Infiltration Trench to Treat Perchlorate in Shallow Soils and Groundwater

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Several perchlorate source areas have been identified at an industrial manufacturing facility that regularly handles ammonium perchlorate. Perchlorate source areas include soil and groundwater. A full-scale, integrated containment/treatment bioremediation system was designed and constructed in August 2003 as an interim measure to mitigate the migration of groundwater and surface water away from the primary perchlorate source area. The containment/treatment system incorporates a 20 foot deep infiltration trench connected to shallow collection trenches that divert storm water into a retention pond. The infiltration trench was designed and constructed to treat the perchlorate-impacted shallow clayey soils at 5-15 feet below ground surface (bgs) and shallow groundwater (8-18 feet bgs), by initiating an anaerobic treatment zone that is intended to stimulate the indigenous bacteria to degrade perchlorate in both soil and water matrices. The infiltration trench also aids in directing perchlorate-impacted storm water into collection trenches and ultimately, a retention pond.

The infiltration trench (IT) is located approximately 50 feet up-water table gradient of the primary source area and is oriented in a north, south direction. The dimensions of the IT, as constructed, are 180 feet long by 3 feet wide by 17 to 20 feet deep. The IT was installed through the shallow perchlorate-impacted clay to the top of a more permeable sand/gravel zone, found to be at approximately 17 feet bgs. Two overlapping, black-poly, leach pipes connected to vertical risers were installed within the trench. These leach pipes are designed as horizontal injection lines to allow for injection of a soluble substrate, increasing the potential treatment zone length parallel to groundwater flow downgradient of the trench. The trench was backfilled to the surface with a 60/40 gravel to mulch mix, with the mulch acting as a long-term substrate to stimulate the reduction of perchlorate. A monitoring point was installed in the trench to allow for sampling of groundwater within the IT.

Two monitoring points are located approximately 20 feet downgradient of the IT, with one screened in the shallow groundwater and the other screened in the perchlorate impacted shallow clay. Monthly groundwater monitoring includes the following: perchlorate, chlorate, acetate, dissolved oxygen, pH, oxidation-reduction potential, dissolved organic carbon, ferrous iron and nitrate.

The laboratory data has shown a reduction of perchlorate in the shallow soil monitoring point from approximately 300 mg/L to less than 10 mg/L in the 3-year operation of the system. The use of this infiltration trench/anoxic pond treatment system has also significantly decreased perchlorate concentration in soils, surface water and groundwater in the rest of the primary source area by up to 75%. Laboratory data also indicates that 100% of the surface water is contained by the integrated system preventing the migration of impacted surface water away from the source area. This integrated approach of using natural biological processes and engineered in situ treatment minimizes the capital and labor costs associated with remediation system installation, operation, and maintenance while still achieving risk-based levels in soil and groundwater that are protective of human health and the environment.