

# TECHNOLOGY

## Pollution becomes fuel for the flames

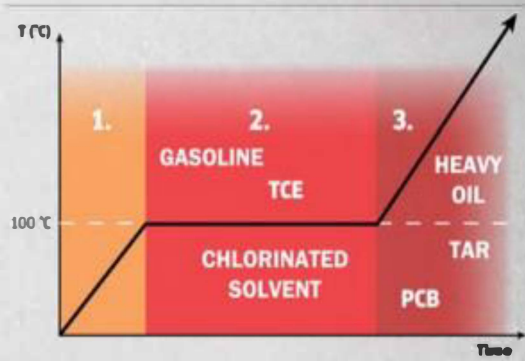
**New method for the purification of soil with chlorinated solvents by burning away pollution**

ENGAGEMENT

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The soil beneath thousands of Danish properties is known to store chlorinated solvents. These chemicals can contaminate groundwater and enter homes via vapor intrusion. It can cost up to 4,000 kr. / tonne of soil to remove chlorinated solvents, such as perchloroethylene (PCE) and trichloroethylene (TCE), from the soil. PCE and TCE are commonly used in dry-cleaning and degreasing industries. Beneath buildings, the soil must be heated in order for PCE and TCE to be removed from the soil vapor. This process usually requires bulky and expensive equipment. However, a new method that Orbicon, Arkil, Force and TPS Tech is testing for Region Capital can complete this process much cheaper, says development manager Thomas Hauerberg Larsen from Orbicon. According to Larsen, typically the ground is heated with the use of an electrical heater or, alternatively, by running electricity directly into the ground. The investigation is exploring whether

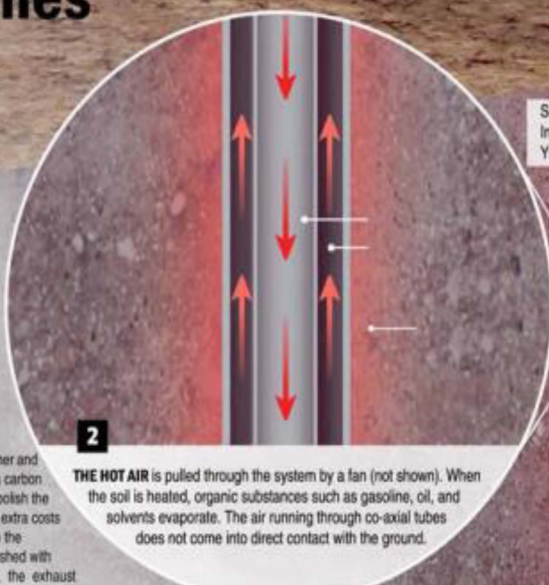
the vapors removed from the ground can effectively act as fuel for the gas burner as it heats the soil. The first test has shown significant destruction of contaminants at a 99.9% removal rate. Further analysis is currently underway concerning the formation of toxic by-products. "There is the possibility of forming toluene and dioxin. Further, the use of a carbon filter is possibly needed to polish the combustion gases. Yet all extra costs are ideally avoided." Before the exhaust gases can be polished with an activated carbon filter, the exhaust must be cooled to room temperature. This must take place because the carbon vessels would be destroyed by the immediate high-temperatures of the combustion gas. The results of the Capital Region Experiment will be reported in June.



**1** The soil is heated to 100° C.

**2** Evaporation Phase. Stable temperature of 100° C. Water in the soil will evaporate. All volatile contaminants including gasoline and chlorinated

**3** The temperature rises to the final treatment temperature at which the heavy components in the soil, such as heavy oils, tar and PCBs are removed.



**2** THE HOT AIR is pulled through the system by a fan (not shown). When the soil is heated, organic substances such as gasoline, oil, and solvents evaporate. The air running through co-axial tubes does not come into direct contact with the ground.



**3** MOBILIZED CONTAMINANTS are removed from the soil through a slotted vapor extraction tube. The vapor extraction tube is routed to the heater where contaminants are destroyed by the flame. Gasoline and oil components act as fuel and are easily transposed. Orbicon is currently testing the extent to which PCE and TCE can be destroyed in the flame. These contaminants require the right combination of turbulence, high temperatures, and retention time. Successful case studies showed degradation products including water, CO<sub>2</sub>, and hydrochloric acid.

**1** A GAS HEATER is mounted on the top of the primary pipes, and heats the air in the system to roughly 1,000 °C.

**4** CAPTURED POLLUTION is routed to the flame where it is consequently destroyed.

Secondary pipes. Inlet approx. 500 C. Yield: approx. 150 C.

Primary heat pipes. Inlet approx. 1,000 C. Yield: approx. 500 C.

0,5 meter

Killbø, Orbicon; Projekt - Grafik, Lasse Geirm Jensen