

Jacobs, James A. (Environmental Bio-Systems, Inc, Mill Valley, CA)

## **CHEMICAL OXIDATION AND ENHANCED NATURAL ATTENUATION FOR OILFIELD REMEDIATION**

Depleted LA Basin oil fields provide land redevelopment opportunities. Properties are several to hundreds of acres and may contain drilling and production fluids, and maintenance chemicals such as solvents and hydrocarbons. Jetting and gas infusion remediation delivery technologies provide chemical oxidation and enhanced bioremediation, respectively.

Chemical oxidation uses hydrogen peroxide with an iron catalyst (Fenton's chemistry) to mineralize hydrocarbons and solvents to carbon dioxide and water. RIP jetting technology delivers rapidly reacting peroxide in 3-10 radius at pressures to 5,000 psi. Studies show volatile organic compounds (VOC) reduced by 78% in soil (Washington) and 93% in soil and 61% in groundwater (California) after one treatment event.

Microbial degradation of hydrocarbons occurs in the presence of dissolved oxygen (DO). ISOC passive gas infusion technology provides bubble-less oxygen to 2-inch monitoring wells through a mass transfer membrane. DO supplied from compressed oxygen tanks provide levels of 30-60 ppm in wells. Oxygen is continuously infused into groundwater during several months at 20 cc/minute providing a 15-foot radius of influence.

A New Jersey study illustrates enhanced natural attenuation technology on MTBE-gasoline. Groundwater depth 12 feet, velocity 0.4 ft/day, conductivity 2.7 ft/day, and gradient was 0.028. Recovery wells pump 1 gpm. Ferrous iron is 80 mg/L. A seven-well DO barrier was established in 6 months and downgradient reductions occurred: MTBE (up to 99%), TBA (50%) and benzene (85%).

Rapid chemical oxidation jetting technologies and passive gas infusion enhanced natural attenuation technologies are effective delivery systems for remediation of hydrocarbons and solvents, common contaminants in oil fields.