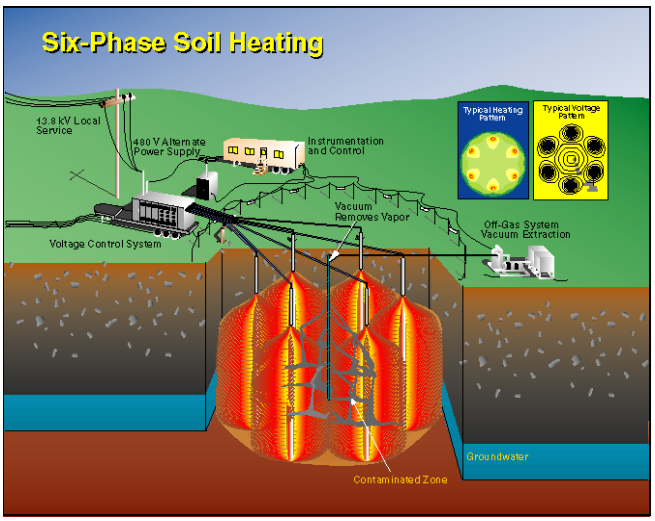
CES
CURRENT ENVIRONMENTAL SOLUTIONS

ENHANCED FREE PRODUCT RECOVERY USING LOW TEMERATURE IN-SITU HEATING - AN OPTION FOR MGP SITES

Six Phase Heating (SPH) (synonymous with Electric Resistance Heating (ERH) as it is more commonly known), was invented at the Battelle Memorial Institute(BMI) in the early 1990's under the auspices of the United States Department of Energy (DOE). The primary developer was William Heath, a former Battelle scientist, author of the Battelle patents, and now the chief Operating Officer of CES. The primary goal of the initial SPH research at BMI was to develop a technology that could address the "technically infeasible" remediation of non-aqueous phase liquids (NAPL) in low permeability soils such as silts and clays. Soon, however, the scientists realized that SPH could be applied to virtually any type soil.

The SPH technology works by imparting electric power into the subsurface soils and groundwater though a series of strategically designed electrodes. The resistance of the subsurface formation causes it to heat-up, and if sufficient power is input, the interstitial pore water in the soils as well as the groundwater can be heated to 100°C or higher, at which point steam is generated. This steam is not injected or conducted at the electrodes, but rather, it is generated at the interstitial soil pore level between the electrodes. The heat increases the volatility of the contaminants while lowering their viscosity. The increased pore pressure created by this expanding steam acts as a carrier gas that strips out contaminants which are collected from the subsurface by a robust soil vacuum extraction process (SVE). The contaminant laden steam is then treated above ground by conventional means, including air stripping, activated carbon, and catalytic or thermal oxidization.



Specifically applicable to MGP Sites is the clean-up efficiency along with energy savings offered by lower temperature, reduced viscosity pumping. This is achieved with SPH by heating the subsurface to temperatures in the range of 30 to 40 ºC. At these temperatures, the viscosity of most hydrocarbons can be reduced by orders of magnitude, making non-aqueous phase liquids (NAPL) such as heavy oils and coal tars easier to pump out. Moreover, the energy savings are significant compared to heating an entire site to boiling. Once most of the NAPL is removed, specific "hot-spots" can be strategically heated further, perhaps even to 100 ºC , for spot treatment and polishing purposes.

SPH is currently being applied at a former MGP site in Illinois. This 200 electrode system is designed to maintain 35 ºC in the subsurface while an integral dual phase extraction and re-injection system extracts the coal tar. In November 2006, after 3 months of full scale operations, the SPH/DPE system had recovered over 5,000 gallons of product. The success of this project has led to SPH being considered for several other MGP sites. Please contact CES at (215) 741-6123 for more information.

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