Over Fifteen Years of Emulsified Vegetable Oil Applications: The Good, the Bad, and the Ugly!

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Background/Objectives. This presentation describes the key elements of effective in situ bioremediation using small droplet emulsified vegetable oil products. In February of 2002 RNAS Remediation Products manufactured the first production lot of a sub-micron emulsified vegetable oil (EVO) product. Approximately 20 million pounds of small droplet EVO products have been injected at hundreds of sites, providing a wealth of experience and data. Brief project case histories will be presented to illustrate both effective EVO application methods as well as to illustrate common problems and how to address them.

Approach/Activities. Cost-effective application of electron donors for in situ bioremediation depends on the primary properties of the electron donors, including hydrogen production rates, the total hydrogen production potential, electron donor longevity, and electron donor mobility. Project examples will be used to illustrate these key elements. Electron donor distribution in the subsurface is critical and application methods greatly affect project performance. Project examples will be used to describe the use of permanent injection wells, direct push injection methods and temporary circulation systems to effectively deliver EVO. Common problems and how to prevent them will also be addressed, including unwanted EVO migration through preferential flow paths and well fouling.

Results/Lessons Learned. Electron donor longevity is highly variable depending on dosage, water temperature and the flux of electron acceptors through the treatment zone. Examples will be presented showing EVO longevity ranging from less than one to more than five years. Droplet size distribution greatly effects emulsion mobility and stability in the subsurface. A small droplet EVO with 90% of the oil droplets by mass under 0.50 microns has greatly improved mobility at sites were large volume injections or temporary circulation systems were used to move EVO along flow paths of 25 meters or more. Project examples will be given illustrating maximum mobility provided by small droplet EVO. In contrast the small droplet EVO may be too mobile for some applications and project examples where EVO “drifted” out of the treatment zone via advective groundwater flow will be presented. Large droplet EVO products with a higher oil retention will be discussed as a solution. Examples of common problems such as well fouling or unwanted transport via preferential flow paths will be explored through project examples. Good practices for preventing these problems will be discussed.