Frequently Asked Questions – FAQ (click to follow link)

How Does The Thermal Well System Work?

The electrical heating elements which are similar to those in an electric oven or toaster hang within pipes installed in the contaminated ground. The heat radiates from the heater elements out to the walls of the pipes, after which it moves into the surrounding formation primarily by thermal conduction. Arrays of thermal wells are used to treat a larger volume at one time, with a typical spacing between wells being about 2 to 6 m. As the soil heats up, water and contaminants in the targeted zone are vaporized. The vapors are drawn out of the soil and into heater-vacuum wells by a vacuum unit, and routed into a vapor processing facility that treats air emissions to meet the required standards.

How Much Does It Cost?

Costs depend on a variety of factors including depth of contamination, soil moisture, contaminant types, and the hydrogeology. In general, In Situ Thermal Desorption is cost competitive with alternative processes in many cases, since excavation, backfilling, and off-site disposal are not required. Also, in many industrial and utility applications, remediation can be completed with minimal disruption to ongoing operations, reducing the overall cost impact. Remediation costs are confirmed after the design has been completed, so that accurate estimates can be given for each site.

Isn't the Power Itself Excessively Expensive?

The power cost is not that high, and represents about 10-15% of the overall cost. Factors include electricity rates, soil moisture, and the geometry of the treatment zone.

What Are The Risks Of Using ISTD?

Working in the subsurface can be uncertain regardless of the technology. The In Situ Thermal Desorption process is quite robust, but at each project site we attempt to avoid overdesigning the system by sizing it to the mass estimated to be in the ground, based on pre-existing site data. If unexpectedly high contaminant mass is encountered, additional time and/or costs may be entailed to address it. Similarly, we design the system to address the estimated water content in the ground; if much greater amounts of water are encountered than expected based on pre-existing data, the time and/or cost to address it can be significant. This is true for other in-situ thermal technologies as well.

Other potential risks, such as electrical hazards, are dealt with using sound work practices and experienced personnel.

Which Contaminants Can Be Treated This Way?

In Situ Thermal Desorption will treat just about any organic compound, including:

- Polychlorinated biphenyls (PCBs), dioxins and dibenzofuran
- Polycyclic aromatic hydrocarbons (PAHs), often present in creosote at wood treatment sites, and coal tar at former Manufactured Gas Plant sites
- Trichloroethene (TCE), tetrachloroethene (PCE), 1,2-dichloroethene (1,2-DCE), trichloroethanes (TCA), and other halogenated hydrocarbons, often referred to as chlorinated solvents
- Pesticides and herbicides
- Petroleum, petroleum products and their volatile constituents including benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl tertiary butyl ether (MTBE)
- Any other volatile or semi-volatile hydrocarbon
- Dense and light non-aqueous phase liquids (DNAPLs and LNAPLs)

- Nearly any other organic compounds or combination of organic compounds

The technology can also collect and capture some low boiling point metals, such as mercury, arsenic, and certain organic forms of cadmium and lead.

Which Contaminants Cannot Be Cleaned With In Situ Thermal Desorption?

- Heavy metals other than Mercury and Arsenic
- Inorganics
- If controlling groundwater influx is impractical then treating SVOCs below the water table to achieve stringent goals may not be possible

How Clean Does It Get?

In comparison with other technologies, contaminant destruction and removal by In Situ Thermal Desorption is very complete. For groundwater VOC sites, concentrations are reduced to less than 1 mg/kg and 0.1 mg/L in soil and groundwater, respectively. Where desired, the system may be operated long enough to achieve Maximum Concentration Limit (MCL) concentrations in the groundwater, and non-detect in soils. For SVOC treatment in soils, non-detect concentrations have been achieved by treating at 300-350 °C for a period of several weeks. Basically, the ISTD system can be designed for the desired remedial efficiency, as demanded by the local regulations.

How Deep Can Thermal Wells Operate?

Thermal wells can be used to treat contaminants to theoretically hundreds of meters, as well as under structures and roads. The deepest full-scale application to date is 32 m. However, thermal conduction heaters are also used for thermally enhanced oil recovery at depths of more than 300 m.

What If Contamination Is Really Shallow?

Contaminants extending no more than 1-2 m in depth may be difficult to treat cost-effectively in-situ. In such cases, it may be more cost-effective to consolidate the material and treat it in aboveground piles using In-Pile Thermal Desorption (IPTD).

Can the Entire Thermal Well field be installed Below Ground Surface?

Yes, it is possible to install the wellheads, electrical cable, collection piping, and instrumentation in below-ground vaults and utility corridors, at additional cost. A period of time would be required for their installation.

Can This Process Be Used Around Buried Utilities?

Many types of buried utilities, such as concrete sewage lines and steel water lines can be left in place and/or protected during heating through appropriate placement of heaters and insulation. Some utilities (e.g., gas lines, PVC pipes) may need to be rerouted or decommissioned.

Can This Process Be Used Adjacent To Foundations?

Yes. Since the heat front drops off sharply adjacent to the heated zone, experience has shown that heating adjacent to foundations typically has no effect on the foundations. Measures can be taken to further protect structures if necessary.

How Do You Know When Cleanup Is Complete?

First, remediation cleanup levels and cleanup times can be predicted accurately by computer simulation before the job starts. After that, monitoring systems and thermocouple probes in the soil are used to evaluate progress throughout the treatment zone. Experience has shown that there is a strong correlation between the computer predictions and actual results, and typically, pre- and post-treatment soil samples are used to confirm the adequacy of remediation. If desired, confirmatory samples are taken before the system is shut down, and the site can be declared clean before demobilization of the equipment.

What about Air Emissions Using This Technology?

Air emissions are treated using conventional treatment components, such as a thermal oxidizer and granular activated carbon filter, designed on a site-specific basis to address each of the constituents as cost-effectively as possible. The principal substances released to the air are carbon dioxide and water.

Does ISTD Create Dioxins?

ISTD is quite different from ex-situ thermal desorption or incineration. With these aboveground thermal technologies, the soil or sludge being treated is exposed to high temperatures only briefly - typically for seconds or minutes. Thus, there can be cool spots where the soil does not get fully treated and where compounds such as dioxins can sometimes be created. By contrast, with ISTD the entire treatment zone is heated to target temperatures for days, at a minimum. Most (> 95-99%) of the organic contaminants are destroyed in-situ. Not only are dioxins not created, treatability and field data indicate they too are destroyed, typically to below background levels. Dioxins that are extracted are treated in the air pollution control system.

How Is Contaminant Spreading Avoided?

It is avoided through the proper placement of the surface insulation/vapor barrier, and the thermal well field. All locations targeted for treatment are thereby heated to the desired temperature, while the boundaries of the treatment zone are maintained at a negative pressure. Thus contaminant movement is toward the vacuum collection points, and condensation of contaminants in cool zones is prevented.

Does This Process Prevent Revegetation After Treatment Is Complete?

No. Immediately after treatment by In Situ Thermal Desorption, the soil is sterile, but experience shows that recovery will be rapid. After the soil is disked, fertilized, and seeded following normal revegetation practices, regrowth during the first growing season after treatment should be as good as with other soil.

Does In Situ Thermal Desorption Sterilize the Soil?

Source zones heated to temperatures at and above the boiling point of water will be sterilized, but upon cooling will undergo repopulation by indigenous microorganisms. Microbiota residing in locations in the downgradient dissolved plume (i.e., outside the target treatment zone) may see mildly elevated temperatures, which are likely to promote rather than hinder their growth and attenuative capacity.

How Does ISTD Compare With Other In-Situ Remediation Technologies?

A major reason for the unsurpassed effectiveness of ISTD is its application of heat to the soil using thermal conduction. During conductive heating, heat generated by simple electrical heating elements moves out through the soil and waste material in a highly predictable fashion, regardless of how heterogeneous the soil is, or its permeability. This is in sharp contrast to the movement of a fluid through the soil, which is the basis for nearly all other in-situ remediation technologies (e.g., groundwater pump-and-treat, soil vapor extraction, air sparging, steam injection, solvent and surfactant injection, or chemical oxidant injection). Rates of fluid flow can vary over many orders of magnitude from one place within the soil to another, depending on how permeable the soil is, and on the degree of heterogeneity. Fluid-based technologies thus tend to bypass some contaminated zones, leading to poor efficiency, diffusion-limited mass transport, and a very protracted duration of remediation. By contrast, the thermal conductivity of a wide range of soil types varies over less than a factor of plus or minus two

ISTD has a wider applicability than other in-situ thermal technologies. For example, the process of electrical resistivity heating, also known as Six-Phase Heating or joule heating, relies on the flow of electrical current through soil. Electrical conductivity can vary over two orders of magnitude. Since electrical current ceases to flow in soils once water has boiled off, moreover, electrical resistivity heating cannot heat the soil above the boiling point of water. Thus, it is not applicable to treatment of high boiling-point compounds such as pesticides, PCBs, and PAHs to stringent soil cleanup levels. Similarly, steam injection in the shallow subsurface is limited to heating approximately to the boiling point of water.