Remediation DST

Ground Water, Surface Water, and Leachate

In-Well Air Stripping

Introduction/Description:

Air is injected into a double screened well, raising the water and pushing it out of the upper screen. Concurrently, extra water is drawn in through the lower screen. Once inside the well, the VOCs present in the contaminated ground water are shifted from the dissolved phase to the vapour phase by air bubbles. The contaminated air rises in the well to the water surface where the vapours are captured and treated via a soil vapour extraction system.

The partially treated ground water is under no circumstances brought to the surface. Typically it is forced into the unsaturated zone, and the process is repeated as water follows a hydraulic circulation pattern or cell that permits uninterrupted cycling of the ground water. As the ground water circulates throughout the treatment system *in situ*, contaminant concentrations are progressively reduced. In-well air stripping is a pilot-scale technology.

Alterations to the standard in-well stripping process might entail additives injected into the stripping well to increase the biodegradation rate (e.g., nutrients). Additionally, the area around the well impacted by the circulation cell can be modified by means of adding certain chemicals to allow *in situ* stabilisation of metals initially dissolved in ground water.

The time duration of the process depends upon the contaminant concentrations, Henry's law constants of the contaminants and the sites hydrogeology.

Circulating Wells (CW):

Circulating wells offer a method for subsurface remediation through creating a 3D circulation pattern of the ground water. Ground water is drawn into a well through one screened section and pumped to a second screened section where it is reintroduced to the aquifer. The flow direction through the well can be either upward or downward depending on site-specific conditions. Due to the fact ground water is not pumped above ground, the pumping costs and permitting issues are reduced. Also, the issues connected with storage and discharge is removed. Additionally circulating well systems can offer synchronised vadose zone treatment by means of bioventing or soil vapour extraction. For efficient in-well treatment, the contaminants must be sufficiently soluble and mobile so they can be transported by the circulating ground water.

Applicability:

The key contaminants for treatment via vacuum vapour extraction are halogenated VOCs, SVOCs, and fuels. Adaptations to the technology may mean some non-halogenated VOCs, SVOCs, pesticides, and inorganics can be treated. Usually, in-well air stripping systems are a cost-effective approach for remediating VOC-contaminated ground water at sites with deep water tables due to the fact the water does not need to be brought to the surface. CW systems are at their most efficient when treating sites impacted with volatile contaminants with relatively high aqueous solubility and strong biodegradation potential, e.g., halogenated and non-halogenated VOCs.

Limitations:

- UVB-type systems only treat the water in the stripping well.
- In general, in-well air strippers are more effective at sites containing high concentrations of dissolved contaminants with high Henry's law constants.
- Fouling of the system may occur by infiltrating precipitation containing oxidised constituents.
- Shallow aquifers may limit process effectiveness.

- Effective CW installations require a well-defined contaminant plume to prevent the spreading or smearing of the contamination. They should not be applied to sites containing NAPLs to prevent the possibility of smearing the contaminants.
- CWs are limited to sites with horizontal hydraulic conductivities greater that 10-5 cm/sec and should not be utilised at sites that have lenses of low-conductivity deposits.
- In well air stripping may not be efficient in sites with strong natural flow patterns.

Data Needs:

Standard data required.

Performance Data:

A variant of this process, called Unterdruck-Verdampfer Brunner (UVB), has been utilised at several sites in Germany and has been introduced lately into the United States. Stanford University has developed a further variation of the process, called NoVOCs, an in-well sparging system. It combines airlift pumping with a vapour stripping technique.

Cost:

Not currently known.