Achieving Favorable Substrate Distribution in Layered, Low-Permeability Aquifers at Hill Air Force Base, Utah

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Background/Objectives. Hill Air Force Base (AFB) in northern Utah has been the site of military activities since 1920, including distribution of military equipment, aircraft rehabilitation and maintenance, and missile assembly. Industrial operations have generated spent chemicals and wastes, including chlorinated and non-chlorinated solvents and degreasers, petroleum hydrocarbons, acids, bases, metals, and other chemicals. Since 1984, the Air Force has committed significant resources to assess and remediate environmental contamination. Today, restoration work at Hill AFB is organized into 15 operable units (OUs), based on geography, hydrogeology, and contaminated media.

Ten of the 15 OUs involve chlorinated solvent plumes, some extending up to several miles off-base. To contain these plumes, hydraulic or physical containment systems have been installed at many OUs and extensive groundwater monitoring networks are in place. This paper discusses part of the remedy optimization program to accelerate progress toward site closeout, including successful enhanced reductive dechlorination treatment of several plumes in layered low-permeability aquifers.

Approach/Activities. As part of an 8-year performance based remediation contract, Jacobs is helping the Air Force systematically accelerate progress toward site closeout while moving toward a greener and more sustainable remediation approach that reduces remediation life-cycle costs. This approach includes treating source areas and plume hotspots by in-situ bioremediation, to eliminate dependence on pump and treat remedies and reduce plume restoration time frames by several decades. Emulsified vegetable oil substrate has been injected at generally low pressures into 2-inch injection wells (almost 80 total) at the four sites discussed in this paper.

Results/Lessons Learned. This paper describes the results of substrate delivery and successful treatment in layered low-permeability aquifers. At sites with predominantly fine-grained lithology (mostly silty clay with fine sand layers and laminae), low-pressure delivery was key to achieving good substrate distribution along groundwater paths. Although hydraulic conductivities were less than 1 feet per day, injection pressures were generally kept below 10 pounds per square inch with injection rates generally in the 2 to 3 gallons per minute range. In a few cases where the formation could not accept substrate at a reasonable rate, a gravity drain system was set up to inject over time and achieve design injection volumes.