FOCUSED
INTERIM REMEDIAL MEASURE
WORK PLAN

ANDERSON CLEANERS SITE
5 HUNT ROAD
JAMESTOWN, NEW YORK
BCP #C907027

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1.0 INTRODUCTION

This document presents a conceptual site model and describes a focused Interim Remedial Measure (IRM) for the Anderson Cleaners, Inc. facility in Jamestown, New York (Anderson Cleaners). The focused IRM is intended to address source removal, sub-slab vapor mitigation and off-site groundwater impact.

Anderson Cleaners entered the Brownfield Cleanup Program (BCP) administered by the New York State Department of Environmental Conservation (NYSDEC) on October 14, 2004. Anderson Cleaners is located at 5 Hunt Road, Jamestown, New York (the "Site") and it is identified as BCP site #C907027. A project locus map is included as Figure 1.

The approximate 2.4-acre Site, located partially in the City of Jamestown and partially in the Town of Ellicott, New York, is currently improved with an approximate 11,400-square foot one-story brick and concrete block building. The Anderson Cleaners building was built in phases with the southwest portion constructed in the 1930's; the south-central portion constructed in 1947; and the northern and eastern portion constructed/re-constructed in 1985 (i.e., following a fire that destroyed a portion of the building). The Site is currently serviced by municipal (City of Jamestown) water and sewer systems. Reportedly, septic systems were never located on the property. Currently, five floor drains are present inside the building (i.e., within the garage area, the laundry area, rug cleaning area, boiler room and dry cleaning area) and these drains discharge to the sanitary sewer system. A 21-inch storm sewer is located on the east side of the Anderson Cleaners building. Roof drains from the building are connected to this storm sewer and a catch basin for the storm sewer is located in a parking lot on the east side of the Site. A 6-inch diameter clay tile pipe located in the Courtyard Area of the Site is also connected to the storm sewer (refer to Section 2.1). The sanitary and storm sewers in proximity of the Site flow to the south and east. A Site Plan, including locations of underground utilities at the Anderson Cleaners facility, is included as Figure 2.

1.1 Site History

The Site was initially developed in the 1930's as a towel factory, and by the mid-1940's Anderson Cleaners occupied the Site and operated a dry cleaning business. The building was expanded over the years. In 1985, a fire destroyed the northern and eastern portions (approximately 8,000 square feet) of the building and some dry cleaning equipment suffered heat damage. It is believed that dry cleaning fluids were released to the environment as a result of the fire. Following the fire, the Anderson Cleaners building was remodeled and reconstructed resulting in the current structure.

Stoddard Solvent was used for dry cleaning operations from approximately 1947 to 1978. The Stoddard Solvent was stored in two underground storage tanks (USTs), each with a capacity of approximately 1,100 gallons. These USTs were located in the area that is currently used for cold storage (refer to the Site Plan included as Figure 2). Available information indicates that the tanks were installed at the time the south-central portion of the building was constructed (i.e., 1947). The use of Stoddard Solvent was discontinued around 1978 when tetrachloroethene (PCE) was first used as the primary dry cleaning agent. Reportedly the Stoddard Solvent USTs were removed when the building was reconstructed in 1985. In 2002, new dry cleaning equipment that used a hydrocarbon-based solvent (DF 2000) was installed and all use of PCE was discontinued at the Site.

2.0 CONCEPTUAL SITE MODEL

This section presents a conceptual site model that describes subsurface conditions, groundwater flow and contaminant types/distribution patterns based upon work completed to date.

2.1 Subsurface Conditions

The Site is underlain by overburden deposits that extend to depths of about 16.3 feet to 22.0 feet below the ground surface. Fill material typically comprised of silty sand and gravel often intermixed with pieces of bricks, concrete and wood is present below surface coverings that consist of lawn/landscape areas, asphalt pavement or buildings. The fill material extends to depths ranging from about 2^+ feet to 8 feet below the ground surface. In some of the test borings advanced at the Site, an approximate 0.5-foot layer of peat was encountered below the fill material. However the fill materials typically overlay glacial deposits consisting of interbedded mixtures of sandy silt and clayey silt often containing lesser amounts of sand, gravel and occasional cobble-size material. In some locations, the sandy silt and clayey silt deposits contain seams of sub-angular to rounded gravel and sand (i.e., likely deposited via glacial melt water). The sandy silt and clayey silt deposits are approximately 4 feet to 12 feet thick extending beneath the fill to the top of a glacial till deposit. The glacial till is typically medium dense gray-brown silty sand with lesser amounts of clay and rock fragments. The glacial till is approximately 3 feet to 7 feet thick extending to the top of fractured shale bedrock and it is winnowed with seams of permeable sand and gravel evident in some locations. The indigenous soil is typical of the ground moraine deposits common in the area of the Site.

It is anticipated that a weathered shale layer (i.e., attributable to glacial scour and groundwater movement) may extend for 10 or more feet from the base of the glacial till until competent bedrock is encountered at suspected depths of about 31 to 33 feet below the ground surface. The weathered shale at the top of rock is a prominent water-bearing zone beneath the Site. Geologic cross sections along lines A-A' and B-B' (refer to Figure 2 for cross section locations) are included as Figure 3.

During subsurface studies conducted within the "Courtyard Area" of the Site (refer to Figure 2), a 6-inch diameter clay tile pipe was encountered in the approximate center of the Courtyard beginning at a depth of approximately 2^+ feet below the ground surface. This 6-inch clay tile pipe extends to the southwest the entire length of the Courtyard and upon exiting the Courtyard the pipe changes direction and heads generally east. Dye testing indicated that the 6-inch clay tile pipe ultimately discharges into a storm sewer located within a parking lot on the eastern side of the building at the Site. As shown on Figure 2, the roof drains for the Finishing and Laundry/Dry Cleaning portions of the Anderson Cleaners building are connected to the clay tile pipe. During subsurface studies, an approximate 4-foot long section of the clay tile pipe (i.e., located near the connection of the roof drain from the Laundry/Dry Cleaning portion of the Anderson Cleaners building in the Courtyard Area) was found to be broken. Testing of soil samples collected from the Courtyard Area, in proximity of the broken clay tile pipe, indicated the presence of concentrations of tetrachloroethene (PCE) that exceeded 60 parts per million (ppm) and lower concentrations of associated breakdown products.

2.2 Groundwater Conditions

Test borings advanced via direct push methodologies encountered refusal at depths of about 10 feet to 15 feet below the ground surface (i.e., terminating at or near the top of the glacial till). The groundwater levels in monitoring wells installed within these test borings (designated herein as top of glacial till monitoring wells) were measured at depths ranging from about 1 to 5 feet below the ground surface. Test borings advanced by conventional rotary drilling techniques were able to penetrate the glacial till. The groundwater levels in monitoring wells installed within these test borings (designated herein as bottom of glacial till monitoring wells) were measured more than 2 feet above the ground surface exhibiting flowing artesian conditions. In locations where a top of glacial till monitoring well and a bottom of glacial till monitoring well were installed in proximity, upward hydraulic gradients were evident.

Groundwater generally flows to the east-southeast across the Site in both the top of glacial till and bottom of glacial till zones. During the August 18, 2005 monitoring event, an average horizontal gradient of 0.011 ft/ft was calculated in the bottom of glacial till monitoring wells. Based upon the testing conducted to date, an average hydraulic conductivity of 6.83×10^{-3} cm/sec was measured in selected bottom of glacial till monitoring wells. Using the average values for horizontal gradient and hydraulic conductivity and an assumed porosity value of 0.35 to 0.50, a groundwater velocity within the bottom of glacial till zone was calculated to range between about 0.43 ft/day and 0.62 ft/day.

2.3 Contaminants of Concern

As discussed previously, the Site has been used for dry cleaning operations and PCE was previously used as the primary dry cleaning agent. In the past, PCE entered the subsurface and this has resulted in PCE and associated and breakdown product impact to the soil and groundwater at the Site. The contaminants of concern (COC) identified in soil and groundwater at the Site include:

- tetrachloroethene (PCE)
- trichloroethene (TCE)
- 1,1-dichloroethene (1,1-DCE)
- cis-1, 2-dichloroethene (cis-1, 2-DCE)
- trans-1, 2-dichloroethene (trans-1, 2-DCE)
- vinyl chloride (VC)
- 1,1,1-trichloroethane (1,1,1-TCA)
- Dense Non-Aqueous Phase Liquid (DNAPL)

2.4 Contaminant Distribution and Migration

The highest concentrations of COC were measured in soil and groundwater samples collected in proximity to the Courtyard Area of the Site. COC, in the form of DNAPL and dissolved constituents, have migrated to the east-southeast through the groundwater. It is also possible that some preferential migration has occurred along the bedding of the 6-inch clay tile pipe and potentially along other buried utilities crossing the Site.

Since July 2006, DNAPL has been observed, and removed from, monitoring well MW-204 (located in the Courtyard Area in the vicinity of the break in clay tile pipe). [Note: Monitoring well MW-204 is constructed of 4-inch diameter PVC riser and screen that extends to a depth of approximately 16 feet below the ground surface.] Evidence of DNAPL was observed on the soil during the advancement of test boring B-2 (MW-02), located approximately 5 feet south of MW-204. However, since its installation on May 6, 2005 DNAPL has not been observed in groundwater monitoring well MW-02. [Note: Groundwater monitoring well MW-02 is a 2-inch diameter groundwater monitoring well constructed of stainless steel with a screened interval between 14.5 and 19.5 feet below the ground surface and a collection sump extending an additional 2 feet beyond the screen. Thus, B-2

(MW-02) is 21.5 feet deep. Groundwater in this monitoring well typically is measured above the existing ground surface and it appears that this upward gradient prevents DNAPL from entering this monitoring well.] Following recent cleaning/development, physical evidence of DNAPL has also been detected in monitoring well MW-207 and potentially monitoring wells MW-7.1 and PW-2 (i.e., based on elevated PID readings). As shown on Figure 2, monitoring well MW-207 is located approximately 7 feet outside the southeastern wall of the garage portion of the Anderson Cleaners building; monitoring well MW-7.1 is located within the garage portion of the building and monitoring well PW-2 is located within the boiler room portion of the building.

To assess the potential extent of DNAPL, the above findings and historic groundwater data were reviewed. Assuming a PCE concentration of 20 ppm or greater is an indicator of DNAPL, an eastward trending plume is evident extending from the Courtyard Area to beyond the southeastern corner of the Anderson Cleaners building (refer to Figure 4). The data indicates that the DNAPL has not migrated through the glacial till layer. This appears to be due to the physical consistency of the DNAPL and the lower relative permeability of the till layer in conjunction with the upward hydraulic gradient created by the artesian conditions.

The DNAPL provides a constant source of dissolved phase PCE and other COC (i.e., the result as breakdown products) in the groundwater. It is possible that some preferential dissolved contaminant flow could occur along buried utilities and this appears to be supported by the concentrations of COC measured in samples collected from monitoring well MW-201, which is positioned adjacent to a 4-inch diameter sanitary sewer located in Huxley Street. A summary of COC concentrations measured in the groundwater samples collected from monitoring wells installed at the Site is depicted on Figure 4.

3.0 REMEDIATION CONDUCTED TO DATE

In conjunction with studies completed to characterize conditions at the Site, some remedial activities have been undertaken to remove contaminant sources and reduce environmental impact. This section describes the status of the remedial efforts conducted to date.

3.1 Courtyard Area Soil Removal

In July 2005, a soil removal IRM was conducted to remove grossly contaminated soil and associated groundwater from the Courtyard Area of the Site (refer to Figure 2). During the July 2005 IRM, approximately 46 tons of soil was removed and transported off-site for disposal.

3.2 Bioremediation Pilot Test

On January 5, 2007, a bioremediation pilot test was initiated in a location downgradient of the identified source area at the Site. This test consisted of injecting a solution of CL-Out microbes (i.e., *Pseudomonas*, a patented strain of aerobic microbes manufactured by CL Solutions, Inc.) and dextrose (i.e., a nutrient source) into two locations (i.e., MW-206 and MW-208). [Note: CL-Out microbes are delivered freeze-dried and each unit has to be hydrated in 55-gallons of potable water 24 hours prior to inoculation. Immediately before the inoculation, 50 pounds of powdered dextrose is dissolved into the hydrated microbe solution. As such, each unit of CL-Out microbe solution consists of 55-gallons.] One "unit" of CL-Out solution was injected into MW-206 and one "unit" was injected into MW-208 during the January 5, 2007 inoculation. On January 6, 2007, a solution of ORC Advanced (i.e., created by dissolving 25 pounds of ORC Advanced in 55 gallons of potable water) was injected into MW-206 and MW-208 (i.e., approximately 25 gallons in each location) to increase dissolved oxygen levels and support microbe growth.

Prior to the January 5, 2007 inoculation, background samples were collected from monitoring wells MW-04, MW-06, MW-07 and MW-201 on January 4, 2007. These samples were tested for field indicator parameters (i.e., dissolved oxygen, ORP and pH) and submitted to an analytical laboratory for testing of halogenated volatile organic compounds (VOCs). To evaluate the effectiveness of the inoculation, samples were collected on February 13, 2007 and March 15, 2007 from monitoring wells MW-04, MW-06, MW-07 and MW-201 and tested for microbe populations and/or halogenated VOCs. The microbe test results for the sample collected on February 13, 2007 indicated the presence of *Pseudomonas* microbe populations in each monitoring well, with the exception of MW-04. Although the microbe populations were lower than the target level of 1×10^{6} CFU/ml, the presence of the *Pseudomonas* microbes in these wells suggests that microbes injected in MW-206 and MW-208 propagated and migrated to the downgradient wells in sufficient populations to promote biodegradation. The VOC test results measured as part of the bioremediation pilot test are included on Figure 4 and summarized in the following table.

Constituent	Sample Locations and Sample Dates											
	MW-04			MW-06			MW-07			MW-201		
	1/4/2007	2/13/2007	3/15/2007	1/4/2007	2/13/2007	3/15/2007	1/4/2007	2/13/2007	3/15/2007	1/4/2007	2/13/2007	3/15/2007
PCE	1,820	1,120	904	369	256	246	5,310	6,440	4,240	14,200	2,610	423
TCE	U (200)	U (200)	U (100)	U (4.0)	U (5.0)	U (5.0)	U (200)	U (200)	U (200)	U (200)	17,500	937
trans 1,2-DCE	U (200)	U (200)	U (100)	U (4.0)	U (5.0)	U (5.0)	U (200)	U (200)	U (200)	U (200)	1,290	94.4
cis 1,2-DCE	U (200)	U (200)	U (100)	U (4.0)	U (5.0)	U (5.0)	U (200)	U (200)	U (200)	U (200)	7,860	U (20)
VC	U (200)	U (200)	U (100)	U (4.0)	U (5.0)	U (5.0)	U (200)	U (200)	U (200)	U (200)	U (200)	U (20)
Total VOCs	1,820	1,120	904	369	256	246	5,310	6,440	4,240	14,200	29,260	1,454

Notes:

All samples tested for halogenated VOCs by USEPA Method 8260B and concentrations are shown in ug/L or parts per billion.

U (200) = constituent not detected at the concentration shown in parenthesis.

PCE = tetrachloroethene

TCE = trichloroethene

trans 1,2-DCE = trans 1,2-dichloroethene

cis 1,2-DCE = cis 1,2-dichloroethene

VC = vinyl chloride

As shown in the above table, total VOC concentrations decreased in each monitoring well sample from the pre-test (background) measurements made on January 4, 2007 to the post-test measurements made on March 15, 2007. Based on this finding, the injection of CL-Out microbes is considered a viable option for future remediation of groundwater impacts at the Site.

3.3 DNAPL Removal

As described in Section 2.4, DNAPL has been encountered in monitoring wells MW-204 and MW-207. This DNAPL is routinely removed using a portable vacuum purge system that consists of dedicated polyethylene tubing connected to a 5-gallon vacuum rated collection Carboy with a Rotary Vane Sampling Pump as manufactured by Allegro Industries to create a vacuum to allow removal of DNAPL from the monitoring wells. Between November 8, 2006 and August 18, 2007, a total of approximately 7.5 gallons of DNAPL was removed from monitoring wells MW-204 and MW-207. The DNAPL removed is stored in a 55-gallon drum located in a waste accumulation area constructed within the Courtyard Area of the Site. During the removal of DNAPL, groundwater and associated sediments are also removed. Grossly contaminated groundwater (i.e., based upon physical evidence of impact and/or elevated PID readings) and soil are placed in a waste accumulation drum (i.e., separate from the DNAPL collection drum), which is also located in the Courtyard Area. Water that does not exhibit obvious environmental impact is placed in a 55-gallon drum filled with activated granular carbon. This drum is fitted with a bottom discharge valve and this valve is opened as needed to allow the treated water to discharge from the drum. Samples of the discharged water are routinely screened with a PID for evidence of impact to determine when the activated granular carbon needs to be replaced.

4.0 FOCUSED INTERIM REMEDIAL MEASURES

Based upon the conceptual site model presented in Section 2.0, DNAPL is an on-going source of COCs within the soil, groundwater and soil vapor at the Site. As such, the intention of this focused IRM is to address the DNAPL source at the same time that sub-slab vapors and the COC groundwater impact identified in monitoring well MW-201 are mitigated. After these issues are adequately addressed, remedial schemes can be developed for other impacted media.

4.1 Source Removal

The effective long-term remediation of the COC's at the Site will require the removal of DNAPL. To this end, initially three additional DNAPL monitoring/removal points (designated WP-1, WP-2 and WP-3) are proposed inside, the boiler room and garage area of the Anderson Cleaners building (refer to Figure 5). These DNAPL monitoring/removal points will consist of hand-driven 1.25-inch diameter wells points constructed of a stainless steel well screen attached to carbon steel casing. It is anticipated that each well point will be driven to a depth of about 15 feet below the ground surface (i.e., into the top of the glacial till).

Following installation, the DNAPL monitoring/removal points will be developed to remove drilling fines and assure the monitoring points are functioning properly. Thereafter, DNAPL will be removed from WP-1, WP-2 and WP-3 (if encountered) and existing wells MW-204 and MW-207. The removal frequency will depend on the rate of DNAPL generation, but it is anticipated that initially removal will be undertaken daily, and the removal rate will be adjusted as necessary. The DNAPL removal will be done using the portable vacuum purge system described in Section 3.3. The DNAPL removed will be placed in a 55-gallon collection drum(s) for subsequent disposal at an approved facility. Water collected during the purging will be placed in a drum filled with activated granular carbon and the treated water will be discharged into the sanitary sewer system. The Jamestown Board of Public Utilities (BPU) was contacted regarding discharge requirements for this water. It was agreed that a sample of the water exiting the treatment drum will be collected and tested for halogenated VOCs via USEPA Method 8260A. If the test results indicate that this water has a total VOC concentration acceptable to the Jamestown BPU, it will be discharged to the sanitary sewer system. Assuming the concentration of the discharge water acceptable, subsequent samples will be collected at maximum 6 month intervals, or sooner if observation and/or screening with a PID indicates potential impact. If the discharge limit is exceeded, the granular activated carbon drum will be replaced with "new" material and the spent carbon drum will be disposed of in accordance with applicable regulations.

Note: Although DNAPL has never been identified in monitoring well MW-02; this well will be decommissioned (i.e., tremie grouted) as a precaution to eliminate a potential pathway from the source area into the top of rock zone.

The well installation and DNAPL removal will be completed in accordance with the Health and Safety Plan (HASP) well decommissioning included as Appendix G in the existing RI Work Plan (refer to Section 6.0).

Based upon the evaluation of the data collected from the initial DNAPL monitoring/removal points, future points may be considered in other locations. The intent of such installations would be to sufficiently characterize and remediate DNAPL at the Site. If additional DNAPL monitoring/removal wells are required, a supplemental IRM work plan will be submitted.

Subsequent to the completion of DNAPL removal to the extent deemed practical (i.e., as defined the presence trace amounts of the DNAPL), additional treatment options will be proposed (if necessary) to address the residual DNAPL impact in the soil and groundwater. This treatment could include treatment via oxygen injection, chemical oxidation, biological treatment or other suitable methodology. Details regarding the residual DNAPL treatment will be provided in a supplemental IRM work plan.

4.2.1 COC Impact at MW-201

Prior to the bioremediation pilot test described in Section 3.2, groundwater samples collected from monitoring well MW-201 contained elevated COC concentrations. However, the total COC concentrations measured in a groundwater sample collected from MW-201 on March 15, 2007 (i.e., approximately 10 weeks subsequent to the January 5, 2007 bioremediation pilot test) decreased by 89.8% when compared to the pre-test value. To evaluate current groundwater conditions, MW-201 will be redeveloped and sampled. This sample will be submitted to an analytical laboratory for testing of halogenated VOCs using United States Environmental Protection Agency (USEPA) Method 8260 to evaluate the long-term effectiveness of the bioremediation conducted on January 5, 2007. It is possible that COC concentrations could have rebounded from the levels measured on March 15, 2007 due to impact from an upgradient source (e.g., the impact of the DNAPL source on downgradient groundwater quality).

Subsequent to the background testing, and assuming that the COC concentrations in MW-201 have not decreased substantially since the March 15, 2007 sample event, an inoculation of CL-Out microbes will be completed. This inoculation will consist of the placement of a total of two units of CL-Out microbes into injection wells MW-206 and MW-208 coupled with the placement of approximately 25 pounds of ORC Advanced to enhance dissolved oxygen levels. Approximately four weeks following the initial inoculation, interim samples will be collected from the downgradient monitoring well MW-201 and tested for in-situ pH, oxygen reduction potential and dissolved oxygen. In addition, samples will be collected and tested for microbe counts and halogenated VOCs. Approximately four weeks after the interim sample event, an initial round of quarterly samples will be collected from selected downgradient monitoring well. These samples will be tested for field parameters and halogenated VOCs to assess the effectiveness of the treatment. Following a review of the test results, additional remedial activities may be implemented.

4.3 Treatment Goals

To assess the effectiveness of remediation at the Site, it will be important to establish goals that are protective of human health and the environment. To this end, the treatment goals of the remedial effort described herein will include:

- Removal of DNAPL to the extent practicable;
- addressing the COC impact at MW-201 to ensure potential off-site receptors are not exposed to levels above regulatory concern;
- development of a long-term environmental management plan to implement institutional and engineering controls designed to control/reduce impacts associated with the COCs;

- development and recording of deed restrictions, which will limit the use of the Site to commercial and industrial purposes and prohibit the use of potable groundwater on the property; and

- completion of quarterly compliance monitoring using monitoring wells MW-200, MW-201, MW-202 and MW-203 to assess off-site impacts and determine the need for additional remedial efforts.

5.0 Schedule

This section describes the anticipated implementation schedule of the remedial activities described in this focused IRM work plan.

Source Removal

- Installation and development of well points WP-1, WP-2 and WP-3: completed on August 31, 2007
- DNAPL removal MW-204, MW-207 (and WP-1, WP-2 and WP-3, if necessary): on-going, time to complete removal to be determined
- Evaluation of DNAPL quantities and submittal of recommendations for additional DNAPL monitoring/collection wells (if deemed necessary): October 12, 2007

COC Impact MW-201

- Redevelopment, sampling and testing of MW-201: September 12, 2007 (receipt of test results)
- Initial inoculation of CL-Out microbes and ORC Advanced in MW-206 and MW-208: October 5, 2007
- Collection of interim samples to assess microbe counts and halogenated VOCs: November 2, 2007
- Collection of quarterly samples from monitoring wells MW-200. MW-201, MW-202 and MW-203 to assess halogenated VOC reduction and assess need for treatment modifications: on or about December 7, 2007, March 7, 2008, June 6, 2008 and September 5, 2008
- Submittal of supplemental work plan to address off-site COC impact (if required): 60 days after receipt of 4th quarterly sample results

6.0 REFERENCES

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