



CURRENT ENVIRONMENTAL SOLUTIONS

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Six-Phase Heating™ at TCE Residential Site in Holland

Client: TerraVista bv

Supervising Engineer: William heath

Location: Zwijndrecht, Netherlands

Partner Engineer: Marcel Kolle

Duration: 60 Days

Site Electrical Sup: Jim Jeffs

SITE

Current Environmental Solutions (CES™) and their affiliated licensee, Terravista bv were contracted to perform a full-scale Six-Phase Heating™ (SPH) remediation in a residential neighborhood in the Netherlands. The SPH system as deployed in an area of attached homes, and a portion of the SPH system was installed directly beneath a single family town home.

The site is located in Prinsessenpark Zwijndrecht. An attached single family residential area that was built upon contaminated soil. The residences were about 80% occupied. It was not until one of the homeowner’s complained that the Dutch government discovered that one particular area of the neighborhood was contaminated with PCE, TCE, cis 1,2-DCE, and vinyl chloride. The homeowners living directly above the hot spot were temporarily relocated, but the surrounding neighbors remained in their homes.



Outside View of Site and Residential Neighborhood

CES’s SPH technology was chosen after a vigorous due diligence on behalf of the Dutch regulators. This time critical project required a safe, efficient, and cost effective technology that could reduce the soil and groundwater contamination to below the residential Dutch “C” MCLs. CES was chosen for the work based upon their role as the leader in applying SPH, and being the most experienced licensee of the Battelle patents for ERH. Clean-up was mandatory within 2 months.

The SPH™ technology uses conventional three phase industrial type power and modifies it for input through specialty electrodes to the treatment volume. The passage of electrical current serves to resistively heat the soil and groundwater to the boiling point of water. While the thermal energy increases the volatility of contaminants, steam generated acts to mobilize the contaminant, acting as a carrier gas as is pressures through tight soil pores. The steam is collected from the subsurface by a soil vapor extraction process, and treated aboveground by conventional means, including air stripping, activated carbon, or catalytic oxidization.

APPLICATION The volume of impacted soil was roughly 2,000m³. As much of the Netherlands is below sea level, the soils were nearly saturated from surface, although the official groundwater level was approximately 1.5m bg. Soils were marine sands and peat. Soil contamination ranged from 300 – 700 mg/kg and groundwater contaminant levels ranged from 100 – 3,800 µg/l.

CES mobilized in August 2002 by first constructing a Power Supply Unit to European Union electrical standards. Authorities from the Dutch Government KEMA (European equivalent of the USA UL Laboratories) Branch oversaw the construction and testing of the PSU at CES's Applied Process Engineering Laboratory in Richland, WA. After vigorous field testing, the unit was shipped to Rotterdam and then transferred to the site.



500 KVA Power Supply Unit Built by CES to KEMA Standards

While constructing the PSU, the site was prepared for SPH. An array of 16 electrodes were installed to 7m bg. Five of the electrodes were directly beneath the living room of the home. A horizontal SVE system was used beneath the house as a safety venting system. Operations began in November 2002.



SPH Electrodes and vents beneath residence

RESULTS

SPH achieved groundwater boiling within two weeks of start-up. By the end of December 2002, preliminary sampling showed that the clean-up criteria had been achieved, but the system was kept running for one extra month in order to reduce groundwater contamination even further. By February 2003, soil sampling showed that the Dutch “C” levels had been exceeded. Groundwater samples showed PCE < 40µg/L, TCE < 500µg/L, and DCE < 20 µg/L. Power was discontinued in February 2003 and the site restored. There was no significant operational difficulties during this project, no adverse impact to the home, its foundation, the surrounding residences, nor any reports of fugitive emissions throughout the project, and the residents were permitted to reoccupy their home.