

# Soil policy on PFAS in Flanders



Flanders  
State of  
the Art

**Griet Van Gestel – Johan Ceenaeme**  
**Soil Management Department**

**Life Phoenix webinar ‘Impact of PFAS on  
agricultural soil and plants’ – 10 March 2021**

WE MAKE  
TOMORROW  
BEAUTIFUL  
**OVAM**

# How to deal with the **legacy** of PFAS in the soil-water system?

## Content

Introduction – setting the scene

*Prelude* – How did we get started?

1. **Guidelines** – When to measure PFAS?
2. **Threshold values** PFOS/PFOA: soil remediation standards/  
background values/criteria for use of excavated soil
3. How to deal with **different PFAS**?

Outlook towards the future & research needs

*Coda* – international collaboration – EmConSoil network

# Introduction – setting the scene

## Flemish Soil Decree & Implementation order VLAREBO

### ► Obligation to soil investigation on land with risk activities, periodically & upon transfer

- When contaminated, remediation is needed
- By **operator** or **owner**, according the '*polluter pays*' - principle
- Guidelines - all **suspected substances** need be analyzed

### ► Regulation on excavated soil



- Guidelines – when, how to sample, which substances to analyze, ... for a technical report

⇒ focus on **well-known contaminants**:  
heavy metals, mineral oil, BTEX, cVOC and PAH

← **PFAS**

Questions:  
analysis?  
which method?  
threshold values?

# Prelude – How did we get started?

## ⇒ Exploratory measuring campaign on PFAS (2016)

Inventory of risk activities

24 sites were selected using OVAM-database and other information

fire fighting training grounds / fire incidents

textile industry / paper industry / paint industry / galvanic industry

water treatment plant

waste dump

Soil and groundwater were analyzed for 21 PFASs

### Conclusions:

conc in soil: 0 – 9000 µg/kg dw  $\sum$  PFAS

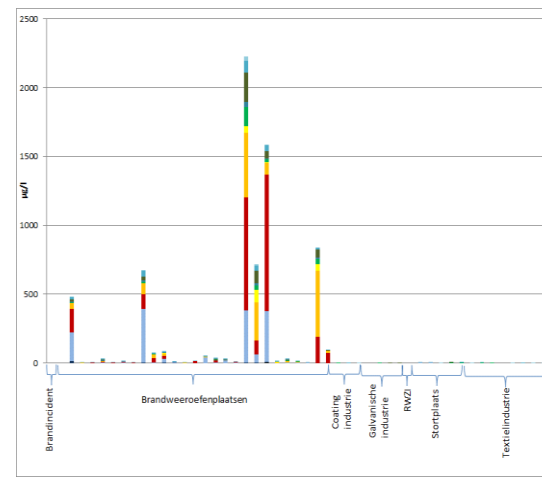
conc in groundwater: 0 – 2000 µg/L  $\sum$  PFAS

Highest conc on **fire fighting training grounds**

→ PFOS, PFOA, PFHxA, PFHxS, PFNA, PFDA, 6:2 FTS



[www:](#) 'PFAS in soil and groundwater around risk activities in Flanders'





# 1 Guidelines – When to measure PFAS?



# Guidelines on PFAS

## ► When is PFAS a 'suspected' substance?

- Soil investigation
- Technical report

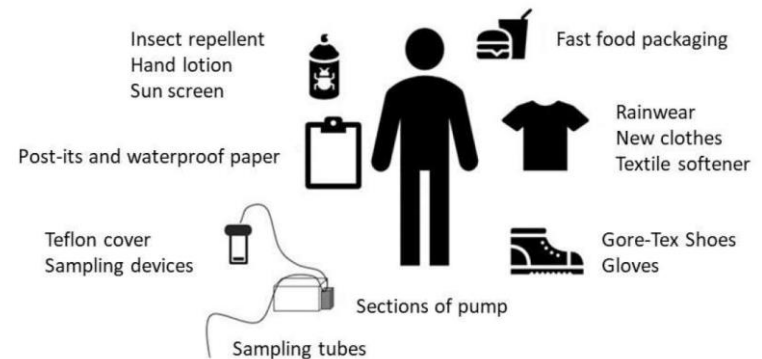
## ► List of risk activities - high/limited risk for PFAS contamination of soil & groundwater

### High risk:

- PFAS production sites
- PFAS processing industry (galvanic industry)
- Sites where fire fighting foam was used (fire incidents & fire fighting training grounds)

- include PFAS when soil investigation is needed
- Include PFAS in technical report on excavated soil

## ► Checklist for sampling



## ► Analytical method: CMA/3/D

→ LC – MS/MS

## ► Starting date: 1/9/2020

## 2 Setting soil standards for PFOS and PFOA

“

Without standards,  
there can be no  
improvement.

Taiichi Ohno



”

# Overview of soil thresholds used in Flanders



soil

background  
values

target  
values

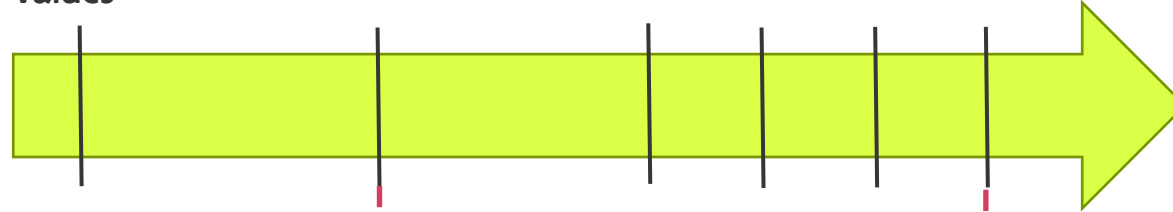
nature  
agriculture

residence

recreation

industry

soil remediation  
standards



conc in soil

values for  
free use

values for  
construction purposes



+ sediments  
conc in soil



excavated soil

Criteria for soil improving  
agents and fertilizers



conc in fertilizer



added to soil



# Development of soil criteria for PFAS

General rule: for parameters without standards in regulations:

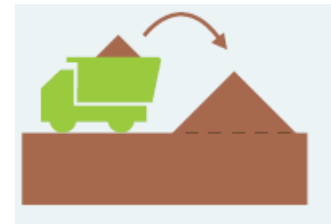
→ **criteria** are proposed by accredited soil experts

Criteria for excavated soil: most urgent

**provisional criteria** : for free use of excavated soil  
for construction purposes

→ responsibility of soil expert

more details in guidelines



Soil remediation criteria are derived by VITO, for **PFOS** & **PFOA**

human tox: using transfer & exposure model [S-Risk](#)

ecotox : same values used as RIVM (NL)

[Proposal\\_SRV\\_PFOS\\_PFOA.pdf](#)

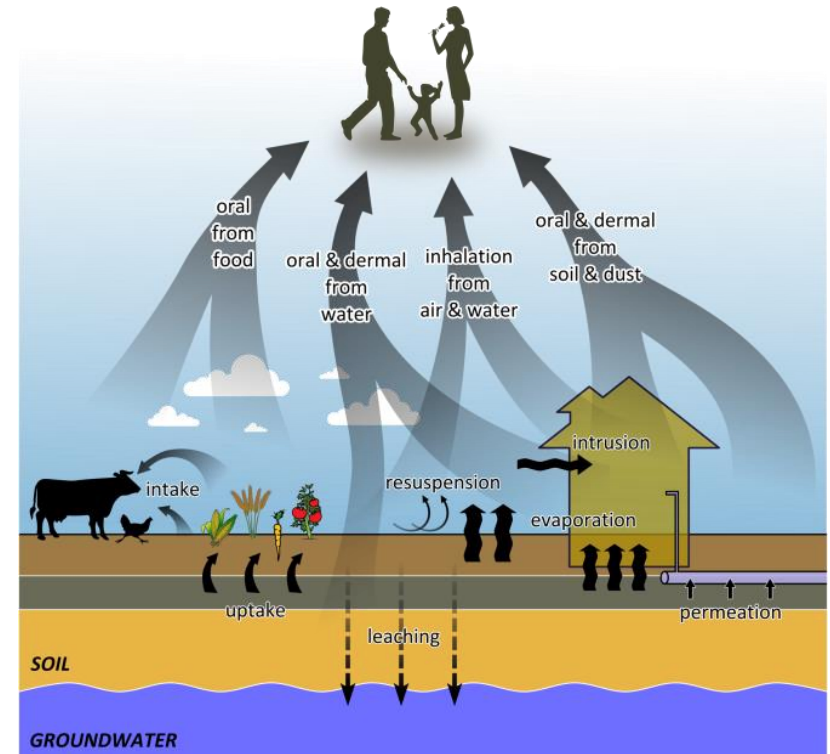


# Transfer & exposure model S-Risk



Uptake of PFOS & PFOA by plants: taken into account for 'agriculture' and 'residence'

→ BCF from literature



# Soil remediation criteria for PFOS

PFOS	I/II nature / agriculture	III residence	IV recreation	V industry
Human tox (µg/kg dm)	3,1	205	1.949	1.949
Ecotox (µg/kg dm)	3	18	110	9.100
Soil remediation value (µg/kg dm)	--	18	110	1.949
Soil remediation value for groundwater	120 ng/L			

- ▶ Is there a background concentration for PFAS in soil? (e.g. Vedagiri et al. 2018)
- ▶ Based on TDI of 20 ng/kg bw/day (US-EPA, 2016)
- ▶ Soil remediation value groundwater ≈ EU quality standard DW (0,1 µg/L)

$$SRV_{gw} = \frac{TDI \times RF \times body\ weight}{Q}$$

# Soil remediation criteria for PFOA

PFOA	Land use type	I/II nature / agriculture	III residence	IV recreation	V industry
	Human tox (µg/kg dm)	4,3	205	643	643
	Ecotox (µg/kg dm)	7	89	1.100	50.000
	Soil remediation value (µg/kg dm)	--	89	643	643
	Soil remediation value for groundwater	120 ng/L			

- ▶ Based on TDI of 20 ng/kg bw/day (US-EPA, 2016)
- ▶ Leaching to groundwater is not taken into account (→ separately in Flemish methodology)
- ▶ **Provisional** criteria, in guidelines, not in implementation order

# Background values for PFAS in soil

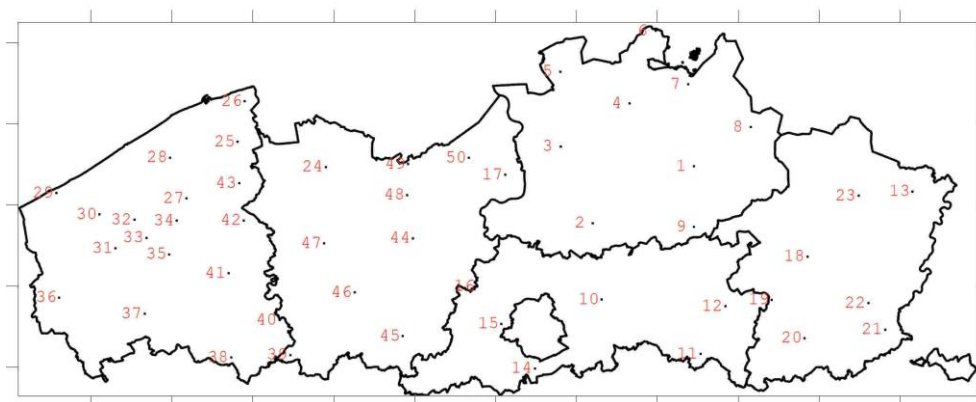


Study commissioned to VITO

50 'unsuspected' sites selected  
top layer (0-20cm)  
40 PFAS analyzed

⇒ PFOS, PFOA and PFBA  
found in almost all samples  
background values derived  
= 90-percentile

⇒ 6:2 FTS found in 27 of 50 samples



	Average ( $\mu\text{g/kg dm}$ )	Background values ( $\mu\text{g/kg dm}$ )	Quantification limit ( $\mu\text{g/kg dm}$ )
PFOS	0,78	1,50	0,2
PFOA	0,56	0,96	0,2
PFBA	0,76	1,25	0,2

[weblink to study \(Dutch\)](#)

Compared to values found in the Netherlands (P95)

PFOS = 1,4  $\mu\text{g/kg dm}$

PFOA = 1,9  $\mu\text{g/kg dm}$



# Criteria for the use of excavated soil

free use of excavated soil – criterium for the use in construction purposes

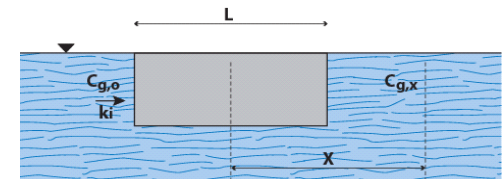
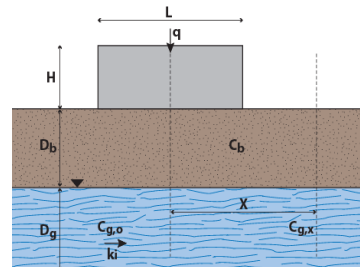
## ➤ Methodology

leaching: different scenario's

calculate LV1 / LV2 / LV3

+ boundary conditions:

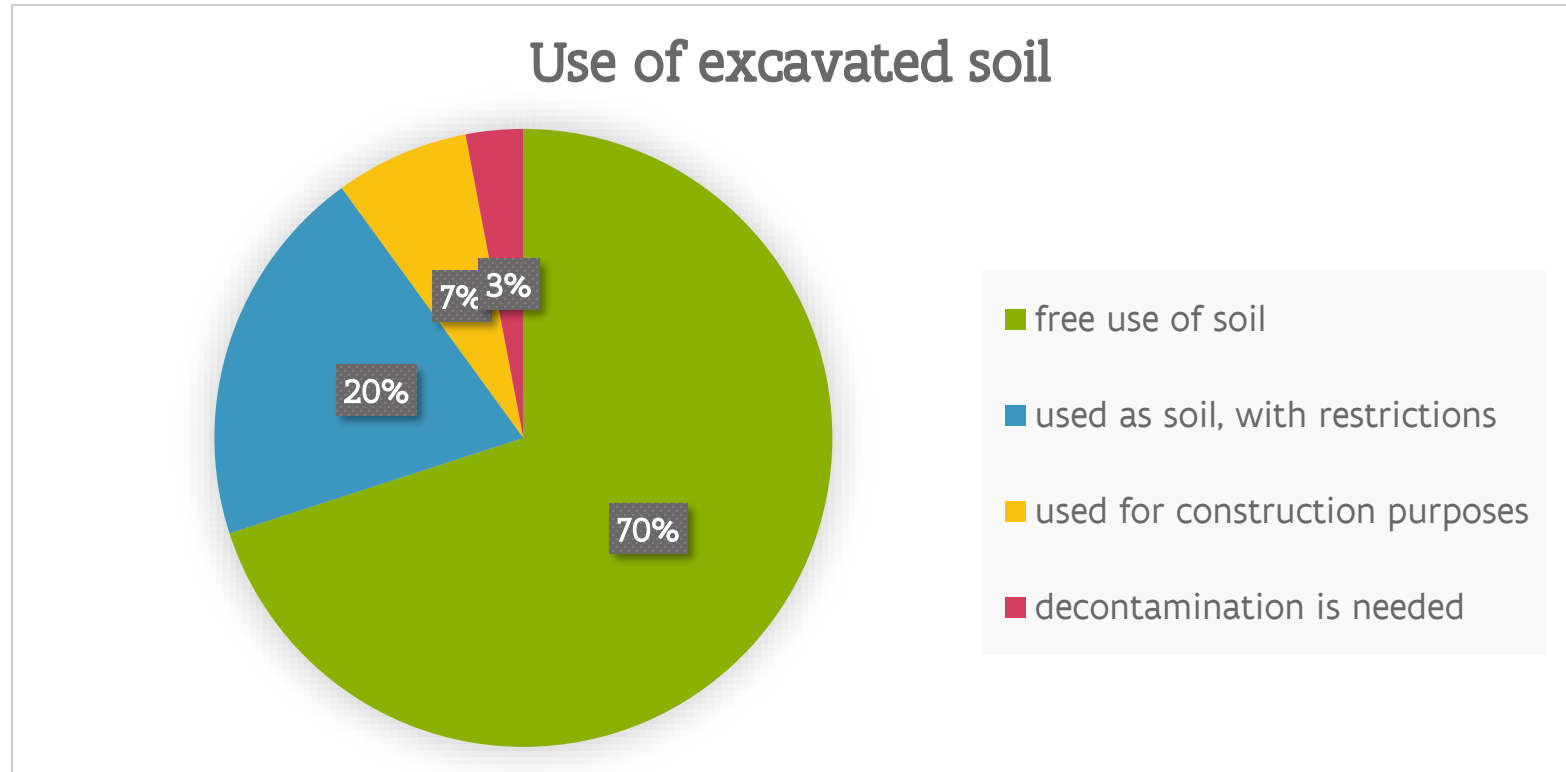
>background, <SRV



## ➤ Values

Parameter ( $\mu\text{g/kg dm}$ )	Quantification limit	LV1	LV2	LV3	Background values	Value for free use	Soil remediation value I/II	Soil remediation value III
PFOS	0,2	0,05	0,2	0,4	1,5	?	3?	18
PFOA	0,2	0,02	0,1	0,2	1,0	?	4,3?	89

# How excavated soil is used in Flanders?



**3**

**How to deal  
with different  
PFAS?**

# How to deal with different PFAS?

- ▶ Soil criteria for PFOS & PFOA
- ▶ Standardized analytical methods: data on 30 – 40 PFASs

⇒ **a pragmatic approach is needed**

Possible ways:

- ▶ Relative potency factors (RIVM, 2018)  
exposure to mixture of PFAS expressed as comparable amount of PFOA  
**in practical guidelines:** PFAS/PFOA or PFAS/PFOS, with value for PFAS  
applying to every substance without adding up
- ▶  $\sum$  PFCA and  $\sum$  PFSA – proposal by VITO  
based on substance properties  
in practice ?

# **Outlook towards the future & Research needs**





# Outlook towards the future / Research needs

## Research needs:

- ▶ Leaching?
- ▶ Uptake in food products?
- ▶ Other PFAS?
- ▶ Combined effects?
- ▶ Relative importance of exposure routes?

Research project started in 2020

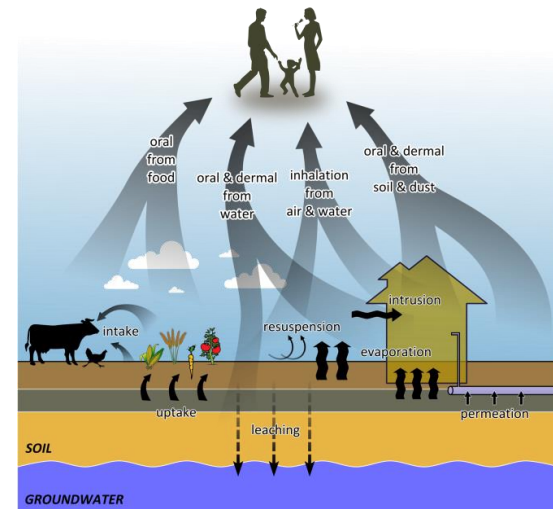
in collaboration with the Department for the Environment  
(Environment & Health)

How are people **exposed** to PFAS? Main exposure routes?  
e.g. (local) food, water, house dust, soil, ...

combined with **biomonitoring** data

part of [Flemish PFAS action plan](#)

- ▶ Inventory of fire fighting training grounds



*Coda*

## International collaboration – network **EmConSoil**

Focus: on **legacy** of emerging soil contaminants

Stakeholders from industry, research, policy, consultancy & civil society

### Aims of the network:

- exchange and dissemination of knowledge, data, technical & juridical experience
- developing strategies and policies through co-creation
- raising awareness among stakeholders
- enabling international and intersectoral collaboration

Please, join the network

Go to:

[www.ovamenglish.be/emconsoil](http://www.ovamenglish.be/emconsoil)



WE MAKE  
TOMORROW  
BEAUTIFUL  
**OVAM**

Save the date  
May 6 & 7th, 2021

**ENSOr**

DEADLINE  
ABSTRACTS  
31 January  
2021

3rd International workshop on Emerging policy  
challenges on New SOil contaminants (ENSOr)

Online event  
[www.2mpact.be/ensor2021/](http://www.2mpact.be/ensor2021/)

# Thank you for your attention !

Contacts:

[griet.van.gestel@ovam.be](mailto:griet.van.gestel@ovam.be)

[johan.ceenaeme@ovam.be](mailto:johan.ceenaeme@ovam.be)

[emconsoil@ovam.be](mailto:emconsoil@ovam.be)

