Ground Water, Surface Water, and Leachate

Bioslurping

Introduction:

Bioslurping merges the remedial technologies of bioventing and vacuum-enhanced free-product recovery. Bioventing encourages the aerobic bioremediation of hydrocarbon-impacted soils. Vacuum-enhanced free-product recovery removes LNAPLs from the capillary fringe and the water table.

Description:

Bioslurping uses elements of both, bioventing and free product recovery, to address two separate contaminant media by simultaneously recovering free product and bioremediation the vadose zone of soils. Bioslurping can enhance free-product recovery without extracting vast quantities of ground water. Vacuum-enhanced pumping allows the LNAPL to be lifted off the water table and removed from the capillary fringe, therefore minimising changes in the water table, which assists in preventing a smear zone. Bioventing is intended to reduce the environmental release of ground water and soil gas. When free-product removal is completed, bioslurping is transformed to a typical bioventing system to conclude the remediation process.

Depending upon site conditions the operation and maintenance time can vary from a few months to years.

Applicability:

Bioslurping has been utilised to remediate soils that are contaminated with petroleum hydrocarbons. It is a cost-efficient technology that concurrently accomplishes the removal or LNAPLs and soil remediation in the vadose zone. Bioslurping can also be applicable at sites with a deep ground water table (>30ft).

Limitations:

- Bioslurping is less effective in low-permeability soils.
- Low soil moisture content can slow biodegradation and the effectiveness of the bioventing process, which tends to dry the soils out.
- Aerobic biodegradation of chlorinated compounds may not be efficient unless there is a co-metabolite present.
- Low temperatures reduce remediation.
- Off-gas from the bioslurper system needs treatment prior to discharge. However, treatment of off-gas can only be undertaken shortly after the start-up of the system due to fuel rates decreasing.
- At certain sites, bioslurper systems can remove large volumes of water that may require treating before discharge, depending on the concentration of contaminants present in the process water.
- Due to the fact that fuel, water and air are removed from the subsurface in a single stream, mixing of the phases almost always occurs. Such mixtures require special oil/water separators or treatment before the treated water can be discharged.

Data Needs:

A feasibility test and an air permeability test are essential in order to determine design data, including time and quantity of release, and the thickness of free product.

Soil grain size and soil moisture greatly influence soil gas permeability. The greatest limitation to air permeability is excess soil moisture. Combinations of high water tables, high moisture, and fine-grained soils make bioslurping infeasible as a remediation option. Optimum soil moisture is soil-specific because too much moisture can reduce the air permeability of the soil and decrease the capability of oxygen transfer, while too little moisture can inhibit microbial activity.

Respiration testing is also required to enable rapid field measurement of the in situ rate of degradation.

Performance Data:

The U.S. Navy has employed bioslurping at the Naval Aviation Facility in Fallon, NV. The system removed 6,500 gallons of JP-5 jet fuel during 1993, with operation 75% of the time.

The U.S. Air Force used a bioslurper on Diego Garcia to remove JP-5 where jet fuel leaked into the ground during the Persian Gulf War. The recovery rate of JP-5 averaged approximately 1,000 gallons a month.

Cost:

Bioslurping of LNAPLs at multiple Air Force sites was thought to be in the region of £25 /gal LNAPL recovered.