A Citizen's Guide to Thermal Desorption

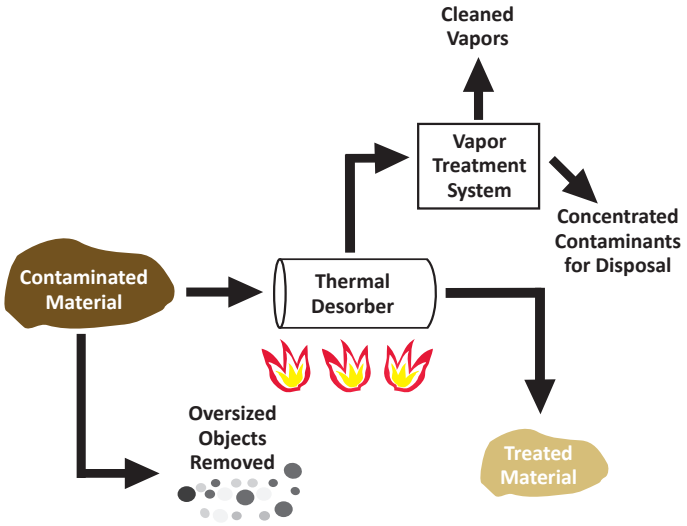
What Is Thermal Desorption?

Thermal desorption removes organic contaminants from soil, sludge or sediment by heating them in a machine called a "thermal desorber" to evaporate the contaminants. Evaporation changes the contaminants into vapors (gases) and separates them from the solid material. Many organic contaminants can be removed by thermal desorption. These include volatile organic compounds or "VOCs" and some semi-volatile organic compounds or "SVOCs." VOCs such as solvents and gasoline evaporate easily when heated. SVOCs require higher temperatures to evaporate and include diesel fuel, creosote (a wood preservative), coal tar, and several pesticides. Thermal desorption generally is not used to treat metals but can partially remove metals like mercury and arsenic, which evaporate at the temperatures sometimes reached in thermal desorption.

A thermal desorber is not the same as an incinerator, which heats contaminated materials to temperatures high enough to destroy the contaminants. (See *A Citizen's Guide to Incineration* [EPA 542-12-010].)

How Does It Work?

Thermal desorption involves excavating soil or other contaminated material for treatment in a thermal desorber. The desorber may be assembled at the site for onsite treatment, or the material may be loaded into trucks and transported to an offsite thermal desorption facility. To prepare the soil for treatment, large rocks or debris first must be removed or crushed. The smaller particle size allows heat to more easily and evenly separate contaminants from the solid material. If the material is very wet, the water may need to be removed to improve treatment. This water removed may require treatment using other methods.



Thermal desorber heats contaminated material to evaporate contaminants.

The prepared soil is placed in the thermal desorber to be heated. Low-temperature thermal desorption is used to heat the solid material to 200-600°F to treat VOCs. If SVOCs are present, then high-temperature thermal desorption is used to heat the soil to 600-1000°F.

Gas collection equipment captures the contaminated vapors. Vapors often require further treatment, such as removing dust particles. The remaining organic vapors are usually destroyed using a thermal oxidizer, which heats the vapors to temperatures high enough to convert them to carbon dioxide and water vapor. At some sites with high concentrations of organic vapors, the vapors may be cooled and condensed to change them back to a liquid form. The liquid chemicals may be recycled for reuse, or treated by incineration. If the concentrations of contaminants are low enough, and dust is not a problem, the vapors may be released without treatment to the atmosphere.

Often, treated soil can be used to fill in the excavation at the site. If the treated soil contains contaminants that do not evaporate, such as most metals, they may be disposed of and capped onsite, or transported offsite to an appropriate landfill.

How Long Will It Take?

Thermal desorption may take from a few weeks to a few years. The actual cleanup time will depend on several factors. For example, thermal desorption may take longer where:

- The contaminated area is large or deep.
- Contaminant concentrations are high.
- The soil contains a lot of dust, clay, or organic material, which causes contaminants to stick to the soil and not evaporate easily.

- A lot of debris must be crushed or removed.
- The capacity of the desorber is small. (Most thermal desorbers can clean over 25 tons of contaminated material per hour.)

These factors vary from site to site.

Is Thermal Desorption Safe?

Thermal desorption has been safely used at many Superfund sites. EPA makes sure that materials are handled properly at each stage of the process. Workers take measures, such as covering loose soil, to control dust and vapors during excavation and treatment. If necessary, they collect and treat the gases that are produced in the desorber.

How Might It Affect Me?

Excavating soil and other contaminated materials for thermal desorption involves the use of heavy machinery, such as backhoes and bulldozers, which may be noisy. Excavation of soil and sediment may release dust and vapors into the air but this is controlled with covers, foam, or water. Nearby residents and businesses also may see increased truck traffic when excavation equipment and thermal desorption systems are delivered to the site. If an offsite desorber is used, truckloads of soil must be transported from the site to the desorber.

Why Use Thermal Desorption?

Thermal desorption is typically used to clean up soil that is contaminated with VOCs and SVOCs at depths shallow enough to reach through excavation. Thermal desorption may be faster and provide better cleanup than other methods, particularly at sites that have high concentrations of contaminants. A faster cleanup may be important if a contaminated site poses a threat to the community or needs to be cleaned up quickly so that it can be reused.

Thermal desorption is being used or has been selected for use at over 70 Superfund sites across the country.

Onsite thermal desorber.

Example

High-temperature thermal desorption was used to clean up contaminated soil at the Industrial Latex Superfund site in New Jersey. From 1951 to 1983, Industrial Latex manufactured rubber and adhesives, contaminating soil with SVOCs, PCBs, and arsenic.

From April 1999 to June 2000, about 53,600 cubic yards of contaminated material were excavated to depths of up to 14 feet. Materials greater than 2 inches in diameter were removed before placing the soil in the desorber and heating it to 900°F. About 225 tons of contaminated soil were treated each day. A small amount of treated soil had to be placed back in the desorber a second time to meet cleanup goals for PCBs, SVOCs, and arsenic. The cleaned soil was used to backfill the areas that had been excavated.

Vapors from the desorber passed through scrubbers and filters that removed dust particles and a filter that removed contaminant vapors. Air quality was monitored daily to make sure the air released from the desorber met permitted levels.

For More Information

For more information on this and other technologies in the Citizen's Guide Series, contact:

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Or visit:
www.cluin.org/ThermalEx

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