VOLUNTARY CLEANUP PROGRAM FINAL REPORT

for

SITE NO. V-00150-7

NYS Department of Environmental Conservation
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Environmental Remediation
Region 7 - Syracuse

VOLUNTARY CLEANUP AGREEMENT NO. A7-0466-0702

I certify that the Remedial Action Work Plan was implemented and that all construction activities were completed substantially in accordance with the Department-approved Remedial Action Work Plan and were personally witnessed by a person under my direct supervision.

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October 2007

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1.0 INTRODUCTION

This Final Report is submitted pursuant to the Voluntary Cleanup Agreement, Index No. A7-0466-0702 (Voluntary Cleanup Agreement) for Site No. V-00150-7, which is the parcel known as 7980-7984 Brewerton Road, Cicero, Onondaga County, which has a Tax Map ID No. of 043.01-17.1 (Site). As set forth in Section 4.8 of the New York State Department of Environmental Conservation (DEC) approved Remedial Work Plan dated February 2004 (Work Plan), this Final Report will summarize the investigation and remedial activities at the Site, including the results of a qualitative public health exposure assessment based on the restricted future site use for commercial/industrial purposes. As discussed herein, the Final Report concludes that no further remedial activities are required for the contemplated use of the Site, and therefore the Release and Covenant Not to Sue should be issued by DEC.

The attached *Site Plan* (Figure 1) details the main property features. The property contains two abandoned buildings and a large paved and gravel-surfaced area for vehicle traffic and parking. The building formerly used as dry cleaning establishment was demolished in 2004, as per the approved remedial work plan. The remaining two buildings were used as automotive repair and restaurant businesses. Only a small portion of the site is surfaced with grass, located along the eastern boundary. There are no residential properties located near the site. Route 11 borders the western side of the property and commercial lots, including an instant oil change facility to the south, a Wegman's grocery store to the east and a Dunn tire store to the north, border the rest of the property. No streams or wetland areas are located on the property. The nearest surface water features are wetland areas located approximately 400 feet to the west and east of the property.

A dry cleaner operated on the site from approximately 1987 to 1999. Prior to that, the building was used as a car wash. Subsurface environmental site assessment work previously completed by others indicated the existence of environmental impacts to soil and groundwater associated with dry cleaning compounds.

2.0 SUMMARY OF FIELD ACTIONS COMPLETED

2.1 Remedial Excavation

A number of field actions were completed to characterize the nature and extent of contamination and to reduce contaminant impact at the site. The following is a summary of field actions completed that caused a significant reduction of soil contaminant concentrations.

2.2 Building Demolition and Utility Abandonment

Pursuant to Section 3.4 of the Work Plan, the former dry cleaner building was demolished in the summer of 2004 and the subsurface utilities were abandoned. As part of this work, the former disposal sump was removed.

2.3 Remedial Excavation Investigation Program

Pursuant to Sections 3.5, 3.6, 4.3 and 4.4 of the Work Plan, eleven test pits and sixteen soil borings were completed to investigate the nature and extend of the soil contamination. Additionally, pursuant to Section 3.7 of the Work Plan, six groundwater wells were installed and sampled, along with the two pre-existing groundwater wells already installed at the Site to assess groundwater quality. Soil and groundwater samples were collected for analysis during this investigation. Results of the investigation were presented to the DEC in the September 9, 2004 letter report, which set forth the excavation limits pursuant to Section 3.8 of the Work Plan. The DEC approved the excavation limits, after some revision, by letter dated December 8, 2004, with an acknowledgement that there would be residual contamination remaining after project completion.

2.4 Remedial Excavation Activities

As required by Sections 3.9 and 4.6 of the Work Plan, the remedial excavation was initiated on January 10, 2005. On Day 1, soils from beneath the former dry cleaner sump were excavated. The former sump was marked in the field during the building demolition. In preparation for the soil excavation, a 40-foot by 40-foot area centered over the former sump was staked and an internal 30-foot by 30-foot area was staked. Soils from grade to 4 feet deep within a square area extending from the 30-foot by 30-foot area at 4 feet deep, extending out to the 40-foot by 40-foot area at the surface, were excavated and stockpiled to the south of the excavation on polyethylene sheeting. Each bucket of soil was screened with a photoionization detection (PID) meter and also for visual or olfactory signs of contamination.

No field indicators of contamination were detected during this portion of the excavation activities. As water initially flowed into the excavation from the northwest corner during this activity, the excavation was completed last in this corner. Three grab soil samples and one composite soil sample were collected from the clean soil pile prior to the conclusion of site work on Day 1.

On Day 2, water that had collected overnight in the excavation was pumped into a temporary frac tank. The excavation of the interior 30-foot by 30-foot area was then completed. Soils excavated on Day 2 were placed on polyethylene sheeting south of the excavation. During this excavation, strong solvent odors were evident once the interior excavation area had penetrated approximately 3 to 4 feet below grade. At the 4 to 5-foot depth, dark soil staining was evident. A portion of the excavated soils from directly beneath the former sump were heavily stained, had a potent odor and PID readings, in one instance, that exceeded the instrument upper limit of 10,000 parts per million (ppm). PID readings in the removed soil generally ranged from 10 to 350 ppm.

The DEC-approved excavation limits were 30 feet by 30 feet at the surface, tapering to 15 feet by 15 feet at a depth below grade of 15 feet. The excavation was continued until these approximate dimensions were achieved, and was continued until all visual soil staining was removed and olfactory odors declined. The final excavation was measured with dimensions of 19 feet by 16.5 feet, to a depth of 15 feet below grade.

The backhoe bucket was used to collect post-excavation soil samples from each sidewall and from the excavation bottom. Samples were screened with the PID meter and all readings were zero ppm. Prior to collection of each post-excavation soil sample, the excavation bucket was washed over the polyethylene sheeting containing the contaminated soil pile with a solution of Alconox soap and water to remove all visual soils and to clean the bucket surface. Once the excavator brought soil to an accessible location on the side of the excavation, the soil inside was separated to expose a fresh surface and a sample collected into a clean, labeled, 6-ounce glass jar and sealed. All samples were placed into a thermally insulated container for transport to the analytical laboratory, accompanied by chain of custody documentation.

The excavation bottom was backfilled with eight buckets of clean No. 2 stone and a 6-inch diameter Schedule 40 PVC remediation well was installed in the hole. This well had 10 feet of slotted screen and a 5-foot riser. At that time, a friction fit cap was placed on the well. (After the excavation was completely backfilled and compacted, this well was subsequently retrofitted with a steel flush mount curb box cemented into place and a locking cap placed onto the well top.) The remainder of the excavation was backfilled with clean No. 2 stone from the bottom to approximately 5 feet below grade.

The "clean" soil was excavated from a 0 to 4 feet depth over the former sump and placed east of the excavation. This soil had been clean backfill emplaced when the building was demolished and the concrete sump excavated in the summer of 2004. Soil samples from the "clean" pile and the post-excavation soil samples from the walls and floor of the open excavation were submitted to Severn Trent Analytical Laboratory for analysis of TCL[1] and STARS[2] volatile organic compounds (VOCs) by EPA Method 8260. Severn Trent is a New York State certified analytical laboratory for the analyses performed. The results are provided in Tables 4 and 5. On January 14, 2005, analytical data from Severn Trent Laboratories, Inc. was faxed to the DEC with a request for approval to backfill the soil back into the excavation. After data review by the DEC, a verbal approval to backfill this soil was received.

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[1] Target Compound List

[2] DEC Spill Technology and Remediation Series (STARS) Memo #1 – *Petroleum-Contaminated Soil Guidance Policy*, dated August 1992.

On January 17, 2005, the excavation backfill was brought to grade. The backhoe operator had previously placed clean No. 2 stone evenly through the excavation, overlain by a geo-textile fabric and covered with a thin layer of clean No. 2 stone. The "clean" soils were then placed on the excavation surface over the No. 2 stone. At the time of backfill, the "clean" soil could not be adequately compacted due to water in the excavation. This soil was allowed to settle naturally, then 1 foot of clean crusher run gravel was placed over the soil and compacted.

2.5 Post-Excavation Soil Sample Results

As required in the Work Plan, the Volunteers excavated the grossly contaminated soil beneath the former sump believed to be the main source and discharge location on the site. A comparison of the analytical data for disposed soils to post-excavation soil sampling data demonstrates a two orders of magnitude reduction at the source area, the former dry cleaner sump. During the excavation, soils were segregated into near surface soils that contained native and recent clean fill resulting from removal of the concrete sump (samples ESP-S-01 through ESP-S-06), and deeper native soils from the middle and bottom of the excavation (WSP-S-07 through WSP-S-12) that contained the most heavily impacted soils. The concentrations of perchloroethene (PCE) in the excavated soils are presented in Table 6.

The concentrations of perchloroethene (PCE) in the excavation sidewalls and bottom are presented in Table 5. The PCE degradation products of trichloroethylene, 1,2-dichloroethylene and vinyl chloride were also present at significantly lower concentrations in these samples. Figure 2 shows the location of each sample. The samples confirm that the significant source contamination was removed from the site, with minor residual contamination remaining within the excavation limits.

The subsurface conditions were characterized through soil boring B-1, which was completed to 52 feet below ground surface (bgs). The presence of 5 feet of clay was identified. Soil boring B-7, completed directly over the former sump to a depth of 18 feet bgs, showed that the clay surface was encountered at a depth of 13.5 feet bgs. This boring also displayed both PID readings and split spoon soil analytical results indicating the PCE contamination declined below a depth of approximately 14 feet bgs. Specifically, B-7 documented the vertical change in PID readings, as shown in Table 7. Concern that the underlying clay layer not be breached during the excavation, coupled with the PID and analytical data from B-7, lead to the decision to excavate only to a depth of 15 feet bgs.

As set forth above, significant chlorinated solvent contamination was found below the former sump. This soil contamination spread vertically downward from the former sump to the clay layer. It also dissolved into groundwater and moved downgradient (northward) and along utility trench gravels out toward Route 11.

The excavation was successful in removing a significant source of contamination from the site. However, residual contamination remains at this site under the former sump and in the utility pipe bedding extending from the former building out to Route 11 was identified and further reduced through implementation of two chemical oxidant applications (see Sections 3.1 and 3.2).

3.0 POST-EXCAVATION REQUIREMENTS

Pursuant to Section 4.7 of the Work Plan, a round of groundwater samples were collected and analyzed (refer to Section 2.4 for a summary of groundwater quality). Additionally, Section 4.7 of the Work Plan required that after the investigation tasks and the remedial excavation work, the Volunteers were obligated to submit a soil vapor sampling and analysis program, as well as a sampling and analysis plan for surface soil samples. The DEC approved the Volunteers' Post-Excavation Requirements Plan on February 17, 2006. As part of the Post-Excavation Requirements Plan, Volunteers proposed to implement an Interim Remedial Measure ("IRM"), which will be discussed next.

3.1 Chemical Oxidations

Two chemical oxidation applications were performed at this site: one in May 2006; and a second in September 2007. Methods, materials, and quantities are described below.

3.1.1 Interim Remedial Measure: Sodium Permanganate

On May 2-4, 2006 and IRM was completed at the Site to infuse sodium permanganate into the subsurface. Construction of a 100 foot long and approximately 8-foot deep treatment trench was completed in late Fall 2005. At that same time, four access pits into the former water/sewer utility bedding were also installed.

This IRM was performed to:

- reduce residual soil contamination in the two defunct utility trenches extending from the former building toward Route 11; and
- intercept and attenuate the shallow groundwater plume north of the former sump.

Four access points were installed by backhoe at approximately 30-40 foot spacing from the edge of the former dry cleaner building to the property boundary at Route 11. These pits provide direct access to the bedding material in the two former utility trenches for the water and sewer lines. Four-inch diameter open-ended schedule 40 PVC piping fitted on the bottom with an inverted an open-ended “T” was installed into each of four access pits to provide an avenue for the addition of chemical oxidant to the affected soils and groundwater along the utility bedding.

A 100-foot trench transecting the groundwater plume was installed south of the line formed by MW-1 through MW-3 as shown on Figure 1. This trench was constructed with approximate dimensions of 4 feet wide for approximately a 25-30 foot length along the western end, then narrowed to approximately 2 feet wide for the remainder of the trench. The trench was began at he western end and widened beyond two feet due to wall collapse. As the trench progressed eastward, greater soil cohesion allowed the trench width to be narrowed. The depth of the trench is uniform at approximately 8 feet below grade. A thin layer of clean No. 2 stone was then placed into the trench to an approximately depth of six inches. Next four 4-inch diameter hand slotted schedule 40

PVC pipes, each wrapped in filter fabric, were placed into the trench at approximately 20-foot spacing. The trench was backfilled with approximately 5 feet of clean No. 2 stone to within approximately 3 feet of the ground surface. Geo-textile fabric was then placed over the stone before native backfill from the trench was replaced to fill the trench to grade. A total of 105 tons of No. 2 stone were placed into the trench (approximately 75 cubic yards).

Trench soils removed from below three feet below grade were stockpiled onsite on plastic sheeting and sampled for TCL and STARS VOCs by EPA Method 8260. The concentrations of perchloroethene (PCE) in the excavated remedial trench soils are presented in Table 8. After review by DEC of these soil sample results, approval was received from DEC to relocate these soils on the Site; the trench soils were subsequently spread on the ground surface south of the Berco Building.

During trench installation, six trench soil samples and one groundwater sample from MW-2 were collected. These samples were shipped to the Carus Chemical Co. for analysis of the total oxidant demand. The six trench soil samples were paired and composited into three soil samples by the laboratory and these three resultant samples plus the MW-2 groundwater sample were analyzed to determine the total oxidant demand in each sample. Based on these results and an oxidant demand calculator supplied by Carus Chemical Co. the total oxidant mass to be applied to the subsurface was calculated to be 13 fifty-five gallon drums of 40 % sodium permanganate solution. Typically, the concentration of permanganate dosed to the subsurface ranges from a few percent up to ten percent. Based on the volume of gravel placed into the remedial trench and an estimated porosity of thirty percent, the trench groundwater volume was estimated to be approximately 1000 gallons. The water volume in the access pits was not estimated as the installation technique did not involve the removal of any soil from the ground, but rather an opening to insert PCV piping to deliver oxidant to the former utility line bedding depth of approximately 42 inches below ground surface. A 550-gallon portable tank was brought to the site and filled with potable water by a contractor. During the course of this IRM, the following quantities of 40 % sodium permanganate were siphoned into the subsurface while potable water was pumped in at a steady-state rate to maintain, as close as possible, consistent concentrations as shown below.

Oxidation was monitored through field measurements, including visual checks (potassium permanganate dyes the water purple which fades as oxidant is consumed) and geochemical measurements, including pH (dechlorination drives the pH downward) and oxidation-reduction potential (ORP). Positive ORP values indicate the solute's (groundwater plus oxidant) ability to reduce (dechlorinate) the contaminants of concern.

Permanganate and Dilution Water Added to Subsurface May 2-4, 2006

Location	40% Sodium Permanganate (gal)	Dilution Water added to Ground (gal)	Groundwater as Dilution estimated (gal)	Final Estimated Concentration
100 ft Trench	550	1210	1000	10.0 %
4 Access Pits	165	750	---	8.8 %

Geochemical parameters have been measured prior to all site groundwater-sampling events since the initiation of the IRM, as an indicator of permanganate spread in the subsurface. The results of the geochemical data are presented below and indicate that by Fall 2006 permanganate had spread in the formation to MW-1 located down gradient and approximately 3 feet from the remedial trench, but had not reached MW-2 or MW-3, both located in the range for 5 – 7 feet down gradient of the trench.

In the table below, the sign of the ORP reading in milli-volts (mV) indicates whether the solution has oxidizing or reducing potential. A positive sign indicates the solution has oxidizing potential and a negative sign indicates the solution has reducing potential. Destruction of chlorinated organics requires a strong oxidizing potential to break the chlorine bond present in halogenated VOCs. Note that wells TW-5 and RW-1 in the above table are located hydraulically up gradient of the remedial trench and access pits.

pH / ORP Measurements Before and After Permanganate Addition to Subsurface

	11-15-05			6-14-06		7-18-06		9-13-06	
Well	**pH**	**ORP**	**IRM**	**pH**	**ORP**	**pH**	**ORP**	**pH**	**ORP**
MW-1	7.54	53.1	**M**	6.46	-20.6	---	---	2.18	264.9
MW-2	7.52	51.6	**A**	6.50	-51.9	---	---	6.33	16.4
MW-3	7.50	53.5	**Y**	6.38	-21.8	---	---	6.63	17.5
MW-11	7.45	76.1		6.64	-26.9	7.62	6.6	6.55	23.9
CES-MW-1	7.41	87.5	**2**	6.41	-27.9	7.33	-26.6	6.58	8.2
TW-5	7.67	51.6	**-**	6.76	-1.9	6.87	21.7	6.67	27.0
RW-1	7.85	41.0	**4**	6.52	-28.3	7.35	-132.0	---	---
MW-12	7.54	53.6		---	---	7.51	5.9	---	---
MW-13	7.56	64.4	**06**	---	---	7.94	-8.7	---	---
MW-14	7.44	64.8		---	---	7.62	-17.4	---	---

On September 13, 2006 during the sampling event, groundwater in MW-1 was visually a light purple indicating the presence of permanganate, this visual observation is supported by the pH and ORP measurements taken in MW-1 on that day. As of that date, oxidant had been in the ground for just over four months with significant residual remaining in the treatment trench and in two of four access pits. All wells measured displayed negative ORP values (groundwater is a reducing agent) on June 14th. By September 13th, all measured wells had switched over to all positive ORP values, however, only MW-1 showed pH, strong ORP, and color indicators supportive of permanganate presence. Also note that on September 13, 2006, ORP and pH readings in TW-5, located up gradient of the IRM, are consistent with readings for all wells except MW-1 on that date. This indicates the permanganate had not spread to other down gradient wells, buts its presence in the subsurface continues to act to intercept groundwater contamination moving toward the treatment zones.

Groundwater quality data shows no indication the permanganate has migrated from the release points across the Dunn Tire Site to monitoring wells MW-12 or MW-14. Geochemical data collected on July 18, 2006 showed no indication of permanganate presence on the Dunn site. However, by September 13, 2006, groundwater in MW-1 was purple and showed clear geochemical indication (pH and ORP) for permanganate presence. The monitoring wells on the adjacent site, however, are located a significant distance from MW-1.

Since the removal of affected soils from the former dry cleaner sump in January 2005, groundwater both onsite and off has shown slow response to changing site conditions. Macro trends are apparent in RW-1 where chlorinated VOCs have declined by 99.96 % since the source area removal, and in MW-2 where chlorinated VOCs have declined by over 82 % since the IRM. Also, CES-MW-1 has shown better than a 40 % decrease from July 2004 to July 2006. MW-3 shows little decline since the IRM. The trends are due in part to the IRM, as well as significant improvement resulting from the January 2005 source area removal.

Due to the low permeability of the fine-grained site soils, the delivery of chemical oxidant to the subsurface is slow. The permanganate was delivered to the subsurface and allowed to persist as an interceptor and to degrade chlorinated organics in the groundwater. This IRM was designed to act passively because the site soils are highly resistant to hydraulic dispersion through the soil column. For chlorinated organics, permanganate has been shown to provide the most effective chemical interaction for dechlorination. However, for it to work contact must be made between the chloroethenes and the oxidant. The difficult task is to attain this contact: in effect a delivery issue, not a chemical interaction issue. The persistence of permanganate was an important factor in selection of this oxidant over other common, but spontaneously decaying oxidants (i.e. Fenton's Reagent) because the permanganate persists in the subsurface until it contacts organics with which to react. No practical alternative could be identified to improve the groundwater plume faster or better. Improvement shown to date (50 % or better) is significant at the source area and in several wells in the plume center.

3.1.2 Second Chemical Oxidation

As requested by DEC in a letter dated August 9, 2007 sodium permanganate was applied to the former dry cleaner sump area, the remedial trench, and five access pits (four along the former utility bedding and one up gradient of TW-5) in accordance with the DEC approved Chemical Oxidation Work Plan dated August 2007. This application was applied to further reduce subsurface contaminant concentrations and to accelerate site improvement demonstrated in 2007.

Two infrastructure additions were made to the site prior to the oxidant application. These were the installation of a 4-inch PVC chemical oxidant application well installed into former sump area gravel and construction of an access pit between the sump area and TW-5. Both were constructed to enhance the 2007 chemical oxidant application.

On September 13, 2007 six drums of Liquox™, a 40% solution of liquid sodium permanganate manufactured by the Carus Chemical Corporation, were applied to the site. Three drums were applied to the former sump area and the access pit near TW-5, two drums were applied to the remedial trench, and one drum was divided equally between the four access pits in the former utility line bedding.

Two thousand gallons of water obtained from the Onondaga County Water Authority was trucked to the site as dilution water for the permanganate. Approximately 1000 gallons of water was piped into RW-1 as dilution water. Approximately 50 gallons of water was put into each of the four access pits in the former utility line bedding. The remainder of the water, approximately 800 gallons was pumped into the remedial trench. Much of this water was applied by first pumping it into the empty permanganate poly drums as a means to provide the required RCRA triple rinse to render the drums clean for disposal as routine trash by a contractor.

A portable pump was used in the former sump (RW-1)_and in the remedial trench to circulate water as a means of achieving complete mixing of the permanganate with both in situ and added water. No water was added to the access pit near TW-5 as it could accept no additional liquid after permanganate installation.

After completing the oxidant application, all well and access pits were re-secured with locking well caps, drips of permanganate washed from the site surface, and the site generally restored to the pre-application condition. Also during this work, one damaged PVC riser in the remediation trench was cut below the ground surface, capped, and buried to prevent accidental or intentional introduction of foreign material to the subsurface.

3.2 Groundwater Investigation

3.2.1 Shallow Groundwater Investigation

Seven rounds of sampling were performed to assess shallow groundwater quality since source removal from the former sump area in January 2005. During these sampling events, groundwater elevations were collected to demonstrate the shallow groundwater flow direction. Figure 1 shows the location of all shallow groundwater monitoring wells and the latest groundwater contours based on depth measurements collected on June 27, 2007.

Well construction for all but TW-5 and RW-1 is 2-inch diameter Schedule 40 PVC casing, consisting of 0.010-slot well screen with solid riser to the ground surface. These wells are secured with locked caps inside flush mount steel curb boxes. The boring annuluses were sealed with No. 2 (or equivalent) clean sand to within approximately 1 to 2 feet of ground surface, overlain by bentonite and finished near the top 6 inches with concrete. RW-1 is a Schedule 40 PVC 6-inch diameter recovery well with 10 feet of slotted screen and 5 feet of solid riser pipe. This well is installed into clean No. 2 gravel backfilled into the excavation of the former dry cleaner sump. It has a flush mount steel curb box sealed neared the ground surface with concrete. TW-5 is a temporary 1-inch diameter Schedule 40 PCV well that sticks up above the ground surface approximately 4 feet. It has a sand pack to within approximately 1 foot of ground surface and a bentonite seal to grade.

Shallow groundwater elevation readings have been collected in shallow wells in November 2005, March 2006, July 2006, September 2006, November 2006, March 2007 and June 2007. The flow direction has remained steady to the northwest. There has been observed a perturbation of localized flow caused by water storage around RW-1 and in the remedial trench, both of which were backfilled with clean No. 2 gravel. However, the overall flow pattern to the northwest is evident.

3.2.2 Deep Groundwater Investigation

A total of five deep groundwater wells (MW-6D, MW-7D, MW-8D, MW-15D and MW-16D) have been installed at the site to evaluate whether free phase products penetrated the shallow aquitard located from approximately 12 to 17 feet bgs across the investigation area. The surface of a 3 to 10-foot thick clay layer aquitard encountered in site wells exists at an approximate depth range of 12 to 13 feet bgs. Below this site-wide feature, interlayered zones of more permeable sands and gravel and low permeability fine-grained silts were encountered until a densely packed till was reached at a depth range of from 48 to 56 feet bgs. Figure 4 shows the location of the deep wells and the groundwater contours from depth to groundwater measurements made on July 18, 2006.

A cased well method for installing the deep wells was used to minimize, to the extent practical, the possibility of cross contamination between aquifers. The surficial water table aquifer (contaminated with dissolved-phase site contaminants as determined by the shallow well program) was sealed off from the lower aquifer by drilling a nominal 8 to 10-inch diameter borehole with hollow stem augers (4.25 or 6.25-inch inside diameter) into the clay aquitard, as determined by employing continuous split spoon sampling methods to confirm stratigraphy. Next, a nominal 4-inch diameter steel casing was installed in the borehole and grouted into place using the auger pull-back and tremie method. The grout was allowed to set for a minimum of 24 hours prior to further drilling. The final depth of the grouted casing was approximately 15 feet. Drilling then continued until the augurs encountered till or refusal. The above method accurately describes the installation of MW-6D, MW-7D, MW-15D and MW-16D. MW-8D was stopped at a total depth of 41 feet below grade after advancement of 2 feet into a cohesive fine sand, silt and clay layer that was determined to be a likely containment layer for the contaminants of concern.

Measurements of depth to water in the five deep monitoring wells were collected on March 13, 2006 and July 18, 2006. Attachment 1 contains boring logs for the entire monitoring well network (14 shallow, 5 deep). All wells were surveyed to determine the relative elevation of a reference point. This data was then used to calculate the relative water level elevations for contouring of the piezometric head in the deep groundwater monitoring wells. Figure 4 presents contours of the piezometric head of the deep groundwater surface elevations. These contours are based on piezometric elevations calculated for MW-6D, MW-7D, MW-15D, and MW-16D. The contours were determined by the triple point method. Groundwater elevations from deep monitoring well MW-8D were excluded from these calculations, as this well was not screened in the same stratum as were the other four monitoring wells. As NYSDEC is aware, MW-8D was completed above the till layer due to presence of a significant confining layer at approximately ten feet above the till.

The results of these two contour data sets shows deep groundwater potentiometric heads indicating groundwater movement deep below the former sump was toward the:

- Southeast on March 13, 2006 based on a total potentiometric difference between the wells of 0.30 feet; and
- Northeast on July 18, 2006 based on a total potentiometric difference between the wells of 0.18 feet.

Associated groundwater results for VOCs indicate that no penetration of significant chlorinated organics exists in the deep groundwater at this site.

The groundwater quality in the deep wells was sampled in the order of installation. Deep wells MW-6D, MW-7D and MW-8D were sampled in November 2005, and MW-15D and MW-16D were sampled in April 2006.

3.2.3 Offsite Investigation

Per DEC request, offsite investigation along Route 11 for site contaminants and to confirm the eastern plume extent on the Dunn Tire Property was completed in June 2007. In the course of this work the following tasks were completed:

- Installation of groundwater monitoring wells MW-17, MW-18 and MW-19 to verify that plume limit delineation was complete (June 18 and 19, 2007).
- Collection of three soil samples from the Route 11 sewer line bedding to evaluate plume migration (June 18 and 19, 2007).
- Groundwater sampling of the three newly installed wells was performed, with concurrent voluntary sampling of additional wells, to further assess site groundwater quality trends (June 27, 2007).

Soil samples were collected from the sanitary sewer bedding along Route 11 from locations up gradient and down gradient (with respect to sewer line gradient) of the former site utility connections. Volatile organic compounds (VOCs) were not detected in the samples from SB-1A or SB-3A. 1,2-Dichloroethene (total) was detected in the sample from SB-2A at 18 parts per billion (ppb), compared to the DEC recommended soil cleanup objective (SCO) of 300 ppb.

Analytical results of groundwater samples from the two new wells along Route 11 showed MW-18 contained 25 ppb of total VOCs that were chlorinated and MW-19 contained 55 ppb of toluene and no chlorinated VOCs. The sample from the new well east of the Dunn Tire building, MW-17, had no detected VOCs.

The results of this June 2007 investigation are incorporated into the following tables and graphs:

- *Table 9 – Summary of Historical Groundwater Analytical Results – Total VOCs*

- *Table16 – Route 11 Sewer Bedding Soils - TCL VOCs* summarizing the analytical results for the sewer line bedding samples SB-1A through SB-3A.

- *Graphs of Total VOC Concentrations Over Time* (Attachment 2) for wells CES-MW-1, MW-1, MW-2, MW-3, TW-5 and MW-11 through MW-14. Wells graphed were selected based on sufficient data (Attachment 2).

3.2.4 Summary of Groundwater Sampling Results

3.2.4.1 Shallow Groundwater

Shallow groundwater has been investigated through installation and sampling of fourteen shallow wells. . These shallow wells investigated the entire site and delineated the plume limits. Since excavation and disposal of source area soils from directly below the former dry cleaning sump in January 2005, on-site shallow wells have shown a downward trend in total VOCs, including CES-MW-1, MW-11, MW-2, and most dramatically, RW-1 (installed directly into the source area). MW-1, MW-2 and MW-3 are directly down gradient of the former dry cleaner sump. Among these wells, MW-2, historically the most heavily affected well outside the source area, has shown a steep decline in total VOC concentration. PCE degradation processes are reducing its concentrations, as demonstrated by the declining trend shown below. Additionally, in MW-11, where PCE and TCE concentrations have been below detection limits, a downward trend in 1,2-DCE concentration is evident.

Well	11/15/05 (ug/l)	5/02/06 (ug/l)	9/13/06 (ug/l)	11/29/06 (ug/l)	3/30/07 (ug/l)	6/27/07 (ug/l)	Compound
MW-2	1,900	560	410	930	200	18	PCE
MW-3	86	11	25	10	3	28	"
TW-5	23	320	160	230	69	82	"
MW-11	250	NS	120	110	55	85	1,2-DCE *

Notes: 1) * PCE has not been detected in MW-11 during any samples

2) NS – denotes "not sampled"

The 2006 IRM was targeted to attenuate the plume center in conjunction with the source area removal. Together the two chemical oxidant applications and source area removal have reduced the shallow plume concentrations. Table 9 presents an historical summary of total VOC groundwater quality. Table 10 presents individual results from all well sampling events.

3.2.4.2 Deep Groundwater

Analytical results from samples from each of the five deep groundwater wells indicate no free phase dense non-aqueous phase liquid (DNAPL) exists below the aquitard layer in the deep aquifer. Three wells had non-detectable levels of VOCs (MW-6D, MW-7D and MW-16D). Two deep wells (MW-8D and MW-15D) contained low concentrations of VOCs: the three compounds detected in MW-8D were at or below the State Standard for each compound, while MW-15D contained one compound (PCE) above the 5 micrograms per liter (μg/l) State Standard at a concentration of 13 μg/l. However, re-sampling of MW-15D showed a concentration of 1.7 μg/l for PCE.

In summary, while groundwater monitoring of the five deep wells did show one compound above the State Standard in one test, subsequent re-testing of this well showed the concentration to be well below the State Standard. This data clearly demonstrates that no significant release of DNAPL to the deep aquifer occurred and that the trace quantities of contaminants in the deep aquifer do not warrant further action.

3.2.4.3 SVOCs and Metals in Groundwater

During the 2004 site investigation seven soil samples were collected from five soil borings and submitted to the laboratory for analysis of SVOCs by EPA Method 8270. Three of the seven samples were collected from SB-7 at differing depths. SB-7 was located in the center of the former dry cleaner sump (source area). Six of seven samples returned results that were non-detect for all SVOC compounds. The last sample in SB-7 at the 4-6 feet depth interval showed less than 2 parts per billion (ppb) of a phthalate compound. These results are presented in Table 3. With regard to SVOCs in the groundwater, subsequently during the 2005 deep groundwater investigation, four deep monitoring wells, MW-6D, MW-7D, MW-8D, MW-15D, and MW-10 were sampled for SVOCs. All five wells returned results that were non-detect for all SVOC compounds. Based on the soil and groundwater SVOC results no impact from this class of compounds exists at this site. The groundwater SVOC results are presented in Table 11.

Groundwater samples were analyzed for RCRA metals to assess whether these contaminants were a concern at this site. On November 15, 2005 groundwater samples were collected from MW-10 and deep monitoring wells MW-6D, MW-7D, MW-8D, and MW-15D. Additionally, MW-10 was re-sampled in March 2006 with low turbidity to confirm the accuracy of the metal results. RCRA metals were analyzed in two surface soil sample locations. Both the location and number of samples were pre-approved by DEC and DOH. RCRA metal results for surface soils are presented in Table 15 and for groundwater are presented in Table 12.

3.3 Soil Vapor Results

Pursuant to the Post-Excavations Requirements Plan, two rounds of soil gas vapor sampling were conducted. First, a round of samples was collected on November 15, 2005 in ten soil vapor points across the Site. Additional sampling was then conducted on the adjacent property, Dunn Tire, as requested by the DEC. This sampling required installation of two soil vapor points through the floor of the Dunn Tire building. During the sample round conducted on March 18 and 19, 2006 while the business was closed, three additional vapor samples were also collected, including one outdoor ambient and two indoor air samples.

3.3.1 Site Soil Gas Vapor

In November 2005, ten soil vapor sampling points were installed at the site in accordance with the Draft DOH February 2005 Guidance Policy for Evaluating Soil Vapor Intrusion in the State of New York (DOH guidelines). Parratt-Wolff, Inc. installed these points using a Geo-Probe™ track-mounted drilling rig. A stainless steel well point was installed in each hole, the annulus filled with glass beads and a flush mount steel curb box cemented into place. Site soil vapor sampling was performed on November 15, 2005 at ten soil vapor points. Sampling was performed in accordance with DOH guidelines.

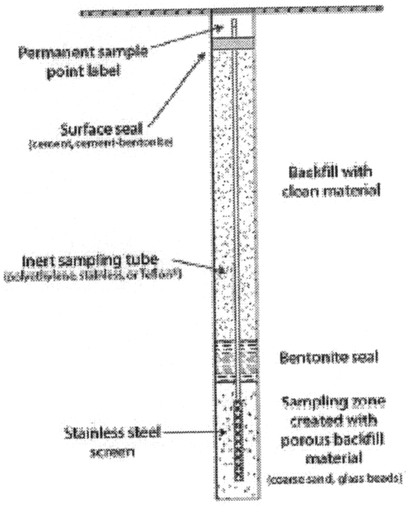
A leak test was performed by inverting a stainless steel dome over the vapor point and sealing its perimeter with modeling clay. The soil vapor point was then purged of stagnant gases using a peristaltic pump for 30 seconds. The dome is fitted with two connector valves: one is used to release helium under the dome and the second is connected to a helium analyzer outside the dome and inside the dome to the tubing for the soil gas vapor point. A pressurized one-liter summa canister of helium gas is used to release helium under the dome while simultaneously the helium detector is collecting and analyzing gas pulled from the vapor point for helium. A successful leak test results in less than or equal to a 20% helium concentration from the soil gas vapor point. All soil gas vapor points passed this leak test (i.e. helium concentrations below 20% in soil gas).

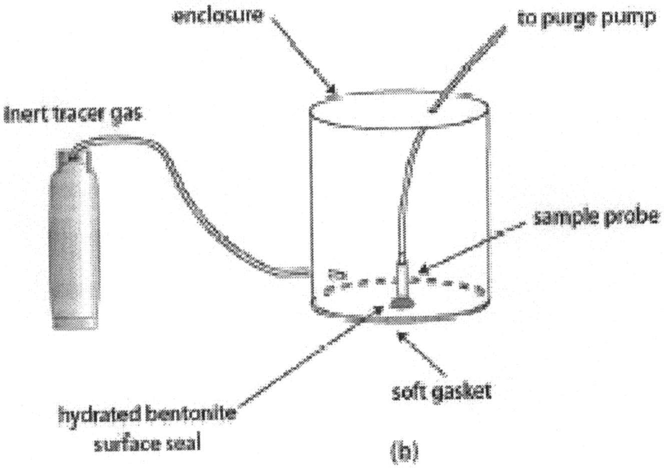
Based on successful leak testing, the vapor points were deemed suitably constructed and sealed for soil gas vapor sampling. Each point was connected to the dome valve for an 8-hour time weighted sampling of soil gases into a vacuum summa canister equipped with a vacuum gauge. Centek Laboratories, LLC in Syracuse, New York analyzed the summa canisters for VOC content by EPA Method T-015. Site soil vapor sampling results are presented in Table 13.

3.3.2 Dunn Tire Soil Gas Sampling

Two soil vapor sampling points were installed on March 7, 2006 in the Dunn Tire building to depths of 14 to 16 inches below the concrete slab. The construction of the soil vapor sampling points consisted of the installation of GeoProbe™ sampling points in accordance with DOH guidance. Two sub-slab sampling points were installed in the Dunn Tire facility at depths between 14 and 16 inches below the concrete slab. The construction included a stainless steel well point, glass beads and a bentonite seal. These points are inside the building and finished with flush mount steel protective casing with screw covers. A round of sub-slab soil vapor and indoor air quality monitoring was conducted from March 18 to 19, 2006. Two indoor air samples were collected from inside the Dunn Tire facility and one outdoor air sample. was collected.

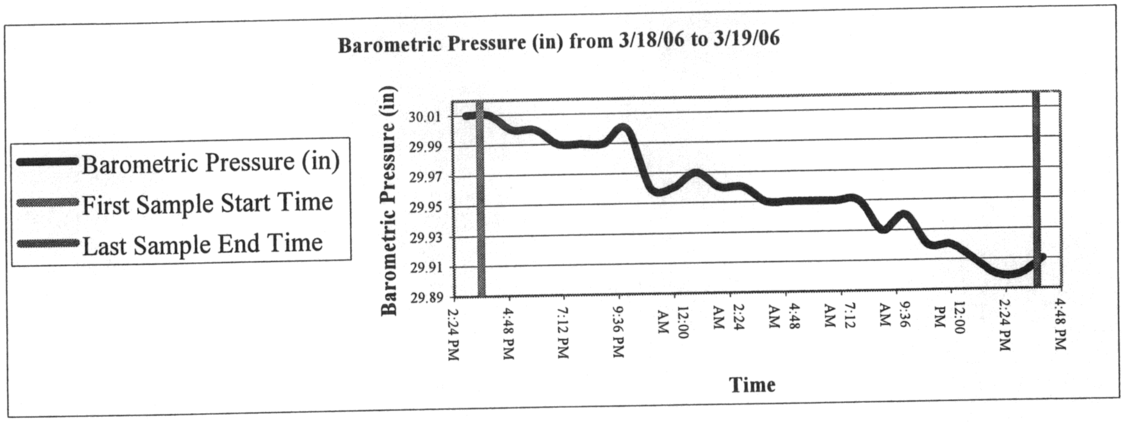
Each of the sub-slab sampling points was purged for 30 seconds with a peristaltic sampling pump to remove "stagnant" air from the sampling location. This pump was set at a flow rate of approximately 1 liter per minute, purging an estimated 0.5 liters from each sampling point. Each sampling location was checked for gross short-circuiting by injecting 1 liter of helium gas into a 4-liter stainless enclosure obtained from the laboratory. A Restec Catalogue No. 22451 helium leak detector was utilized to check for leaks in accordance with the procedures outlined in the Draft DOH Soil Vapor Guidance Policy mentioned above. No soil vapor sampling location exceeded 10% helium during the field testing, indicating the construction of the soil vapor sampling points was adequately limiting short-circuiting to the atmosphere. A schematic of the soil vapor sampling point construction and the field-constructed leak test appear below:





As set forth in the Post-Excavation Requirements Plan, 1-liter Summa™ canisters were selected for the soil vapor sampling. The sampling rate of the Summa™ canisters was preset at the laboratory for an 8-hour sampling period, resulting in a flow rate of 0.002 liters per minute. The Summa™ canister at location SVE-2 was 1.4-liters to allow for the collection of matrix spike and matrix spike duplicate (MS/MSD) samples. The regulator for this sampling location was preset at the laboratory for an 8-hour sampling period, resulting in a flow rate of 0.003 liters per minute. Both regulator settings are below the DOH specified flow rate of 0.2 liters per minute.

Barometric pressure for the sampling period was tracked and appears on the chart below. Collection of the first sample began at 3:35 p.m. on March 18, 2006 and collection of the last sample ceased at approximately 3:55 p.m. on March 19, 2006. As can be seen on the chart, the majority of this sampling interval coincides with a period of falling barometric pressure.



As previously stated, this sampling period was selected to optimize the soil vapor sampling, as the soil vapor mobility would be toward the atmosphere. and there is less likelihood of short-circuiting directly to atmosphere during sample collection.

A total of five samples were collected during the sub-slab soil vapor investigation activities conducted on March 18 and 19, 2006. All vapor samples were submitted to Centek Laboratories, LLC for analysis of VOCs per EPA Method TO-15. The analytical results are summarized as follows:

- *SV-1 (sub-slab soil vapor sample, office area):* The total VOC concentration detected at this location was 7,634 micrograms per cubic meter (µg/m³). Twenty-six VOCs were detected in the sub-slab soil vapor sample collected at this location. The site COC PCE was detected at this location at a concentration below its NYSDOH draft guidelines of 100 µg/m³. The TCE concentration detected at this location (29.5µg/m³) exceeded its NYSDOH draft guidelines of 5µg/m³. A concentration of 6.3% tracer gas was detected at this soil vapor sampling location during the field testing.

- *SV-2 (sub-slab soil vapor sample, shop area):* The total VOC concentration detected at this location was 18,485µg/m³. Twenty-four VOCs were detected in the sub-slab soil vapor sample collected at this location. The site COC PCE was detected at this location at a concentration below its NYSDOH draft guidelines of 100 µg/m³. The TCE concentration detected at this location (33.3 µg/m³) exceeded its NYSDOH draft guidelines of 5µg/m³. A concentration of 9.5% tracer gas was detected at this soil vapor sampling location during the field testing.

- *IA-1 (indoor air sample, office area):* The total VOC concentration detected at this location was 195 µg/m³. Twenty-six VOCs were detected in the indoor air sample collected at this location. The site COCs PCE and TCE were detected at this location at concentrations below their respective NYSDOH draft guidelines.

- PID scans in this vicinity indicated a peak VOC concentration of 160 parts per billion (ppb).

- *IA-2 (indoor air sample, shop area):* The total VOC concentration detected at this location was 314 µg/m³. Twenty-four VOCs were detected in the soil vapor sample collected at this location. The site COCs PCE and TCE were detected at this location at concentrations below their respective NYSDOH draft guidelines. PID scans in this vicinity were negative (0 ppb VOC concentration), though a strong odor associated with the tires was observed.

- *OA-1 (outdoor air, at Dunn/Northstar boundary):* The total VOC concentration detected at this location was 37 µg/m³. Twelve VOCs were detected in the soil vapor sample collected at this location. No site COCs (PCE, TCE, DCE and VC) were detected at this location. PID scans in this vicinity were negative (0 ppb VOC concentration), and no odors were observed.

During the PID sweep, a shop employee was observed to have applied aftershave/cologne that resulted in PID readings near the facility bathroom as high as 160 ppb. The DOH reviewed this data and in its May 19, 2006 correspondence, concluded that contaminants of concern do not appear to be penetrating the Dunn Tire by citing that indoor air quality that is above background is directly attributable to chemicals in products used and stored at Dunn Tire. The indoor air quality is subject to the Occupational Safety and Health Agency (OSHA) exposure standards and the concentrations are below the OSHA exposure limits, indicating no further action is required.

Refer to Figure 1 for soil vapor sampling locations, and Table 14 and the Laboratory Analytical Results for additional information.

3.4 Surface Soil Sampling

Pursuant to Section 3.8 of the Work Plan, surface soil samples were required in the vicinity of the dry cleaning facility that will not be paved. As set forth in a proposed site development plan provided by Widewaters Property Development Company through their attorney on December 5, 2005, the Site is proposed to be developed with a significant amount of paving. The Volunteer proposed soil samples in areas that will not be paved, which locations were approved by the DEC on June 6, 2006. The sample locations are shown on Figure 6. The DEC reviewed and approved the May 25, 2006 letter indicating these samples would be analyzed for the eight RCRA metals and TCL VOCs by EPA Method 8260. These samples were submitted to Life Science Laboratories (LSL) for analysis. Due to quality control variances, these samples were reanalyzed (within the EPA allowable holding time) by LSL for specific analytes. The metal results do not indicate any unusual metals concentrations in the surface soils. All VOC compounds were below the method limit of detection. Table 154 contains a summary of analytical metal and VOC results.

3.5 Data Usability Report

In accordance with the approved Work Plan, analytical data generated by this project was validated. Data Validation Services (DVS) and Premier Environmental Services (PES) performed data validation. Each evaluator reviewed approximately 50% of the laboratory analytical data and prepared Data Usability Reports (DUSRs) of findings in accordance with DEC guidelines. This data review did not result in the identification of substantive data changes affecting the conclusions reached throughout this project.

The validators marked abbreviations on laboratory report forms to annotate the reported data. These abbreviations have the meanings provided below.

ND - Indicates analyte was not non-detect at concentrations exceeding the instrumentation detection limit

J/UJ - Indicates an estimated value

R - Indicates that the sample results were rejected (unusable) due to serious quality control deficiencies

NJ - Indicates a tentatively identified estimated value

E - Indicates analytical result exceeded the calibration range of laboratory instrumentation

D - Indicates reported value is from the dilution run

B - Indicates analyte was detected in an associated blank sample analysis

Attachment 5 – Data Usability Report and Raw Analytical Data (attached CD containing pdf of laboratory report files) presents both the detailed Usability Reports and raw data in electronic format. The above abbreviations have been incorporated into the sixteen data tables.

4.0 NATURE AND EXTENT OF CONTAMINATION

4.1 Standards, Criteria and Guidance

Pursuant to Section 3.2 of the Work Plan, the following guidance or regulatory criteria will be used to evaluate the analytical results obtained from the investigation activities:

Soil.. DEC Technical Administrative Guidance Memorandum (TAGM) No. 4046, *Determination of Soil Cleanup Objectives and Cleanup Levels*, dated January 1994 and revised April 10, 2001.

Groundwater..................................... DEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1, *Ambient Water Quality Standards and Guidance Values*, dated June 1998 and 6NYCRR Part 703 – Groundwater Quality Standards, dated June 1998.

4.2 Chemicals of Concern

A review of the historical information and available soil and groundwater analytical data from prior investigations in the area was completed to identify the chemicals of concern (COCs) for this Site. The primary COCs are the halogenated VOCs associated with dry cleaning.

Halogenated VOCs: Sampling and analysis data from prior site investigation work demonstrated the presence of halogenated VOCs in soil and groundwater. The following halogenated VOCs have been shown to be the primary site COCs:

- 1,1-dichloroethane
- 1,1-dichloroethene
- c-1,2-dichloroethene
- 1,4-dichlorobenzene
- chloroethane
- methylene chloride
- chloroform (trichloromethane)
- t-1,2-dichloroethene
- tetrachloroethylene
- trichloroethene
- vinyl chloride

The investigation work performed to implement the Work Plan confirmed this designation.

Petroleum VOCs: None of the historical research provided evidence that petroleum VOC products were an integral part of the former dry cleaning operation. However, these compounds had historical use in the industry and prior sampling and analysis data for soil and groundwater from the Site revealed the presence of petroleum VOCs. Therefore, the following were identified as "secondary" COCs.

- Benzene
- 1,3,5-trimethylbenzene
- 1,2,4-trimethylbenzene
- ethylbenzene
- m&p-xylene
- o-xylene
- toluene

The investigation work performed in implementing the Work Plan confirmed this designation.

MTBE: MTBE was not proposed as a COC, but was requested by the DEC to be on the list. Analysis for MTBE was included in site analyses.

SVOCs: SVOCs were not proposed as COCs, since none had been detected in the area of the dry cleaning building on the Site. However, SVOC analyses were included for five deep groundwater monitoring wells with the results that all wells were non-detect for all SVOC constituents.

4.3 Contaminant Fate and Transport Characteristics

As discussed in Section 3.1.2 of the Work Plan, the fate and transport properties of the site COCs chemical classes were briefly generalized in order to evaluate their expected potential occurrence at the Site, which was confirmed as part of the Work Plan. The following is a general summary.

Halogenated VOCs: The general chemical properties for the most prevalent halogenated VOCs are summarized as follows:

- The compounds have specific densities greater than water.
- The compounds have moderate to high vapor pressures and are considered volatile.

- The compounds are moderately soluble in water.
- Vapor densities for these compounds are greater than that of air.
- Sorption coefficient data suggests these compounds are not highly sorptive to soil.
- The physical properties of the site contaminants suggest they partition readily into the groundwater and soil vapor phases.

Petroleum VOCs: These compounds tend to have relatively high values of solubility in water and are more easily leached in the soil column. Their relatively high vapor pressures tend to increase their occurrence in the vapor phase.

4.4 Extent of Contamination Remaining at the Site

Groundwater contaminants are PCE and degradation products, primarily trichloroethylene, 1,2-dichloroethylene and vinyl chloride. Other chlorinated degradation products are present but at significantly lower concentrations than the compounds listed above. In addition, traces of MTBE occur in several wells in concentrations at or below the Technical and Operational Guidance Series (TOGS 1.1.1) threshold of 10 μg/l.

Based on a network of on and off-site groundwater monitoring wells, groundwater contamination remaining at the site exists within a groundwater plume extending from the former sump area to the north-northwest. This plume extends onto the Dunn Tire site to the north. Groundwater contamination also moved linearly along the former water-sewer utility bedding out toward Route 11. There has been minor migration of groundwater contaminants to the west toward MW-10, but the plume center exists north-northwest of RW-1 toward MW-2, MW-12, and MW-14.

The plume boundary extends from the former sump north to under the Dunn Tire building, but does not emerge on the north side of Dunn Tire. The plume curves westward to MW-14 on the west side of Dunn Tire and wraps back southeastward toward the former dry cleaner sump. The extension along the former utility bedding reaches outside the primary groundwater plume to MW-11.

Since the removal of soils from the source area in January 2005, groundwater in RW-1 (installed in the source area during backfill operations) has declined from 164.8 ppm to a high of 0.069 ppm in three post excavation samples collected over an eight month time period. The remnant groundwater plume north of the former source area extends onto the adjacent site, but shows a declining trend in wells including CES-MW-1, MW-2, TW-5, and MW-11.

5.0 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

Based on the information obtained from the investigation, a qualitative human health exposure assessment (EA) for the Site has been completed. The purpose of the assessment was to qualitatively determine the route, intensity, frequency and duration of potential human exposures to the COCs. The assessment evaluates the exposure setting (site characteristics), characterizes fate and transport properties of the COCs, and identifies the elements of exposure pathways that could lead to potential human health exposures. The EA includes characterizing exposed populations, if any.

An exposure pathway describes how exposure to a site contaminant may occur. The five elements of an exposure pathway include: 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. Release and transport mechanisms are the way the contaminant may be brought into contact with a receptor. The point of exposure is the location where exposure may occur. An exposure route is the manner in which the contaminant can enter the receptor body (inhalation, dermal absorption, ingestion or penetration). The receptor population is the group likely to be exposed at the point of exposure.

It has been demonstrated that PCE and its degradation products and a trace quantity of petroleum solvents exist at this Site. These contaminants, however, pose no risk to humans if one or more of the five exposure pathway elements do not exist.

This Site will be served by municipal water and sewer utilities. Any structure used for human occupancy will have a sub-slab depressurization system installed to alleviate any residual risk due to vapor instrusion potential. Pursuant to Section 4.8 of the Work Plan, this EA focuses on future commercial site use, and considers the potential for impact to construction workers during site development.

5.1 Exposure Setting

The potential exposure setting at this Site is directly related to proposed land use for the subject site. The likely commercial use of the property will be commercial retail or restaurant establishment, and the Site will contain a Declaration of Covenants and Restrictions, which will limit the use of the Site to commercial / industrial uses. Based on the proposed plans for the Site, the bulk of the site would be covered with either a slab on grade building or paved parking area. There will be little vegetative ground cover with exception of near building landscaping and a small portion of the site perimeter with turf or other vegetative ground cover.

5.2 Potential Exposure Pathways

An exposure assessment considers the following five elements of an exposure pathway:

- Contaminant sources.
- Contaminant source release and transport (migration) pathways.
- An exposure point (location or area where contacts can occur).
- An exposure route (“uptake” mechanism, i.e. ingestion).
- A receptor population.

An exposure pathway is complete when all five elements are present and documented. An exposure pathway can be eliminated if any one of the five elements does not exist in the past, present or future conditions. A potential exposure pathway exists if any one of the five elements comprising an exposure pathway is not documented. Each element of an exposure pathway is discussed below.

5.2.1 Contaminant Source

The likely contaminant source would be volatilization from groundwater, but could also be volatilization as contaminants desorb from soil. The site has been shown to contain PCE and its daughter products, primarily trichloroethylene, 1,1-dichloroethylene, or vinyl chloride. There are additional chlorinated ethenes and ethanes that can be formed from degradation of PCE, but in much smaller proportion to the dominant species found. This source is residual after the soil excavation performed in January 2005.

5.2.2 Contaminant Release and Transport Mechanisms

The contaminant release mechanism to groundwater is either desorption from soil particles and advective transport downgradient with groundwater flow, or to a much lesser degree, molecular dispersion in all directions. As the site investigation concluded that the source area was removed and no free phase DNAPL exists in the shallow or deep environment, the source of contaminants available for transport is residual contamination in the subsurface. Another release and transport mechanism is volatilization of contaminants into the soil vadose zone and transport as a gas either to atmosphere or into a structure through its foundation.

5.2.3 Exposure Points

Exposure points are the locations where exposure to contaminants might occur. The most likely exposure point is inside the commercial structure erected at the site. A secondary exposure point would be in areas of excavation during site development or repair to subterranean utilities.

5.2.4 Exposure Routes

Exposure routes for the COCs are inhalation and dermal absorption. All of the COCs are volatile and capable of penetrating through the skin if contact with affected soil is made and remains over a moderate time period.

5.2.5 Receptor Population

The receptor populations are workers and customers of the commercial establishment, and construction and utility repair workers performing construction or repair services within the designated soil zone (refer to Soil Management Plan).

A summary of EA elements evaluated for these contaminants is presented in Tables 5A through 5E below.

Table 5A - Release and Transport Mechanisms

Receiving Medium	Pathway	Release Sources
Air	• Vapor migration from contaminated subsurface soil and groundwater into buildings and to outdoor locations.	• Surface soils • Shallow groundwater plume • Subsurface soils
Groundwater	• Downgradient migration of contaminated groundwater to off-site areas.	• Subsurface soils

This EA considered direct contact with contaminants by potential receptors. Direct contact exposure may result from contacting contaminants at their source location.

Table 5B – Exposure Points

Contaminated Medium	Points of Exposure
Subsurface Soils / Groundwater	During Construction Activities: • Contact with affected medium within affected soil management zone during site excavation or significant grading activities.
Groundwater	• Vapor intrusion inside future commercial building.

Table 5C – Exposure Routes

Residual Contaminated Medium	Routes of Exposure
Subsurface Soil	Dermal absorption, inhalation
Groundwater	Ingestion, Inhalation, Dermal absorption

Table 5D – Receptor Population

Land Use and Population Analysis		
Conditions	**Description**	**Activity Analysis**
Land Uses	- Site is zoned for commercial use.	- Current and expected future conditions.
	- Land to the east, west, and south is under commercial use.	- Current and expected future conditions.
Potential Receptor Populations Relative to Site	<u>On-Site future use</u>: - Indoor commercial workers / customers.	- Current and expected future conditions. - Standard work day/ week schedules.
	- Construction workers (indoors and outdoors).	- Occasional activities; current and expected future conditions.

Table 5E – Summary of Conceptual Exposure Analysis completes the EA. This table indicates the completed pathways for exposure to site contaminants and recommends action to mitigate these pathways. Potentially completed exposure pathways to site contaminants are limited to subsurface excavation activities. A Soil Management Plan, engineering and institutional controls are proposed to mitigate these pathways.

Table 5E – Summary of Conceptual Exposure Scenario Analyses

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Complete?	Reason for Selection or Non-Selection	Exposure Risk	Action
On-Site Construction Worker	Ingestion of groundwater	No	Municipal water supply serves area.	NA	NA
	Inhalation of volatiles from subsurface soils	Yes	Incidental exposure during excavation activities.	Minimal**	Soil Mgmt Plan
	Inhalation of volatiles from shallow groundwater	Yes	Incidental exposure during excavation activities.	Minimal**	Soil Mgmt Plan
	Dermal contact with shallow groundwater	Yes	Exposure during excavation activities.	Minimal *	Soil Mgmt Plan
	Dermal contact with subsurface soils	Yes	Exposure during excavation activities.	Minimal **	Soil Mgmt Plan

Table 5E – Summary of Conceptual Exposure Scenario Analyses (Continued)

Potentially Exposed Population	Exposure Route, Medium and Exposure Point	Pathway Complete?	Reason for Selection or Non-Selection	Exposure Risk	Action
On-Site Future Worker	Ingestion of groundwater	No	Municipal water supply serves area.	NA	NA
	Inhalation of volatiles from subsurface soils	No	New building to have sub-slab depressurization system.	NA	NA
	Inhalation of volatiles from shallow groundwater	No	New building to have sub-slab depressurization system.	NA	NA
	Dermal contact / ingestion of shallow groundwater	No	Municipal water supply.	NA	NA
	Dermal contact with surficial soils	No	No exposure - majority of site is to be paved / landscaped / covered by site structure	NA	NA
	Dermal contact with subsurface soils	No	No exposure - majority of site is to be paved / landscaped / covered by site structure	NA	NA
Off-Site Construction Worker	Inhalation of volatiles from shallow groundwater	Yes	Incidental exposure during excavation activities.	Minimal	Soil Mgmt Plan
	Dermal contact with shallow groundwater	Yes	Exposure during excavation activities.	Minimal *[1]	Soil Mgmt Plan

Notes:

* Groundwater contaminant concentrations of 1 ppm or less indicate minimal risk to human health from incidental dermal contact.

** Soil is impacted within designated Site zone. Remedial excavation / controlled management of soil disturbance during site redevelopment will minimize exposure.

NA Not Applicable

Unless otherwise noted, rationale applies to both current and future conditions.

6.0 SITE USE: RESTRICTED COMMERCIAL / INDUSTRIAL

The Declaration of Covenants and Restrictions (Attachment 3) will limit the use of the Site to restricted commercial/industrial use. The Town of Cicero currently zones the site for regional commercial use. The Declaration of Covenants will prohibit use or discharge of groundwater and will require soil be managed in accordance with the Soil Management Plan. A sub-slab depressurization (SSD) system will be required to be installed in renovated or newly constructed structures intended for human occupation at this Site.

7.0 SITE REMEDY

The remedy for this site was selected based on the information obtained throughout the course of the site characterization that included an extensive investigation of the shallow groundwater quality, surficial soil analyses, review of historical site investigations, a remedial excavation and a 2006 IRM (chemical oxidation) and a second 2007 chemical oxidant application performed in accordance with a DEC-approved work plan. The crucial action was the remedial excavation that removed the bulk of the site contamination under the former dry cleaner sump. The residual groundwater plume was targeted for localized interruption by the 2006 IRM and was more broadly addressed through the 2007 chemical oxidant application. Based on the groundwater data, a trend has emerged for declining groundwater concentrations. Both chemical oxidation applications were intended to accelerate this decline by targeting the plume to reduce its impact. The primary issue related to this Site is soil vapor intrusion, however, this issue will be addressed through engineering controls. The nature of chlorinated solvent impact requires that engineering controls be implemented as a precaution to eliminate a the potential exposure pathway.

7.1 Monitored Natural Attenuation

In conjunction with the source removal completed and the two chemical oxidant applications, the proposed remedy for additional environmental improvement at this site is monitored natural attenuation. The primary source area was removed in January 2005 and four quarterly samples collected from RW-1 (installed in the former sump area) have shown VOC concentrations of 69 ppb or less in comparison to a pre-excavation concentration of 164,800 ppb (164.8 ppm).

7.2 Overall Protectiveness of Public Health and Environment

The proposed remedy has included a source area removal that left residual contamination and an two chemical oxidant applications that impeded and reduced the groundwater plume. These actions, coupled with the Declaration of Covenants and Restrictions, will prevent completion of all potential public health exposure pathways. The remedy is therefore protective of public health and represents a significant improvement from the initial site conditions.

7.3 Short-Term Effectiveness and Impact

In the short term, groundwater concentrations remain above the State guideline concentrations, but are shown to be declining due to source area removal completed in January 2005 and active impedance of plume migration and limited reduction through the two chemical oxidant applications. The observed result is a declining groundwater concentration trend.

7.4 Long-Term Effectiveness and Permanence

The proposed remedy will produce a continued improvement of site conditions. The remedy protects human health through institutional and engineering controls, but is anticipated in the long term to stand alone to render the site to a minimal health concern even for subsurface excavation. Analytical results from samples of the soils excavated to construct the remedial trench for the 2006 IRM illustrate this point. In the fall of 2005, soils excavated to construct the remedial trench were shown to contain a maximum of 15 µg/kg of total VOCs. The plume itself has shown decreasing concentrations. In the 32 month period since source area excavation, groundwater concentrations decreased, not precipitously, but rather more slowly. This scenario is consistent with plume decay.

7.5 Reduction of Toxicity, Mobility or Volume

The residual compounds present on the site retain their toxicity and mobility. Over the near term, degradation of the chlorinated solvents can produce daughter products of varying toxicity. The primary improvement results from reduced contaminant volume. This was accomplished in three actions: the source area removal that excavated and disposed of approximately 180 to 200 cubic yards of impacted soil from directly beneath the release point and the two chemical oxidant applications. Based on data gathered to date, the plume is in decay.

7.6 Implementability

The proposed remedy is implementable in that the source area excavation was completed in January 2005 and two chemical oxidant applications were performed in May 2006 and September 2007. The Operations, Maintenance and Monitoring Plan requires that eight consecutive quarters of groundwater samples be collected and analyzed to demonstrate that the plume continues its decline. At the conclusion of the quarterly groundwater monitoring, a summary report shall be prepared that draws conclusions on the progress toward site improvement and will include recommendation for future actions on the basis of the data.

The Operations, Maintenance, and Monitoring (OM&M) Plan for Groundwater (Attachment 4) details the wells, analytical methods, and reporting for OM&M actions to monitor groundwater quality for eight consecutive quarters following DEC issuance of a site release.

8.0 NO NEED FOR FURTHER REMEDIATION

The activities completed to date support the issuance of the Release and Covenant Not to Sue pursuant to the Voluntary Cleanup Agreement.