



# Site Revitalisation Projects

## Examples from Saxony-Anhalt

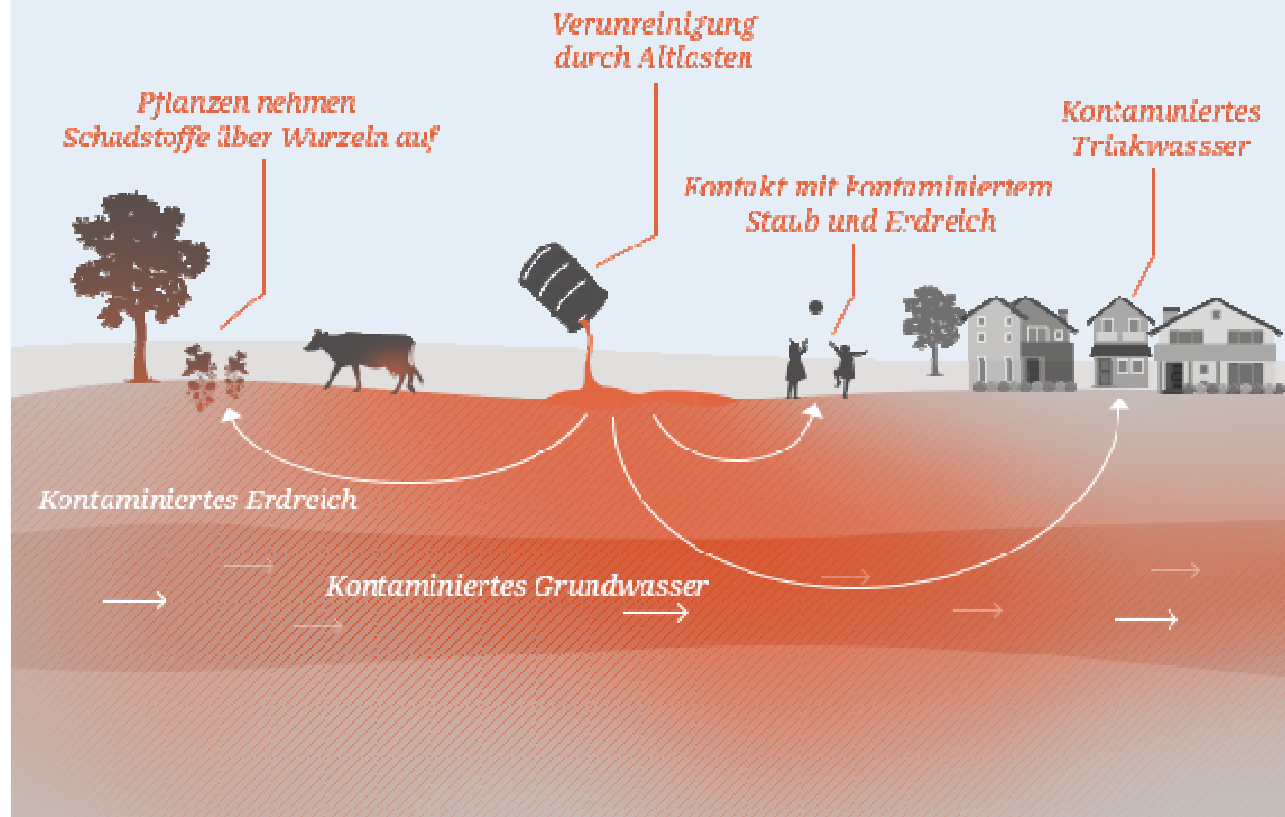


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3. Building Remediation Magdeburg
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5. Megasite Bitterfeld
6. RESITES TOOL



## Possible pathways from contaminated sites



**Revitalization of contaminated sites requires securing measures**



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## Former Main Gas Works



Subjects of protection according to planned use:

- Health of employees
- Buildings

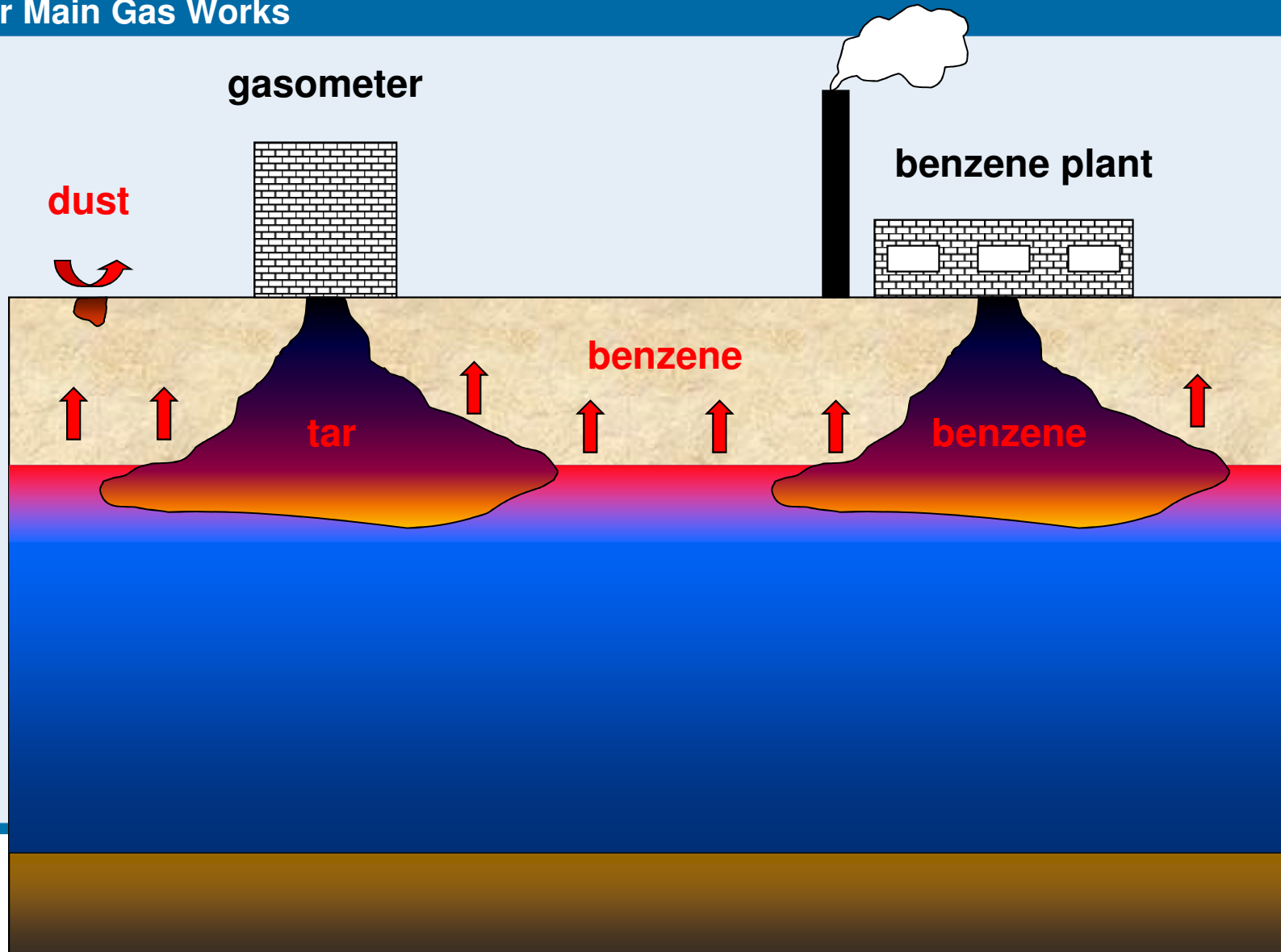
Hazards from:

- Tar
- Benzene

- Northern part of former main gas works, operational from 1930 to 1993
- The aim is to build the production facilities for the laminated wood producer (Nordlam)



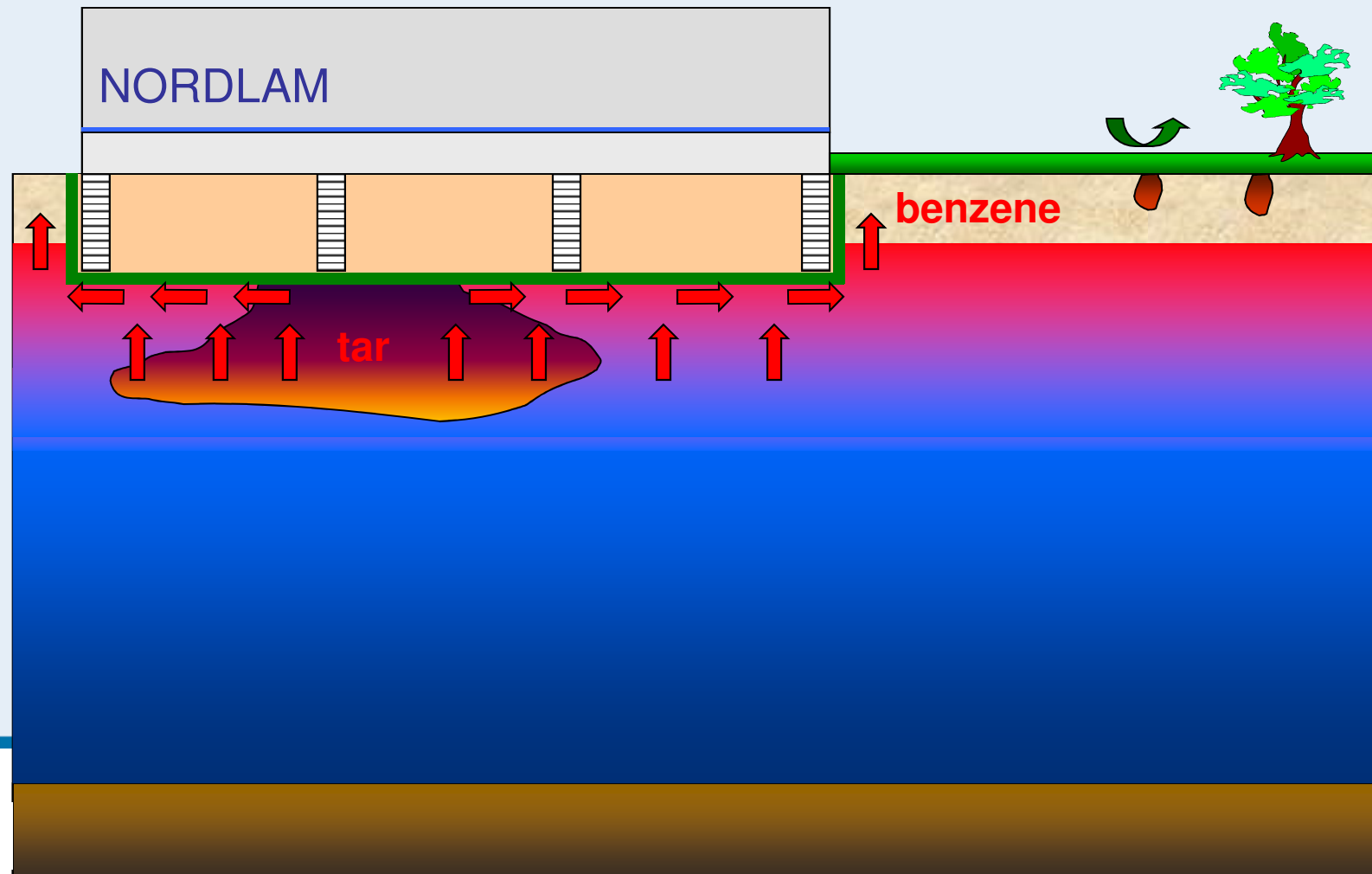
### Former Main Gas Works





## Former Main Gas Works

### Securing measure: interruption of exposure pathways





## Former Main Gas Works

### Securing measure: interruption of exposure pathways using plastic sealing



Revitalisation possible with partly remaining contamination in the soil and in the groundwater!







### Former Main Gas Works

- Located NE of Magdeburg, at the port of Magdeburg
- Size approx. 10 km<sup>2</sup> with 96 old industrial locations
- Today increasingly used by industry, trading and service companies

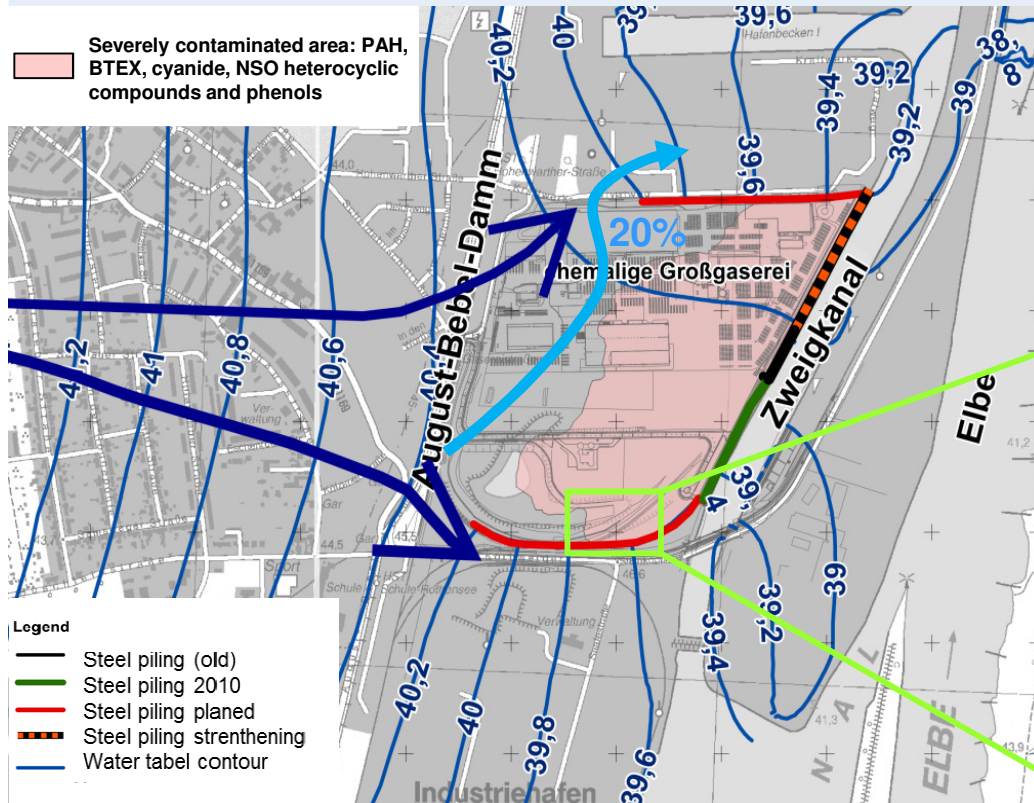
### Subarea TF12

#### former main gas production site

- Strongly contaminated with **PAH, BTEX, NSO heterocyclic compounds, cyanide, ammonia, phenols**
- remedial actions in planning stage  
→ partial groundwater containment  
→ inflow reduced by **80%**
- **remaining 20% inflow: EMNA treatment**  
(Enhanced Monitored Natural Attenuation)

#### Field test site for EMNA

- Stage 1: **off site**  
Batch tests and column experiments
- Stage 2: **on site**  
Infiltration of H<sub>2</sub>O<sub>2</sub>, subs. technical oxygen
- Stage 3: **on site**  
Infiltration of airborne oxygen





## Former main Gas Works: EMNA concept (Enhanced Monitored Natural Attenuation)

### 1. Step: Batch tests, off-site

Investigating the processes of **adsorption and precipitation as well as aerobic and anaerobic microbial decomposition** of the respective pollutants based on water samples from the TF12.

#### Results

No signs of anaerobic microbial activity, aerobic microbial decomposition inconclusive.

### 2. Step: Column Experiments under aerobic conditions, off-site

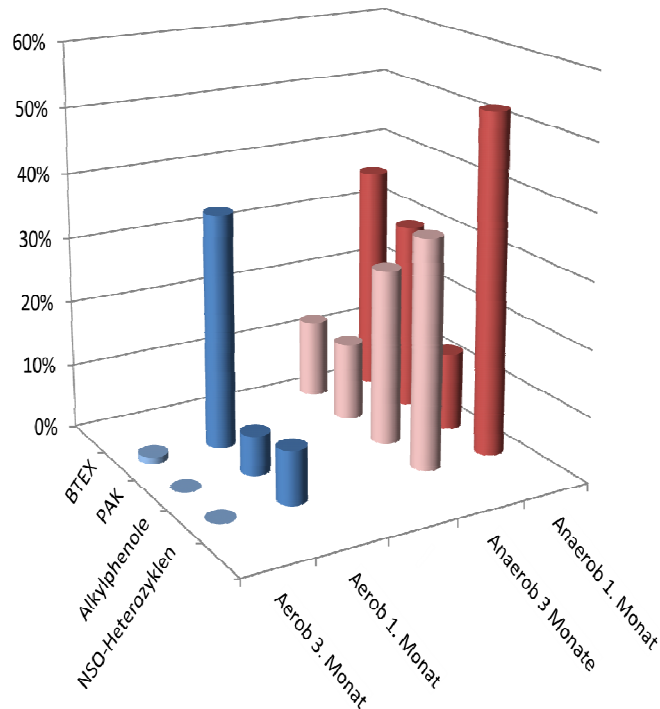
Investigating **the release and microbial decomposition** of pollutants **in the phreatic zone** based on soil and water samples from the TF12 under **aerobic and anaerobic conditions**.

For checking purpose parallel running of poisoned column experiments (mercuric chloride, sodium azide).



Former main Gas Works: EMNA concept – phase 1, off-site

residual contamination  
column experiments



Results

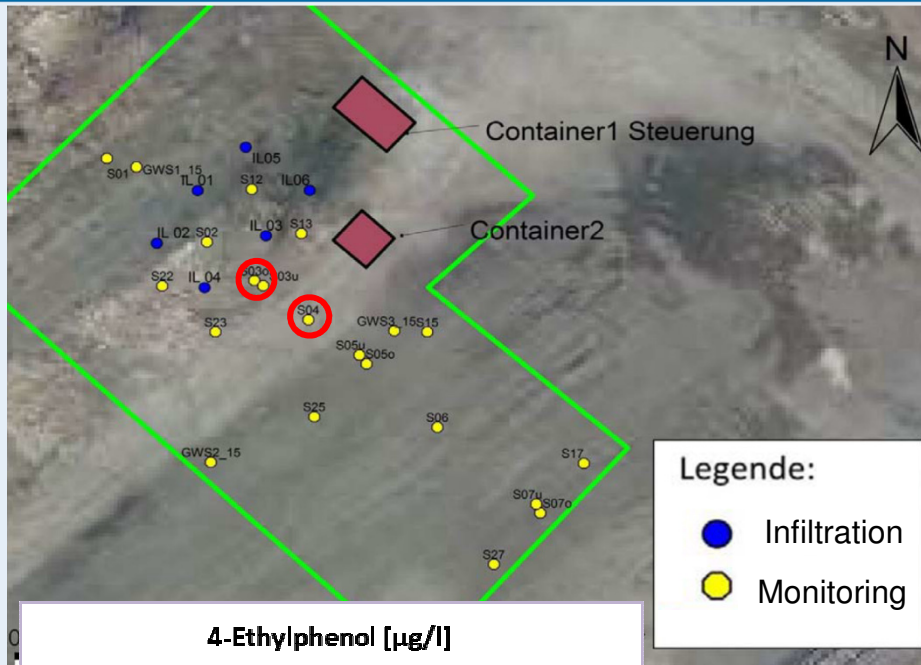
- Infiltration of oxygen (**aerobic depletion**):  
after 3 months → residual contamination < 1%
- Infiltration of nitrate (**anaerobic depletion**):  
after 3 months → residual contamination approx. 12 – 35%

Conclusions insights from off-site investigations and transfer to on-site application:

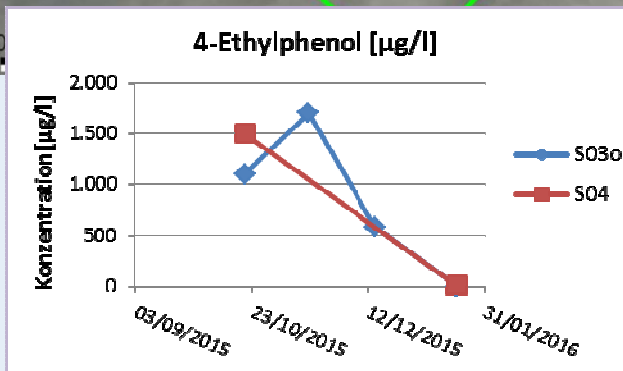
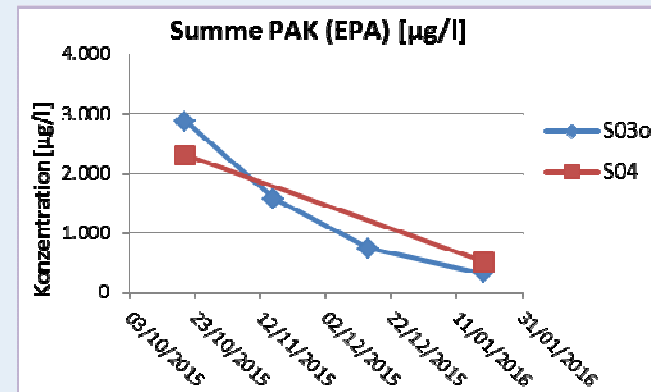
**Choosing aerob depletion  
based on technical oxygen for  
the on-site tests**



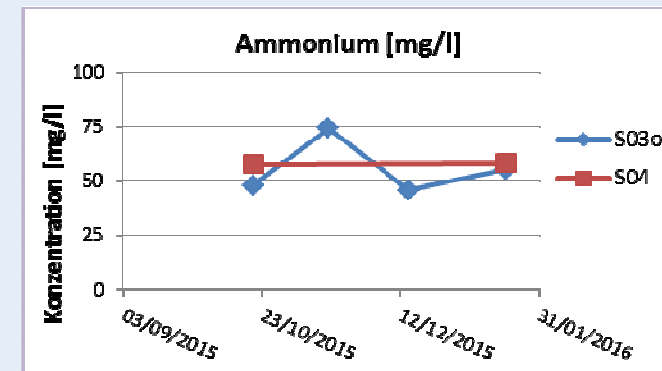
Former main Gas Works: EMNA concept – phase 2, on-site



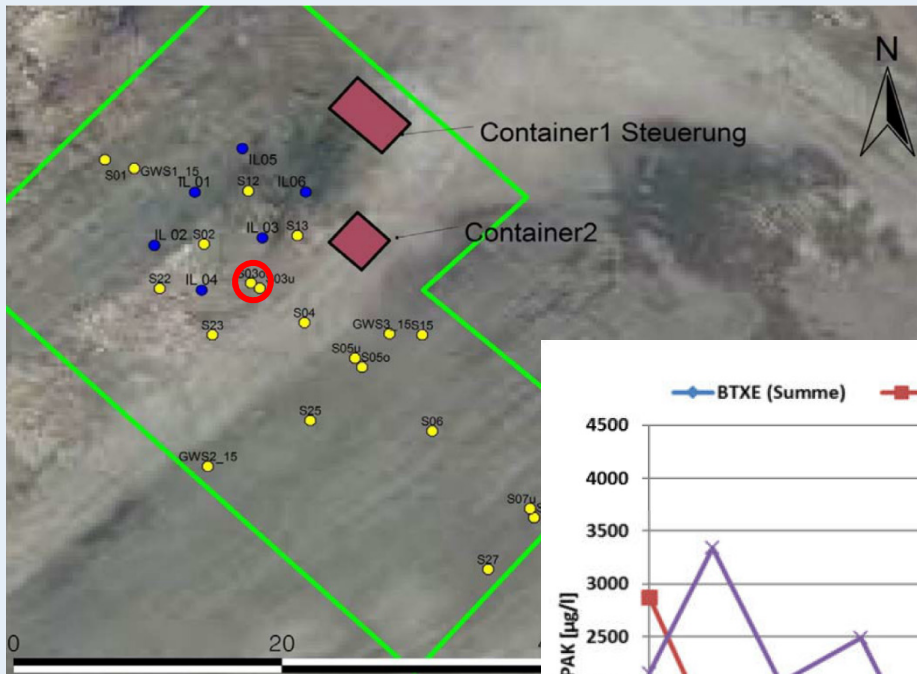
Injection of technical oxygen (11.2015 – 08.2016), temporarily infiltration of H<sub>2</sub>O<sub>2</sub>



Distance from injection  
S03o: 2.5 m      S04: 7.5 m

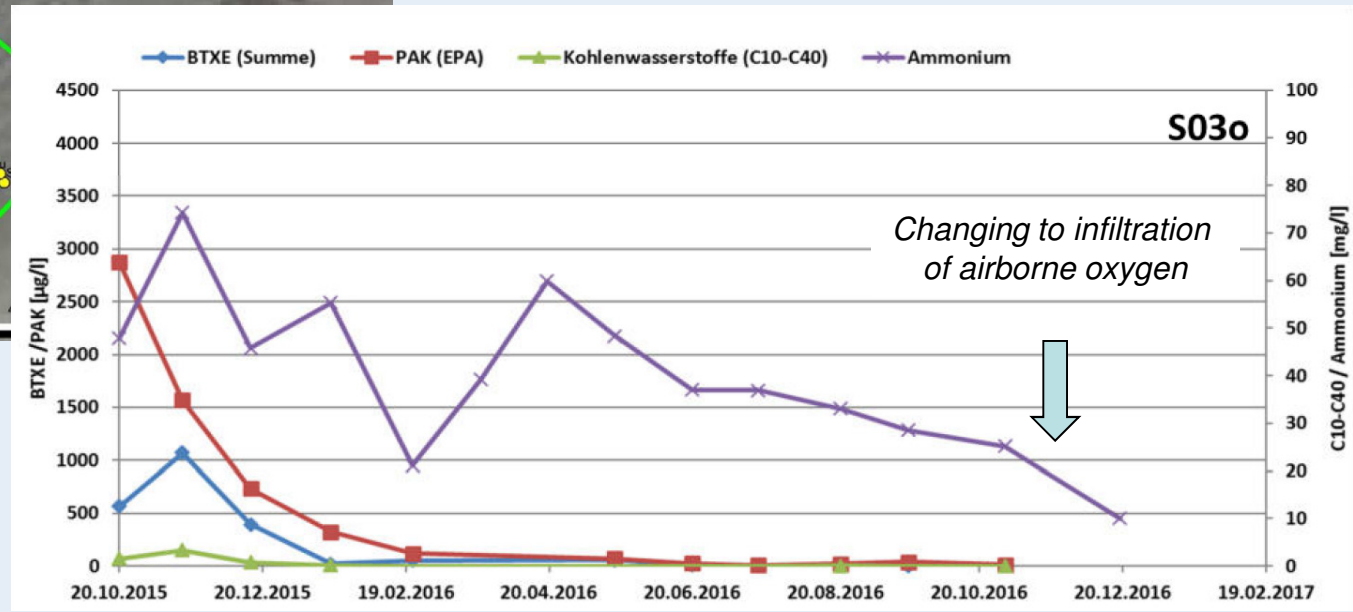
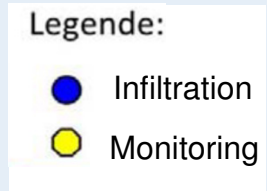


Former main Gas Works: EMNA concept – phase 3, on-site



Change from infiltration of technical oxygen to infiltration of airborne oxygen (11.2016)

Distance from injection  
S03o: 2.5 m





- Magdeburg Rothensee
- **Building Remediation Magdeburg**
- Weissandt-Gölzau
- Megasite Bitterfeld
- RESITES TOOL



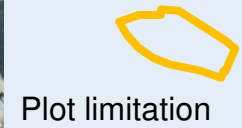
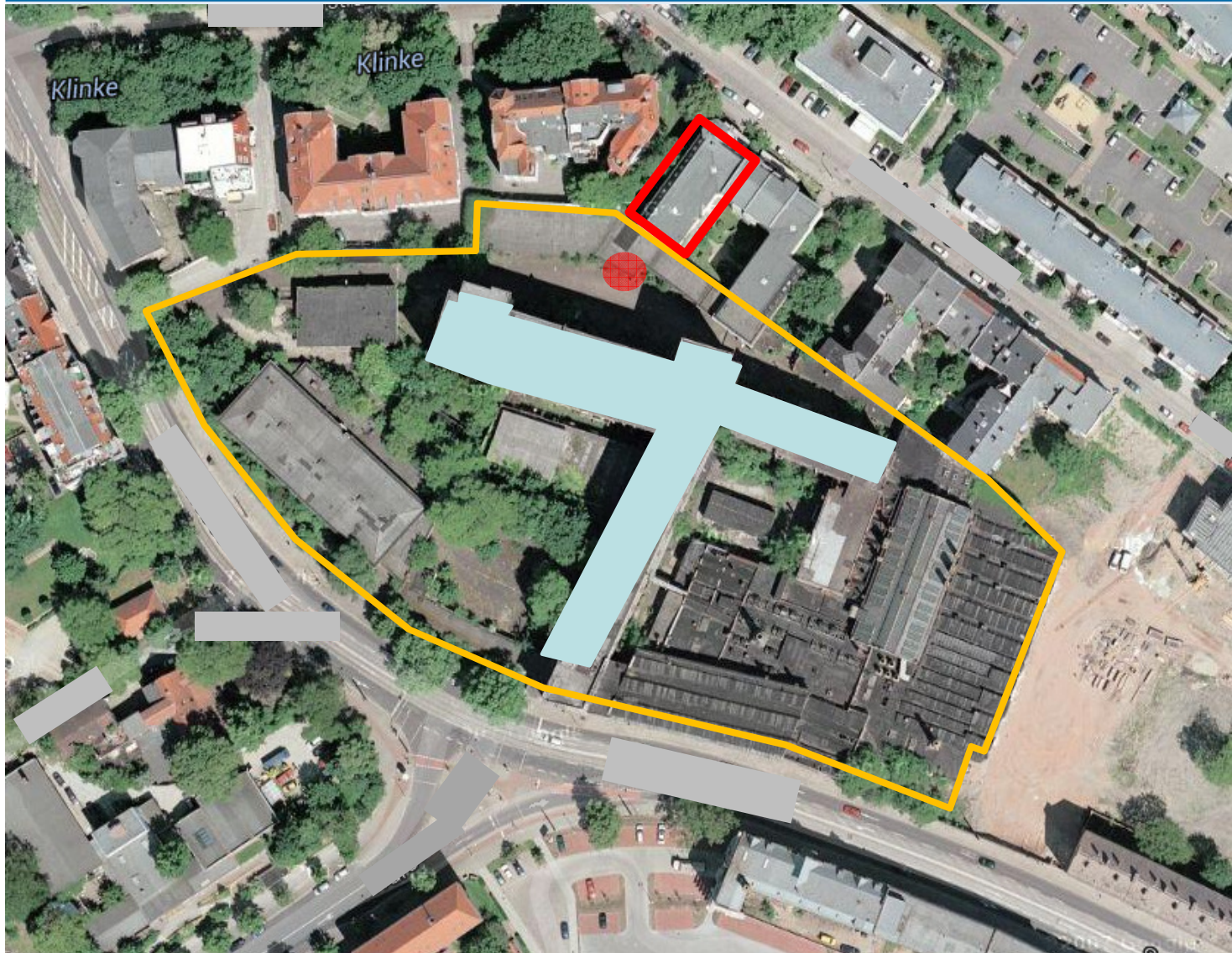
Former production of measuring apparatus

## Transformation of an industrial wasteland into a residential area

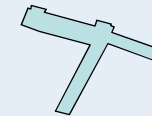




## Former production of measuring apparatus



Plot limitation



Building for transformation into an apartment house



Contaminated residential building



Sub-surface tank for volatile chlorinated hydrocarbons

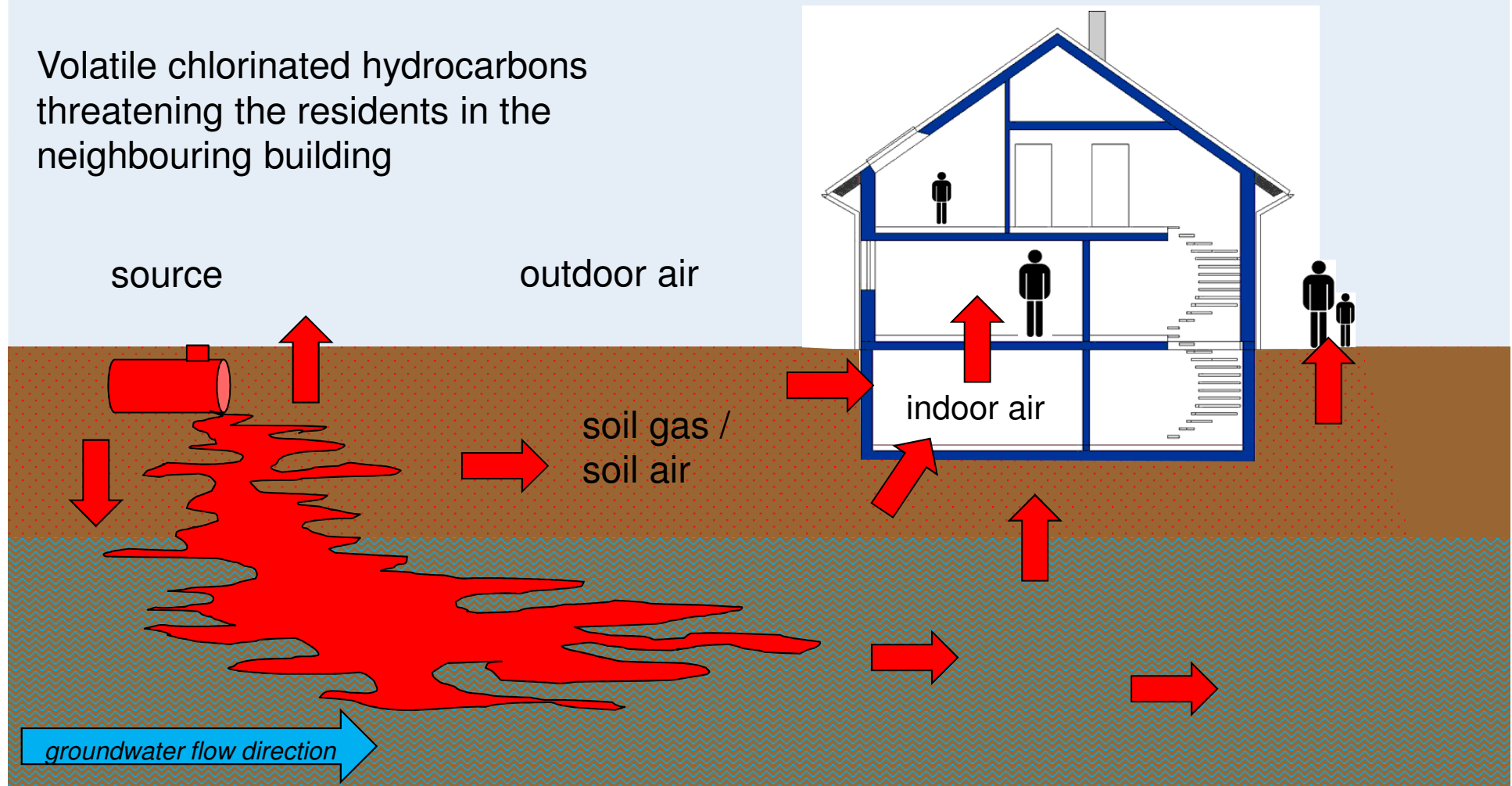
maps.google.de





## Former production of measuring apparatus: Health risks to neighbouring residents

Volatile chlorinated hydrocarbons threatening the residents in the neighbouring building





Former production of measuring apparatus: Health risks to neighbouring residents

## Securing measure: polymer coating as floor sealing and wall grouting





## Former production of measuring apparatus: Health risks to neighbouring residents

### Remediation targets ?

Tetrachloroethene **100**  $\mu\text{g}/\text{m}^3$

Limit value according to German law (2. BImSchV) for residential rooms next to dry cleaning, 7-days-mean value

Tetrachloroethene **250**  $\mu\text{g}/\text{m}^3$   
WHO

Tetrachloroethene **10**  $\mu\text{g}/\text{m}^3$

Recommended by German expert committee for immission control (Länderausschuss), annual mean value 1997





- Magdeburg Rothensee
- Building Remediation Magdeburg
- **Weissandt-Gölzau**
- Megasite Bitterfeld
- RESITES TOOL



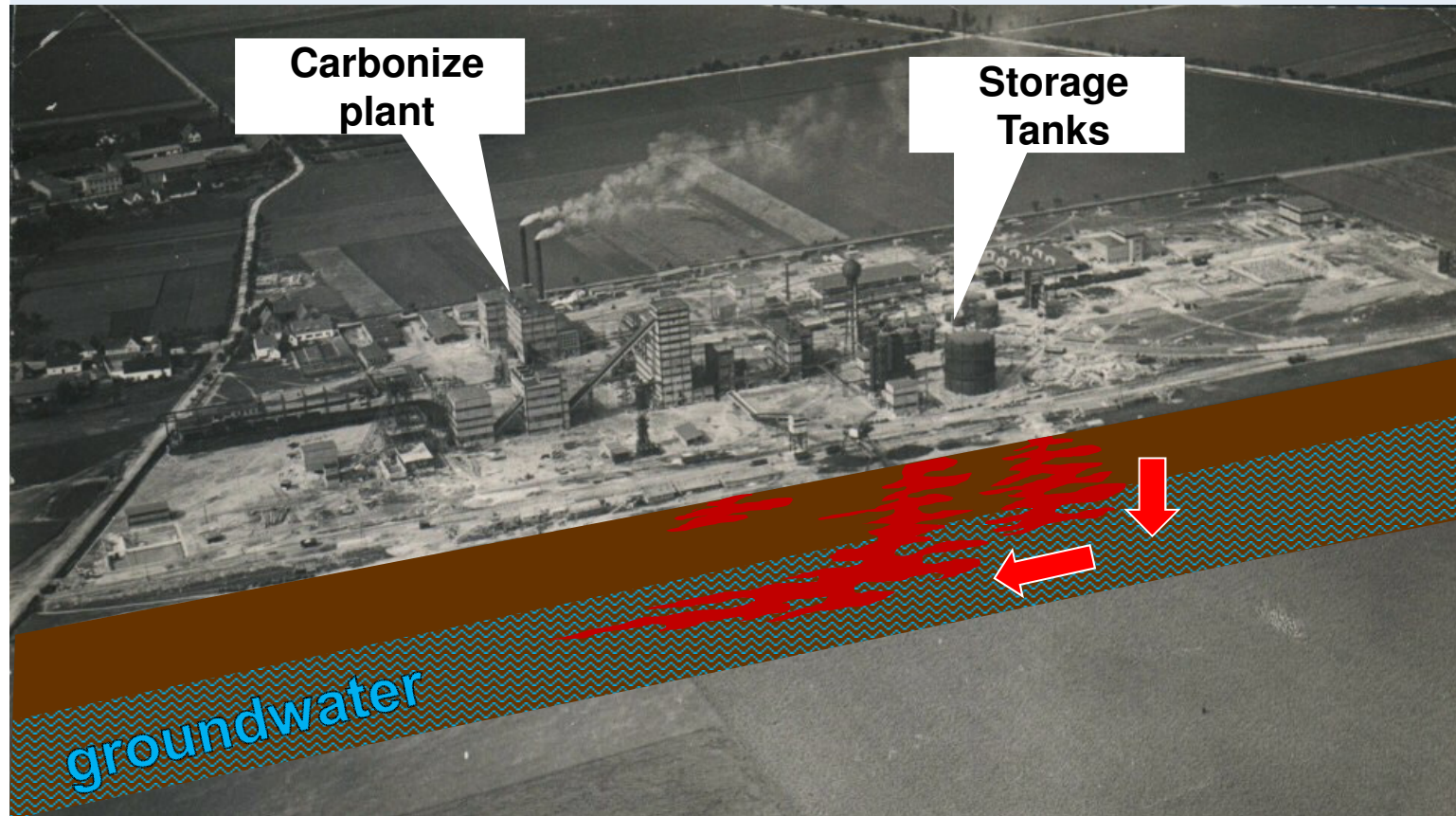
## Former carbonize plant

**Industrial park with 1.500 employees**





Former carbonize plant



1876 – startup of lignite mining

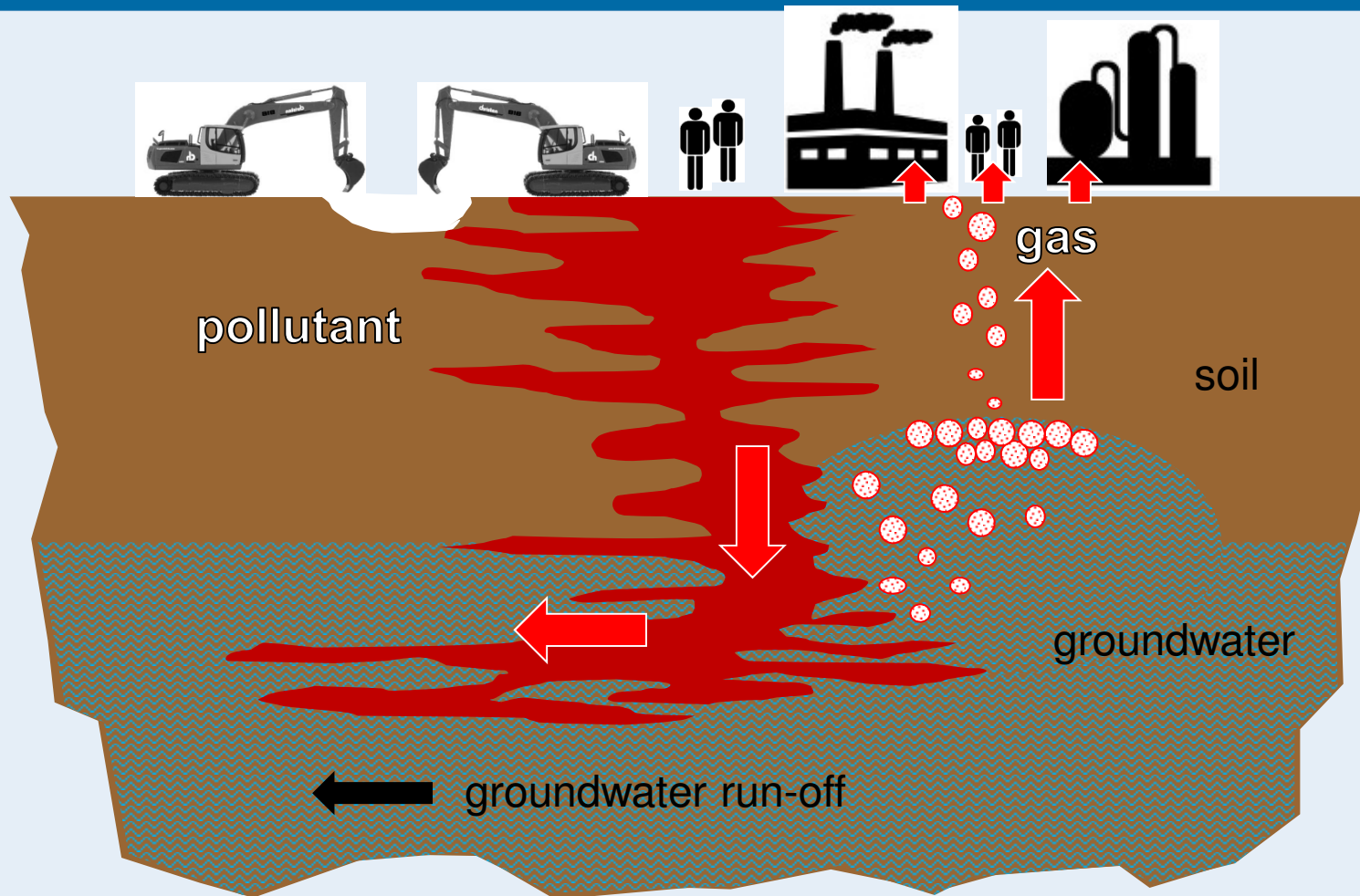
1928 – startup of carbonize plant

1965 – shutdown of carbonize plant

1965 – VEB Orbitaplast: production of polyethylene products



Former carbonize plant



**Hazards for buildings, infrastructure and employees as a result of gas formation (methane) due to microbiological degradation processes!**



## Former carbonize plant





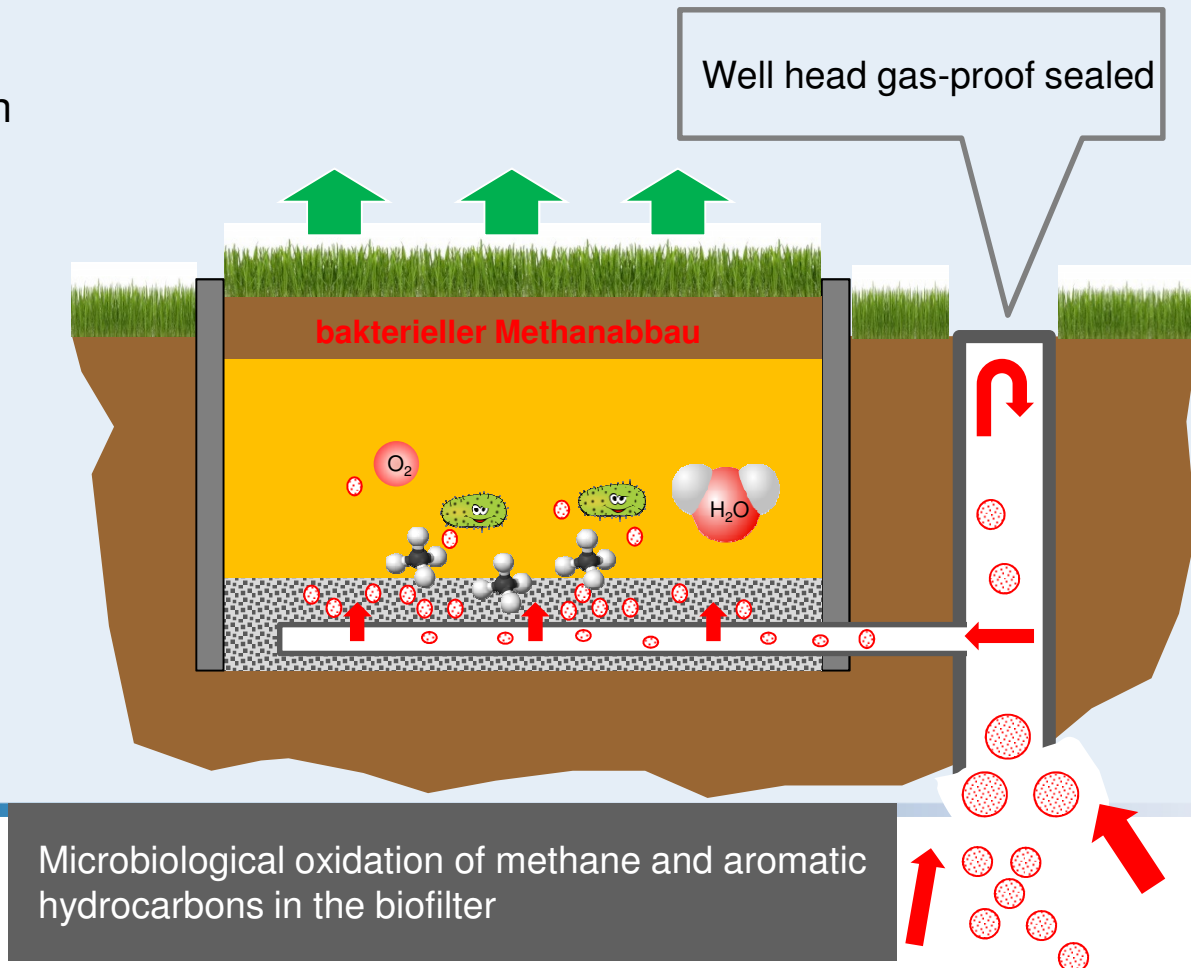


Former carbonize plant

Carried out securing measure

Pressure relief through  
natural degradation in  
the biological filter

Use of  
microbiological  
processes





## Former carbonize plant

### Carried out securing measure



Biofilter at several  
places in the  
industrial park



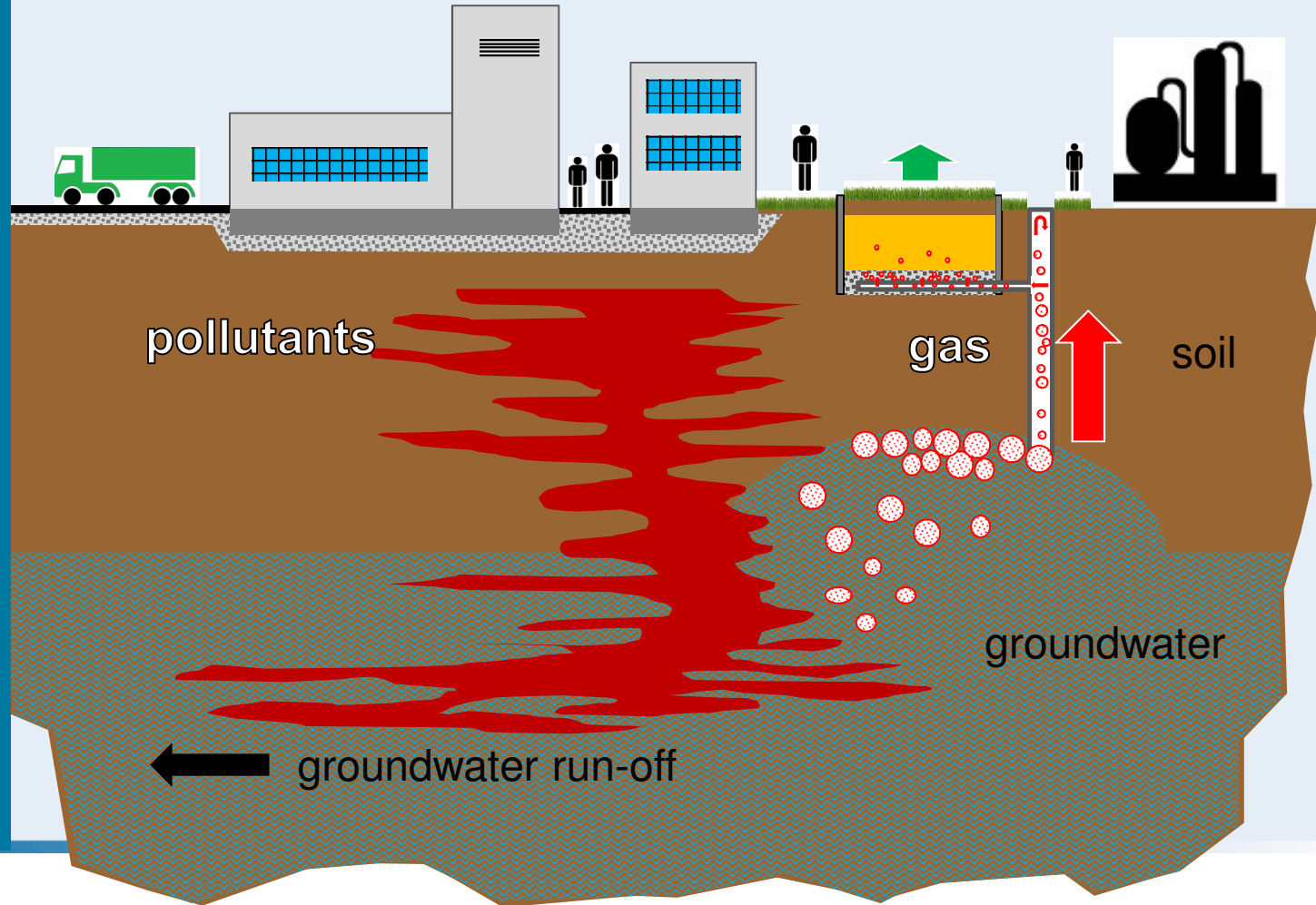
**Former carbonize plant**

**Modern  
infrastructure**

**8.2 million EUR  
spent for  
hazard  
protection**

**1.500 jobs**

**MNA- concept  
agreed with  
relevant  
authorities**



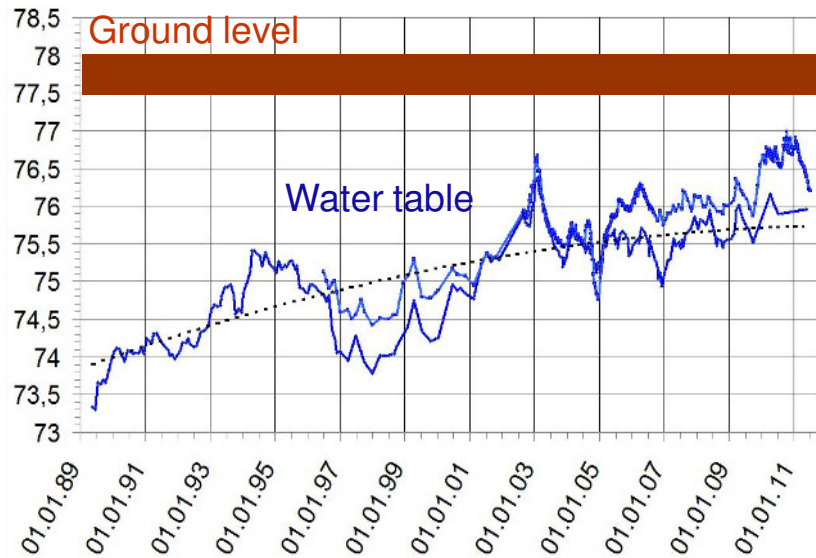
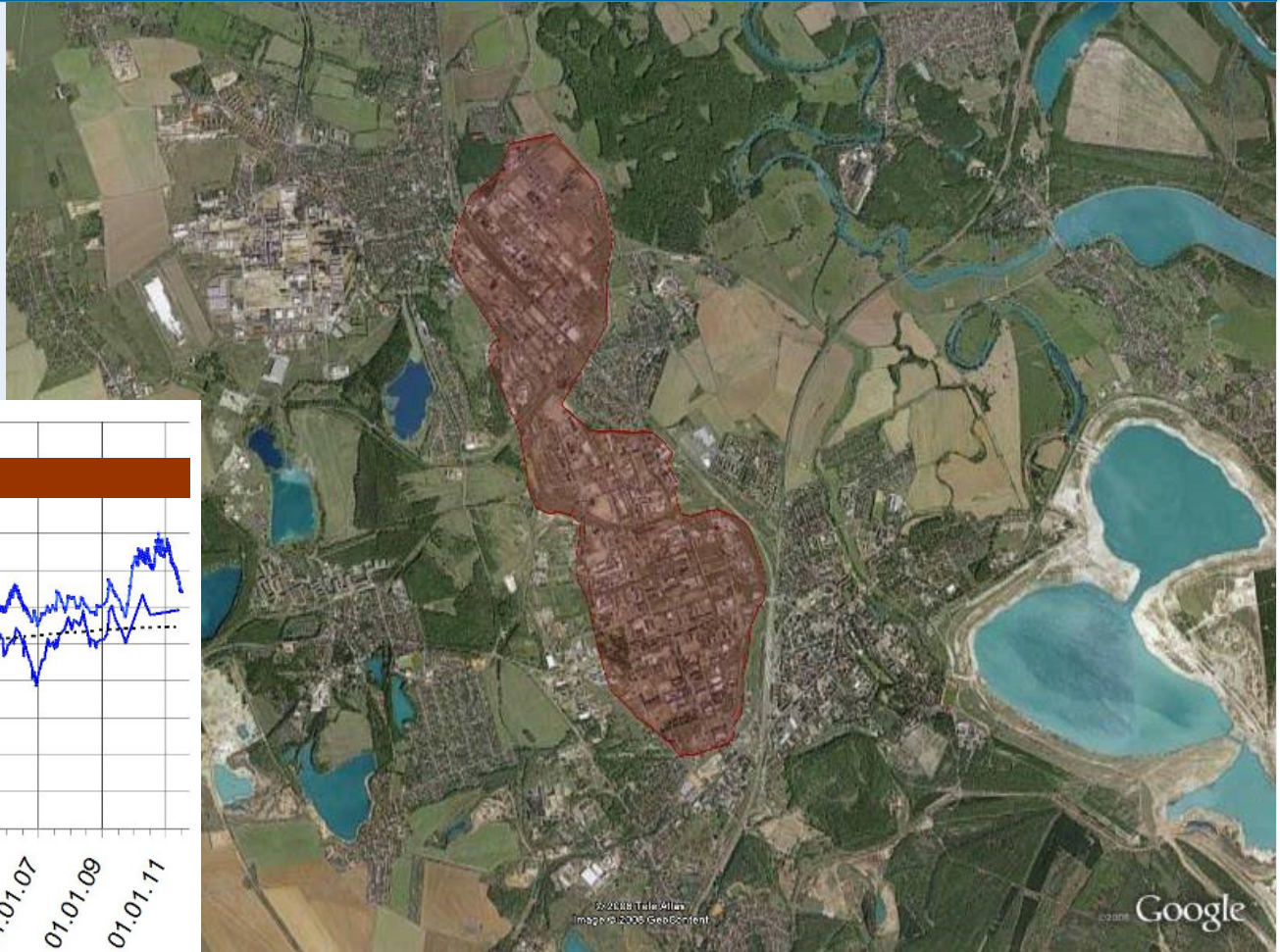


- Magdeburg Rothensee
- Building Remediation Magdeburg
- Weissandt-Gölzau
- **Megasite Bitterfeld**
- RESITES TOOL



## Rising of groundwater in the Bitterfeld area

open pit lignite mining  
 operational 1839 – 1992  
 flooding of Goitsche Lake  
 in 2002



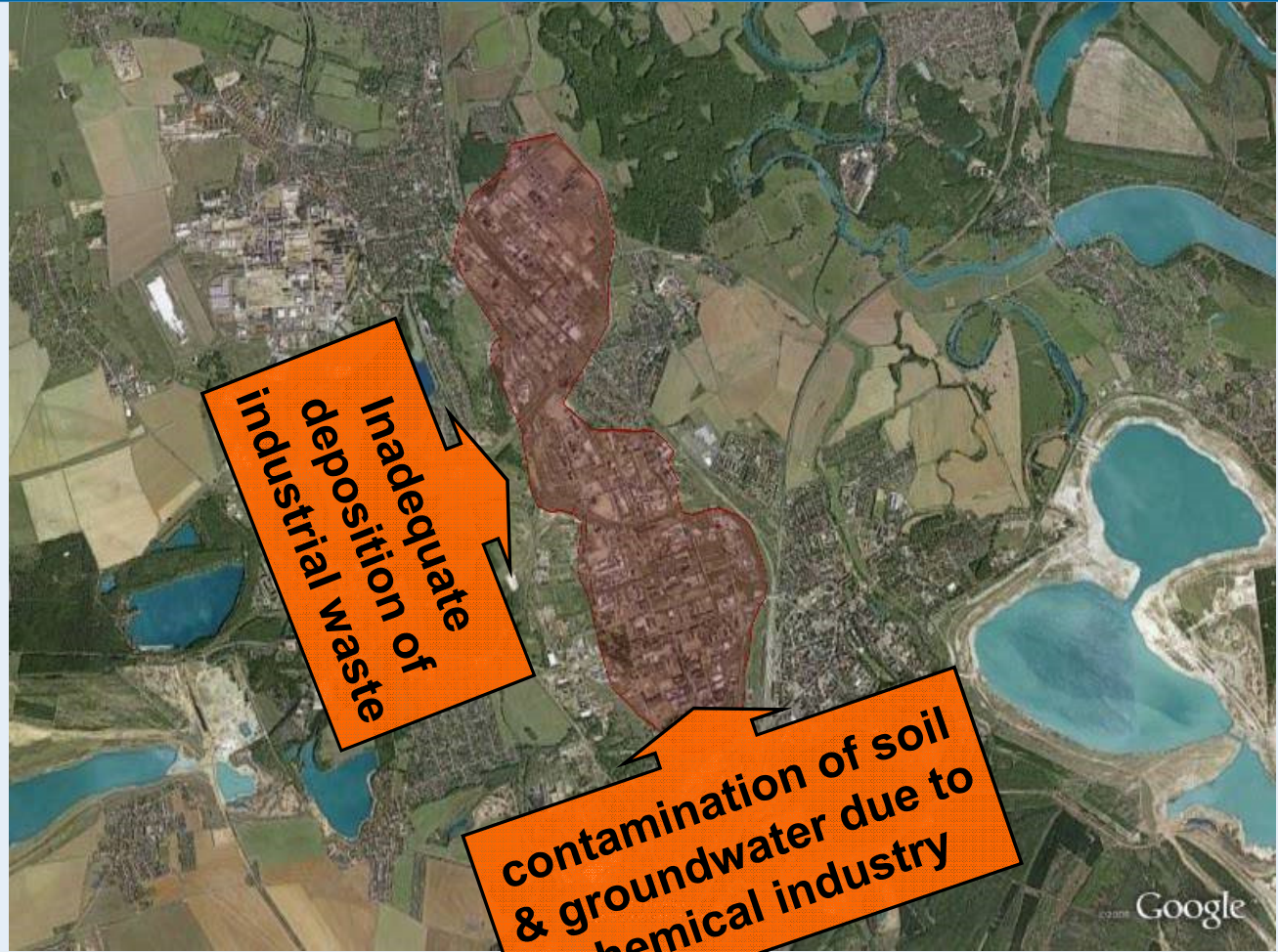


## Rising of groundwater in the Bitterfeld area

Chemical production as from 1893

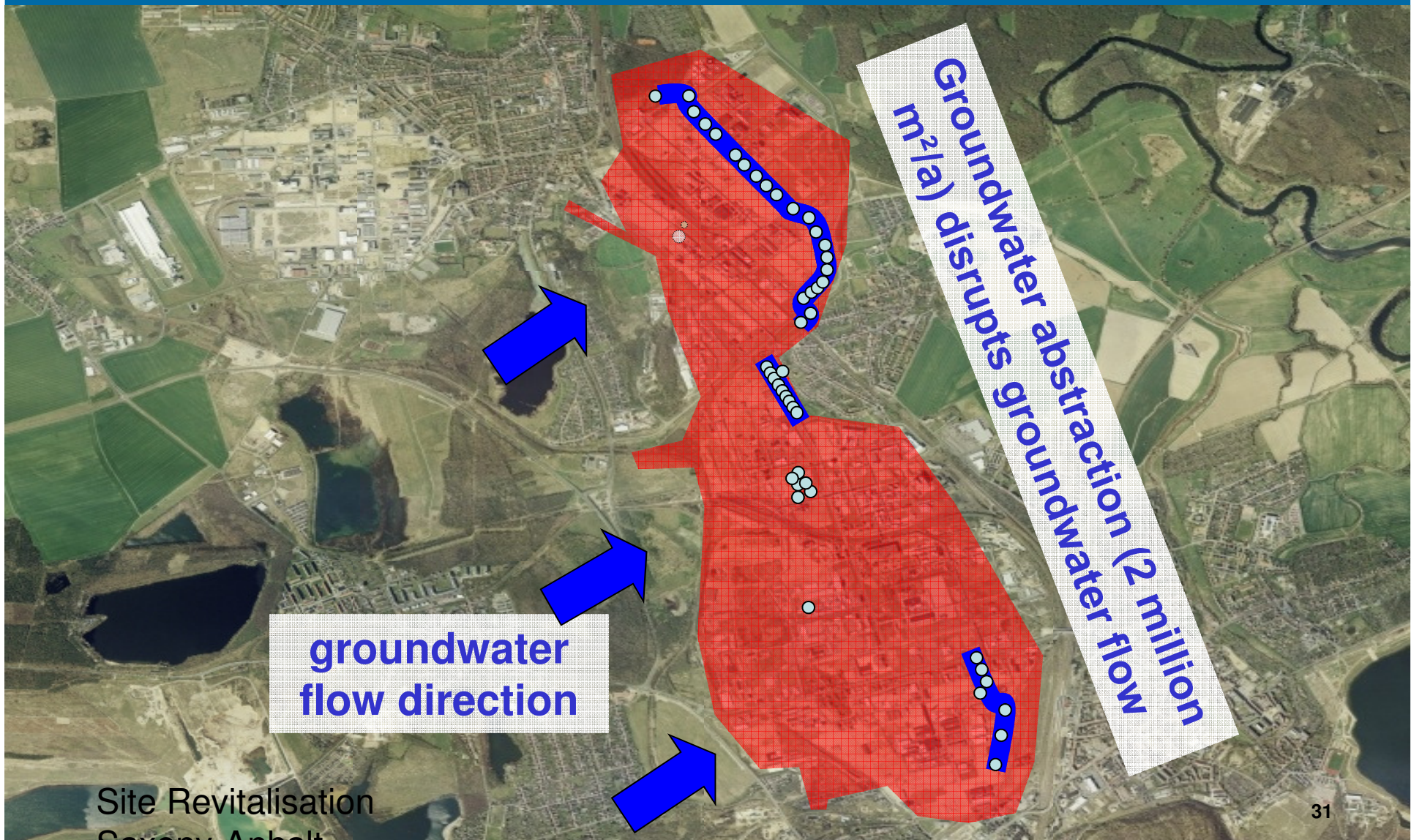
Major European centre of chlorine chemistry

Today: wide spread contamination of soil and groundwater (chlorinated organic compounds)





## Remediation measures for groundwater contamination





## High groundwater level threatens buildings and workers







## High groundwater level threatens buildings and workers





## High groundwater level threatens infrastructure





## High groundwater level threatens infrastructure

**Risk: contaminated groundwater enters rainwater sewage system and pollutes surface water bodies → violation of WFD values!**





## Urgent need of durable solutions

Locally installed companies try to evacuate infiltrating groundwater



Simple solutions are not always sustainable solutions !



## Financial concept

**LAF = Brownfield  
Authority, resp. for  
costs of contamination**

**Chemiepark Bitterfeld-Wolfen  
GmbH = Privately-owned  
infrastructure provider**

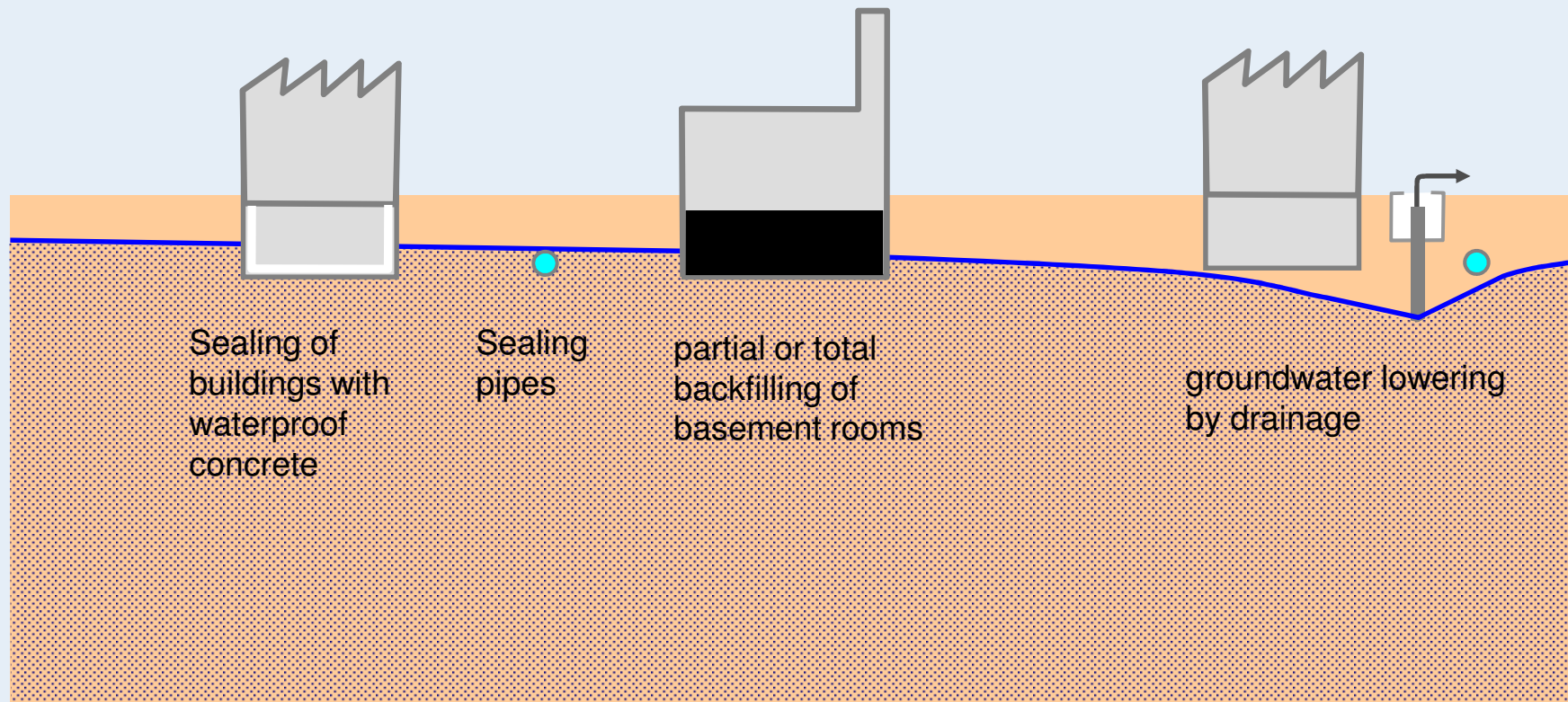
§  
**Financial agreement  
for the implementation  
of the industrial area  
securing project**  
§

**Private companies  
located at Chemiepark**

**LMBV = Federal agency for  
post-mining remediation  
activities, resp. For  
groundwater rising costs**

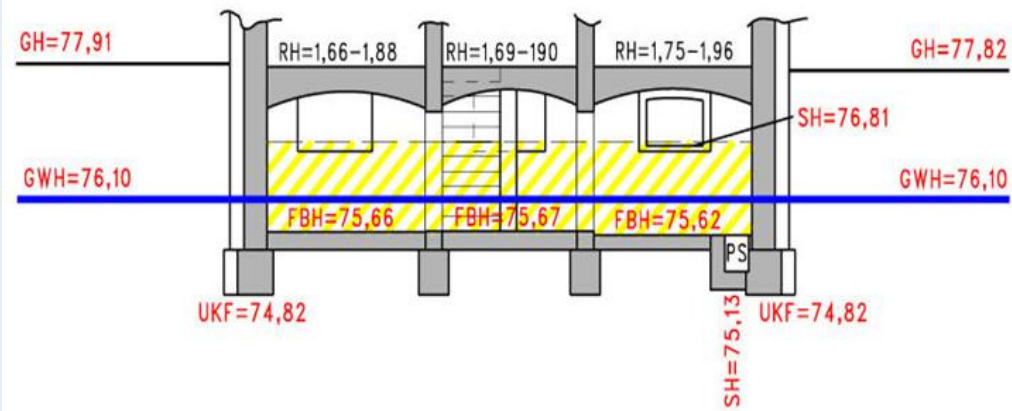


## Technical concept



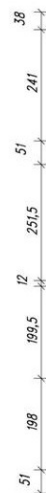
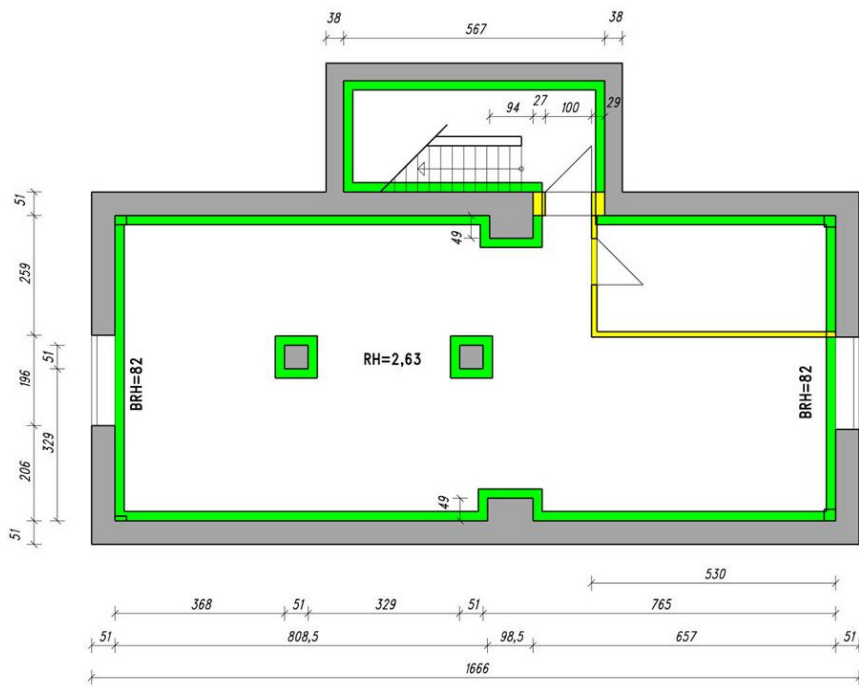
**Appropriate solution to be investigated and realised**

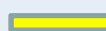
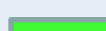
## Example No 1 – partial backfilling of basement rooms





## Example No 2 – waterproof concrete sealing of basement rooms



-  *demolished walls*
-  *waterproof concrete sealing*







## Example No 3 – sewer rehabilitation



Replacing old sewer pipes in Hauptstrasse area



- Magdeburg Rothensee
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- Megasite Bitterfeld
- **RESITES TOOL**



## Requirements to provide information

### Main targets of the RESITES - Tool

- ReSites Tool is planned as a site information system for online collaboration of public authorities that are concerned with brownfield rehabilitation.
- It will be an easy to use Web GIS tool including only the most essential maps and data.
- Sensitive data are included as metadata describing the content and providing information about the location of the original data.



## Requirements to provide information

### Main information for brownfield evaluation:

- Maps showing use-related needs of remediation, distinguished in industrial use, agricultural purpose, residential use
- Maps showing the environmental medias affected by pollutants: soil, soil gas, groundwater, surface water, atmospheric air
- Risk maps showing active exposure pathways & exposure pathways to be interrupted (related to future use options)
- Maps showing depth to groundwater table (important for the issues of hydrostatic uplift and wet basement walls)
- More information → RESITES TOOL QUESTIONNAIRE



**Many thanks  
for  
your attention**

**We are looking forward to a good cooperation**