



Advanced  
Bioremediation  
Solutions

# Anaerobic - Reductive Remediation Solutions Guide

2017





# ISD™

## Turnkey Automated Solution In Situ Delivery Systems

A primary limitation of in-situ remediation processes (i.e. chemical oxidation, bioremediation) is the lack of contact between delivered amendments and the contaminants. Unfortunately, many pilot-scale and full-scale in situ processes are implemented using slug injections, which are often ineffective because they have minimal radius-of-influence, so they fail to maintain appropriate subsurface conditions or deliver the required mass of amendments. In order to overcome these limitations, ETEC has developed automated recirculation systems that can deliver liquid and slurry-phase substrates, nutrients, or chemical oxidants to the subsurface on a consistent, scheduled basis. The In Situ Delivery (ISD™) systems are fully automated and programmable, allowing you to optimize delivery of subsurface amendments based on your site-specific remediation needs.

- ✓ Customized for site-specific applications
- ✓ Fixed or Portable
- ✓ Various sizes to fit your needs
- ✓ Ideal for substrate delivery at chlorinated solvent sites
- ✓ Programmable logic control (PLC) integration

### ISD™ DELIVERS:

#### Anaerobic Substrates:

Lactate  
Benzoate  
Dextrose  
Molasses  
Soybean Oil  
[CarBstrate™](#)

#### Nutrients:

Nitrogen  
Phosphorus  
Potassium  
Trace Metals

#### Oxidants:

Peroxide  
Permanganate  
Persulfate  
Ozone  
Fenton's Reagent

### EQUIPMENT LINE

Capabilities	ISD-Mobile	ISD-10	ISD-20	ISD-40
Max Flow Rate, GPM	10	10	20	40
# of Injection Stations	1	1 to 12	variable	variable
Product Injection	Automated	Automated	Automated	Automated
Mobility	Mobile Trailer	Portable	Fixed	Fixed
Insulation/Heating	No	Yes	Yes	Yes
Length	12 ft.	Varies	9 ft.	9 ft.
Width	6 ft.	Varies	8 ft.	8 ft.
Height	5 ft.	Varies	8 ft.	8 ft.
Customization Available	Yes	Yes	Yes	Yes

ETEC BUILDS CUSTOM  
SYSTEMS TO MEET YOUR  
SITE REQUIREMENTS





ISD<sup>TM</sup>

## APPLICATIONS

### Reductive Dechlorination of Chlorinated Compounds

Reductive dechlorination remains a popular and effective method for remediation of chlorinated solvents like PCE, TCE, TCA and pentachlorophenol. Major advantages of anaerobic biological processes include the ability to achieve required cleanup levels (i.e. 1 ppb for PCE and TCE). Typical reductive dechlorination projects generally require only the addition of a carbon substrate (lactate, edible oil, etc.) to produce reductive groundwater conditions. However, many solvent plumes are very large and the main challenge is being able to deliver the correct mass of substrate throughout an entire impacted area. The ISD<sup>TM</sup> systems are specifically designed for plume-wide delivery of soluble or viscous substrates. The ISD<sup>TM</sup> systems accomplish delivery by performing consistent groundwater recirculation (extraction, amendment and re-injection) to optimize substrate delivery throughout the treatment zone, thus stimulating large-scale reductive dechlorination of dissolved constituents and DNAPL.

### Substrates for Reductive Dechlorination

Many anaerobic substrates being used today are thick, viscous products designed to slowly dissolve in groundwater, thereby providing long-term reductive conditions. The primary drawback with this approach is that these substrates have a very limited radius-of-influence, so they can't provide treatment of an entire plume efficiently. ETEC's soluble, highly-degradable, nutrient-amended CarBstrate<sup>TM</sup> substrate makes it possible to treat an entire plume efficiently. By combining continuous groundwater recirculation with pulsed substrate injection, the ISD<sup>TM</sup> systems produce targeted, site-wide reductive conditions and explosive growth of biomass in the soil pore space quickly and efficiently. As this biomass begins to "rot", it acts as an ideal substrate for long-term dechlorination. Current site data indicates that with distribution of CarBstrate<sup>TM</sup> active dechlorination can be maintained for years after treatment.

### Chemical Oxidation

Chemical oxidation processes (Fenton's, permanganate, persulfate) are used to oxidize a broad range of organic compounds. Since chemical oxidation relies on contact between the oxidant and the target contaminant, in situ delivery is critical. Specifically, oxidant loading rates and soil oxidant demand significantly affects the oxidant mass required to complete remediation. Because oxidant cost is very high (and often cost-prohibitive), minimizing these costs via efficient subsurface injection is imperative. Recent studies show that slug injections of high-concentration oxidant solution are ineffective, unsafe, and can waste a significant mass of oxidant (thus increasing costs). Smaller injection volumes on a consistent basis using lower oxidant concentrations are more cost-effective and more successful. The ISD<sup>TM</sup> systems provide precise injection control of the volumes and concentrations of oxidants and catalysts, which saves you money, increases contaminant destruction and protects your field personnel from dangerous chemical reactions.

ISD<sup>TM</sup>

CASE STUDIES

REQUEST INFORMATION





Advanced  
Bioremediation  
Solutions

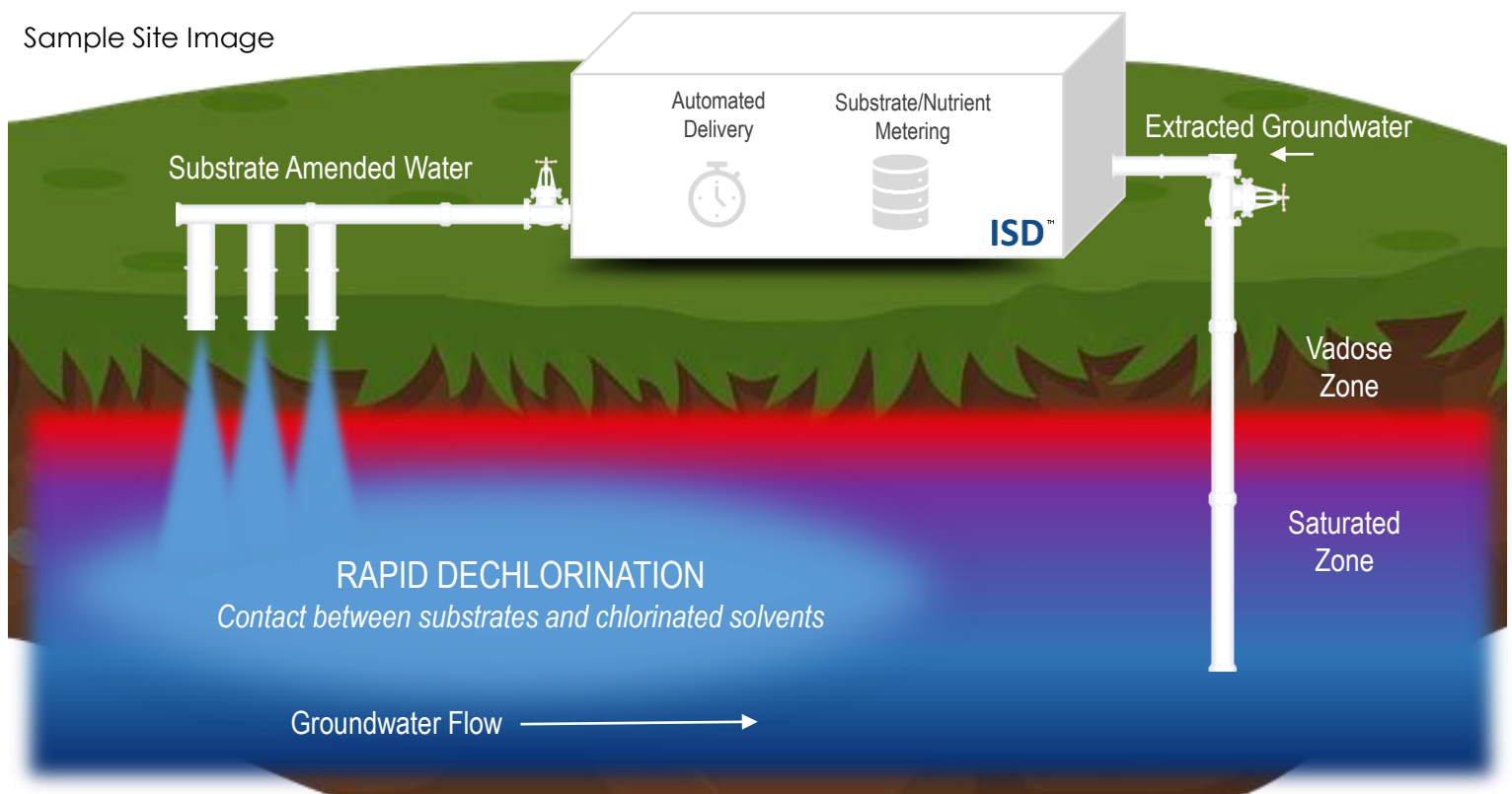
ANAEROBIC-REDUCTIVE  
REMEDIATION SOLUTIONS

# ISD™

## Turnkey Automated Solution In Situ Delivery Systems

- ✓ Customized for site-specific applications
- ✓ Fixed or Portable
- ✓ Various sizes to fit your needs
- ✓ Ideal for substrate delivery at chlorinated solvent sites
- ✓ Programmable logic control (PLC) integration

Sample Site Image



ISD™

CASE STUDIES

REQUEST INFORMATION



INFO@ETECCLLC.COM



(971) 222-3616

© 2017







# ISD™

## Turnkey Automated Solution In Situ Delivery Systems

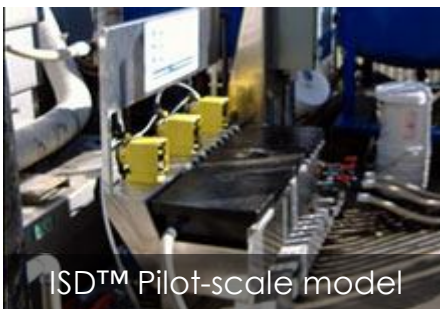
### Models & Product Specifications



The Automatic models come standard with 10, 20, or 40 gpm flowrates. Includes automated product/oxidant application system and re-injects treatment water through a touch-screen, multi-station controller for focused treatment of different areas of a site. Equipment can be customized for granular or liquid product addition. Fully insulated and heated. The unit can be customized to include a groundwater extraction system or simply use effluent from an existing pump and treat or multi-phase extraction system.



The 10-Mobile (10-M) includes an integrated holding/batching tank. All units are fully customizable, and can include such features as an on-board generator, multiple injection lines, and extraction system. This equipment is great for consultants with multiple small projects or multiple treatment areas of a large site. Can be used for several hours of attended injection, or can be left to continuously operate overnight.



The ISD™ Pilot-scale model offers a cost-effective, space saving option for pilot-scale applications. These units deliver metered amounts of electron donor substrate to the injection infrastructure. Like all ISD™ equipment systems, the ISD™ Pilot-scale model can be fully-customized to meet your site-specific needs.

ISD™

CASE STUDIES

REQUEST INFORMATION





Advanced  
Bioremediation  
Solutions

ANAEROBIC-REDUCTIVE  
REMEDIATION PRODUCTS

# CarBstrate™

## THE INDUSTRY'S #1 COMPLETE SUBSTRATE

CarBstrate™ is a B-vitamin and nutrient-amended carbohydrate substrate specifically designed for in situ application. In addition to its high solubility and low-retardation factor, it is a non-toxic, food-grade product that includes the macro-nutrients that are necessary for effective microbial growth (i.e. N and P) as well as a specific suite of trace metals that are critical for active anaerobic microbial activity.

### PROPERTIES & CHARACTERISTICS

CarBstrate™ is a dry powder that is mixed with water for subsequent subsurface injection or recirculation. Once delivered into a target saturated zone, this nutrient-amended carbohydrate will stimulate consumption of terminal electron acceptor (TEA) sinks (i.e. dissolved oxygen, nitrate, sulfate, etc.) and provide available total organic carbon (TOC) that will maintain sulfate-reducing and/or methanogenic conditions throughout the target saturated zone. Additional product information includes:

Product Information	CarBstrate™ Characteristics
Packaging	50-lb. bags
Physical Composition	Dry powder
Changes groundwater pH	No
Water Soluble	Yes
Food-Grade Product	Yes
Effective Remediation of:	Chlorinated Solvents, Pentachlorophenol, Hexavalent, Chromium, Energetics, Nitrates, and More
Typical Injection Solution Strength	0.1 - 1 lb. per gallon of water
Field Application Assistance	Yes, upon request
Typical Application Method	Mix with water to make working solution, then pressure-inject into subsurface

## CarBstrate™

Click a link below

CASE STUDIES

RELATED SERVICES

TECHNICAL RESOURCES

REQUEST INFORMATION

ORDER NOW

BioPro™  
BIOLOGICAL PRODUCTS



INFO@ETECCLLC.COM



(971) 222-3616



2017





# PetroSolv™

## Effective, Biodegradable, Low-Cost Non-Ionic Surfactant

PetroSolv™ is a low cost, biodegradable, non-ionic surfactant specially-formulated for cleaning, soil flushing and enhanced free product recovery. PetroSolv™ is also applicable for vapor suppression of volatile organic constituents.

### Properties and Characteristics

PetroSolv™ represents a major advancement in natural, biodegradable surfactant products – extremely effective yet environmentally responsible. PetroSolv™ is formulated for cost effective, simple specification and application. Additional product information includes:

Product Information	PetroSolv™ Characteristics
Packaging	5-gallon plastic jugs, 55-gallon drums or 275 gallon totes
Physical Composition	Clear or milky liquid
Changes groundwater pH	No
Water Soluble	No
Type of Surfactant	Non-ionic
Tracer Dye	Upon request
Effective Emulsification of:	LNAPL & DNAPL
Typical Injection Solution Strength	1-10%
Field Application Assistance	Yes, upon request
Safe for workers	Yes
Biodegradable	Yes
Typical Application Method	Dilute PetroSolv™ with water to make working solution

- ETEC manufactures, distributes and provides technical support
- Non-ionic surfactant designed for free-product recovery of petroleum or solvents
- Emulsifies and solubilizes free-product and soil bound contaminants
- Quantity estimates are based on impacted soil volume and extractable groundwater volume
- Use in conjunction with groundwater extraction or recirculation.

**PetroSolv™**  
Click a link below

CASE STUDIES

REQUEST INFORMATION

ORDER NOW

