For our Environment

Umwelt Bundesamt

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Emerging Contaminants: Threats, Issues, future developments

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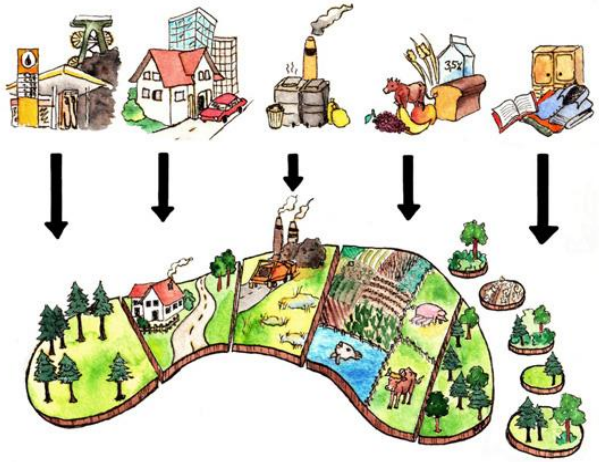
Section: Soil Protection Measures

> 3000 substances and mixtures



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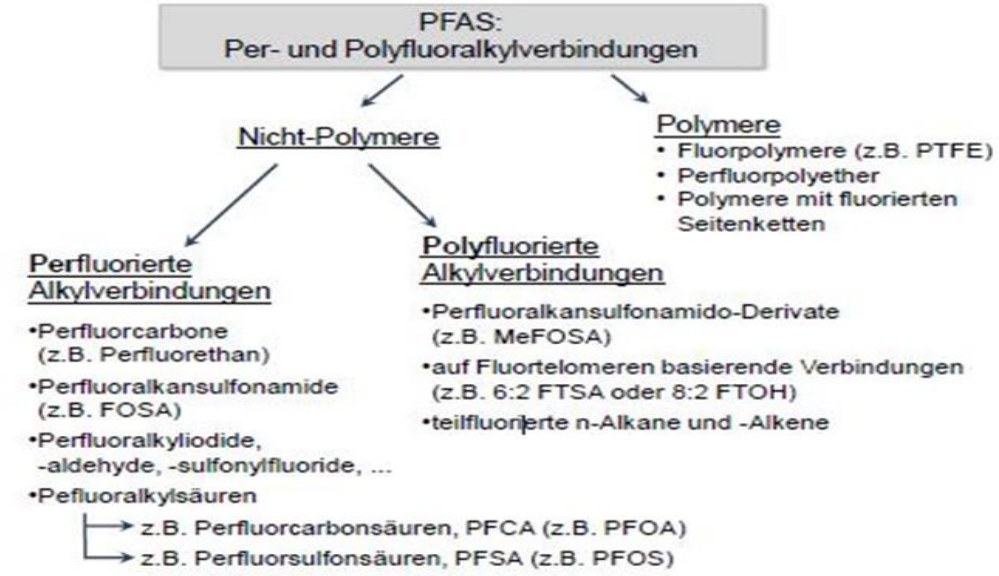

Abbildung 1-1: Übersicht, Beschreibung und Einordnung der umweltrelevanten PFAS mit Beispielen

(PTFE: Polytetrafluorethylen; MeFOSA: N-Methyl-perfluorooktansulfonamid; 6:2 FTSA: 6:2 Fluorotelomer sulfonic acid; 8:2 FTOH: 8:2 Fluortelomeralkohol; FOSA: Perfluoroktansulfonsäureamid; PFCA: perfluoroalkyl carboxylic acid; PFSA: perfluoroalkyl sulfonic acid) (modifiziert nach Buck et al. 2011).

Status Quo

- Incomplete data about the dimension of the problem in the environment
- PFAS are not yet permanent part of monitoring
- Analytical challenges
- Broad variety of sources (fire fighting foams, outdoor clothes, non-stick coatings, glossy covers in papers and photoprints

airports, training areas fire fighters, electroplating, sewage sludges

- Problem and dimension understanding Investigation concepts (improving)
- Investigation issues; analytical and monitoring challenges(improving)
- Assessment and related criteria (improving)
- Legal value setting (improving)
- **Remediation options and management concepts (improving for groundwater, lacking for soil and diffuse pollution)**

Corner stones for PFAS remediation and related management concepts

- PFAS - a very complex group of substances with many difficult characteristics with regard environmental issues.
- A permanent increase of number of “artificial” substances (not always less problematic, precursor problems, substitutes are often not so effective an less dangerous…)
- A widely lack of knowledge and expertise about fate and behavior in soil and groundwater and missing feasible and proportional remediation /management approaches.
- Deficits regarding available and reliable data and information about the presence in soil and groundwater.
- Low concentrations in the environmental media are causing challenges to provide analytical evidence.

What is actually remarkable ?

Chemical industry is much quicker to develop new substances as we are able to find proper concepts to remove problematic substances from the environment.

Improvement and strict implementation of REACH procedures

A “future” approach, how to deal with emerging pollutants to reduce the delay between first indications and appropriate actions.

Quicker transfer of applied research findings with suitable translation for practical implementation.

Reliable legal framework (Threshold values,
proportional remediation targets, approved management concepts)

Development and implementation of (innovative) remediation measures with (based on sufficient experience)

REMEDIATION TECHNOLOGIES

Technology	Status	Media		In-Situ	Ex-Situ	Treatment Type	Includes all PFAS	Cost	Efficiency		Comments
		Soil	Groundwater								
P&T, with GAC	●		●	?	●	A	●	●	●		Secondary treatment/disposal required for adsorptive media, not as efficient for PFOA and other PFAS
P&T, with synthetic resin (ion exchange)	●		●	?	●	A	●	?	●		Media can be regenerated on-site, still in research stage
Advanced Chemical Oxidation	●	?	●	●		D	●	●	●	●	Conditions to destroy PFAS are difficult to apply at full scale for in-situ remediation. Competition from other substances. Transformation to other PFAS?
Sonochemical Decomposition	●		●		●	D	●	?	●		Competition. May be effective towards some PFAS. Still in research stage
Air Separation	●		●	?	●	S	●	●	●	●	Secondary treatment/disposal required for separated concentrate
Filtration, Reverse Osmosis	●		●		●	S	●	?	●		Pretreatment required to increase filtration efficiency, still experimental
Nanofiltration	●		●		●	S	●	?	●		Pretreatment required to increase filtration efficiency, limited in total processing capacity
Sorption	?	●	●	●	●	A	?	?	?		Emerging. Efficiency in the long run?
Excavation and Incineration	●	●			●	D	●	●	●		High temperature incinerators required to completely destroy PFOS and PFOA
Stabilization	●	●	●	?	●	A	●	●	?		
A=Adsorption											
D=Destructive											
S=Separation											

Adjusted from Travers and Nielsen, 2016