Ground Water, Surface Water, and Leachate

Dual Phase Extraction

Introduction:

High vacuum system is employed to concurrently remove mixtures of contaminated ground water, and separate-phase petroleum product and hydrocarbon vapour from the subsurface.

Description:

In DPE systems for liquid/vapour treatment, a high vacuum system removes liquid and gas from low permeability or heterogeneous formations. The vacuum extraction well comprise of a screened section in the zone of contaminated soils and ground water. It removes contaminants from above and below the water table. The system lowers the water table in the region of the well, therefore exposing more of the formation. Contaminants in the recently exposed vadose zone are then easily reached for vapour extraction to occur. Above ground, the removed vapours/liquid-phase organics and ground water are separated and treated. DPE for liquid/vapour treatment is usually combined with another technology, namely bioremediation, air sparging, or bioventing when the target contaminants comprise of long-chained hydrocarbons. The use of a dual phase extraction with these technologies can cut down the cleanup time on site and can be used in conjunction with pump-and-treat technologies to recover ground water in higher-yielding aquifers.

Applicability:

Contaminant groups for dual phase extraction are VOCs and fuels such as LNAPLs. Dual phase vacuum extraction is more efficient than SVE for heterogeneous clays and fine sands. However, it is not suggested for lower permeability formations because of the potential to leave isolated lenses of undissolved product in the formation.

Limitations:

- Site geology and contaminant characteristics/distribution.
- Combination with paired technologies may be needed to recover ground water from high yielding aquifers.
- Dual phase extraction necessitates both water treatment and vapour treatment.

Data Needs:

Data needs consist of physical and chemical properties of the product released (e.g., viscosity, density, composition, depth, and solubility in water); soil properties (e.g., capillary forces, porosity, moisture content, organic content, hydraulic conductivity, and texture); geology (e.g., stratigraphy that promotes trapped pockets of free product); hydrogeological regime (e.g., permeability, depth to water table, ground water flow direction, and gradient); and anticipated recharge rate.

Performance Data:

Once contaminants are identified, the response should embrace both removal of the source and recovery of product by the most practical means. Dual Phase Extraction methods will extract contaminated water with the product. It may be needed to separate water and product before disposal or recycling of the product. Due to the removal of considerable quantities of water throughout dual pumping operations, on-site water treatment will generally be required. When treatment of recovered water is required, permits will more often than not be compulsory.

Cost:

The cost estimate does not consider the costs for supplementary treatment steps, which may be needed when making use of dual phase extraction technology.

Soil type drives permeability, which is the primary cost driver. Dual phase extraction is most efficient for sand-silt mixtures. Impermeable (high clay) or extremely permeable (gravel/sand) soils are more obstinate.

The depth to the base of the contamination is the second driver, as increased thickness and depth of contaminated groundwater ultimately increases the costs.