Former Loudon and Kem Cleaners
Operable Unit 02 – Off-Site Groundwater
Albany County
Albany, New York

Groundwater Monitoring and Sampling Plan

NYSDEC Site Number: 401060
Operable Unit 02

Prepared by:
New York State Department of Environmental Conservation
625 Broadway
Albany, NY

April 2018

Contents

Introduction

This groundwater monitoring and sampling plan describes inspection and sampling procedures for the off-site portion (OU2) of the Loudon and Kem Cleaners Site, State Superfund Site No. 401060. The March 2015 Record of Decision called for a soil vapor extraction (SVE) system to remove tetrachloroethene (PCE) from the subsurface, sub-slab depressurization systems (SSDSs) to protect occupants in on-site buildings as needed, and subsurface injections to remediate the off-site PCE groundwater plume. The New York State Department of Environmental Conservation (NYSDEC) executed a Brownfield Cleanup Agreement (BCA) with a Volunteer who has agreed to implement the on-site remedy, and the NYSDEC implemented the off-site remedy.

The off-site remedy to address the PCE groundwater plume that had migrated across Northern Boulevard (see Figure 1) to the Albany Memorial Hospital parking lot was implemented by NYSDEC in October 2017. NYSDEC's contractor, Precision Environmental Services (PES) – see Appendix A for executed work authorization, contracted Regenesis Remediation Services (RRS) to inject PlumeStop with biodechlor inoculum (BDI) and hydrogen release compound (HRC) (herein referred to as "the remedy") to contain the PCE plume, and create an environment suitable for the biodegradation of PCE and its breakdown products.

1.0 Site History

The Former Loudon and Kem Cleaners Site is located at 350 Northern Boulevard in Albany, NY and was listed on the hazardous waste registry as a Class 2 Inactive Hazardous Waste Disposal facility on January 18, 2011. Two separate tenant spaces within the plaza were occupied by different dry cleaners (Loudon Dry Cleaners, Kem Cleaners, and possibly others) where tetrachloroethene was used from approximately 1954 to 1997. The former drycleaner operations have caused PCE impacts to on-site soils, soil vapor, and off-site groundwater.

The NYSDEC performed the remedial investigation since there was no viable responsible party, and issued the Record of Decision (ROD) on March 6, 2015. The ROD selected on-site soil vapor extraction and vapor mitigation for occupants exposed to PCE via soil vapor intrusion as necessary, and off-site injections to address the groundwater plume that had migrated across the street.

The NYSDEC executed a Brownfield Cleanup Agreement (BCA) with a Volunteer on September 8, 2016 to address the on-site remedy as described in the ROD, and the NYSDEC addressed the off-site PCE plume that had migrated across the street beneath the Albany Memorial Hospital parking lot. PES and RRS implemented the

remedy, which requires groundwater monitoring to determine the remedy's effectiveness.

2.0 Geology

The overburden geology consists of varied medium to fine sands, silts, and clays. The depth to groundwater varies across the on-site and off-site areas from 13 to 32 feet below ground surface (bgs) (13-20 feet bgs on-site and up to 32 feet bgs off-site). The ground water flow direction is to the southeast.

The off-site groundwater plume is considered a "detached plume", and the elevated off-site concentrations of PCE are likely due to an observed clay lens near MW-18 that has likely absorbed PCE over time, and is acting as a source to groundwater contamination in the parking lot. Prior to a decrease in elevation of the water table towards the end of 2015, the clay lens was more submerged within the saturated zone, but since the significant decrease in elevation of the water table, most of the clay lens likely resides above the water table, which is thought to have caused the decrease in CVOC concentrations since 2015.

Monitoring well MW-18 had shown the highest off-site CVOC concentrations prior to the decrease with the water table elevation, but a groundwater sample can no longer be collected from this well since the depth to water is below the well screen.

3.0 Monitoring and Sampling Plan

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of groundwater monitoring for the site are included below.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of groundwater;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Analytical sampling program requirements;

- Inspection and maintenance requirements for monitoring wells; and
- Monitoring well decommissioning procedures.

Reporting requirements are provided in Section 5.0 of this Monitoring and Sampling Plan.

3.1 Monitoring Wells

Quarterly monitoring at below wells for 2 years (unless otherwise specified by NYSDEC), then annually:

1. Monitoring Well No. 15
2. Monitoring Well No. 18D
3. Monitoring Well No. 23
4. Monitoring Well No. 24
5. Monitoring Well No. 29 – installed by Precision Environmental Services on October 19, 2017 to provide a monitoring location that is immediately downgradient of the PlumeStop remedy.

See Figure 2 for locations of the above wells.

3.2 Monitoring frequency/schedule

The first sampling event occurred on November 29, 2017, so each subsequent monitoring event should be based on a quarterly sampling schedule that is 3, 6, 9, and 12 months apart from this date until November 29, 2019, at which time the sampling schedule will switch to annual, unless otherwise determined by NYSDEC.

3.3 Monitoring Parameters

The below table summarizes the frequencies of monitoring parameters for each well in the monitoring program. In addition to the below samples, a duplicate, matrix spike, and 1 matrix spike duplicate should be analyzed during each sampling event.

Well ID	Parameters – Method	Frequency
MW15 – upgradient	VOCs – EPA Method 8260 Field parameters (ORP, pH, DO, conductivity)	Quarterly for 2 years, then annually
MW18D – within injection grid	VOCs – EPA Method 8260 Iron/Manganese – EPA Method 6010C Methane/Ethane/Ethene – RSK 175 Sulfate Alkalinity Nitrate Nitrite	Quarterly for 2 years, then annually

	Total Organic Carbon Field parameters (ORP, pH, DO, conductivity)	
	Microbial Analysis via standard bio-trap	As determined by NYSDEC/if warranted
MW29 – downgradient	VOCs – EPA Method 8260 Iron/Manganese – EPA Method 6010C Methane/Ethane/Ethene – RSK 175 Sulfate Alkalinity Nitrate Nitrite Total Organic Carbon Field parameters (ORP, pH, DO, conductivity)	Quarterly for 2 years, then annually
	Microbial Analysis via standard bio-trap	As determined by NYSDEC/if warranted
MW23 – downgradient	VOCs – EPA Method 8260 Field parameters (ORP, pH, DO, conductivity) Methane/Ethane/Ethene – RSK 175	Quarterly for 2 years, then annually
MW24 – downgradient	VOCs – EPA Method 8260 Field parameters (ORP, pH, DO, conductivity) Methane/Ethane/Ethene – RSK 175	Quarterly for 2 years, then annually

3.4 Monitoring Well Inspection Procedures

Monitoring wells will be inspected during each sampling event to ensure the monitoring wells are useable for collecting samples, and to determine if any maintenance is necessary such as bolt replacement, replacement of the concrete and/or curb boxes, or any other pro-active maintenance activity as-needed to ensure long-term functionality of the monitoring wells.

3.5 Monitoring Well Decommission Procedures

Once NYSDEC determines that groundwater concentrations have reached asymptotic levels, groundwater monitoring is no longer required and all off-site wells related to the site will need to be decommissioned in accordance with Commissioner Policy 43 – Monitoring Well Decommissioning Policy.

3.6 Monitoring Well Access

Access for groundwater sampling has been granted by the Albany Memorial Hospital – see Appendix B for the access agreement. Advance notice will be given to the hospital prior to sampling activities.

4.0 Reporting

Once groundwater data is analyzed by Test America, it will be sent electronically to NYSDEC. Test America has been contracted by NYSDEC to perform laboratory analysis of collected groundwater samples throughout the quarterly monitoring period – a copy of the executed work authorization is included in Appendix A.

NYSDEC or its contractor will tabulate and update CVOC concentration trend plots, and tabulate field parameters and bioremediation parameters on a yearly basis as determined by the certification period of the Periodic Review Reporting period.

Groundwater data will be entered into EQuIS, NYSDEC's electronic data deliverable format.

5.0 Corrective Measures

If it has been determined, through sampling results or otherwise, that the effectiveness of the remedy has diminished (e.g., significant detections of elevated PCE in downgradient groundwater, elevated groundwater concentrations outside of normal trends at the site, or other indicators that the remedy is performing poorly), a corrective measures work plan will be developed for additional remedial measures as necessary.

Figure 1 - Site Location Map
Former Loudon & Kem Cleaners
Site No. 401060
Albany, NY

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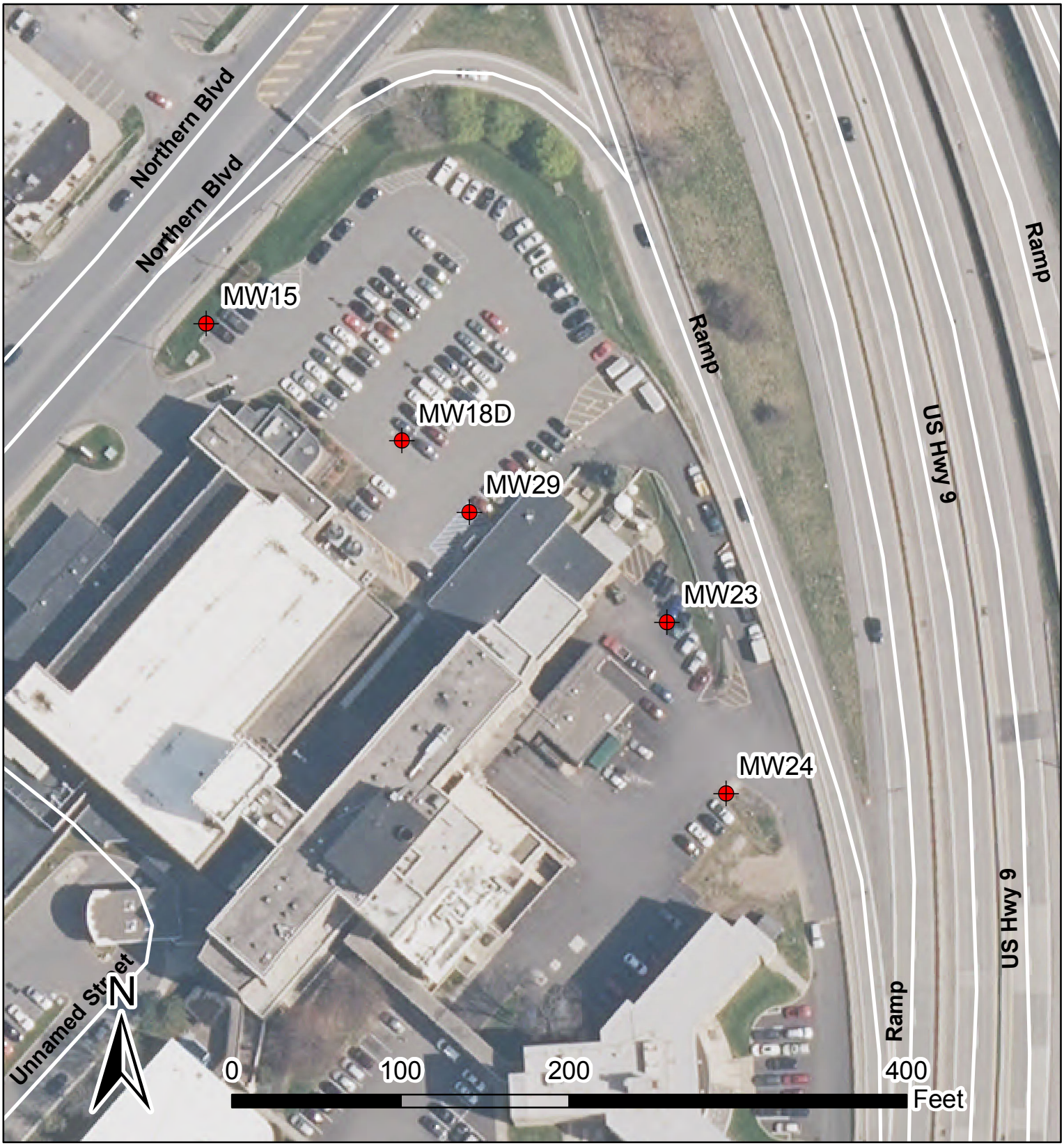

Figure 2
Former Loudon & Kem Cleaners
Performance Monitoring Well locations
Albany, NY

NEW YORK STATE OF OPPORTUNITY
Department of Environmental Conservation

Appendix A

PES and TA Work Authorizations

PES Work Authorization

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION

STANDBY CONTRACTOR AUTHORIZATION FORM
For Response & Containment, Investigation & Remediation

General Information

Region: 4 **Site No.:** 401060 **CallOut ID:** 128450

CallOut Date 11/01/2016

Contract No.: C100614 **PIN (if applicable):**

Contractor Selected: PRECISION ENVIRON SVCS INC (REM)

Site Information - Name: Former Loudon and Kem Cleaners **County:** Albany
Address: 350 Northern Boulevard, Albany

SCOPE OF WORK (Provide brief detailed description):

Scope of Work for Regenesis Injection Remedy as of 7/18/2017

Precision Environmental Services (PES), in conjunction with Regenesis, will implement the PlumeStop Liquid Activated Carbon (PlumeStop) with Hydrogen Releasing Compound (HRC) and BioDechlor Inoculum (BDI) Remedy designed by Regenesis for the Loudon and Kem Cleaners State Superfund Site, Site No. 401060, Operable Unit #02. PES will work with Regenesis to implement the remedy in accordance with Regenesis' attached Proposal, "Delegation of Work Tasks," "Equipment to be supplied by Precision," and the "Staging" Figure that are appended at the end of this work authorization.

Specific responsibilities of PES include:
1. Mark-out of all subsurface utilities and geophysical scanning of the injection locations to ensure the proposed injection locations are not going to contact any utilities,
2. Notify EPA in accordance with 40 Code of Federal Regulations Part 144, EPA's Underground Injection Control (UIC) Program at least 30 days prior to implementation of the remedy,
3. Acquire the necessary hydrant permits or supplying the required amount of water as indicated in Regenesis' Proposal,
4. Arrange the necessary storage space and fencing required for staging the product at the site and coordination with Albany Memorial Hospital,
5. Supply the necessary drill rig – model 6620 or 7822, 120 feet of 1.5 inch rods, a YSI 556 or equivalent with down-hole sensor and groundwater level indicator, along with each item in the attached "Equipment to be Supplied by Precision,"
6. Signing the attached Proposal and paying Regenesis in accordance with the Proposal, and
7. Adding the Albany Memorial Hospital, NYS, and NYSDEC to PES' certificate of insurance.

Regenesis will be supplying the required quantities of remediation agents, mixing equipment, personnel, and a site-specific Health and Safety Plan (HASP) as documented in their Proposal. Regenesis will also provide an Application Summary Report following completion of the injection work which will document the field activities and reagent distribution monitoring.

Following completion of injections, up to 3 monitoring wells will be installed by PES at specific downgradient locations agreed upon by the NYSDEC.

As noted above, Regenesis will be providing a site-specific (HASP) which will be made available to NYSDEC before the start of work. If Regenesis' HASP does not sufficiently cover the drilling work or other tasks that are the responsibility of PES, PES will develop their own HASP before the start of work.

Completed Work:

This updated work authorization is for the continuation of work that began under old Precision's old contract, which expired on October 31, 2016 (under old Call Out ID 126456). Completed Work is listed below. The balance of the funds from Call Out 126456 will be rolled to this call out to continue the related Work, including assistance with pre-design work plan development and data evaluation, coordination and interaction with the injection sub-contractor/chemical provider and NYSDEC. .

Completed Work:

The Contractor shall furnish all labor, equipment, materials, supplies, facilities, power and incidentals as necessary to perform the Work as specified herein, and as directed by the New York State Department of Environmental Conservation (NYSDEC), or the Department. The contractor will follow the technical guidance as detailed in the document "Draft DER-10 Technical Guidance for Site Investigation and Remediation" dated May 2010 (DER-10) or latest available whenever applicable/possible. The Work includes:
A. Drilling of nine (9) soil borings to a depth of 40' below ground surface (bgs) as located on Figures 1 and 2 as determined by the Department. All borings, except GP-5, shall be logged continuously from 15' bgs to termination and be completed by direct push methods unless the soil formation does not permit, in which case a hollow stem auger may be used. GP-5 shall be logged continuously from ground surface to termination. Locations GP-1, GP-5 and GP-7 should be logged via MacroCore (or hollow stem auger/split spoon if soil formation does not permit the use of MacroCore) in order to estimate the fluid acceptance capacity of the formation and verify the vertical distribution of contaminants. At these locations, testing shall include soil sample collection for laboratory analysis of Volatile Organic Compounds (VOCs) and grain size distribution. Soil for potential VOC analysis should be assessed at 2-foot intervals from approximately 25 – 40' bgs. Only select samples may be analyzed for VOCs based on the PID readings. The core logging should be conducted by a geologist with experience logging soils. Particular emphasis should be placed on visual evidence of permeable flow pathways in the cores. Cores should be logged and photographed. Grain size distribution samples should be collected from zones exhibiting obviously different grain size or textures. The number of samples collected for grain size distribution testing is at the discretion of the DEC oversight personnel; up to 15 samples may be collected for analysis.
At the other locations (GP-2, GP-3, GP-4, GP-5, GP-8, GP-9) soil samples to be analyzed for VOCs may be collected at locations where the highest indication of contamination is present based on staining, olfactory indication of contamination, or elevated PID readings. If no indication of contamination is found at a location, then no samples will be taken. For budgeting purposes, up to 12 soil samples to be analyzed for VOCs may be collected across the site.
All nine of the boring locations will also be used as temporary groundwater wells where grab groundwater samples will be collected. Upon grab water sampling and boring completion, each borehole shall be backfilled to grade with the drill cuttings and finished with hydrated bentonite and pavement patch or concrete seal, if necessary.
In addition to sampling of the nine temporary wells, 22 existing permanent groundwater monitoring wells shall also be sampled. The contractor shall gauge the depth to water of each monitoring well prior to sampling.

Groundwater samples from all locations, new (grabs) and existing (monitoring wells), shall be sampled and analyzed for VOCs. Samples from GP-1, GP-5 and GP-7 should also be analyzed for field parameters including dissolved oxygen (DO), oxidation-reduction potential (ORP), pH and conductivity. Additional laboratory analytical parameters including terminal electron acceptor analysis (nitrate, sulfate, total and dissolved iron), COD, dissolved gas (methane, ethane, ethene). A set of matrix spike/matrix spike duplicate (MS/MSD) samples and a field duplicate will need to be collected for laboratory analysis; MS/MSD and a field duplicate will also have to be collected for soils if any soil samples are collected.

It should be noted that the contractor will collect the groundwater and soil samples and send them to the analytical laboratory as selected by the Department.

B. The Contractor shall perform all Work in compliance with all applicable requirements of governing authorities having jurisdiction. The Contractor shall identify, apply for, obtain and pay all fees for licenses, permits, approvals and insurance required from federal, state and local government and public agencies and authorities as necessary to perform the work.

C. The Contractor is required to take any and all precautions necessary to locate, support and protect utilities which may exist throughout the performance of the work. All costs associated with protecting, supporting, locating, etc. of all utilities or process pipelines shall be included in the price of this work. The Contractor shall obtain utility markouts on all public and private properties in accordance with all local and state requirements where the work will be performed. Prior to the performance of intrusive activities, the Contractor shall notify the Department, all utility companies and applicable agencies and request a markout of their lines and properties in the field in the areas of the proposed work. In addition, the Contractor shall provide the services of an independent utility markout service subcontractor qualified to locate and mark out all utilities in the vicinity of the work using the appropriate equipment and methods available prior to performance of intrusive activities.

D. At the completion of the work, the Contractor shall remove and properly dispose off-site all rubbish and other investigation derived waste (IDW) from the location of the Work, and all tools, materials, supplies, equipment that he/she may have used in the performance of the work. Contractor shall broom clean paved surfaces and rake clean other surfaces of grounds.

E. The Contractor is responsible to ensure that all project personnel have been trained in accordance with Occupational Safety and Health Administration (OSHA) 29 CFR 1910.120 and 29 CFR 1926.65 regulations. The Contractor shall be responsible for, and guarantee that, personnel not successfully completing the required training are not permitted to enter the Project Site to perform the work.

ACCESS TO THE WORK

a. Whenever work is in progress or preparation, the Contractor shall permit access and inspection and shall provide proper and necessary facilities to the Department and their associated representatives.

DECONTAMINATION PROCEDURES

a. All decontamination activities will be conducted at the designated decontamination area or as directed by the Department. The Contractor shall provide/construct a decontamination pad/area on which to clean all equipment, materials and supplies. The Contractor shall also be responsible for removing the decontamination pad at the end of the project and prior to demobilization from the site. Any drill cuttings, water, drilling fluids, and decontamination materials that could not be backfilled into the borehole shall be properly containerized by the Contractor and removed from the work area and properly characterized and disposed of.

b. Drilling Equipment - All drilling equipment including drill rigs, auger flights, drill rods, and drill bits shall b cleaned prior to usage on-site. Following the initial cleaning, cleaning may be reduced to those areas that are in close proximity to the materials being sampled. The equipment shall be cleaned prior to leaving the site. The

two options that are available and allowable to accomplish cleaning the equipment include steam cleaning and manual scrub brushing and/or washing as described in Paragraph C.
c. Sampling Equipment - All sampling equipment shall be cleaned of all foreign matter, washed with a non-phosphate detergent, rinsed with tap water or cleaned of foreign matter, steam-cleaned and void of any external soils, sand, oils and greases prior to use in each well and/or boring.
d. All water used in the drilling operation and decontamination procedure shall be provided by the Contractor. Acquisition (including permits and other approvals), transport and storage of all water shall be the responsibility of the Contractor. All water used for drilling, coring and cleaning/decontamination must be potable and approved by the Department.

See the attached figures for further details.

ESTIMATED BUDGET: $377,558.86

This serves as authorization to incur costs up to the budgeted amount indicated, to perform the scope of work outlined above in connection with the above-referenced spill/site call out number. The contractor is responsible for immediately notifying the DER project manager if it becomes apparent that the scope of work can not be completed within the budget and/or the scope of work should be amended. The contractor should not incur costs that exceed the budget or perform activities outside the scope of work without the verbal or written approval of the DER project manager. The DER project manager must confirm that approval in writing in an amended Standby Contractor Authorization Form signed by the DER project manager and Rep within two business days.

DER Project Manager Name/Title:

Kyle Forster (Print) | (Signature) | Date: 7/18/2017

Authorized DER Representative Name/Title:

Janet Brown (Print) | Janet E Brown (Signature) | Date: 7/18/2017

Regenesis Proposal

July 13, 2017

James Guarino
Precision Environmental Services, Inc.
831 Route 67, Lot 38A
Ballston Spa, NY 12020

RE: Proposal for Remedial Application Services using PlumeStop, Hydrogen Reducing Solution, and BDI Plus at the Former Louden and Kem Cleaners site located in Louden, NY.

Regenesis Proposal No. 53629

Dear James,

REGENESIS® appreciates the opportunity to evaluate this project and provide Precision Environmental Services, Inc. (PES) with this proposal and cost estimate to implement full-scale remediation. REGENESIS presents a remedial program designed to meet regulatory standards across the site. REGENESIS is committed to working with PES to develop a remediation program that meets these site objectives. REGENESIS proposes the application of PlumeStop® Liquid Activated Carbon™ (PlumeStop) with Hydrogen Releasing Compound (HRC) and BioDechlor Inoculum (BDI) to rapidly and permanently reduce cVOC concentrations in groundwater to low ppb levels.

The Remedial Goal

Two primary treatment areas were identified at the Former Louden and Kem Cleaners site: the core area which is located in the vicinity of MW 18/18D and the plume area that is upgradient of MW 18. The treatment areas identified for this action are based on information found in the Final Feasibility Report prepared by Shaw December 2014 and results from additional site investigation conducted in 2016.

The total treatment area encompasses 20,034ft^2. Regenesis proposes to break this into two different treatment zones, Area 1: a 3000ft^2 grid application near MW18/18D and Area 2 covers 17,034ft^2 a application is proposed using series of treatment barriers placed upgradient and around MW18/18D. See Figure 1 and 2.

The primary contaminants of concern include tetrachloroethene (PCE), trichloroethene (TCE) and cis-dichloroethene (cis-DCE). The maximum concentration detected in groundwater is 5100ug/L PCE, 140ug/L TCE and 890ug/L cis DE. The groundwater cleanup targets are 5ug/L for each constituent (PCE, TCE and cis-DCE).

REGENESIS is excited to work on this project, believing we have the remedial technologies and skills to achieve your objectives and overcome the critical items mentioned. Our REGENESIS Remediation Services (RRS) team is highly experienced in delivering our amendments by using application-

appropriate equipment, maintaining critical health and safety practices, and providing the highest-level of remediation expertise to ensure that there will be no safety or performance concerns on your end.

Our Recommended Remedial Solution

Our proposal outlines a process for creating a continuous and robust *in situ* passive barrier system. Groundwater will be able to flow through this barrier system while at the same time the barrier will extract contaminants from groundwater. Such treatment will prevent off-site migration of the contaminant plume while also reducing long-term vapor risk to off-site properties.

Our proposal for the creation of this passive barrier system is with our PlumeStop liquid activated carbon (Plume Stop). The low viscosity of this product allows for relatively simple installation and control of its placement in the aquifer. Once injected the PlumeStop liquid activated carbon coats aquifer soil particles with a very thin layer of carbon. The PlumeStop begins working immediately by allowing sorption of contaminants from the dissolved phase to the thin layer of carbon resulting in rapid reductions of contaminant concentrations from groundwater (i.e. the extraction phase). The barrier is maintained in the long-term (years to decades) by destroying sorbed contaminants from the PlumeStop carbon through the use of enhanced *in situ* anaerobic bioremediation which frees up new carbon sites for continued contaminant sorption (i.e., the PlumeStop regeneration phase). The ability to initiate a sorption + bioremediation approach with the unique liquid properties of PlumeStop offers groundbreaking results. Key features include:

- **Ability to create a full barrier wall leaving few zones for contaminant escape.** PlumeStop is injected using low pressure and high volume without the need or uncontrollability of *in situ* fracturing common to other carbon-based injectates. PlumeStop injects with the same ease as injecting water. By flooding the subsurface using simpler injection and pumping techniques we can fully coat the entire treatment pore space of an aquifer for a more complete barrier system.

- **Immediate contaminant reduction**. Any migrating contaminant passing through the PlumeStop zone will be adsorbed to the material through the well understood mechanisms of activated carbon.

- **A lifespan from years to decades with relatively minimal maintenance.** We are not proposing an expensive barrier system that must be re-installed at great cost every few years, but a system that is expected to last for decades. As with all remediation systems some maintenance is required, although continued applications of PlumeStop are not anticipated.

Full Scale Design: Remedial Design Elements and Material Requirements

Using available data Regenesis prepared a design for the implementation of the Plume Stop barrier. The proposed plan includes the injection of Plume Stop Liquid Activated Carbon (Plume Stop) , HRC (HRC) and bioaugmentation culture BDI (BDI) . The site figure showing approximate location of the Plume Stop Treatment barrier

Figure 1. Injection Area

Figure 2: Treatment Area

Area 1 denoted by red box, MW18: 3000ft^2 spacing 8x9ft for a total of 42 points

Area 2 (yellow lines): 220 feet barrier for a total of 28 injection points

The design assumptions, product quantities and injection volumes are shown in Table 1/2.

Table 1/2. Product Assumptions and Design Summary

REGENESIS

Project Info		
Former Loudon and Kem Cleaners		
Albany, NY 12204		
Pilot-MW-18 Grid		
Prepared For:		
Kyle Forster, NYDEC		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area	ft^2	3,000
Top Treat Depth	ft	20.0
Bot Treat Depth	ft	35.0
Vertical Treatment Interval	ft	15.0
Treatment Zone Volume	ft^3	45,000
Treatment Zone Volume	cy	1,667
Soil Type	---	silty sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	111,086
Treatment Zone Effective Pore Volume	gals	67,325
Fraction Organic Carbon (foc)	g/g	0.003
Soil Density	g/cm^3	1.6
Soil Density	lb/ft^3	100
Soil Weight	lbs	4.5E+06
Hydraulic Conductivity	ft/day	0.7
Hydraulic Conductivity	cm/sec	2.47E-04
Hydraulic Gradient	ft/ft	0.045
GW Velocity	ft/day	0.16
GW Velocity	ft/yr	58
Sources of Hydrogen Demand	**Unit**	**Value**
Dissolved Phase Contaminant Mass	lbs	1
Sorbed Phase Contaminant Mass	lbs	4
Competing Electron Acceptor Mass	lbs	83
Total Mass Contributing to H_2 Demand	**lbs**	**89**
Stoichiometric Demand	**Unit**	**Value**
Stoichiometric H_2 Demand	lbs	6
Stoichiometric HRC Demand	**lbs**	**255**
Application Dosing	**Unit**	**Value**
Plume Stop to be Applied	lbs	14,000
HRC to be Applied	lbs	2,250
BDI Plus to be Applied	Liters	35

PlumeStop® Application Design Summary		
Pilot-MW-18 Grid		**Field App Instructions**
Application Method	**Direct Push**	
Spacing Within Rows (ft)	8	
Spacing Between Rows (ft)	9	
Application Points	**42**	
Areal Extent (square ft)	3,000	
Top Application Depth (ft bgs)	20	
Bottom Application Depth (ft bgs)	35	
PlumeStop to be Applied (lbs)	**14,000**	
PlumeStop per point (lbs)	333	
PlumeStop per point (gals)	40	
Mixing Water (gal)	**11,748**	
Mixing Water (per pt)	280	
Total Application Volume (gals)	**13,426**	
Injection Volume per Point (gals)	320	
Anaerobic Bioremediation - HRC		
HRC Application Points	42	
HRC to be Applied (lbs)	2,250	
HRC per point (lbs)	54	
Total Application Volume (gals)	207	
Injection Volume per Point (gals)	4.9	
Bioagumentation - BDI Plus		
BDI Plus Application Points	42	
BDI Plus to be Applied (Liters)	35	
BDI Plus per point (Liters)	0.8	

Technical Notes/Discussion

Prepared By: DaP-MaD53629
Date: 5/3/2017

Assumptions/Qualifications

In generating this preliminary estimate, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.

REGENESIS

Project Info		
Former Loudon and Kem Cleaners		
Albany, NY 12204		
Single barrier for plume		
Prepared For:		
Kyle Forster, NYDEC		
Target Treatment Zone (TTZ) Info	**Unit**	**Value**
Treatment Area (102' x 167' less 3,000 ft2 grid)	ft^2	4,400
Top Treat Depth	ft	25.0
Bot Treat Depth	ft	40.0
Vertical Treatment Interval	ft	15.0
Treatment Zone Volume	ft^3	66,000
Treatment Zone Volume	cy	2,444
Soil Type	---	silty sand
Porosity	cm^3/cm^3	0.33
Effective Porosity	cm^3/cm^3	0.20
Treatment Zone Pore Volume	gals	162,926
Treatment Zone Effective Pore Volume	gals	98,743
Fraction Organic Carbon (foc)	g/g	0.003
Soil Density	g/cm^3	1.6
Soil Density	lb/ft^3	100
Soil Weight	lbs	6.6E+06
Hydraulic Conductivity	ft/day	0.7
Hydraulic Conductivity	cm/sec	2.47E-04
Hydraulic Gradient	ft/ft	0.045
GW Velocity	ft/day	0.16
GW Velocity	ft/yr	58
Sources of Hydrogen Demand	**Unit**	**Value**
Dissolved Phase Contaminant Mass	lbs	2
Sorbed Phase Contaminant Mass	lbs	5
Competing Electron Acceptor Mass	lbs	122
Total Mass Contributing to H_2 Demand	**lbs**	**130**
Stoichiometric Demand	**Unit**	**Value**
Stoichiometric H_2 Demand	lbs	8
Stoichiometric HRC Demand	**lbs**	**372**
Application Dosing	**Unit**	**Value**
Plume Stop to be Applied	lbs	17,200
HRC to be Applied	lbs	2,640
BDI Plus to be Applied	Liters	42

PlumeStop® Application Design Summary

Single barrier for plume	
Application Method	**Direct Push**
Spacing Within Rows (ft)	8
Spacing Between Rows (ft) rows	20
Application Points	**28**
Areal Extent (square ft)	4,400
Top Application Depth (ft bgs)	25
Bottom Application Depth (ft bgs)	40
PlumeStop to be Applied (lbs)	**17,200**
PlumeStop per point (lbs)	614
PlumeStop per point (gals)	74
Mixing Water (gal)	**14,433**
Mixing Water (per pt)	515
Total Application Volume (gals)	**16,495**
Injection Volume per Point (gals)	589
Anaerobic Bioremediation - HRC	
HRC Application Points	28
HRC to be Applied (lbs)	2,640
HRC per point (lbs)	94
Total Application Volume (gals)	243
Injection Volume per Point (gals)	8.7
Bioagumentation - BDI Plus	
BDI Plus Application Points	28
BDI Plus to be Applied (Liters)	**42**
BDI Plus per point (Liters)	1.5

Field App Instructions

1 row points per barrier covering 220 ft
3 barriers as shown in attached figure

Technical Notes/Discussion

Prepared By: DaP-MaD53629
Date: 5/3/2017

Assumptions/Qualifications

In generating this preliminary estimate, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site.

Project Cost and Schedule

Injection of PlumeStop is currently conducted exclusively through our turn-key remediation services division, RRS. Costs provided for the application injection are inclusive of all products, product mixing, injection services, materials, tax and shipping to complete the work. Upon completion of injection work performed by RRS, an Application Summary Report will be prepared and submitted to PES documenting the field activities and reagent distribution monitoring.

Total Product:
Plume stop: 31,200lbs
HRC: 4710lbs
BDI: 77 liters

The cost for the prescribed treatment is $205,500

Payment Schedule will be:

- Invoice after shipment of product - $149,433.61 (includes estimated shipping/tax)
- Invoice for application injection services $56,066.39 (invoiced monthly)

*Please note that this pricing is contingent upon completion of this scope of work without delays or work stoppages once mobilization occurs. RRS has allotted a total of 15 on-site working days, (10 hours per day), to complete the injection activities. In most cases, RRS completes work on time and on budget. If additional days on site are required to complete this project RRS can perform at a $3,200 daily rate. The work duration is assumed to take place during business days (Monday thru Friday). Payment terms are net thirty (30) days.

As part of this proposal, PES will contract for and provide RRS with the following:

- one direct push rig with at least 150 linear feet of 1½ inch Geoprobe® injection rods and expendable tips to perform bottom-up injections at up to 87 injection locations per event
- Two man crew to operate rig and assist in the RRS application process
- The rig and two man crew will be available to RRS to work 10 hour days on site for each day of injection events.

The length of 1 ½" Geoprobe rods required will allow us to apply the remediation reagents in up to three locations simultaneously on this project. The 1 ½" Geoprobe rods are needed to match our equipment.

RRS Scope of Services

As mentioned, RRS will implement the turn-key application injection. The implementation of this phase of work includes:

- RRS will provide and ship the specified quantities of remediation reagents to the site prior to personnel mobilization.
- PES will receive product delivery at the site prior to mobilization and arrange for secure storage near the work area during product application.
- RRS will provide the injection trailer with a project manager and project supervisor, direct-push rig with operator, and perform product application, which will include the following:
  - Mix and prepare remedial reagents for application
  - Injection trailer apparatus (equipped with pumps, mixing tanks, injection heads with flow and pressure gauges, safety bypass valves, first aid station, etc.
  - PPE and safety equipment for RRS personnel
- Collect empty remediation reagent containers, used PPE and RRS generated refuse daily. This nonhazardous material will be placed in the client's refuse container on-site for disposal. All product containers will be left on-site for proper disposal by PES.
- Utilize up to 4,000 gallons of water per day for the application injection.
- Perform real-time reagent distribution diagnostics to allow for field modifications, as needed.
- After completion of the application pilot test, prepare and submit a Post-Application Summary Report including application depths, material quantities applied, injection pressures, and other noteworthy field observations.

RRS has based our approach on DPT application techniques utilizing a Geoprobe® track rig (or equivalent) with 1.5 inch injection rods. The remediation reagents will be prepared and applied via the injection trailer, which is fully enclosed and contains mixing tanks, pumps, and a delivery system equipped for direct connection to the downhole injection tooling. In short each trailer has the following components:

- Complete drain conical mixing tanks
- Vortex/Cyclone mixer
- Application pump

- Multiple fluid delivery lines
- Self-sufficient, dedicated power
- Slip-resistant and chemical resistant flooring
- Flow and pressure controls
- Backflow prevention
- Pressure bypass controls
- Emergency eyewash and First-Aid station

The application pump is a multiple diaphragm positive displacement pump designed to prevent pulsation of the remediation chemistry while being applied. The application pump is capable of delivering the remediation chemistry at up to 250 pounds per square inch (psi) at up to 20 gallons per minute (gpm) to overcome any potential hydraulic limitations. Mechanisms capable of maintaining injection pressures of 0 to 250 psi and injection flow rates of 0 to 20 gpm per injection point have been installed to control and maintain desired application pressures and flow rates. Safety bypass mechanisms are also installed to release back pressure buildup in the event injection pressures exceed commonly accepted application ranges. Our application delivery system is capable of delivering the remediation chemistry at up to four (4) points at a time utilizing separate delivery lines simultaneously, each having the capability of monitoring injection pressures and injection flow rates at any given time.

The application delivery system is design to mix and delivery the remediation chemistry per the intended design. The remediation chemistry is prepared in two (2) 350 gallon sized conical tanks that are configured with chemically resistant materials. A vortex/cyclone mixer mounted to the mixing tanks rated with a liquid movement of 1800 gpm in water is outfitted with a shaft and propellers to properly mix and prepare the remediation chemistry.

This specialized equipment will be utilized for the purpose of handling and delivering the remediation chemistry into the anticipated groundwater treatment interval. For these sites, we anticipate injection flow rates of 2.0 to 5.0 gpm and injection pressures of 0 to 50 psi. The remediation chemistry will be injected with a bottom-up approach at approximately 3.0 foot intervals to cover the entire treatment interval utilizing a retractable screen or expendable tip. Injection volumes will be applied at equal intervals as the injection rods are pulled up. This process will be repeated until completion of the prescribed injection volume has been met per injection point. Injection point locations will be spread out over the work area as to limit overfilling the pore volume of the aquifer resulting in unnecessary surfacing of the remediation chemistry. Each completed or abandoned injection point will be filled with bentonite chips to approximately 6.0 inch from the surface.

The injection trailer will be staffed with two (2) experienced personnel consisting of a Project Manager and Project Supervisor to ensure proper delivery and distribution of the remediation chemistry throughout the targeted treatment zone. The project personnel each have the ability to make modifications to the injection depth, injection point spacing, percent solution of the remediation chemistry, injection rates and pressures as necessary based on the evaluation of the real-time monitoring and observations in the field to ensure the application is performed in the most efficient and effective manner while adhering to the intent and goals of the application. All observations, real-time monitoring, and application delivery information will be documented in a way that can be efficiently turned around to PES. Application delivery information such as start/stop times, injection intervals, flow rater, pressures, total gallons, gallons per intervals, etc. will be documented per each injection point.

Our RRS personnel are dedicated to making sure this scope of work is completed as efficiently as possible to minimize on-site field time and overall remediation cost. RRS will apply the remediation

chemistry in multiple injection point locations simultaneously for this scope of work utilizing the injection trailer.

RRS Assumptions and Qualifications

In generating this proposal, Regenesis relied upon professional judgment and site specific information provided by others. Using this information as input, we performed calculations based upon known chemical and geologic relationships to generate an estimate of the mass of product and subsurface placement required to affect remediation of the site. Other assumptions and qualifications related to this proposal are as follows:

- PES personnel will take delivery of the remedial products prior to RRS mobilization and arrange for secure storage in an environment that will prevent exposure to inclement weather (e.g., freezing temperatures, rain, etc.). If material is stored off-site, client personnel will coordinate the delivery of the material to the site. All of the products will be shipped to the site in one (1) delivery.

- PES will locate the product within 10 feet of each work area prior to mobilization. RRS has NOT included cost for a skid steer loader with forks to maneuver product around the work area as needed.

- All public and private, on-site underground utilities and any known subsurface features (e.g., piping, storage tanks, septic systems, etc.) will be clearly marked/cleared by client prior to RRS mobilization to the site. RRS is not responsible for damage to any unmarked utilities or subsurface features. If as-built drawings are available for any on-site subsurface features, RRS request the right to review these drawing with the PES to confirm clearance for the advancement of DPT injection points.

- RRS will collect project related refuse, empty product containers and used PPE on a daily basis to keep the site clean. This nonhazardous refuse will be placed in an on-site refuse container provided by PES. All empty product containers (totes) will be left on-site upon completion of the injection activities for disposal by PES.

- A high volume water source (e.g., hydrant) capable of producing at least 30 gpm will be available to RRS for the duration of the project within 100' of the project staging area, at no cost to RRS. RRS will utilize this water for the injection activities. If water is provided via holding tanks, RRS will provide a means to transfer water from the tanks to the injection trailer. Water and/or holding tanks utilized for the injection activities must be clean/clear of all debris and sediment prior to use.

- RRS personnel will have access to the site for work up to 10 hours per day. We estimate 15 on-site working days to complete the application.

- Drilling permits and closing/backfilling of abandoned borings is the responsibility of PES

- Pricing and work schedule assume union labor and prevailing wages (Davis-Bacon) are not required.

- RRS will have access to the site for equipment operation and storage of materials and equipment.

- RRS understands that injection permits for this work is not needed and cost has not been included for securing such permits.

- RRS will not be responsible for any treatment chemistry infiltration into undesired locations (e.g., subsurface utility corridors). Damage to utilities via infiltration will not be the responsibility of RRS.

- PES will provide a field water quality meter similar to an YSI 556 with a down-hole sensor and groundwater level indicator while on-site for injection monitoring activities.

- This proposal assumes probing and drilling will begin at ground surface. If hand auger, concrete coring or air knife services will be required, additional charges will apply.

Regenesis appreciates the opportunity to present you with this proposal. If you need any additional information please feel free to contact me at 630.335.9563.

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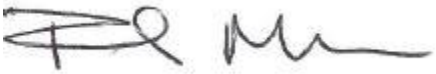

Paul Mansur
Remediation Services East Region Project Manager

Please sign below to acknowledge acceptance of proposal # 53629 for Louden Kem Cleaner site and authorize RRS to perform stated work:

Precision Environmental Services Inc.

Authorized Signature	Date
Name (print)	P.O. or Project Number

Delegation of Work Tasks and Equipment to be Supplied by Precision

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Delegation of Work Tasks

Regenesis would be responsible to handle, mix and pump the remediation products. In order to accomplish this we will supply a specialized injection trailer and up to 500 ft. of hoses, four (4) injection pull caps (to hook up to downhole tooling), a variety of fittings, electric power source and mixing equipment. Precision would be responsible for all work related to the Geoprobe, essentially driving injection rods to depth, removing injection rods, and abandoning the completed borings. All injection rods would need to be 1.5 inch outside diameter, and standard Geoprobe thread as this is compatible with the injection pull caps. Precision is also providing a means to supply the water for the injections, which has been discussed as a 4,000 gallon water truck. Prior to the injection event Regenesis will need to know the hose size (diameter) and thread (type) to ensure correct fittings to properly hook water hose to plumbing in the injection trailer. During the injection process Regenesis will direct Precision on the preferred sequence of injection locations where tooling should be advanced as well as when injections are completed at specific depths requiring the tooling to be lifted or removed. Regenesis will defer to Precision on issues specific to the drilling such as refusal.

Regenesis will be responsible for all documentation associated with the injection event. A electronic tablet or field notebook will be used to record quantities injected, injection intervals, flow rates, pressures, time/dates the injection occur and all pertinent notes relating to the project. Regenesis will also collect notes on influence/distribution as well as geochemical parameters from monitoring wells within the work area. At the end of the project Regenesis will compile this data into a report and send it to New York State Department of Environmental Conservation.

Regenesis will provide the SDS sheets for all remediation products being used at this site. Regenesis will also supply a site-specific health and safety plan (HASP), this document will be available for review by any on site personnel. All Regenesis employees will work under this HASP. On the first day of this project Regenesis will hold a comprehensive discussion of our HSAP in order to bring a greater awareness of the the site hazards to all parties involved in this project. Each subsequent day Regenesis will hold a tailgate safety meeting that will be an abridged version of our initial comprehensive health and safety meeting. Additional discussion, by Precision, on task specific hazards or JSA's relating to the Geoprobe or other work tasks is requested to be included in these talks.

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Equipment to be Supplied by Precision:

- Geoprobe with operator– typically we use model no. 6620 of 7822
- 120 feet of 1.5 inch injection rods
- Traffic cones
- Granular bentonite and bentonite chips (approximately 15 bags of each)
- 2 bags of asphalt patch
- Detachable rods to run through the tooling in the event of a clog
- 4 expendable point holders
- Teflon or vinyl tape to seal rod joints
- 80 expendable points
- Water Truck
- Means to stage remediation products (pallet jack or skid steer)

Staging Figure

Key

Injection Trailer

Water Truck

Staging

Equipment for this scope of work will be staged in three (3) separate phases to minimize disruption to the property. The injection trailer will be placed on the northeast end of each barrier to allow easy access. Work will begin an the 75 ft barrier and shift to the 50 ft barrier and grid area, followed by the 100 ft barrier. RRS estimates 2 to 3 day to complete the injections at the 75 ft and 100 ft barrier, and 9 to 10 days to complete the injection into the 50 ft barrier and grid. The remediation products are shown on this map in a specific location adjacent to the 100 ft barrier work area. This location can be viewed as a suggestion as the remediation products will be easily accessible if they are placed anywhere within the blacktop parking

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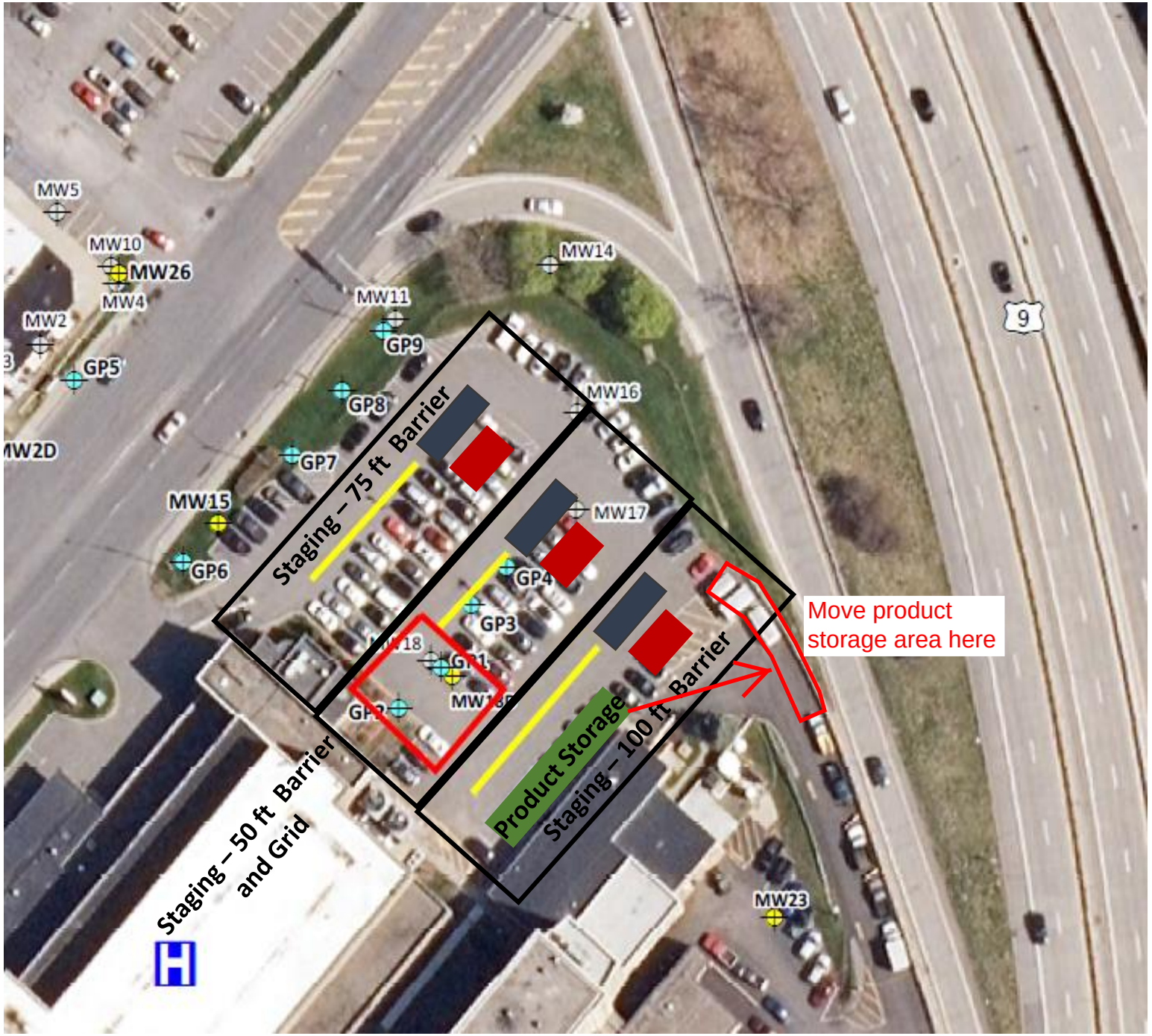

Key

Injection Trailer

Water Truck

Staging

Equipment for this scope of work will be staged in three (3) separate phases to minimize disruption to the property. The injection trailer will be placed on the northeast end of each barrier to allow easy access. Work will begin an the 75 ft barrier and shift to the 50 ft barrier and grid area, followed by the 100 ft barrier. RRS estimates 2 to 3 day to complete the injections at the 75 ft and 100 ft barrier, and 9 to 10 days to complete the injection into the 50 ft barrier and grid. The remediation products are shown on this map in a specific location adjacent to the 100 ft barrier work area. This location can be viewed as a suggestion as the remediation products will be easily accessible if they are placed anywhere within the blacktop parking

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Test America Work Authorization

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION

STANDBY CONTRACTOR AUTHORIZATION FORM
For Response & Containment, Investigation & Remediation

General Information

Region: 4 **Site No.:** 401060 **CallOut ID:** 134205

CallOut Date 10/19/2017

Contract No.: C008010 **PIN (if applicable):**

Contractor Selected: TEST AMERICA LABORATORIES, INC (LAB)

Site Information - Name: Former Loudon and Kem Cleaners **County:** Albany
Address: 350 Northern Boulevard, Albany

SCOPE OF WORK (Provide brief detailed description):

Test America (TA) shall provide Precision Environmental Services (PES) with sample jars for groundwater analysis via EPA Method 8260, on a quarterly basis for up to 2 years. It is anticipated that up to 64 groundwater samples will be submitted to the lab for analysis. Each quarterly sampling event may consist of up to 8 total samples being submitted to the lab, including 5 samples analyzed for VOCs via EPA Method 8260, 1 duplicate, 1 matrix spike, and 1 matrix spike duplicate.

In addition to VOCs analyzed via EPA Method 8260, additional parameters for bio-monitoring may need to be analyzed on a quarterly or lesser frequency (semi-annual), including:

- Total Dissolved Iron
- Total Dissolved Mn
- Nitrate
- Sulfate
- Methane, ethane, and ethene via RSK 175
- Microbial analysis via standard bio-trap

Deliverables: At a minimum, 30-day turnaround shall be provided for all samples including the microbial analysis. Analytical results shall be forwarded to the NYSDEC and PES via email as soon as they are available. Analytical reports shall be Superfund CLP Category A deliverables.

Bio-trap sampling will likely be conducted at a lesser frequency than other parameters. The sampling device must remain in the well for a minimum of 30-days and will be sent for analysis approximately 1 month after th VOC and associated bio-monitoring parameters are submitted.

Test America and PES shall coordinate bottle shipment and sample delivery for each sampling event. PES will clearly specify what analyses/bottles will be required for each sampling event.

Additional soil sampling for analysis via EPA Method 8260 was previously submitted to TA October 20th, 2017 and will be included in this budget.

PES' Contact Info:
James M. Guarino

Precision Environmental Services
831 Route 67, Lot 38A
Ballston Spa, NY 12020
Office: 518-885-4399
Email: jguarino@precisionenvironmentalny.com

ESTIMATED BUDGET: $12,000.00

This serves as authorization to incur costs up to the budgeted amount indicated, to perform the scope of work outlined above in connection with the above-referenced spill/site call out number. The contractor is responsible for immediately notifying the DER project manager if it becomes apparent that the scope of work can not be completed within the budget and/or the scope of work should be amended. The contractor should not incur costs that exceed the budget or perform activities outside the scope of work without the verbal or written approval of the DER project manager. The DER project manager must confirm that approval in writing in an amended Standby Contractor Authorization Form signed by the DER project manager and Rep within two business days.

DER Project Manager Name/Title:

Kyle Forster (Print) _____ (Signature) Date: 11/1/2017

Authorized DER Representative Name/Title:

Janet Brown (Print) _____ (Signature) Date: 11/1/2017

Appendix B

Access Agreement

Form 1 (continued) Property Owner Acknowledgment Form

New York State Department Environmental Conservation

Property Owner Acknowledgment/Consent Form

I LAWRENCE TILTON hereby acknowledge and consent to the
Print Name

Department's right of entry for purposes of remediation and monitoring activities associated with the Former Loudon and Kem Cleaners, Site No. 401060 onto the premises described below:

Tax Map ID # 65.08-1-1.100
Address 600 Northern Blvd, Albany, NY

Signature _____

Date 2/7/16

Daytime Phone Number 518-471-3015

- **Return This Copy to the NYSDEC in the Postage-Paid Envelope Provided**