

EXCAVATION
APPLICATIONS

BIOAMENDMENTS



INNOVATIVE
REMEDIAL
SOLUTIONS, INC

Before you backfill that excavation don't just add dissolved oxygen (DO) when you should add the complete package of bacteria, multiple electron acceptors, nutrients, and a surfactant for less cost!!! These in situ products provide fast, complete biodegradation of ...

- GASOLINE
- DIESEL
- HEATING OIL
- BTEX
- NAPHTHALENES
- PAHs
- ORANGIC SOLVENTS
- PESTICIDES

Obtain GCTLs/NADCs in a reasonable time frame!

Environmental consultants conducting excavations at industrial sites are looking for cost-effective bioremediation products they can apply to open excavation pits to stimulate biodegradation of residual petroleum hydrocarbons and other problem contaminants in soil and groundwater. Open excavations are a one-time opportunity to get bioamendments into the source zone, so proper selection of bioamendments is critical.

The Lie: Consultants and Regulators have been lied to by vendors saying oxygen-releasing products are all they need for effective in situ bioremediation. **This is fundamentally incorrect, and gives an incomplete understanding of bioremediation.** In addition, these highly expensive slow-release DO products typically cause the groundwater pH to rise above 10, which actually inhibits biodegradation!!

The Truth: DO and other electron acceptors (nitrate and sulfate) are only one critical component for stimulating effective bioremediation. Other fundamental requirements include nutrients (N, P, K) a desorption agent (bioremediation only occurs in the dissolved phase!), and the addition of facultative hydrocarbon-degrading bacteria. Used in combination with the properly engineered delivery approach, all of these components will produce rapid, measurable biodegradation of residual TPH constituents in a proper pH environment unlike the other products.

Delivery/Mass Balance: IRS's approach is to **obey the fundamental laws** of bioremediation by obtaining contact via a volumetric approach and adding the correct mass of soluble electron acceptors (DO, nitrate, and sulfate) based on the mass of residual TPH. IRS process includes a blended biosurfactant that increases the bioavailability of the sorbed TPH mass, the correct ratio of C:N:P, and a concentrated petroleum-degrading bacterial consortium that accelerates biodegradation rates. These products are all highly soluble and can be applied rapidly in a variety of subsurface soil types. IRS can apply these products for you, or you can apply them yourself. Our engineers, field technicians and equipment are Florida-based and ready to assist you!



IRS PRODUCTS VS. OXYGEN-RELEASE PRODUCTS

IRS's products for petroleum remediation include critical nutrients and electron acceptors that are required for microbial activity, as well as petroleum-degrading bacteria and a biosurfactant to maximize contact with highly sorbed soil contaminants. Oxygen-release products provide only DO in a high pH environment. While the excavation is open, be sure what you are adding is going to be the most complete and cost-effective products on the market. The comparisons in the table below show the differences that you need to know before you select a product for a project.

Product Information	IRS Products	Oxygen-release Products
Packaging	50-lb bags, 5-gal containers	Plastic buckets
Physical Compositions	Highly Soluble Dry and Conc. Liquid Products	Slightly Soluble Dry Products, SUSPENDED SOLIDS
Does it foul the pore space with suspended particles?!	No	Yes
Increases groundwater pH?!	No	Yes
Nutrients Included?!	Yes	No
Bacteria and Biosurfactant Included?!	Yes	No
Type of Electron Acceptors	DO, Nitrate, Sulfate	DO
% wt/wt Electron Acceptors	60%	17%
Florida-based Field Application Assistance?	Yes	No
Application Methods	<ul style="list-style-type: none"> ◆ Dissolve in solution and spray or dry application to open excavations. ◆ Dissolve in solution for injection into trenches and/or infiltration galleries. ◆ Direct push injection using fully dissolved solution and high volume approach. ◆ If needed, nutrients can be applied dry or as slurry. 	<ul style="list-style-type: none"> ◆ Dry product spread directly into excavation or applied via slurry. ◆ Direct push injection using a slurry and low volume approach.
Amount of product to degrade 100 lbs TPH	833 lbs	1,765 lbs
Product Cost (\$/lb)	\$3.00	\$9.00
Cost (\$/lb of TPH degraded)	\$24.99	\$158.82

As this table shows, when you compare the cost per pound of TPH that can be biodegraded, IRS's products are **6.3 TIMES CHEAPER** than oxygen-releasing products, **AND** you get bacteria, nutrients, multiple electron acceptors, and the desorption agent. The choice is obvious for your next excavation project, contact us today to discuss your project!