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Validation of an On-Site Component-Specific Detection Method for Volatile Organic Components: EnISSA-MIP

Pieter Buffel (**pieter.buffel@enissa.com**);
Wouter Vandeputte; Samuel Van Herreweghe; Wim Vansina and Mark Van Straaten
(EnISSA – MAVA, BELGIUM)

B. Van Goidsenhoven (bert.van.goidsenhoven@ovam.be);
Inge De Vrieze and Veerle Labeeuw
(OVAM, The Public Waste Agency of Flanders, BELGIUM)

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1. Introduction
2. EnISSA MIP
3. Validation/demonstration case study
4. Cost comparison
5. Conclusions

1. Introduction

Focus on:

- Social-economical aspects
- Remediation techniques
- Characterisation techniques

Investing in Opportunities

This project has received European Regional Development Funding through INTERREG IVB.

INTERREG IVB

Pilot project 2:

Validation & demonstration of an innovative site characterisation tool

EnISSA
enhanced in-situ soil analysis

1. Introduction

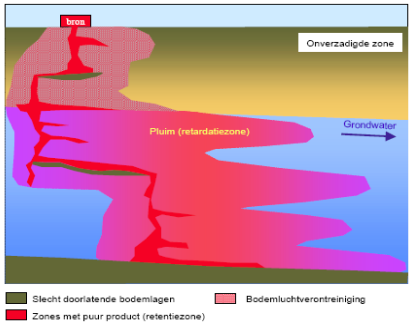
classic sampling strategies (groundwater wells)

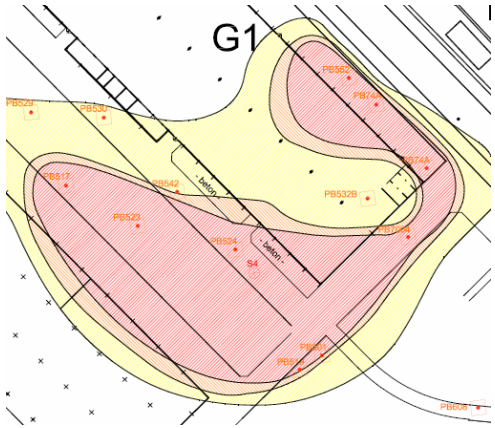
+ low detection level

+ broad analysis spectrum

- decision making: time inefficient

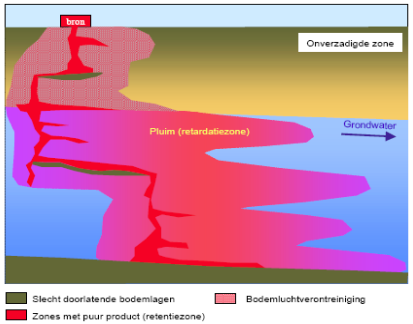
- large contaminated area: large information gaps





1. Introduction

classic ↔ Current “On Site” soil investigation (MIP, ROST, …)



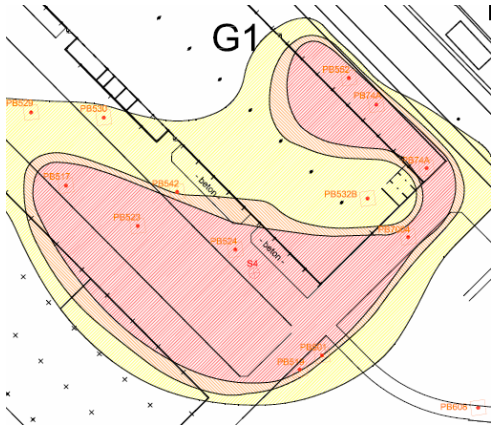
+ information in the field

+ detailed soil profiles

- information quality not equal to classic sampling

  - detection limit > clean up values

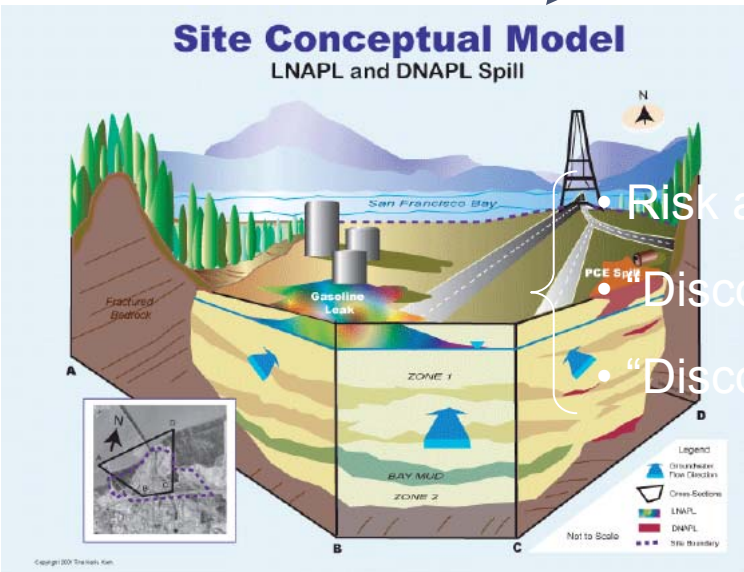
  - sum detectors (indistinct)



1. Introduction

Analytical uncertainty

Spatial uncertainty



- Risk a
- "Disco
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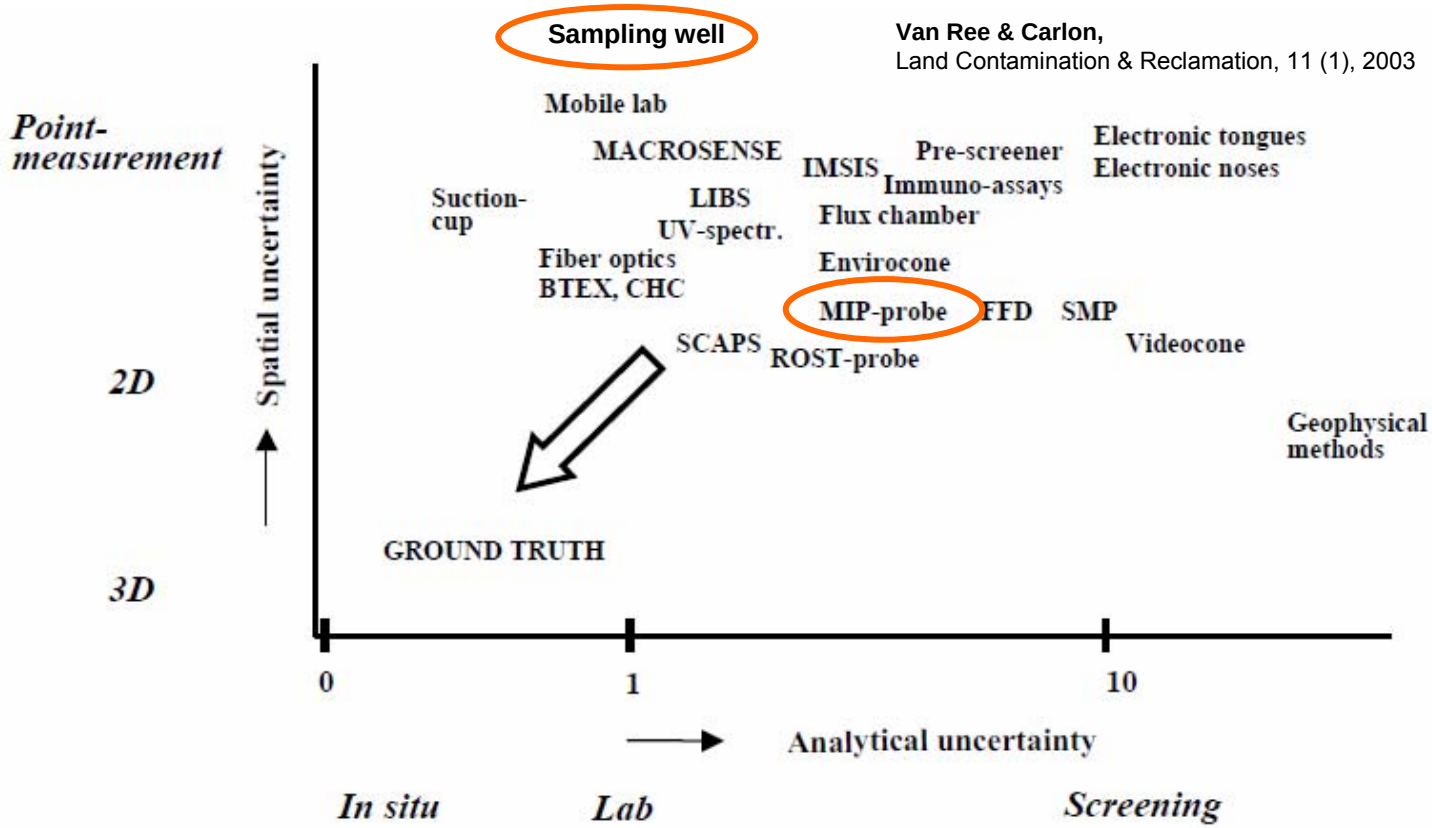
1. Introduction



decrease uncertainty in conceptual site model by combining

***"Best of both worlds"* in one method.**

1. Introduction

Combining best of both worlds

+ low detection level
+ broad analysis spectrum
+ information in the field
+ detailed soil profiles

Development of a **fast** in situ technology with detection limits and selectivity comparable to classical sampling methods.

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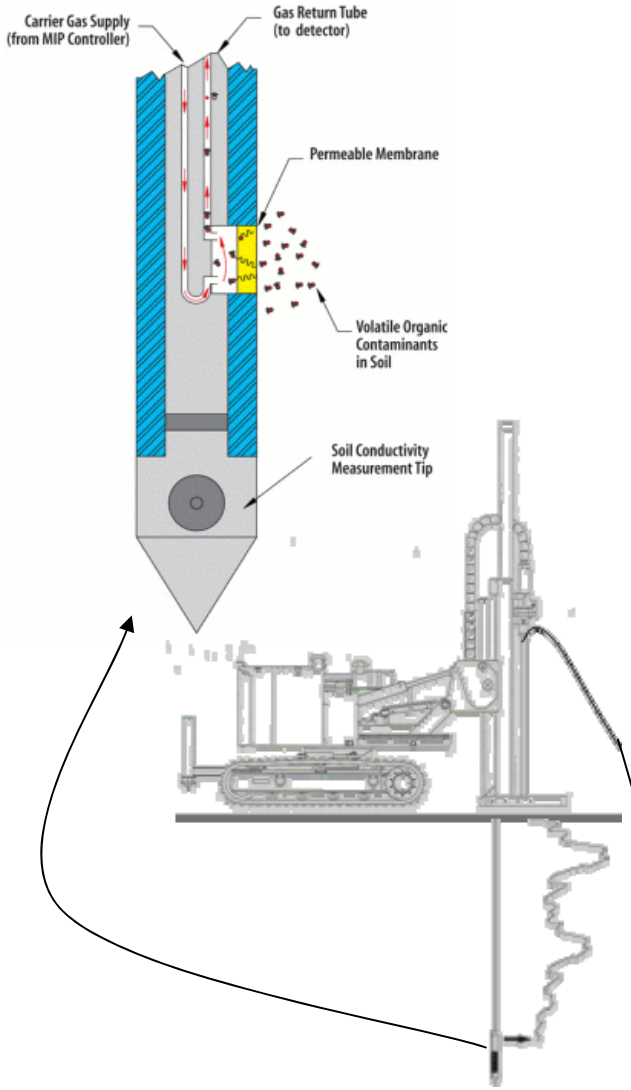
2. MIP



Membrane Interface Probe

- **Screening tool** for VOC ➔ Log contaminants with depth
- Direct push
- Cone: **heated block** and hydrophobic semi permeable membrane
- Volatilization and diffusion through **membrane**
- Inert **carrier gas** & transport to detector

Typical setup: Combination of three detectors:

* Dry electrolytic detector (**DELCD**) or Halogen specific detector (XSD)
* Photo ionisation detector (**PID**)
* Flame ionisation detector (**FID**)

2. MIP ➔ EnISSA MIP

Traditional MIP Detectors
(PID,FID,DELCD/XSD)

→ summation-detectors: no information on individual contaminants: problem with contaminant cocktails, daugther products

→ response is component specific ➔ quantification difficult

→ detection limit > clean-up values

2. MIP ➔ EnISSA MIP

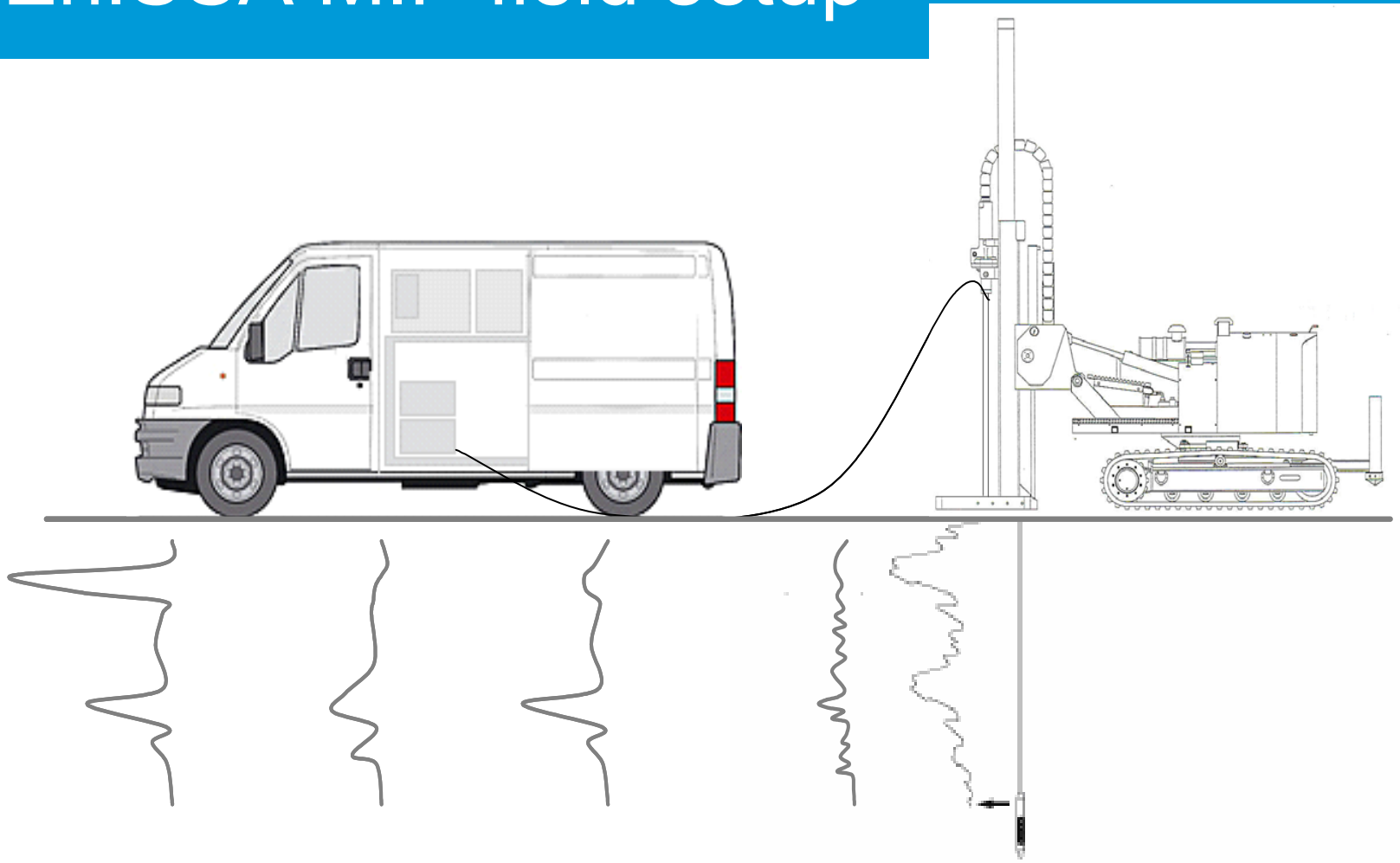
EnISSA MIP

- Proprietary contaminant sampling technology ➔ **GCMS detection**
- GC-MS system ruggedized for **field measurements**
- **Analysis/method time optimized : <u>1 min</u>**

  ➔ probing speed of 30 cm/min; up to 12 compounds simultaneously

Highly detailed profiles for individual compounds on ppb level

2. EnISSA MIP field setup



Tetrachloroethylene	Vinylchloride	1,2 dichloroethylene	PID	Soil Conductivity
Measurement of individual components			Measurement of sum parameters	Measurement of soil parameters

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3. Validation/demonstration study

Site description:

* Location: Kortrijk (Belgium)
* Former spinning and weaving mill
* Contaminants: CVOC & BTEX
* Three sources, possible DNAPL

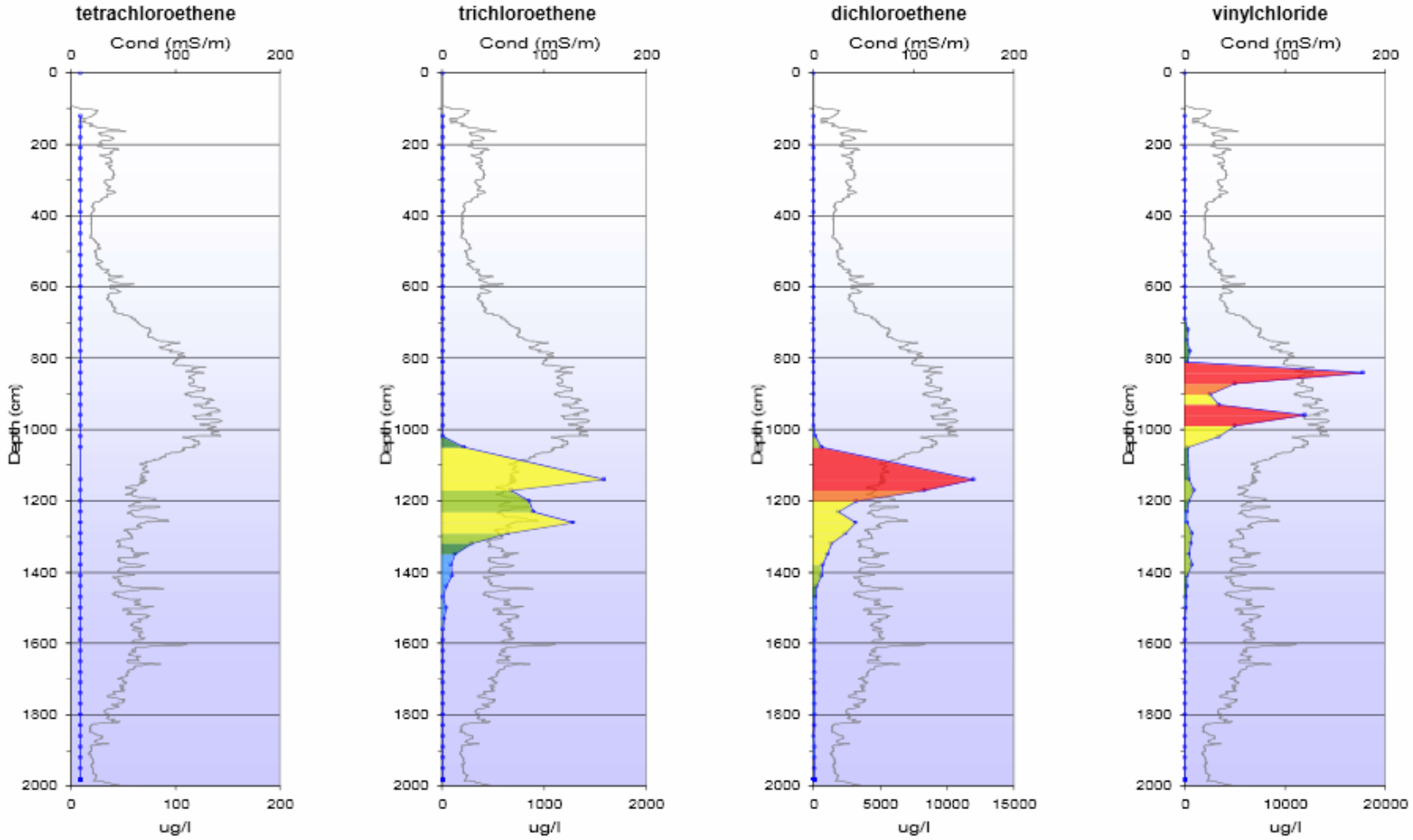
Purpose: Validation of the EnISSA MIP

➔ comparison with traditional sampling (soil/groundwater)

MIP configuration:

- MIP Controller Model MP6505 / Field Instrument Model FI6000
- 40 m unheated Teflon-Peek trunkline
- 35 ml/min N2 flow

3. Field results: EnISSA MIP 10004



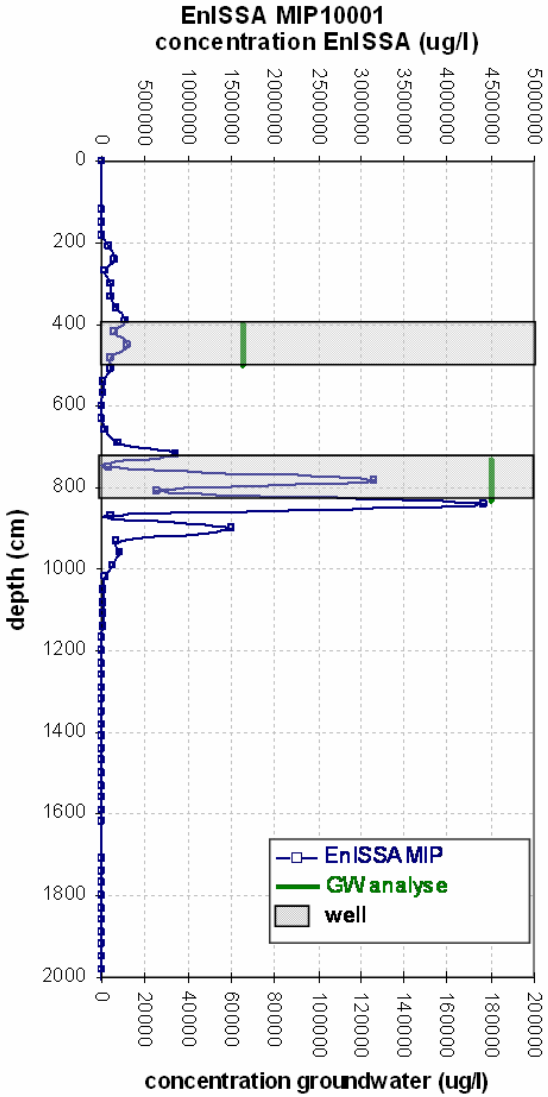
legend:
- 10 - 200 ug/l
- 200 - 500 ug/l
- 500 - 1000 ug/l
- 1000 - 5000 ug/l
- 5000 - 10 000 ug/l
- 10 000 - 100 000 ug/l
- >100 000 ug/l

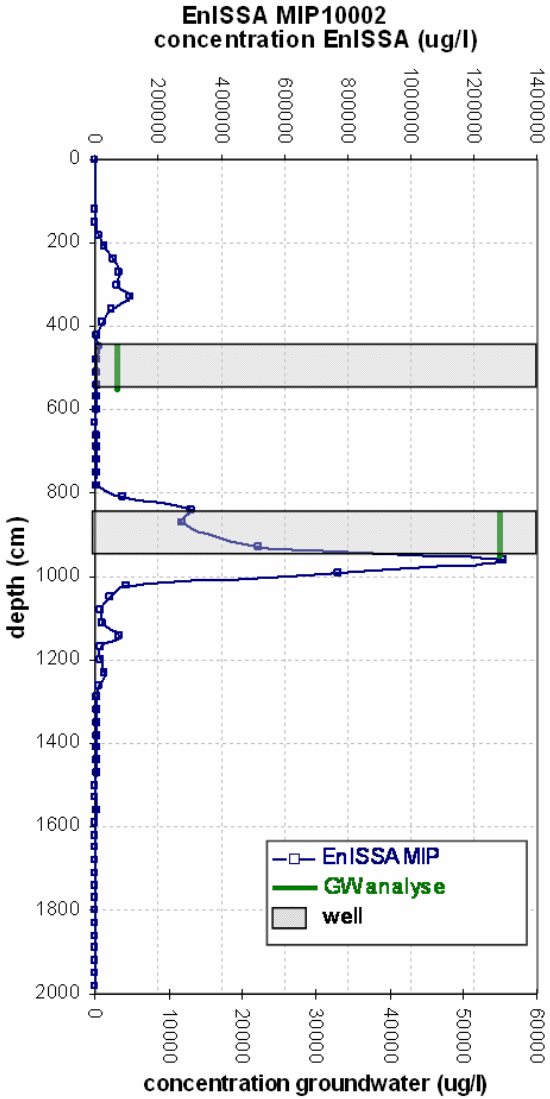
EnISSA → detailed soil profiles for individual compounds

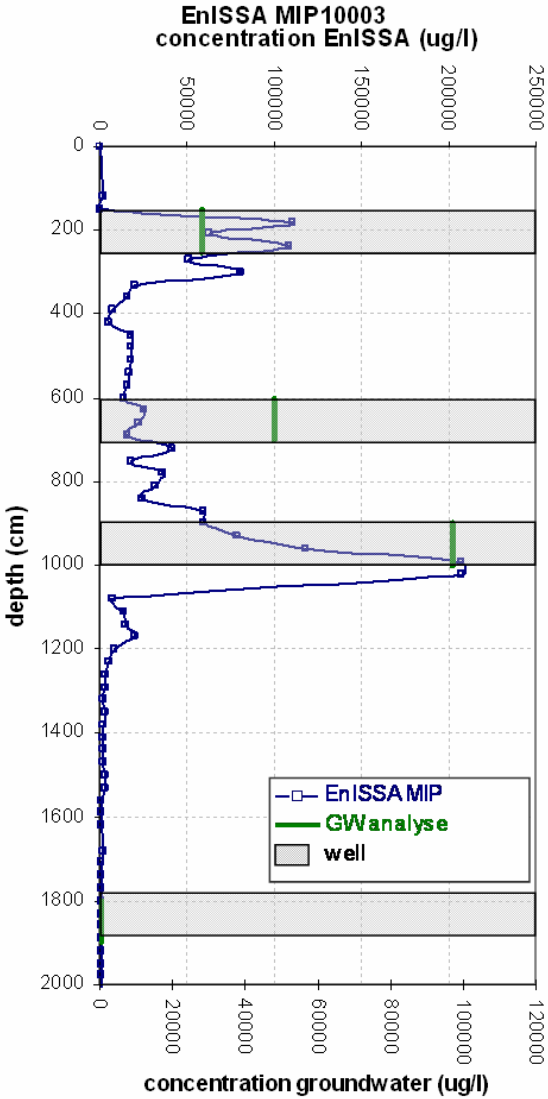
* low detection limit

* each 30 cm or less: characterization of up to 12 compounds

3. DCE in source: EniSSA – Monitoring wells







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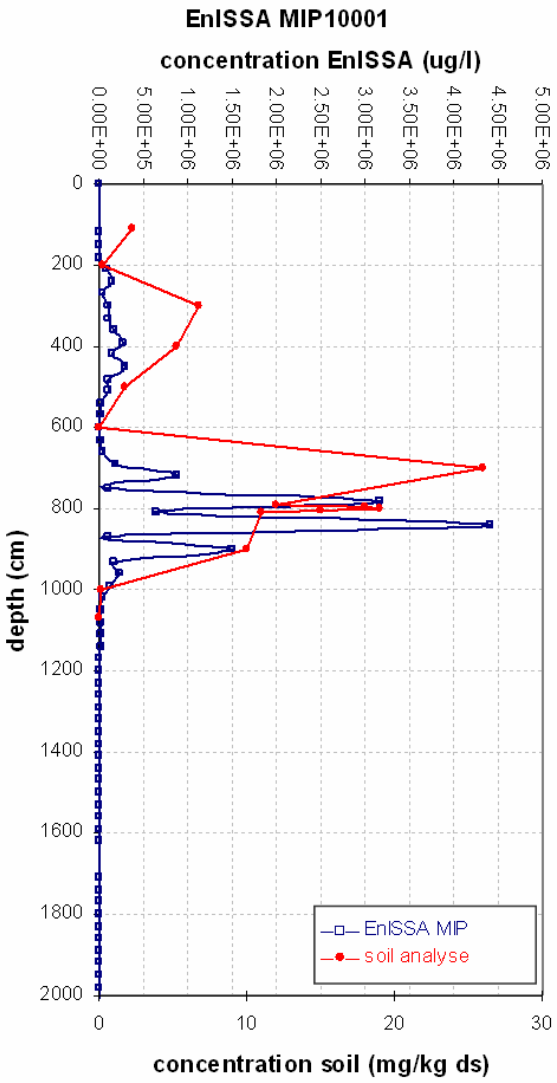
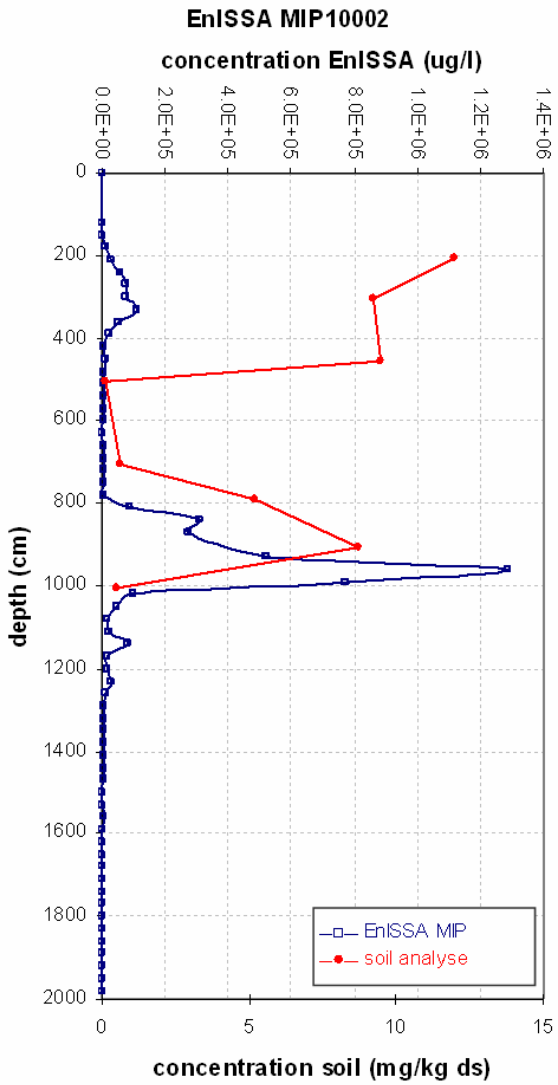
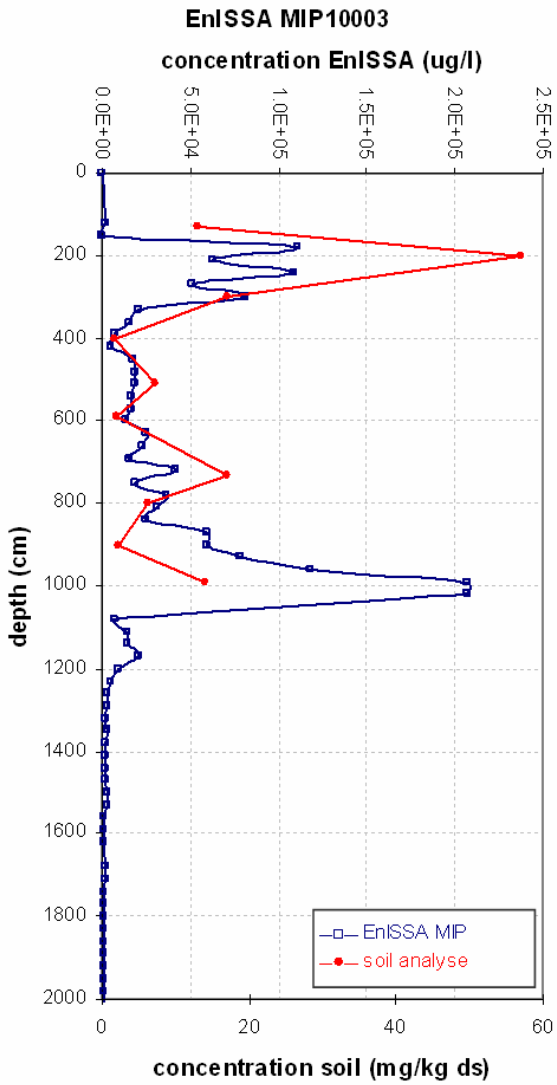
enhanced in-situ soil analysis

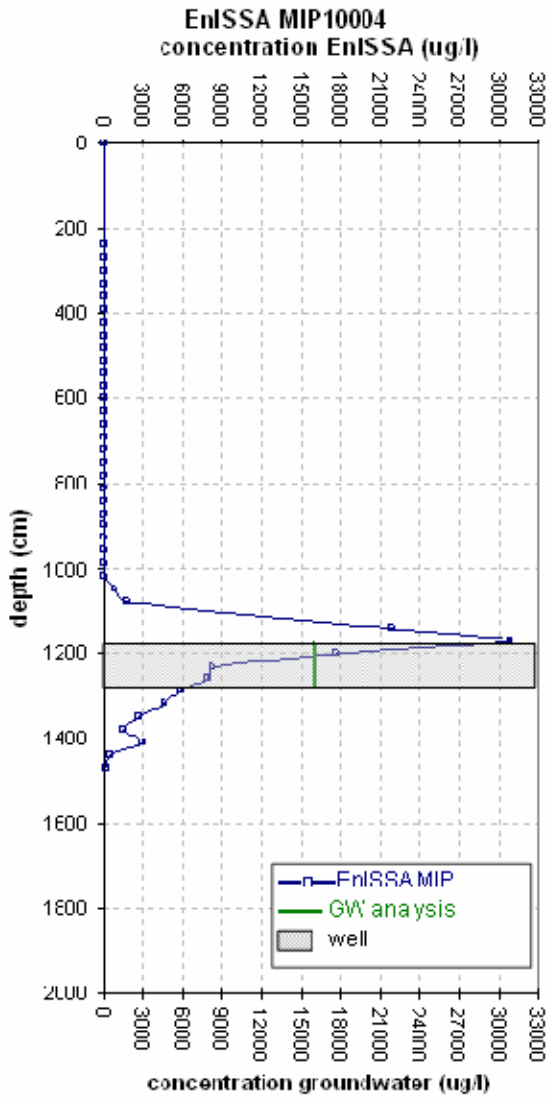
3. DCE in source: EnISSA – Soil samples

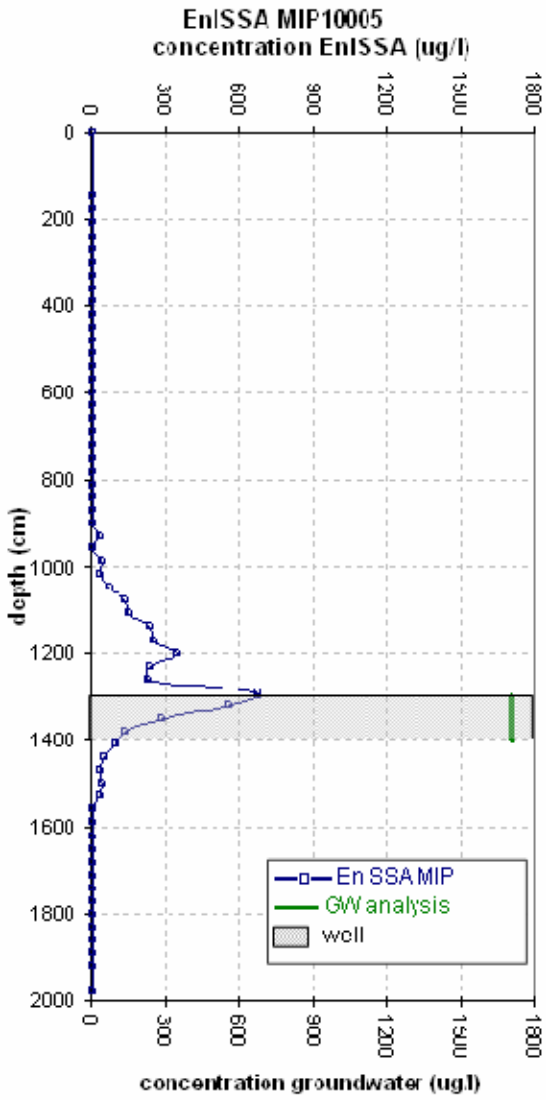


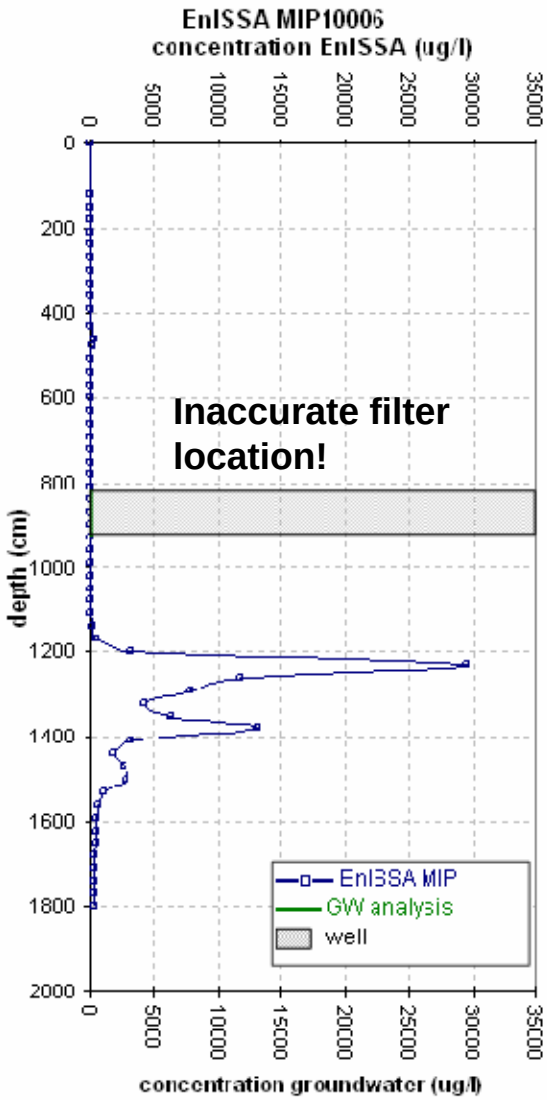




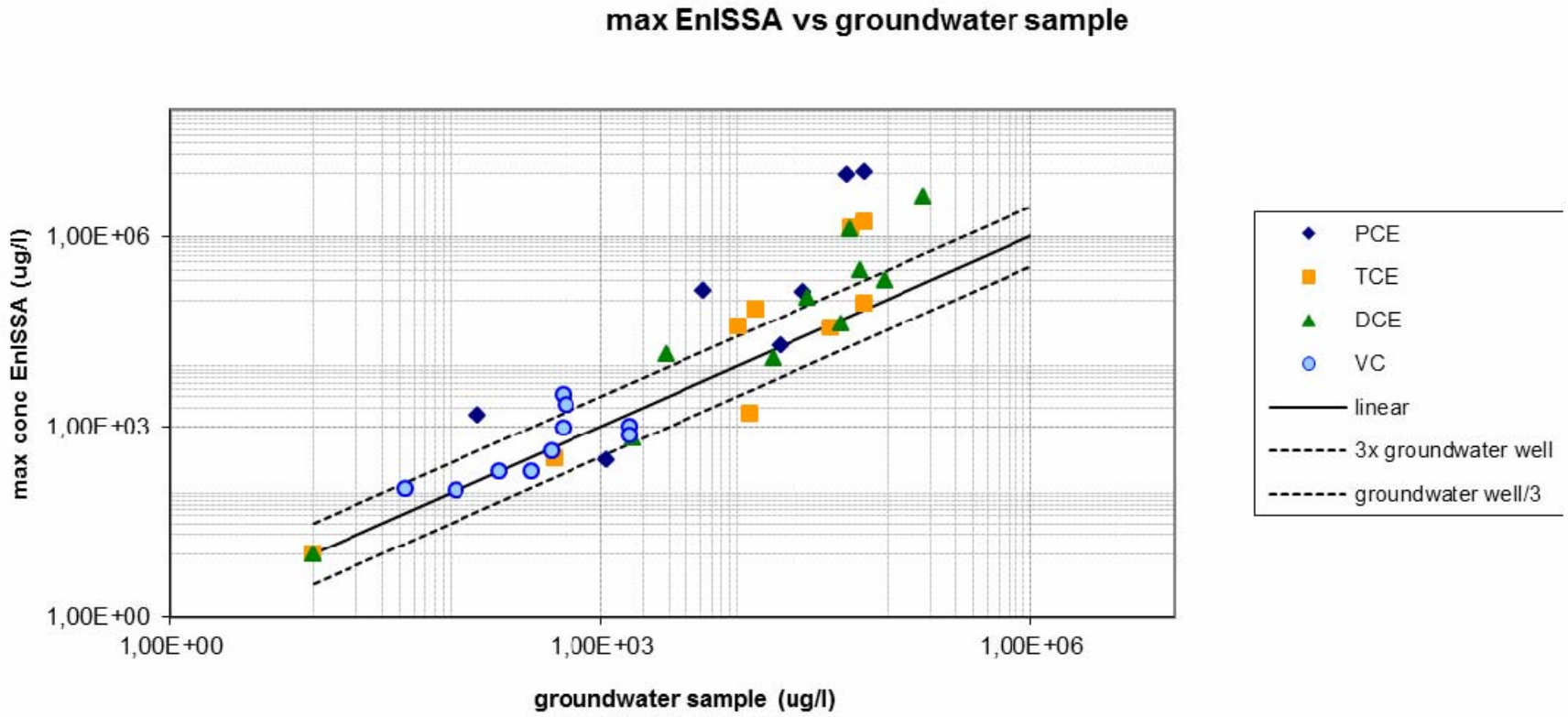
3. Plume: DCE EniSSA – monitoring wells







3. Field results



* contribution of adsorbed contaminants which will be measured by EnISSA but not in groundwater samples

* EnISSA results vs. groundwater results: order of magnitude is comparable → nearly-quantitative

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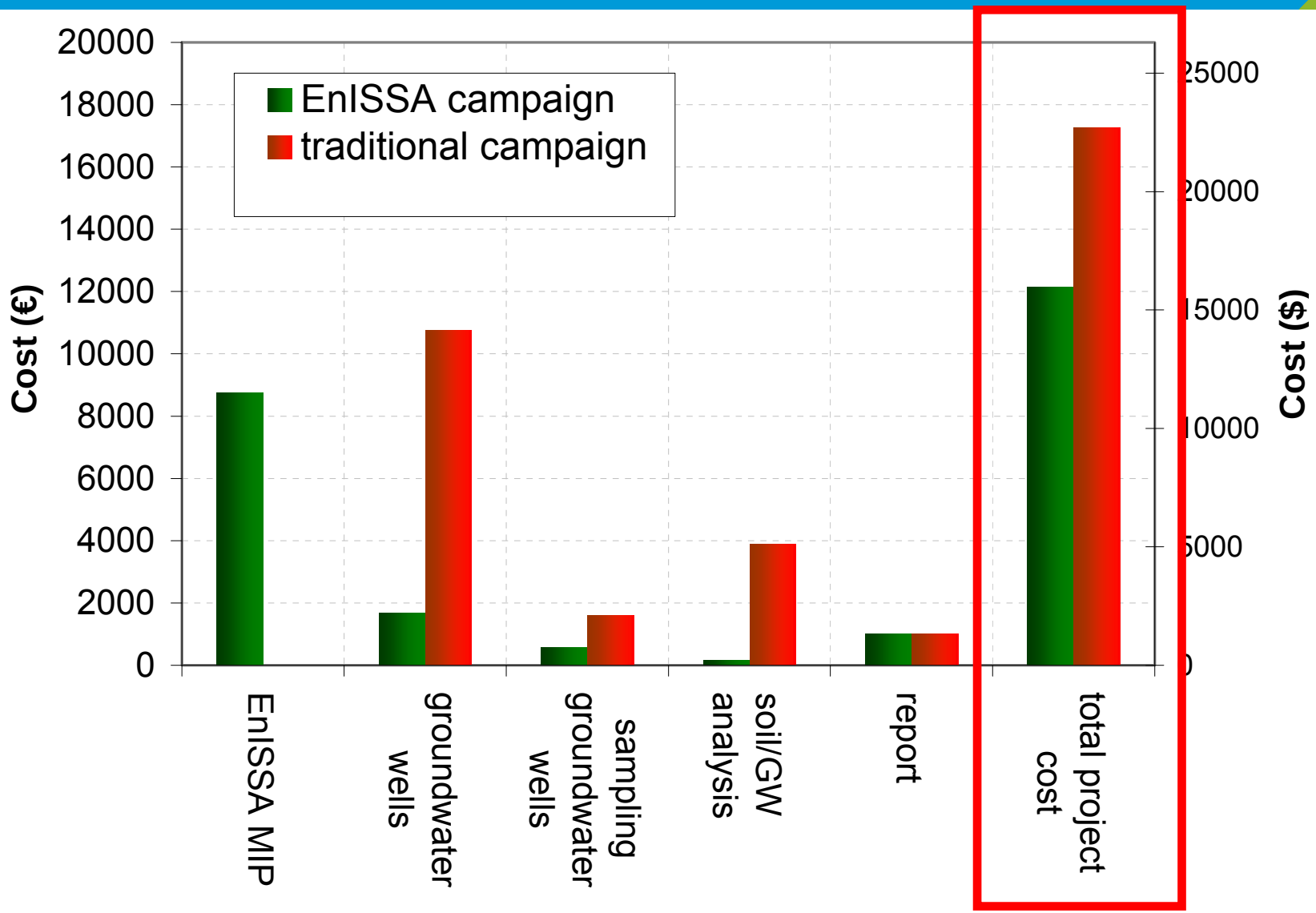
4. Cost comparison: Project cost



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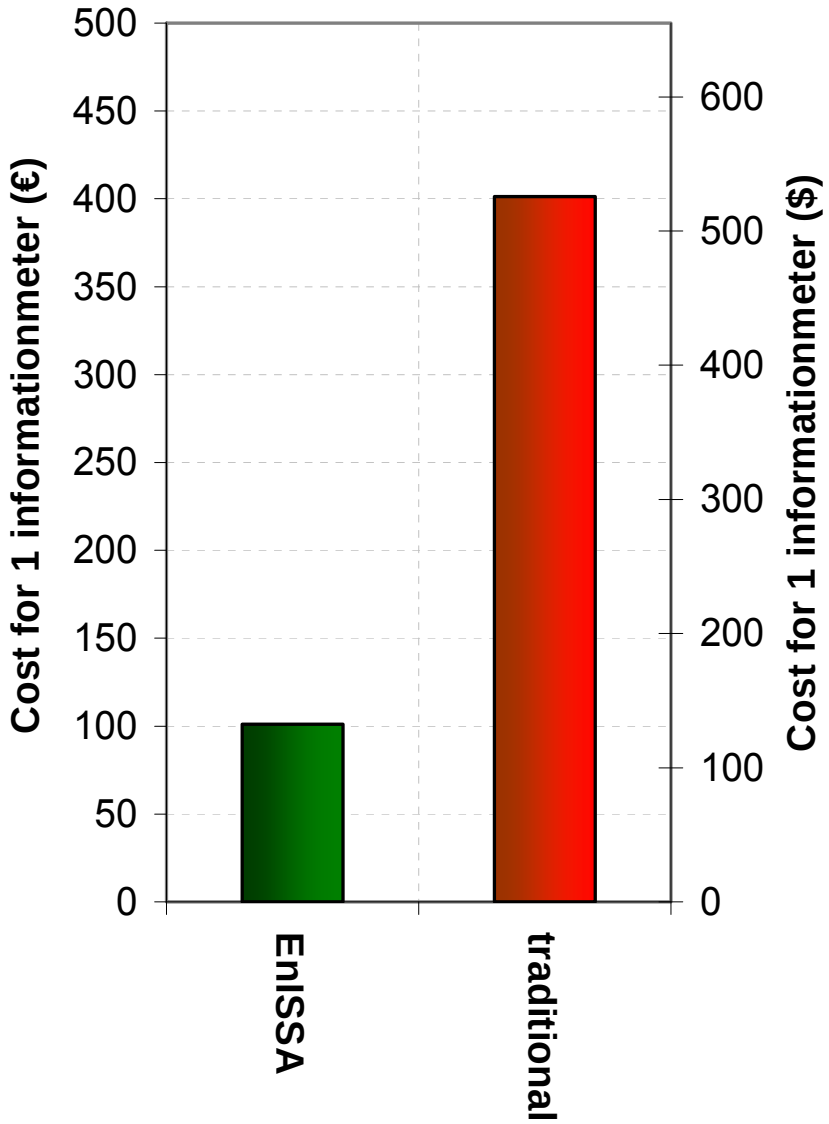
enhanced in-situ soil analysis

4. Cost comparison: information meter



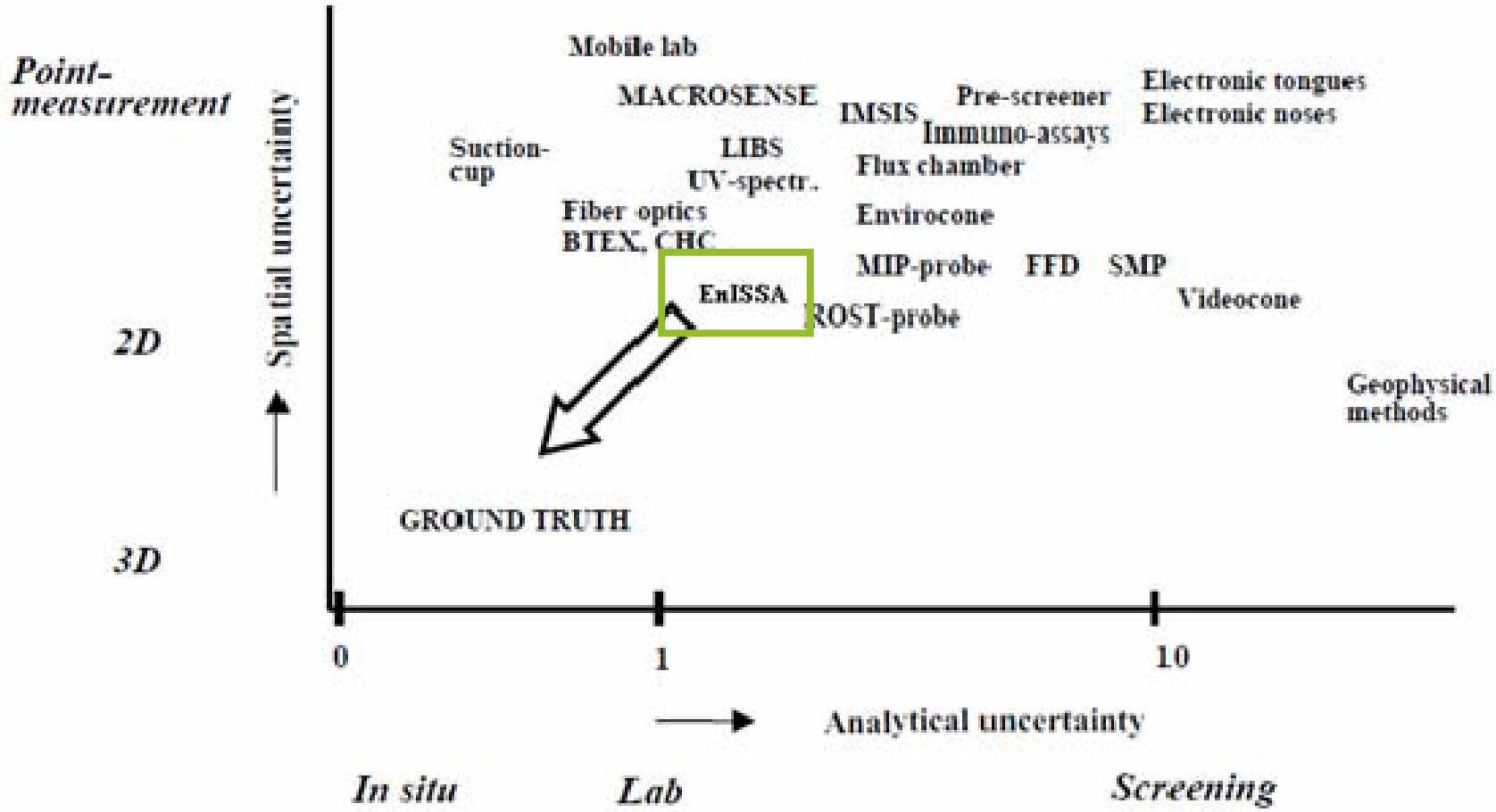
More information

Better conceptual site model

Higher succesrate of remediation projects

5. Conclusions

ARE WE THERE YET?



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5. Conclusions

- EnISSA MIP: component specific results (µg/l level)
- Each 30 cm up to 12 compounds can be distinguished
- Order of magnitude ~ groundwater samples

  ➔ valuable assessment tool to delineate source + plume

- Immediately "On site" availability of information of contamination

  ➔ flexible adaptation of site research project

  ➔ strategic sampling well locations ➔ reducing sampling costs and time

Better CSM, better risk assessment

More accurate remediation design, lower remediation cost

More effective remediation, less remediation failure.

EnISSA possibilities

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enhanced in-situ soil analysis

- VOCl, BTEX, MTBE: the usual suspects
- (Semi-) volatile exotics → feasibility test and calibration (e.g. acetone, ...)
- Usually with Geoprobe rig
- Combination with CPT probe (20ton truck)

More information:

www.ovam.be

www.CityChlor.eu

Info@citychlor.eu

www.EnISSA.com

info@EnISSA.com