Community Guide to Soil Vapor Extraction and Air Sparging

What Are Soil Vapor Extraction and Air Sparging?

Both soil vapor extraction, or "SVE," and air sparging extract (remove) contaminant vapors from below ground for treatment above ground. Vapors are the gases that form when chemicals evaporate. SVE extracts vapors from the soil above the water table by applying a vacuum to pull the vapors out. Air sparging, on the other hand, pumps air underground to help extract vapors from groundwater and wet soil found beneath the water table. The addition of air makes the chemicals evaporate faster, which makes them easier to extract with another technology, such as SVE.

SVE and air sparging are often used together. Both methods are used for chemicals that evaporate easily—like those found in solvents and gasoline. These chemicals are known as "volatile organic compounds," or "VOCs."

How Do They Work?

Extraction:

SVE involves drilling one or more extraction wells into the contaminated soil to a depth above the water table, which must be deeper than 3 feet below the ground surface. Attached to the wells is equipment (such as a blower or vacuum pump) that creates a vacuum. The vacuum pulls air and vapors through the soil and up the well to the ground surface for treatment.

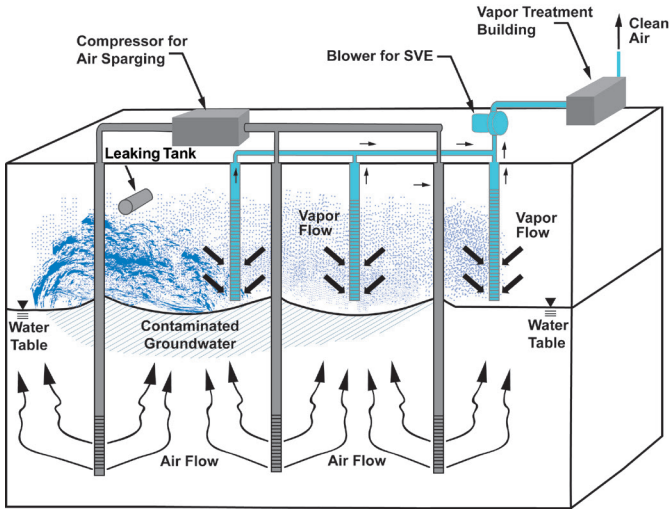

Illustration of a combined air sparging and SVE system.

Sometimes the ground must be paved or covered with a tarp to make sure that the vacuum does not pull air from above into the system. Pulling in clean air would reduce the efficiency of the cleanup. The cover also prevents any vapors from escaping from the ground to the air above.

Air sparging involves drilling one or more injection wells into the groundwater-soaked soil below the water table. An air compressor at the surface pumps air underground through the wells. As air bubbles through the groundwater, it carries contaminant vapors upward into the soil above the water table. The mixture of air and vapors is then pulled out of the ground for treatment using SVE.

Treatment:

Extracted air and contaminant vapors, sometimes referred to as "off-gases," are treated to remove any harmful levels of contaminants. The off-gases are first piped from the extraction wells to an air-water separator to remove moisture, which interferes with treatment. The vapors are then separated from the air, usually by pumping them through containers of activated carbon. The carbon captures the chemicals while clean air exits to the atmosphere. (See *Community Guide to Granular Activated Carbon Treatment*.)

Filter materials other than activated carbon may be used. In a process called "biofiltration," tiny microbes (bacteria) are added to break down the vapors into gases, such as carbon dioxide and water vapor. Another option is to destroy vapors by heating them to high temperatures.

How Long Will It Take?

Cleaning up a site using SVE or air sparging may take several years. The cleanup time will depend on

several factors that vary from site to site. For example, SVE and air sparging will take longer where:

- Contaminant concentrations are high.
- The contaminated area is large or deep.
- The soil is dense or moist, which slows the movement of vapors.

Are SVE and Air Sparging Safe?

When properly designed and operated, SVE and air sparging pose little risk to site workers or the community. Treatment of the vapors involves no harmful chemicals that must be transported to the site. Chemical vapors are contained from extraction to treatment so they cannot be accidentally inhaled by anyone nearby. Only clean air that meets air quality standards is released. The air released to the atmosphere following treatment may be sampled to make sure all harmful vapors have been removed or destroyed.

How Might They Affect Me?

You may notice some increased truck traffic as the equipment for SVE or air sparging is delivered and later removed. Installation of the systems involves drilling rigs and sometimes other heavy machinery to install wells, blowers and treatment equipment. Sheds or larger buildings may be built to house the treatment systems and keep operating noise to a minimum. Workers will visit these systems regularly to ensure they are working.

Why Use Soil Vapor Extraction and Air Sparging?

SVE and air sparging are efficient ways to remove VOCs above and below the water table. Both methods can help clean up contamination under buildings and cause little disruption to nearby activities when in full operation. SVE and air sparging have been selected for use at Superfund sites and other cleanup sites across the country.

Pipes transport vapors from the underground SVE extraction well to treatment.

Aboveground treatment system includes two tanks of activated carbon.

Example

Both SVE and air sparging are being used to clean up several acres of contaminated soil and groundwater at the Vienna PCE Superfund site in West Virginia. Two dry cleaning facilities contaminated the area with perchloroethene (also known as PCE), a solvent used to clean clothing, forcing the shutdown of the town's drinking water wells.

In 2005, construction of the cleanup systems was completed and included 74 air sparging wells, 34 extraction wells, and four treatment buildings. The off-gases are piped to an air-water separator, followed by containers of activated carbon for treatment. By the end of 2015, over 1,859 pounds of PCE had been removed. PCE concentrations are decreasing. EPA will continue to operate the systems and monitor PCE levels until cleanup objectives are met throughout the site.

For More Information

- About this and other technologies in the Community Guide Series, visit: https://clu-in.org/cguides or https://clu-in.org/remediation/
- About use of cleanup technologies at a Superfund site in your community, contact the site's community involvement coordinator or remedial project manager. Select the site name from the list or map at http://www.epa.gov/superfund/sites to view their contact information.

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