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Contaminant Mass Discharge Reduction as a Compliance Metric for a Multi-Technology Remedial Action

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Background/Objectives. This presentation will address challenges encountered, adaptive management strategies employed, and lessons learned associated with use of contaminant mass discharge as a compliance metric to evaluate performance of a multi-technology remedial action. Although remedial performance has traditionally been measured by comparing contaminant concentrations in soil and groundwater to numerical standards, use of contaminant mass discharge as an interim performance metric is gaining acceptance within the remediation industry and regulatory community. The Time Oil Well 12A Superfund Site in Tacoma, Washington is the first known site to use contaminant mass discharge reduction as a compliance goal in a Record of Decision (ROD). The site has been undergoing remediation since 1983 to address soil and groundwater contamination, principally chlorinated volatile organic compounds (VOCs), including dense non-aqueous phase liquids (DNAPL), that pose a risk to the City of Tacoma municipal water supply. The original ROD (1983) involved wellhead treatment at Well 12A (a municipal water supply well). A ROD Amendment (1985) involved soil excavation, soil vapor extraction, and operation of a groundwater extraction and treatment system (GETS). After 25 years of remedial action, a review concluded that the ongoing remedy was inadequate to achieve groundwater restoration in a time frame sufficient for the City of Tacoma's projected future water use. A second ROD Amendment (2009) specified that a 90% reduction in contaminant mass discharge from the source area to the dissolved phase plume would be achieved through a multi-technology approach, including excavation of shallow soils and filter cake, in situ thermal remediation (ISTR), and enhanced anaerobic bioremediation (EAB).

Approach/Activities. To implement the remedy, it was necessary to measure and gain regulatory acceptance of the pre-remedial action baseline mass discharge from the site and to establish the criteria and methods for the post-remedial action measurement. After evaluating alternative methods, the baseline mass discharge measurement was completed in 2013 using a pumping test method conducted with the existing GETS and a baseline mass discharge of 403 grams per day was established. The subsequent remedial action included excavation of 2,130 tons of shallow soil and filter cake, removal of two underground storage tanks, ISTR of a 13,000-square foot (SF) area beneath a building and former tank pad, and EAB throughout the remainder of the 162,000-SF source area. More than 850,000 gallons of emulsified vegetable oil amendments were injected, with variable mixtures of shear-thinning fluids used to optimize the amendment delivery. Low-temperature electrical resistance heating was applied to enhance the EAB remedy within two identified DNAPL source areas.

Results/Lessons Learned. After nearly four years of remedial action, remedy optimization, and monitoring, the project team concluded that the post-remedial action mass discharge measurement should be conducted to determine whether the mass discharge reduction objective had been achieved. Pumping of the GETS was initiated in August 2016 and the post-remedial action mass discharge measurement was completed in April 2017. The presentation

will include results of remedy performance monitoring and the post-remedial action mass discharge measurement.