Use of Flux Measurement for Remedial Design Optimization of a Combined Remedy for Source Treatment and Large Dilute Plume Management

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Background/Objectives. Complex contaminated sites, such as those containing dense non-aqueous phase liquids (DNAPLs) and large dilute plumes, pose some of the most difficult challenges for environmental cleanup programs. Successful cleanup is often not achieved at sites that have stringent remedial goals, in large part due to a lack of adequate characterization to achieve a detailed understanding of phenomena such as DNAPL distribution and architecture, contaminant diffusion into low-permeability media, heterogeneity in lateral and vertical subsurface soil stratigraphy, and preferential pathways for hydraulic flow and contaminant transport. Designing characterization programs to quantify these phenomena is essential for developing remedial strategies that include realistic objectives and expectations for site remediation, and appropriate selection and implementation of remedial technologies. In addition, management strategies are increasingly using adaptive site management and metrics such as mass flux and mass discharge to establish performance objectives, evaluate interim remedial progress, and optimize remedial design. The Well 12A Superfund Site, in Tacoma Washington, is a case that exemplifies how management of complex sites with large dilute plumes has evolved.

Approach/Activities. The Well 12A Site has undergone remediation since 1983 to address soil and groundwater contamination (including DNAPL) that poses unacceptable risk to the City of Tacoma municipal water supply. The original Record of Decision (ROD) (1983) involved wellhead treatment at Well 12A, and a ROD Amendment (1985) involved soil excavation and operation of a groundwater extraction and treatment system (GETS). A review of the existing remedy for the Site concluded that it was inadequate to meet remedial goals of achieving groundwater restoration in a timeframe sufficient for the City of Tacoma future water use. Therefore, a second ROD Amendment (2009) was developed that added excavation of shallow soils, in situ thermal remediation, and enhanced anaerobic bioremediation for source treatment. One of the key compliance metrics for the source treatment is an interim goal of a 90% reduction in contaminant mass discharge from the high-concentration source area to the low-concentration groundwater plume. The ROD Amendment was also designed to allow adaptive application of a suite of technologies and encourage a lifecycle optimization approach to the plume management strategy.

Results/Lessons Learned. This paper will present how mass flux and mass discharge measurements have been used to optimize design of the various remedial action phases for the Well 12A site and key performance metrics that have been used to assess progress. All remedial actions specified in the 2009 ROD Amendment have been completed, lessons learned on the use of mass flux and mass discharge during the remedial action implementation, and groundwater plume changes as the remedial action has progressed will be presented.