Design of Bioaugmented Biobarriers for Remediation of a TCE Plume

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Bioremediation using emulsified vegetable oil (EVO) and bioaugmentation is planned for the full-scale remediation of a trichloroethene (TCE) plume at a former rocket engine test facility. Groundwater contamination extends from the water table near the source area to approximately 170 ft below ground surface (bgs). The dissolved phase plume extends more than 2800 ft downgradient and is present in three hydrogeologic units: the first sand at approximately 65-105 ft bgs, the shell horizon at 105 to 135 ft bgs and the deep sand from 135 to 170 ft bgs. The site is located within an area of potential salt water intrusion, with sulfate concentrations ranging from several hundred to several thousand parts per million.

Several transects of electron donor injection wells (biobarriers) to treat the dissolved phase plume and a grid of donor injection wells to treat the source area have been installed. Emulsified vegetable oil (EVO) was selected as the electron donor, and all injection wells will receive a one-time addition of KB-1®, a dechlorinating culture capable of complete dechlorination of TCE to ethene. This implementation will represent one of the largest biobarrier applications in North America.

To determine the injection well spacing in the source and plume and to determine the optimal number and spacing of the biobarriers, EVO pilot injection tests and groundwater transport modeling were conducted. To determine bioremediation rate constants, which determine the minimum required biobarrier thickness in the direction of groundwater flow, a series of microcosm studies were performed. These studies included KB-1® bioaugmented treatments using aquifer material amended with EVO, three intrinsic control treatments using aquifer material from the shallow sand, shell layer, and deep sand with no amendments and a sterile control.

This presentation will focus on the results of the microcosm studies, the EVO pilot tests and the biobarrier configuration determined as a result of the groundwater transport modeling. The status of the field implementation will also be discussed.

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Carol Aziz is a licensed Senior Engineer with Geosyntec Consultants. She has over 14 years of professional experience in soil and groundwater remediation. Dr. Aziz has served as project manager or director for several remediation and monitored natural attenuation (MNA) projects. She has managed numerous bench-scale studies and pilot- and full-scale field projects evaluating innovative technologies, such as emulsified vegetable oil biobarriers, biosparging, and in situ mulch walls. She is the lead author of the MNA model, Biochlor, distributed by the USEPA and has served as co-PI on several R&D projects funded by the U.S. Department of Defense.