

PFAS MONITORING IN AIR: METHOD DEVELOPMENT & FIRST INSIGHTS

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Tackling PFAS Pollution, 1/2/2024



Turning fundamental research into solutions

Creating value and increased competitiveness for companies and governments



No eating eggs from hens ‘in the whole of Flanders’ due to PFAS contamination

Monday, 7 February 2022
By Helen Lyons



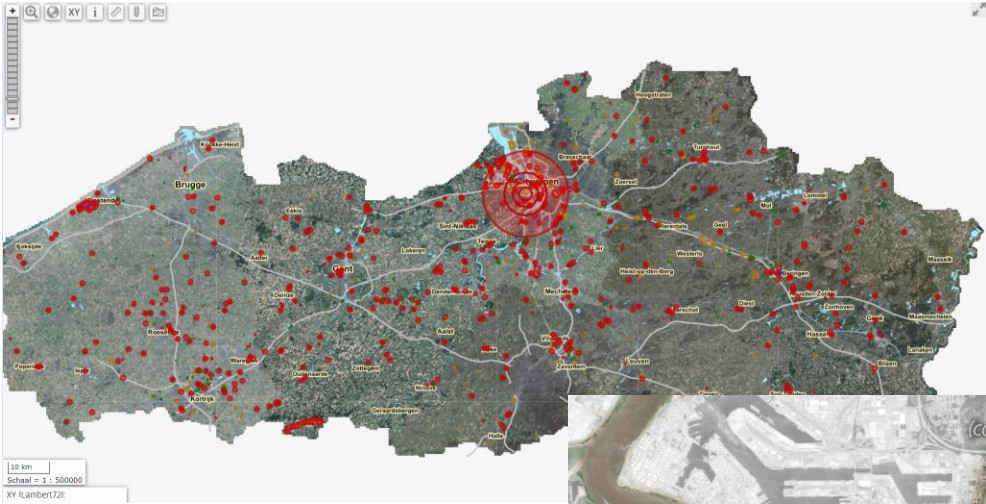
Photo by Debashis RC Biswas on Unsplash

If adhering to the strict European standards for PFAS contamination, anyone with backyard hens in the whole of Flanders should not be eating their eggs, according to a new Flemish report by Professor Karl Vrancken, the PFAS commissioner of the Flemish government.

EPA and Government of Flanders, Belgium Pledge to Share Enforcement and Compliance Assurance Information on PFAS and other Fluorocarbon Chemicals

August 24, 2022
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EPA Press Office (press@epa.gov)

WASHINGTON (August 24, 2022) – This week, EPA’s Office of Enforcement and Compliance Assurance signed a Statement of Intent (SOI) with representatives from the Government of Flanders, Belgium pledging to share publicly available information on enforcement and compliance assurance issues related to PFAS and other fluorocarbon chemicals.



Flanders to launch large-scale investigation into PFAS in groundwater

Tuesday, 2 November 2021
By Lauren Walker



Agentschap Zorg en Gezondheid waarschuwt kustgangers voor PFAS: ‘Laat kinderen niet spelen in het zeeschuim’



Getty Images



PFOS-waarden in Willebroek tien keer hoger dan in woongebied rond 3M-fabriek in Zwijndrecht



Op de site van voormalige papierfabriek De Naeyer werd PFOS-vervuiling vastgesteld. Beeld David Legreve

De PFOS-waarden in een woongebied in Willebroek zijn zodanig hoog dat binnenkort een heel woongebied gesaneerd moet worden. Tuinen en opritten moeten worden afgegraven en het stof in de ongeveer 200 huizen geanalyseerd. Dat meldt VTM Nieuws. ‘We gaan dit zo snel mogelijk opkuisen’, reageert Vlaams minister Demir.

REDACTIE en JONAS MUYLAERT 24 november 2021 19:11

Around 70,000 people in Flanders can get blood tested for PFAS pollution

Tuesday, 19 April 2022
By Maïthé Chini



Credit: Eric Lalmand/ Belga

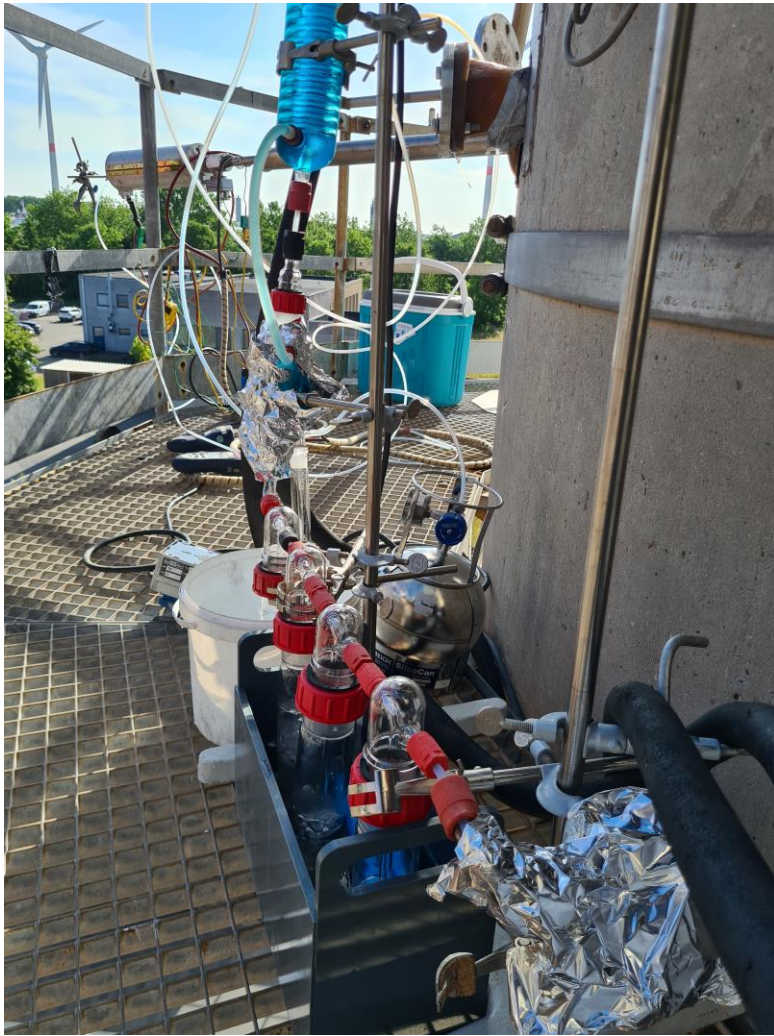
As of today (19 April), anyone living within a 5 km radius of the 3M plant in the Antwerp municipality of Zwijndrecht – which is around 60,000 to 70,000 people – can sign up to have their blood tested for the presence of PFAS.

3M PFAS Production Shut Down in Belgium By Environmental Regulators



PFAS IN AIR

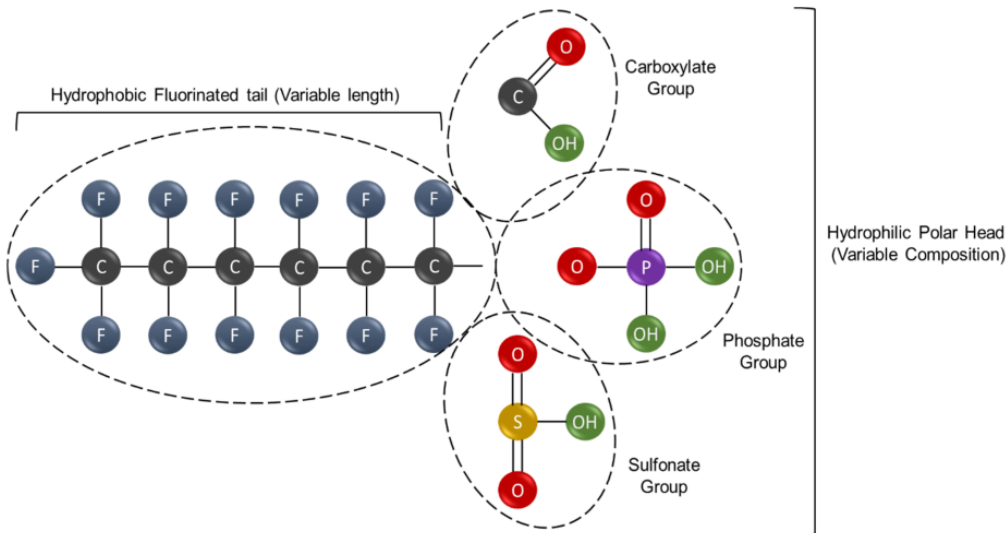
EMISSION
IMMISSION
DEPOSITION



PFAS DIVERSITY

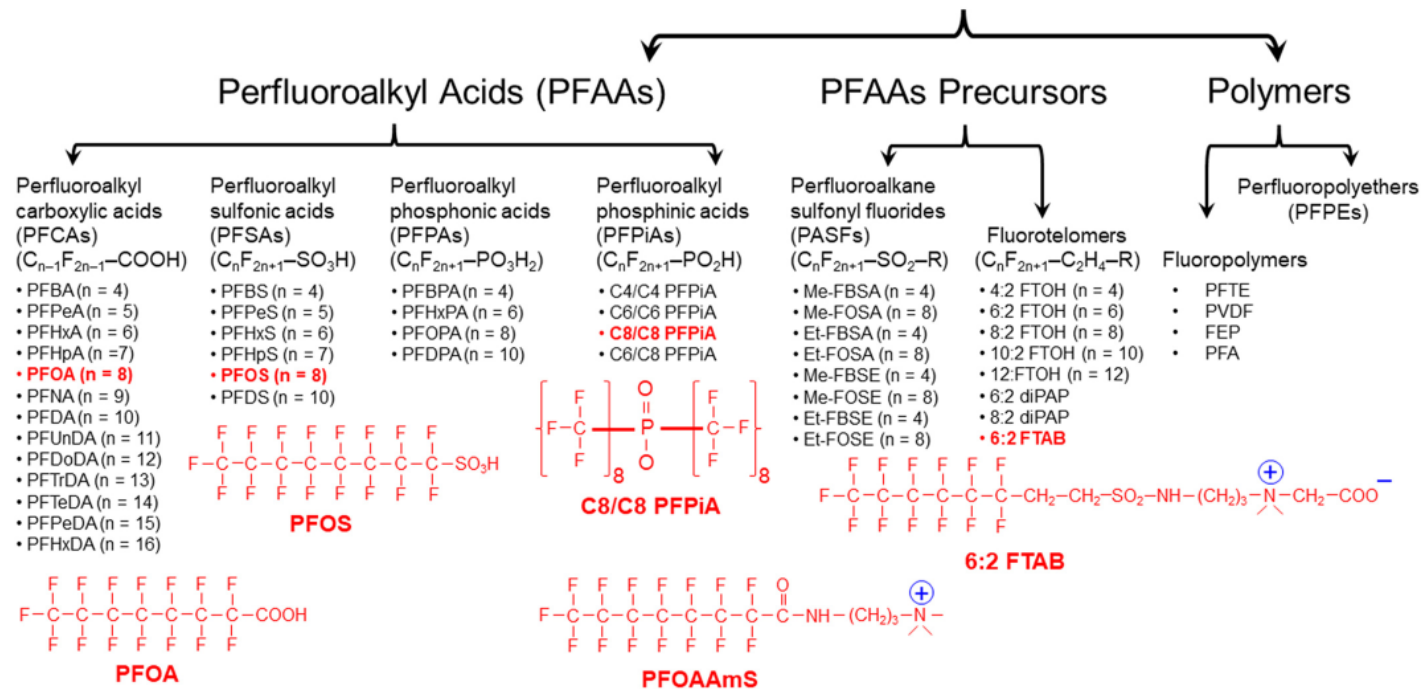
WHAT?

- Molecules with varying (i) carbon chain length, (ii) functional groups and (iii) number of fluor atoms
- PFAA + Polymers + Precursors
- Water, soil, air
- Particle-bound, semi-volatile and volatile



<https://doi.org/10.3390/toxics10020044>

Per- and Polyfluoroalkyl Substances (PFAS; $C_nF_{2n+1}-R$)

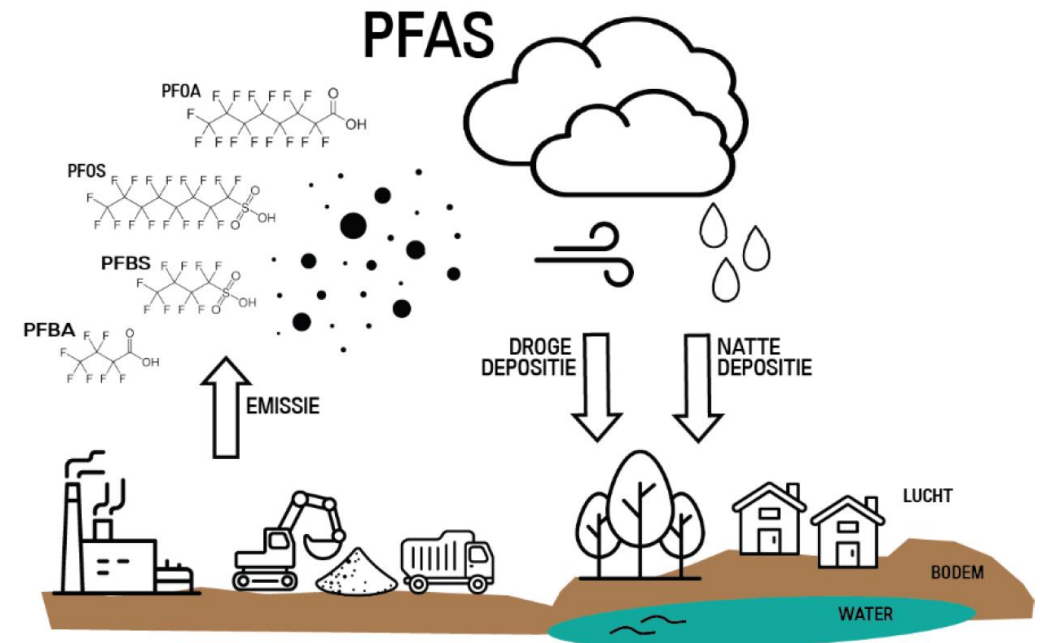


<https://doi.org/10.1029/2021RG000765>

PFAS DIVERSITY

WHAT?

- Temporary assessment framework: **inhalation equivalent** derived from the EFSA tolerable weekly intake (TWI; 4.4 ng/kg/week): 0.4 ng/m³ for chronic exposure to the sum of the 4 EFSA-PFAS compounds (PFNA+PFOA+PFHx+PFOS)
- Understanding **sources, pathways, transformation process, exposed populations and exposure levels & routes**, is critical to characterize potential risks to human health and the environment associated with PFAS



AMBIENT PFAS & DEPOSITION

VALIDATION

No standardized methods for PFAS monitoring in ambient air

- Validation of both **sampling** and **analytical methods**
 - Both for particle-bound (filter) and semi-volatile PFAS (PUF/XAD)
 - Both active (HV-AAS) as passive sampling (deposition jars, SIP-PAS) methods
- Quantitative analysis using LC-MS/MS ([WAC/IV/A/025](#))

4-weekly samples
Deposition jars

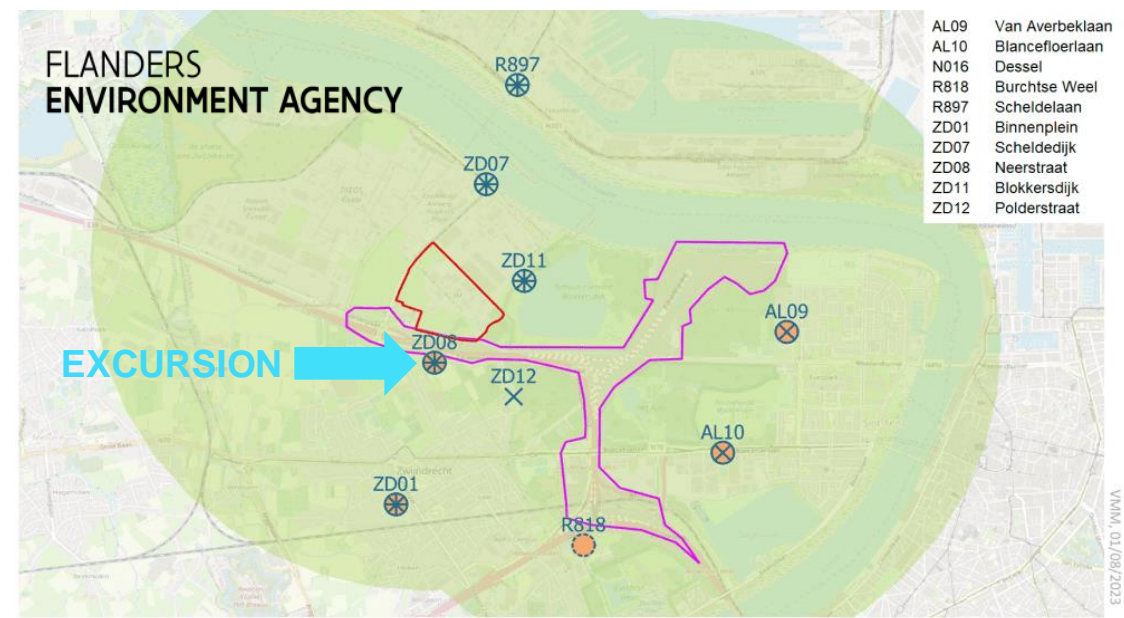
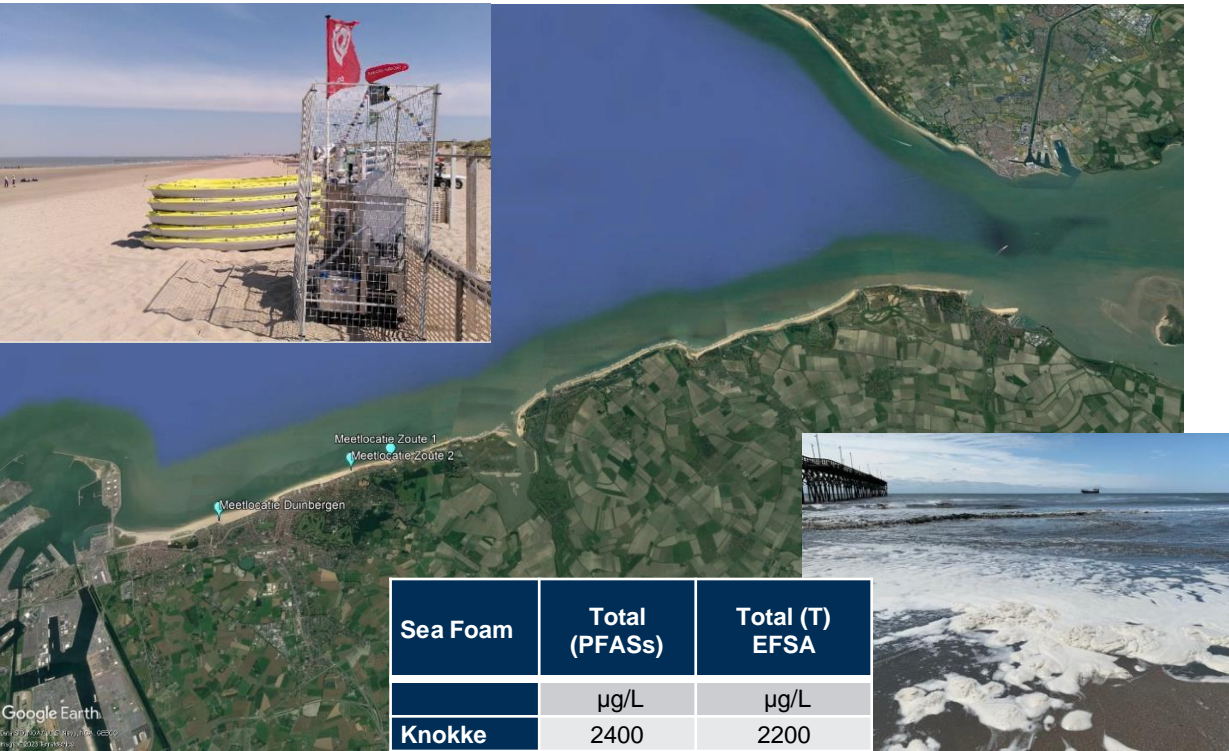


2-weekly samples
Filter/PUF

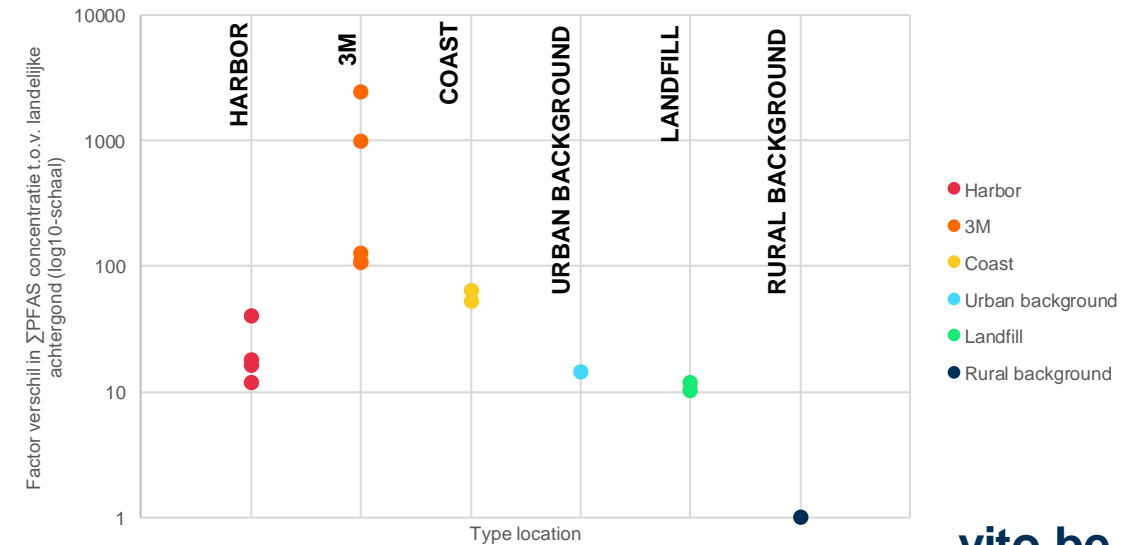
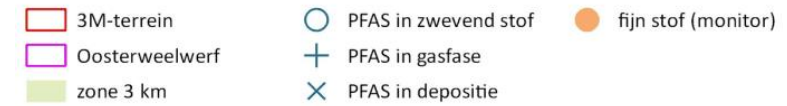
AMBIENT PFAS & DEPOSITION

FIRST INSIGHTS

“PFAS are measurable in the ambient air and deposition at all considered locations in Flanders”



Meetplaatsen lucht in de buurt van 3M, Zwijndrecht

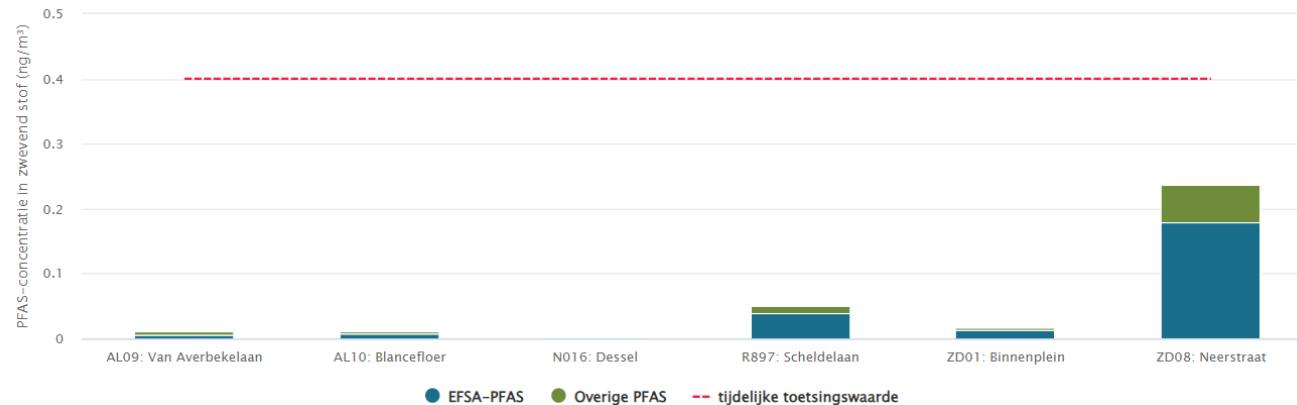
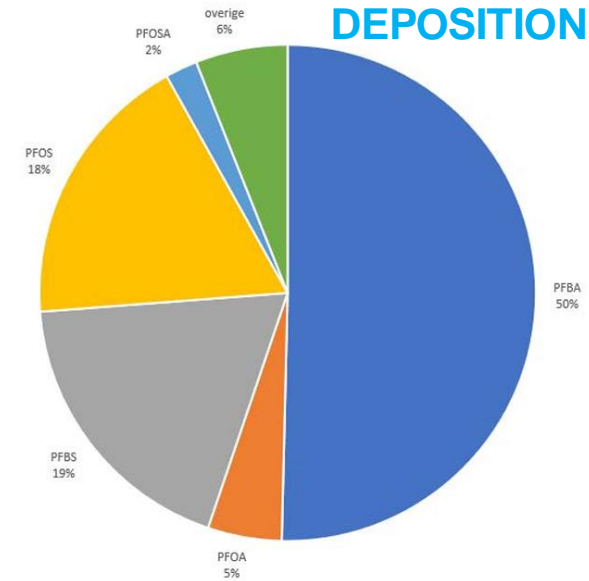
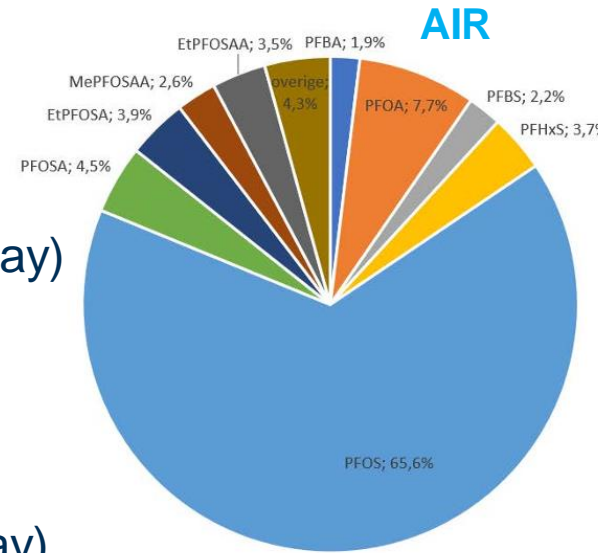


AMBIENT PFAS & DEPOSITION

FIRST INSIGHTS

- **BACKGROUND vs COAST (3 months):**
 - EFSA PFAS: 0.002 - 0.082 ng/m³ (2-61 ng/m²/day)
 - ΣPFAS: 0.009 – 0.219 ng/m³ (18-80 ng/m²/day)

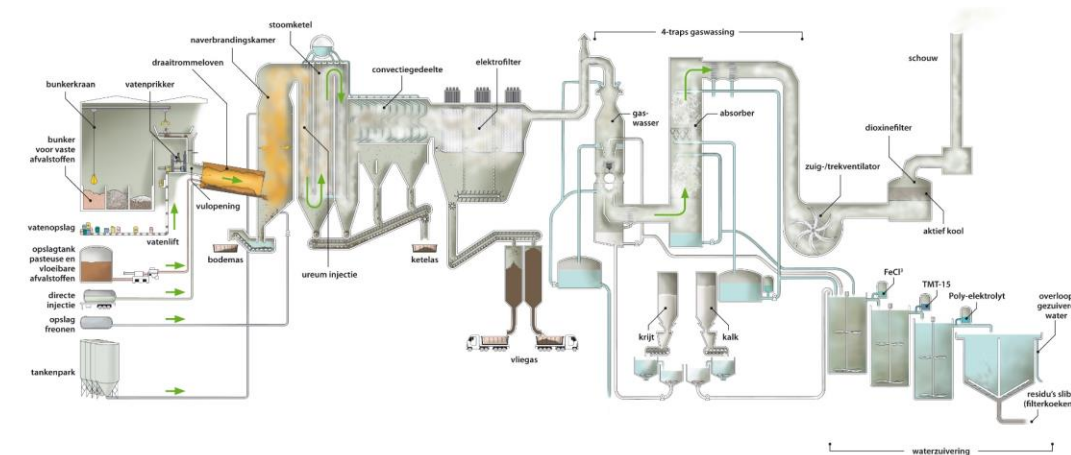
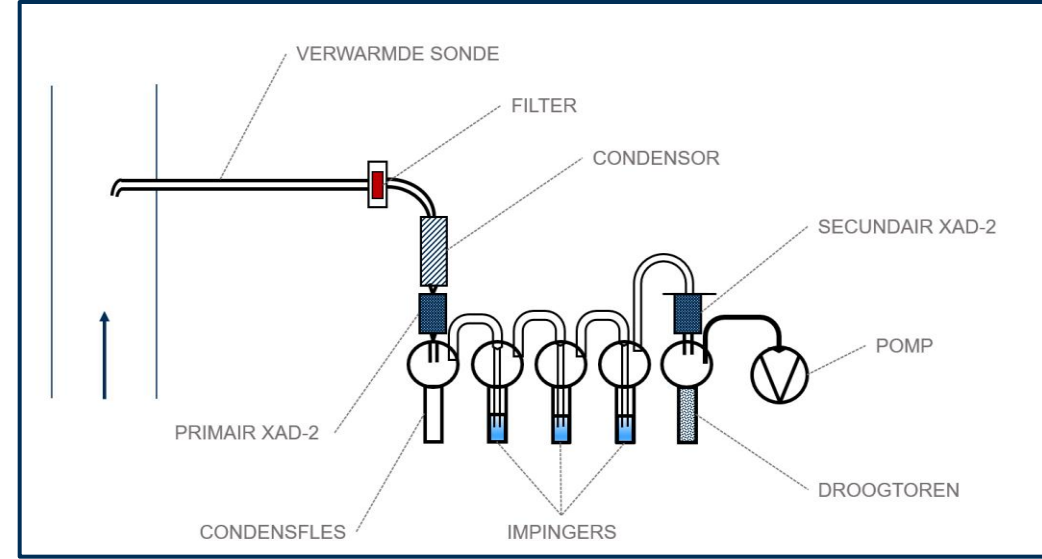
- **BACKGROUND vs HOTSPOT (18 months):**
 - EFSA PFAS: 0.001 – 0.18 ng/m³ (6-69 ng/m²/day)
 - ΣPFAS: 0.002 – 0.23 (15-264 ng/m²/day)



PFAS EMISSIONS

METHOD DEVELOPMENT

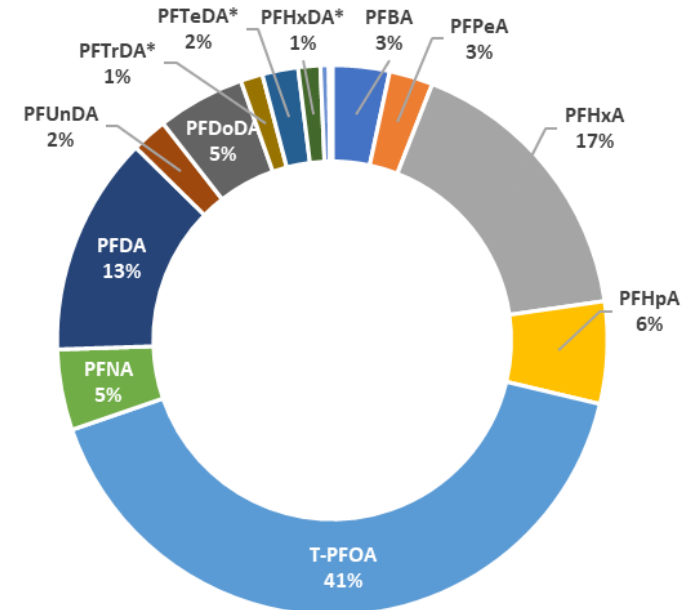
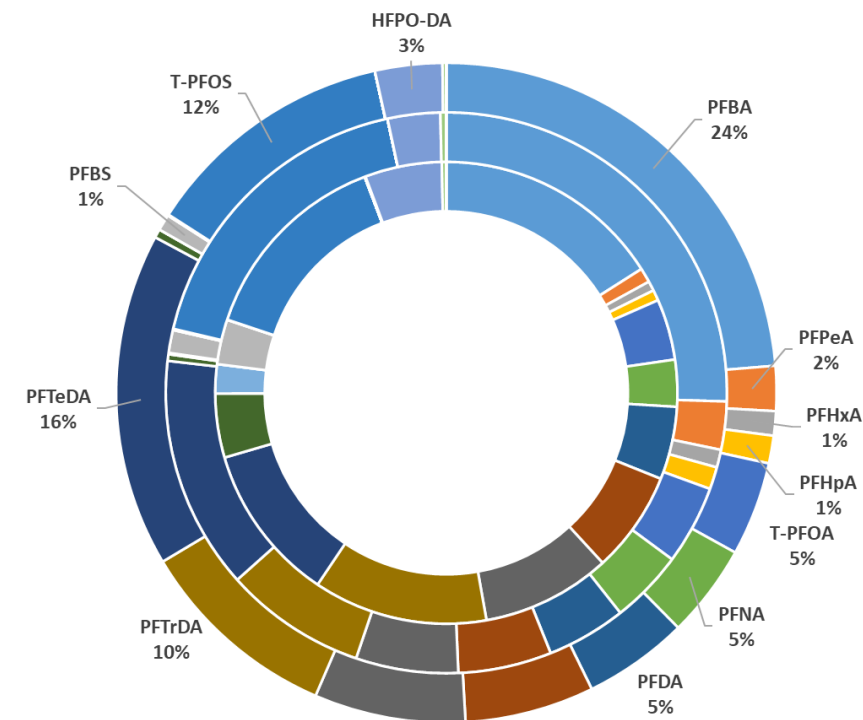
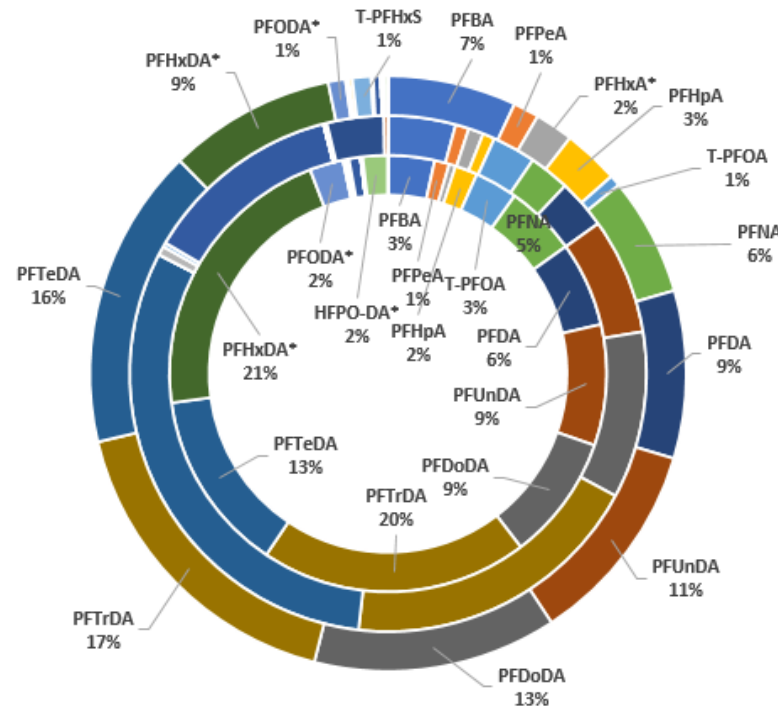
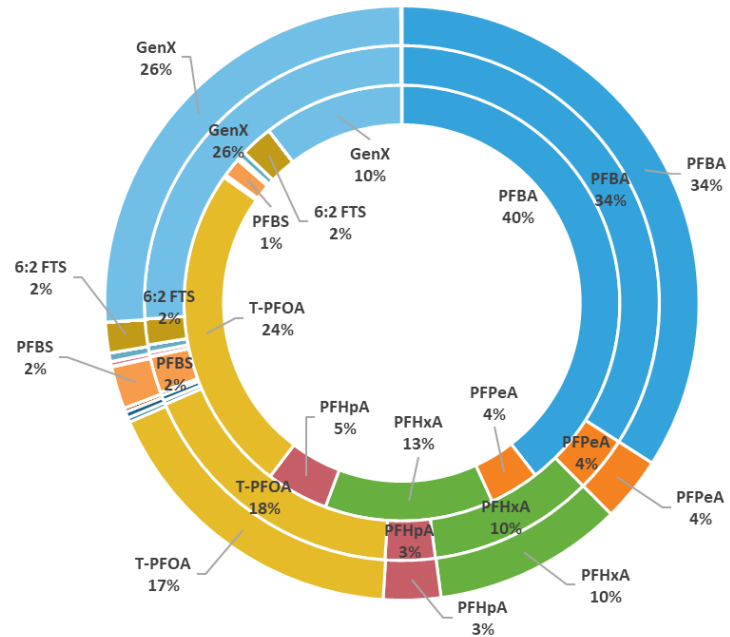
- US EPA [OTM-45](#) (2021)
- Indaver Site, Antwerp
 - ~150 000 tons of hazardous waste per year
 - High temperature (>950°C) incineration in rotary kilns
 - 15 repeated PFAS emission measurements (Dec, 2021 - June, 2023)
 - 38 → 50 individual PFAS cpds
- AIM:
 - Development Compendium Method for PFAS emissions ([LUC/VI/003](#))



PFAS EMISSIONS

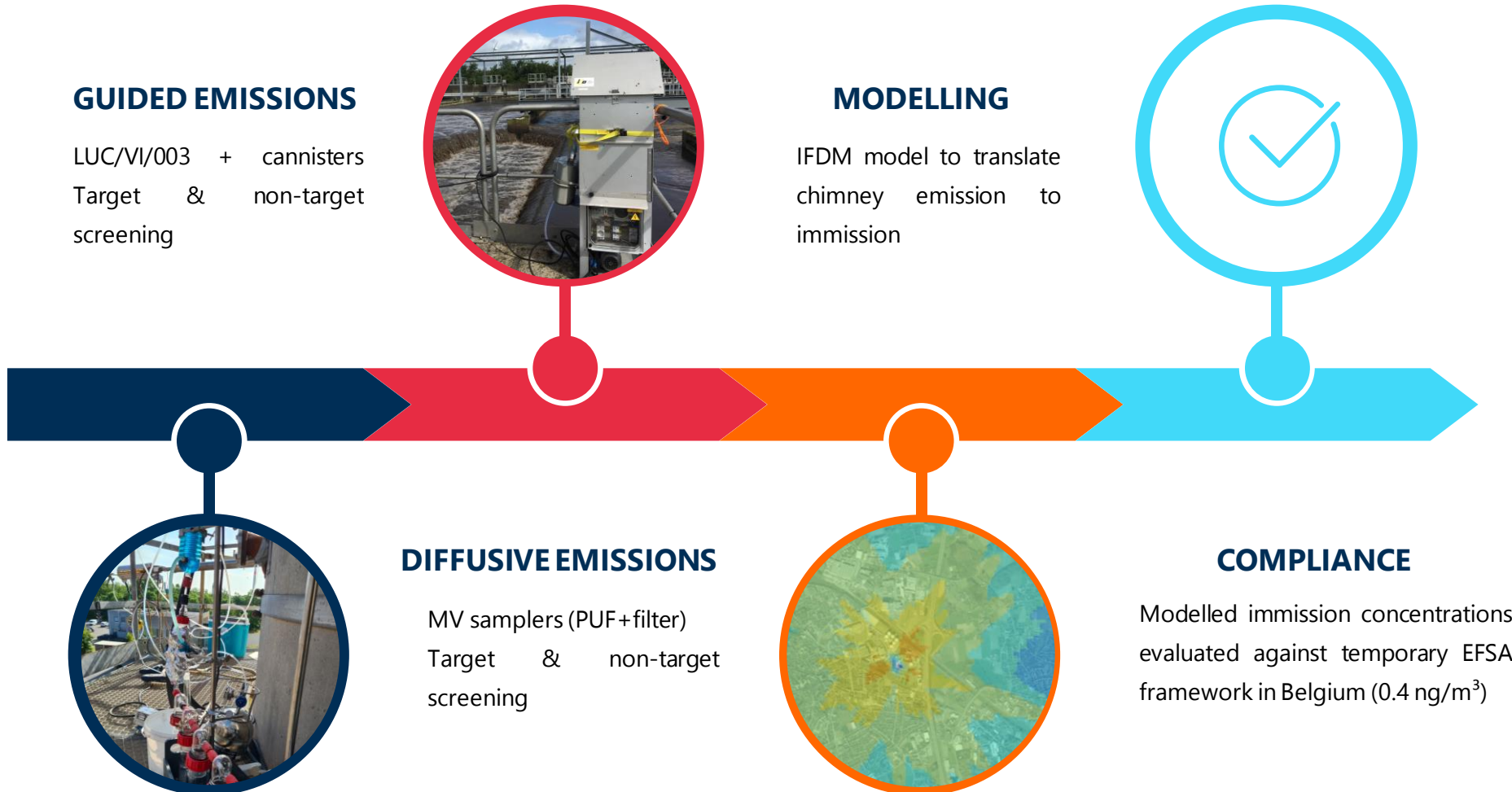
FIRST INSIGHTS

- Various chimneys/processes in Flanders
 - 11 – 43 mg/Nm³ (Σ PFAS)
 - 2.5 - 6.7 mg/Nm³ (EFSA PFAS)
- Emission concentrations (ng/Nm³) \rightarrow immission (ng/m³)



PFAS EMISSIONS

MONITORING APPROACH



CONCLUSION

“PFAS are measurable in the ambient air, deposition & emissions of all considered locations/industries”

“Yearly averages are typically below temporary assessment framework for chronic exposure (0.4 ng/m³)”

BUT

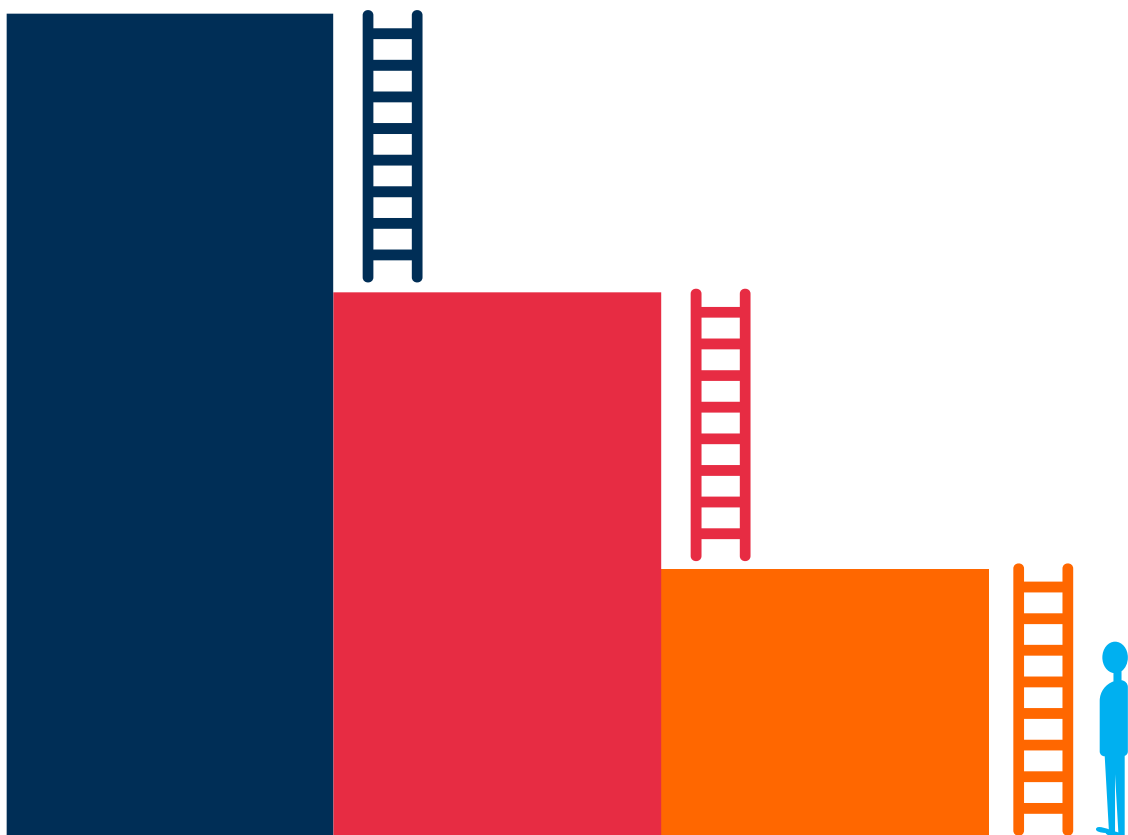
“We only quantitatively measure ~50 PFAS compounds (vs >10 000)”

“The temporary assessment framework is only based on 4 PFAS compounds”

OUTLOOK

COMPLEXITY

PFAS RISK ASSESSMENT



01 MONITORING

- Representative sampling
- Background vs emissions
- Diffusive vs guided emissions

02 ANALYTICAL

- Physicochemical diversity
- Tip of the iceberg
- Combination TA, NTA, Non-specific, total PFAS
- LUC: ~50 target cpds
- Standards needed

03 RISK ASSESMENT

- EFSA4 vs > 10 000 PFAS
- Relative Potency Factors
- Replacement PFAS?
- harmonized PFAS policy & air quality standards



“you can only find what you search for”

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