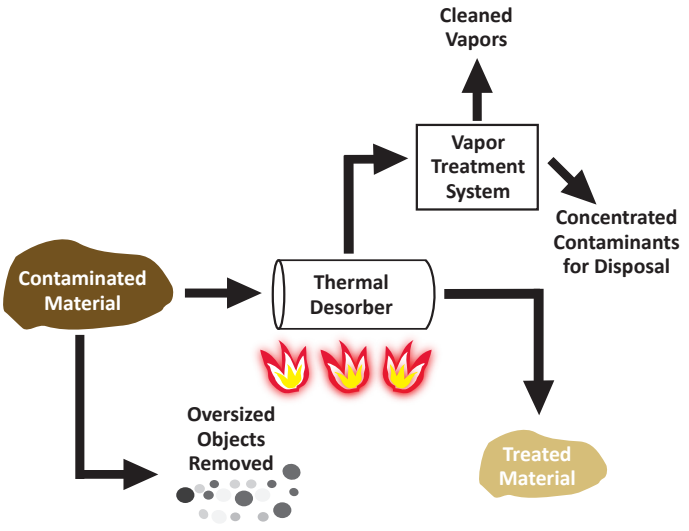
Community Guide to Thermal Desorption

What Is Thermal Desorption?

Thermal desorption removes contaminants by heating them so that they un-stick (desorb) from soil, sludge or sediment. This heating is done in a machine called a thermal desorber, and causes the contaminants to evaporate. Evaporation changes the contaminants into vapors (gases) and separates them from the solid material. Thermal desorption can remove many organic contaminants. These include volatile organic compounds, or "VOCs," and some semi-volatile organic compounds (SVOCs). VOCs such as solvents and gasoline evaporate easily when heated. SVOCs such as diesel fuel, creosote (a wood preservative), coal tar and some pesticides require higher temperatures to evaporate. Thermal desorption generally is not used to treat metals but can partially remove metals like mercury and arsenic, which may evaporate at the temperatures used 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 *Community Guide to Incineration*.)



Thermal desorber heats contaminated material to evaporate contaminants.

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 soil for treatment, large rocks or debris are first 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, water may need to be removed to improve treatment. The water may require treatment using other methods.

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

Gas collection equipment captures the vapors, which may require further treatment, such as removal of dust particles. 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 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.

Treated soil often can be used to backfill the excavation at the site.

How Long Will It Take?

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

- The contaminated area is large or deep.
- Contaminant concentrations are high.
- The soil contains a lot of 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.)

Is Thermal Desorption Safe?

A well-designed and operated desorber will safely remove harmful chemicals from contaminated materials. Workers take measures, such as covering loose soil during excavation, to control dust and vapors. Proper temperatures are maintained in the desorber to ensure complete removal of contaminants. If necessary, gases will be collected for treatment.

How Might It Affect Me?

You may notice increased truck traffic when excavation equipment and thermal desorption systems come to the site. You also might hear heavy machinery, such as backhoes and bulldozers, during construction and treatment. If an offsite desorber is used, truckloads of soil must be transported from the site to the desorber.

Why Use Thermal Desorption?

Thermal desorption can be used to clean up soil that has been contaminated with VOCs and SVOCs 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 has been selected for use at dozens of Superfund sites and other cleanup sites across the country.

Onsite thermal desorber.

Example

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 PCBs and SVOCs.

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 and SVOCs. The cleaned soil was used to backfill the excavated areas.

Vapors from the desorber passed through scrubbers and filters that removed dust particles and contaminant vapors. Air quality was monitored daily to make sure the air released from the desorber met permitted levels. The site was removed from the National Priorities List in 2003.

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.