



# DNAPL REMEDIATION IN A RESIDENTIAL NEIGHBORHOOD

Client: Dutch Environment Agency

Zwijndrecht, The Netherlands

February 2003

Current Environmental Solutions (CES) and their Dutch affiliated 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 home.

## SITE

The site is located in Prinssepark 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 tetrachloroethylene (PCE), trichloroethylene (TCE), and Cis 1,2-dichloroethylene (DCE). The homeowners living directly above the soil hot spot were temporarily relocated, but the surrounding neighbors remained.

CES' 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" contaminant levels. CES was chosen for the work based upon our reputation 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.

## APPLICATION

The volume of impacted soil was roughly 2,000m<sup>3</sup>. As much of the Netherlands is below sea level, the soils were nearly saturated from surface, although the technical 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 u/l.

CES mobilized in August 2002 by first constructing a Power Supply Unit to European Union 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.

While constructing the PSU, the site was prepared for SPH. A series of 20 electrodes were installed to 7m bg. Two 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.

## RESULTS

Groundwater was 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. By February 2003, soil sampling showed that the Dutch "C" levels had been exceeded. Groundwater samples showed PCE < 40u/l, TCE < 500u/l, and DCE < 20 u/l. Power

was discontinued in February 2003 and the site restored. There was no adverse impact to the home, its foundation, the surrounding residences, nor any reports of fugitive emissions throughout the project.



