

# Soil Vapor Extraction Versus Bioventing for Petroleum Remediation

Petroleum-based spills are among the most prevalent of all contaminants. Whether oil, gasoline or other derived product, most of them have one thing in common – they can be relatively easy to remediate over time.

When confined to land, these spills are often remediated using a common technology known as soil vapor extraction (SVE). This is an in-situ technique whereby the volatile and semi-volatile components of the petroleum-based hydrocarbons are drawn into extraction wells using a vacuum applied to the contaminated soils. The volatile vapors are then removed from the extraction wells, treated and either released or placed in permitted injection wells.

This process works very well on spills in the vadose (unsaturated) zone – the layer of soil that begins at the surface of the earth and extends to the water table. Contaminants like gasoline that volatilize quickly respond very well to SVE in the vadose zone. Other heavier, less volatile petroleum products respond better to microbiological activity enhanced by air pulled through the contaminated area. This highly effective remediation technology that relies primarily on bacterial activity is called bioventing.

Bioventing is a hybrid of technology and Mother Nature. The natural degradation of some types of contaminants by bacteria has been recognized for many years. However, remediation experts discovered they could assist and enhance this process by simply adding air to the equation.



*Photograph of monitor wells, biovent wells and monitor points.*

The aerobic bacteria that live in soil will consume hydrocarbons when conditions like moisture, pH, and temperature are right. However, when available oxygen is depleted by the bacteria feeding on the hydrocarbons, the process slows and eventually halts as the bacteria die of asphyxiation. They essentially eat and breathe themselves to death.

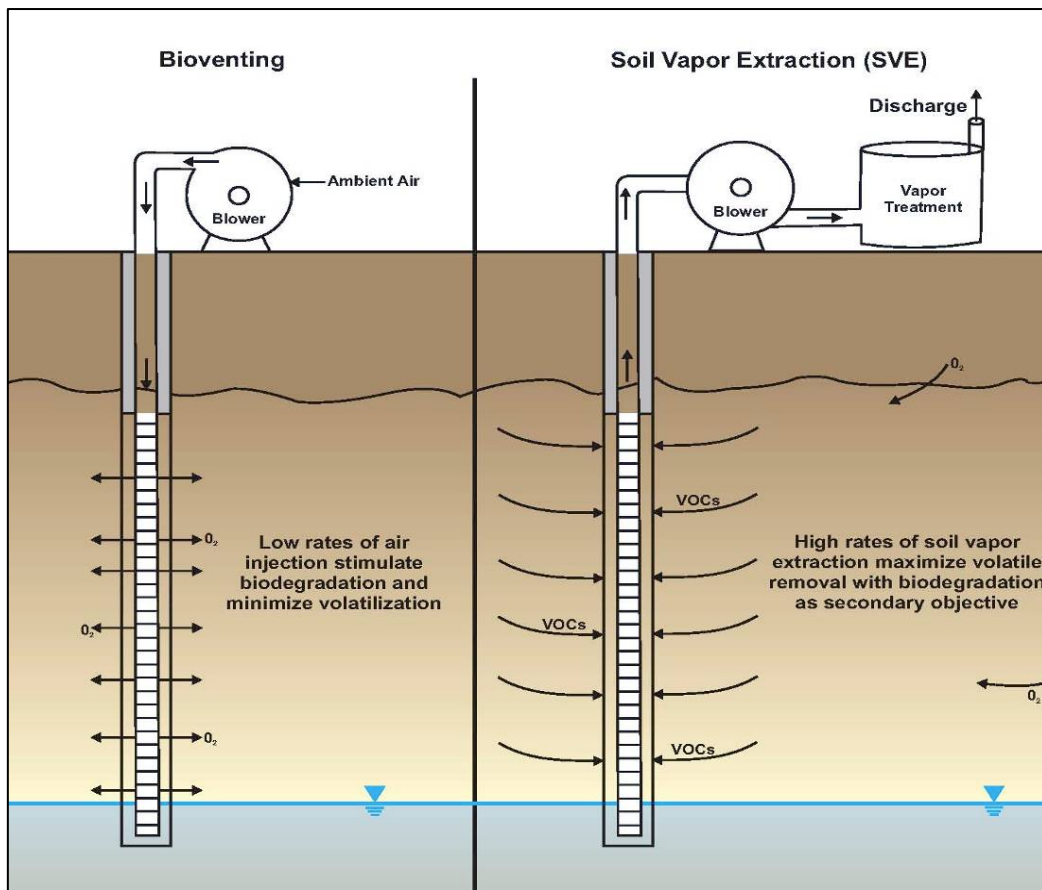


*Photograph of a typical biovent blower and enclosure.*

According to the U.S. Environmental Protection Agency (EPA), approximately 3-3.5 pounds of oxygen are required to degrade one pound of petroleum product. This air can be introduced using the same equipment employed by SVE, except that there is no resulting volatilized gas to treat or dispose of since bioremediation renders only carbon dioxide and water as byproducts.

The key to successful bioventing is to supply only enough oxygen to enhance and sustain the bacterial activity. This process minimizes vapor travel and expansion of the bioreactive zone. The speed of remediation is relative to the weight of the product and heavier contaminants are generally less volatile and degrade slower than lighter weight contaminants.

Of course, not all technologies work in all subsurface environments. Very wet or very tight soils limit the amount of air that can be transported. Both of these scenarios will extend the remediation time period required, however, low operating and maintenance costs can make up for an expanded cleanup time.



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Let's consider an example where a barrel or two of hydrocarbons was released and covered 50 feet of sandy soil column. The initial cost of equipment for the bioventing system is relatively small and consists of a low-pressure blower with a two-horsepower motor. Unlike SVE, there are no expensive vapor treatment technologies such as catalytic oxidizers or activated carbon usage rates. High motor operation and heater electrical costs are also not associated with bioventing and there are usually no emissions tracking requirements.

Where SVE would likely require weekly visits to adjust a catalytic oxidizer, check for carbon breakthrough and track air emissions, bioventing visits are generally monthly with no motor maintenance or well manipulation. Vapor sampling can be reduced to quarterly or semi-annually. If the bugs take longer than expected to do their job, the incremental cost to extend bioventing is nominal compared to the operation and maintenance of SVE systems.

Not all contaminated sites offer the opportunity to utilize bioventing technology and in many cases, SVE technology must be used. However, if a spill occurs and the site conditions are appropriate, bioventing should be considered by your environmental professional. It may save you a significant amount of money in remediating the spill.

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