Implementing Monitored Natural Attenuation with Multiple Contaminants, Modulating Groundwater Flow, and Multiple Attenuation Mechanisms

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Background/Objectives. A site in an industrialized area in the western United States had ground water impacts of TCE and Freon 113. An air-sparging/soil-vapor extraction system had effectively remediated the source area, and an MNA remedy was proposed as a “polishing step” for the source area and a way to remediate the down-gradient plume. However, it was not clear MNA was appropriate because the site was far from typical. The direction of ground water flow modulated throughout the year. TCE seemed to be attenuating, but cis-DCE was rarely observed and when it was observed, it was not at concentrations commensurate with the attenuated TCE. Freon 113 was present and there have been literature reports of Freon 113 hindering the reductive dechlorination of TCE. Finally, Freon 113 has no readily measured degradation products, so it was difficult to be sure that it was biodegrading.

Approach/Activities. Four quarters of contaminant concentrations were collected. In addition, at each quarter geochemical, microbiological and isotopic data were also collected. These data were to be used to see if the biodegradation was truly occurring at the site.

Results/Lessons Learned. It was shown that the site can be thought of as two regions: one near to the source and one more down-gradient of it. It was also found that the geochemistry was controlled by a sulfate release that didn’t necessarily occur at the same time or location as either the Freon 113 release or the TCE release, but was comingled with them and had a concentration over 9000 mg/l at its peak. There was clear evidence in the compound specific isotope analysis (CSIA) and the of both Freon 113 biodegradation and TCE biodegradation. While the Freon 113 may have hindered reductive dechlorination it didn’t completely stop it, as shown by observations of ethene. Finally, everything suggested the TCE and cis-DCE were also being degraded through other mechanisms.