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EPA

A Citizen's Guide to Soil Vapor Extraction and Air Sparging

The Citizen's Guide Series

EPA uses many methods to clean up pollution at Superfund and other sites. If you live, work, or go to school near a Superfund site, you may want to learn more about cleanup methods. Perhaps they are being used or are proposed for use at your site. How do they work? Are they safe? This Citizen's Guide is one in a series to help answer your questions.

What are soil vapor extraction and air sparging?

Soil vapor extraction or *SVE* removes harmful chemicals, in the form of *vapors*, from the soil above the water table. Vapors are the gases that form when chemicals evaporate. The vapors are extracted (removed) from the ground by applying a vacuum to pull the vapors out.

What is the Water Table?

The water table is the level of groundwater below the ground surface.

Air sparging uses air to help remove harmful vapors from polluted soil and groundwater below the water table. When air is pumped underground, the chemicals evaporate faster, which makes them easier to remove. Like SVE, a vacuum then extracts the vapors. Certain chemicals—like solvents and fuel—evaporate easily. SVE and air sparging work best on these types of chemicals. SVE and air sparging are often used at the same time to clean up both soil and groundwater.

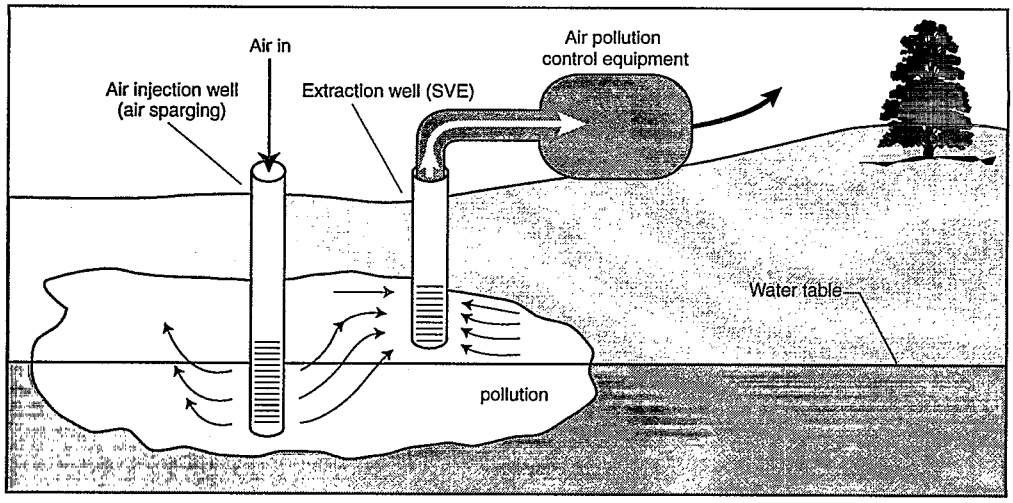
How do they work?

SVE requires drilling *extraction wells* within the polluted area. These wells are drilled into the soil, but not the groundwater. Attached to the wells is equipment that creates a vacuum, which pulls air and vapors through the soil and up to the surface.

Air injection wells can be drilled to help the cleanup. Air injection wells pump air into the ground. The air causes the pollution to evaporate faster. Sometimes air vents are used instead of air injection wells. Air vents don't pump air, but provide a passage for fresh air to enter the ground. The number of air injection and extraction wells can range from one to hundreds, depending on the size of the polluted area.

Once the extraction wells pull the air and vapors out of the ground, special air pollution control equipment collects them. The equipment separates the harmful vapors from the clean air. Then, the vapors *sorb* or stick to solid materials. Or they are condensed to liquids. These polluted solids and liquids are disposed of safely.

Air sparging works very much like SVE. However, the wells that pump air into the ground are drilled into water-soaked soil below the water table. Air pumped into the wells disturbs the groundwater. This helps the pollution change into vapors. The vapors rise into the drier soil above the groundwater and are pulled out of the ground by extraction wells. The harmful vapors are removed in the same way as SVE.

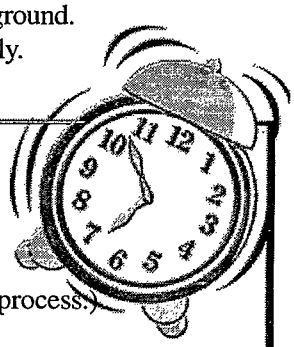


The air used in SVE and air sparging also helps clean up pollution by encouraging the growth of *microbes*. These tiny bugs are found naturally in soil and can use pollution for food. When microbes completely digest pollution, they can change it into water and harmless vapors. (*A Citizen's Guide to Bioremediation* [EPA 542-F-01-001] describes how microbes work.)

Are soil vapor extraction and air sparging safe?

When properly designed and operated, SVE and air sparging are safe cleanup methods. No one has to dig up the pollution, and no chemicals—just air—are added to the ground. EPA makes sure that harmful vapors are collected and disposed of properly.

How long will it take ?



Cleaning up a site using SVE and air sparging can take years. The time depends on several factors:

- size and depth of the polluted area
- type of soil and conditions present (wet or dense soil can slow the process.)
- type and amounts of harmful chemicals present

The air injected into the ground can be heated to speed up the process. The heated soil helps evaporate the chemicals faster. Also, other sources of heat, like steam or hot water can be pumped into the injection wells to heat up the soil. (See *A Citizen's Guide to In Situ Thermal Treatment* [EPA 542-F-01-012].)

Why use soil vapor extraction and air sparging?

SVE and air sparging are quicker than cleanup methods that rely on natural processes to do the work. In general, the wells and equipment are simple to install and maintain. And they can reach greater depths than methods that involve digging up soil. SVE and air sparging are effective at removing many types of pollution that can evaporate. Both methods can be used with other methods to clean up other types of pollution as well. Both methods work best in loose soils—like sand and gravel. But they both work well under many types of conditions.

SVE and air sparging are often chosen to clean up Superfund sites. EPA has selected SVE for use at approximately 196 sites and air sparging for use at roughly 48 sites.

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