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**To:** Laura Klasner, Washington State Department of Ecology  
**From:** Bruce Williams *Bow*  
**Date:** June 19, 2014  
**File:** 0504-078-01  
**Subject:** Moxee City Shop Site Remedial Approach

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Dear Laura,

Per our recent discussions regarding the Moxee City Shop, GeoEngineers has prepared this memorandum describing a remedial approach to address petroleum contamination at the site. This memorandum can be utilized to satisfy requirements under the Model Toxics Control Act (MTCA); the contaminants of concern, cleanup standards, remedial approach proposed, and site conditions comply with the MTCA definition for a "routine cleanup action" (WAC 173-340-200). Therefore, this memorandum satisfies the requirement needed to evaluate and select a cleanup action, without having to prepare a comprehensive or focused feasibility study.

Petroleum hydrocarbons have been documented at concentrations greater than MTCA Method A cleanup levels in recent groundwater samples collected from monitoring well MW-1. Petroleum hydrocarbons have not been detected in groundwater samples collected from other site wells (MW-2 through MW-6) located both upgradient and downgradient of the former USTs and well MW-1. Soil samples have been collected during numerous assessment activities, but none of the samples contained petroleum hydrocarbon concentrations greater than MTCA Method A cleanup levels. A few soil samples contained detectable petroleum hydrocarbon concentrations or field screening observations of petroleum content. These samples were collected from borings located near well MW-1 and include borings DP-1, DP-4 and DP-6. Soil conditions encountered beneath the site generally consist of silty fine sand, with occasional silt layers and some gravel. A shallow unconfined aquifer is present at depths ranging from about 3 to 8 feet below grade, as measured in site wells since November 2012.

Although petroleum hydrocarbons have not been detected in soil at concentrations exceeding cleanup levels, remnant petroleum (gasoline) within soil continues to result in concentrations greater than cleanup levels in groundwater samples collected from well MW-1. This petroleum-impacted area measures approximately 50 feet by 30 feet (1,500 square feet [sf]). To address remnant petroleum in soil within the groundwater fluctuation zone and cause minimal disturbance to site operations, we propose to apply a chemical oxidant, microbes and nutrients through lance injection to target depths between about 3 and 10 feet below grade. This technology primarily relies on chemical oxidation followed up by anaerobic respiration to remediate the subsurface. Approximately 10 to 15 lance injection points (1-inch-diameter and no greater than 10 feet deep) will be advanced at approximate 10-foot spacing within the 1,500 sf area. Lance injection points will be used to dose the groundwater fluctuation zone with oxidants, surfactants, nutrients and microbes to breakdown gasoline contamination.

The oxidant application will consist of NovIOX™ (chemical oxidant) followed by AM3™ (microbes), AnoxEA-aq™ (biological oxidants) and ReleaSE™ (surfactant) injected over a 2-day period. Upon completion of application,

the lance injection points will be backfilled with bentonite and then covered with surface materials. Oxidant metabolism and groundwater re-equilibration with the soil matrix is expected to take about 180 to 365 days.

Groundwater monitoring will be conducted 30 and 90 days after injection, and continue quarterly for 1 year to monitor remedial effectiveness. One year after injection, the remedial effectiveness will be evaluated, which could prompt continued groundwater monitoring or additional applications. (Note that GeoEngineers' costs for groundwater monitoring already are authorized.)

The estimated subcontractor costs to implement this approach ranges between about \$20,000 to \$30,000, plus about \$15,000 for GeoEngineers services to coordinate activities, develop a more detailed plan, oversee field operations and report activities and results. Thus, overall costs range from about \$35,000 to \$45,000.