2 Februari 2024

Enforcement of 3M, Oosterweel and Indaver

Wilfried Van den Acker

Enforcement Manager

- # Introduction

Kris De Wree

Environmental Supervisor

Enforcement at 3M

3M Zwijndrecht production site PFAS enforcement

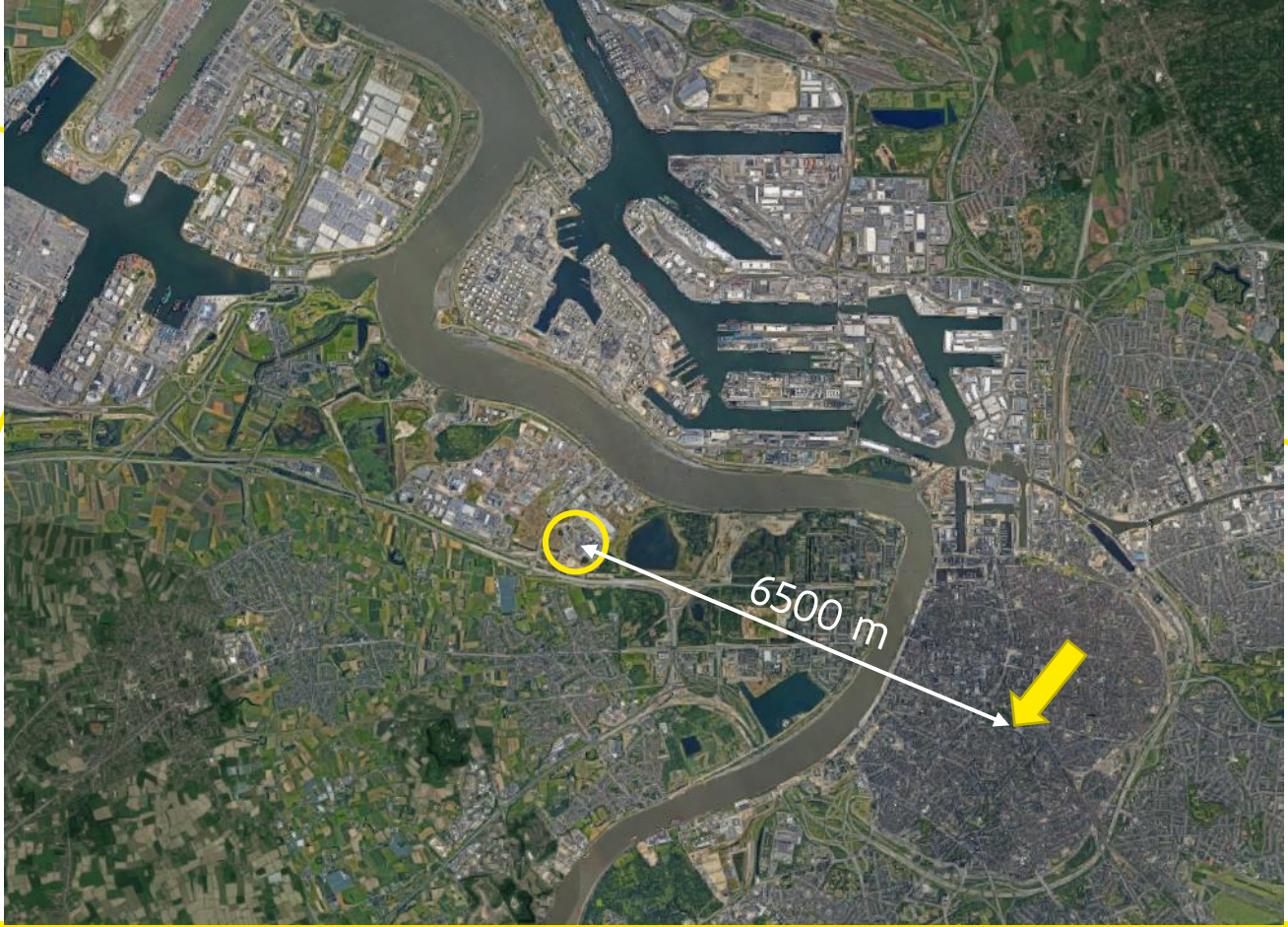
3M PFAS enforcement

1. Introduction to 3M facility in Zwijndrecht

2. Enforcement timeline of PFAS emissons to **surface water**

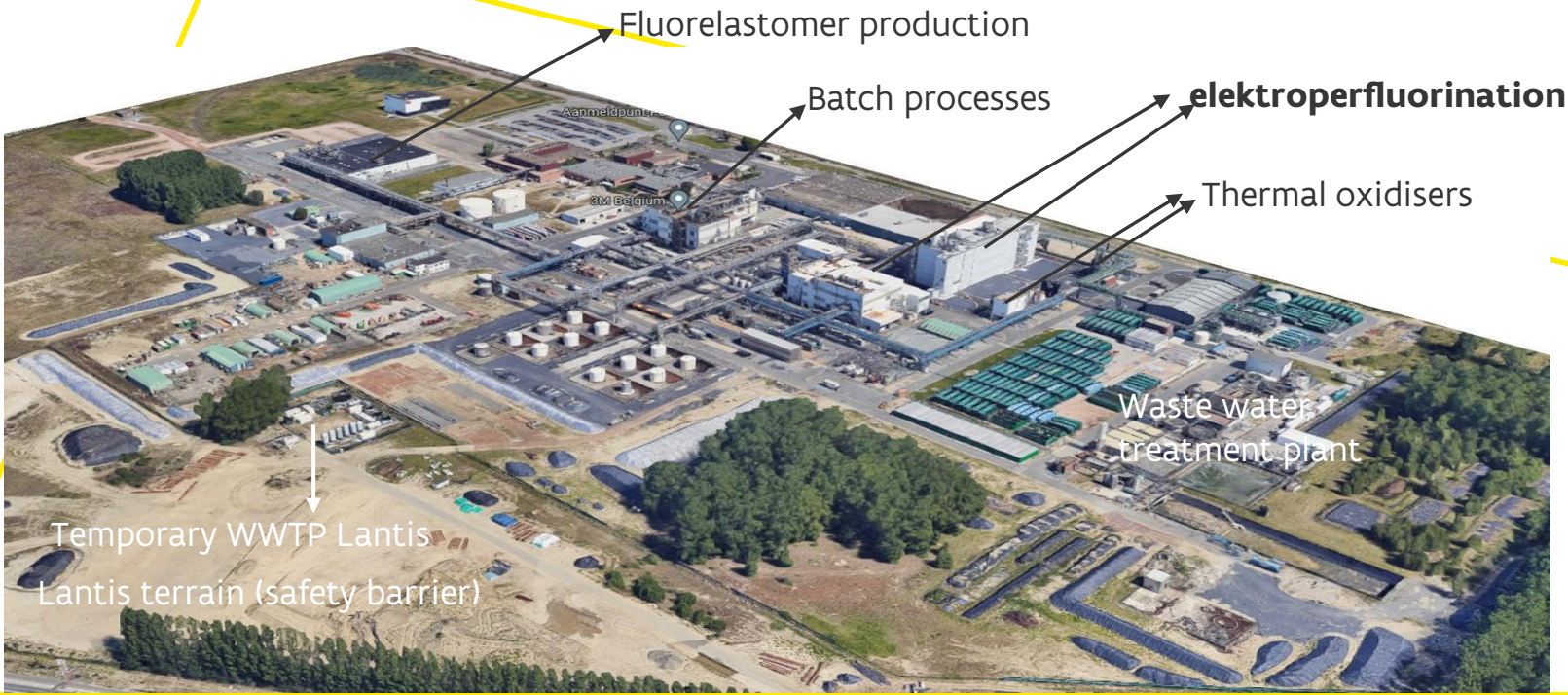
3. Enforcement timeline of PFAS emissions **to air**

4. Bottlenecks & Lessons learned



Introduction to 3M facility in Zwijndrecht

Introduction to the 3M facility in Zwijndrecht



Introduction to the 3M facility in Zwijndrecht

PFAS emissions to surface water

PFAS emissions to air

(historical) PFAS emissions to soil

PFAS emissions to waste

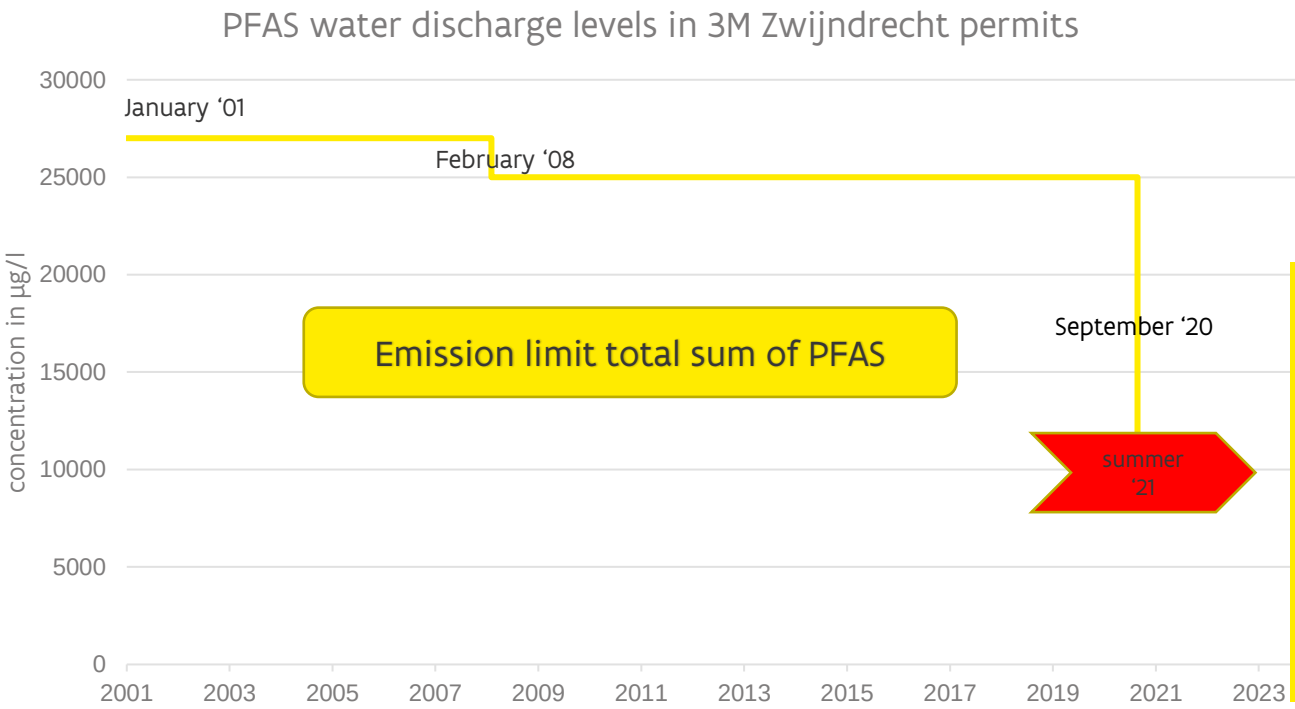
Introduction to the 3M facility in Zwijndrecht

3M PFAS enforcement

1. Introduction to 3M facility in Zwijndrecht

Emission limits for PFAS

2. Enforcement timeline of PFAS emissons to **surface water**



Determination of unpermitted discharge of PFBSA in waste water effluent

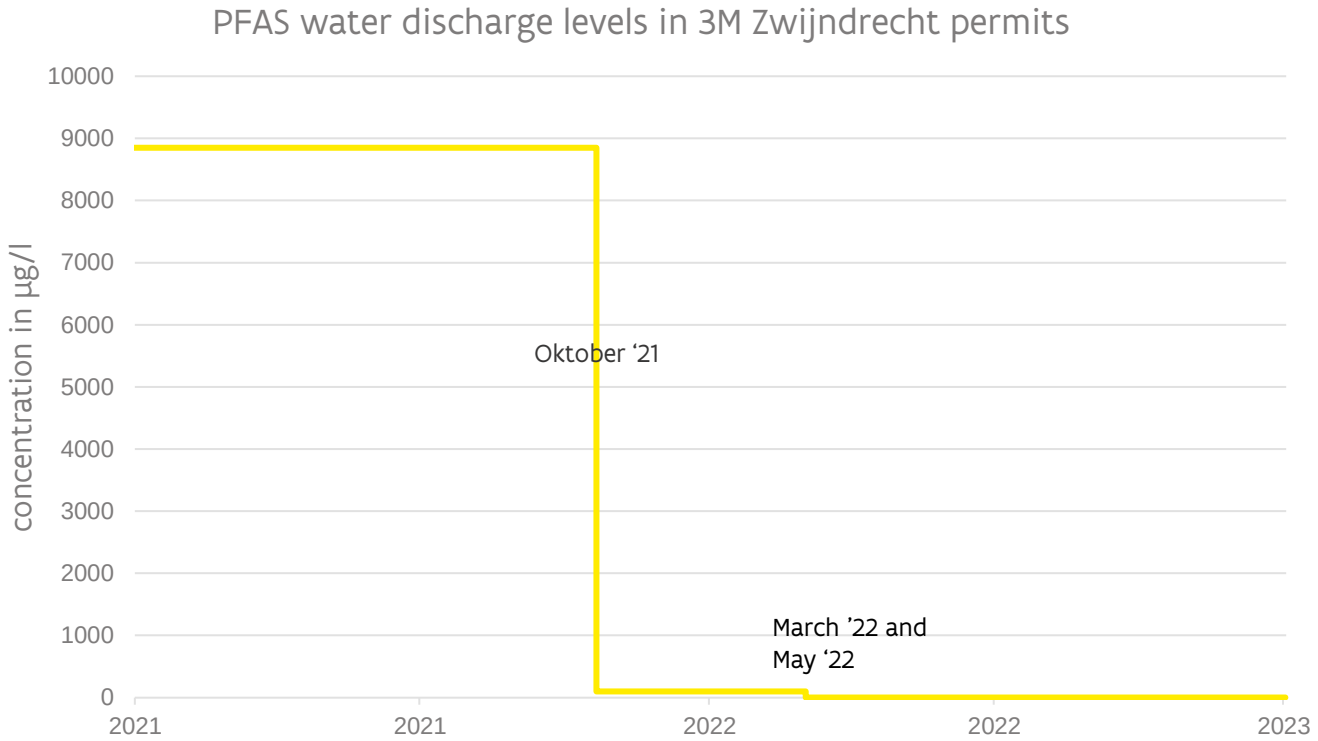
+

Increasing data on high levels of PFAS in soil, groundwater, egs in Zwijndrecht

+

Research by department of Care showing unsafe levels of PFAS in blood of 3M neighbours

Enforcement timeline of PFAS emissons to surface water



Enforcement timeline of PFAS emissons to surface water

Enforcement timeline concerning PFAS in surface water

August '21 — Determination of the unpermitted discharge op PFBSA in surface water

August '21 — **Safety measure** prohibiting the discharge of waste water streams from 2 specific production processes generating the PFBSA concentration

Oktober '21 — Research done by departement of care shows unsafe levels of PFAS in blood of 3M Zwijndrecht neighbours

Oktober '21 — **Safety measure** prohibiting the production of all processes that potentially could emit PFAS to the environment

March '22 — environmental permit with updated and new emisson levels to surface water for PFAS

december '22 — Determination of the unpermitted discharge of (ultra) short PFAS, originating from the pollu

Bottleneck: PFAS that is not yet quantifiable by official standards!

December '22 — Order to submit a licence application for the discharge of these PFAS

Enforcement timeline concerning PFAS in surface water

current situation on site

- Highly efficient WWTP
- Non-treatable PFAS waste water from production is shipped as waste
- On site construction in progress of 2 new parallel WWTP plants
- still limited discharge of (ultrashort) PFAS from ground water remediation

Enforcement timeline concerning PFAS in surface water

Different ways of monitoring

- Increased sampling frequency of 3M waste water
- Analysis used: WAC/IV/A/025
- Active screening of 3M self control data

WAC/IV/A/025: bottleneck = limited number of quantifiable PFAS

3M PFAS enforcement

1. Introduction to 3M facility in Zwijndrecht

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3. Enforcement timeline of PFAS emissions **to air**

No emission limits for PFAS

Enforcement timeline concerning PFAS in air

Okt '21

Research done by departement of care shows unsafe levels of PFAS in blood of 3M Zwijndrecht neighbours

Okt '21

Safety measure prohibiting the production of all processes that potentially could emit PFAS to the environment

Feb '22

Permission of lab scale production process

- Co-signed by the departement of care
- main articles:
  - Prohibition on PFAS production
  - Take action on minimising diffuse PFAS emission from dust
  - PFAS production can only be permitted after approval based on an independent expert judgement under specific conditions

may '22

3M announces the definitive stop of C4-PFAS production on the Zwijndrecht site

june '22

Permission of replacement production process

June '23

3M Zwijndrecht announces an accelerated PFAS production stop by 2024
3M announces the definitive stop of NOVEC1230 on the Zwijndrecht site

Sept '23

The latest expert judgement indicates that PFAS air emissions from specific production process can cause an increase in PFAS levels in the ground water above the temporary legal frame.

Enforcement timeline concerning PFAS in air

Current situation

- 3M Zwijndrecht has permanently stopped the perfluorination cells.
- Processing of intermediates
- Cleaning installation + PFAS waste shipping

Enforcement timeline concerning PFAS in air

Different ways of monitoring

monitoring PFAS **e**mission in stacks

- Sampling + lab analysis LC/MS en GC/MS
- EPA's OTM-45 and recently developed LUC/VI/003

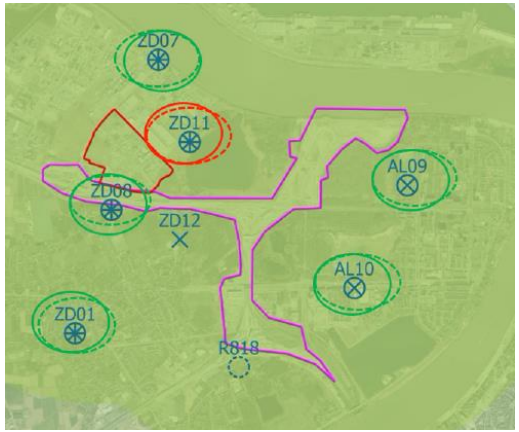
bottleneck = limited number of quantifiable PFAS

Enforcement timeline concerning PFAS in air

Different ways of monitoring

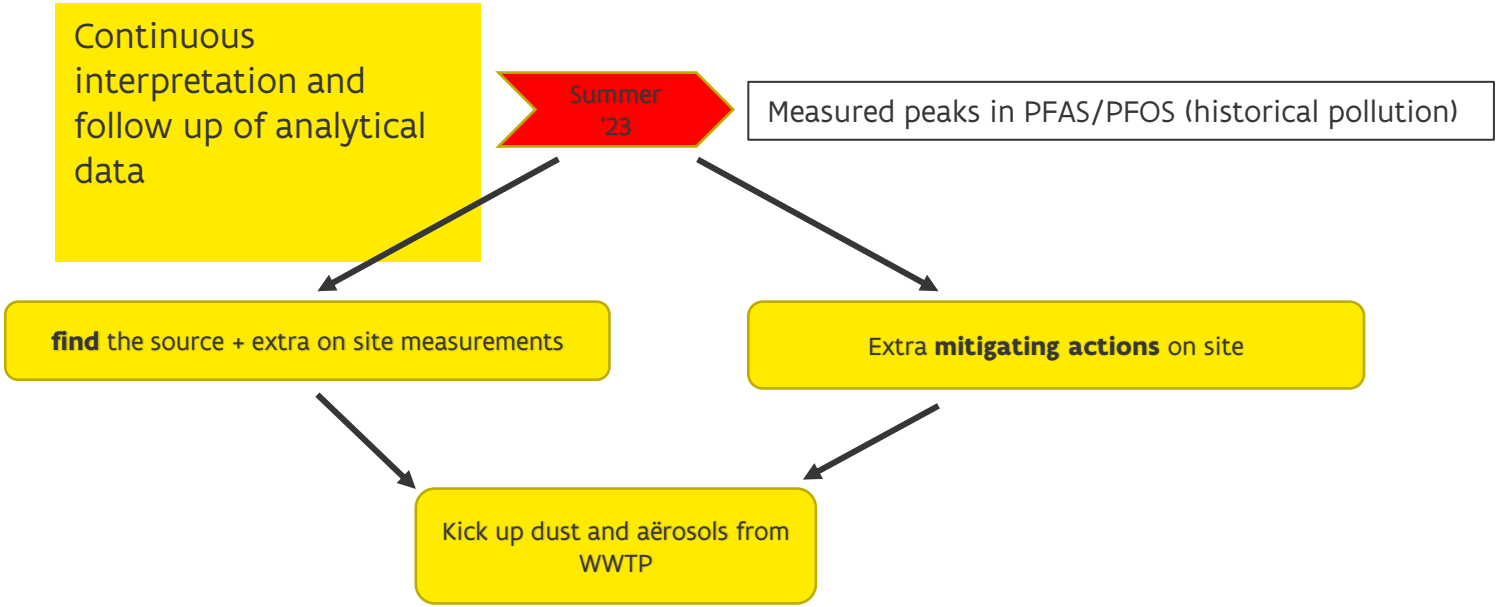
monitoring PFAS immission in the environment

Continuous interpretation and follow up of analytical data



Enforcement timeline concerning PFAS in air

monitoring PFAS immission in the environment



3M PFAS enforcement

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4. Bottlenecks & Lessons learned

Bottlenecks & Lessons Learned

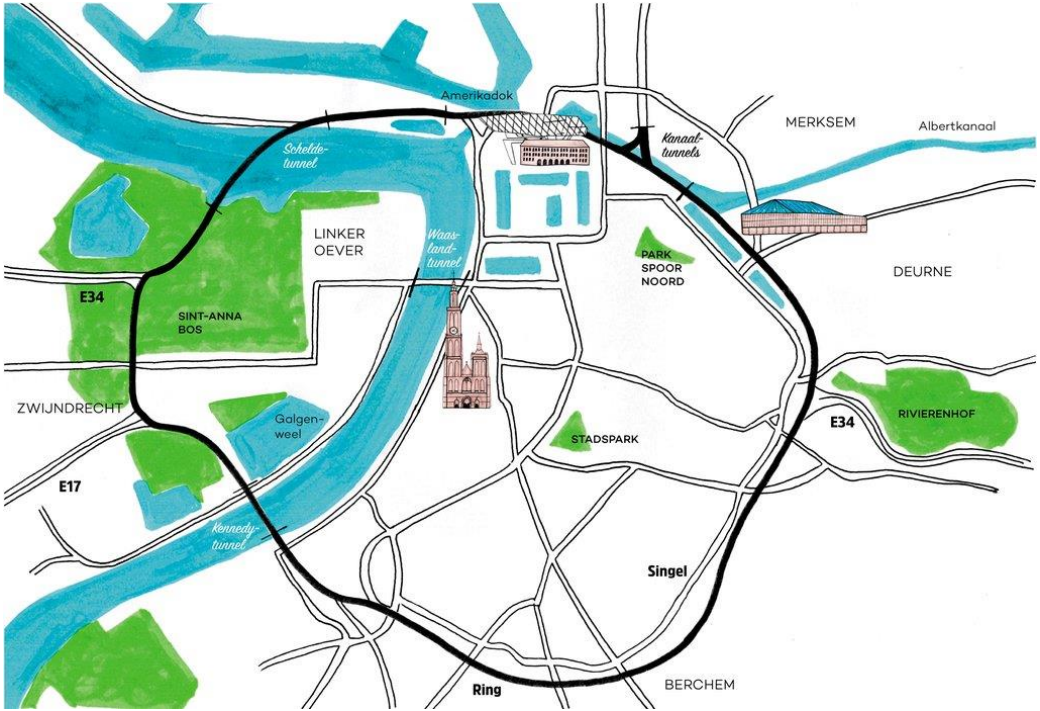
- Emission limits + Methods of measurements and analysis
- Importance of monitoring
- Team effort of different actors with specific expertise:
  - VMM
  - OVAM
  - departement of Care
  - VITO

Thank You for your attention

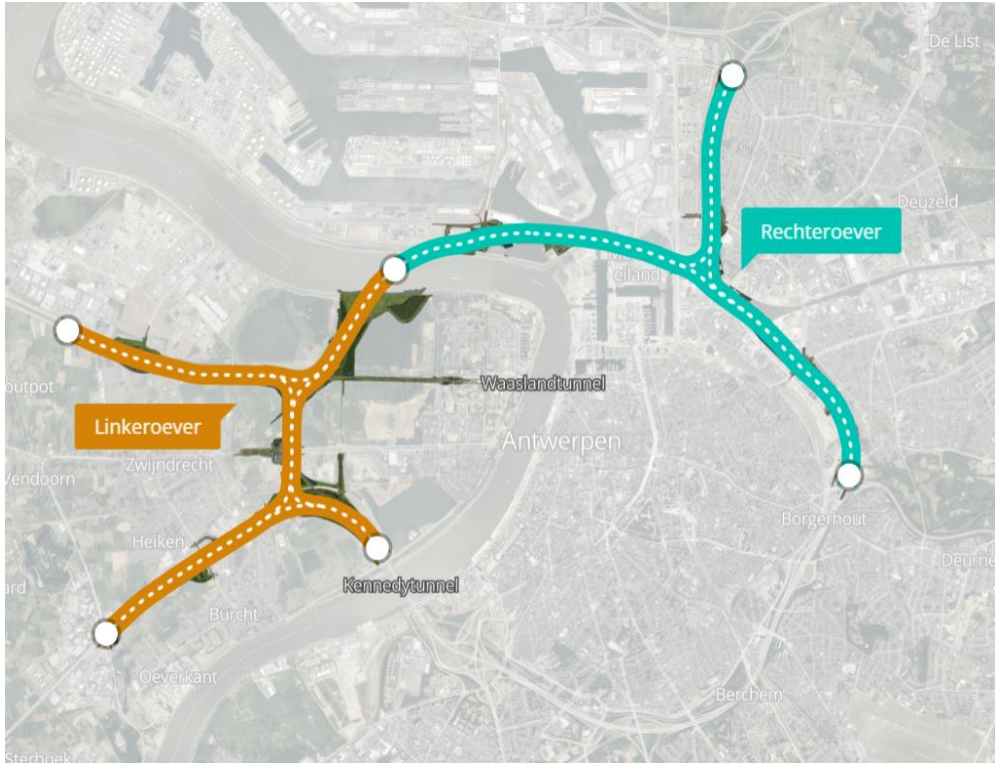
An Swinnen

Environmental Supervisor

Enforcement at Oosterweel

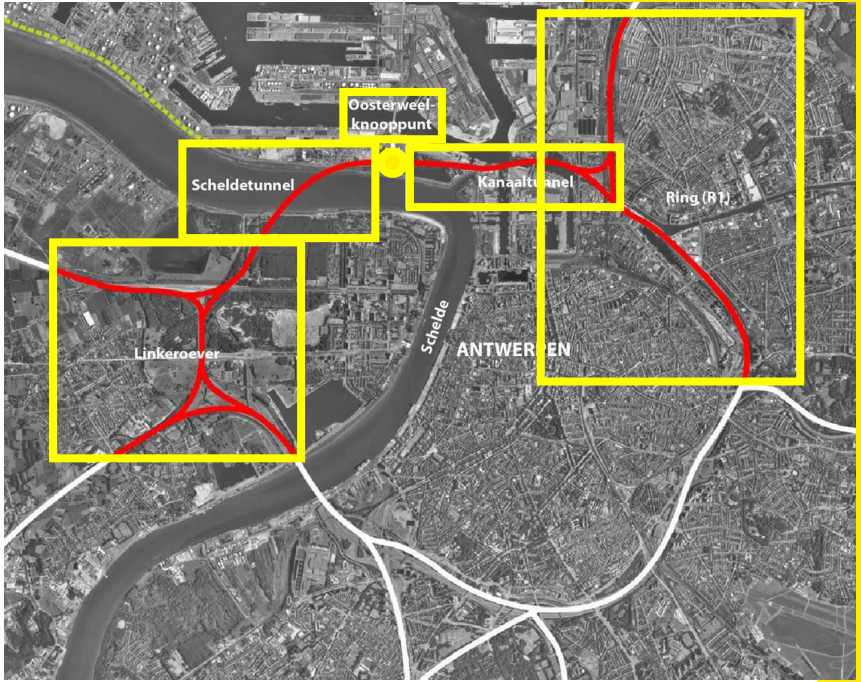


The construction site of the century



The construction site of the century

- **Zwijndrecht – Linkeroever**
  Rinkoniên
- **Scheldetunnel**
  COTU
- **Oosterweelknoop**
  Rinkoniên Oosterweelknoop
- **Rechteroever – Kanaaltunnels**
- **R1**
  ROCO
- **Side projects**
  Often not class 1 permits



Construction zones

PFAS hotspot

Problem: 2.5 million m^3 of PFAS-contaminated soil

> 70 µg/kg dm — Safety barrier at 3M

< 70/47 µg/kg dm — Reuse on site

PFAS-contaminated groundwater

Water treatment

Reality: Evolving scientific insights

Lawsuits / Appeals

New legislation

→ Permits are getting more strict

Zwijndrecht - Linkeroever

PFAS contaminated groundwater Permit

2019	PFOS	1 µg/l
	PFOA	5 µg/l
	SOF	200 µg/l

Today	PFOS	0.1 µg/l
	PFOA	0.1 µg/l
	PFAS other	0.1 µg/l

Zwijndrecht - Linkeroever

Inspection / Enforcement

groundwater

Sampling of groundwater / wastewater

Evaluate permit conditions:

follow up Water Treatment

Detection of PFBA in purified wastewater:
Advice to update permit

Zwijndrecht - Linkeroever

Inspection / Enforcement

Air monitoring

- Permit condition: Dust preventing measures
  - Speed limit
  - Sweeping the roads
  - Spraying water
  - Transport routes away from populated areas

Zwijndrecht - Linkeroever

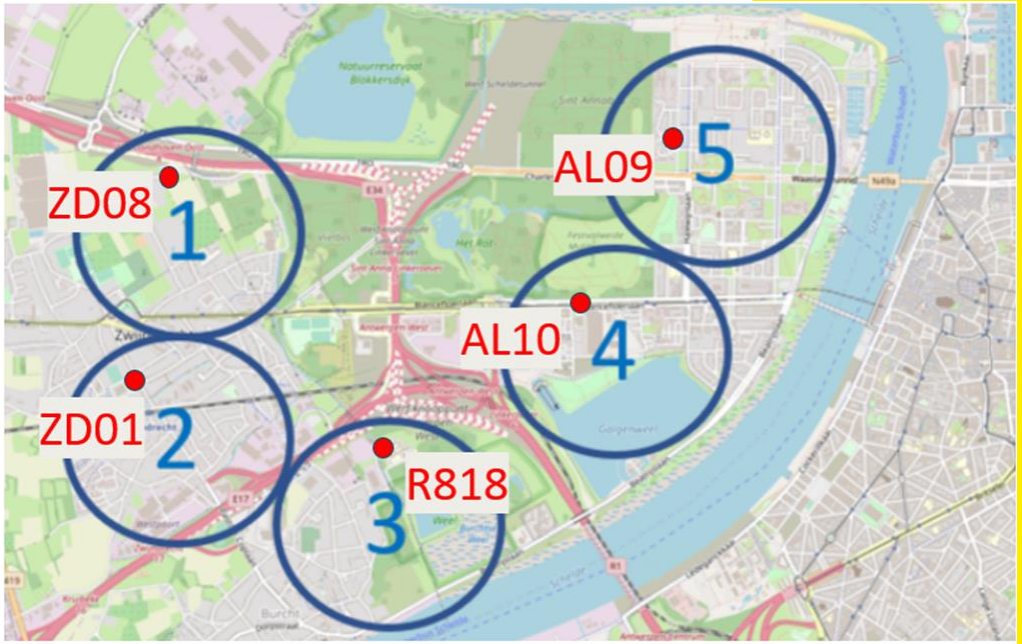
Inspection / Enforcement

Air monitoring

Permit condition: Monitoring plan

- → 5 fixed PM10 monitors, TSP samplers and deposition collectors (VMM): populated areas
- → Mobile air samplers (Lantis): construction site
- → Netto PM10 for 3 sequential hours, warning (20) and action (40) thresholds
- → Notification mail

DUST ≠ PFAS



Zwijndrecht - Linkeroever

Zwijndrecht - Linkeroever

Tabel: Netto PM_{10} ($\mu g/m^3$) voor de meetstations

	Meetstations uitgebaat door VMM					Meetstations uitgebaat door VITO					
Tijdstip (lokale tijd)	42ZD08	42ZD01	42R818	42AL10	42AL09	FLM3M1	FLM3M2	FLM3M3	FLM3M4	FLM3M5	FLM3M6
2024-01-22 00:30	1	1	0	1	1	2	0	0	0	1	-9999
2024-01-22 01:00	0	1	0	1	1	2	0	0	0	0	-9999
2024-01-22 01:30	0	1	0	1	1	3	1	1	0	1	-9999
2024-01-22 02:00	0	1	1	3	1	2	2	0	1	1	-9999
2024-01-22 02:30	0	1	0	4	2	2	2	0	0	1	-9999
2024-01-22 03:00	0	0	0	3	2	1	1	0	0	0	-9999
2024-01-22 03:30	0	1	1	3	0	1	0	1	1	1	-9999
2024-01-22 04:00	0	0	0	1	0	1	2	0	1	1	-9999
2024-01-22 04:30	0	0	0	0	0	1	1	0	1	0	-9999
2024-01-22 05:00	0	1	0	1	0	1	1	1	0	0	-9999
2024-01-22 05:30	0	0	0	1	0	0	0	0	0	0	-9999
2024-01-22 06:00	0	0	0	1	0	0	0	1	0	0	-9999
2024-01-22 06:30	0	0	0	2	1	0	2	1	1	3	-9999
2024-01-22 07:00	0	0	0	1	1	0	1	0	1	1	-9999
2024-01-22 07:30	0	1	0	0	0	0	1	1	1	2	-9999

Inspection / Enforcement

Groundwater

Towards Schelde
Towards Blokkersdijk (dry period)

Sampling of groundwater / wastewater
Evaluate permit conditions:
follow up Water Treatment

Cover and removal PFAS soil

Scheldetunnel

Lessons learned Zwijndrecht-Linkeroever-Scheldetunnel

- Prevention dust
- Air monitoring
- Groundwater treatment
- Cover and removal PFAS soil

Rechteroever

Joffrey Vanmoer

Environmental Supervisor

Enforcement at Indaver

Table of content

Waste-managing activities at Indaver

Incineration, physicochemical treatment and landfill, specialized in industrial waste

Waste-managing activities

Incineration, physicochemical treatment and landfill, specialized in industrial waste

Wastewater

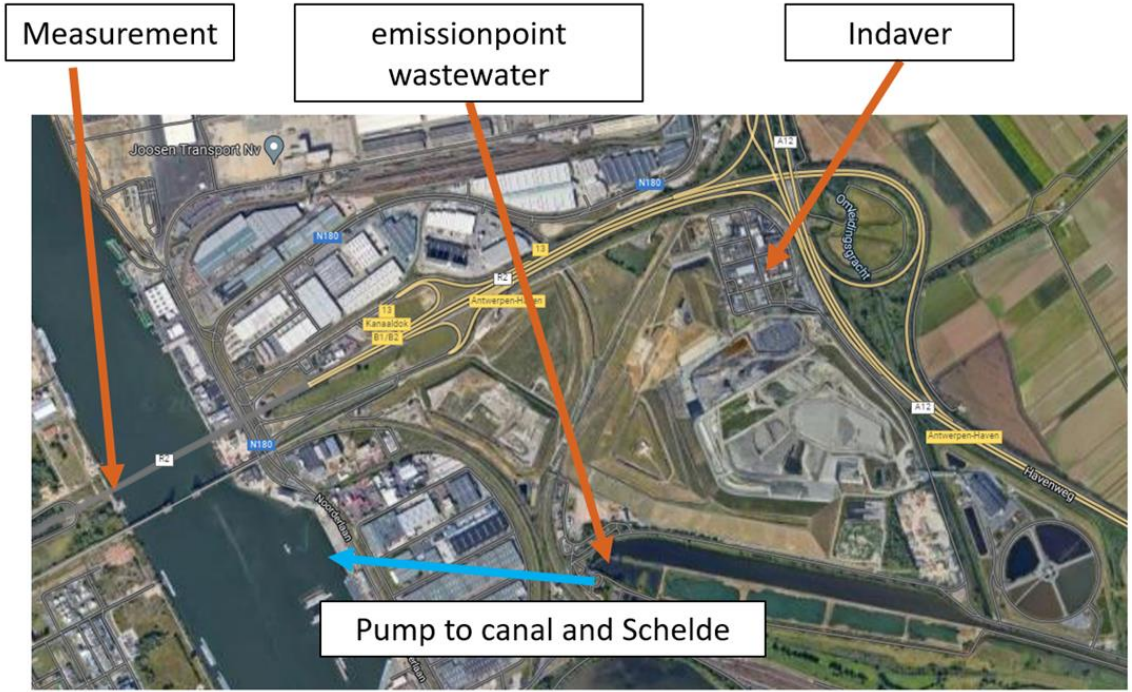
- 2021: development new method for quantification of more PFAS by VITO
  - Not usable for enforcement before published as law (“validated method”)
  - Already in use by commercial laboratory
  - Decision Enforcement Flanders:
    - Take samples as soon as possible, no need to wait until the method is published as law!
- Wastewater-sample by Enforcement Flanders on 14/8/2021
  - PFBA 1100 µg/L
  - Second analysis on 2/9/2021: 1600µg/L PFBA
  - Counteranalyses: +/- same results
- No publication of new method as law/validated method
  - Enforcement = “order” (in Dutch: “aanmaning”)

Wastewater

- Remediation in phases
- First: waste with high concentration of PFBA in landfill:
    - In special matrix (“cement”) before going to landfill
    - Dumped in saltcells inside existing landfill
    - Burning of remaining water that collects on bottom of landfill instead of emitting through wastewater
- Concentration PFBA in wastewater remained high
    - Indaver: extra purification + adjustment of emission-permit
- June 2022: permit was denied: only further purification was possible
    - Installation of sandfilter + active carbon (2 streets of 4 filters)
    - From august 2022: no more PFAS detected in wastewater in concentrations above detection limit

Wastewater

Effect on the canal



Wastewater

Effect on the canal

Meetpuntnummer	Datum	PFBA (ng/L)
804000	17/01/2022	798
	14/02/2022	426
	14/03/2022	316
	11/04/2022	214
	09/05/2022	212
	13/06/2022	83
	04/07/2022	NG
	08/08/2022	41,1
	05/09/2022	30,3

Soil and groundwater

- February 2022: PFAS in groundwater (50m)
  - Enforcement = “order”: plan of action
- Plan of action Indaver:
  - Sampling monitoring pits surrounding Indaver
  - Verification flow groundwater
- Sampling of monitoring pits by Enforcement Flanders (summer 2022)
  - 45 samples

Soil and groundwater

Legend:

Green point =
$PFAS_{(tot)}$ < norm groundwater

Yellow point =
Norm < $PFAS_{(tot)}$ < norm groundwater x 10

Orange point =
Norm groundwater x 10 < $PFAS_{(tot)}$ < norm groundwater x 50

Red point =
Norm groundwater x 50 < $PFAS_{(tot)}$ < norm groundwater x 100

Purple point =
Norm groundwater x 100 < $PFAS_{(tot)}$ < norm groundwater x 500

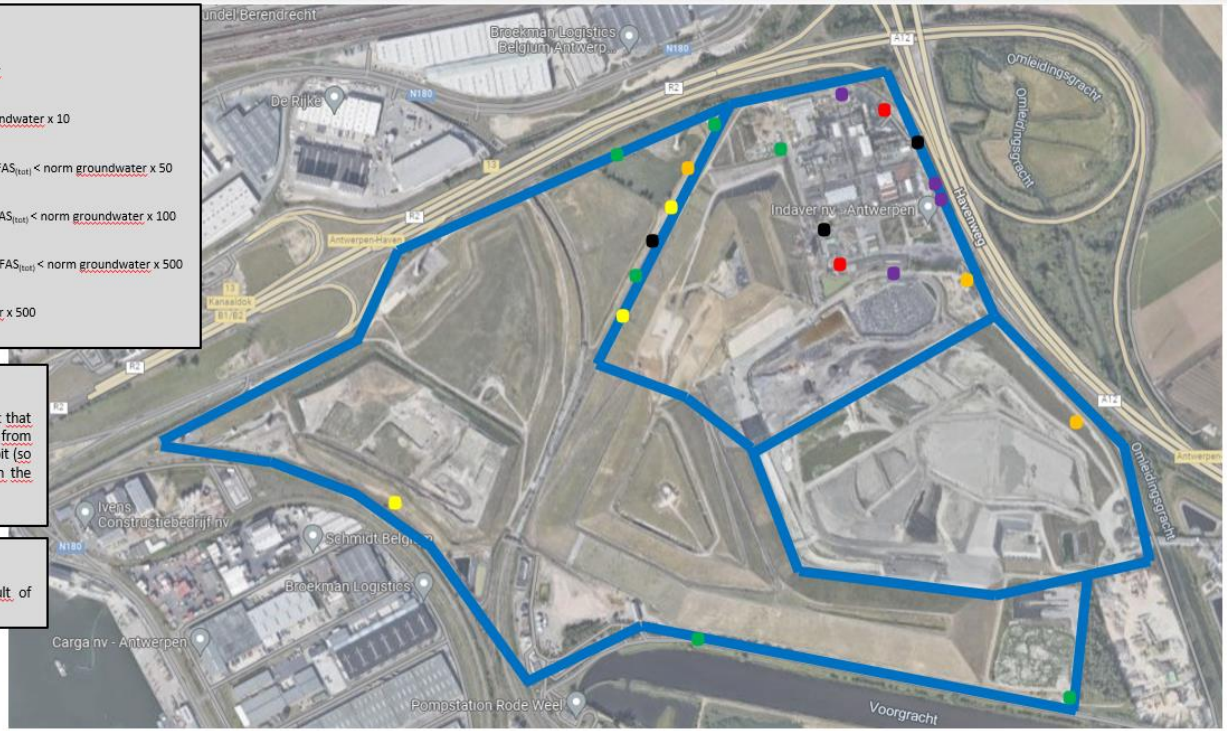
Black point=
$PFAS_{(tot)}$ > norm groundwater x 500

Remark:

Based on highest value at that location, indifferently from depth of the monitoring pit (so if this was a triplet, then the highest value is used).

Remark 2:

Values don't include fault of analyses (+/- 50%).



Soil and groundwater

- Extra samples of additionally installed monitoring pits by Indaver
  - Even higher concentrations were found
- Sources
  - Some historic smaller sources (former waste-colletionpits, fires etc.)
  - Old landfill (!) – up to 28,000,000 ng/l PFAS at one samplepoint
- Current state and further enforcement:
  - Enforcement Flanders: “Proces-verbaal” (police report) has been written
  - Smaller sources probably remediated
  - One source at the old landfill was remediated
  - Enforcement Flanders:
    - 31/1/2024: identification of additional sources at landfill
    - 1/5/2024: remediation of landfill-source(s)
    - 1/6/2024: proposal of monitoring

Air

- Uncertainty about PFAS-emissions by air:
  - Enforcement = “order”: measuring of emissions
- 3 different researches:
  - Sampling of the emissions
  - Deposition of PFAS in the environment
  - PFAS in environmental air
- Problem:
  - No validated measurement protocols
  - Solution: VITO was developing measurement protocols
- Enforcement:
  - No emissionlimit
  - Base = “what is acceptable”: in close collaboration with Flanders Environmental Agency (“VMM Vlaamse Milieu Maatschappij”) and Department of Care (“Departement Zorg”).

Air

- *Based on **current** results and knowledge (!):*
  - No immediate reasons for concern
- Remediating actions
  - Use of clean water instead of PFAS-polluted groundwater in the treatment of emitted air
  - Changing the active carbon that was used in the air-emission treatment
  - Result = lower emissions
- Unresolved questions and further research
  - Emission measurement during a worst-case-scenario
  - Is emission acceptable taking into account the PFAS that are already in the surrounding areas?
  - What about the PFAS (and intermediates) that we can't measure with the current techniques?

Future

- Non-targeted analysis and semi-quantification