Life project Vopak-EXPERO3 (LIFE09 ENV/BE/000407)

5 August 2014

RSK

BADECO

Vopak

Vopak Chemical Terminals Belgium N.V.
Member of Royal Vopak

Demonstration project Vopak-ExperO3

LIFE09 ENV/BE/000407

Using ISCO with perozone for the remediation of a cocktail of organic contaminants at an EX-rated industrial site in operation

Toepassing van ISCO dmv perozone voor de sanering van een mengsel van organische contaminanten op een EX-gezoneerde industriële site

Info: **www.vopak-ExperO3.be**

Vopak

RSK GROUP PLC

BADECO

Objectives of the project

- Demonstrate the application of ISCO with perozone on EX-rated sites.
- Develop an extensive health and safety plan defining the necessary safety measures for the use of the technique at EX-rated sites.
- Develop working procedures for implementation of the technique.
- Demonstrate the advantages (less carbon emission, more time-, cost- and energy efficient) of the technique in comparison with traditional remediation techniques.
- Evaluate the remediation technique in terms of viability and economical and environmental feasibility
- Dissemination of knowledge gathered in this project to target groups and stakeholders.

Partnership

- between the owner of the soil contamination

Vopak

and the soil&GW remediation consultant and the safety expert

RSK

BADECO

- with remediation contractor Verhoeve Milieu & Water

Aurora Solutions
Verhoeve
Milieu & Water

- and funded by the EU

Life

- World's largest independent tank storage provider
- Customers: multinationals of chemical and oil industry
- Highest priority: SHEQ and continuous improvement
- More than 5000 people all over the world are working for Vopak

- Environmental consultant with offices in Europe and Middle East
- Customers: from multinationals to small and/or local companies
- About 800 technical staff

- Belgian based safety expert focusing on H&S at environmental projects

Timeline

		2010				2011				2012				2013				2014				2015				2016			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	Cost (€)
Actie 1	Project coordination																												135.448
Actie 2	Extensive H&S-plan pilot test																												20.324
Actie 3	Pilot test																												100.882
Actie 4	Extensive H&S-plan full-scale																												26.949
Actie 5	Full-scale remediation																												807.700
Actie 6	Monitoring of demonstration																												112.543
Actie 7	Dissemination of knowledge																												52.456
Actie 7	After Life communication plan																												0
																										TOTAL			**1.256.302**

Completed

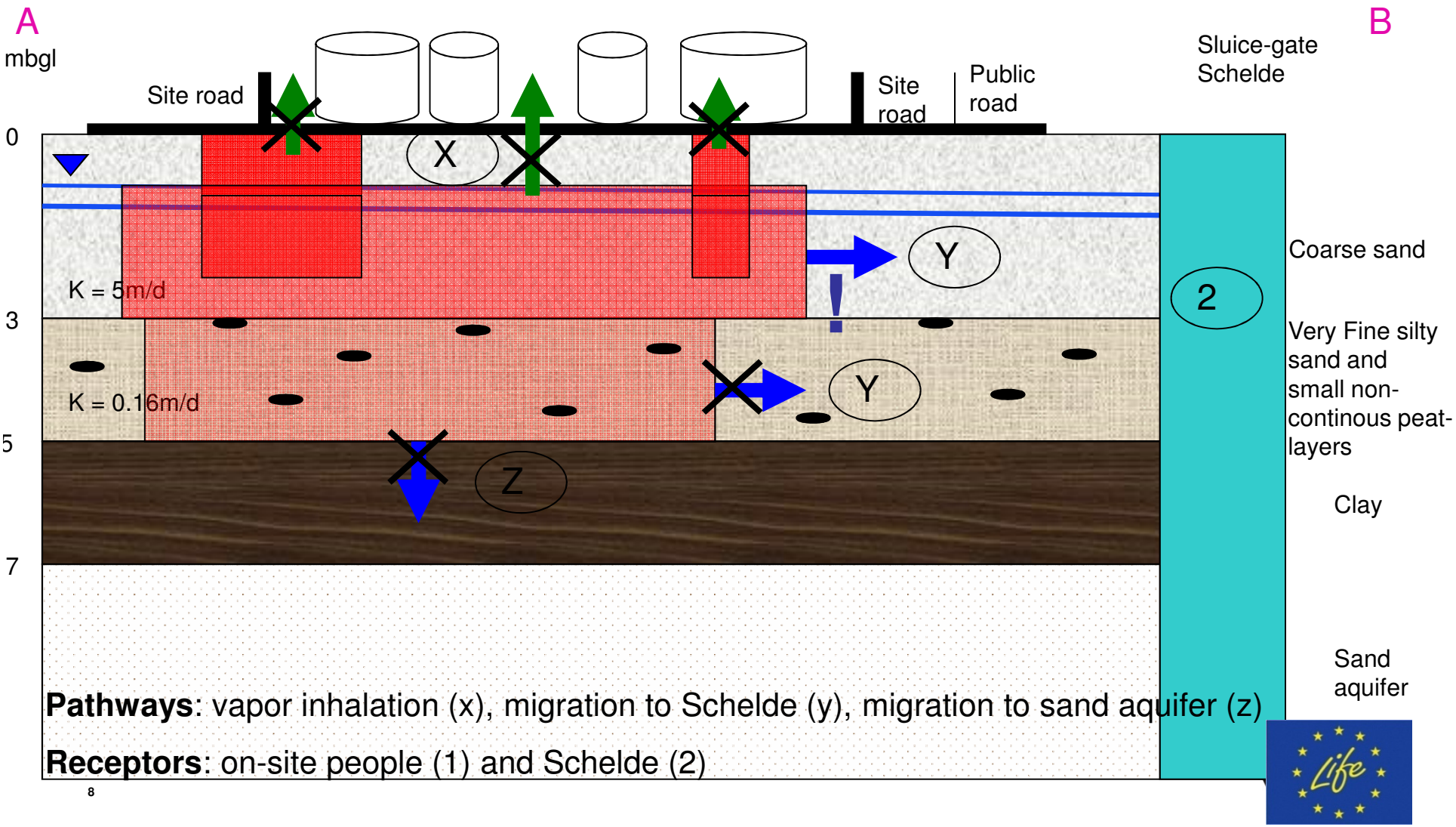
On going

To do

Tools & approaches

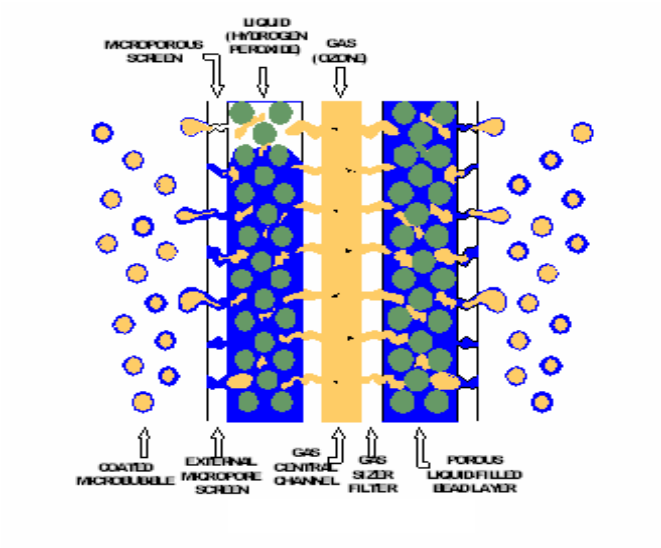
➢ EX-rated site with an historical soil and groundwater contamination with VOC's

Conceptual site model



- Remediation by <u>in-situ chemical oxidation</u> (ISCO) using ozone and hydrogen peroxide (Perozone®)

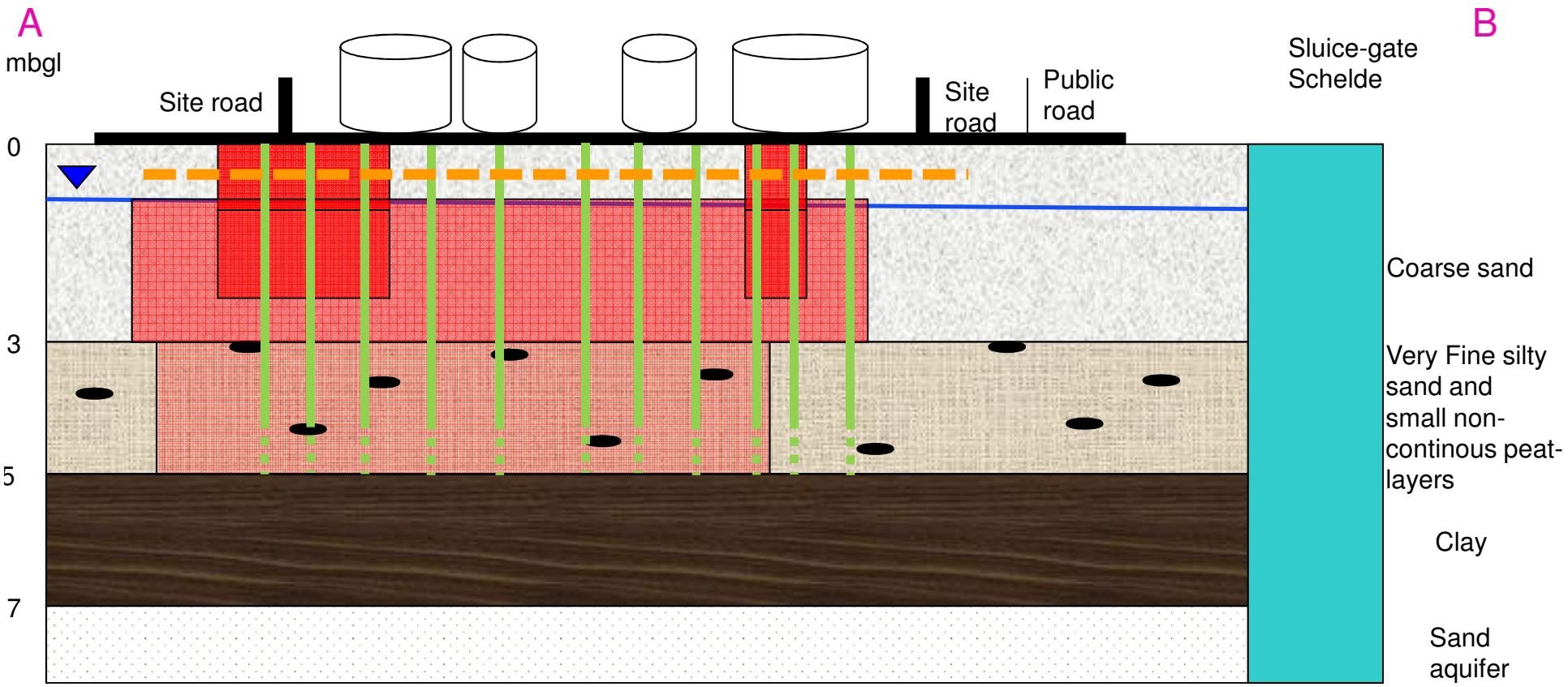
Laminar Spargepoint®



Microbubbles of ozone coated with peroxide

- Combined with soil vapor extraction (SVE) by horizontal drains for safety purposes

Underground remediation infrastructure



5 Drains (SVE)

61 Laminar Spargepoint® (ISCO)

H&S approach

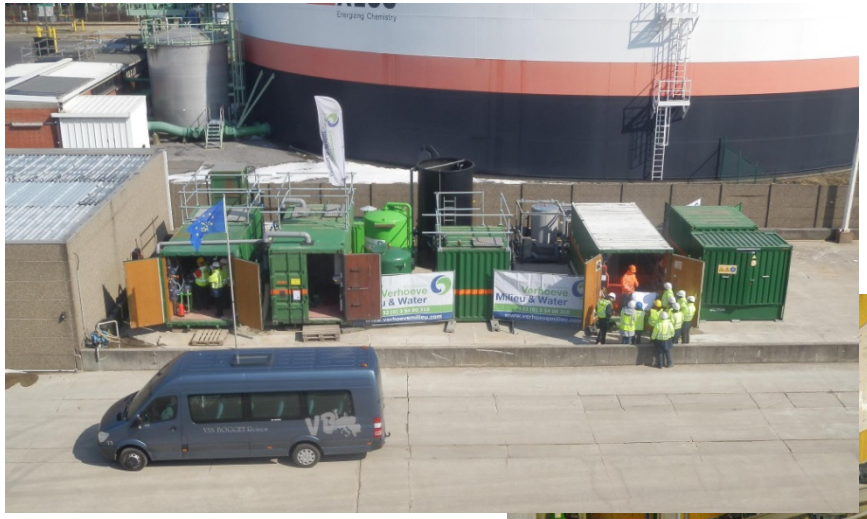
- Safety risks are:
  - Explosion or fire:
    - flammable liquids vs oxidants
    - New EX-zones due to SVE (soil vapor extraction)
    - Heating of active carbon due to adsorption
  - Uncontrolled emissions of VOC and ozone:
    - Health risk
    - Corrosion of metals/tank floor
  - Tank shell stress due to subsidence

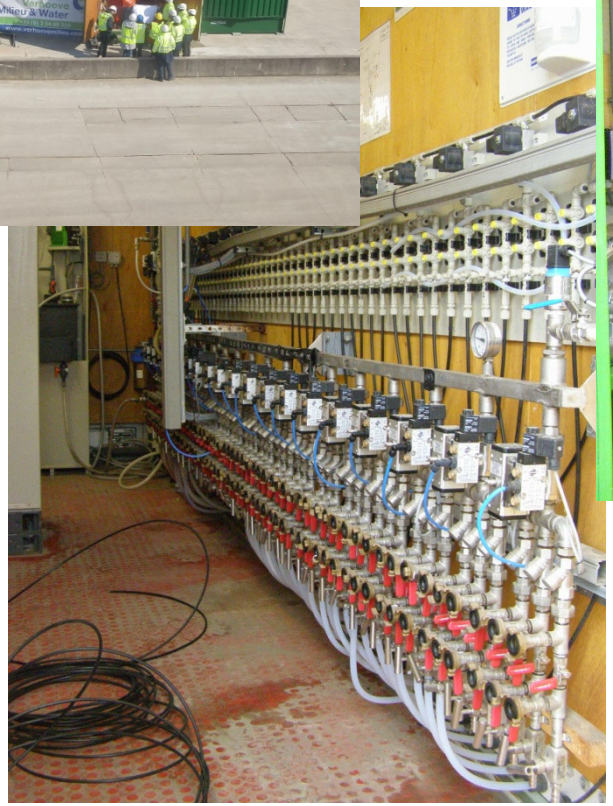
Works developed

Installation Laminar sparge points

Piping and drains

ISCO and SVE-unit





Results

- H&S:

Emission of VOC's (>300ppm) and ozone (>0.1ppm)

↓

Human health risk

Explosion/fire

Corrosion of tank floors/metals

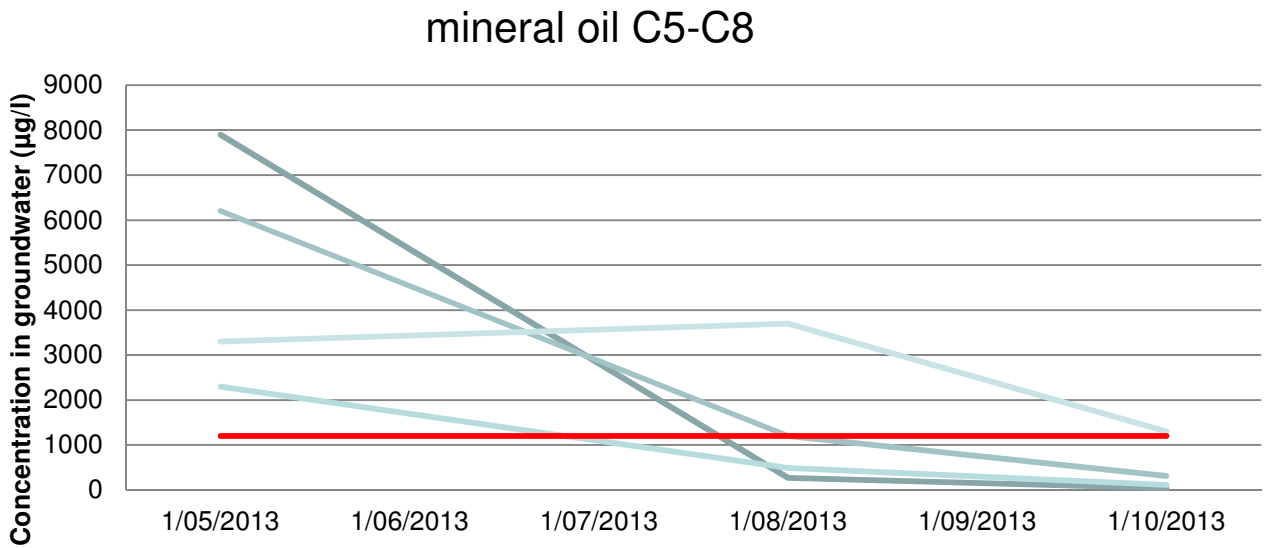
↓

Adequate design, maintenance and control of ISCO and SVE

Thorough monitoring of VOC's & ozone in ambient air, subsoil and underground infrastructures (like sewers, manholes, …)

Results

- Remediation technology:
- ISCO with perozone is effective technology – one area successfully treated!



Results

- Remediation technology:

- Each zone has its own characteristics and needs its own injection regime

- Solid connection and good sealing (during installation) of injection well and piping: double check!

- Ensure flexibility in the design of the SVE system to respond to unexpected circumstances

Future works

- Start/continue remediation by ISCO in source areas (>100mg/l VOC's) and in areas near storage tanks

- Find adequate injection regime in these areas to avoid VOC and ozone emissions and associated risks

- Continue monitoring of process and safety parameters, remediation conditions and contaminant levels

- Draw up final evaluation report and dissemination of knowledge

Benefits / non-benefits of Life instrument

EU Life project Vopak-ExperO3	Positive contributions	Restrictions observed
From the Project	Use of ISCO on EX-rated site	Delays due to unexpected observations
	Improving groundwater quality (below risk limits)	Delays due to unexpected extra costs
	Detailed design and thorough monitoring	
	Remediation without disturbance of the site activities	

Benefits / non-benefits of Life instrument

EU Life project Vopak-ExperO3	Positive contributions	Restrictions observed
With respect to the EU Life program	Incentive to try not-conventional, technologies that may lead to better results and more sustainable results than traditional technologies	Administration
	Incentive to do more detailed research by experts in different disciplines	Rigid framework
	Dissemination of knowledge and experience	Uncertainty of receiving funds at the end

More information

- www.vopak-expero3.be

- Newsletters for stakeholders

Questions

"We have built our company over 400 years on trust and reliability."

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