U S EPA FACT ABOUT THERMAL DESORPTION NAS JACKSONVILLE FL
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EPA Facts About *Thermal Desorption*

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What is thermal desorption?

Thermal desorption is a low-temperature heat line separation process designed to remove organic contaminants from soils and *sludges.* Contaminated soils are heated at relatively low temperatures (200°F to 900°F) so that only those contaminants with low boiling points will vaporize by turning into a gas. These vaporized contaminants removed from the soils or liquids are collected and treated. Thermal desorption is not an incinerator system, and no hazardous combustion by-products are formed. Thermal desorption technology is useful in treating organic contaminants that become gases at relatively low temperatures. These contaminants include volatile organic compounds (VOCs), polychlorinated biphenyls (PCBs), and some polynuclear aromatic hydrocarbons (PAHs).

How does thermal desorption technology work?

Thermal desorption is a three step process: first, the soil is heated to vaporize the contaminants; next, the vaporized contaminants are treated; and, finally, the treated soil is tested. The contaminated soil is heated at temperatures between 200° F and 900° F to reduce the chance that the organic contaminants will ignite. Four different methods of heating the soil are available. Each method is described below:

(1) **In-place steam extraction** (Figure 1): The contaminated soil is left in place while steam is pumped through the ground. The contaminants vaporize to a gas form, move through the air spaces in the soil, and the gases are collected by a vacuum. Since steam, and not a flame, is used to vaporize the contaminants, there is no risk that the organic contaminants will ignite and form hazardous combustion by-products.

(2) **Direct heating**: This heating method is like heating with a gas oven in your home. A disadvantage of this heating method is that the flame is in direct contact with the contaminants, and therefore, increases the chances that the contaminants will burn and form hazardous combustion by-products.

(3) **Indirect heating**: The contaminated soil is placed in a kiln-type furnace. The outside of the kiln is heated using fuel oil, and the heat is transferred through the kiln's metal surface to the soil. Since the soil is enclosed in the kiln, the fuel's combustion by-products and the vaporized contaminants do not mix.

(4) **Oxygen free heating**: The soil is placed in a container which is sealed to avoid any contact between the soil and oxygen in the air. The outside of the container is heated using a burner system, and the contaminants vaporize. Without air, the risk of forming combustion by-products is virtually eliminated.

What happens once the contaminants are vaporized?

Once vaporized, the contaminants can be treated in the same manner regardless of which heating method is used. The vaporized contaminants may be cooled and condensed into a liquid, which is then placed in drums for treatment or disposal. The vaporized contaminats may also be treated using a carbon filtration system to meet applicable federal, state, and local air emission standards.

Once thermal desorption is completed using one of the four heating methods described above, the soil is tested to verify that all contaminants have been removed. The moisture content is adjusted to eliminate dust particles and produce a solid that is ready to be placed and compacted in its original location. The organic contaminants and water vapor driven from the solids are transported out of the dryer by a nonreactive nitrogen gas. The inert gas flows through a duct to the gas treatment system, where organic vapors, water vapors, and dust particles are removed from the gas. This gas treatment system is made up of a high-energy *scrubber* in which dust particles and 10 to 30 percent of the organic contaminants are removed. The gases then pass through two heat exchangers, where they are cooled to below 40°F. Most of the remaining water and organic vapors are condensed to liquids in the *heat exchangers.* The cleaned soils and sludges can be returned to the site as backfill.

Why consider thermal desorption?

Thermal desorption has a high success rate in removing volatile organic compounds (VOCs). VOCs are chemicals which tend to vaporize easily into the air, creating an exposure hazard by inhalation. Existing equipment is capable of treating up to 10 ons of contaminated soil per hour. In addition, since thermal desorption operates at low temperatures, the risk of VOCs and other organic contaminants burning and, consequently, forming hazardous gaseous emissions is reduced. Finally, the low temperatures require less fuel than other treatment technologies, and so this method is less costly.

What kinds of waste can be treated by thermal desorption?

This technology was developed primarily for on-site remediation (clean-up) of soils contaminated with organic contaminants. The process can remove and collect volatiles, semi-volatiles, and PCBs, and has been demonstrated on a variety of soils ranging from sand to very heavy clays. Filter cakes from water treatment processes and pond sludges have also been successfully processed. In most cases, volatile organics are reduced to below 1 part per million (ppm) and frequently to below the levels which the laboratory can detect.

Thermal desorption cannot be used to treat heavy metals, with the exception of mercury. Tars and heavy pitches cannot be processed using this technology because they create materials handling problems.

GLOSSARY

Heat Exchangers: A chamber used to add or remove heat; a common example is a car radiator which uses water (coolant) to accept the heat of your car's engine and releases this heat to the atmosphere as the heated water passes through the exposed metal chambers (fins) of the radiator. An air conditioner works on a similar principle.

Scrubber: An air pollution device that uses a spray of water (or reactant) or a dry process (such as filters or centrifugal scrubbers) to trap pollutants in gaseous emissions.

Sludges: A semi-solid waste product generated from air or water treatment processes.

For more information about Thermal Desorption, please contact EPA at the following address:

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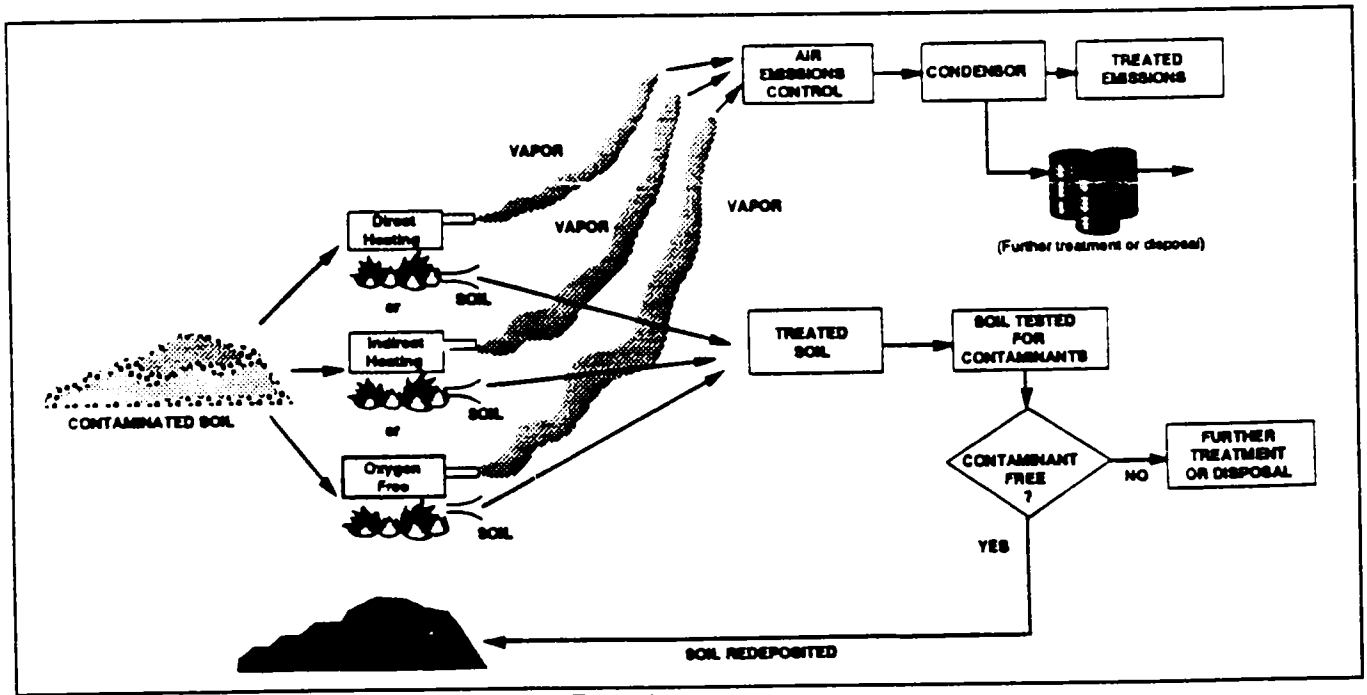

Figure 1: Thermal Desorption Process Following Soil Excavation

The information contained in this fact sheet was compiled from A Citizen's Guide: Thermal Desorption, a publication of the U.S. Environmental Protection Agency, November, 1991.