

PFAS in Soil – Limitation and Solution in Germany

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Content

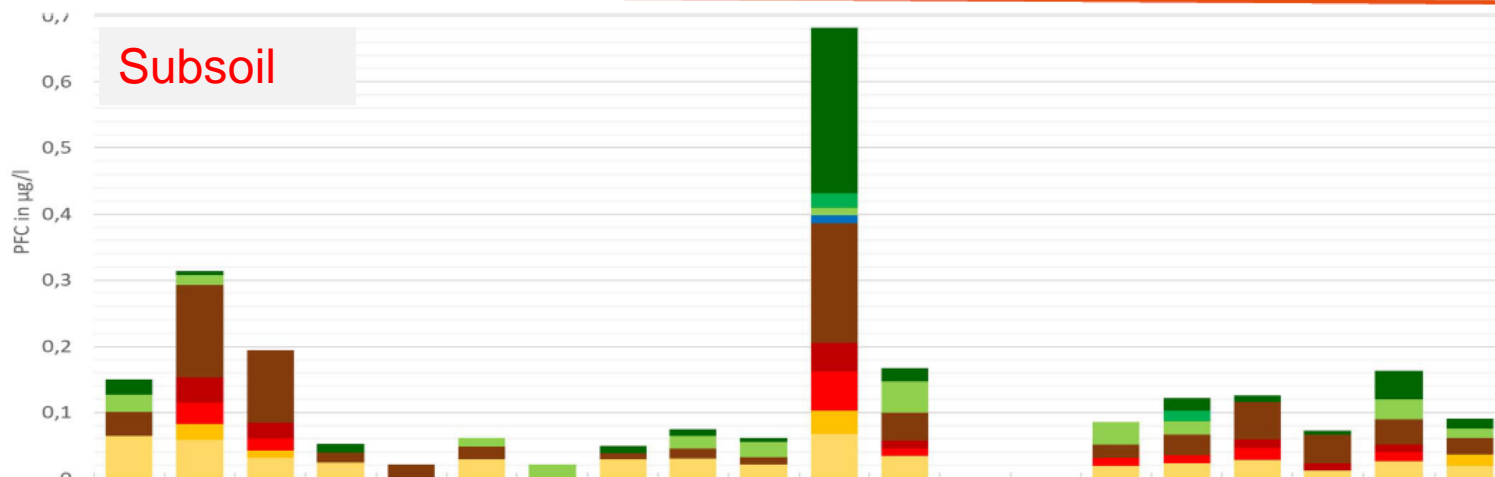
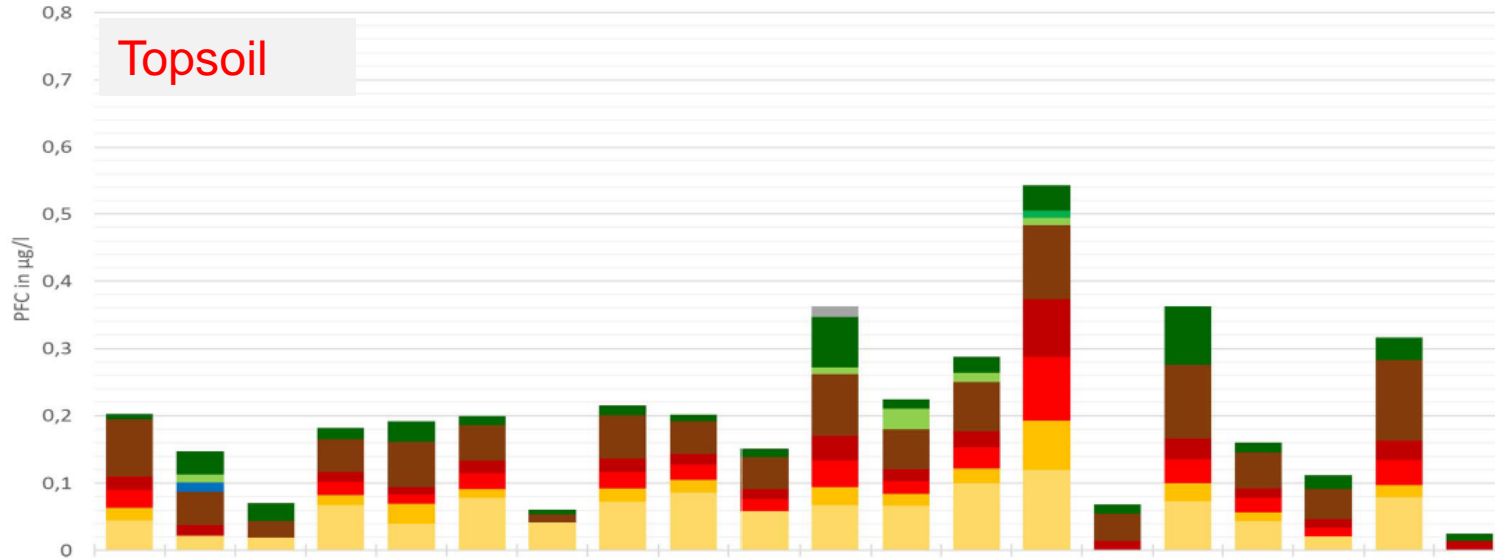
- Techniques
- Limitations
- Alternative
- Data
- Conclusion



PFAS in Soil

Stichprobe: PFC in Ackerflächen NRW (2:1 Schütteleluat) in µg/l

PFBA PFPeA PFHxA PFHpA PFOA PFNA PFDA PFBS PFHxS PFOS 6:2 FTS



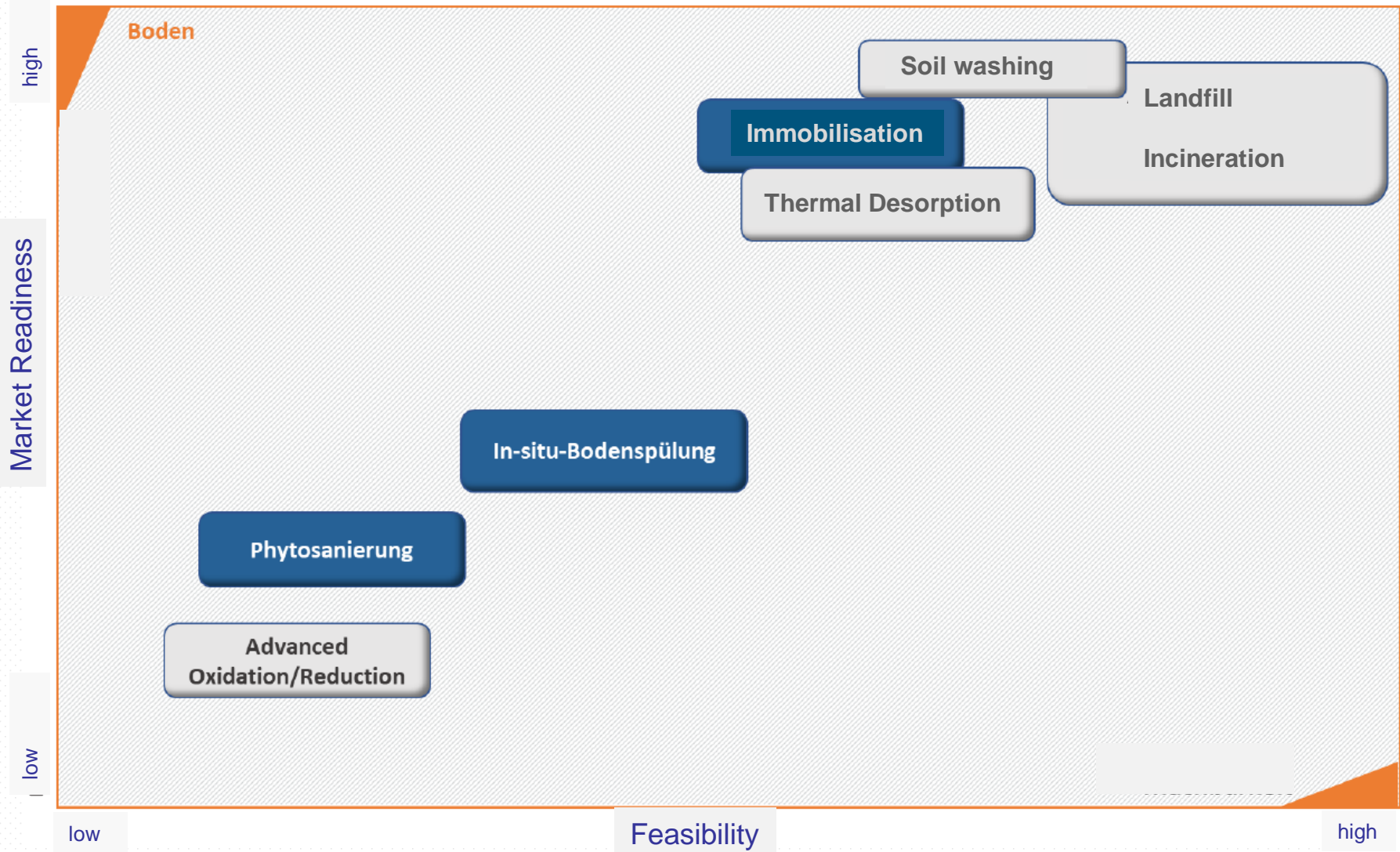
Results of investigation in Germany -

Rural field without any Suspicion

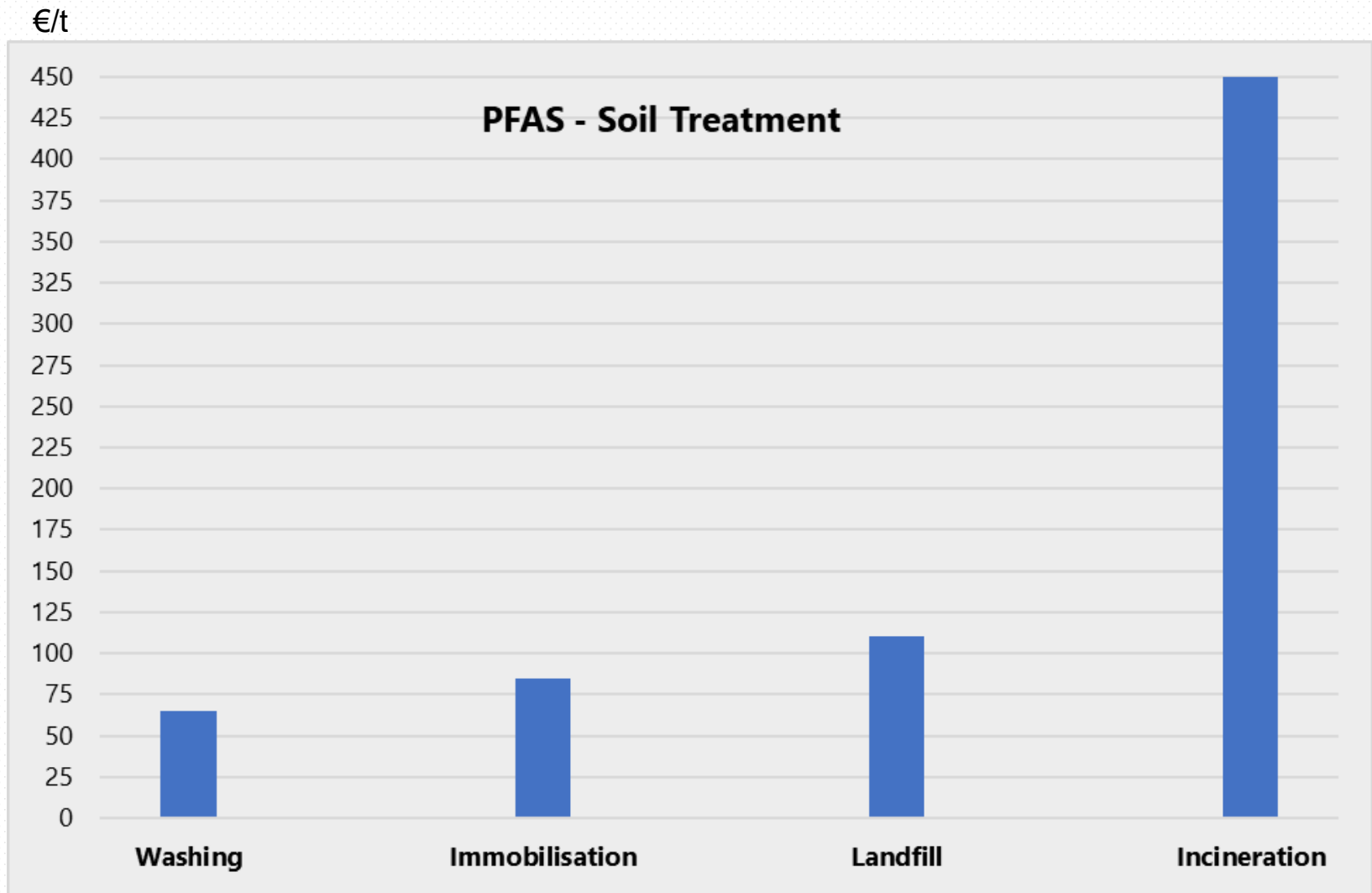
Source: Mersmann 2019

Treatment Techniques

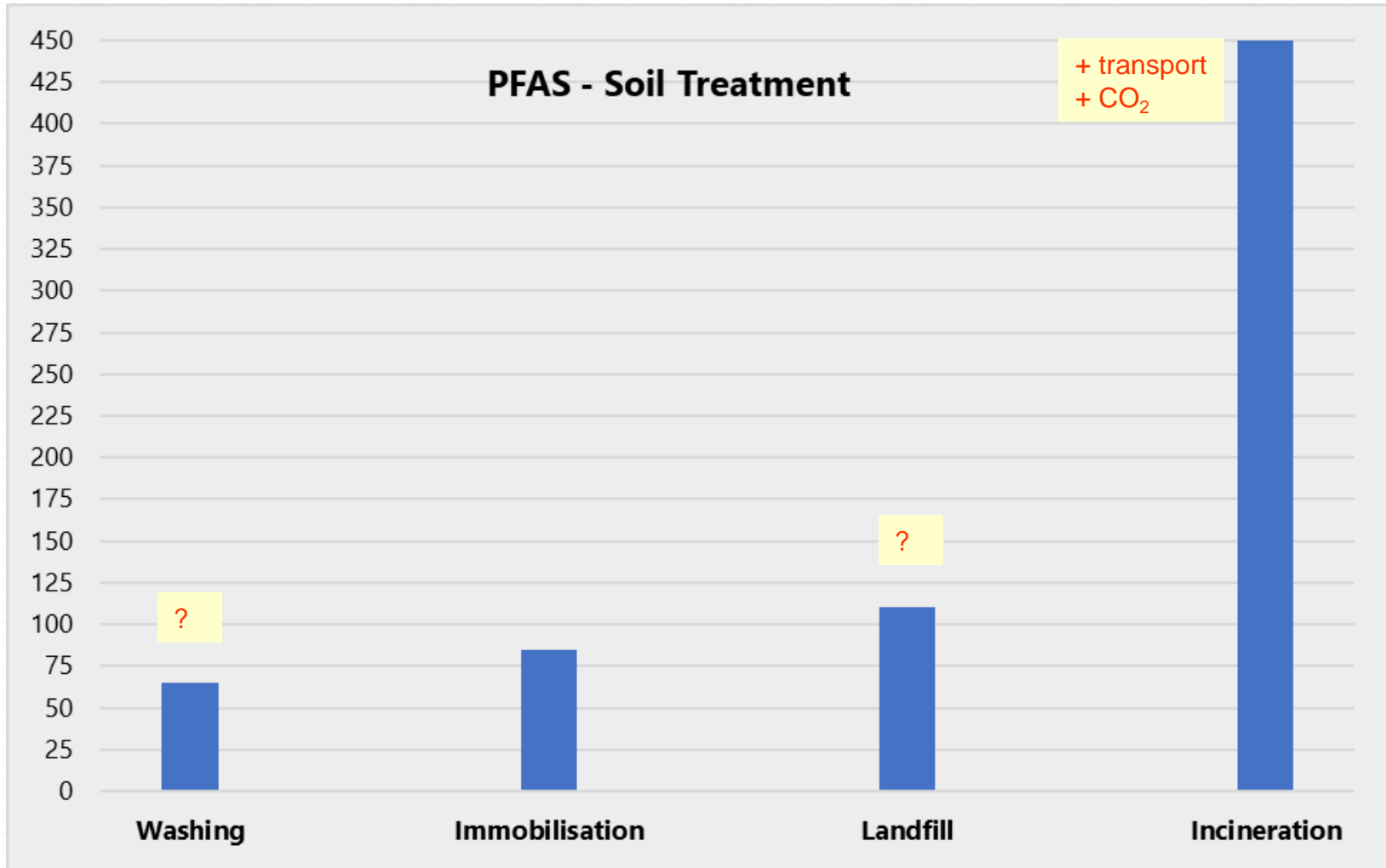
Source: UBA 2020



Treatment Cost



Treatment Cost



Limitations – Soil Washing

- treatment successful
- for gravel and sand (fines < 8 or 10%)
- larger volume of soil
- PFAS accumulate in water
- requires treatment (not easy)
- PFAS can remain in fines

Source: Company Schauenburg



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Limitations - Landfill

- landfills with limited remaining time
- federal states in Germany
- with different limits
- PFAS $\mu\text{g}/\text{kg}$ vs. $\mu\text{g}/\text{l}$
- >50 mg/kg PFAS/PFOS hazardous waste (EU)
- not above ground (treatment, removal or below ground)

Limitations - Landfill

- disposal still preferred
- in some states no landfill for PFAS
- long transport
- treatment of landfill leachate
- limited capacity
- not for larger mass

Source: PressePortal Fraport



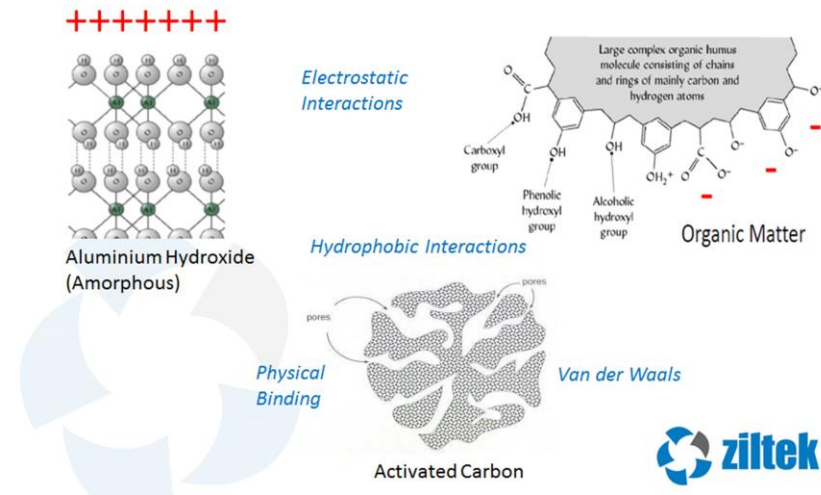
> 500.000 m³ PFAS soil

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Immobilisation

RemBind (AUS)

- activated carbon
- Aluminium hydroxide
- Kaolin
- Additives



➡ Aktivkohle



Medizinisch
genutzt

➡ Kaolin



Papierbeschichtung,
Füllstoff, Porzellan

➡ Aluminiumhydroxid



Zahnpflege,
Medizin

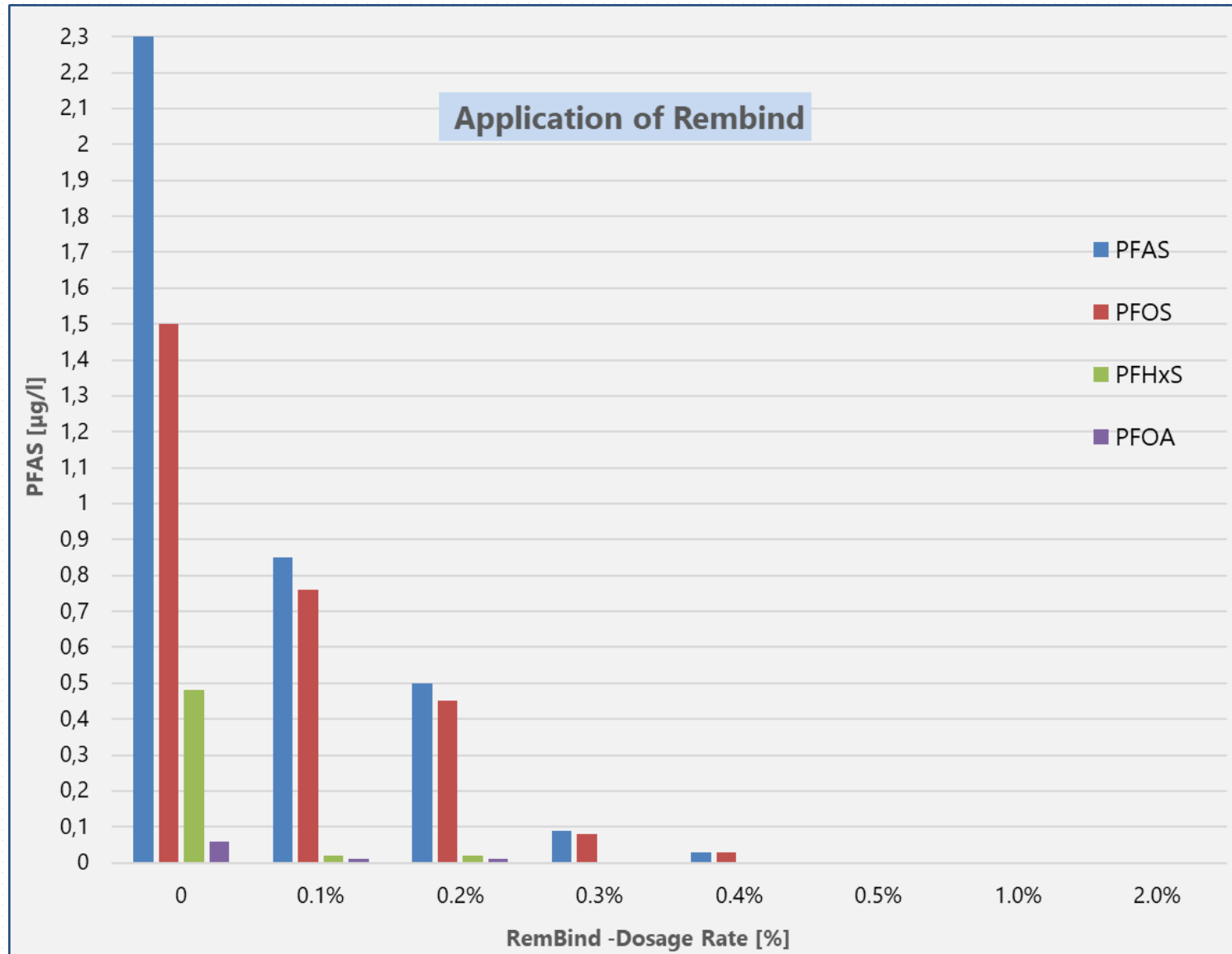
RemBind - Application

- Dosing based on mass
- about 1% to 2,5%
- moisture about 20%
- proper mixing (contact)
- 24 hrs fixation
- test in advance
- what achievable

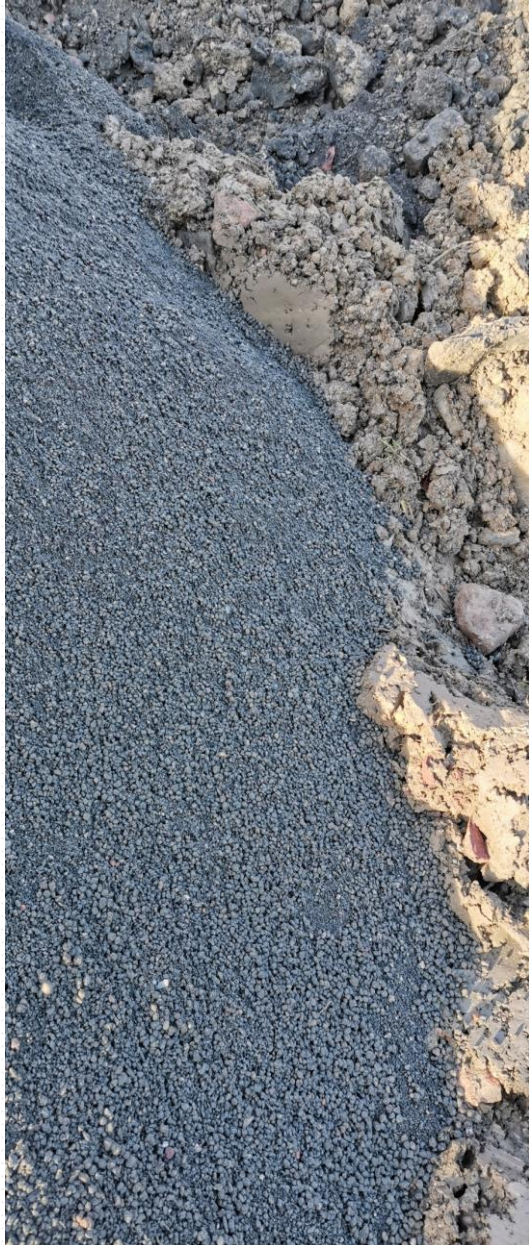


Photo: EnvyTech

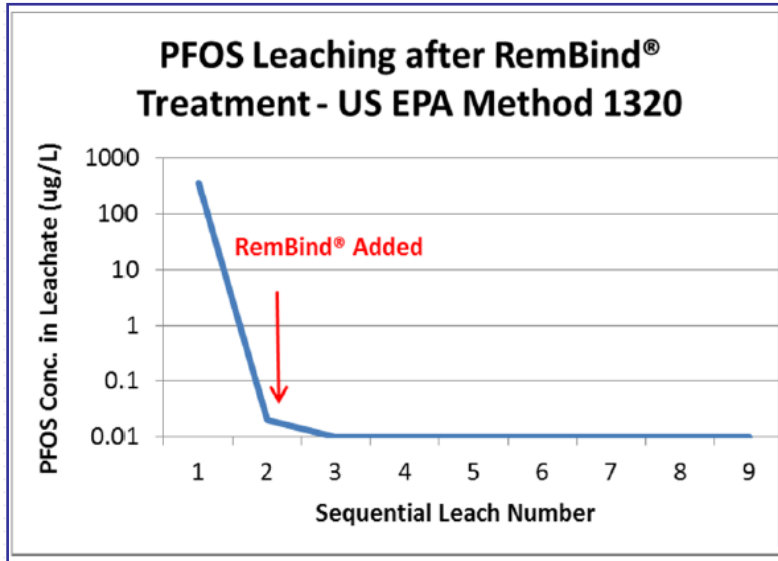
Application 200 t (D)



Application 200 t (D)



RemBind – Long Term



Environ. Chem.
<https://doi.org/10.1071/EN18156>

Sorptive remediation of perfluorooctanoic acid (PFOA) using mixed mineral and graphene/carbon-based materials

Supriya Lath,^{A,D} Divina A. Navarro,^{A,B} Dusan Losic,^C Anupama Kumar^B and Michael J. McLaughlin^{A,B}

Journal of Hazardous Materials 367 (2019) 639–646

Contents lists available at ScienceDirect

Journal of Hazardous Materials

journal homepage: www.elsevier.com/locate/jhazmat

Stabilization and solidification remediation of soil contaminated with poly- and perfluoroalkyl substances (PFASs)

Mattias Söregård^{a,*}, Dan B. Kleja^b, Lutz Ahrens^a

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Durability of sorption of per- and polyfluorinated alkyl substances in soils immobilised using common adsorbents: 1. Effects of perturbations in pH

Shervin Kabiri^{a,*}, Marc Centner^b, Michael J. McLaughlin^{a,*}

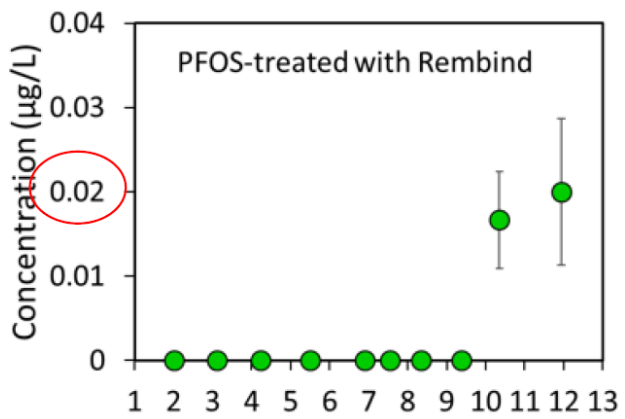
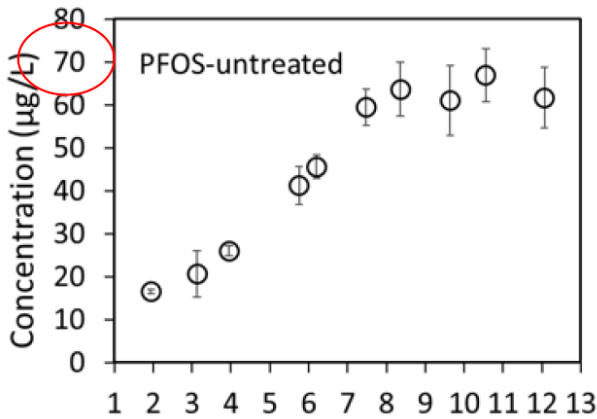
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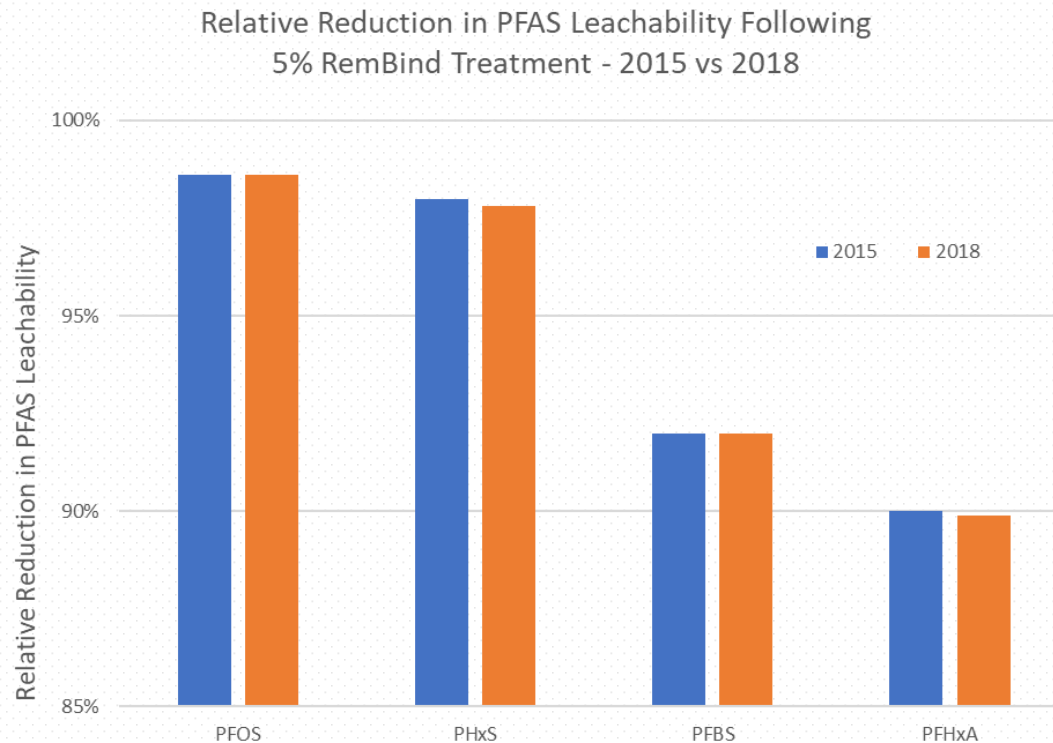
Durability of sorption of per- and polyfluorinated alkyl substances in soils immobilised using common adsorbents: 2. Effects of repeated leaching, temperature extremes, ionic strength and competing ions

Shervin Kabiri^{a,*}, Michael J. McLaughlin^{a,*}



RemBind – Long Term

- Treated soil re-sampled
- After 3,5 years
- Almost no difference

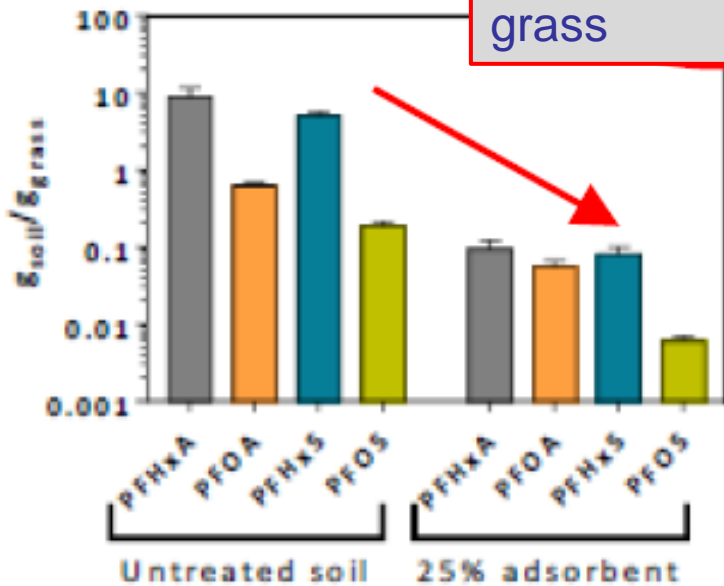


RemBind – Reduced Uptake

Grass accumulation

GSAF

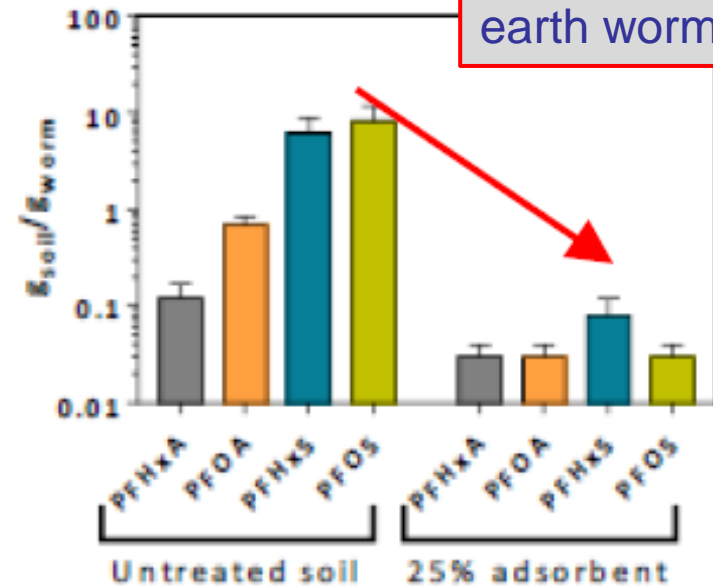
Up to 96%
reduction in
grass



Earthworm accumulation

BSAF

Up to 99%
reduction in
earth worm



Quelle: Bräunig, Baduel & Mueller
u.a. Univ. of Queensland

Conclusions

- space on landfills is limited
- new landfill: „not in my backyard“
- uniform classification of contamination
- development of brownfields
- PFAS has an inhibiting effect
- PFAS not simple for leachate treatment

Conclusions

- immobilisation promising
- eluate ND or close to
- adjustable on site specific PFAS level
- long term stability (lab, field)
- subject of study now in D
- recommendations for regulators



Many Thanks!

- Questions?
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