Electrical Resistance Heating Remediation in Interstate Median

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Background/Objectives. A tanker truck overturned in 2014, releasing approximately 1,200 gallons of trichloroethylene (TCE) into an Interstate median, between the east and west bound travel lanes. Contaminated surface soil from the area was excavated a few feet below ground surface (bgs). The median is only 60 feet wide, and has steep slopes towards a center drainage ditch, which restricted the potential depth of excavation in order to maintain the integrity of interstate lanes. In subsequent investigations, TCE impacts were detected to a depth of almost 40 feet bgs. The soil consisted predominantly of a very tight clay (with minor lenses of silty clay) underlain by a drinking water aquifer. The maximum concentration of TCE in soil was 1,100 mg/kg which was identified at 32 to 33 feet bgs. The total, potential mass of TCE was estimated at 14,500 pounds, based on a maximum of 1,200 gallons TCE. The remediation goal was established at 0.073 mg/kg TCE in soil, which is the State's risk-based screening standard for soil protective of groundwater.

Alternative remedial technologies were evaluated, and electrical resistance heating (ERH) was selected as it was determined to be the most practical remedy. Injection in tight clays was believed to be technically impracticable and further soil removal would have resulted in significant risk to the structural integrity of the interstate. ERH minimized risks, had the ability to treat both saturated and unsaturated soils, and remove TCE in low permeability soils.

Approach/Activities. The proposed ERH remediation zone within the median was 6,015 square feet. The treatment depth ranged from 0 to 40 feet bgs, resulting in a treatment volume of approximately 8,100 cubic yards. Thirty-nine electrodes, with collocated vapor recovery screens, were installed to a maximum depth of 42 feet bgs. An additional 20 independent vapor recovery wells and six temperature monitoring points (TMPs) were also installed within the remediation zone. An impermeable liner was installed over the remediation zone at the surface.

A vapor / liquid treatment system was installed north of the interstate. Treatment system power cables, vacuum piping, and other system equipment were installed under the interstate to connect the equipment in the remediation zone with the treatment system. The electrodes were energized to heat the soil, while a vacuum was established in the remediation zone to extract vapors to the treatment system. Removed TCE vapor was captured on vapor-phase granular activated carbon.

Results/Lessons Learned. After approximately 9 months of active remediation, the maximum concentration of TCE in soil within the remediation zone was reduced to less than 0.073 mg/kg (from 1100 mg/kg max), as demonstrated via soil confirmation sampling. Much of the remediation zone soils were non-detect for TCE. Due to the method of removal, no TCE rebound is anticipated.

The results demonstrate that ERH remediation can achieve very aggressive remediation goals in a very tight clay and an extremely challenging location. These goals were achieved in a relatively short time frame and the work was conducted in a manner that was protective of the public and site workers.