



Isodetect - Good exploration pays off



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**„Business initiation trip: Remediation of contaminated sites in Slovakia “
Bratislava, 25.06.2024**

Isodetect – nearly 20 years experiences



- 2019 — 1. workshop on pollutant degradation evaluation
- 2017 — New office in Munich outside the Helmholtz Centres
- 2014 — Own lab in the BioCity Leipzig
- 2005 — Spin-off from two Helmholtz Centres
 **HelmholtzZentrum münchen**
German Research Center for Environmental Health
- 2000 — Patent for evaluation of pollutant degradation using isotope analysis



Dr. Heinrich Eisenmann
Senior manager
Hydrology/Hydrogeology



Dr. Anko Fischer
CEO
Contaminated sites



Dr. Petra Bombach
Project manager
Energy



Falk Bratfisch
Lab technician
Analyses

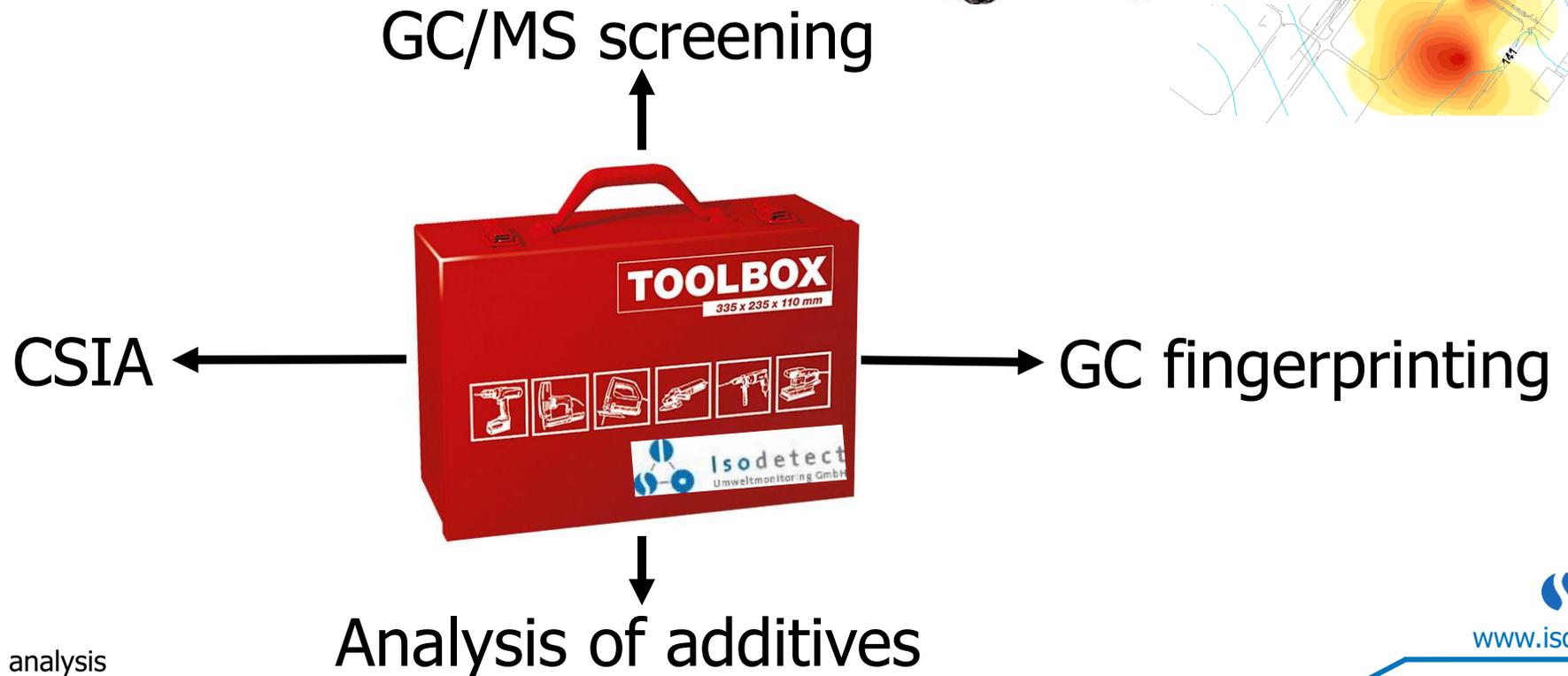
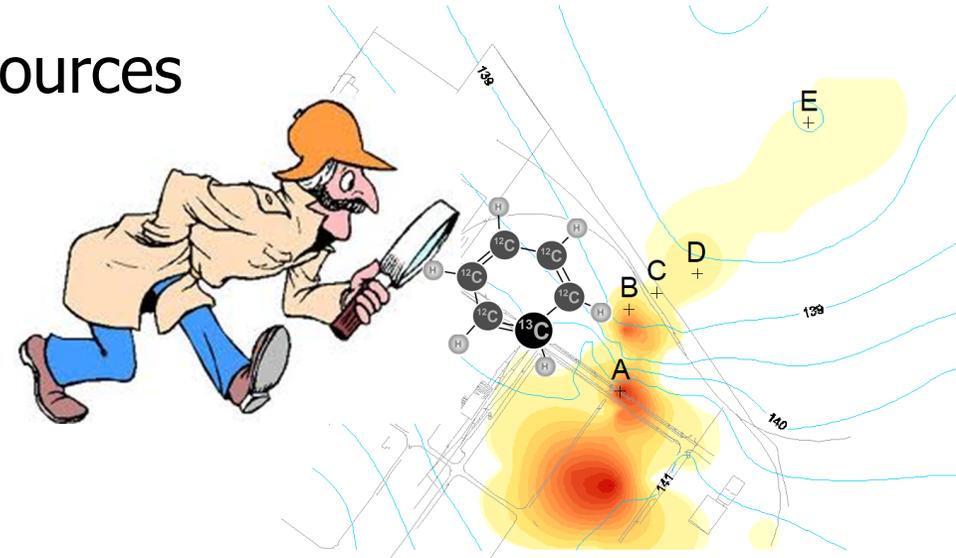


Dr. Kevin Kuntze
CEO
Lab manager



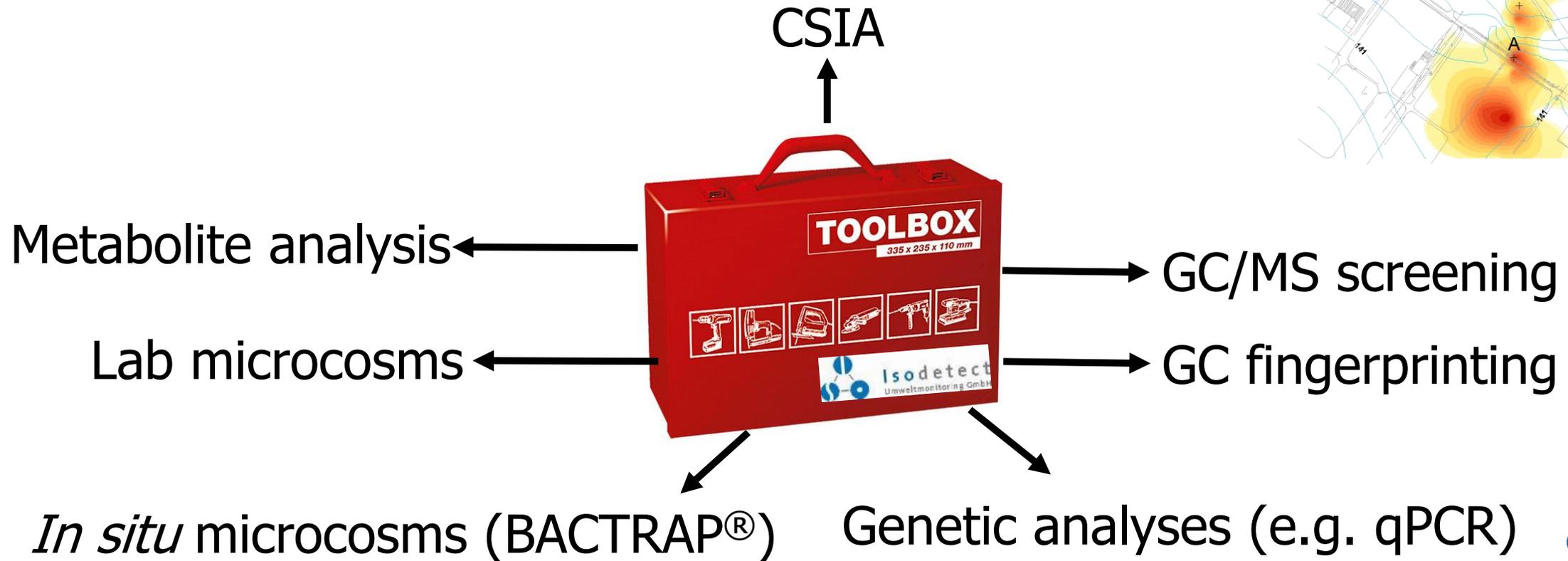
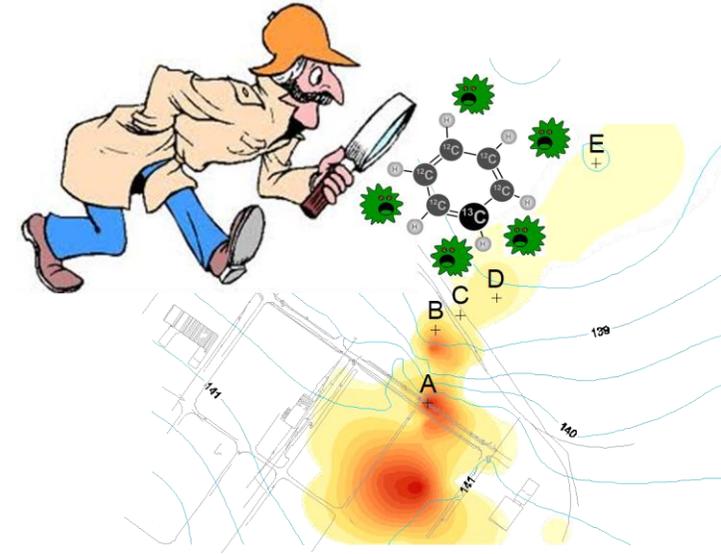
Monitoring of contaminated sites: Forensic investigation

- Apportionment / differentiation of pollutant sources
- Contaminant age assessment
- Identification of causes of contamination



Monitoring of contaminated sites: Evaluation of degradation

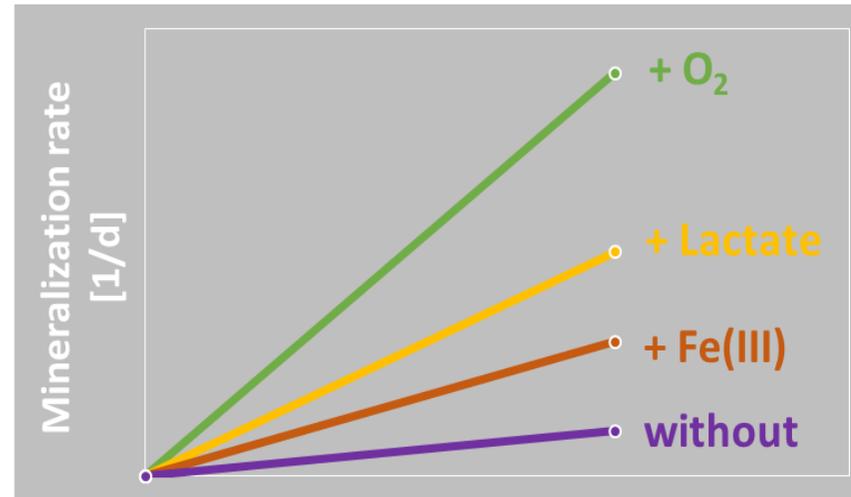
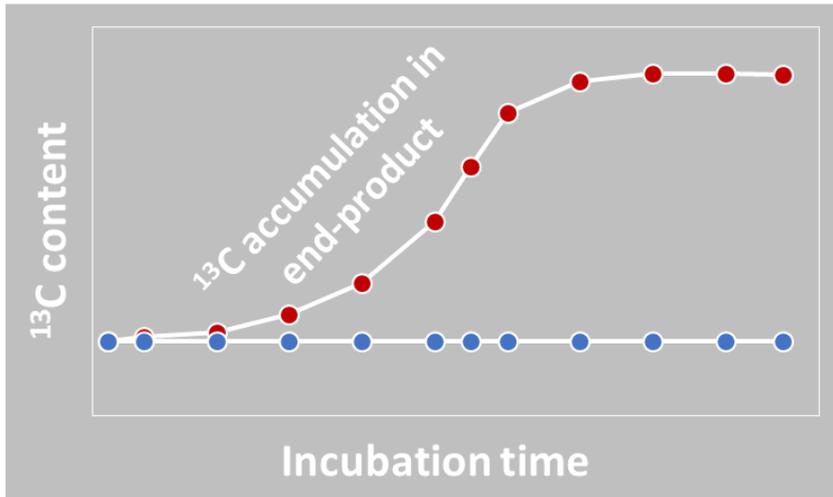
- Ascertainment of natural degradation
- Success control of stimulated degradation
- Quantification of pollutant degradation



Remediation of contaminated sites: Pre-assessment

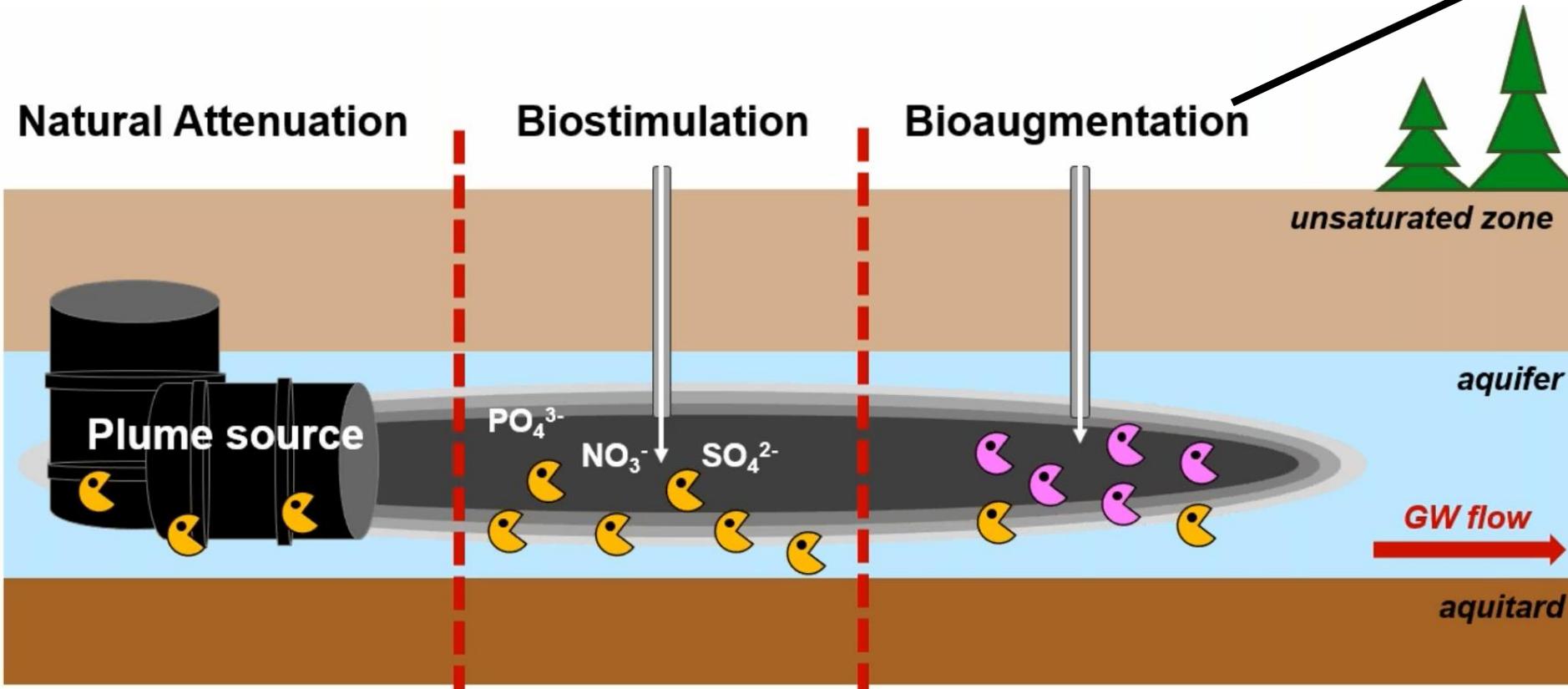


- Laboratory Treatability studies
- Design and success control of field pilot studies
- Design and success control of full-scale remediation



Remediation of contaminated sites: Stimulation of degradation

- Injection of electron donors (e.g. HRC, molasses)
- Injection of electron acceptors (e.g. O_2 , peroxides)
- Injection of pollutant-degrading microorganisms



European marketer of
KB-1[®]
KB-1[®] plus
DGG[™] Plus
DXO-88

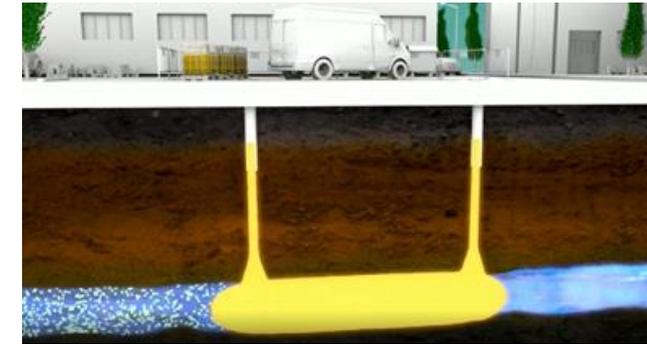


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Remediation of contaminated sites: *In situ* adsorption

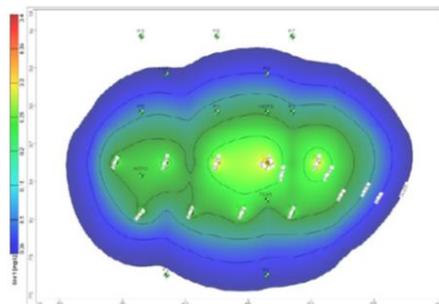
ColFerroX[®] - Iron oxide nanoparticles

- Adsorption barriers in aquifers
- Suitable for As, heavy metals (Zn, Ni, Pd, Cd, Cr, Cu,...), cyanide, fluoride and phosphate
- High adsorption capacity to immobilize pollutants for decades



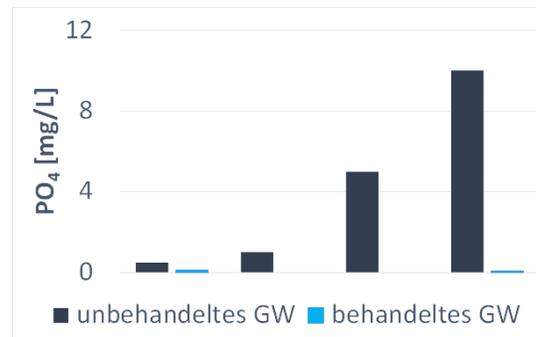
mobile

Retained concentration of goethite particles



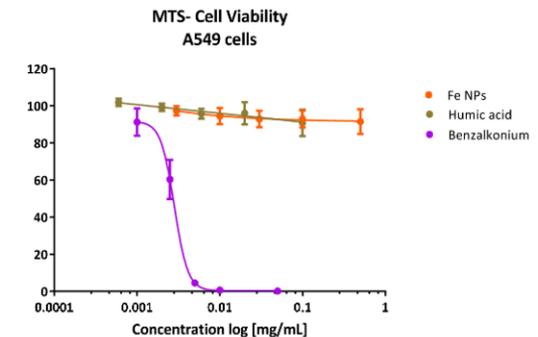
Easy to implement
Lower expense
Low potential for disruption

effektive



High sorption capacity
Long-term support
pH range 4-12

harmless



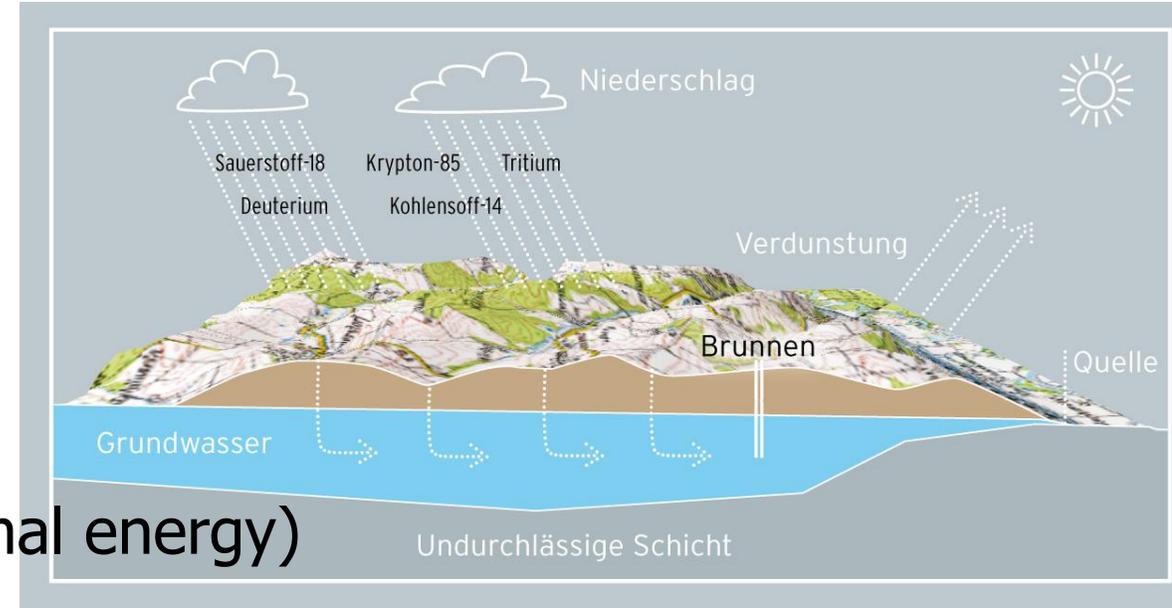
Non-toxic,
non-corrosive
No water hazard



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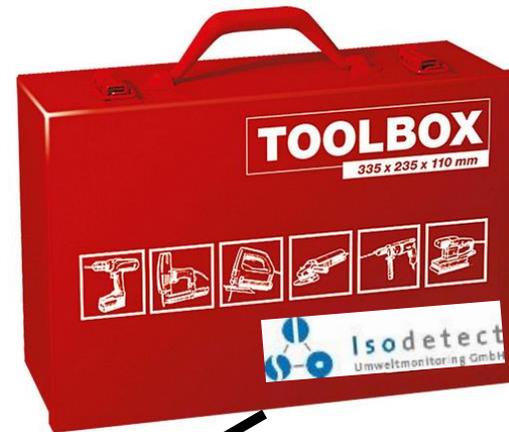
Hydrology / Hydrogeology

- Age and origin of groundwater
- Protection of drinking water resources
- Quality in well construction
- Apportionment of water catchment areas
- Infiltration of river and surface water
- Influence on deep aquifers (e.g. geothermal energy)



Stable isotope analysis, e.g. ←

$^2\text{H}/^1\text{H}$ & $^{18}\text{O}/^{16}\text{O}$ of water
 $^{15}\text{N}/^{14}\text{N}$ & $^{18}\text{O}/^{16}\text{O}$ of nitrate
 $^{34}\text{S}/^{32}\text{S}$ & $^{18}\text{O}/^{16}\text{O}$ of sulfate



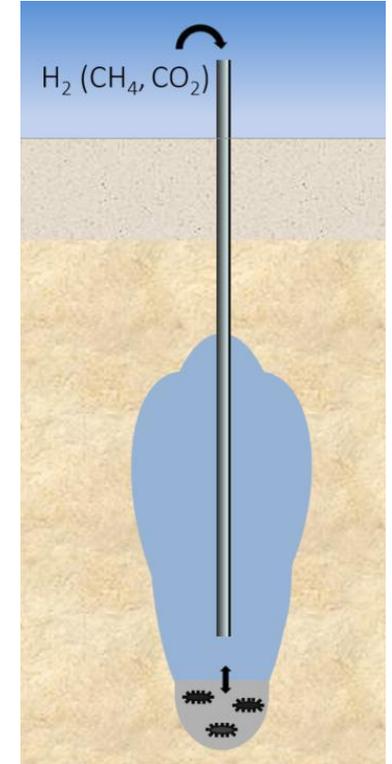
→ Radio isotope analysis, e.g.

^3H (and its stable product ^3He), ^{85}Kr
 ^{14}C , ^{40}Ar , ^{36}Cl
 ^{222}Rn , ^{137}Cs , ^{210}Pb , ^{210}Po

↙ Anthropogenic tracers (e.g. CFCs, SF_6 , sweeteners)

Production/storage of gaseous energy sources

- Tightness of geological gas storage facilities
- Maturity of natural gas
- Gas & water migration during fracking
- Suitability test for hydrogen underground storage
- Detection of biogeochemical hydrogen conversion processes
- Monitoring leaks and processes in CO₂ storage
- Early detection of disruptions in biogas production



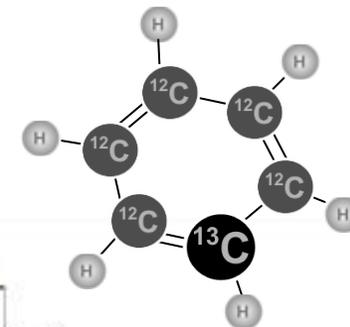
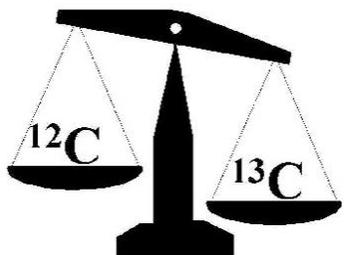
Stable isotope analysis, e.g.
 $^{13}\text{C}/^{12}\text{C}$ of CH_4 , C_2H_6 , C_3H_8 , CO_2
 $^2\text{H}/^1\text{H}$ of H_2 , CH_4 , C_2H_6 , C_3H_8
 $^2\text{H}/^1\text{H}$ & $^{18}\text{O}/^{16}\text{O}$ of water



Radio isotope analysis, e.g.
 ^3H (and its stable product ^3He), ^{85}Kr
 ^{14}C , ^{40}Ar , ^{36}Cl
 ^{222}Rn , ^{137}Cs , ^{210}Pb , ^{210}Po

Lab microcosms

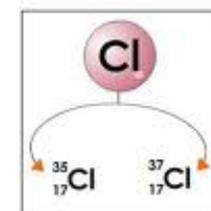
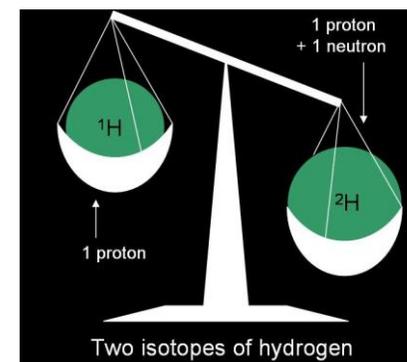
Finding Synergies



1	2	3	4	5	6	7	8	9	10	11	12	
0	¹ H	² He	Li	Be	5	6						
1	² D	³ He	⁴ Li	⁶ Be	B	C	7					
2	³ T	⁴ He	⁶ Li	⁷ Be	⁷ B	⁹ C	N	8				
3	⁴ H	⁶ He	⁶ Li	⁷ Be	⁹ B	¹⁰ C	¹² N	O	9	10		
4	⁶ H	⁶ He	⁷ Li	⁸ Be	⁹ B	¹⁰ C	¹¹ N	¹² O	F	Ne		
5	⁶ H	⁷ He	⁸ Li	⁹ Be	¹⁰ B	¹¹ C	¹² N	¹³ O	¹⁴ F	¹⁶ Ne	11	
6	⁷ H	⁸ He	⁸ Li	⁹ Be	¹⁰ B	¹² C	¹³ N	¹⁴ O	¹⁵ F	¹⁶ Ne	Na	12
7	⁸ He	⁹ Li	¹⁰ Be	¹¹ B	¹² C	¹⁴ N	¹⁵ O	¹⁶ F	¹⁷ Ne	¹⁹ Na	Mg	
8	¹⁰ He	¹¹ Li	¹² Be	¹³ B	¹⁴ C	¹⁵ N	¹⁶ O	¹⁷ F	¹⁸ Ne	¹⁹ Na	²⁰ Mg	
		9	¹² Li	¹³ Be	¹⁴ B	¹⁵ C	¹⁶ N	¹⁷ O	¹⁸ F	¹⁹ Ne	²⁰ Na	²¹ Mg



Thanks for your attention



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