Remediation

Radio Frequency (RF) Soil Heating

The Problem

Many current remediation technologies in the UK have limited efficiency and costly in removing Volatile Organic Contaminants (VOCs), Semi Volatile Organic Contaminants (SVOCs) and Dense Non-Aqueous Phase Liquids (DNAPLs) especially from tightly compacted soils and from hard to reach areas such as below permanent structures or in fractured bedrock.

Excavation was until recently the most popular solution employed in the UK, more commonly known as 'dig and dump'. The dig and dump method does not ensure complete removal of the contamination from a site and excavating to depth poses its own problems. The fact is this approach does not solve the problem. It merely moves it elsewhere.

Other technologies such as Soil Vapour Extraction (SVE), Dual Phase Vapour Extraction (DPVE) and In-situ Chemical Oxidation, have limited efficiency on NAPL contaminated soils.

The Situation

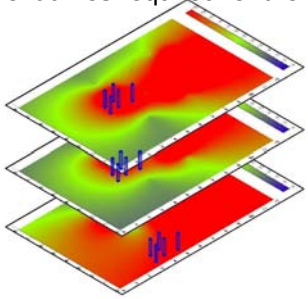
Heating and Removal technologies can be used to treat a spectrum of contaminants in vadose and saturated zones. VOC and SVOC contamination (including Petroleum range hydrocarbon, BTEX and chlorinated solvents) is more readily mobile at temperatures within the range 20º - 30º Celsius. To overcome the above mentioned limitations, the physical and chemical properties of the soils can be modified by controlled heating such that they are amenable for remediation. A 10º C increase in the soil temperature can significantly improve desorption of compounds, increase volatility and enhance microbial degradation. To date, the following four major methodologies have been used and investigated for soil heating: hot air injection; steam injection; heating lances; resistive and dielectric heating. The dielectric heating method has proven to be the most effective technique in a wide range of soils (dry, humid, tight soils). The most efficient way of producing dielectric heating is by applying RF energy to the soil. The main advantage of the RF treatment technology is that it is considerably less dependent on either the soil type or the contaminant type. RF technology will probably be applied only in selected parts of the contaminated site, for example in contamination 'hot spot' areas, hard to reach areas and within tightly compacted soils. Conversely, RF is a complex process which requires contractors with a high technical competence in electronics.

The System

RF technology uses electromagnetic energy. RF frequency current heats the soil which in turn enhances the mobility, volatility and therefore removal of VOCs and SVOCs from soil: An RF generator produces high frequency electromagnetic current which when applied to electrodes or antennae installed in the ground, generate heat, thereby increasing the ambient temperature of the soil. The heat generation greatly reduces the viscosity and density of NAPL/DNAPL plume. When RF is combined with conventional treatment like SVE or dual phase extraction the removal efficiency of the system is greatly enhanced thus reducing the treatment times required for the remediation.

The Test

Tests have been initially conducted in chalk. The test results indicate that none of the drawbacks associated with other in situ thermal systems are inherent in Ecologia's design technology. Process scale up of the system is currently being performed at a test site in the UK.



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experts on the ground