		B (5'-0')		C (-42' to -47')	
PC-1	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	ND	ND	13	2.8	16	ND
TCE	ND	ND	1.8	1.2	2.2	ND
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND

	RESULT (ug/L)	
	3' to -7'	
PC-9	5/12/2010	10/21/2010
PCE	0.65 (J)	0.62 (J)
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT BY ZONE (ug/L)					
	B (-22' to -27')			C (-55' to -60')		
MC-12	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	420 (D)	640 (D)	390	170 (D)	170 (D)	130
TCE	40	22	21	32	47	35
Cis 1,2 DCE	25	15	14	6.2	5.5	4

	RESULT BY ZONE (ug/L)								
	A (60'-50')			B (30'-25')			C (12'-7')		
MC-10	9/10/08	5/13/10	10/21/10	9/10/08	5/13/10	10/21/10	9/10/08	5/13/10	10/21/10
PCE	ND	ND	ND	ND	0.65 (J)	ND	ND	1.5	ND
TCE	ND	ND	ND	ND	ND	ND	1.7	2.4	ND
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND	ND	2.4	ND

	RESULT BY ZONE (ug/L)					
	B (51'-46')			C (31'-26')		
MC-6	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	47	16	9.6	120 (D)	100 (D)	57
TCE	3	ND	0.92 (J)	12	3.6	3.2
Cis 1,2 DCE	1.1	ND	ND	21	7.5	5

	RESULT (ug/L)	
MC-3	5/12/10	10/21/10
PCE	390 (D)	240 (E)
TCE	12	10
Cis 1,2 DCE	22	17

	RESULT (ug/L)	
	14'-4'	
PC-3	5/12/2010	10/21/2010
PCE	ND	ND
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT BY ZONE (ug/L)			
	A (36'-26')		B (-4' to -14')	
PC-11	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	ND	ND	ND	ND
TCE	ND	ND	ND	ND
Cis 1,2 DCE	ND	ND	ND	ND

	RESULT BY ZONE (ug/L)					
	A (23'-13')		B (6'-1')		C (-6' to -11')	
PC-2	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	ND	ND	1.6	0.7 (J)	16	13
TCE	ND	ND	ND	ND	13	23
Cis 1,2 DCE	ND	ND	ND	ND	ND	5.3

	RESULT BY ZONE (ug/L)					
	A (95'-90')		B (54'-49')		C (8'-3')	
PC-7	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	240 (D)	52	130 (D)	4.5	69	14
TCE	4.9	1.1	2.4	ND	4.1	3.1
Cis 1,2 DCE	0.93 (J)	ND	0.58 (J)	ND	0.69 (J)	ND

	RESULT (ug/L)	
MW-5	5/12/2010	10/21/2010
PCE	1200	230 (E)
TCE	3.7	ND
Cis 1,2 DCE	2.8	ND

	RESULT (ug/L)	
MW-4	5/12/2010	10/21/2010
PCE	21	53
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT (ug/L)	
MW-3	5/12/2010	10/21/2010
PCE	93 (D)	77
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT (ug/L)	
MW-6	5/12/2010	10/21/2010
PCE	3.2	1.4
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT (ug/L)	
MW-2	5/12/2010	10/21/2010
PCE	510 (D)	640 (E)
TCE	1.1	2.6
Cis 1,2 DCE	ND	2.1

	RESULT (ug/L)	
MW-7	5/12/2010	10/21/2010
PCE	120 (D)	18
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT (ug/L)	
MW-1	5/12/2010	10/21/2010
PCE	40	58
TCE	ND	ND
Cis 1,2 DCE	ND	ND

	RESULT BY ZONE (ug/L)								
	A (68'-58')			B (49'-44')			C (38'-33')		
MC-9	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	4.8	ND	ND	6.3 (J)	6.2	7.2	31 (J)	30	40
TCE	ND	ND	ND	ND	ND	ND	1 (J)	3.2	4.3
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND	ND	ND	0.51 (J)

	RESULT BY ZONE (ug/L)																				
	1 (68.9')			2 (61.9')			3 (53.9')			4 (43.9')			5 (34.9')			6 (26.9')			7 (17.9')		
MC-CMT-01	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10	9/9/08	5/13/10	10/22/10
PCE	ND	NS	NS	ND	ND	1.7	ND	ND	ND	1.8	3.3	2.3	ND	3.7	3.9	ND	4.1	6.7	ND	2.2	ND
TCE	ND	NS	NS	ND	ND	ND	ND	ND	ND	ND	1.7	0.81 (J)	ND	1.2	1.3	ND	1.6	1.5	ND	1.9	ND
Cis 1,2 DCE	ND	NS	NS	ND	ND	ND	0.71 (J)	0.56 (J)	ND	1.5	2.1	0.86 (J)	0.82	1.7	ND	0.87	2	1.1	1	2.1	1.6

	RESULT BY ZONE (ug/L)								
	A (80'-70')			B (56'-51')			C (35'-30')		
MC-7	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10	9/10/08	5/12/10	10/21/10
PCE	380 (D)	290 (D)	150 (E)	240 (D)	260 (D)	410 (E)	870 (D)	580 (D)	290 (E)
TCE	0.8 (J)	ND	0.53 (J)	3.8	2.2	1.8	2.5	4.1	4.2
Cis 1,2 DCE	1.3	ND	ND	18	5.8	1.1	17	18	14

	RESULT BY ZONE (ug/L)					
	A (98'-88')		B (27'-22')		C (-19' to -24')	
PC-8	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	2.4	6.2	57	52	2.7	1.1
TCE	ND	ND	ND	ND	ND	4.8
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND

	RESULT BY ZONE (ug/L)					
	A (91'-81')		B (42'-37')		C (-4' to -9')	
PC-12	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
PCE	3.5	1.8	0.84 (J)	2	1.4	1.3
TCE	ND	ND	ND	ND	ND	ND
Cis 1,2 DCE	ND	ND	ND	ND	ND	ND

BASEMAP SOURCE(S): NYSDOT, 1991. New York State Department of Transportation Digital Raster Quadrangle, Sea Cliff, NY Quadrangle: Original Scale 1:24,000. Based on USGS Topographic Quadrangle Data: USGS (1979), Earth Science Information Center, Reston, VA. Provided by NYS GIS Clearinghouse at www.nysgis.state.ny.us.

M:\GISMOD\0266380\Sampling Locations_labels_DOT_Quad2.mxd

ARCADIS
Infrastructure · Water · Environment · Buildings

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
MUNSEY AND PLAZA CLEANERS SITES
TOWN OF NORTH HEMPSTEAD, NEW YORK

SUMMARY OF SELECT VOLATILE ORGANIC COMPOUNDS DETECTED IN 2008 AND 2010 GROUNDWATER MONITORING WELL SAMPLES

DECEMBER 2011

FIGURE 3

Tables

Table 1
EVALUATION OF POTENTIAL SCGs
Former Munsey and Plaza Cleaners
(NYSDEC HW ID 130081 and 130108)
Port Washington, New York

Medium/Location/Action	Citation	Requirements	Comments	Potential SCG
Potential chemical-specific SCGs				
Ground water	6 NYCRR 703 - Class GA ground water quality standards	Promulgated state regulation that requires that fresh ground waters of the state must attain Class GA standards	Potentially applicable to site ground water.	Yes
Indoor Air	NYSDOH - Guidance for Evaluating Soil Vapor Intrusion	Guidance that discusses generic levels for monitoring potential exposures, as well as for mitigating current or potential exposures.	Potentially applicable to all occupied structures affected by soil vapor intrusion as a result of the dissolve-phase CVOC plume.	Yes
Potential location-specific SCGs				
Wetlands	6 NYCRR 633 - Freshwater wetland permit requirements	Actions occurring in a designated freshwater wetland (within 100 ft) must be approved by NYSDEC of its designee. Activities occurring adjacent to freshwater wetlands must: be compatible with preservation, protection, and conservation of wetlands and benefits; result in no more than insubstantial degradation to or loss of any part of the wetland; and be compatible with public health and welfare.	No applicable because wetlands will not be destroyed or modified.	No
	Executive Order 11990 - Protection of Wetlands	Activities occurring in wetlands must avoid, to the extent possible, the long- and short-term adverse impacts associated with the destruction or modification of wetlands. The procedures also require USEPA to avoid direct or indirect support of new construction in wetlands wherever there are practicable alternatives or minimal potential harm to wetlands when there are no practicable alternatives.	No applicable because wetlands will not be destroyed or modified.	No
100-year flood plain	6 NYCRR 373-2.2 - Location standards for hazardous waste treatment, storage, and disposal facilities - 100-yr floodplain	Hazardous waste treatment, storage, or disposal facilities located in a 100-yr floodplain must be designed, constructed, operated and maintained to prevent washout of hazardous waste during a 100-yr flood.	Not applicable or relevant and appropriate as no activities will be conducted within a flood plain.	No
	Executive Order 11988 - Floodplain Management	EPA is required to conduct activities to avoid, to the extent possible, the long- and short- term adverse impacts associated with the occupation or modification of floodplain. The procedures also require EPA to avoid direct or indirect support of floodplain development wherever there are practicable alternatives and minimize potential harm to floodplains when there are no practicable alternatives.	Not applicable or relevant and appropriate as no flood plains will be occupied or modified.	No
Within 61 meters (200 ft) of a fault displaced in Holocene time	40 CFR Part 264.18	New treatment, storage, or disposal of hazardous waste is not allowed.	Not applicable or relevant and appropriate. Site is not located within 200 ft of a fault displaced in Holocene time, as listed in 40 CFR 264 Appendix VI.	No
River or stream	16 USC 661 - Fish and Wildlife Coordination Act	Required protection of fish and wildlife in a stream when performing activities that modify a stream or river.	Not applicable or relevant and appropriate as no streams or rivers will be modified.	No
Habitat of an endangered or threatened species	6 NYCRR 182	Provides requirements to minimize damage to habitat of an endangered species.	Not applicable; threatenced species are not known to be present.	No

Table 1
EVALUATION OF POTENTIAL SCGs
Former Munsey and Plaza Cleaners
(NYSDEC HW ID 130081 and 130108)
Port Washington, New York

Medium/Location/Action	Citation	Requirements	Comments	Potential SCG
Habitat of an endangered or threatened species	Endangered Species Act	Provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction.	Not applicable; threatenced species are not known to be present.	No
Historical property or district	National Historic Preservation Act	Remedial actions are required to account for the effects of remedial activities on any historic properties included on or eligible for inclusion on the National Register of Historic Places.	Not applicable or relevant and appropriate. Site not identified as a historic property and no properties will be impacted.	No
Potential action-specific SCGs				
Treatment actions	6 NYCRR 373- Hazardous waste management facilities	Provides requirements for managing hazardous wastes.	Not applicable. No hazardous waste anticipated to be produced.	No
Construction	29 CFR Part 1910 - Occupational Safety and Health Standards - Hazardous Waste Operations and Emergency Response	Remedial activities must be in accordance with applicable OSHA requirements.	Applicable for construction and monitoring phase of remediation.	Yes
	29 CFR Part 1926 - Safety and Health Regulations for Construction	Remedial construction activities must be in accordance with applicable OSHA requirements.	Applicable for construction and monitoring phase of remediation.	Yes
Transportation	6 NYCRR 364 - Waste Transporter Permits	Hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364.	Not applicable. Hazardous waste is not anticipated to be generated.	No
	6 NYCRR Part 372- Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	Substantive hazardous waste generator and transportation requirements must be met when hazardous waste is generated for disposal. Generator requirements include obtaining an EPA Identification Number and manifesting hazardous waste for disposal.	Not applicable. Hazardous waste is not anticipated to be generated.	No
	49 CFR 172-174 and 177-179 - Department of Transportation Regulations	Hazardous waste transport to offsite disposal facilities must be conducted in accordance with applicable DOT requirements.	Not applicable. Hazardous waste is not anticipated to be generated.	No
Generation of air emissions	NYS Air Guide 1	Provides annual guideline concentrations (AGCs) and short-term guideline concentrations (SGCs) for specific chemicals. These are property boundary limitations that would result in no adverse health effects.	Not applicable. No air emisions expected.	No
	NYS TAGM 4031- Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites	Provides limitations on dust emissions.	Potentially applicable. Dust emissions, specifically during drilling activities, may be anticipated depending on remedy selected.	Yes
Construction storm water management	NYSDEC General permit for storm water discharges associated with construction activities. Pursuant to Article 17 Titles 7 and 8 and Article 70 of the Environmental Conservation Law.	The regulation prohibits discharge of materials other than storm water and all discharges that contain hazardous substance in excess of reportable quantities established by 40 CFR 117.3 or 40 CFR 302.4, unless a separate NPDES permit has been issued to regulate those discharges. A permit must be acquired if activities involve the disturbance of 5 acres or more. If the project is covered under the general permit, the following are required: development and implementation of a monitoring program; all records must be retained for a period of at least 3 years after construction is complete.	Not applicable. Construction disturbances will not exceed the limits.	No
Underground Injection	40 CFR 144 and 146 USEPA Underground Injection Control Regulations	This regulation sets forth minimum requirements for the UIC program promulgated under Part C of the Safe Drinking Water Act and describes the technical standards to follow when implementing the UIC program.	Applicable for the installation of injection wells.	Yes

Table 2
REMEDIAL ALTERNATIVES EVALUATION CRITERIA COMPARISON
Former Munsey and Plaza Cleaners
(NYSDEC HW ID 130081 and 130108)
Port Washington, New York

		Evaluation Criteria Alternatives							
		Overall Protection of Public Health and the Environment	**Compliance with Standards, Criteria, and Guidance (SCGs)**	**Long-term Effectiveness and Permanence**	**Reduction of Toxicity, Mobility or Volume**	**Short-term Effectiveness**	**Implementability**	**Cost**	**Land Use**
Remedial Alternatives	**No Further Action With Monitoring**	No active protection; Surface water pathway incomplete if upgradient shallow groundwater concentrations decrease; Vapor pathway controled through sub-slab depressurization systems	Non Compliant	As effective in long-term as ISCO and Bioremediation Alternative	Volume reduction expected to continue at a slow natural rate; potential exists for vapor mobility and toxicity.	Not effective in the short term.	Easy to implement	Minimal Costs	No restrictions on land use
	Targeted In-situ Chemical Oxidation	No completed pathways; Institutional controls ensure protection of the human health and the environment;	Compliant only within selected treatment areas. Non compliant outside of treatment areas.	As effective in long-term as NFA with Monitoring and Bioremediation Alternative	Reduction of toxicity and mobility achieved within the treatment area. Volume reduction expected to continue at a slow natural rate outside of treatment area; potential exists for vapor mobility and toxicity.	Effective in the short term in treatment area only	Considered easy to implement with minimal disruption to site activities, however, success of treeatment is dependent upon the degree at which the oxidant is in contact with contamination, and the number of injections needed.	Moderate Costs	No restrictions on land use
	Targeted Enhanced In-situ bioremediation	No completed pathways; Institutional controls ensure protection of the human health and the environment;	Compliant only within selected treatment areas. Non compliant outside of treatment areas.	As effective in long-term as NFA with Monitoring and ISCO Alternative	Reduction of toxicity and mobility achieved within the treatment area. Volume reduction expected to continue at a slow natural rate outside of treatment area; potential exists for vapor mobility and toxicity.	Not as effective as ISCO in the short term.	Alternative can be implented without many obstacles and with minimal disruption to site activities., however, multipile injections may be needed.	Moderate Costs	No restrictions on land use
	Restoration to Achieve Pre-disposal Conditions	No completed pathways; Institutional controls ensure protection of the human health and the environment;	Compliant with SCGs	RAOs achieved in less time than other alternatives	Reduction of toxicity and mobility achieved.	Effective in the short term, but relatively high disruption to local community	Impracticable; may require relocation or disruption of public water supply wells	Prohibitively Expensive	No restrictions on land use

Appendix A

Analytical Data

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY AND PLAZA CLEANERS
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	**NYSDEC Class GA Standard or Guidance Value (ug/l)**	**MC-B-1 (51.6)**	**MC-B-1 (85)**	**MC-B-2 (41.4)**	**MC-B-2 (85)**	**MC-B-3 (43)**	**MC-B-3 (85)**	**MC-B-4 (44)**	**MC-B-5 (60)**	**MC-B-5 (85)**	**MC-B-6 (57)**	**MC-B-7 (48)**	**MC-B-8 (60)**	**MC-B-8 (85)**	**MC-B-9 (40)**	**MC-B-9 (85)**	**MC-B-10 (65)**
Sampling Date		**1/22/2008**	**1/22/2008**	**1/23/2008**	**1/23/2008**	**1/24/2008**	**1/24/2008**	**1/25/2008**	**1/28/2008**	**1/28/2008**	**1/28/2008**	**1/28/2008**	**1/29/2008**	**1/29/2008**	**1/29/2008**	**1/30/2008**	**2/11/2008**
Units		**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ
Acetone	50*	20	16	15 J	6.2 J	7.7	7.8	3.8 J	5 U	5 U	4.2 J	5 U	5 U	5 U	5 U	5 U	18 J
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.8	3.2	1 U	1 U	1 U	1 U	1 UJ
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2	0.98 J	1 U	1 U	1 U	0.9 J	1 U	1 U	1 UJ
Chloromethane		1 U	1 U	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
cis-1,2-Dichloroethene	5	1 U	0.61 J	1 U	1 U	1.8	2.1	3.3	1 U	1 U	1 U	1.4	1 U	1 U	21	1 U	1 UJ
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Dichlorodifluoromethane	5	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.9 J	1 U	1 U	1 U	1 U	1 UJ
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
m/p-Xylenes	5	1.4 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 UJ
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Methyl tert-butyl Ether	10	1.5	1.3	1 J	52	3.5	3.8	14	1 U	1 U	1 U	1	5.4	1 U	1.8	1 U	1 UJ
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	0.56 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
o-Xylene	5	0.83 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Tetrachloroethene	5	91	76	5.6	1 U	18	460	1500	0.86 J	1 U	23	17	1.4	1 U	290	13	1 UJ
Toluene	5	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2.4 J
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.1	1 U	1 UJ
Trichloroethene	5	0.82 J	0.99 J	5	1 U	1 U	5.4	3.4	1 U	1 U	1 U	1.1	1 U	1 U	34	1 U	1 UJ
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value
**Sum of these compounds can not exceed 0.4 ug/L.
U - Compound not detected, Reporting Limit provided.
J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY AND PLAZA CLEANERS
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	**NYSDEC Class GA Standard or Guidance Value (ug/l)**	**MC-B-11 (25)**	**MC-B-11 (60)**	**MC-B-12 (45)**	**MC-B-13 (44)**	**MC-B-14 (73)**	**MC-B-15 (55)**	**MC-B-16 (55)**	**MC-B-16 (85)**	**MC-B-17 (55)**	**MC-B-17 (100)**	**MC-B-18 (63)**	**MC-B-19 (60)**	**MC-B-20 (55)**	**MC-B-20 (85)**	**PC-B-01 (50)**	**PC-B-01 (99)**
Sampling Date		**1/30/2008**	**1/30/2008**	**2/11/2008**	**2/12/2008**	**2/12/2008**	**2/12/2008**	**2/13/2008**	**2/14/2008**	**2/13/2008**	**2/13/2008**	**2/13/2008**	**2/14/2008**	**2/14/2008**	**2/14/2008**	**6/23/2009**	**6/23/2009**
Units		**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
1,1,1-Trichloroethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,1,2-Trichloroethane	1	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,1-Dichloroethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,1-Dichloroethene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2-Dibromoethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2-Dichlorobenzene	3	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2-Dichloroethane	0.6	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,2-Dichloropropane	1	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,3-Dichlorobenzene	3	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
1,4-Dichlorobenzene	3	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
2-Butanone	50	5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	4.9 J	5 U	5 U	5 UJ	8.6 J
2-Hexanone		5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 UJ	25 U
4-Methyl-2-Pentanone		5 U	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 UJ	5 U	5 U	5 U	5 J	25 U
Acetone	50*	5 U	5 U	12 J	12 J	7.2 J	6.9 J	16 J	8.7	8.1 J	17 J	11 J	20 J	5.1	12	30 J	81
Benzene	1	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Bromodichloromethane	50*	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Bromoform	50*	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Bromomethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Carbon Disulfide		1 U	1 U	0.59 J	0.51 J	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 UJ
Carbon Tetrachloride	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Chlorobenzene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Chloroethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Chloroform	7	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	0.71 J	5 U
Chloromethane		1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
cis-1,2-Dichloroethene	5	1 U	6.1	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	2.4	1 U	1 U	1 UJ	1.8 J
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Cyclohexane		1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Dibromochloromethane	50	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Dichlorodifluoromethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Ethyl Benzene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Isopropylbenzene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
m/p-Xylenes	5	2 U	2 U	2 UJ	2 UJ	2 UJ	2 UJ	2 UJ	2 U	2 UJ	2 UJ	2 UJ	2 U	2 U	2 U	3 J	10 U
Methyl Acetate		1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Methyl tert-butyl Ether	10	1 U	3.6	1 UJ	1.7 J	1.9 J	1.6 J	1 UJ	1 U	0.87 J	1 UJ	1 UJ	7.2	1 U	1 U	1 UJ	5 U
Methylcyclohexane		1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Methylene Chloride	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
o-Xylene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	0.86 J	5 U
Styrene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Tetrachloroethene	5	1 U	440	30 J	7.2 J	69 J	24 J	1 UJ	1 U	0.68 J	1 UJ	1 UJ	1 U	1 U	1 U	200 J	170 J
Toluene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	0.52 J	1.2	1 UJ	1 UJ	1 UJ	0.51 J	1 U	1 U	0.57 J	5 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Trichloroethene	5	1 U	9.7	1 UJ	1 UJ	0.83 J	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	12	1 U	1 U	2.8 J	14
Trichlorofluoromethane	5	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U
Vinyl Chloride	2	1 U	1 U	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 UJ	5 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY AND PLAZA CLEANERS
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	**NYSDEC Class GA Standard or Guidance Value (ug/l)**	**PC-B-02 (45)**	**PC-B-02 (89)**	**PC-B-03 (68)**	**PC-B-04 (45)**	**PC-B-04 (99)**	**PC-B-05 (45)**	**PC-B-05 (99)**	**PC-B-06 (50)**	**PC-B-06 (100)**	**PC-B-06 (145)**	**PC-B-07 (60)**	**PC-B-07 (100)**	**PC-B-07 (155)**	**PC-B-08 (60)**	**PC-B-08 (100) NP**	**PC-B-08 (140) NP**
Sampling Date		**6/24/2009**	**6/24/2009**	**6/25/2009**	**6/25/2009**	**6/25/2009**	**6/26/2009**	**6/26/2009**	**5/19/2011**	**5/19/2011**	**5/19/2011**	**5/20/2011**	**5/20/2011**	**5/20/2011**	**5/25/2011**	**5/25/2011**	**5/25/2011**
Units		**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**	**µg/L**
1,1,1-Trichloroethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,1,2,2-Tetrachloroethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,1,2-Trichloroethane	1	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,1,2-Trichlorotrifluoroethane		1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6.3 J	1 UJ
1,1-Dichloroethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,1-Dichloroethene	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2,4-Trichlorobenzene	5	1 UJ	4.4 J	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2-Dibromo-3-Chloropropane	0.04	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2-Dibromoethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2-Dichlorobenzene	3	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2-Dichloroethane	0.6	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,2-Dichloropropane	1	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,3-Dichlorobenzene	3	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
1,4-Dichlorobenzene	3	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
2-Butanone	50	5 UJ	33 J	5 U	25 U	8.2 J	25 U	8.3 J	5 U	5 U	5 U	4.4 J	5.3	84	5 U	5 UJ	5 UJ
2-Hexanone		1 UJ	50 U	5 U	25 U	50 U	4 J	50 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ
4-Methyl-2-Pentanone		5 UJ	14 J	1 U	25 U	50 U	25 U	50 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ	5 UJ
Acetone	50*	6.6 J	510	5 U	25 U	47 J	55	37 J	5 U	5 U	5 U	3.2 J	5 U	80	5 U	5 UJ	5 UJ
Benzene	1	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Bromodichloromethane	50*	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Bromoform	50*	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1.3	1 U	1 UJ	1 UJ
Bromomethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Carbon Disulfide		0.69 J	10 UJ	2.3 J	5 UJ	10 UJ	5 UJ	10 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Carbon Tetrachloride	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Chlorobenzene	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Chloroethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Chloroform	7	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Chloromethane		1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
cis-1,2-Dichloroethene	5	2.1 J	10 U	30	5 U	10 U	2.7 J	10 U	1 U	1 U	1 U	1 U	0.54 J	1 U	1 U	7.8 J	3.3 J
cis-1,3-Dichloropropene	0.4**	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Cyclohexane		1 UJ	10 U	1 U	5 U	10 U	13	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Dibromochloromethane	50	5 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	0.54 J	1 U	1 UJ	1 UJ
Dichlorodifluoromethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Ethyl Benzene	5	1 UJ	10 U	1 U	5 U	10 U	31	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Isopropylbenzene	5	1 UJ	10 U	1 U	5 U	10 U	9.6	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
m/p-Xylenes	5	2.4 J	20 U	1.6 J	10 U	20 U	67	20 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 UJ	2 UJ
Methyl Acetate		1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Methyl tert-butyl Ether	10	21 J	1.7 J	1 U	5 U	2.2 J	5 U	1.7 J	9.6	0.76 J	9.8	0.55 J	1.7	1 U	0.88 J	9 UJ	1.8 J
Methylcyclohexane		1 UJ	10 U	1 U	5 U	10 U	38	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Methylene Chloride	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
o-Xylene	5	0.73 J	10 U	1 U	5 U	10 U	21	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Styrene	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
t-1,3-Dichloropropene	0.4**	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Tetrachloroethene	5	430 J	8.7 J	1 U	11	7.1 J	81	3 J	1 U	1 U	0.92 J	0.61 J	28	0.4 J	20	0.66 J	0.95 J
Toluene	5	0.73 J	1.2 J	1 U	5 U	10 U	2 J	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.56 J	1.5 J
trans-1,2-Dichloroethene	5	1 UJ	10 U	2.7	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Trichloroethene	5	3.5 J	10 U	20	1.1 J	10 U	30	10 U	1.2 U	1 U	1 U	1 U	1 U	1 U	1 U	5.1 J	2.4 J
Trichlorofluoromethane	5	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ
Vinyl Chloride	2	1 UJ	10 U	1 U	5 U	10 U	5 U	10 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value
**Sum of these compounds can not exceed 0.4 ug/L.
U - Compound not detected, Reporting Limit provided.
J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY AND PLAZA CLEANERS
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	PC-B-09 (60)	PC-B-09 (100)	PC-B-09 (145)	PC-B-10 (60)	PC-B-10 (100)	PC-B-10 (135)	PC-B-11 (60)	PC-B-11 (90)	PC-B-11 (120)	TRIP BLANK	TRIP BLANK
Sampling Date		5/26/2011	5/26/2011	5/26/2011	5/27/2011	5/27/2011	5/27/2011	5/31/2011	5/31/2011	5/31/2011	5/12/2011	5/12/2011
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	8.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	1.4 J	3.1 J	12	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	7.9	77	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	2.9 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	0.65 J	1 U	1 U	0.57 J	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1.7	16	1 U	1 U	1 U	1 U	1	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	0.96 J	1 U	1 U	0.61 J	1 U	0.62 J	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	190 E	1 U	1 U	1 U	1 U	1 U	36	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.63 J	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	11	14	1 U	1 U	1 U	1 U	7.1	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-3	MC-3	MC-3	MC-5	MC-5	MC-5	MC-6B	MC-6B	MC-6B	MC-X (MC-6B DUP)	MC-6C	MC-6C	MC-6C	MC-7A	MC-7A	MC-7A	MC-7B	MC-7B	MC-7B
		9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	7.4	6.2	5 U	7.7	7.5	5 U	5.5	5 U	10 J	5 U	5.9	5 U	5 U	5 U	5 U	5 U	5 U	6.3
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.2
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	0.57 J	1 U	1 U	1 U	1.2	4.1	3.5	4.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	45	22	17	1 U	1 U	1 U	1.1	1 U	1 U	1 U	21	7.5	5	1.3	1 U	1 U	18	5.8	1.1
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	7.6	1 U	0.59 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.87 J	0.69 J	0.58 J	6.6	0.66 J	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	670	390	240 E	91 J	2.3 J	84	47 J	16	9.6	13	120	100	57	380	290	150 E	240	260	410 E
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	2.2	0.77 J	0.65 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.72 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	17	12	10	0.67 J	1 U	1 U	3	1 U	0.92 J	1 U	12	3.6	3.2	0.8 J	1 U	0.53 J	3.8	2.2	1.8
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-7C	MC-7C	MC-7C	MC-8A	MC-8A	MC-8A	MC-8B	MC-8B	MC-8B	MC-8C	MC-8C	MC-8C	MC-9A	MC-9A	MC-9A	MC-9B	MC-9B	MC-9B
		9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U	5 U	5 U
Acetone	50*	5 U	5 U	5.1	5 U	4.8 J	5 UJ	5 U	5.1	10	5 U	7	8.1	5 U	6.8	7.2	1 U	7.1	7.8
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	17	18	14	1 U	1 U	1 U	0.58 J	1 U	1 U	0.53 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	870	580	290 E	1.8 J	21	1 U	28 J	14	1 U	42 J	17	20	4.8 J	1 U	1 U	1 J	6.2	7.2
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	2.5	4.1	4.2	1 U	1 U	1 U	0.63 J	1 U	1 U	0.87 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-9C	MC-9C	MC-9C	MC-10A	MC-10A	MC-10A	MC-10B	MC-10B	MC-10B	MC-10C	MC-10C	MC-10C	MC-11A	MC-11A	MW-XZ (MC-11A Dup)	MC-11A	MW-Y (MC-11A Dup)
		9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/13/2010	10/21/2010	9/10/2008	5/13/2010	10/21/2010	9/10/2008	5/13/2010	10/21/2010	9/10/2008	5/12/2010	5/12/2010	10/21/2010	10/21/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3.6	2.4	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	5.6	8.3 J	5 U	5 U	13	5 U	5 U	12	5 U	5 U	8.3	5 U	5.5	5 U	5.2	5 UJ
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 UJ	1 U	1 U	1 U	1 U	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.5	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	0.51 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.5 J	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	0.69 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	31 J	30	40	1 U	1 U	1 U	1 UJ	0.65 J	1 U	1 UJ	1.5 J	1 U	4.9	17	14	17	20
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 J	3.2	4.3	1 U	1 U	1 U	1 U	1 U	1 U	1.7	2.4 NJ	1 U	4.5	9.6	8.7	14	16
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES - VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-11B	MC-11B	MC-11B	MC-11C	MC-X (MC-11C DUP)	MC-11C	MC-11C	MC-12B	MC-12B	MC-12B	MC-12C	MC-12C	MC-12C
		9/10/2008	5/12/2010	10/21/2010	9/10/2008	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010	9/10/2008	5/12/2010	10/21/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	5 U	12	5 U	5 U	5 U	3.8 J	5 U	5 U	4.7 J	5 U	5 U	5
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 UJ	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1.5	1.4	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	0.66 J	1	1.4	1 U	1 U	1 U	1 U	25	15	14	6.2	5.5	4
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	6	3.1	3.6	1 U	0.91 J	0.95 J
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	7.1	10	6.8	1 U	1 U	1 U	1 U	420	640	390 E	170	170	130
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.95 J	0.55 J	1 U	1 U	1 U	1 U
Trichloroethene	5	14	23	24	1 U	1 U	1 U	1 U	40	22	21	32	47	35
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER PLAZA CLEANERS (SITE #130108)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	MW-1	MW-1	MW-2	MW-2	MW-3	MW-3	MW-4	MW-4	MW-5	MW-X (MW-5 Dup)	MW-5	MW-6	MW-6	MW-7	MW-7	PC-1A	PC-1A
Sampling Date		5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1.5 J	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	6.5	5 U	5.6	5 U	5.5	5 U	9.6	5 U	5 U	5 U	5 U	4.3 J	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	0.74 J	1 U	0.54 J	1 U	1 U	1 U	0.57 J	1 U	1 U	0.66 J	1 U	1 U	1 U	0.58 J	1 U	1.8
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	2.1	1 U	1 U	1 U	1 U	2.8	2.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	40	58	510	640 E	93	77	21	53	1200	1400	230 E	3.2	1.4	120	18	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1.1	2.6	1 U	1 U	1 U	1 U	3.7	2.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER PLAZA CLEANERS (SITE #130108)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	PC-1B	PC-1B	PC-1C	PC-1C	PC-2A	PC-2A	PC-2B	PC-2B	PC-2C	PC-2C	PC-3	PC-3	PC-4A	PC-4A	PC-4B	PC-4B	PC-4C	PC-4C
Sampling Date		5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	6.8	5 U	5 U	5 U	6.6	5 U	7.5	5 U	5 U	5 U	7.7	5 U	5.4	14	5.5	15	6.4	8.4
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	0.96 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	13	2.8	16	1 U	1 UJ	1 U	1.6 J	0.7 J	16	13	1 U	1 U	2.1	1 U	1.4	1 U	1 UJ	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.4	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1.8	1.2	2.2	1 U	1 U	1 U	1 U	1 U	13	23	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER PLAZA CLEANERS (SITE #130108)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	PC-5B	PC-5B	PC-5C	PC-5C	PC-6A	PC-6A	PC-6B	PC-6B	PC-6C	PC-6C	PC-7A	PC-7A	PC-7B	PC-7B	PC-7C	PC-7C
Sampling Date		5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 UJ	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	6.8	5 U	5 U	5 U	7	8.7	9.3	12	9 J	8.6	11	5 U	5 U	5 U	5 U	6.1
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.67 J	1 U	1 U	0.73 J	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	21	15	52	49	1 U	1 U	23	25	1 U	1 U	0.93 J	1 U	0.58 J	1 U	0.69 J	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.68 J
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1.2	1.5	1 U	1 U	2	2.5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	430 J	280	390	260 E	1.3 J	1 U	820	240 E	1 UJ	1 U	240	52	130	4.5	69	14
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	0.92 J	0.69 J	1.2	1.2	1 U	1 U	0.75 J	1.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	13	8.6	19	14	1 U	1 U	36	34	1 U	1 U	4.9	1.1	2.4	1 U	4.1	3.1
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER PLAZA CLEANERS (SITE #130108)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	PC-8A	PC-8A	PC-8B	PC-8B	PC-8C	PC-8C	PC-9	PC-9	PC-10B	PC-10B	PC-10C	PC-10C	PC-11A	PC-11A	PC-11B	PC-11B
Sampling Date		5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	6.1	5 U	5.4	5 U	6.2	5 U	8.2	5 U	5.6	5 U	4.6 J	5 U	6.2	7.2	5.5	9.6
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.71 J	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	2.4	6.2	57	52	2.7	1.1	0.65 J	0.62 J	1 U	1 U	1 U	1 U	1 UJ	1 U	1 UJ	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1.8	1 U	1 U	1 U	1 U	1 U	0.57 J	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	4.8	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER PLAZA CLEANERS (SITE #130108)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-14.1

Sample ID	NYSDEC Class GA Standard or Guidance Value (ug/l)	PC-12A	PC-12A	PC-12B	PC-12B	PC-12C	PC-12C	PWSH-1	PWSH-1	PWSH-2	PWSH-2	TRIPBLANK	TRIPBLANK	TRIPBLANK	TRIPBLANK	TRIPBLANK	TRIPBLANK
Sampling Date		5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/12/2010	10/21/2010	5/20/2010	10/21/2010	5/20/2010	10/21/2010	5/13/2010	5/14/2010	5/12/2010	10/21/2010	10/21/2010	10/21/2010
Units		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	6	5 UJ	6.8	5 U	6.6	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 UJ	1 U	1 UJ	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 UJ
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	0.73 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.83 J	1 U	1 U	0.83 J	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	3.5	1.8	0.84 J	2	1.4	1.3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes:

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

	NYSDEC Class GA Standard or Guidance Value	MC-CMT-01-1	MC-CMT-01-2	MC-CMT-1(P2)	MC-CMT-1(P2)	MC-CMT-01-3	MC-CMT-1(P3)	MC-CMT-1(P3)	MC-CMT-01-4	MC-CMT-1(P4)	MC-CMT-1(P4)	MC-CMT-01-5	MC-CMT-1(P5)	MC-CMT-1(P5)
		9/9/2008	9/9/2008	5/13/2010	10/22/2010	9/9/2008	5/13/2010	10/22/2010	9/9/2008	5/13/2010	10/22/2010	9/9/2008	5/13/2010	10/22/2010
Parameter	(µg/l)	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	24	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	7.2	5 U	5 U	5 U	5 U	5 U	9.9	5 U	5 U	11	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	190	20	5 U	36	5 U	5 U	24	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	0.81 J	1 U	1 U	1 U	0.96 J	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	0.71 J	0.56 J	1 U	1.5	2.1	0.86 J	0.82	1.7	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	1 U	1 U	1 U	1 U	0.54 J	1 U	1 U	0.82 J	0.69 J	1 U	1.4	0.91 J
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	1 U	1 U	1 U	1.7	1 U	1 U	1 U	1.8	3.3	2.3	1 U	3.7	3.9
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.7	0.81 J	1 U	1.2	1.3
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-CMT-01-(P6)	MC-CMT-1(P6)	MC-CMT-1(P6)	MC-CMT-01-7	MC-CMT-1(P7)	MC-CMT-1(P7)	MC-CMT-02-1	MC-CMT-02-2	MC-CMT-2(P2)	MC-CMT-02-3	MC-CMT-2(P3)	MC-CMT-2(P3)
		9/9/2008	5/13/2010	10/22/2010	9/9/2008	5/13/2010	10/22/2010	9/9/2008	9/9/2008	5/13/2010	9/9/2008	5/13/2010	10/22/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	8.7	5 U	5 U	8.4	5 U	5 U	5 U	7.8	5 U	5 U	5 U	5 U
2-Hexanone		25	5 U	5 U	14	5 U	5 U	5 U	13	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	3.6 J	5 U	5 U	5 U	5 U
Acetone	50*	83	5 U	5 UJ	40	5 U	5 U	5 U	44	5 U	13	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.66 J	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1.1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	0.87	2	1.1	1	2.1	1.6	1 U	1 U	1 U	1 U	1 U	2.7
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	0.69 J	4.2	0.51 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.2
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	1 U	4.1	6.7	1 U	2.2	1 U	1 U	1.4	1 U	3.7	4.4	84
Toluene	5	1 U	1 U	1 U	0.51 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1.6	1.5	1 U	1.9	1 U	1 U	1 U	1 U	1 U	0.72 J	9.5
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	MC-CMT-02-4	MC-CMT-2(P4)	Dup MC-CMT-2(P4)	MC-CMT-2(P4)	MC-CMT-02-7	MC-CMT-2(P7)	MC-CMT-2(P7)	Dup MC-CMT-2(P7)	CMT FIELD BLANK	CMT FIELD BLANK
		9/9/2008	5/13/2010	5/13/2010	10/22/2010	9/9/2008	5/13/2010	10/22/2010	10/22/2010	9/9/2008	10/22/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	18	5 U	5 U	5 U	7.1	5 U	5 U	5 U	5 U	1 U
2-Hexanone		10	5 U	5 U	5 U	9.1	5 U	5 U	5 U	5 U	1 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	1 U
Acetone	50*	110	5 U	5 U	5 UJ	27	5 U	5 U	5 UJ	5 U	5 U
Benzene	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Bromoform	50*	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	5 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		0.79 J	1 U	1 U	1 U	0.83 J	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	0.52 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1.6	5.4	4	16	1.5	4.8	9.4	8.5	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1.4	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	1 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	1 U	2.1	2	0.88 J	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.67 J	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	1.8	54	38	21	1.4	7.1	7.4	6.7	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1	9	7.6	29	1.1	6.4	13	11	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	0.58 J	1 U	1 U	0.79 J	1.2	1.3	1 U	1 U

1 U
1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF GROUNDWATER SAMPLES -
VALIDATED ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class GA Standard or Guidance Value (µg/l)	PWSH-1	PWSH-1	PWSH-1	PWSH-2	PWSH-2	PWSH-2	X-71	X-72	X-73	FIELDBLANK	TRIPBLANK	TRIPBLANK	TRIPBLANK	TRIPBLANK
		9/10/2008	5/20/2010	10/22/2010	9/10/2008	5/20/2010	10/22/2010	9/10/2008	9/10/2008	9/10/2008	5/13/2010	5/12/2010	5/13/2010	5/14/2010	10/22/2010
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone	50	5 U	5 U	5 UJ	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 UJ
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50*	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	1 U	1 U	1 U	0.95 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform	50*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	50	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	5	1 U	1 U	1 U	0.9 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	5	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether	10	0.51 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	3.6	1 U	1 U	0.83 J	1 U
o-Xylene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene	0.4**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	5	1 UJ	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichlorofluoromethane	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class GA Standard or Guidance Value.

* Guidance Value

**Sum of these compounds can not exceed 0.4 ug/L.

U - Compound not detected, Reporting Limit provided.

J - Estimated

N - Tentative in identification

SUMMARY OF SURFACE WATER SAMPLE
ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class C Standard or Guidance Value (µg/l)	MC-SFC-01	MC-SFC-1	MC-SFC-1	MC-Z (Dup MC-SFC-1)	MC-SFC-1	MC-SFC-02	MC-SFC-2	MC-SFC-2	MC-SFC-2
		1/23/2008	5/13/2010	10/22/2010	10/22/2010	10/3/2011	1/23/2008	5/13/2010	10/22/2010	10/3/2011
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane		1 U	1 U	1 U	0.74 J	1	1 U	1 U	1 U	1 U
1,2-Dichloropropane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone		5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 UJ	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone		5 UJ	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U
Benzene	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	400 or 5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
cis-1,2-Dichloroethene		2.7	3.7	2.2	2.2	2.3	0.89 J	1.6	0.58 J	1.1
cis-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	150* or 17*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	23* or 2.6*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	590* or 65*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether		3.4	4.4	3.1	2.9	7.7	1.7	3	1.4	4
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	590* or 65*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1*	13	15	6.8	6.7	6.8	14	12	5.4	7.7
Toluene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	6000, 480*, or 100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	40	1.4	0.99 J	1 U	1 U	0.47 J	0.56 J	1 U	1 U	1 U
Trichlorofluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class C Standard or Guidance Value from TOGS 1.1.1 - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

* Guidance Value

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF SURFACE WATER SAMPLE
ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class C Standard or Guidance Value (µg/l)	MC-SFC-03	MC-SFC-3	MC-SFC-3 Dup	MC-SFC-3	MC-SFC-3	MC-SFC-3 Dup	MC-SFC-4	MC-SFC-4	MC-SFC-4
		1/23/2008	5/13/2010	5/13/2010	10/22/2010	10/3/2011	10/3/2011	5/13/2010	10/21/2010	10/3/2011
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
1,1,1-Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
2-Butanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
2-Hexanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone		5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	10	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromoform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
CarbonTetrachloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	400 or 5	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane		1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene		1.3	0.7 J	0.72 J	1.4	2	1.5	1 U	1 U	1 U
cis-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethyl Benzene	150* or 17*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene	23* or 2.6*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m/p-Xylenes	590* or 65*	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl Acetate		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl Ether		1 U	0.72 J	0.81 J	0.57 J	1.2	0.88 J	1 U	1 U	0.48 J
Methylcyclohexane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
o-Xylene	590* or 65*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
t-1,3-Dichloropropene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethene	1*	6.8	2.5	2.8	5.2	8.5	9	3	2.2	2.4
Toluene		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	6000, 480*, or 100*	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	40	1 U	1 U	1 U	0.53 J	0.97 J	0.93 J	1 U	1 U	0.49 J
Trichlorofluoromethane		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class C Standard or Guidance Value from TOGS 1.1.1 - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

* Guidance Value

U - Compound not detected, Reporting Limit provided.

J - Estimated

SUMMARY OF SURFACE WATER SAMPLE
ANALYTICAL RESULTS
FORMER MUNSEY CLEANERS (SITE #130081)
NORTH HEMPSTEAD, NEW YORK
WORK ASSIGNMENT #D-004439-18

Parameter	NYSDEC Class C Standard or Guidance Value (µg/l)	PC-SFC-1	PC-SFC-2
		10/22/2010	10/22/2010
		µg/L	µg/L
1,1,1-Trichloroethane		1 U	1 U
1,1,2,2-Tetrachloroethane		1 U	1 U
1,1,2-Trichloroethane		1 U	1 U
1,1,2-Trichlorotrifluoroethane		1 U	1 U
1,1-Dichloroethane		1 U	1 U
1,1-Dichloroethene		1 U	1 U
1,2,4-Trichlorobenzene	5	1 U	1 U
1,2-Dibromo-3-Chloropropane		1 U	1 U
1,2-Dibromoethane		1 U	1 U
1,2-Dichlorobenzene	5	1 U	1 U
1,2-Dichloroethane		1 U	1 U
1,2-Dichloropropane		1 U	1 U
1,3-Dichlorobenzene	5	1 U	1 U
1,4-Dichlorobenzene	5	1 U	1 U
2-Butanone		5 U	5 U
2-Hexanone		5 U	5 U
4-Methyl-2-Pentanone		5 U	5 U
Acetone		5 U	5 U
Benzene	10	1 U	1 U
Bromodichloromethane		1 U	1 U
Bromoform		1 U	1 U
Bromomethane		1 U	1 U
Carbon Disulfide		1 U	1 U
CarbonTetrachloride		1 U	1 U
Chlorobenzene	400 or 5	1 U	1 U
Chloroethane		1 U	1 U
Chloroform		1 U	1 U
Chloromethane		1 U	1 U
cis-1,2-Dichloroethene		0.64 J	1 U
cis-1,3-Dichloropropene		1 U	1 U
Cyclohexane		1 U	1 U
Dibromochloromethane		1 U	1 U
Dichlorodifluoromethane		1 U	1 U
Ethyl Benzene	150* or 17*	1 U	1 U
Isopropylbenzene	23* or 2.6*	1 U	1 U
m/p-Xylenes	590* or 65*	2 U	2 U
Methyl Acetate		1 U	1 U
Methyl tert-butyl Ether		1 U	1 U
Methylcyclohexane		1 U	1 U
Methylene Chloride		1 U	1 U
o-Xylene	590* or 65*	1 U	1 U
Styrene		1 U	1 U
t-1,3-Dichloropropene		1 U	1 U
Tetrachloroethene	1*	5.1	0.82 J
Toluene		1 U	1 U
trans-1,2-Dichloroethene	6000, 480*, or 100*	1 U	1 U
Trichloroethene	40	1.3	1 U
Trichlorofluoromethane		1 U	1 U
Vinyl Chloride		1 U	1 U

Notes

🟨 - Concentration exceeds corresponding NYSDEC Class C Standard or Guidance Value from TOGS 1.1.1 - Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations.

* Guidance Value

U - Compound not detected, Reporting Limit provided.

J - Estimated

Appendix B

Remedial Alternatives Cost Estimates

Table B-1
Remedial Alternative Opinion of Probable Cost

Alternative 1
NO FURTHER ACTION WITH MONITORING

OPINION OF PROBABLE COST SUMMARY

Site: Former Munsey and Plaza Cleaners
Location: Port Washington, New York
Phase: Feasability Study (-30% to +50%)
Base Year: 2012
Date: December 22, 2011

Description: Alternative 2 consists of no further remedial action with 30 years of semi-annual groundwater monitoring. Capital costs and first year O&M costs occur in Year 1. Annual O&M costs occur in Years 1-30.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Report Preparation					
Site Management Plan	60	hours	$100.00	$6,000	
Soil Vapor Intrusion Action Plan	40	hours	$100.00	$4,000	
SUBTOTAL				$10,000	
SUBTOTAL				$10,000	
Contingency	25%			$2,500	10% scope + 15% Bid
SUBTOTAL				$12,500	
Project Management*	10%			$1,250	Planning, reporting, and administration.
Remedial Design*	0%			$0	Design analysis, plans, specs, costing, and scheduling.
Construction Management*	0%			$0	Submittal review, design modifications, construction oversight.
First year operation and maintenance	1	lump sum		$23,000	See cost breakdown below
TOTAL CAPITAL COST				$37,000	

OPERATION & MAINTENANCE COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Monitoring					
Groundwater Sampling	96	hours	$80.00	$7,680	2 people, 2 days, 2 times/year
Passive Diffusion Bags and Weights	20	bags	$40.00	$800	
Groundwater Laboratory Analysis	22	samples	$100.00	$2,200	VOC analysis: 10 samples+ trip blank semi-annually
Data Validation	22	samples	$30.00	$660	
Data Compliation and Evaluation	40	hours	$100.00	$4,000	20 hours/event
SUBTOTAL				$15,340	
SUBTOTAL				$15,340	
Contingency	25%			$3,835	
SUBTOTAL				$19,175	
Project Management*	10%			$1,918	
Technical Support*	10%			$1,918	
TOTAL ANNUAL O&M COST				$23,000	

PERIODIC COSTS IN YEARS 10 and 20:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Fan Replacement					
Fan Replacement	9	fan	$150.00	$1,350	
Subcontractor Installation	1	lump sum	$1,000.00	$1,000	
Installation Oversight	72	hours	$85.00	$6,120	
SUBTOTAL				$8,470	
Contingency	25%			$2,118	10% scope + 15% Bid
SUBTOTAL				$10,588	
Project Management*	10%			$1,059	
Technical Support*	10%			$1,059	
TOTAL PERIODIC COST FOR FAN REPLACEMENT				$12,700	

Note:
Expected life of a fan is 5 to 15 years.
Assume fan is replaced every 10 years.
Replace fans in nine systems at year 10 and year 20 to get usable fans to year 30.

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	PRESENT VALUE	NOTES
Capital	1	$37,000	$37,000	$37,000	
Annual O&M	2-5	$92,000	$23,000	$86,944	
		$129,000		$123,944	5 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR FIVE YEARS				$124,000	
Capital	1	$37,000	$37,000	$37,000	
Periodic Cost	10	$12,700	$12,700	$10,350	
Periodic Cost	20	$12,700	$12,700	$8,245	
Annual O&M	2-30	$667,000	$23,000	$482,862	
		$729,400		$538,456	30 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR THIRTY YEARS				$538,000	

** Per USEPA 540-R-00-002, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". July 2000.*

Table B-2
Remedial Alternative Opinion of Probable Cost

Alternative 2
TARGETED IN-SITU CHEMICAL OXIDATION

OPINION OF PROBABLE COST SUMMARY

Site:	Former Munsey and Plaza Cleaners
Location:	Port Washington, New York
Phase:	Feasability Study (-30% to +50%)
Base Year:	2012
Date:	December 22, 2011

Description: Alternative 2 consists of in-situ chemical oxidation to treat the area of the plume with the highest concentrations. Assumes a one time oxidant injection event into shallow, intermediate, and deep wells at five well clusters in year 1 and semi-annual groundwater sampling for 30 years. Capital costs and first year O&M costs occur in Year 1. Annual O&M costs occur in Years 1-30.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Report Preparation					
Site Management Plan	60	hours	$100.00	$6,000	
Soil Vapor Intrusion Action Plan	40	hours	$100.00	$4,000	
SUBTOTAL				$10,000	
Pre- and Post-injection Performance Monitoring					
Groundwater Sampling	96	hours	$80.00	$7,680	2 people, 2 days, 2 times
Passive Diffusion Bags and Weights	30	bags	$40.00	$1,200	
Groundwater Laboratory Analysis	32	samples	$100.00	$3,200	VOC analysis: 15 samples+ trip blank/event
Data Validation	32	samples	$30.00	$960	
SUBTOTAL				$13,040	
Injection Well Install					
Drilling Mobilization	1	lump sum	$10,000.00	$10,000	
Decon Pad	1	lump sum	$500.00	$500	
Monitoring Well Drilling	1,350	linear feet	$25.00	$33,750	
Monitoring Well Installation	1,350	linear feet	$23.00	$31,050	
Flush-mount Monitoring Well Casing	15	wells	$235.00	$3,525	
Drums	100	Drums	$55.00	$5,500	
Purge Water and Cuttings Disposal	100	Drums	$250.00	$25,000	
SUBTOTAL				$109,325	
ISCO Injections					
Bench scale and pilot test	1	lump sum	$20,000.00	$20,000	Hydraulic and geochemical analyses
Injection Mobilization	1	lump sum	$32,000.00	$32,000	
Injection Crew and Equipment	25	days	$800.00	$20,000	Assuming injecting at 5 gallons per minute
Injection Material	47,000	pounds	$3.10	$145,700	
SUBTOTAL				$217,700	
SUBTOTAL				$350,065	
Contingency	25%			$87,516	10% scope + 15% Bid
SUBTOTAL				$437,581	
Project Management*	8%			$35,007	Planning, reporting, and administration.
Remedial Design*	15%			$65,637	Design analysis, plans, specs, costing, and scheduling.
Construction Management*	10%			$43,758	Submittal review, design modifications, construction oversight.
First year operation and maintenance	1	lump sum		$36,000	See cost breakdown below
TOTAL CAPITAL COST				$618,000	

OPERATION & MAINTENANCE COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Monitoring					
Groundwater Sampling	144	hours	$80.00	$11,520	2 people, 3 days, 2 times/year
Passive Diffusion Bags and Weights	50	bags	$40.00	$2,000	
Groundwater Laboratory Analysis	52	samples	$100.00	$5,200	VOC analysis: 25 samples+ trip blank semi-annually
Data Validation	52	samples	$30.00	$1,560	
Data Compliation and Evaluation	40	hours	$100.00	$4,000	20 hours/event
SUBTOTAL				$24,280	
SUBTOTAL				$24,280	
Contingency	25%			$6,070	
SUBTOTAL				$30,350	
Project Management*	10%			$3,035	
Technical Support*	10%			$3,035	
TOTAL ANNUAL O&M COST				$36,000	

PERIODIC COSTS IN YEARS 10 and 20:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Fan Replacement					
Fan Replacement	9	fan	$150.00	$1,350	
Subcontractor Installation	1	lump sum	$1,000.00	$1,000	
Installation Oversight	72	hours	$85.00	$6,120	
SUBTOTAL				$8,470	
Contingency	25%			$2,118	10% scope + 15% Bid
SUBTOTAL				$10,588	
Project Management*	10%			$1,059	
Technical Support*	10%			$1,059	
TOTAL PERIODIC COST FOR FAN REPLACEMENT				$12,700	

Note:
Expected life of a fan is 5 to 15 years.
Assume fan is replaced every 10 years.
Replace fans in nine systems at year 10 and year 20 to get usable fans to year 30.

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	PRESENT VALUE	NOTES
Capital	1	$618,000	$618,000	$618,000	
Annual O&M	2-5	$144,000	$36,000	$136,086	
		$762,000		$754,086	5 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR FIVE YEARS				$754,000	
Capital	1	$618,000	$618,000	$618,000	
Periodic Cost	10	$12,700	$12,700	$10,350	
Periodic Cost	20	$12,700	$12,700	$8,245	
Annual O&M	2-30	$1,044,000	$36,000	$755,784	
		$1,687,400		$1,392,378	30 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR THIRTY YEARS				$1,392,000	

** Per USEPA 540-R-00-002, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". July 2000.*

Table B-3
Remedial Alternative Opinion of Probable Cost

Alternative 3
TARGETED ENHANCED IN-SITU BIOREMEDIATION

OPINION OF PROBABLE COST SUMMARY

Site:	Former Munsey and Plaza Cleaners
Location:	Port Washington, New York
Phase:	Feasability Study (-30% to +50%)
Base Year:	2012
Date:	December 22, 2011

Description: Alternative 3 consists of in-situ bioremediation to treat the area of the plume with the highest concentrations. Assuming 1 injection into shallow, intermediate, and deep wells at five well clusters in year 1 and semi-annual groundwater sampling for 30 years. Capital costs and first year O&M costs occur in Year 1. Annual O&M costs occur in Years 1-30.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Report Preparation					
Site Management Plan	60	hours	$100.00	$6,000	
Soil Vapor Intrusion Action Plan	40	hours	$100.00	$4,000	
SUBTOTAL				$10,000	
Pre- and Post-injection Performance Monitoring					
Groundwater Sampling	96	hours	$80.00	$7,680	2 people, 2 days, 2 times
Passive Diffusion Bags and Weights	30	bags	$40.00	$1,200	
Groundwater Laboratory Analysis	32	samples	$100.00	$3,200	VOC analysis: 15 samples+ trip blank/event
Data Validation	32	samples	$30.00	$960	
SUBTOTAL				$13,040	
Injection Well Install					
Drilling Mobilization	1	lump sum	$10,000.00	$10,000	
Decon Pad	1	lump sum	$500.00	$500	
Monitoring Well Drilling	1,350	linear feet	$25.00	$33,750	
Monitoring Well Installation	1,350	linear feet	$23.00	$31,050	
Flush-mount Monitoring Well Casing	15	wells	$235.00	$3,525	
Drums	100	Drums	$55.00	$5,500	
Purge Water and Cuttings Disposal	100	Drums	$250.00	$25,000	
SUBTOTAL				$109,325	
Bioremediation Injections					
Bench scale and pilot test	1	lump sum	$20,000.00	$20,000	Hydraulic and geochemical analyses
Injection Mobilization	1	lump sum	$32,000.00	$32,000	
Injection Crew and Equipment	25	days	$800.00	$20,000	Assuming injecting at 5 gallons per minute
Injection Ammendment	42,000	gallons	$1.23	$51,660	Cost for 10% mixture of ammendment (Emulsified Veg. Oil)
Micro-organism Innoculation (KB-1®)	1	lump sum	$20,000.00	$20,000	
SUBTOTAL				$143,660	
SUBTOTAL				$276,025	
Contingency	25%			$69,006	10% scope + 15% Bid
SUBTOTAL				$345,031	
Project Management*	8%			$27,603	Planning, reporting, and administration.
Remedial Design*	15%			$51,755	Design analysis, plans, specs, costing, and scheduling.
Construction Management*	10%			$34,503	Submittal review, design modifications, construction oversight.
First year operation and maintenance	1	lump sum		$36,000	See cost breakdown below
TOTAL CAPITAL COST				$495,000	

OPERATION & MAINTENANCE COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Monitoring					
Groundwater Sampling	144	hours	$80.00	$11,520	2 people, 3 days, 2 times/year
Passive Diffusion Bags and Weights	50	bags	$40.00	$2,000	
Groundwater Laboratory Analysis	52	samples	$100.00	$5,200	VOC analysis: 25 samples+ trip blank semi-annually
Data Validation	52	samples	$30.00	$1,560	
Data Compliation and Evaluation	40	hours	$100.00	$4,000	20 hours/event
SUBTOTAL				$24,280	
SUBTOTAL				$24,280	
Contingency	25%			$6,070	
SUBTOTAL				$30,350	
Project Management*	10%			$3,035	
Technical Support*	10%			$3,035	
TOTAL ANNUAL O&M COST				$36,000	

PERIODIC COSTS IN YEARS 10 and 20:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Fan Replacement					
Fan Replacement	9	fan	$150.00	$1,350	
Subcontractor Installation	1	lump sum	$1,000.00	$1,000	
Installation Oversight	72	hours	$85.00	$6,120	
SUBTOTAL				$8,470	
Contingency	25%			$2,118	10% scope + 15% Bid
SUBTOTAL				$10,588	
Project Management*	10%			$1,059	
Technical Support*	10%			$1,059	
TOTAL PERIODIC COST FOR FAN REPLACEMENT				$12,700	

Note:
Expected life of a fan is 5 to 15 years.
Assume fan is replaced every 10 years.
Replace fans in nine systems at year 10 and year 20 to get usable fans to year 30.

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	PRESENT VALUE	NOTES
Capital	1	$495,000	$495,000	$495,000	
Annual O&M	2-5	$144,000	$36,000	$136,086	
		$639,000		$631,086	5 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR FIVE YEARS				$631,000	
Capital	1	$495,000	$495,000	$495,000	
Periodic Cost	10	$12,700	$12,700	$10,350	
Periodic Cost	20	$12,700	$12,700	$8,245	
Annual O&M	2-30	$1,044,000	$36,000	$755,784	
		$1,564,400		$1,269,378	30 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR THIRTY YEARS				$1,269,000	

** Per USEPA 540-R-00-002, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". July 2000.*

Table B-4
Remedial Alternative Opinion of Probable Cost

Alternative 4
RESTORATION TO ACHIEVE PRE-DISPOSAL CONDITIONS

OPINION OF PROBABLE COST SUMMARY

Site:	Former Munsey and Plaza Cleaners
Location:	Port Washington, New York
Phase:	Feasability Study (-30% to +50%)
Base Year:	2012
Date:	December 22, 2011

Description: This alternative consists of injecting an oxidant into the subsurface to treat groundwater throughout the dissolved-phase CVOC plume and restore the site to pre-disposal conditions. Capital costs and first year O&M costs occur in Year 1. Annual O&M costs occur in Years 1-30.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Report Preparation					
Site Management Plan	60	hours	$100.00	$6,000	
Soil Vapor Intrusion Action Plan	40	hours	$100.00	$4,000	
SUBTOTAL				$10,000	
Site Work					
Drilling Mobilization	1	lump sum	$11,000.00	$11,000	
Decon Pad	1	lump sum	$500.00	$500	
Monitoring Well Drilling	50	days	$7,000.00	$350,000	Horizontal Drilling, 14 wells to 250 feet
Monitoring Well Installation	3,500	linear feet	$40.00	$140,000	2" PVC, Schedule 40
Flush Mount Monitoring Well Casing	14	wells	$235.00	$3,290	6 Monitoring Wells
Drums	200	Drums	$55.00	$11,000	
Purge Water and Cuttings Disposal	200	Drums	$250.00	$50,000	
SUBTOTAL				$565,790	
ISCO Injections					
Bench scale and pilot test	1	lump sum	$20,000.00	$20,000	Hydraulic and geochemical analyses
Injection Shipping and Mobilization	1	lump sum	$80,000.00	$80,000	
Injection Crew and Equipment	200	days	$800.00	$160,000	Assuming injecting at 10 gallons per minute
Injection Material	1,085,000	pounds	$3.10	$3,363,500	
SUBTOTAL				$3,623,500	
SUBTOTAL				$4,199,290	
Contingency	25%			$1,049,823	10% scope + 15% Bid
SUBTOTAL				$5,249,113	
Project Management*	5%			$262,456	Planning, reporting, and administration.
Remedial Design*	8%			$419,929	Design analysis, plans, specs, costing, and scheduling.
Construction Management*	6%			$314,947	Submittal review, design modifications, construction oversight.
First year operation and maintenance	1	lump sum		$23,000	See cost breakdown below
TOTAL CAPITAL COST				$6,269,000	

OPERATION & MAINTENANCE COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Site Monitoring					
Groundwater Sampling	96	hours	$80.00	$7,680	2 people, 2 days, 2 times/year
Passive Diffusion Bags and Weights	20	bags	$40.00	$800	
Groundwater Laboratory Analysis	22	samples	$100.00	$2,200	VOC analysis: 10 samples+ trip blank semi-annually
Data Validation	22	samples	$30.00	$660	
Data Compliation and Evaluation	40	hours	$100.00	$4,000	20 hours/event
SUBTOTAL				$15,340	
SUBTOTAL				$15,340	
Contingency	25%			$3,835	
SUBTOTAL				$19,175	
Project Management*	10%			$1,918	
Technical Support*	10%			$1,918	
TOTAL ANNUAL O&M COST				$23,000	

PERIODIC COSTS IN YEARS 10 and 20:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Fan Replacement					
Fan Replacement	9	fan	$150.00	$1,350	
Subcontractor Installation	1	lump sum	$1,000.00	$1,000	
Installation Oversight	72	hours	$85.00	$6,120	
SUBTOTAL				$8,470	
Contingency	25%			$2,118	10% scope + 15% Bid
SUBTOTAL				$10,588	
Project Management*	10%			$1,059	
Technical Support*	10%			$1,059	
TOTAL PERIODIC COST FOR FAN REPLACEMENT				$12,700	

Note:
Expected life of a fan is 5 to 15 years.
Assume fan is replaced every 10 years.
Replace fans in nine systems at year 10 and year 20 to get usable fans to year 30.

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	PRESENT VALUE	NOTES
Capital	1	$6,269,000	$6,269,000	$6,269,000	
Annual O&M	2-5	$92,000	$23,000	$86,944	
		$6,361,000		$6,355,944	5 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR FIVE YEARS				$6,356,000	
Capital	1	$6,269,000	$6,269,000	$6,269,000	
Periodic Cost	10	$12,700	$12,700	$10,350	
Periodic Cost	20	$12,700	$12,700	$8,245	
Annual O&M	2-30	$667,000	$23,000	$482,862	
		$6,961,400		$6,770,456	30 years, 2.3 %
TOTAL PRESENT VALUE OF ALTERNATIVE FOR THIRTY YEARS				$6,770,000	

The above costs do not include relocating the Sandy Hollow Well Field.
** Per USEPA 540-R-00-002, "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study". July 2000.*

Table B-5
Remedial Alternatives Opinion of Probable Cost Summary

OPINION OF PROBABLE COST SUMMARY

Site: Former Munsey and Plaza Cleaners
Location: Port Washington, New York
Phase: Feasability Study (-30% to +50%)
Base Year: 2012
Date: December 22, 2011

Alternative	Description	Capital Costs	Annual OM&M Costs	Total Present Value
Alternative 1	NO FURTHER ACTION WITH MONITORING	$37,000	$23,000	$538,000
Alternative 2	TARGETED IN-SITU CHEMICAL OXIDATION	$618,000	$36,000	$1,392,000
Alternative 3	TARGETED ENHANCED IN-SITU BIOREMEDIATION	$495,000	$36,000	$1,269,000
Alternative 4	RESTORATION TO ACHIEVE PRE-DISPOSAL CONDITIONS	$6,269,000	$23,000	$6,770,000

Notes:
Total Present Value costs assume implementation of each alternative for 30 years.
Periodic, non-annual O&M costs are not listed above but are included in the the Total Present Value costs.

Table B-6
Remedial Alternatives 30-Year Cost Summary

OPINION OF PROBABLE COST SUMMARY

Site:	Former Munsey and Plaza Cleaners
Location:	Port Washington, New York
Phase:	Feasability Study (-30% to +50%)
Base Year:	2012
Date:	December 22, 2011

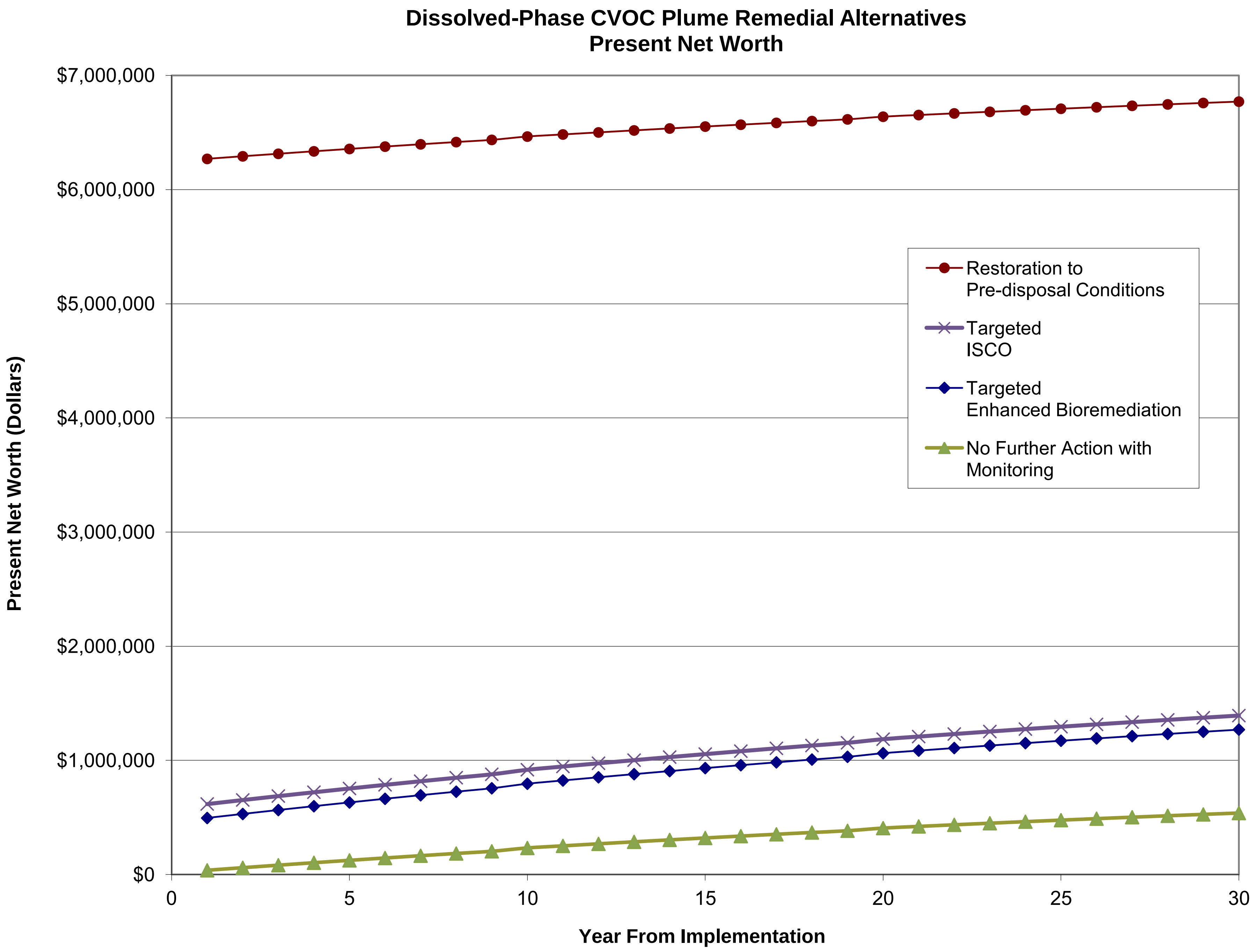
	1	2	3	4
Alternative	No Further Action with Monitoring	Targeted ISCO	Targeted Enhanced Bioremediation	Restoration to Pre-disposal Conditions
Capital Cost	$37,000	$618,000	$495,000	$6,269,000
Annual O&M	$23,000	$36,000	$36,000	$23,000
Periodic Cost Year 10	$12,700	$12,700	$12,700	$12,700
Periodic Cost Year 20	$12,700	$12,700	$12,700	$12,700
Year				
1	$37,000	$618,000	$495,000	$6,269,000
2	$59,483	$653,191	$530,191	$6,291,483
3	$81,460	$687,590	$564,590	$6,313,460
4	$102,944	$721,216	$598,216	$6,334,944
5	$123,944	$754,086	$631,086	$6,355,944
6	$144,472	$786,217	$663,217	$6,376,472
7	$164,539	$817,626	$694,626	$6,396,539
8	$184,154	$848,328	$725,328	$6,416,154
9	$203,329	$878,340	$755,340	$6,435,329
10	$232,421	$918,027	$795,027	$6,464,421
11	$250,743	$946,705	$823,705	$6,482,743
12	$268,653	$974,738	$851,738	$6,500,653
13	$286,161	$1,002,141	$879,141	$6,518,161
14	$303,275	$1,028,928	$905,928	$6,535,275
15	$320,003	$1,055,112	$932,112	$6,552,003
16	$336,356	$1,080,708	$957,708	$6,568,356
17	$352,341	$1,105,728	$982,728	$6,584,341
18	$367,967	$1,130,186	$1,007,186	$6,599,967
19	$383,242	$1,154,094	$1,031,094	$6,615,242
20	$406,417	$1,185,709	$1,062,709	$6,638,417
21	$421,013	$1,208,554	$1,085,554	$6,653,013
22	$435,280	$1,230,885	$1,107,885	$6,667,280
23	$449,226	$1,252,714	$1,129,714	$6,681,226
24	$462,859	$1,274,053	$1,151,053	$6,694,859
25	$476,186	$1,294,911	$1,171,911	$6,708,186
26	$489,213	$1,315,301	$1,192,301	$6,721,213
27	$501,946	$1,335,232	$1,212,232	$6,733,946
28	$514,394	$1,354,716	$1,231,716	$6,746,394
29	$526,562	$1,373,761	$1,250,761	$6,758,562
30	$538,456	$1,392,378	$1,269,378	$6,770,456

Notes:

Present Net Worth is based on a 2.3% discount rate.

Capital costs, which include the first year of O&M, occur in year 1.

Assumes O&M costs incurred at the end of each year.


Dissolved-Phase CVOC Plume Remedial Alternatives
Present Net Worth
Present Net Worth (Dollars)
$7,000,000
$6,000,000
$5,000,000
$4,000,000
$3,000,000
$2,000,000
$1,000,000
$0
0
5
10
15
20
25
30
Year From Implementation
Restoration to Pre-disposal Conditions
Targeted ISCO
Targeted Enhanced Bioremediation
No Further Action with Monitoring