Between the Lines: Reference Site Verification

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VEGAS
Versuchseinrichtung zur Grundwasser- und Altlastensanierung

Reference Site: *Concept*

- Test of measurement equipment at different scales up to field scale but under well defined conditions (“between the lab and the field”)
- Stepwise approach

1. **Principle function tests with “ideal” samples (standards / +interfering conditions)**
2. **Function tests using realistic application procedure**
3. **Function tests under field conditions (varying boundary conditions e.g. different soil material)**

PROMOTE: *The Systems to Test*

- IMW (Hansjörg Weiss)
  - Ceramic dosimeters
  - Packer systems
  - Minipressure pump
- Slandi (Andrzej Szlapa)
  - LED-Photometer

Commercially available systems

- ***VEGAS***
  - MOX-System
  - Fibre optic fluorometer

Prototypes

VEGAS: The Infrastructure – the reference container

VEGAS: The Infrastructure – the big container

Length: 18.5 m
Width: 9 m
Height: 4.5 m
More than 1000 sampling locations

3 Compartments (9m ☞ 6.2m ☞ 4.5m)

VEGAS: The Infrastructure – the Analytical Lab

Analytical Methods:

GC/MS	GC/ECD/FID
HPLC	TOC with SSM
ASE	UV/Vis-Photometer
ICP-OES	etc.

Additionally:
Metal, wood, electronics workshops

Test Activities: *Minipressure Pump (imw, Tübingen)*

Sample is delivered by repeatedly applying and releasing pressure to one of two tubes (pendulum principle)

Claims

Claim 1: The recovery of volatiles is minimum 95 %.

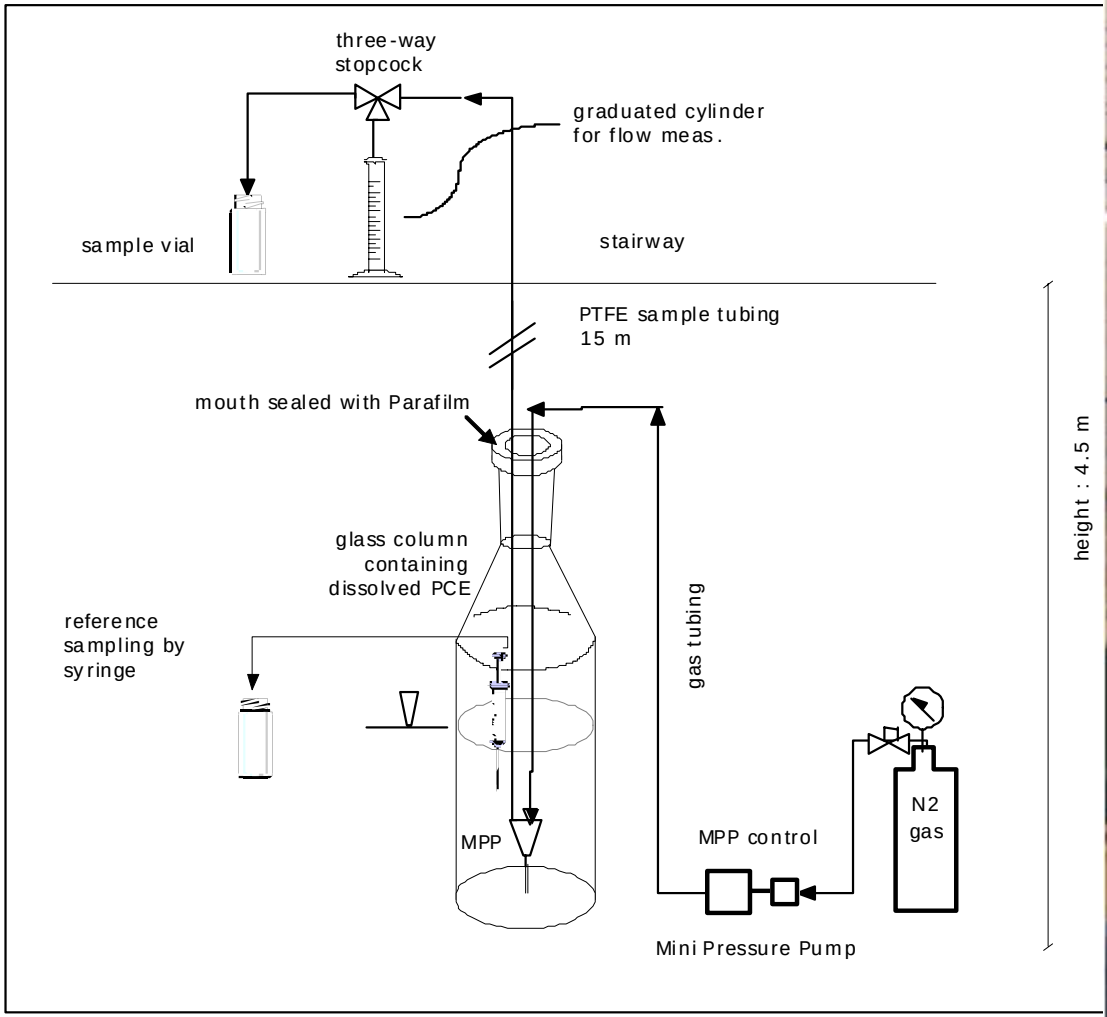
Claim 2: The pump works down to 80 m below surface level.

Claim 3: The maximum contamination level with O_2 is 0.1 mg/L or 1% of saturation, whichever is higher.

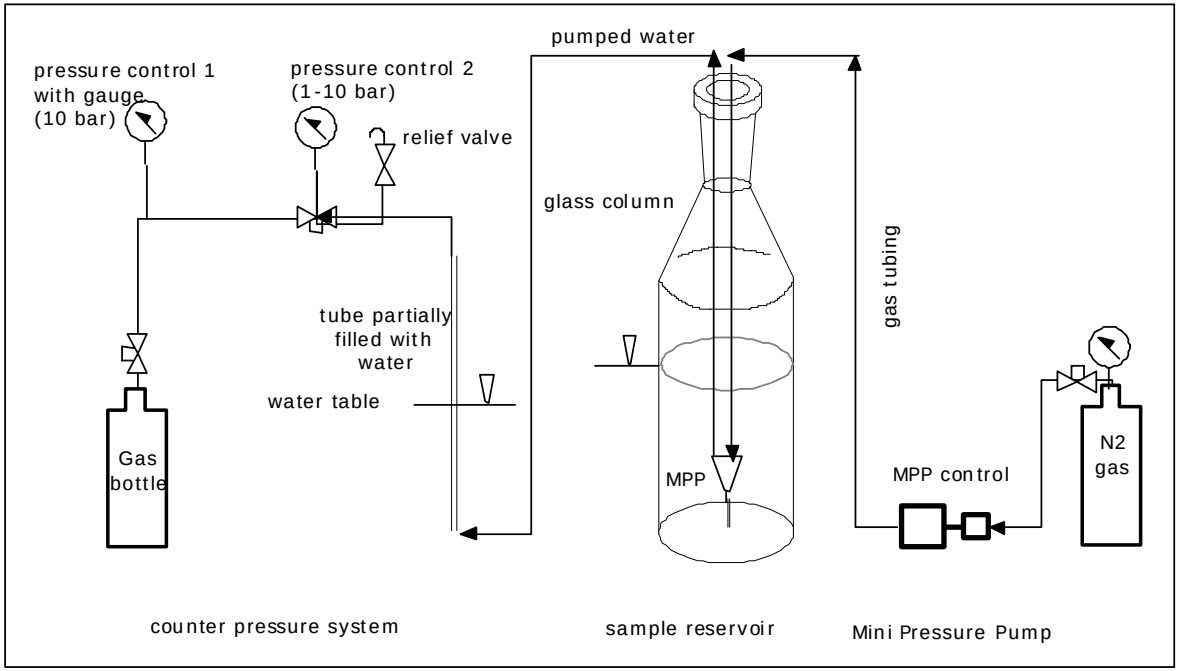
Claim 4: Use of Mini-Pressure-Pump (MPP) in combination with a Multilevel Packer System provides samples that differ less than 40% from the *"true concentration"*.

(claims slightly adapted)

Tests for Claim 1 (Recovery of Volatiles)



Tests for Claim 2 (Pressure Stability)



Tests for Claim 3 (Oxygen Uptake)

Indirect method:

- Glass column filled with a Fe(II) salt (very sensitive to Oxygen)
- Sampling and measurement of the loss of dissolved Fe(II)

Tests of Claim 4 (Combination with Mulitlevel Well)

1st decision:
Claim can only be tested in the field!

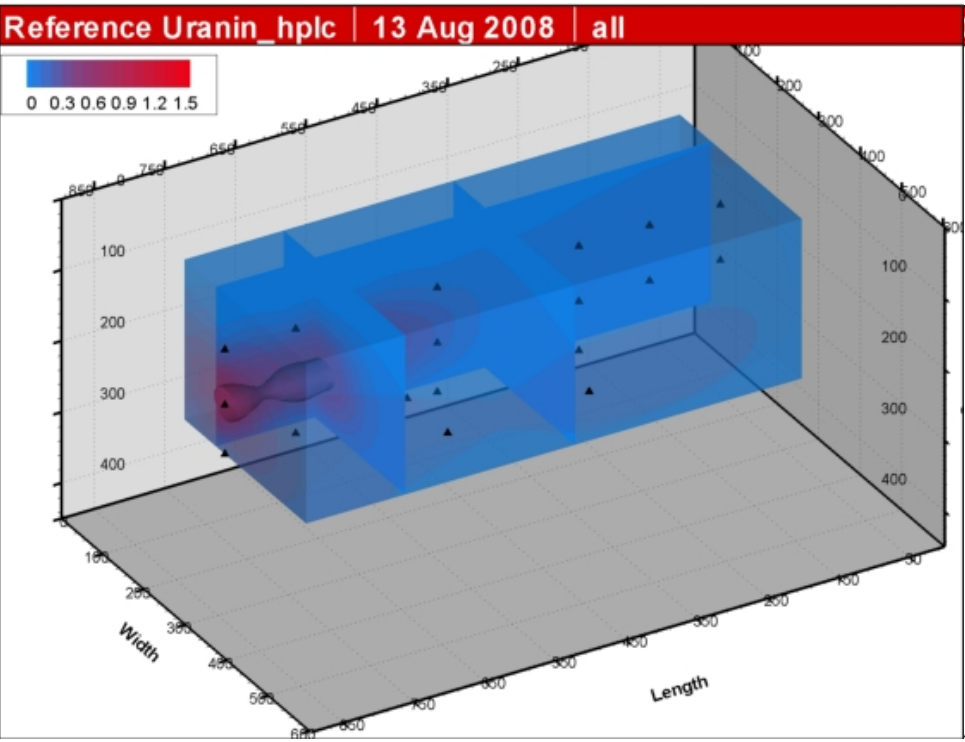
Problem:
What is the „true Value“?

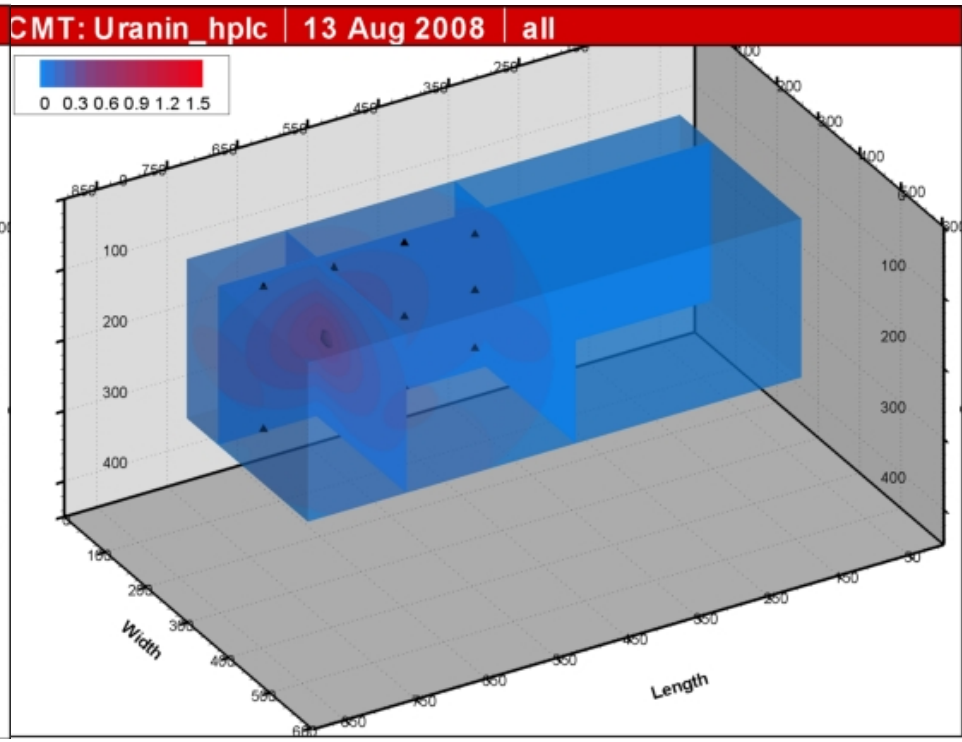
Parameters:
- VOC (Benzene)
- PAH

Boundary Effects:
- Heterogeneity
- 2nd Sampling method necessary
- Sample transport

Test of Claim 4: Back to the Reference Lab

Test Activities: Plume in Big *VEGAS*-Container





Reference measurements

MPP sampling

Tests were performed acording to CWA

Reference Testing: *Lessons Learned*

- The definition of claims is a crucial part and requires a close cooperation of the vendor, the VB and the test lab
- The conception of the tests is a time consuming step and requires a detailed discussion between the vendor and the test lab
- A revision of the claims should be an option during the testing procedure
- Since tests may fail (for many reasons!), a repetition of tests should be considered during set up of the time schedule
- The documentation of tests and the evaluation is very time consuming!
- The better the planning, the less efforts later on…

The Role of the Reference *Lab*

- That's where the expertise about the technologies to be tested should be, along with the possibilities to conduct tests (and to claim things!)
- The reference lab should be involved as early as possible
- The time required for preparation, performance, and documentation of the tests should be accounted for
- The reference lab should have a certain infrastructure in order to be flexible enough for possible claims

Reference *Lab* vs. Field activities

- **What should be tested in the reference lab:**
  - Statistical parameters
  - Interferences (boundary conditions, matrix effects…)
  - Strongly varying parameters

    => Everything that needs control and flexibility
- **What should be tested in the field:**
  - Handling under field conditions
  - Influence of environmental influences
  - Influences caused by the subsurface

    => But one is restricted to the conditions found

thank you for your attention!

Lit: Deliverable 9/10: “ETV System Testing at Technical Scale and Feasibility report of ECV system for practical application, including a reference site preparation guide”, ***www.promote-etv.org***