



## Liquid Iron™ for Enhanced Biogeochemical In Situ Chemical Reduction (ISCR)

DESCRIPTION

CRS® (Chemical Reducing Solution) is an iron-based amendment for *in situ* chemical reduction (ISCR) of halogenated hydrocarbon contaminants such as chlorinated ethenes and ethanes. CRS is a pH neutral, liquid iron solution that is easily mixed with 3-D Microemulsion Factory Emulsified before injection into contaminated groundwater. CRS is a soluble, food-grade source of ferrous iron (Fe<sup>2+</sup>), designed to precipitate reduced iron sulfides, oxides, and/or hydroxides as shown in equation 1. These Fe<sup>2+</sup> minerals are capable of destroying chlorinated solvents via chemical reduction pathways (equation 2), thus improving the efficiency of the overall reductive dechlorination process by providing multiple pathways for contaminant degradation in groundwater.



CHEMICAL REDUCING SOLUTION (CRS®)

- 1 **CRS (Fe<sup>2+</sup>) + anaerobic groundwater → FeS + FeS<sub>2</sub> + Fe<sub>x</sub>O<sub>y</sub> + Fe<sub>x</sub>O<sub>y</sub>(OH)<sub>z</sub>**
- 2 **Reduced iron minerals + PCE → ethene + ethane + iron chlorides**

FUNCTION

The incorporation of iron as metallic particles or ferrous salts (Fe<sup>2+</sup>) can enhance chlorinated contaminant remediation by enabling various chemical reduction pathways. The overall combination of biological and chemical processes displayed in equations 1 and 2 are referred to as “biogeochemical” reduction of contaminants. Biogeochemical reduction utilizes the biologically-generated reducing environment to create reduced iron precipitates that then go on to chemically reduce chlorinated solvents.

FEATURES & BENEFITS

CRS is used in conjunction with 3-D Microemulsion Factory Emulsified to provide the necessary iron to activate abiotic chemical reduction (including the β-elimination pathway) of chlorinated organic groundwater contaminants like perchloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride (VC). The end products of these biogeochemical reductions are ethene and ethane. CRS provides the following benefits for groundwater remediation:

- Facilitates biogeochemical *In-Situ* Chemical Reduction (ISCR) of chlorinated contaminants
- Liquid iron form provides better distribution than can be achieved by directly injecting a solid iron material
- Seamless integration with anaerobic bioremediation
- CRS is easy to apply with 3-D Microemulsion Factory Emulsified
- Provides multiple pathways, both abiotic and biotic, for contaminant degradation in groundwater



**REGENESIS**

Advanced Technologies for Contaminated Site Remediation

For a Free Consultation and Application Design for the use of CRS visit [www.regenesis.com](http://www.regenesis.com) or e-mail us at [tech@regenesis.com](mailto:tech@regenesis.com)