PROPOSED REMEDIAL ACTION PLAN
APPLE VALLEY SHOPPING CENTER

Town of LaGrange, Dutchess County, New York
Site No. 314084

February 2008

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: <u>SUMMARY AND PURPOSE OF THE PROPOSED PLAN</u>

The New York State Department of Environmental Conservation (Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Apple Valley Shopping Center. The presence of hazardous waste has created significant threats to human health and the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, improper materials management has resulted in the disposal of a hazardous waste, the dry-cleaning solvent, tetrachloroethene, also known as perchloroethene (PCE). On-site soil and groundwater are contaminated with PCE and its breakdown products, trichloroethene (TCE) and cis-1,2-dichloroethene (DCE). This contamination has resulted in:

- a significant threat to human health associated with exposure to contaminated groundwater.
- a significant threat to human health associated with exposure to contaminant soil vapor intrusion in to on-site structures.
- a significant environmental threat associated with the impacts of contaminants to the groundwater resource.

To eliminate or mitigate these threats, the Department proposes in-situ chemical oxidation to treat the contamination source areas and hydraulic containment with the continued operation, maintenance and monitoring (OM&M) of the on-site groundwater extraction and treatment system. The proposed remedy would also include an investigation of off-site soil vapor and continued OM&M of sub-slab depressurization systems in some areas of the shopping center buildings to maintain acceptable indoor air quality. An environmental easement would be placed on the deed to prohibit consumption of on-site groundwater and restrict the property to commercial use.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the January 2002 "Remedial Investigation (RI) Report, Apple Valley Shopping Center," the January 2002 "Feasibility Study (FS) Report, Apple Valley Shopping Center," the "Interim Remedial Measures (IRM) Report" and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

New York State Department of Environmental Conservation (NYSDEC) Central Office
625 Broadway
Albany, New York 12233-7015
Attn.: Michael MacCabe
518-402-9620
Mon. - Fri. - 8:30 a.m. to 4:45 p.m.

NYSDEC Region 3 Headquarters
21 South Putt Corners Road
New Paltz, NY 12561
Attn.: Michael Knipfing
845-256-3154
Mon. - Fri. - 8:30 a.m. to 4:45 p.m.

LaGrange Town Clerk
Town Hall
Town of LaGrange
120 Stringham Road
LaGrangeville, NY 12540
Mon. - Fri. 8:30 to 4:30

LaGrange Association Library
488 Freedom Plains Rd.
Poughkeepsie, NY 12603
845-452-3141
Mon. - 9:30 to 8:00,
Tues. & Thurs. - 9:30 to 5:00
Wed & Fri. - 2:00 to 8:00, Sat - 10:00 to 2:00

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 27 through March 28, 2008 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for March 6, 2008 at the LaGrange Town Hall beginning at 7:00 PM.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. MacCabe at the above address through March 28, 2008.

The Department may modify the preferred alternative or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Apple Valley Shopping Center (AVSC) site, Site # 314084, is located about seven miles east of the City of Poughkeepsie in the Town of LaGrange, Dutchess County (See Figure 1, Site Location Map). The approximately four acre site is situated at the southwest corner of the intersection of Freedom Plains Road (State Route 55) and Titusville Road (County Route 49). Route 55 has a mix of residential and commercial properties. The shopping center was constructed at the site in 1967 - 1968, and contains a number of businesses including restaurants, a bank, a grocery store, and a variety of retail stores (see Figure 2, Site Plan). A pizzeria presently occupies the former location of the dry cleaners. The front (north) portion of the site is covered with asphalt. The area behind the shopping center building, and the area of the groundwater contamination, is covered with weathered asphalt, gravel and hard-packed dirt. Beyond that, a wooded area lies uphill in the south-east corner of the site and a wooded wetland with a small stream forms part of the southern site boundary. The Woodbridge Estates residential subdivision lies beyond the wetland.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

Following a November 27, 1985 delivery of the dry cleaning solvent, tetrachloroethene (PCE), to the former dry cleaners, there was a discrepancy between the 160 gallons that was reported to have been delivered and the 100 gallons that the dry cleaners said was received. A similar discrepancy of 9.5 gallons occurred on June 2, 1992. Anecdotal reports suggest that the PCE supplier employed poor material management techniques and other undocumented spills may have occurred.

PCE was stored at the dry cleaners in a 55-gallon drum that was kept inside, at the rear of the facility. The drum was moved in February 1991 and was found to be corroded and leaking onto the concrete floor.

A laundromat in the AVSC also had a coin operated dry cleaning machine. The laundromat stored PCE in a 55-gallon drum in a back closet and received PCE from the same supplier as the dry cleaners.

3.2: Remedial History

A supply well, AV-1, was installed and put in to service when the shopping center was constructed in 1968. AV-1 was constructed behind what was to become the dry cleaner facility. Due to poor yield, use of AV-1 was discontinued in 1981and replaced by a new well, AV-2. All well locations are depicted in Figure 4.

In September 1988, AVSC supply well AV-2 was tested for volatile organic compounds (VOCs) by the Dutchess County Department of Health (DCDOH). The samples contained the VOCs PCE, trichloroethene (TCE), and cis-1,2-dichloroethene (DCE). In 1988, a carbon filter system was installed to treat the shopping center's well water. In early 1989, a deeper well, AV-3, was installed on the shopping center property to the east of the grocery store. Treated water from AV-3 was used until 1992, when AV-2 was brought back on-line with a treatment system.

A residential well located in the Woodbridge Estates subdivision behind and just to the south of AVSC was sampled by the DCDOH in November 1988. The well contained PCE, TCE, and DCE at concentrations above NYS standards for public drinking water supplies.

The former supply well, AV-1, was sampled in September 1990. Laboratory analysis found PCE at 5,150 parts per billion (ppb), TCE at 74 ppb, DCE at 110 ppb, and 1,1,2-trichloroethane (TCA) at 45 ppb. The Department drinking water standard for each of these compounds is 5 ppb.

During the spring and summer of 1990, the DCDOH expanded its investigation of residential wells. Tap water samples were collected from 32 homes in the subdivision. Site related contaminants were detected in numerous residential wells at concentrations exceeding drinking water standards. The investigation results prompted the DCDOH to issue health advisories to affected residents in the subdivision. Beginning in 1990, affected residents were supplied with bottled water for drinking and cooking purposes.

In 1990, the Department added the Apple Valley Shopping Center site to New York State's Registry of Inactive Hazardous Waste Disposal Sites as a Class 2 site. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

A soil vapor investigation was conducted at the site in February 1991. Elevated levels of VOCs were detected in the soil vapor in the area behind the dry cleaners. VOCs were also detected in soil vapor behind the laundromat and in the former site septic leach field. A May 1993 soil gas investigation confirmed the findings of the 1991 investigation.

Soil sampling was conducted at the site on behalf of the AVSC owner and a tenant during three separate investigations in August 1991, April 1993, and January 1997. Low level chlorinated VOC contamination was detected behind and under the laundromat and in the septic leach field. Greater concentrations of soil contamination were detected beneath and behind the dry cleaner facility. However, PCE was detected above the soil cleanup standard in only one sample.

In September 1991, the site owner, James A. Klein entered in to an order on consent with the United States Environmental Protection Agency (EPA). The order required Mr. Klein to install, maintain and monitor granular activated carbon (GAC) filter systems on eight of the impacted residential wells to remove the site-related contaminants from the well water prior to household use. The order also included construction and maintenance of two air stripper treatment systems. In 1992, two groundwater extraction and treatment systems consisting of air strippers were constructed to address groundwater contamination related to the site. One of the air strippers treated water from one residential well and provided treated water to the two adjacent residences located immediately behind the shopping center. The other air stripper was constructed on-site. The on-site system was designed to treat water for potable use by the shopping center and act as a groundwater extraction and treatment system. It serviced AVSC supply well AV-2 at 20 gallons per minute (gpm). Excess water was discharged to the adjacent wetland.

The constant pumping of the groundwater had helped to limit the migration of the contaminated groundwater from the site. In early 1999, the shopping center was placed on municipal water and all water treated by the on-site air stripper which has been upgraded and currently discharges to the wetland.

SECTION 4: <u>ENFORCEMENT STATUS</u>

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

Documented to date, the PRP for the site is James A. Klein, currently doing business as Apple Valley Corp.

As described above in Section 3.2, the PRP entered into an order on consent with the EPA on September 30, 1991 requiring installation, maintenance, and monitoring of groundwater treatment systems.

The PRP declined to implement the RI/FS at the site when requested to do so by the Department. Following the State funded RI/FS, the Department and the Apple Valley Corp. entered into an order on consent on November 5, 2004. The order obligated the responsible party to implement an interim remedial measure (IRM) consisting of the construction, operation, maintenance and monitoring of the groundwater extraction and treatment system described below in Section 5.2.

The remedy proposed in this PRAP is not covered under the scope of the aforementioned IRM order on consent. If the proposed remedy is selected in the ROD, the Department will approach the PRP to implement the selected remedial action under another order on consent. If an agreement cannot be reached with the PRP, the Department will evaluate the project and site conditions for further action under the State Superfund. The PRP is subject to legal actions by the state for recovery of all response costs the state has incurred.

SECTION 5: <u>SITE CONTAMINATION</u>

A remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: <u>Summary of the Remedial Investigation</u>

The purpose of the RI was to define the nature and extent of any contamination resulting from previous activities at the site.

The RI was conducted between April 2001 and January 2002. The field activities and findings of the investigation are described in the February 2003 RI report entitled “Remedial Investigation (RI) Report, Apple Valley Shopping Center.”

Eight subsurface soil samples were collected from areas in and around the laundromat, the former location of the dry cleaners, and the septic leach field.

Five bedrock groundwater monitoring wells were drilled and packer tested at sequential core-length intervals. The packer tests were conducted to investigate vertical variations in hydrogeologic conditions and to identify discrete zones of groundwater contamination. A sixth open borehole well was constructed at a down-gradient location. The bedrock cores from the wells constructed in the source areas were examined for the presence of site contaminants in the form of dense non-aqueous phase liquid (DNAPL). As a DNAPL, the liquid contaminants are immiscible and are denser than water and, therefore form a separate phase from the water. Subsequently, DNAPLs dissolve very slowly in groundwater and can provide a continuing source of groundwater contamination.

Three surface water and three sediment samples were collected from the wetland in the western portion of the AVSC property. Indoor air samples were collected from four businesses in the shopping center.

Since the completion of the RI and FS, a design investigation was conducted by the PRP for construction of an expanded groundwater extraction and treatment system. This included additional sampling of existing monitoring wells as well as the construction and sampling of two additional monitoring wells and three extraction (a.k.a. recovery) wells.

At the request of the Department and the New York State Health Department (NYSDOH) an investigation of indoor air impacts and sub-slab soil vapor commenced in January 2005 by the PRP. The latest data are summarized in the January 2007 letter report and discussed below in Section 5.1.2.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the soil, groundwater, surface water, sediment and indoor air contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater, drinking water, and surface water SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values" and Part 5 of the New York State Sanitary Code.

- Soil SCGs are based on the Department's Cleanup Objectives Technical and Administrative Guidance Memorandum [TAGM] 4046, "Determination of Soil Cleanup Objectives and Cleanup Levels" and 6 NYCRR Subpart 375-6, "Environmental Remediation Programs."

- Sediment SCGs are based on the Department's "Technical Guidance for Screening Contaminated Sediments."

- Concentrations of VOCs in air were evaluated using the air guidelines provided in Section 3.4 of the NYSDOH guidance document titled "Guidance for Evaluating Soil Vapor Intrusion in the State of New York," dated October 2006.

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the January 2003 Remedial Investigation / Feasability Study RI Report.

5.1.2: Nature and Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

As described in the RI report, many soil, groundwater, surface water, sediment and indoor air samples were collected to characterize the nature and extent of contamination. Volatile organic compounds (VOCs) is the category of contaminants that exceed its SCGs at this site.

Chemical concentrations are reported in parts per billion (ppb) for water, parts per million (ppm) for waste, soil, and sediment. Air samples are reported in micrograms per cubic meter ($\mu g/m^3$).

Table 1 summarizes the degree of contamination for the contaminants of concern in groundwater, surface water, wetland sediment and indoor air and compares the data with the SCGs for the site. All of the environmental sampling locations are depicted in Figures 3 and 4. The following are the media which were investigated and a summary of the findings of the investigation.

Subsurface Soil

As shown in Figure 3, no compounds detected in on-site soils were found above their SCGs.

Tetrachloroethene (PCE), was detected in seven of the ten subsurface soil samples analyzed during the RI. None of the PCE concentrations detected in the subsurface soil samples exceeded the recommended soil clean-up objective of 1.3 ppm for the protection of groundwater. The degradation products of PCE, tricholoroethene (TCE) and cis-1,2-dichloroethene (DCE), were detected in some of the subsurface soil samples at concentrations below there respective SCGs.

Polycyclic aromatic hydrocarbons (PAHs); anthracene, fluoranthene, chrysene, and benzo(b)fluoranthene were detected at low concentrations that were less than their respective SCGs.

No site-related subsurface soil contamination of concern was detected in accessible soil above their respective SCGS during the RI/FS. Due to the active businesses, most areas under the laundromat and the pizzeria were unaccessible during the RI. Therefore, there may be impacted soil in these source areas that was not identified. Further sub-surface soil samples collected during the construction of the extraction wells also found no contamination above SCGs. Therefore, no remedial alternatives need to be evaluated for subsurface soil.

Groundwater

Bedrock is about eleven feet below grade surface in the source areas and, as discussed above, no significant soil contamination was detected in accessible soil. Therefore, the source of the groundwater contamination appears to be in the bedrock. PCE, in the form of dense non-aqueous phase liquid (DNAPL), is suspected to be present in the source areas, under and behind the former dry cleaners and the laundromat. Although no DNAPL was found during the RI, the continuous source of groundwater contamination is indicative of a DNAPL source in the bedrock.

All of the wells except MW-5 were tested at discrete depth intervals during construction. The wells in the source area behind the laundromat MW-4A, MW-4B and AV-1 had total VOC (PCE and related compounds) contamination at all depth intervals from the water table to 158 feet below the ground surface. The highest on-site concentration of 9,003 ppb for total VOCs was detected at 40.9 feet in MW-4A. PCE, the principal contaminant of concern, was also detected at its maximum concentration of 8,690 ppb at the same depth. MW-4B was constructed close to MW-4A to allow for deeper sampling in the source area.

In January 2002, groundwater samples were collected from the six monitoring wells and one piezometer. PCE was detected at concentrations of 1,400 ppb, 2,600 ppb, 1,900 ppb, and 5 ppb in four of the groundwater samples. The PCE concentrations greatly exceeded the groundwater SCG and NYSDOH drinking water standard of 5 ppb in all of the wells.

TCE was detected in three of the groundwater samples at concentrations of 48 ppb, 130 ppb, and 32 ppb. These concentrations exceed the groundwater SCG of 5 ppb. The same three wells exhibited the respective cis-1,2-dichloroethene (DCE) concentrations of 27 ppb, 74 ppb, and 19 ppb. The groundwater and drinking water SCG for DCE is 5 ppb.

No semi-volatile organic compounds were detected in any of the groundwater samples collected during the RI.

During the construction of the groundwater extraction and treatment system IRM in late 2005, three extraction wells (RW-1, RW-2, and RW-3) and two additional monitoring walls were constructed. Total site-related VOCs were found at a maximum concentration of 4,742 ppb at the depth interval of 9-20 feet below the ground surface (bgs) in RW-1. In RW-2, the maximum concentration of site-related VOCs was 14,329 ppb at 40-50 feet bgs. Toluene was also detected in RW-2 at 213 ppb. Total VOCs in RW-3 were found at 2,300 ppb at 60-70 ft bgs.

Once the groundwater extraction system was placed online, a quarterly groundwater monitoring program of all of the recovery wells and the monitoring wells was initiated in February 2006. The August and December 2007 groundwater sampling events showed no discernable change in groundwater contaminant concentrations for the preceding 21 months. The history of the quarterly monitoring data is presented in Table 1A.

Groundwater contamination identified during the RI/FS and further documented in the later investigation and the quarterly monitoring program is being addressed by the groundwater extraction and treatment IRM described in Section 5.2.

Surface Water

In November 2001, three surface water samples were collected from the adjacent wetland (see Figure 3).

The background sample collected in the drainage swale along the north side of NY Route 55 exhibited methyl-tert-butyl ether (MTBE) at a concentration of 12 ppb that exceeded the Department surface water standard of 10 ppb. MTBE is a gasoline oxygenator and is likely present due to surface water run off from nearby roads and parking lots. MTBE is not considered a site-related contaminant because this sample location is upgradient of site source areas and it is not a constituent of dry cleaning solvents. No other VOCs were detected in the surface water samples.

No SVOCs were detected in the surface water samples above the analytical method detection limits.

No site-related surface water contamination of concern was identified during the RI/FS. Therefore, no remedial alternatives need to be evaluated for surface water.

Sediments

In November 2001, three sediment samples, shown in Figure 3, were collected from the wetland and drainage ditch in the southeast corner of the site and from a background location. All volatile organic analytical results for the three sediment samples were reported as non-detect.

Semi volatile compounds were detected in the background sediment sample collected upstream from the site. The concentrations of chrysene (5.8 ppm) and benzo(b)fluoranthene (6.5 ppm) exceeded their associated SCG value of 1.3 ppm. The SVOCs detected in SED-01 are poly-cyclic aromatic hydrocarbons (PAHs) that are products of incomplete combustion of petroleum based fuels and are also the primary component of asphalt and are washed from roadways by surface water runoff.

Sediment samples from the wetland also showed detectable concentrations of SVOCs. The likely source for these PAH compounds is surface water runoff from nearby roads and parking lots. These chemicals are not related to dry cleaning processes and therefore are not considered contaminants of concern for the site.

No site-related sediment contamination of concern was identified during the RI/FS. Therefore, no remedial alternatives need to be evaluated for sediment.

Air

In June 2002, indoor air was sampled by the NYSDOH at two locations in the pizzeria, two locations in the laundromat, and two other tenant spaces at the shopping center. The sampling showed PCE concentrations above NYSDOH guidance values in the kitchen of the pizzeria and the rear storeroom of the adjacent liquor store. PCE was undetectable at the minimum detection limit of 5 $\mu g/m^3$ in the other locations

Due to the indoor air impacts detected in 2002, further indoor air and sub-slab soil vapor sampling has been conducted by the PRP under the Department's direction. In January 2005, indoor air and sub-slab soil gas samples were collected in the pizzeria, the grocery store, the pharmacy, and a vacant store front. The sampling locations are shown in Figure 5. Additional sampling points were added in February, April and November 2005. All of the sampling locations were sampled in June 2006 and January 2007.

The indoor air and soil gas sampling data to date are summarized in the February 20, 2007 letter report entitled, January 2007 Vapor Intrusion Sampling Results. Impacts in indoor air were observed in two locations in the eastern building of the shopping center, the pizzeria and the grocery store. In January 2005, a sub-slab soil vapor sample collected in the grocery store had a PCE concentration of 7,200 $\mu g/m^3$ and an indoor air sample had a PCE concentration of 9.7 $\mu g/m^3$. In June of 2006, the respective PCE concentrations were 386 $\mu g/m^3$ and 3.47 $\mu g/m^3$. In January 2007, the sub-slab PCE concentration had declined to 4.41 $\mu g/m^3$ and indoor air concentration had declined to 2.09 $\mu g/m^3$.

Sampling conducted in the pizzeria found sub-slab vapor concentrations of PCE at 160 $\mu g/m^3$ and TCE at 3.6 $\mu g/m^3$ in January 2005. Then, in January 2006, PCE was 307,000 $\mu g/m^3$ and TCE was 8,900 $\mu g/m^3$ beneath the slab. In August 2006, PCE was 20,800 $\mu g/m^3$ and TCE was 643 $\mu g/m^3$. The respective indoor air PCE and TCE concentrations were 28 $\mu g/m^3$ and non-detect in January 2005. Later, the respective indoor air concentrations of PCE and TCE were 584 $\mu g/m^3$ and 7.39 $\mu g/m^3$ in January 2006 and 44.7 $\mu g/m^3$ and non-detect in August 2006. January 2007 sampling showed further reductions to the respective PCE and TCE concentrations of 2.86 $\mu g/m^3$ and 0.316 $\mu g/m^3$ in soil vapor and 1.82 $\mu g/m^3$ and non-detect in indoor air. The large increase and subsequent decreases in sub-slab soil vapor and indoor air concentrations may have been due to the temporary shutdown, upgrade, and resumption of the groundwater extraction and treatment system.

In the western building, air impacts were observed in the pharmacy. This is likely due to the second source area at the laundromat. Unlike in the other building, the indoor air and sub-slab concentrations of PCE and TCE don't show a clear trend. The respective PCE and TCE concentrations peaked in indoor air in January 2006 at 172 $\mu g/m^3$ and 4.62 $\mu g/m^3$. The respective indoor concentrations were 1.16 $\mu g/m^3$ and 0.261 $\mu g/m^3$ in June 2006 and 22.9 $\mu g/m^3$ and 0.457 $\mu g/m^3$ in January 2007. The sub-slab soil vapor PCE data at the laundromat show no relative change. The most-recent, January 2007, sub-slab PCE concentration was 213 μg/m^3. The sub-slab TCE concentration has shown some reduction to 7.44 μg/m^3 in January 2007.

Soil vapor and indoor air contamination identified during the aforementioned investigations are being mitigated by the sub-slab depressurization systems installed in the grocery store and the pizzeria as an interim remedial measure (IRM) described in Section 5.2. Operation, maintenance and monitoring (OM&M) of the sub-slab depressurization systems will include annual sampling of the indoor air and the sub-slab soil vapors. Based on the decision matrices in the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York," no mitigation action is presently required at the pharmacy. However, as per the guidance and based on data to-date, annual monitoring at the pharmacy would continue. If the findings of future air sampling show a need based on the aforementioned guidance, additional sub-slab depressurization systems may be installed or the existing systems may be supplemented, retrofitted or decommissioned as needed.

5.2: <u>Interim Remedial Measures</u>

An interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. There were two IRMs conducted at the AVSC site, one to address groundwater contamination and a second to address indoor air impacts from site contaminants.

The first IRM was an upgrade to the existing groundwater extraction and treatment system that was installed in 1992 under the 1991 EPA consent order. The original air stripper treated groundwater extracted from former supply well AV-2 at 20 gallons per minute (gpm). The upgraded system was placed into service on February 9, 2006 to treat a combined flow of groundwater pumped from AV-2 and the three new recovery wells, RW-1, RW-2, RW-3. The system currently consists of a stackable tray air stripper that is rated to operate at a flow range of 1 to 40 gpm. The air stripper configuration consists of a series of four shell/tray modules. Based on the results of pump tests, the pumping rate for each well was determined, resulting in a total flow rate of 22 gpm.

The quarterly groundwater monitoring will continue along with the operation of the treatment system. An effluent sample is also collected from the groundwater remediation system.

The second IRM consisted of mitigation measures taken at two locations in the shopping center to address current human exposures (via inhalation) to volatile organic compounds associated with soil vapor intrusion. In February 2006, one sub-slab depressurization system (SSDS) each was installed in the pizzeria and in the grocery store. The sub-slab depressurization systems depressurize the sub-slab environment relative to the indoor space, thus restricting the migration of contaminant vapors into the building. The site SSDSs consist of one or more points drilled through the floor slab, manifolded to an electric blower, and vented to the outside air. The locations of the SSDSs and the monitoring locations are shown in Figure 5.

5.3: <u>Summary of Human Exposure Pathways</u>:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6.1.4 of the RI report.

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway are documented. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

Analytical results obtained during the remedial investigation indicate that, based on the level and frequency of exceedances of recommended cleanup objectives, VOCs are the primary contaminants of concern in site groundwater and soil.

Current and reasonable anticipated potential future exposures were evaluated for Site visitors (i.e.: customers, employees, construction workers) and nearby residents from contaminants in groundwater, soil and soil vapor. The following discussion addresses the current/potential exposure pathways present at the Site:

<u>Groundwater</u>

Prior to connecting to public water, casual visitors and business employees/tenants to the site may have been exposed to contaminants in groundwater through ingestion of drinking water. Currently, exposure to contaminants in drinking water is not expected as the shopping center businesses are connected to public water. Exposure to contaminated groundwater through direct contact or incidental ingestion is not expected. During construction activities, workers could be exposed to contaminated groundwater through dermal contact and incidental ingestion.

An evaluation of off-site groundwater indicated that private water supplies were impacted by site related contaminants. Exposure to contaminants in groundwater at off-site residences occurred in the past through ingestion, dermal contact and inhalation of vapors while showering. Granulated activated carbon treatment systems were installed at homes where drinking water supplies were impacted by site-related contaminants above New York State drinking water standards. Currently, public water is available to these residences and a few homes have opted to connect. Two homes continue to have in-line water treatment systems. Routine analyses of other select private water supply samples do not indicate site-related contaminants above NYS drinking water standards. During activities where groundwater would be encountered, workers may be exposed to contaminants through dermal contact and incidental ingestion.

Soil and Sediment

Localized areas of on-site residual soil contamination exist at low levels. Dermal contact with, or incidental ingestion of, residual soil contamination is not expected as buildings and parking lots or hard pan gravel covers the area of concern. During construction activities, where soils are disturbed or removed, workers could be exposed to residual contaminant in soil through dermal contact or incidental ingestion.

Sediment data show no detection of site-related contaminants in wetland sediments.

Soil Vapor

An evaluation of sub-slab soil vapor and indoor air samples indicated that the indoor air of three businesses at the shopping center was impacted by site related contaminants. Mitigation and /or monitoring measure were implemented to minimize soil vapor intrusion into these spaces. Future exposure to soil vapors by visitors or employees/tenants is not expected as long as the systems remain in place and operational. Monitoring of the systems will provide information regarding the effectiveness of the systems to mitigate soil vapor intrusion. During construction activities, workers could be exposed to contaminated vapors that volatilize off of the groundwater.

While only low level contamination was detected in off-site groundwater there is a potential for contaminants to volatilize off of groundwater and enter into off-site residences. This potential pathway of exposure will be characterized as part of the remedy for this site.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

Site contamination has significantly impacted the groundwater resource in the aquifer. A change in site conditions, such as discontinuing the active groundwater containment system, would result in groundwater contamination migrating beyond its current limits.

Sediment and surface water samples from the adjacent wetland and drainage ditch did not contain elevated levels of contaminants, therefore a viable exposure pathway to fish and wildlife receptors is not present under current site conditions. The groundwater contamination is at a deeper elevation than the wetland. Therefore, surface water discharges to the wetland are unlikely.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- exposures of persons at or around the site to PCE, TCE, DCE, and vinyl chloride in groundwater;

- exposures of persons at the site to PCE, TCE and DCE in indoor air from the intrusion of contaminated soil gas into occupied businesses at the shopping center; and

- the release of contaminants from the source area into groundwater that have created exceedances of groundwater quality standards.

Further, the remediation goals for the site include attaining to the extent practicable:

- removal or treatment of the DNAPL and/or the highly contaminated groundwater that is residing in the on-site bedrock and providing a continuous source of groundwater contamination;

- ambient groundwater quality standards in on-site groundwater; and

- NYSDOH indoor air quality guidelines.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the AVSC site were identified, screened and evaluated in the January 2003 FS report entitled “Feasibility Study (FS) Report, Apple Valley Shopping Center” which is available at the document repositories identified in Section 1.

A summary of the remedial alternatives that were considered for this site are discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated groundwater, soil vapor, and indoor air at the site.

Alternatives 2, 3 and 4 contain common elements that include a site management plan (SMP). The SMP would include engineering and institutional controls. The engineering controls would consist of the implementation of the operation, maintenance and monitoring (OM&M) plans. For these three alternatives, an OM&M plan would be implemented for the sub-slab depressurization systems presently operating in the shopping center. For Alternatives 3 and 4, the SMP would also include direction for OM&M of the groundwater extraction and treatment system. The institutional controls for the site would be contained in an environmental easement.

The environmental easement would require compliance with the site management plan, restrict the use of groundwater, prohibit certain uses for the property and require that the property owner submit a periodic certification to demonstrate that the institutional and engineering controls remain in place and remain protective of human health and the environment.

Under all three alternatives, operation of the two sub-slab depressurization systems and periodic monitoring of the indoor air and sub-slab soil vapor would continue. The need for additional depressurization systems or expansion of the existing systems would be based on the continued evaluation of the monitoring data.

All three alternatives would also include continuation of the long-term groundwater monitoring program. There is some variation between the alternatives.

Alternative 1: No Action

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. The existing containment / remedial systems (groundwater and sub-slab depressurization) would be discontinued. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment.

Present Worth: $297,000
Capital Cost: $0
Annual Sampling: (Years 1-30): $21,600

Alternative 2: Monitored Natural Attenuation

Present Worth: $593,000
Capital Cost: $0
Annual OM&M: (Years 1-30): $34,000
Reevaluation and reporting every five years for 30 years : $25,000

Monitored Natural Attenuation (MNA) is the observation of groundwater conditions over an extended time period to monitor the reduction of the volume and toxicity of contaminants in groundwater through naturally occurring processes in soil and groundwater.

The natural attenuation processes that can reduce contaminant concentrations in groundwater include dispersion, dilution, volatilization, adsorption, and biodegradation. The effectiveness and applicability of MNA is generally a complex function of subsurface conditions, residence time of contaminants, and proximity of down gradient receptors.

Under the MNA alternative, the existing containment/remedial system would be discontinued and no additional actions taken to remove or treat contaminated media or otherwise restrict the use of, or access to, these resources. Groundwater samples would be collected periodically from the on-site monitoring wells, one off-site monitoring well MW-5 and up to six off-site residential wells. The groundwater samples would be analyzed for site-related volatile organic compounds (VOCs) and the monitored natural attenuation parameters such as nitrate, sulfate, dissolved oxygen, iron, methane. Every five years, the effectiveness of the MNA would be reevaluated. The three extraction wells constructed for the groundwater treatment system could also be added to the monitoring program.

Alternative 3: Hydraulic Containment using Current Extraction and Treatment System with Sub-Slab Depressurization

Present Worth: $926,000
Capital Cost: $0
Annual OM&M (Years 1-30): $56,000
Reevaluation and reporting every five years for 30 years $25,000

Alternative 3 assumes that the existing hydraulic containment and groundwater treatment system and the two sub-slab vapor extraction systems installed in the shopping center would continue to operate.

Groundwater samples would be collected periodically from the four recovery wells, the on-site monitoring wells, one off-site monitoring well, and up to six off-site residential wells. The groundwater samples would be analyzed for the site related VOCs. The sampling regimes for all of the wells, both monitoring and residential, are subject to reevaluation based on data history and need. All changes to the groundwater sampling program must be approved by the Department and the NYSDOH.

Alternative 4: In-Situ Chemical Oxidation, Hydraulic Containment, Sub-Slab Vapor Extraction and Sub-Slab Depressurization

Present worth: $1,294,000
Capital cost: $743,000
Annual groundwater monitoring (assuming 20 years): $22,000
Annual system O&M (assuming 5 years): $65,000

Alternative 4 would involve the destruction of contamination in the source areas by injection of chemical oxidants and the active removal of residual contamination by soil vapor extraction (SVE). Chemical oxidation would involve an in-situ (in place) treatment method consisting of the injection of the oxidant into the groundwater in the source areas to reduce DNAPL present in the bedrock and reduce the concentration of the contaminants dissolved in the groundwater. SVE would remove vapor phase contaminants in the area above the water table. Operation of the existing groundwater extraction and treatment system would continue to ensure containment of groundwater contamination to the site. The sub-slab depressurization systems would continue to operate as long as indoor air and sub-slab sampling data show a need to do so based on NYSDOH guidance.

A total treatment time of approximately four to six months, including the bench-scale treatability study, pilot test, injection point construction, and reagent application, including the waiting period between injection events, is assumed. Treatment verification monitoring would include collection of groundwater samples from wells within and down gradient of the treatment areas for analysis for the site related VOCs. Results from the monitoring program would determine whether or not additional rounds of reagent application are required to meet the treatment objectives.

The current hydraulic containment, pumping and treatment system would continue to operate and be maintained to protect down gradient receptors until monitoring indicates that contaminant concentrations have been acceptably reduced. It is anticipated that the system would need to be operated for a minimum of two years after completion of the injection program to remove residual groundwater contamination and to establish conclusive proof of the effectiveness of the process. For estimating purposes, five years of continued operations is assumed.

Following the oxidation program, all relevant extraction, monitoring and residential wells would be sampled periodically to monitor groundwater conditions until ambient water quality standards are achieved.

Under this alternative, operation of the two sub-slab depressurization systems and periodic monitoring of the indoor air and sub-slab soil vapor would continue. The need for additional depressurization systems or expansion of the existing systems would be based on the continued evaluation of the monitoring data.

A soil vapor extraction (SVE) system would be installed using the wells constructed for the chemical oxidation injection. The SVE system would also remove any residual contamination existing in the soils under the suspected spill areas. Vapors extracted from the soil would be discharged to the atmosphere or initially be treated with granular activated carbon until VOC levels are reduced to an acceptable discharge concentration. The use of the SVE system, in conjunction with the sub-slab depressurization systems currently installed, would restrict the infiltration of vapors in to the buildings. The SVE and/or sub-slab depressurization systems would continue to operate until such time that the Department concludes that the sampling data show that the sub-slab soil vapor and indoor air are no longer impacted.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York State. 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.

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.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance.

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

3. Short-term 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.

4. 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.

5. 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.

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.

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 costs for each alternative are presented in Table 2.

This final criterion 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.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department 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.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing Alternative 4, in-situ chemical oxidation, hydraulic containment, sub-slab vapor extraction and sub-slab depressurization as the remedy for this site. The proposed remedy is based on the results of the RI, the evaluation of alternatives presented in the FS and groundwater and air data obtained since the completion of the RI.

Alternative 4 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve the remediation goals for the site by the direct injection of chemical oxidants into the source areas to facilitate the destruction of the contaminants and the active removal of residual contamination with soil vapor extraction (SVE). The proposed remedy would also include hydraulic containment via continued operation of the groundwater extraction and treatment system. The sub-slab depressurization systems would continue to operate in the on-site buildings. The sub-slab depressurization systems and/or the soil vapor extraction system would continue to operate as long as annual monitoring of indoor air and sub-slab vapor shows a continued need for vapor mitigation. The elements of the proposed remedy are described at the end of this section.

Site history since 1990 shows that the on-site groundwater contamination remains elevated after more than 16 years with no significant change in site conditions. Therefore, no action or a passive remedy would not meet the threshold criteria. Neither Alternative 1 (no action) nor Alternative 2 (monitored natural attenuation) meet the threshold criteria, protection of human health and the environment, nor compliance with New York State SCGs. Alternatives 1 and 2 would permit on-site exposures to workers and customers via indoor air contamination at the shopping center and off-site exposures to down gradient residents via groundwater contamination. Alternatives 3 and 4 would both meet the threshold criteria discussed in Section 7.2. However, Alternative 4 would be a more dynamic remedy and would be expected to meet SCGs in a shorter period of time.

Alternative 3 would be effective in the short term because it is already being implemented to treat the groundwater contamination and containing it to the site. Currently, Alternative 3 would also mitigate indoor impacts within the shopping center with the sub-slab depressurization systems. Alternative 3 would have minimal short-term impacts because all of the major construction activities have been completed. Alternative 4 would have short-term impacts to the site during the injection well drilling, the injection of the chemical oxidant, and the construction of the SVE components. The short-term impacts associated with Alternative 4 would be offset by the increased short-term effectiveness of the chemical oxidation and SVE and the subsequent decrease in long-term impacts.

The objectives of both Alternatives 3 and 4 are to remove all VOC contamination from the bedrock source area and reduce groundwater contaminant concentrations to less than SCGs. Therefore, both alternatives are capable of achieving long-term effectiveness and permanence. As described above, Alternative 4 would be expected to achieve the objectives much faster.

Both Alternatives 3 and 4 would include continued operation of the groundwater extraction and treatment system which has been shown to contain the groundwater contamination to the site and therefore limit its mobility. Alternative 3 would reduce the toxicity and volume of the contamination by removing it over time. Alternative 4 would reduce the toxicity and volume by destroying the contamination in the bedrock source area and the residual groundwater contamination.

Alternative 3 is currently being implemented and would require little additional effort except maintenance and monitoring. The remediation process presented in Alternative 4 has been implemented at other sites. Alternative 4 would require additional drilling, the chemical oxidant injection, and the construction and operation of the SVE system. Drilling is a common activity at most site investigations and is employed in many site remedies. Chemical oxidation is commonly used to promote the destruction of VOCs in groundwater and soil. The chemical oxidants are mixed on site and pumped into the injection points. SVE is commonly used to remove vapor-phase contaminants from soil and bedrock. The SVE system proposed for Alternative 4 would use the wells drilled for the chemical oxidation.

Of the two viable remedies, the calculations show Alternative 4 to be the most cost effective, as it would achieve the groundwater SCGs within a much shorter time period. The groundwater extraction and treatment system of Alternative 3 requires a lot of electricity over a long period and may be impacted by energy cost increases. Alternative 4 would cost about 40% more than Alternative 3, but would likely achieve the remedial goals much sooner.

The estimated present worth cost to implement the remedy is $1,294,000. The cost to construct the remedy, consisting of drilling wells, injection of the chemical oxygenate, and construction of the SVE system is estimated to be $743,000. The estimated average annual operation and maintenance is $65,000. The annual groundwater monitoring would cost approximately $22,000.

The elements of the proposed remedy are as follows:

1. The existing remedy would be expanded with tasks that would include:
    a. Implementation of a remedial design program to provide the information necessary for the construction, operation, maintenance, and monitoring of the remedial program.

    b. In-situ treatment of groundwater by injection of a chemical oxidant in the identified source areas to reduce DNAPL to the extent feasible, and to significantly reduce the dissolved concentrations of contaminants.

    c. A soil vapor extraction system would be installed to extract contaminant vapors from the source areas.

2. Continued periodic sampling of the on-site monitoring wells, the off-site monitoring well and up to six off-site residential wells as per the existing groundwater monitoring program. The sampling regimes for all of the wells, both monitoring and residential wells, would be subject to reevaluation based on data history and need. The need and frequency of sampling the wells would be determined by changes in sub-surface site conditions such as a decrease in contaminant concentrations or the type of change that would be expected after the remedy is implemented.

3. Operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the Department determines that continued remediation is technically impracticable or not feasible.

4. Imposition of an institutional control in the form of an environmental easement that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use if local zoning permits; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH; and (d) the property owner to complete and submit to the Department an annual periodic certification of institutional and engineering controls.

5. Development of a site management plan which would include the following institutional and engineering controls: (a) continued operation and maintenance of the groundwater extraction and treatment system; (b) periodic monitoring of groundwater conditions to evaluate the effectiveness of the remedy and to monitor for potential off-site impacts; (c) continued operation and maintenance of the sub-slab depressurization systems; (d) continued monitoring of indoor air and soil gas and evaluation of the potential need for further mitigation of vapor intrusion impacts; (e) identification of any use restrictions on the site.

6. The property owner would provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the

previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

7. Since the remedy results in groundwater contamination remaining at the site until the remedy is complete, a long-term monitoring program would be instituted to monitor the effectiveness of the remedy and ensure containment of the groundwater contamination to the site. This program would be a component of the long-term management for the site.

8. An investigation of the potential for off-site soil vapor intrusion impacts would be conducted during the remedial design phase.

TABLE 1
Nature and Extent of Contamination
June 2001 - January 2002

GROUNDWATER	Contaminants of Concern	Concentration Range Detected (ppb)[a]	SCG[b] (ppb)[a]	Frequency of Exceeding SCG
Volatile Organic Compounds (VOCs)	tetrachloroethene	ND (10)* - 6,600	5	10 / 15
	trichlorethene	ND (10) - 200	5	7 / 15
	cis-1,2-dichlorethene	ND (10) - 220	5	6 / 15

[a] ppb = parts per billion, which is equivalent to micrograms per liter, ug/L, in water;
ND = non detect

[b] SCG = standards, criteria, and guidance values

* The elevated detection limits are due to sample dilution that is necessary for accurate analyses.

Table 1A
Volatile Organic Compounds (VOCs) in Quarterly Groundwater Monitoring Samples January 2006 through November 2007

Sample Identification	Dates Sampled	Chemical Constituent				
		tetrachloroethene (5 µg/L)	trichloroethene (5 µg/L)	cis-1,2-dichloroethene (5 µg/L)	vinyl chloride (2 µg/L)	Total COC
extraction well RW-1	2-9-06	**2,850**	**119**	**53.6**	ND < 10	3,022.6
	3-9-06	**412**	**19.9**	**13.6**	ND < 1.0	445.5
	5-16-06	**394**	**21.0**	**19.0**	ND < 1.0	434
	8-22-06	**583**	**6.4**	**8.6 M**	ND < 2.5	598
	11-28-06	**265**	**7.7**	**10**	ND < 1.0	282.7
	12-11-06	**217**	**6.9**	**9.4**	ND < 2.5	233.3
	3-1-07	**591**	**7.4**	**5.4**	ND < 2.5	603.8
	5-29-07	**298**	**8.4**	**ND < 1.0**	ND < 1.0	306.4
	8-28-07	**763**	**9.1**	**5.2**	ND < 5.0	777.3
	11-28-07	**606**	**7.8**	**7.4**	ND < 25	621.2
extraction well RW-2	2-9-06	**7,860**	**132**	**148**	ND < 25 *	8,140
	3-9-06	**2,960**	**24.8**	**20.8**	ND < 10	3,005.6
	5-16-06	**1,800**	**12.2**	**20.1**	ND < 5	1,832.3
	8-22-06	**14,100**	**76**	177 M	ND < 50	14,353
	11-28-06	**3,340**	ND < 25	**25.5**	ND < 25	3,365.5
	12-11-06	**1,190**	**10.9**	**22.1**	ND < 5.0	1,223
	3-1-07	**5,100**	ND < 50	ND < 50	ND < 50	5,100
	5-29-07	**1,080**	**16.6**	ND < 10	ND < 10	1,096.6
	8-28-07	**325**	4.1	3.6	ND < 2.5	332.7
	11-28-07	**1,770**	ND < 10	ND < 10	ND < 10	1,770

Table 1A (continued)
Volatile Organic Compounds (VOCs) in
Quarterly Groundwater Monitoring Samples
January 2006 through November 2007

Sample Identification	**Dates Sampled**	**Chemical Constituent**				
		Tetrachloroethene (5 µg/L)	Trichloroethene (5 µg/L)	cis-1,2-Dichloroethene (5 µg/L)	Vinyl Chloride (2 µg/L)	Total COC
extraction well RW-3	2-9-06	**1,250**	**102**	**88.8**	ND < 5.0	1,440.8
	3-9-06	**567**	**67.3**	**72.8**	**3.9**	711
	5-16-06	**538**	**53.8**	**99.4**	ND < 2.5	691.2
	8-22-06	**151**	**19.6**	**34.1 M**	ND < 2.5	204.7
	11-28-06	**451**	**49.5**	**103**	**4.0**	607.5
	12-11-06	**467**	**66.4**	**147**	**5.7**	686.1
	3-1-07	**494**	**59**	**75.3**	ND < 2.5	628.3
	5-29-07	**550**	**54.3**	**93.8**	**5.2**	703.3
	8-28-07	**657**	**69.7**	**121**	**4.4**	852.1
	11-28-07	**541**	**57.0**	**103**	ND < 5.0	701

Table 1A (continued)
Volatile Organic Compounds (VOCs) in
Quarterly Groundwater Monitoring Samples
January 2006 through November 2007

Sample Identification	Dates Sampled	Chemical Constituent				
		Tetrachloroethene (5 µg/L)	Trichloroethene (5 µg/L)	cis-1,2-Dichloroethene (5 µg/L)	Vinyl Chloride (2 µg/L)	Total COC
extraction well AV-2	2-9-06	**3,560**	**380**	**979**	ND < 10	4,919
	3-9-06	**90.7**	**11.0**	**19.5**	ND < 0.5	121.2
	5-16-06	**913**	**13.2**	**18.0**	ND < 2.5	944.2
	8-22-06	**28.4**	3.4	**9.9 M**	ND < 0.5	41.7
	11-28-06	**24.7**	3.5	**6.6**	ND < 0.5	34.8
	12-11-06	**28.5**	4.0	**9.2**	ND < 0.5	41.7
	3-1-07	**25.4**	4.0	**5.2**	ND < 0.5	34.6
	5-29-07	**26.0**	3.8	**6.1**	ND < 0.5	35.9
	8-28-07	**24.4**	ND < 0.5	**6.5**	ND < 0.5	30.9
	11-28-07	**13.2**	2.1	3.6	ND < 0.5	18.9

Table 1A
Volatile Organic Compounds (VOCs) in Quarterly Groundwater Monitoring Samples
January 2006 through November 2007

Sample Identification	Dates Sampled	Chemical Constituent				
		Tetrachloroethene (5 µg/L)	Trichloroethene (5 µg/L)	cis-1,2-Dichloroethene (5 µg/L)	Vinyl Chloride (2 µg/L)	Total COC
monitoring well AV-1	1-16-06	**35.5**	1.4	2.0	ND < 0.5	38.9
	5-16-06	**13.9**	ND < 0.5	ND < 0.5	ND < 0.5	13.9
	8-23-06	**10.3**	0.6	0.8 M	ND < 0.5	11.7
monitoring well MW-1	1-17-06	ND < 0.5	ND < 0.5	ND < 0.5	ND < 0.5	0
	5-16-06	ND < 0.5	2.2	ND < 0.5	ND < 0.5	2.2
	8-22-06	ND < 0.5	ND < 0.5	ND < 0.5	ND < 0.5	0
	8-28-07	ND < 0.5	ND < 0.5	ND < 0.5	ND < 0.5	0
monitoring well MW-2	1-13-06	**967**	**95.7**	**94.9**	ND < 5.0	1,157.6
	5-16-06	**4,440**	**638**	**1,300**	ND < 25.0	6,378
	8-22-06	**2,710**	**390**	**943 M**	**24.2**	4,067.2
	8-28-07	**2,760**	**396**	**752**	**31.0**	3,939
monitoring well MW-3	1-16-06	0.6	ND < 0.5	ND < 0.5	ND < 0.5	0.6
	5-16-06	2.6	ND < 0.5	ND < 0.5	ND < 0.5	2.6
	8-23-06	4.3	ND < 0.5	ND < 0.5	ND < 0.5	4.3
	8-28-07	2.5	ND < 0.5	ND < 0.5	ND < 0.5	2.5

Table 1A
Volatile Organic Compounds (VOCs) in
Quarterly Groundwater Monitoring Samples
January 2006 through March 2007

Sample Identification	Dates Sampled	Chemical Constituent				
		Tetrachloroethene (5 µg/L[1])	Trichloroethene (5 µg/L[1])	cis-1,2-Dichloroethene (5 µg/L[1])	Vinyl Chloride (2 µg/L[1])	Total COC
monitoring well MW-5	1-18-06	ND < 0.5	ND < 0.5	ND < 0.5	ND < 0.5	0
	8-23-06	4.0	ND < 0.5	0.6 M	ND < 0.5	4.6
	3-5-07	2.0	ND < 0.5	ND < 0.5	ND < 0.5	2.0
	8-28-07	3.3	ND < 0.5	ND < 0.5	ND < 0.5	3.3
monitoring well MW-6	1-16-06	**21.6**	3.4	**7.9**	ND < 0.5	32.9
	5-16-06	**6.0**	0.6	ND < 0.5	ND < 0.5	6.6
	8-22-06	3.7	ND < 0.5	ND < 0.5	ND < 0.5	3.7
	8-28-07	ND < 0.5	ND < 0.5	ND < 0.5	ND < 0.5	0
monitoring well MW-7	1-16-06	**6.1**	3.6	0.9	ND < 0.5	10.6
	5-16-06	**34.0**	3.2	**7.3**	ND < 0.5	44.5
	8-22-06	**23.6**	2.8	**8.7 M**	ND < 0.5	35.1
	8-28-07	**12.5**	1.9	2.8	ND < 0.5	17.2

* The elevated detection limits are due to sample dilution that is necessary for accurate analyses.

Table 1B
Volatile Organic Compounds (VOCs) in
Sub-Slab Vapor, Ambient Indoor Air, and Ambient Outdoor Air Samples
January 2005 through January 2007

Sample Identification		Dates Sampled	Constituent			
			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
Volatile Organic Compounds						
grocery store	SVFT-1 (sub-slab vapor)	1-26-05	***2,500***	13	ND < 0.82	ND < 0.82
		4-29-05	***1,400***	17	ND < 1.2	ND < 1.2
		6-1-06	48.2	4.14	ND < 7.46	ND < 4.82
	SVFT-2 (sub-slab vapor)	4-29-05	8.7	ND < 0.71	ND < 0.71	ND < 0.71
		6-1-06	10.7	2.84	ND < 1.11	ND < 0.715
	SVFT-3 (sub-slab vapor)	4-29-05	86	3.8	ND < 0.70	ND < 0.70
		6-1-06	47.6	***7.07***	ND < 7.46	ND < 4.82
		1-16-07	24.4	1.33	ND < 0.522	ND < 0.337
	SVFT-4 (sub-slab vapor)	4-29-05	***7,200***	***210***	260	ND < 14
		6-1-06	***386***	ND < 0.771	ND < 14.3	ND < 9.23
		1-16-07	16.4	ND < 0.249	ND < 0.392	ND < 0.253
	SVFT-5 (sub-slab vapor)	6-1-06	***354***	***12.2***	ND < 7.46	ND < 4.82
		1-16-07	44.1	4.27	ND < 0.656	ND < 0.423
	IAFT-1 (indoor air)	1-26-05	***9.7***	ND < 0.97	ND < 0.97	ND < 0.97
		4-29-05	***8.6***	ND < 0.74	ND < 0.74	ND < 0.74
		6-1-06	***3.47***	***0.267***	ND < 0.393	ND < 0.254
		1-16-07	1.70	ND < 0.249	ND < 0.391	ND < 0.252
	IAFT-2 (indoor air)	6-1-06	***3.47***	***0.276***	ND < 0.393	ND < 0.254
		1-16-07	2.09	ND < 0.250	ND < 0.393	ND < 0.254

Table 1B (continued)
Volatile Organic Compounds (VOCs) in
Sub-Slab Vapor, Ambient Indoor Air, and Ambient Outdoor Air Samples
January 2005 through January 2007

Sample Identification		Dates Sampled	Constituent			
			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
Volatile Organic Compounds						
pizzeria	SVAP-1 (sub-slab vapor)	1-26-05	***160***	3.6	ND < 0.79	ND < 0.79
		1-17-06	***307,000E***	***8,990E***	277	ND < 1.27
		6-1-06	***119,000E***	***3,550E***	269	ND < 5.07
		8-7-06	***20,800E***	***643E***	34.5	ND < 7.25
		1-16-07	2.86	ND < 0.316	ND < 0.483	ND < 0.312
	IAAP-1 (indoor air)	1-26-05	***26***	ND < 0.84	ND < 0.84	ND < 0.84
		1-17-06	***584E***	***7.39***	ND < 1.96	ND < 1.27
		6-1-06	***57.1***	***1.38***	ND < 2.49	ND < 1.61
		8-7-06	***44.7***	ND < 4.05	ND < 11.2	ND < 7.25
		1-16-07	1.82	ND < 0.294	ND < 0.463	ND < 0.299

Table 1B (continued)
Volatile Organic Compounds (VOCs) in Sub-Slab Vapor, Ambient Indoor Air, and Ambient Outdoor Air Samples January 2005 through January 2007

Sample Identification		Dates Sampled	Constituent			
			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
Volatile Organic Compounds						
cleaners	SVSE-1 (sub-slab vapor)	1-26-05	14	ND < 0.64	ND < 0.64	ND < 0.64
		6-1-06	64.8	8.67	ND < 7.85	ND < 5.07
		1-16-07	9.59	0.442	ND < 0.393	ND < 0.254
	IASE-1 (indoor air)	1-26-05	ND < 0.69	ND < 0.69	ND < 0.69	ND < 0.69
		6-1-06	1.23	0.248	ND < 0.392	ND < 0.253
		1-16-07	ND < 8.92	ND < 3.33	ND < 5.22	ND < 3.37
pharmacy	SVLP-1 (sub-slab vapor)	1-26-05	***220***	10	ND < 0.85	ND < 0.85
		1-17-06	***166***	***42.1***	4.67	ND < 1.27
		6-1-06	***235***	***17.0***	ND < 7.85	ND < 5.07
		1-16-07	***213***	***7.44***	ND < 7.46	ND < 4.82
	IALP-1 (indoor air)	1-26-05	1.5	ND < 1.5	ND < 1.5	ND < 1.5
		1-17-06	***172***	4.62	ND < 1.96	ND < 1.27
		6-1-06	1.18	***0.261***	ND < 0.392	ND < 0.253
		1-16-07	***22.9***	***0.457***	1.16	ND < 0.330

Table 1B (continued)
Volatile Organic Compounds (VOCs) in
Sub-Slab Vapor, Ambient Indoor Air, and Ambient Outdoor Air Samples
January 2005 through January 2007

Sample Identification		Dates Sampled	Constituent			
			Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	Vinyl Chloride
Volatile Organic Compounds						
insurance company	SVSF-1 (sub-slab vapor)	11-29-05	ND < 3.35	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	ND < 13.4	12.5	ND < 7.85	ND < 5.07
		1-16-07	ND < 0.731	0.395	ND < 0.428	ND < 0.276
	IASF-1 (indoor air)	11-29-05	ND < 3.35	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	6.77	ND < 0.0212	ND < 0.392	ND < 0.253
		1-16-07	ND < 0.805	ND < 0.301	ND < 0.471	ND < 0.304
dollar store	SVDS-1 (sub-slab vapor)	11-29-05	ND < 3.35	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	3.82	***9.15***	ND < 1.45	ND < 0.938
		1-16-07	ND < 0.765	ND < 0.286	ND < 0.448	ND < 0.289
	IADS-1 (indoor air)	11-29-05	ND < 3.35	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	0.420	***1.41***	4.87	ND < 0.254
		1-16-07	ND < 0.704	ND < 0.262	ND < 0.412	ND < 0.266
sub shop	SVSW-1 (sub-slab vapor)	11-29-05	3.94	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	ND < 12.7	5.15	ND < 7.46	ND < 4.82
	IASW-1 (indoor air)	11-29-05	ND < 3.35	ND < 2.66	ND < 1.96	ND < 1.27
		6-1-06	1.53	ND < 0.221	ND < 0.408	ND < 0.264

Table 2
Remedial Alternative Costs

	Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
1	No Action	$0	$21,600	$297,000
2	Monitored Natural Attenuation	$0	$34,000 5-year reevaluation - $25,000	$593,000
3	Hydraulic Containment Using Current Extraction and Treatment System	$0	$56,000 5-year reevaluation - $25,000	$926,000
4	In-Situ Oxidation of Source Area Contaminants, Hydraulic Containment and Sub-Slab Vapor Extraction	$743,000	Years 1-5 - $65,000 Years 1-20 - $22,000	$1,294,000