

Large-Scale Remediation of TCE Using Abiotic Degradation with ZVI and Enhanced Biological Degradation

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Background/Objectives. As part of an environmental remediation effort at the McConnell Air Force Base in Wichita, Kansas, a pneumatic emplacement technology (Ferox™) has been used for in situ ZVI injections on six sites. Treatment was applied to chlorinated solvent contaminated soils and groundwater. At some sites, there has been an increase in daughter products including vinyl chloride and high levels of methane. However, the contribution of biological activities and the role of the levels of carbon (electron donor) to these increases was not clear.

Approach/Activities. Over 3,000 tons of ZVI was injected during four campaigns between 2014 and 2017. All the sites treated with ZVI saw a greater than 100 mV decrease in ORP as reductive conditions were established. The pH slightly increased and methane, ethane and ethene concentrations increased. On average at most sites, the TCE concentrations were below USEPA MCL and KDHE Risk levels within a couple of months. The Ferox™ patent is based on the results that less iron distributed better through the formation give a better result. Pneumatic emplacement of in-situ amendments increased contact and permeability within the contaminated zones in order to achieve treatment goals within a short period of time. Experience has also shown that too much carbon in the system can lead to methanogenic conditions and less reductive dechlorination. A variety of products and techniques have been used to determine the optimum balance of ZVI and carbon to produce degradation of the TCE at several sites on base. In some areas, more ZVI was injected, and in other area a molasses-base product or a nutrient blend product was added.

Results/Lessons Learned. A wide range of biogeochemical conditions were detected throughout the base. Each of these conditions required a different approach. The results of these different approaches and how each approach was selected will be presented.