Environmental Consultants
and Contractors

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SCS ENGINEERS

October 25, 2017
File No. 25212159.01

Ms. Nancy D. Ryan, Hydrogeologist
Bureau for Remediation and Redevelopment
Wisconsin Department of Natural Resources
2300 N. Dr. Martin Luther King, Jr. Drive
Milwaukee, WI 53212

Subject: Interim Actions Options
Queens Way Cleaners (former), aka Speedy Lube
117 East Capitol Drive, Milwaukee, Wisconsin
BRRTS #02-41-182420

Dear Nancy:

The following information is being submitted by SCS Engineers (SCS) on behalf of the Hunn Family Trust for the former Queens Way Cleaners, located at 117 East Capitol Drive, Milwaukee, Wisconsin. This letter is a follow-up to the Additional Site Investigation Report submitted by SCS on May 17, 2017, which noted that SCS would submit an analysis of interim actions and ballpark costs as requested by the WDNR in the approval letter dated November 10, 2016. The following is a summary of findings from the Additional Site Investigation Report that are critical to the evaluation of interim options.

## Groundwater Flow

The depth to groundwater at the site has been consistent based on measurements made in 2013 to 2017. Based on topography and surface water, the groundwater flow is expected to be to the northeast, to the Milwaukee River. A water table contour map based on the most recent water level measurements indicates groundwater flow at the water table radially outward from former tetrachloroethene (PCE) tank location near MW1. The former PCE tank excavation is acting as an area of increased infiltration to groundwater due to the permeable backfill, the grass-covered ground surface over lying the area, and runoff from the garage roof.

## Volatile Organic Compound (VOC) Concentrations in Groundwater

An isoconcentration map of VOCs in groundwater based on the most recent groundwater sampling event, shows the same radial pattern as the groundwater flow map. The contamination observed at MW-2A may be due to the mounding condition caused by the increased infiltration in the former tank area or may be associated with another source of chlorinated VOCs (CVOCs), possibly the body shop at 3913 North Palmer Street.

### Site Geology

The soils in the area of the site are predominantly lean clay and silt to a depth of about 23 feet – the maximum depth of on-site borings. The cross-sections show the water table a few feet below the bottom of the former PCE tank basin, indicating the effect of increased infiltration in the (bathtub) former tank basin due to the gravelly backfill placed in an excavation dug in low permeability clayey soils.

Auger drilling at MW-12 met refusal at a depth of about 20 feet. Logs of private wells located in the area (primarily north of E. Capitol Drive) indicated "limestone" bedrock at a depth of about 40 feet. The refusal at MW-12 may be due to the presence of a very dense, gravelly sediment layer above the bedrock.

## 1 INTERIM ACTIONS OPTIONS ANALYSIS

Analysis of interim actions options will be focused on the high concentrations of CVOCs in soil and groundwater in the area of the former PCE tank. Constraints include the following:

- The identified source area location's proximity to the property line.
- The off-site garage located adjacent/over the source area.
- The automobile service business at the site operated by a tenant.
- The proximity of the residence at 3935 N. Palmer Street to the source area.
- The underground gas line north of, and adjacent to, the source area.
- The overhead electric service line south of, and adjacent to, the source area.
- The native clayey and silty soils with low permeability.
- The high permeability sand and gravel backfill in the PCE tank excavation.
- The depth of high concentrations of contamination (155,000 micrograms per kilogram [µg/kg] PCE in soil at 22 feet below the ground surface).
- Contaminants in soil at hazardous concentrations.
- Permeable surface cover over the source area.

SCS considered two options for removal of contaminated soil in the area of the former tank location. A third option considered is capping with very minimal soil excavation. The scope of work for each option is outlined in the following sections and cost summaries are provided in **Attachments 1 - 3**.

**Option 1** included the removal of 51 tons of shallow non-hazardous soil, and 267 tons of hazardous soil from the former tank area. The cost for excavation, hauling, and disposal of the contaminated soil, and site restoration is estimated to be $221,600. The cost for option 1 is prohibitive.

**Option 2** included the removal of 51 tons of shallow non-hazardous soil, and mixing in of a treatment additive (such as Regenesis PersulfOx) is to address the remaining hazardous soil in the former tank area. The cost for excavation, hauling, and disposal of the contaminated soil, and treatment additive is estimated to be $28,700. The costs for option 2 are high on per ton of

soil removed/treated. This option is not recommended because of the low potential for the treatment additive to treat the low permeability native contaminated soil outside of the excavation backfill, and the potential for vapors created by the additive to intrude the adjacent building.

**Option 3**, capping the former tank basin source area, is the recommended option because it will reduce preferential infiltration and decrease the hydraulic head driving the plume migration. The estimated cost is $8,200.

Following is a description of each option.

### Option 1 – Removal of Source Area Hazardous and Non-Hazardous Soil & Capping

This option includes the removal non-hazardous shallow (to about 8 feet depth) soils, and hazardous soils (to about 12 feet depth) in the area of the PCE tank bed, backfilling with low permeability soil, and capping the area with concrete or asphalt to prevent infiltration of surface water and precipitation. Monitoring well MW1 would be abandoned and replaced; underground utilities and sidewalks would be replaced.

**Pros**

- Removes the greatest amount of PCE mass.
- Removes the groundwater mound so the groundwater flow can return to normal, pre-excavation state, and the direction of flow can be determined.
- Removes the head driving the contaminated groundwater radially outward.
- Prevents infiltration through the contaminant source area.

**Cons**

- Generates hazardous waste.
- Costs for soil disposal and site restoration are very high.

**Option 1 - Hazardous & Non-Hazardous Soil Removal**

| | SCS Labor & Expenses | Lab | Soil Excavation & Disposal | Utility locate | Site Restoration | Drilling | Subtotal |
|---|---|---|---|---|---|---|---|
| Planning | $4,050 | | | | | | $4,050 |
| Field Investigation | $6,190 | $940 | $186,400 | $400 | $17,322 | $1,480 | $212,732 |
| Reporting | $4,780 | | | | | | $4,780 |
| Totals | $15,020 | $940 | $186,400 | $400 | $17,322 | $1,480 | $221,562 |
| **Total Estimated Amount (rounded to $100)** | | | | | | | $221,600 |

| **Scope of Work** |
|---|
| Excavate shallow CVOC (non-hazardous) soil from tank basin. |
| Backfill with low permeability soil. |
| Cap area with concrete or asphalt. |
| Move gas line to on-site building and electric to neighbor's garage |
| Excavate hazardous soil to 12 ft bgs (~water table depth) in area of B2, B18, SB2 |
| Excavate hazardous soil at 8-12 ft bgs (below water table depth) in area of tank basin, S100, MW1 |
| Backfill with low permeability soil, replace sidewalk, and top soil & grass |
| Replace MW1. |

See **Attachment 1** for cost estimate details.

### Option 2 – Non-Hazardous Source Area Soil Removal with Treatment Additive & Capping

This option includes the removal non-hazardous shallow (to about 8 feet depth) soils, and placement of a treatment additive such as PersulfOx in the excavation backfill in the area of the PCE tank bed, backfilling with low permeability soil, and capping the area with concrete or asphalt to prevent infiltration of surface water and precipitation. The monitoring well MW1 would be abandoned and replaced; underground utilities and sidewalks would be replaced.

**Pros**

- Removes some PCE mass.
- The excavation provides a means of incorporating a treatment additive.
- Removes the groundwater mound so the groundwater flow can return to normal, pre-excavation state, and the direction of flow can be determined.
- Removes the head driving the contaminated groundwater radially outward.
- Prevents infiltration through the contaminant source area.
- Does not generate hazardous waste.
- The additive potentially provides on-going treatment of soil and groundwater in the immediate area.
- Costs for soil disposal and site restoration are moderate.

**Cons**

- Treatment additive potentially generates toxic or otherwise undesirable products in close proximity to the garage service bays and the house basement.

**Option 2 - Non-Hazardous Soil Removal with Treatment Additive**

| | SCS Labor & Expenses | Lab | Soil Excavation & Disposal | Utility locate | Treatment & Restoration | Drilling | Subtotal |
|---|---|---|---|---|---|---|---|
| Planning | $3,490 | | | | | | $3,490 |
| Field Investigation | $4,300 | $780 | $5,078 | $400 | $10,736 | $1,480 | $22,774 |
| Reporting | $2,480 | | | | | | $2,480 |
| Totals | $10,270 | $780 | $5,078 | $400 | $10,736 | $1,480 | $28,744 |
| **Total Estimated Amount (rounded to $100)** | | | | | | | $28,700 |

**Scope of Work**

Excavate shallow CVOC (non-hazardous) soil from tank basin.
Place PersulfOx in excavation.
Backfill with low permeability soil.
Cap area with concrete or asphalt.
Replace MW1.

See **Attachment 2** for cost estimate details.

### Option 3 – Capping Source Area

This option involves capping the tank basin source area with concrete or asphalt, removing soil to allow proper installation of the capping material, and pumping water from MW1 to facilitate removal of the groundwater mound.

The cap could consist of impervious material (asphalt, concrete) installed over the existing ground surface and extend to Lindem's garage and the house garage walls. Some shallow soil may need to be removed to create a base for the asphalt or concrete. Pumping from MW1 is recommended to reduce the head in excavation backfill.

The scope of work includes the following:

- Coordinate access with Lindem's garage and the owner of the garage at 3913 North Palmer Street for the installation of the cap.
- Install a cap over the tank excavation area, an area of approximately 10 X 30 feet.
- Maintain MW1.
- Pump from MW1 using a vacuum truck or similar and dispose of water at a waste water treatment plant.

| Option 3 - Capping Source Area | | | | | |
|---|---|---|---|---|---|
| | SCS Labor & Expenses | Soil Excavation & Disposal | Utility locate | Cap | Subtotal |
| Planning | $1,900 | | | | $1,900 |
| Field Documentation | $1,960 | $1,447 | $300 | $1,724 | $5,431 |
| Reporting | $870 | | | | $870 |
| Totals | $4,730 | $1,447 | $300 | $1,724 | $8,201 |
| **Total Estimated Amount (rounded to $100)** | | | | | $8,200 |
| | | | | | |
| **Scope of Work** | | | | | |
| Excavate shallow CVOC (non-hazardous) soil from tank basin to allow installation of cap. | | | | | |
| Install concrete or asphalt cap over tank excavation | | | | | |
| Pump MW1 and dispose at waste water treatment plant. | | | | | |

See **Attachment 3** for cost estimate details.

# 2 RECOMMENDATIONS

SCS makes the following recommendations:

## 2.1 Source Area Cap

In order to better evaluate the groundwater flow pattern at the water table, and decrease infiltration, we recommend capping the area of the tank excavation to eliminate preferential infiltration in this area of highly contaminated soil.

## 2.2 Completion of the Site Investigation

The vertical extent of groundwater contamination has not been determined. The top of the bedrock is commonly a zone of high permeability and may be a zone of high contamination including free product. We recommend:

- Installing 3-4 piezometers adjacent the existing monitoring well, and screened in the top of the bedrock (at an estimated total depth of 40-50 feet).
- Collecting 2 rounds of groundwater samples from the piezometers.
- Complete single well hydraulic conductivity tests to characterize the aquifer.
- Collecting at least 2 rounds of water levels from the water table wells and piezometers following the capping of the former tank bed, to evaluate the need for any additional wells or groundwater sampling.
- Assuming the scope of work adequately addresses the NR 715 site investigation requirements, prepare a site investigation report and proceed with an analysis of remedial actions.

**The estimated approximate cost is $35,000 - $40,000.**

**Additional Water Table Well**

The WDNR requested identification of a location for installation of a well on the west side of the building. The space between the building and Midwest Die Casting is too narrow to allow a drill rig access. A small Geoprobe™ rig could fit inside the former warehouse to install a well approximately 20 feet east of boring B20. Access is limited by overhead lighting, the overhead furnace, and heating ducts and the concrete block room in the northwest corner of the warehouse. Installation of the well would require removal of equipment, tires, and vehicles being serviced and stored in the warehouse. There are no plans available showing the location of subfloor electrical or other utilities.

Because of the access issues, and the results of vapor testing on the adjacent property that do not indicated a vapor intrusion issue, we do not recommend installation of a well at this location at this time. Higher concentrations of contamination have been identified elsewhere on the site, and we recommend evaluating the vertical extend in these areas, and the potential off-site source to the south, prior to further investigation on the west edge of the property.

At your request we will prepare a detailed cost estimate for option 3 - capping of the source area, and completion of the site investigation.

Please contact us at (608) 224-2830 if you have any comments or questions. Thank you.

Sincerely,

Betty J. Socha, PhD, PG
Senior Project Manager
**SCS ENGINEERS**

Tony Kollasch
Project Hydrogeologist
**SCS ENGINEERS**

cc: Mr. Lou Dodulik, Mudroch & Dodulik, S.C.

Enclosures: Attachments 1 through 3

# ATTACHMENT 1

**Summary**

**Option 1 - Hazardous & Non-Hazardous Soil Removal**

| | SCS Labor & Expenses | Lab | Soil Excavation & Disposal | Utility locate | Site Restoration | Drilling | Subtotal |
|---|---|---|---|---|---|---|---|
| Planning | $4,050 | | | | | | $4,050 |
| Field Investigation | $6,190 | $940 | $186,400 | $400 | $17,322 | $1,480 | $212,732 |
| Reporting | $4,780 | | | | | | $4,780 |
| Totals | $15,020 | $940 | $186,400 | $400 | $17,322 | $1,480 | $221,562 |
| **Total Estimated Amount (rounded to $100)** | | | | | | | $221,600 |

**Scope of Work**

Excavate shallow CVOC (non-hazardous) soil from tank basin.
Backfill with low permeability soil.
Cap area with concrete or asphalt.
Move gas line to on-site building and electric to neighbor's garage
Excavate hazardous soil to 12 ft bgs (~water table depth) in area of B2, B18, SB2
Excavate hazardous soil at 8-12 ft bgs (below water table depth) in area of tank basin, S100, MW1
Backfill with low permeability soil, replace sidewalk, and top soil & grass
Replace MW1.

I:\25212159\Remediation Options\[Option 1 - Haz & Non-Haz Soil Removal.xlsx]Summary

**Option 1 - Hazardous & Non-Hazardous Soil Removal**
**SCS File No. 25212159.01**
**Soil Management**
SCS Opinion of Costs

| Excavation Areas | Length | Width | Depth | Volume (Cu Yds) | Tons | |
|---|---|---|---|---|---|---|
| **Non- haz** | 8 | 5 | 8 | 12 | 18 | Total tons non-haz |
| **Non- haz** | 15 | 5 | 8 | 22 | 33 | 51 |
| **Haz** | 25 | 15 | 12 | 167 | 250 | Total tons haz |
| **Haz** | 15 | 5 | 4 | 11 | 17 | 267 |
| | | | Total | 212 | 318 | |

| **Item** | **Estimated Quantity** | **Unit** | **Estimated Unit Rate** | **Estimated Subtotals** |
|---|---|---|---|---|
| Mobilization | 1 | Lump Sum | $2,000 | $2,000 |
| Excavate, load (CVOC soils) | 318 | Tons | $25 | $7,944 |
| Haul non-hazardous to landfill | 51 | Tons | $10 | $511 |
| Haul & dispose hazardous | 267 | Tons | $588 | $156,800 |
| Tipping fee for non-haz | 51 | Tons | $35 | $1,789 |
| **Subtotal for Soil Excavation & Disposal** | | Tons | | **$169,044** |
| | | | | |
| Backfilling and compaction | 318 | Tons | $35 | $11,122 |
| Concrete cap over tank basin, replace side walk | 1 | Lump Sum | $3,000 | $3,000 |
| Move gas line | 1 | Lump Sum | $1,500 | $1,500 |
| Move electric line | 1 | Lump Sum | $700 | $700 |
| Haul & Dispose of concrete sidewalk | 10 | Tons | $50 | $500 |
| Topsoil & grass placed | 1 | Lump Sum | $500 | $500 |
| **Subtotal for Restoration** | | | | **$17,322** |
| **Construction Total** | | | | **$186,366.67** |
| | | | | |
| **Total Estimated Amount (rounded to $100)** | | | | **$186,400** |

Notes: Soil Disposal at Waste Management
Soil Unit Weight = 1.5 tons/cubic yard
Hazardous tipping fee per quote provided to SCS Engineers.
I:\25212159\Remediation Options\[Option 1 - Haz & Non-Haz Soil Removal.xlsx]Soil

**Cost Estimate - SCS Engineers**
**Option 1 - Hazardous & Non-Hazardous Soil Removal**
**SCS File No. 25212159.01**

SCS ENGINEERS

| Task Description | Project Director $190 | Senior Project Manager $155 | Senior Project Professional $125 | Field Professional $100 | Designer/ CAD Tech $80 | Admin Asst $67 | Total Hours | Subtotal | Exp | Subs | Total | Task Total Rounded to $10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task 1 – Planning** | | | | | | | | | | | | |
| H&S plan | | 0.5 | 1 | 1 | | | 2.5 | $303 | | | $303 | |
| Bidding & Contracting | 1 | 6 | 6 | | | | 13 | $1,870 | | | $1,870 | |
| Client & DNR correspondence | | 4 | 4 | | | | 8 | $1,120 | | | $1,120 | |
| Kick-off meeting | | 2 | 2 | 2 | | | 6 | $760 | | | $760 | |
| **Subtotal** | **1** | **12.5** | **13** | **3** | **0** | **0** | **29.5** | **$4,053** | **$0** | **$0** | **$4,053** | **$4,050** |
| | | | | | | | | | | | | |
| **Task 2 – Field Documentation** | | | | | | | 0 | $0 | | | $0 | |
| Profiles, permitting with landfill | | 4 | 6 | 2 | | | 12 | $1,570 | | | $1,570 | |
| Field screening, sampling, (2 days) | | 4 | 4 | 20 | | | 28 | $3,120 | $420 | | $3,540 | |
| Ship samples, field notes, decon | | | | 4 | | | 4 | $400 | | | $400 | |
| Install MW1R | | 1 | 1 | 4 | | | 6 | $680 | | | $680 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| **Subtotal** | **0** | **9** | **11** | **30** | **0** | **0** | **50** | **$5,770** | **$420** | **$0** | **$6,190** | **$6,190** |
| | | | | | | | | | | | | |
| **Task 3 – Reporting** | | | | | | | 0 | $0 | | | $0 | |
| Tables & Figures, photos | | 2 | 4 | 4 | 4 | 4 | 18 | $1,798 | | | $1,798 | |
| Text | | 2 | 12 | 4 | | 4 | 22 | $2,478 | | | $2,478 | |
| Review | 1 | 2 | | | | | 3 | $500 | | | $500 | |
| **Subtotal** | **1** | **6** | **16** | **8** | **4** | **8** | **43** | **$4,776** | **$0** | **$0** | **$4,776** | **$4,780** |
| | | | | | | | | | | | | |
| **Total** | **2** | **27.5** | **40** | **41** | **4** | **8** | **122.5** | **$14,599** | **$420** | **$0** | **$15,019** | **$15,020** |

**$15,019** **$15,020**

I:\25212159\Remediation Options\[Option 1 - Haz & Non-Haz Soil Removal.xlsx]Labor 10/25/17

# TestAmerica Estimated Analytical Costs 2017

Project Number: SCS File No. 25212159.01
Project Name: Option 1 - Hazardous & Non-Hazardous Soil Removal

Description of Work: Soil Excavation Documentation

**Total Estimated Analytical Costs:**

| Parameter | Soil Samples | Soil Dup | Methanol Fld Blank | Cost $ | Soil Subtotal |
|---|---|---|---|---|---|
| 8 RCRA Metals (SPLP) | | | | $145 | $0 |
| 8 RCRA Metals (TCLP) | | | | $145 | $0 |
| 8 RCRA Metals (total) | 1 | | | $75 | $75 |
| Alkalinity | | | | | $0 |
| Arsenic, Cadmium, Chromium, Lead | | | | $40 | $0 |
| GRO | | | | $25 | $0 |
| GRO/PVOC | | | | $27 | $0 |
| GRO/PVOC + 1,2-DCA | | | | $35 | $0 |
| GRO/PVOC + Naphthalene | | | | $27 | $0 |
| PAH | | | | $65 | $0 |
| Paint Filter | | | | $12 | $0 |
| PCBs | | | | $65 | $0 |
| Pesticides | | | | $100 | $0 |
| pH | | | | $10 | $0 |
| SVOCs | 1 | | | $85 | $85 |
| PNA (high levels) | | | | $65 | $0 |
| PNA (lower levels) | | | | $100 | $0 |
| Protocol B (WMgmt) | | | | $840 | $0 |
| PVOC | | | | $25 | $0 |
| PVOC + 1,2-DCA | | | | $35 | $0 |
| PVOC + Naphthalene | | | | $27 | $0 |
| VOCs | 12 | | | $65 | $780 |
| Lead | | | | $10 | $0 |
| **Totals** | **14** | **0** | **0** | | **$940** |

**Total Estimated Costs without markup =** $940
**Total Estimated Costs with 10% markup =** $1,034.0

I:\25212159\Remediation Options\[Option 1 - Haz & Non-Haz Soil Removal.xlsx]Lab

PROJECT/PROPOSAL NAME: Option 1 - Hazardous & Non-Hazardous Soil Removal

PROJECT/PROPOSAL NUMBER: SCS File No. 25212159.01
PREPARED BY: BJS
DATE: 24-Jun-17

| Description | Estimated Quantity | Unit | Unit Cost | Estimated Cost |
|---|---|---|---|---|
| | | | | |
| **SOIL SAMPLING AND TESTING** | | | | |
| FID/PID rental | 2 | Day | $75.00 | $150.00 |
| Meals | 2 | Meal | $10.00 | $20.00 |
| Mileage (200 miles RT + local = 220 miles/day) 2 days | 440 | Miles | $0.56 | $246.40 |
| Motel | | Day | | $0.00 |
| | | | | |
| **TOTAL FIELD EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$420.00** |
| | | | | |
| **OFFICE AND MISCELLANEOUS EXPENSES** | | | | |
| Document Reproduction ($0.07/copy) | 1 | L.S. | | $0.00 |
| Postage/Shipping | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | | | | |
| **TOTAL OFFICE/MISCELLANEOUS EXPENSES (Rounded to Nearest $10)** | | | | **$0.00** |
| | | | | |
| **TOTAL EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$420.00** |

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# Drilling Cost Estimate

Project Number: SCS File No. 25212159.01
Project Name: Option 1 - Hazardous & Non-Hazardous Soil Remova

| Mobilization | $500 |
|---|---|

$275 if < 50 miles
$325 if > 50 miles (Stiles)

**Soil Borings**

| Qty | Depth | Unit Price | Est Cost |
|---|---|---|---|
| 1 | 20 | $16 | $320 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $320 |

**Wells**

| Qty | Depth | Unit Price | Est Cost |
|---|---|---|---|
| 1 | 20 | $18 | $360 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $360 |

**Other**

| Description | Qty | Unit Price | Est Cost |
|---|---|---|---|
| Protectors (each) | 1 | $200 | $200 |
| Clean-up (per boring) | 1 | $100 | $100 |
| Well Develop (per well) | | $75 | $0 |
| Air Compressor (per day) | | $200 | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $300 |

| **Total Cost** | **$1,480** |
|---|---|

I:\25212159\Remediation Options\[Option 1 - Haz & Non-Haz Soil Removal.xlsx]Drilling

# Industrial Waste & Disposal Services Agreement

# Exhibit A

Profile number: SCS0705 TSR: Brad Vanderkin Sales person: Brian Smith

## A. GENERATOR

1. Name: SCS Engineers
2. Address: 117 E Capitol Drive
   City: Milwaukee County:
   State: WI ZIP code: 53212

## B. CUSTOMER BILLING INFORMATION

1. Name: SCS Engineers
2. Address: 2830 Dairy Drive
   City: Madison
   State: WI ZIP code: 53718
3. Contact name: Betty Socha
4. Email: BSocha@scsengineers.com
5. Phone: 608.224.2830 6. Fax:
7. P.O. number:

## C. FACILITY

1. Name(s):

## D. MATERIAL

1. Name: PCE Contaminated Soil
2. Anticipated volume: 300 Tons

## E. CHARGES

❑ See Attached

| DESCRIPTION | RATE | MINIMUM |
|---|---|---|
| Disposal - Chem OX Treatment | $385.00 Per Ton | |
| MI - Haz Tax | $11.68 Per Ton | |
| Live Load End Dumps Transportation | $85.00 Per Ton | (22 Ton Min) |
| Variable Fuel Surcharge | %22.00 (Current) | |
| | | |
| | | |
| | | |

**Other services not listed above will incur additional charges that vary by location and are subject to change without notice. Payment of invoice represents agreement of such charges.**

## F. COMMENTS

❑ See Attached

- Demurrage per hour after 2hrs - $100.00 /hr
- Truck Ordered & Not Used $1,400.00
- Rejected Load Charges: $5.00/mile (Minimum:$500.00)
- Pricing subject to completed profile analytical and technical review.

**The work contemplated by this Exhibit A is to be done in accordance with the terms and conditions of the Industrial Waste & Disposal Services Agreement or other contractual agreement between the parties dated:**

**COMPANY**

By: Date:
Name:
Title:

**COMPANY**

Signature: Date:
Name:
Title:

**E. CHARGES**

❑ See Attached

| DESCRIPTION | RATE | MINIMUM |
|---|---|---|
| | | |
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**Other services not listed above will incur additional charges that vary by location and are subject to change without notice. Payment of invoice represents agreement of such charges.**

**F. COMMENTS**

**Socha, Betty**

**From:** Vanderkin, Brad <bvander1@wm.com>
**Sent:** Wednesday, July 05, 2017 4:08 PM
**To:** Socha, Betty
**Subject:** RE: Quote for Hazardous Soil Disposal

Betty –

The waste would be sent to Belleville, MI for hazardous waste treatment and disposal.

Thanks,

**Brad Vanderkin**
bvander1@wm.com

**Waste Management**
Tel (608) 215-7202

http://www1.wmsolutions.com/facilities/

**From:** Socha, Betty [mailto:BSocha@scsengineers.com]
**Sent:** Wednesday, July 5, 2017 12:20 PM
**To:** Vanderkin, Brad <bvander1@wm.com>
**Subject:** [EXTERNAL] RE: Quote for Hazardous Soil Disposal

Brad,
Where would the soil be going for treatment/disposal?
Thanks,
Betty

---

**From:** Vanderkin, Brad [mailto:bvander1@wm.com]
**Sent:** Wednesday, July 05, 2017 12:12 PM
**To:** Socha, Betty
**Cc:** Smith, Brian
**Subject:** RE: Quote for Hazardous Soil Disposal

Betty –

Please see attached pricing for transportation and disposal. Testing requirement RCRA metals, Totals VOCs and SVOCs. If you have any questions please let me know.

Thanks,

**Brad Vanderkin**
bvander1@wm.com

**Waste Management**
Tel (608) 215-7202

http://www1.wmsolutions.com/facilities/

**From:** Socha, Betty [mailto:BSocha@scsengineers.com]
**Sent:** Wednesday, July 5, 2017 10:46 AM
**To:** Vanderkin, Brad <bvander1@wm.com>
**Subject:** [EXTERNAL] RE: Quote for Hazardous Soil Disposal

Sounds good, thanks!

---

**From:** Vanderkin, Brad [mailto:bvander1@wm.com]
**Sent:** Wednesday, July 05, 2017 8:16 AM
**To:** Socha, Betty
**Subject:** RE: Quote for Hazardous Soil Disposal

Betty –

I'll have it over to you by EOD day today. Sorry for the delay.

Thanks,

**Brad Vanderkin**
bvander1@wm.com

**Waste Management**
Tel (608) 215-7202

http://www1.wmsolutions.com/facilities/

---

**From:** Socha, Betty [mailto:BSocha@scsengineers.com]
**Sent:** Monday, July 3, 2017 1:46 PM
**To:** Vanderkin, Brad <bvander1@wm.com>
**Subject:** [EXTERNAL] RE: Quote for Hazardous Soil Disposal

Hi Brad,
How is the quote coming? I need to have it soon – This week?
Thank you,
Betty

---

**From:** Vanderkin, Brad [mailto:bvander1@wm.com]
**Sent:** Tuesday, June 27, 2017 4:18 PM
**To:** Socha, Betty
**Subject:** RE: Quote for Hazardous Soil Disposal

Betty –

I didn't forget about you. Just waiting on a few more numbers. I'll have a quote soon.

Thanks,

**Brad Vanderkin**
bvander1@wm.com

**Waste Management**
Tel (608) 215-7202

http://www1.wmsolutions.com/facilities/

**From:** Socha, Betty [mailto:BSocha@scsengineers.com]
**Sent:** Friday, June 23, 2017 2:45 PM
**To:** Vanderkin, Brad <bvander1@wm.com>
**Subject:** Quote for Hazardous Soil Disposal

Hi Brad,
Can you provide a budget number for hauling and disposal of soil that contains tetrachloroethylene (PCE) at concentrations that exceed the "contained-out" determination concentration? The data table is attached. The data for the soil that would be excavated and disposed is highlighted in light green. We estimate about 300 tons. If this remedial option were selected the work would likely be done in fall 2017. What additional testing would be needed?
The site is located at 117 E. Capitol Drive, Milwaukee, and was a dry cleaners from about 1962 to 1987. It is an open case with the DNR in the DERF program.
Thank you,
Betty

**Betty J. Socha, PhD, PG**
Senior Project Manager/Hydrogeologist

**SCS ENGINEERS**
2830 Dairy Drive
Madison, WI 53718
608.224.2830
Direct: 608.216.7331 • Cell: 608.212.6664
www.scsengineers.com

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# ATTACHMENT 2

**Summary**

**Option 2 - Non-Hazardous Soil Removal with Treatment Additive**

| | SCS Labor & Expenses | Lab | Soil Excavation & Disposal | Utility locate | Treatment & Restoration | Drilling | Subtotal |
|---|---|---|---|---|---|---|---|
| Planning | $3,490 | | | | | | $3,490 |
| Field Investigation | $4,300 | $780 | $5,078 | $400 | $10,736 | $1,480 | $22,774 |
| Reporting | $2,480 | | | | | | $2,480 |
| Totals | $10,270 | $780 | $5,078 | $400 | $10,736 | $1,480 | $28,744 |
| | | | | | **Total Estimated Amount (rounded to $100)** | | $28,700 |

**Scope of Work**

Excavate shallow CVOC (non-hazardous) soil from tank basin.

Place PersulfOx in excavation.

Backfill with low permeability soil.

Cap area with concrete or asphalt.

Replace MW1.

**Cost Estimate - SCS Engineers**

SCS ENGINEERS

**Option 2 - Non-Hazardous Soil Removal with Treatment Additive**

**SCS File No. 25212159.01**

| Task Description | Project Director $190 | Senior Project Manager $155 | Senior Project Professional $125 | Field Professional $100 | Designer/ CAD Tech $80 | Admin Asst $67 | Total Hours | Subtotal | Exp | Subs | Total | Task Total Rounded to $10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task 1 – Planning** | | | | | | | | | | | | |
| H&S plan | | 0.5 | 1 | 1 | | | 2.5 | $303 | | | $303 | |
| Bidding & Contracting | 1 | 4 | 4 | | | | 9 | $1,310 | | | $1,310 | |
| Client & DNR correspondence | | 4 | 4 | | | | 8 | $1,120 | | | $1,120 | |
| Kick-off meeting | | 2 | 2 | 2 | | | 6 | $760 | | | $760 | |
| **Subtotal** | **1** | **10.5** | **11** | **3** | **0** | **0** | **25.5** | **$3,493** | **$0** | **$0** | **$3,493** | **$3,490** |
| | | | | | | | | | | | | |
| **Task 2 – Field Documentation** | | | | | | | 0 | $0 | | | $0 | |
| Profiles, permitting with landfill | | 2 | 4 | 1 | | | 7 | $910 | | | $910 | |
| Field screening, sampling, (1 days) | | 3 | 3 | 10 | | | 16 | $1,840 | $210 | | $2,050 | |
| Ship samples, field notes, decon | | | | 2 | | | 2 | $200 | | | $200 | |
| Install MW1R, develop | | 1 | 1 | 6 | | | 8 | $880 | | | $880 | |
| Coordinate with Regenesis | | 1 | | 1 | | | 2 | $255 | | | $255 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| **Subtotal** | **0** | **7** | **8** | **20** | **0** | **0** | **35** | **$4,085** | **$210** | **$0** | **$4,295** | **$4,300** |
| | | | | | | | | | | | | |
| **Task 3 – Reporting** | | | | | | | 0 | $0 | | | $0 | |
| Tables & Figures, photos | | 1 | 2 | 2 | 2 | 2 | 9 | $899 | | | $899 | |
| Text | | 1 | 6 | 2 | | 2 | 11 | $1,239 | | | $1,239 | |
| Review | 1 | 1 | | | | | 2 | $345 | | | $345 | |
| **Subtotal** | **1** | **3** | **8** | **4** | **2** | **4** | **22** | **$2,483** | **$0** | **$0** | **$2,483** | **$2,480** |
| | | | | | | | | | | | | |
| **Total** | **2** | **20.5** | **27** | **27** | **2** | **4** | **82.5** | **$10,061** | **$210** | **$0** | **$10,271** | **$10,270** |
| | | | | | | | | | | | **$10,271** | **$10,270** |

I:\25212159\Remediation Options\[Option 2 - Non-Haz Soil Removal.xlsx]Labor 10/25/17

# TestAmerica Estimated Analytical Costs 2017

Project Number: SCS File No. 25212159.01
Project Name: Option 2 - Non-Hazardous Soil Removal with Treatment Additive

Description of Work: Soil Excavation Documentation

**Total Estimated Analytical Costs:**

| Parameter | Soil Samples | Soil Dup | Methanol Fld Blank | Cost $ | Soil Subtotal |
|---|---|---|---|---|---|
| 8 RCRA Metals (SPLP) | | | | $145 | $0 |
| 8 RCRA Metals (TCLP) | | | | $145 | $0 |
| 8 RCRA Metals (total) | | | | $75 | $0 |
| Alkalinity | | | | | $0 |
| Arsenic, Cadmium, Chromium, Lead | | | | $40 | $0 |
| GRO | | | | $25 | $0 |
| GRO/PVOC | | | | $27 | $0 |
| GRO/PVOC + 1,2-DCA | | | | $35 | $0 |
| GRO/PVOC + Naphthalene | | | | $27 | $0 |
| PAH | | | | $65 | $0 |
| Paint Filter | | | | $12 | $0 |
| PCBs | | | | $65 | $0 |
| Pesticides | | | | $100 | $0 |
| pH | | | | $10 | $0 |
| Phosphorus | | | | $18 | $0 |
| PNA (high levels) | | | | $65 | $0 |
| PNA (lower levels) | | | | $100 | $0 |
| Protocol B (WMgmt) | | | | $840 | $0 |
| PVOC | | | | $25 | $0 |
| PVOC + 1,2-DCA | | | | $35 | $0 |
| PVOC + Naphthalene | | | | $27 | $0 |
| VOCs | 12 | | | $65 | $780 |
| Lead | | | | $10 | $0 |
| **Totals** | **12** | **0** | **0** | | **$780** |

**Total Estimated Costs without markup =** $780
**Total Estimated Costs with 10% markup =** $858.0

I:\25212159\Remediation Options\[Option 2 - Non-Haz Soil Removal.xlsx]Lab

PROJECT/PROPOSAL NAME: Option 2 - Non-Hazardous Soil Removal with Treatment Additive
PROJECT/PROPOSAL NUMBER: SCS File No. 25212159.01
PREPARED BY: BJS
DATE: 24-Jun-17

| Description | Estimated Quantity | Unit | Unit Cost | Estimated Cost |
|---|---|---|---|---|
| | | | | |
| **SOIL SAMPLING AND TESTING** | | | | |
| FID/PID rental | 1 | Day | $75.00 | $75.00 |
| Meals | 1 | Meal | $10.00 | $10.00 |
| Mileage (200 miles RT + local = 220 miles/day) 1 days | 220 | Miles | $0.56 | $123.20 |
| Motel | | Day | | $0.00 |
| | | | | |
| **TOTAL FIELD EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$210.00** |
| | | | | |
| **OFFICE AND MISCELLANEOUS EXPENSES** | | | | |
| Document Reproduction ($0.07/copy) | 1 | L.S. | | $0.00 |
| Postage/Shipping | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | | | | |
| **TOTAL OFFICE/MISCELLANEOUS EXPENSES (Rounded to Nearest $10)** | | | | **$0.00** |
| | | | | |
| **TOTAL EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$210.00** |

I:\25212159\Remediation Options\[Option 2 - Non-Haz Soil Removal.xlsx]Exp

**Option 2 - Non-Hazardous Soil Removal with Treatment Additive**
**SCS File No. 25212159.01**
**Soil Management**
SCS Opinion of Costs

| Excavation Areas | Length | Width | Depth | Volume (Cu Yds) | Tons | |
|---|---|---|---|---|---|---|
| **Non- haz** | 8 | 5 | 8 | 12 | 18 | Total tons non-haz |
| **Non- haz** | 15 | 5 | 8 | 22 | 33 | 51 |
| **Haz** | | | | - | - | Total tons haz |
| **Haz** | | | | - | - | - |
| Total | | | | 34 | 51 | |

| **Item** | **Estimated Quantity** | **Unit** | **Estimated Unit Rate** | **Estimated Subtotals** |
|---|---|---|---|---|
| Mobilization | 1 | Lump Sum | $1,500 | $1,500 |
| Excavate, load (CVOC soils) | 51 | Tons | $25 | $1,278 |
| Haul non-hazardous to landfill | 51 | Tons | $10 | $511 |
| Haul & dispose hazardous | 0 | Tons | $588 | $0 |
| Tipping fee for non-haz | 51 | Tons | $35.00 | $1,789 |
| **Subtotal for Soil Excavation & Disposal** | | Tons | | **$5,078** |
| | | | | |
| Backfilling and compaction | 51 | Tons | $35 | $1,789 |
| Concrete cap over tank basin | 1 | Lump Sum | $1,500 | $1,500 |
| Move gas line | 0 | Lump Sum | $1,500 | $0 |
| Move electric line | 0 | Lump Sum | $700 | $0 |
| Dispose of concrete sidewalk | 0 | Tons | $50 | $0 |
| Mix-in PersulfOx | 1 | Lump Sum | $1,000 | $1,000 |
| PersulfOx (delivered, includes tax) | 1 | Tons | $6,447 | $6,447 |
| Topsoil & grass placed | 0 | Tons | $50 | $0 |
| **Subtotal for Treatment & Restoration** | | | | **$10,736** |
| **Construction Total** | | | | **$15,813.67** |
| | | | | |
| **Total Estimated Amount (rounded to $100)** | | | | **$15,800** |

Notes: Soil Disposal at Waste Management
Soil Unit Weight = 1.5 tons/cubic yard
Hazardous tipping fee per quote provided to SCS Engineers.

I:\25212159\Remediation Options\[Option 2 - Non-Haz Soil Removal.xlsx]Soil

# Drilling Cost Estimate

Project Number: SCS File No. 25212159.01
Project Name: Option 2 - Non-Hazardous Soil Removal with Treatm

| **Mobilization** | $500 |
|---|---|

$275 if < 50 miles
$325 if > 50 miles (Stiles)

**Soil Borings**

| Qty | Depth | Unit Price | Est Cost |
|---|---|---|---|
| 1 | 20 | $16 | $320 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $320 |

**Wells**

| Qty | Depth | Unit Price | Est Cost |
|---|---|---|---|
| 1 | 20 | $18 | $360 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $360 |

**Other**

| Description | Qty | Unit Price | Est Cost |
|---|---|---|---|
| Protectors (each) | 1 | $200 | $200 |
| Clean-up (per boring) | 1 | $100 | $100 |
| Well Develop (per well) | | $75 | $0 |
| Air Compressor (per day) | | $200 | $0 |
| | | | $0 |
| | | | $0 |
| | | Subtotal | $300 |

| **Total Cost** | **$1,480** |
|---|---|

I:\25212159\Remediation Options\[Option 2 - Non-Haz Soil Removal.xlsx]Drilling

**Socha, Betty**

**From:** Owen Miller <OMiller@Regenesis.com>
**Sent:** Monday, July 03, 2017 4:51 PM
**To:** Socha, Betty
**Cc:** Ryan Moore
**Subject:** Queens Way Cleaners - Preliminary Proposal
**Attachments:** SCS Engineers - Queens Way Cleaners - Preliminary Proposal (58569).pdf

Betty,

Nice talking to you earlier today. As discussed, we have put together our preliminary approach for the Queens Way Cleaners site.

This approach is predicated off excavating the source materials and backfilling with PersulfOx. We recommend sampling 30, 60 and 90 days post-excavation to assess the results and the biogeochemistry of the aquifer. Biogeochemical sampling should take place on the sampling event occurring 90 days after the application. I have attached a recommended sampling program on the biogeochemistry parameters.

The second phase of the proposed design assumes treat the majority of the plume body with our enhanced reductive dechlorination (ERD) approach. This hones in on the source area to further induce source reductions and establish a shrinking plume. As mentioned on the phone, the cost associated with this phase of the work is inclusive of turn-key services through our service division, RRS. Please note that this approach may change following any new data uncovered during the investigation.

Once you've had a chance to review this proposal, please feel free to contact me or my colleague Ryan Moore should you have any questions or want to discuss this approach further.

Best regards,

REGENESIS®

Owen Miller, Remediation Design Specialist
T: 630.277.0855
omiller@regenesis.com

For leading vapor intrusion mitigation, please visit www.landsciencetech.com, a division of REGENESIS

## Remedial Cost Proposal

**To:** Betty Socha, SCS Engineers

**Date:** July 3, 2017

**From:** Owen Miller - Design Specialist
omiller@regenesis.com 630-277-0855

**Subject:** ***Preliminary Design and Cost Estimate***

**Site:** *Queens Way Cleaners*
*Milwaukee, WI*

**Location:** Saturated soil

| **Applicable Products** | **Links to View/Download Product Information** |
|---|---|
| **PersulfOx®** | PersulfOx |
| **3-D Microemulsion® Factory Emulsified** | 3-D Microemulsion - Factory Emulsified |
| **Bio-Dechlor INOCULUM® PLUS** | BDI Plus |
| **CRS® Chemical Reducing Solution** | CRS |

REGENESIS is pleased to present you with this design and cost estimate for the proposed treatment at your site utilizing the remediation technologies referenced above. Included within this document you will find the following attachments supporting the proposed approach:

- Map Depicting Treatment Area
- Remedial Design and Cost Estimate
- Product Technical Sheets
- Suggested Performance Monitoring Parameters
- Regenesis Remediation Services Scope of Services and Assumptions

**Project Summary**

This proposal is to treat the cVOC impacts at the Queens Way Cleaners site in Milwaukee, WI ("the site"). It is our understanding that the goal behind these remedial efforts is to reduce and shrink the source area. In order to facilitate this treatment objective, we recommend that PersulfOx be applied during the backfill process of the anticipated excavation. PersulfOx is an chemical oxidant that does not require the use of a sacrificial activator (e.g. heat, lime or iron) like the majority of oxidants used for environmental remediation. This is due to the unique and built-in silicia catalyst employed within PersulfOx, resulting in a safer and field friendly application. PersulfOx will provide a mechanism to destroy any residual contaminants remaining in the vicinity of the excavation.

Following this first phase of work, we recommend that sampling be conducted 30, 60 and 90 days following the application to assess results and the biogeochemistry of the aquifer prior to addressing the dissolved phase (plume) impacts. Pending these results, we propose transitioning to Enhanced Reductive Dechlorination (ERD) to treat the plume. This approach consists of using 3D Microemulsion (3DME) and Hydrogen Release Compound (HRC) to provide electron donor sources and BDI Plus (BDI+) as a bioaugmentation culture capable of fully dechlorination chloroethene compounds, such as those found at this site, to non-toxic endproducts (e.g. ethane and CO2). Additionally, we are proposing the use of Chemical Reducing Solution (CRS) to facilitate abiotic reductive dechlorination by precipitating out iron based minerals (e.g. iron sulfides and iron hydroxides). This second phase of the work will be implemented through our service division, RRS, to complete the work turn-key. This preliminary design and cost estimate assumes that RRS also provide a geoprobe to carry out the in-situ injections.

**Assumptions**

In generating this design proposal REGENESIS relied upon professional judgment and site specific information provided by SCS. 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. The attached design summary tables specify the assumptions used in preparation of this technical design. We request that these modeling input assumptions be verified by your firm.

REGENESIS developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.

**Closing**

Please feel free to contact me if you need additional information or have any questions regarding our evaluation and/or this correspondence (contact info listed above). Thank you for considering REGENESIS as part or your remedial solution for this project.

PARKING LOT
(207)

GRASS

N. PALMER ST.

TREE PLANTERS

GRASS

GRASS

GRASS

GRASS

GRASS

GRASS

GRASS

GRASS

PARKING LOT
(100)

E. CAPITOL DRIVE

E. CAPITOL DRIVE

HOUSE
(3935)

CONCRETE

ASPHALT

GARAGE

(FORMER DRY CLEANERS)
(117)

(FORMER WAREHOUSE)

BODY SHOP
(3913)

MIDWEST DIE
CASTING CO.
(3930)

TURNER BOX CO.
(FORMER HART ENGRAVING)
(106 E. MELVINA ST.)

ND

MW12

MW3A

ND

Injection Area

cDCE=25,400
PCE=25,000
TCE=4,990
VC=<70.2

MW2A

MW14

ND

MW4

MW5

MW1

cDCE=228
PCE=58.9
TCE=73

cDCE=15.3
PCE=2370

cDCE=2,620
PCE=102,000
TCE=3080

B1 B2 B3 B4 B5 B6 B7 B7A B15 B16 B17 B18 B19 B20 B21 B200 B300

SB1 SB2 SB3

VP1 VP2 VP3 VP4

S1

1

10

100

?

## LEGEND

- OU — OVERHEAD ELECTRIC
- E — UNDERGROUND ELECTRIC
- G — UNDERGROUND GAS LINE
- T — UNDERGROUND TELEPHONE
- SA — SANITARY SEWER
- EXISTING MONITORING WELL
- EXISTING BORING
- HAND AUGERED BORING
- (3913) — PROPERTY ADDRESS
- DOOR
- POWER POLE
- SUMP
- FLOOR DRAIN
- S1 — FORMER PCE USE
- 2,000 GALLON WASTE OIL USE (IN USE)
- SUB-SLAB VAPOR SAMPLING LOCATION
- --10-- CONTOUR OF PCE CONCENTRATION (mg/l) (12/21/2016)
- PCE=2370 CONTAMINANT CONCENTRATION IN µg/l ON 12/21/2016 AND 01/03/17 (MW2A)

NOTES:

1. UTILITY AND SAMPLING LOCATIONS ARE COMPILED FROM VARIOUS SOURCES AND ARE APPROXIMATE.
2. ABBREVIATIONS:
   tDCE=TRANS-1,2-DICHLOROETHENE
   cDCE=CIS-1,2-DICHLOROETHENE
   PCE=TETRACHLOROETHENE
   TCE=TRICHLOROETHENE
   VC=VINYL CHLORIDE
   ND=NO DETECTION

N

30 0 30

SCALE: 1" = 30'

| | | | |
|---|---|---|---|
| PROJECT NO. | 25212159.00 | DRAWN BY: | AHB |
| DRAWN: | 12/03/13 | CHECKED BY: | BJS |
| REVISED: | 04/11/17 | APPROVED BY: | |

ENGINEER: SCS ENGINEERS
2830 DAIRY DRIVE MADISON, WI 53718-6751
PHONE: (608) 224-2830

CLIENT: HUNN FAMILY TRUST
946 ELM GROVE ROAD
ELM GROVE, WISCONSIN

SITE: FORMER QUEENS WAY CLEANERS
117 E. CAPITOL DRIVE
MILWAUKEE, WI

# VOC CONCENTRATIONS IN GROUNDWATER

FIGURE 3

I:\25212159\Drawings-General\CAP AREA.dwg, 4/11/2017 10:07:39 AM

REGENESIS

## Project Information

**Queens Way Cleaners**
**Milwaukee, WI**
**Saturated soil**
Prepared For:
**Betty Socha, SCS Engineers**

| Target Treatment Zone (TTZ) Info | Unit | Value |
|---|---|---|
| Treatment Area | $ft^2$ | 600 |
| Top Treat Depth | ft | 8.0 |
| Bot Treat Depth | ft | 12.0 |
| Vertical Treatment Interval | ft | 4.0 |
| Treatment Zone Volume | $ft^3$ | 2,400 |
| Treatment Zone Volume | cy | 89 |
| Soil Type | --- | silt |
| Porosity | $cm^3/cm^3$ | 0.40 |
| Effective Porosity | $cm^3/cm^3$ | 0.15 |
| Treatment Zone Pore Volume | gals | 7,181 |
| Treatment Zone Effective Pore Volume | gals | 2,693 |
| Fraction Organic Carbon (foc) | g/g | 0.005 |
| Soil Density | $g/cm^3$ | 1.5 |
| Soil Density | $lb/ft^3$ | 94 |
| Soil Weight | lbs | 2.2E+05 |
| Hydraulic Conductivity | ft/day | 1.0 |
| Hydraulic Conductivity | cm/sec | 3.53E-04 |
| Hydraulic Gradient | ft/ft | 0.007 |
| GW Velocity | ft/day | 0.05 |
| GW Velocity | ft/yr | 17 |
| **Sources of Oxidant Demand** | **Unit** | **Value** |
| Sorbed Phase Contaminant Mass | lbs | 203 |
| Dissolved Phase Contaminant Mass | lbs | 6.8 |
| Total Contaminant Mass | lbs | 210 |
| Stoichiometric PersulfOx Demand | lbs | 713 |
| Stoichiometric PersulfOx Required | lbs | 1,425 |
| Additional Soil Oxidant Demand | g/kg | 2.0 |
| SOD PersulfOx Required | lbs | 499 |
| **Total PersulfOx Required** | **lbs** | **1,925** |

**Application Dosing**

| | | |
|---|---|---|
| **PersulfOx Required** | **lbs** | **2,039** |

## PersulfOx® Application Design Summary

| Saturated soil | | Field App. Instructions |
|---|---|---|
| **Application Method** | **Excavation** | |
| Spacing Within Rows (ft) | 10 | |
| Spacing Between Rows (ft) | 10 | |
| Injection Points (per app.) | 6 | |
| **Number of Applications** | **1** | |
| Areal Extent (square ft) | 600 | **Field Mixing Ratios** |
| Top Application Depth (ft bgs) | 8 | Water per Pt per app (gals) |
| Bottom Application Depth (ft bgs) | 12 | 366 |
| **PersulfOx to be Applied (lbs)** | **2,039** | PersulfOx per Pt per app (lbs) |
| PersulfOx Solution % | 10% | 340 |
| **Volume Water (gals)** | **2,199** | Total Volume per Pt per app (gals) |
| **Total Volume (gals)** | **2,301** | 383 |

*Per Application Totals*

| | | |
|---|---|---|
| *PersulfOx per app. (lbs)* | *2,039* | *Volume per vertical ft (gals)* |
| *Volume Water per app. (gals)* | *2,199* | *96* |
| *Total Volume per app. (gals)* | *2,301* | |

### Technical Notes/Discussion

**Apply during the backfill process of the excavation. Apply PersulfOx in one to two foot lifts. Mix PersulfOx with water when applying in the unsaturated portion of the aquifer. We recommend applying PersulfOx as a 10% solution in the unsaturated zone.**

### 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 developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.

***Prepared By: Owen Miller - Design Specialist***
***Date: 7/3/2017***

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## Purchasing Information

| Queens Way Cleaners | -- | Saturated soil |
|---|---|---|
| | | |
| **PersulfOx Required** | **lbs** | **2,039** |
| | | |
| **PersulfOx Cost** | **$** | **$5,606** |
| | | |
| Estimated Tax and Freight % | % | 15% |
| Estimated Tax and Freight Cost* | $ | $841 |
| **Estimated Total Product Cost** | **$** | **$6,447** |

***Note that the combined tax and freight costs are preliminary estimates only. Please contact your local sales manager or Customer Service at 949-366-8000 to obtain a shipping quote. You will be asked to provide a ship-to address and estimated time of delivery.**

## Currently Available Packaging Options

| PersulfOx Package Type*** | # of packages | lbs required |
|---|---|---|
| 55.1 lb poly-lined bag | 37 | 2,039 |
| 2,204 lb supersacks | 1 | 2,204 |

****Total Project cost is only an estimate; actual project cost may change as the final scope and/or RRS proposal are developed.**

*****Available Package Types are subject to change.**

REGENESIS

| Project Information | | |
|---|---|---|
| Queens Way Cleaners | | |
| City, State | | |
| Saturated soil | | |
| Prepared For: | | |
| Betty Socha, SCS Engineers | | |
| **Target Treatment Zone (TTZ) Info** | **Unit** | **Value** |
| Treatment Area | $ft^2$ | 3,000 |
| Top Treat Depth | ft | 10.0 |
| Bot Treat Depth | ft | 25.0 |
| Vertical Treatment Interval | ft | 15.0 |
| Treatment Zone Volume | $ft^3$ | 45,000 |
| Treatment Zone Volume | cy | 1,667 |
| Soil Type | --- | silt |
| Porosity | $cm^3/cm^3$ | 0.40 |
| Effective Porosity | $cm^3/cm^3$ | 0.15 |
| Treatment Zone Pore Volume | gals | 134,649 |
| Treatment Zone Effective Pore Volume | gals | 50,494 |
| Fraction Organic Carbon (foc) | g/g | 0.005 |
| Soil Density | $g/cm^3$ | 1.5 |
| Soil Density | $lb/ft^3$ | 94 |
| Soil Weight | lbs | 4.2E+06 |
| Hydraulic Conductivity | ft/day | 1.0 |
| Hydraulic Conductivity | cm/sec | 3.53E-04 |
| Hydraulic Gradient | ft/ft | 0.007 |
| GW Velocity | ft/day | 0.05 |
| GW Velocity | ft/yr | 17 |
| **Sources of 3-D Microemulsion Demand** | **Unit** | **Value** |
| Dissolved Phase Mass | lbs | 128 |
| Sorbed Phase Contaminant Mass | lbs | 503 |
| Competing Electron Acceptor Mass | lbs | 101 |
| **Stoichiometric 3DME Demand** | **lbs** | **706** |
| TTZ Groundwater Mass Flux | L/day | 178 |
| CVOC Mass Flux through TTZ | lb/yr | 16 |
| CEA Mass Flux through TTZ | lb/yr | 13 |
| Total Mass Flux through TTZ | lb/yr | 29 |
| **Total Mass Flux 3DME Demand** | **lbs** | **78** |
| **Application Dosing** | | |
| **3-D Microemulsion to be Applied** | **lbs** | **4,000** |
| **CRS to be Applied** | **lbs** | **2,000** |
| **BDI Plus to be Applied** | **liters** | **20** |
| **HRC Primer to be Applied** | **lbs** | **990** |

## 3-D Microemulsion®, BDI® Plus, CRS® Application Design Summary

| Saturated soil | | Field App. Instructions |
|---|---|---|
| **Application Method** | **Direct Push** | |
| Spacing Within Rows (ft) | 10 | |
| Spacing Between Rows (ft) | 9 | |
| **Application Points** | **33** | |
| Areal Extent (square ft) | 3,000 | |
| Top Application Depth (ft bgs) | 10 | **Field Mixing Ratios** |
| Bottom Application Depth (ft bgs) | 25 | 3DME Concentrate per Pt (lbs) |
| **3DME to be Applied (lbs)** | **4,000** | 121 |
| 3DME to be Applied (gals) | 479 | Mix Water per Pt (gals) |
| 3DME Mix % | 10% | 131 |
| **Volume Water (gals)** | **4,314** | 3DME Mix Volume per Pt (gals) |
| 3DME Mix Volume (gals) | 4,793 | 145 |
| **CRS to be Applied (lbs)** | **2,000** | CRS Volume per Pt (gals) |
| CRS Volume (gals) | 228 | 7 |
| **BDI Plus to be Applied (L)** | **20** | BDI Volume per Pt (L) |
| BDI Mix Water Volume (gals) | 200 | 0.6 |
| **HRC Primer to be Applied (lbs)** | **990** | HRC Primer per Pt (lbs) |
| HRC Primer Volume (gals) | 103 | 30 |
| **Total Application Volume (gals)** | **5,330** | Volume per pt (gals) |
| Estimated Radius of Injection (ft) | 2.6 | 162 |
| **Prepared by: Owen Miller - Design Specialist** | | Volume per vertical ft (gals) |
| **Date: 7/3/2017** | | 11 |

### Technical Notes/Discussion

**We recommend this application be conducted using Direct Push Technology (DPT).**

### 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 developed this Scope of Work in reliance upon the data and professional judgments provided by those whom completed the earlier environmental site assessment(s). The fees and charges associated with the Scope of Work were generated through REGENESIS' proprietary formulas and thus may not conform to billing guidelines, constraints or other limits on fees. REGENESIS does not seek reimbursement directly from any government agency or any governmental reimbursement fund (the "Government"). In any circumstance where REGENESIS may serve as a supplier or subcontractor to an entity which seeks reimbursement from the Government for all or part of the services performed or products provided by REGENESIS, it is the sole responsibility of the entity seeking reimbursement to ensure the Scope of Work and associated charges are in compliance with and acceptable to the Government prior to submission. When serving as a supplier or subcontractor to an entity which seeks reimbursement from the Government, REGENESIS does not knowingly present or cause to be presented any claim for payment to the Government.

REGENESIS

## Purchasing Information

| Queens Way Cleaners | -- | Saturated soil |
|---|---|---|
| 3-D Microemulsion Required | lbs | 4,000 |
| CRS Required | lbs | 2,000 |
| BDI Plus Required | liters | 20 |
| HRC Primer Required | lbs | 990 |
| Total Estimated Project Cost** | $ | $48,120 |
| Estimated RRS Days to Apply | --- | 2 |

*Note that the combined tax and freight costs are preliminary estimates only. Please contact your local sales manager or Customer Service at 949-366-8000 to obtain a shipping quote. You will be asked to provide a ship-to address and estimated time of delivery.

## Currently Available Packaging Options

| 3DME Package Type*** | # of packages | lbs required |
|---|---|---|
| 400 lb poly drums | 10 | 4,000 |
| 2,000 lb reinforced plastic totes | 2 | 4,000 |

| CRS Package Type*** | # of packages | lbs required |
|---|---|---|
| 400-lb poly drums | 5 | 2,000 |

| BDI Plus Package Type*** | # of packages | L required |
|---|---|---|
| 18-L kegs | 2 | 20 |

| HRC Primer Package Type*** | # of packages | L required |
|---|---|---|
| 30-lb pails | 33 | 990 |

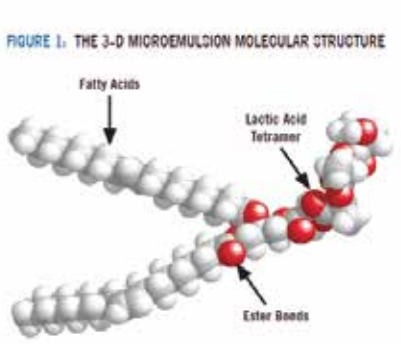
**Total Project cost is only an estimate; actual project cost may change as the final scope and/or RRS proposal are developed.

***Available Package Types are subject to change.

# 3-D Microemulsion® Factory Emulsified Technical Description

3-D Microemulsion (3DME®) is comprised of a patented molecular structure containing oleic acids (i.e., oil component) and lactates/polylactates, which are molecularly bound to one another (figure 1). The 3DME molecule contains both a soluble (hydrophilic) and in-soluble (lipophilic) region. These two regions of the molecule are designed to be balanced in size and relative strength. The balanced hydrophilic/lipophilic regions of 3DME result in an electron donor with physical properties allowing it to initially adsorb to the aquifer material in the area of application, then slowly redistribute via very small 3DME "bundles" called micelles. These 3DME micelles spontaneously form within sections of the aquifer where concentrations of 3DME reach several hundred parts per million. The micelles' small size and mobility allow it to move with groundwater flow through the aquifer matrix, passing easily through the pore throats in between soil grains resulting in the further redistribution of 3DME within the aquifer. This allows for advective distribution of the oleic acids which are otherwise insoluble and unable to distribute in this manner, allowing for increased persistence of the lactate/polylactates component due to their initial attachment to the oleic acids.

Example of 3-D Microemulsion




Due to its patented molecular structure, 3DME offers far greater transport when compared to blended emulsified vegetable oil (EVO) products, which fail to distribute beyond the limits of pumping. 3DME also provides greater persistence when compared to soluble substrates such as lactates or simple sugars. The 3DME molecular structures capitalize on the best features of the two electron-donor types while at the same time, minimize their limitations. 3DME is delivered to the site as a ready-to-apply emulsion that is simply diluted with water to generate a large volume of a 3DME colloidal suspension.

Suspension of 3DME generated by this mixing range from micelles on the order of .02 microns to .05 microns in diameter, to "swollen" micelles, (termed "microemulsions") which are on the order of .05 to 5 microns in diameter. Once injected into the subsurface in high volumes, the colloidal suspension mixes and dilutes in existing pore waters. The micelles/microemulsions on the injection front will then begin to sorb onto the surfaces of soils as a result of zeta potential attraction and organic matter within the soils themselves. As the sorption continues, the 3DME will "coat" pore surfaces developing a layer of molecules and in some cases a bilayer. This sorption process continues as the micelles/microemulsion moves outward and disassociates into their hydrophilic/hydrophobic components. The specialized chemistry of 3DME results in a staged release of electron donors: free lactate (immediate); polylactate esters (mid-range) and free fatty acids & fatty acid esters (long-term). Material longevity of three years or greater has been seen at most sites as determined from biogeochemical analyses.

For a list of treatable contaminants with the use of 3DME, view the Range of Treatable Contaminants Guide

## Chemical Composition

- Hydrogen Release Compound Partitioning Electron Donor – CAS #823190-10-9
- Sodium Lactate – CAS# 72-17-3
- Water – CAS# – 7732-18-5

# 3-D Microemulsion® Factory Emulsified Technical Description

## Properties

- Density – Approximately 1.0 grams per cubic centimeter (relative to water)
- pH – Neutral (approximately 6.5 to 7.5 standard units)
- Solubility – Soluble in Water
- Appearance – White emulsion
- Odor – Not detectable
- Vapor Pressure – None
- Non-hazardous

## Storage and Handling Guidelines

| Storage |
| --- |
| Store in original tightly closed container |
| Store in a cool, dry, well-ventilated place |
| Store away from incompatible materials |
| Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass |

| Handling |
| --- |
| Avoid contact with eyes, skin, and clothing |
| Provide adequate ventilation |
| Wear appropriate personal protective equipment |
| Observe good industrial hygiene practices |

## Applications

- 3DME is diluted with water prior to application. Resulting emulsion has viscosity similar to water.
- Easily injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here 3DME FE Application Instructions.

## Health and Safety

Material is food grade and relatively safe to handle. We recommend avoiding contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including vinyl or rubber gloves, and eye protection are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: SDS-3DME FE.

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949.366.8000

# BDI PLUS® Technical Description

Bio-Dechlor INOCULUM Plus (BDI PLUS®) is an enriched natural consortium containing species of Dehalococcoides sp. (DHC). BDI PLUS has been shown to simulate the rapid and complete dechlorination of chlorinated solvents such as tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE) and vinyl chloride (VC) to non-toxic end products, ethene, carbon dioxide and water.

The culture also contains microbes capable of dehalogenating halomethanes (e.g., carbon tetrachloride and chloroform) and haloethanes (e.g., 1,1,1-TCA and 1,1-DCA) as well as mixtures of these contaminants.

Species of Dehalococcoides sp. (DHC)

For a list of treatable contaminants with the use of BDI PLUS, view the Range of Treatable Contaminants Guide

## Chemical Composition

- Non-hazardous, naturally-occurring, non-altered anaerobic microbes and enzymes in a water-based medium.

## Properties

- Appearance – Murky, yellow to grey water
- Odor – Musty
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Soluble in Water
- Vapor Pressure – None
- Non-hazardous

## Storage and Handling Guidelines

| Storage |
|---|
| Store in original tightly closed container |
| Store away from incompatible materials |
| Recommended storage containers: plastic lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass |
| Store in a cool, dry area at 4-5°C (39 - 41°F) |
| Material may be stored for up to 3 weeks at 2-4°C without aeration |

| Handling |
|---|
| Avoid prolonged exposure |
| Observe good industrial hygiene practices |
| Wear appropriate personal protective equipment |

# BDI PLUS® Technical Description

## Applications

- BDI PLUS is delivered to the site in liquid form and is designed to be injected directly into the saturated zone requiring treatment.
- Most often diluted with de-oxygenated water prior to injection into either hydraulic push injection points or properly constructed injection wells.
- The typical dilution rate of the injected culture is 10 gallons of deoxygenated water to 1 liter of standard BDI PLUS culture.

Application instructions for this product are contained here BDI PLUS Application Instructions.

## Health and Safety

Material is non-hazardous and relatively safe to handle; however avoid contact with eyes and prolonged contact with skin. OSHA Level D personal protection equipment including: vinyl or rubber gloves and safety goggles or a splash shield are recommended when handling this product. An eyewash station is recommended. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: BDI PLUS SDS.

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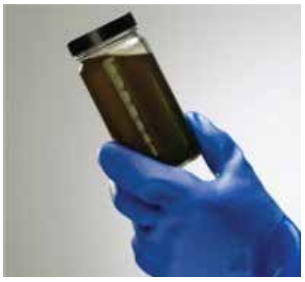
949.366.8000

# CRS® Technical Description

CRS® (Chemical Reducing Solution) is an iron-based reagent that facilitates biogeochemical *in situ* chemical reduction (ISCR) of halogenated contaminants such as chlorinated ethenes and ethanes. CRS is a pH neutral, liquid iron solution that is easily mixed with 3-D Microemulsion® Factory Emulsified before injection into a contaminated aquifer. CRS provides a soluble, food-grade source of ferrous iron ($Fe^{2+}$), designed to precipitate as reduced iron sulfides, oxides, and/or hydroxides. These $Fe^{2+}$ minerals are capable of destroying chlorinated solvents via chemical reduction pathways, thus improving the efficiency of the overall reductive dechlorination process by providing multiple pathways for contaminant degradation in groundwater.



Example of CRS

For a list of treatable contaminants with the use of CRS, view the Range of Treatable Contaminants Guide.

## Chemical Composition

| | |
|---|---|
| • Water | 7732-18-5 |
| • Ferrous Gluconate | 299-29-6 |

## Properties

- Appearance – Dark green to black
- Odor – Odorless
- pH 6.0 to 8.0
- Density – Approximately 1.0 grams per cubic centimeter (0.9 to 1.1 g/cc)
- Solubility – Miscible
- Vapor Pressure – None
- Non-hazardous

## Storage and Handling Guidelines

| Storage |
|---|
| Store in original tightly closed container |
| Store away from incompatible materials |
| Recommended storage containers: plastic-lined steel, plastic, glass, aluminum, stainless steel, or reinforced fiberglass |
| Store in a cool, dry, well-ventilated place |
| Keep away from extreme heat and strong oxidizing agents |

| Handling |
|---|
| Avoid prolonged exposure |
| Observe good industrial hygiene practices |
| Wear appropriate personal protective equipment |
| Avoid contact with eyes, skin, and clothing |
| Avoid breathing spray mist |
| Use with adequate ventilation |

# CRS® Technical Description

## Applications

- Permanent injection wells
- Direct-push injection points

Application instructions for this product are contained in the CRS Application Instructions.

## Health and Safety

The manufacturer lists no ingredients as hazardous according to OSHA 29 CFR 1910.1200. Observe good industrial hygiene practices. Wash hands after handling. Store away from incompatible materials. Dispose of waste and residues in accordance with local authority requirements. Please review the CRS PLUS Material Safety Data Sheet for additional storage, usage, and handling requirements.

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1011 Calle Sombra, San Clemente CA 92673
949.366.8000

HYDROGEN RELEASE COMPOUND

# HRC® Technical Description

HRC® is an engineered, hydrogen release compound designed specifically for enhanced, in situ anaerobic bioremediation of chlorinated compounds in groundwater or highly saturated soils. Upon contact with groundwater, this viscous, polylactate ester material becomes hydrated and subject to microbial breakdown producing a controlled-release of hydrogen for periods of up to 18-24 months on a single application.

HRC enables enhanced anaerobic biodegradation by adding hydrogen (an electron donor) to groundwater and/or soil to increase the number and vitality of indigenous microorganisms able to perform the naturally occurring process of enhanced reductive dechlorination. During this process, certain naturally occurring microorganisms replace chlorine atoms on chlorinated contaminants with the newly available hydrogen effectively reducing the contaminant to a less harmful substance with the preferred and innocuous endpoints of ethene or ethane.

For a list of treatable contaminants with the use of HRC, view the Range of Treatable Contaminants Guide.

Example of HRC

## Chemical Composition

- Glycerol Tripolylactate- CAS #201167-72-8
- Glycerin- CAS #56-81-5
- Lactic acid- CAS #50-21-5

## Properties

- pH - 3 (3% solution/water)
- Appearance – Viscous gel/liquid. Amber color
- Odor – Odorless
- Vapor Pressure – None

## Storage and Handling Guidelines

| Storage |
| --- |
| Store away from incompatible materials |
| Store in original tightly closed container |
| Store in a cool, dry, well-ventilated place |

| Handling |
| --- |
| Wash thoroughly after handling |
| Wear appropriate personal protective equipment |
| Wear eye/face protection |
| Provide adequate ventilation |
| Observe good industrial hygiene practices |

HYDROGEN RELEASE COMPOUND

# HRC® Technical Description

## Applications

- Permanent injection wells
- Direct-push injection (barriers and grids)
- Recirculating wells
- Soil borings
- Excavation applications into soil or on top of bedrock
- Gravity feed into bedrock wells

Application instructions for this product are contained in the HRC Application Instructions.

## Health and Safety

Avoid contact with eyes, skin, and clothing. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.

Please review the HRC Material Safety Data Sheet for additional storage, usage, and handling requirements.

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1011 Calle Sombra, San Clemente CA 92673
949.366.8000

# PersulfOx® Technical Description

PersulfOx is an *In Situ* Chemical Oxidation (ISCO) reagent that destroys organic contaminants found in groundwater and soil through powerful, yet controlled, chemical reactions. A sodium persulfate-based technology (figure 1), PersulfOx employs a patented catalyst to enhance the oxidative destruction of both hydrocarbons and chlorinated contaminants in the subsurface.

Typically, sodium persulfate is activated with the addition of heat, chelated metals, hydrogen peroxide, or base in order to generate sulfate radicals. These activation processes are inherently complex, costly and can pose additional health and safety risks. In comparison, PersulfOx is a relatively safe and easy-to-use ISCO agent with a built-in catalyst which activates the persulfate component, generating contaminant-destroying free radicals without the need for the addition of a separate activator. The equation below shows the net complete oxidation of toluene, a constituent of gasoline, by PersulfOx:


Example of PersulfOx

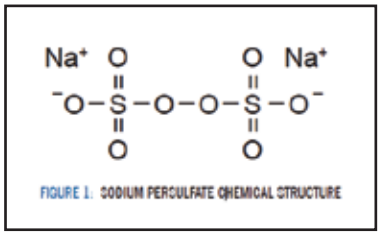


FIGURE 1: SODIUM PERSULFATE CHEMICAL STRUCTURE

For a list of treatable contaminants with the use of PersulfOx, view the Range of Treatable Contaminants Guide

## Chemical Composition

- Sodium Persulfate - CAS #7775-27-1
- Sodium Silicate - CAS #1344-09-8

## Properties

- pH - 7 to 11.5 at 25°C
- Appearance – White, free-flowing powder, clear to cloudy when mixed with water
- Odor – Not detectable
- Vapor Pressure – None
- Chemical Hazard Classification - Class 5.1 Oxidizer

## Storage and Handling Guidelines

| Storage |
| --- |
| Store locked up |
| Keep away from heat |
| Store in a cool, dry place out of direct sunlight |

| Handling |
| --- |
| Minimize dust generation and accumulation |
| Routine housekeeping should be instituted to ensure that dust does not accumulate on surfaces |

# PersulfOx® Technical Description

| **Storage** (continued) |
|---|
| Store in original tightly closed container |
| Store in a well-ventilated place |
| Do not store near combustible materials |
| Store away from incompatible materials |
| Recommended to store at less than 40°C |
| Provide appropriate exhaust ventilation in places where dust is formed |

| **Handling** (continued) |
|---|
| Avoid mixing with combustibles |
| Avoid contamination |
| Keep away from clothing and other combustible materials |
| Wear appropriate personal protective equipment |
| Avoid breathing dust |
| Avoid contact with eyes, skin, and clothing |
| Avoid prolonged exposure |
| Do not taste or swallow |
| When using, do not eat, drink or smoke |
| Wear appropriate personal protective equipment |
| Wash hands thoroughly after handling |
| Observe good industrial hygiene practices |

## Applications

- PersulfOx is mixed with water at a rate of 5% to 20% prior to application.
- For most applications, REGENESIS suggests a 10-15% solution. The resulting mixture has viscosity similar to water.
- Injects into formation through direct push injection points, injection wells or other injection delivery systems.

Application instructions for this product are contained here PersulfOx Application Instructions.

## Health and Safety

Material is relatively safe to handle; however, avoid contact with eyes, skin and clothing. OSHA Level D personal protection equipment including: vinyl or rubber gloves, eye protection, and dust mask are recommended when handling this product. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: PersulfOx SDS.

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# In-Situ Anaerobic Bioremediation Performance Monitoring Parameters

| Analytical Parameter | Method |
|---|---|
| Contaminants of Concern (COC's) | Varies |
| pH | Meter reading taken in flow-through cell (DO can also be measured with a Hach kit) |
| Dissolved Oxygen (DO) | |
| Oxidation Reduction Potential (ORP) | |
| Total Fe | Colorimetric Hach Method or EPA 6000 series with filtered and unfiltered samples |
| Total Mn | |
| Dissolved Fe | |
| Dissolved Mn | |
| Sulfate | EPA 375.3 or EPA 9056 |
| Nitrate | EPA 353.1 or EPA 9056 |
| Total Organic Carbon (TOC) | EPA 415.1 or EPA 9060 |
| Chemical Oxygen Demand (COD) | EPA 410.1-.2 |
| Biological Oxygen Demand (BOD) | EPA 5210B |
| Alkalinity | EPA 310.2 |
| Methane, Ethane, Ethene, CO2 | ASTM D1945 |

REGENESIS

# PersulfOx/ORC Advanced™ Excavation Application Instructions

The purpose of PersulfOx is to rapidly reduce the mass of contaminants in the subsurface. Application of ORC *Advanced* will sustain dissolved oxygen concentrations in the treatment area to facilitate aerobic biodegradation of any remaining residual contamination.

## Application Methods

### PersulfOx

PersulfOx is an all-in-one oxidant that provides powerful and highly efficient chemical oxidation performance. It is easily mixed with water and applied into the contaminated matrix using subsurface injection techniques or soil mixing tools.

PersulfOx application into an excavation pit is typically done by adding PersulfOx with no amendments. First, all personnel within the exclusion zone of the excavation application should have proper Personal Protection Equipment to protect eyes, respiratory systems and skin. The recommended dose of PersulfOx power should be added to the excavation pit. PersulfOx should be distributed evenly and mixed as prescribed in the design. This is typically done with the excavator bucket. To further distribute the PersulfOx throughout the treatment area, water should be added until standing (saturated). If standing water is already present then this step is not necessary.

### ORC *Advanced Pellets*

This pelletized form allows the user to simply and easily apply the ORC Advanced in a dry format using existing on-site operations or by manual methods. For this project the following is recommended:

Application via the excavator bucket:

- Manually or mechanically broadcast/spread pelletized ORC-A Pellets into the excavation in 1 foot lifts at the pre-determined rate noted in the design tables, as the soil is being backfilled.
- Follow the manual broadcast step with mechanically mixing the ORC-A Pellets directly into the backfill using the excavator equipment.

**RRS Assumptions and Qualifications**

- Client personnel will take delivery of the remediation chemistry prior to RRS mobilization and arrange for secure storage where the material will not be affected by inclement weather. This may include the use of a pallet jack, forklift (or equivalent), and storage containers given the site circumstances. If material is stored off-site, Client personnel will coordinate the delivery of the material to the site.
- All quoted product rates and delivery dates are based on Standard Delivery Terms, which allow or provide only an estimated date and time of delivery of product to the site. Delivery times will vary per carrier. A guaranteed delivery can be arranged for an additional cost, and must be placed 7 days prior to shipment. Quoted shipping rates are valid for 25 days from date of proposal.
- Cost outlined will be valid for 60 days from date of proposal. If beyond 60 days, REGENESIS reserves the right to update cost.
- Client will locate the product within 10 feet of the RRS injection trailer during application activities.
- RRS will collect project related refuse and empty treatment chemistry containers on a daily basis to keep the site clean. This nonhazardous refuse will be placed in the Client-provided refuse container on-site for disposal. Client is responsible for disposal or recycling of totes, drums and pallets.
- 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 300' of the project staging area, at no cost to RRS. RRS will supply 300 linear feet of 1.5 inch National Standard Thread fire hose.
- RRS will have access to the site for equipment operation and secure storage of materials and equipment throughout the duration of the project.
- Client will provide field water quality meter similar to a YSI 556 with a down-hole sensor, a water level meter, bailers and a technician while on-site for injection activities to assist RRS in assessing groundwater from monitoring wells.
- Client is responsible for securing any permits prior to mobilizing to the site.
- Client is responsible for all soil, air and groundwater sampling and analysis.
- Client is responsible for transportation and disposal of any contaminated waste generated on-site, though we do not anticipate generating any such waste during direct push injection activities.
- For safety reasons, access to the treatment area will be limited to RRS and Client personnel.
- The proposed quantity of reagents can be delivered to the treatment area without significant surfacing/short-circuiting via the prescribed number of injection points. RRS will take precautions to prevent surfacing, but if surfacing occurs, RRS is not responsible for any treatment chemistry infiltration into undesired locations beyond their visual observations.

- RRS will call in a public utility locate for the injection zone area if responsible for providing Direct Push Technology subcontractor. Private utility locates will be the Client's responsibility. RRS is not responsible for damage to unmarked utilities and subsurface structures. If as-built drawings are available for any on-site subsurface features, RRS request the right to review to confirm clearance for the advancement of subsurface drilling and injection.
- RRS personnel will have access to the site for work up to 12 hours per day Sunday through Saturday. However, the standard workday does not exceed 10 hours with travel time Monday through Friday.
- Pricing and work schedule assume union labor and prevailing wages (Davis-Bacon) are not required.
- Proposal assumes standard probing and drilling will begin at ground surface. If hand augering, concrete coring or air knife services will be required, additional charges will apply.
- RRS assumes that Direct Push style drill rig can access all injection point locations and drive injection tooling to the required depth. If site conditions limit the use of the provided Direct Push rig for any injection points and other drilling methods are required to complete the task, additional charges will apply.
- All traffic control requirements will be provided by the client.
- All injection point will be closed/backfilled with bentonite chips to ground surface by RRS. Additional costs associated with restoration of the ground surface have not been included. If restoration of the ground surface is needed, additional charges will apply.
- In generating this 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.

# ATTACHMENT 3

**Summary**

**Option 3 - Capping Source Area**

| | SCS Labor & Expenses | Soil Excavation & Disposal | Utility locate | Cap | Subtotal |
|---|---|---|---|---|---|
| Planning | $1,900 | | | | $1,900 |
| Field Documentation | $1,960 | $1,447 | $300 | $1,724 | $5,431 |
| Reporting | $870 | | | | $870 |
| Totals | $4,730 | $1,447 | $300 | $1,724 | $8,201 |
| **Total Estimated Amount (rounded to $100)** | | | | | $8,200 |

**Scope of Work**

Excavate shallow CVOC (non-hazardous) soil from tank basin to allow installation of cap.

Install concrete or asphalt cap over tank excavation

Pump MW1 and dispose at waste water treatment plant.

**Cost Estimate - SCS Engineers**
**Option 3 - Capping Source Area**
**SCS File No. 25212159.01**

SCS ENGINEERS

| Task Description | Project Director $190 | Senior Project Manager $155 | Senior Project Professional $125 | Field Professional $100 | Designer/ CAD Tech $80 | Admin Asst $67 | Total Hours | Subtotal | Exp | Subs | Total | Task Total Rounded to $10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Task 1 – Planning** | | | | | | | | | | | | |
| H&S plan | | 0.5 | 0.5 | 1 | | | 2 | $240 | | | $240 | |
| Bidding & Contracting | 1 | 2 | 3 | | | | 6 | $875 | | | $875 | |
| Client & DNR correspondence | | 1 | 2 | | | | 3 | $405 | | | $405 | |
| Kick-off meeting | | 1 | 1 | 1 | | | 3 | $380 | | | $380 | |
| **Subtotal** | **1** | **4.5** | **6.5** | **2** | **0** | **0** | **14** | **$1,900** | **$0** | **$0** | **$1,900** | **$1,900** |
| | | | | | | | | | | | | |
| **Task 2 – Field Documentation** | | | | | | | 0 | $0 | | | $0 | |
| Pump MW1R | | 1 | 1 | 4 | | | 6 | $680 | | | $680 | |
| Field coordination, documentation | | 1 | 1 | 4 | | | 6 | $680 | | | $680 | |
| Vacuum truck pumping & water disposal | | | | | | | 0 | $0 | | $600 | $600 | |
| | | | | | | | 0 | $0 | | | $0 | |
| | | | | | | | 0 | $0 | | | $0 | |
| **Subtotal** | **0** | **2** | **2** | **8** | **0** | **0** | **12** | **$1,360** | **$0** | **$600** | **$1,960** | **$1,960** |
| | | | | | | | | | | | | |
| **Task 3 – Documentation Report** | | | | | | | 0 | $0 | | | $0 | |
| Figures, photos | | | 1 | 1 | 0.5 | | 2.5 | $265 | | | $265 | |
| Text | | 1 | 1 | 1 | | 1 | 4 | $447 | | | $447 | |
| Review | | 1 | | | | | 1 | $155 | | | $155 | |
| **Subtotal** | **0** | **2** | **2** | **2** | **0.5** | **1** | **7.5** | **$867** | **$0** | **$0** | **$867** | **$870** |
| | | | | | | | | | | | | |
| **Total** | **1** | **8.5** | **10.5** | **12** | **0.5** | **1** | **33.5** | **$4,127** | **$0** | **$600** | **$4,727** | **$4,730** |
| | | | | | | | | | | | **$4,727** | **$4,730** |

I:\25212159\Remediation Options\[Option 3 - Capping Source Area.xlsx]Labor 10/25/17

PROJECT/PROPOSAL NAME: Option 3 - Capping Source Area

PROJECT/PROPOSAL NUMBER: SCS File No. 25212159.01
PREPARED BY: BJS
DATE: 24-Jun-17

| Description | Estimated Quantity | Unit | Unit Cost | Estimated Cost |
|---|---|---|---|---|
| | | | | |
| **SOIL SAMPLING AND TESTING** | | | | |
| FID/PID rental | 1 | Day | $75.00 | $75.00 |
| Meals | 1 | Meal | $10.00 | $10.00 |
| Mileage (200 miles RT + local = 220 miles/day) 1 days | 220 | Miles | $0.56 | $123.20 |
| Motel | | Day | | $0.00 |
| | | | | |
| **TOTAL FIELD EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$210.00** |
| | | | | |
| **OFFICE AND MISCELLANEOUS EXPENSES** | | | | |
| Document Reproduction ($0.07/copy) | 1 | L.S. | | $0.00 |
| Postage/Shipping | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | 1 | L.S. | | $0.00 |
| | | | | |
| **TOTAL OFFICE/MISCELLANEOUS EXPENSES (Rounded to Nearest $10)** | | | | **$0.00** |
| | | | | |
| **TOTAL EQUIPMENT AND EXPENSES (Rounded to Nearest $10)** | | | | **$210.00** |

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**Option 3 - Capping Source Area**
**SCS File No. 25212159.01**
**Soil Management**
SCS Opinion of Costs

| Excavation Areas | Length | Width | Depth | Volume (Cu Yds) | Tons | |
|---|---|---|---|---|---|---|
| **Non- haz** | 8 | 5 | 1 | 1 | 2 | Total tons non-haz |
| **Non- haz** | 15 | 5 | 1 | 3 | 4 | 6 |
| **Haz** | | | | - | - | Total tons haz |
| **Haz** | | | | - | - | - |
| Total | | | | 4 | 6 | |

| **Item** | **Estimated Quantity** | **Unit** | **Estimated Unit Rate** | **Estimated Subtotals** |
|---|---|---|---|---|
| Mobilization | 1 | Lump Sum | $1,000 | $1,000 |
| Excavate, load (CVOC soils) | 6 | Tons | $25 | $160 |
| Haul non-hazardous to landfill | 6 | Tons | $10 | $64 |
| Haul & dispose hazardous | 0 | Tons | $588 | $0 |
| Tipping fee for non-haz | 6 | Tons | $35.00 | $224 |
| **Subtotal for Soil Excavation & Disposal** | | Tons | | **$1,447** |
| | | | | |
| Backfilling and compaction | 6 | Tons | $35 | $224 |
| Concrete cap over tank basin | 1 | Lump Sum | $1,500 | $1,500 |
| Move gas line | 0 | Lump Sum | $1,500 | $0 |
| Move electric line | 0 | Lump Sum | $700 | $0 |
| Dispose of concrete sidewalk | 0 | Tons | $50 | $0 |
| Mix-in PersulfOx | 0 | Lump Sum | $1,000 | $0 |
| PersulfOx (delivered, includes tax) | 0 | Tons | $6,447 | $0 |
| Topsoil & grass placed | 0 | Tons | $50 | $0 |
| **Subtotal** | | | | **$1,724** |
| **Construction Total** | | | | **$3,170.83** |
| | | | | |
| **Total Estimated Amount (rounded to $100)** | | | | **$3,200** |

Notes: Soil Disposal at Waste Management
Soil Unit Weight = 1.5 tons/cubic yard
Hazardous tipping fee per quote provided to SCS Engineers.
I:\25212159\Remediation Options\[Option 3 - Capping Source Area.xlsx]Soil