

# PetroFix™ Installation Instructions

## Direct Push Injection

### General Guidelines

One of the methods to deliver PetroFix Remediation Fluid 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 direct push equipment. For advice on other injections methods such as soil mixing, hydraulic and pneumatic fracturing, and vertical injection, please contact Technical Services directly.

The installation of PetroFix should span the entire vertical contaminated saturated thickness, or in the case of vadose zone treatment the entire affected vadose zone targeted for treatment.

### Typical Installation Equipment Required

- Direct push rig
- Drive Rods (typically 1 ½-inch O.D.) & Injection Tooling with fluid deliver sub-assembly
- Injection Pump rated for 5 gpm @ 200 psi for sandy formations and 800 psi for silt and clay formations (Geoprobe DP-800, Yamada, Moyno, Rupe Models 9-1500 and 9-1600, Wilden, etc.)
- Injection hosing and a pressure relief valve with a bypass
- Clear hosing between mixing tank/drum and pump
- Pressure gauges
- Power drill paint stirrer (3-inch diameter or smaller propeller tip)
- Plastic bucket lid puller tool/opener tool
- 5-amp sump pump (such as Little Giant) and hose
- Three to four 55-gallon drums or similarly sized mixing tanks for RegenOx mixing
- Sand, bentonite chips, granular bentonite, cement, hydraulic cement, and quick-set concrete for closing and sealing temporary injection holes
- Wood plugs or similar for temporarily sealing injection holes prior to grout sealing
- Access to water
- Access to electricity

### Personal Protective Equipment (PPE)

Personnel working with or in areas of potential contact with PetroFix should be required at a minimum to be fitted with modified Level D personal protective equipment:

- Eye protection – Wear well sealed goggles or a face shield (recommended for full face protection)
- Head – Hard hat when required
- Respiratory – Use dust respirator approved by NIOSH/MSA
- Hands – Wear neoprene gloves
- Feet – Wear steel toe shoes with chemical resistant soles or neoprene boots
- Clothing – Wear long sleeve shirts and long pant legs. Consider using a Tyvek® body suit, Carhartt® coverall or splash gear

## Required Tools and Supplies Needed

- Lift Gate Truck
- Pallet Jack
- Secure Storage Area
- Suction or braided hose that will fit with your transfer system
- Pneumatic Pump – minimum power size needed to specify
- Air compressor – minimum power (confirm)
- Mixing tanks - size based on product ordered
- Water source for mixing
- Lightening or drum mixer
- Flow meter for tracking injection volumes
- Pressure gauge
- Appropriate Personal Protective Equipment (PPE)
- PetroFix SDS
- Product delivery system including pumps, hoses. Ensure all equipment is rated for expected injection pressures required
- Qualified driller/applicator

**FOR DETAILED APPLICATION INSTRUCTIONS, VIEW VIDEO at**  
[www.PetroFix.com/applicationvideo](http://www.PetroFix.com/applicationvideo)

## Application & Installation Procedures:

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 safety tailgate
4. Walk the site and make note of any obstacles or infrastructure that may impede application
5. Prior to the installation of PetroFix, any surface or overhead impediments should be identified 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.
6. The planned installation locations should be adjusted to account for all impediments and obstacles.
7. Pre-mark the installation locations, noting any points that may have different vertical application requirements or total depth.
8. 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 assure that probe holes remain in the vertical.

## Application & Installation Procedures: continued

9. For most applications, REGENESIS suggests using 1.5-inch O.D./0.625-inch I.D drive rods. However, some applications may require the use of 2.125-inch O.D./1.5-inch I.D. or larger drive rods.
10. Advance drive rods through the surface pavement, as necessary, following SOP.
11. Push the drive rod assembly with an expendable tip to the desired maximum depth. REGENESIS suggests pre-counting the number of drive rods needed to reach depth prior to starting injection activities.
12. After the drive rods have been pushed to the desired depth, the rod assembly should be withdrawn three to six inches. Then the expendable tip can be dropped from the drive rods, following SOP. If an injection tool was used instead of an expendable tip, the application of material can take place without any preliminary withdrawal of the rods.
13. Mark injection points based on site design provided in the PetroFix App
  - a. Outlining injection area
  - b. Mark all points
  - c. Call in the public locate for underground utilities
  - d. Ensure points are spaced appropriately based on recommended design provided by the PetroFix app
14. Driller/applicator begins drilling points
15. Set up area for mixing PetroFix Remediation Fluid with water and PetroFix Electron Acceptor Blend
16. Assemble product transfer system
17. Add water to the mixing tank prior to adding PetroFix Remediation Fluid
18. Transfer designed ratio of mixed solution to the water in the mix tank
19. Mix PetroFix Remediation Fluid to water in the mixing tank using Lightning Mixer
20. Add recommended ratio of PetroFix Electron Acceptor Blend to the mixed solution in the tank
21. Continue mixing the combined solution
22. Begin pumping into injections points
23. As drum is emptied into the mixing tank, flush out drum with water. Flush water can be used as mix water

## Proper Handling

- Always add water to mixing tank prior to adding PetroFix Remediation Fluid
- DO NOT mix PetroFix Electron Acceptor Blend into undiluted PetroFix Remediation Fluid drums
- Flush PetroFix Remediation Fluid drums with water in order to fully use all material
- Flush out equipment and injection lines with clean water at the end of application
- Recycle drums as part of site clean up
- Wash hands after handling
- Dispose of any waste and residue in accordance with local authority requirements

### 1. PetroFix Pump Information

REGENESIS® has evaluated a number of pumps that are capable of delivering PetroFix to the subsurface at a sufficient pressure and volumetric rate. Although a number of pumps may be capable of delivering the PetroFix to the subsurface at adequate pressures and volume, each pump has a set of practical issues that make it difficult to manage in a field setting. In general, REGENESIS strongly recommends using a pump with a minimum pressure rating of 200 pounds per square inch (psi) in sandy formations or 800 psi in silt, clay or weathered bedrock formations, 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 of liquids typically associated with a PetroFix injection (i.e. 1,000 lbs of PetroFix [100 lbs PetroFix Electron Acceptor require roughly 1,100 gallons of water to make a 5% solution]).

### 2. Pump Cleaning

For best results, use a hot water pressure washer (150-170 °F or 66-77 °C) to clean equipment and rods periodically throughout the day. Internal pump mechanisms and hoses can be easily cleaned by circulating hot water and a biodegradable cleaner such as Simple Green® through the pump and delivery hose. 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.

**For more information contact REGENESIS at 949.366.8000**