

# Remediation

of polluted site

## ZWEVEGEM

FLANDERS - BELGIUM



## Treatment of groundwater, polluted by chlorinated solvents, by permeable reactive barrier utilising the Keops Process

**T**wo distinct sources of DNAPL (dense non aqueous phase liquid) situated below the factory are the origin of significant groundwater pollution by a series of dissolved phase chlorinated solvents.

SITA-Soletanche Bachy proposed a unique solution to protect the groundwater, by providing a barrier equipped with filter gates and utilising the Keops® process.

### Keops® Process

This process provides an efficient solution for the treatment of chlorinated solvents dissolved in groundwater.

It results from the combination of 2 original and patented methods:

- The Panneau-drain® method allowing installation of filter gates equipped with easily removable cartridges (Soletanche Bachy Patent).

- The use of zero valent iron with precious metal catalysts, which is approximately fifteen times more efficient than zero valent iron alone, for the reduction of chlorinated solvents (SITA Remediation patent).

The Keops process, together with associated maintenance, allows the guarantee in the long term of the quality of the outflow at the exit from the gates.

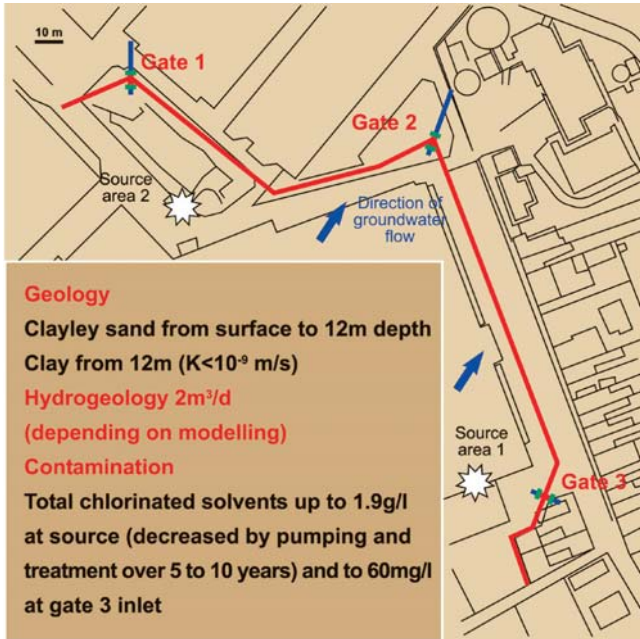


Placing of the filter gate

WORKS OWNER:	CONFIDENTIAL
MAIN CONTRACTOR:	SITA NV
EMPLOYER'S REPRESENTATIVE:	ERM BELGIUM
GATES ENGINEERING AND SUPPLIER:	SOLETANCHE BACHY
DESIGN, FILTER SUPPLY AND MAINTENANCE:	SITA REMEDIATION
INSTALLATION OF GATES, DRAINAGE:	FONTEC
CONSTRUCTION:	APRIL TO JUNE 2002

### WORKS CARRIED OUT:

Installation of 3 filter gates to a maximum depth of 13.00m and associated drainage



Installation of the drains

< Layout of PRB

The filters inside the gates were subsequently installed by SITA Remediation who were also responsible for the maintenance associated with the guarantee.

### Design of the Barrier

The design of the permeable reactive barrier was carried out in stages:

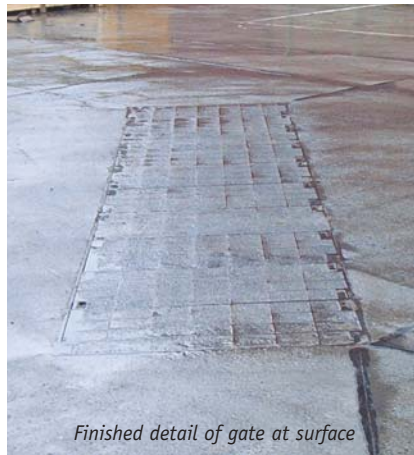
- Initially column tests were performed to determine the half-life of the chlorinated solvents under the specific site conditions. This allowed the calculation of the dimensions of the filters to accommodate the estimated flows at the site.

- Subsequent modelling (Feflow) allowed final design of the barrier (location of the gates, size of the filters in this case 3 etc...).

### Execution of the Works

The works, carried out by Fontec, with the technical support of Soletanche Bachy, have comprised the construction of filter gates by the panneau-drain process and the installation of a drainage network to guide the groundwater flow through the filter gates.

The stainless steel gates were installed in 2 elements (main body and an extension tube) allowing the collection of water to 12.00m depth). The separate elements were connected on site during installation into a fresh slurry panel.



Finished detail of gate at surface

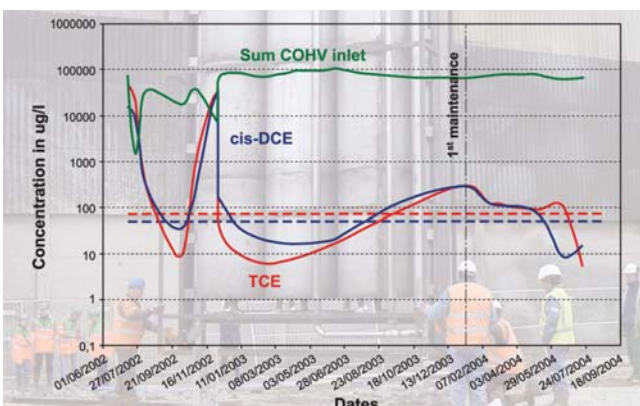
The drains were installed with the help of a Mastenbroek 50-60 trencher.

### Results

The attached graph shows the performance of gate 2. After an initial "bedding-in" period of about 6 months for both the groundwater regime and the reactive material, the results have been excellent. The results in March 2003 demonstrate the efficiency of this treatment. For example, the concentration of vinyl chloride has reduced by a factor 500 at the gate outlet which clearly meets the set objective ( $< 5 \mu\text{g/l}$ ). The first maintenance operation was carried out 18 months after commissioning. After cleaning of the gate, and after re-establishment of groundwater flow through the gate, the outlet values again become lower than the set objectives.

The flows passing through the gates vary between 0.01 and 0.13 m<sup>3</sup>/h.

**The guarantee associated with the maintenance is for 10 years.**



Variation of outlet concentrations gate 2

Results gate 2

	INLET	OUTLET	OBJECTIVE
Vinyl Chloride	250	0.4	$< 5 \mu\text{g/l}$
Cis 1,2 DCE	19 000	35	$< 50 \mu\text{g/l}$
TCE	300	20	$< 70 \mu\text{g/l}$
PCE	39	1.5	$< 40 \mu\text{g/l}$
SUM	19 589	56.9	