

HMVT

Specialist in-situ soil and groundwater remediation

Presented by: Klaas de Jong



About HMVT (1)

- Selected, enthusiastic team - app. 40 people
- 20 years of experience (one of the first in-situ remediation companies)
- Executed hundreds of in-situ projects
- At this moment: app. 80 remediation projects in progress



Hannover Milieu- en Veiligheidstechniek B.V.

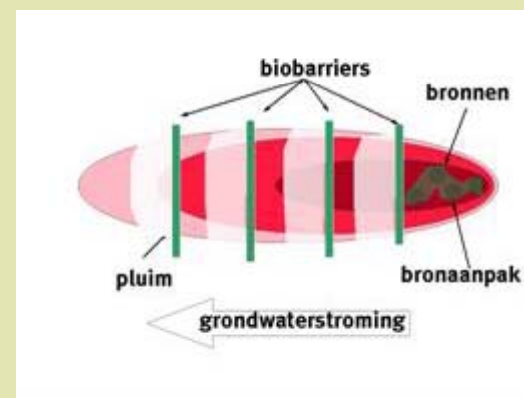
About HMVT (2)

- Expert in a lot of techniques (flexibility in design and execution)
- Team of experts (engineers, chemists, technicians)
- Design and construct contracts (proper solution for our customer)
- Specialized in turn-key projects (take over of risks)
- Using constantly new (innovated) and proofed techniques
- Consultancy agency (back-up)



Different pollutants

- LNAPL from jet- and car fuels, oils, naphtha, etc.
- BTEX and mineral oil
- Chlorinated compounds (also DNAPL)
- Heavy metals
- Salts
- Etc. etc.



Case studies

Case 1: MPE and ISCO Kerosene Spill Ermelo

Case 2: Biological enhancement gas station Borculo

Case 3: Design & Construct Int. company Antwerp



Case 1: MPE and ISCO of LNAPL Spill

Site characteristics

Site: Ermelo (The Netherlands)

Pollutant: LNAPL of Kerosene

Depth: 12 m below GL

Amount: 6,000 kg of product

Pilot: December 2000 to Spring 2001

Execution: Spring 2001 to Spring 2002



Case 1: MPE and ISCO of LNAPL Spill

Remediation techniques

Excavation of polluted soil to 3 m-gl

Multi-Phase-Extraction (MPE)

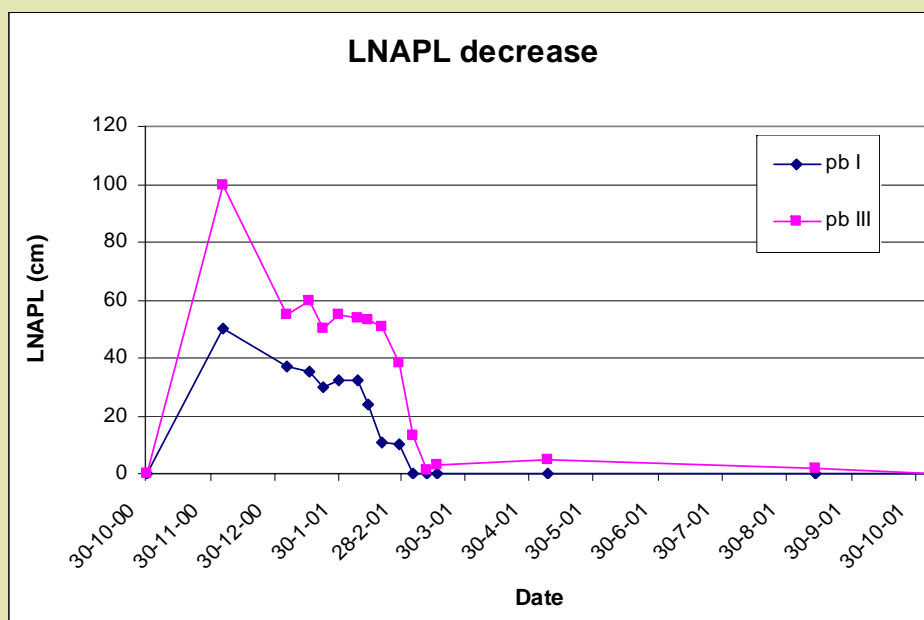
Chemical oxidation (Fenton's reagents)



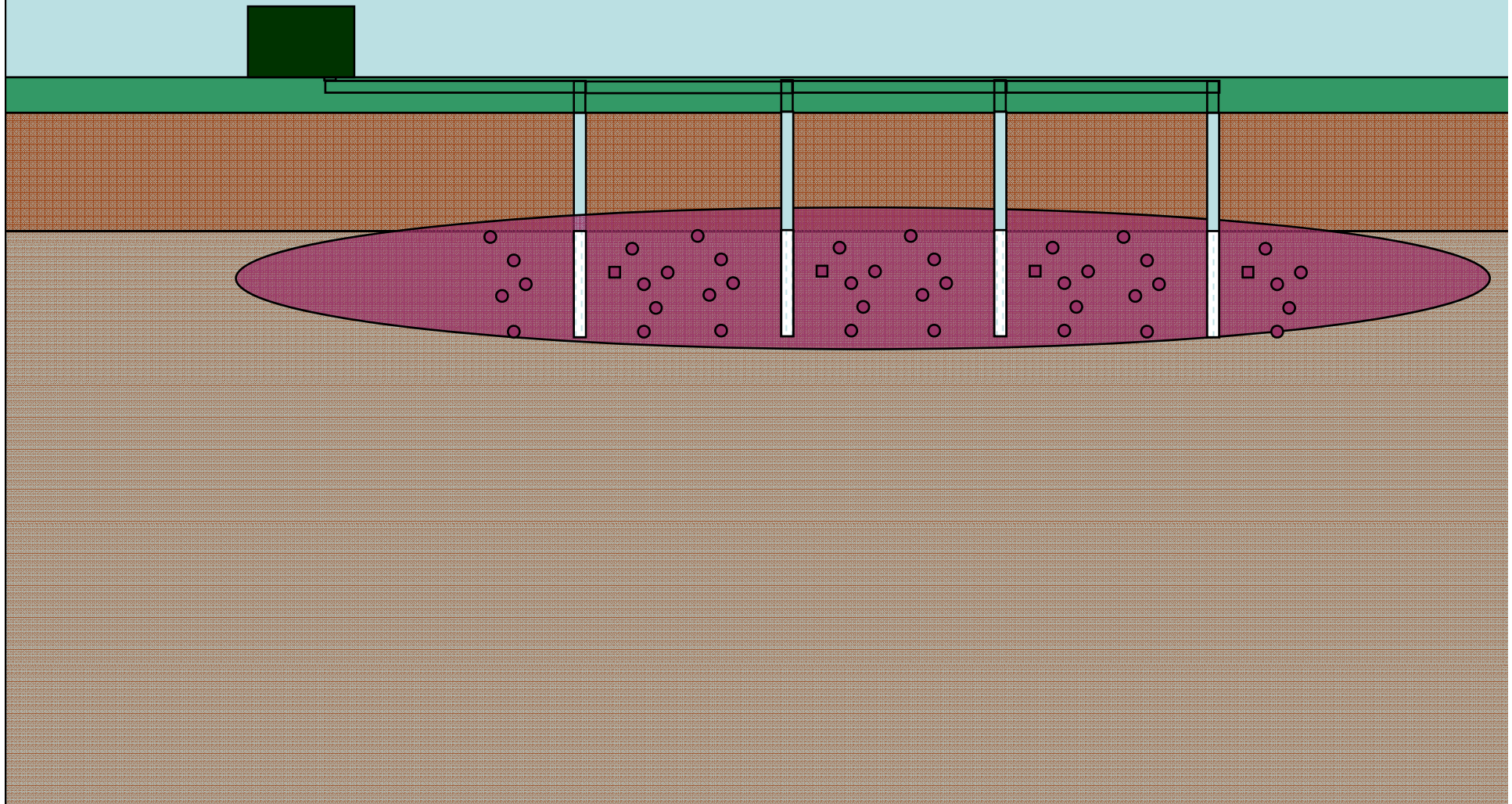
Case 1: MPE and ISCO of LNAPL Spill

MPE extraction:

- short extraction filters (15 filters)
- position in LNAPL layer
- high vacuum extraction (0.4 to 0.9 bar)



Multi-Phase-Extraction



Case 1: MPE and ISCO of LNAPL Spill

ISCO:

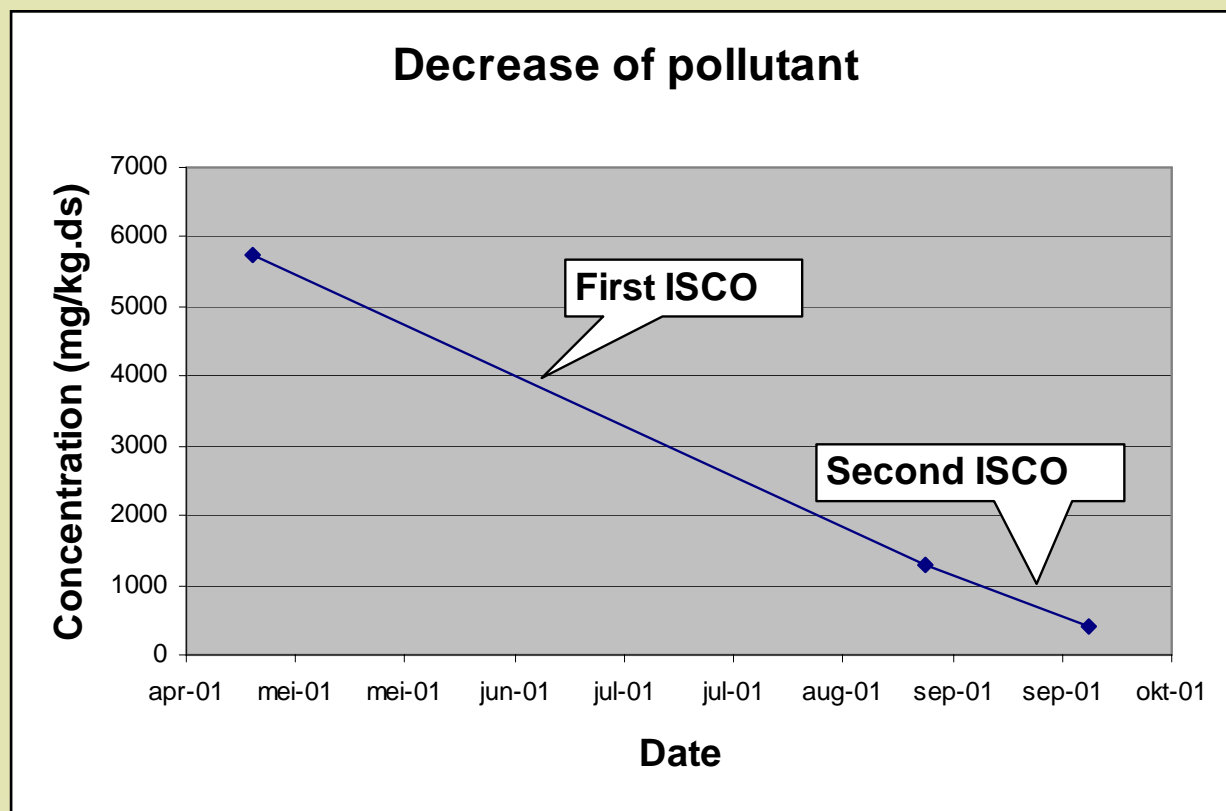
- injection lances (22 lances)
- soil vapor extraction (polluted gasses)
- using Fenton's reagents

Fenton's reagents:



Case 1: MPE and ISCO of LNAPL Spill

Results ISCO:



Case 2: Biological Enhancement Gas station Borculo

Site characteristics

Site: Borculo (The Netherlands)

Pollutant: Diesel

Depth: 1.5 m below GL

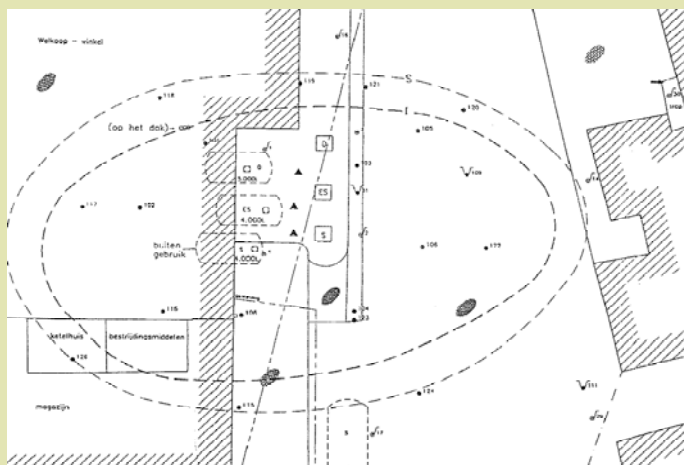
Max. concentration: 4,700 ug/l



Case 2: Biological Enhancement Gas station Borculo

In-situ system

- 25 air sparging filters
- 14 air extraction filters
- 23 dual phase extraction filters
- 32 injection filters for nutrients



Case 2: Biological Enhancement Gas station Borculo

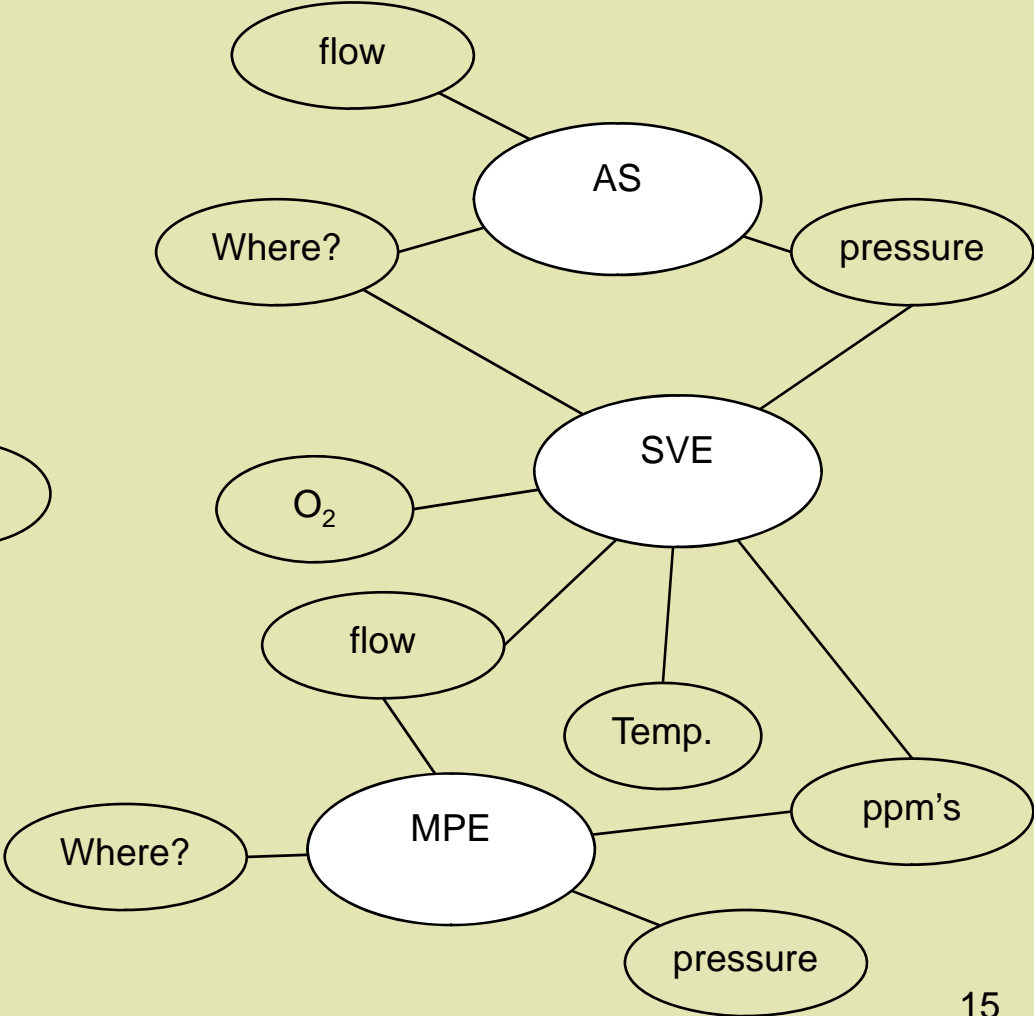
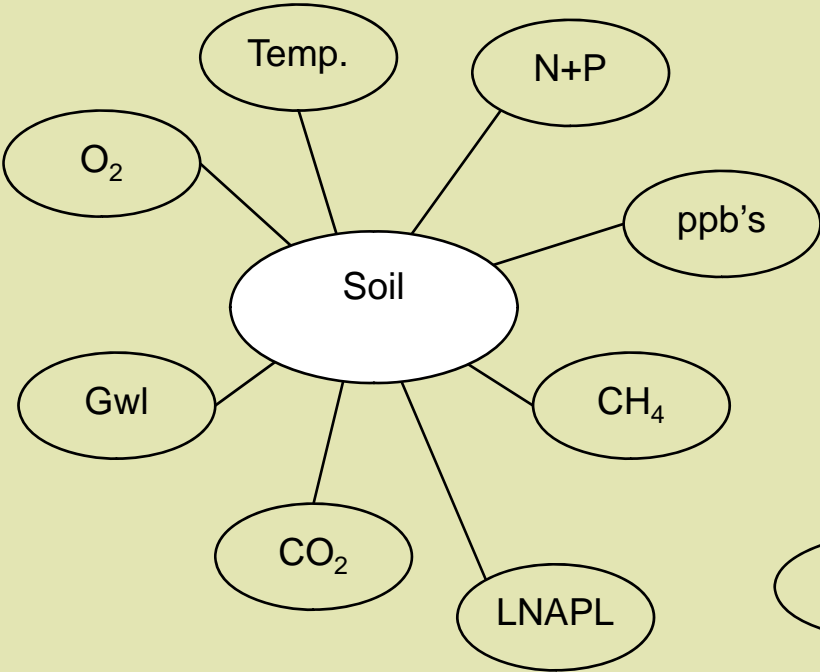
Treatment system (ex-situ)

- Dual Phase extraction system
- Oil-water separator
- Stripping tower
- Activated carbon later on Retox (air treatment)



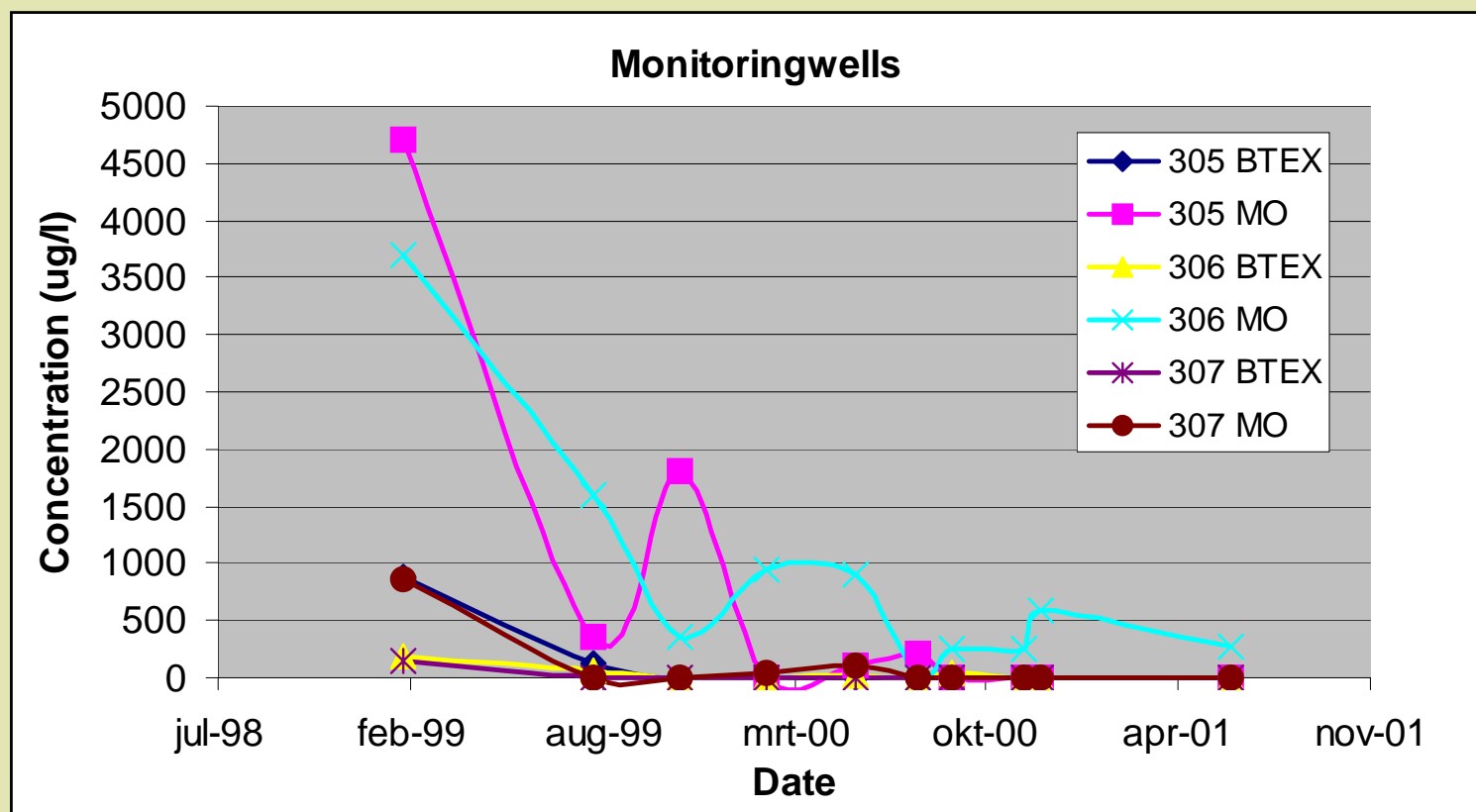
Case 2: Biological Enhancement Gas station Borculo

Process parameters



Case 2: Biological Enhancement Gas station Borculo

Decrease of concentration in groundwater



Case 3: Design&Construct Int. company Antwerp

Site characteristics

Site: Antwerp (Belgium)

Pollutant: LNAPL of Naphtha

Depth: 3 m below GL

Amount: 60,000 kg of product

Area floating layer: 3,150 m²

Phase 1: LNAPL Remediation

Phase 2: Air sparging combined with soil vapor extraction

Phase 3: Air sparging and bio sparging



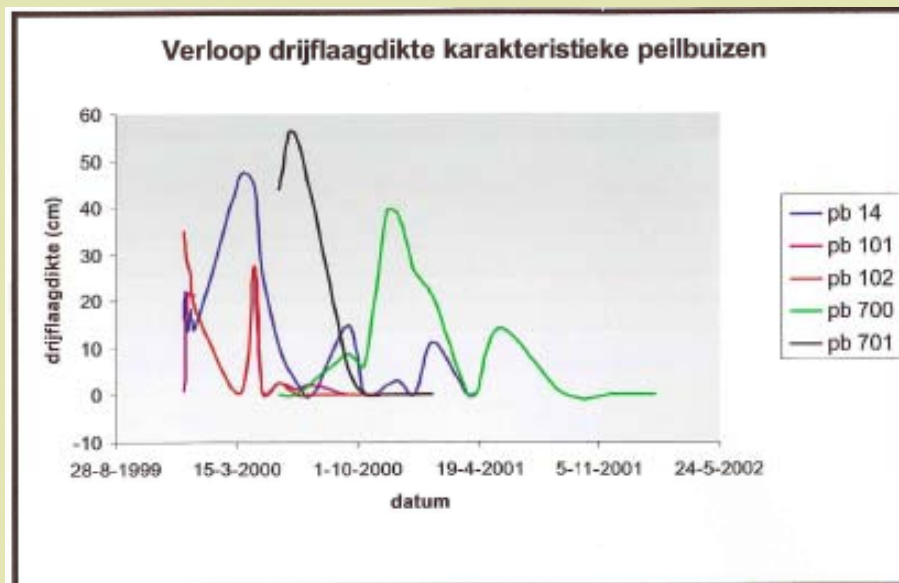
Case 3: Design&Construct Int. company Antwerp



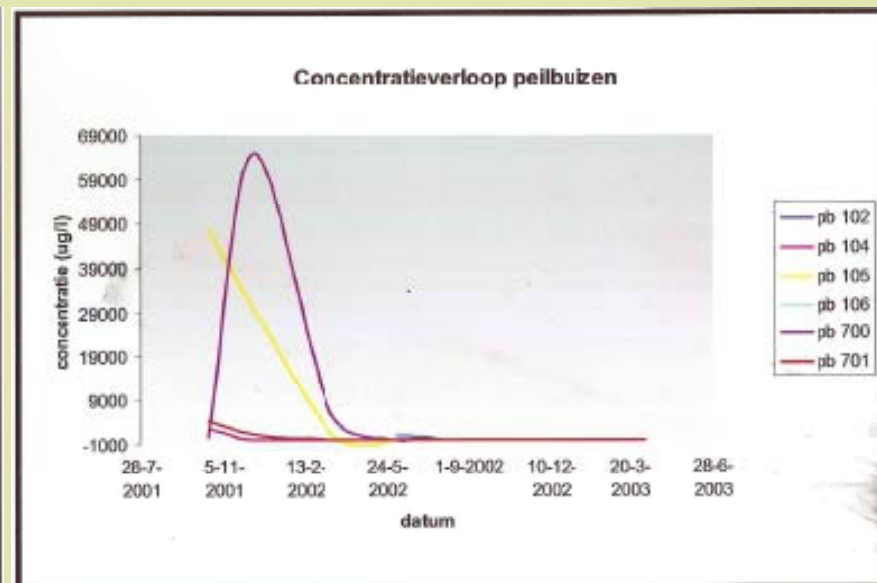
Case 3: Design&Construct Int. company Antwerp

First phase: LNAPL remediation

LNAPL removal



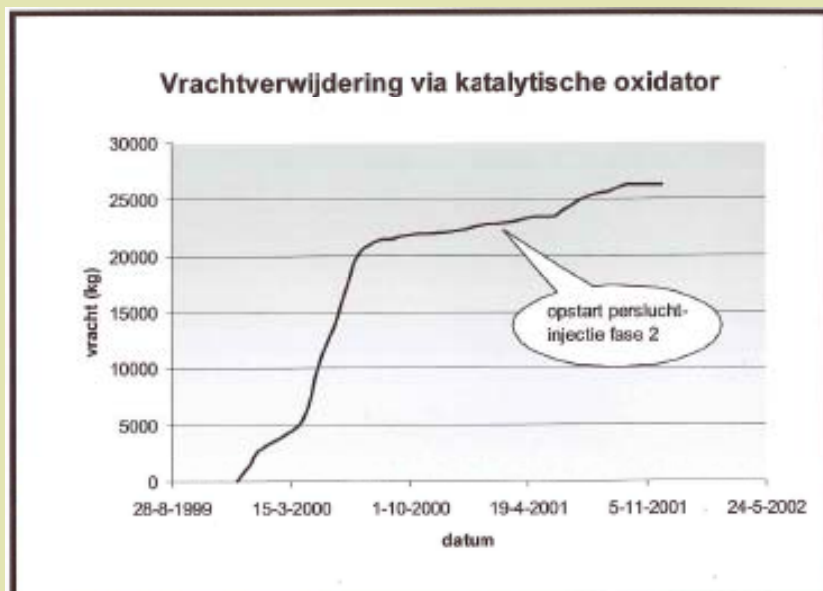
Concentration



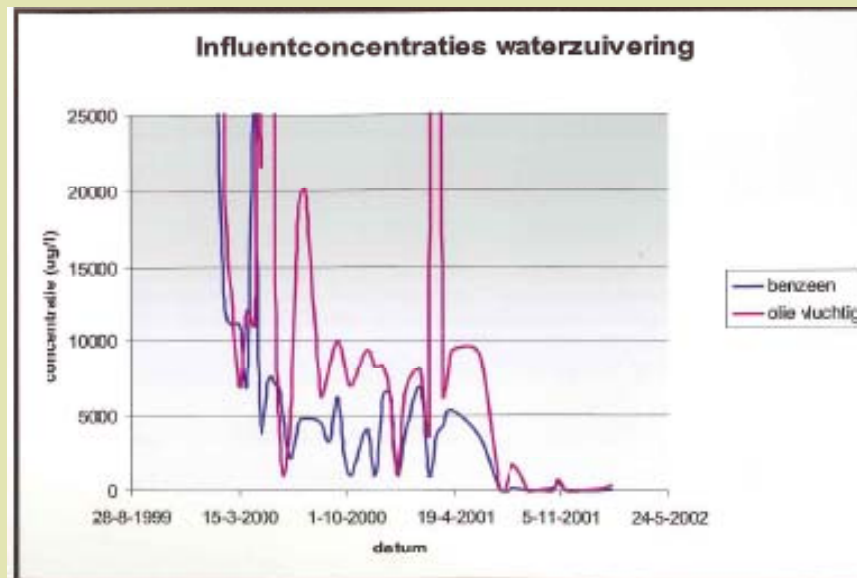
Case 3: Design&Construct Int. company Antwerp

First phase: LNAPL remediation

Removal by air treatment



Removal by water treatment



Case 3: Design&Construct Int. company Antwerp

Second phase: Groundwater treatment

- Air sparging/bio venting
- Dual phase extraction
- Groundwater extraction



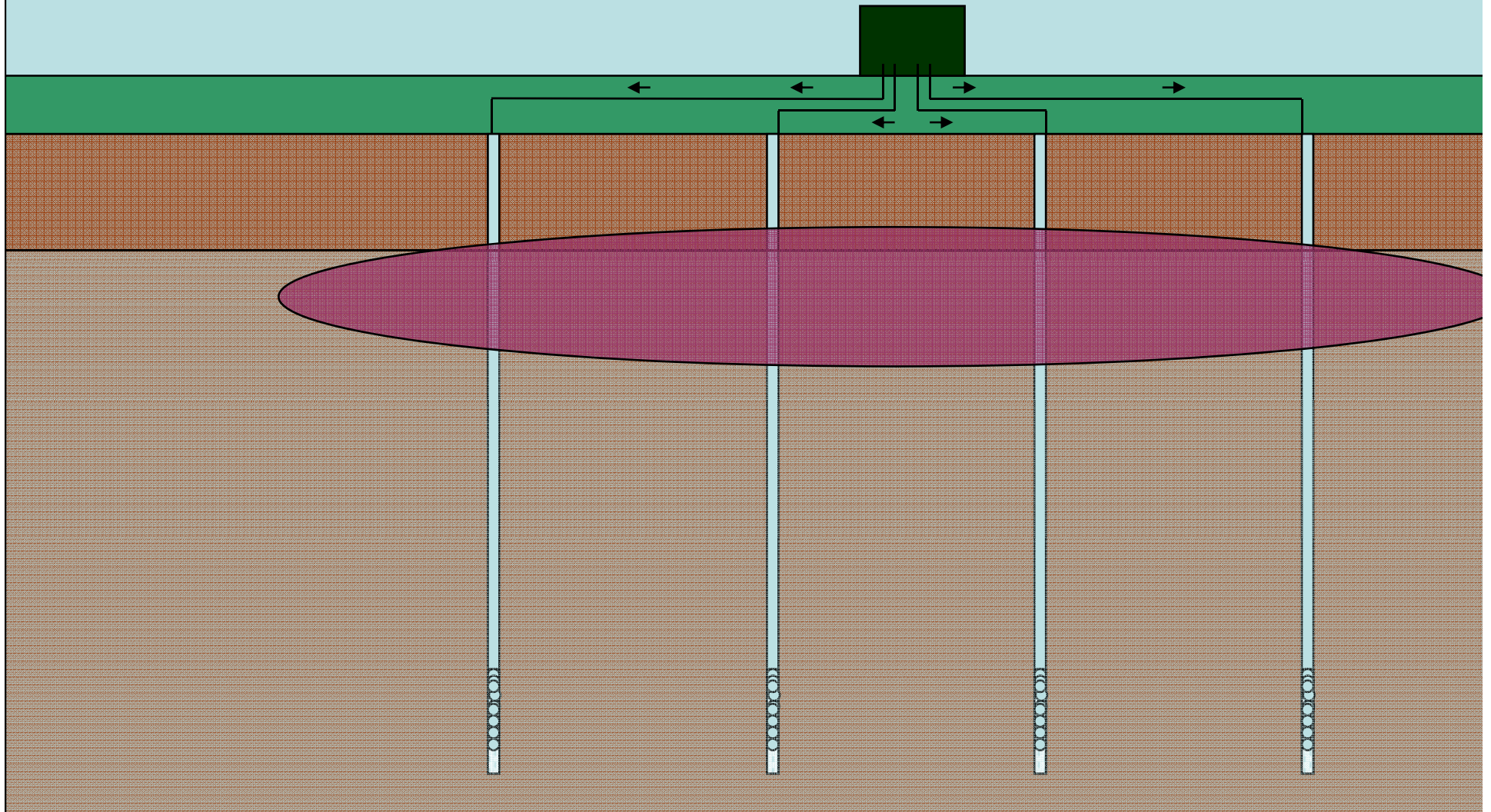
Case 3: Design&Construct Int. company Antwerp

Third Phase: Air sparging/bio sparging

- Stimulation biological degradation by injection of air
- Injection in unsaturated en saturated zone
- Monitoring biological environment



Air sparging



Case 3: Design&Construct Int. company Antwerp

Results:

- Fully removal of LNAPL
- Ground en groundwater concentration almost in all monitoringwells below background levels
- Excellent biological environment (Temp. >21 °C)

Thanks for your attention !

Klaas de Jong

Questions?