

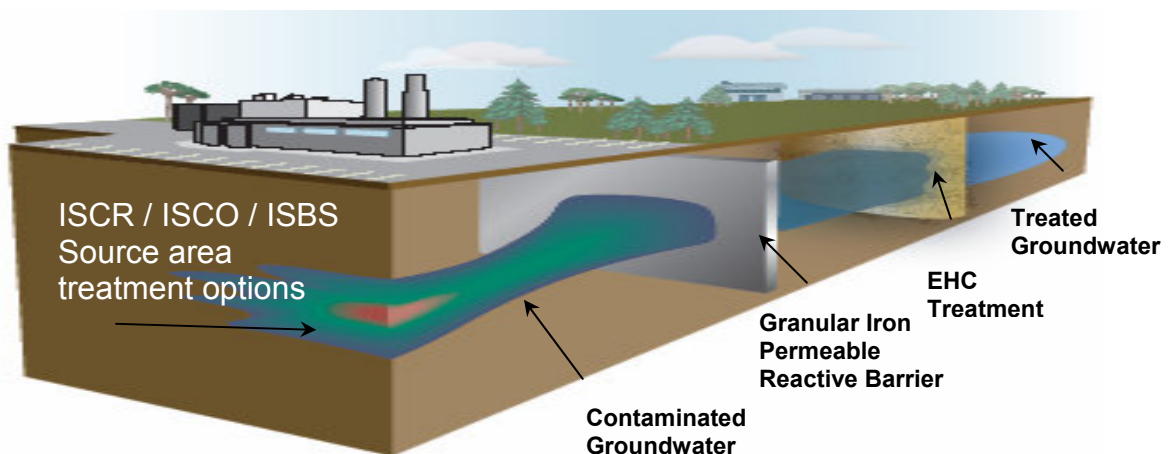


# ADVENTUS

Proven Soil, Sediment, and Groundwater  
Remediation Technologies

## ISCR vs. ISCO? THE CHOICE IS USUALLY CLEAR

Many chlorinated hydrocarbon compounds (CHCs) can be degraded via oxidative or reductive processes (<http://umbbd.ahc.umn.edu>). Accordingly, various *in situ* chemical oxidation (ISCO) technologies using oxidizing agents such as Fenton's chemistry, permanganate and persulfate have been developed to remediate impacted environments. Each of these oxidants and their activators offer seemingly unique features and they can be very effective on a varying range of CHCs (ISBS technology described at <http://www.adventus.us/isbs.htm>). However, a potentially more effective remedial strategy may entail *in situ* chemical reduction (ISCR) using EHC™ ([www.AdventusGroup.com](http://www.AdventusGroup.com)) or granular iron (zero-valent metal) ([www.eti.ca](http://www.eti.ca)) as the reductant.



### So – which technology is more appropriate for a given site?

In general, if the targeted environment is hypoxic (low Eh; oxygen limited), it seems intuitive to employ an ISCR strategy using EHC™ or ZVI technology. Conversely, an ISCO strategy would likely be more effective in an oxic environment. Iron permeable reactive barriers (PRBs) are extremely robust and can be deployed in both anoxic and oxic environments.

A number of other important factors should be considered when selecting between an ISCR or ISCO approach for a specific site. As summarized in the following table, these include: targeted treatment area (source removal, plume control or both), contaminant characteristics, presence of free product, residuals or phase-separated hydrocarbons (e.g., NAPL), desired clean-up time, chemical recalcitrance and degradation kinetics, longevity of the added reagents in the subsurface, environmental impacts (secondary plumes) and health & safety issues.

Contact us at toll-free at 888 295-8661, or online at [www.AdventusGroup.com](http://www.AdventusGroup.com) for a free situation analysis and independent assessment of various ISCO, ISBS or ISCR remedial alternatives.

### COMPARATIVE ANALYSIS OF ISCR vs. ISCO REMEDIAL TECHNOLOGIES

ADVENTUS – USA  
2871 W. Forest Road, Suite 2  
Freeport, IL, 61032, USA  
Ph: 815.235.3503  
Fx: 815.235.3506

ADVENTUS – CANADA  
1345 Fewster Drive  
Mississauga, ON, L4W 2A5, Canada  
Ph: 905.273.5374  
Fx: 905.273.4367

ENVIROMETAL TECHNOLOGIES  
745 Bridge Street West, Suite 7  
Waterloo, ON, N2V 2G6, Canada  
Ph: 519.746.2204  
Fx: 519.746.2209

Factor	ISCR (EHC™)	Granular Iron (Zero-Valent Iron)	ISCO (Fenton's, Peroxide, Persulfate, Permanganates)
Existing redox conditions	More appropriate for reduced environments (ORP < 0 mV; DO < 2 mg/L).	Can be applied in any Eh condition.	More appropriate for oxidized environments (ORP > 0; DO > 2 mg/L).
Material handling safety	Non-hazardous; Minor dust consideration.	Environmentally friendly materials.	Some require significant health and safety precautions during installation.
Treatable Constituents of Interest (COI)	Active towards a wide range of COIs, including ethenes and ethanes. Can reduce and immobilize / adsorb certain metals; Ineffective on BTEX and other refined petroleum hydrocarbons.		Active towards a wide range of COIs, including chlorinated and non-chlorinated compounds; Reactivity sometimes variable and dependent upon activators; Active on BTEX and related COIs.
PRB applicability	Very applicable to PRBs for plume control - estimated lifetime of 3 to 5 years for EHC.	Very applicable to PRBs for plume control - estimated lifetime of 20+ years for iron PRBs.	Not applicable for PRBs due to liquid nature of products; Usually too expensive for treatment of larger plumes or situations where the source cannot be treated.
NAPL applicability	Not widely considered applicable for NAPL situations.	Iron or iron/ clay can be mixed into NAPL zones.	Some technologies have shown success on NAPL; ISBS technology demonstrated for flux reduction.
Non-NAPL source applicability	Potentially applicable to non-NAPL sources, if reagents are appropriately distributed and source is accurately delineated.		
COI concentrations in groundwater plumes	More cost efficient at lower COI concentrations.	Particularly effective at reducing large concentrations in a short period of time.	Effective at various COI concentrations.
Organic content of soils	Applicable to soils of high or low organic content.	Application independent of soil organic content.	Best suited to oxic soils with low organic content due to increased reagent loading requirements for soils high in organic content.
Other factors influencing application rate	High concentrations of competing electron acceptors such as oxygen, sulfate and nitrate will increase EHC loading requirements.	Nitrate will increase rate of iron passivation.	Usually difficult to accurately assess Total Oxidant Demand (TOD); May need to repeat applications.
	Field performance highly dependent upon effective construction techniques; Field performance usually adheres to engineered variables.	Predictable performance.	Field performance highly dependent upon effective construction techniques; Field performance does not always adhere to engineered variables.

The Adventus Group exclusively offers EHC™ and ZVI technologies along with ISBS *in situ* stabilization technology. Other ISCO technologies available from various vendors and suppliers.

Please contact us for more information on any of these technologies.

**ADVENTUS – USA**  
2871 W. Forest Road, Suite 2  
Freeport, IL, 61032, USA  
Ph: 815.235.3503  
Fx: 815.235.3506

**ADVENTUS – CANADA**  
1345 Fewster Drive  
Mississauga, ON, L4W 2A5, Canada  
Ph: 905.273.5374  
Fx: 905.273.4367

**ENVIROMETAL TECHNOLOGIES**  
745 Bridge Street West, Suite 7  
Waterloo, ON, N2V 2G6, Canada  
Ph: 519.746.2204  
Fx: 519.746.2209