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HOlistic Management of Brownfield REgeneration (HOMBRE)

HOMBRE technology trains:

smoothening the transition of brownfields to new uses?

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In cooperation with:

www.cabernet.org.uk www.greenland-project.eu www.timbre-project.eu www.dais.unive.it/~glocom

GLOCOM Global Partners in Contaminated Land Management

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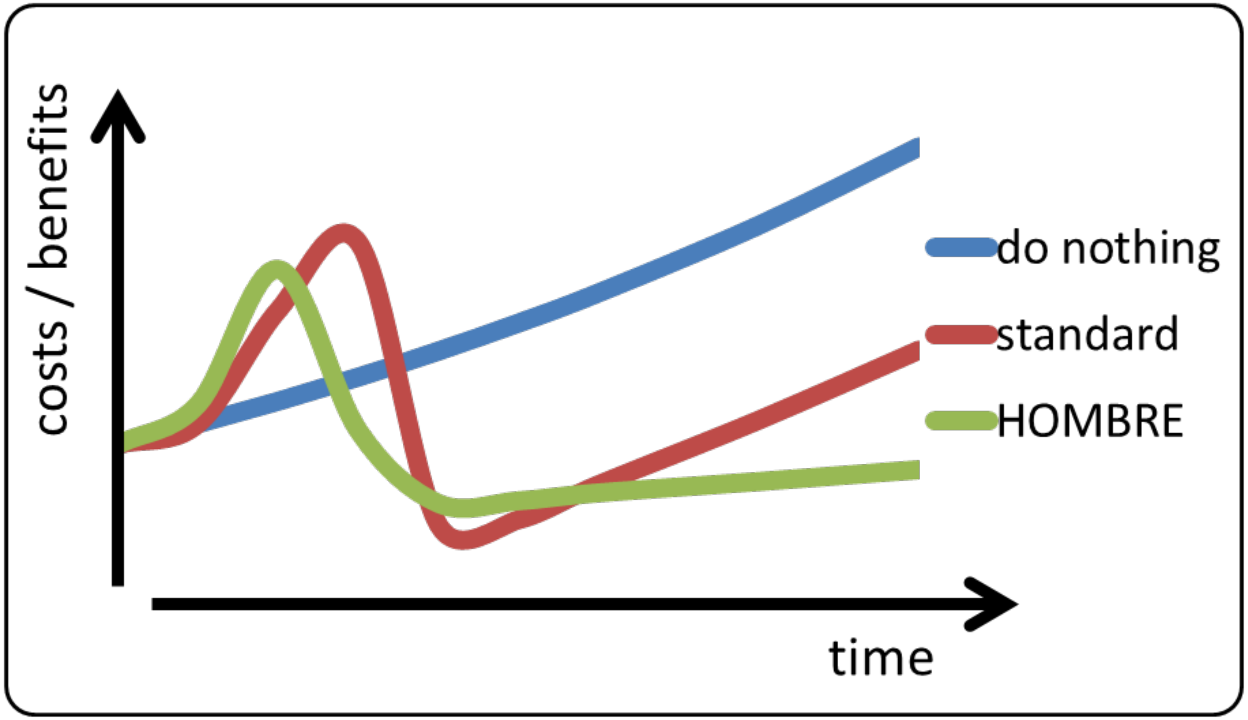
Context for technology trains

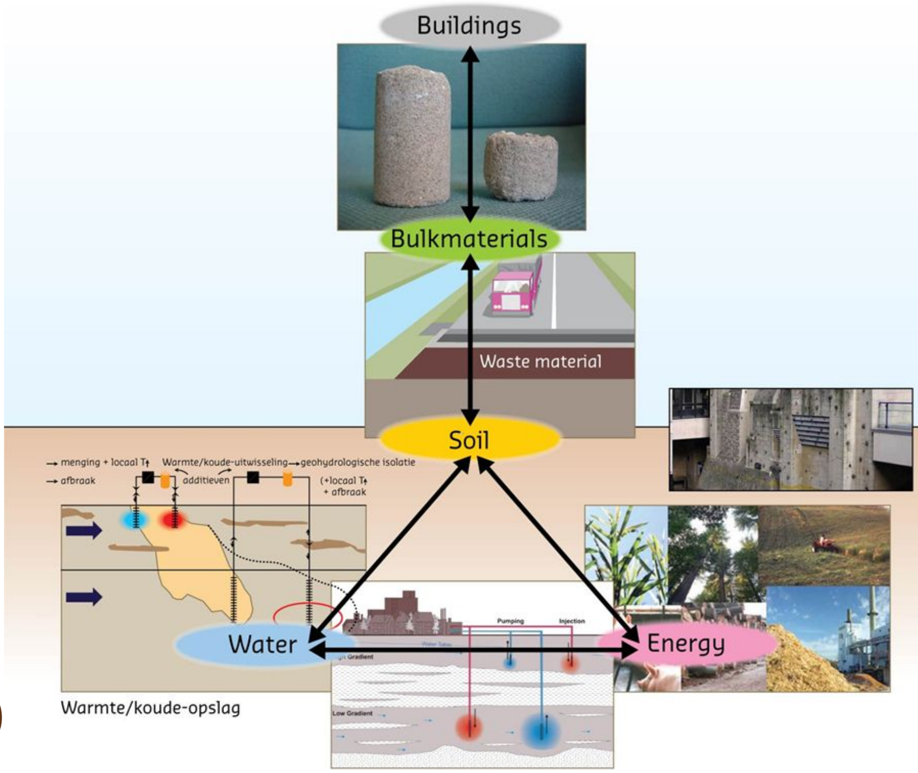


Principle of technology trains

More than just optimised combination of remediation techniques (treatment train)

➔ **Integrated assessment of BF resources and potential**

- What resources has the site to offer?
- What goods & services are valued (locally or regionally)?
- Looking for synergies & combinations to couple available resources (supply) with goods & services (demand)



Assembling technology trains at BF sites: Key considerations

1. Which **Barriers** prevent BF-site redevelopment?
2. Existing **ambitions** for BF-site and surroundings?
3. What can be **supplied from the BF-site** that can fulfil the demands at the (re)developed site?

4. How can Technology Trains **support** the development plan of the Brownfield site in time and space? → combining 1+2+3

5. How to **organize** and **finance** the intervention?

examples technology trains

3 Technology trains were elaborated as examples:

1. **Energy – Water: ATES + bioremediation of PCE**

   This presentation

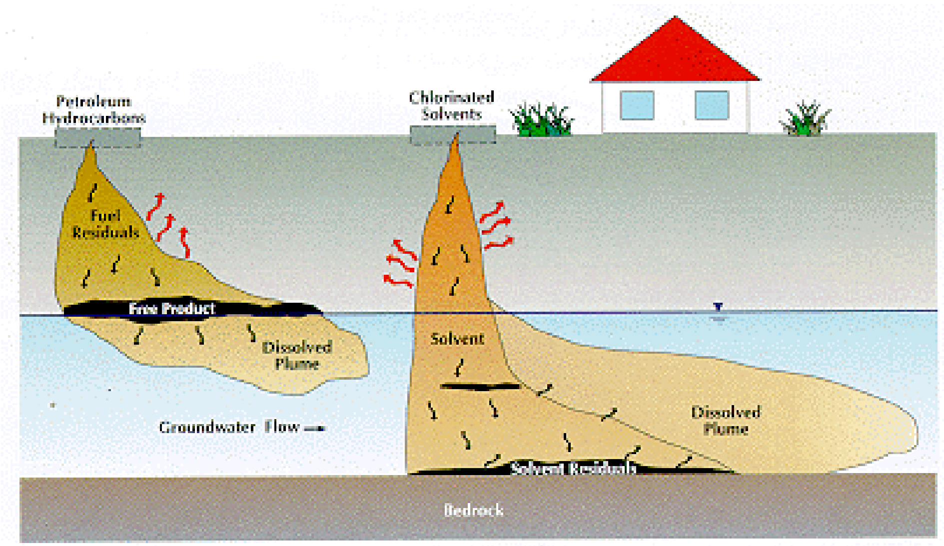
2. **Soil – building materials: producing aggregates from industrial soil**

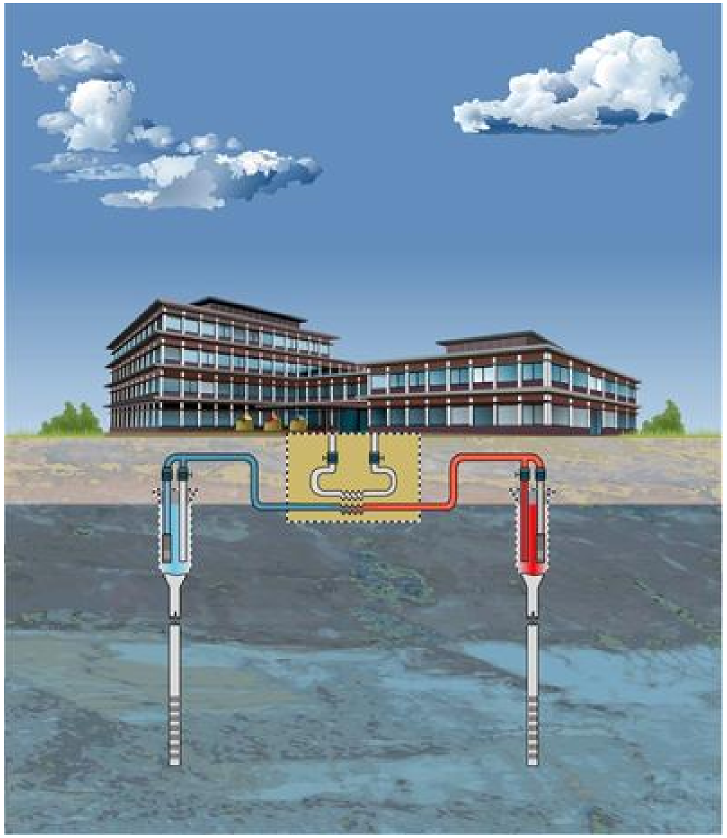
   Presentation Renato Baciocchi

3. **Water – Soil: Ecogrout soil reinforcement**

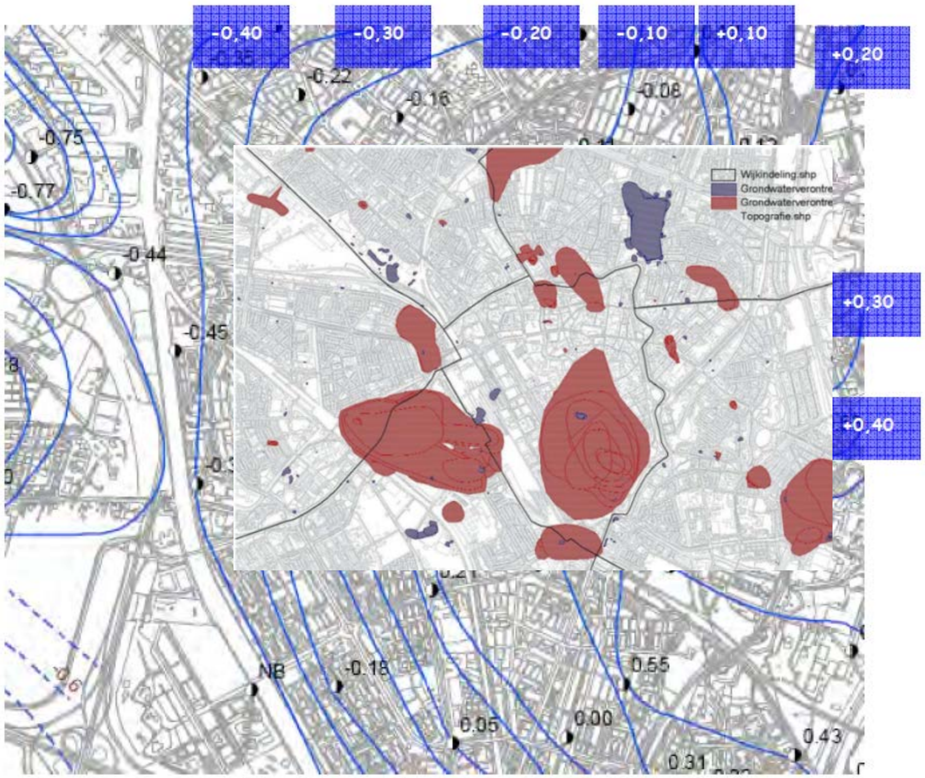
   Presentation Wouter van der Star

Technology train energy and water



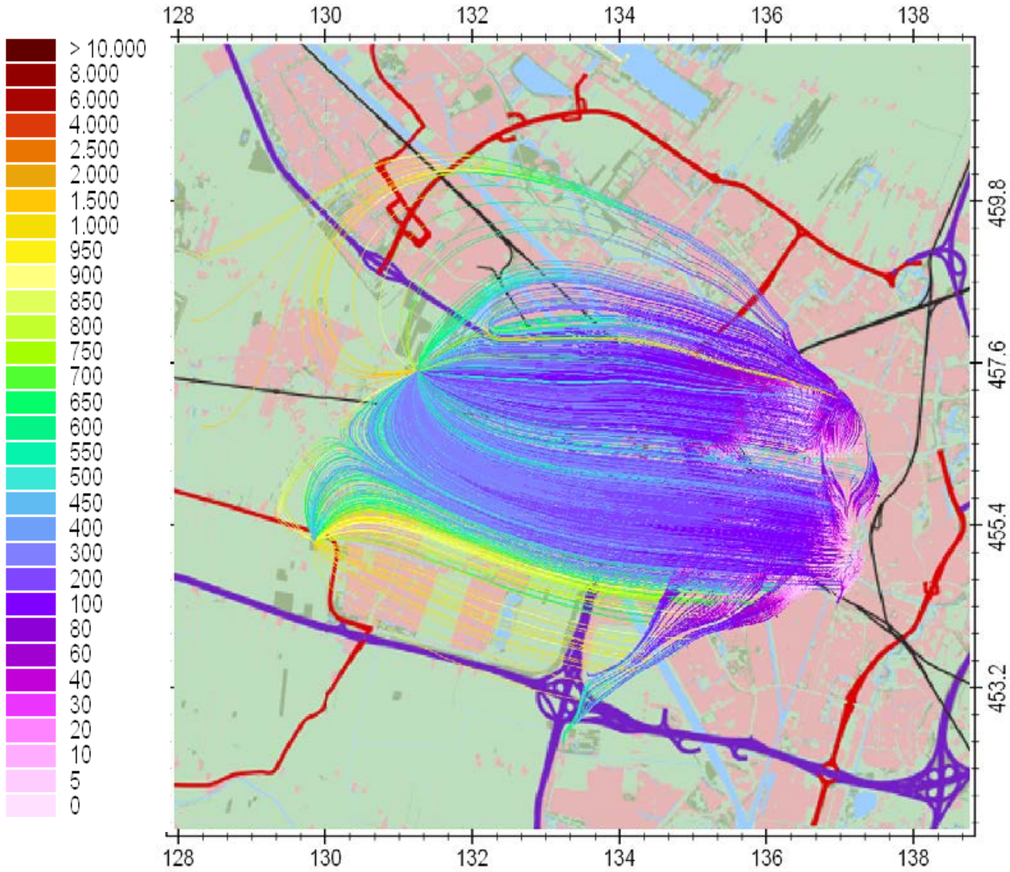


Barriers / problems



- Large scale contamination of phreatic and deeper aquifer
  - Chlorinated ethenes
  - Mineral oil
- Human health risks present
  - vapours
- Potable water well at risk after 300 years

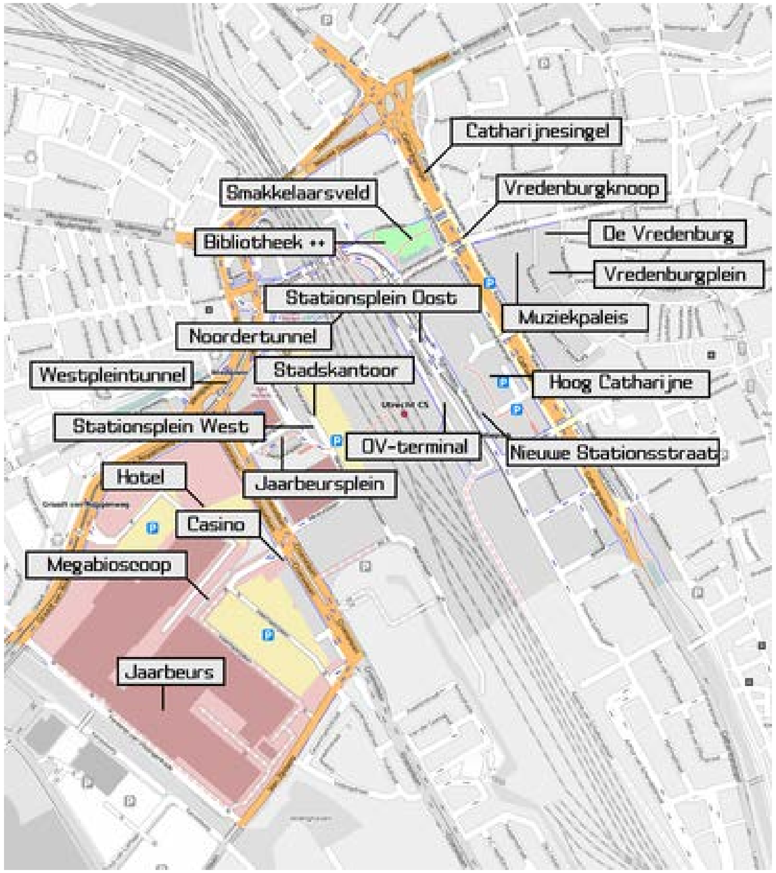
Groundwater contamination



- Polluter pays principle not working
  - No finances
  - Mixing of contaminants
- Spatial scale too large
  - Too costly
  - Impossible planning

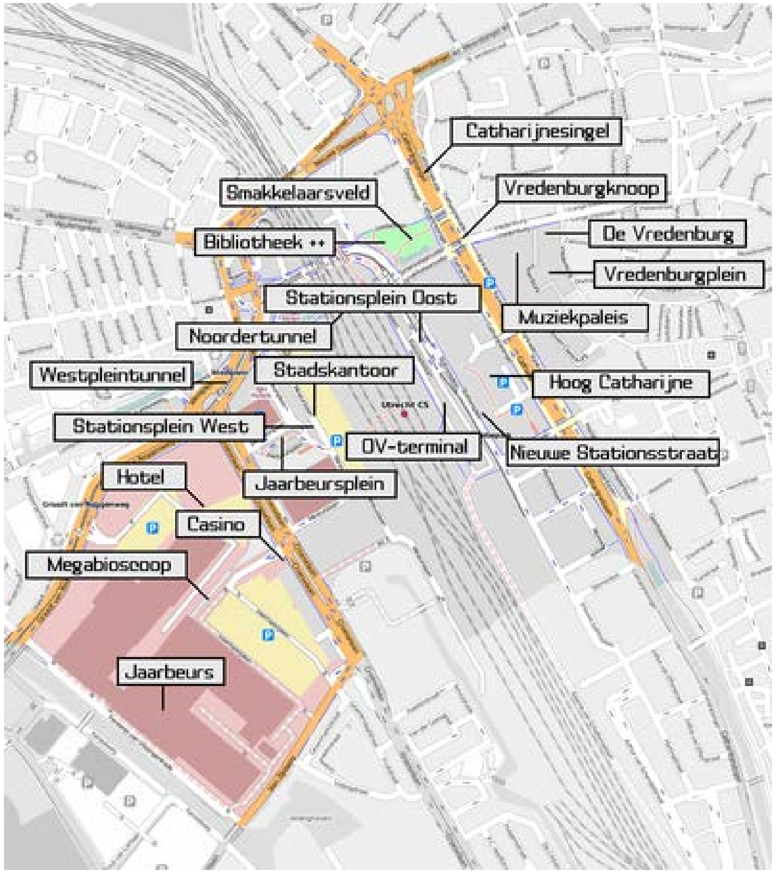
→ status quo:
  - increasing volume of contaminated groundwater
  - no other use of aquifer

Ambitions



- Adding floor space
  - residential
  - commercial
  - mixed
- Renewal of existing infrastructure, buildings, and public space
- Improving groundwater quality
  - protect drinking water supply
- Reducing CO_2 emissions by 30% in 2020

“New problems”

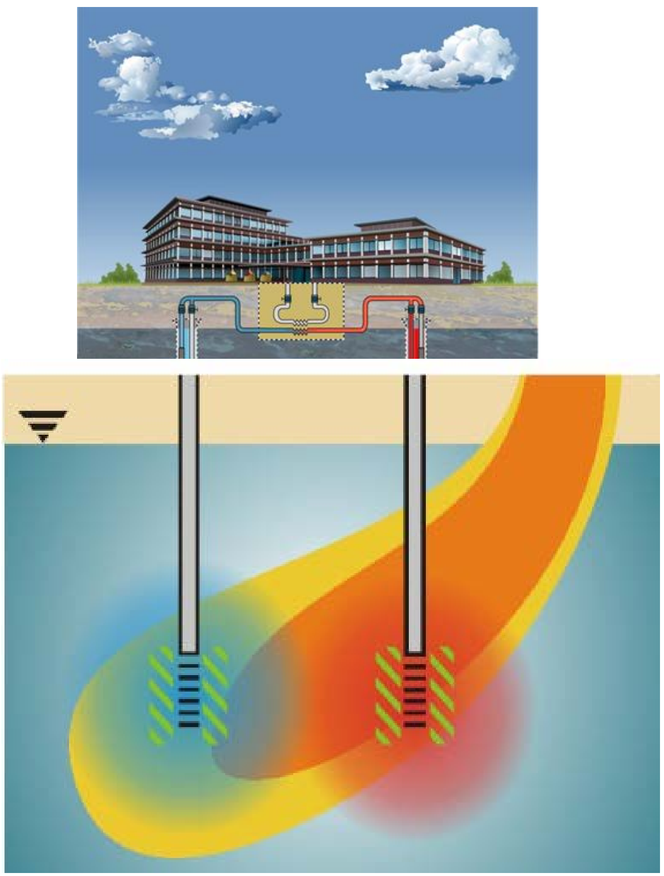


- Increased floor space:
  – Increase in demand for heating
  – Strong increase in demand for cooling → electricity
- Limited capacity of electricity grid
- Change in acceptable risk level of contaminants
  – commercial → residential

Supplies from the BF-site

- Aquifer with constant temperature, high capacity
- Low groundwater speed (10 m/year)
  - good source for energy supply
- Heat distribution network is present
- Good infrastructure (road/railway connection)

Technology train energy and water



- Combine the need for low electric power cooling with quality improvement of groundwater

→ **ATES + bioremediation**

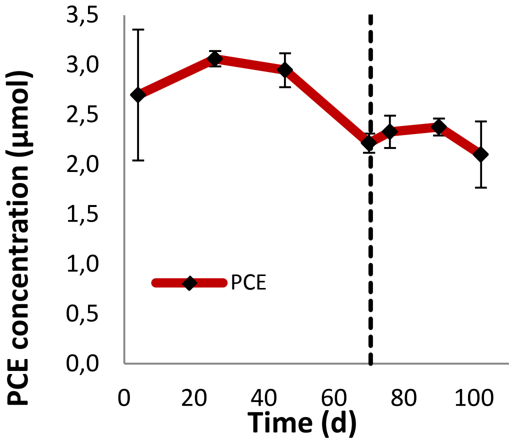
- Multiple use of infiltration/extraction wells
- Increased shear forces mobilize electron donors?
- Interest to continuously monitor the aquifer
- Unlock the use of aquifer

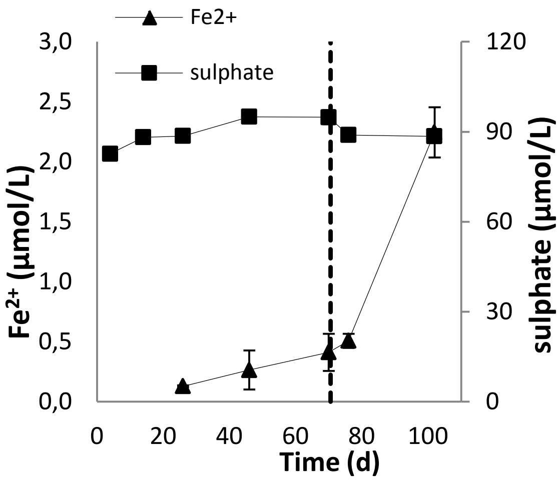
Knowledge gaps

- Does ATES affect the biological degradation of chlorinated ethenes?
- Does the biological degradation of chlorinated ethenes affect the functioning of ATES?
- Will ATES lead to uncontrolled spreading of contaminants?
  - enhanced transfer to atmosphere
  - enhanced transfer in aquifer
  - short circuiting in vertical direction

Effect ATES on biological degradation of chlorinated ethenes

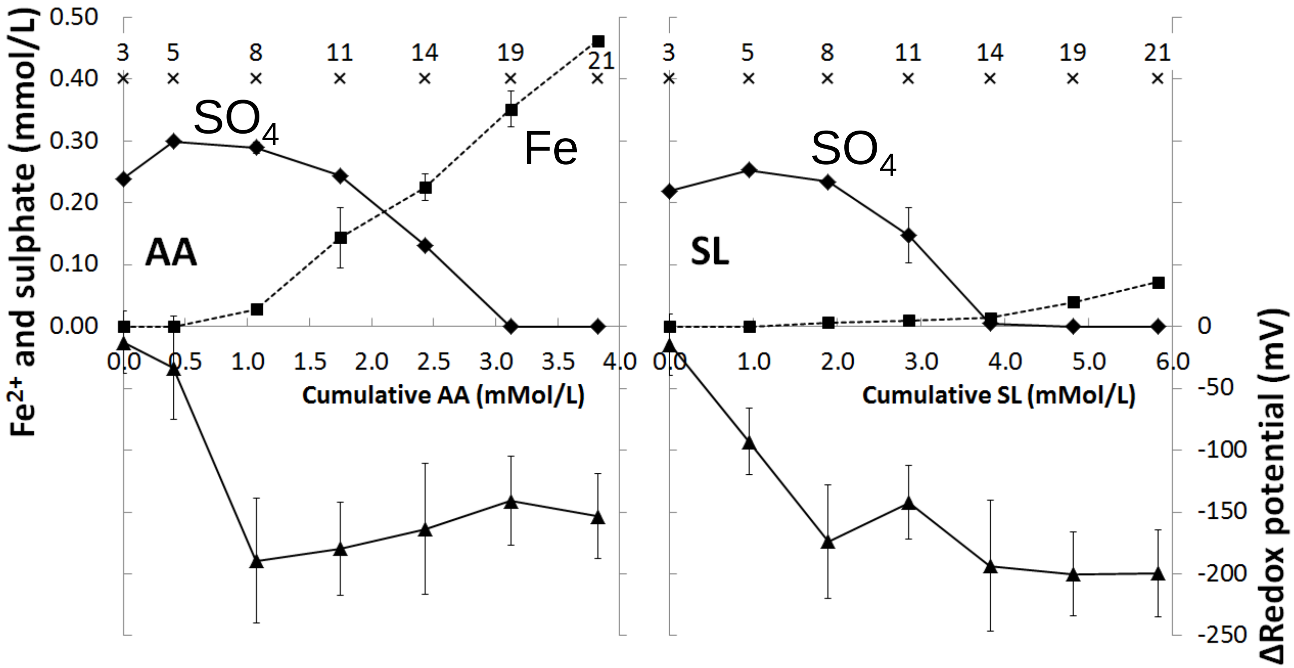
Natural attenuation





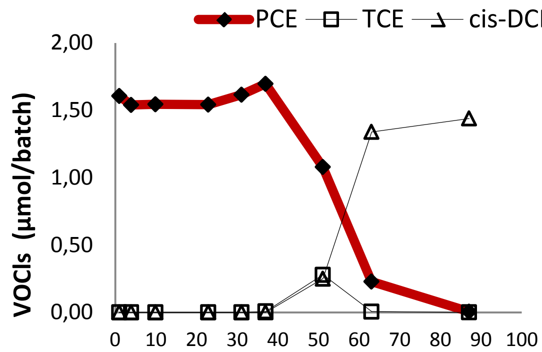
Effect ATES on biological degradation of chlorinated ethenes

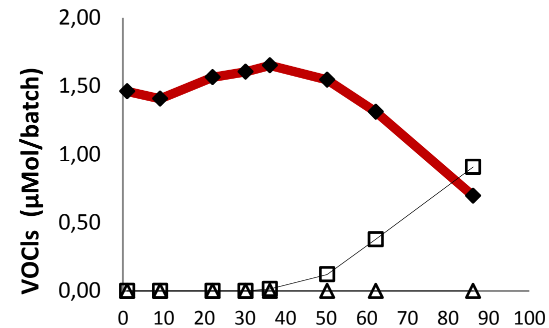
Addition electron donor



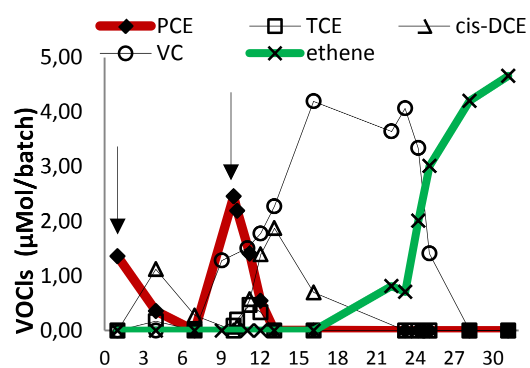
Effect ATES on biological degradation of chlorinated ethenes

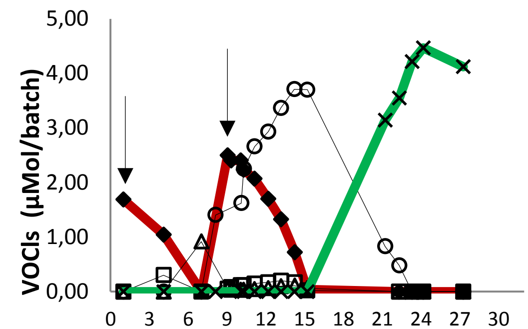
After redox conditioning





After redox conditioning and
bio-augmentation





Ascorbic Acid

Na-lactate

Effect ATES on biological degradation of chlorinated ethenes

- Does ATES affect the biological degradation of chlorinated ethenes?
  - No natural attenuation capacity → (very) limited enhancement of biodegradation
  - Robust technology through fall back strategy (contingency plan)
    - addition of electron donor
    - addition of bacteria
    - nett extraction of groundwater → hydrological containment

Effect ATES on biological degradation of chlorinated ethenes

- Does the biological degradation of chlorinated ethenes affect the functioning of ATES?
  - possibly: biofilm formation, precipitation by oxidizing Fe(II) species

- Will ATES lead to uncontrolled spreading of contaminants?
  - depends on spatial configuration; design of ATES can be iteratively adapted based on model outcomes

organizing and financing the intervention

	Traditional	→	Integrated
ATES	individual		areal approach
Soil pollution	case by case		areal approach
Spatial Planning	2D		3D

- Advantages:
  - Improved economic perspectives
  - Improved environment (reduction CO_2 emission)

- Profits / savings of BF-use pays for risk mitigation
  - Founding of a specific, areal organization that becomes liable (for contaminants) and organizes cash-flow

- Considerations
  - Legislative: risk based approach

Conclusions

- Local conditions are key (legislation/economics/ demographics/stakeholders)
  - Technological flexibility can meet local requirements
- As conceptual framework it (should) work BUT
  - Level of detail depends on position in transition process
  - No generic template can be made for “best technologies”
  - Other then technological solutions exist
  - Technology is rarely the bottleneck in BF redevelopment