An Adaptive Approach Facilitates Successful In Situ Remediation of a Mile-Long Solvent Plume and Source Area

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Background/Objectives. The Bountiful/Woods Cross Operable Unit 1 Site is located in southern Davis County, Utah, roughly 10 miles north of Salt Lake City. The several acre source area was impacted with elevated trichloroethene (TCE) concentrations including residual dense, non-aqueous phase liquid (DNAPL) from past industrial activities, and a mile-long plume was generated. Across the Site, the targeted treatment zone comprises heterogeneous deposits of dense, well-graded sand and gravel alternating with layers of sandy, silty clay. Conventional bioremediation injections led to near complete destruction of TCE and daughter products in the source, with the exception of the residual DNAPL area. Targeted permeability enhancement to emplace sand and zero-valent iron (ZVI) was used to address the DNAPL. In the plume, a combination of biobarriers (using conventional injection wells) and targeted permeability enhancement in hot spots have been used to significantly reduce contaminant concentrations and contaminant mass flux.

Approach/Activities. Throughout the Site remedial action, a TRIAD approach to hot spot and plume investigation was utilized to define the extent and distribution of contaminants using membrane interface probe (MIP) and hydraulic profiling tool (HPT) data. The data were used to tailor injection well placement in the source area and biobarriers, as well as for development of a 3-D Leapfrog® model to determine the targeted permeability enhancement approach. Source area and biobarrier conventional injections were completed with emulsified oil products, resulting in nearly complete contaminant degradation throughout the source, and halting of plume advancement in the downgradient plume, each of which was achieved in less than 4 years. In areas where high concentrations and low-permeability lithology were present, permeability enhancement with ZVI emplacement has been used to more aggressively reduce contaminants with the goal of transitioning the Site to a monitored natural attenuation remedy as quickly as possible.

Results/Lessons Learned. The presentation conveys the importance of an adaptive approach to site remediation, which may require different remedial technologies to achieve cleanup goals. Both the conventional injection approach, as well as targeted permeability enhancement, have proven extremely effective at reducing contaminant concentrations. However, a thorough understanding of the site conceptual model is necessary to achieve desired results. Using this approach, in a period of less than 10 years, a high concentration source area with concentrations exceeding 100 parts per million (ppm) has been reduced to near target cleanup goals (maximum contaminant levels [MCLs]), the remainder of the several ppm source is below MCLs, and an extensive contaminant plume with concentrations exceeding 1 ppm has been reduced to a few remaining areas that exceed MCLs. The state of Utah will take over remediation in 2020, and will comprise MNA only.