

Surfactant Enhanced Remediation (SER) of Contaminated Solid-liquid Drilling Wastes, Industrial Waste Water, and Groundwater (In-situ and Ex-situ Case Studies)

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This paper will focus on the application of Surfactant Enhanced Remediation (SER) Technology using non-ionic surfactants to improve the in-situ and ex-situ treatment of contaminated solid drilling wastes, industrial waste water, and groundwater in commercial, industrial and oil and gas settings.

Normally hydrophobic organic chemicals (HOC) exhibit limited solubility in water as the contaminants tend to partition (i.e., absorb) onto the soil, solid waste and or bedrock matrix. This partitioning can account for as much as 90-95% or more of the total contaminant mass. As a consequence, the subject contaminants exhibit a limited response for in-situ and or ex-situ treatment. This includes technologies such as: contaminant recovery via pump and treatment; limited bioavailability to microorganisms during waste water treatment, and limited chemical availability to oxidative and reductive chemicals applications, and soil washing of oil and gas liquid/solid wastes. Hence certain HOC's can persist in solids, soils, solid waste, bedrock, waste water and or groundwater for extended periods of time.

The sorption of contamination onto solids is often considered the principal limiting factor affecting the effectiveness of the many solid and liquid treatment technologies. This coupled with complex contaminant chemistry and variations in solids originating from commercial, industrial and oil and gas settings, only further complicates their application.

Ivey-sol[®] is a non-ionic surfactant technology, comprised of several proprietary formulations, and is capable of selectively desorbing and dissolving contaminants as microscopic 'surfactant-hydrocarbon-water' partial encapsulations, called partial micelles, well below their critical micelle concentration (CMC). In addition, Ivey-sol[®] can lower the surface tension of water from 72 dynes to less than 30 dynes increasing the wetting and permeability properties of water in fine grain soils and fractured bedrock.

Ivey-sol[®] surfactants affect the sorption of HOC and surfactants at the solid-liquid interface (i.e., the surface-H₂O-NAPL interface). As a result, they increase the solubility of the petroleum contaminants in water-phase for their improved removal and treatment or recovery.

Through desorbing contamination and lowering the surface tension, Ivey-sol[®] formulations address two principal factors affecting the successful application of water remediation technologies. They overcome the contaminant sorption limitations, and improve the transitivity of the water by reducing the surface tension allowing greater effective penetration into and through finer grained less permeable solid substrates (i.e., silts, clays, drilling mud, etc.).

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Mr. Ivey is the President and Senior Remediation Specialist with Ivey International Inc. He has over twenty year's environmental experience, and has worked on more than

1200 projects internationally. His background includes: Organic Chemistry, Geological Engineering, and a Master's Certification in Project Management.

Among some of his more recent accomplishments include his being awarded:

- The 2007 Environmental Business Journal Technology Achievement Bronze Award (February 20, 2008);
- The 2006 North American Frost & Sullivan Award for Technology Innovation (February 7, 2007)
- The 2006 Environmental Business Journal Remediation Technology Merit Award (February 28, 2007); and
- The 2006 Globe Award for Environmental Innovation and Application (March 31, 2006).

He holds several international patents; continues to conduct applied soil, solid waste, waste water, and groundwater research, and is currently working on several research and remediation projects around the world.