



OSBO™ proceedings at the former sleeper factory Zernsdorf

Deconstruction and remediation: ARGE GKU / Halter

Soil washing and bioremediation: GBU mbH

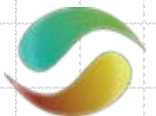
On site Separation

Biodegradation

Oxidation



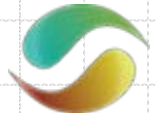
Dipl.-Ing. Wilko Werner, Dr. Johannes Arens, Dipl.-Geol. Gert Gruner





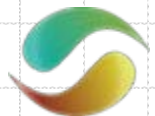
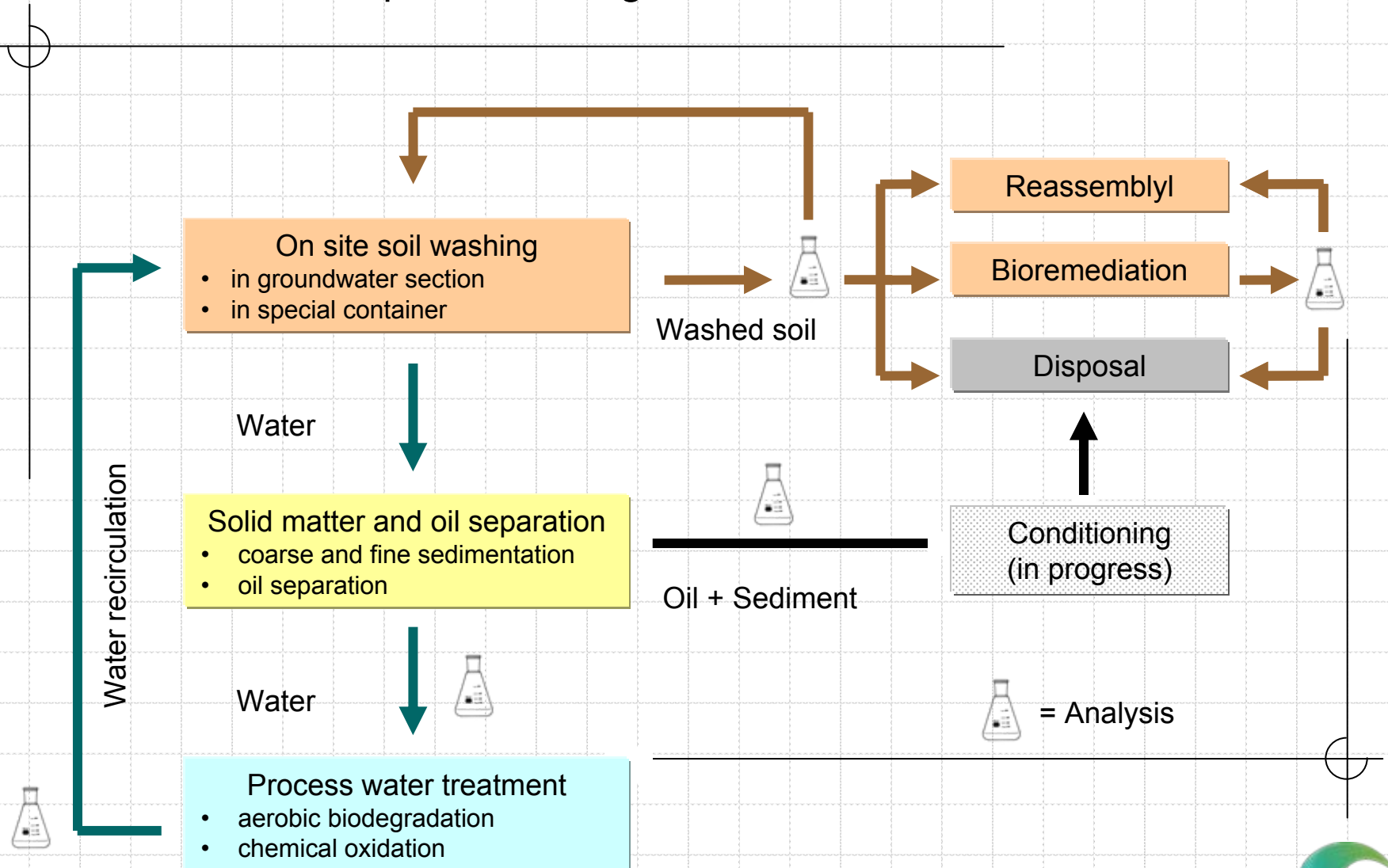
Structure

- Description of process design
 - Active principle
 - Application range
- Example of usage: former sleeper factory Zernsdorf
 - Damage pattern
 - In situ soil washing
 - On site soil washing
 - Solid matter and oil separation
 - Biological and oxidative process water treatment
 - Bioremediation in heaps
 - Scientific monitoring



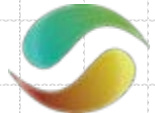
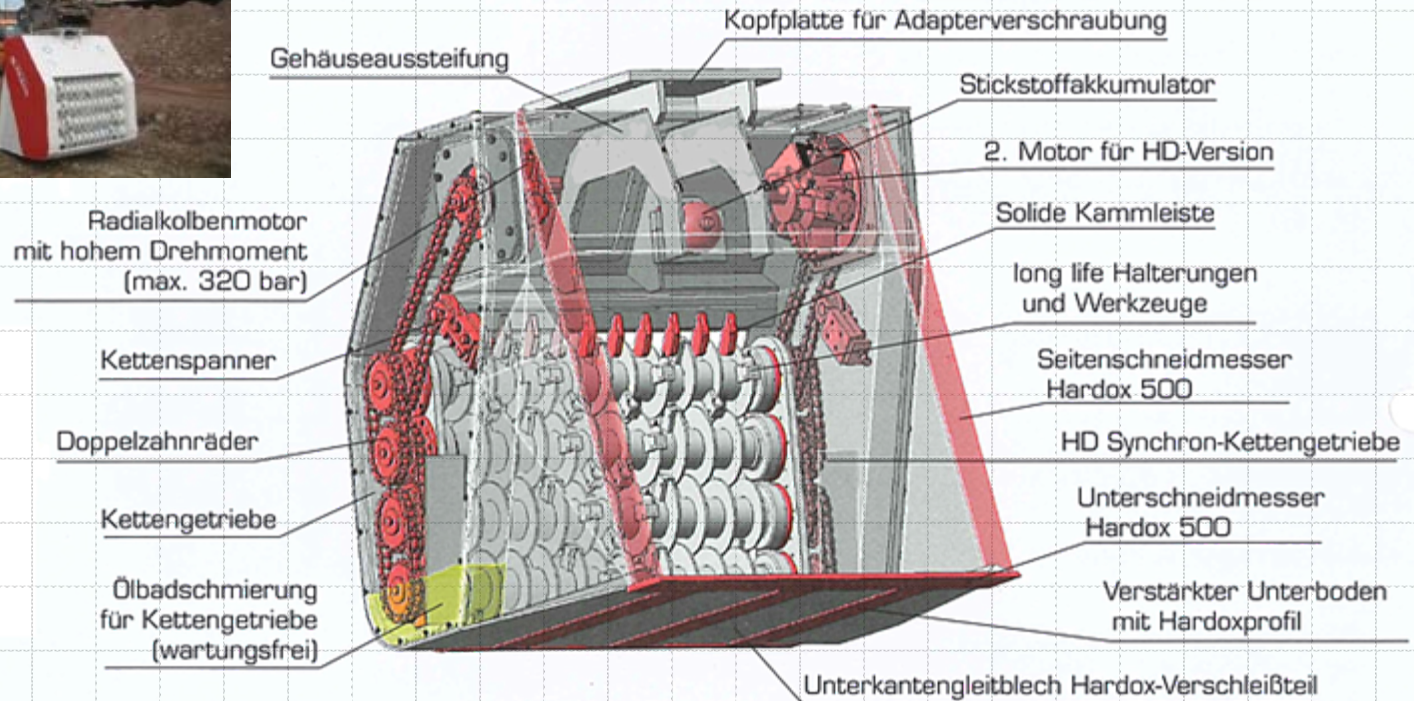


The OSBO™ process design





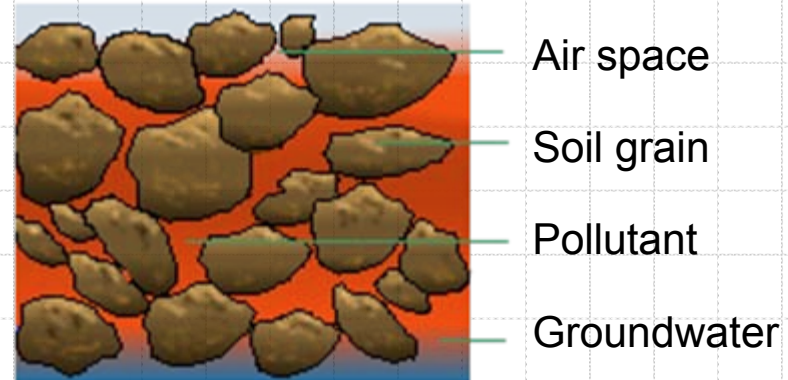
Design of OSBOmat™



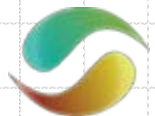
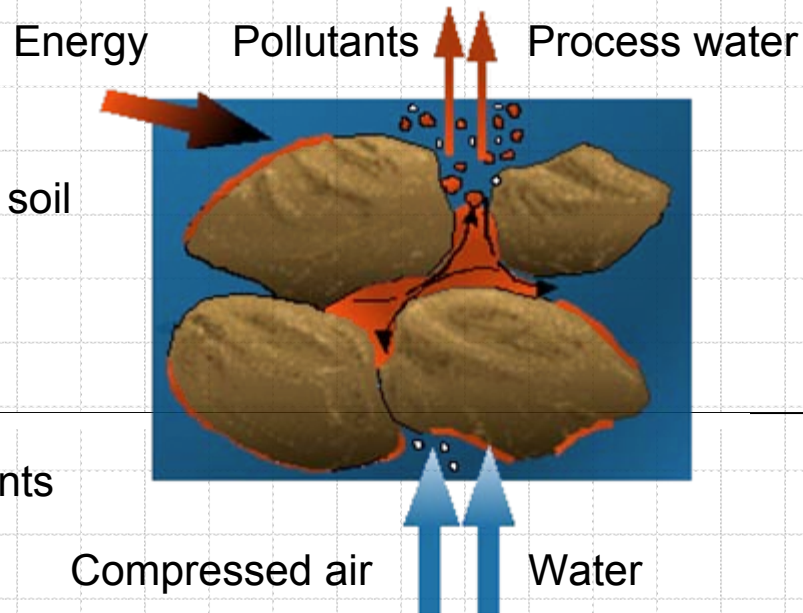


The active principle of OSBOmat™

- Contaminated soil in stationary position: pollutants associated to soil grain and enclosed by soil matrix



- Effect of OSBOmat™: Abrasion of the pollutants from soil grain by shearing forces and transfer into the liquid phase
- Result: enhancement of the bioavailability of the contaminants





Application range of OSBO™ soil washing

Soil matrix

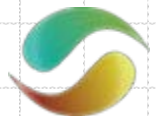
- Coarse and fine grained soil with silt <10%
- Silt > 10%: extra costs for process water treatment (sedimentation, adsorption effects and sludge formation)

Type of contamination

- Originally developed for short chained mineral oils as well as mono- and diaromatics
- Current status: established for long chained TPH and higher condensed PAH by optimization of separation techniques and the biological and oxidative process water treatment plant
- Heavy metals under development (container washing under acidic conditions)

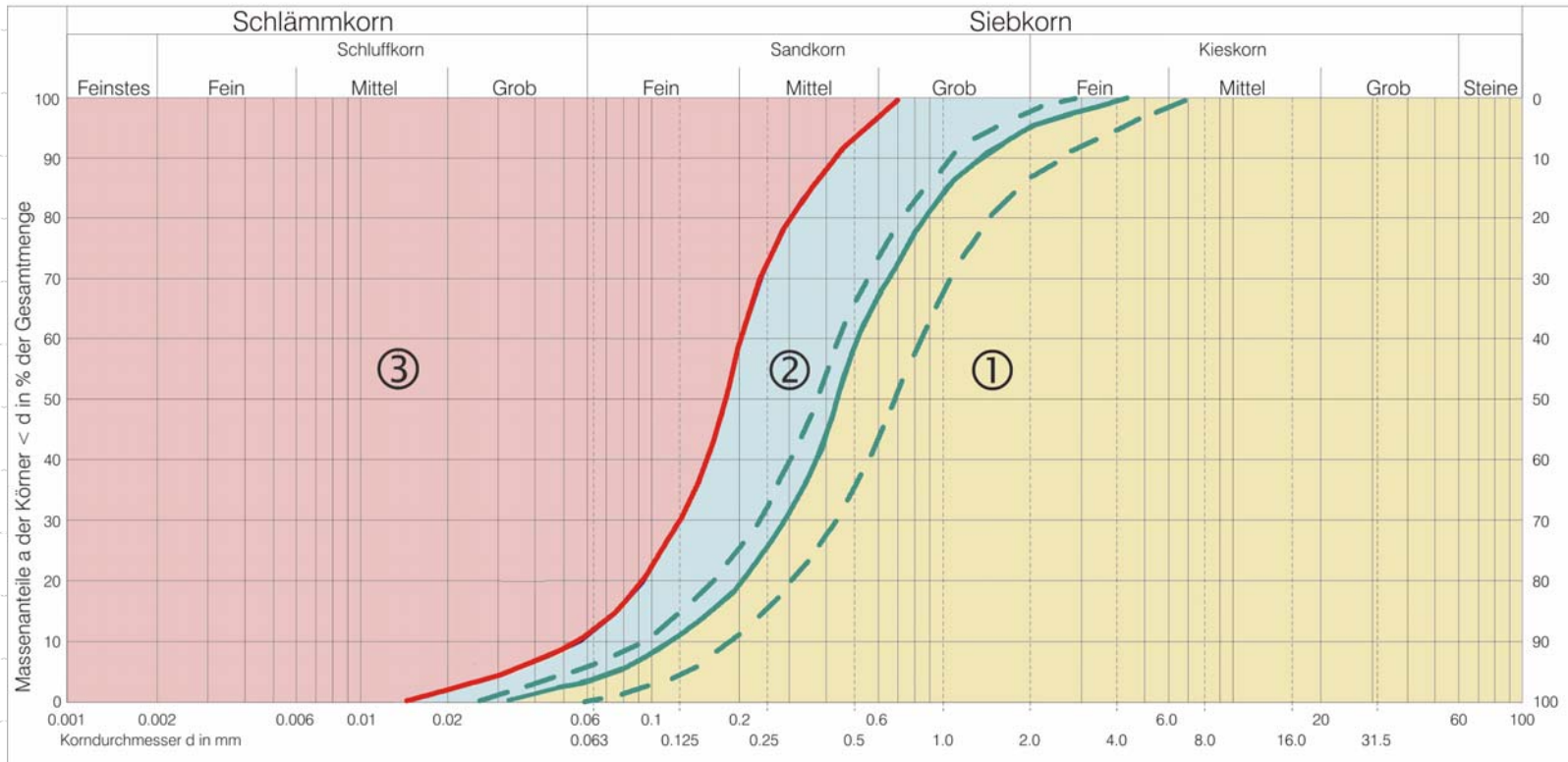
Geological and hydrogeological peripherals

- Depth of groundwater level 1 - 8 m
- Continuous ground water flow of $Q \geq 3,5 \text{ m}^3/\text{h}$ (needed as process water)





Application range of OSBO™ proceedings

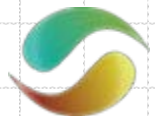


- ① Idealer Anwendungsbereich für On-Site-Bodenwäsche
- ② Zusatzmodule für erweiterte Trennverfahren erforderlich
- ③ Bioremediation im Mietenverfahren

Nass- / Trockensiebung nach DIN 18123

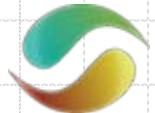
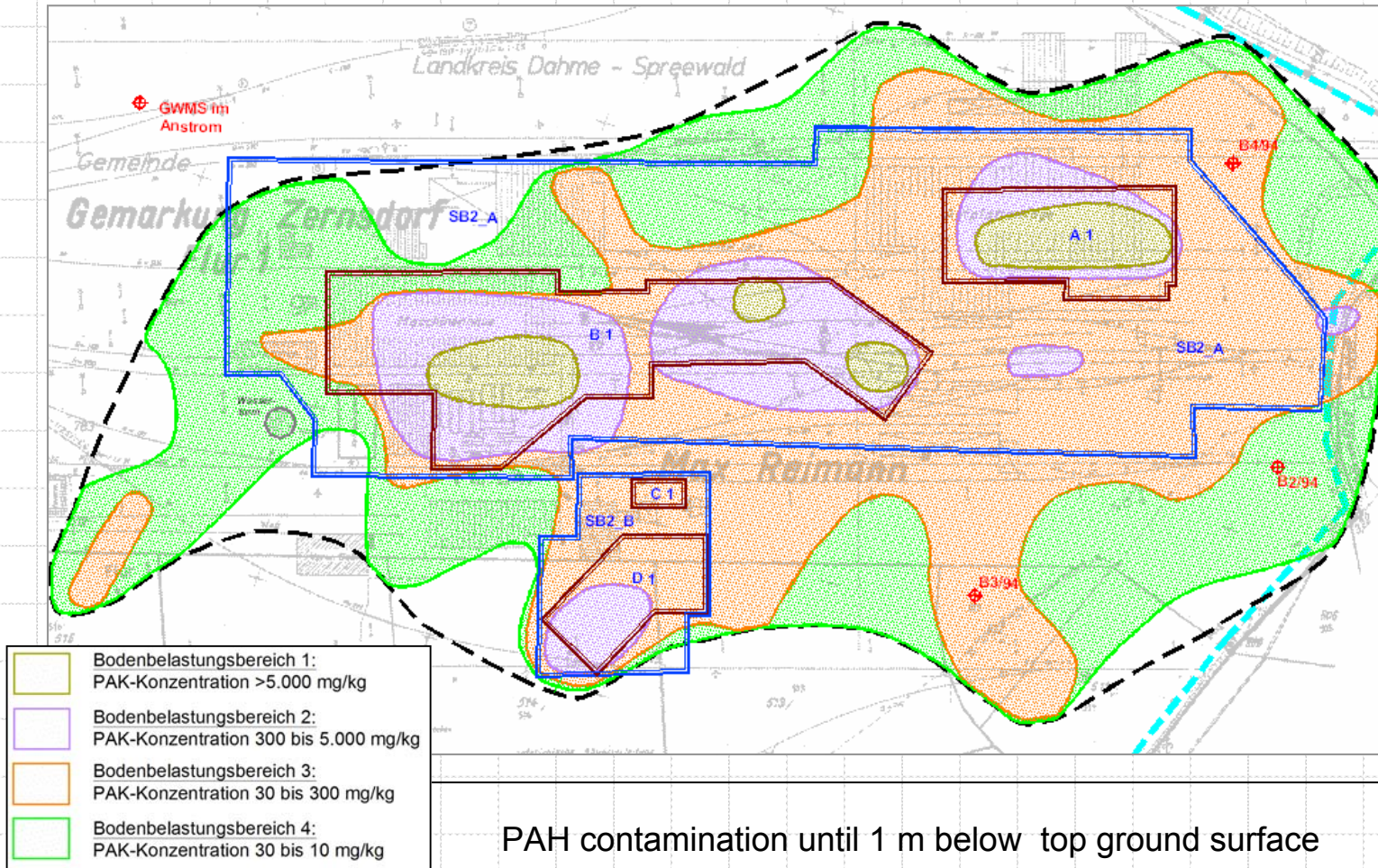
≡ Typische Sieblinien in Zernsdorf

— Grenze zwischen On-Site-Bodenwäsche und Bioremediation



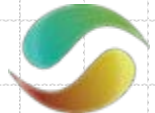


Contamination zones in former sleeper factory Zernsdorf



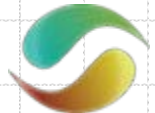


Soil excavation in the groundwater section





In situ soil washing





On site soil washing

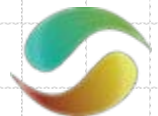
Separation of tar oil contamination from soil grain



Soil washing in special container



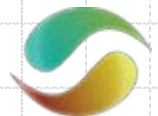
Soil washing in an old basin





On site soil washing

Separation of tar oil contamination from soil grain and transfer of pollutants into the liquid phase

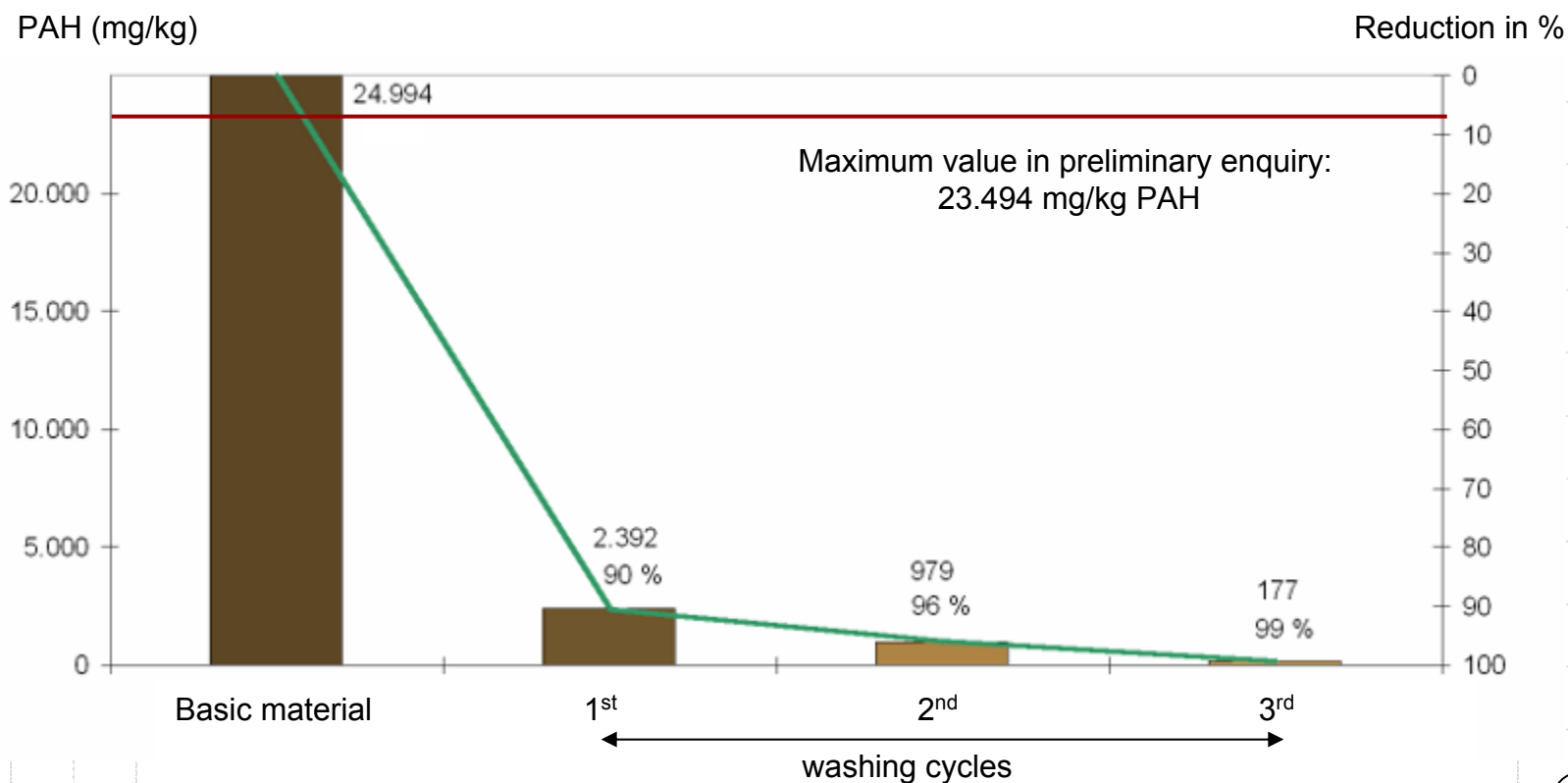


OSBO™ proceedings in a
soil washing container
followed by separation tank

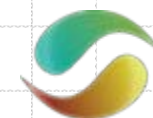




On site soil washing - PAH reduction in soil

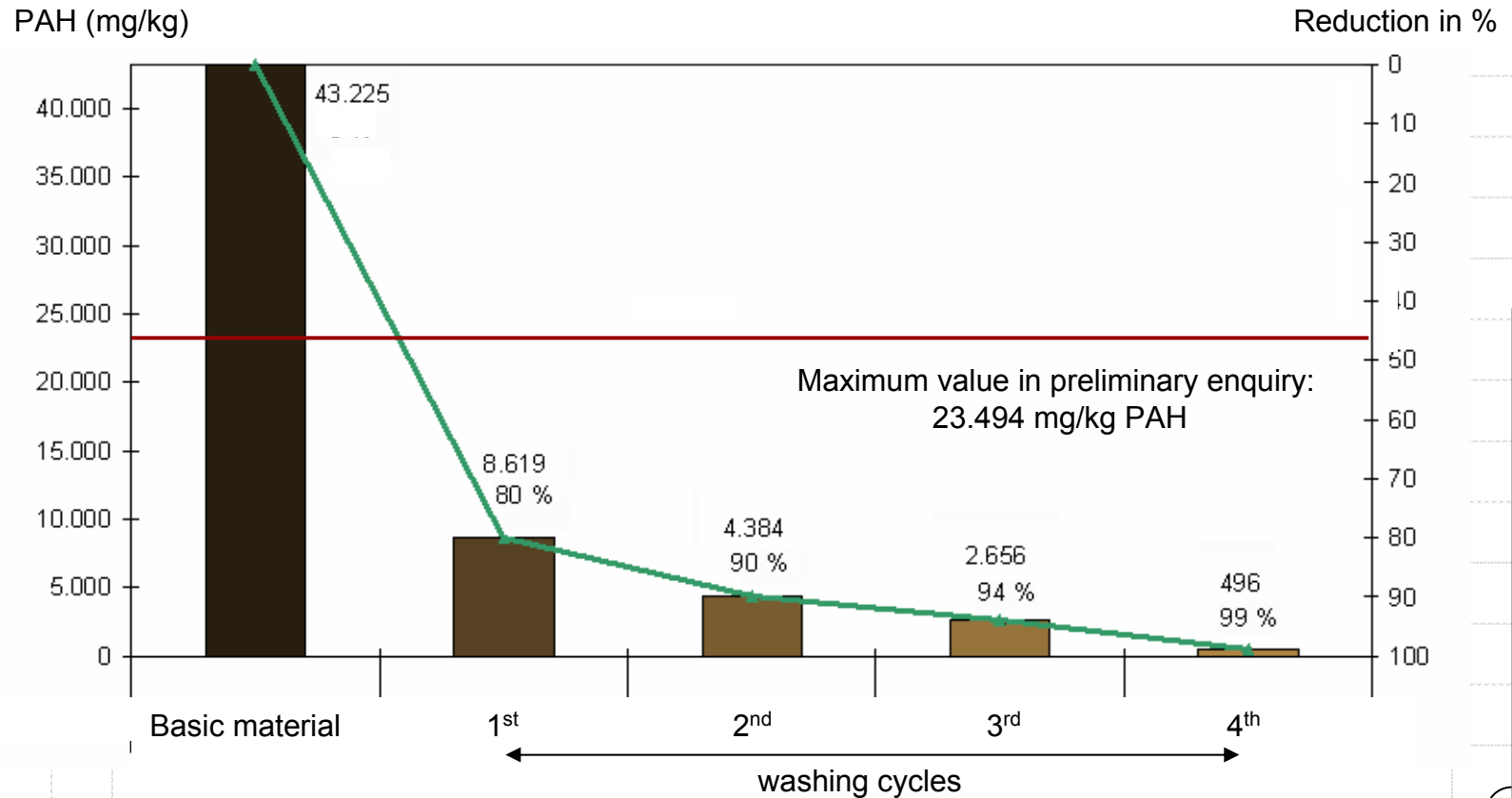


Zernsdorf excavation A2 (summer 2008)

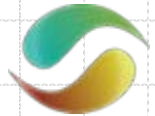




On site soil washing - PAH reduction in soil

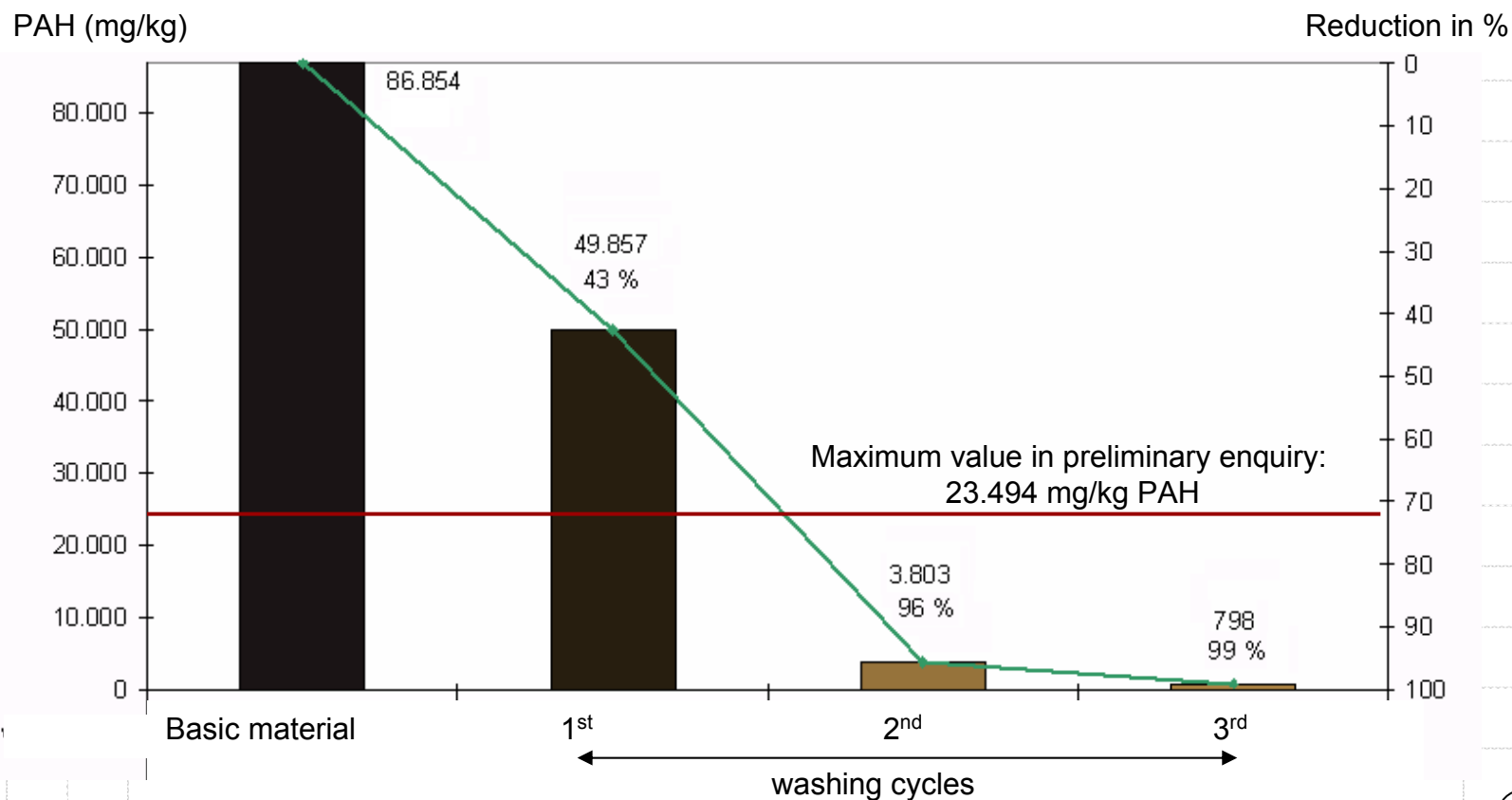


Zernsdorf excavation B2 (fall 2008)

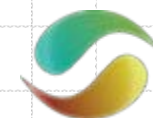




On site soil washing - PAH reduction in soil



Zernsdorf excavation D2 (spring 2009)





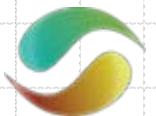
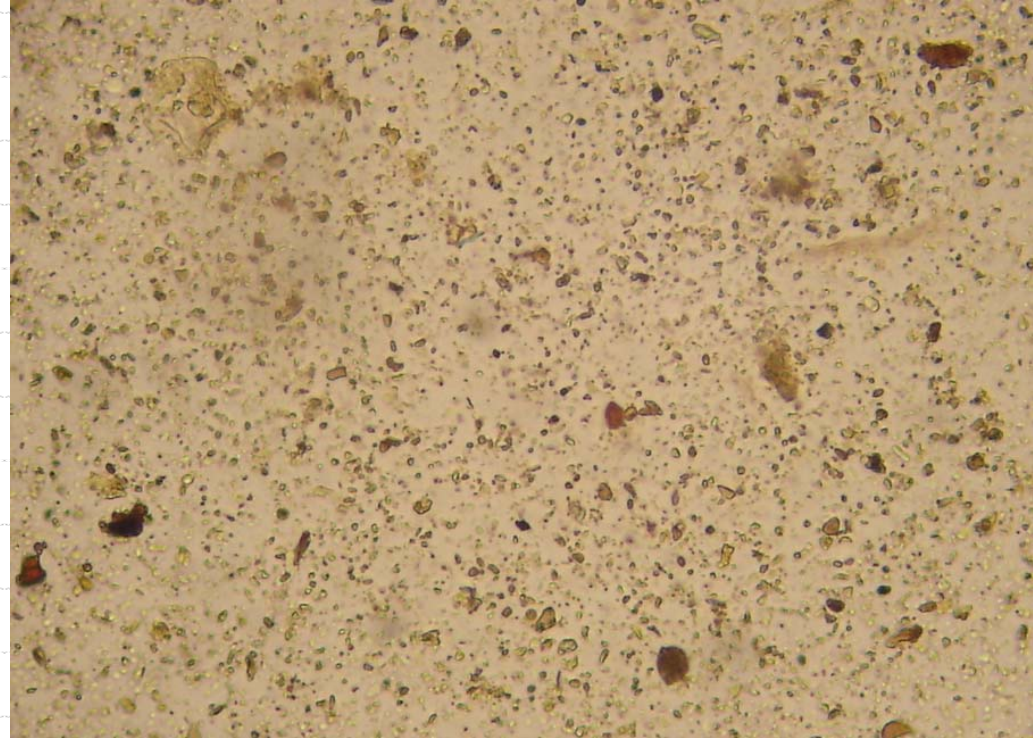
Solid matter and oil separation

Problematic silt separation



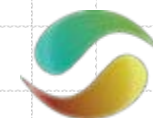
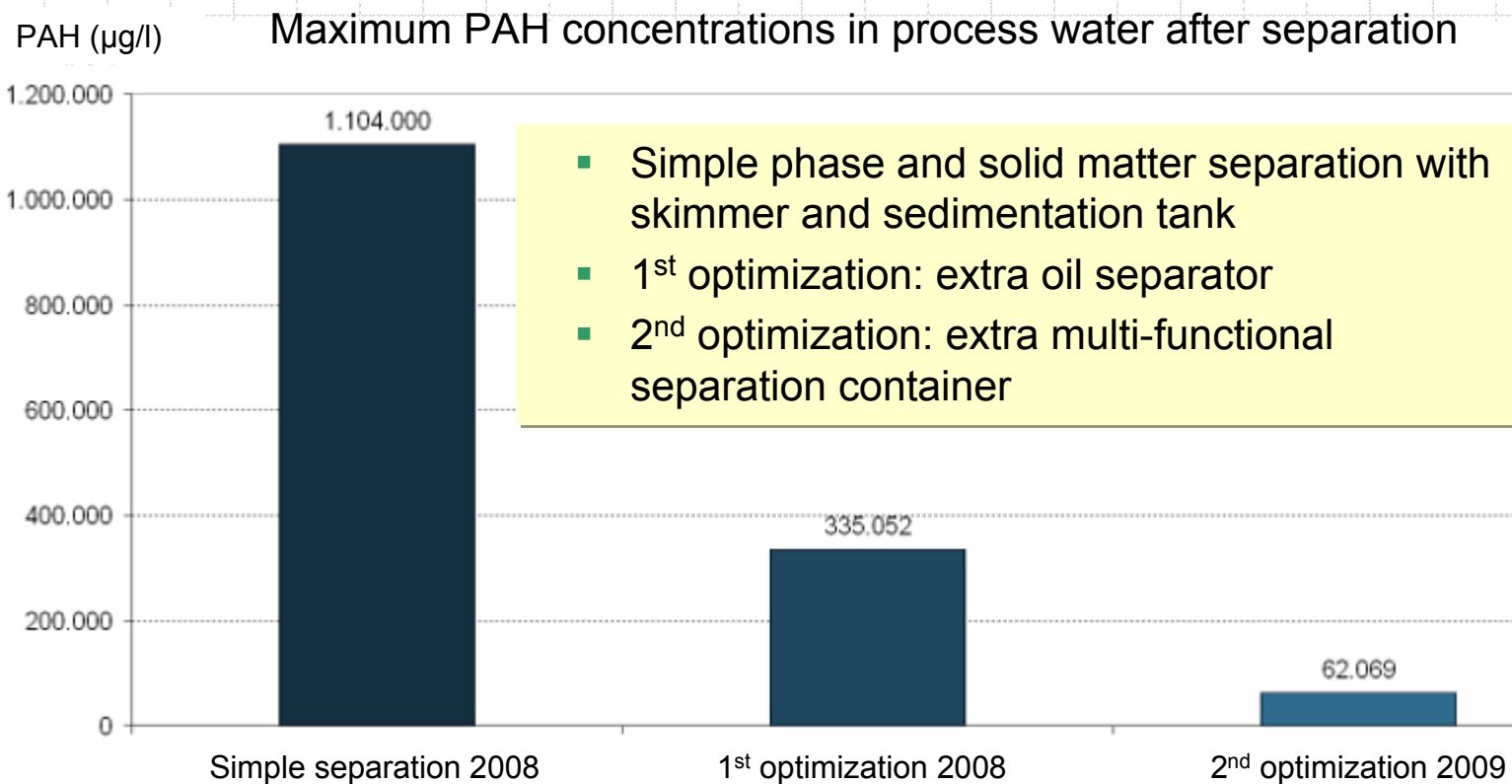
Sedimentation after 3 days

Silt in process water
(400-fold magnification)





Solid matter and oil separation





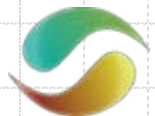
Solid matter and oil separation



Multi-functional separation container



Collection tank





Solid matter and oil separation

Oil separation

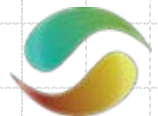


Heavy oil fraction

Water content: max. 10 %



Oil separator





Biological and oxidative process water treatment

Alternating stages:

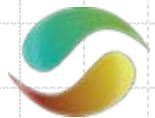
- 3 aerobic fixed-bed reactors
- 2 oxidation reactors



Oxygen and
ozone generator

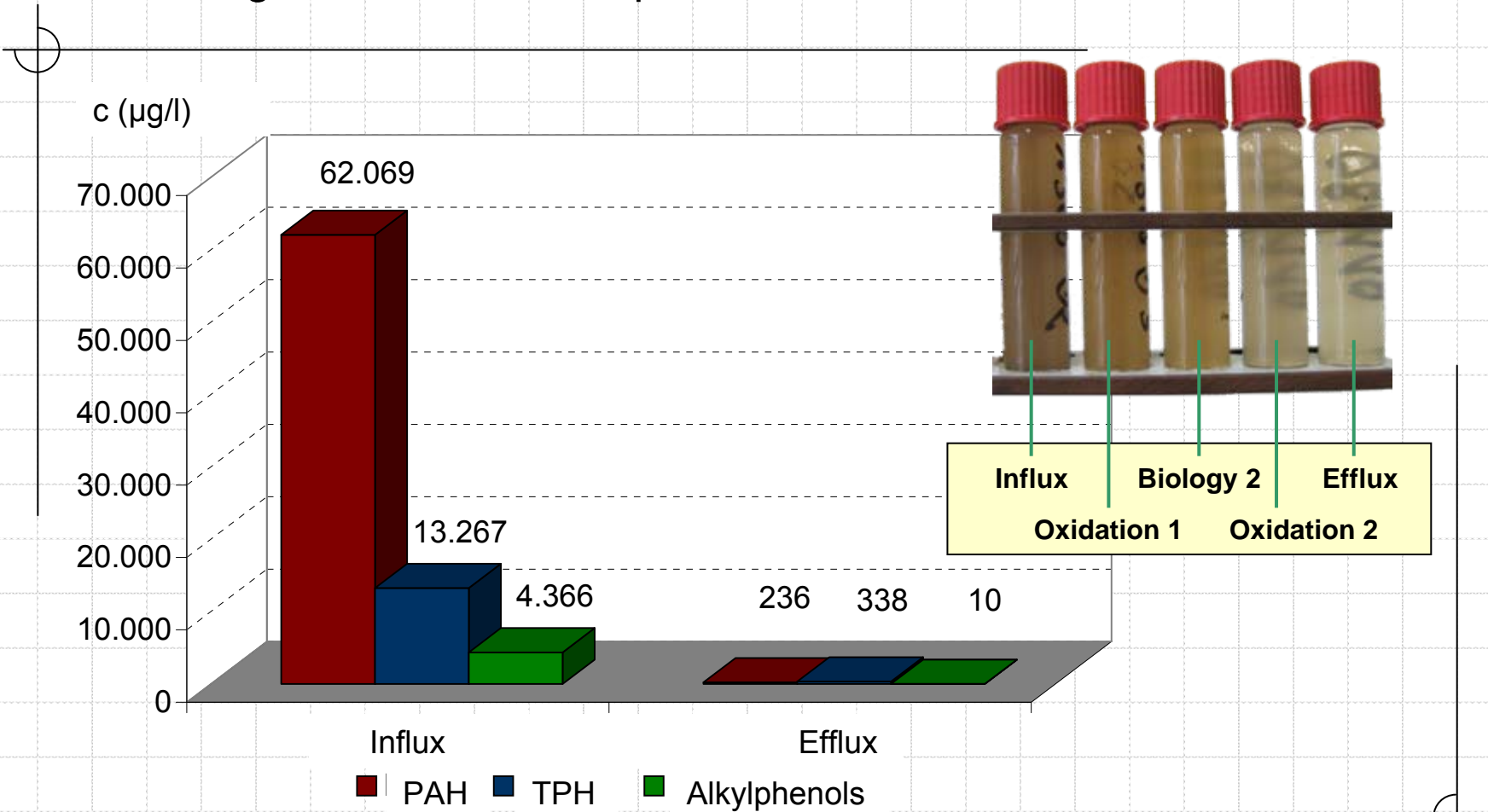


Mobility

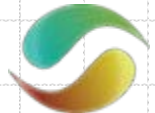




Biological and oxidative process water treatment



Maximal concentration in 2009 (May 28, 2009)



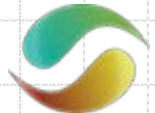


Bioremediation in heaps



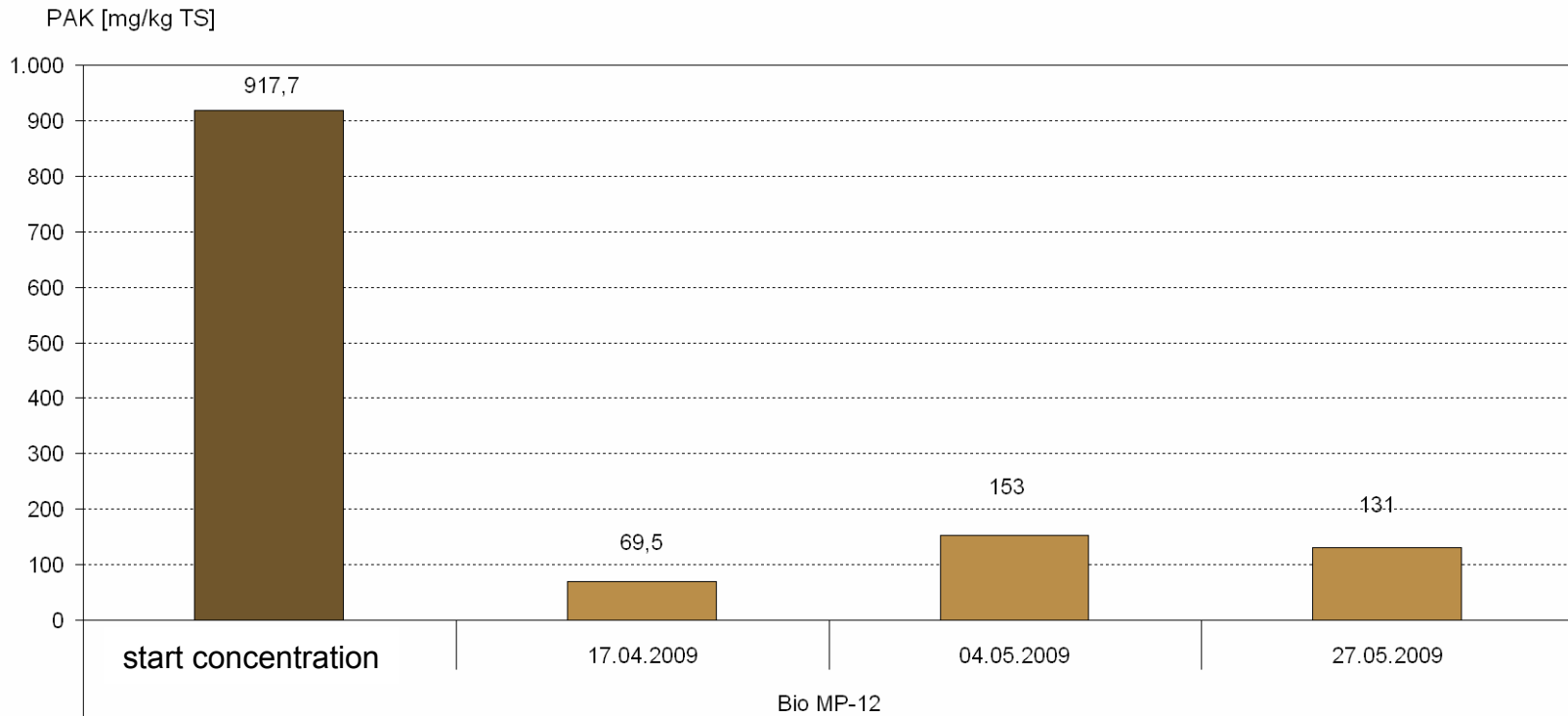
Biological soil conditioning to reduce organic pollutants

- Inoculation of supplements
- Aeration of heaps by OSBOmat™

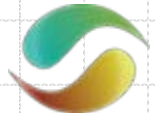




Bioremediation of washed soil

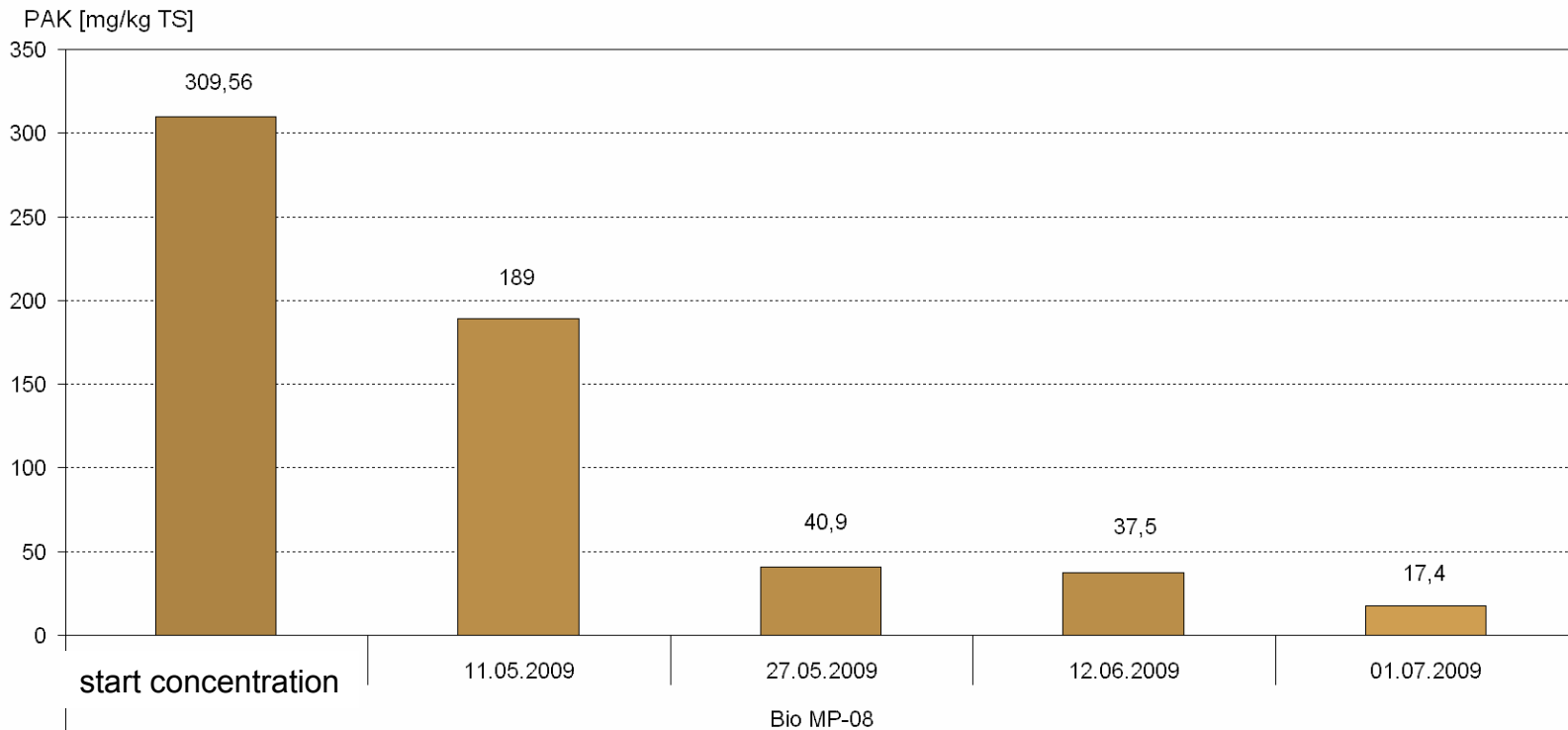


PAH start concentration = arithmetic mean of polluted soil and inoculation material

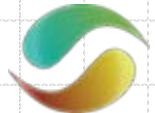




Bioremediation of dry excavated soil



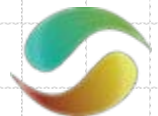
PAH start concentration = arithmetic mean of polluted soil and inoculation material





Scientific attendance and technology development

- Site-specific lab and pilot tests for process optimization
- Rapid on site analysis
- Scientific evaluation



Thank you for attention

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