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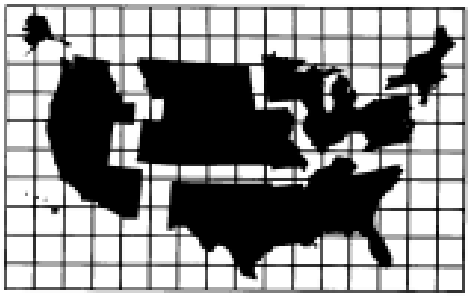

adapted by P. Kulakow

A Guide to Thermal Desorption

Adapted from EPA Technology Fact Sheet: EPA 542-F-96-005

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Thermal desorption is one of many methods used to clean up soil that has been contaminated with hazardous chemicals. The purpose of this brief is to describe thermal desorption along with some of its advantages and disadvantages. Before any cleanup method is chosen for use at a location, many potential cleanup choices must be carefully studied and compared to determine how well each will work at that site. The information presented in this brief has been adapted from the EPA Technology Fact Sheet: EPA 542-F-96-005.

What is thermal desorption?

Thermal desorption is a way to treat soils contaminated with hazardous wastes. By heating these soils to temperatures of 200-1,000 degrees F, contaminants with low boiling points will vaporize or turn into gas and separate from the soil. These vaporized contaminants are then collected and treated, usually by an air emissions treatment system. (If there are other contaminants present in the soil, they are treated in other ways.)

Thermal desorption is a different process than incineration because it uses heat to physically separate the contaminants from the soil. They will then require further treatment. Incineration uses heat to actually destroy the contaminants.

How does thermal desorption work?

Typical thermal desorption systems are made up of three parts: the pretreatment and material handling system, the desorption unit, and the post-treatment system for both the gas contaminants and the remaining soil (See Figure 1 on page 2).

Pretreatment and Material Handling System

Pretreatment of contaminated material involves sifting it to remove large clods and foreign objects. If the contaminated material is very wet or has a lot of contamination, it may need to be mixed with sand or dried to make it a more workable product for treatment in the desorption unit.

Desorption Unit

The desorption unit is used to heat the contaminated soil to a high enough temperature for a long enough time to dry it and vaporize the contaminants from it. A common design for this unit is a rotary desorber, which has a rotating, cylindrical metal drum. In a direct-fired rotary desorber, the contaminated soil enters the rotating cylinder and is heated by direct contact with a flame or the hot gasses coming off a flame. In an indirect-fired rotary desorber, the soil does not come into contact with a flame or combustion gases. Instead, the outside of the cylinder is heated and the hot metal indirectly heats the soil tumbling inside. As the soil is heated, the contaminants vaporize and become part of the gas stream of air and contaminated vapors flowing through the desorber toward the post-treatment system. Sometimes a non-reactive gas, such as nitrogen, is added to the gas stream to keep the vaporized contaminants from catching fire in the desorption unit and to help in vaporizing and removing the contaminants.

Post-Treatment System

"Offgas" from the desorber is usually processed to take out particulate matter still in the gas stream after the desorption step. The vaporized contaminants in this offgas may be burned in an afterburner, collected on activated carbon, or recovered in condensation equipment. Depending on what the contaminants are and the amount of them present, any or all of these methods can be used. But disposal methods must meet federal, state, and local standards.

Treated soil from the desorber is tested to see how well the process worked in removing the target contaminants. This is usually done by comparing the contaminant levels in treated soils with those of untreated soils. If the treated soil is nonhazardous, it is put back on site or taken somewhere else to be used as backfill. If, however, the soil needs further treatment, it may be treated using another method, or taken off site for disposal.

Why consider thermal desorption?

Thermal desorption works well at separating organics from refining wastes, coal tar wastes, waste from wood treatment, and paint wastes. It can separate solvents, pesticides, PCBs, dioxins, and fuel oils from contaminated soil. The equipment needed to do this can treat up to 10 tons of contaminated soil per hour. Finally, the lower temperatures used in the desorber take less fuel than other treatment methods.

Will it work at every site?

Thermal desorption does not work on most metals, although mercury can be removed by this process. Other metals will tend to stay in the soil and not evaporate enough to be reasonably separated from the soil. Also, capturing evaporated metals might complicate the offgas treatment. A decision about metals needs to be made before the soil is processed.

Thermal desorption does not work well for treating all types of soil. If the soil is wet, water will vaporize along with the contaminants. This means more fuel would be needed to vaporize all of the contaminants in wet soil. Soils high in silt and clay are also harder to treat with thermal desorption. When silt and clay are heated, they give off a dust which can interfere with the air emission equipment used to treat the vaporized contaminants. Also, tightly packed soil often won't permit the heat to make contact with all the contaminants, making it more difficult for them to vaporize. Finally, thermal desorption would not be a very good choice for treating heavy metal contaminants, since they do not separate easily from soil; or strong acids, since they can corrode the treatment equipment.

Where is thermal desorption being used?

Thermal desorption is the treatment method of choice at many Superfund sites. For example, it was used at the TH Agriculture & Nutrition Company site in Albany, Georgia, to treat 4,300 tons of soil contaminated with pesticides. The system ran from July to October 1993 and met the cleanup goals, removing over 98% of the pesticides in the treated soil.

References:

EPA Technology Fact Sheet:EPA 542-F-96-005

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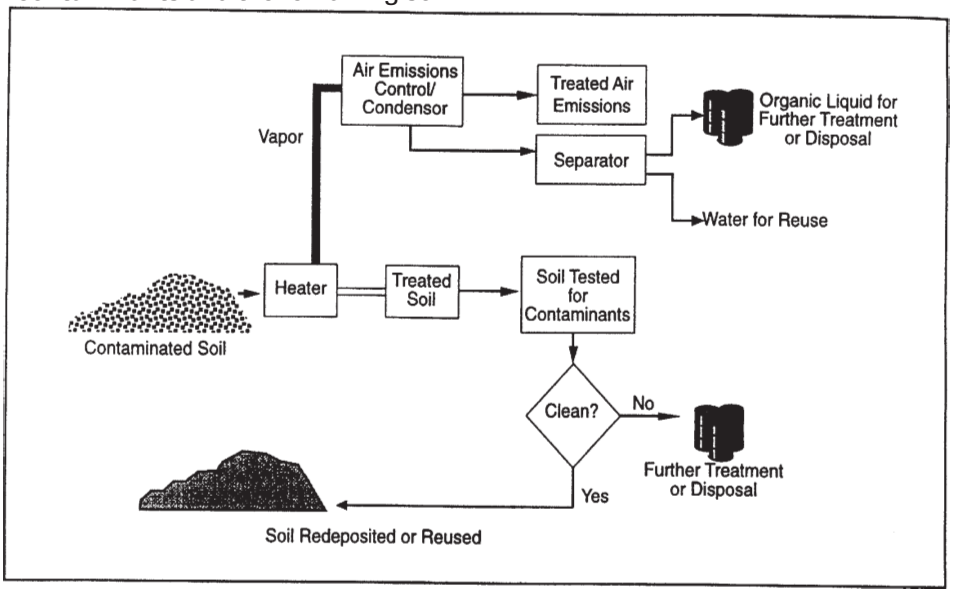
ABOUT THE AUTHOR: Peter Kulakow has a Ph.D. degree in genetics from the University of California-Davis and is currently doing research on the use of vegetation to clean up hazardous waste sites.

Figure 1. The Thermal Desorption Process. Typical thermal desorption systems are made up of three parts: the pretreatment and material handling system, the desorption unit, and the post-treatment system for both the gas contaminants and the remaining soil.



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