

# In situ bioremediation using soil fracturing technology

## **In place clean-up of contaminants**

Clean-up of contaminants in low permeability soils using conventional methods such as excavation, land treatment, and pump & treat is often costprohibitive, lengthy or technically unfeasible.

**Soil hydraulic fracturing offers a cost-effective, non-disruptive alternative that expedites the removal and/or destruction of subsurface contaminants in place.**

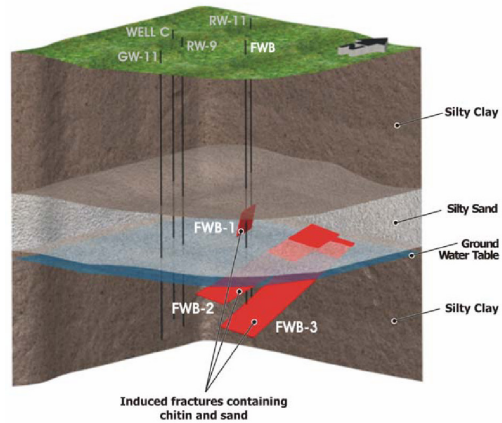
The same principles are used in environmental fracturing. The process creates a network of permeable fracture pathways in soils or bedrock to expedite contaminant recovery or treatment.

During the fracturing process, individual subsurface fractures can be mapped using tiltmeter technology.

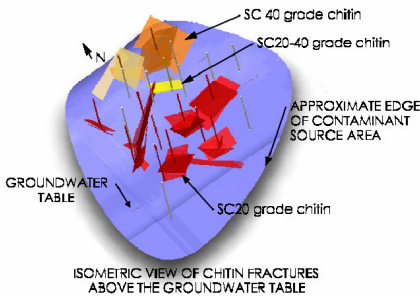
The bio-process can be used to co-inject treatment amendments during or after fracturing to chemically or biologically degrade contaminants in place.

### **Benefits**

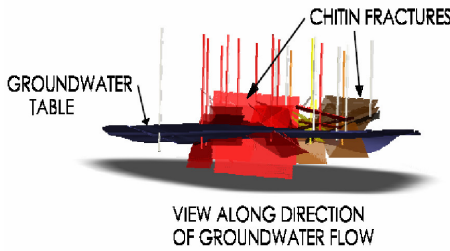
- cost savings
- a "best practices" remedial approach
- no excavation required
- small footprint
- improved bioavailability
- minimal infrastructure
- more remedial options
- enhanced MNA
- faster clean-ups



Induced fractures containing chitin and sand



ISOMETRIC VIEW OF CHITIN FRACTURES ABOVE THE GROUNDWATER TABLE



VIEW ALONG DIRECTION OF GROUNDWATER FLOW

### **Examples of treatment amendments**

- Calcium or Magnesium peroxide
- Sodium Percarbonate
- Potassium Permanganate
- Hydrogen Peroxide
- Polylactates
- Polyglucosamines
- Enzyme accelerators w. nutrients
- Zero valent iron
- Zeolites

