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Master Thesis Abstract

of

Awandu, Willis

Determination of mass transfer rates of Contaminants during Steam-Air Enhanced in-situ remediation processes.

Steam injection also known as in-situ Thermal remediation (ISTR) is an efficient and effective remediation technique which has attracted enormous interest in its application by world financially endowed countries in their need for improving contaminated sites/ grounds. Due to its ability to penetrate both homogeneous and heterogeneous subsurface, its application therefore has numerous progress as opposed to the standard technologies such as chemical remediation, pump and treat, excavation and incineration compared. Steam serves as the source of energy that heats the subsoils and causes volatilization, displacement and vaporization of organic contaminants like chlorinated hydrocarbons. The use of air injection is to provide the transport mechanism through which the vaporized contaminants are forced upwards till they are extracted from the soil by soil vapour extraction. The added air is minimizing he risk of downward migration of the DNAPL (dense non-aqueous phase liquid) which may cause further dispersion in the deeper regions.

This thesis examines the heat propagation and remediation time of contaminant in different soil types namely, GEBA fine sand, coarse sand and silt. Due to the adsorption nature of chlorinated hydrocarbons to the soil matrix because of the soil organic content, the fine and coarse sand were found to have meaningless organic carbon content (approximately 0.001%). In this regard, experiments are carried out using the different soil types in their pure/ natural state, and when treated with 1% and 2% activated carbon, respectively. Activated carbon is used as a carbon source, organic carbon (OC). The variation of organic carbon will result in different remediation times to remove the contaminants. Silt material is tested in its natural state and additionally treated with 1% activated carbon. The results show remarkedly longer time requirement to achieve complete remediation even in natural state. Generally, it is observed that 1% increase in carbon content increases the remediation time by a factor of 2-3.

Keywords: Chlorinated hydrocarbons, heterogeneous, organic content, transport mechanism, downward migration.