**Soil, Sediment, Bedrock and Sludge**

**Soil Vapour Extraction**

**Introduction:**

A vacuum is applied to extraction wells to generate a pressure/concentration gradient that stimulates the removal of gas-phase volatiles from soil through the extraction wells. The technology also is known as *in situ* soil venting, *in situ* volatilisation, enhanced volatilisation, or soil vacuum extraction.

**Description:**

Soil vapour extraction (SVE) is an *in situ* soil remediation technology. The gas departing from the soil can be treated in order to recover or destroy the contaminants, depending on air discharge regulations. Vertical extraction vents are usually used at depths of 1.5 meters (5 feet) or greater and have been applied as deep as 90 meters (300 feet). Horizontal extraction vents (installed in trenches or horizontal borings) can also be used depending on contaminant zone geometry, drill rig access, or other site-specific conditions.

For the soil surface, geo-membrane covers are positioned over the soil surface to stop short-circuiting and to increase the radius of influence of the wells.

Ground water depression pumps reduce ground water upwelling brought about by the vacuum or to enlarge the depth of the vadose zone. Air injection is efficient at facilitating extraction of deep contamination, contamination in low permeability soils, and contamination present in the saturated zone. The length of operation and maintenance for *in situ* SVE is usually medium to long term.

**Applicability:**

Applicable contaminants for treatment via *in situ* SVE are VOCs and fuels. The process is applicable only to volatile compounds with a Henry's law constant more than 0.01 or a vapour pressure greater than 0.5 mm Hg (0.02 inches Hg). Moisture content and air permeability of the soil, will also impact the efficiency of *in situ* SVE'. The technology is not capable of removing heavy oils, metals, PCBs, or dioxins. As the process necessitates the continuous flow of air through the soil, it regularly encourages the *in situ* biodegradation of low-volatility organic compounds that could be present.

**Limitations:**

- Soil that has a high percentage of fines and a high degree of saturation will require higher vacuums (increasing costs) and/or hindering the operation of the *in situ* SVE system.
- Soil that has high organic content or is extremely dry has a high sorption capacity of VOCs, which results in reduced removal rates.
- Exhaust air from *in situ* SVE system may require treatment to eliminate possible harm to the public and the environment.
- As a result of off-gas treatment, residual liquids may require treatment/disposal. Spent activated carbon will definitely require regeneration or disposal.
- SVE is not effective in the saturated zone; however, lowering the water table can expose more media to SVE (this may address concerns regarding LNAPLs).

**Data Needs:**

The depth and extent of contamination, the concentration of the contaminants, depth to water table, and the soil type and properties namely the structure, texture, permeability, and moisture content should be identified.

**Performance Data:**

A field pilot study would assist in determining the feasibility of the method, as well as to acquire information needed to design and configure the system. During full-scale operation, *in situ* SVE can be run intermittently once the extracted mass removal rate has reached a suitable level. This can help increase the cost efficiency of the system by facilitating extraction of higher concentrations of contaminants. Once the contaminants have been extracted via *in situ* SVE, other remedial options such as biodegradation can be explored if the remedial objectives have not been met. *In situ* SVE projects are on average concluded within 1 to 3 years.

**Cost:**

The quantity of material to be treated has a sizeable impact. The cost of *in situ* SVE is site specific, hinging on the size of the site, the nature and extent of contamination, and the hydrogeological setting. Such issues impact on the number of wells and the length of time required to remediate the site. A need for off-gas treatment attaches significant costs to the process. Water is also regularly extracted during the procedure and typically necessitates treatment before being disposed, adding further to the overall costs.