Validation Of The Leachate Prognosis With PAH Contaminated Soil, Ash Of Domestic Waste And Material Of Road And House Demolition

Diffuse Einträge ins Grundwasser:
Monitoring – Modellierung - Management
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Introduction & Objective

Recycling material

- Low contaminated materials
- Used for road construction

→ Distribution in sensitive soil depth

→ Stays permanently in soil

Hazards:

1) Contamination of deeper soil layers
2) Groundwater contamination

⟹ **Leachate prognosis**

Location of prognosis:
upper edge of the saturated zone

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SiWaP – BMBF – Leachate prognosis project

Emission rate

- Elution of inorganic pollutants
- Mobilization of particle bounded pollutants
- Microbiological processes of release and fixation
- Column experiments to study the desorption of inorganic compounds
- Determination of emission rates with triaxial cell
- Simulation with TENSIC

Transport prognosis

- Microbial degradation
- Column experiments
- Batch experiments/elution tests
- Macro pore flow
- Simulation with RICHY, SMART (Science), SEEPER (practice)
- Central data base (DaSiWa)

Reference experiments

Standard reference materials
central lysimeter experiments
(FZJ, GSF, LUA)

Application – reference materials in lysimeters

PAH contaminated soil – lysimeter 302 ("Soil")
BO/IV.31-630/GB2
< 2 mm, 1510.0 kg
Layer thickness: 0.47 m

Ash of domestic waste – lysimeter 306 ("Ash")
MV/IV.31.-631/GB 15
< 4 mm, 1660.0 kg
Layer thickness : 0.46 m

Material of road and house demolition – lysimeter 307 ("Demolition")
BS/4.31-632/B109B110
< 4 mm, 1544.2 kg
Layer thickness : 0.45 m

Application – reference materials in lysimeters

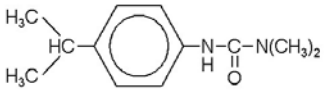
Parameter	„Soil"	„Demolition"	„Ash"
Filled amount [kg]	1510.0	1660.0	1544.2
Layer thickness [m]	0.47	0.46	0.45
Grain size [mm]	< 2	< 4	< 4
Acenaphthene [mg kg^{-1}]	10-50	1-5	-
Anthracene [mg kg^{-1}]	1-5	1-5	-
Fluorene [mg kg^{-1}]	10-50	1-5	-
Phenanthrene [mg kg^{-1}]	10-50	-10	-
As [mg kg^{-1}]	n.d.	1-5	5-10
Pb [mg kg^{-1}]	5-10	10-50	500-1000
Cu [mg kg^{-1}]	10-50	10-50	1000-2000
Zn [mg kg^{-1}]	10-50	50-100	2000-3000
Ca [g kg^{-1}]	10-50	10-50	50-100

Application – indicator substance/water tracer

1. Isoproturon:

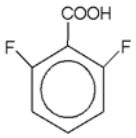
IUPAC: 3-(4-isopropylphenyl)-1,1-dimethylurea

Solubility in water: 0.065 g L^{-1}
n-octanol/water-coeffizient: 2.5



- transport process
- applied 0.80 m below top ground surface (TGS)
- application rate: 0.263 mL/lysimeter

2. 2,6-difluorobenzoic acid:



- transport process
- applied 0.80 m below top ground surface
- application rate : 12.6 g/lysimeter

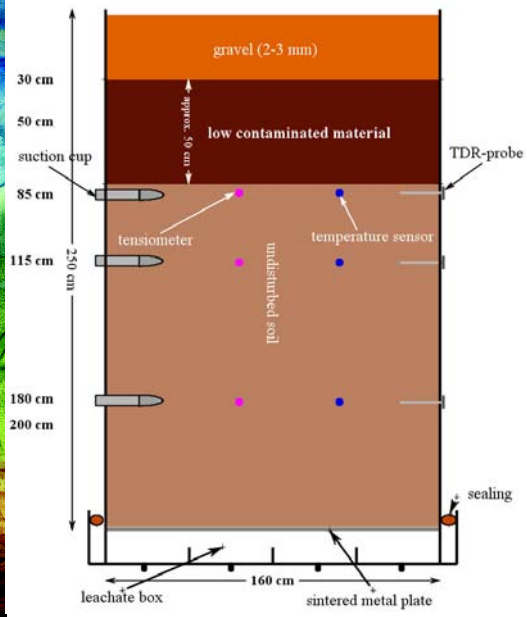
3. D_2O (deuterium oxide)

- conservative water tracer
- applied on surface
- application rate: 2 L/lysimeter

4. Potassium bromide

- conservative water tracer
- applied 0.80 m below top ground surface
- application rate: 31.3 g/lysimeter

Experimental design – cross section of complete installed lysimeter

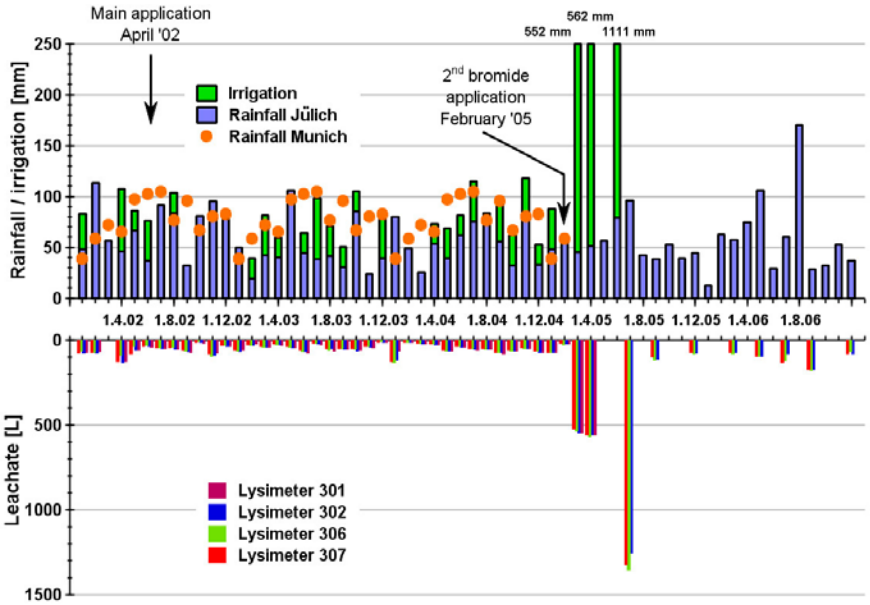


Filled with a soil monolith of an orthic luvisol

Experimental design

Experimental design

Leachate: rainfall, irrigation and leachate amount



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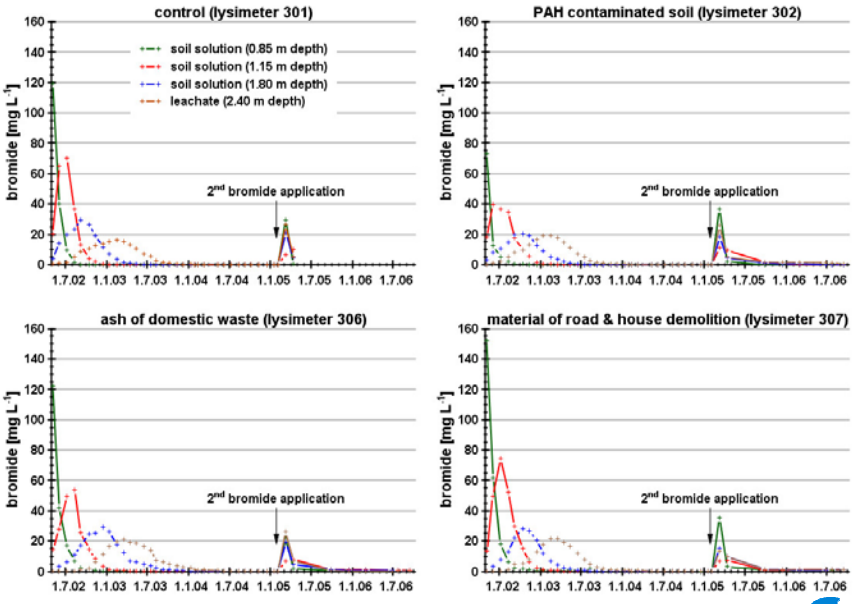
Soil solution & leachate: amounts from 6.05.02 to 14.12.06

lysimeter/ depth	301	302	306	307
0,85 m	161.3	302.3	282.2	322.5
1,15 m	54.0	126.1	93.7	126.6
1,80 m	346.7	390.2	575.0	633.8
Leachate	5778.8 [1]	9631.2	9740.8	9435.1
Sum	6340.8	10449.8	10691.7	10518.0
% of rain	79.5/83.4	81.5/85.7	82.4/88.6	79.8/86.0

[1] experiment ended April 2005

Water tracer: bromide



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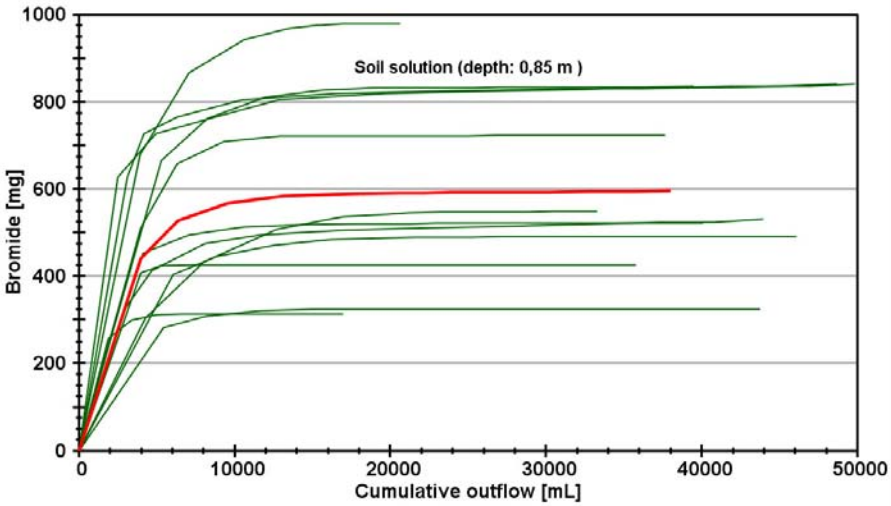
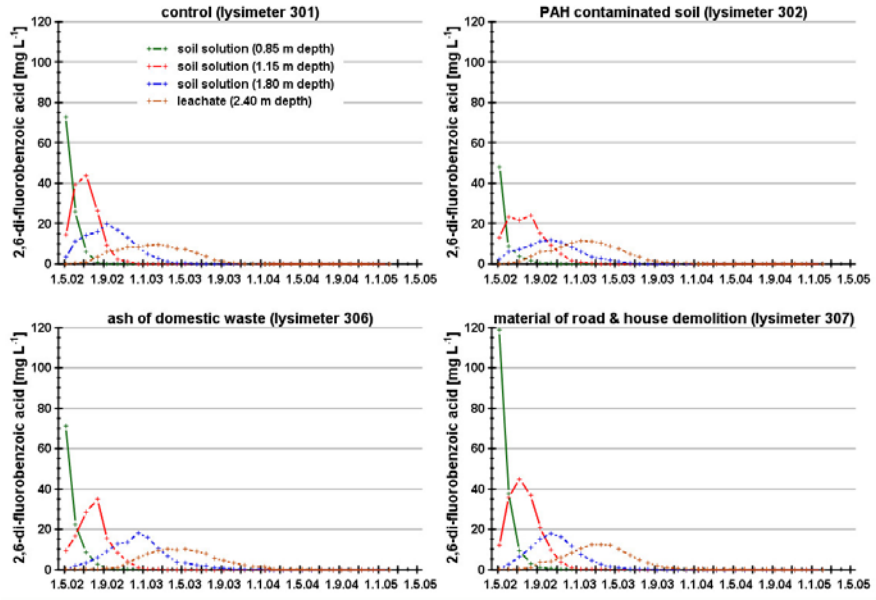
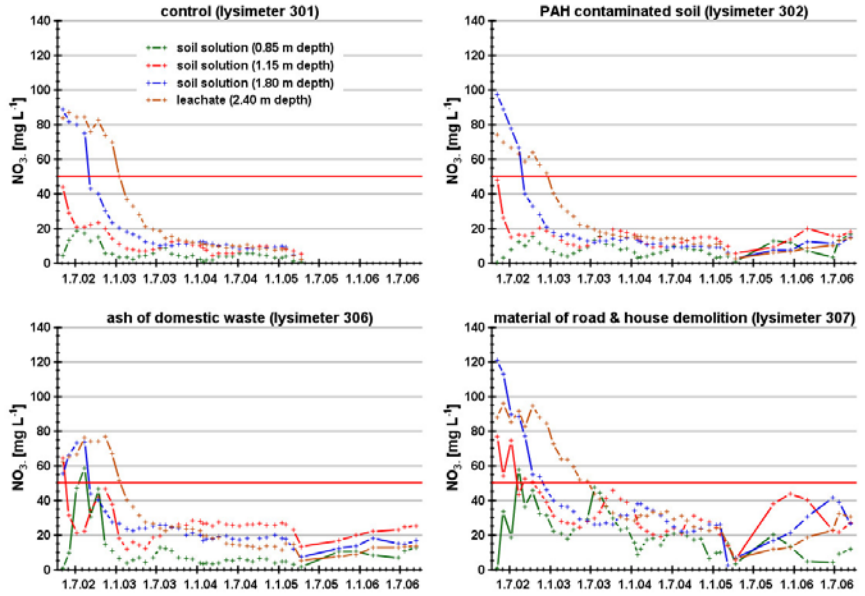
Water tracer: bromide breakthrough curves – variation



Indicator substances: 2,6-di-fluorobenzoic acid



Reference materials – general parameters: nitrate



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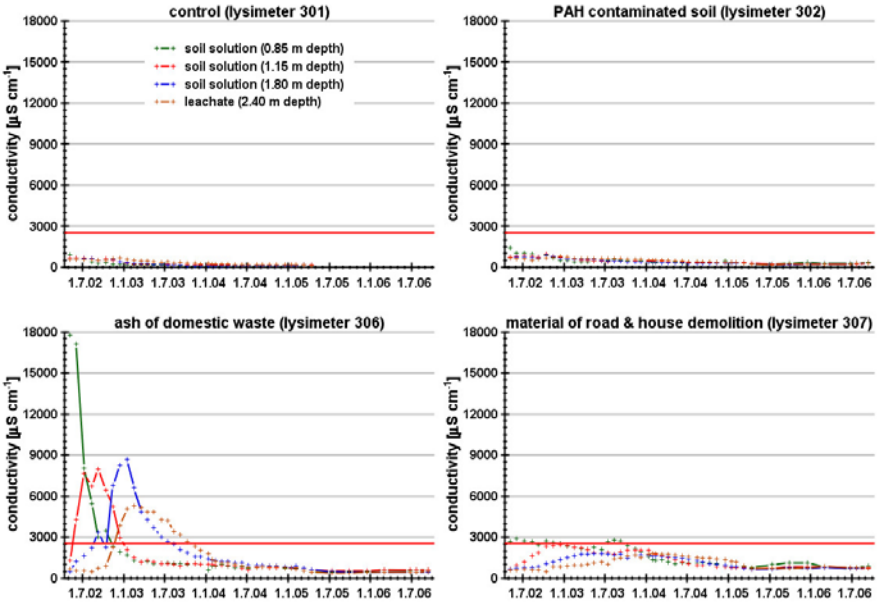
Reference materials – general parameters: conductivity



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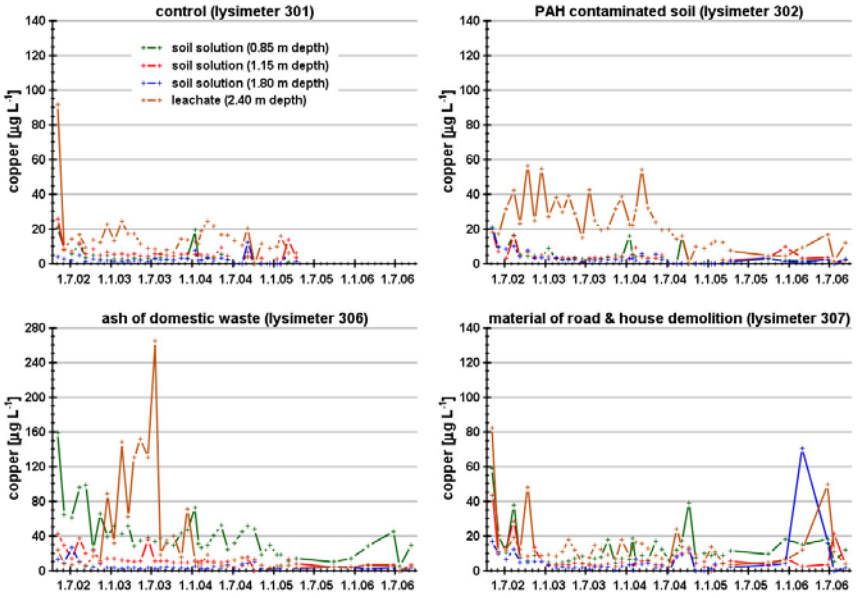
Reference materials – heavy metals: copper



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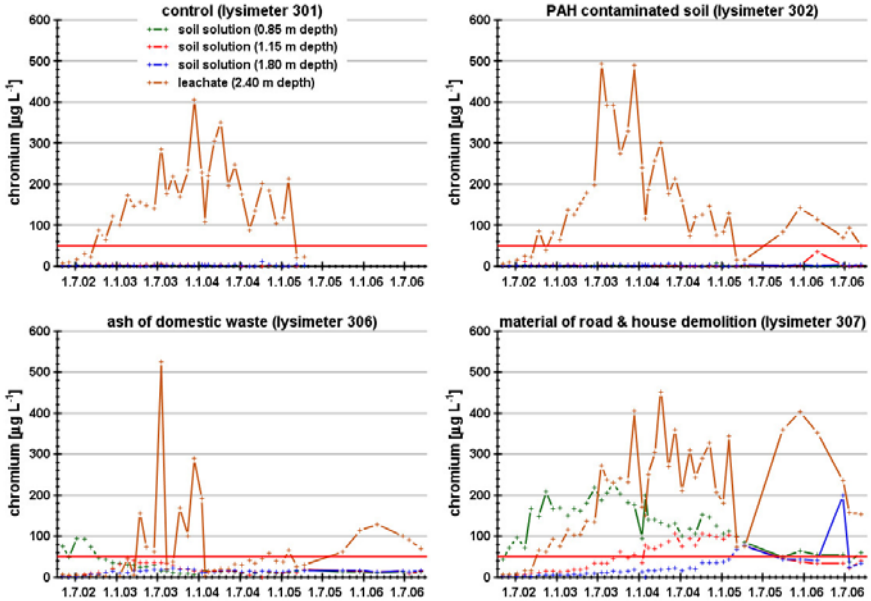
Reference materials – heavy metals: chromium



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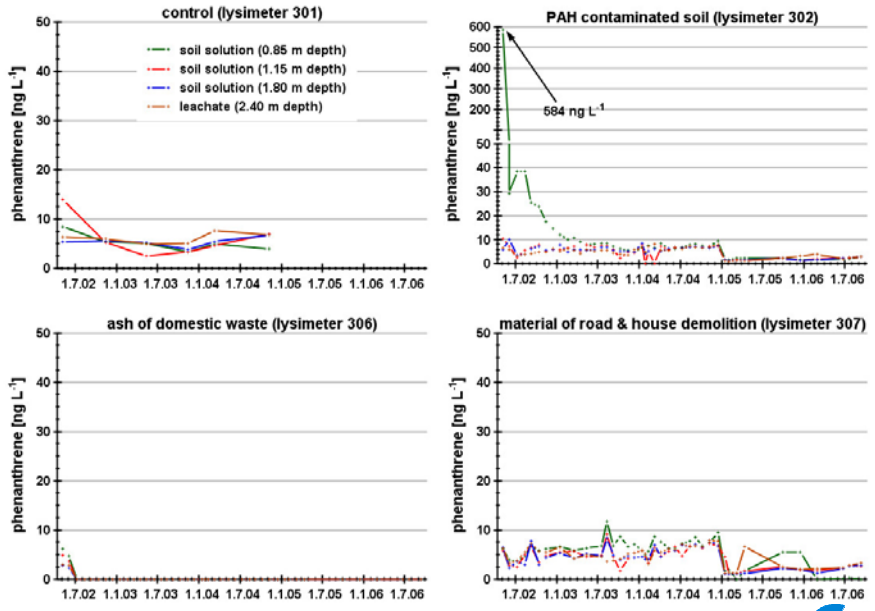
Reference materials – PAH: phenanthrene



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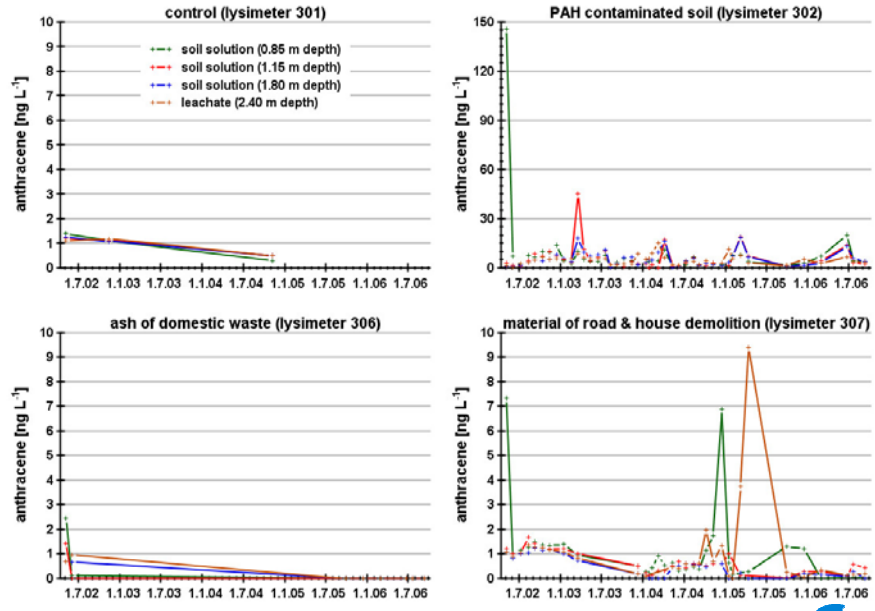
Reference materials – PAH: anthracene



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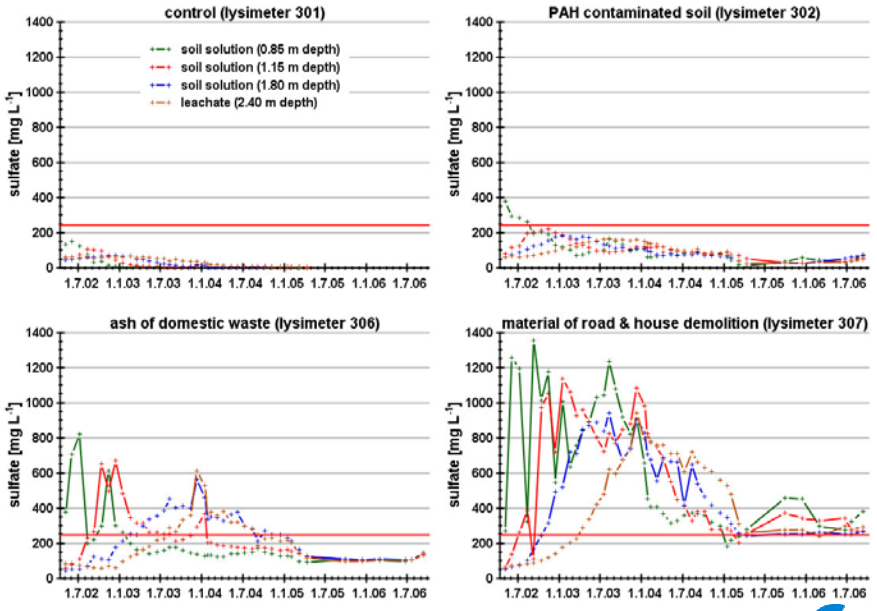
Reference materials – ions: sulfate



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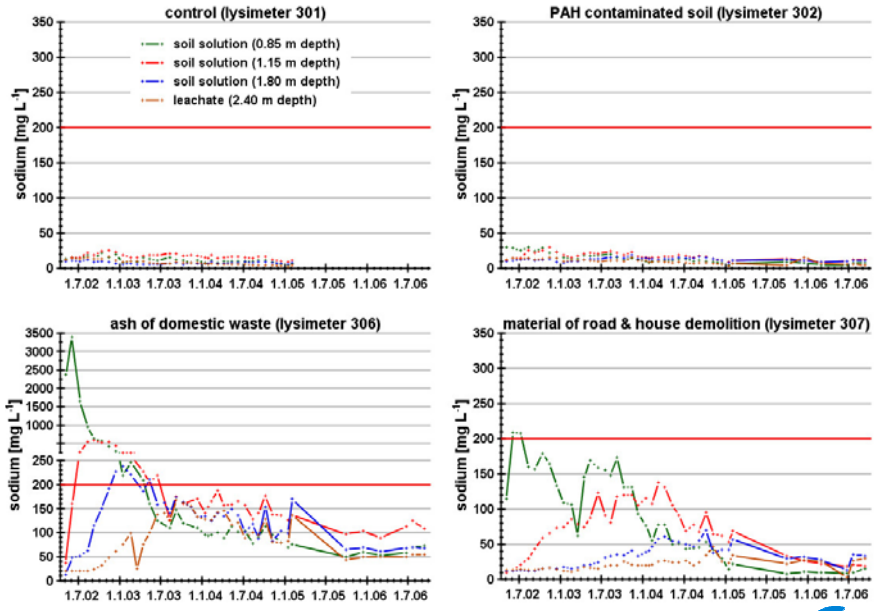
Reference materials – ions: sodium



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Conclusions

Only interim result is possible !!!!

Following trends are cognizable:

General parameters:	very high leachate amounts, at the beginning in part high values, stabilization on low level
Water tracer:	complete breakthrough curves
Indicator substances:	complete breakthrough curves or single detections (preferential flow)
Heavy metals:	in essence no critical concentrations, but nickel and chromium exceeded significantly the threshold values
Ions:	breakthrough in part on a very high level, all ions exceeded significantly the threshold values (exception: potassium)
PAH:	in part continuous low level detections

Thank

Thank you very much for your attention!

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