CAMPBELL
ENVIRONMENTAL GROUP

October 10, 2016

Nicholas Mayhew, Project Manager
Uncontrolled Sites Program
Division of Remediation
Maine Department of Environmental Protection
State House Station
Augusta, Maine 04333

RE: Remedial Options Analysis/Feasibility Study
Former Charlotte Smith Residence
881 Main Street
Meddybemps, Maine

CEG has prepared this Remedial Options Analysis/Feasibility Study (ROA/FS) for the Maine Department of Environmental Protection (MEDEP) per Task Order #44, *C. Smith Property, Meddybemps, Remedial Options Analysis/Feasibility Study*, dated July 20, 2016. The purpose of the ROA/FS is to address contamination remaining on the former Charlotte Smith site in Meddybemps, Maine. The goal of the ROA/FS is to outline remedial options and evaluate the approaches and technologies for addressing risks associated with corresponding contaminants of concern.

If you have any questions or comments, please do not hesitate to contact us. CEG appreciates working with you on this project.

Sincerely,

Danica Kay
Senior Geologist

Richard Campbell
Maine Certified Geologist
President

Enclosure

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1.0 INTRODUCTION & BACKGROUND

1.1 Site Location Description

The Site is an approximately 0.7 acre parcel with an address of 188 Main Street and identified by the Town of Meddybemp's tax assessor as Map 12, Lot 9. The ownership of the property transferred from Charlotte Smith to her daughter, Dawn Smith, following her death in January 2000. The deed documenting the transfer is recorded in the Washington County Registry of Deeds: Book 2132, Page 138. The geographic coordinates for the approximate center of the property are latitude 45° 2"19.39" North, longitude3 67°21'26.01" West.

The site is a flat parcel that is bounded by Main Street (Route 191) to the south, by the Dennys River to the north and west, and by Lombard Road to the east. The area surrounding the Subject Property is primarily residential or undeveloped. Homes in the area are serviced by private water supply wells. The Subject Property has a water supply well located approximately 15 feet from the southeast corner of the house. The closest occupied residence is approximately 600 feet southeast of the Subject Property boundary.

The Dennys River which is adjacent to the Subject Property is protected under the Clean Water Act. The Dennys River is one of the "Distinct Population Segments" for the Atlantic Salmon, which has been listed on the Federal Endangered Species list.

Under the *Designation of Uncontrolled Hazardous Substance Site CHARLOTTE SMITH PROPERTY SITE*, dated June 24, 2004, the geology of the Subject Property consists of glacio-marine till of the Presumpscot Formation which is characterized by low permeability and poor drainage. The underlying bedrock is Devonian-age Meddybemps granite. The surficial tills at the site are relatively thin, and the relatively low relief of the area keeps the water table close to the surface. The groundwater flow is west-southwest of the Subject Property.

In October 2004, Hank Andolsek, of the Maine Department of Environmental Protection (MEDEP), supervised and logged overburden soil and bedrock borings. The boring logs (CS-1A, CS-1B, CS-2A, CS-2B, and CS-3B) indicated approximately 20 feet of fill or clay existed over till until bedrock was encountered between 22 and 28 feet below grade.

1.2 Previous Site Use, Assessments, or Cleanup

The Subject Property is somewhat of an extension of the Eastern Surplus (Harry Smith) Superfund Site located north west from the Subject Property across Main Street. According to a Memorandum from Jean Firth to Denny Harnish, Assistant Attorney General, dated February 3, 2004, "*in 2000 an Environmental Protection Agency (EPA) contractor working at the Eastern Surplus Site reported that there were drums of chemicals located in the basement of the Charlotte Smith residence*." In January 2002, EPA was granted permission to enter the

basement of Charlotte Smith's residence accompanied by Harry Smith. EPA noted drums and containers of liquid chemicals. Some contents from labels were noted from the report. These included petroleum products, fungicides, ketone, and perchloroethylene (PCE). EPA did not pursue removal of the chemicals at the time; however, in 2002 when MEDEP requested permission to access and remove the chemicals, they were denied permission by both Harry and Dawn Smith.

On June 3, 2004, MEDEP obtained a search warrant allowing access to the Charlotte Smith property. On June 8, 2004, MEDEP conducted an initial inventory of the site. According to a letter from Mark Hyland to Dawn Smith, dated June 15, 2004, MEDEP "*revealed the presence of hazardous waste in the basement, in the barn/garage, in the bus and on the grounds of the site. The waste materials and their containers were found to be in generally poor condition, some of the containers having discharged their contents*".

According to the MEDEP, more than 200 5-gallon containers of solvents including tetrachloroethylene (PCE) from the basement of the home were removed. Subsequent investigations included the collection of concrete dust from the basement floor, and soil and soil gas samples from below the concrete slab.

1.3 Site Assessment Findings

Analytical results from within the basement indicated elevated levels of volatile organic compounds (VOCs) in the ambient air, concrete, soil, and soil gas of the residence. Sampling of groundwater from the onsite monitoring wells indicates the presence of PCE. Sampling of site soils has shown isolated areas with volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCB) contamination. According to MEDEP, surface soil samples were collected from four locations between the house and the garage located on the subject property and two were collected from the dirt floor within the garage. PCBs were detected at three locations (SS-101, SS-103, and SS-104) above the residential Remedial Action Guideline (RAG) value.

Sub-slab soil gas and indoor air samples were collected from the house on site. All samples were tested for VOCs. Two sub-slab soil gas samples (SG-101 and SG-102) were collected from beneath the concrete basement floor. Trichloroethylene (TCE) and PCE were detected at both locations above the RAG values. Chloroform was detected in sample SG-102 at the residential RAG value. One indoor air sample was collected from the basement (Basement Ambient) and two indoor air samples were collected from the first floor living space (1st Floor Kitchen, 1st Floor Bedroom). Several VOCs were detected in the samples, including PCE which was detected in all three samples above the associated RAG value. Concrete dust samples were "screened" for VOCs in field and labeled WT-1 through WT-10. The screening results indicated "*PCE concentrations ranged from 57 to 110,500 micrograms per kilogram*."

Sample results show that, in isolated areas, soils at the Subject Property remain impacted by historical poor onsite housekeeping practices. Surface soil in the area directly to the north of the house is contaminated with PCBs above regulatory guidelines. MEDEP personnel estimated the volume of contaminated soil to be approximately 80 cubic yards (assuming a contaminant depth of 2 feet). Sub-slab soil gas, indoor air, and concrete dust sample results indicate that the concrete and soils underlying the house foundation floor are impacted and contribute VOCs to indoor air within the house.

1.4 Project Goal/Reuse

Unless otherwise specified, CEG shall assume the site shall remain residential.

1.5 Remedial Objectives

Based on our understanding of current site conditions and from discussions with MEDEP, CEG did not evaluate impacts to surface or groundwater. CEG has developed the following remedial objectives to mitigate the risk of human risk exposure from PCB impacted surface soils and PCE impacted ambient air in the Charlotte Smith residence by:

- Eliminating or reducing human exposure to PCB impacted soil within 2 feet of grade surface. Exposure pathways include direct dermal contact, ingestion, and inhalation of contaminants from these shallow soils.
- Eliminate or reduce human exposure of PCE impacted ambient air in the Smith residence. The exposure pathway is primarily through inhalation. The source is anticipated to be from PCE spills directly onto the basement concrete floor and to soils beneath the foundation.
- Select mitigation of these two contaminants may also protect other sensitive receptors at the site such as PCE impacting the groundwater used for drinking water and migration of contaminants toward Dennys River through stormwater runoff.

2.0 APPLICABLE REGULATIONS AND CLEAN-UP STANDARDS

2.1 Cleanup Standards for Major Contaminants

Indoor air quality shall be compared with RAG Table 2. Soil gas has no direct corresponding RAG; however, the *Supplemental Guidance for Vapor Intrusion of Chlorinated Solvents and other Persistent Chemicals*, dated February 5, 2016 shall be used for comparison/evaluation.

Soil and concrete analytical results shall be compared with *Maine Remedial Action Guidelines (RAGs) for Sites Contaminated with Hazardous Substances*, February 5, 2016 and appropriate risk based scenarios (ie Residential). PCE in soil has a RAG of 1,000 milligrams per kilogram (mg/kg) for a residential scenario and a leaching to groundwater RAG of 2.7 mg/kg. The

residential RAG for PCBs is 2.4 mg/kg. PCBs will also be evaluated according to 40 CFR 761 of the Toxic Substances Control Act (TSCA).

Applicable or relevant and appropriate requirements (ARARs) must be complied with for all removal actions, to the extent practicable.

2.2 Laws & Regulations Applicable to the Cleanup of PCBs

TSCA has defined PCB Remediation Waste as**:** *waste containing PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations:*

- *materials disposed of prior to April 18, 1978, that are currently at concentrations ≥50 mg/kg PCBs, regardless of the concentration of the original spill**;***
- *materials which are currently at any volume or concentration where the original source was ≥500 mg/kg PCBs beginning on April 18, 1978, or ≥50 mg/kg PCBs beginning on July 2, 1979; and*
- *materials which are currently at any concentration if the PCBs are spilled or released from a source not authorized for use under this part.*

PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup, including, but not limited to:

(1) Environmental media containing PCBs, such as soil and gravel; dredged materials, such as sediments, settled sediment fines, and aqueous decantate from sediment.

(2) Sewage sludge containing <50 mg/kg PCBs and not in use according to §761.20(a)(4); PCB sewage sludge; commercial or industrial sludge contaminated as the result of a spill of PCBs including sludges located in or removed from any pollution control device; aqueous decantate from an industrial sludge.

(3) Buildings and other man-made structures (such as concrete floors, wood floors, or walls contaminated from a leaking PCB or PCB-Contaminated Transformer), porous surfaces, and non-porous surfaces."

Since the spill date and original concentration of PCB containing material impacting the Subject Property are not known. CEG assumes that the spill date is after July 2, 1979 and the concentration of the original material was equal to or greater than 50 mg/kg. Therefore, associated impacted material meets the definition of a PCB Remediation Waste. PCB remediation Waste should be managed according to federal regulations which apply to disposal, characterization, and remediation activities.

There are different options for cleanup and disposal. For most cleanups, the generator of the waste must submit a notification under 40 CFR 761.61(a)(3) to the regional TSCA coordinator. If PCB impacted media is remediated by removal and disposal, PCB Remediation Waste must be managed according to TSCA regulations which apply to disposal, characterization, and

remediation activities. There are different options for cleanup and disposal. The cleanup requirements for porous media are dependent on several factors including the frequency of human occupancy of the area, the concentration of the PCBs, and the future use of the area. Any solid sample equal to or exceeding 50 ppm for PCBs is characterized in the state of Maine as hazardous and, therefore, must be transported and disposed as hazardous waste.

3.0 EVALUATION OF CLEANUP ALTERNATIVES

The following sections shall briefly outline factors impacting cleanup and various clean-up alternatives selected to protect sensitive receptors from known contaminants of concern. The two recognized environmental conditions being evaluated under this ROA/FS are: 1) the PCB impacted soils located north of the house and; 2) the PCE impacts from subsurface soils and basement concrete impacting indoor air quality. The clean-up alternatives are described in a manner that shall assist in selecting the best practical method for protecting human health and the environment.

Certain soil properties including soil density, particle size distribution, moisture content, and permeability are known to affect the mobility of PCBs and PCE. In addition, climatological and chemical characteristics such as rainfall, organic carbon content and the presence of organic colloids can affect mobility.

Physical Properties of Contaminants of Concern		
Property	**PCBs**	**PCE**
Molecular Weight	292-361 grams/mole	165.83 grams/mole
Vapor Pressure	0.1 mm Hg	14 mm Hg
Vapor Density	3.94 kilogram/cubic centimeter	5.7 kilogram/cubic centimeter
Specific Gravity	1.6	1.4
Water Solubility	Insoluble in water	0.015%
Evaporation Rate	Not available	2.8

Physical characteristics and logistical considerations could impact the installation and operation of any remedial alternative selected. For land based (non-aquatic) sites, these items include:

Site layout- The size of the parcel (approximately 0.7 acres) limits any excessive stockpile or large scale mixing or segregation of materials. Care should be taken to prevent runoff and or sedimentation from entering the adjacent Dennys River.

Activities conducted at the site- Historical activities resulting in contamination of soils and indoor air quality is from many years of hazardous waste accumulation and storage that have leaked to surface and subsurface soils. The identified contaminants to be addressed by this ROA/FS include PCB impacted surface soils and PCE impacted concrete and subsurface soils.

Site access-Access to the site is relatively easy from Main Street using the existing driveway; however, vegetation growth has encroached with the former yard areas.

Terrain features and topography-The natural topography slopes southwesterly toward Dennys River. Terrain is relatively flat with the exception of the stream embankment and gradual slope toward Dennys River. Vegetation consists of mature woods, shrubs, and overgrown lawn.

Drainage patterns-Surface runoff follows natural topography in a southwesterly direction toward Dennys River.

Facility footprint and traffic patterns- The house is approximately 25 feet by 40 feet. The driveway terminates at the west side of the residence. A somewhat open area exists between the house and garage and is where the PCB impacted soil was encountered.

Security considerations including:
Utility connections and locations-Water is provided by a private water supply well located approximately 15 feet south of the residence's southeast corner. Electrical source enters the house from overhead power poles to the southeast corner of the house. It is not known where the septic tank or leachfield is located.

Buffer zones-A buffer zone should be maintained along Dennys River and the adjacent property boundary to the east.

Community setting- The Subject Property and vicinity are rural. The nearest resident is approximately 600 feet southeast of the Subject Property boundary and also has a private water supply well.

3.1 Remedial Actions Evaluated

3.1.1 Remedial Actions Evaluated for PCB Impacted Soil

- No Action;
- Containment/Capping assuming that the concentrations are less than or equal to 10 milligrams per kilogram (mg/kg) and this is a high occupancy area as defined by TSCA;
- Excavation and Off-site Disposal of Impacted Soils; and
- In-Situ Solidification.

3.1.2 Remedial Actions Evaluated for PCE Impacted Soil and Concrete Impacting Indoor Air

- No Action;
- Demolition of the house;
- Excavation of basement concrete floor and subsurface soils below foundation; and
- Installation of sub-slab depressurized system, indoor ventilation, and sealed basement floor;

3.2 Cleanup Alternative Options for PCB Impacted Soil

CEG recommends and has incorporated further delineation of the PCB impacted soils for all alternative options with the exception of the "No Action" option. The delineation investigation proposed and budgeted in the cost estimate is intended to characterize the PCB impacted area per TSCA Subpart O using a 10- foot sampling grid. CEG also assumes no PCB concentrations are equal or greater than 50 ppm. The disposal costs and capping requirements for samples exceeding 50 ppm are not addressed in the feasibility study. For the purpose of this ROA/FS, CEG shall assume the volume of soil impacted is 80 cubic yards and it is in a high occupancy area as defined by TSCA.

3.2.1. Effectiveness

3.2.1.1 No Action

No action relies on natural attenuation for the reduction or elimination of contaminants of concern. With PCB contamination, PCBs are not very mobile since they are not very soluble or volatile and adhere strongly to soil particles.

No action also means there is no barrier between the PCB contaminated surface soils and direct human contact or migration to sensitive receptors via surface water runoff. The effectiveness of no action terminating an exposure pathway is **very low**.

3.2.1.2 Containment/Capping

The physical properties of PCBs make capping a favorable remedial method with minimal migration or volatilization potential. Capping can only be implemented if the concentrations of PCBs are equal to or less than 10 mg/kg.

The effectiveness of capping the soils will eliminate direct exposure pathways to humans if properly communicated, documented, and implemented. If these insurance methods are disregarded through lack of knowledge, neglect, or mismanaged, the effectiveness is reduced and risk to exposure increased. The effectiveness of capping is **moderate to good.**

3.2.1.3 Excavation and Off-site Disposal of Impacted Soils

According to MEDEP, the extent of the PCB impacted soil has been delineated and estimated at a volume of 80 cubic yards of material. Excavation and proper off-site disposal of PCB impacted soils will remove any risk to exposure and eliminate any potential for migration to a sensitive receptor. Confirmation sampling post excavation shall document representative remaining soils are below regulatory guidelines. The effectiveness of excavation and off-site disposal of PCB impacted soils is **very good**.

3.2.1.4 In-Situ Solidification

Waste stabilization involves the addition of a binder, such as Portland cement, cement kiln dust, fly ash, or a combination of the three to a waste to convert contaminants into an insoluble, less mobile, and less toxic form. Solidification processes utilize one or both of these techniques and are fundamentally different from other PCB remedial technologies in that they reduce the mobility of PCBs, but do not concentrate or destroy them.

Physical mechanisms that can interfere with the solidifying process include: (1) incomplete mixing due to the presence of high moisture or organic chemical content resulting in only partial wetting or coating of the waste particles with the stabilizing and binding agents and, (2) the aggregation of untreated waste into clumps. Wastes with high clay content may aggregate, interfering with uniform mixing of the solidifying agents, and/or the clay surface may adsorb key reactants, interrupting the polymerization chemistry of the solidifying agents. Wastes with a high hydrophilic organic content may interfere with solidification by disrupting the gel structure of the curing cement or pozzolanic mixture. The onsite soils are characteristic of Presumpscot Formation consisting primarily of heterogeneous silt and clay with a shallow water table. Therefore, the effectiveness of the solidification is **low** and would likely require similar deed restrictions and institutional controls as capping since the contaminant still remains.

3.2.2 Implementability

3.2.2.1 No Action

No action has no implementability. No action also means no sampling or monitoring to document any changes in concentrations or migration over time as a result of natural attenuation. There is also no method implemented to monitor effects on sensitive receptors.

3.2.2.2 Containment/Capping

Capping requires initial construction activities which should include measures for protecting the construction workers and general public during and subsequent to the capping activities. Implementation of capping includes, but is not limited to, equipment access, appropriate marking,

grading, compaction, survey location documentation, deed restriction for informing future property owners for perpetuity, periodic inspections and all necessary maintenance of institutional controls, and a soil management plan for any future earthwork. The most challenging aspect of capping is having the property owner, subcontractor, or other designated party responsible for conducting the inspections and performing necessary repairs, as warranted. For this reason, the implementability of capping is initially **good but may decrease** over time through generations and or future divestments of the property.

3.2.2.3 Excavation and Off-Site Disposal of Impacted Soils

The implementation of excavation and off-site disposal of PCB impacted soil consists of notification to the TSCA regional representative, preparing a work plan, contracting an excavator and operator, supervisor documenting the work, scheduling and coordinating the transportation and disposal of impacted soil, collecting and analyzing remaining soil to confirm PCB concentrations are below the regulatory guideline, possible re-excavation based on laboratory results, collecting another set of confirmation samples for PCB analysis, and the backfill of the excavation. The confirmation sampling is vital for documenting remaining soil conditions but the possibility of multiple sampling and excavation events are time consuming and costly. However, the actual implementability is **good**.

3.2.2.4 In-Situ Solidification

The implementation of in-situ solidification consists of, but is not limited to, the excavation and mixture of impacted soils with a solidifying compound such as Portland cement to further bind the contaminants into a media that prevents PCBs from volatilizing or migrating. The most common inorganic binders are Portland cement, pozzolans (siliceous or aluminous materials that can react with calcium hydroxide to form compounds with cementitious properties), and cement/pozzolan mixtures. The process does not destroy PCB concentrations; therefore, the final product may still be characterized as PCB waste. CEG does not anticipate an appropriate end use of the material at the Subject Property such as incorporating into a cell as part of a structure. If buried on-site, it may require similar measures as capping.

Factors considered most important in applicability determinations are design, implementation, and performance of solidification processes and products, including the waste characteristics (chemical and physical), processing requirements, solidification product management objectives, regulatory requirements, and economics. These and other site-specific factors (e.g. location, condition, climate, hydrology, etc.) that must be taken into account when determining whether, how, where, and to what extent a particular solidification method should be used at a particular site. The implementability of solidification is **low**.

3.2.3 Cost

The following sections outline a brief work scope and assumptions made when calculating costs for each alternative method listed.

3.2.3.1 No Action

No action generates no cost.

3.2.3.2 Containment/Capping

The cost for capping assumes the following:

- Area to be capped is 50 feet by 21.5 feet;
- The area will require grubbing of current vegetation and continued maintenance;
- Cap consists of 2 feet thickness

The estimated cost is $31,687.50. A break down of the time and materials is included in **Appendix B**.

3.2.3.3 Excavation and Off-site Disposal of impacted Soils

The cost for the excavation and off-site disposal of impacted soils assumes the following:

- costs for the preparation of a TSCA Self Implementing Cleanup of PCB Remediation Waste Work Plan for submission to TSCA;
- costs for a supplemental characterization for further delineating the lateral and vertical extent of PCB impacts using TSCA's recommended 10 foot grid sampling procedure;
- assume the volume of soil to be excavated and disposed is the estimated 80 cubic yards of soil during one mobilization with no subsequent excavations following confirmation sampling;
- Confirmation sampling for PCB concentrations remaining in adjacent soils shall be conducted according to TSCA Subpart O at a 5 foot grid interval with no composite sampling. Estimated the initial sampling grid shall consist of approximately 60-90 samples (75 samples for cost purposes) depending on the actual excavation dimensions upon completion;
- A Self-Implementing Cleanup of PCB Remediation Waste Notification Summary Report shall be prepared and submitted to TSCA following final cleanup confirmation sampling;

The estimated cost is $54,396. A break down of the time and materials is included in **Appendix B**.

3.2.3.4 In-Situ Solidification

The cost for in-situ solidification of impacted soils assumes the following:

- The binding material consists of Portland cement;
- The ratio of impacted soil and binding material is 80/10;
- The solidification mixture is re-spread in generally the same area but expanded due to the addition and capped with 2 feet of fill material;
- The capping will require the same deed restrictions and measures as the capping described in the containing/Capping option.

The estimated cost is $50,029.00. A break down of the time and materials is included in **Appendix B**.

3.3 Cleanup Alternative Options for VOCs Impacting Indoor Air Quality

CEG recommends and has incorporated further delineation of the PCE impacted concrete for the Removal of Basement Floor and Subsurface Soils option. The delineation investigation proposed and budgeted in the cost estimate is intended to characterize the material for disposal as well as identify the limits of PCE impacts for select removal to minimize removal and disposal costs. All other options include the concrete material and soil below the concrete to remain in-place.

3.3.1 Effectiveness

3.3.1.1 No Action

Chlorinated solvents may volatize but are mobile in the environment and likely to migrate rapidly to sensitive receptors. With no proposed removal, reduction, or containment measures implemented, the contaminant in the soil and concrete are likely to remain a source and continue to infiltrate to the groundwater table and migrate with the groundwater gradient potentially impacting other private water supply wells and or the adjacent Dennys River, as well as continued vapor intrusion issue with the house.

3.3.1.2 Demolition of the House

The removal of the house eliminates any vapor intrusion since vapors are no longer impacting indoor air quality. A deed restriction prohibiting the construction of any habitable space in this area would be required to prevent any future vapor intrusion potential. This alternative does not eliminate or reduce PCE contamination and therefore sensitive receptors are still at risk. The effectiveness of this alternative is **good for the short term but limits the redevelopment of the site**.

3.3.1.3 Removal of Basement Floor and Subsurface Soils

It is CEG's understanding that the concrete floor of the basement is the primary source of PCE impacting indoor air quality. CEG anticipates that some residual PCE impacts to subsurface soils below the concrete foundation may need to be removed and disposed as well. By removing the source, backfilling with clean material, and pouring a new concrete floor, there should be little to no PCE impacts to indoor air quality; therefore, the effectiveness of this method is **very good**.

3.3.1.4 Installation of Sub-Slab Depressurized System, Indoor Air System, and Sealed Basement Floor

The effectiveness of a sub-slab depressurized system and or indoor air system shall be partially dependent on the design of the system. The system should be designed to provide adequate areas of influence that overlap in the subsurface vadose zone through the number or type of underground ventilation points or trenches with the appropriate sized blower. The system should also account for potential contaminants that are derived from the concrete floor. This would allow indoor air within the basement to be evacuated to the exterior of the structure.

Another factor involved with the effectiveness of this type of design is that it be periodically monitored to verify PCE concentrations are within indoor air quality standards for perpetuity. Without any contaminant removal, the source of PCE remains below the house indefinitely and therefore, the system must be operated continuously. Some reduction of the PCE concentrations are expected to occur through volatilization however, the system is not intended or designed as a remedial soil vapor extraction system. Even temporary disruptions such as power outages or equipment malfunctions could cause harmful conditions. There is no guarantee that property owners or occupants of the structure will have knowledge of the operation and maintenance of the system and therefore it may be disconnected or ignored.

An added measure for insuring the vapors in soils below or within the foundation do not impact the indoor air quality is to seal the floor. Following system installation, an initial confirmation indoor air sample for VOCs should be collected and analyzed. Upon completion of the system, a concrete seal may be appropriate to further reduce the potential for indoor air impacts. Sealants selected may include a concrete skim coat, an epoxy, or other approved product.

Based on the factors mentioned above, the effectiveness of the sub-slab depressurized system combined with a basement indoor air system, and foundation sealing is **moderate** for the short term; however, does not provide source removal or guarantee for proper operation and maintenance.

3.3.2 Implementability

3.3.2.1 No Action

No action is easy to implement, but will not improve any health risks.

3.3.2.2 Demolition of the House

To implement the demolition of the house would require an excavator, trucks for transporting the demolition debris to an appropriate disposal facility, and backfilling the excavation to natural grade. A deed restriction, appropriate survey, and all other necessary documentation shall be required to prevent any future development unless mediated in the future to current State guidelines. The implementability of demolishing the house is **very good**. Implementing the land use restrictions will be harder to evaluate and will be based on oversight of future land owners. Therefore, the implementability of these restrictions is **moderate**.

3.3.2.3 Installation of Sub-Slab Depressurized System, Indoor Air System, and Sealed Basement Floor

The implementability of the sub-slab depressurized system and indoor air system includes vacating the residence during construction, drilling through the concrete foundation, connecting piping to a vacuum pump, ventilating pump effluent outside, provide any additional electrical needs, and sound proof (if necessary). An example of a proposed system may include five suction points into which three inch PVC pipes will be sealed. These five pipes will be run vertically into a common four inch header which will be run to a point outside the house. An inline exhaust fan will be installed on the exterior side of the building. The exhaust fan will be hard wired to a weatherproof disconnect switch by a Licensed Master Electrician. From the exhaust fan the pipe will continue vertically to a point above the roof. Fan selection will be based on the condition of the sub-slab aggregate and required air flow. A second blower could be installed to vent indoor air directly from the basement into the exterior atmosphere.

Testing of the system subsequent to completion will verify if the anticipated area of influence was obtained. The system can be modified by the addition or change in vacuum pump and or additional points. Following the completion of the sub-slab depressurized system and indoor air system, the concrete basement floor may be sealed. If sealing is performed, particular care will be given in areas of apparent cracks and piping entering or exiting from the concrete floor. The floor seal will require inspection and periodic maintenance. Subsequent indoor air sampling should also be conducted to verify the indoor air quality meets health guidelines. The implementability for this system is **fair to good** based on the sub-slab aggregate material and area of influence and the appropriate and adequately applied sealant.

3.2.3.4 Removal of Basement Floor and Subsurface Soils

The removal of the basement floor and subsurface soils is somewhat problematic based on limited access. Removal will be based on an earlier assessment of concrete conditions to determine the amount needed to be removed. The majority of the work will require extensive manual labor for breaking up the concrete, removing the concrete through the bulkhead, a combination of hand shoveling and use of a vactor truck (if feasible) for transferring the material out of the basement. Based on the estimated dimensions of the house (25 feet by 40 feet) and an assumed concrete thickness of 6-inches, generates 18.5 cubic yards of concrete to crush and handle and up to approximately 75 cubic yards of impacted soil (assuming 2 feet thick) to hand shovel and transfer out of the basement. There is a major assumption that the majority of the impacted area can be removed without compromising the integrity of the house.

Other implementability factors include necessary ventilation, dust mitigation, and any additional support systems for maintaining the integrity of the house during excavation for the safety of the workers. The implementability of this method is considered **fair**.

3.3.3 Cost

3.3.3.1 No Action

No action incurs no cost.

3.3.3.2 Demolition of Building

CEG has assumed the following for estimating costs associated with this option:

- No hazardous materials are associated with the house (other than the concrete floor) so no additional costs are included for items such as asbestos, lead paint, and PCBs, etc;
- All building materials can be disposed as construction debris; and
- The concrete foundation and soils below foundation are proposed to remain in place.

The estimated cost is $25,900. A break down of the time and materials is included in **Appendix C**.

3.3.3.3 Installation of Sub-Slab Depressurized System and Sealed Basement Floor

CEG has made the following assumptions for the purpose of estimating costs:

- A pilot test shall be conducted following installation and modifications made to system;
- Basement floor to be sealed with an epoxy unless specified otherwise.

The estimated cost is $43,743.50. A break down of the time and materials is included in **Appendix C**.

3.3.3.4 Removal of Basement Floor and Subsurface Soils

CEG has made the following assumption for the purpose of estimating associated costs:

- Concrete foundation will be disposed at a Subtitle C Hazardous Waste Landfill; and
- Volume of impacted soil below the basement foundation is estimated at 75 cubic yards for trucking and disposal costs.

The estimated cost is $173,867.75. A break down of the time and materials is included in **Appendix C**.

3.4 Recommended Cleanup Alternative

3.4.1 Recommended PCB Remedial Option

Since no action is not appropriate, the cost differential for addressing the PCB-impacted soil ranges from $31,687 to $54,396. Excavation and disposal is the most costly option, but it will also allow the property to be unencumbered with the stigma and deed restriction requirements of leaving the PCB-impacted soil on site. This additional $22,709 worth of cost will be small investment when evaluating the potential worth of the property as time increases. It is anticipated that the value of the property will continue to grow at a much higher rate when not encumbered by the PCB-impacted soil. CEG recommends excavation and disposal of the PCB-impacted soil.

Table 1
ROA/FS PCB Impacted Soils

Remedial Option	Overall Protection of Human Health & the Environment	Technical Practicality	Implementability	Reduction of Toxicity, Mobility, & Volume	Short Term Effectiveness	Cost	Comments
1A-No Action	None	NA	NA	None	None	$0	
1B-Capping	Eliminates direct contact with humans	Provides long term exposure barrier if properly maintained	Short time frame and low costs for the initial construction but difficult to insure cap is inspected and maintained as needed for the long term	No reduction in toxicity or volume. Mobility by stormwater runoff will be eliminated.	Barrier can be installed within days.	Initial costs-$**31,687** Long-term maintenance costs can vary significantly.	
1C-Excavation & Disposal	Removes all contaminants exceeding a RAG off-site	Removal of COC eliminates exposure risk and migration to sensitive receptors	Equipment can easily access surface soils	Removal of all soils exceeding a regulatory guideline eliminates toxicity and mobility of COC	Confirmation sampling shall dictate the need for subsequent excavation and sampling events	One time cost of $**54,396**	
1D-Solidification	Reduces mobility and provides exposure barrier	Does not remove or reduce COC.	Soils and mixing are readily accessible, increase in volume requires larger spread area and capping dimensions	No reduction in toxicity, decrease in mobility, and increase in volume	Mixing and capping can be completed in a couple weeks. Inspecting and maintaining IC can be difficult to enforce	Cost-**$50,029**	

COC-contaminant of concern, RAG-remedial Action Guideline, IC-Institutional Control, PCB-polychlorinated biphenyls

3.4.2 Recommended PCE Remedial Option

There is no guarantee that the subslab depressurization system combined with the indoor air system and concrete sealing will work or more importantly will be maintained by future owners. Excavation and disposal of the source would be the most probable way of eliminating the risks. The costs displayed for this study represent what is envisioned as a worst case scenario. There is a probability that removal costs of the concrete and soil in the basement could be greatly reduced. The extent of the PCE-impacted materials requiring remediation will be better evaluated once an assessment is complete. As a result, CEG assumes that the removal cost will decrease and be a more viable financial solution. CEG recommends performing a basement assessment and then, pending favorable results, conducting a limited excavation and disposal of the impacted materials.

Table 2
ROA/FS PCE Impacted Concrete and Ambient Air Quality

Remedial Option	Overall Protection of Human Health & the Environment	Technical Practicality	Implementability	Reduction of Toxicity, Mobility, & Volume	Short Term Effectiveness	Cost	Comments
2A-No Action	None	NA	NA	None	None	$**0**	
2B-House Demolition	No longer a residence at that location, restricted	Does not address COC unless impacted concrete is removed	Standard demolition project with exception of proper disposal of PCE impacted concrete	Reduction of COC occurs if PCE impacted concrete floor is properly disposed off-site	Addresses vapor intrusion by removing the structure but does not address PCE COC in subsurface soil	$**25,900**	
2C-Depressurized Sub-Slab System, Indoor Air System, and Seal Concrete	Designed to protect human health as long as operating properly and continuously.	For most effective results vacuum points must be in gravel base below foundation	The design should be tested after installation and modified as necessary based on pilot test/area of influence and indoor air testing	Depressurization not intended to mitigate VOCs but will cause some minor reduction.	Sealing concrete should provide barrier from exposure and depressurized system should eliminate VOC from encroaching into indoor air.	$**43,743.50**	
2D-Excavation & Disposal	Removal of impacted concrete and soil removed risk	Removal of COC eliminates exposure pathways and therefore no longer a risk	Potentially labor intensive due to limited basement access. Also limits equipment use.	Removal of all PCE impacted material > than RAG should eliminate toxicity, mobility, and volume	Once removal complete within a couple weeks and basement is aerated no additional work anticipated	$**173,867.75**	

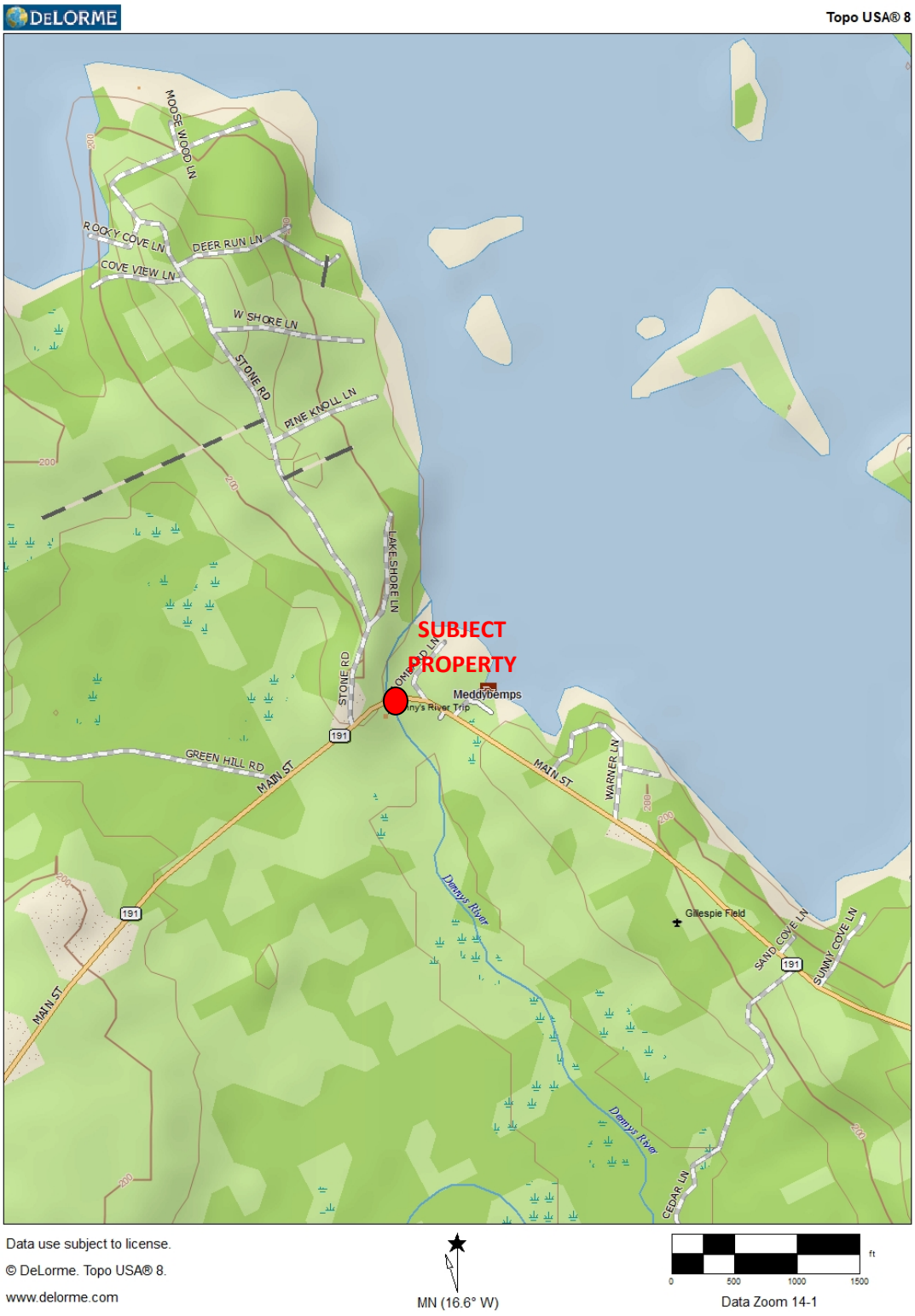
COC-contaminant of concern, VOCs-volatile organic compounds, PCE-tetrachloroethylene,

CAMPBELL ENVIRONMENTAL GROUP

APPENDIX A
Figures

FIGURE 1

Locus Map



APPENDIX B
Cost Sheets For PCBs Remedial Options

Cost Estimate
PCB Soil Capping

Task	Scope of Work	Unit	Rate	Estimated Costs		
				w/o markup	w/markup	Total
1	**TSCA and DEP Work Plan**					
	Labor:	1	$4,370.00	$4,370.00	$4,370.00	$4,370.00
2A	**Update Current Health & Safety Plan**					
	Labor:	1	$150.00	$150.00	$150.00	$150.00
B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
3	**TSCA 10' Grid Delineation (estimated 1 day on-site)**					
	Labor:	1	$1,125.00	$1,125.00	$1,125.00	
	Truck Mileage	350	$0.50	$175.00	$175.00	
	Laboratory					
	PCBs	30	$90.00	$2,700.00	$2,970.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	$4,325.00
4	**Clean-up Oversight (estimated 3 days on-site)**					
	Labor:	1	$4,125.00	$4,125.00	$4,125.00	
	Truck Mileage Mob/Demob	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	80	$0.50	$40.00	$40.00	
	Subcontractors					
	Excavator/Fill	1	$12,555.00	$12,555.00	$13,810.50	
	Survey	1	$1,200.00	$1,200.00	$1,320.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	
	Per Diem	3	$89.00	$267.00	$267.00	
	PPE	3	$5.00	$15.00	$15.00	
	Camera	3	$20.00	$60.00	$60.00	$19,867.50
5	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$1,660.00	$1,660.00	$1,660.00	$1,660.00
6	**Prepare & Submit Deed Restriction for Registry of Deeds**					
	Labor:	1	$565.00	$565.00	$565.00	
	Fees	1	$100.00	$100.00	$110.00	$675.00
Notes:						
					Total Cost Estimate	**$31,687.50**

Cost Estimate
PCB Soil Excavation Disposal

Task	Scope of Work	Unit	Rate	Estimated Costs w/o markup	Estimated Costs w/markup	Total
1	**TSCA and DEP Work Plan**					
	Labor:	1	$3,990.00	$3,990.00	$3,990.00	$3,991.00
2A	**Update Current Health & Safety Plan**					
	Labor:	1	$150.00	$150.00	$150.00	$150.00
B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
3	**TSCA 10' Grid Delineation (estimated 1 day on-site)**					
	Labor:	1	$1,125.00	$1,125.00	$1,125.00	
	Truck Mileage	350	$0.50	$175.00	$175.00	
	Laboratory					
	PCBs	30	$90.00	$2,700.00	$2,970.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	$4,325.00
4	**Clean-up Oversight (estimated 5 days on-site)**					
	Labor:	1	$2,325.00	$2,325.00	$2,325.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	80	$0.50	$40.00	$40.00	
	Subcontractors					
	Excavate	1	$17,255.00	$17,255.00	$17,255.00	
	T & D 80 CY	1	$13,200.00	$13,200.00	$14,520.00	
	Laboratory					
	Waste Disp Package	1	$700.00	$700.00	$770.00	
	RCRA 8 Metals					
	VOC 8260					
	SVOC 8270					
	PCB 8082					
	Ign/Flash					
	Corrosivity/pH					
	Reactivity Sulfide					
	Reactivity Cyanide					
	Pest 8081	1	$108.00	$108.00	$108.00	
	Herb 8151	1	$264.00	$264.00	$264.00	
	Confirmation Sampling TSCA SubPart-O					
	Laboratory					
	PCBs	60	$90.00	$5,400.00	$5,940.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	
	Per Diem	2	$89.00	$178.00	$178.00	
	PPE	2	$5.00	$10.00	$10.00	
	Camera	2	$20.00	$40.00	$40.00	$41,680.00
5	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$3,610.00	$3,610.00	$3,610.00	$3,610.00
Notes:						
					Total Cost Estimate	**$54,396.00**

Cost Estimate
PCB Soil Solidification

Task	Scope of Work	Unit	Rate	Estimated Costs		
				w/o markup	w/markup	Total
1	**TSCA and DEP Work Plan**					
	Labor:	1	$4,370.00	$4,370.00	$4,370.00	$4,370.00
2A	**Update Current Health & Safety Plan**					
	Labor:	2	$75.00	$150.00	$150.00	$150.00
2B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
3	**TSCA 10' Grid Delineation (estimated 1 day on-site)**					
	Labor:	1	$1,125.00	$1,125.00	$1,125.00	
	Truck Mileage	350	$0.50	$175.00	$175.00	
	Laboratory					
	PCBs	30	$90.00	$2,700.00	$2,970.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	$4,325.00
4	**Clean-up Oversight (estimated 5 days on-site)**					
	Labor:	1	$3,750.00	$3,750.00	$3,750.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	80	$0.50	$40.00	$40.00	
	Subcontractors					
	Excavate	1	$19,775.00	$19,775.00	$19,775.00	
	Cap	1	$12,544.00	$12,544.00	$12,544.00	
	Survey	1	$1,200.00	$1,200.00	$1,320.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	
	Per Diem	5	$89.00	$445.00	$445.00	
	PPE	5	$5.00	$25.00	$25.00	
	Camera	5	$20.00	$100.00	$100.00	$38,229.00
5	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$1,660.00	$1,660.00	$1,660.00	$1,660.00
6	**Prepare & Submit DEC for Registry of Deeds**					
	Labor:	1	$555.00	$555.00	$555.00	
	Fees	1	$100.00	$100.00	$100.00	$655.00
Notes:						
					Total Cost Estimate	**$50,029.00**

APPENDIX C
Cost Sheets For PCE Remedial Options

Cost Estimate
House Demolition

Task	Scope of Work	Unit	Rate	Estimated Costs		
				w/o markup	w/markup	Total
1	**Design/Remedial Action Plan**					
	Labor:	1	$190.00	$190.00	$190.00	$190.00
2A	**Update Current Health & Safety Plan**					
	Labor:	2	$75.00	$150.00	$150.00	$150.00
B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
4	**House Demolition**					
	Labor:	1	$1,125.00	$1,125.00	$1,125.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	20	$0.50	$10.00	$10.00	
	Subcontractors					
	Demo & Disposal of House Debris	1	$18,000.00	$18,000.00	$18,000.00	
	Survey	1	$1,200.00	$1,200.00	$1,320.00	
	PID	1	$75.00	$75.00	$75.00	
	Camera	1	$20.00	$20.00	$20.00	$20,725.00
5	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$3,610.00	$3,610.00	$3,610.00	$3,610.00
6	**Prepare & Submit Deed Restriction for Registry of Deeds**					
	Labor:	1	$475.00	$475.00	$475.00	
	Fees	1	$100.00	$100.00	$110.00	$585.00
Notes:						
					Total Cost Estimate	**$25,900.00**

Cost Estimate
PCE Sub-Slab depressure and indoor Air ventilation W/ Floor Sealant

Task	Scope of Work	Unit	Rate	Estimated Costs w/o markup	Estimated Costs w/markup	Total
1	**Design/Remedial Action Plan**					
	Labor:	1	$3,420.00	$3,420.00	$3,420.00	$3,420.00
2A	**Update Current Health & Safety Plan**					
	Labor:	1	$150.00	$150.00	$150.00	$150.00
B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
3	**Depressurized Sub-slab System Installation & Pilot Test (estimated 3 days on-site)**					
	Labor:	1	$2,125.00	$2,125.00	$2,125.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	150	$0.50	$75.00	$75.00	
	Subcontractors					
	Radon Contractor	1	$5,000.00	$5,000.00	$5,000.00	
	Waste Mgmt T & D	21	$561.00	$11,781.00	$11,781.00	
	Laboratory					
	Waste Disp Package	1	$700.00	$700.00	$770.00	
	RCRA 8 Metals					
	VOC 8260					
	SVOC 8270					
	PCB 8082					
	Ign/Flash					
	Corrosivity/pH					
	Reactivity Sulfide					
	Reactivity Cyanide					
	Pest 8081	1	$108.00	$108.00	$108.00	
	Herb 8151	1	$264.00	$264.00	$264.00	
	Ambient air					
	TO-15 Air	1	$125.00	$125.00	$137.50	
	Misc Expenses	1	$50.00	$50.00	$55.00	
	Per Diem	2	$89.00	$178.00	$178.00	
	PID	2	$75.00	$150.00	$150.00	
	PPE	2	$5.00	$10.00	$10.00	
	Camera	2	$20.00	$40.00	$40.00	$20,868.50
4	**Modifications to the Depressurized Sub Slab System (estimated 1 day on-site)**					
	Labor:	1	$425.00	$425.00	$425.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	20	$0.50	$10.00	$10.00	
	Subcontractors					
	Radon Contractor	1	$2,500.00	$2,500.00	$2,500.00	$3,110.00
5	**Indoor Air Ventilation System (estimated 1 day on-site)**					
	Labor:	1	$525.00	$525.00	$525.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	20	$0.50	$10.00	$10.00	
	Subcontractors					
	Radon Contractor	1	$2,500.00	$2,500.00	$2,500.00	$3,210.00
6	**Sealing Basement Floor (estimated 1 day on-site)**					
	Labor:	1	$1,050.00	$1,050.00	$1,050.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	20	$0.50	$10.00	$10.00	
	Subcontractors					
	EPI	1	$7,500.00	$7,500.00	$7,500.00	$8,735.00
7	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$3,610.00	$3,610.00	$3,610.00	$3,610.00
Notes:						
					Total Cost Estimate	**$43,743.50**

Cost Estimate
PCE Basement Floor and Subsurface Soil Excavation Disposal

Task	Scope of Work	Unit	Rate	Estimated Costs w/o markup	Estimated Costs w/markup	Estimated Costs Total
1	**Design/Remedial Action Plan**					
	Labor:	1	$4,370.00	$4,370.00	$4,370.00	$4,370.00
2A	**Update Current Health & Safety Plan**					
	Labor:	2	$75.00	$150.00	$150.00	$150.00
B	**Preparation of the Site Specific QAPP**					
	Labor:	1	$640.00	$640.00	$640.00	$640.00
3	Further Delineation of PCE Impacts to Basement Floor					
	Labor:	1	$975.00	$975.00	$975.00	
	Truck Mileage	350	$0.50	$175.00	$175.00	
	Laboratory					
	Chlorinated VOCs	40	$170.00	$6,800.00	$6,800.00	
	Equip & Expenses					
	Generator	1	$100.00	$100.00	$100.00	
	Hammer drill	1	$120.00	$120.00	$120.00	
	Miscellaneous	1	$50.00	$50.00	$50.00	$8,220.00
4	**Excavate Basement Floor (estimated 5 days on-site)**					
	Labor:	1	$4,500.00	$4,500.00	$4,500.00	
	Truck Mileage Mob/Demob 1st event	350	$0.50	$175.00	$175.00	
	Truck Mileage Daily	150	$0.50	$75.00	$75.00	
	Subcontractors					
	EPI	1	$65,000.00	$65,000.00	$65,000.00	
	Waste Management T & D					
	Concrete 18.5 CY	37.5	$561.00	$21,037.50	$23,141.25	
	Soil 75 CY	100	$561.00	$56,100.00	$61,710.00	
	Laboratory					
	Waste Disp Package	1	$700.00	$700.00	$770.00	
	RCRA 8 Metals					
	VOC 8260					
	SVOC 8270					
	PCB 8082					
	Ign/Flash					
	Corrosivity/pH					
	Reactivity Sulfide					
	Reactivity Cyanide					
	Pest 8081	1	$108.00	$108.00	$108.00	
	Herb 8151	1	$264.00	$264.00	$264.00	
	Ambient air					
	TO-15 Air	2	$125.00	$250.00	$275.00	
	Misc Expenses	1	$50.00	$50.00	$55.00	
	PID	5	$75.00	$375.00	$412.50	
	Per Diem	3	$89.00	$267.00	$267.00	
	PPE	5	$5.00	$25.00	$25.00	
	Camera	5	$20.00	$100.00	$100.00	$156,877.75
5	**Preparation of a Remedial Action Completion Report**					
	Labor:	1	$3,610.00	$3,610.00	$3,610.00	$3,610.00
Notes:						
					Total Cost Estimate	**$173,867.75**