

Ground Water, Surface Water, and Leachate

Air Stripping

Introduction:

Volatile organics are partitioned from ground water by increasing the surface area of the water exposed to the air. Aeration methods can include packed towers and diffused, tray and spray aeration.

Description:

Air stripping involves the mass transfer of volatile contaminants from water to air. For ground water remediation, the process is normally performed in an aeration tank. The typical packed tower air stripper include a spray nozzle at the top of the tower to deliver contaminated water over the packing in the column, where a fan is used to force air counter current to the water flow and a sump at the bottom of the tower to collect the decontaminated water. Packed tower air strippers are installed either as permanent installations on concrete pads or on a skid or a trailer.

Aeration tanks strip the volatile compounds by bubbling air into a tank through which contaminated water flows. A forced air blower and a distribution manifold are designed to ensure air-water contact without the need for packing materials. The baffles and multiple units ensure adequate residence time for stripping to occur. Aeration tanks are sold as continuously operated skid-mounted units. The advantages offered by aeration tanks are considerably lower profiles (less than 2 meters or 6 feet high) than packed towers (5 to 12 meters or 15 to 40 feet high) where height may be a problem, and the ability to modify performance or adapt to changing feed composition by adding or removing trays or chambers. The discharge air from aeration tanks can be treated using the same technology as for packed tower air discharge treatment.

Modifying packing arrangement can increase removal efficiency. A recent innovation is the low-profile air stripper. This unit packs a number of trays in a very small chamber to maximise air-water contact while minimising space. Due to the significant vertical and horizontal space savings, these units are increasingly being used in the treatment process.

Air strippers can be operated continuously or in a batch mode where the air stripper is fed from a collection tank. The batch mode guarantees consistent air stripper performance and superior energy efficiency than continuously operated units because mixing in the storage tanks reduce inconsistencies in feed water composition. The duration of cleanup using this system can be tens of years and be governed by the confinement of the plume in the ground water.

Applicability:

Air stripping is ineffective for inorganic contaminants. Henry's law constant is used to determine whether air stripping will be effective. Generally, organic compounds with constants larger than 0.01 atmospheres - m³/mol are deemed agreeable to stripping. Some compounds that have been successfully separated from water using air stripping include BTEX, TCE, DCE, and PCE.

Limitations:

- Potential exists for inorganic or biological fouling of the equipment, requiring pre-treatment or periodic column cleaning.
- Effective only for contaminated water with VOC or semi-volatile concentrations with a dimensionless Henry's constant greater than 0.01.
- Type and amount of packing used in the tower fundamental to success of treatment.
- Process energy costs are high.

- Compounds with low volatility at ambient temperature may require preheating of the ground water.

Data Needs:

The following information is required to select the proper configured tower and packing for a specific application: range of feed water flow rates; range of water and air temperatures; whether the tower will operate continuously or intermittently; tower feed and discharge systems (gravity feed or type and location of pumps); height restrictions on the tower; influent contaminant identification and concentrations; mineral content; pH.

Performance Data:

Removal efficiencies around 99% are characteristic for towers that have 4.6 to 6 meters of conventional packing and are removing compounds suitable to the stripping process. Adding a second air stripper in series with the first, heating the contaminated water, or changing the configuration of packing material can improve removal. The performance of aeration tanks can be improved by adding chambers or trays, or by increasing the air supply, depending on the design of the tank.

The major problem encountered with packed tower air strippers is fouling of the packing, which reduces the airflow rate. Fouling is caused by oxidation of minerals in the feed water, such as iron and manganese, the precipitation of calcium, and the potential for biological growth to occur on the packing material.

Cost:

Low Profile Tray Stacks

Key Cost Drivers

- Influent flow rate
- Relative contaminant volatility
- Off-gas treatment (when necessary)

Packed Towers

Key Cost Drivers

- Influent flow rate
- Relative contaminant volatility
- Off-gas treatment (when necessary)

A major operating cost of air strippers is the electricity required for the ground water pump, the sump discharge pump, and the air blower. As a general rule, pumps in the 4 to 80 litres per minute range require from 0.33 to 2 HP; from 80 to 290 litres per minute power ratings are 1 to 5 HP; and from 380 to 2,270 litres per minute, power ratings range from 5 to 30 HP.