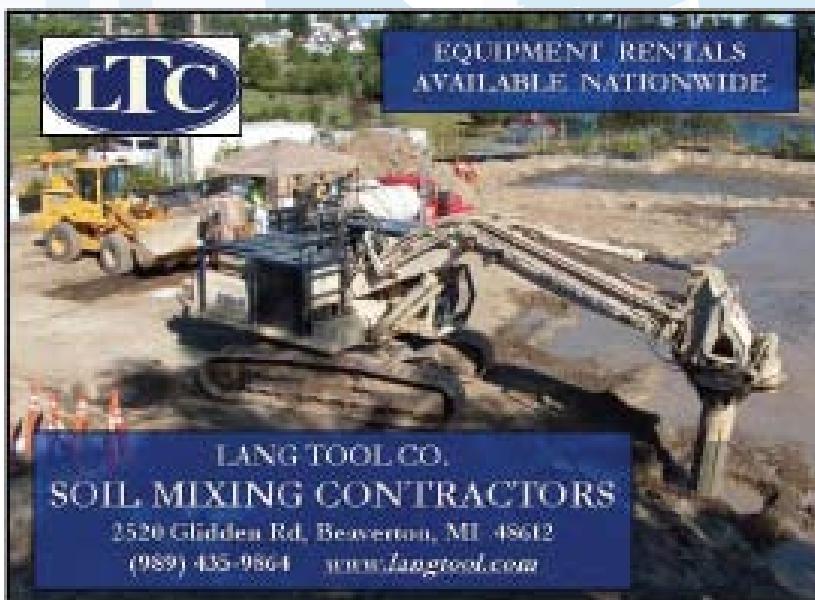


In-Situ Soil Mixing Former Tank Farm Property Restoration

Lang Tool Co.

Parametrix, a civil and environmental consulting firm with a local office in Bremerton, Wash., was retained to formulate a soil and groundwater remediation plan for a petroleum-contaminated site adjacent to Puget Sound. The approach selected was to reduce the soil contaminant mass by in-situ mixing of RegenOx™, a chemical oxidant, and ORC™, an oxygen-releasing compound manufactured by Regensis. The site was challenging due to its environmentally sensitive location and because it contained 3,870 cubic yards of contaminated soil in a “smear zone” between 8 and 14 feet bgs. This meant that the soil mixing equipment employed had to be capable of penetrating 8’ of clean soil without the addition of the reagents and then proceeding down to 14’ while the reagents were accurately pumped and thoroughly mixed with the contaminated soil. The equipment and methods employed had to be capable of reaching any areas that required retreatment if samples indicated that the initial treatment was not sufficient to reduce contaminants to acceptable levels. Neither conventional rotary mixers nor hollow stem augers are capable of these tasks.

The owner, a local government agency, issued a RFP that included the remediation work, removing and recycling concrete structures, replacing a storm sewer, and excavating and removing some isolated hot spots outside the soil mixing area. Strider Construction Company of Bellingham, Wash., submitted the winning proposal as general contractor. Strider handled the excavation, demolition and sewer replacement. The soil-mixing work was subcontracted to Doyle & Lang LLC a Michigan firm with the specialized equipment and experience required to successfully complete the mixing work. Strider commenced the removal work on May 26th, allowing the four man D&L crew to begin soil-mixing work on June 4th. D&L equipment consisted of a Lang Tool Co. Dual Axis Blender with a GPS location system, an LTC Chemical Reagent Mixing Truck with GPS monitor, and a compact loader. It was originally estimated that the project would require 18 working days for the initial soil mixing plus additional time for any necessary retreatment. D&L accomplished the initial treatment plus 5,000 square feet of retreatment in 13 working days. Much of the increased efficiency is attributable to the GPS location system on the Dual Axis blender. D&L topographically surveyed the 17,400 square foot treatment area, overlaid a 10- by 10-foot treatment cell grid over the survey, and transferred it into the machine system. The system allows the blender operator to see the cell grid, the machine position, and the tool position relative to the grid and vertically



relative to the ground surface. This imagery is transmitted to the reagent mixing truck as well. This feature was extremely beneficial because the contaminant levels varied across the site, making it necessary to double the reagent quantity in some areas. The aggressive dosing areas were crosshatched on the treatment grid so the reagent delivery crew could see when the soil mixer was in aggressive dosing areas and could adjust the reagent delivery accordingly. The sewer location was also identified on the grid overlay so that there was no chance of accidentally hitting the line, as the tool position was co-monitored by the blender operator and the reagent mixing truck operator.

The remedial goal, to ultimately achieve Washington Department of Ecology’s levels for unrestricted use, required a 70 percent reduction of the pre-treatment concentrations on this site. Samples indicated seven locations did not meet the goal after the initial application. These locations were retreated and a second set of samples collected. Final results showed all areas met cleanup levels for diesel, achieving an average decrease of 94 percent. The results for gasoline were mixed with an average decrease of 89 percent in six locations and a slight increase in five locations. The increase is most likely due to localized gasoline hot spots not detected during the pre-treatment sampling. Future sampling will be conducted to monitor ground-water concentrations. Locations that did not attain cleanup levels for gasoline will be sampled in six months to allow the RegenOx™ reaction to be completed and to assess the enhanced bio-attenuation rate.