Stratigraphic Flux: Applying Sequence Stratigraphy and High-Resolution Site Characterization to Find Contaminant Flux

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Background/Objectives. The advent of mass flux and high-resolution site characterization methods in recent years has led to more quantitative conceptual site models. Stratigraphic flux combines relative mass flux derived from high resolution site characterization with a sequence stratigraphy perspective on geologic interpretation to provide a framework for classifying and ranking transport potential: transport zones, slow advection zones, and storage zones. The goal of the approach is to develop a 3D stratigraphic flux model to enable stakeholders to understand the controlling influence of aquifer architecture on plume dynamics, thereby improving the reliability and cost-effectiveness of restoration strategies.

Approach/Activities. To demonstrate the utility of the method and enhance understanding of flow and transport at sites with complex geology, the stratigraphic flux approach was applied at an Air Force Plant 4 former chrome pit in Fort Worth, Texas. Real-time, high-resolution site characterization methods were used to develop geologic descriptions and to estimate the permeability of the alluvium, based on the finer grained nature of the site's soils. Whole core saturated soil sampling and calculated equivalent groundwater concentrations were performed to map distributions of trichloroethene (TCE) and daughter products, as well as total chrome. Comparative analyses were completed using the hydraulic profiling tool (HPT) and vertical aquifer profile groundwater sampling at select locations to verify method results. The 10-day field effort enabled completion of 32 borings in 4 transects with over 600 samples adjacent to and downgradient of the TCE and chrome source.

Results/Lessons Learned. A 3-D stratigraphic flux model was developed to classify and evaluate migration pathways associated with the former chrome pit. Results showed that subsequent to excavation and injection remedial activities, significant TCE source mass continues to reside in the saturated clay-rich soils. Groundwater concentrations in the alluvium decreased several orders of magnitude with distance from the source and limited transport was focused in a relatively narrow band in the unconsolidated aquifer. The results from this project suggest that the stratigraphic flux approach is a useful tool for tracking contaminants at sites with complex geology, allowing for targeted remedial approaches.