FINAL FEASIBILITY STUDY REPORT

Former Loudon and Kem Cleaners Site
350 Northern Blvd., Albany, Albany County, New York
Site/ Spill Number 401060
Contract Work Authorization Number: D006132-26

Shaw Project No.: 134685.26

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List of Acronyms and Abbreviations

µg/L	microgram per liter
µg/m^3	microgram per cubic meter
ARs	Applicable Requirements
ARARs	Applicable or Relevant and Appropriate Requirements
BASE	Building Assessment and Survey
bgs	below ground surface
CFR	Code of Federal Regulations
cVOCs	chlorinated Volatile Organic Compounds
DCE	Dichloroethene
DER	Department of Environmental Remediation
DPT	Direct Push Technologies
EPA	US Environmental Protection Agency
FS	Feasibility Study
ft	feet
g/Kg	grams per kilogram
GW	Groundwater
HDPE	High-density polyethylene
HSVE	horizontal soil vapor extraction
HVV	Hanson Van Vleet, LLC
ISCO	In-Situ Chemical Oxidation
ISCR	In-Situ Chemical Reduction
msl	mean sea level
MW	Monitoring Well
NA	Not Applicable
NCP	National Contingency Plan
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSGWQS	New York State Groundwater Quality Standards
OSHA	Occupational Safety and Health Administration
PCE	Perchloroethylene
PES	Precision Environmental Services

ppm	parts per million
PRAP	Proposed Remedial Action Plan
PRBs	Permeable Reactive Barriers
PVC	polyvinyl chloride
RAOs	Remedial Action Objectives
RI	Remedial Investigation
ROD	Record of Decision
RSCO	Recommended Soil Cleanup Objectives
SCGs	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objectives
SCR	Site Classification Report
sf	square feet
Shaw	Shaw Environmental & Infrastructure Engineering of New York, P.C.
Site	Former Loudon and Kem Cleaners Site
SMP	Site Management Plan
SSDS	Sub-slab Depressurization System
SSI	Subsurface Investigation
SVE	Soil Vapor Extraction
TBCs	To Be Considered Criteria
TCA	Trichloroethane
TCE	trichloroethylene
TOGS	Technical and Operational Guidance Series
UUSCO	Unrestricted Use Soil Cleanup Objectives
VC	vinyl chloride
VOCs	volatile organic compounds
WA	Work Assignment
ZVI	zero valent iron

1.0 INTRODUCTION

1.1 Purpose and Organization

Shaw Environmental & Infrastructure Engineering of New York, P.C. (Shaw) has prepared this Feasibility Study (FS) Report for the Former Loudon and Kem Cleaners Site (Site) (Site # 401060). This work was completed for the New York State Department of Environmental Conservation (NYSDEC) under State Superfund Contract Work Assignment (WA) D006132-26. The Site is located within and around the vicinity of 350 Northern Boulevard, in Albany County, Albany, NY (**Figure 1**). The Site is bounded to the north and west by the Loudon Arm Apartment Complex and by Albany Memorial Hospital to the southeast.

This FS was prepared using information from the sources described in **Section 5.0**.

A remedial investigation (RI) report was completed by Shaw in May 2013. This report discussed the results of the site investigative activities that were completed to characterize and delineate the extent of soil, groundwater and soil vapor impacts that may have existed on and surrounding the Site. Details regarding the RI are described in the Phase I and Phase II Remedial Investigation Reports for the Former Loudon and Kem Cleaners Site (Shaw 2013).

The FS describes a selection of remedial alternatives that may be employed to address both on and off Site groundwater and soil vapor impacts as characterized in the RI. The report has been prepared in five (5) sections which include:

- Section 1 – Purpose and Site background for preparation of the FS.
- Section 2 – The identification of applicable Standards, Criteria and Guidelines that have been used to assist in the selection process for potential remedial alternatives.
- Section 3 – Identifies the selected remedial alternatives for the contaminated area and their applicability to the Site.
- Section 4 – Provides a detailed comparative analysis of each proposed remedial alternative including supporting methodology information and preliminary cost estimates for each alternative.
- Section 5 – Provides all references used for preparation of the report.

1.2 Site Area Off-Site Property Description

The property at 350 Northern Boulevard encompasses approximately 3.99 acres and is developed with an L-Shaped retail building with an asphalt paved parking lot. The property is referred to as Loudon Plaza (Site). The Site is bound by Northern Boulevard and the Albany Memorial Hospital to the south and southeast, Loudon Arms Apartment Complex to the west, private residences to the north and Route 9 to the northeast. The topography of Loudon Plaza gently slopes from north to south towards Northern Boulevard. The surface features in the area of the Site are shown in **Figure 2**.

Two (2) separate addresses/tenant spaces at Loudon Plaza were historically occupied by dry cleaners (known as Loudon Dry Cleaners, Kem Cleaners, and possibly other names) that reportedly used tetrachloroethene (PCE) in their operations from approximately 1954 to 1997 according to information provided to Shaw. Kem Cleaners, the most recent dry cleaners operated as a 'drop off service only' from 1997 until the summer of 2011. Loudon Dry Cleaners was in operation from 1954 to 1960.

1.3 Geology and Hydrogeology

1.3.1 Regional Geology

The investigative area is located in the Hudson Mohawk Physiographic Province. The overburden soils of the surrounding area have been characterized as lacustrine sands, which are composed of generally well sorted, stratified coarse sands to fine sands (Cadwell et al., 1987). Previous reports provided to Shaw identified the bedrock geology as Normanskill Shale consisting of mudstone and sandstone of Middle Ordovician origin referenced to Fisher, et al 1970. Field observations made by Shaw personnel as well as referencing the New York State Geological Map (1986) indicates, that the area of investigation is underlain by the eastern flank of the Middle Ordovician Snake Hill Formation consisting of shale and siltstone.

1.3.2 Local Geology

Twenty-four soil borings were advanced to a maximum depth of 46 feet or until reaching a till/shale layer (bedrock) during the (RI) conducted by Shaw. The till/shale layer is underlain by weathered shale bedrock. Subsurface soils at the Site indicate silty sands with sporadic sandy gravel, silt and clay lenses. As indicated in the RI, one (1) anomalous area of highly plastic clay (ranging from 3' to 10' bgs within the Former Loudon and Kem Cleaners Site) was characterized during advancement of boring SB-9. Geological cross-sections illustrating the apparent sub-surface soil conditions at the Site are provided in the RI Report under separate cover.

As discussed in the RI Report at approximately 25 – 30 feet below ground surface there appears to be a consistent silt/clay layer approximately 2 – 6 feet in depth. The Site exhibits significant topographic change with surface elevation ranging from 211 feet above mean seal level (msl) at (MW-24 approximately 600 feet south east of the site) to 242 feet above msl at (MW-7 at the north end of the site); a difference of 31 feet. Bedrock dips to the southeast and depths below ground surface range from 25 to 45 feet.

1.3.3 Hydrogeology

Based upon recorded groundwater elevation measurements collected during the RI, the hydraulic gradient for the Site is approximately 0.0452 ft/ft. The hydraulic gradient and resulting hydraulic conductivity values determined through the slug tests produces a relatively fast groundwater flow in a southeasterly direction toward Albany Memorial Hospital and Route 9. The groundwater table soil interface is located primarily within silty sands on the Site but appears to intersect with a silt/clay layer approximately 100 feet down gradient of MW-18.

Two rounds of slug tests were performed during the RI. Aquifer permeability ranged from 1.34 ft/day to .046 ft/day (4.74 E^{-04} to 1.63 E^{-05} cm/sec), which is indicative of and consistent with a sandy silt based upon published data. Based on this information, using the average aquifer permeability of 0.70 ft/day, hydraulic gradient of 0.045 and effective soil porosity of 0.20 (typical for sand/silt), the average groundwater velocity is estimated at 0.16 ft/day (58 ft/year). The groundwater velocity can be used as a measure to delineate contaminant plume migration. This value is consistent with the known presence of chlorinated Volatile Organic Compounds (cVOC (s) contamination at distances of 600 to 700 feet offsite and down gradient at monitoring wells MW-18, MW-23 and MW-24.

1.4 Remedial History

1.4.1 Previous Site Investigations

Previous subsurface and groundwater investigations completed at the Site confirmed chlorinated solvent contamination within and around the former Kem Cleaners location. The Site was designated as a "Class 2" site by the New York State Department of Environmental Conservation (NYSDEC) as documented in the Site Classification Report (SCR) dated December 21, 2010. The listing report is based upon an October 12, 2009 initial Subsurface Investigation (SSI) completed by Northeastern Environmental Technologies Corporation and additional investigative work requested by NYSDEC in 2010, completed by Hanson Van Vleet, LLC (HVV) to further delineate lateral and vertical contamination on and off Site. In September 2011, the tenant spaces of one of the former dry cleaners (Kem Cleaners) and the adjacent

business (a former barbershop) were renovated for use as a restaurant (Risotto) which opened in October 2011. Prior to opening the restaurant, Precision Environmental Services (PES) was contracted by the NYSDEC to perform a subsurface investigation in the proposed restaurant space. The findings were summarized in a *Subsurface Investigation Report* dated November 2011 (provided under separate cover).

1.4.2 Former Loudon and Kem Cleaners Site Cleaners Remedial Investigation

Shaw was retained by the NYSDEC to complete an RI at the Former Loudon and Kem Cleaners Site in late 2011 through early 2013 in an effort to further delineate and characterize the extent of horizontal and vertical soil, groundwater and vapor phase impacts. The results of these investigations are summarized below.

1.4.2.1 Summary of RI Analytical Results

The RI analytical results confirmed that (cVOC), primarily PCE and to a lesser extent cis-1,2-DCE and TCE were and are present both on and off the Site. Analytical results from both groundwater sampling events completed by Shaw demonstrated the occurrence of cVOC concentrations above the New York State Groundwater Quality (NYSGWQ) standards for PCE, TCE and cis-1,2-DCE at several locations across the Site. PCE, the primary contaminant of concern and known source contaminant, exhibited the highest concentrations among samples collected at monitoring well locations in the south/southeast portion the Site and off Site (southeast) in the apparent direction of groundwater flow. Vertically, PCE analytical results yielded higher concentrations in monitoring wells with screened intervals positioned within the top five (5) feet of the water column (shallow screened intervals with low standing groundwater well volumes). The site exhibits a steep hydraulic gradient (4.5%) based upon existing monitoring well data, and is underlaid by silty sands (higher permeable soils). The soil and groundwater conditions appear to consist of preferential pathway(s) for PCE migration along the groundwater table/soil interface in a southeasterly direction towards MW-18. Based upon existing data, the water table/soil interface intersects with a clay/silt layer immediately down gradient (approximately 100 feet) of MW-18. These lower permeable soils may potentially be acting as a "barrier" causing a "pooling" of PCE contamination which may be the reason for higher PCE concentrations that have been observed at MW-18 in the Phase I (630 µg/l) and Phase II (5,100 µg/l) investigations based upon interpretation of the existing data. Down gradient monitoring wells exhibited a significant decrease in PCE concentration in both the Phase I and Phase II investigations with concentrations in MW-23 at 1.9 and 2.7 µg/l and MW-24 at 16 and 12 µg/l respectively.

TCE concentrations observed during the Phase I and II remedial investigations ranged from 0.65J µg/l at MW-10 to 120D µg/l in MW-18.

Trends of cis-1,2,-DCE concentrations, with the exception of samples collected at MW-8, increased from Phase I to Phase II at locations where this compound was detected. Detections from both investigations ranged from 0.47J µg/l at MW-24 to 890D µg/l at MW-18.

There were no target cVOC analytes detected above the Recommended Soil Cleanup Objectives (RSCOs) for unrestricted use in any of the soil boring samples collected during the Phase I investigation. Four (4) target cVOC analytes, two (2) for PCE, one (1) for TCE and one (1) for vinyl chloride (VC) were detected above unrestricted RSCOs from three (3) samples collected during the Phase II investigation. Soil samples were collected from five (5) to 18 feet bgs at locations above the water table. Soil cVOC contamination above the water table can be considered "minimal" based upon existing information. The highest concentration of adsorbed PCE contamination was observed to be present near the former Kem Cleaners location based upon the results from Monitoring Well MW-26. A VC concentration of 0.0562 µg/l was also detected at this location, indicate the potential presence of partial biodegradation of parent compounds PCE and TCE in this area.

Concentrations of PCE, TCE and cis-1,2-DCE remained elevated in samples collected from soil vapor points located in the Former Loudon and Kem Cleaners during both Phase I and II remedial investigations. In both investigations soil vapor samples yielded PCE concentrations which exceeded 100,000 µg/m^3 in the Former Loudon and Kem Cleaners Site location. Soil vapor samples analyzed for cVOCs at the Former Loudon Cleaners only detected PCE during Phase I of the investigation at a concentration of 67,000 µg/m^3. Sub-slab PCE air sample results were significantly lower with the highest concentrations ranging from 9,700 to 11,000 µg/m^3 at the Former Loudon Cleaners location. Sub-slab samples were not collected at the Former Kem Cleaners. In general, soil gas concentrations increased with depth below the ground surface. Due to a lack of detected adsorbed soil contamination, the elevated concentrations of cVOC soil gas are most likely attributed to the volatilization of dissolved PCE in the groundwater and/or residual PCE vapors retained within the sub-slab soils/gravels based upon existing information.

1.5 Contamination Fate and Transport

Based on information provided in the RI, surface water contaminant infiltration or migration does not appear to contribute a significant transport mechanism due to the large amount of impervious surface area (i.e. entire site is paved and/or covered by improved structures). There are no surface water bodies such as lakes, rivers, streams or ditches present at the Site. The

closest water body is the Hudson River which is located approximately 7,500 feet down gradient of the Site.

Infiltration of historic dry cleaner waste discharge through the soil pore space into groundwater was a potential transport mechanism. Currently cVOCs are no longer used at the Site and contaminant infiltration is no longer anticipated to be a potential transport mechanism.

There is a significant change in groundwater elevation across the Site with a groundwater flow in a southeasterly direction. The hydraulic gradient at this area is approximately 045 ft/ft (4.5%) and soils are mostly silty sands. Groundwater flow is considered to be a significant lateral and vertical mechanism for cVOC contaminant transport both on and off the Site based upon existing data. Information in the RI indicates that groundwater flow velocity is significantly reduced immediately down gradient of MW-18/MW-18D where the water table intersects a silty clay layer.

Indoor, outdoor, sub-slab and soil vapor sampling has confirmed the presence of cVOC impacts in the vadose zone above the water table. Preferential pathways for soil vapor migration include permeable soil layers, utility bedding pathways as well as asphalt, concrete slab and footing cracks in roadways and buildings; the highest vapor concentrations have been detected in the soil vapor points located in the Former Loudon and Kem Cleaners.

1.6 Qualitative Human Health Risk Evaluation

Currently the Former Kem Cleaners area has been remodeled and converted into a restaurant. Based on these conditions two (2) populations, restaurant employees and customers, have been evaluated for contaminant exposure. This location was chosen because the highest cVOC air sample results were observed in this area in the RI. In order for a contaminant to pose risk to human health, a complete exposure pathway must be present with contaminant concentrations high enough to potentially cause an adverse health effect. Human exposure pathways can occur through ingestion, inhalation, absorption and injection.

Ingestion, inhalation and absorption of soil are potential pathways for human exposure. Indoor air sample analytical results collected at the Site indicate low cVOC concentrations and contamination detected is located below mostly impervious ground surfaces. Therefore, it is unlikely that a pathway for human exposure exists for cVOC contamination in soil based upon existing data.

Ingestion and absorption of contaminated groundwater are also considered to be possible pathways for human exposure. The Site groundwater table is located approximately 13 to 18 feet

below ground surface (bgs), therefore absorption of groundwater is highly unlikely. A municipal water source is used as the water supply for the Site and surrounding area which would indicate that groundwater ingestion is most likely not a human exposure pathway under current site conditions.

Inhalation of contaminated soil vapor from the subsurface soil/groundwater is a potential pathway for human exposure. RI analytical results indicate elevated cVOC concentrations in the soil vapor and sub-slab sample locations. This information is indicative of a complete exposure pathway for Site workers and Site visitors. Existing conditions may potentially pose a human health risk at the Former Kem Cleaners (now a restaurant) as well as the former Loudon Cleaners (currently vacant). Although cVOC concentrations tend to increase with depth, over time, building settlement may cause the foundation to crack and create preferential pathways which may subsequently facilitate an increase in indoor air cVOC concentrations.

2.0 IDENTIFICATION OF STANDARDS, CRITERIA, GUIDELINES AND REMEDIAL ACTION OBJECTIVES

2.1 Introduction

As identified in the RI, cVOCs were detected across the Site at various concentrations in soil, groundwater and vapor matrices. However, as previously discussed in **Section 1.6**, cVOC soil vapor is the only apparent complete human exposure pathway based upon existing analytical data. For purposes of this report only a human health exposure assessment has been provided. An ecological assessment was not conducted due to the Site being zoned as a commercial property and the closest proximity to a down gradient surface water body is greater than 0.3 miles.

2.2 Potentially Applicable Standards, Criteria, Guidelines (SCGs), and Remedial Action Objectives

Standards, Criteria and Guidelines (SCGs) are defined below as follows:

"Standards and criteria are cleanup standards, standards of control, and other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance."

"Guidelines are non-promulgated criteria, advisories and/or guidance that are not legal requirements and do not have the same status as standards and criteria; however, remedial alternatives should consider guidance documents that, based on professional judgment, may be applicable to the project."

SCGs may include Applicable Requirements (ARs), Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered Criteria (TBCs) where:

1) ARs are legally enforceable standards or regulations, such as groundwater standards for drinking water that have been promulgated under state law.

2) ARARs include those requirements that have been promulgated under state law that may not be "applicable" to the specific contaminant released or the remedial actions contemplated but are sufficiently similar to site conditions to be considered relevant and appropriate. If a relevant or appropriate requirement is well suited to a site, it carries the same weight as an applicable requirement during the evaluation of remedial alternatives.

3) TBCs are non-promulgated advisories or guidance issued by state agencies that may be used to evaluate whether a remedial alternative is protective of human health and the environment in cases where there are no standards or regulations for a particular contaminant or site condition. These criteria may be considered along with SCGs when establishing cleanup goals for protection of human health and the environment.

The *Final Guidance for Evaluating Soil Vapor Intrusion (2006)* by the New York State Department of Health was used to evaluate vapor phase data and further described in Section 2.4.2.1.

2.2.1 Chemical Specific SCGs

Chemical Specific SCGs define health or risk based numerical limits on the concentration of contaminants in the environment. These concentration limits may be established by Government Agencies and are used to provide protective cleanup levels or may be used to consider the extents of contamination and the need for remediation at a site. For the purposes of the Former Loudon and Kem Cleaners Site groundwater is considered Class GA. Class GA groundwater pertains to fresh groundwater found in the saturated zone of unconsolidated deposits and bedrock. The best usage of Class GA groundwater is a source of potable water supply; however, Site groundwater is not used as a drinking water source. The NYS water quality standards and guidance values for Class GA groundwater are stipulated in:

1. New York Water Classifications and Quality Standards (6 NYCRR Parts 609, and 700-704),

2. ii) Technical and Operation Guidance Standards (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values dated October 22, 1993 (reissued June1998)

As stated in Part 375-6, Soil Cleanup Objectives (SCOs) will be required to achieve the lowest of the three (3) potentially applicable contaminant specific SCOs for all soils above bedrock. NYSDEC has developed SCOs for protection of public health, for protection of groundwater, and for protection of ecological resources. The Former Loudon and Kem Cleaners Site is zoned in a commercial area and is located greater than 0.3 miles from the nearest surface water body, therefore, the SCOs for the protection of ecological resources are not applicable to this Site. Applicable SCOs for the Site include clean up for the protection of groundwater which is more stringent than SCOs for the protection of public health. Chemical specific SCGs considered at the Former Loudon and Kem Cleaners Site are provided in **Table 1**.

2.2.2 Location Specific SCGs

Potential location-specific SCGs are requirements that set restrictions on activities depending upon the physical and environmental characteristics of the Site or its immediate surroundings. These are typically building, construction and zoning codes. Location-specific SCGs also generally include floodplain and wetland regulations, or restrictions promulgated under federal acts. Potential location-specific SCGs that may be applicable to potential Site remedial technologies are the City of Albany zoning ordinances and building codes. Location specific SCGs considered at the Former Loudon and Kem Cleaners Site are provided in **Table 2**.

2.2.3 Action Specific SCGs

Action Specific SCGs are requirements determined by particular remedial activities taking place during the remediation process. Action specific SCGs establish controls or restrictions on the design, implementation, and performance of remedial activities. These can include reporting requirements for governments, general health and safety requirements and handling and disposing of waste (including permitting, manifesting, transportation and disposal, and treatment and disposal facility operations). Remedial actions conducted at the Site would be required to comply with applicable requirements established by the Occupational Safety and Health Administration (OSHA) and general industry standards. A complete list of Action Specific SCGs considered for this Site can be found in **Table 3**.

2.3 Remedial Action Objectives

The development of RAOs was completed with the goal of eliminating the potential to expose humans to contaminated media. As previously discussed in **Section 1.4.2** and as indicated in the RI, this includes the:

2.3.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water.
- Remove the source of ground or surface water contamination.

2.3.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

2.3.3 Soil Vapor

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

2.4 Cleanup Objectives and Volume of Impacted Media

2.4.1 Selection of Soil Cleanup Goals

2.4.1.1 Soil

Specific soil clean up objectives based on the protection of public health based on land use is found in 6 NYCRR Part 375-6.8. This guidance provides numeric guidance values for specific individual chemical compounds for various uses.

- Unrestricted Use: use without restriction or environmental controls;

- Protection of Groundwater: use at restricted-use sites where contamination has been identified in on-site soil by the RI and groundwater standards are, or are threatened to be, contravened by the presence of soil contamination at concentrations above the protection of groundwater soil cleanup objectives;

- Residential Use: use with limited restrictions, such as not allowing the raising or animals for human consumption;

- Restricted Residential Use: use with restrictions, such as limiting ownership or size or number of units as well as the ability to grow vegetables for consumption;

- Commercial Use: Use for the purposes of conducting businesses including buying and selling merchandise and services;

- Industrial Use: use for the processes of manufacturing, producing, or assembling goods.

Based on the City of Albany Zoning Map developed by the City of Albany Department of Development and Planning, the Former Loudon and Kem Cleaners Site has a zoning designation of C-1, which is classified as a "Neighborhood Commercial District". The proximity to adjacent residentially zoned districts including a "Multi-Family Low Density Residential District" R-3A to the south and Multi-Family High-Rise Residential district to the north east contribute to Site's current classification. The current and projected use of the Former Loudon and Kem Cleaners Site is expected to continue with Commercial Use operations. Based on the commercial site use, the RI soil analytical results were compared to the following: the commercial use SCOs presented in 6NYCRR Part 375 6.8 for those contaminants not present in site groundwater; the protection of groundwater SCOs for those contaminants also present in the groundwater; and the unrestricted use SCOs (UUSCO). Note that the protection of GW SCOs and the UUSCOs are the same for all compounds with the exception of hexachlorobenzene (0.33 parts per million [ppm] for UUSCO and 3.2 ppm for the protection of groundwater) and mixed xylenes (0.26 ppm for UUSCO and 1.6 ppm for Protection of Groundwater). Neither of these compounds was detected during site investigative activities or are considered contaminants of concern.

As previously mentioned, SCOs for the protection of ecological resources were not considered applicable as indicated in 6 NYCRR Part 375-6.8 as the closest surface water body is greater than 0.3 miles from the Site and ecological receptors are not expected to be impacted by Site contamination.

There were four (4) exceedances of the contaminants of concern when compared the unrestricted use and protection of groundwater SCOs, which are the same for the chlorinated VOCs found at the site (e.g., PCE, TCE, cis-1,2 DCE, carbon tetrachloride). No exceedances for contaminants of concern greater than commercial use SCOs.

For comparison purposes, a list of soil cleanup goals is presented in 6 NYCRR Part 375-6.8 tables. Based on the RI soil sample analytical results and the commercial use zoning designation of Site, no significant soil source areas were identified. However, in those areas with soil contamination above the applicable SCOs (protection of groundwater SCOs), remediation of the potential soil sources would occur in the alternatives that have a soil vapor extraction (SVE) component as part of the remedial strategy.

2.4.1.2 Groundwater

New York State provides cleanup goals for groundwater as part of the Division of Water, Technical and Operational guidance Series (1.1.1) (TOGS 1.1.1) *Ambient Water Quality Standards and Guidance Value and Groundwater Effluent Limitations.*

2.4.1.3 Soil Vapor

The State of New York has no official regulation for Soil Vapor; the Department of Health issued *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (2006) for the "guidance for parties evaluating soil vapor intrusion in the State of New York". This document provides indoor and outdoor air recommended guidance criteria for both PCE and TCE.

Concentrations of cis-1,2-DCE and carbon tetrachloride were also detected in vapor phase samples collected during the RI. A comparison should be made to determine the relevance of the concentration in regards to background levels. NYSDOH guidance presents the Building Assessment and Survey (BASE) database which can be used as a guide. As a conservative measure, the 90th percentile of background was chosen for cis-DCE and Carbon tetrachloride.

2.4.2 Selection of Contaminants of Concern

2.4.2.1 Soil

Carbon tetrachloride, PCE, TCE and cis-DCE are the contaminants of concern based on the historic operations which took place at the site.

2.4.2.2 Groundwater

PCE, TCE and cis-DCE are the contaminants of concern based on the historic operations which took place at the site. Detections above the TOGS guidance values only occurred for PCE, TCE and cis-DCE.

The maximum detected concentrations during phases I and II of the RI and the selected clean up guidance are shown below:

Contaminant of Concern	TOGS (1.1.1) (µg/L)	Maximum Detected Concentration (µg/L)
PCE	**5**	5,100
TCE	**5**	140
cis-DCE	**5**	890

2.4.2.3 Soil Vapor

PCE, TCE, Carbon tetrachloride, cis-DCE, and 1,1,1-TCA are the vapor phase contaminants of concern at this Site based upon the historic operations (use of several spaces as dry cleaners) and resulting analytical data generated during the RI.

The contaminants of concern and the selected clean up guidance is shown below. The maximum detected concentrations represent results detected in Phase I and Phase II of the RI.

Contaminant of Concern	NYS DOH Guidance Value (µg/m3)	BASE Database (90th percentile) (µg/m3)	Maximum Detected Concentration (µg/m3)
PCE	**100**	15.9	130,000
TCE	**5**	4.2	14,000
cis-DCE	NA	**<1.9**	720
1,1,1-TCA	NA	20.6	9.8
Carbon Tetrachloride	NA	**<1.3**	44,000

NA – Not Applicable

2.4.3 Determination of Extent of Soil Vapor Intrusion

2.4.3.1 Soil

No definitive source area or area of impacted soils has been identified during the RI. However, an unidentified "mass" may be contributing to the observed soil vapor intrusion. The alternatives below have taken this issue into consideration this issue.

2.4.3.2 Groundwater

Results from Phase I and II of the RI indicate the presence of dissolved cVOC constituents moving in a southeasterly direction. The vertical and horizontal extents of the PCE plume have been generally been delineated during the completion of several phases of assessment that have been completed at the Site. This data has been included in the RI provided under separate cover.

2.4.3.3 Soil Vapor

Elevated PCE concentrations were detected during both phases of the RI. The highest detections occurred at the soil vapor locations (completed approximately 8 feet bgs) at the Former Kem Cleaners location, with PCE detections exceeding 100,000 µg/m^3. There were also detections of PCE exceeding 50,000 µg/m^3 at vapor locations installed at the Former Loudon Cleaners location. The sample locations and analytical results are provided in the RI under separate cover.

The areas of the Former Loudon and Kem Cleaners yielding the highest PCE concentrations encompass approximately 1,800 and 2,200 square feet (sf) respectively.

There were two air (indoor air, sub-slab soil gas and soil vapor) sampling events completed at this Site. In comparing the Phase I air sampling event (January 2012) with the NYSDOH VI Guidance, seven locations had PCE results that required "mitigation" and two that required "monitoring". Additionally, samples collected in a building located in a "down-gradient" direction on the southern side of Northern Boulevard had results that required "mitigation" under the NYSDOH VI Guidance.

Soil vapor samples collected in a parking lot southeast of that building had PCE detections of 100 and 820 $\mu g/m^3$. Five locations in the Former Loudon and Kem Cleaners building required "mitigation" during the second sampling event (December 2012-January 2013). In general an increase in PCE concentrations was observed on the west/southwestern side of the building between the two air sampling events.

3.0 IDENTIFICATION OF ALTERNATIVES

3.1 Introduction

The following section details the development of several remedial options to achieve the RAOs stated above. In consultation with the NYSDEC, Shaw has identified six (6) alternatives that may be employed to successfully remediate the vapor phase and dissolved groundwater impacts that have been observed at the Site. These alternatives were selected based upon observed site conditions, previous experience as well as cost and technological constraints. Additional remedial alternatives have been briefly reviewed for applicability and feasibility purposes and are described in **Table 4**.

3.2 Alternative Number 1: No Action

No action as an alternative is only an option at sites that could benefit from natural processes which would degrade the contamination to levels below the Cleanup Goals. This alternative is considered as a baseline for comparison as required by the National Contingency Plan (NCP). This alternative would not include institutional controls and would not involve quarterly monitoring to evaluate natural attenuation.

3.3 Alternative Number 2: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and Long Term Air and Groundwater Monitoring)

This alternative consists of mitigation methods that involve sealing preferential pathway infiltration points and actively manipulating the pressure differential between the building's interior and exterior (on a continuous basis). The buildings foundation is slab-on-grade. In conjunction with sealing potential subsurface vapor entry points, active Sub-Slab Depressurization Systems (s) (SSDS) would be installed to draw vapors from the soil beneath the impacted buildings slab (creating a vacuum) and subsequently discharging the vapors to the atmosphere. Additionally, implementation of this alternative will include long term groundwater sampling to further evaluate contaminant migration and natural attenuation at the following frequency:

- Quarterly for years 1 – 5
- Once every five (5) years for years 6 – 30

Long term groundwater sampling (years 6 – 30) has been selected at a one event per five (5) year frequency for budgetary purposes only. The actual frequency maybe increased or decreased pending sampling analytical results from years one (1) through five (5).

3.4 Alternative Number 2A: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) and Long Term Air and Groundwater Monitoring

This alternative consists of mitigation methods by sealing preferential pathways and installation of SSDS as described in alternative 2. Additionally, In-situ Chemical Reduction (ISCR) groundwater treatment will be employed using a product called EHC® to create a combination of grid injections and permeable reactive barriers (PRBs) strategically located on site to destroy cVOCs as they migrate through the treatment zones under natural groundwater flow conditions. Grid injections will be installed at locations of known impacted PCE areas.

Based upon existing data the entire delineated plume would not be treated as it would not be a cost effective remedy.

Therefore, this alternative involves the direct injection of ISCR product at two (2) to three (3) elevated (e.g. "Hot Spot") PCE locations and installing two (2) to three (3) PRBs perpendicular to groundwater flow to intercept contaminants migrating down gradient.

Initial treatment will include the installation of a grid injection pilot test at MW-18 to ensure adequate EHC® product performance and to identify any modifications that may need to be completed prior to implementation of the full scale remedy. Long term groundwater monitoring is proposed to monitor contaminant attenuation at frequencies described in alternative 2.

3.5 Alternative Number 2B: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) and Long Term Air and Groundwater Monitoring

This alternative consists of mitigation methods by sealing preferential pathways and installation of SSDS as described in alternative 2. Additionally, in-situ groundwater treatment will be applied to enhance PCE plume mitigation using In-Situ Chemical Oxidation (ISCO). This alternative involves utilizing permanganate (by methods of direct injection) to address the areas with cVOC impacted groundwater. The ISCO treatment would utilize direct injection at two (2) to three (3) elevated PCE locations and installing two (2) to three (3) "injection lines"

perpendicular to groundwater flow to remediate groundwater contamination as the injected treatment migrates down gradient.

Initial treatment will include the installation of a grid injection pilot test at MW-18 to ensure adequate permanganate product performance and to identify any modifications that may need to be completed prior to implementation of the full scale remedy. Two (2) rounds of full scale injection treatment are anticipated to be needed to reduce contaminant levels to the respective chemical specific SCGs. Long term groundwater monitoring is proposed to monitor contaminant attenuation at frequencies described in alternative 2.

3.6 Alternative Number 3: Horizontal Soil Vapor Extraction System with Long Term Air and Groundwater Monitoring

This alternative proposes to install a horizontal soil vapor extraction (HSVE) system beneath the Loudon and Kem Cleaners building; a technique used to remediate contaminated subsurface soil vapor. The proposed layout is shown on **Figure 3**. Installation and operation of an HSVE system will involve using high flow rates, induced vacuum or a combination of high flow/induced vacuum to collect and remove vapor phase contamination. The HSVE system will also be designed so that the operation of this system could be used/employed to mitigate vapor phase intrusion to indoor air. The system would be installed to reduce vapor concentrations at both the Former Loudon and Former Kem Cleaner locations. Long term groundwater sampling would be proposed to monitor contaminant natural attenuation at frequencies described in alternative 2.

3.7 Alternative Number 4: Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) with Long Term Air and Groundwater Monitoring

This remedial alternative proposes to install a HSVE system as described in Alternative 3 and apply in-situ groundwater treatment to enhance PCE plume mitigation using In-Situ Chemical Reduction (ISCR) as described in alternative 2A. Long term groundwater sampling will be proposed to monitor contaminant attenuation at frequencies described in alternative 2.

3.8 Alternative Number 5: Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) with Long Term Air and Groundwater Monitoring

This remedial alternative proposes to install a HSVE system as described in alternative 3 and apply in-situ groundwater treatment to enhance PCE plume mitigation using ISCO as described

in alternative 2B. Long term groundwater sampling is proposed to monitor contaminant attenuation at frequencies described in alternative 2.

3.9 Alternative Number 6: Soil Vapor Extraction/ Sub-Slab Depressurization System with Focused In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) with Long Term Air and Groundwater Monitoring

This remedial alternative proposes to install vertical SVE system(s) at three locations where elevated soil vapor concentrations were observed near the Former Loudon and Kem Cleaners and apply grid in-situ groundwater treatment at known impacted areas near MW-18 to reduce PCE concentrations using ISCO. Based on the pilot test results the proposed remedy would be implemented over a larger area of roughly 15,000 sf. Long term groundwater sampling is proposed to monitor contaminant natural attenuation at frequencies described in alternative 2.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

4.1 Introduction

This section provides a detailed analysis of the remedial alternatives outlined in **Section 3** of this document. Each remedy is evaluated to ensure that the alternative can employ a remedy to protect against a threat to public health and/or the environment and is technically suitable at the Site. Each alternative is described in detail and compared on the basis of environmental benefits and costs using criteria established by 6 New York Code Rules and Regulations (NYCRR) Part 375, NYSDEC and Division of Environmental Remediation-10 (DER-10). A total of six (6) remedial alternatives, (including a "No Action" alternative) are described in this section and compared to the RAOs for groundwater and soil vapor intrusion on this site.

4.1.1 Detailed Evaluation of Criteria

This section discusses each remedial alternative compared against nine (9) evaluation criteria that were used to select each alternative. These criteria include:

- Overall protection of public health and the environment
- Standards, criteria and guidance;
- Long-term effectiveness and permanence;
- Reduction in toxicity, mobility or volume of contamination through treatment;
- Short-term impacts and effectiveness;
- Implementability;
- Community and state acceptance;
- Cost-effectiveness, including capital costs and annual site maintenance plan costs;
- Community acceptance; and
- Land use.

4.1.2 Overall Protection of Human Health and the Environment

This criterion assesses the effect of each proposed alternative on human health and the environment. The assessment is based on a number of factors included in the short and long term effectiveness criteria, and compliance with statutory requirements. This site specifically includes the effect of contaminated soil vapor intrusion and groundwater on human health and the environment.

4.1.3 Reduction of Toxicity, Mobility and Volume through Treatment

This criterion compares the remedial technology selected for the Site to the technologies effectiveness in reducing the overall toxicity, mobility and quantity of contamination of concern in the treated matrix. It evaluates the degree to which the selected alternative can efficiently reduce the concentrations and volume as well as prevent contaminant migration down gradient of the Site.

4.1.4 Long-Term Impacts Effectiveness and Permanence

This criterion addresses the long-term effectiveness of the selected remedial alternative post completion of the remedial action. It compares and evaluates the effectiveness of the remedial action to remaining contamination on the Site as well as the long-term reliability of the alternative to the protection of the environment and human health.

4.1.5 Short-Term Impacts and Effectiveness

This criterion compares how the selected alternative will impact the Site during the implementation phase of the project. Considerations include the protection of the surrounding community; construction workers involved the remedial process and the protection of the surrounding environment. It compares and evaluates the effectiveness in meeting the RAOs for the remedial action to remaining contamination on the Site as well as the short-term reliability of the alternative.

4.1.6 Implementation and Technical Reliability

This criterion evaluates the overall feasibility of the selected remedial alternative which may include a number of factors including the administrative and technical aspects, and availability of services to conduct the work. Administratively, the remedial alternative must be in compliance with all federal, state and local regulatory requirements and proper permits must be established as necessary. Technically, the remedial alternative must include the site-specific capabilities of being constructed, operated and subsequently maintained. Availability of services includes the means of feasibly establishing and implementing the remedial alternative at the site.

4.1.7 Compliance with Statutory Requirements

This criterion is used to evaluate whether the selected alternative achieve the proposed cleanup goals as described in **Section 2** of this report.

4.1.8 Community and State Acceptance

This criterion evaluates potential feasibility concerns that the public or the state may have regarding each remedial alternative. Typically these criteria are addressed in the Record of Decision (ROD) provided by NYSDEC.

4.1.9 Cost

This criterion provides a cost estimate for the selected alternative which includes design, construction and long-term operation and maintenance at the site. The cost estimates herein reflect remedial alternative costs estimated to an accuracy of +/- 30%.

4.1.10 Land Use

This criterion is an evaluation of the current, intended and reasonably anticipated future use of the site and its surroundings. Land use is discussed within the other evaluation criteria since site use is currently commercial and is expected to remain as such in the future.

4.2 Remedial Alternatives

4.2.1 Alternative Number 1: No Action

4.2.1.1 Description

This alternative involves taking no further action to remedy existing contamination on the site. The NCP at 40 CFR §300.430(e) (6) states that a "No Action" alternative be evaluated during Feasibility Studies to use as a baseline for comparison with other remedial alternatives. This alternative relies on the natural processes occurring in the subsurface to provide all and any remedial action. It does not include any design, construction, installation or long-term monitoring of existing monitoring wells on the Site.

4.2.1.2 Detailed Evaluation of Criteria

4.2.1.3 Overall Protection of Human Health and the Environment

This alternative is not protective of human health and the environment. Based on information included in the RI, natural attenuation dechlorination processes are occurring at a slow rate. PCE daughter products (including TCE, cis-1,2-DCE and vinyl chloride) have been identified in the soil, soil vapor and/or groundwater. However, significant dechlorination of the contaminants has not occurred based upon existing data. CVOC impacts would be expected to remain in the soil vapor and groundwater. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.1.4 Compliance with Statutory Requirements

Applying this alternative as the remedial action for the Site would not significantly reduce contaminant concentrations. The selected chemical specific SCGs for the Site (as discussed in **Section 2)** for both groundwater and soil vapor intrusion would not be achieved.

4.2.1.5 Short-Term Impacts and Effectiveness

Short-term impacts of implementing this alternative would be considered negligible. Soil vapor PCE and associated cVOC constituents around and under the existing structure would be expected to remain at or near concentrations indicated in the RI. Groundwater cVOC impacts would be expected to continue migration with the groundwater flow path. There is no treatment involved with this alternative and therefore would be no short term effectiveness to meet any RAOs.

4.2.1.6 Long-Term Effectiveness and Permanence

Long-term effectiveness of implementing this alternative would involve only the natural attenuation processes to degrade the existing cVOC contamination. Based on results from the RI, PCE has begun the dechlorination process with detections of TCE and cis-1,2-DCE; however the "bulk" of contamination remains as PCE and the anaerobic biodegradation process is apparently occurring at a slow rate. The risks associated with contaminated soil vapor and groundwater would be expected to remain the same because this alternative does not involve the removal or treatment of the delineated contamination. This alternative is not considered to be a long-term effective remedy.

4.2.1.7 Reduction of Toxicity, Mobility, and Volume through Treatment

There is no reduction or removal of contaminant volume with this alternative. Therefore, the toxicity, mobility, and volume of contamination would not be reduced.

4.2.1.8 Implementability

There is no action to implement by using this alternative.

4.2.1.9 Cost

There are no costs associated with this alternative.

4.2.1.10 Land Use

The anticipated use of the site is commercial; however, there is no action to implement by using this alternative.

4.2.2 Alternative Number 2: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and Long Term Air and Groundwater Monitoring

4.2.2.1 Description

The remedial action associated with this alternative involves sealing preferential pathways (cracks in foundation, etc.) within the existing building and the installation of SSDS within each impacted building "unit". Each system will be powered by an electric blower/fan that discharges to the atmosphere. The blower/fan will be connected to a Polyvinyl Chloride (PVC) pipe network that extends below the concrete slab to mitigate soil vapor intrusion. These systems will be designed pursuant to the guidelines included in the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006) and EPA - OSWER *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance* – November 2002). Air samples will be collected to determine the system's effectiveness.

Long Term air monitoring would include indoor air (5 samples), outdoor ambient (2 samples), sub-slab (3 samples) and soil vapor sampling (3 samples) annually for the first five (5) years. The same samples will be collected at a frequency of one (1) sampling event every five (5) years from years 6 to 30. Long term soil vapor sampling (years 6 – 30) has been selected at a one (1) event per five (5) year frequency for anticipated budgetary purposes only. The actual frequency maybe changed pending sampling analytical results from years one (1) through five (5).

Additionally, this alternative proposes the inclusion of a long-term groundwater monitoring program and the installation of six (6) groundwater monitoring wells to more adequately identify and delineate groundwater contamination. Long- term monitoring and sampling of existing and new monitoring wells will be conducted to evaluate cVOC contaminant migration both on and offsite at 30 – 35 locations at an initial frequency of four (4) times per year (quarterly) for the first five (5) years. From years 6 – 30 the sampling frequency would be reduced to one (1) sampling event every five (5) years. Long term groundwater sampling (years 6 – 30) has been selected at a one (1) event per five (5) year frequency for anticipated budgetary purposes only. The actual frequency maybe increased or decreased pending sampling analytical results from years one (1) through five (5). SSDS and proposed monitoring well locations are identified on **Figure 3**.

4.2.2.2 Detailed Evaluation of Criteria

4.2.2.3 Overall Protection of Human Health and the Environment

Installing SSDS at each building "unit" would provide protection to human health by mitigating soil vapor intrusion. Air monitoring and sampling will be established to verify the effectiveness of these systems. In addition, the site is zoned as "commercial" thereby limiting the site use and potential exposure. The SSDS will not remove any significant mass of contamination from potential source areas that may be present under the building, nor will it actively address groundwater contamination. Since the nearest surface water body is located further than 0.3 miles from the site, contaminated groundwater is not expected to reach/impact surface water and no ecologic risk/exposures are anticipated.

4.2.2.4 Compliance with Statutory Requirements

This alternative proposes to mitigate soil vapor to reduce risk to human health. The installation of SSDS would largely prevent soil vapor from entering the structure. Matrix 2 provided in the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006) states that mitigation is needed to minimize the risk for PCE soil vapor exposure for sub-slab detected concentrations exceeding 1,000 µg/m^3. Based on results from the RI, sub-slab soil vapor detections for PCE exceeded concentrations greater than 1,000 µg/m^3 in both Phase I and Phase II investigations. Providing SSDS for each building unit and sealing preferential pathways could adequately mitigate the potential for soil vapor intrusion. However, it will not remove/remediate the "mass" of observed soil vapor contamination that has previously been observed in these areas.

This alternative proposes long term monitoring to continue to evaluate and delineate the migration of groundwater contamination. As discussed in **Section 4.2.1.2** and as indicated by results of data collected during the RI, naturally occurring anaerobic biodegradation is occurring at a slow rate and can therefore be eliminated as strategy for remediation. Therefore implementing this alternative would not meet the chemical-specific SCGs for the Site.

4.2.2.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the SSDS. However, the work would be implemented in a controlled manner to limit potential dust generation/impacts to workers, employees at the Building and residents nearby. Installation of SSDS and sealing of preferential pathways in each building unit would help to mitigate soil vapor intrusion into the structure. This would provide

short-term protection to employees and customers/visitors that enter each building unit. Annual air sampling would be implemented to evaluate the systems effectiveness.

4.2.2.6 Long-Term Effectiveness and Permanence

Installation of the SSDS would continue to be effective long-term for the protection of human health for building occupants if proper operation and maintenance of the blower units was completed. However, since this alternative does not provide "mass" removal of soil vapor, it is not considered to be a long-term/permanent effective measure for protection of human health and the environment with respect to addressing potential source areas.

4.2.2.7 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative does not target high "mass" removal or treatment of impacted soil vapor or the remediation of groundwater. Therefore, the toxicity, mobility, and volume of contamination would not be expected to significantly decrease.

4.2.2.8 Implementability

Implementation of this alternative could begin immediately following technical design of the SSDS and establishing proper administrative controls/permits and related operational requirements. Materials included in the design of the SSDS are readily available and of minimal cost. SSDS are not structurally complex and therefore exhibit inexpensive design costs. Structural sealants are readily available and involve mostly labor to identify and seal existing preferential pathways. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.2.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $473,000. Quantities, assumptions and unit price information are provided in a cost estimate spreadsheet as **Table 5**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.2.10 Land Use

No changes to land use would be made; the land use is anticipated to remain commercially zoned. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination would be addressed through implementation of a Site Management Plan.

4.2.3 Alternative Number 2A: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) and Long Term Air and Groundwater Monitoring

4.2.3.1 Description

The remedial action associated with this alternative involves sealing preferential pathways (cracks in foundation, etc.) within the existing building and the installation of SSDS within each building "unit" as described in alternative 2.

Additionally, this alternative proposes treating contaminated groundwater using In-situ Chemical Reduction (ISCR) technology. The treatment will involve using a Direct Push Technologies (DPT) to directly inject EHC® and/or EHC-L® which are groundwater treatment products that consist of a combination of controlled-release carbon and zero valent iron (ZVI) particles used for stimulating ISCR or otherwise persistent organic compounds in groundwater. The ISCR technology is primarily used for the destruction of groundwater contaminants (such as PCE/TCE and associated daughter products) through reductive dehalogenation.

This alternative implements a "grid injection" pilot test to treat groundwater cVOC impacts at the location surrounding MW-18. The pilot test includes the mobilization and installation of 52 direct injection points over a 75 ft by 100 ft area with an estimated 747 lbs of EHC® mixed and injected per point. The treatment depth interval for each location extends 15 feet below the groundwater table/soil interface. The spacing between each injection is estimated at 12 feet. The area would be monitored and evaluated for a period of six (6) to nine (9) months prior to mobilization for implementation of the full scale remedial program.

A full scale remedy would be implemented after an evaluation of the results of the pilot test. The proposed remedy includes the installation of two (2) additional "grid injections" near monitoring well locations MW-01 and MW-04 and the installation of three (3) permeable reactive barriers (PRBs). The injection locations and PRBs are shown on **Figure 5**.

Based on RI analytical results from samples collected at MW-01 and MW-04 (cVOC concentrations at approximately 0.5 ppm), EHC-L® was selected as preferred product for use in this application. The grid injection near MW-01 includes the installation of 11 direct injection points spread over a 40 ft by 40 ft area with an estimated 3,780 lbs of EHC-L® mixed and injected over the specified area. The grid injection near MW-04 includes the installation of 17 direct injection points over a 50 ft by 50 ft area with an estimated 5,880 lbs of EHC-L® mixed and injected over the specified area. The treatment depth interval for at both locations extends

15 feet below the groundwater table/soil interface. The spacing between each injection is estimated at 12 feet. Three (3) EHC® PRBs would be installed by means of direct injection at lengths of PRB-01 = 250 ft, PRB-02 = 300 ft and PRB-03 = 280 feet respectively. The mass of EHC® for each PRB is estimated at 22,866, 25,900 and 24,150 lbs at a treatment depth interval of 15 ft below the water table/soil interface. Spacing between injection points is estimated at 15 ft. The pilot test and full scale remedy is illustrated on **Figure 5.**

Additionally, this alternative proposes the inclusion of a long-term air and groundwater monitoring program as described in alternative 2. SSDS and proposed monitoring well locations are identified on **Figure 3**.

4.2.3.2 Detailed Evaluation of Criteria

4.2.3.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the mitigation of soil vapor and remediation of groundwater. Installing SSDS at each building "unit" would reduce the risk and provide protection to human health by mitigating soil vapor intrusion. Air monitoring and sampling would be established to verify the effectiveness of these systems. The SSDS will not remove any significant mass of contamination from potential source areas that may be present under the building, nor will it actively address groundwater contamination.

ISCR groundwater treatment is anticipated to reduce the dissolved cVOC contaminant mass by chemically enhancing dehalogenation processes while also increasing the effect of natural anaerobic biodegradation processes. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.3.4 Compliance with Statutory Requirements

This alternative proposes to mitigate soil vapor and actively treat groundwater to reduce risk to human health and the environment. The installation of SSDS would largely prevent soil vapor from entering the structure. Matrix 2 provided in the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006) states that mitigation is needed to minimize the risk for PCE soil vapor exposure for sub-slab detected concentrations exceeding 1,000 µg/m^3. Based on results from the RI, sub-slab soil vapor detections for PCE exceeded concentrations greater than 1,000 µg/m^3 in both Phase I and Phase II investigations. Providing SSDS units for each building unit and sealing preferential pathways could adequately mitigate the potential for soil vapor intrusion. However, it would not remove/remediate the "mass" of observed soil vapor contamination.

Direct injection groundwater treatment using ISCR technology with a combination of grid pattern injections and permeable reactive barrier injections is anticipated to provide a sustained treatment that has the potential to meet Chemical specific SCGs for PCE and associated daughter products.

This alternative proposes long term monitoring to continue to evaluate and delineate the migration of groundwater contamination and evaluate the effectiveness of ISCR groundwater treatment. Implementing this alternative may potentially meet the chemical-specific SCGs for the Site.

4.2.3.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the SSDS and groundwater treatment injection points. However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional potential impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. Post installation of building preferential pathway sealing and operating the SSDS is anticipated to mitigate the potential for soil vapor intrusion immediately. Following the implementation of enhanced bioremediation using direct injection, cVOC concentrations would be expected to steadily decrease within the first few years to meet NYSDEC indicated levels (as described in **Section 2.3**) for the protection of groundwater. This alternative did not evaluate environmental receptors as the nearest surface water body is greater than 0.3 mile from the Site.

4.2.3.6 Long-Term Effectiveness and Permanence

Alternative 2A can be considered an effective measure for reducing the potential for soil vapor intrusion into the building as well as for the treatment of both on and offsite impacted groundwater. Installation of the SSDS would continue to be effective long-term for the protection of human health if proper operation and maintenance of the blower units was completed. However, since this alternative does not provide "mass" removal of soil vapor, it is not considered to be a long-term/permanent effective measure for protection of human health and the environment. Using enhanced bioremediation for the treatment of groundwater is expected to significantly enhance contaminant dehalogenation processes while naturally enhancing anaerobic biodegradation processes. This combination would likely reduce the bulk of the

contaminant mass and yield a sustaining long-term effect. Therefore, this alternative is anticipated to be effective in the long-term.

4.2.3.7 Reduction of Toxicity, Mobility, and Volume through Treatment

SSDS do not target high "mass" removal or treatment of contaminated soil vapor, therefore, the toxicity, mobility, and volume of soil vapor contamination is not anticipated to significantly decrease in the vadose zone. ISCR groundwater treatment technology would actively remediate cVOCs below the groundwater table and significantly reduce the toxicity, mobility, and volume of cVOC contamination.

4.2.3.8 Implementability

Implementation of this alternative could begin immediately following technical design of the SSDS/ groundwater treatment system(s), establishing proper administrative controls/permits and related operational requirements and establishing means and methods for traffic controls. Materials included in the design of the SSDS are readily available and of minimal cost. SSDS are not structurally complex and therefore exhibit inexpensive design costs. Structural sealants are readily available and involve mostly labor to identify and seal existing preferential pathways. Groundwater treatment using direct injection does not include permanent wells and implementation would largely depend upon lead times and shipping requirements to obtain the required quantity of EHC® product as well as the DPT contractor availability. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.3.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $1,600,000. Quantities, assumptions and unit price information are provided in a cost estimate spreadsheet as **Table 5A**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.3.10 Land Use

No changes to land use would be made; the land use is anticipated to remain commercially zoned. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination would be addressed through implementation of a Site Management Plan.

4.2.4 *Alternative Number 2B: Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) and Long Term Air and Groundwater Monitoring*

4.2.4.1 Description

The remedial action associated with this alternative involves sealing preferential pathways (cracks in foundation, etc.) within the existing building and the installation of SSDS within each building "unit" as described in alternative 2.

Additionally, this alternative proposes treating contaminated groundwater using ISCO technology. The treatment would involve using a DPT to directly inject potassium permanganate ($KMnO_4$) which is a chemical that oxidizes organic compounds in groundwater to carbon dioxide and water. The ISCO technology is used primarily for the destruction of groundwater contaminants such as PCE/TCE and associated daughter products through reductive dehalogenation.

This alternative implements a "grid injection" pilot test to treat groundwater cVOC contamination at the location surrounding MW-18. As described in alternative 4, RI results indicated that the highest observed PCE concentrations at MW-18. The pilot test would include the mobilization and installation of none (9) direct injection points which would be advanced into the subsurface with a geoprobe over a 3000 square foot area at a target thickness of 15 feet. An estimated 11,261 lbs of $KMnO_4$ would be required to treat the pilot test area. The treatment depth interval of 15 feet would begin at the groundwater table/soil interface. Each injection point would receive a total of 1,250 gallons of 10 wt% KMnO4 slurry. The area would be monitored and evaluated for a period of six (6) to nine (9) months prior to mobilization for implementation of full scale remedial action.

After an evaluation of results from the pilot test, a full scale remedy would be implemented. The proposed remedy includes the installation of an additional "grid injection" at the location of the pilot test and the installation of three (3) $KMnO_4$ injection lines. Details of the full scale remedy injection lines and grid injection are as follows:

$KMnO_4$ Injection Line No.1: Injection of potassium permanganate would be performed through 18 temporary injection points which would be advanced into the subsurface with the use of DPT. The line of injection points would be approximately 200 feet long and 25 feet wide. The injection point spacing would be approximately 20 feet in a hexagonal grid. Assuming a

5,000 square foot total treatment area, a target thickness of 15 feet and a total oxidant demand of 2.5 g/Kg, 18,772 pounds of permanganate would be required to treat the groundwater in this area. Each injection point would receive a total of 1,250 gallons of 10 wt% permanganate solution. This solution would be divided between 5 depth intervals ranging between 20 and 35 feet below ground surface (bgs).

$KMnO_4$ Injection Line No.2: Injection of potassium permanganate would be performed through forty (40) temporary injection points which would be advanced into the subsurface with the use of DPT. The line of injection points would be approximately 450 feet long and 25 feet wide. The injection point spacing would be approximately 20 feet in a hexagonal grid. Assuming a 11,250 square foot total treatment area, a target thickness of 15 feet and a total oxidant demand of 2.5 g/Kg, 42,236 pounds of permanganate would be required to treat the groundwater in this area. Each injection point would receive a total of 1,250 gallons of 10 wt% permanganate solution. This solution would be divided between five (5) depth intervals between 20 and 35 feet bgs.

$KMnO_4$ Injection Line No.3: Injection of potassium permanganate would be performed through 36 temporary injection points which would be advanced into the subsurface with the use of DPT. The line of injection points would be approximately 400 feet long and 25 feet wide. The injection point spacing would be approximately 20 feet in a hexagonal grid. Assuming a 10,000 square foot total treatment area, a target thickness of 15 feet and a total oxidant demand of 2.5 g/Kg, 37,554 pounds of permanganate would be required to treat the groundwater in this area. Each injection point would receive a total of 1,250 gallons of 10 wt% permanganate solution. This solution would be divided between five (5) depth intervals between 20 and 35 feet bgs.

Grid Injection Area: Injection of potassium permanganate would be performed through 53 temporary injection points, which would be advanced into the subsurface with DPT. Assuming a 15,000 square foot total treatment area in the vicinity of MW-18, a target thickness of 15 feet and a total oxidant demand of 2.5 g/Kg, 56,316 pounds of permanganate would be required to treat the area. This remedy is illustrated on **Figure 6.**

Additionally, this alternative proposes the inclusion of a long-term air and groundwater monitoring program as described in alternative 2. SSDS and proposed monitoring well locations are identified on **Figure 3**.

4.2.4.2 Detailed Evaluation of Criteria

4.2.4.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the mitigation of soil vapor and remediation of groundwater. Installing SSDS at each building "unit" would reduce the risk and provide protection to human health by mitigating soil vapor intrusion. Air monitoring and sampling would be established to verify the effectiveness of these systems.

ISCO groundwater treatment is anticipated to significantly reduce the cVOC impacts by oxidizing PCE and associated daughter products to carbon dioxide, water and inorganic salts. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.4.4 Compliance with Statutory Requirements

This alternative proposes to mitigate soil vapor and actively treat groundwater to reduce risk to human health. The installation of SSDS would largely prevent soil vapor from entering the structure. Matrix 2 provided in the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006) states that mitigation is needed to minimize the risk for PCE soil vapor exposure for sub-slab detected concentrations exceeding 1,000 µg/m^3. Based on results from the RI, sub-slab soil vapor detections for PCE were greater than 1,000 µg/m^3 in both Phase I and Phase II investigations. Providing SSDS for each building unit and sealing preferential pathways could adequately mitigate the potential for soil vapor intrusion. However, it would not remove/remediate the "mass" of observed soil vapor contamination.

Groundwater treatment through direct injection using a combination of $KMnO_4$ grid pattern injections and injection lines is anticipated to provide an efficient treatment that has the potential to meet chemical specific SCGs for PCE and associated daughter products.

This alternative proposes long term air and groundwater monitoring to continue to evaluate soil vapor impacts, delineate the migration of groundwater impacts and evaluate the effectiveness of ISCO groundwater treatment. Implementing this alternative is anticipated to meet the chemical-specific SCGs for the Site based upon existing Site data.

4.2.4.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the SSDS and groundwater treatment injection points.

However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. Sealing of building preferential pathways (cracks, etc.) and installation of the SSDS is anticipated to immediately mitigate the potential for soil vapor intrusion.

ISCO treatment reactions occur at a faster rate which is highly desirable due to the hydrologic and geologic conditions at the Site as described in Section 1.3. Following the implementation of ISCO direct injection treatment, cVOC concentrations are expected to decrease within the first year towards NYSDEC limit requirements (as described in **Section 2.4.2 Selection of Contaminants of Concern**) for groundwater. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.4.6 Long-Term Effectiveness and Permanence

Alternative 2B can be considered to be an effective measure for reducing the potential for soil vapor intrusion into the building as well as for the treatment of both on and offsite impacted groundwater. Installation of the SSDS would continue to be effective long-term remedies for the protection of human health of building occupants if proper operation and maintenance of the blower units was completed. However, since this alternative does not provide "mass" removal of soil vapor or removal of potential sources under the building, it is not considered to be a long-term/permanent measure for protection of human health and the environment. Using ISCO treatment in groundwater is expected to significantly enhance contaminant dehalogenation processes. This treatment would likely reduce the bulk of the contaminant mass producing a permanent remedial solution for the Site. ISCO treatment reactions occur at a faster rate over ISCR technologies which is highly desirable due to the hydrologic and geologic conditions at the Site. Therefore, this alternative is anticipated to be effective in the long-term for groundwater treatment and for mitigation of soil vapor exposures.

4.2.4.7 Reduction of Toxicity, Mobility, and Volume through Treatment

SSDS do not target high "mass" removal or treatment of contaminated soil vapor, therefore, the toxicity, mobility, and volume of soil vapor contamination is not anticipated to significantly decrease. ISCO groundwater treatment technology would actively remediate cVOCs below the

groundwater table and significantly reduce the toxicity, mobility, and volume of cVOC contamination.

4.2.4.8 Implementability

Implementation of this alternative could begin immediately following technical design of the SSDS/ groundwater treatment system(s), establishing proper administrative controls/permits and related operational requirements and establishing means and methods for traffic controls. Materials included in the design of the SSDS are readily available and of minimal cost. SSDS are not structurally complex and therefore exhibit inexpensive design costs. Structural sealants are readily available and involve mostly labor to identify and seal existing preferential pathways. Groundwater treatment using direct injection does not include permanent wells and implementation would largely depend on lead times and shipping requirements to obtain the required quantity of $KMnO_4$ product as well as the availability of DPT contractor availability. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.4.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $2,020,000. Quantities, assumptions and unit price information are provided in a cost estimate spreadsheet as **Table 5B**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.4.10 Land Use

No changes to land use would be made; the land use is anticipated to remain commercially zoned. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination would be addressed through implementation of a Site Management Plan.

4.2.5 Alternative Number 3: Horizontal Soil Vapor Extraction System with Long Term Air and Groundwater Monitoring

4.2.5.1 Description

This remedial action associated with this alternative involves the installation of a HSVE system using six (6) slotted PVC lateral pipes extending beneath the structure. The series of horizontal pipes would be installed from one central location (vault) that extends in a “fan-like” pattern underneath the building’s footprint. The vault would contain the pipe penetrations for each lateral and their respective valves, fittings and appurtenances. A skid mounted sound proof SVE system would be installed along the west/southwest side of the building or as determined by the

predesign investigation and pilot test. Components of the system would include but not be limited to a demister (knock out) tank, purge water pump, blower unit with filter, lead and lag carbon vessels and full process control system with high level alarms and temperature shut off sensors. All waste (e.g used carbon vessels and knock out water) will be properly packaged and shipped off-site for proper disposal. Electricity used to run the HSVE system would be provided by the Loudon Plaza building. The system has been priced to run for two (2) years with bi-weekly operation and maintenance costs. The HSVE system layout is provided on **Figure 4.** Influent, effluent and equipment blank tedlar bag air samples are proposed for collection to monitor the effectiveness of the system. Post operation of the HSVE system, SSDS blower units would be installed (as needed) to continue mitigation of the remaining soil vapor beneath the building and to prevent soil vapor intrusion into the building. These blower units would be installed to discharge directly to the atmosphere and operate in the same manner as a standard SSDS as described in alternative 2.

Air samples would be collected annually to determine if the system is adequately remediating the sub-slab/subsurface and is preventing soil vapor intrusion into the structure. Air monitoring includes indoor air (5 samples), outdoor ambient (2 samples), sub-slab (3 samples) and soil vapor sampling (3 samples) annually for the first five (5) years. From years 6 – 30 the same samples would be collected at a frequency of one (1) sampling event every five (5) years.

This alternative also proposes the implementation of a long-term groundwater monitoring program and installation of six (6) groundwater monitoring wells further mitigate the migration of groundwater impacts. Long- term monitoring and sampling of existing and new monitoring wells would be conducted to evaluate cVOC contaminant migration both on and offsite at 30 – 35 locations at an initial frequency of four (4) times per year (quarterly) for the first five (5) years. From years 6 – 30 the sampling frequency would be reduced to one (1) sampling event every five (5) years.

4.2.5.2 Detailed Evaluation of Criteria

4.2.5.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the remediation of soil vapor. It is anticipated that the HSVE system is anticipated to remove the majority of soil vapor contamination (a typical SVE system is capable of up to 90% mass reduction). Installation of SSDS blower/fan units would provide a “polishing” effect to further mitigate and provide protection to human health and the environment once the HSVE system has reached asymptotic levels. As discussed in alternative 2, natural biodegradation processes in groundwater are

occurring at a slow rate. CVOC impacts would be expected to remain in the groundwater. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.5.4 Compliance with Statutory Requirements

Installation of the HSVE system and subsequent conversion to SSDS would significantly reduce soil vapor impacts and would be anticipated to meet the guidance suggesting in Matrix 2 of the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). Chemical specific SCGs (as discussed in Section 2), for groundwater on this Site would not be achieved.

4.2.5.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during the implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the horizontal wells. However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. Post installation and startup of the HSVE system, cVOC concentrations are expected to decrease immediately (within the first few months of operation). The expectation of the HSVE system is to decrease contaminant concentrations to below the NYSDOH recommended guidance criteria. As stated in Section 4.2.5.1, SSDS blower units would be installed (as needed) to continue mitigation of the remaining soil vapor beneath the building and to prevent soil vapor intrusion into the building subsequent to cessation of "active" venting using the HSVE system.

This alternative does not include groundwater treatment and would not meet the RAOs (as defined in Section 2.3) in a reasonable or predictable time frame. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.5.6 Long-Term Effectiveness and Permanence

Alternative 3 can be considered to be an effective remedy for the treatment of soil vapor below the footprint of the existing structure. The installation and operation of the HSVE system would significantly reduce soil vapor concentrations and mitigate soil vapor intrusion into the structure.

However, given that this alternative does not involve the treatment of contaminated groundwater, the permanence of this remedial action cannot be confirmed. Based on results of the RI, it is unknown whether the "bulk" of the soil vapor is being emitted from the soil or the groundwater. RI analytical results indicate low cVOC detections in soil samples collected; therefore, the majority of observed soil vapor may likely be attributed to volatization. Over longer periods of time, volatization of dissolved cVOC impacts in groundwater may potentially cause soil vapor concentrations to rebound under the footprint of the structure given that groundwater is not treated in this alternative. If soil vapor concentrations rebound a subsequent conversion to SSDS would significantly reduce soil vapor impacts in this area and protect the health of building occupants. Therefore, this alternative would effective in the long-term to remediation soil vapor intrusion issue but not for mass removal.

4.2.5.7 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative involves the mass removal or treatment of impacted vadose zone soils/soil vapor and, therefore, for this matrix, the toxicity, mobility, and volume of contamination would significantly be reduced. This alternative does not propose treatment of groundwater therefore the toxicity, mobility and volume of this matrix (groundwater) is not expected to be significantly reduced.

4.2.5.8 Implementability

Implementation of this alternative could begin immediately following technical design of the HSVE system and establishing proper administrative controls/permits etc. Slotted pipe materials included in the design of the HSVE are readily available and would need to be custom slotted to meet the requirements of the design. Structurally, the pipe network of the HSVE system (or subsequent conversion to a SSDS, if necessary) is not complex and the majority of design costs would be incurred sizing the powered equipment and treatment components of the system.

Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.5.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $864,000. Quantities, assumptions and unit price information are provided on **Table 6**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.5.10 Land Use

No changes to land use would be made; the land use is anticipated to remain commercially zoned. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination (i.e. "mass") could potentially be remediated with this remedy. This alternative does not remediate groundwater.

4.2.6 Alternative Number 4: Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) with Long Term Air and Groundwater Monitoring

4.2.6.1 Description

As discussed in alternative 3, the remedial action associated with this alternative involves the installation operation and maintenance of a HSVE system using six (6) slotted PVC/HDPE lateral pipes extending underneath the structure. A detailed description of the system is provided in alternative 3. SSDS blower units would be installed (as needed) to continue mitigation of the remaining soil vapor beneath the building and to prevent soil vapor intrusion into the building subsequent to operation of the HSVE system. These blower units would be installed to discharge directly to the atmosphere and operate in the same manner as a standard SSDS as described in alternative 2.

Additionally, this alternative proposes treating contaminated groundwater using In-situ Chemical Reduction (ISCR) technology as described in alternative 2A. The pilot test and full scale remedy is illustrated on **Figure 5.**

Air samples would be collected annually as described in alternative 2 to determine if the system is adequately remediating the sub-slab/subsurface and is preventing soil vapor intrusion into the structure.

Long-term groundwater monitoring and sampling of existing and new monitoring wells would be conducted as described in alternative 2.

4.2.6.2 Detailed Evaluation of Criteria

4.2.6.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the remediation of soil vapor and groundwater. The HSVE system would remove the majority of soil vapor contamination (typical SVE system is capable of up to 90% mass reduction). Installation of SSDS blower/fan units would provide a "polishing" effect to further reduce impacts and provide protection to human health and the environment. ISCR groundwater treatment would

significantly reduce the dissolved cVOC impacts by chemically enhancing dehalogenation processes while also increasing the effect of natural anaerobic biodegradation processes. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.6.4 Compliance with Statutory Requirements

Applying this alternative as the remedial action for the Site includes treatment for both soil vapor and groundwater. Installation of the HSVE system (and subsequent conversion to SSDS) would significantly reduce soil vapor contaminant concentrations and potentially meet the guidance suggesting in Matrix 2 of the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York,* October 2006 (NYSDOH VI Guidance). Direct injection groundwater treatment using a combination of grid pattern injections and permeable reactive barrier (PRB) injections is anticipated to provide a sustained treatment that has the potential to meet chemical specific SCGs for PCE and associated daughter products.

4.2.6.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during the implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the horizontal wells and groundwater treatment injection points. However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. . cVOC concentrations are expected to decrease (within the first few months of operation) post installation and startup of the HSVE system. The expectation of the HSVE system is to decrease contaminant concentrations to below the NYSDOH recommended guidance criteria. Following the implementation of enhanced bioremediation using direct injection, cVOC concentrations are expected to steadily decrease within the first few years and provide means to meet NYSDEC groundwater standards as described in Section 2.4.2. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.6.6 Long-Term Effectiveness and Permanence

Alternative 4 can be considered to be an effective remedy for the treatment of delineated soil vapor below the footprint of the existing structure as well as for the treatment of both on and

offsite impacted groundwater. The installation and operation of the HSVE system would significantly reduce soil vapor concentrations and mitigate soil vapor intrusion into the structure (anticipated to be upwards of 90% mass reduction). Using enhanced bioremediation for the treatment of groundwater is expected to significantly enhance contaminant dehalogenation processes while naturally promoting anaerobic biodegradation processes. This combination is anticipated to destroy the bulk of the contaminant mass and yield a sustaining long-term effect. Therefore, this alternative is anticipated to be effective in the long-term.

4.2.6.7 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative involves the mass removal and/or treatment of impacted soil vapor and groundwater therefore, for these matrices, the toxicity, mobility, and volume of contamination would be significantly reduced.

4.2.6.8 Implementability

Implementation of this alternative could begin immediately following technical design of the HSVE and groundwater treatment system. Both soil vapor and groundwater treatment construction activities could begin simultaneously upon completion of a utility markout, establishing proper administrative controls/permits, related operational requirements and establishing means and methods for traffic controls The HSVE system would require custom slotted pipe to meet the requirements of the design. Structurally, the pipe network of the HSVE system is not complex and therefore design costs would largely be incurred sizing the powered and treatment components of the system. Groundwater treatment using direct injection does not include permanent wells and implementation would largely depend on lead times and shipping requirements to obtain the required quantity of EHC® product as well as the availability of DPT. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.6.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $2,010,000. Quantities, assumptions and unit price information are provided on **Table 7**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.6.10 Land Use

No changes to land use would be made; the land use is anticipated to remain commercially zoned. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination (i.e. “mass”) could potentially be remediated with this remedy. This

remedy would remediate the observed groundwater contamination and observed soil vapor intrusion. Therefore, this remedy could potentially remediate the site to pre-existing conditions.

4.2.7 Alternative Number 5: Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) with Long Term Air and Groundwater Monitoring

4.2.7.1 Description

As discussed in alternative 3, the remedial action associated with this alternative involves the installation, operation and maintenance of a HSVE system using six (6) slotted PVC/HDPE lateral pipes extending underneath the structure. A detailed description of the system is provided in alternative 3, **Section 4.2.5.1**. SSDS blower units would be installed (as needed) to continue mitigation of the remaining soil vapor beneath the building and to prevent soil vapor intrusion into the building subsequent to operation for the HSVE system. These blower units would be installed to discharge directly to the atmosphere and operate in the same manner as a standard SSDS as described in alternative 2.

Additionally, this alternative proposes treating contaminated groundwater using ISCO technology as described in alternative 2B. The pilot test and full scale remedy is illustrated on **Figure 6.**

Air sampling would continue on an annual basis as described in alternative 2 to determine if the HSVE system is adequately mitigating soil vapor intrusion into the structure (See **Section 4.2.2.1**).

Additionally, this alternative proposes long-term groundwater monitoring and the installation of up to six (6) groundwater monitoring/observations wells to more adequately identify and evaluate the effectiveness of the of ISCO groundwater treatment. Long- term monitoring and sampling of existing and new monitoring wells would be conducted as described in alternative 2, **Section 4.2.2.1**.

4.2.7.2 Detailed Evaluation of Criteria

4.2.7.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the remediation of soil vapor and groundwater. The HSVE system would remove the majority of soil vapor contamination (typical SVE system is capable of up to 90% mass reduction). Installation of SSDS blower/fan units would provide a “polishing” effect to further reduce impacts and provide protection to human health and the environment. ISCO groundwater treatment would

significantly reduce the cVOC impacts by oxidizing PCE and associated daughter products to carbon dioxide, water and inorganic salts. The risk to ecological receptors was not evaluated because the Site is located in a commercial zoned area and the closest water body is greater than 0.3 miles away.

4.2.7.4 Compliance with Statutory Requirements

Applying this alternative as the remedial action for the Site includes treatment for both soil vapor and groundwater. Installation of the HSVE system and subsequent conversion to SSDS would significantly reduce soil vapor contaminant concentrations and potentially meet the guidance suggesting in Matrix 2 of the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). Groundwater treatment through direct injection using a combination of $KMnO_4$ grid pattern injections and injection lines is likely to provide an efficient treatment that has the potential to meet Chemical specific SCGs for PCE and associated daughter products.

4.2.7.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during the implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the horizontal wells and groundwater treatment injection points. However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. Post installation and startup of the HSVE system, cVOC concentrations are expected to decrease immediately (within the first few months of operation). The expectation of the HSVE system is to decrease cVOC concentrations to below the NYSDOH recommended guidance criteria.

Following the implementation of ISCO direct injection treatment, cVOC concentrations are expected to decrease within the first year towards NYSDEC limit requirements for the protection of groundwater. ISCO treatment reactions occur at a faster rate compared to ISCR technology which is highly desirable due to the hydrologic and geologic conditions at the Site. This alternative did not evaluate environmental receptors as the nearest surface water body is greater than 0.3 mile from the Site.

4.2.7.6 Long-Term Effectiveness and Permanence

Alternative 5 can be considered an effective remedy for soil vapor as well as on and offsite impacted groundwater. The installation and operation of the HSVE system would significantly reduce soil vapor concentrations and mitigate soil vapor intrusion into the structure. Using ISCO treatment in groundwater is expected to significantly enhance contaminant dehalogenation processes to meet RAOs. ISCO treatment reactions occur at a faster rate compared to ISCR technology which is highly desirable due to the hydrologic and geologic conditions at the Site. This treatment would likely remove the bulk of the contaminant mass and yield a sustaining long-term effect. Therefore, this alternative is anticipated to be effective in the long-term.

4.2.7.7 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative involves the mass removal and/or treatment of impacted soil vapor and groundwater therefore, for these matrices, the toxicity, mobility, and volume of contamination would be significantly reduced.

4.2.7.8 Implementability

Implementation of this alternative could begin immediately following the technical design of the HSVE and groundwater treatment system. Upon completion of a utility mark-out, establishing proper administrative controls/permits etc. and establishing means and methods for traffic controls both soil vapor and groundwater treatment construction activities could begin simultaneously. The HSVE system would require custom slotted pipe to meet the requirements of the design. Structurally, the pipe network of the HSVE system is not complex and therefore design costs would largely be incurred sizing the powered and treatment components of the system. Groundwater treatment using direct injection does not include permanent wells and implementation would largely depend on lead times and shipping requirements to obtain the required quantity of $KMnO_4$ product as well as the availability of the DPT contractor. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.7.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $2,360,000. Quantities, assumptions and unit price information are provided on **Table 8**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.7.10 Land Use

No changes to land use would be made; the land use is anticipated to remain zoned commercial. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination (i.e. "mass") could potentially be remediated with this remedy. This remedy would remediate the observed groundwater contamination and observed soil vapor intrusion. Therefore, this remedy could potentially remediate the site to pre-existing conditions.

4.2.8 Alternative Number 6: Soil Vapor Extraction/ Sub-Slab Depressurization System with Focused In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) with Long Term Air and Groundwater Monitoring

4.2.8.1 Description

The remedial action associated with this alternative involves the installation, operation and maintenance of SVE system(s) using three (3) vertical slotted PVC pipes at impacted areas near the structure. Skid mounted sound proof SVE system(s) would be installed near the Former Loudon Cleaner (north/northwest) and Former Kem Cleaner (south/southeast) locations adjacent to the building. Components of the system would include but not be limited to a demister (knock out) tank, purge water pump, blower unit with filter, lead and lag carbon vessels and full process control system with high level alarms and temperature shut off sensors. Electricity used to run the SVE system would be provided by the Loudon Plaza building. The system has been priced to run for two (2) years with bi-weekly operation and maintenance costs. Influent, effluent and equipment blank tedlar bag air samples are proposed for collection to monitor the effectiveness of the system. Additionally, SSDS blower units would be installed (as needed) to continue mitigation of the remaining soil vapor beneath the building. Four (4) SSDS units would be installed in the building and operate in the same manner as described in alternative 2 (**Figure 7**). Air samples would be collected annually to determine if the system is adequately mitigating/remediating the sub-slab/subsurface and is preventing soil vapor intrusion into the structure.

Long Term air monitoring includes indoor air (5 samples), outdoor ambient (2 samples), sub-slab (3 samples) and soil vapor sampling (3 samples) annually for the first five (5) years. From years 6 – 30 the same samples would be collected at a frequency of one (1) sampling event every five (5) years. The SVE system projected locations are provided on **Figure 7.**

Additionally, this alternative proposes treating contaminated groundwater using ISCO technology as described in alternative 2B. The treatment would include a grid injection pattern applied at an area near MW-18. This area is illustrated on **Figure 7.**

Long-term groundwater monitoring and the installation of up to three (3) groundwater monitoring/observations wells would be implemented to more adequately identify and evaluate the effectiveness of the of ISCO groundwater treatment. Long- term monitoring and sampling of existing and new monitoring wells would be conducted as described in alternative 2, **Section 4.2.2.1**.

4.2.8.2 Detailed Evaluation of Criteria

4.2.8.3 Overall Protection of Human Health and the Environment

This alternative is protective of human health and the environment for the remediation of soil vapor and groundwater. The SVE system(s) would address soil vapor impacts near the former cleaner building units. Installation of SSDS units would mitigate soil vapor intrusion into the structure and would provide protection to human health and the environment. ISCO groundwater treatment is anticipated to reduce the cVOC impacts by oxidizing PCE and associated daughter products to carbon dioxide, water and inorganic salts. There are no anticipated ecological risks/receptors because the Site is located in a commercial zoned area and the closest water body is situated greater than 0.3 miles away.

4.2.8.4 Compliance with Statutory Requirements

Applying this alternative as the remedial action for the Site includes treatment for both soil vapor and groundwater. Installation of the SVE system and SSDS would reduce soil vapor concentrations and potentially meet the guidance suggesting in Matrix 2 of the *NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). Groundwater treatment through direct injection using $KMnO_4$ grid pattern injection is likely to provide an efficient treatment to potentially meet Chemical specific SCGs for PCE and associated daughter products within and down gradient of the proposed treatment area.

4.2.8.5 Short-Term Impacts and Effectiveness

Short-term impacts anticipated during the implementation of this alternative include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the vertical SVE wells and groundwater treatment injection points. However, the work will be implemented in a controlled manner to limit potential dust generation/impacts. Additional impacts include the short-term impact to traffic with equipment occupying parking lot space and inhalation of soil vapor by workers during the installation process, which would be addressed through the donning of personal protective equipment as appropriate. Proper collection of drilling spoils and well development fluids would be performed to ensure protection to human health and the environment. cVOC impacts are expected to

decrease within the first few months of operation post-installation and startup of the SVE system. The expectation is that the operation of the SVE system would decrease impacted areas to below the NYSDOH recommended guidance criteria.

Following the implementation of ISCO direct injection treatment, cVOC concentrations are expected to decrease at the injection locations within the first year towards levels provided in the NYSDEC criteria for the protection of groundwater described in **Section 2.3**. ISCO treatment reactions occur at a faster rate compared to ISCR technology which is highly desirable due to the hydrologic and geologic conditions at the Site. This alternative did not evaluate environmental receptors as the nearest surface water body is greater than 0.3 mile from the Site.

4.2.8.6 Long-Term Effectiveness and Permanence

Alternative 6 can be considered an effective remedy for soil vapor treatment and for the treatment of offsite impacted groundwater. The installation and operation of the SVE system(s) would reduce soil vapor impacts and mitigate soil vapor intrusion into the structure. SSDS would further provide means to mitigate soil vapor intrusion into the structure. Using ISCO treatment in groundwater is expected to reduce the dissolved groundwater impacts providing means to meet RAOs. This treatment would likely remove the bulk of the impacted mass located at MW-18. ISCO treatment reactions occur at a faster rate compared to ISCR technology which is highly desirable due to the hydrologic and geologic conditions at the Site. The long term effectiveness of this remedy would be evaluated over time in the field.

4.2.8.7 Reduction of Toxicity, Mobility, and Volume through Treatment

This alternative involves the mass removal and/or treatment of impacted soil vapor and groundwater therefore, for these matrices, the toxicity, mobility, and volume of impacted mass would be significantly reduced.

4.2.8.8 Implementability

Implementation of this alternative could begin immediately following the technical design of the SVE and groundwater treatment system(s). Upon completion of a utility mark-out, establishing proper administrative controls/permits etc. and establishing means and methods for traffic controls both soil vapor and groundwater treatment construction activities could begin simultaneously. Structurally, the pipe network of the SVE system is not complex and therefore design costs would largely be incurred sizing the powered and treatment components of the system. Groundwater treatment using direct injection does not include permanent wells and implementation would largely depend on lead times and shipping requirements to obtain the

required quantity of $KMnO_4$ product as well as the availability of the DPT contractor. Monitoring well installation involves minimal design and could be implemented immediately upon regulatory approval of locations and completion of a utility mark-out.

4.2.8.9 Cost

The 2014 cost to design, implement, operate and maintain this alternative based on a 30-year period is $1,500,000. Quantities, assumptions and unit price information are provided on **Table 9**. Unit price information was provided by contractor quotes and best engineering judgment.

4.2.8.10 Land Use

No changes to land use would be made; the land use is anticipated to remain zoned commercial. Current soil results are below Restricted Commercial SCOs; however, any potential residual contamination (i.e. “mass”) could potentially be remediated with this remedy. This remedy would remediate the observed groundwater contamination and observed soil vapor intrusion. Therefore, this remedy could potentially remediate the site to pre-existing conditions.

4.3 Basis for Selection

The proposed remedies are based on the results of the RI and the evaluation of alternatives. The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375. A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

4.3.1 Protection of Human Health and the Environment

This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

Alternative 1 is not protective of public health and is not considered further in this evaluation. Alternatives 2, 2A, 2B, 3, 4, 5, and 6 are all protective of public health and the environment to varying degrees and are considered further in this evaluation.

4.3.2 Compliance with New York State Standards, Criteria, and Guidance (SCGs)

Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the NYSDEC has determined to be applicable on a case-specific basis.

Alternative 2 does not attempt to attain either soil or groundwater SCGs and is not considered further. Alternatives 2A and 2B do not attempt to attain soil SCGs and are not considered further. Alternative 3 does not attempt to attain groundwater SCGs and therefore is not considered further. Alternatives 4, 5, and 6 all attempt to attain soil and groundwater SCGs and are considered further.

The next six "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

4.3.3 Long-term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

Alternatives 4, 5, and 6 can be considered effective remedies for soil, soil vapor treatment and for the treatment of impacted groundwater. The installation and operation of the SVE system(s) would reduce soil vapor impacts and mitigate soil vapor intrusion into the structure. Alternative 6 includes the potential addition of SSDS which would provide additional means to mitigate soil vapor intrusion into the structure. Using in-situ treatment in groundwater is expected to reduce the dissolved groundwater impacts providing means to meet RAOs. The long term effectiveness of any of these alternatives would be evaluated over time in the field.

4.3.4 Reduction of Toxicity, Mobility or Volume

Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

Alternative 4, 5, or 6 involves the mass removal and/or treatment of impacted soil vapor and groundwater therefore, for these matrices, the toxicity, mobility, and volume of impacted mass would be significantly reduced.

4.3.5 Short-term Impacts and Effectiveness

The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

Short-term impacts anticipated during the implementation of alternative 4, 5, or 6 include a potential dust and noise concern to the workers, employees at the building and residents along the adjacent properties during the installation of the SVE wells and groundwater treatment injection points. The permeable reactive barrier under alternative 4 has the potential to create more short-term impacts than the injection points under alternative 5 or 6. Under alternative 6, the installation of a SSDS could be problematic to an existing business if the system installation involves significant trenching in the floors of the different tenant spaces. Additional potential impacts include the short-term impact to traffic (with equipment occupying parking lot space), inhalation of soil vapor by workers during the installation process and proper collection of drilling, and well development fluids to ensure protection to human health and the environment. Engineering controls will be employed to mitigate impacts to workers during installation.

Using in-situ treatment in groundwater is expected to reduce the dissolved groundwater contamination within the first year, ultimately providing means to meet RAOs over the longer term.

4.3.6 Implementability

The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

Implementation of alternative 4, 5, or 6 could begin immediately following the technical design of the SVE and groundwater treatment system(s). Upon completion of a utility mark-out, establishing proper administrative controls/permits etc. and establishing means and methods for traffic controls both soil vapor and groundwater treatment construction activities could begin simultaneously. Structurally, the pipe network of the SVE system is not complex and therefore design costs would largely be incurred sizing the powered and treatment components of the system. The permeable reactive barrier under alternative 4 would be somewhat more difficult to implement than the injection points under alternative 5 or 6.

4.3.7 Cost-Effectiveness

Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision.

The present worth cost of alternative 4 is 37 percent more than alternative 6. The present worth cost of alternative 5 is 62 percent more than alternative 6. Since all three of these alternatives would be effective at meeting the remedial goals for this site, alternative 6 is the most cost-effective of these alternatives.

4.3.8 Land Use

When cleanup to pre-disposal conditions is determined to be infeasible, the Department may consider the current, intended, and reasonable anticipated future land use of the site and its surroundings in the selection of the soil remedy.

Alternative 4, 5, or 6 address exposures from contaminated groundwater and soil vapor at the site. The site will continue to be allowed for commercial use since none of the soils sampled during this investigation exceeded those SCOs. Only unrestricted use SCOs were found to be exceeded in one area and restrictions on the use of those soils will be addressed through the Site Management Plan.

The final criterion, Community Acceptance, is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

4.3.9 Community Acceptance

Concerns of the community regarding the investigation and the evaluation of alternatives are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the NYSDEC will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

4.4 Recommendation

Based on a site wide evaluation of soil, soil vapor and groundwater impacts during the remedial investigation, a remedial action has been determined to be necessary to address chemical specific SGCs for the protection of human health and the environment. Based on data collected during the RI, site-wide soil vapor concentrations continue to be a significant concern and threat to human health and the environment; however, no significant sources areas were identified in soils thus far. There were no VOCs detections greater than NYSDEC unrestricted RSO or protection of groundwater standards for any soil sample collected. s. . Alternatives 2, 2A, 2B, 3, 4, 5 and 6 will protect building occupants from soil vapor intrusion. Alternatives 2A, 2B, 4, 5 and 6 address the required chemical specific SCGs for groundwater Both in-situ groundwater remedial

technologies described in alternatives 2A and 4 (ISCR) and 2B, 5 and 6 (ISCO) are anticipated to provide effective means for the degradation of cVOC contaminants in groundwater to provide means to meet desired chemical specific SGCs. As previously mentioned, ISCR technology using zero valent iron under anaerobic conditions provides an increased treatment sustainability (e.g. longer lasting) over ISCO technology. However, ISCO treatment reactions occur at a faster rate which is highly desirable due to the hydrologic and geologic conditions at the Site. Consequently, ISCO is the recommended groundwater remedial technology for the Site. The three alternatives that propose the use of ISCO technology include alternative 2B, 5 and 6. Given the uncertainty of the presence of elevated cVOC concentrations exceeding NYSDEC Protection of Groundwater SCOs in the soil, at a minimum, mitigation of soil vapor is recommended for this Site.

Alternatives 2, 2A and 2B propose soil vapor mitigation by means of SSDS operation vs. horizontal or vertical soil vapor extraction systems for treatment in alternatives 3 through 6 (with an option to convert to SSDS for long-term SVI protection if necessary); therefore all alternatives except 1 address soil vapor intrusion and will protect on-site building occupants. Alternatives 3-6 provide for some amount of treatment of potential source areas that may be present beneath the building through the use of horizontal or vertical SVE systems. Since alternatives 2B, 5 and 6 include ISCO treatment for groundwater as well as building mitigation via SSDS or horizontal/vertical SVE with future use of SSDS if necessary, the costs of these alternatives were compared. The estimated cost for alternative 2B (**Table 5B**) is approximately $2,020,000, the estimated cost for alternative 5 is $2,360,000 (**Table 8**) and the estimated cost for alternative 6 is $1,500,000 (**Table 9**). Based on analytical results from the RI, and cost considerations, and the above alternatives analysis, the recommended alternative for the Former Loudon and Kem Cleaners Site is alternative 6. Pre-design investigation activities will be performed to effectively design the proposed remedy.

5.0 REFERENCES

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Tables

TABLE 1
Chemical Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
Chemical-Specific SCGs				
Federal				
Clean Water Act (CWA) -Ambient Water Quality Criteria	40 CFR Part 131; EPA 440/5-86/001 "Quality Criteria for Water -1986", superseded by EPA-822-R-02-047 "National Recommended Water Quality Criteria: 2002"	S	Criteria for protection of aquatic life and/or human health depending on designated water use	Not applicable. Previous site investigations support that site constituents are not adversely affecting surface waters or sediments.
CWA Section 136	40 CFR 136	G	Identifies guidelines for test procedures for the analysis of pollutants.	
CWA Section 404	33 USC 1344	S	Regulates discharges to surface water or ocean, indirect discharges to POTWs, and discharge of dredged or fill material into waters of the U.S. (including wetlands).	
RCRA-Regulated Levels for Toxic Characteristics Leaching Procedure (TCLP) Constituents	40 CFR Part 261	S	These regulations specify the TCLP constituent levels for identification of hazardous wastes that exhibit the characteristic of toxicity.	Not applicable. No materials are anticipated for removal.
Universal Treatment Standards/Land Disposal Restrictions (UTS/LDRs)	40 CFR Part 268	S	Identifies hazardous wastes for which land disposal is restricted and provides a set of numerical constituent concentration criteria at which hazardous waste is restricted from land disposal (without treatment).	Applicable if waste is determined to be hazardous and for remedial alternatives involving off-site land disposal.
New York State				
Environmental Remediation Programs	6 NYCRR Part 375	S	Provides an outline for the development and execution of the groundwater remedial programs. Includes cleanup objective tables.	Applicable for site remediation.
NYSDEC Ambient Water Quality Standards and Guidance Values	Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 (6/98)	S	Provides ambient water quality standards and guidance values for toxic and non-conventional pollutants for use in the NYSDEC programs.	These standards and guidance values are to be considered in evaluating groundwater and surface water quality.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	No soil removal anticipated. Regulation applicable for determining if soil generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
New York State Surface Water and Groundwater Quality Standards	6 NYCRR Part 703	S	Provided standards for both surface water and groundwater.	Applicable for assessing groundwater quality at the site. The surface water quality standards are not applicable.

TABLE 2
Location Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
Location-Specific SCGs				
Local				
Local Building Permits	N/A	S	Local authorities may require a building permit for any permanent or semi-permanent structure, such as an on-site water treatment system building or a retaining wall.	Substantive provisions are potentially applicable to remedial activities that require construction of permanent or semi-permanent structures.
Local Right-of-Way Permits	N/A	S	Local authorities may require permits for remedial work on city owned property, such as sidewalks and roads.	Applicable to remedial work on or near city owned property.
Local Noise Ordinances	City of Albany, NY Code, Chapter 255, Article V.	S	Loud noises which distrub the public shall not occur bewteen 8pm and 6am, and shall be kept to a minimum between 6am and 8pm.	All unnessesary noises shall be kept to a minimum to ensure the welfare of the public is kept to a high standard.

TABLE 3
Action Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
Action-Specific SCGs				
Federal				
Occupational Safety and Health Act (OSHA) - General Industry Standards	29 CFR Part 1910	S	Specifies the 8-hour time-weighted average concentration for worker exposure to various compounds. Training requirements for workers at hazardous waste operations are specified in 29 CFR 1910.120.	Appropriate training requirements will be met for remedial workers. Air monitoring will be required.
OSHA - Safety and Health Standards	29 CFR Part 1926	S	Specifies types of safety equipment and procedures to be followed during site remediation.	Appropriate safety equipment will be utilized on-site and appropriate procedures will be followed during remedial activities.
OSHA - Record-keeping, Reporting and Related Regulations	29 CFR Part 1904	S	Outlines record-keeping and reporting requirements for an employer under OSHA.	These regulations apply to the company(s) contracted to install, operate, and maintain remedial actions at hazardous waste sites.
RCRA - Preparedness and Prevention	40 CFR Part 264.30 - 264.31	S	Outlines requirements for safety equipment and spill control when treating, handling and/or storing hazardous wastes.	Safety and communication equipment will be utilized at the site as necessary. Local authorities will be familiarized with the site.
RCRA - Contingency Plan and Emergency Procedures	40 CFR Part 264.50 - 264.56	S	Provides requirements for outlining emergency procedures to be used following explosions, fires, etc. when storing hazardous wastes.	Emergency and contingency plans will be developed and implemented during remedial design. Copies of the plan will be kept onsite.
CWA - Discharge to Waters of the U.S., and Section 404	40 CFR Parts 403, and 230 Section 404 (b) (1); 33 USC 1344	S	Establishes site-specific pollutant limitations and performance standards which are designed to protect surface water quality. Types of discharges regulated under CWA include: Indirect discharge to a POTW, and discharge of dredged or fill material into U.S. waters.	No dewatering anticipated. Regulation would apply for potential discharge of water generated by excavation dewatering and treated in a temporary onsite water treatment system.
CWA Section 401	33 U.S.C. 1341	S	Requires that 401 Water Quality Certification permit be provided to federal permitting agency (USACE) for any activity including, but not limited to, the construction or operation of facilities which may result in any discharge into jurisdictional waters of the U.S. and/or state.	No excavation anticipated. Regulation would apply for potential discharge of water generated by excavation dewatering and treated in a temporary onsite water treatment system.
90 Day Accumulation Rule for Hazardous Waste	40 CFR Part 262.34	S	Allows generators of hazardous waste to store and treat hazardous waste at the generation site for up to 90 days in tanks, containers and containment buildings without having to obtain a RCRA hazardous waste permit.	Potentially applicable to remedial alternatives that involve the storing or treating of hazardous materials onsite.

TABLE 3
Action Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
RCRA - General Standards	40 CFR Part 264.111	S	General performance standards requiring minimization of need for further maintenance and control; minimization or elimination of post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products. Also requires decontamination or disposal of contaminated equipment, structures and soils.	Decontamination actions and facilities will be constructed for remedial activities and disassembled after completion.
Standards Applicable to Transporters of Applicable Hazardous Waste - RCRA Section 3003	40 CFR Parts 170-179, 262, and 263	S	Establishes the responsibility of off-site transporters of hazardous waste in the handling, transportation and management of the waste. Requires manifesting, recordkeeping and immediate action in the event of a discharge.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
United States Department of Transportation (USDOT) Rules for Transportation of Hazardous Materials	49 CFR Parts 107 and 171.1 - 172.558	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous materials.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Clean Air Act-National Ambient Air Quality Standards	40 CFR Part 50	S	Establishes ambient air quality standards for protection of public health.	Remedial operations will require the use of air monitoring equipment.
USEPA-Administered Permit Program: The Hazardous Waste Permit Program	RCRA Section 3005; 40 CFR Part 270.124	S	Covers the basic permitting, application, monitoring and reporting requirements for off-site hazardous waste management facilities.	Any offsite facility accepting hazardous waste from the site must be properly permitted. Implementation of the site remedy will include consideration of these requirements.

TABLE 3
Action Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
RCRA Subtitle C	40 U.S.C. Section 6901 et seq.; 40 CFR Part 268	S	Restricts land disposal of hazardous wastes that exceed specific criteria. Establishes UTSs to which hazardous wastes must be treated prior to land disposal.	Potentially applicable to remedial activities that include disposal of generated waste material from the site.
New York State				
NYSDEC's Monitoring Well Decommissioning Guidelines	NPL Site Monitoring Well Decommissioning dated May 1995	G	This guidance presents procedure for abandonment of monitoring wells at remediation sites.	This guidance is applicable for soil or groundwater alternatives that require the decommissioning of monitoring wells onsite.
Guidelines for the Control of Toxic Ambient Air Contaminants	DAR-1 (Air Guide 1)	G	Provides guidance for the control of toxic ambient air contaminants in New York State and outlines the procedures for evaluating sources of air pollution .	This guidance may be applicable for soil or groundwater alternatives that result in certain air emissions.
New York Hazardous Waste Management System -General	6 NYCRR Part 370	S	Provides definitions of terms and general instructions for the Part 370 series of hazardous waste management.	Hazardous waste is to be managed according to this regulation.
Identification and Listing of Hazardous Wastes	6 NYCRR Part 371	S	Outlines criteria for determining if a solid waste is a hazardous waste and is subject to regulation under 6 NYCRR Parts 371-376.	Applicable for determining if solid waste generated during implementation of remedial activities are hazardous wastes. These regulations do not set cleanup standards, but are considered when developing remedial alternatives.
Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities	6 NYCRR Part 372	S	Provides guidelines relating to the use of the manifest system and its recordkeeping requirements. It applies to generators, transporters and facilities in New York State.	This regulation will be applicable to any company(s) contracted to do treatment work at the site or to transport or manage hazardous material generated at the site.
New York Regulations for Transportation of Hazardous Waste	6 NYCRR Part 372.3 a-d	S	Outlines procedures for the packaging, labeling, manifesting and transporting of hazardous waste.	These requirements will be applicable to any company(s) contracted to transport hazardous material from the site.
Waste Transporter Permits	6 NYCRR Part 364	S	Governs the collection, transport and delivery of regulated waste within New York State.	Properly permitted haulers will be used if any waste materials are transported offsite.
NYSDEC Technical and Administrative Guidance Memorandums (TAGMs)	NYSDEC TAGMs	G	TAGMs are NYSDEC guidance that are to be considered during the remedial process.	Appropriate TAGMs will be considered during the remedial process.
New York Regulations for Hazardous Waste Management Facilities	6 NYCRR Part 373.1.1 - 373.1.8	S	Provides requirements and procedures for obtaining a permit to operate a hazardous waste treatment, storage and disposal facility. Also lists contents and conditions of permits.	Any off-site facility accepting waste from the site must be properly permitted.

TABLE 3
Action Specific Standards, Criteria, and Guidelines

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Regulation	Reference	Potential Standard (S) or Guidance (G)	Requirement Summary	Applicability to the Loudon and Kem Cleaners Site
Land Disposal of a Hazardous Waste	6 NYCRR Part 376	S	Restricts land disposal of hazardous wastes that exceed specific criteria.	New York defers to USEPA for UTS/LDR regulations.
National Pollutant Discharge Elimination System (NPDES) Program Requirements, Administered Under New York State Pollution Discharge Elimination System (SPDES)	40 CFR Parts 122 Subpart B, 125, 301, 303, and 307 (Administered under 6 NYCRR 750-758)	S	Establishes permitting requirements for point source discharges; regulates discharge of water into navigable waters including the quantity and quality of discharge.	Remedial activities may involve treatment/disposal of water. If so, water generated at the site will be managed in accordance with NYSDEC SPDES permit requirements.

TABLE 4
Summary of Remedial Technologies

Former Loudon and Kem Cleaners
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General Response Actions and Remedial Technology	Description	Preliminary Screening Evaluation	Feasible Technology
No Action			
	No further action to remedy soil conditions at the site.	Ineffective for the protection of human health and environment.	No
Monitored Natural Attenuation (MNA)			
	Ongoing physical, chemical, and/or natural biological processes to reduce the concentrations of contaminants at the site. Includes monitoring of existing groundwater wells to provide documentation that these processes are occurring.	MNA may be appropriate if ongoing physical, chemical, and/or natural processes would achieve the RAOs in a reasonable time frame compared to active remedial measures. However, geochemical and microbiological analyses of groundwater samples at this site indicate that the potential for anaerobic biodegradation is limited and likely not occurring at a significant rate.	No
Long Term Monitoring			
	Monitoring of existing groundwater wells to provide documentation that the remedial measure is reducing contamination at the site.	Provides evidence to verify if a remedial activity is working or not.	Yes
Institutional Controls			
	Includes public notification, deed restrictions, fencing and signs.	Does not reduce contamination concentrations buy can reduce potential exposure to the contamination media.	Yes
In-Situ Treatment			
Thermal			
Thermally Enhances Soil Vapor Extraction (SVE)	Uses electrical resistance/electromagnetic/ radio frequency heating, or hot-air steam injection to facilitate volatilization and extraction of the contaminant vapors.	Based on the current site conditions and limited area (approx. 300 sqft), this technology is likely cost prohibitive.	No
Thermal Desorption (thermal blankets and wells)	Thermal blankets and thermal wells are places on contaminated ground surface. A majority of contaminants are vaporizes out by thermal conduction. Vapors are drawn out by a vacuum system, oxidized, cooled, and passed through activated-carbon beds.	This technique is not effective in the saturated zone or in low permeability soils such as those observed at the site.	No
Physical/Chemical			
SVE	A negative pressure gradient is created by the application of a vacuum to contaminated soils through extraction wells that strips volatile constituents from the soil in the vadose zone, causing movement of vapors toward the wells.	This technique is not effective in the saturated zone or in low permeability soils such as those observed at this site.	Yes
Chemical Oxidation	Commonly used oxidizing agents include ozone, hydrogen peroxide, permanganate, hypochlorite, chlorine, and chlorine dioxide.	Low permeability of the soil is not conducive for injection due to inability to distribute material; however, an oxidizing agent may be spread on the inside of excavation pit as polishing step.	Yes

TABLE 4
Summary of Remedial Technologies

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Pump-and-Treat System	Contaminated groundwater is pumped out of the ground and treated with methods such as granulated activated carbon, chemical reagents, or air stripping.	Not effective in very low permeability aquifers such as those which exist at this site	No
Solidification / Stabilization	Solidification/stabilization treatment systems, sometimes referred to as fixation systems, seek to trap or immobilize contaminants within their "host" medium using chemical reactions instead of removing them through chemical or physical treatment.	Stabilization technologies have not been successfully demonstrated on a full-scale basis for treating organics. Solidified material may hinder future site use. Treatability studies would be required prior to implementing this technology.	No
Biological			
Biological Treatment	Uses indigenous or selectively cultured microorganisms to reduce hazardous organic compounds into water, carbon dioxide, and chlorinated hydrogen chloride.	This technology involves a relatively longer remediation period compared to other treatment technologies, but can enhance natural attenuation. Site does not contain sufficient amount native bacteria. Addition of microorganisms and required electron donor material would be limited due to the low permeability of the site.	No
Soil Excavation			
On-Site Disposal	Requires construction of a secure landfill that meets RCRA and state requirements	Containment of the waste material in an on-site landfill is not possible at the small commercial facility.	No
Off-Site Disposal	Involves the excavation and hauling of contaminated material to appropriate commercially licensed disposal facilities. The non-hazardous spoils would go to a non-hazardous/solid waste facility, while the hazardous spoils would go to a RCRA-permitted facility.	Excavation and disposal of contaminated soil at a permitted landfill is an effective method of removing at the source of site contamination. Backfill materials would need to be imported to fill the site.	Yes
Building Soil Vapor Technology			
Sub-slab Depressurization System (SSDS)	A suction pit is created below the concrete floor slabs by drilling a hole through the slab and hand excavating to form a void in the soil. A fan-powered vent draws air beneath the slab to above the surface of the room through a PVC pipe.	Inexpensive; east to install and effectively mitigates vapor intrusion, thereby disrupting this exposure pathway. Can be used in source area for source mass reduction. Not typically intended as sole remedial measure; used as interim mitigation until selected site remedy is implemented.	Yes

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
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Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - SSDS CRACK SEALANT INSTALLATION				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 5,850.00	$ 5,850.00
LS-2	Site Preparation	1	Lump Sum	$ 3,210.00	$ 3,210.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ 1,260.00	$ 6,300.00
UC-2	Health and Safety	1	Lump Sum	$ 1,000.00	$ 1,000.00
UC-3	Monitoring Well Installation	4	Each	$ 2,100.00	$ 8,400.00
UC-4	SSDS Installation and Startup	6	Each	$ 6,600.00	$ 39,600.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
		Subtotal			$ 77,860.00
		Project Administration (15%)			$ 11,679.00
		Design and Legal (15%)			$ 11,679.00
		Contingency (20%)			$ 15,572.00
		Total Cost for RA Design and Installation			**$ 117,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-6	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-7	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-8	SSDS Maintenance and Operating Costs	6	Each	$ 6,283.33	$ 37,700.00
		Subtotal			$ 200,200.00
		Project Administration (5%)			$ 10,010.00
		Contingency (5%)			$ 10,010.00
		Total Cost for Years 1-5 O&M			**$ 221,000**
		Average Annual Costs			**$ 44,200**
		Present Worth Cost			**$ 192,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-9	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-10	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-11	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
		Subtotal			$ 234,300.00
		Project Administration (5%)			$ 11,715.00
		Contingency (5%)			$ 11,715.00
		Total Cost for Years 5-30 O&M			**$ 258,000**
		Average Annual Costs			$ 10,320
		Present Worth Cost			**$145,500**
				Total Present Worth Cost	**$455,000**
				Grand Total	**$ 596,000**

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
(Limit 5% of Total Bid)

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM[1]	$	120.00	20	hr	$	2,400.00		$	2,400.00
Supervisor[1]	$	85.00	20	hr	$	1,700.00		$	1,700.00
Laborer[1]	$	75.00	20	hr	$	1,500.00		$	1,500.00
Permits	$	200.00	1	ls	$	200.00	25%	$	250.00
					$	5,800.00		**$**	**5,850.00**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
Supervisor[2]	$ 85.00	1	hr	$ 85.00		$ 85.00
Equipment Operator[2]	$ 75.00	1	hr	$ 75.00		$ 75.00
Laborer[2]	$ 65.00	2	hr	$ 130.00		$ 130.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 3,210**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, Electrical Work and Connections

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	2	hr	$ 240.00		$ 240.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 75.00	40	hr	$ 3,000.00		$ 3,000.00
Titebond Radon Sealant[2]	$ 10.00	100	ea	$ 1,000.00	10%	$ 1,100.00
Misc Sealant Measures	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
				$ 6,090.00		**$ 6,300**

Notes:
1) Cost includes all labor, equipment and materials necessary to seal the structure. Labor cost was based on the assumption the work would be completed in 2 days.
2) Titebond cost was based on quote for this project with an assumed quantity.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2] Hasp Prep etc.	$ 1,000.00	1	LS	$ 1,000.00		$ 1,000.00
				$ 1,000.00		**$ 1,000**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	4	hr	$ 480.00		$ 480.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 65.00	20	hr	$ 1,300.00		$ 1,300.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	4	ea	$ 2,000.00	10%	$ 2,200.00
Development[1]	$ 150.00	4	ea	$ 600.00	10%	$ 660.00
Disposal of Purge Water[1]	$ 200.00	2	drum	$ 400.00	10%	$ 440.00
				$ 8,030.00		**$ 8,400**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Sub Slab Depressurization System and Start-Up

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Grout	$ 4.00	200	lf	$ 800.00	10%	$ 880.00
Gravel Base[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
4" Dia. PVC Pipe and Fittings[3]	$ 10.00	50	lf	$ 500.00	10%	$ 550.00
4" Dia. Perforated Pipe[3]	$ 2.00	50	lf	$ 100.00	10%	$ 110.00
HS-5000 Blower/Fan Units[4]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	40	hr	$ 3,200.00	10%	$ 3,520.00
Monitoring Point Installation[7]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
Tedlar Bag Sampling/PID[8]	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
				$ 36,970.00		**$ 39,600**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Pipe and fittings costs are typ. Lengths and quantities assumed. Exact lengths will be determined during the design.
4) HS 5000 fan costs are based on Radon Away quote with shipping and installation preparation.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements.
Cost was estimated based on typ. Cost to install points
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM	$	120.00	0	hr	$	-		$	-
Supervisor	$	85.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-		$	-
Materials	$	-	0	ls	$	-	10%	$	-
Disposal of Piping	$	-	0	ls	$	-	10%	$	-
					$	-		**$**	**-**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, Long Term Groundwater Monitoring for VOCs
(35 wells Quarterly for 5 Years)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, Long Term Air Monitoring for VOC Analysis
Assume Seasonally for 5 years
(Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, Sub Slab Depressurization System O&M
Years 1-5

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units[1]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Site Maintenance visits[2]	$ 80.00	100	hr	$ 8,000.00		$ 8,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	5	yr	$ 18,000.00	10%	$ 19,800.00
				$ 35,000.00		**$ 37,700**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, Long Term Groundwater Monitoring for VOCs
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, Long Term Air Monitoring for VOCs
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 5
Alternative 2 FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for1 year.

TABLE 5A
Alternative 2A FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and SSDS using ISCR with PRB
and Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - SSDS Installation and In-Situ Groundwater Treatment				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ -	$ -
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ 1,260.00	$ 6,300.00
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring/Observation Well Installation	6	Each	$ 1,666.67	$ 10,000.00
UC-4	SSDS Installation and Startup	6	Each	$ -	$ -
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
UC-6	In-Situ Groudwater Treatment Pilot Test at MW-18	1	Each	$ 187,000.00	$ 187,000.00
UC-7	In-Situ Groundwater Treatment Full Scale Remedy	1	Each	$ 411,000.00	$ 411,000.00
	Subtotal				$ 646,740.00
	Project Administration (15%)				$ 97,011.00
	Design and Legal (15%)				$ 97,011.00
	Contingency (20%)				$ 129,348.00
	Total Cost for RA Design and Installation				**$ 971,000**
	OPTIONAL POST REMEDIAL ACTION - In-Situ Groundwater Treatment				
UC-8	In-Situ Groundwater Treatment with Innoculant Additive Post Full Scale Remediation	1	Each	$ 92,200.00	$ 92,200.00
UC-9	In-Situ Groundwater Treatment Polishing Post Full Scale Remediation	1	Each	$ 82,500.00	$ 82,500.00
	Subtotal				$ 174,700.00
	Project Administration (15%)				$ 26,205.00
	Design and Legal (15%)				$ 26,205.00
	Contingency (20%)				$ 34,940.00
	Total OPTIONAL Cost for Additional RA				**$ 263,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-10	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-11	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-12	SSDS Maintenance and Operating	6	Each	$ 6,283.33	$ 37,700.00
	Subtotal				$ 200,200.00
	Project Administration (5%)				$ 10,010.00
	Contingency (5%)				$ 10,010.00
	Total Cost for Years 1-5 O&M				**$ 220,300**
	Average Annual Cost				**$ 44,060**
	Present Worth Cost				**$191,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-13	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-14	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-15	SSDS Maintenance and Operating	25	Each	$ 6,740.00	$ 168,500.00
	Subtotal				$ 234,300.00
	Project Administration (5%)				$ 11,715.00
	Contingency (5%)				$ 11,715.00
	Total Cost for Years 5-30 O&M				**$ 258,000**
	Average Annual Cost				**$ 10,320**
	Present Worth Cost				**$ 145,500**
				Total Present Worth Cost	$ 1,580,000
				Grand Total	**$ 1,720,000.00**

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, Electrical Work

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	2	hr	$ 240.00		$ 240.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 75.00	40	hr	$ 3,000.00		$ 3,000.00
Titebond Radon Sealant[2]	$ 10.00	100	ea	$ 1,000.00	10%	$ 1,100.00
Misc Sealant Measures	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
				$ 6,090.00		**$ 6,300**

Notes:
1) Cost includes all labor, equipment and materials necessary to seal the structure. Labor cost was based on the assumption the work would be completed in 2 days.
2) Titebond cost was based on quote for this project with an assumed quantity.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer[3]	$ 80.00	80	HR	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.
3) Assumed Health and Safety office would be onsite during in-situ groundwater remediation only.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring/Observation Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	4	hr	$ 480.00		$ 480.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 65.00	20	hr	$ 1,300.00		$ 1,300.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	6	ea	$ 3,000.00	10%	$ 3,300.00
Development[1]	$ 150.00	6	ea	$ 900.00	10%	$ 990.00
Disposal of Purge Water[1]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
				$ 9,530.00		**$ 10,000**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Sub Slab Depressurization System and Start-Up

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Grout	$ 4.00	200	lf	$ 800.00	10%	$ 880.00
Gravel Base[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
4" Dia. PVC Pipe and Fittings[3]	$ 10.00	50	lf	$ 500.00	10%	$ 550.00
4" Dia. Perforated Pipe[3]	$ 2.00	50	lf	$ 100.00	10%	$ 110.00
HS-5000 Blower/Fan Units[4]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	40	hr	$ 3,200.00	10%	$ 3,520.00
Monitoring Point Installation[7]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
Tedlar Bag Sampling/PID[8]	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
				$ 36,970.00		**$ 39,600**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Pipe and fittings costs are typ. Lengths and quantities assumed. Exact lengths will be determined during the design.
4) HS 5000 fan costs are based on Radon Away quote with shipping and installation preparation.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on typ. Cost to install points
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning
Assume 270 linear feet.

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM	$	120.00	0	hr	$	-		$	-
Supervisor	$	85.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-		$	-
Materials	$	-	0	ls	$	-	10%	$	-
Disposal of Piping	$	-	0	ls	$	-	10%	$	-
					$	-		**$**	**-**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, In-Situ Groudwater Treatment Pilot Test at MW-18

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Pilot Test Grid Injection Material (100ftx75ft) with 15ft treatment zone thickness using EHC[2]	$ 2.30	38850	lbs	$ 89,355.00	10%	$ 98,290.50
Injection Drilling Construction Costs including equipment and labor[3]	$ 1,200.00	52	pt	$ 62,400.00	10%	$ 68,640.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight EHC[4]	$ 8,789.59	1	ls	$ 8,789.59	10%	$ 9,668.55
				$ 170,344.59		**$ 187,000**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Pilot test material costs are based on quote from FMC/Peroxychem.
3) Pilot test implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, In-Situ Groundwater Treatment Full Scale Remedy

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Full Scale Grid Injection Material Near MW-01 (40x40x15) and MW-04 (50x50x15) using EHC-L[2]	$ 1.58	9660	lbs	$ 15,262.80	10%	$ 16,789.08
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	28	pt	$ 33,600.00	10%	$ 36,960.00
Full Scale Permeable Reactive Barrier using EHC (PRB-01, PRB-02 and PRB-03)[2]	$ 2.30	71650	lbs	$ 164,795.00	10%	$ 181,274.50
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	110	pt	$ 132,000.00	10%	$ 145,200.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight EHC-L[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
Freight EHC[4]	$ 16,210.41	1	ls	$ 16,210.41	10%	$ 17,831.45
				$ 373,668.21		**$ 411,000**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Injection material costs are based on quote from FMC/Peroxychem.
3) Injection remedy implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8,In-Situ Groundwater Treatment with Innoculant Additive Post Full Scale Remediation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Inoculant Additive with Dehalococcoides to Grid Injection Areas[2]	$ 150.00	116	L	$ 17,400.00	10%	$ 19,140.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	50	pt	$ 60,000.00	10%	$ 66,000.00
Freight Inoculant[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 84,200.00		**$ 92,200**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Innoculant material costs are based on quote from FMC/Peroxychem.
3) Innoculant Injection labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, In-Situ Groundwater Treatment Polishing Post Full Scale Remediation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
EHC-L and Inoculant Additive with Dehalococcoides to Grid Injection Area[1]	$ 35,000.00	1	LS	$ 35,000.00	10%	$ 38,500.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[1]	$ 40,000.00	1	LS	$ 40,000.00	10%	$ 44,000.00
				$ 75,000.00		**$ 82,500**

Notes:
1) Cost was assumed as approximately 1/2 the cost of the Pilot Test.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)
Assume Quarterly due to high gw gradient

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Long Term Air Monitoring (Indoor, Outdoor, Sub-Slab and Soil Vapor)
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-12, Sub Slab Depressurization System O&M
Years 1-5

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units[1]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Site Maintenance visits[2]	$ 80.00	100	hr	$ 8,000.00		$ 8,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	5	yr	$ 18,000.00	10%	$ 19,800.00
				$ 35,000.00		**$ 37,700**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-13, Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-14, Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 5A - NYSDEC Alternative 2A Feasibility Study Cost Estimate
Mitigation of SV by Sealing and Installation of SSDS and In-Situ GW Treatment Using ISCR with PRBs and Long Term GW Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area),6 fans and misc. operation costs for 1 year.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of SSDS, using ISCO and Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - SSDS Installation and In-Situ Groundwater Treatment				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ 1,260.00	$ 6,300.00
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring/Observation Well Installation	6	Each	$ 1,663.33	$ 9,980.00
UC-4	SSDS Installation and Startup	6	Each	$ 6,600.00	$ 39,600.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
UC-6	In-Situ Groudwater Treatment Pilot Test at MW-18	1	Each	$ 60,400.00	$ 60,400.00
UC-7	In-Situ Groundwater Treatment Full Scale Remedy	1	Each	$ 768,800.00	$ 768,800.00
		Subtotal			$ 921,000.00
		Project Administration (15%)			$ 138,150.00
		Design and Legal (15%)			$ 138,150.00
		Contingency (20%)			$ 184,200.00
		Total Cost for RA Design and Installation			**$ 1,390,000**
	OPTIONAL POST REMEDIAL ACTION - In-Situ Groundwater Treatment				
UC-8	2nd Round Injection Post Remedial Action	1	Each	$ 102,000.00	$ 102,000.00
UC-9	In-Situ Groundwater Treatment Polishing Post Full Scale Remediation	1	LS	$ 82,500.00	$ 82,500.00
		Subtotal			$ 184,500.00
		Project Administration (15%)			$ 27,675.00
		Design and Legal (15%)			$ 27,675.00
		Contingency (20%)			$ 36,900.00
		Total OPTIONAL Cost for Additional RA			**$ 277,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-10	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-11	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-12	SSDS Maintenance and Operating Costs	6	Each	$ 6,283.33	$ 37,700.00
		Subtotal			$ 200,200.00
		Project Administration (5%)			$ 10,010.00
		Contingency (5%)			$ 10,010.00
		Total Cost for Years 1-5 O&M			**$ 221,000**
		Average Annual Cost			**$ 44,200**
		Present Worth Cost			**$ 192,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-13	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-14	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-15	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
		Subtotal			$ 234,300.00
		Project Administration (5%)			$ 11,715.00
		Contingency (5%)			$ 11,715.00
		Total Cost for Years 5-30 O&M			**$258,000**
		Average Annual Cost			**$10,320**
		Present Worth Cost			**$146,000**
				Total Present Worth Cost	**$2,010,000**
				Grand Total	**$ 2,150,000**

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	2	hr	$ 240.00		$ 240.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 75.00	40	hr	$ 3,000.00		$ 3,000.00
Titebond Radon Sealant[2]	$ 10.00	100	ea	$ 1,000.00	10%	$ 1,100.00
Misc Sealant Measures	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
				$ 6,090.00		**$ 6,300**

Notes:
1) Cost includes all labor, equipment and materials necessary to seal the structure. Labor cost was based on the assumption the work would be completed in 2 days.
2) Titebond cost was based on quote for this project with an assumed quantity.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer	$ 80.00	80	Hr	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	4	hr	$ 480.00		$ 480.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 65.00	20	hr	$ 1,300.00		$ 1,300.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	6	ea	$ 3,000.00	10%	$ 3,300.00
Development[1]	$ 150.00	6	ea	$ 900.00	10%	$ 990.00
Disposal of Purge Water[1]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
				$ 9,530.00		**$ 9,980**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Sub Slab Depressurization System

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Laborer[1]	$ 75.00	50	hr	$ 3,750.00		$ 3,750.00
Grout	$ 4.00	200	lf	$ 800.00	10%	$ 880.00
Gravel Base[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
4" Dia. PVC Pipe and Fittings[3]	$ 10.00	50	lf	$ 500.00	10%	$ 550.00
4" Dia. Perforated Pipe[3]	$ 2.00	50	lf	$ 100.00	10%	$ 110.00
HS-5000 Blower/Fan Units[4]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	40	hr	$ 3,200.00	10%	$ 3,520.00
Monitoring Point Installation[7]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
Tedlar Bag Sampling/PID[8]	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
				$ 36,970.00		**$ 39,600**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Pipe and fittings costs are typ. Lengths and quantities assumed. Exact lengths will be determined during the design.
4) HS 5000 fan costs are based on Radon Away quote with shipping and installation preparation.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on typ. Cost to install points
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning
Assume 270 linear feet.

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM	$ 120.00	0	hr	$ -		$ -
Supervisor	$ 85.00	0	hr	$ -		$ -
Laborer	$ 75.00	0	hr	$ -	10%	$ -
Laborer	$ 75.00	0	hr	$ -	10%	$ -
Materials	$ -	0	ls	$ -	10%	$ -
Disposal of Piping	$ -	0	ls	$ -	10%	$ -
				$ -		**$ -**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, In-Situ Groudwater Treatment Pilot Test at MW-18
ISCO

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Pilot Test Grid Injection Material (3000sft) with 15ft treatment zone thickness using permanganate[2]	$ 2.66	11261	lb	$ 30,000.00	10%	$ 33,000.00
Injection Drilling Construction Costs including equipment and labor[3]	$ 1,227.27	11	pt	$ 13,500.00	10%	$ 14,850.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight EHC[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 55,300.00		**$ 60,400**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Pilot test material costs are based on vendor quote
3) Pilot test implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote .

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, In-Situ Groundwater Treatment Full Scale Remedy

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	120	hr	$ 14,400.00		$ 14,400.00
Full Scale Grid Injection Material Near MW-18 (15,000sft) at a 15 ft treatment depth[2]	$ 3.00	56316	lbs	$ 168,948.00	10%	$ 185,842.80
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	53	pt	$ 68,900.00	10%	$ 75,790.00
Full Scale KMnO4 Injection Line (IL-01, IL-02 and IL-03)[2]	$ 3.00	98562	lbs	$ 295,686.00	10%	$ 325,254.60
Injection Drilling Construction Costs for Injection Line including equipment and labor[3]	$ 1,300.00	94	pt	$ 122,200.00	10%	$ 134,420.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight KMnO4[4]	$ 25,000.00	1	ls	$ 25,000.00	10%	$ 27,500.00
Freight EHC[4]		1	ls	$ -	10%	$ -
				$ 700,134.00		**$ 768,800**

1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Injection material costs are based on vendor quote.
3) Injection remedy implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, 2nd Round KMnO4 Injection

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
2nd Round KMnO4 to Treat Remaining Elevated Concentrations Grid Injection Areas[2]	$ 3.00	20000	lb	$ 60,000.00	10%	$ 66,000.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	20	pt	$ 26,000.00	10%	$ 28,600.00
Freight Inoculant[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 92,800.00		**$ 102,000**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Innoculant material costs are based on vendor quote.
3) Innoculant Injection labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, In-Situ Groundwater Treatment Polish

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Inoculant Additive with Dehalococcoides to Grid Injection Areas[1]	$ 35,000.00	1	LS	$ 35,000.00	10%	$ 38,500.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[1]	$ 40,000.00	1	LS	$ 40,000.00	10%	$ 44,000.00
				$ 75,000.00		**$ 82,500**

Notes
1) Cost was assumed as approximately 1/2 the cost of the Pilot Test.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, Long Term Groundwater Monitoring
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Long Term AIR Monitoring
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-12, Sub Slab Depressurization System O&M
Years 1-5

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units[1]	$ 1,500.00	6	ea	$ 9,000.00	10%	$ 9,900.00
Site Maintenance visits[2]	$ 80.00	100	hr	$ 8,000.00		$ 8,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	5	ea	$ 18,000.00	10%	$ 19,800.00
				$ 35,000.00		**$ 37,700**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-13, Long Term Groundwater Monitoring
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-14, Long Term AIR Monitoring
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 5B
Alternative 2B FS Cost Estimate
Mitigation of Soil Vapor by Sealing Preferential Pathways Installation of SSDS using ISCO and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-15, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
and Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - HSVE System Installation				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ -	$ -
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring Well Installation	6	Each	$ 2,083.33	$ 12,500.00
UC-4	HSVE Installation and Startup	6	Each	$ 32,666.67	$ 196,000.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
		Subtotal			$ 243,440.00
		Project Administration (15%)			$ 36,516.00
		Design and Legal (15%)			$ 36,516.00
		Contingency (20%)			$ 48,688.00
		Total Cost for RA Design and Installation			**$ 366,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-6	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-7	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-8	HSVE/SSDS Maintenance and Operating Costs	6	Each	$ 18,333.33	$ 110,000.00
		Subtotal			$ 272,500.00
		Project Administration (5%)			$ 13,625.00
		Contingency (5%)			$ 13,625.00
		Total Cost for Years 1-5 O&M			**$ 300,000.00**
		Average Annual Cost			**$ 60,000.00**
		Present Worth Cost			**$260,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-9	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-10	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-11	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
		Subtotal			$ 234,300.00
		Project Administration (5%)			$ 11,715.00
		Contingency (5%)			$ 11,715.00
		Total Cost for Years 5-30 O&M			**$ 258,000.00**
		Average Annual Cost			**$ 10,320.00**
		Present Worth Cost			**$145,500.00**
				Total Present Worth Cost	**$772,000.00**
				Grand Total	**$ 924,000.00**

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM	$ 120.00	0	hr	$ -		$ -
Supervisor	$ 85.00	0	hr	$ -		$ -
Laborer	$ 75.00	0	hr	$ -		$ -
Titebond Radon Sealant	$ 10.00	0	ea	$ -	10%	$ -
Misc Sealant Measures	$ 1,000.00	0	ls	$ -	10%	$ -
				$ -		**$ -**

Notes:
1) No sealing is proposed under this alternative

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer[3]	$ 80.00	80	HR	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.
3) Assumed Health and Safety office would be onsite during in-situ groundwater remediation only.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	6	hr	$ 720.00		$ 720.00
Supervisor[1]	$ 85.00	15	hr	$ 1,275.00		$ 1,275.00
Laborer[1]	$ 65.00	30	hr	$ 1,950.00		$ 1,950.00
Geoprobe[2]	$ 1,200.00	3	day	$ 3,600.00		$ 3,600.00
2"Dia prepacked MWs and materials[2]	$ 500.00	6	ea	$ 3,000.00	10%	$ 3,300.00
Development[2]	$ 150.00	6	ea	$ 900.00	10%	$ 990.00
Disposal of Purge Water[2]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
Notes:				$ 12,045.00		**$ 12,500**

1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area
2) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Horizontal Soil Vapor Extraction System

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Gravel Base/Backfill Materials[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
Horizontal Well Installation including Labor Equipment and materials[3]	$ 120.00	500	lf	$ 60,000.00	10%	$ 66,000.00
Vaults for HSVE Pipe Pentrations[3]	$ 4,000.00	2	ea	$ 8,000.00	10%	$ 8,800.00
Skid Mounted SVE Blower System with Knockout tank, filter, carbon treatment[4]	$ 3,000.00	24	mo	$ 72,000.00	10%	$ 79,200.00
Conex with Sound proof and silencing unit[7]	$ 350.00	24	mo	$ 8,400.00	10%	$ 9,240.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete/Asphalt Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	50	hr	$ 4,000.00	10%	$ 4,400.00
Monitoring Point Installation (use existing monitoring wells)	$ 1,200.00	0	ea	$ -	10%	$ -
Tedlar Bag Sampling/PID	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
HS-5000 fans -Conversion To SSDS after SVE Remediation	$ 1,500.00	5	ea	$ 7,500.00	10%	$ 8,250.00
Installation/materials for SSDS fans, and stack	$ 80.00	20	hr	$ 1,600.00	10%	$ 1,760.00
Monitoring Point Installation [3]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
				$ 161,770.00		**$ 196,000**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on contractor quotes.
4) Costs based on vendor quote.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Based on vendor quote
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning
Assume 270 linear feet.

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM	$	120.00	0	hr	$	-		$	-
Supervisor	$	85.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Materials	$	-	1	ls	$	-	10%	$	-
Disposal of Piping	$	-	1	ls	$	-	10%	$	-
					$	-		**$**	**-**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, Long Term Groundwater Monitoring
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, Long Term AIR Monitoring
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, HSVE Operation and Maintenance
2yrs of HSVE Operation followed by System use a SSDS System for 3 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Parts/Misc.	$ 1,000.00	5	yr	$ 5,000.00	10%	$ 5,500.00
Site Maintenance visits During SVE Operation (Bi Monthly for 2 yrs)[1]	$ 80.00	480	hr	$ 38,400.00		$ 38,400.00
Operating Costs During SVE Operation[2]	$ 1,000.00	36	mo	$ 36,000.00	10%	$ 39,600.00
Conversion to SSDS System (included in UC-4)						
Operating Costs for SSDS ($50/mo/fan)[3]	$ 3,600.00	3	year	$ 10,800.00	10%	$ 11,880.00
Maintenance Costs for SSDS (Quarterly for three years)[1]	$ 80.00	120	hr	$ 9,600.00		$ 9,600.00
PM and Reporting (yearly)4	$ 1,000.00	5	ea	$ 5,000.00		$ 5,000.00
				$ 104,800.00		**$ 110,000**

Notes:
1) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
2) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area) and misc. operation costs.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.
4) Project Management and reporting costs are typical based on consultant experience.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, Long Term Groundwater Monitoring
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, Long Term AIR Monitoring
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 6
Alternative 3 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System
Long Term Air and Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - HSVE Installation and In-Situ Groundwater Treatment				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ -	$ -
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring/Observation Well Installation	6	EACH	$ 1,663.33	$ 9,980.00
UC-4	HSVE Installation and Startup	6	Each	$ 32,566.67	$ 195,400.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
UC-6	In-Situ Groudwater Treatment Pilot Test at MW-18	1	Each	$ 187,000.00	$ 187,000.00
UC-7	In-Situ Groundwater Treatment Full Scale Remedy	1	Each	$ 411,000.00	$ 411,000.00
	Subtotal				$ 838,320.00
	Project Administration (15%)				$ 125,748.00
	Design and Legal (15%)				$ 125,748.00
	Contingency (20%)				$ 167,664.00
	Total Cost for RA Design and Installation				**$ 1,260,000**
	OPTIONAL POST REMEDIAL ACTION - In-Situ Groundwater Treatment				
UC-8	In-Situ Groundwater Treatment with Innoculant Additive Post Full Scale Remediation	1	Each	$ 92,200.00	$ 92,200.00
UC-9	In-Situ Groundwater Treatment Polishing Post Full Scale Remediation	1	LS	$ 82,500.00	$ 82,500.00
	Subtotal				$ 174,700.00
	Project Administration (15%)				$ 26,205.00
	Design and Legal (15%)				$ 26,205.00
	Contingency (20%)				$ 34,940.00
	Total OPTIONAL Cost for Additional RA				**$ 263,000**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-10	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-11	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-12	HSVE/SSDS Maintenance and Operating Costs	6	Each	$ 18,416.67	$ 110,500.00
	Subtotal				$ 273,000.00
	Project Administration (5%)				$ 13,650.00
	Contingency (5%)				$ 13,650.00
	Total Cost for Years 1-5 O&M				**$ 301,000.00**
	Average Annual Cost				**$ 60,200.00**
	Present Worth Cost				**$261,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-13	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-14	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-15	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
	Subtotal				$ 234,300.00
	Project Administration (5%)				$ 11,715.00
	Contingency (5%)				$ 11,715.00
	Total Cost for Years 5-30 O&M				**$ 258,000.00**
	Average Annual Cost				**$ 10,320.00**
	Present Worth Cost				**$146,000.00**
				Total Present Worth Cost	$1,930,000.00
				Grand Total	**$ 2,090,000.00**

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350.00**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590.00**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500.00**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, Electrical Work and Connections

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000.00**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM	$ 120.00	0	hr	$ -		$ -
Supervisor	$ 85.00	0	hr	$ -		$ -
Laborer	$ 75.00	0	hr	$ -		$ -
Titebond Radon Sealant	$ 10.00	0	ea	$ -	10%	$ -
Misc Sealant Measures	$ 1,000.00	0	ls	$ -	10%	$ -
				$ -		**$ -**

Notes:
1) No sealing is proposed under this alternative

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer[3]	$ 80.00	80	HR	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500.00**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.
3) Assumed Health and Safety office would be onsite during in-situ groundwater remediation only.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	4	hr	$ 480.00		$ 480.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 65.00	20	hr	$ 1,300.00		$ 1,300.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	6	ea	$ 3,000.00	10%	$ 3,300.00
Development[1]	$ 150.00	6	ea	$ 900.00	10%	$ 990.00
Disposal of Purge Water[1]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
				$ 9,530.00		**$ 9,980.00**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Horizontal Soil Vapor Extraction System

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Gravel Base/Backfill Materials[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
Horizontal Well Installation including Labor Equipment and materials[3]	$ 120.00	500	lf	$ 60,000.00	10%	$ 66,000.00
Vaults for HSVE Pipe Pentrations[3]	$ 4,000.00	2	ea	$ 8,000.00	10%	$ 8,800.00
Skid Mounted SVE Blower System with Knockout tank, filter, carbon treatment[4]	$ 3,000.00	24	mo	$ 72,000.00	10%	$ 79,200.00
Conex with Sound proof and silencing unit[7]	$ 350.00	24	mo	$ 8,400.00	10%	$ 9,240.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete/Asphalt Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	50	hr	$ 4,000.00	10%	$ 4,400.00
Monitoring Point Installation (use existing monitoring wells)	$ 1,200.00	0	ea	$ -	10%	$ -
Tedlar Bag Sampling/PID	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
HS-5000 fans -Conversion To SSDS after SVE Remediation	$ 1,500.00	5	ea	$ 7,500.00	10%	$ 8,250.00
Installation/materials for SSDS fans, and stack	$ 80.00	20	hr	$ 1,600.00	10%	$ 1,760.00
Monitoring Point Installation [3]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
				$ 161,770.00		**$ 195,400.00**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on contractor quotes.
4) Costs based on vendor quote.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Based on vendor quote
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning
Assume 270 linear feet.

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM	$	120.00	0	hr	$	-		$	-
Supervisor	$	85.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Materials	$	-	1	ls	$	-	10%	$	-
Disposal of Piping	$	-	1	ls	$	-	10%	$	-
					$	-		**$**	**-**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, In-Situ GW Treatment Pilot Test at MW-18

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Pilot Test Grid Injection Material (100ftx75ft) with 15ft treatment zone thickness using EHC[2]	$ 2.30	38850	lbs	$ 89,355.00	10%	$ 98,290.50
Injection Drilling Construction Costs including equipment and labor[3]	$ 1,200.00	52	pt	$ 62,400.00	10%	$ 68,640.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight EHC[4]	$ 8,789.59	1	ls	$ 8,789.59	10%	$ 9,668.55
				$ 170,344.59		**$ 187,000.00**

1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Pilot test material costs are based on quote from FMC/Peroxychem.
3) Pilot test implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, In-Situ Groundwater Treatment Full Scale Remedy

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Full Scale Grid Injection Material Near MW-01 (40x40x15) and MW-04 (50x50x15) using EHC-L[2]	$ 1.58	9660	lbs	$ 15,262.80	10%	$ 16,789.08
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	28	pt	$ 33,600.00	10%	$ 36,960.00
Full Scale Permeable Reactive Barrier using EHC (PRB-01, PRB-02 and PRB-03)[2]	$ 2.30	71650	lbs	$ 164,795.00	10%	$ 181,274.50
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	110	pt	$ 132,000.00	10%	$ 145,200.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight EHC-L[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
Freight EHC[4]	$ 16,210.41	1	ls	$ 16,210.41	10%	$ 17,831.45
				$ 373,668.21		**$ 411,000.00**

1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Injection material costs are based on quote from FMC/Peroxychem.
3) Injection remedy implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, In-Situ Groundwater Treatment with Innoculant Additive-Post Remediation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Inoculant Additive with Dehalococcoides to Grid Injection Areas[2]	$ 150.00	116	L	$ 17,400.00	10%	$ 19,140.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,200.00	50	pt	$ 60,000.00	10%	$ 66,000.00
Freight Inoculant[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 84,200.00		**$ 92,200.00**

1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Innoculant material costs are based on quote from FMC/Peroxychem.
3) Innoculant Injection labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote (FMC/Peroxychem).

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, In-Situ Groundwater Treatment with Innoculant Additive-Post Remediation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Inoculant Additive with Dehalococcoides to Grid Injection Areas[1]	$ 35,000.00	1	LS	$ 35,000.00	10%	$ 38,500.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[1]	$ 40,000.00	1	LS	$ 40,000.00	10%	$ 44,000.00
				$ 75,000.00		**$ 82,500.00**

1) Cost was assumed as approximately 1/2 the cost of the Pilot Test.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, Long Term Groundwater Monitoring
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Long Term AIR Monitoring
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-12, HSVE Operation and Maintenance
2yrs of HSVE Operation followed by System use a SSDS System for 3 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Parts/Misc.	$ 1,000.00	5	yr	$ 5,000.00	10%	$ 5,500.00
Site Maintenance visits During SVE Operation (Bi Monthly for 2 yrs)[1]	$ 80.00	480	hr	$ 38,400.00		$ 38,400.00
Operating Costs During SVE Operation[2]	$ 1,000.00	36	mo	$ 36,000.00	10%	$ 39,600.00
Conversion to SSDS System (included in UC-4)						
Operating Costs for SSDS ($50/mo/fan)[3]	$ 3,600.00	3	yr	$ 10,800.00	10%	$ 11,880.00
Maintenance Costs for SSDS (Quarterly for three years)[1]	$ 80.00	120	hr	$ 9,600.00		$ 9,600.00
PM and Reporting (yearly)4	$ 1,000.00	5	ea	$ 5,000.00	10%	$ 5,500.00
				$ 104,800.00		**$ 110,500.00**

Notes:
1) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
2) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area) and misc. operation costs.
2) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.
3) Project Management and reporting costs are typical based on consultant experience.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-13, Long Term Groundwater Monitoring
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-14, Long Term AIR Monitoring
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 7
Alternative 4 FS Cost Estimate
Horizontal Soil Vapor Extraction System using ISCR and PRB and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-15, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500.00**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year

TABLE 8
Alternative 5 FS Cost Estimate
Horizontal Soil Vapor Extraxtion System using ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - HSVE Installation and In-Situ Groundwater Treatment				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	Soil Vapor Mitigation - Sealing Existing Structure	5	Day	$ -	$ -
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring/Observation Well Installation	6	EACH	$ 1,663.33	$ 9,980.00
UC-4	HSVE Installation and Startup	6	Each	$ 32,566.17	$ 195,397.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
UC-6	In-Situ Groudwater Treatment Pilot Test at MW-18	1	Each	$ 60,400.00	$ 60,400.00
UC-7	In-Situ Groundwater Treatment Full Scale Remedy	1	Each	$ 769,000.00	$ 769,000.00
	Subtotal				$ 1,069,717.00
	Project Administration (15%)				$ 160,457.55
	Design and Legal (15%)				$ 160,457.55
	Contingency (20%)				$ 213,943.40
	Total Cost for RA Design and Installation				**$ 1,605,000.00**
	OPTIONAL POST REMEDIAL ACTION - In-Situ Groundwater Treatment				
UC-8	2nd Round Injection Post Remedial Action	1	Each	$ 101,600.00	$ 101,600.00
UC-9	In-Situ Groundwater Treatment Polishing Post Full Scale Remediation	1	LS	$ 82,500.00	$ 82,500.00
	Subtotal				$ 184,100.00
	Project Administration (15%)				$ 27,615.00
	Design and Legal (15%)				$ 27,615.00
	Contingency (20%)				$ 36,820.00
	Total OPTIONAL Cost for Additional RA				**$ 277,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-10	Long Term Groundwater Sampling for VOCs (35 wells Quarterly for 5 Years)	845	Each	$ 160.95	$ 136,000.00
UC-11	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-12	HSVE/SSDS Maintenance and Operating Costs	6	Each	$ 18,416.67	$ 110,500.00
	Subtotal				$ 273,000.00
	Project Administration (5%)				$ 13,650.00
	Contingency (5%)				$ 13,650.00
	Total Cost for Years 1-5 O&M				**$ 301,000.00**
	Average Annual Cost				**$ 60,200.00**
	Present Worth Cost				**$261,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-13	Long Term Groundwater Sampling for VOCs (All Wells once every 5 years for 25 years)	255	Each	$ 157.65	$ 40,200.00
UC-14	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-15	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
	Subtotal				$ 234,300.00
	Project Administration (5%)				$ 11,715.00
	Contingency (5%)				$ 11,715.00
	Total Cost for Years 5-30 O&M				**$ 258,000.00**
	Average Annual Cost				**$ 10,320.00**
	Present Worth Cost				**$145,500.00**
				Total Present Worth Cost	$2,290,000.00
				Grand Total	**$ 2,450,000.00**

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350.00**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590.00**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500.00**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, Electrical Work and Connections

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000.00**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, Soil Vapor Mitigation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM	$ 120.00	0	hr	$ -		$ -
Supervisor	$ 85.00	0	hr	$ -		$ -
Laborer	$ 75.00	0	hr	$ -		$ -
Titebond Radon Sealant	$ 10.00	0	ea	$ -	10%	$ -
Misc Sealant Measures	$ 1,000.00	0	ls	$ -	10%	$ -
				$ -		**$ -**

Notes:
1) No sealing is proposed under this alternative

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer[3]	$ 80.00	80	HR	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500.00**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.
3) Assumed Health and Safety office would be onsite during in-situ groundwater remediation only.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	4	hr	$ 480.00		$ 480.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00		$ 850.00
Laborer[1]	$ 65.00	20	hr	$ 1,300.00		$ 1,300.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	6	ea	$ 3,000.00	10%	$ 3,300.00
Development[1]	$ 150.00	6	ea	$ 900.00	10%	$ 990.00
Disposal of Purge Water[1]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
				$ 9,530.00		**$ 9,980.00**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, Horizontal Soil Vapor Extraction System

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Gravel Base/Backfill Materials[2]	$ 16.00	20	tn	$ 320.00	10%	$ 352.00
Horizontal Well Installation including Labor Equipment and materials[3]	$ 120.00	500	lf	$ 60,000.00	10%	$ 66,000.00
Vaults for HSVE Pipe Pentrations[3]	$ 4,000.00	2	ea	$ 8,000.00	10%	$ 8,800.00
Skid Mounted SVE Blower System with Knockout tank, filter, carbon treatment[4]	$ 3,000.00	24	mo	$ 72,000.00	10%	$ 79,200.00
Conex with Sound proof and silencing unit[7]	$ 350.00	24	mo	$ 8,400.00	10%	$ 9,240.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete/Asphalt Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	50	hr	$ 4,000.00	10%	$ 4,400.00
Monitoring Point Installation (use existing monitoring wells)	$ 1,200.00	0	ea	$ -	10%	$ -
Tedlar Bag Sampling/PID	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
HS-5000 fans -Conversion To SSDS after SVE Remediation	$ 1,500.00	5	ea	$ 7,500.00	10%	$ 8,250.00
Installation/materials for SSDS fans, and stack	$ 80.00	20	hr	$ 1,600.00	10%	$ 1,760.00
Monitoring Point Installation [3]	$ 1,200.00	6	ea	$ 7,200.00	10%	$ 7,920.00
				$ 178,070.00		**$ 195,397.00**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on contractor quotes.
4) Costs based on vendor quote.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Based on vendor quote
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning
Assume 270 linear feet.

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM	$ 120.00	0	hr	$ -		$ -
Supervisor	$ 85.00	0	hr	$ -		$ -
Laborer	$ 75.00	0	hr	$ -	10%	$ -
Laborer	$ 75.00	0	hr	$ -	10%	$ -
Materials	$ -	1	ls	$ -	10%	$ -
Disposal of Piping	$ -	1	ls	$ -	10%	$ -
				$ -		**$ -**

Notes:
1) No monitoring well decommissioning is proposed under this alternative

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, In-Situ Groudwater Treatment Pilot Test at MW-18
ISCO

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Pilot Test Grid Injection Material (3000sft) with 15ft treatment zone thickness using permanganate[2]	$ 2.66	11261	lb	$ 30,000.00	10%	$ 33,000.00
Injection Drilling Construction Costs including equipment and labor[3]	$ 1,227.27	11	pt	$ 13,500.00	10%	$ 14,850.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight Product	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 55,300.00		**$ 60,400.00**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Pilot test material costs are based on vendor quote
3) Pilot test implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, In-Situ Groundwater Treatment Full Scale Remedy

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	120	hr	$ 14,400.00		$ 14,400.00
Full Scale Grid Injection Material Near MW-18 (15,000sft) at a 15 ft treatment depth[2]	$ 3.00	56316	lbs	$ 168,948.00	10%	$ 185,842.80
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	53	pt	$ 68,900.00	10%	$ 75,790.00
Full Scale KMnO4 Injection Line (IL-01, IL-02 and IL-03)[2]	$ 3.00	98562	lbs	$ 295,686.00	10%	$ 325,254.60
Injection Drilling Construction Costs for Injection Line including equipment and labor[3]	$ 1,300.00	94	pt	$ 122,200.00	10%	$ 134,420.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight KMnO4[4]	$ 25,000.00	1	ls	$ 25,000.00	10%	$ 27,500.00
				$ 700,134.00		**$ 769,000.00**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Injection material costs are based on vendor quote.
3) Injection remedy implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Includes freight and miscellaneous material costs.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, 2nd Round KMnO4 Injection

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
2nd Round KMnO4 to Treat Remaining Elevated Concentrations Grid Injection Areas[2]	$ 3.00	20000	lb	$ 60,000.00	10%	$ 66,000.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	20	pt	$ 26,000.00	10%	$ 28,600.00
Freight Inoculant[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 92,800.00		**$ 101,600.00**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Innoculant material costs are based on vendor quote.
3) Innoculant Injection labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, In-Situ Groundwater Treatment Polish

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Inoculant Additive with Dehalococcoides to Grid Injection Areas[1]	$ 35,000.00	1	LS	$ 35,000.00	10%	$ 38,500.00
Injection Drilling Construction Costs for Grid Injection including equipment and labor[1]	$ 40,000.00	1	LS	$ 40,000.00	10%	$ 44,000.00
				$ 75,000.00		**$ 82,500.00**

Notes:
1) Cost was assumed as approximately 1/2 the cost of the Pilot Test.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, Long Term Groundwater Monitoring
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	700	EA	$ 61,600.00	10%	$ 67,760.00
MS[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
MSD[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
DUP[1]	$ 88.00	35	EA	$ 3,080.00	10%	$ 3,388.00
Trip Blanks[1]	$ 88.00	40	EA	$ 3,520.00	10%	$ 3,872.00
Laborer[1]	$ 65.00	240	hr	$ 15,600.00		$ 15,600.00
Shipping[1]	$ 40.00	40	EA	$ 1,600.00	10%	$ 1,760.00
Data Validation[2]	$ 10.00	845	EA	$ 8,450.00	10%	$ 9,295.00
Project Management and Data Reporting[3]	$ 1,000.00	20	EA	$ 20,000.00	10%	$ 22,000.00
Equis Reporting[3]	$ 250.00	20	EA	$ 5,000.00	10%	$ 5,500.00
				$ 125,010.00		**$ 136,000**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Long Term AIR Monitoring
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-12, HSVE Operation and Maintenance
2yrs of HSVE Operation followed by System use a SSDS System for 3 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Parts/Misc.	$ 1,000.00	5	yr	$ 5,000.00	10%	$ 5,500.00
Site Maintenance visits During SVE Operation (Bi Monthly for 2 yrs)[1]	$ 80.00	480	hr	$ 38,400.00		$ 38,400.00
Operating Costs During SVE Operation[2]	$ 1,000.00	36	mo	$ 36,000.00	10%	$ 39,600.00
Conversion to SSDS System (included in UC-4)						
Operating Costs for SSDS ($50/mo/fan)[3]	$ 3,600.00	3	yr	$ 10,800.00	10%	$ 11,880.00
Maintenance Costs for SSDS (Quarterly for three years)[1]	$ 80.00	120	hr	$ 9,600.00		$ 9,600.00
PM and Reporting (yearly)4	$ 1,000.00	5	ea	$ 5,000.00	10%	$ 5,500.00
				$ 104,800.00		**$ 110,500.00**

Notes:
1) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
2) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area) and misc. operation costs.
2) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.
4) Project Management and reporting costs are typical based on consultant experience.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-13, Long Term Groundwater Monitoring
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	210	EA	$ 18,480.00	10%	$ 20,328.00
MS[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
MSD[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
DUP[1]	$ 88.00	11	EA	$ 968.00	10%	$ 1,064.80
Trip Blanks[1]	$ 88.00	12	EA	$ 1,056.00	10%	$ 1,161.60
Laborer[1]	$ 65.00	72	hr	$ 4,680.00		$ 4,680.00
Shipping[1]	$ 40.00	12	EA	$ 480.00	10%	$ 528.00
Data Validation[2]	$ 300.00	6	EA	$ 1,800.00	10%	$ 1,980.00
Project Management and Data Reporting[3]	$ 1,000.00	6	EA	$ 6,000.00	10%	$ 6,600.00
Equis Reporting[3]	$ 250.00	6	EA	$ 1,500.00	10%	$ 1,650.00
				$ 36,900.00		**$ 40,200.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-14, Long Term AIR Monitoring
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 8
Alternative 5 FS Cost Estimate
HSVE System with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO)

Former Loudon and Kem Cleaners
Albany, NY

Item UC-15, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	yr	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500.00**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for one year.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

ITEM	Description	Approximate Quantity	Unit of Measurement	Unit Price Dollars & Cents	Lump Sum Price Dollars & Cents
	REMEDIAL ACTION - SVE/SSDS Installation and In-Situ Groundwater Treatment				
LS-1	Mobilization/Demobilization (Limit 5% of Total)	1	Lump Sum	$ 7,350.00	$ 7,350.00
LS-2	Site Preparation	1	Lump Sum	$ 6,590.00	$ 6,590.00
LS-3	Monitoring Well As-Built Survey	1	Lump Sum	$ 2,500.00	$ 2,500.00
LS-4	Electrical Work and Connections	1	Lump Sum	$ 11,000.00	$ 11,000.00
UC-1	SSDS Installation and Startup-Sealing Existing Structure	4	Each	$ 6,700.00	$ 26,800.00
UC-2	Health and Safety	1	Lump Sum	$ 7,500.00	$ 7,500.00
UC-3	Monitoring/Observation Well Installation	3	Each	$ 2,390.00	$ 7,170.00
UC-4	SVE Installation and Startup	1	Each	$ 109,100.00	$ 109,100.00
UC-5	Monitoring Well Decommissioning	1	Each	$ -	$ -
UC-6	In-Situ Groudwater Treatment Pilot Test at MW-18	1	Each	$ 61,000.00	$ 61,000.00
UC-7	In-Situ Groundwater Treatment Full Scale Remedy	1	Each	$ 416,000.00	$ 416,000.00
	Subtotal				$ 655,010.00
	Project Administration (15%)				$ 98,251.50
	Design and Legal (15%)				$ 98,251.50
	Contingency (20%)				$ 131,002.00
	Total Cost for RA Design and Installation				**$ 990,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 1 - 5				
UC-8	Long Term Groundwater Sampling for VOCs (On-Site)	386	Each	$ 163.09	$ 63,000.00
UC-8a	Long Term Groundwater Sampling for VOCs (Off-Site)	459	Each	$ 161.32	$ 74,000.00
UC-9	Long Term Air Monitoring and for VOC Analysis (Indoor, Outdoor, Sub-Slab and Soil Vapor Seasonally for 5 years)	75	Each	$ 353.33	$ 26,500.00
UC-10	SVE Maintenance and Operating Costs	3	Each	$ 28,133.33	$ 84,400.00
UC-10a	SSDS Maintenance and Operating Costs	4	Each	$ 8,525.00	$ 34,100.00
	Subtotal				$ 282,000.00
	Project Administration (5%)				$ 14,100.00
	Contingency (5%)				$ 14,100.00
	Total Cost for Years 1-5 O&M				**$ 311,000.00**
	Average Annual Cost				**$ 62,200.00**
	Present Worth Cost				**$270,000.00**
	OPERATION AND MAINTENANCE COST FOR YEARS 6-30				
UC-11	Long Term Groundwater Sampling for VOCs (On-Site)	116	Each	$ 159.68	$ 18,600.00
UC-11a	Long Term Groundwater Sampling for VOCs (Off-Site)	139	Each	$ 157.38	$ 21,800.00
UC-12	Long Term Air Monitoring and for VOC Analysis (Once every 5 years for 25 years)	70	Each	$ 365.71	$ 25,600.00
UC-13	SSDS Maintenance and Operating Costs	25	Each	$ 6,740.00	$ 168,500.00
	Subtotal				$ 234,500.00
	Project Administration (5%)				$ 11,725.00
	Contingency (5%)				$ 11,725.00
	Total Cost for Years 5-30 O&M				**$ 258,000.00**
	Average Annual Cost				**$ 10,320.00**
	Present Worth Cost				**$145,500.00**
				Total Present Worth Cost	$1,410,000.00
				Grand Total	**$ 1,560,000.00**

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-1, Mobilization/Demobilization
Limit 5% of Total Bid)

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	20	hr	$ 2,400.00		$ 2,400.00
Supervisor[1]	$ 85.00	20	hr	$ 1,700.00		$ 1,700.00
Laborer[1]	$ 75.00	20	hr	$ 1,500.00		$ 1,500.00
Permits	$ 200.00	1	ls	$ 200.00	25%	$ 250.00
Equipment	$ 1,200.00	1	ls	$ 1,200.00	25%	$ 1,500.00
				$ 7,000.00		**$ 7,350.00**

Notes:
1) Costs for this task were based on typical environmental field rates for a laborer, supervisor and project management in the Albany, NY area with 20 hours of preparation assumed for the crew to set up the work.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-2, Site Preparation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Misc. Materials/Supplies	$ 1,000.00	1	ls	$ 1,000.00	10%	$ 1,100.00
Utility Locator[1]	$ 1,300.00	1	ea.	$ 1,300.00	10%	$ 1,430.00
Decontamination Station[3]						
PM[2]	$ 120.00	10	hr	$ 1,200.00		$ 1,200.00
Supervisor[2]	$ 85.00	10	hr	$ 850.00		$ 850.00
Equipment Operator[2]	$ 75.00	10	hr	$ 750.00		$ 750.00
Laborer[2]	$ 65.00	10	hr	$ 650.00		$ 650.00
Truck	$ 20.00	10	hr	$ 200.00	10%	$ 220.00
HDPE Buckets/Brushes and Materials[3]	$ 250.00	1	ls	$ 250.00	10%	$ 275.00
Alconox[3]	$ 100.00	1	ls	$ 100.00	10%	$ 110.00
					TOTAL	**$ 6,590.00**

Notes:
1) Utility location cost was based on previous daily rate quote for this Site.
2) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
3) Decontamination station and material cost is based on previous quotes for contractor install of a decontamination area.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-3, MW As-Built Survey

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
MW Survey[1,2]	$ 2,500.00	1	ls	$ 2,500.00		$ 2,500.00
				$ 2,500.00		**$ 2,500.00**

Notes:
1) Cost includes monitoring well and miscellaneous survey work necessary to accurately complete the work.
2) Survey cost includes mobilization, 1 full day of surveying, demobilization and reporting (typ.)

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item LS-4, Electrical Work and Connections

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Electrical Work[1,2]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
				$ 10,000.00		**$ 11,000.00**

Notes:
1) Cost includes all electrical work necessary to install the SSDS and any miscellaneous electrical modifications to the extisting electrical service
2) Cost was estimated based on engineering judgement and recent similar project costs.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-1, SSDS Installation - Sealing Existing Structure

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	10	hr	$ 1,200.00	10%	$ 1,320.00
Supervisor[1]	$ 85.00	10	hr	$ 850.00	10%	$ 935.00
Laborer[1]	$ 75.00	34	hr	$ 2,550.00	10%	$ 2,805.00
Laborer[1]	$ 75.00	34	hr	$ 2,550.00	10%	$ 2,805.00
Grout	$ 4.00	134	lf	$ 536.00	10%	$ 589.60
Gravel Base[2]	$ 16.00	14	tn	$ 224.00	10%	$ 246.40
4" Dia. PVC Pipe and Fittings[3]	$ 10.00	34	lf	$ 340.00	10%	$ 374.00
4" Dia. Perforated Pipe[3]	$ 2.00	34	lf	$ 68.00	10%	$ 74.80
HS-5000 Blower/Fan Units[4]	$ 1,500.00	4	ea	$ 6,000.00	10%	$ 6,600.00
Saw Cut[5]	$ 10.00	134	lf	$ 1,340.00	10%	$ 1,474.00
Concrete Work[5]	$ 100.00	7	cy	$ 700.00	10%	$ 770.00
Startup - 5 visits[6]	$ 80.00	27	hr	$ 2,160.00	10%	$ 2,376.00
Monitoring Point Installation[7]	$ 1,200.00	4	ea	$ 4,800.00	10%	$ 5,280.00
Tedlar Bag Sampling/PID[8]	$ 250.00	4	ea	$ 1,000.00	10%	$ 1,100.00
				$ 24,318.00		**$ 26,800.00**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Pipe and fittings costs are typ. Lengths and quantities assumed. Exact lengths will be determined during the design.
4) HS 5000 fan costs are based on Radon Away quote with shipping and installation preparation.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on typ. Cost to install points
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-2, Health and Safety

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Health and Safety[1,2]	$ 1,000.00	1	LS	$ 1,000.00	10%	$ 1,100.00
H&S Onsite officer[3]	$ 80.00	80	HR	$ 6,400.00		$ 6,400.00
				$ 7,400.00		**$ 7,500.00**

Notes:
1) Cost includes all time to generate HASP. Estimated cost was based on typical HASP preparation time for small projects
2) Cost was estimated based the assumption the HASP would be completed in 1 day.
3) Assumed Health and Safety office would be onsite during in-situ groundwater remediation only.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-3, Monitoring/Observation Well Installation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	2	hr	$ 240.00		$ 240.00
Supervisor[1]	$ 85.00	8	hr	$ 680.00		$ 680.00
Laborer[1]	$ 65.00	16	hr	$ 1,040.00		$ 1,040.00
Geoprobe[1]	$ 1,200.00	2	day	$ 2,400.00		$ 2,400.00
2"Dia prepacked MWs and materials[1]	$ 500.00	3	ea	$ 1,500.00	10%	$ 1,650.00
Development[1]	$ 150.00	3	ea	$ 450.00	10%	$ 495.00
Disposal of Purge Water[1]	$ 200.00	3	drum	$ 600.00	10%	$ 660.00
				$ 6,910.00		**$ 7,170.00**

Notes:
1) Cost was generated based on previous costs to install monitoring wells at this Site.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-4, SVE Installation and Startup

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Gravel Base/Backfill Materials[2]	$ 16.00	10	tn	$ 160.00	10%	$ 176.00
Well Installation including Labor Equipment and materials (3 Wells)[3]	$ 120.00	50	lf	$ 6,000.00	10%	$ 6,600.00
Skid Mounted SVE Blower System with Knockout tank, filter, carbon treatment[4]	$ 3,000.00	24	mo	$ 72,000.00	10%	$ 79,200.00
Conex with Sound proof and silencing unit[7]	$ 350.00	24	mo	$ 8,400.00	10%	$ 9,240.00
Saw Cut[5]	$ 10.00	200	lf	$ 2,000.00	10%	$ 2,200.00
Concrete/Asphalt Work[5]	$ 100.00	10	cy	$ 1,000.00	10%	$ 1,100.00
Startup - 5 visits[6]	$ 80.00	50	hr	$ 4,000.00	10%	$ 4,400.00
Tedlar Bag Sampling/PID	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
				$ 99,610.00		**$ 109,100.00**

Notes:
1) Cost includes all labor, equipment and materials necessary to install the SSDS. Labor rates are typical Environmental rates for the Albany area. Estimated time was based on previous contractor quote and schedule.
2) Gravel cost is typical delivery cost per ton. Quantity was assumed.
3) Monitoring point costs include labor, equipment and material costs to install monitoring points and collect measurements. Cost was estimated based on typ. Cost to install points
4) Costs based on vendor quote.
5) Saw cutting based on similar recent project cost. Concrete work is assumed.
6) Start up includes 1 laborer for 5 daily trips to start, set-up, operate and adjust system to run efficiently
7) Based on vendor quote
8) Sampling costs include tedlar bag VOC samples - method 8260 and labor cost to collect and ship to laboratory.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-5, Monitoring Well Decommissioning

	Cost		Quantity	Units	Costs		Mark-up	Bill Price	
PM	$	120.00	0	hr	$	-		$	-
Supervisor	$	85.00	0	hr	$	-		$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Laborer	$	75.00	0	hr	$	-	10%	$	-
Materials	$	-	1	ls	$	-	10%	$	-
Disposal of Piping	$	-	1	ls	$	-	10%	$	-
					$	-		**$**	**-**

Notes:
No Monitoring Wells are proposed for decommissioning under this alternative.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-6, In-Situ Groudwater Treatment Pilot Test at MW-18
ISCO

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	40	hr	$ 4,800.00		$ 4,800.00
Pilot Test Grid Injection Material (3000sft) with 15ft treatment zone thickness using permanganate[2]	$ 2.66	11261	lb	$ 30,000.00	10%	$ 33,000.00
Injection Drilling Construction Costs including equipment and labor[3]	$ 1,227.27	11	pt	$ 13,500.00	10%	$ 14,850.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight[4]	$ 2,000.00	1	ls	$ 2,000.00	10%	$ 2,200.00
				$ 55,300.00		**$ 61,000.00**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Pilot test material costs are based on vendor quote.
3) Pilot test implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-7, In-Situ Groundwater Treatment Full Scale Remedy

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
PM[1]	$ 120.00	60	hr	$ 7,200.00		$ 7,200.00
INJECTION 1						
Full Scale Grid Injection Material Near MW-18 (15,000sft) at a 15 ft treatment depth[2]	$ 3.00	56316	lbs	$ 168,948.00	10%	$ 185,842.80
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	53	pt	$ 68,900.00	10%	$ 75,790.00
Decon/Misc.	$ 5,000.00	1	ls	$ 5,000.00	10%	$ 5,500.00
Freight KMnO4[4]	$ 10,000.00	1	ls	$ 10,000.00	10%	$ 11,000.00
INJECTION 2 - Assumed as half of injection 1 costs for materials and drilling injection services only						
Full Scale Grid Injection Material Near MW-18 (15,000sft)	$ 3.00	28158	lbs	$ 84,474.00	10%	$ 92,921.40
Injection Drilling Construction Costs for Grid Injection including equipment and labor[3]	$ 1,300.00	26	pt	$ 33,800.00	10%	$ 37,180.00
				$ 378,322.00		**$ 416,000.00**

Notes:
1) Labor costs were based on typical environmental field rates for a laborer, supervisor and project manager in the Albany, NY area.
2) Injection material costs are based on vendor quote.
3) Injection remedy implementation labor and equipment costs are based on Loudon Kem Cleaners site specific Contractor quote.
4) Shipping costs were estimated by vendor quote.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8, Long Term Groundwater Monitoring (On-Site)
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	320	EA	$ 28,160.00	10%	$ 30,976.00
MS[1]	$ 88.00	16	EA	$ 1,408.00	10%	$ 1,548.80
MSD[1]	$ 88.00	16	EA	$ 1,408.00	10%	$ 1,548.80
DUP[1]	$ 88.00	16	EA	$ 1,408.00	10%	$ 1,548.80
Trip Blanks[1]	$ 88.00	18	EA	$ 1,609.14	10%	$ 1,770.06
Laborer[1]	$ 65.00	110	hr	$ 7,131.43		$ 7,131.43
Shipping[1]	$ 40.00	18	EA	$ 731.43	10%	$ 804.57
Data Validation[2]	$ 10.00	386	EA	$ 3,862.86	10%	$ 4,249.14
Project Management and Data Reporting[3]	$ 1,000.00	9	EA	$ 9,142.86	10%	$ 10,057.14
Equis Reporting[3]	$ 250.00	9	EA	$ 2,285.71	10%	$ 2,514.29
				$ 57,147.43		**$ 63,000.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-8a, Long Term Groundwater Monitoring (Off-Site)
Assume Quarterly due to high gw gradient for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	380	EA	$ 33,440.00	10%	$ 36,784.00
MS[1]	$ 88.00	19	EA	$ 1,672.00	10%	$ 1,839.20
MSD[1]	$ 88.00	19	EA	$ 1,672.00	10%	$ 1,839.20
DUP[1]	$ 88.00	19	EA	$ 1,672.00	10%	$ 1,839.20
Trip Blanks[1]	$ 88.00	22	EA	$ 1,910.86	10%	$ 2,101.94
Laborer[1]	$ 65.00	130	hr	$ 8,468.57		$ 8,468.57
Shipping[1]	$ 40.00	22	EA	$ 868.57	10%	$ 955.43
Data Validation[2]	$ 10.00	459	EA	$ 4,587.14	10%	$ 5,045.86
Project Management and Data Reporting[3]	$ 1,000.00	11	EA	$ 10,857.14	10%	$ 11,942.86
Equis Reporting[3]	$ 250.00	11	EA	$ 2,714.29	10%	$ 2,985.71
				$ 67,862.57		**$ 74,000.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-9, Long Term AIR Monitoring
Assume Seasonally for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 24,425.00		**$ 26,500**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once per year for 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10, SVE Operation and Maintenance
2yrs of SVE Operation

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Parts/Misc.	$ 1,000.00	2	yr	$ 2,000.00	10%	$ 2,200.00
Site Maintenance visits During SVE Operation (Bi Monthly for 2 yrs)[1]	$ 80.00	480	hr	$ 38,400.00		$ 38,400.00
Operating Costs During SVE Operation[2]	$ 1,500.00	24	mo	$ 36,000.00	10%	$ 39,600.00
PM and Reporting (yearly)[3]	$ 750.00	5	ea	$ 3,750.00	10%	$ 4,125.00
				$ 80,150.00		**$ 84,400**

Notes:
1) Operation and maintenance labor includes one technician ($80/hr) with bi-monthly site visits to check system.
2) Operating costs include electrical costs and carbon change out/ misc maint as needed. Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area) and misc. operation costs.
3) Project management and reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-10a, SSDS Operation and Maintenance
SSDS System for 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
Parts/Misc.	$ 600.00	5	yr	$ 3,000.00	10%	$ 3,300.00
Operating Costs for SSDS ($50/mo/fan)[1]	$ 3,600.00	5	yr	$ 18,000.00	10%	$ 19,800.00
Maintenance Costs for SSDS (Bi-Annually for 5 years)[2]	$ 80.00	120	hr	$ 9,600.00		$ 9,600.00
PM and Reporting (yearly)[3]	$ 250.00	5	ea	$ 1,250.00	10%	$ 1,375.00
				$ 31,850.00		**$ 34,100**

Notes:
1) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area),6 fans and misc. operation costs for a year.
2) Operation and maintenance labor includes one technician ($80/hr) with one bi-annual site visit to check system.
3) Project management and reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11, Long Term Groundwater Monitoring (On-Site)
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	96	EA	$ 8,448.00	10%	$ 9,292.80
MS[1]	$ 88.00	5	EA	$ 440.00	10%	$ 484.00
MSD[1]	$ 88.00	5	EA	$ 440.00	10%	$ 484.00
DUP[1]	$ 88.00	5	EA	$ 440.00	10%	$ 484.00
Trip Blanks[1]	$ 88.00	5	EA	$ 482.74	10%	$ 531.02
Laborer[1]	$ 65.00	33	hr	$ 2,139.43	10%	$ 2,353.37
Shipping[1]	$ 40.00	5	EA	$ 219.43	10%	$ 241.37
Data Validation[2]	$ 137	6	EA	$ 822.86	10%	$ 905.14
Project Management and Data Reporting[3]	$ 457	6	EA	$ 2,742.86	10%	$ 3,017.14
Equis Reporting[3]	$ 114	6	EA	$ 685.71	10%	$ 754.29
				$ 16,861.03		**$ 18,600.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-11a, Long Term Groundwater Monitoring (Off-Site)
After 5 years assume 1 round every 5 years

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
VOC Method 8260[1]	$ 88.00	114	EA	$ 10,032.00	10%	$ 11,035.20
MS[1]	$ 88.00	6	EA	$ 528.00	10%	$ 580.80
MSD[1]	$ 88.00	6	EA	$ 528.00	10%	$ 580.80
DUP[1]	$ 88.00	6	EA	$ 528.00	10%	$ 580.80
Trip Blanks[1]	$ 88.00	7	EA	$ 573.26	10%	$ 630.58
Laborer[1]	$ 65.00	39	hr	$ 2,540.57		$ 2,540.57
Shipping[1]	$ 40.00	7	EA	$ 260.57	10%	$ 286.63
Data Validation[2]	$ 162.86	6	EA	$ 977.14	10%	$ 1,074.86
Project Management and Data Reporting[3]	$ 542.86	6	EA	$ 3,257.14	10%	$ 3,582.86
Equis Reporting[3]	$ 135.71	6	EA	$ 814.29	10%	$ 895.71
				$ 20,038.97		**$ 21,800.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze the samples from 35 monitoring wells both on and off the Site. VOC analytical costs are based on lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis and data reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-12, Long Term AIR Monitoring
Assume 1 round every 5 years for years 6 - 30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
IA VOC Method 8260[1]	$ 165.00	25	EA	$ 4,125.00	10%	$ 4,537.50
OA VOC Method 8260[1]	$ 165.00	10	EA	$ 1,650.00	10%	$ 1,815.00
SS/SV VOC Method 8260[1]	$ 165.00	30	EA	$ 4,950.00	10%	$ 5,445.00
DUP[1]	$ 165.00	5	EA	$ 825.00	10%	$ 907.50
Laborer[1]	$ 65.00	60	hr	$ 3,900.00		$ 3,900.00
Shipping[1]	$ 40.00	10	EA	$ 400.00	10%	$ 440.00
Data Validation[2]	$ 300.00	5	EA	$ 1,500.00	10%	$ 1,650.00
Project Management and Data Reporting[3]	$ 1,000.00	5	EA	$ 5,000.00	10%	$ 5,500.00
Equis Reporting[3]	$ 250.00	5	EA	$ 1,250.00	10%	$ 1,375.00
				$ 23,600.00		**$ 25,600.00**

Notes:
1) Cost includes all labor equipment and materials to collect, ship and analyze 6 IA, 2 OA, and 6 SS/SV samples once every 5 years. VOC sample costs are from lab quote from recent project.
2) Data Validation cost based on previous contractor quote from similar project.
3) Equis reporting costs are typical based on consultant experience.

TABLE 9
Alternative 6 FS Cost Estimate
SVE/SSDS using Focused ISCO
and Long Term Air Groundwater Monitoring

Former Loudon and Kem Cleaners
Albany, NY

Item UC-13, Sub Slab Depressurization System O&M
Years 6-30

	Cost	Quantity	Units	Costs	Mark-up	Bill Price
HS-5000 Blower/Fan Units (replace every 5 years)[1]	$ 1,500.00	30	ea	$ 45,000.00	10%	$ 49,500.00
Site Maintenance visits (one visit per year)[2]	$ 80.00	250	hr	$ 20,000.00		$ 20,000.00
Operating Costs ($50/mo/fan)[3]	$ 3,600.00	25	years	$ 90,000.00	10%	$ 99,000.00
				$ 155,000.00		**$ 168,500.00**

Notes:
1) Cost includes one replacement of the HS-5000 fans (6 total). Quote from Radon Away.
2) Operation and maintenance labor includes one technician ($80/hr) with one annual site visit to check system.
3) Operation costs are based on $0.12 cost of electricity/kwh (typical for Albany area), 6 fans and misc. operation costs for 1 year.

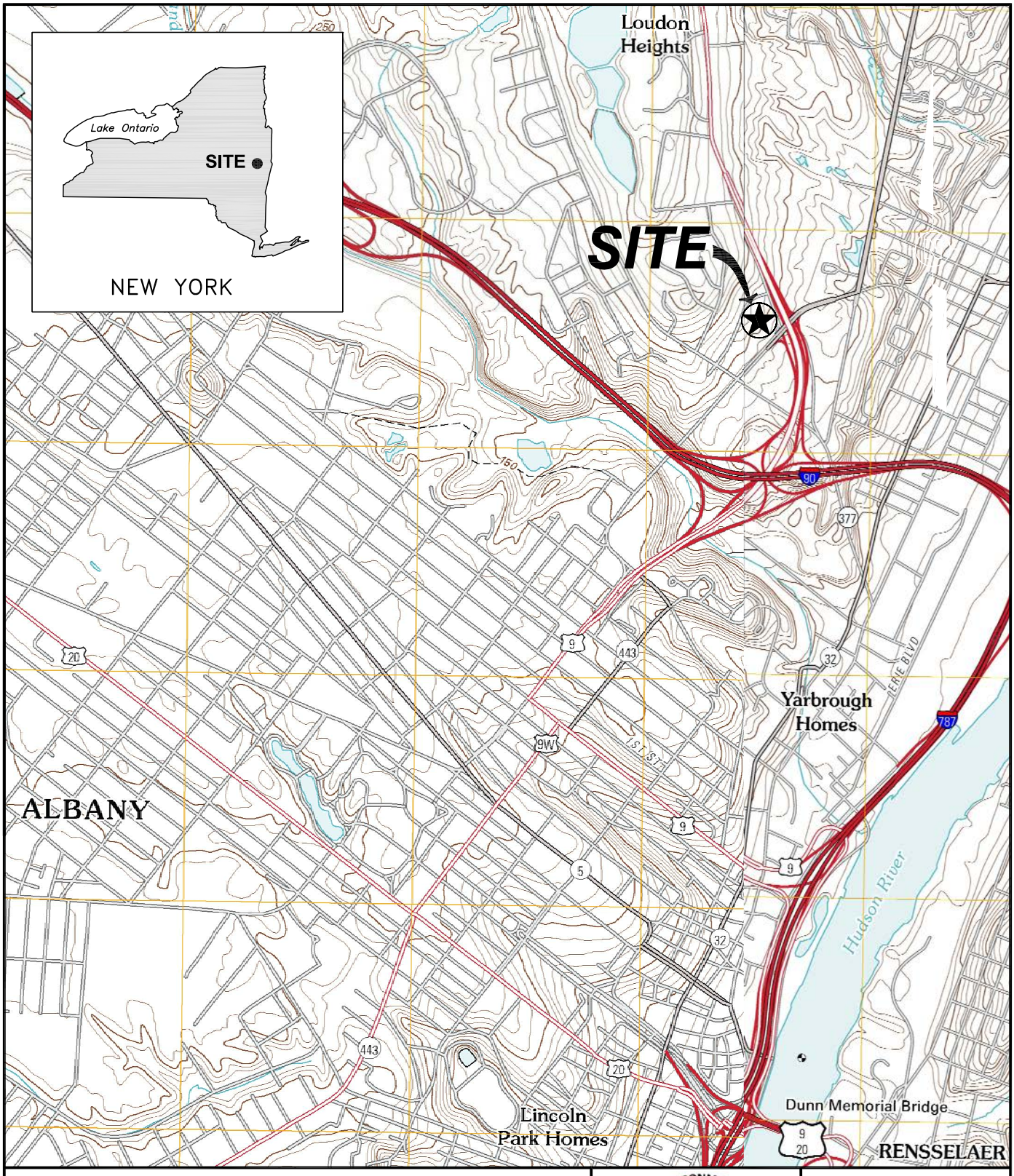
TABLE 10
Cost Estimate Comparison of Remedial Alternatives

Former Loudon and Kem Cleaners
Albany, NY
Feasibility Study Report

Description	Alternative 1 No Action	Alternative 2 Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and Long Term Air and Groundwater Monitoring	Alternative 2A Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) and Long Term Air and Groundwater Monitoring	Alternative 2B Mitigation of Soil Vapor by Sealing Preferential Pathways and Installation of Sub-Slab Depressurization System(s) and In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) and Long Term Air and Groundwater Monitoring	Alternative 3 Horizontal Soil Vapor Extraction System with Long Term Air and Groundwater Monitoring	Alternative 4 Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Reduction (ISCR) with Permeable Reactive Barriers (PRBs) with Long Term Air and Groundwater Monitoring	Alternative 5 Horizontal Soil Vapor Extraction with In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation (ISCO) with Long Term Air and Groundwater Monitoring	Alternative 6 SVE/SSDS with Focused In-Situ Groundwater Treatment Using In-Situ Chemical Oxidation with Long Term Air and Groundwater Monitoring
Capital Cost	$ -	$ 117,000	$ 1,240,000	$ 1,660,000	$ 412,000	$ 1,580,000	$ 1,930,000	$ 1,030,000
Average Annual O&M (Years 1-5)	$ -	$ 40,000	$ 41,200	$ 40,800	$ 59,200	$ 55,600	$ 55,000	$ 61,400
Average Annual O&M (Years 6-30)	$ -	$ 6,240	$ 6,240	$ 6,240	$ 6,240	$ 6,240	$ 6,240	$ 6,240
Total O&M (Years 1-5)	$ -	$ 200,000	$ 206,000	$ 204,000	$ 257,000	$ 278,000	$ 275,000	$ 307,000
Total O&M (Years 6-30)	$ -	$ 156,000	$ 156,000	$ 156,000	$ 156,000	$ 156,000	$ 156,000	$ 156,000
Total Present Worth	$ -	$ 379,000	$ 1,510,000	$ 1,930,000	$ 757,000	$ 1,910,000	$ 2,260,000	$ 1,390,000
Total Cost	**$ -**	**$ 473,000**	**$ 1,600,000**	**$ 2,020,000**	**$ 864,000**	**$ 2,010,000**	**$ 2,360,000**	**$ 1,500,000**

Notes:
1. Full cost estimates are shown in Tables 5-9.
2. Alternatives 2A, 2B, 4 and 5 include optional post-remedial actions.
3. All costs have been rounded to 3 significant figures.
4. Present Worth Costs were calculated using a 5% interest rate per year.

Figures



SCALE

0 2000 4000 FEET

REFERENCE:

DRAWING CREATE WITH USGS 7.5–MINUTE QUADRANGLE MAPS: ALBANY, NEW YORK AND TROY SOUTH, NEW YORK.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

FIGURE 1

SITE LOCATION MAP
FORMER LOUDON AND KEM CLEANERS

LOUDON PLAZA 350 NORTHERN BOULEVARD
ALBANY, NEW YORK

EXISTING LEGEND

PROPERTY LINE		CATCH BASIN	DS	GAS MAIN	8"G
RIGHT-OF-WAY LINE		MANHOLE	MH	WATER MAIN	8"W
EASEMENT LINE		WATER SHUTOFF		STORM SEWER	8"ST
MUNICIPAL BOUNDARY		WELL	W	SANITARY SEWER	8"SA
CAPPED IRON ROD/PIPE FOUND	CIRF/IPF	UTILITY POLE W/WO GUY		SANITARY FORCEMAIN	8"FM
MONUMENT	MON.	LIGHT POLE		OVERHEAD WIRE	OW
PAVED ROADS		SIGN			
SHOULDERS		EXISTING SPOT	x 202.12		
GRAVEL ROAD OR RD. UNDER CONSTRUCTION		CONTOUR	100		
WALK, DRIVEWAY		RETAINING WALL			
BUILDINGS		FENCE	x x x x		

LANDS OF
LOUDON VILLAGE LLC
L. 2594 PG. 1079
TAX MAP NO. 65.7-3-23

LOUDON ARMS APARTMENTS

2 STORY BRICK (TYP.)

N32°28'00"E

L=467.04'

R=2230.00'

S54°14'00"W
609.57'

6' CHAIN LINK FENCE

ASPHALT DRIVE

S06°41'58"E 131.69'

S54°14'00"W
8.47'

S04°15'05"E
90.41'

RETAINING WALL

NM 6 NM 5 NM 2 NM 48 NM 4A

MH RIM=240.25

CB RIM=240.11

ASPHALT PARKING LOT

LANDS OF
SKY-FOUR REALTY CO.
L. 2330 PG. 71
TAX MAP NO. 65.7-3-24

STRIP MALL

3 STORY OFFICE BUILDING

MH RIM=239.95

CB-1

CURB

ASPHALT PARKING LOT

CONC. WALK

MH RIM=238.05

MH RIM=233.71

CB-2

CB-3

S06°27'30"E 133.00'

LOUDON ROAD

S03°22'10"W
128.89'

S27°27'54"W
19.35'

S33°06'25"W
105.11'

S54°18'08"W
236.00'

CB RIM=230.09

BENCH MARK
"X" CUT SW BOLT
LIGHT POLE
ELEV.=232.00
NAVD '88

MH RIM=230.25

S68°20'18"W
61.85'

S54°18'08"W
4.55'

S35°46'00"E
3.37'

S35°46'00"E 324.26'

N44°28'00"E

N45°32'00"W 232.51'

ALBANY - SHAKER ROAD

N61°26'02"W
35.54'

S80°07'46"W
42.32'

MON.

S54°08'00"W 483.71'

NORTHERN BOULEVARD

CB RIM=235.63

CB RIM=232.00

MH RIM=235.04

NM 70

NG 7 NG 9 NM 8 NM 8-1

POOL AREA

6-1 6-2

CB RIM=236.10

NM 67-2 NM 67-3

STMH RIM=232.18

CB RIM=229.59

MH RIM=230.01

GRASS

CURB

ALBANY MEMORIAL HOSPITAL

ASPHALT PARKING LOT

LOUDON ROAD

ROUTE 9

ACCESS DRIVE

SCALE
0 100 200 FEET

NOTES:

1. SURVEY INFORMATION SHOWN HEREON WAS COMPILED FROM AN ACTUAL FIELD SURVEY CONDUCTED DURING THE MONTH OF JANUARY, 2012.
2. CONTOURS SHOWN ARE PROVIDED BY NYS GIS CLEARINGHOUSE AND ARE BASED ON 2010 LIDAR PHOTOGRAPHY OF ALBANY COUNTY.
3. COORDINATES AND ELEVATIONS ARE BASED ON STATE PLANE COORDINATES FOR NEW YORK STATE EAST ZONE NAD 83 AND NAVD '88.
4. MANHOLES AND CATCH BASINS HAVE BEEN PLOTTED BASED ON FIELD SURVEY. NO ATTEMPT HAS BEEN MADE ON THIS MAP TO CONNECT UNDERGROUND UTILITIES.
5. SURVEY COMPLETED BY LABERGE ENGINEERING AND ARCHITECTURE GROUP, SURVEYING AND PLANNING.

Shaw® Shaw Environmental, Inc.

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS

FIGURE 2
SITE SURVEY MAP

ALBANY, NEW YORK

DRAWING NUMBER	APPROVED BY	CHECKED BY	DRAWN BY	DESIGNED BY	DATE	OFFICE
134685-26B1	MJS	MJS	MJS	MJS	07/18/13	LATHAM, NY

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Plot Date/Time: Aug 28, 2014 - 2:30pm
Plotted By: steven.walsh
Xref :
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DRAWING NUMBER	134685-26B20
APPROVED BY	MJS
CHECKED BY	MJS
DRAWN BY	MJS
DESIGNED BY	MJS
DATE	01/08/14
OFFICE	LATHAM, NY

NOTE:

1) AERIAL IMAGERY TAKEN FROM 2009 VITUAL EARTH.

2) SAMPLING LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.

3) ONLY SAMPLES SS-3, SS-5, SS-6, SV-3, SV-A, SV-B, SV-C IA-3, IA-5, IA-6, INDOOR AMBIENT, OA-1 AND OUTDOOR AMBIENT WERE RE-SAMPLED DURING THE PHASE II REMEDIAL INVESTIGATION.

4) LOCATION OF SSDS BLOWER UNIT AND PIPE NETWORK IS APPROXIMATE. EXACT LOCATION OF BLOWER AND ASSOCIATED PIPING WILL BE DETREMINED IN THE REMEDIAL DESIGN.

Legend

- Existing Monitoring Well
- Phase II Monitoring Well
- Phase I Monitoring Well
- Proposed Monitoring Well
- SSDS Blower Unit
- SSDS Piping Network
- Indoor Ambient Air Locations
- Outdoor Ambient Air Locations
- Historical Sub-Slab Sample Locations
- Temporary Sub-Slab Sample Locations
- Soil Gas Locations
- Building Boundaries
- Area of Concern

MW-7 MW-9 MW-1 MW-27 MW-22 MW-5 MW-10 MW-26 MW-4 MW-25 MW-8 MW-12 MW-28 MW-3 MW-2 MW-2D MW-14 MW-11 MW-16 MW-20 MW-13 MW-13D MW-15 MW-17 MW-18 MW-18D MW-4LA MW-23

SS-1 SS-2 SS-3 SS-4 SS-5 SS-6 SS-7 SS-9

IA-1 IA-2 IA-3 IA-4 IA-5 IA-6 IA-7

OA-1 OA-2

SV-1 SV-2 SV-A SV-B SV-C

INDOOR AMBIENT

OUTDOOR AMBIENT

SSDS BLOWER VENT TO ATMOSPHERE

Former Loudon Dry Cleaning (currently vacant)

Pizza Shop

Pharmacy

Dentist

Coast Gaurd Recruiters

Former KEM Cleaners & Barbershop (currently restaurant)

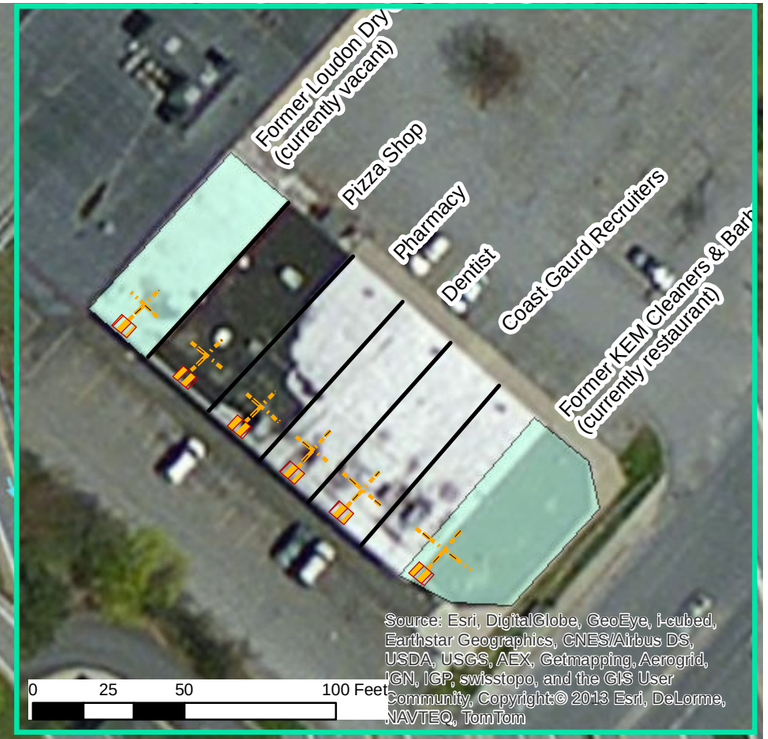
Former KEM Cleaners & Barb

Northern Blvd

US-9 S

US-9 N

498 398 348 338



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Copyright© 2013 Esri, DeLorme, NAVTEQ, TomTom

0 30 60 120 Feet

N

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Copyright© 2013 Esri, DeLorme, NAVTEQ, TomTom

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS
FIGURE 3

ALTERNATIVES 2, 2A AND 2B
SUB-SLAB DEPRESSURIZATION
SYSTEM LAYOUT
ALBANY, NY

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DRAWING NUMBER	134685-26B20
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OFFICE	LATHAM, NY

NOTE:

1) AERIAL IMAGERY TAKEN FROM ESRI.

2) SAMPLING LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.

3) ONLY SAMPLES SS-3, SS-5, SS-6, SV-3, SV-A, SV-B, SV-C IA-3, IA-5, IA-6, INDOOR AMBIENT, OA-1 AND OUTDOOR AMBIENT WERE RE-SAMPLED DURING THE PHASE II REMEDIAL INVESTIGATION.

4) LOCATION OF HORIZONTAL SVE SYSTEM, LATERALS AND VAULT IS APPROXIMATE.

5) EXISTING, PHASE I AND PHASE II AND ADDITIONALLY PROPOSED MONITORING WELLS ARE SHOWN ON FIGURE 3.

0 30 60 120 Feet

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS
FIGURE 4

ALTERNATIVES 3, 4 AND 5
HORIZONTAL SVE SYSTEM LAYOUT

ALBANY, NY

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DRAWING NUMBER	134685-26B21
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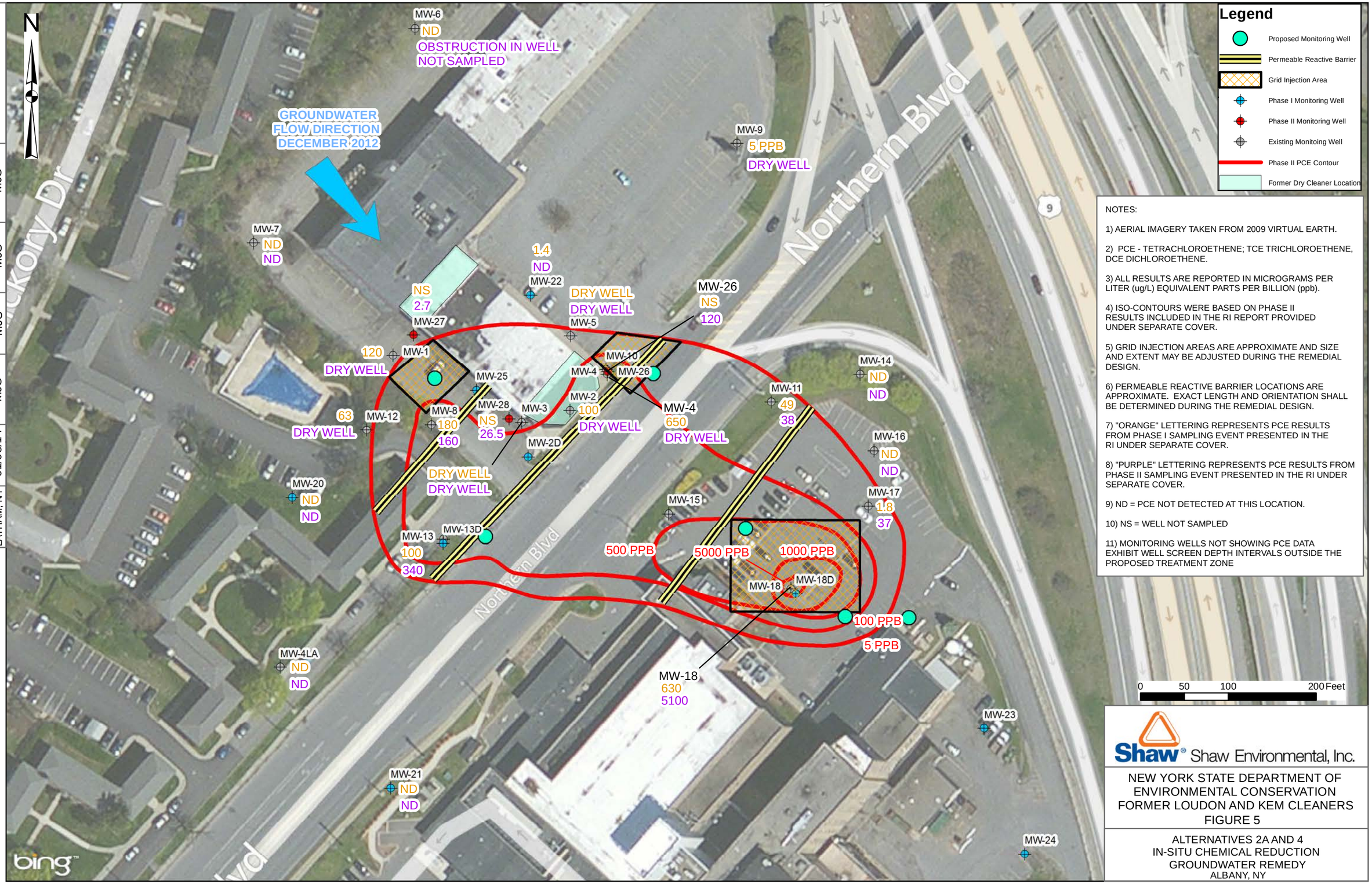

Legend

- Proposed Monitoring Well
- Permeable Reactive Barrier
- Grid Injection Area
- Phase I Monitoring Well
- Phase II Monitoring Well
- Existing Monitoing Well
- Phase II PCE Contour
- Former Dry Cleaner Location

NOTES:

1) AERIAL IMAGERY TAKEN FROM 2009 VIRTUAL EARTH.

2) PCE - TETRACHLOROETHENE; TCE TRICHLOROETHENE, DCE DICHLOROETHENE.

3) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L) EQUIVALENT PARTS PER BILLION (ppb).

4) ISO-CONTOURS WERE BASED ON PHASE II RESULTS INCLUDED IN THE RI REPORT PROVIDED UNDER SEPARATE COVER.

5) GRID INJECTION AREAS ARE APPROXIMATE AND SIZE AND EXTENT MAY BE ADJUSTED DURING THE REMEDIAL DESIGN.

6) PERMEABLE REACTIVE BARRIER LOCATIONS ARE APPROXIMATE. EXACT LENGTH AND ORIENTATION SHALL BE DETERMINED DURING THE REMEDIAL DESIGN.

7) "ORANGE" LETTERING REPRESENTS PCE RESULTS FROM PHASE I SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

8) "PURPLE" LETTERING REPRESENTS PCE RESULTS FROM PHASE II SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

9) ND = PCE NOT DETECTED AT THIS LOCATION.

10) NS = WELL NOT SAMPLED

11) MONITORING WELLS NOT SHOWING PCE DATA EXHIBIT WELL SCREEN DEPTH INTERVALS OUTSIDE THE PROPOSED TREATMENT ZONE

0 50 100 200 Feet

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NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS
FIGURE 5

ALTERNATIVES 2A AND 4
IN-SITU CHEMICAL REDUCTION
GROUNDWATER REMEDY
ALBANY, NY

Document Path: U:\Project\GIS\134685\26-LOUDON KEM\MXD\FS\134685-26B21.mxd

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DESIGNED BY	MJS
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OFFICE	LATHAM, NY

N

GROUNDWATER FLOW DIRECTION DECEMBER 2012

Hickory Dr

Northern Blvd

MW-6 ND OBSTRUCTION IN WELL NOT SAMPLED

MW-9 5 PPB DRY WELL

MW-7 ND ND

MW-22 1.4 ND

MW-27 NS 2.7

MW-5 DRY WELL DRY WELL

MW-26 NS 120

MW-1 120 DRY WELL

MW-10

MW-4

MW-25

MW-2 100 DRY WELL

MW-28 NS 26.5

MW-3

MW-8 180 160

MW-12 63 DRY WELL

MW-2D

MW-4 650 DRY WELL

MW-11 49 38

MW-14 ND ND

MW-16 ND ND

MW-17 18 37

MW-15

DRY WELL DRY WELL

MW-20 ND ND

MW-13 100 340

MW-13D

500 PPB

5000 PPB

1000 PPB

MW-18 MW-18D

100 PPB

5 PPB

MW-4LA ND ND

MW-18 630 5100

MW-23

MW-21 ND ND

MW-24

bing

Legend

- Proposed Monitoring Well
- KMNO4 GRID INJECTION LINES
- KMNO4 GRID INJECTION
- Phase I Monitoring Well
- Phase II Monitoring Well
- Existing Monitoing Well
- Phase II PCE Contour
- Former Dry Cleaner Location

NOTES:

1) AERIAL IMAGERY TAKEN FROM 2009 VIRTUAL EARTH.

2) PCE - TETRACHLOROETHENE; TCE TRICHLOROETHENE, DCE DICHLOROETHENE.

3) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L) EQUIVALENT PARTS PER BILLION (ppb).

4) ISO-CONTOURS WERE BASED ON PHASE II RESULTS INCLUDED IN THE RI REPORT PROVIDED UNDER SEPARATE COVER.

5) GRID INJECTION AREAS ARE APPROXIMATE AND SIZE AND EXTENT MAY BE ADJUSTED DURING THE REMEDIAL DESIGN.

6) INJECTION LINE LOCATIONS ARE APPROXIMATE. EXACT LENGTH AND ORIENTATION SHALL BE DETERMINED DURING THE REMEDIAL DESIGN.

7) "ORANGE" LETTERING REPRESENTS PCE RESULTS FROM PHASE I SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

8) "PURPLE" LETTERING REPRESENTS PCE RESULTS FROM PHASE II SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

9) ND = PCE NOT DETECTED AT THIS LOCATION.

10) NS = WELL NOT SAMPLED

11) MONITORING WELLS NOT SHOWING PCE DATA EXHIBIT WELL SCREEN DEPTH INTERVALS OUTSIDE THE PROPOSED TREATMENT ZONE

0 50 100 200 Feet

Shaw® Shaw Environmental, Inc.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS
FIGURE 6

ALTERNATIVES 2B AND 5
IN-SITU CHEMICAL OXIDATION
GROUNDWATER REMEDY
ALBANY, NY

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APPROVED BY	MJS
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DRAWN BY	MJS
DESIGNED BY	MJS
DATE	08/11/13
OFFICE	LATHAM, NY

N

MW-6
ND
OBSTRUCTION IN WELL
NOT SAMPLED

GROUNDWATER
FLOW DIRECTION
DECEMBER 2012

MW-9
5 PPB
DRY WELL

MW-7
ND
ND

1.4
ND
MW-22

NS
2.7
MW-27

DRY WELL
DRY WELL
MW-5

MW-26
NS
120

120
MW-1
DRY WELL

MW-10
MW-4
MW-26

MW-14
ND
ND

MW-25

MW-11
49
38

MW-28
NS
26.5

MW-3

MW-2
100
DRY WELL

MW-4
650
DRY WELL

63
MW-12
DRY WELL

MW-8
180
160

MW-2D

DRY WELL
DRY WELL

MW-16
ND
ND

MW-20
ND
ND

MW-15

MW-17
18
37

MW-13
100
340

MW-13D

500 PPB

5000 PPB

1000 PPB

100 PPB

MW-18
MW-18D

5 PPB

MW-4LA
ND
ND

MW-18
630
5100

MW-23

MW-21
ND
ND

MW-24

Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, U
and the GIS User Community

Legend

- SSDS BLOWER
- SSDS PIPING
- Vertical SVE System
- Proposed Monitoring Well
- Phase I Monitoring Well
- KMNO4 GRID INJECTION
- Phase II Monitoring Well
- Existing Monitoing Well
- Phase II PCE Contour
- Building Boundaries
- Former Dry Cleaner Location

NOTES:

1) AERIAL IMAGERY TAKEN BING MAPS.

2) PCE - TETRACHLOROETHENE; TCE - TRICHLOROETHENE, DCE - DICHLOROETHENE.

3) ALL RESULTS ARE REPORTED IN MICROGRAMS PER LITER (ug/L) EQUIVALENT PARTS PER BILLION (ppb).

4) ISO-CONTOURS WERE BASED ON PHASE II RESULTS INCLUDED IN THE RI REPORT PROVIDED UNDER SEPARATE COVER.

5) GRID INJECTION AREA IS APPROXIMATE AND SIZE AND EXTENT MAY BE ADJUSTED DURING THE REMEDIAL DESIGN.

6) VERTICAL SVE LOCATIONS ARE APPROXIMATE AND EXACT LOCATION WILL BE DETERMINED DURING THE REMEDIAL DESIGN.

7) "ORANGE" LETTERING REPRESENTS PCE RESULTS FROM PHASE I SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

8) "PURPLE" LETTERING REPRESENTS PCE RESULTS FROM PHASE II SAMPLING EVENT PRESENTED IN THE RI UNDER SEPARATE COVER.

9) ND - ANALYTE NOT DETECTED AT THIS LOCATION.

10) NS - WELL NOT SAMPLED

11) MONITORING WELLS NOT SHOWING DATA EXHIBIT WELL SCREEN DEPTH INTERVALS OUTSIDE THE PROPOSED TREATMENT ZONE

0 50 100 200 Feet

Shaw® Shaw Environmental, Inc.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
FORMER LOUDON AND KEM CLEANERS
FIGURE 7

ALTERNATIVE 6 - IN-SITU CHEMICAL OXIDATION GROUNDWATER REMEDY WITH VERTICAL SVE AND SSDS
ALBANY, NY

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