O'BRIEN & GERE

October 12, 2007

Mr. Jason Pelton
NYSDEC
Remedial Bureau D
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233-7013

Re: Feasibility Study Report
Carriage Cleaners
File: 10653/35749 #2

Dear Jason:

Please find enclosed the Final Feasibility Study Report (FS Report) associated with the Remedial Investigation/Feasibility Study (RI/FS) for the Carriage Cleaners Site (Site #8-28-120) located in the Town of Brighton, New York.

Based on the evaluation of alternatives presented in the FS Report, Alternative 2 appears to be the preferred remedy. Alternative 2 would achieve the remedial objectives and provide attainment of SCGs (applying a TI waiver for the Class GA ground water standards), but at a lower cost than the other alternatives. Remedial objectives would be achieved under Alternative 2 through the following remedy components:

- Presumptive Remedy of soil vapor extraction of Site soils;
- Ground water extraction for control of Site ground water;
- Monitored natural attenuation of ground water off-site;
- Vapor intrusion mitigation and monitoring of off-site properties;
- Excavation of Site soils;
- Ground water monitoring; and
- Deed restrictions.

If you have any questions regarding the FS Report, please do not hesitate to contact David Carnevale or me.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

Douglas M. Crawford

Douglas M. Crawford, P.E.
Vice President

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cc: Clare F. Leary – O'Brien & Gere
David J. Carnevale – O'Brien & Gere

**REPORT**

# Feasibility StudyReport
# Carriage Cleaners - Site #8-28-120
# Town of Brighton, New York

New York State Department of Environmental Conservation

October 2007

Job No. 10653/35749

# REPORT

## Feasibility Study Report
## Carriage Cleaners - Site #8-28-120
## Town of Brighton, New York

***New York State Department of Environmental Conservation***

Douglas M. Crawford

Douglas M. Crawford, Vice President
O'Brien & Gere Engineers, Inc.

October 2007

O'BRIEN & GERE

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# 1. Introduction

## 1.1 Purpose

The purpose of this report is to present the Feasibility Study for the Carriage Cleaners property Site (Site), New York State Superfund Site #8-28-120, located in the Town of Brighton, Monroe County, New York. A Site map is provided as Figure 1.

## 1.2. Site Background

On behalf of the New York State Department of Environmental Conservation (NYSDEC), O'Brien & Gere performed a Remedial Investigation (RI) to investigate environmental contamination at the Site. The results of the RI are documented in an RI Report prepared by O'Brien & Gere and dated January 2007. Following the RI, O'Brien & Gere performed a Feasibility Study (FS) to evaluate remedial alternatives for the Site.

As documented in the RI Report, Carriage Cleaners is an active dry cleaning business located at 2101 Monroe Avenue in the Town of Brighton, New York. The property is approximately 0.35 acres in size and located within a densely populated mixed commercial/residential area. Carriage Cleaners has been the owner/operator over the past 12 years; however, the Site has apparently operated as a dry cleaning business for more than 25 years. A residential rental building is also located along the east-side of the 0.35 acre Carriage Cleaners property.

## 1.3. Summary of Remedial Investigation

Following the discovery of PCE in ground water media during a site investigation performed in 2003 at the nearby former Citgo Gasoline Station (located at 2087 Monroe Ave., Brighton, NY), NYSDEC completed an indoor air sampling program in January 2004. A total of six properties, including the residential unit on the Carriage Cleaners property, were included in the January 2004 indoor air sampling program. Based on the presence of PCE in subslab and indoor air samples, mitigation systems were installed at three of the properties. Subsequently, LaBella Associates conducted a Phase II Environmental Site Assessment (ESA) at the Carriage Cleaners facility, located at 2101 Monroe Avenue, Brighton, NY. The objective of this investigation was the preliminary characterization of the Site to determine potential PCE source areas in either soil or shallow overburden ground water at the Site. The analytical results from the sampling identified PCE in soil and ground water at concentrations above the corresponding NYSDEC standards at the Carriage Cleaners Site.

The conclusions of the Phase II ESA indicated that there appear to have been releases of PCE at the Carriage Cleaners property and the releases have impacted shallow soil and overburden ground water at the Site. The Phase II report also concluded that the soil near the sanitary and storm sewer lateral servicing the Carriage Cleaners facility is impacted with both PCE and petroleum hydrocarbons. A potential failed section of the sanitary and/or storm sewer lines exiting the Carriage Cleaners building was identified as the likely location of the PCE release. The former Citgo gas station was identified as the likely source of petroleum compounds detected in ground water within the investigation area.

Following the Phase II ESA an RI was performed by New York State Standby Contractor O'Brien & Gere on behalf of the NYSDEC. Consistent with the NYSDEC-approved RI/FS Work Plan, the field investigation activities were conducted in 2005 and 2006. The investigation included the collection of samples from the following environmental media:

- Soil vapor
- Residential sub-slab and indoor air
- Subsurface soil
- Ground water.

In addition to this sampling, the RI field investigation activities included:
- Utility video survey
- Excavation and subsequent repair of a storm sewer utility
- Hydraulic conductivity testing.

The findings of the RI were documented in the RI Report. A summary of the findings is presented in the following section.

## 1.4. RI Conclusions

Results of the subsurface geologic data collected during the RI field investigation indicate that the geology in the study area consists of overburden fine-grained soils such as silt and fine sand overlying a unit of dense to loose sandy till. The total thickness of these unconsolidated units range from approximately 5-ft to 12-ft. Bedrock geology consists of dolomite and is present beneath the unconsolidated deposit. The bedrock exhibits an undulating erosional surface. Based on the contour of bedrock elevations, the bedrock surface beneath the Carriage Cleaners property slopes to the south. Beneath the former Speedy's Cleaners property (2150 Monroe Avenue), the bedrock surface appears to slope to the northeast beneath the southwestern portion of the property and to the southwest beneath the northeastern portion of the property, creating a bedrock trough in an approximate northwest to southeast orientation. To the northeast of the Carriage Cleaners and former Speedy's Cleaners properties, a bedrock high is apparent, centered around monitoring well HA-115.

The bedrock high centered around HA-115 appears to influence ground water flow potentials in the shallow bedrock interface zone. While the overall ground water flow potential in the shallow bedrock interface zone is predominantly and consistently to the northeast, an easterly component becomes evident in the southern portion of the study area. The ground water velocity within the shallow bedrock interface zone is estimated to be approximately 1.4 ft/day (511 ft/year).

Based on the distribution and magnitude of concentrations of VOCs, it appears that releases of PCE occurred on the Carriage Cleaners and former Speedy's Cleaners properties. These releases have impacted soil and ground water on each property, as well as ground water, soil vapor, and indoor air downgradient of these properties.

The highest PCE concentrations in soil were on the Carriage Cleaners property at areas along the western-side of the building near the sewer line running toward Brooklawn Drive and near the PCE above ground storage tank (AST) located in the alleyway between the Carriage Cleaners building and the residential dwelling on the property. The highest PCE concentrations detected in soil beneath the former Speedy's Cleaners property were along the eastern and northern sides of the site building. The areal extent of soil impacts on both properties appears limited.

Analytical data within the overburden and shallow bedrock interface zones indicate that ground water has been impacted by PCE and its degradation products. PCE and its degradation products have migrated laterally to the northeast and east approximately 1,200-ft from the Carriage Cleaners property. Both the Carriage Cleaners and former Speedy's Cleaners properties are likely the sources of PCE and its degradation products detected at downgradient locations within the investigation area.

The primary constituents of concern (COCs) to environmental media associated with the Carriage Cleaners RI/FS is the chlorinated solvent PCE and its degradation products, trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), trans-1,2-DCE, and vinyl chloride. While COCs and other VOCs were detected in sub-slab and associated indoor air samples, the majority of these detections are considered to be associated with indoor and/or outdoor sources. As discussed in the RI Report, of the forty-five properties from which air samples were collected, no further action was considered appropriate at thirty-five residential properties and two commercial properties; additional monitoring was considered appropriate at seven residential properties; and mitigation was considered necessary at one commercial property. However, additional air sampling data were collected subsequent to completion of the RI Report. These results are provided in Appendix A. Based on these results, one residential property identified in the RI Report as requiring "no action" was subsequently identified as requiring "additional monitoring".

The analytical data collected as part of the RI field investigation are sufficient to complete the Feasibility Study. However, data gaps exist. While these data gaps may not significantly alter the current understanding of the nature and extent of contamination, further data should be collected as a pre-design effort based on the development of remedial alternatives as part of the Feasibility Study.

## 1.5. Human Health Risk Assessment

As part of the RI, a qualitative exposure pathway analysis was performed for the Site to evaluate the potential for human contact with site constituents. Following is a summary of the potentially complete pathways.

### 1.5.1 Potentially Complete Pathways:

Potentially complete exposure pathways identified in the Exposure Pathway Analysis Report (EPAR) provided in the RI Report included the following:

*Current and Future Potential On-Site Exposure Pathways*

- Ingestion and dermal contact of subsurface soil by adult utility contractor or construction worker
- Inhalation of air from open trenches/excavations by adult utility contractor or construction worker or patrons
- Ingestion and dermal contact with Site ground water by adult (utility contractor or construction worker).

*Current/Future Potential Off-Site Exposure Pathways*

- Ingestion and dermal contact with ground water by adult construction worker
- Inhalation of air from open trenches/excavations by adult utility contractor or construction worker or residents
- Inhalation of indoor air (vapor intrusion) by adult, adolescent, and child residents.

# 2. Development of Remedial Alternatives

The objective of this phase of the FS was to develop a range of remedial alternatives for on-site and off-site soil, ground water, and indoor air media. The process for development of alternatives consisted of six steps:

- identification of potential standards, criteria and guidance (SCGs)
- development of remedial action objectives (RAOs)
- identification of general response actions
- identification of areas or volumes of media
- identification, screening, and evaluation of remedial technologies and process options
- compilation of remedial alternatives.

## 2.1. Identification of Potential Standards, Criteria and Guidance (SCGs)

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 the 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.

## 2.2. Development of Remedial Action Objectives

Remedial action objectives are medium specific goals for protecting human health and the environment. These remedial action objectives form the basis for the FS by providing overall goals for site remediation. The remedial action objectives are considered during the identification of appropriate remedial technologies and formulation of alternatives for the site, and later during the evaluation of remedial alternatives.

Remedial action objectives are based on risk-based information established in the risk assessment and potentially applicable or relevant and appropriate SCGs. Documentation of the rationale employed in the development of the RAOs for the Site is presented in the following sections.

### 2.2.1 Remedial Action Objectives for Air

Results of indoor air and sub-slab samples for the forty five studied properties were compared to the decision-making matrices presented in the *New York State Department of Health (NYSDOH) Guidance for Evaluating Vapor Intrusion in the State of New York* (NYSDOH 2006), identified as a potentially applicable SCG for the Site. Comparison of off-site property data to these matrices indicated that some off-site properties require mitigation and/or additional monitoring. Appendices A and B include tables showing the results of this comparison for off-site properties.

The Site continues to operate as a dry cleaning facility, therefore, OSHA exposure limits are considered applicable for potential Site air exposures. As documented in the conceptual site model (CSM), indoor air at the Site does not exceed permissible exposure limits (PELs) established for Site COCs in the workplace. Also present at the Site is a building currently used as a residence. This building is currently equipped with a vapor intrusion mitigation system.

As documented in the RI Report, a qualitative exposure pathway analysis was performed for the Site. This analysis identified inhalation of air from open trenches/excavations by adult utility or construction workers both on-site and off-site as a current and future potentially complete exposure pathway for construction and utility workers.

Accordingly, the following RAOs were developed for air:

- Achieve, to the extent practicable, conformance with the NYSDOH vapor intrusion guidance for off-site properties
- Minimize, to the extent practicable, inhalation of on-site and off-site air present in trenches or excavations and off-site indoor air that would result in unacceptable health risks.

### 2.2.2 Remedial Action Objectives for Soil

In the RI Report, soil concentrations were compared to TAGM #4046 screening values during the evaluation of the nature and extent of contaminated soil on-site. Since completion of the nature and extent evaluation for soil in the RI, NYS has promulgated 6 NYCRR Part 375. 6 NYCRR 375-6 provides soil cleanup objectives for various property uses that became effective on November 14, 2006. 6 NYCRR 375-6 "applies to the development and implementation of…remedial programs". Part 375-6 provides soil cleanup objectives for the following re-uses: unrestricted, residential, restricted residential, commercial, industrial, and for the protection of ground water and ecological receptors. A comparison of detected VOCs in soil to the soil cleanup objectives presented in 6 NYCRR Part 375-6 is provided in Appendix C.

The Site is currently used as a commercial building, however, a rental property also exists on the property that is used for residential purposes. Additionally, as described in the RI, ground water has been impacted at the Site and downgradient of the Site. As such, on-site and off-site soils were compared to soil cleanup objectives for residential and commercial property uses and the protection of ground water. Soil screening values for the protection of ground water represent the most stringent values, therefore, these values have been used for the development of RAOs for Site soil media. Analytical results for soil at the Site were above the soil cleanup objectives for the protection of ground water in some soil samples collected at the Site.

As documented in the RI Report, a potentially complete pathway exists for direct contact with subsurface soil by construction and utility workers performing excavation work at the Site.

Accordingly, the RAOs developed for the Site soil consists of:

- Attain, to the extent practicable, applicable soil clean up objectives for the protection of ground water for subsurface soil on-site
- Minimize, to the extent practicable, direct contact with on-site subsurface soil that could result in unacceptable health risks.

### 2.2.3 Remedial Action Objectives for Ground Water

Analytical results indicate the presence of Site-related COCs in samples collected from both on-site and off-site ground water monitoring wells. The NYS Class GA Ground Water Standards are identified as a potential SCG. Exceedances of the NYS Class GA Ground Water Standards for Site related COCs, though generally limited, were observed both on-site and off-site. It is also noted that the Monroe County Water Authority (MCWA) provides a water supply for potable water use and ground water near the Site is not used as a drinking water source.

As documented in the RI Report, potentially complete exposure pathways for direct contact with ground water by construction workers performing excavation activities exist both on-site and off-site within the distribution area of COCs downstream of the Site.

Accordingly, the RAOs identified for ground water consist of:

- Attain, to the extent practicable, NYS Class GA Ground Water Standards
- Minimize, to the extent practicable, contact with ground water that would result in unacceptable health risks.

## 2.3. Identification of Areas and Volumes of Media

Site conditions, the nature and extent of contamination, and preliminary remediation goals were taken into consideration to estimate the volumes and areas of media to be addressed by the general response actions.

The Site occupies a parcel of property measuring approximately 0.35 acres. Two portions of the Site exhibit concentrations of COCs in soil exceeding the soil cleanup objectives for the protection of ground water, as presented in 6 NYCRR Part 375-6. Specifically, exceedances of the soil cleanup objectives occur along the west-side of the Carriage Cleaners facility adjacent to the storm and sanitary sewer lines and along the east-side of the site building near an above ground storage tank historically used to store dry cleaning solvents. It is estimated that approximately 635 cubic yards of soil ranging in depth to 15 ft below ground surface exhibit contaminant concentrations in excess of the soil cleanup objectives. Due to the presence of site buildings, nearby road and underground utilities it is estimated that approximately 83 cubic yards could be feasibly removed via excavation.

The ground water plume extends approximately 1,500 ft downgradient northeast of the Site with an average width of approximately 900-ft. The plume extends from approximately 5-ft to approximately 30-ft below grade. Assuming a porosity of 0.05 %, the estimated volume of ground water exceeding NYS Class GA Ground Water Standards is approximately 12.6 million gallons.

Forty-five single family, multi-family and commercial structures that exist within the approximate area of the off-site plume were investigated during the vapor intrusion assessment. Based on a comparison of the vapor intrusion data to the DOH guidance matrices, one of these structures requires vapor intrusion mitigation, eight structures require monitoring, and the remaining thirty-six require “no action”.

## 2.4. Presumptive Remedy

USEPA has developed presumptive remedies for certain types of sites. The objective of presumptive remedies is to make use of past experience to streamline the remediation process. If a presumptive remedy is applicable for the Site, a focused FS can be prepared. The study can then be limited to the “no action” alternative and the presumptive remedy technologies for the appropriate environmental media. This is possible because USEPA has conducted an analysis of potentially available technologies for the presumptive remedy site categories and has determined that certain technologies are routinely and appropriately screened out. This detailed analysis serves to substitute for the development and screening of alternatives phases of the FS and will allow the remaining alternatives to be limited to variations of the presumptive remedy (USEPA 1993).

The presumptive remedy guidance documents that were considered relevant and appropriate for the Site are *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils (EPA, 1993),* and the supplemental guidance bulletin *Presumptive Remedy: Supplemental Bulletin Multi-Phase Extraction (MPE) Technology for VOCs in Soil and Groundwater (*USEPA 1997). As stated in the USEPA presumptive remedy guidance, presumptive remedies are “expected to be used at all appropriate sites”. USEPA regards extraction and treatment (if necessary) as the presumptive remedy for sites with soils contaminated by VOCs (USEPA 1993). Site COCs are identified in Table 2 of the presumptive remedy guidance (USEPA 1993).

Three treatment technologies are identified in the presumptive remedy document. These are soil vapor extraction (SVE), thermal desorption, and incineration. SVE is identified as the "primary presumptive remedy" as it is typically the cost-effective option, however, SVE is only appropriate for remediation of unsaturated soils (EPA 1993). The supplemental bulletin identifies multi-phase extraction as a variant of SVE that recovers both soil vapor and ground water. Greater remediation can be achieved by drawing down ground water allowing vapor extraction of soils that were previously saturated (USEPA 1997).

Similarly, NYSDEC has draft a program policy entitled *DER-15 – Presumptive/Proven Remedial Technologies (NYSDEC 2006)*. This document also identifies SVE as the primary presumptive/proven remedial technology for VOCs in soil. NYSDEC's DER-15 document also identified excavation as a conventional remedial method. Given that SVE has been identified by USEPA and NYSDEC as a presumptive remedy for VOCs in soil, the screening of remedial technologies for soil will be streamlined. Specifically, SVE and excavation for soil will be included in the screening of technologies for the Carriage Cleaners Site.

## 2.5. Physical and Technical Limits to Remediation

Site conditions limit the alternatives available for remediation of ground water at the Site. Specifically, the following physical and hydrogeologic conditions limit the technical practicability of ground water remediation technologies at this Site:

- For the chlorinated VOCs in the shallow ground water at the Site, source material may not be completely accessible due to the presence of the currently occupied buildings and the presence of fractured bedrock underlying the Site
- Although *in situ* technologies can be used to reduce concentrations of the source material, they have not demonstrated the ability to remediate sources to meet ground water standards (Fountain, 1998; ITRC, 2002; and USEPA, 2004). Ground water concentrations at the Site suggest the potential presence of dense non-aqueous phase liquid (DNAPL) source material, though none has been identified.
- The existence of a separate off-site uncontrolled source of chlorinated VOCs at the Former Speedy's Cleaner property may limit the overall effectiveness of remediation of ground water downgradient of the Former Speedy's Cleaner property.

USEPA's September 1993 *Guidance for Evaluating the Technical Impracticability of Ground Water Restoration* recognizes that some sites will not attain chemical-specific SCGs and provides for implementation of Technical Impracticability (TI) waivers (USEPA 1993a). Under CERCLA, a "…TI waiver must be invoked when either of the following specific criteria are met:

- Engineering feasibility. The current engineering methods necessary to construct and maintain an alternative that will meet the SCGs cannot reasonably be implemented.
- Reliability. The potential for the alternative to continue to be protective into the future is low, either because the continued reliability of technical and institutional controls is doubtful, or because of inordinate maintenance costs."

  Similarly, under NYSDEC environmental regulations (6 NYCRR 375-1.10 (1) (i) a-d) "…conformity with an SCG can be dispensed with if a good cause such as the following exists:

- The proposed action is only part of a complete program that will conform to such standard or criterion [of *[sic]* guidance] upon completion;
- Conformity with such standard or criterion will result in greater risk to the public health or to the environment than alternatives; or

- Conformity with such standard or criterion is technically impracticable from an engineering perspective; or
- The program will maintain a level of performance that is equivalent to that required by the standard or criterion through the use of another method or approach."

At the Site, a TI waiver may be applicable to the NYS Class GA Ground Water Standards due to technical impracticability from an engineering perspective. As discussed above, it is likely to be technically impracticable at this Site to restore ground water to NYS Class GA Ground Water Standards for VOCs in Site ground water.

## 2.6. Identification of General Response Actions

General response actions are medium-specific actions that may be combined into alternatives to satisfy the remedial action objectives. General response actions that address the remedial action objectives related to the Site media include institutional controls, containment, removal, disposal, reuse, and treatment. General response actions applicable to the Site are included in Table 2.

## 2.7. Identification and Screening of Remedial Technologies and Process Options

Potentially applicable remedial technology types and process options for each general response action were identified during this step. Process options were screened on the basis of technical implementability. The technical implementability of each identified process option was evaluated with respect to site contaminant information, site physical characteristics, and areas and volumes of affected media.

Descriptions and screening comments for technologies and process options identified for the Site are presented in Table 2. Process options that were viewed as not implementable for the Site were not considered further in the FS. Following are descriptions of technologies that were considered potentially implementable for the Site.

### 2.7.1. Air/Vapor

*No action.* The no action general response action must be considered in the FS, as specified in the NCP (40 CFR Part 300.430).

*Institutional actions.* The remedial technologies associated with the institutional general response action that was identified for the Site were monitoring and use restrictions. Access restrictions identified consist of deed restrictions.

- **Monitoring.** Monitoring of sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling would be conducted to evaluate VOC concentrations in indoor air and sub-slab soil vapor. Air monitoring and/or communication testing could also provide a means to detect changes in VOC concentrations to evaluate if existing mitigation systems are functioning as desired.

- **Use Restrictions.** With respect to indoor air, land use restrictions would be reflected in the property deed. The deed restrictions would preclude the use of a building influenced by vapor intrusion unless the building is proven to be in compliance with recommendations set forth in applicable guidance. Compliance status would be subject to review and approval by NYSDOH.

*Collection actions.* The remedial technology related to the control of sub-slab vapors and vapor intrusion at the Site, and at off-site buildings, was vapor control. The process option considered potentially applicable is described as follows.

- **Pumping/Ventilation (Sub-Slab Depressurization).** Pumping to ventilate the sub-slab of a building would involve the installation of a soil vapor extraction point/points through the slab and a blower to exert a vacuum to depressurize the sub-slab environment. Sub-slab depressurization is identified as the most effective means of mitigating vapor intrusion in the NYSDOH's *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYSDOH 2006).

### 2.7.2. Soil

As described in Section 2.4, USEPA and NYSDEC recognize a presumptive remedy for VOCs in soil. Consistent with USEPA and NYSDEC presumptive remedy documents, the screening of technologies was be streamlined for soil at the Site. In addition to the presumptive remedy of SVE, excavation will be screened in the FS.

*No action.* The no action general response action must be considered in the FS, as specified in the NCP (40 CFR Part 300.430).

*Institutional actions.* The remedial technology associated with the institutional general response action that was identified for the Site was access restrictions. Access restrictions identified consist of deed restrictions. The process options considered potentially applicable are described as follows.

- **Use Restrictions.** With respect to contaminated soil, land use restrictions would be reflected in the property deed. The deed restrictions would preclude activities which would potentially expose contaminated materials (and require health and safety precautions) without prior review and approval by NYSDEC.

*Presumptive remedy.* The presumptive remedy for soils contaminated by VOCs is SVE as described in section 2.4. SVE involves removal of VOCs in the unsaturated zone. The soil would be decontaminated in place by pulling air through the soil. The air flow displaces the soil gas, disrupting the equilibrium existing between VOCs that are (1) sorbed on the soil, (2) dissolved in soil-pore water, (3) present in a separate hydrocarbon phase, and (4) present as vapor. This air causes volatilization and subsequent removal of the contaminants in the air stream. Depending on the flow rate, contaminant type and concentration, as well as federal, state, and local environmental regulations, the extracted gas stream may be discharged directly to the atmosphere or sent to an emissions-control device. SVE would likely be an effective treatment technology for Site COCs.

In addition to SVE, NYSDEC recognizes excavation of soil contaminated by VOCs as a presumptive remedy. Though building locations and subsurface utilities present at the Site make excavation difficult, limited excavation is being evaluated in this FS.

### 2.7.3. Ground Water

*No action.* The no action general response action must be considered in the FS, as specified in the NCP (40 CFR Part 300.430).

*Institutional actions.* The remedial technologies associated with the institutional general response action that was identified for the Site were monitoring and access restrictions. Access restrictions identified consist of ground water use restrictions. Ground water monitoring was identified as the monitoring process option. The process options considered potentially applicable are described as follows.

- **Ground Water Monitoring.** Ground water monitoring would involve periodic sampling and analysis of ground water on- and off- site. Ground water monitoring would provide a means to detect changes in constituent concentrations in the ground water.

- **Ground Water Use Restrictions.** Currently, ground water is not used as a potable water source. Ground water use restrictions would include deed restrictions that would preclude the use of ground water at the Site as a potable source of water without proper treatment. In addition, deed restrictions would preclude excavation and construction activities that would subject workers to contact with affected ground water without proper protective equipment.

*Collection actions.* The remedial technology that was identified for the Site related to the collection general response action for ground water was ground water extraction. The ground water extraction process options considered applicable were recovery wells.

- **Recovery wells.** Contaminated ground water would be collected by pumping from recovery wells. A pumping test performed on the Site would be required to identify locations to place the extraction well(s) and evaluate appropriate pumping rates and/or levels to minimize migration of contaminated ground water from the source areas.

- **Recovery trench.** Contaminated ground water would be collected by pumping from recovery trenches.

*In situ treatment actions.* The remedial technology that was identified for the Site related to the *in situ* treatment general response action for ground water was natural attenuation. Natural attenuation is described below.

- **Natural Attenuation.** Natural attenuation relies on naturally occurring *in situ* biotic and abiotic processes to degrade organic constituents in the saturated zone. Baseline and ongoing monitoring is required to evaluate the effectiveness of this process option.

*Ex situ treatment actions.* The remedial technologies that were identified for the Site related to the *ex situ* treatment general response action for ground water were physical, chemical and biological treatment. The ground water extraction process options considered applicable are described below.

- **Air Stripping.** Air stripping involves the contact of ground water with air in a countercurrent packed column, tray, or bulk reactor to transfer volatile contaminants from the ground water to the air.

- **Carbon Adsorption.** Activated carbon can adsorb organic contaminants from ground water onto its surfaces during contact. The carbon must be periodically replaced, regenerated, treated and/or disposed. Regeneration may be accomplished at the Site or off-site at a permitted commercial hazardous waste facility.

- **Adsorptive Resins.** Commercial resins are available which can adsorb organic contaminants from the ground water during contact. Such resins are typically regenerated on the Site on a periodic basis.

- **Chemical Oxidation.** Chemical oxidation involves the addition of oxidation agents such as hydrogen peroxide or ozone to the ground water in the presence of ultraviolet light to oxidize organic contaminants to non-toxic byproducts. Chemical oxidation is typically performed in a closed reactor system.

- **Biological Reactor.** A biological reactor could be used to enhance conditions for co-metabolic degradation of chlorinated organics. Nutrients, cometabolities, and aeration would be provided as necessary to optimize degradation. Sludge management would be required.

*Discharge actions.* The discharge process options considered applicable are presented below:

- **Discharge to Surface Water.** Extracted and/or treated ground water would be discharged to the storm sewer pursuant to a State Pollutant Discharge Elimination System (SPDES) permit.

- **Discharge to POTW.** Extracted and/or treated ground water would be released to municipal sanitary sewers, ultimately treated and discharged by a municipal treatment plant.

## 2.8. Evaluation of Remedial Technologies

The process options remaining after the initial screening were evaluated further according to the criteria of effectiveness, implementability, and cost. The effectiveness criterion included the evaluation of: potential effectiveness of the process options in meeting remedial objectives and handling the estimated volumes or areas of media; potential effects on human health and the environment during construction and implementation; and experience and reliability of the process options for Site contaminants and conditions. Technical and institutional aspects of implementing the process options were assessed for the implementability criterion. The capital and operation and maintenance (O&M) costs of each process option were evaluated as to whether they were high, medium, or low relative to the other process options of the same technology type.

Based on the evaluation, the more favorable process options of each technology type were chosen as representative process options. The selection of representative process options simplifies the assembly and evaluation of alternatives, but does not eliminate other process options. The process option actually used to implement remediation may not be selected until the remedial design phase. A summary of the evaluation of process options and selected representative process options is presented in Table 3.

## 2.9. Assembly of Remedial Alternatives

Remedial alternatives were developed by assembling general response actions and representative process options into combinations that address the Site. Three alternatives were developed for the Site. A summary of the alternatives and their components is presented in Table 4. A description of each alternative is included in the following subsections.

### 2.9.1. Common Components of Alternatives

Deed restrictions and five-year reviews are common elements to each of the alternatives being evaluated for the Site. A description of these elements is included below.

*Environmental easements.* Environmental easements would impose land use restrictions, ground water use restrictions, and requirements for continued indoor air monitoring and operation of vapor intrusion mitigation systems at selected off-site properties (except as described below). Land use restrictions would require proper worker protections during construction or excavation activities that would potentially cause a worker to contact contaminated soil, ground water or soil vapor. Ground water use restrictions would preclude the use of ground water at the Site without prior notification and approval from NYSDEC. Restrictions related to soil, ground water, and soil vapor would be implemented on the Site property. Restrictions related to ground water and soil vapor would be implemented for off-site properties.

*Five-year reviews.* Each alternative would include a five-year review, as required by the NCP (Federal Register 1990) when impacted soil or ground water remains as a result of Site releases. The five-year review would focus on evaluating the on-site and off-site conditions with regard to the continuing protection of human health and the environment as evidenced by information such as ground water monitoring, vapor intrusion monitoring, and documentation of field inspections.

### 2.9.2. Alternative 1

Alternative 1 is the no further action alternative. The no further action alternative is required by the NCP and serves as a benchmark for the evaluation of action alternatives. This alternative provides for an assessment of the environmental conditions if no active remedial actions are implemented. The no further action alternative consists of ground water monitoring, environmental easements, and five-year reviews. Environmental easements related to indoor air refer to only those systems currently in place. No new additional systems are proposed under this alternative. These actions are described in Section 2.9.1.

*Ground water monitoring.* Ground water monitoring would be implemented to track VOC concentrations in ground water both on- and off-site and would be instrumental in detecting any increases or decreases in concentrations. For cost estimation purposes, sampling of up to 30 wells was assumed.

### 2.9.3. Alternative 2

Alternative 2 consists of the presumptive remedy for VOCs in soil, extraction of on-site ground water, monitored natural attenuation for off-site ground water, and vapor intrusion mitigation. This alternative would involve the following process options in addition to those presented in 2.9.1.

*Soil vapor extraction.* A SVE system would consist of three wells to recover soil vapor. For cost estimation purposes it was assumed that recovered soil vapor would be treated by activated granular carbon prior to release to the atmosphere. For cost estimation purposes, a pilot study was assumed.

*On-site ground water extraction.* A ground water extraction system would consist of one extraction well to collect on-site bedrock ground water. Disposal of extracted ground water would be to the municipal sewer system. It is not anticipated that pre-treatment of recovered ground water would be required prior to disposal. Extraction of ground water would also serve to control releases of ground water from the Site. A rate of approximately 2.5 gpm was assumed for cost estimation purposes.

*Off-site monitored natural attenuation.* This alternative would utilize natural attenuation mechanisms to achieve off-site ground water RAOs. RI results have shown that breakdown products of PCE exist in the off-site plume suggesting that natural attenuation is occurring. Natural attenuation monitoring would consist of ground water monitoring at representative wells for natural attenuation parameters.

*Vapor intrusion monitoring/mitigation.* Vapor intrusion conditions present within the off-site plume would be addressed consistent with NYSDOH guidance. As summarized in Appendix B, based on an evaluation of the RI results for sub-slab and indoor air samples, one mitigation system would be installed at one off-site commercial property (Former Speedy's Cleaners). Also as summarized in Appendix B, monitoring for vapor intrusion would occur on an as needed basis for up to 10 buildings. Additional monitoring would consist of sampling and analysis of indoor air and sub-slab vapor samples. For cost purposes, this monitoring was assumed to be conducted annually.

*Ground water monitoring.* Ground water monitoring would be implemented to track VOC concentrations in ground water on-site and would be instrumental in detecting increases or decreases in concentrations. Additionally, as described above, off-site ground water would be monitored for natural attenuation parameters. For cost estimation purposes, quarterly sampling of up to six on-site wells was assumed for on-site sampling and up to twenty-four wells was assumed for off-site sampling.

*Soil excavation.* Limited soil excavation would be included in this alternative. Excavation areas would remove, to the extent practicable, soil exhibiting concentrations greater than soil cleanup objectives. As described in Section 2.3, approximately 83 cubic yards of soil ranging to a depth of 15 ft below grade was estimated to exhibit concentrations in excess of soil cleanup objectives. The presence of utilities in the front of the building and the close proximity of buildings and the road to the areas requiring excavation are physical limitations to the extent of excavation that will be feasible. For purposes of the cost estimation, it was assumed that approximately 83 cubic yards of soil would be removed to the extent practicable adjacent to Brooklawn Drive.

### 2.9.4. Alternative 3

Alternative 3 consists of the presumptive remedy for VOCs in soil, extraction of on-site ground water, extraction of off-site ground water, and vapor intrusion mitigation. In addition to the components presented in 2.9.1, this alternative would involve the following process options:

*Soil vapor extraction.* A SVE system would consist of three wells to recover soil vapor. For cost estimation purposes it was assumed that recovered soil vapor would be treated by activated granular carbon prior to release to the atmosphere. For cost estimation purposes, a pilot study was assumed.

*On-site ground water extraction.* A ground water extraction system would consist of one extraction well to collect on-site bedrock ground water. Disposal of extracted ground water would be to the municipal sewer system. It is not anticipated that pre-treatment of recovered ground water would be required prior to disposal. Extraction of ground water would also serve to control releases of ground water from the Site. A rate of approximately 2.5 gpm was assumed for cost estimation purposes.

*Off-site ground water recovery.* A ground water extraction system would consist of 12 wells installed to recover the off-site ground water plume. The wells would be installed to depths up to 50 ft below ground surface in order to contain and recover the existing off-site plume. Disposal of extracted ground water would be to the municipal sewer system. It is not anticipated that pre-treatment of recovered ground water would be required prior to disposal. A total rate of approximately 20 gpm was assumed for cost estimation purposes.

*Ground water monitoring.* Ground water monitoring would be implemented to track VOC concentrations in ground water both on- and off-site and would be instrumental in detecting any increases or decreases in concentrations. For cost estimation purposes, quarterly sampling of up to 30 wells was assumed.

*Vapor intrusion monitoring/mitigation.* Vapor intrusion conditions present within the off-site plume would be addressed consistent with NYSDOH guidance. As summarized in Appendix B, based on an evaluation of the RI results for sub-slab and indoor air samples, one mitigation system would be installed at one off-site commercial property (Former Speedy's Cleaners). Also as summarized in Appendix B, monitoring for vapor intrusion would occur on an as needed basis for up to 10 buildings. Additional monitoring would consist of sampling and analysis of indoor air and sub-slab vapor samples. For cost purposes, this monitoring was assumed to be conducted annually.

*Soil excavation.* Limited soil excavation would be included in this alternative. Excavation areas would remove, to the extent practicable, soil exhibiting concentrations greater than soil cleanup objectives. As described in Section 2.3, approximately 635 cubic yards of soil ranging to a depth of 15 ft below grade was estimated to exhibit concentrations in excess of soil cleanup objectives. The presence of utilities in the front of the building and the close proximity of buildings and the road to the areas requiring excavation are physical limitations to the extent of excavation that will be feasible. For purposes of the cost estimation, it was assumed that approximately 83 cubic yards of soil would be removed to the extent practicable adjacent to Brooklawn Drive.

# 3. Detailed Analysis of Alternatives

The following section documents the detailed evaluation of the alternatives developed for the Site. The objective of the detailed analysis of alternatives was to analyze and present sufficient information to allow the alternatives to be compared and a remedy selected. The analysis consisted of an individual assessment of each alternative with respect to nine evaluation criteria that encompass statutory requirements and overall feasibility and acceptability. The detailed evaluation of alternatives also included a comparative evaluation designed to consider the relative performance of the alternatives and identify major trade-offs among them. The nine evaluation criteria are:

- Overall protectiveness of human health and the environment
- Compliance with SCGs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- Support agency acceptance
- Community acceptance

The preamble to the NCP (Federal Register 1990) indicates that, during remedy selection, these nine criteria should be categorized into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The two threshold criteria, overall protection of human health and the environment, and compliance with SCGs, must be satisfied in order for an alternative to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implemetability; and cost are primary balancing criteria that are used to balance the trade-offs between alternatives. The modifying criteria are state and community acceptance, which are formally considered after public comment is received on the Proposed Remedial Action Plan. The New York State TAGM entitled *Selection of Remedial Actions at Inactive Hazardous Waste Sites*, (NYSDEC 1990) and NYSDEC's Department of Environmental Restoration (DER)-10 draft guidance entitled *Technical Guidance or Site Investigation and Remediation* (NYSDEC 2002) were also considered during this evaluation.

## 3.1. Individual Analysis of Alternatives

In the individual analysis of alternatives, each of the remedial alternatives was evaluated with respect to the evaluation criteria. A summary of the individual analysis of alternatives is presented in Table 5.

### 3.1.1. Overall Protection of Human Health and the Environment

The analysis of each alternative with respect to this criterion provides an evaluation of whether the alternative achieves and maintains adequate protection and a description of how site risks are eliminated, reduced, or controlled through treatment, engineering, or institutional controls. The individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

No current receptors are identified for ground water use. Environmental easements included in Alternative 1 would provide protection to human health related to potential exposures to soil and ground water.

Environmental easements included in Alternative 2 would provide protection to human health related to potential exposures to indoor air, soil and ground water. Protection of human health is also afforded by on-site ground water extraction and treatment. Soil excavation and treatment under Alternatives 2 and 3 also afford protection of human health related to soil exposures. Protection of human health related to indoor air exposures is also afforded by implementation of an indoor air mitigation system included in Alternative 2.

Environmental easements included in Alternative 3 would provide protection to human health related to potential exposures to indoor air, soil and ground water. On-site and off-site ground water extraction and treatment would also afford protection of human health. Soil excavation and treatment under Alternative 3 would afford protection of human health related to soil exposures. Protection of human health related to indoor air exposures is also afforded by implementation of an indoor air mitigation system included in Alternative 3.

Alternative 1 would rely on natural attenuation of ground water for protection of the environment.

Under Alternative 2, protection of the environment is provided through hydraulic control of on-site ground water. Alternative 2 would rely on natural attenuation for off-site protection of the environment. Protectiveness of off-site ground water under this alternative would be contingent on control of the off-site source (Speedy's Cleaners).

Under Alternative 3, protection of the environment would be provided through hydraulic control of on-site and off-site ground water. Protectiveness of off-site ground water under this alternative would be contingent on control of the off-site source (Speedy's Cleaners).

**3.1.2. Compliance with SCGs**

Potential SCGs for the Site are presented in Table 1 and the individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

As described in Section 2.5, attainment of NYS Class GA Ground Water Standards is technically impractical for on-site ground water. An SCG waiver may be appropriate for the Site.

Alternative 1 would rely on natural attenuation to achieve ground water SCGs. Alternative 1 would not be anticipated to achieve NYS Class GA Ground Water Standards in the foreseeable future. SCGs for soil and indoor air would not be achieved for Alternative 1.

Alternative 2 would rely on natural attenuation to achieve ground water SCGs in off-site ground water, in conjunction with hydraulic control of on-site ground water. Extraction and treatment of on-site ground water included in Alternative 2 is not anticipated to achieve NYS Class GA Ground Water Standards in the foreseeable future. SCGs for soil would be addressed through soil treatment and excavation. Indoor air SCGs would be achieved for affected off-site properties for Alternative 2.

Alternative 3 would rely on ground water extraction and treatment of on-site and off-site ground water. Extraction and treatment of on-site ground water included in Alternative 3 would not be anticipated to achieve NYS Class GA Ground Water Standards in the foreseeable future. SCGs for soil would be addressed through soil treatment and excavation. Indoor air SCGs would be achieved for affected off-site properties for Alternative 3.

No potential location specific SCGs were identified for the Site.

No action-specific SCGs were identified for Alternative 1.

For Alternative 2, off-site disposal of treatment residuals would be conducted in accordance with transportation and disposal requirements. Construction activities would be conducted in accordance with OSHA safety requirements. SVE system and ground water treatment system would be operated according to applicable air and water discharge regulations.

Under Alternative 3, off-site disposal of treatment residuals would be conducted in accordance with transportation and disposal requirements. Construction activities would be conducted in accordance with OSHA safety requirements. SVE system and ground water treatment system would be operated according to applicable air and water discharge regulations.

### 3.1.3. Long-Term Effectiveness and Permanence

This criterion assesses the magnitude of residual risk remaining from untreated material or treatment residuals at the Site. The adequacy and reliability of controls used to manage untreated material or treatment residuals are also evaluated. The individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

For Alternative 1 impacted ground water and soil would remain on-site and off-site. Residual risks would be adequately controlled through environmental easements. No control of risks due to indoor air off-site would be included in this alternative.

Under Alternative 2, treatment and excavation would result in a reduction of residual risks associated Site soil. Ground water extraction and treatment would result in a reduction of risks associated with Site ground water, though it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Natural attenuation of off-site ground water included in Alternative 2 would result in a reduction of risks associated with off-site ground water, though it is not anticipated that NYS Ground Water Standards would be achieved in the foreseeable future. Residual risks associated with soil and ground water are adequately and reliably controlled through environmental easements. Ground water monitoring included in Alternative 2 would be an adequate and reliable means of evaluating residual risks associated with this alternative. Indoor air mitigation and monitoring components of this alternative would be adequate and reliable means of reducing risks associated with off-site indoor air.

Under Alternative 3, treatment and excavation would result in a reduction of residual risks associated Site soil. Ground water extraction and treatment would result in a reduction of risks associated with on-site and off-site ground water, though it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Residual risks associated with soil and ground water would be adequately and reliably controlled through environmental easements. Ground water monitoring included in Alternative 3 would be an adequate and reliable means of evaluating residual risks associated with this alternative. Indoor air mitigation and monitoring components of this alternative would be adequate and reliable means of reducing risks associated with off-site indoor air.

### 3.1.4. Reduction of Toxicity, Mobility, or Volume though Treatment

The evaluation of this criterion addressed the expected performance of treatment technologies in each alternative. The individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

No active treatment technologies are included in Alternative 1. Alternative 1 would rely on natural attenuation to treat on-site and off-site ground water. Long term reduction of compounds in on-site off-site ground water is unknown, though it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Natural attenuation of ground water is considered to be an irreversible technology, however, continuing sources adversely impact effectiveness of this method of ground water treatment.

Alternative 2 would address soil through excavation and treatment using SVE. These methods are anticipated to address 625 cubic yards of soil identified to exhibit VOC concentrations above soil cleanup objectives. It is anticipated that approximately 1,314,000 gallons per year of ground water would be extracted and discharged to the sanitary sewer in Alternative 2. The off-site ground water plume would be addressed with natural attenuation. Long term reduction of compounds in on-site and off-site ground water is unknown, though it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Mobility of VOCs in on-site ground water would be controlled under Alternative 2 through hydraulic control of on-site ground water. SVE and excavation are considered to be irreversible treatment technologies. Ground water extraction and treatment are considered to be irreversible technologies, however, continuing sources adversely impact effectiveness of this method of ground water treatment.

Alternative 3 would address soil through excavation and treatment using SVE. These methods are anticipated to address 625 cubic yards of soil identified to exhibit VOC concentrations above soil cleanup objectives. It is anticipated that approximately 5,256,000 gallons per year of ground water would be extracted and discharged to the sanitary sewer in Alternative 3. Long term reduction of compounds in on-site and off-site ground water is unknown, though it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Mobility of VOCs in ground water would be controlled under Alternative 3 through hydraulic control of on-site and off-site ground water. SVE and excavation are considered to be irreversible treatment technologies. Ground water extraction and treatment are considered to be irreversible technologies, however, continuing sources adversely impact effectiveness of this method of ground water treatment.

### 3.1.5. Short-Term Effectiveness

The evaluation of short-term effectiveness addressed the protection of workers and the community during construction and implementation of each alternative, and potential environmental effects resulting from implementation of each alternative. The time required to achieve remedial objectives was also evaluated under this criterion. The individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

There would be no environmental impacts expected as a result of implementation of Alternative 1. With the exception of off-site indoor air, RAOs related to human health exposures would be met upon completion of Alternative 1 through institutional controls. Alternative 1 would rely on natural attenuation of ground water for protection of the environment. As discussed in Section 2.5, it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future. Soil and off-site indoor air SCGs are would not be addressed under this alternative.

Under Alternative 2, soil excavation, SVE, and ground water extraction and treatment systems would be designed and implemented such that construction activities and operation are protective to the community. Proper worker health and safety measures would be established and implemented during remedial activities. Alternative 2 would require the discharge of approximately 3,600 gallons per day of ground water to sanitary sewers. RAOs related to human health exposures would be met upon completion of Alternative 2 through institutional controls, soil excavation and treatment, and indoor air mitigation. Alternative 2 would rely on hydraulic control of on-site ground water and natural attenuation of off-site ground water for protection of the environment. As discussed in Section 2.5, it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future.

Under Alternative 3, soil excavation, SVE, ground water extraction and treatment systems would be designed and implemented such that construction activities and operation are protective to the community. Proper worker health and safety measures would be established and implemented during remedial activities. Alternative 3 would require the discharge of approximately 14,400 gallons per day of ground water to sanitary sewers. RAOs related to human health exposures would be met upon completion of Alternative 3 through institutional controls, soil excavation and treatment, and indoor air mitigation. Alternative 3 would rely on hydraulic control of on-site and off-site ground water for protection of the environment. As discussed in Section 2.5, it is not anticipated that NYS Class GA Ground Water Standards would be achieved in the foreseeable future.

### 3.1.6. Implementability

The analysis of implementability involved an assessment of the ability to construct and operate the technologies, the reliability of the technologies, the ease of undertaking additional remedial action, the ability to monitor the effectiveness of each remedy, and the ability to obtain necessary approvals from other agencies. Additionally, the availability of services, capacities, equipment, materials, and specialists necessary for implementation of the alternative was also assessed. The individual analysis of each remedial alternative with respect to this criterion is presented below and summarized in Table 5.

Institutional controls and ground water monitoring included in Alternative 1 are readily implementable and are reliable technologies. Additional remedial actions, if necessary, could be readily implementable. Ground water sampling and analysis included in this alternative is a reliable means to monitor on- and off-site ground water concentrations. Coordination with local authorities would be necessary to implement use and access restrictions included in this alternative.

Institutional controls and ground water monitoring included in Alternative 2 are readily implementable and reliable technologies. Excavation and SVE are readily implementable technologies. Ground water extraction and natural attenuation technologies are readily constructable and operable technologies. Indoor air mitigation systems are readily constructable and operable. Additional remedial actions, if necessary, could be readily implementable. Ground water and indoor air sampling and analysis included in this alternative are reliable means to monitor ground water and indoor air concentrations. Coordination with local authorities would be necessary to implement use and access restrictions included in this alternative. Coordination with local authorities would be necessary to implement discharge of extracted ground water included in Alternative 2. Coordination with property owners would be necessary to implement indoor air mitigation and monitoring included in this alternative.

Institutional controls and ground water monitoring included in Alternative 3 are readily implementable and reliable technologies. Excavation and SVE are readily implementable technologies. Ground water extraction and treatment technologies are readily constructable and operable technologies. Indoor air mitigation systems are readily constructable and operable. Additional remedial actions, if necessary, could be readily implementable. Ground water and indoor air sampling and analysis included in this alternative are reliable means to monitor ground water and indoor air concentrations. Coordination with local authorities would be necessary to implement use and access restrictions included in this alternative. Coordination with local authorities would be necessary to implement discharge of extracted ground water included in Alternative 3. Coordination with property owners would be necessary to implement indoor air mitigation and monitoring included in this alternative.

### 3.1.7. Cost

For the cost analysis, cost estimates were prepared for each alternative based on vendor information and quotations, cost estimating guides, and experience. Cost estimates were prepared for the purpose of alternative comparison and were based on information currently known about the study area. The cost estimates include capital costs, annual operation and maintenance costs, and present worth cost. The present worth cost for these alternatives was calculated for the expected duration of the remedy at a 3% discount rate.

The individual cost estimates for the remedial alternatives are included in Tables 6 through 8.

### 3.1.8. Support Agency Acceptance

Support agency acceptance would be addressed during development of the preferred alternative.

### 3.1.9. Community Acceptance

Community acceptance would be addressed during the preferred alternative public comment period prior to the ROD.

## 3.2. Comparative Analysis of Alternatives

In the comparative analysis of alternatives, the performance of each alternative relative to the others was evaluated for each criterion. As discussed in the following subsections, with the exception of Alternative 1, each alternative would satisfy the threshold criteria by providing protection to human health and the environment and by complying with the identified SCGs; therefore, each active alternative is eligible for selection as the final remedy. The primary balancing criteria (long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implemetability; and cost) were used for balance in the comparative evaluation of alternatives.

### 3.2.1. Overall Protection of Human Health and the Environment

With respect to protection of human health, each alternative would provide equal protectiveness from ground water and soil potential impacts through the adoption of institutional controls. Alternatives 2 and 3 would be more protective of human health than Alternative 1 for impacts due to soil vapor through institutional controls and vapor intrusion mitigation for affected off-site properties.

Alternative 3 would provide more protection of the environment with respect to VOC-contaminated ground water through treatment of on-site and off-site ground water than Alternatives 1 and 2. Alternative 2 would offer the next most protection to the environment through treatment of on-site ground water. Alternatives 1 and 2 both rely on natural attenuation for protection of the environment for off-site ground water. Control of source contamination afforded in Alternative 2 results in a better prognosis for natural attenuation than under Alternative 1, where no source control is provided.

It should be noted, that the protectiveness of the environment with respect to the off-site VOC-contaminated ground water is also contingent on the control of the off-site source (former Speedy's Cleaners at 2150 Monroe Avenue).

### 3.2.2. Compliance with SCGs

Table 1, summarizes chemical-specific SCGs that were identified for ground water, soil and indoor air. Attainment of ground water chemical-specific SCGs on-site is technically impracticable due to fractured bedrock on-site and the potential presence of DNAPL. Though SCGs for ground water would not be met, each alternative would address ground water SCGs through institutional controls. Additionally, Alternatives 2 and 3 address ground water SCGs through ground water hydraulic control.

Attainment of soil SCGs on-site would be anticipated following implementation of Alternatives 2 and 3. Alternative 1 would not meet soil SCGs. Similarly, attainment of indoor air SCGs would be anticipated following implementation of Alternatives 2 and 3. Alternative 1 would not meet off-site indoor air SCGs.

Action specific SCGs could be met for both Alternatives 2 and 3. No action specific SCGs were identified for Alternative 1. No location specific SCGs have been identified for any of the alternatives.

### 3.2.3. Long-Term Effectiveness and Permanence

Institutional controls and treatment technologies included in Alternatives 2 and 3 would provide for long term effectiveness and permanence through adequate and reliable controls of impacts from ground water, soil, and indoor air. It should be noted that adequacy and reliability of controls related to off-site ground water is contingent on ground water control of the off-site source (former Speedy's Cleaners at 2150 Monroe Avenue). Institutional controls would provide for adequate and reliable control of impacts from ground water and soil for Alternative 1. Alternative 1 does not provide control of indoor air impacts for off-site properties.

### 3.2.4. Reduction of Toxicity, Mobility, or Volume though Treatment

Excavation of soil and extraction of VOCs from soil by SVE included in Alternatives 2 and 3 would reduce toxicity and volume of contaminated Site soils. Excavation and SVE are considered to be irreversible.

Extraction of on-site ground water included in Alternatives 2 and 3 would reduce the mobility and volume of affected ground water at the Site. Treatment of ground water by natural attenuation, included in Alternatives 1 and 2, would reduce toxicity of compounds in off-site ground water. Natural attenuation is considered irreversible. Extraction of off-site ground water, included in Alternative 3, would provide a reduction of toxicity to human receptors and a reduction of mobility of the off-site plume.

Disposal of extracted ground water to the sanitary sewer system for treatment would reduce toxicity of ground water and would be irreversible.

### 3.2.5. Short-Term Effectiveness

Alternative 1 could be implemented immediately. Alternative 2 and 3 would require approximately 1 to 2 years to fully design and construct.

Site soil RAOs would be achieved at the completion of excavation and SVE included in Alternatives 2 and 3. Engineering controls would be implemented during construction of the alternatives that would be adequately protective of the community and the environment.

Attainment of NYS Class GA Ground Water Standards on-site is technically impracticable due to fractured bedrock on-site and the potential presence of DNAPL. Thus, it is not anticipated that Alternative 1, 2 or 3 would attain NYS Class GA Ground Water Standards in the foreseeable future. However, control of releases to off-site ground water would be achieved at the start-up of the on-site ground water extraction well, included in Alternatives 2 and 3. Off-site ground water remedies, included in Alternatives 2 and 3, would have limited short-term effectiveness while uncontrolled releases remain from off-site source (former Speedy's Cleaners at 2150 Monroe Avenue).

### 3.2.6. Implementability

Each alternative is implementable. The technologies being used are reliable technologies. Each alternative allows for additional remedial actions to be implemented if necessary, and is readily monitored for effectiveness of the remedy.

### 3.2.7. Cost

Detailed cost estimates for Alternatives 1 through 3 are included as Tables 6, through 8.

Alternative 1, the no further action alternative, is the least cost alternative with an estimated present worth value of approximately $980,000. This cost is due primarily to ongoing ground water monitoring.

Alternative 2, the presumptive remedy with monitored natural attenuation alternative, is the second least cost alternative with an estimated present worth of approximately $3,700,000.

Alternative 3, the presumptive remedy with off-site ground water extraction alternative, is the most expensive alternative with an estimated present worth of approximately $4,610,000.

### 3.2.8. Support Agency Acceptance

Support agency acceptance will be addressed during development of the preferred alternative.

### 3.2.9. Community Acceptance

Community acceptance will be addressed during the preferred alternative public comment period prior to the ROD.

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**Table 1.** *Evaluation of Potential SCGs*

| Medium/Location/ Action | Citation | Requirements | Comments | PotentialSCG | Alternative |
|---|---|---|---|---|---|
| **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 | 1, 2, 3 |
| Indoor Air | NYSDOH - Guidance for Evaluating Soil Vapor Intrusion. | Guidance that provides action levels for mitigation of indoor air influences | Potentially applicable for on-site residential and off-site buildings. | Yes | 1, 2, 3 |
| Soil | NYSDEC 6 NYCRR Part 375-2 Inactive Hazardous Waste Disposal Site Remedial Program | Regulation that provides guidance for soil cleanup objectives for various property uses. | Potentially applicable to site soil. | Yes | 1, 2, 3 |
| | NYSDEC TAGM HWR-94-4046 - Recommended soil cleanup objectives | Guidance that provides recommended soil cleanup objectives. | Not selected, but potentially applicable to site soil. NYSDEC has determined that TAGM SCOs, though more stringent for certain constituents than Part 375 SCOs, "will not be substantially more protective of human health and the environment". (NYSDEC. *Development of Soil Cleanup Objectives, Technical Support Document*. 2006) | No | None |
| **Potential location-specific SCGs** | | | | | |
| Wetlands | 6 NYCRR 663 - Freshwater wetland permit requirements | Actions occurring in a designated freshwater wetland (within 100 ft) must be approved by NYSDEC or 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. | Not applicable or relevant and appropriate. No wetlands located at Site. | No | None |
| | 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 minimize potential harm to wetlands when there are no practicable alternatives. | Not applicable or relevant and appropriate. No wetlands located at Site. | No | None |
| 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. Site is not located in the 100-year floodplain. | No | None |
| | 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 floodplains. 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. Site is not located in the 100-year floodplain. | No | None |
| 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 | None |
| River or stream | 16 USC 661 - Fish and Wildlife Coordination Act | Requires protection of fish and wildlife in a stream when performing activities that modify a stream or river. | Not applicable or relevant and appropriate. No rivers or streams located at Site. | No | None |
| Habitat of an endangered or threatened species | 6 NYCRR 182 | Provides requirements to minimize damage to habitat of an endangered species. | Not applicable or relevant and appropriate. No habitat of endangered species identified at the Site. | No | None |

**Table 1.** *Evaluation of Potential SCGs*

| Medium/Location/ Action | Citation | Requirements | Comments | PotentialSCG | Alternative |
|---|---|---|---|---|---|
| **Potential location-specific SCGs (cont.)** | | | | | |
| 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 or relevant and appropriate. No endangered species identified at the Site. | No | None |
| 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 | No | None |
| **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 | None |
| 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 | 2,3 |
| | 29 CFR Part 1926 - Safety and Health Regulations for Construction | Remedial construction activities must be in accordance with applicable OSHA requirements. | Applicable for construction phase of remediation. | Yes | 2,3 |
| Transportation | 6 NYCRR 364 - Waste Transporter Permits | Hazardous waste transport must be conducted by a hauler permitted under 6 NYCRR 364. | Not applicable. No hazardous waste anticipated to be produced. | No | None |
| | 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. No hazardous waste anticipated to be produced. | No | None |
| | 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. No hazardous waste anticipated to be produced. | No | None |
| Generation of air emissions | NYS Air Guide 1 | Provides annual guideline concentrations (AGLs) and short-term guideline concentrations (SGCs) for specific chemicals. These are property boundary limitations that would result in no adverse health effects. | Potentially applicable. | Yes | 2,3 |
| | NYS TAGM 4031 - Dust Suppressing and Particle Monitoring at Inactive Hazardous Waste Disposal Sites | Provides limitations on dust emissions. | Not applicable. No dust emissions anticipated during construction or operation. | No | None |
| 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 a 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.<br>If the project is covered under the general permit, the following are required: development and implementation of a storm water pollution prevention plan; 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 | None |

**Table 2.** *Screening of Remedial Technologies and Process Options*

| General Response Action | Remedial Technology | Process Option | Description | Screening Comments |
|---|---|---|---|---|
| **Air/Vapor** | | | | |
| Institutional Actions | Monitoring | Air/vapor monitoring | Periodic sampling for indoor and sub-slab air/vapor. | Potentially applicable. |
| | Use restrictions | Deed restrictions | Restrictions to building uses and site activities that result in unprotected, unacceptable exposures to contaminated vapors.<br><br>Requirements that mitigation systems be operated and monitored to maintain protectiveness from unacceptable exposures to contaminated vapors. | Potentially applicable. |
| Control Actions | Vapor control | Pumping/ventilation | Removal of subsurface soil vapors beneath the building slab to prevent intrusion of vapors to the building. | Potentially applicable. |
| *Ex Situ* Treatment Actions | Physical | Carbon adsorption | Adsorption of organic constituents from vapor phase to activated carbon. | Potentially applicable. Not likely required for small vapor control systems. |
| | | Thermal oxidation | Destruction of organic constituents in a vapor phase by heating. | Potentially applicable. Not likely required for small vapor control systems. |
| | | Catalytic oxidation | Destruction of organic constituents in a vapor phase by a combination heating and oxidation by solid media. | Potentially applicable. Not likely required for small vapor control systems. |
| **Soil** | | | | |
| Institutional Actions | Use restrictions | Deed restrictions | Restrictions on building uses and site activities that result in unprotected, unacceptable exposures to contaminated soils and soil vapor.<br><br>Requirements that mitigation systems be operated and monitored to maintain protectiveness from unacceptable exposures intruding soil vapors. | Potentially applicable. |

**Table 2.** *Screening of Remedial Technologies and Process Options*

| General Response Action | Remedial Technology | Process Option | Description | Screening Comments |
|---|---|---|---|---|
| Presumptive Remedy | Soil Vapor Extraction (SVE) | Air stripping of VOCs from soil media by vapor extraction wells. | Potentially applicable for source area. | Potentially applicable. Identified by USEPA as “preferred presumptive remedy”. |
| | Multi-phase Extraction (source area) | SVE occurs while ground water is simultaneously recovered. | Potentially applicable for source area. | Extraction of shallow ground water is not feasible due to limited saturated thickness of overburden shallow ground water. |
| Removal Actions | Excavation | Excavation | Use of construction equipment, such as backhoes, bulldozers, clamshells, draglines, or conveyors to remove site soils. | Identified as a “conventional remedial method” by NYSDEC. Excavation of site soils is limited in feasibility due to site constraints (building locations, depth of contaminated soils, adjacent buried utilities). |
| **Ground Water** | | | | |
| Institutional Actions | Monitoring | ground water monitoring | Periodic sampling and analysis of ground water. | Potentially applicable. |
| Institutional Actions | Use restrictions | Deed restrictions | Restriction of ground water use at the site, and off-site where ground water exceeds Class GA standards. | Potentially applicable. |
| Containment Actions | Vertical barrier | Slurry wall | Soil- or cement-bentonite slurry wall placed around the area of contamination to contain ground water. | Not feasible due to presence of fractured bedrock (no confining layer). |
| | | Sheet piles | Sheet piles installed around the area of contamination to contain ground water. | Not feasible due to presence of fractured bedrock (no confining layer). |
| Collection Actions | Ground water extraction | Recovery wells | Removal of ground water by pumping from recovery wells for hydraulic containment or mass removal. | Potentially applicable. |
| | Ground water extraction | Recovery trench | Removal of ground water by pumping from recovery trenches for hydraulic containment or mass removal. | Potentially applicable |

**Table 2.** *Screening of Remedial Technologies and Process Options*

| General Response Action | Remedial Technology | Process Option | Description | Screening Comments |
|---|---|---|---|---|
| *In Situ* Treatment Actions | Physical | Air sparging | Injection of air into the saturated zone to volatilize constituents, which are collected in the unsaturated zone by an SVE system. | Not feasible due to presence of contaminated ground water in fractured bedrock. |
| *In Situ* Treatment Actions | Natural attenuation | Intrinsic bioremediation | Biological degradation of organic constituents by indigenous microbes. | Potentially applicable. |
| *In Situ* Treatment Actions | Biological | Bioremediation | Injection of oxygen and nutrient sources to the aquifer to enhance biological degradation of organic constituents by indigenous microbes. | Not feasible due to presence of contaminated ground water in fractured bedrock. |
| | Chemical | Treatment wall | Construction of an iron wall, biobarrier, or carbon wall to treat ground water as it flows through the treatment zone. | Not feasible due to presence of contaminated ground water in fractured bedrock. |
| *Ex Situ* Treatment Actions | Physical | Air stripping | Contact of air with water in countercurrent column or bulk reactor to transfer VOCs from water to air. | Potentially applicable. |
| | | Carbon adsorption | Adsorption of organic constituents from water to activated carbon. | Potentially applicable. |
| | | Adsorptive resin | Adsorption of organic constituents from water to commercial adsorptive resin. | Potentially applicable. |
| | | Settling | Retention of aqueous stream in tank to settle/separate light or heavy components. | Not applicable for dissolved VOC constituents. |
| *Ex Situ* Treatment Actions | | Filtration | Separation of solids from water phase using semipermeable filter medium. | Not applicable for dissolved VOC constituents. |
| | Chemical | Chemical oxidation | Addition of oxidation agents such as hydrogen peroxide and ultraviolet light to water to oxidize/destroy organic contaminants. | Potentially applicable. |

**Table 2.** *Screening of Remedial Technologies and Process Options*

| General Response Action | Remedial Technology | Process Option | Description | Screening Comments |
|---|---|---|---|---|
| | Chemical | Precipitation | pH adjustment of ground water to separate out dissolved metal contaminants. | Not applicable for dissolved VOC constituents. |
| | | Ion exchange | Chemical alternation of a hazardous to a non-hazardous constituent. | Not applicable for dissolved VOC constituents. |
| | Biological | Biological reactor | Addition of oxygen, nutrients, and cometabolites to ground water in reactor to enhance co-metabolic degradation of organic constituents. | Potentially applicable. RI results have shown that breakdown products of PCE exist in the off-site plume suggesting that natural attenuation is occurring. |
| Discharge Actions | Treated water discharge | Discharge to surface water | Discharge of extracted ground water to surface water features such as streams, ponds, culverts, *etc.* | Not applicable as surface water features are not located within a suitable distance. |
| | | Discharge to POTW | Discharge of extracted ground water to sanitary or storm sewers. | Potentially applicable. |

**Table 3.** ***Evaluation of Process Options***

| General Response Action | Remedial Technology | Process Option | Effectiveness | Implementability | Costs |
|---|---|---|---|---|---|
| **Air/Vapor** | | | | | |
| Institutional Actions | Monitoring | Air/vapor monitoring* | Effective method for monitoring changes in VOC concentrations in air over time. Useful for evaluating remedy effectiveness. | Readily implementable. | Low capital<br>Low O&M |
| | Use restrictions | Deed restrictions* | Effectively control exposure to VOCs in indoor air by restricting use of affected buildings. | Readily implementable. | Low capital.<br>No O&M |
| Control Actions | Vapor control | Pumping/ventilation* | Effective for control of vapor intrusion to indoor air. | Readily implementable. | Low capital<br>Low O&M |
| **Soil** | | | | | |
| Institutional Actions | Use restrictions | Deed restrictions* | Effectively minimizes access to the site. | Readily implementable. | Low capital<br>No O&M |
| Presumptive Remedy | Soil Vapor Extraction (SVE) | Air stripping of VOCs from soil media by vapor extraction wells* | Effective for removal of VOCs from unsaturated soils. | Readily implementable. | Low capital<br>Medium O&M |
| Removal Actions | Excavation | Excavation* | Effective for removal of contaminated soils. | Implementability limited by presence of building foundations and underground utilities. | Low capital<br>No O&M |
| **Ground Water** | | | | | |
| Institutional Actions | Monitoring | Ground water monitoring* | Effective method for monitoring changes in VOCs. Useful for evaluating remedy effectiveness. | Readily implementable. | Low capital<br>Low O&M |
| Institutional Actions | Use restrictions | Deed restrictions* | Effectively minimizes potable water use of ground water. | Readily implementable. | Low capital<br>No O&M |
| Collection Actions | Ground water extraction | Recovery wells* | Effectively removes contaminated ground water. | Readily implementable. | Low capital<br>Medium O&M |
| | Ground water extraction | Recovery trench | Effectively removes contaminated ground water. | Difficult to implement due to underground utilities and fractured bedrock. | Low capital<br>Medium O&M |

**Table 3.** ***Evaluation of Process Options***

| General Response Action | Remedial Technology | Process Option | Effectiveness | Implementability | Costs |
|---|---|---|---|---|---|
| **Ground Water (cont.)** | | | | | |
| *In Situ* Treatment Actions | Natural attenuation | Intrinsic bioremediation* | Likely effective for destruction of chlorinated VOCs in saturated zone. Treatability study would be necessary. | Readily implementable. | Low capital<br>No O&M |
| *Ex Situ* Treatment Actions | Physical | Air stripping | Effective for removal of chlorinated VOCs | Readily implementable. | Medium capital<br>Medium O&M |
| | | Carbon adsorption | Effective for removal of chlorinated VOCs. | Readily implementable. | Low capital<br>High O&M |
| | | Adsorptive resin | Effective for removal of chlorinated VOCs. | Readily implementable. | Medium capital<br>Medium O&M |
| | Chemical | Chemical oxidation | Effective for removal of chlorinated VOCs. | Readily implementable. | Medium capital<br>Medium O&M |
| | Biological | Biological reactor | Effective for removal of chlorinated VOCs. | Readily implementable. | Medium capital<br>Medium O&M |
| Discharge Actions | Treated water discharge | Discharge to POTW* | Effective for disposal of extracted water. | Readily implementable. | Low capital<br>Medium O&M |

*Denotes representative process option.

**Table 4.** *Components of Remedial Alternatives*

| General Response Actions | Remedial Technology - Process Option | Alternative 1 | Alternative 2 | Alternative 3 |
|---|---|---|---|---|
| Institutional Actions | Access/Use Restrictions | | x | x |
| | Ground Water Monitoring | x | x | x |
| | Air Monitoring | x | x | x |
| | Five-Year Reviews | x | x | x |
| Removal Actions | Ground Water Extraction (Site Ground Water) | | x | |
| | Ground Water Extraction (Off-Site Ground Water) | | | x |
| | Soil Vapor Extraction | | x | x |
| | Excavation | | x | x |
| Treatment Actions | Monitored Natural Attenuation | | x | |
| Disposal Actions | Discharge of Treated Ground Water to Municipal Sewer System | | x | x |

Alternative 1: No further action
Alternative 2: On-site presumptive remedy with off-site monitored natural attenuation
Alternative 3: On-site presumptive remedy with off-site monitored extraction of ground water

**Table 5.** *Detailed Analysis of Alternatives*

| Criterion | Alternative 1: No Further Action | Alternative 2: SVE/On-site GW Extraction/MNA | Alternative 3: SVE/On-site and Off-site GW Extraction |
|---|---|---|---|
| | ◆ **Access/Use restrictions**<br>◆ **Five year reviews** | ◆ **Ground water extraction (on-site)**<br>◆ **Sewer discharge**<br>◆ **Soil vapor extraction (on-site)**<br>◆ **Soil excavation (on-site)**<br>◆ **Monitored Natural Attenuation (off-site)**<br>◆ **Indoor air mitigation (off-site)**<br>◆ **Ground water and air monitoring**<br>◆ **Access/Use restrictions**<br>◆ **Five year reviews** | ◆ **Ground water extraction (on-site)**<br>◆ **Sewer discharge**<br>◆ **Soil vapor extraction (on-site)**<br>◆ **Soil excavation (on-site)**<br>◆ **Groundwater extraction (off-site)**<br>◆ **Indoor air mitigation (off-site)**<br>◆ **Ground water and air monitoring**<br>◆ **Access/Use restrictions**<br>◆ **Five year reviews** |
| **Overall Protection of Human Health and the Environment** | | | |
| Overall Protection of human Health | No current receptors are identified for ground water use. Deed restrictions provide a means of preventing potential unprotected contact with soil and ground water during future construction activities. | No receptors are identified for ground water use. Ground water control would address existing impacts to ground water at the Site. Use restrictions would outline adequate protection requirements for potential contact with soil and ground water during construction activities. Use restrictions would preclude potential future use of on-site and off-site ground water. Protection is also afforded by deed restrictions requiring monitoring and operation of mitigation systems. | No receptors are identified for ground water use. Ground water control would address existing impacts to ground water at the Site. Ground water extraction and treatment of off-site ground water would address existing impact to off-site ground water. Use restrictions would outline adequate protection requirements for potential contact with soil and ground water during construction activities. Use restrictions would preclude potential future use of on-site and off-site ground water. Protection is also afforded by deed restrictions requiring monitoring and operation of mitigation systems. |
| Overall Protection of the Environment | Relies on natural attenuation for protection of the environment. | Protection of the environment is provided through extraction of the Site ground water. Relies on natural attenuation for protection of the environment offsite. Protectiveness of off-site ground water is contingent on control of the off-site source (Speedy's Cleaners). | Protection of the environment is provided through extraction of both Site and off-site ground water. Protectiveness of off-site ground water is contingent on control of the off-site source (Speedy's Cleaners). |
| **Compliance with Standards, Criteria, and Guidance (SCGs)** | | | |
| Compliance with Chemical-Specific SCGs | Relies on natural attenuation to achieve ground water SCGs for VOCs. Attainment of NYS Class GA ground water standard is technically impractical for on-site ground water. SCG waiver may be necessary. SCGs for soil and indoor air would not be achieved for this alternative. | Relies on natural attenuation to achieve ground water SCGs for VOCs in off-site ground water. Attainment of off-site ground water SCGs is contingent on control of the off-site source (Speedy's Cleaners). Attainment of NYS Class GA ground water standard is technically impractical for on-site ground water. SCG waiver may be necessary. SCGs for soil would be achieved through treament of soil. Indoor air SCGs would be achieved for affected off-site properties. | Relies on extraction of ground water to achieve ground water SCGs for VOCs in off-site ground water. Attainment of off-site ground water SCGs is contingent on control of the off-site source (Speedy's Cleaners). Attainment of NYS Class GA ground water standard is technically impractical for on-site ground water. SCG waiver may be necessary. SCGs for soil would be achieved through treament of soil. Indoor air SCGs would be achieved for affected off-site properties. |
| Compliance with Location-Specific SCGs | No potential location specific SCGs were identified. | No potential location specific SCGs were identified. | No potential location specific SCGs were identified. |
| Compliance with Action-Specific SCGs | No actions are part of this alternative. | Offsite disposal of treatment residuals would be conducted in accordance with transportation and disposal requirements. Construction activities would be conducted in accordance with OSHA safety requirements. SVE system and ground water treatment system would be operated according to applicable air and water discharge regulations. | Offsite disposal of treatment residuals would be conducted in accordance with transportation and disposal requirements. Construction activities would be conducted in accordance with OSHA safety requirements. SVE system and ground water treatment system would be operated according to applicable air and water discharge regulations. |

**Table 5.** *Detailed Analysis of Alternatives*

| Criterion | Alternative 1: No Further Action | Alternative 2: SVE/On-site GW Extraction/MNA | Alternative 3: SVE/On-site and Off-site GW Extraction |
|---|---|---|---|
| | **• Access/Use restrictions<br>• Five year reviews** | **• Ground water extraction (on-site)<br>• Sewer discharge<br>• Soil vapor extraction (on-site)<br>• Soil excavation (on-site)<br>• Monitored Natural Attenuation (off-site)<br>• Indoor air mitigation (off-site)<br>• Ground water and air monitoring<br>• Access/Use restrictions** | **• Ground water extraction (on-site)<br>• Sewer discharge<br>• Soil vapor extraction (on-site)<br>• Soil excavation (on-site)<br>• Groundwater extraction (off-site)<br>• Indoor air mitigation (off-site)<br>• Ground water and air monitoring<br>• Access/Use restrictions** |
| **Long-Term Effectiveness and Permanence** | | | |
| Magnitude of Residual Risk | Impacted media would remain on-site and offsite. No control of risks due to indoor air off-site is included in this alternative. | Reduction in source mass would reduce quantity of impacted media on-site. Minimal potential residual risk of exposure would remain for on-site or off-site ground water through use controls. Vapor intrusion mitigation would minimize the impacts due to VOCs in indoor air at affected off-site properties. | Reduction in source mass would reduce quantiy of impacted media on-site. Minimal potential residual risk of exposure would remain for on-site or off-site ground water through use controls. Vapor intrusion mitigation would minimize the impacts due to VOCs in indoor air at affected off-site properties. |
| Adequacy and Reliability of Controls | Ground water monitoring is an adequate and reliable method for detecting increasing concentrations in ground water. Use restrictions are adequate and reliable controls for exposure to on-site soil and on-site or off-site ground water. No control of risks due to indoor air off-site is included in this alternative. | Removal of source material onsite would provide adequate and reliable control of exposures at the Site. Use restrictions are adequate and reliable controls for exposure to on site soil and onsite or offsite ground water. Vapor intrusion mitigation would provide adequate control of impacts due to VOCs in indoor air at affected off-site properties. | Removal of source material onsite would provide adequate and reliable control of exposures at the Site. Removal of off-site material would provide adequate and reliable control of exposures off-site. Use restrictions are adequate and reliable controls for exposure to on site soil and onsite or offsite ground water. Vapor intrusion mitigation would provide adequate control of impacts due to VOCs in indoor air at affected off-site properties. |
| **Reduction of Toxicity, Mobility, or Volume through Treatment** | | | |
| Treatment Process Used and Materials Treated | No active treatment processes are used in this alternative. Natural attenuation will be used for ground water. | SVE and ground water extraction and treatment address removal of VOCs from soil and ground water. No active treatment processes are used for offsite ground water in this alternative. Natural attenuation will be used for off-site ground water. | SVE and ground water extraction and treatment address removal of VOCs from soil and ground water. Ground water extraction will be used for off-site ground water. |
| Amount of Hazardous Material Destroyed or Treated | No active treatment processes or removal are used in this alternative. Natural attenuation will be used for ground water. | Approximately 500 cubic yards of soil will be treated. Approximately 83 cubic yards of soil would be excavated. Approximately 1,314,000 gallons per year of ground water will be extracted. | Approximately 500 cubic yards of soil will be treated. Approximately 83 cubic yards of soil would be excavated. Approximately 5,256,000 gallons per year of ground water will be treated. |
| Degree of Expected Reduction in Toxicity, Mobility, or Volume | No active treatment processes or removal are used in this alternative. Natural attenuation would proved provide some degree of reduction in concentration of organic compounds in ground water. Long term reduction of compounds is not known. | Natural attenuation would provide some degree of reduction in concentration of organic compounds in offsite ground water. Long term reduction of compounds is not known. | Ground water extraction would provide some degree of reduction in concentration of organic compounds in offsite ground water. Long term reduction of compounds is not known. |
| Degree to Which Treatment is Irreversible | Natural attenuation of ground water is irreversible. | SVE is irreversible. Extraction of ground water is reversible by reinjection. | SVE is irreversible. Extraction of ground water is reversible by reinjection. |
| Type and Quantity of Residuals Remaining After Treatment | No active treatment processes or removal are used in this alternative. | Minimal quantities of residuals would remain after treatment. | Minimal quantities of residuals would remain after treatment. |

**Table 5.** *Detailed Analysis of Alternatives*

| Criterion | Alternative 1: No Further Action | Alternative 2: SVE/On-site GW Extraction/MNA | Alternative 3: SVE/On-site and Off-site GW Extraction |
|---|---|---|---|
| | **• Access/Use restrictions<br>• Five year reviews** | **• Ground water extraction (on-site)<br>• Sewer discharge<br>• Soil vapor extraction (on-site)<br>• Soil excavation (on-site)<br>• Monitored Natural Attenuation (off-site)<br>• Indoor air mitigation (off-site)<br>• Ground water and air monitoring<br>• Access/Use restrictions** | **• Ground water extraction (on-site)<br>• Sewer discharge<br>• Soil vapor extraction (on-site)<br>• Soil excavation (on-site)<br>• Groundwater extraction (off-site)<br>• Indoor air mitigation (off-site)<br>• Ground water and air monitoring<br>• Access/Use restrictions** |
| | | **Short-term effectiveness** | |
| Protection of Community During Remedial Actions | No remedial actions are considered under this alternative. | The SVE and ground water treatment systems would be designed such that emissions will be protective of the community. | The SVE and ground water treatment systems would be designed such that emissions will be protective of the community. |
| Protection of Workers During Remedial Actions | No remedial actions are considered under this alternative. | Proper health and safety measures will be established and implemented during remedial activities. | Proper health and safety measures will be established and implemented during remedial activities. |
| Environmental Impacts | There are no environmental impacts expected as a result of implementation of this alternative. | This action will require the discharge of approximately 2.5 gallons per day of treated ground water to sanitary sewers. | This action will require the discharge of approximately 10 gallons per day of treated ground water to sanitary sewers. |
| Time until Remedial Action Objectives (RAOs) are Achieved | RAOs related to human health and to ecological receptors will not be met upon completion of the remedy. Natural attenuation under this alternative is not anticipated to achieve NYS Class GA standards in ground water in the foreseeable future, due to the presence of a continuing source of VOCs. | RAOs associated with direct contact of Site soil would be met upon completion of SVE. NYS Class GA standards would not be attainable in ground water in the foreseeable future, due to the presence of a continuing off-site source of VOCs. | RAOs associated with direct contact of Site soil would be met upon completion of SVE. NYS Class GA standards would not be attainable in ground water in the foreseeable future, due to the presence of a continuing off-site source of VOCs. |
| | | **Implementability** | |
| Ability to Construct and Operate the Technology | There are no technologies to be constructed in this alternative. | An SVE system is readily constructable. Installation and operation of ground water recovery wells is readily constructable and operable. | An SVE system is readily constructable. Installation and operation of ground water recovery wells is readily constructable and operable. |
| Reliability of Technology | Ground water sampling and analysis is a reliable means to continue to monitor on- and off-site ground water concentrations. | SVE is a reliable technology. Air stripping is a reliable technology to remove VOCs in ground water. | SVE is a reliable technology. Air stripping is a reliable technology to remove VOCs in ground water. |
| Ease of Undertaking Additional Remedial Actions, if necessary | Additional remedial actions, if necessary, would be readily implementable. | Additional remedial actions, if necessary, would be readily implementable. | Additional remedial actions, if necessary, would be readily implementable. |
| Ability to monitor effectiveness of remedy | No monitoring is part of this alternative. | Effectiveness of remedy could be monitored through ground water monitoring. | Effectiveness of remedy could be monitored through ground water monitoring. |
| Coordination with other Agencies and Property Wwners | None required. | Coordination with local authorities would be necessary to implement use and access restrictions. Coordination with local authorities would be necessary to implement discharge of extracted ground water. | Coordination with local authorities would be necessary to implement use and access restrictions. Coordination with local authorities would be necessary to implement discharge of extracted ground water. |
| Availability of Off-Site Treatment Storage and Disposal Services and Capacities | None required. | Offsite disposal facilities for treatment residuals are readily available. | Offsite disposal facilities for treatment residuals are readily available. |
| Availability of necessary equipment, specialists, and materials | Readily available. | Readily available. | Readily available. |

**Table 5.** *Detailed Analysis of Alternatives*

| Criterion | Alternative 1:<br>No Further Action | Alternative 2:<br>SVE/On-site GW Extraction/MNA | Alternative 3:<br>SVE/On-site and Off-site GW Extraction |
|---|---|---|---|
| | ♦ Access/Use restrictions<br>♦ Five year reviews | ♦ Ground water extraction (on-site)<br>♦ Sewer discharge<br>♦ Soil vapor extraction (on-site)<br>♦ Soil excavation (on-site)<br>♦ Monitored Natural Attenuation (off-site)<br>♦ Indoor air mitigation (off-site)<br>♦ Ground water and air monitoring<br>♦ Access/Use restrictions | ♦ Ground water extraction (on-site)<br>♦ Sewer discharge<br>♦ Soil vapor extraction (on-site)<br>♦ Soil excavation (on-site)<br>♦ Groundwater extraction (off-site)<br>♦ Indoor air mitigation (off-site)<br>♦ Ground water and air monitoring<br>♦ Access/Use restrictions |
| **Costs** | | | |
| Capital cost | $180,000 | $1,080,000 | $1,960,000 |
| Present Worth of Operation and Maintenance Cost | $800,000 | $2,620,000 | $2,650,000 |
| Approximate Total Net Present Worth Cost | $980,000 | $3,700,000 | $4,610,000 |

**Table 6**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #1 - No Further Action**

**COST ESTIMATE SUMMARY**

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #1 consists of ground water use and building/property use restrictions via the implementation of environmental easements, and ground water and air monitoring.

| TEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | | NOTES |
|---|---|---|---|---|---|---|
| **Direct Capital Costs** | | | | | | |
| 1) Environmental easement | | | | | | |
| Ground water use restrictions | LS | 1 | $15,000 | $15,000 | | |
| Building/property use restrictions | LS | 1 | $3,500 | $3,500 | | |
| Site information database | LS | 1 | $25,000 | $25,000 | | |
| | | | | **SUBTOTAL:** | **$43,500** | |
| 2) Site management plan | LS | 1 | $20,000 | $20,000 | | |
| | | | | **SUBTOTAL:** | **$20,000** | |
| 3) Baseline monitoring | | | | | | |
| Vapor monitoring | EA | 8 | $4,000 | $32,000 | | |
| Ground water monitoring | EA | 1 | $25,000 | $25,000 | | |
| | | | | **SUBTOTAL:** | **$57,000** | |
| | | | | **TOTAL DIRECT CAPITAL COST:** | **$120,500** | |
| **Indirect Capital Costs** | | | | | | |
| 1) Contingency (30% of Direct Capital Costs) | | 1 | $36,150 | $36,150 | | |
| | | | | **SUBTOTAL:** | **$36,150** | |
| 2) Engineering (15% of Direct Capital Costs) | | 1 | $18,075 | $18,075 | | |
| | | | | **SUBTOTAL:** | **$18,075** | |
| 3) Legal Fees ( 5% of Direct Capital Costs) | | 1 | $6,025 | $6,025 | | |
| | | | | **SUBTOTAL:** | **$6,025** | |
| | | | | **TOTAL INDIRECT CAPITAL COSTS (rounded):** | **$60,000** | |
| | | | | **TOTAL CAPITAL COSTS (rounded):** | **$180,000** | |

**Table 6**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #1 - No Further Action**

O'BRIEN & GERE

**COST ESTIMATE SUMMARY**

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #1 consists of ground water use and building/property use restrictions via the implementation of environmental easements, and ground water and air monitoring.

| TEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | NOTES |
|---|---|---|---|---|---|
| **Operation & Maintenance Costs** | | | | | |
| 1) Periodic Review | LS | 1 | $10,000 | $10,000 | Assumes reviews are conducted every 5 years. |
| 2) Ground Water Monitoring, Years 1 to 2 - Quarterly VOCs Only | EA | 4 | $25,000 | $100,000 | Assumes quarterly sampling at 30 existing wells. |
| 3) Ground Water Monitoring, Years 3 to 4 - Semi annual VOCs Only | EA | 2 | $25,000 | $50,000 | Assumes semi-annual sampling at 30 existing wells. |
| 4) Ground Water Monitoring, Years 5 to 30 - Annual VOCs Only | EA | 1 | $25,000 | $25,000 | Assumes annual sampling at 30 existing wells. |
| 5) Ground Water Monitoring Well Maintenance, Years 1 to 5 | LS | 1 | $500 | $500 | |
| 6) Ground Water Monitoring Well Maintenance, Years 6 to 30 | LS | 1 | $2,000 | $2,000 | |
| 7) Ground Water Monitoring Well Abandonment | EA | 30 | $350 | $10,500 | |
| 8) Insurance (1% Direct Capital Cost) | LS | 1 | $1,205 | $1,205 | |
| 9) Reserve Fund (1% Direct Capital Cost) | LS | 1 | $1,205 | $1,205 | |

**PRESENT WORTH OF O&M COSTS (rounded):** **$800,000** Assumes discount rate of 3%.

**APPROXIMATE TOTAL PRESENT WORTH COST (rounded):** **$980,000**

**Table 7**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #2 - Presumptive Remedy and Off-site MNA**

O'BRIEN & GERE

**COST ESTIMATE SUMMARY**

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #2 consists of on-site SVE and ground water extraction with off-site ground water MNA.

| ITEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | | NOTES |
|---|---|---|---|---|---|---|
| **Direct Capital Costs** | | | | | | |
| 1) Environmental Easement | | | | | | |
| Ground water use restrictions | LS | 1 | $15,000 | $15,000 | | |
| Building/property use restrictions | LS | 102 | $3,500 | $357,000 | | |
| Site information database | LS | 1 | $25,000 | $25,000 | | |
| | | | | **SUBTOTAL:** | **$397,000** | |
| 2) Site management plan | LS | 1 | $20,000 | $20,000 | | |
| | | | | **SUBTOTAL:** | **$20,000** | |
| 3) Baseline monitoring | | | | | | |
| Ground water monitoring | EA | 1 | $33,000 | $33,000 | | |
| | | | | **SUBTOTAL:** | **$33,000** | |
| 4) Vapor intrusion baseline investigation/VI mitigation | | | | | | |
| Vapor monitoring | EA | 8 | $4,000 | $32,000 | | |
| Vapor mitigation | EA | 2 | $10,000 | $20,000 | | |
| | | | | **SUBTOTAL:** | **$52,000** | |
| 5) Ground water extraction | | | | | | |
| Pump test | LS | 1 | $25,000 | $25,000 | | |
| Permitting, sampling | LS | 1 | $8,600 | $8,600 | | |
| Extraction wells | EA | 1 | $15,000 | $15,000 | | One 6-inch - 30 ft deep well pumping @ 2.5 GPM. Includes mob. |
| Municipal Groundwater Discharge (1 yr discharge) | LS | 1 | $1,600 | $1,600 | | |
| Piping, utilities, equipment | LS | 1 | $17,500 | $17,500 | | |
| Electrical | LS | 1 | $700 | $700 | | |
| | | | | **SUBTOTAL:** | **$68,400** | |
| 6) Soil vapor extraction (SVE) system | | | | | | |
| Pilot study | LS | 1 | $40,000 | $40,000 | | Skid mounted 1.5 HP blower with 2-200 lb carbon units. |
| Full scale system | LS | 1 | $15,000 | $15,000 | | SVE pilot system utilized as full-scale system. |
| | | | | **SUBTOTAL:** | **$55,000** | |
| 7) Limited soil excavation | | | | | | |
| Mobilization | LS | 1 | $35,000 | $35,000 | | Two mobilizations: one for sheeting and one for general. |
| Excavation support system | LS | 1 | $35,000 | $35,000 | | Sheeting and bracing to 15 ft below grade. |
| Piping abandonment | LF | 40 | $20 | $800 | | Abandon 6 inch storm sewer and 4 inch sanitary before sheeting installed. |
| Piping replacement | LF | 40 | $25 | $1,000 | | |
| Excavation | CY | 57 | $33 | $1,900 | | |
| Backfilling | CY | 57 | $20 | $1,100 | | |
| Disposal | TON | 86 | $150 | $12,800 | | |
| Restoration | LS | 1 | $2,900 | $2,900 | | |
| | | | | **SUBTOTAL:** | **$91,000** | |
| | | | **TOTAL DIRECT CAPITAL COST:** | | **$716,400** | |

**Table 7**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #2 - Presumptive Remedy and Off-site MNA**

O'BRIEN & GERE

**COST ESTIMATE SUMMARY**

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #2 consists of on-site SVE and ground water extraction with off-site ground water MNA.

| ITEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | | NOTES |
|---|---|---|---|---|---|---|
| **Indirect Capital Costs** | | | | | | |
| 1) Contingency (30% of Direct Capital Costs) | LS | 1 | $214,920 | $214,920 | | |
| | | | | **SUBTOTAL:** | **$214,920** | |
| 2) Engineering (15% of Direct Capital Costs) | LS | 1 | $107,460 | $107,460 | | |
| | | | | **SUBTOTAL:** | **$107,460** | |
| 3) Legal Fees ( 5% of Direct Capital Costs) | LS | 1 | $35,820 | $35,820 | | |
| | | | | **SUBTOTAL:** | **$35,820** | |
| 4) Construction Performance Bond (1.25% Direct Capital Construction Costs) | LS | 1 | $3,330 | $3,330 | | |
| | | | | **SUBTOTAL:** | **$3,330** | |
| | | | **TOTAL INDIRECT CAPITAL COSTS:** | | **$361,530** | |
| | | | **TOTAL CAPITAL COSTS (rounded):** | | **$1,080,000** | |
| **Operation & Maintenance Costs** | | | | | | |
| 1) Periodic Review | LS | 1 | $10,000 | $10,000 | | Assumes reviews are conducted every 5 years. |
| 2) Ground Water Monitoring, Year 1 - Quarterly VOCs & MNA | EA | 4 | $33,000 | $132,000 | | Assumes quarterly sampling at 30 existing wells. |
| 3) Ground Water Monitoring, Years 2 to 3 - Semi annual VOCs & MNA | EA | 2 | $33,000 | $66,000 | | Assumes semi-annual sampling at 30 existing wells. |
| 4) Ground Water Monitoring, Years 4 to 30 - Annual VOCs & MNA | EA | 1 | $33,000 | $33,000 | | Assumes annual sampling at 30 existing wells. |
| 5) Ground Water Monitoring Well Maintenance, Years 1 to 5 | LS | 1 | $500 | $500 | | |
| 6) Ground Water Monitoring Well Maintenance, Years 6 to 30 | LS | 1 | $2,000 | $2,000 | | |
| 7) Ground Water Monitoring Well Abandonment | EA | 30 | $350 | $10,500 | | |
| 8) Vapor Intrusion Monitoring, Years 1 to 30 | EA | 10 | $5,000 | $50,000 | | Includes ambient, sub-slab, and indoor air samples and a data summary report. |
| 9) Ground Water Extraction System O&M, Years 1 to 30 | LS | 1 | $14,000 | $14,000 | | Assumes GW can be directly disposed in sanitary sewer. |
| 10) SVE System O&M, Years 1 to 5 | LS | 1 | $30,000 | $30,000 | | Includes 12 carbon changeouts/yr and disposal costs of spent carbon. |
| 11) Vapor Intrusion Mitigation System Operation and Maintenance, Years 1 to 30 | EA | 2 | $1,700 | $3,400 | | |
| 12) Insurance (1% Direct Capital Cost) | LS | 1 | $7,164 | $7,164 | | |
| 13) Reserve Fund (1% Direct Capital Cost) | LS | 1 | $7,164 | $7,164 | | |
| | | **PRESENT WORTH OF O&M COSTS (rounded):** | | | **$2,620,000** | Assumes discount rate of 3% |
| | | **APPROXIMATE TOTAL PRESENT WORTH COST (rounded):** | | | **$3,700,000** | |

**Table 8**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #3 - Presumptive Remedy and Off-site Ground Water Extraction**

O'BRIEN & GERE

**COST ESTIMATE SUMMARY**

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #3 consists of on-site SVE and ground water extraction with off-site ground water extraction.

| ITEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | | NOTES |
|---|---|---|---|---|---|---|
| **Direct Capital Costs** | | | | | | |
| 1) Environmental Easement | | | | | | |
| Ground water use restrictions | LS | 1 | $15,000 | $15,000 | | |
| Building/property use restrictions | LS | 102 | $3,500 | $357,000 | | |
| Site information database | LS | 1 | $25,000 | $25,000 | | |
| | | | | **SUBTOTAL:** | **$397,000** | |
| 2) Site management plan | LS | 1 | $20,000 | $20,000 | | |
| | | | | **SUBTOTAL:** | **$20,000** | |
| 3) Baseline monitoring | | | | | | |
| Ground water monitoring | EA | 1 | $25,000 | $25,000 | | |
| | | | | **SUBTOTAL:** | **$25,000** | |
| 4) Vapor intrusion baseline investigation/VI mitigation | | | | | | |
| Vapor monitoring | EA | 8 | $4,000 | $32,000 | | |
| Vapor mitigation | EA | 2 | $10,000 | $20,000 | | |
| | | | | **SUBTOTAL:** | **$52,000** | |
| 5) On-site Ground water extraction | | | | | | |
| Pump test | LS | 1 | $25,000 | $25,000 | | |
| Permitting, sampling | LS | 1 | $8,600 | $8,600 | | |
| Extraction wells | EA | 1 | $15,000 | $15,000 | | One 6-inch - 30 ft deep well pumping @ 2.5 GPM. |
| Municipal Groundwater Discharge (1 yr discharge) | LS | 1 | $1,600 | $1,600 | | |
| Piping, utilities, equipment | LS | 1 | $17,500 | $17,500 | | |
| Electrical | LS | 1 | $700 | $700 | | |
| | | | | **SUBTOTAL:** | **$68,400** | |
| 6) Off-site Ground water extraction | | | | | | |
| Pump test | LS | 1 | $25,000 | $25,000 | | |
| Permitting, sampling | LS | 1 | $103,200 | $103,200 | | |
| Extraction wells | EA | 12 | $20,000 | $240,000 | | Twelve 6-inch - 50 ft deep wells pumping a total of 20 GPM. |
| Solar Powered Electrical System and hook-up | EA | 12 | $5,000 | $60,000 | | |
| Municipal Groundwater Discharge (1 yr discharge) | LS | 1 | $4,800 | $4,800 | | |
| Piping, utilities, equipment | LS | 1 | $162,000 | $162,000 | | |
| | | | | **SUBTOTAL:** | **$595,000** | |
| 6) Soil vapor extraction (SVE) system | | | | | | |
| Pilot study | LS | 1 | $40,000 | $40,000 | | Skid mounted 1.5 HP blower with 2-200 lb carbon units. |
| Full scale system | LS | 1 | $15,000 | $15,000 | | SVE pilot system utilized as full-scale system. |
| | | | | **SUBTOTAL:** | **$55,000** | |
| 7) Limited soil excavation | | | | | | |
| Mobilization | LS | 1 | $35,000 | $35,000 | | Two mobilizations: one for sheeting and one for general. |
| Excavation support system | LS | 1 | $35,000 | $35,000 | | Sheeting and bracing to 15 ft below grade. |
| Piping abandonment | LF | 40 | 20 | 800 | | Abandon 6 inch storm sewer and 4 inch sanitary before sheeting installed. |
| Piping replacement | LF | 40 | $25 | $1,000 | | |
| Excavation | CY | 57 | $33 | $1,900 | | |
| Backfilling | CY | 57 | $20 | $1,100 | | |
| Disposal | TON | 86 | $150 | $12,800 | | |
| Restoration | LS | 1 | $2,900 | $2,900 | | |
| | | | | **SUBTOTAL:** | **$91,000** | |
| | | | | **TOTAL DIRECT CAPITAL COST:** | **$1,303,400** | |

**Table 8**
**REMEDIAL ALTERNATIVE COST SUMMARY**

**Alternative #3 - Presumptive Remedy and Off-site Ground Water Extraction**

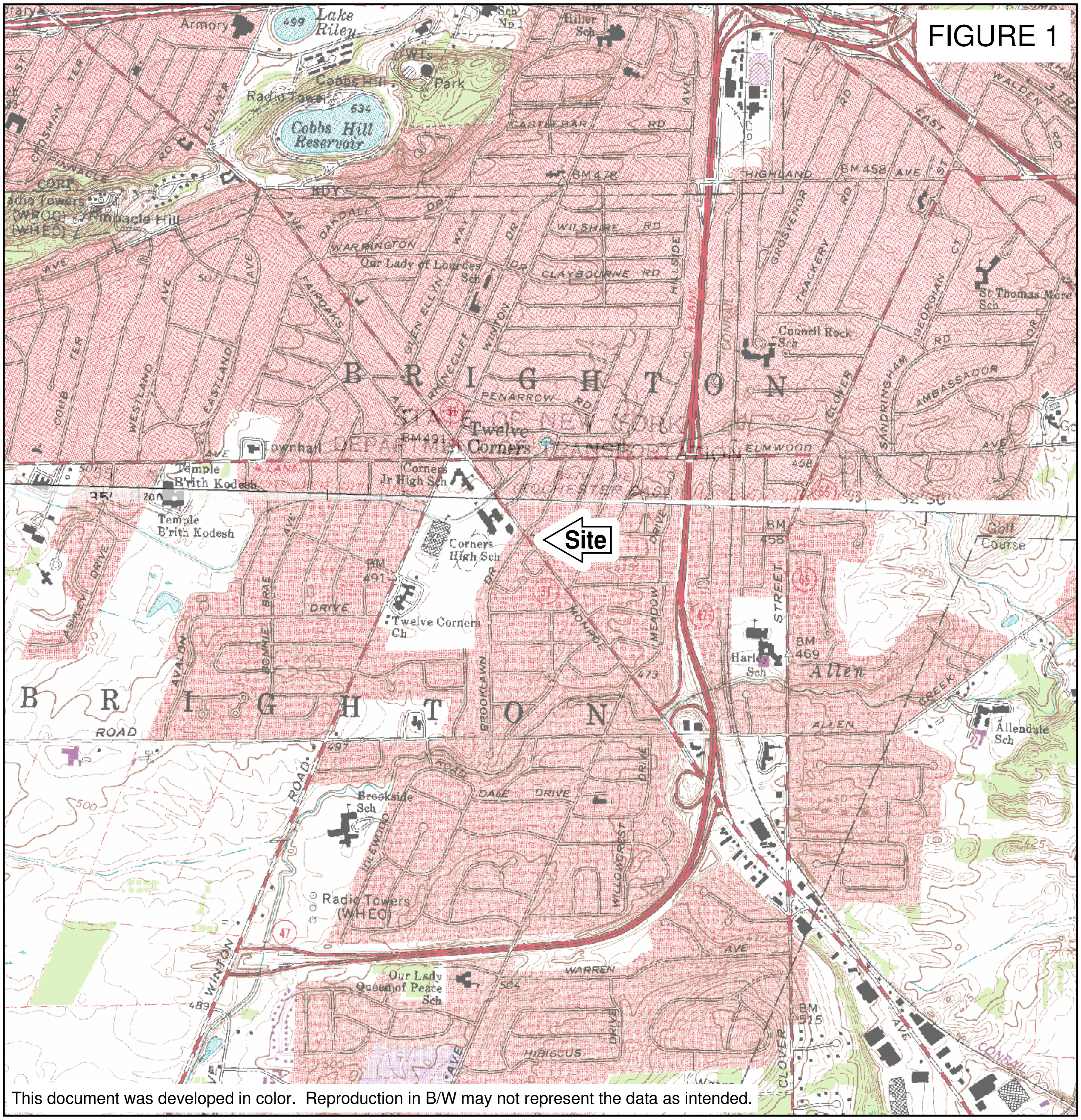
O'BRIEN & GERE

## COST ESTIMATE SUMMARY

Site: Carriage Cleaners
Location: 2101 Monroe Ave, Brighton, NY
Phase: Feasibility Study (-30% to +50%)
Base Year: 2007

Description: Alternative #3 consists of on-site SVE and ground water extraction with off-site ground water extraction.

| ITEM | UNIT | ESTIMATED QUANTITY | ESTIMATED UNIT COST | ESTIMATED COST | | NOTES |
|---|---|---|---|---|---|---|
| **Indirect Capital Costs** | | | | | | |
| 1) Contingency (30% of Direct Capital Costs) | LS | 1 | $391,020 | $391,020 | | |
| | | | | **SUBTOTAL:** | **$391,020** | |
| 2) Engineering (15% of Direct Capital Costs) | LS | 1 | $195,510 | $195,510 | | |
| | | | | **SUBTOTAL:** | **$195,510** | |
| 3) Legal Fees ( 5% of Direct Capital Costs) | LS | 1 | $65,170 | $65,170 | | |
| | | | | **SUBTOTAL:** | **$65,170** | |
| 4) Construction Performance Bond (1.25% Direct Capital Construction Costs) | LS | 1 | $9,630 | $9,630 | | |
| | | | | **SUBTOTAL:** | **$9,630** | |
| | | | **TOTAL INDIRECT CAPITAL COSTS:** | | **$661,330** | |
| | | | **TOTAL CAPITAL COSTS (rounded):** | | **$1,960,000** | |
| **Operation & Maintenance Costs** | | | | | | |
| 1) Periodic Review | LS | 1 | $10,000 | $10,000 | | Assumes reviews are conducted every 5 years. |
| 2) Ground Water Monitoring, Year 1 - Quarterly VOCs Only | EA | 4 | $25,000 | $100,000 | | Assumes quarterly sampling at 30 existing wells. |
| 3) Ground Water Monitoring, Years 2 to 3 - Semi annual VOCs Only | EA | 2 | $25,000 | $50,000 | | Assumes semi-annual sampling at 30 existing wells. |
| 4) Ground Water Monitoring, Years 4 to 30 - Annual VOCs Only | EA | 1 | $25,000 | $25,000 | | Assumes annual sampling at 30 existing wells. |
| 5) Ground Water Monitoring Well Maintenance, Years 1 to 5 | LS | 1 | $500 | $500 | | |
| 6) Ground Water Monitoring Well Maintenance, Years 6 to 30 | LS | 1 | $2,000 | $2,000 | | |
| 7) Ground Water Monitoring Well Abandonment | EA | 30 | $350 | $10,500 | | |
| 8) Vapor Intrusion Monitoring, Years 1 to 30 | EA | 10 | $5,000 | $50,000 | | Includes ambient, sub-slab, and indoor air samples and a data summary report. |
| 9) Ground Water Extraction System O&M, Years 1 o 30 | LS | 1 | $14,000 | $14,000 | | Assumes GW can be directly disposed in sanitary sewer. |
| 10) SVE System O&M, Years 1 to 5 | LS | 1 | $30,000 | $30,000 | | Includes 12 carbon changeouts/yr and disposal costs of spent carbon. |
| 11) Vapor Intrusion Mitigation System Operation and Maintenance, Years 1 to 30 | EA | 2 | $1,700 | $3,400 | | |
| 7) Insurance (1% Direct Capital Cost) | LS | 1 | $13,034 | $13,034 | | |
| 8) Reserve Fund (1% Direct Capital Cost) | LS | 1 | $13,034 | $13,034 | | |
| | | | **PRESENT WORTH OF O&M COSTS (rounded):** | | **$2,650,000** | Assumes discount rate of 3% |
| | | | **APPROXIMATE TOTAL PRESENT WORTH COST (rounded):** | | **$4,610,000** | |

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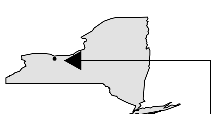
PLOT DATE: 1/30/07

ADAPTED FROM: ROCHESTER EAST AND PITTSFORD, NY USGS QUADRANGLES.



QUADRANGLE LOCATION

NYSDEC
CARRIAGE CLEANERS
TOWN OF BRIGHTON
ROCHESTER, NEW YORK

## SITE LOCATION

0 1,000 2,000 4,000 6,000 8,000

Feet

1:24,000

10653.35749

JANUARY 2007

O'BRIEN & GERE ENGINEERS, INC.


This document was developed in color. Reproduction in B/W may not represent the data as intended.

# FIGURE 2

NYSDEC
CARRIAGE CLEANERS
TOWN OF BRIGHTON, NY

## INVESTIGATION AREA REFERENCE MAP

0 75 150 300
Feet

JUNE 2006
10653\35749

O'BRIEN & GERE ENGINEERS, INC.

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PLOT DATE: 6/2/06

**Appendix A**

# March 2007 Indoor Air Results

Appendix A

Carriage Cleaners RI/FS
NYSDEC Site #8-28-120

NYSDOH Decision Matrix Outcomes - Indoor Air
March 2007

| | | | MATRIX 2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1,1,1-Trichloroethane - Matrix 2 | | | | | Tetrachloroethene - Matrix 2 | | | | | |
| **Location I.D.** | **Sample I.D.** | **Sample Period** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** |
| Location 1 | 032007-SS-1 | Mar-07 | 0.61 J | | | <0.832 | NO FURTHER ACTION | 830 | | | <1.03 / 7.52 | MONITOR |
| | 032007-B-1 | Mar-07 | | 3.16 | | <0.832 | | | 2.76 | | <1.03 / 7.52 | |
| | 032007-FF-1 | Mar-07 | | | 1.72 | <0.832 | | | | 1.93 | <1.03 / 7.52 | |
| Location 2 | 032007-SS-2 | Mar-07 | <0.83 | | | <0.832 | NO FURTHER ACTION | 560 | | | <1.03 / 7.52 | MONITOR / MITIGATE |
| | 032007-B-2 | Mar-07 | | 1.11 | | <0.832 | | | 6.14 | | <1.03 / 7.52 | |
| | 032007-FF-2 | Mar-07 | | | 0.666 J | <0.832 | | | | 3.03 J | <1.03 / 7.52 | |
| Location 3 | 032007-SS-3 | Mar-07 | <0.83 | | | <0.832 | NO FURTHER ACTION | 180 | | | <1.03 / 7.52 | MONITOR |
| | 032007-B-3 | Mar-07 | | 1.33 | | <0.832 | | | 2.9 J | | <1.03 / 7.52 | |
| | 032007-FF-3 | Mar-07 | | | <0.832 | <0.832 | | | | <1.03 | <1.03 / 7.52 | |
| Location 4 | 032007-SS-4 | Mar-07 | <0.83 | | | <0.832 | NO FURTHER ACTION | 190 | | | <1.03 / 7.52 | MONITOR |
| | 032007-B-4 | Mar-07 | | <0.832 | | <0.832 | | | 1.24 | | <1.03 / 7.52 | |
| | 032007-FF-4 | Mar-07 | | | <0.832 | <0.832 | | | | 0.758 J | <1.03 / 7.52 | |

Notes: J - Estimated Concentration

Appendix A

Carriage Cleaners RI/FS
NYSDEC Site #8-28-120

NYSDOH Decision Matrix Outcomes - Indoor Air
March 2007

| | | | MATRIX 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Trichloroethene - Matrix 1 | | | | | Carbon Tetrachloride - Matrix 1 | | | | |
| **Location I.D.** | **Sample I.D.** | **Sample Period** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** |
| Location 1 | 032007-SS-1 | Mar-07 | 13 | | | <0.218 | NO FURTHER ACTION | <0.96 | | | | NO FURTHER ACTION |
| | 032007-B-1 | Mar-07 | | <0.218 | | <0.218 | | | 0.576 | | | |
| | 032007-FF-1 | Mar-07 | | | <0.218 | <0.218 | | | | <0.256 | 0.576 / <0.256 | |
| Location 2 | 032007-SS-2 | Mar-07 | 15 | | | <0.218 | MONITOR | <0.96 | | | 0.576 / <0.256 | NO FURTHER ACTION |
| | 032007-B-2 | Mar-07 | | 0.328 | | <0.218 | | | 0.512 | | 0.576 / <0.256 | |
| | 032007-FF-2 | Mar-07 | | | <0.218 | <0.218 | | | | 0.576 | 0.576 / <0.256 | |
| Location 3 | 032007-SS-3 | Mar-07 | 14 | | | <0.218 | MONITOR | <0.96 | | | 0.576 / <0.256 | NO FURTHER ACTION |
| | 032007-B-3 | Mar-07 | | 0.273 | | <0.218 | | | 0.512 | | 0.576 / <0.256 | |
| | 032007-FF-3 | Mar-07 | | | <0.218 | <0.218 | | | | 0.512 | 0.576 / <0.256 | |
| Location 4 | 032007-SS-4 | Mar-07 | 31 | | | <0.218 | MONITOR | <0.96 | | | 0.576 / <0.256 | NO FURTHER ACTION |
| | 032007-B-4 | Mar-07 | | 1.04 | | <0.218 | | | 0.512 | | 0.576 / <0.256 | |
| | 032007-FF-4 | Mar-07 | | | 4.59 | <0.218 | | | | 0.512 | 0.576 / <0.256 | |

Notes: J - Estimated Concentration

**Appendix B**

# NYSDOH Decision Matrix Outcomes – Indoor Air

Appendix B

Carriage Cleaners RI/FS
NYSDEC Site #8-28-120

NYSDOH Decision Matrix Outcomes - Indoor Air

| | | | MATRIX 2 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1,1,1-Trichloroethane - Matrix 2 | | | | | Tetrachloroethene - Matrix 2 | | | | |
| | **Sample I.D.** | **Sample Period** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** | **Subslab** | **Basement** | **First Floor** | **Ambient** | **Matrix Decision Outcome** |
| 1 | 01A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 2.8 J | 1.6 J | 2.4 J | 1.2 J | No Further Action |
| 2 | 01B | Apr-05 | 2.7 | 5.9 | 3.5 | <0.83 | Take reasonable and practical actions to identify source(s) and reduce exposures | 2.5 J | 2.2 J | 3.2 J | 6 J | No Further Action |
| 3 | 02A | Apr-05 | <0.83 | 0.78 J | 0.61 J | <0.83 | No Further Action | 2.7 J | 1 J | <1.0 | 1.2 J | No Further Action |
| 4 | 03A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 3.7 J | 2.8 J | 2.3 J | 1.2 J / <1 | No Further Action |
| 5 | 04A | Apr-05 | 1.2 J | 3.8 | 2.9 | <0.83 | Take reasonable and practical actions to identify source(s) and reduce exposures | 868.7 J | 7.9 J | 3.2 J | <1 | Monitor / Mitigate |
| | 012406-1 | Jan-06 | 0.78 J | NA | NA | <0.832 | No Further Action | 230 | 4.2 | 3.2 | 2.69 | Monitor / Mitigate |
| 6 | 05A-1 | Apr-05 | <0.83 | <0.83 | NS | <0.83 | No Further Action | 2.3 J | 1.2 J | NS | <1 | No Further Action |
| | 05A-2 | Apr-05 | <0.83 | <0.83 | NS | <0.83 | No Further Action | 2.3 J | 0.69 J | NS | <1 | No Further Action |
| 7 | 06A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 1.9 J | 2.6 J | 2.5 J | <1 | No Further Action |
| 8 | 07A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 2.2 J | 1.6 J | 2.2 J | 6 / 1.2 J | No Further Action |
| 9 | 08A | Apr-05 | <0.83 | <0.83 | 0.55 J | <0.83 | No Further Action | 3.1 J | 5.9 J | 3.6 J | 6 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 10 | 09A | Apr-05 | <0.83 | 0.44 | 0.39 J | <0.83 | No Further Action | 12 J | <1 | 0.90 J | 6 J | No Further Action |
| 11 | 10A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 0.69 J | 3.4 J | 0.83 J | <1 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 12 | 11A | Apr-05 | <0.83 | 0.89 | <0.83 | <0.83 | No Further Action | 2.5 J | 0.83 J | 3.9 | 1.5 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 13 | 12A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 5 | 1.4 J | 1 | 1.5 | No Further Action |
| 14 | 13A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 6.9 | 2.8 | 1 | 1.5 | No Further Action |
| 15 | 14A | Apr-05 | <0.83 | 0.72 | 1.1 | <0.83 | No Further Action | 83 J | 3.2 | 3.1 | 1.5 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 012306-1 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 49 | 2.2 | 2.4 | 2.9 | No Further Action |
| 16 | 15A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 5.1 J | 0.97 J | 1.4 | 1.5 | No Further Action |
| 17 | 16A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 5.7 J | 0.76 J | 0.69 J | 1.5 | No Further Action |
| 18 | 17A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 130 J | 360 | 3.8 | 1.5 | Mitigate |
| | 030206-4 | Mar-06 | <28 | NA | NA | <0.832 | Incomplete data for decision making | 280 | 3.5 | 2.3 | 0.689 | Monitor |
| 19 | 18A | Apr-05 | <0.83 | <0.83 | <0.83 | <0.83 | No Further Action | 1.7 | 0.83 J | 2.5 J | 1.5 | No Further Action |
| 20 | 19A | Apr-05 | 5.5 | 6.2 | 6.6 | <0.83 | Take reasonable and practical actions to identify source(s) and reduce exposures | 67 | 30 | 27 | 1.2 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 012406-2 | Jan-06 | 1.2 | NA | NA | <0.832 | No Further Action | 110 | 7 | 6.3 | 2.69 | Monitor |
| 21 | 20A | Apr-05 | 0.67 J | <0.83 | <0.83 | <0.83 | No Further Action | 270 | 2 | 5.4 | 1.2 J | Monitor |
| | 013106-1 | Jan-06 | NS | <0.832 | NA | <0.832 | No Further Action | NS | 1.31 J | 3.6 | 0.483 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 22 | C1-1 | Aug-05 | 2.4 | <0.83 | <0.83 | NS | No Further Action | 250 | 340 | 150 | NS | Mitigate |
| | C1-2 | Aug-05 | 3.9 | | | | | 280 | | | | |
| 23 | 012306-2 | Jan-06 | 2.2 | NA | NA | <0.832 | No Further Action | 23 | 5.5 | 2.1 | 2.9 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 24 | 012306-3 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 3.1 J | <1.5 | <1.5 | 2.9 | No Further Action |
| 25 | 012306-4R | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 34 | <1.5 | <1.5 | 2.9 | No Further Action |
| 26 | 012306-5 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 11 J | 4.7 | 3.7 | 2.9 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 27 | 012406-3 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 2.5 J | <1.4 | <1.4 | 2.69 | No Further Action |
| 28 | 012506-1 | Jan-06 | 0.33 J | NA | NA | <0.832 | No Further Action | 100 | 13 | 7.1 | <1.03 | Monitor / Mitigate |
| 29 | 012506-2 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 370 J | 1.9 | <1.4 | <1.03 | Monitor |
| 30 | 012506-3 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 8.5 J | 2.3 | 1.2 | <1.03 | No Further Action |
| 31 | 012506-4 | Jan-06 | NS | NA | NA | <0.832 | Incomplete data for decision making | NS | <1.4 | <1.4 | <1.03 | No Further Action |
| 32 | 012506-5 | Jan-06 | 0.22 J | NA | NA | <0.832 | No Further Action | 2.1 J | <1.5 | <1.5 | <1.03 | No Further Action |
| 33 | 012606-1 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 16 | <1.4 | 1.4 | <1.03 | No Further Action |
| 34 | 013006-1 | Jan-06 | 0.44 J | 27.2 | NA | <0.832 | Take reasonable and practical actions to identify source(s) and reduce exposures | 2.8 J | 1.17 | 1.9 | 0.827 | No Further Action |
| 35 | 013006-2 | Jan-06 | 0.61 J | NA | NA | <0.832 | No Further Action | 72 J | 2.2 | 2.2 | 0.827 | No Further Action |
| 36 | 013006-3 | Jan-06 | 0.61 J | 1.05 | NA | <0.832 | No Further Action | 440 J | 3.38 J | 2.1 | 0.827 | Monitor / Mitigate |
| 37 | 013006-4 | Jan-06 | NS | <0.832 | NA | <0.832 | No Further Action | NS | 25.5 | 15 | 0.827 | Incomplete data for decision making |
| 38 | 013006-5 | Jan-06 | <0.83 | <0.832 | NA | <0.832 | No Further Action | 45 J | 1.17 J | 1.7 | 0.827 | No Further Action |
| 39 | 013106-2 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 1.1 J | 2.7 | 1.9 | 0.483 | No Further Action |
| 40 | 013106-3 | Jan-06 | <0.83 | NA | NA | <0.832 | No Further Action | 13 J | 2.2 | NS | 0.483 | No Further Action |
| 41 | 013106-4 | Jan-06 | 0.28 J | <0.832 | NA | <0.832 | No Further Action | 50 J | 0.896 J | 1.4 | 0.483 | No Further Action |
| 42 | 030206-1 | Mar-06 | NS | NA | NA | <0.832 | Incomplete data for decision making | NS | <1.4 | <1.4 | 0.689 | No Further Action |
| 43 | 030206-2 | Mar-06 | <280 | NA | NA | <0.832 | Incomplete data for decision making | 47000 | NS | 1.9 | 22 / 12 | Mitigate |
| | 030206-3 | Mar-06 | <550 | NA | NA | <0.832 | Incomplete data for decision making | 13000 | NS | 1.9 | 22 / 12 | Mitigate |
| 44 | 041006-1A | Apr-06 | <0.83 | NA | NA | <0.832 | No Further Action | <1 | 2 | 2 | 1.59 | No Further Action |
| | 041006-1B | | | | | | | | 2 | 2.5 | 1.59 | No Further Action |
| 45 | 041106-1 | Apr-06 | 0.67 J | NA | NA | NS | No Further Action | 0.97 J | 2.3 | 2 | NS | No Further Action |

Notes: NA - Not Analyzed
NS - Not Sampled
J - Estiated Concentration
OSHA PELs - Occupational Safety and Health Administration Permissible Exposure Limits

Appendix B

Carriage Cleaners RI/FS
NYSDEC Site #8-28-120

NYSDOH Decision Matrix Outcomes - Indoor Air

| | | | MATRIX 1 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Trichloroethene - Matrix 1 | | | | | Carbon Tetrachloride - Matrix 1 | | | | |
| | Sample I.D. | Sample Period | Subslab | Basement | First Floor | Ambient | Matrix Decision Outcome | Subslab | Basement | First Floor | Ambient | Matrix Decision Outcome |
| 1 | 01A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | 1 | <0.96 | <0.96 | 1.1 | No Further Action |
| 2 | 01B | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.83 J | 0.58 J | 0.51 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 3 | 02A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | 1.2 | 1 | 1 | 1.1 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 4 | 03A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 1.1 | 3 | 1.1 / 0.9 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 5 | 04A | Apr-05 | 20 | <0.82 | 4 | <0.82 | Monitor | 0.64 J | 1 | 0.9 J | 0.9 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 012406-1 | Jan-06 | 14 J | NA | NA | 0.874 J | Monitor | 0.58 J | NA | NA | 0.64 J | No Further Action |
| 6 | 05A-1 | Apr-05 | <0.82 | <0.82 | NS | <0.82 | No Further Action | 0.64 J | <0.96 | NS | 0.9 J | No Further Action |
| | 05A-2 | Apr-05 | <0.82 | <0.82 | NS | <0.82 | No Further Action | 0.77 J | <0.96 | NS | 0.9 J | No Further Action |
| 7 | 06A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | <0.96 | <0.96 | 0.9 J | No Further Action |
| 8 | 07A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.45 J | <0.96 | 0.51 J / 0.96 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 9 | 08A | Apr-05 | <0.82 | <0.82 | 36 | <0.82 | Take reasonable and practical actions to identify source(s) and reduce exposures | <0.96 | 0.45 J | 0.64 J | 0.51 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 10 | 09A | Apr-05 | 0.55 J | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.45 J | 0.38 J | 0.51 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 11 | 10A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | 0.64 J | <0.96 | 0.64 J | 0.64 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 12 | 11A | Apr-05 | <0.82 | 5.3 | 2.2 | <0.82 | Take reasonable and practical actions to identify source(s) and reduce exposures | 0.58 J | 0.64 J | <0.96 | 0.7 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 13 | 12A | Apr-05 | 8.4 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | <0.96 | <0.96 | 0.7 J | No Further Action |
| 14 | 13A | Apr-05 | 5.7 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 12.3 | 0.64 J | 0.7 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 15 | 14A | Apr-05 | 7 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.64 J | <0.96 | 0.7 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 012306-1 | Jan-06 | 2.2 J | NA | NA | 1.15 J | Take reasonable and practical actions to identify source(s) and reduce exposures | 0.45 J | NA | NA | 0.576 J | No Further Action |
| 16 | 15A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.83 J | 0.77 J | 0.7 J | No Further Action |
| 17 | 16A | Apr-05 | <0.82 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.7 J | 0.64 J | 0.7 J | No Further Action |
| 18 | 17A | Apr-05 | 23 | <0.82 | <0.82 | <0.82 | Take reasonable and practical actions to identify source(s) and reduce exposures | <0.96 | <0.96 | 0.64 J | 0.7 J | No Further Action |
| | 030206-4 | Mar-06 | 30 | NA | NA | <0.218 | Incomplete data for decision making | <32 | NA | NA | 0.767 J | Incomplete data for decision making |
| 19 | 18A | Apr-05 | <0.82 | 6.9 | <0.82 | <0.82 | Take reasonable and practical actions to identify source(s) and reduce exposures | <0.96 | 0.64 J | <0.96 | 0.7 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 20 | 19A | Apr-05 | 4.6 | 3 | 2.7 | <0.82 | Take reasonable and practical actions to identify source(s) and reduce exposures | <0.96 | <0.96 | 0.64 J | 0.96 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 012406-2 | Jan-06 | 0.38 J | NA | NA | 0.874 | No Further Action | 0.38 J | NA | NA | 0.64 J | No Further Action |
| 21 | 20A | Apr-05 | 16 | <0.82 | <0.82 | <0.82 | No Further Action | <0.96 | 0.64 J | <0.96 | 0.96 | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | 013106-1 | Jan-06 | NS | <0.218 | NA | <0.218 | No Further Action | NS | 0.703 J | NA | 0.576 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 22 | C1-1 | Aug-05 | 190 | 2.8 | 2.2 | NS | Mitigate | <0.96 | 0.64 J | <0.96 | NS | Take reasonable and practical actions to identify source(s) and reduce exposures |
| | C1-2 | Aug-05 | 270 | | | | | <0.96 | | | | |
| 23 | 012306-2 | Jan-06 | 3.2 J | NA | NA | 1.15 J | No Further Action | 0.58 J | NA | NA | 0.576 J | No Further Action |
| 24 | 012306-3 | Jan-06 | 0.22 J | NA | NA | 1.15 J | No Further Action | 0.58 J | NA | NA | 0.576 J | No Further Action |
| 25 | 012306-4R | Jan-06 | 0.55 J | NA | NA | 1.15 J | No Further Action | 0.45 J | NA | NA | 0.576 J | No Further Action |
| 26 | 012306-5 | Jan-06 | <0.82 | NA | NA | 1.15 J | No Further Action | 0.77 J | NA | NA | 0.576 J | No Further Action |
| 27 | 012406-3 | Jan-06 | 0.44 J | NA | NA | 0.874 J | No Further Action | 0.7 J | NA | NA | 0.64 J | No Further Action |
| 28 | 012506-1 | Jan-06 | 9.3 J | NA | NA | <0.218 | Incomplete data for decision making | 0.77 J | NA | NA | 0.576 J | No Further Action |
| 29 | 012506-2 | Jan-06 | 6.9 J | NA | NA | <0.218 | Incomplete data for decision making | 0.32 J | NA | NA | 0.576 J | No Further Action |
| 30 | 012506-3 | Jan-06 | 0.33 J | NA | NA | <0.218 | No Further Action | 0.83 J | NA | NA | 0.576 J | No Further Action |
| 31 | 012506-4 | Jan-06 | NS | NA | NA | <0.218 | Incomplete data for decision making | NS | NA | NA | 0.576 J | Incomplete data for decision making |
| 32 | 012506-5 | Jan-06 | 0.27 J | NA | NA | <0.218 | No Further Action | 0.64 J | NA | NA | 0.576 J | No Further Action |
| 33 | 012606-1 | Jan-06 | 0.82 | NA | NA | 0.328 J | No Further Action | 0.51 J | NA | NA | 0.576 J | No Further Action |
| 34 | 013006-1 | Jan-06 | 0.22 J | 2.2 | NA | <0.218 | No Further Action | 0.51 J | 0.767 J | NA | 0.767 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 35 | 013006-2 | Jan-06 | 9 J | NA | NA | <0.218 | Incomplete data for decision making | 0.26 J | NA | NA | 0.767 J | No Further Action |
| 36 | 013006-3 | Jan-06 | 39 J | 0.328 J | NA | <0.218 | Monitor | 0.51 J | 0.831 J | NA | 0.767 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 37 | 013006-4 | Jan-06 | NS | 1.37 J | NA | <0.218 | Incomplete data for decision making | NS | 1.92 | NA | 0.767 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 38 | 013006-5 | Jan-06 | 1.5 J | <0.218 | NA | <0.218 | No Further Action | 0.38 J | 0.64 J | NA | 0.767 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 39 | 013106-2 | Jan-06 | <0.82 | NA | NA | <0.218 | No Further Action | 0.58 J | NA | NA | 0.576 J | No Further Action |
| 40 | 013106-3 | Jan-06 | 1 J | NA | NA | <0.218 | No Further Action | 0.58 J | NA | NS | 0.576 J | No Further Action |
| 41 | 013106-4 | Jan-06 | <0.82 | <0.218 | NA | <0.218 | No Further Action | 0.32 J | 0.767 J | NA | 0.576 J | Take reasonable and practical actions to identify source(s) and reduce exposures |
| 42 | 030206-1 | Mar-06 | NS | NA | NA | <0.218 | Incomplete data for decision making | NS | NA | NA | 0.767 J | Incomplete data for decision making |
| 43 | 030206-2 | Mar-06 | 2100 | NA | NA | <0.218 | Mitigate | <320 | NS | NA | 0.767 J | Incomplete data for decision making |
| | 030206-3 | Mar-06 | 1300 | NA | NA | <0.218 | Mitigate | <640 | NS | NA | 0.767 J | Incomplete data for decision making |
| 44 | 041006-1A | Apr-06 | <0.82 | NA | NA | <0.218 | No Further Action | <0.96 | NA | NA | <0.959 | No Further Action |
| | 041006-1B | | | | | | No Further Action | | | | | No Further Action |
| 45 | 041106-1 | Apr-06 | 1.9 J | NA | NA | NS | No Further Action | <0.96 | NA | NA | NS | No Further Action |

Notes: NA - Not Analyzed
NS - Not Sampled
J - Estiated Concentration
OSHA PELs - Occupational Safety and Health Administration Permissible Exposure Limits

Appendix B

Carriage Cleaners RI/FS
NYSDEC Site #8-28-120

NYSDOH Decision Matrix Outcomes - Indoor Air

| | Sample I.D. | Sample Period | NYSDEC Action |
|---|---|---|---|
| 1 | 01A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 2 | 01B | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 3 | 02A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 4 | 03A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 5 | 04A | Apr-05 | Additional monitoring to evaluate needed for mitigation |
| | 012406-1 | Jan-06 | |
| 6 | 05A-1 | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| | 05A-2 | Apr-05 | |
| 7 | 06A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 8 | 07A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 9 | 08A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 10 | 09A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 11 | 10A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 12 | 11A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 13 | 12A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 14 | 13A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 15 | 14A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| | 012306-1 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 16 | 15A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 17 | 16A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 18 | 17A | Apr-05 | Additional monitoring to evaluate needed for mitigation |
| | 030206-4 | Mar-06 | |
| 19 | 18A | Apr-05 | No Action Needed; concentrations not attributed to vapor intrusion |
| 20 | 19A | Apr-05 | Additional monitoring to evaluate needed for mitigation |
| | 012406-2 | Jan-06 | |
| 21 | 20A | Apr-05 | Additional monitoring to evaluate needed for mitigation |
| | 013106-1 | Jan-06 | |
| 22 | C1-1 | Aug-05 | Mitigate due to presence of PCE and TCE |
| | C1-2 | Aug-05 | |
| 23 | 012306-2 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 24 | 012306-3 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 25 | 012306-4R | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 26 | 012306-5 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 27 | 012406-3 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 28 | 012506-1 | Jan-06 | Additional monitoring to evaluate needed for mitigation |
| 29 | 012506-2 | Jan-06 | Additional monitoring to evaluate needed for mitigation |
| 30 | 012506-3 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 31 | 012506-4 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 32 | 012506-5 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 33 | 012606-1 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 34 | 013006-1 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 35 | 013006-2 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 36 | 013006-3 | Jan-06 | Additional monitoring to evaluate needed for mitigation |
| 37 | 013006-4 | Jan-06 | No Action Needed; vapor mitigation system in-place |
| 38 | 013006-5 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 39 | 013106-2 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 40 | 013106-3 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 41 | 013106-4 | Jan-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 42 | 030206-1 | Mar-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| 43 | 030206-2 | Mar-06 | No Action Needed (OSHA PELs apply to active dry cleaner); house on property has vapor mitigation system in-place |
| | 030206-3 | Mar-06 | |
| 44 | 041006-1A | Apr-06 | No Action Needed; concentrations not attributed to vapor intrusion |
| | 041006-1B | | |
| 45 | 041106-1 | Apr-06 | No Action Needed; concentrations not attributed to vapor intrusion |

Notes: NA - Not Analyzed
NS - Not Sampled
J - Estiated Concentration
OSHA PELs - Occupational Safety and Health Administration Permissible Exposure Limits

**Appendix C**

# Detected Concentrations of VOCs in Soil

Appendix C
Carriage Cleaners RI/FS
NYSDEC Site #8-28-120
Detected Volatile Organic Compounds - Soil

| Chemical Name | Part 375 RSCO - GW[1] ug/kg | Sample ID / Sample Date / Unit | SB-DEC-1 (8-12) 4/10/2006 ug/kg | SB-DEC-2 (8-12) 4/10/2006 ug/kg | SB-DEC-3 (8-12) 4/10/2006 ug/kg | SB-DEC-4 (8-12) 4/10/2006 ug/kg | SB-DEC-6 (9-11) 4/10/2006 ug/kg | SB-DEC-7 (12-14) 4/10/2006 ug/kg |
|---|---|---|---|---|---|---|---|---|
| Benzene | 60 | | < 12 | 2 J | 15 R | < 100 | < 100 | < 1200 |
| Carbon disulfide | NE | | < 12 | < 12 | 1 R | < 100 | < 100 | < 1200 |
| Chlorobenzene | 1100 | | < 12 | < 12 | 0.9 R | < 100 | < 100 | < 1200 |
| cis-1,2-Dichloroethene | 250 | | < 12 | < 12 | 12 R | < 100 | < 100 | 740 J |
| Cyclohexane | NE | | < 12 | 10 J | < 120 | < 100 | < 100 | < 1200 |
| Ethylbenzene | 1000 | | < 12 | 15 | 96 DJ | 22 J | 150 | 780 J |
| Isopropylbenzene | NE | | < 12 | 2 J | 120 R | 10 J | 20 J | 140 J |
| Methyl ethyl ketone | 120 | | < 12 | < 12 | < 12 | < 100 | 17 J | < 1200 |
| Methyl tert-butyl ether (MTBE) | 930 | | < 12 | 1 | < 12 | < 100 | < 100 | < 1200 |
| Methylcyclohexane | NE | | < 12 | 10 J | 570 D | 95 J | < 100 | 470 J |
| Tetrachloroethene | 1300 | | 31 | 17 | 8 R | 82 J | 14 J | **48000 D Y** |
| Toluene | 700 | | < 12 | 42 | 62 R | 14 J | 35 J | 110 J |
| Trichloroethene | 470 | | < 12 | < 12 | < 12 | < 100 | < 100 | 520 J |
| Vinyl chloride | 20 | | < 12 | < 12 | 1 R | < 100 | < 100 | < 1200 |
| Xylenes, Total | 1600 | | < 12 | 310 | 690 R | 300 | 1100 | **2700 J Y** |

| Chemical Name | Part 375 RSCO - GW[1] ug/kg | Sample ID / Sample Date / Unit | SB-DEC-8 (8-12) 4/10/2006 ug/kg | SB-DEC-9 (10-11) 4/10/2006 ug/kg | SB-DEC-10 (8-10) 4/10/2006 ug/kg | SB-DEC-27 (9-10) 4/11/2006 ug/kg | SB-DEC-29 (6-8) 4/11/2006 ug/kg | SB-DEC-29 (8-10) 4/11/2006 ug/kg | SB-DEC-30 (6-8) 4/11/2006 ug/kg |
|---|---|---|---|---|---|---|---|---|---|
| Benzene | 60 | | < 130 | < 120 | 0.8 J | < 100 | < 110 | < 1200 | < 12 |
| Carbon disulfide | NE | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Chlorobenzene | 1100 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| cis-1,2-Dichloroethene | 250 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Cyclohexane | NE | | < 130 | < 120 | 2 J | < 100 | < 110 | < 1200 | < 12 |
| Ethylbenzene | 1000 | | 39 J | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Isopropylbenzene | NE | | 16 J | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Methyl ethyl ketone | 120 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Methyl tert-butyl ether (MTBE) | 930 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Methylcyclohexane | NE | | 150 | < 120 | 3 J | < 100 | < 110 | < 1200 | 1 J |
| Tetrachloroethene | 1300 | | 19 J | **1600 Y** | 18 | 350 | 340 | 1300 | 10 J |
| Toluene | 700 | | 17 J | < 120 | 2 J | < 100 | < 110 | < 1200 | 1 J |
| Trichloroethene | 470 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Vinyl chloride | 20 | | < 130 | < 120 | < 11 | < 100 | < 110 | < 1200 | < 12 |
| Xylenes, Total | 1600 | | **3200 J Y** | < 120 | 4 J | < 100 | < 110 | < 1200 | 2 J |

Notes: [1] Part 375-6.8(b): Restricted Use Soil Cleanup Objectives for Protection of Groundwater (RSCO - GW)
NE - Not established
**Y - Analyte concentration exceeds Part 375-6.8(b) RSCO - GW**