September 20, 2019

Ms. Marla Stremcha, P.E.
Project Manager
Petroleum Tank Cleanup Section
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901

RE: Standardized Generic Applications Corrective Action Work Plan (AC-07)
Zeiler Farm Facility
1236 Mullowney Lane, Billings, MT
Facility ID# 56-04962 (TREADS ID 29958), Release #4959, WP ID #33935

Dear Ms. Stremcha:

On behalf of Zeiler Farm, Pioneer Technical Services, Inc. (Pioneer) is submitting the following work plan and cost estimate to conduct groundwater monitoring well installation and *in-situ* chemical treatment activities to address Release #4959 at the Zeiler Farm Facility. As requested in correspondence from the Montana Department of Environmental Quality (DEQ) dated August 30, 2019, the scope of work and cost are outlined below. The location of the project facility is shown on the Location and Vicinity Map in Attachment 1.

1 SCOPE OF SERVICES

The scope of the work for this project includes installing and sampling a groundwater monitoring well to be located near the former underground storage tank (UST) basin and completing the *in-situ*, subsurface injection of the chemical treatment product, PetroFix™, to further remediate and address Release #4959. This work is divided into the tasks below (each task is detailed in the respective section).

Task 1 - Project Management.
Task 2 - Complete Boring and Well Installation and Sampling Activities.
Task 3 - Perform *In-Situ* Chemical Treatment Application.
Task 3 - Reporting (completing a Standardized Generic Applications Report (Report_AR-07).

1.1 Task 1 – Project Management

This task includes scheduling, securing site access, organizing, and planning tasks and ordering and coordinating resources to complete the project. Specific activities are listed below:

- Scheduling personnel and subcontractors to ensure work is completed efficiently.
- Preparing, submitting, and implementing this work plan #33935.
- Securing site access.
- Calculating, ordering, and securing injection materials.
- Coordinating schedules and activities of owners and regulators.

- Supervising all work activities.
- Completing accounting, invoicing, and budget-tracking tasks.
- Preparing a site-specific health and safety plan.

We will prepare a project site-specific health and safety plan and implement this work plan as approved by the Montana DEQ and the Petroleum Release Compensation Release Board (Petro Board). We will also manage payments for suppliers and subcontractors and deliver the final summary report to the DEQ.

1.2 Task 2 – Complete Boring and Well Installation and Sampling Activities

The work plan includes drilling 1 soil boring near the former UST basin and constructing it into a 2-inch groundwater monitoring well. The boring will be located within or very near the former UST basin. The location of the proposed boring is shown on Figure 2, Site Map in Attachment 1. The anticipated total depth of the boring is 22 to 25 feet. This is based on groundwater measured at 16 to 19 feet below ground surface (bgs) at the site. We will advance the boring with a truck-mounted drill rig using hollow-stem auger methods. Final boring locations will be determined in the field after consultations with the DEQ project manager and based on accessibility, underground utilities, the presence of unforeseen impedances, or other factors.

The monitoring well will be constructed with 2-inch diameter, schedule 40 polyvinyl (PVC) pipe. All well screens and piping will be delivered to the site factory wrapped. The monitoring well screen will be 0.01-inch, factory-slotted screen. The well will be screened from the depth of 10 feet to 25 feet to facilitate entry of petroleum vapors and light non-aqueous phase liquids (LNAPL). The remainder of the borehole will be completed with PVC riser pipe to grade. The annular space between the well screen and the borehole will have 10-20 sand completion whereas the annual space between the well casing and the borehole will have bentonite completion. The well will also be developed by pumping until it is clear of sediment. Following well installation and development, the new and existing wells will be surveyed by a licensed surveyor and the top of casings will be determined to within 0.01 feet of mean sea level.

A Pioneer engineer or geologist will supervise drilling operations and be present to collect, screen, and log soil types. Soil samples will be collected at 2.5-foot intervals and personnel will log the soil type and consistencies and document any visible signs of petroleum impacts. Standard headspace readings will be collected using a photoionization (PID) meter. No soil samples will be submitted for analytical testing.

In order to document pre-treatment groundwater conditions within the treatment zone, Pioneer will collect groundwater samples prior to the treatment process. One week after well installation, the new well and existing well (MW-6) will be sampled and tested for volatile petroleum hydrocarbons (VPH) and extractable petroleum hydrocarbons (EPH) screen; fractions will be run if the results are over the greater than1,000 parts per billion (ppb) threshold.

1.3 Task 3 – Perform In-Situ Chemical Treatment Application

The field team will inject into the subsurface approximately 1,200 pounds of the Regenesis, PetroFix™,chemical treatment compound using a direct-push Geoprobe drill rig. PetroFix™ is a highly concentrated water-based suspension consisting of micron-scale activated carbon and bio-stimulating electron acceptors. The Geoprobe rig will be used to inject and apply the PetroFix™ solution through 45

injection points that are spaced within the treatment area on a grid with 6-foot centers. The targeted depth of treatment chemical injection will be from the depth of 16 to 20 bgs. The proposed surface area of the treatment zone measures 20 feet wide by 80 feet long for a total treatment area of 1,600 square feet. The proposed treatment area is a rectangular shaped area that encompasses the former UST basin and extends to the southeast direction as defined by the groundwater flow direction of the site. The proposed treatment area and injection points are shown on the Site Map in Attachment 1.

The PetroFix™ will be shipped to Pioneer's Billings office in 55-gallon drums and securely stored until ready for use. The PetroFix™ compound will be blended as per instructions on the site with fresh water in a portable mixing tank prior to injection.

The blended chemical mixture will be injected under low pressure (<50 pounds per square inch) through approximately 45 injection points to a depth of 16 to 20 feet (bgs). The injection plan calls for the injection of approximately 109 gallons of injectate per injection point. The proposed dose will be 5.06 pounds/cubic yard, with a total treatment volume of 237 cubic yards. The injection process will follow the manufacturer's recommended procedures as outlined in the procedure's manual in Attachment 2.

1.4 Task 3 – Reporting

Pioneer will review all previous remediation reports of the release and tabulate current and historical data, analyze the results from the treatment program and groundwater sampling events, and compile a Standardized Abbreviated Generic Applications Report (Report AR-07). Pioneer will complete a Release Closure Plan for Release #4959 and append it to the report. Pioneer will also perform data validation of the laboratory data and will append the DEQ Data Validation Summary Form to the report.

We will prepare the report according to the Montana DEQ report format, which includes the following:

- Groundwater monitoring well installation results.
- Treatment and injection procedure results including injection volumes, locations, dosage, frequency, pressures, and operating conditions.
- Groundwater monitoring results.
- Updated facility map illustrating locations of utilities, former fuel systems, site buildings, underground utilities, injection points, treatment area, and monitoring wells.
- Groundwater contour and gradient maps and an iso-concentration map, if needed.
- Tables summarizing locations/depth of field treatment data, and cumulative laboratory analytical data for groundwater water samples.
- Laboratory analytical reports for groundwater samples.
- Logs, field data sheets, and related field data.
- Data interpretation and discussion of results and remediation effectiveness, and recommendations relevant for further remediation and/or closure for the release.

2 COST ESTIMATES

The detailed cost estimate to perform this scope of work is in Attachment 3.

3 SCHEDULE

We expect to begin work on this project within 30 days following receipt of both Montana DEQ and Petro Board approvals and obligations, which is expected to be by early November 2019. The first phase of the project will be the installation of the new source area well near the former UST basin. This new well and existing well (MW-6) will be sampled one week after installation of the new well. Once these results are received, then the treatment phase will begin. The treatment process is expected to take three days. The last groundwater sample event will take place at least two weeks following the treatment process. The total project duration, as described in this work plan, will last up to three months. We expect to complete the final report by the end of January 2020.

If you have any questions about this project or the proposed scope of work, please call me at (406) 702-2430 or email me at cpeterson@pioneer-technical.com.

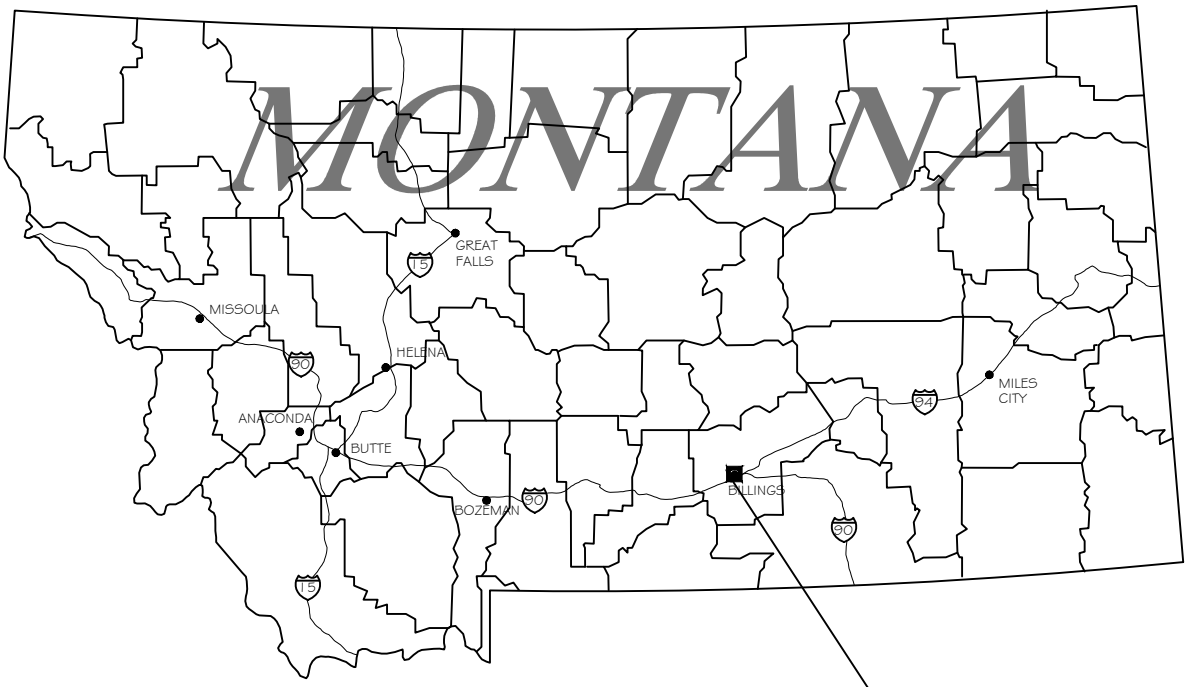
Sincerely,

Charles L. Peterson, P.G.
Project Manager

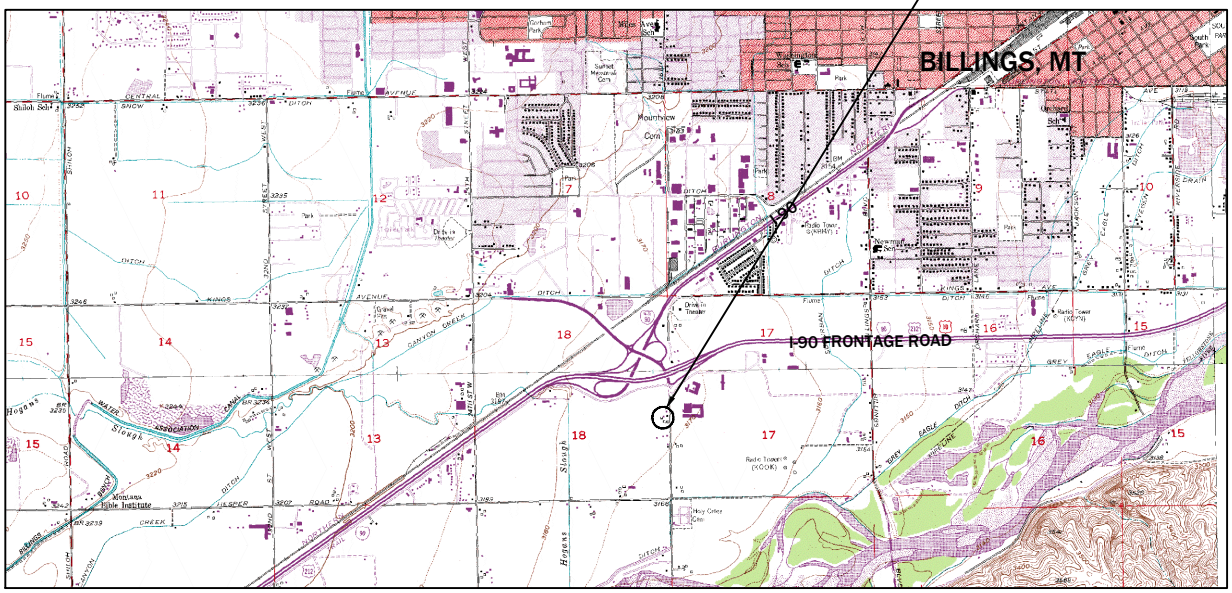
Attachment 1: Figures
Attachment 2: Injection Procedures
Attachment 3: Cost Estimates

cc: Steve Zeiler, 22240 Village Pins Drive, Beverly Hills, MI 48025

Attachment 1
Figures



PROJECT LOCATION



SITE VICINITY MAP

DEQ FACILITY ID: 56-04962
RELEASE NUMBER: 4959
WORK PLAN NUMBER: 33935

N

DISPLAYED AS:	
COORD SYS/ZONE:	NAD 83, NAVD 88
DATUM:	MSP
UNITS:	INT. FEET
SOURCE:	GOOGLE

SCALE IN FEET
0 1000 2000

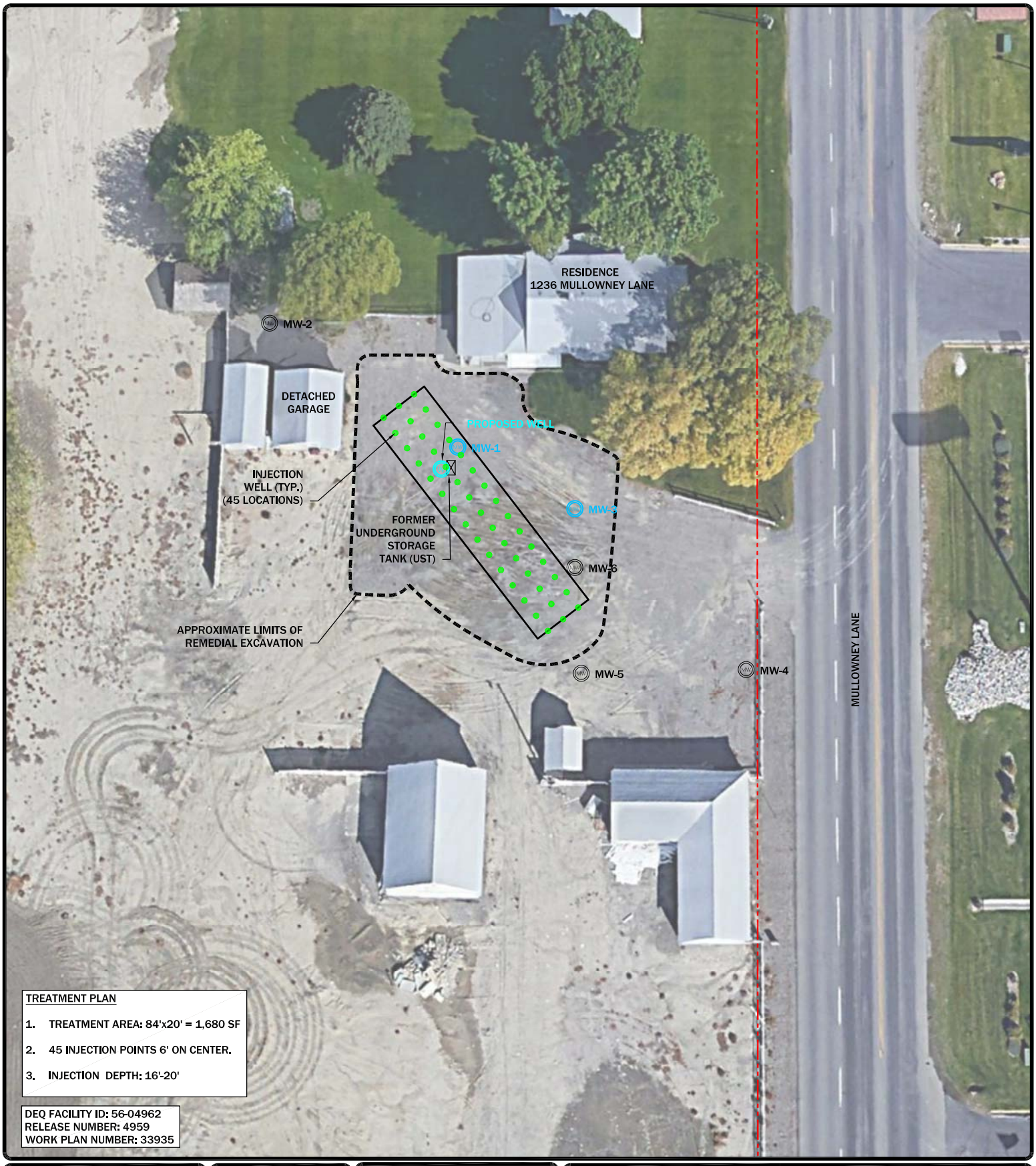
FIGURE 1

PIONEER TECHNICAL SERVICES, INC.
2310 BROADWATER AVE, SUITE 1
BILLINGS, MT 59102
(406) 545-4805

LOCATION AND VICINITY MAP
ZEILER FARM
BILLINGS, MT
1236 MULLOWNEY LANE

DATE: 09-2019

9/18/2019 10:11:39 AM Z:\SHARED\ACTIVE PROJECTS\ZEILERFARM\DRAWINGS\FIGURES\ZEILERFARM-FIG-PLN-001-19.DWG



LEGEND:
- PROPERTY LINE
- LIMITS OF EXCAVATION
- MONITORING WELL
- FORMER MONITORING WELL
- PROPOSED WELL
- INJECTION WELL

N

DISPLAYED AS:
COORD SYS/ZONE: NAD 83, NAVD 88
DATUM: MSP
UNITS: INT. FEET
SOURCE: GOOGLE

SCALE IN FEET
0 20 40

FIGURE 2

SITE MAP
ZEILER FARM
BILLINGS, MT
1236 MULLOWNEY LANE

PIONEER TECHNICAL SERVICES, INC.
2310 BROADWATER AVE, SUITE 1
BILLINGS, MT 59102
(406) 545-4805

DATE: 09-2019

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Attachment 2
Regenesis Injection Procedures

PetroFIX™
Remediation Fluid

DIRECT PUSH APPLICATION INSTRUCTIONS

www.regenesis.com

PetroFIX™
Remediation Fluid

TABLE OF CONTENTS

Introduction 1
Direct Push Guidance 2
Typical Installation Equipment and Supplied Needed 2
Personal Protective Equipment 3
PetroFix Application Steps 3
Injection Preparation and Mixing 3
Injecting PetroFix 6
Examples of Petrofix Injection Tooling 7
Multi-Port Bottom-Up Retractable or Multi-Port Top-Down Injection Tooling 7
Examples of bottom-up retractable or top-down injection tooling 8
Tips on using bottom-up retractable or top-down injection tooling 8
Pressure Activated Tool Tip 8
Tips on using pressure activated tooling 9
Expendable Drive Points and Injection Through Rod Bottom 9
Verifying PetroFix Distribution In the Field 10
Q: "How do I know if I am fracturing soil and having uncontrolled product placement?" 12
Q: "What if I want to try and achieve larger injection spacing than the PetroFix Design Assistant Specifies?" 12
PetroFix Pump Information 12
Pump Cleaning 12

REGENESIS
Technology-Based Solutions for the Environment
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PetroFIX™ Remediation Fluid

INTRODUCTION

One of the methods to deliver PetroFix™ Remediation Fluid (PetroFix) into the subsurface is to inject the material through direct push rods using hydraulic equipment. This approach increases the spreading and mixing of PetroFix into the aquifer. This set of instructions is specific to the direct push injection of PetroFix. For advice on other potential delivery techniques please contact REGENESIS directly at 949-366-8000 or send an inquiry to info@petrofix.com.

PetroFix should be installed with the goal of having the material fully coat all conductive zones of an aquifer to prevent any mobility or escape of contaminants to downgradient locations. Because PetroFix is a liquid-carbon suspension amended with soluble electron acceptors, it flows easily into most aquifers using relatively low-pressure. Adequate injection volume is needed to ensure that PetroFix contacts enough aquifer pore-space to fully coat aquifer transmissive zones and the starting volumes recommended to achieve this goal is provided as part of the PetroFix design assistant output. To achieve optimal contact and coverage with PetroFix, we recommend that the user consider these estimates as a starting point and be willing to adjust injection volumes and injection tooling as described later in this document.

When PetroFix is injected properly it will evenly coat the soil matrix across the horizontal and vertical transport zones of an aquifer and will appear as if the aquifer was "painted" black as shown in Figure 1. Most soils prior to PetroFix application are either brown or grayish in color and the presence of PetroFix post application is very evident.

PetroFix Distribution Goal

Fully coat all aquifer conductive pathways in the treatment zone with PetroFix and adjust field injection spacing, injection volumes, injection pressure, or injection tooling to accomplish that goal.

PetroFIX™
Remediation Fluid

FIGURE 1 *The photo on the left shows a soil core collected before a PetroFix application. The photo on the right shows a soil core collected after a PetroFix application exhibiting black soil where the PetroFix was successfully distributed.*

DIRECT PUSH GUIDANCE

Typical Installation Equipment and Supplied Needed

- Secure storage area
- Qualified driller/applicator
- Water source for mixing
- Access to electricity
- Appropriate Personal Protective Equipment (PPE) PetroFix SDS
- Direct Push Rig (such as a Geoprobe®) and associated probe tooling
- Mixing tanks – size based on product quantity to be applied per injection point
- Drum mixer for homogenizing PetroFix in its 55-gallon drums [can be power drill paint stirrer (3-inch diameter or smaller propeller tip)]
- Injection tooling with fluid delivery sub-assembly (see injection tooling section)
- Injection pump rated to at least 200 psi and at least 5 gpm
- Injection hosing and pressure relief valve with a bypass (make sure all equipment is rated for expected injection pressures required)
- Hosing between mixing tank/drum and pump
- Pressure gauges to monitor injection pressure
- Flow meter for tracking injection volumes (or use visual drops in tank volumes over time)
- Pressure regulator to prevent pressure spikes (recommended, but not mandatory)
- Granular bentonite or grout to abandon completed injection boreholes. Some regulatory agencies have specific requirements for backfilling subsurface borings, so check with your local agency prior to beginning field work.
- Quick-set concrete or asphalt patch for surface closing

FIGURE 2 *PetroFix ships in 55-gallon poly drums (400 lb of product) plus one 20 lb bucket of electron acceptor blend per drum*

PERSONAL PROTECTIVE EQUIPMENT

Personnel working with or in areas where there is a potential for contact with PetroFix should be required at a minimum to be fitted with Level D personal protective equipment. However, this recommendation is only for PetroFix and does not supersede additional precautions due to site conditions and potential exposures.

PPE should be upgraded from modified Level D based on site-specific hazards and requirements.

PETROFIX APPLICATION STEPS

Injection Preparation and Mixing

1) Print a copy of the Area Summaries for your site created in the PetroFix App.

2) Review design with drilling crew.

3) Review SDS during health and safety tailgate.

4) Walk the site and make note of any obstacles or infrastructure that may impede application based on utility locates.

a. Make sure you have called in utility locates before mobilizing to the site.

b. Prior to the installation of PetroFix, identify any surface or overhead impediments as well as the location of all underground structures. Underground structures include but are not limited to: utility lines, tanks, distribution piping, sewers, drains, and landscape irrigation systems.

c. The planned installation locations should be adjusted to account for all impediments and obstacles while being mindful of PetroFix distribution needs.

5) Mark injection points based on site design provided in the PetroFix App.

a. Outlining injection area.

b. Mark all points and note any points that may have different vertical application requirements or total depth.

c. Ensure points are spaced appropriately based on recommended design provided by the PetroFix App.

6) Set up area for mixing PetroFix Remediation Fluid with water and PetroFix Electron Acceptor Blend.

7) Assemble product transfer system.

8) Assemble injection system.

9) NOTE: REGENESIS recommends injecting clean water (i.e. water without PetroFix mixed in) prior to mixing a PetroFix batch to check for leaks within the mixing and injection system. Repair any leaking equipment prior to mixing PetroFix in the mix tank.

a. It is critical to always depressurize the injection lines before disconnecting any fittings . This can be accomplished by fitting a bleed off valve near the injection pull cap (see Figure 3 below).

10) Advance the probe rods to the first vertical treatment interval and inject clean water into the interval while monitoring for leaks. If the leak test proved successful, continue to mix PetroFix into the mixing system.

a. During this step make sure to account for pressures and make sure the equipment is rated for the expected pressures.

11) Always add water to mixing tank prior to adding PetroFix Remediation Fluid

12) Always pre-mix PetroFix in its container prior to pumping material out of the container

a. **Note:** PetroFix drums are not completely full and PetroFix fills to roughly 10 to 12 inches below the top of the drum (See Figure 4).

13) Transfer designed ratio of PetroFix remediation fluid to the water in the mix tank. **Recommended batch sizes should range from 50 to 350 gallons to aid in easy mixing and for measuring injection volumes per point.**

14) Thoroughly mix PetroFix solution in the mixing tank using an impeller type drum mixer or by recirculating the product inside the tank.

15) Add recommended ratio of PetroFix Electron Acceptor Blend to the mixed solution in the tank. One tip is to use a scale to measure mass of electron acceptor blend needed for partial mix batches (Figure 4). Standard dosing is one bucket of electron acceptor blend per one drum of PetroFix.

a. **DO NOT mix PetroFix Electron Acceptor (EA) blend from the 20 lb buckets into undiluted PetroFix Remediation Fluid in the drums or totes. Only add the PetroFix EA blend into the diluted PetroFix solution in the mix tank.**

FIGURE 3 *LEFT: The pull cap can be outfitted with a bleed off valve to depressurize injection lines prior to breaking probe rods to advance to next vertical treatment interval.* *RIGHT: Geoprobe injection pull cap (1.5”).*

FIGURE 4 *Image on left shows undiluted PetroFix in a drum prior to homogenization. PetroFix doesn't fully fill the drum and this is normal (a 400 lb drum of PetroFix contains approximately 41 gallons of product). The image in the middle shows an example transfer and PetroFix mixing setup where a 330-gallon tote was chosen as the mix tank. The picture on the right shows some PetroFix electron acceptor being weighed before placement into the mixing tank.*

Injecting PetroFix

1) Set up the direct push unit over each specific point and follow the manufacturer standard operating procedures (SOP) for the direct push equipment. Care should be taken to ensure that the probe holes remain in the vertical. If there are enough personnel, this step can be accomplished while other attend to the mixing phase.

a. To prevent fluid and pressure loss between probe rod connections, we advise that the threads be Teflon® taped for the best possible seal.

2) Advance drive rods through the surface and through any pavement or concrete at locations cleared for utilities, as necessary, following SOP.

a. Assure all personnel have hearing protection during this step when close to the direct push rig.

3) Push the drive rod assembly with your selected tool tip to the desired depth. This depth will depend on if you are performing a bottom up or top down injection – see section on "Examples of PetroFix Injection Tooling". REGENESIS suggests pre-counting the number of drive rods needed to reach depth prior to beginning injection activities.

4) After the drive rods have been pushed to the desired depth, apply the designed quantity of prepared PetroFix solution at the target treatment intervals specified in the design. The target injection volume will be determined by multiplying the volume per foot by the injection tooling length.

a. As a rule-of-thumb, 20 to 100 psi and 2 to7 gpm flow rates are common through a single injection point.

b. Whip checks should be used throughout the process when working with pressurized hoses.

5) Once target volume is reached, close off the injection line leading to the probe rods and depressurize the injection lines by draining the product into a bucket or similar. Use caution before and during opening any injection lines as there might be backpressure that could kick back or spray. See Figure 3 for an example of an injection pull cap outfitted with a bleed off valve.

6) Continue mixing and injecting the combined solution using the target injection volumes for the injection point described in the PetroFix design output page.

7) Once all injection points are completed, begin site cleanup by emptying the drums and flushing all injection lines using clean water. Product containers can be recycled after they are rinsed.

8) Dispose of any waste and residue in accordance with local authority requirements.

EXAMPLES OF PETROFIX INJECTION TOOLING

Injection tooling can be selected based on the type of soil present, logistic needs of the site, and prior experience of the consultant and injection crews. Our suggestions below are not exhaustive, but enough to outline injection tips common to most injection contractors. We advise that injection distribution is verified in field regardless of injection tooling used (see section of **"Verifying PetroFix Distribution In The Field"**). Injection tooling can be chosen in a variety of sizes (1.25", 1.5", 1.75", and 2.25"). Most environmental drillers will carry probe rods with 1.5" and 2.25" diameters for soil sampling and these same sizes can be used for injection. Geoprobe manufactures an injection pull cap that is designed to thread directly onto Geoprobe threaded probe rods. These pull caps can be outfitted with a bleed off valve steel pipe fittings available from McMaster-Carr®, Grainger®, or pipe fitting supply stores.

Multi-Port Bottom-Up Retractable or Multi-Port Top-Down Injection Tooling.

For injecting at lower pressures (typically below 60 psi) and maintaining relatively high volumetric injection rates, **REGENESIS recommends using multi-port retractable or top-down injection tooling** using 1-foot, 2-foot, or larger exposed injection screens (See Figure 5). An advantage of these types of tooling is they usually require no pre-probing and allows targeting larger vertical intervals of the aquifer. Retractable injection tooling also allows for semi-discrete targeting of the aquifer and allowing PetroFix to flow into hard to identify small or large conductive zones that are likely contaminant transport pathways.

EXAMPLES OF BOTTOM-UP RETRACTABLE OR TOP-DOWN INJECTION TOOLING:

- Variety of 1.5" OD bottom-up retractable and top-down injection tooling in different lengths available (Figure 5).
  https://www.shop-esp.com/ESP-Injection-Tooling-C517.aspx

- See section on remediation injection tooling for retractable remedial Injection tooling (RRIT) options.
  https://www.ams-samplers.com/powerprobe/direct-push-tooling-catalog.html

FIGURE 5 *Image on the left is an Environmental Service Products (ESP) bottom-up retractable tool. Image on the right is an ESP top-down injection tool.*

TIPS ON USING BOTTOM-UP RETRACTABLE OR TOP-DOWN INJECTION TOOLING:

- It is advisable not to exceed 24" of exposed retractable screen in silts and clays which will give you better control of the vertical distribution of the PetroFix solution.

- Larger than 24" injection tooling can be used in homogeneous, permeable soils (sand and gravel) where more even product distribution is expected through exposed screen if enough flow rate and pressure can be maintained.

- The selection of bottom-up retractable or top-down injection depends on the preference and experience of the drilling operator. A top-down tool is more robust when hammered into hard soils and allows the applicator to more quickly set a vertical interval without the need to pull the rods back; however, the top-down tool is more prone to clogging if pushing through silts or clays to get to the injection interval.

PRESSURE ACTIVATED TOOL TIP

Many injection companies make use of a pressure **activated injection probe** (Figure 6) that is supplied by Geoprobe®. These probes are effective in aquifers that have a higher permeability (high percentage of sand); however, in tighter formations these tool tips tend to generate enough pressure to cause hydraulic fracturing of PetroFix that may result in uncontrolled placement or surfacing.

TIPS ON USING PRESSURE ACTIVATED TOOLING:

- Top-down injection usually recommended in most formation with this tip.
- Be cautious of hydraulic fracturing with this tip. To get the uniform distribution shown in Figure 1 this approach may require that the vertical distance between push-and-inject intervals as low as 1 to 2 feet to prevent gaps in product coverage vertically.

FIGURE 6 *Image of Geoprobe® pressure activated injection probe*

EXPENDABLE DRIVE POINTS AND INJECTION THROUGH ROD BOTTOM

Bottom-up injection using expendable tool tips (Figure 7) is an option if the aquifer grades from tight soils at maximum injection depth to permeable soils at minimum injection depth, for instance injecting into clay or silt that grades to sand as you approach the surface. If the geology were reversed, one needs to be concerned about preferential delivery of PetroFix into deeper zones as the rod is raised and the PetroFix fluid preferentially flows to the zone of least resistance down the injection hole. For flowing sands and highly permeable environments, injection through rod bottom can achieve effective product delivery. The vertical distance between pull-and-inject lifts may need to be as low as 1 to 2 feet to prevent gaps in product coverage vertically. Bottom-up injection with expendable drive points offers the least control over injection and is least recommended, particularly for soils with silts and clays.

FIGURE 7 *Geoprobe® expendable steel point allowing for bottom-up injection through rod opening.*

VERIFYING PETROFIX DISTRIBUTION IN THE FIELD

PetroFix has the unique advantage of being its own tracer due to being black in color and this fact can be used to verify its distribution in the field. The PetroFix Design assistant **(https://petrofix.com/design/)** is an excellent starting point to estimate spacing and volumes to use for an application, but one should expect to make some minor adjustments in field due to natural variability of geology and pore space.

The easiest way to determine if PetroFix is distributing is to collect one or more soil cores at your site after the first 2 to 4 injection points have been placed. Most direct push operators have the tools required for rapid soil core sampling and we recommend that you double check this when bidding out your work. We recommend that a soil core be collected with the following criteria:

1. Take the observational soil core half-way between two PetroFix injection points or half the spacing distance away from any given injection point;

2. Take the observational soil core over the entire vertical interval. This may require more than one core be taken.

If you see a strong black color (like Figure 1 or Figure 8 below) coating the conductive zones of your aquifer, then congratulations as you are achieving product distribution. If you don't observe black, then you are not making distribution and should diagnose the reason why. It is important that PetroFix be observed both laterally and vertically at your site. It also is important to investigate if your injection is distributing PetroFix into the one or more geologic conductive zones at your site. A small percentage of sites may have dark or black soils because of hydrocarbon staining and it is important to distinguish if this is the case. Ideally, we recommend that you take a baseline soil core before injection and then compare this to one or more post-injection samples to see the difference.

FIGURE 8 *Photo showing an in-field verification of PetroFix distribution and its optimal coverage. Gray soil in upper right shows the edge of the injection zone where PetroFix not injected.*

Here are a few tips if PetroFix is not observed in your soil core:

- **Double check injection pressures** – Am I injecting with a steady pressure? If not, consider increasing pressure (which will also be increasing volumetric flow rate). If you are very low in pressure (<10 psi) it may be that you are not achieving enough product velocity to cause delivery far enough from your injection points. As a general rule-of-thumb most sites range in pressure from 20 to 100 psi and volumetric injection rates of 5 to 7 gpm. If you are not exceeding fracture pressures and are getting uniform distribution, then feel free to use the maximum volumetric flow rates or pressures that you can achieve.

- **Double check spacing** – Am I within the recommended spacing suggested by the PetroFix design assistant? If not, consider tightening spacing.

- **Double check volumes** – Have I injected the recommended volume of water and product together? If not, inject recommended volumes of water.

If spacing, volumes, and injection pressures are as initially designed, and you are still not getting distribution, it may be that the aquifer has a higher pore space than assumed for design purposes. Consider increasing the dilution water used for PetroFix by increments of 10% to 15% volume until distribution is achieved. Furthermore, it may be that the injection tooling you are using is not suited to your aquifer type and you should consider changing injection tooling.

Alternatively, you may find that you need less mix water and PetroFix verification testing can be used to minimize needed water if your effective porosity is less than designed for. If less water is needed to obtain the required ROI then we recommend that you reduce the overall injection volume, but keep the same design spacing versus spreading the points farther apart.

Q: "How do I know if I am fracturing soil and having uncontrolled product placement?"

A: *Fractures are induced by rapid pressure build-up followed by high volumetric flow rates. If you notice a spike in pressure followed by a rapid drop in pressure, yet high-volumetric flow rates are sustained it is likely that you are pushing PetroFix into created fractures. You may not see any observable evidence of this happening or you may begin to see surfacing into utility corridors, ground surface, etc. We advise that pump pressures are slowly increased as well as volumetric flow rates where everything is steady without big pressure spikes and big pressure drops. The use of a pressure regulator as mentioned in the equipment list to prevent pressure spikes and the use of pressure gauges between the pump and the injection rods is very important to be able to monitor this process. Soil sampling is a good visual method to answer your questions as to if you are getting uniform and complete coverage or if you are creating fractures.*

Regarding the monitoring of pressures, it is common to see pressures rise to the point that fluid begins moving into the formation and then those pressures gradually decrease (versus a rapid decrease). This is different than the hydraulic fracturing of soil. We see this as a normal initiation pressure as the PetroFix fluid needs to overcome either partially occluded pore space immediately around the tooling because of soil smearing or through the compaction of soils around the tooling that can happen when the tooling is pushed into the formation.

Q: "What if I want to try and achieve larger injection spacing than the PetroFix Design Assistant Specifies?"

A: *Many customers ask if they can use injection spacing larger than specified by our PetroFix Design Assistant. Our answer is that we believe that our recommended spacing is a good recommendation and starting point (typically 5 ft- to 6.5 ft-on-center), particularly for sites with more silt and clay than sand. However, sites do vary in their characteristic effective porosities and percentage of fine-grained to course-grained materials and how they are layered. If stable pressures and flows are maintained, then it may be that larger ROI's can be achieved given the starting volumes that were calculated. If this is the case, our recommendation is to maintain injection spacing but reduce injection volumes to cut down on field time.*

However, if you want to spread injection points out, we encourage you to explore the ability to do so by performing an injection and follow the PetroFix distribution verification process we discussed earlier to document that you achieved distribution. If you can document distribution and are able to accommodate the change in volume injected and time spent per point you should feel free to use whatever spacing can be accommodated.

PETROFIX PUMP INFORMATION

REGENESIS strongly recommends using a pump with a minimum pressure rating of 200 pounds per square inch (psi) and a minimum delivery rate of 5 gallons per minute (gpm). A lower gpm rated pump can be used; however, they are not recommended due to the amount of time required to inject the volume typically associated with a PetroFix injection (i.e. 1,200 lb of PetroFix with 60 lb PetroFix Electron Acceptor will require 2,460 gallons of water to make a 5% by volume PetroFix solution).

PUMP CLEANING

Internal pump mechanisms and hoses can be easily cleaned by circulating water through the pump and injection lines until clear. Flush water can be injected into the treatment zone. Further cleaning and decontamination (if necessary due to subsurface conditions) should be performed according to the equipment supplier's standard procedures and local regulatory requirements.

REGENESIS

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San Clemente, CA 92673

Attachment 3
Cost Estimate

PROJECT: Zeiler Farms , DEQ ID # 56-04962, Release# 4959, WP 33935

Client: Zeiler Farm
Site Address: 1236 Mullowney Lane
Project Location: Billings, MT

Start Date: September 2019
End Date : December 2019
Pioneer Project Manager: Charlie Peterson

Project Description: Zeiler Farm LUST Cleanup.

Description of Services: Groundwater Monitoring Well Installation and Sampling and In-Situ Treatment and Reporting.

TASK 1: Project Management

CATEGORY	EMPLOYEE	PRICE/UNIT	UNITS	QUANTITY	PRICE
Project Manager	C. Peterson (Project Manager)	$ 130.00	hrs	12	$ 1,560.00
Work Plan AC-07	Petro Rate Estimated	$ 1,200.00	Each	1	$ 1,200.00
Health and Safety Plan	P .Olson (Staff Engineer)	$ 111.00	hrs	2	$ 222.00
				Total Labor=	**$ 2,982.00**
				Task 1 Total Cost =	**$ 2,982.00**

TASK 2: Groundwater Monitoring Well Installation and Sampling

CATEGORY	EMPLOYEE	PRICE/UNIT	UNITS	QUANTITY	PRICE
Senior Geologist	C. Peterson	$ 130.00	hrs	2	$ 260.00
Staff Engineer	J. Decker	$ 111.00	hrs	4	$ 1,776.00
GW sampling	Petro unit rate	$ 186.00	each	2	$ 372.00
				Total Labor=	**$ 2,408.00**
OTHER DIRECT COST					
CATEGORY		**PRICE/UNIT**	**UNITS**	**QUANTITY**	**PRICE**
Mob/Demob	Pioneer Eng/Geologist	$ 4.000	Mileage	30	$ 120.00
Driller Contractor	Haz Tech	$ 1,500.00	Each	1.07	$ 1,605.00
Well Development	Pioneer	$ 150.00	Each	1	$ 150.00
Well Survey	MM	$ 750.00	Each	1.07	$ 802.50
Energy Labs	Water VPH	$ 120.000	Lab	2	$ 240.00
Energy Labs	Water EPH Screen	$ 75.000	Lab	2	$ 150.00
Energy Labs	EPH Fractions	$ 150.000	Lab	2	$ 300.00
Sample fee	Petro Unit Rate	$ 10.000	Each	2	$ 20.00
				Task 2 Total Direct Cost =	**$ 3,387.50**
				Task 2 Total Cost=	**$ 5,795.50**

TASK 3: In-Situ Treatment

CATEGORY	EMPLOYEE	PRICE/UNIT	UNITS	QUANTITY	PRICE
Senior Geologist	C. Peterson	$ 130.000	hrs	6	$260.00
Staff Engineer	J. Decker	$ 111.000	hrs	24	$1,776.00
				Total Labor=	**$2,036.00**
OTHER DIRECT COST					
Mob/Demob	Pioneer Engineer/Geologist	$ 4.000	Mileage	45	$ 180.00
Mob/Demob-Geo-probe	Pioneer	$ 4.15	Mile	450	$ 1,867.50
Geo-probe	Pioneer	$ 205.00	Hours	35	$ 7,175.00
Geo-probe Crew	Lodging	$ 130.00	Day	8	$ 1,040.00
Geo-probe Crew	Per Deim	$ 30.50	Day	10	$ 305.00
Regeneses PetroFix	Product	$ 1,200.00	lbs	3.95	$ 4,740.00
Regeneses PetroFix	Product Shipping	$ 750.00	Each	1	$ 750.00
Material and Supplies	Supplies	$ 250.000	Each	1	$ 250.00
emical Mixing and Pumping Supp	Big Sky Irrigation	$ 850.000	Day	3	$ 2,550.00
Water	Fischer Water	$ 100.000	Load	3	$ 300.00
				Task 3 Total Direct Cost =	**$ 19,157.50**
				Task 3 Total Cost=	**$ 21,193.50**

Task 4 Reporting

CATEGORY	EMPLOYEE	PRICE/UNIT	UNITS	QUANTITY	PRICE
Report (AR-07)	C. Peterson	$ 130.000	hrs	6	$ 780.00
Report (AR-07)	J. Decker (Staff Engineer)	$ 111.000	Hour	16	$ 1,776.00
Report (AR-07)	C. Richards (AutoCAD)	$ 98.750	Hour	4	$ 395.00
Report (AR-07)	R. Gleason (Tech 2)	$ 90.000	Hour	3	$ 270.00
Report (AR-07)	E Loudan (Tech 2)	$ 90.000	Hour	2	$ 180.00
Report (AR-07)	N. Griffis (Staff Scientist)	$ 111.000	Hour	2	$ 222.00
RCP	J. Decker (Staff Engineer)	$ 111.000	Hour	8	$ 888.00
RCP	C.Peterson (Project Geologist)	$ 130.000	Hour	4	$ 520.00
				Task 4 Total Direct Cost =	**$ 5,031.00**
				Task 4 Total Cost=	**$ 5,031.00**
				Project Total Cost=	**$ 35,002.00**