Tersus Environmental, LLC
Products and Technical Support
for Soil and Groundwater Remediation
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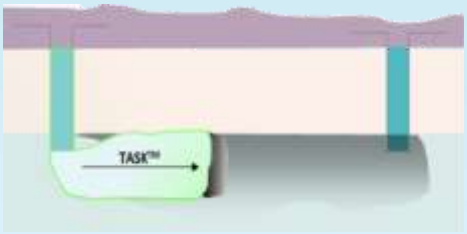
TASK™ Surfactant

Surfactant-Enhanced Aquifer Remediation



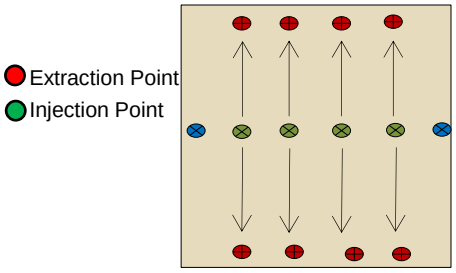
- Low concentration, low pore-volume surfactant demand for high NAPL recovery
- Optimal formulation dramatically reduces treatment costs
- No creation of stable-emulsion: the oil separates from the water in a holding tank
- Food grade or food contact formulations
- Years of treatability study experience in Environmental and Oilfield Industries

SEAR

OU-Designed *TASK*™ Blend

Column study comparing NAPL recovery using water, food-grade surfactant, high efficiency synthetic surfactant or an optimized surfactant formulation.

Typical injection/extraction patterns



Principle

Non-aqueous phase liquids (NAPLs) are organic liquids, such as gasoline and diesel, that are scarcely soluble in water. NAPL contamination commonly takes the form of blobs that become trapped within the formation. Due to their lack of solubility, these compounds can remain as separate phase liquids for decades.

Because of the interfacial forces between NAPLs and groundwater, they are difficult to remove from the subsurface. They can be lighter than water (LNAPL), such as the aforementioned compounds, or denser than water (DNAPL), such as chlorinated ethenes. Surfactant Enhanced Aquifer Remediation (SEAR) involves the injection of specialty compounds with molecular structures that are drawn to both the NAPL and the groundwater. These compounds, called surfactants, can enhance the mobility and recovery of the trapped, separate phase liquids by lowering the surface tension between oil and water. The removal of NAPL will enhance the effectiveness of bioremediation and chemical oxidation processes.

The Tersus approach is to optimize anionic surfactants for site-specific conditions (i.e., the NAPL's characteristic itself, groundwater chemistry, and matrix mineralogy) thus reducing the interfacial force by three to four orders of magnitude. The optimization process also allows using less than 1% active surfactant in the formulation. This means an enormous reduction in project costs.

Advantages

- Dramatic reduction in surfactant cost
- 1 to 1.4 pore volumes for up to 95% mass removal
- Easy-to-handle waste stream
- Any surfactants remaining in the subsurface are easily biodegradable
- SEAR reduces contaminant mass flux
- SEAR can use existing pump and treat or NAPL recovery infrastructure.

Field Application Design

The subsurface environment is notoriously difficult to remediate. Contact of the surfactant with the LNAPL and the maintenance of hydraulic control are exceedingly important. Line drives or five-spot cells are the typical flood patterns used to maximize sweep efficiencies of the subsurface. These patterns can be altered during the remediation process to contact unswept oil. 1 of 2 Pore Volumes (PV) of a low concentration surfactant solution are typically followed by 2 to 5 PV of water rinse to extract residual NAPL.

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Product Content

Chemical Name	CAS Number	Composition (% wt.)
Food-contact and food-grade Surfactant and cosolvent blends. Typically, anionic.	(TBD based on site-conditions)	54%. Typically, < 1% as injected

Product Characteristics (GRO and DRO baseline formulation)

Parameter	Specification
Specific Gravity	1.045
Solubility in water	>10%, Miscible organic solvents
Flash Point	31 °C (Closed Cup)
Appearance	Clear yellow to clear brown liquid
Viscosity	500 cSt at 40°C

Packaging Options

- 55-gallon poly drums
- IBC totes
- Bulk tankers

Safety

- Chemical googles, neoprene or rubber gloves and appropriate clothing should be worn when handling surfactant solutions. All ingredients consist of food or food grade additives. This product, when spilled, creates very slippery conditions raising the risk of falling and accidents.
- Up to 20% alcohol could be mixed in the surfactant blend, making the classification of this product as highly flammable.
- Water fauna is sensitive to surfactant. This product is considered a Marine Pollutant and very toxic to aquatic organisms.
- Hazard pictograms (CLP) :

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