Experiences after 1 year of PFAS crisis in Flanders

Flanders
State of the Art

Griet Van Gestel - Johan Ceenaeme
Soil Management Department, OVAM
Mechelen, Belgium

ENSOr4 – 20-21 October 2022
'PFAS, more than a technical matter'

WE MAKE TOMORROW BEAUTIFUL

OVAM

How helpfull is media attention for solving problems … ?

→ **PFAS became a priority for other environmental administrations, for local authorities, for research institutes, …**

→ **This resulted in a more intensive cooperation**

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

Content

Introduction

1. Inventory of PFAS contaminated sites in Flanders
2. First results & insights – fire services related sites
3. Guidelines for soil investigations
4. Trigger values for PFAS in soil and groundwater
5. What's next? Outlook towards the future

INTRODUCTION

Before the crisis …

⇒ Exploratory measuring campaign on PFAS (2016 - 1018)

Inventory of risk activities

24 sites were selected; soil and groundwater were analyzed for **21 PFASs**

Conclusions:

→ Especially on fire fighting training grounds soil & groundwater are contaminated with PFAS

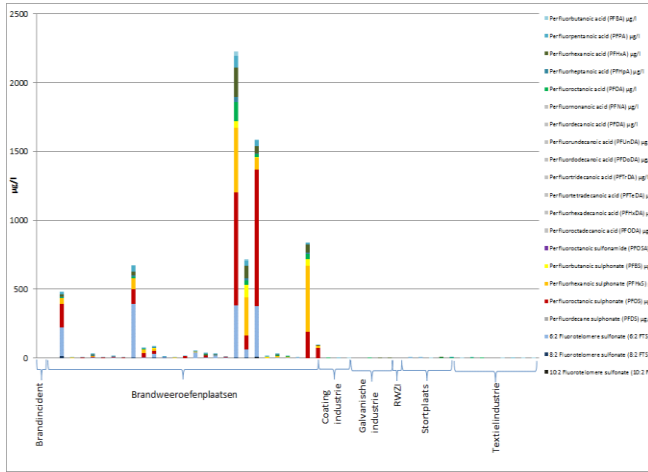
→ PFAS must be included as a suspect substance in soil investigations

These actions were started:

- ✓ preventive actions in collaboration with fire services organizations
- ✓ development of trigger values for PFAS in soil & groundwater
- ✓ identification and inventory of PFAS contaminated sites
- ✓ development of guidelines for soil investigation

www: '*PFAS in soil and groundwater around risk activities in Flanders*'

Accelerated by the crisis !



Flanders
State of the Art

1 Inventory of PFAS contaminated sites

Inventory of PFAS contaminated sites

- In Flanders: inventory of land with risk activities ('GI')

- Use of fire extinguishing foam
  - Not included in 'GI'
  - **Call to local authorities (July 2021, first part) for inventory of**
    - Fire service training site
    - Fire service facilities (industry)
    - Fire extinguishing calamities
    - Military training areas and airports
    - Civil airports

  → Result: 826 locations (fire service training sites and calamities)

Inventory of PFAS contaminated sites

- PFAS processing industry

  Call (July 2021, second part) to local authorities for inventory of risk activities as determined in the study of 2018

  - Textile industry
  - Paper industry
  - Galvanic industry
  - …

  → Result: more than **4.000** locations (screening and prioritisation is still going on - two consultants)

Investigation of fire services related sites

- In July 2021 OVAM started with the investigations
- By soil experts commissioned by OVAM (+/- 40 sites/month)
- 'Preliminary' soil investigations (according to a specific protocol):
  - → Focused on PFAS
  - → Limited sampling in source area
  - → Sampling at borders of source area (to estimate risks surroundings)
  - → Decision whether further soil investigations are needed
  - → Determine priority class (1-5)
  - → Determine 'no regret measures' by the Agency of Care and Health (AZG)

What after the preliminary soil investigation?

- Meeting OVAM/AZG

- Letter with offical request from OVAM to operator or owner ('polluter pays' principle)

  → descriptive soil investigation:

  - Investigation of the whole contamination
  - Determine the risks of the contamination

- Communication by AZG to the local authorities about the no regret measures

No regret measures

Agency for Health and Care advice to residents in the neighbourhood (100 m) of PFAS risk sites (fire fighting training sites and sites large industrial fires) to limit : No regret-maatregelen brandweeroefenterreinen en sites van een zware industriële brand | Vlaanderen.be

To avoid/limit*

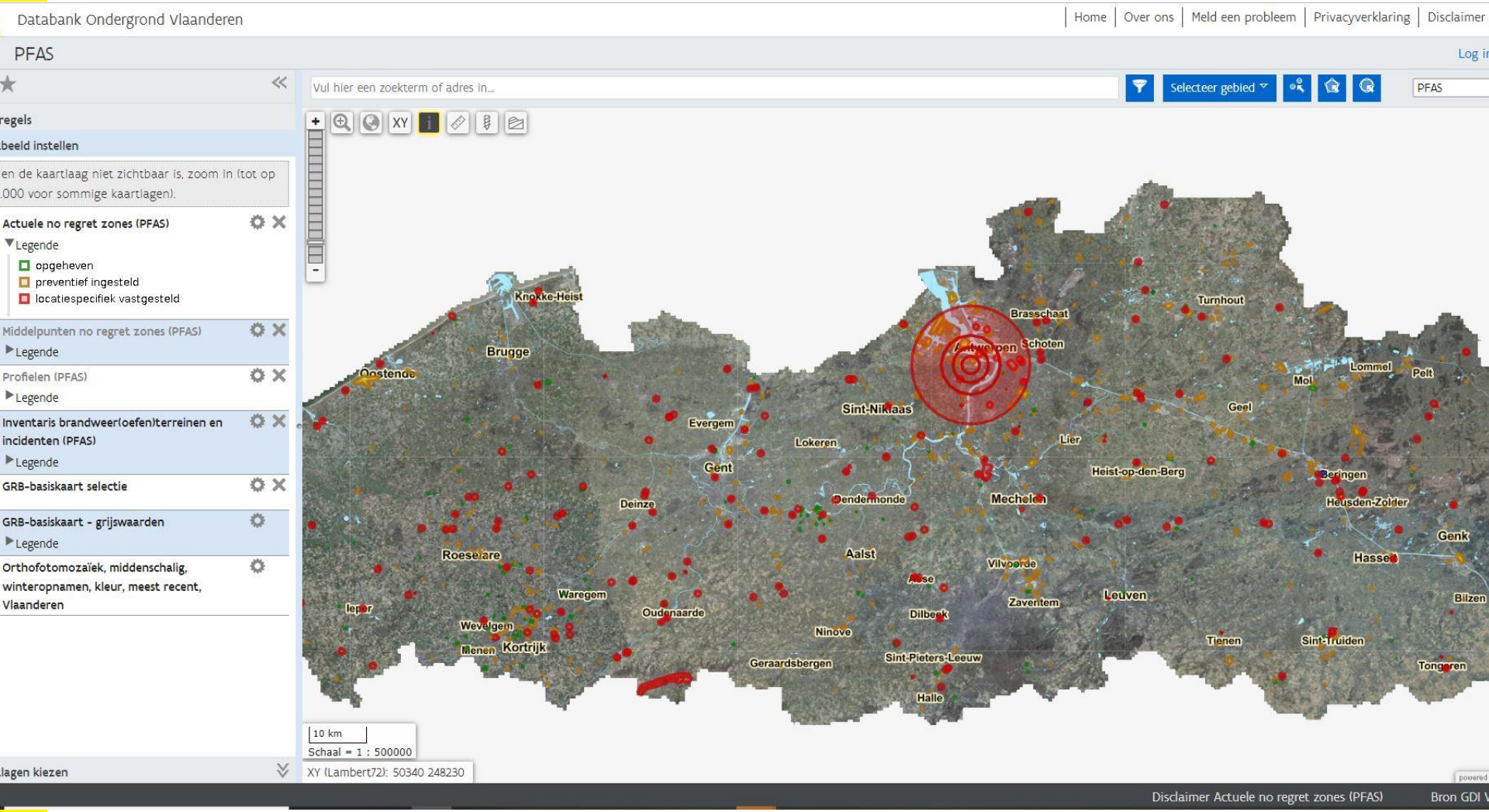
- Consumption of local food (**eggs**, vegetables)
- Use of groundwater (as drinking water, irrigation of kitchen garden and swimming pool)
- Use of compost

Apply exposure migitation measure for soil contact

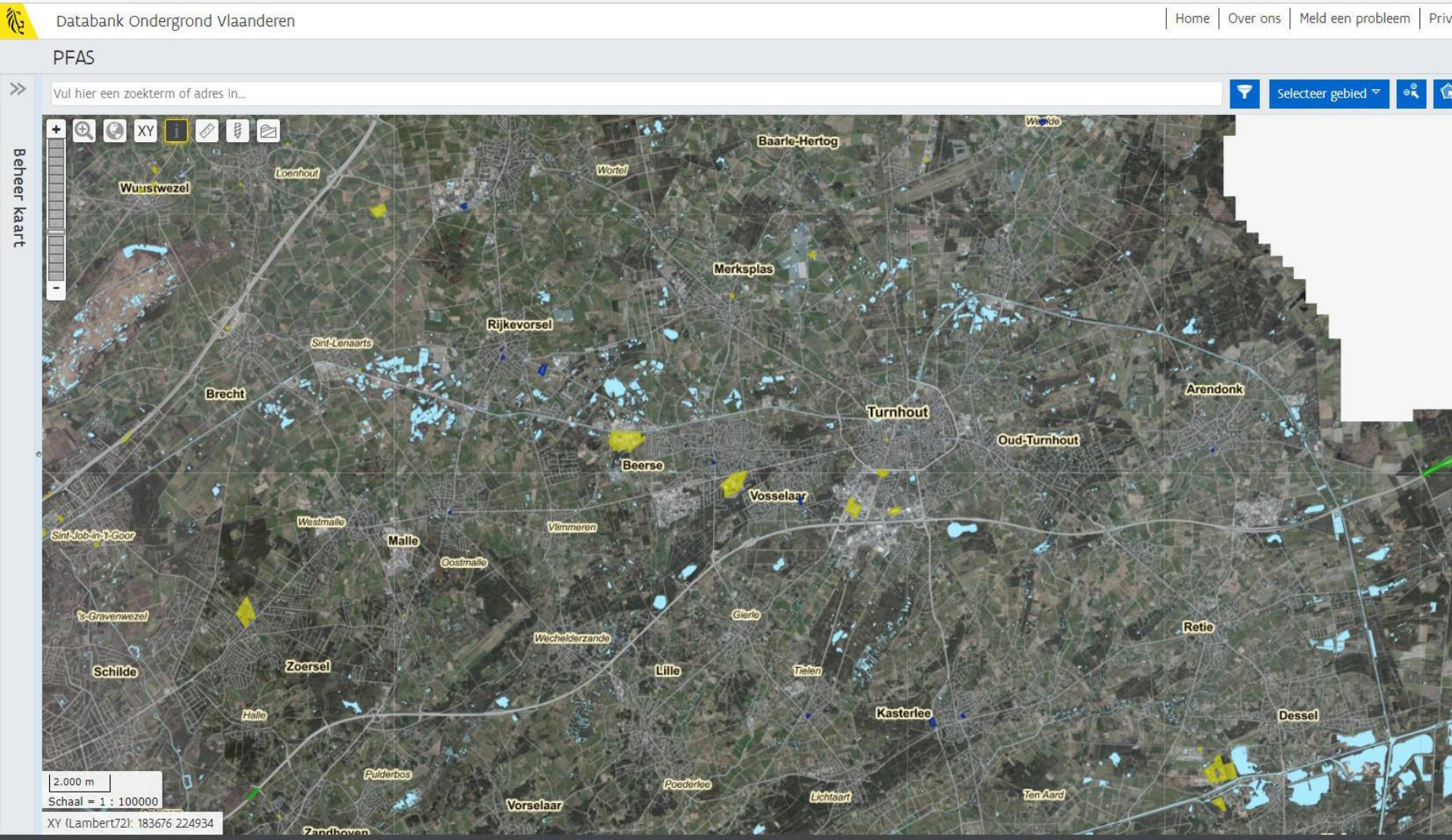
*Advices are more stringent for vulnerable populations

'no regret' advices will be re-evaluated and communicated after evaluation of on site measurements

No regret measures – in database DOV



Preliminary soil investigations on fire services related sites – in database DOV



Current state of affairs

- 826 fire fighting related sites inventoried
- on 619 sites preliminary investigations are started
- 97 sites appear to be not PFAS suspected
- 397 investigations are in completion phase
  of which 268 are finished (i.e. local communities informed)
- For 189 out of 268 finished preliminary investigations there is a need for further action: a descriptive soil investigation and possibly remediation

2
First results & insights – fire services related sites

Evaluation of results of the first preliminary soil investigation reports

- 68 reports were evaluated

Amount of reports	Soil analysed (59)	Groundwater analysed (55)
Further investigation needed	23 (39%)	47 (85%)
No further investigation needed	36 (61%)	8 (15%)

- Per site: max conc in soil and in groundwater for the different PFAS listed

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

Soil investigations (fire services related sites)

- Frequently found PFAS parameters
(in more than 25% of the cases max conc > target value)

Soil	Groundwater	Soil and groundwater
8:2 FTS	PFBA	PFOS
10:2 FTS	PFHxA	PFHxS
	PFHpA	6:2 FTS
	PFOA	PFPA
	PFPeS	
	PFBS	

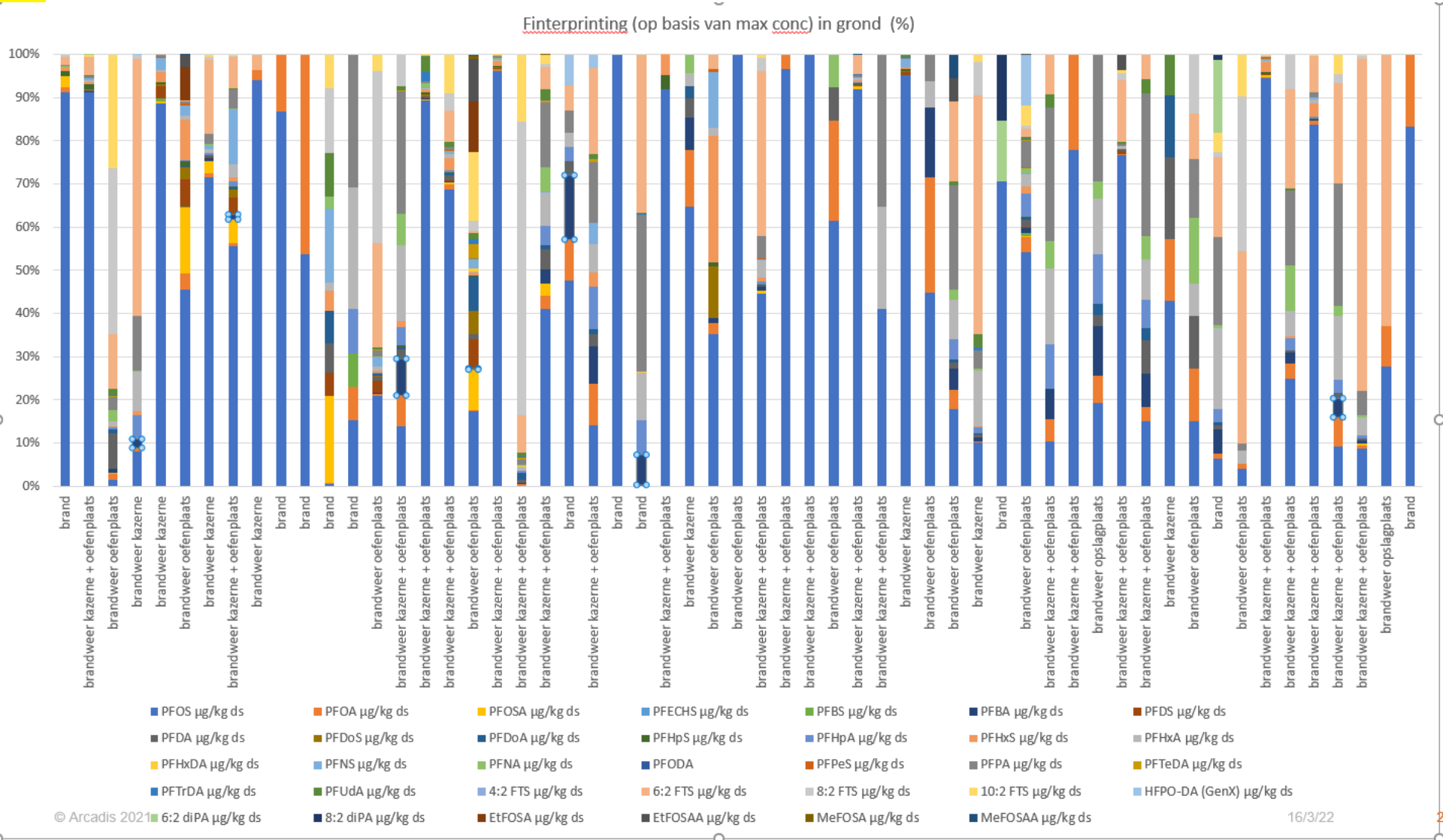
- Focus for further research on risk assessment, setting of trigger values, ...

Flanders
State of the Art

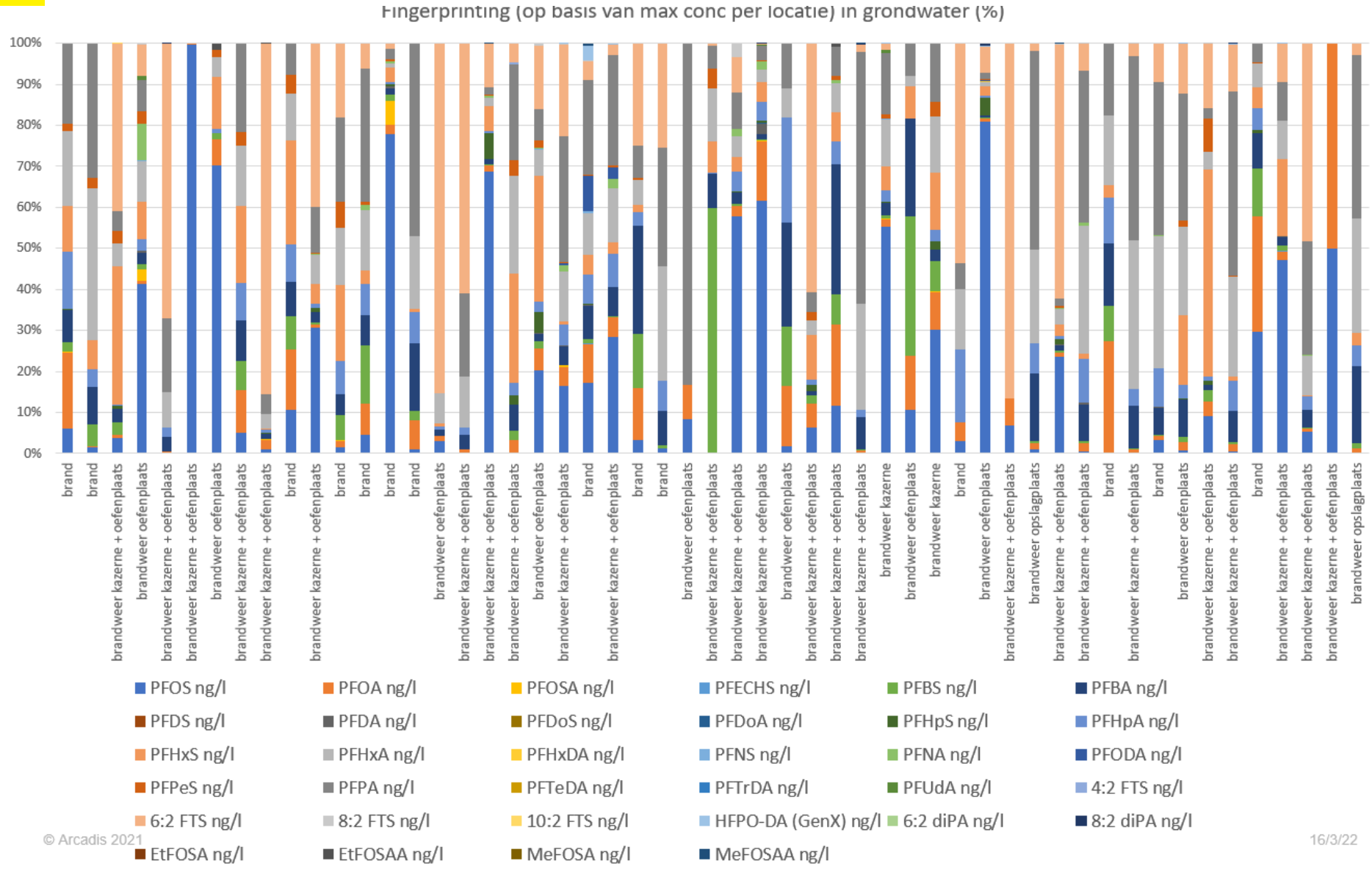
Soil investigations (fire services related sites)

- Effect of pavement?
- High variability in PFAS compounds (fingerprinting)
  → Old extinguishing foam: PFOS important
  → New extinguishing foam: 10:2 FTS, 8:2 FTS en 6:2 FTS
  → Before / after 2011 – difficult to distinguish
- Different composition in soil vs groundwater
  (complex leaching behaviour)

Flanders
State of the Art



Flanders
State of the Art



Flanders
State of the Art

3 Guidelines for soil investigations

Available guidelines on PFAS

- General guidelines
  - → When is a soil investigation needed? When is PFAS a 'suspected' substance?
  - → Specific recommendations on PFAS - analytical methods
  - → Excavated soils

- Guidelines for preliminary soil investigation

- Code of good practice – additional guidelines for descriptive soil investigation

General guidelines on PFAS

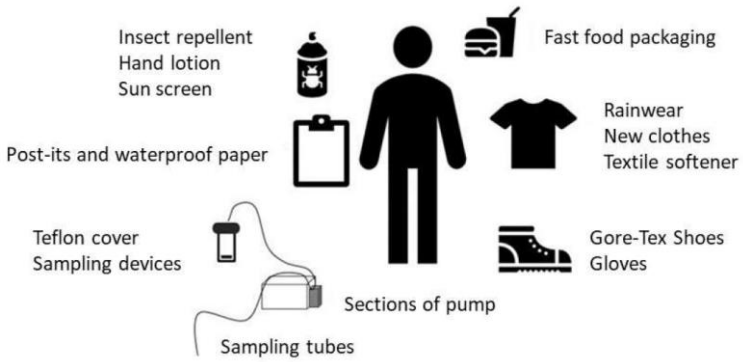
- **When is PFAS a 'suspected' substance?**
  - → Soil investigation
  - → Technical report

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

  <u>High risk:</u>
  - 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**

Flanders
State of the Art

Guidelines for descriptive soil investigations – Code of good practice – some highlights

- A conservative & pragmatic methodology is followed for risk assessment:

→ 3 groups: PFCAs / PFSAs / other PFAS

Sum PFCAs → PFOA
Sum PFSAs → PFOS
Other: highest value → PFOS

PFCA's (20)		PFSA's (14)		Andere PFAS (2)	
PFBA	375-22-4	PFBS	375-73-5	HFPODA - GenX	13252-13-6
PFPeA	2706-90-3	PFPeS	2706-91-4	ADONA	919005-14-4
PFHxA	307-24-2	PFHxS	355-46-4		
PFHpA	375-85-9	PFHpS	375-92-8		
PFOA	335-67-1	PFOS	1763-23-1		
PFNA	375-95-1	PFNS	68259-12-1		
PFDA	335-76-2	PFDS	335-77-3		
PFUnDA	2058-94-8	PFECHS	646-83-3		
PFDoA	307-55-1	*PFDoS*	79780-39-5		
PFTrDA	72629-94-8	PFOSA	754-91-6		
PFTeDA	376-06-7	MePFOSA	31506-32-8		
PFHxDA	67905-19-5	EtPFOSA	4151-50-2		
PFODA	16517-11-6	MePFOSAA	2355-31-9		
4:2 FTS	757124-72-4	EtPFOSAA	2991-50-6		
6:2 FTS	27619-97-2				
8:2 FTS	39108-34-4				
10:2 FTS	120226-60-0				
6:2 diPAP	57677-95-9				
6:2/8:2 diPAP	943913-15-3				
8:2 diPAP	678-41-1				

Tabel 1: Pragmatische indeling van de PFAS-parameters

Flanders
State of the Art

Guidelines for descriptive soil investigations – Code of good practice - some highlights

- For large vegetable gardens:
  analyses of vegetables is needed

- When free range chicken are present:
  analyses of eggs is needed

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

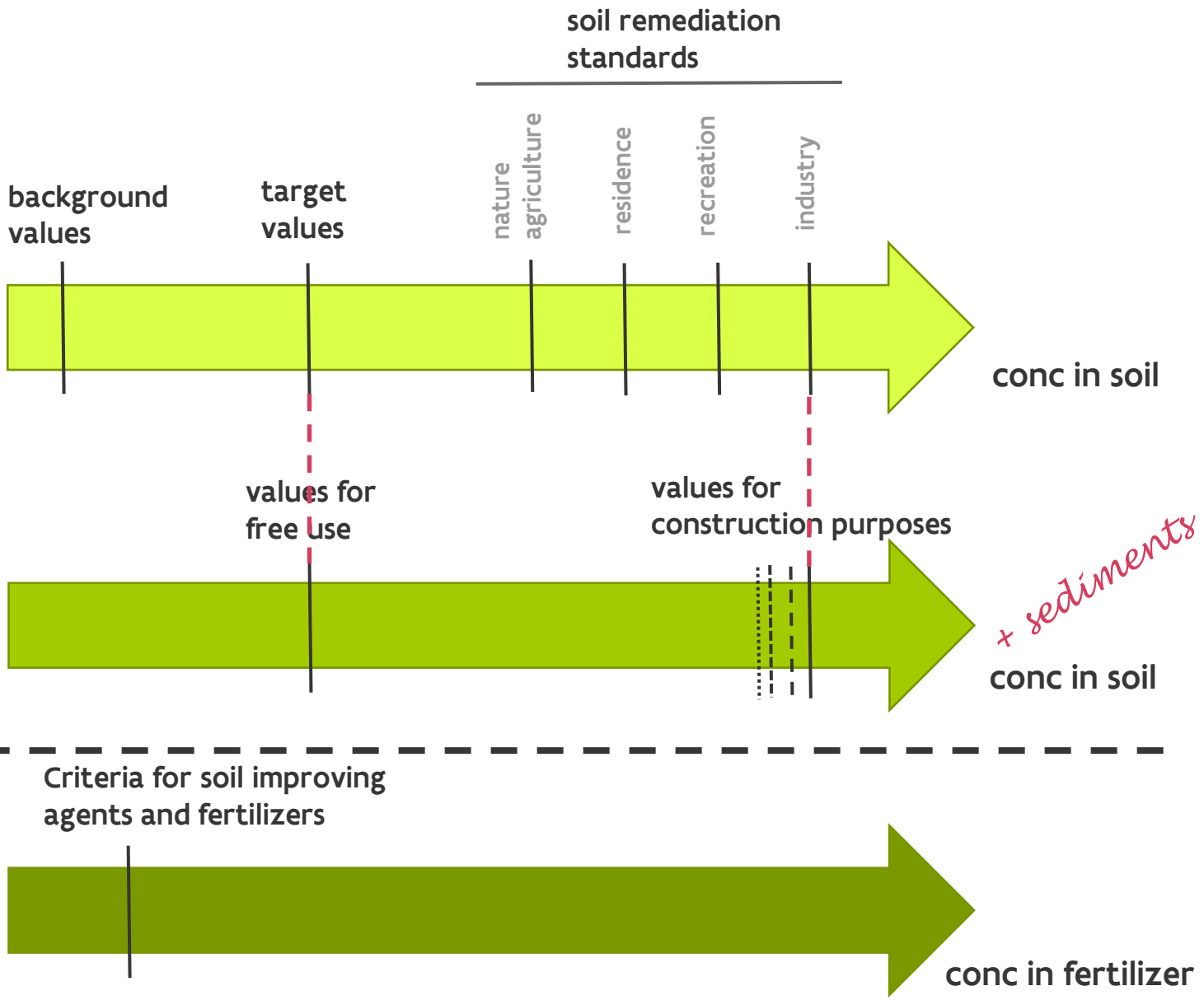
4
Trigger values for PFAS in soil and groundwater

Overview of soil thresholds used in Flanders

soil

excavated soil

added to soil



Development of soil criteria for PFAS

Only for PFOS and PFOA: necessary data available to derive soil remediation criteria

Soil remedition criteria are derived by VITO, for PFOS & PFOA

human tox: using transfer & exposure model S-Risk

ecotox : same values used as RIVM (NL)

→ lowest value is retained

S-Risk
contaminated Sites RISK Assessment

Criteria for excavated soil & soil materials: most urgent

for free use of excavated soil

for construction purposes

→ derivation based on soil remediation criteria & leaching properties

Discussion in working groups with different experts & stakeholders

resulted in a temporary action framework

→ soil criteria were adjusted; applicable since April 19, 2022

Flanders
State of the Art

Soil remediation criteria for PFOS - soil

PFOS Land use type	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)	**3,8***	**3,8** / 18**	**110**	**110**

* adjusted for background value & target value

** for residential area with vegetable garden / free range chicken coop

- Applicable since April 19, 2022
- Temporary framework

Flanders
State of the Art

Soil remediation criteria for PFOA - soil

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)	**4,3**	**4,3* / 89**	**643**	**643**

* for residential area with vegetable garden / free range chicken coop

- Applicable since April 19, 2022
- Temporary framework

Flanders
State of the Art

Soil remediation criterium - groundwater

Soil remediation criterium for groundwater is set at the European limit for drinking water:

0,1 µg/l for the sum of 20 PFAS (Drinking Water Directive) &
0,5 µg/l for the sum of all quantitative measurable PFAS

Applicable since April 19, 2022 - temporary framework

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

Background values, target values / values for free use of excavated soil

	Background values (µg/kg dm)	Target value / free use of excavated soil (µg/kg dm)
PFOS	1,5	3
PFOA	1,0	3
Sum PFAS (quantitative measurable)		8

For the **use in construction purposes** less strict criteria can be applied, on the responsibility of the soil expert.

Applicable since April 19, 2022 - temporary framework

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

Implementation in legislation

- A demand for more legal certainty from stakeholders
  → implementation in legal documents

- EFSA's recommended daily intake of PFAS translated into food criteria

  → new update of the framework by VITO:

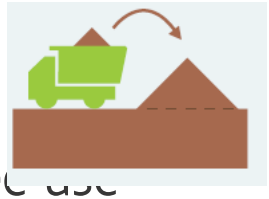
Soil remediation criteria Land use type	I/II nature / agriculture	III residence	IV recreation	V industry
PFOS (µg/kg dm)	3,8*	4,9	110	268
PFOA (µg/kg dm)	2,5*	7,9	632	303

* adjusted for background value & target value

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

Implementation in legislation



- For excavated soils / soil materials: target value / free use

	Background values (µg/kg dm)	Target value / free use of excavated soil (µg/kg dm)
PFOS	1,5	3
PFOA	1,0	2
Sum PFAS (quantitative measurable)		8

+ quality test for underwater applications & applications in drinking water protection zones

- For use in construction purposes: → decision tree & methodology based on leaching - max. conc = highest SRV

Decision process is ongoing, not yet final!

Flanders
State of the Art

WE MAKE TOMORROW BEAUTIFUL
OVAM

5
What's next?

Outlook towards the future

Ongoing actions and research activities

- Leaching of PFAS from soil to groundwater: experiments + modelling
- Diffuse presence of PFAS in groundwater in Flanders
- Development of methods for dealing with the sum of PFAS in action frameworks
- Characterisation of PFAS in soil & groundwater on sites with different risk activities, using non target methods
- Measurement of PFAS in house dust & contribution to exposure
- …
- International knowledge exchange: EmConSoil, …

Thank you for your attention

OVAM
Public Waste agency of Flanders

www.ovam.be

EmConSoil:
www.ovamenglish.be/emconsoil