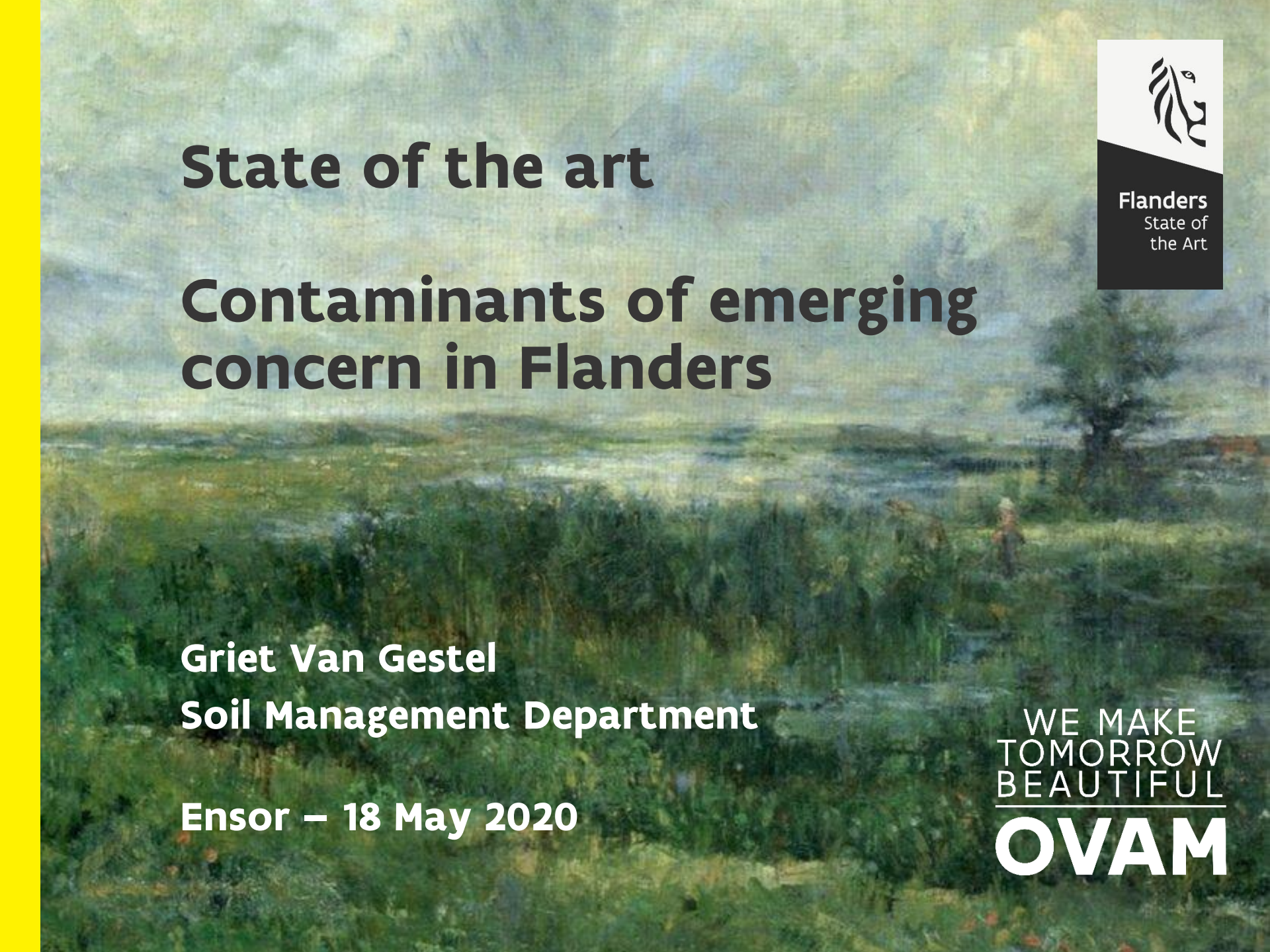

State of the art

Contaminants of emerging concern in Flanders

Griet Van Gestel
Soil Management Department

Ensor – 18 May 2020

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Every year more chemicals are used, and end up in the environment, also in soils

Complex, many unknowns regarding their fate, behaviour, toxicity, …

Ubiquitousness of many substances, e.g. microplastics, pesticides

Little is known about combined effects

⇒ risks for **human health** & **soil ecosystems !**

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What are the challenges for soil management policy & practice?

- We need: guidelines, threshold values, remediation technologies
- Most urgently, when dealing with excavated soil
  - delays are costly for construction projects
  - undesirable cross-boundary transport
    - (large differences in threshold values)
- Legal uncertainty for problem owners
- Liability: 'polluter pays'- principle ?
- Diffuse soil contamination

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Content

- Introduction: What challenges do we face?
- What actions did we take?
  - → Action line 1: Emerging contaminants: a phased approach with exploratory measuring campaigns
  - → Action line 2: An approach for diffuse soil contamination
- Outlook towards the future

Action line 1

Emerging contaminants:

a **phased** approach

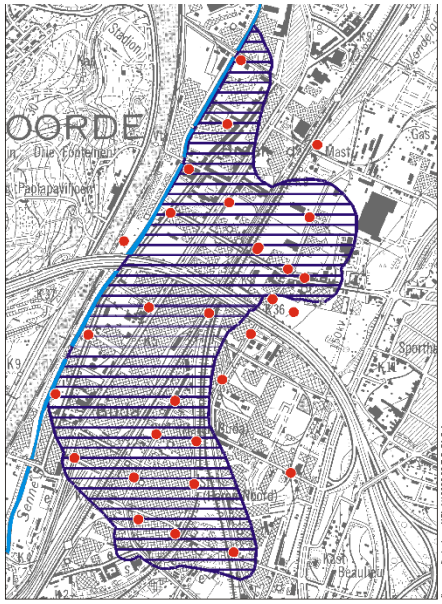
with **exploratory**

measuring campaigns

Some key issues of the Flemish Soil Decree and implementation order

- Obligation of soil investigation on land with risk activities
- When contaminated, remediation is needed
- By operator or owner, according the '*polluter pays*' - principle
- All suspected substances should be analyzed
- In practice: heavy metals, mineral oil, BTEX, cVOC and PAH

⇒ **Emerging contaminants** are not analyzed
guidelines, threshold values, … are missing



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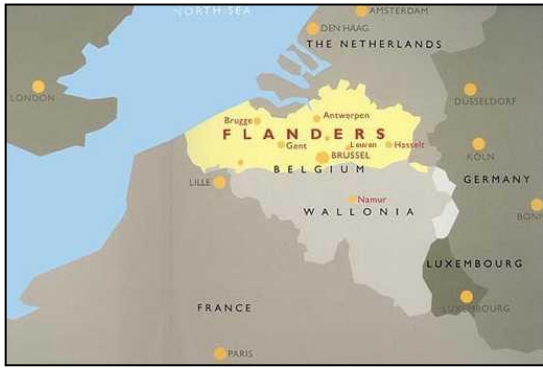
Emerging contaminants: a phased approach

Key: organizing exploratory measuring campaigns for relevant substances:

limited size, randomly distributed

aim: global risk assessment for Flanders

improvement of procedures to avoid and remove risks



A phased approach, by substance or by group of substances

For prioritization, taking into account:

expected risks (toxicity, mobility, persistence, ...)

expected extent of the problem (# cases)

→ risk activities

OVAM-database

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Measuring campaigns

- Dioxines (2011)
  advisory system for safe local food production

- TBA (tributylalcohol) (2013)
  additive of gasoline
  no further action needed

- 1,4-dioxane (2015)
  stabilizer of chlorinated solvents
  to be analyzed on sites where 1,1,1-TCA was used
  Web link to report: Additives of chlorinated solvents – 1,4-dioxane in Flanders

- PFAS (2017)

PFAS measuring campaign

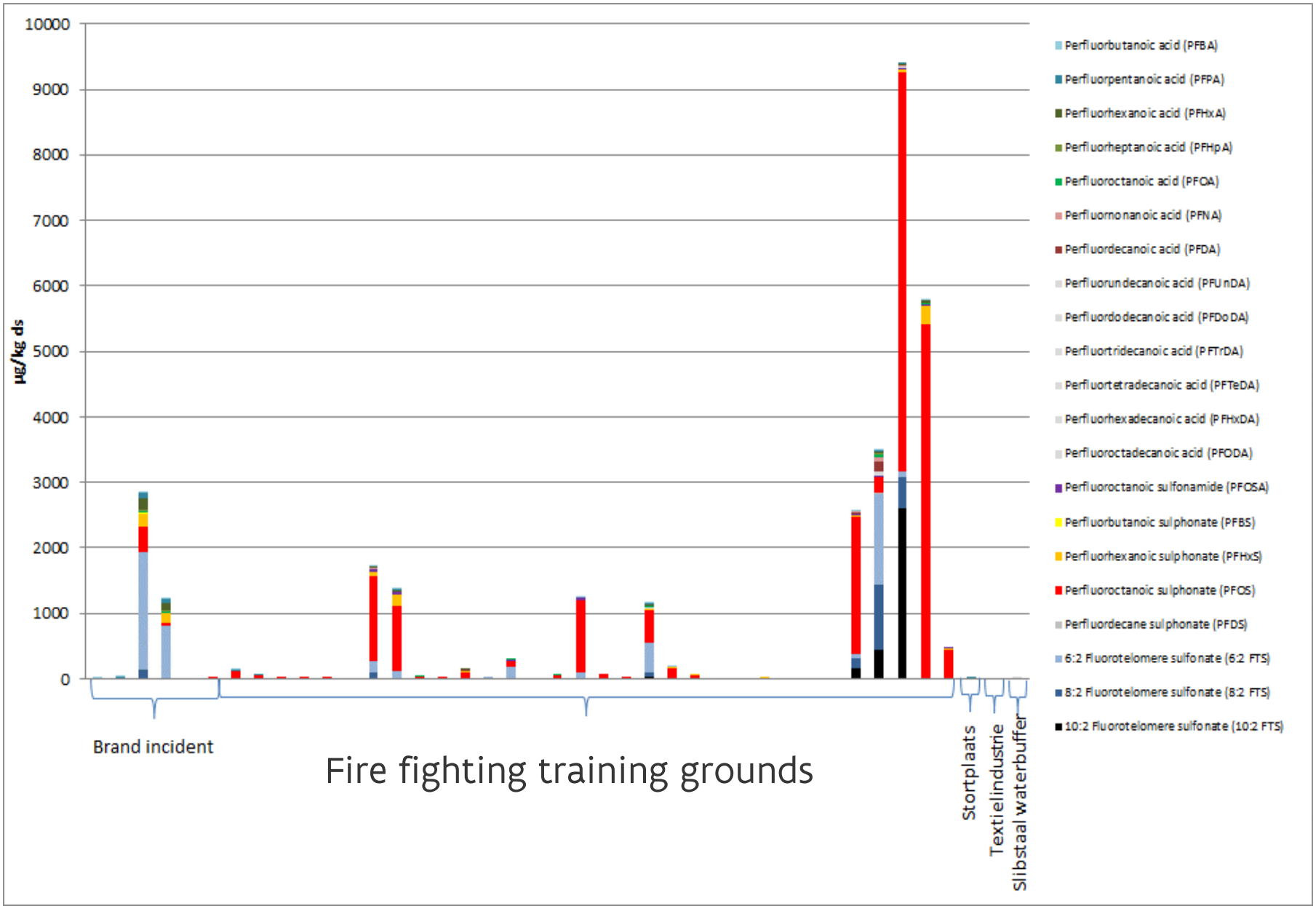
Inventory of risk activities

24 sites were selected using
OVAM-database and other information

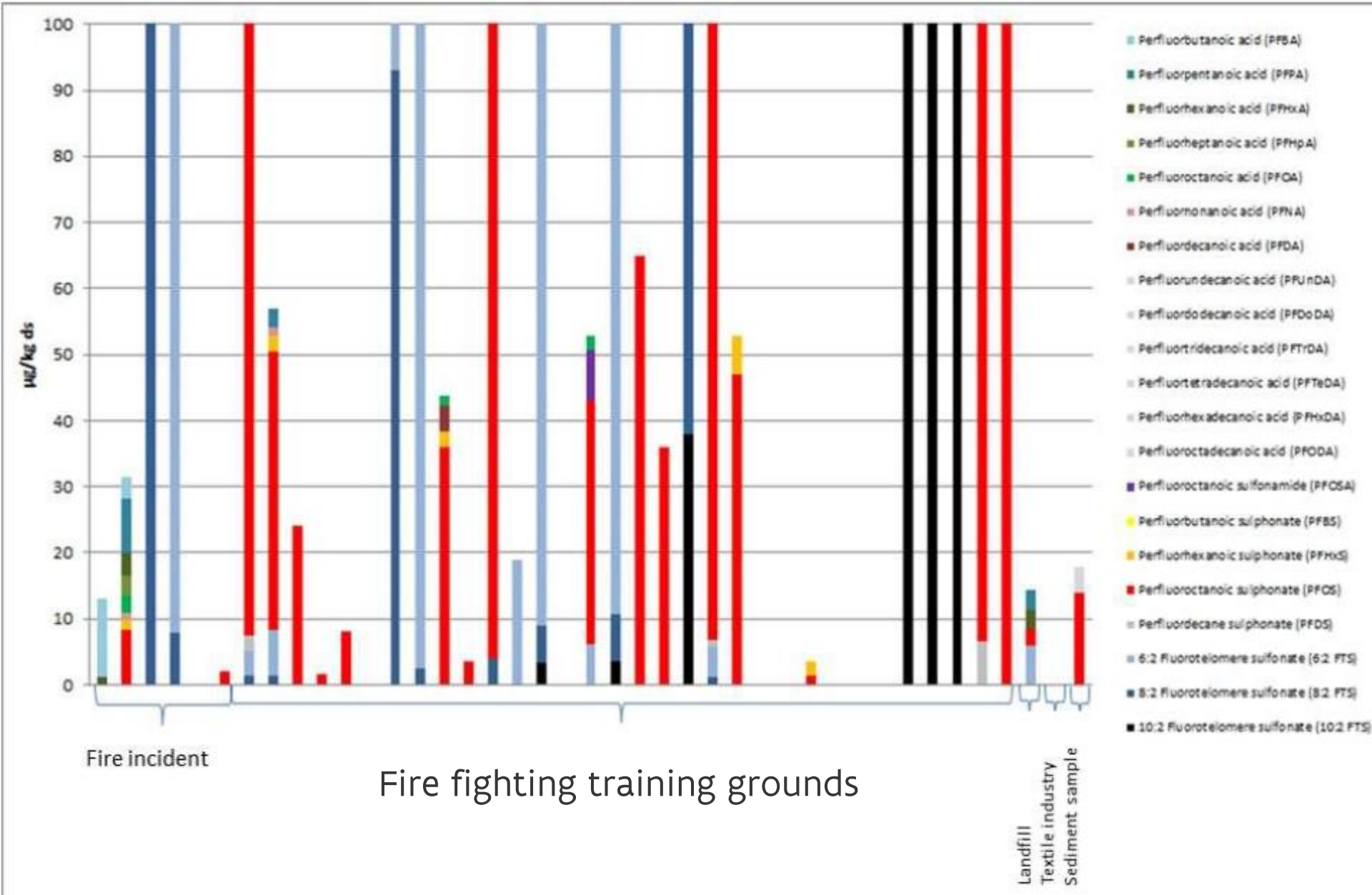
Soil and groundwater were analyzed for 21 PFASs

Type of location	Subcategory	Activity	No. of sites
PFAS processing industry	Galvanic industry	Use of PFAS as a spray suppressor	1
	Paint industry	Production of paint using PFAS	1
	Textile industry	Treating textiles with PFAS components	2
	Paper industry	Treatment (grease and water repellent) paper and cardboard	1
Use of fire extinguishing foam (AFFF)	Fire extinguishing	Calamity	2
	Fire service training site	Regular use of extinguishing foams	3
	Fire service facilities (industry)	Calamities and testing extinguishing foams	5
	Military training areas and airports	Calamities and testing extinguishing foams	3
	Civil airports	Use and testing extinguishing foams	3
Landfill sites		Demolition material + landfill material itself (carpets, textiles, paper, etc.)	2
Water treatment plant		Water treatment from industry	1

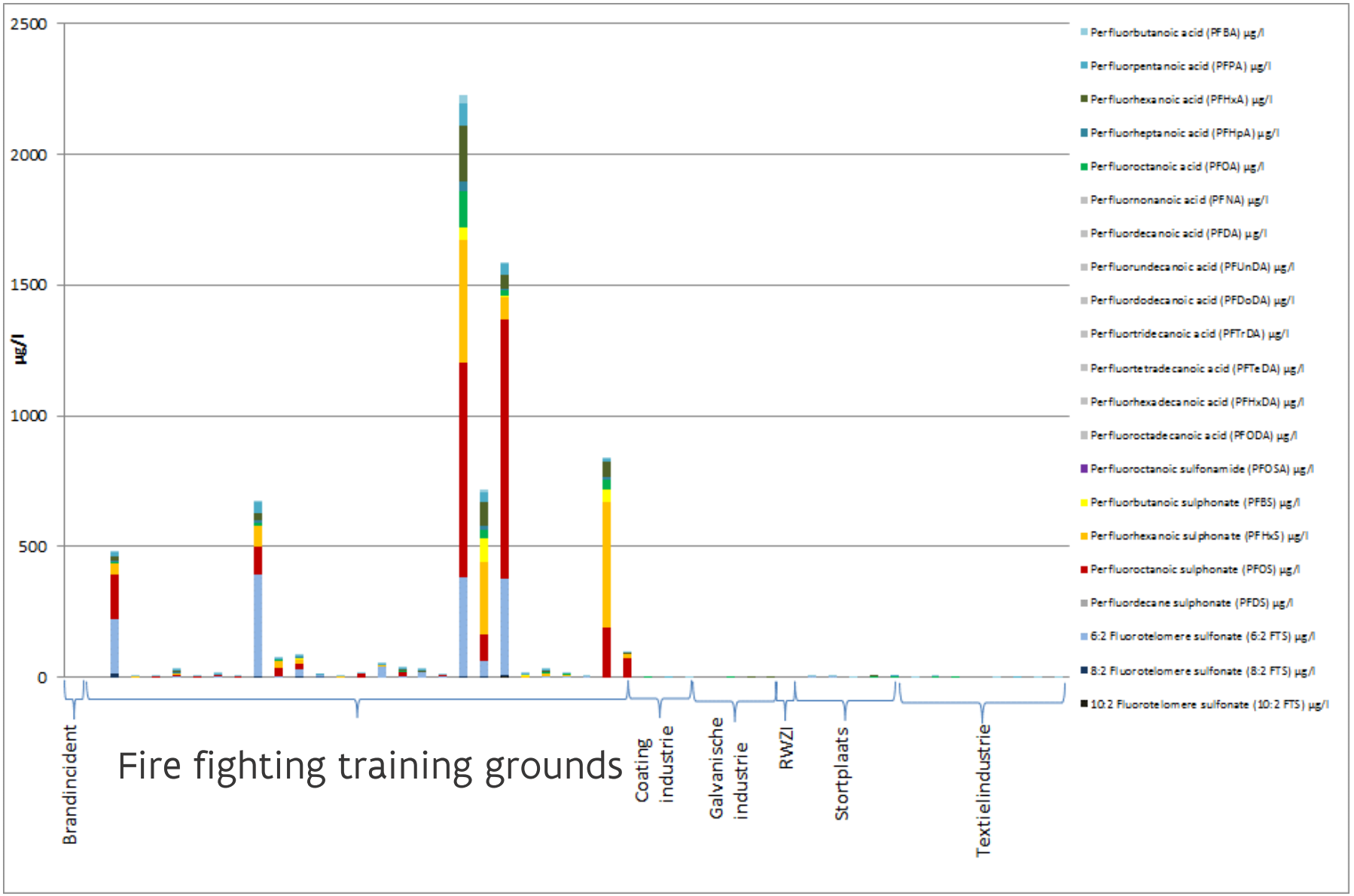
Results soil (in µg/kg dm)



Results soil (in µg/kg dm)

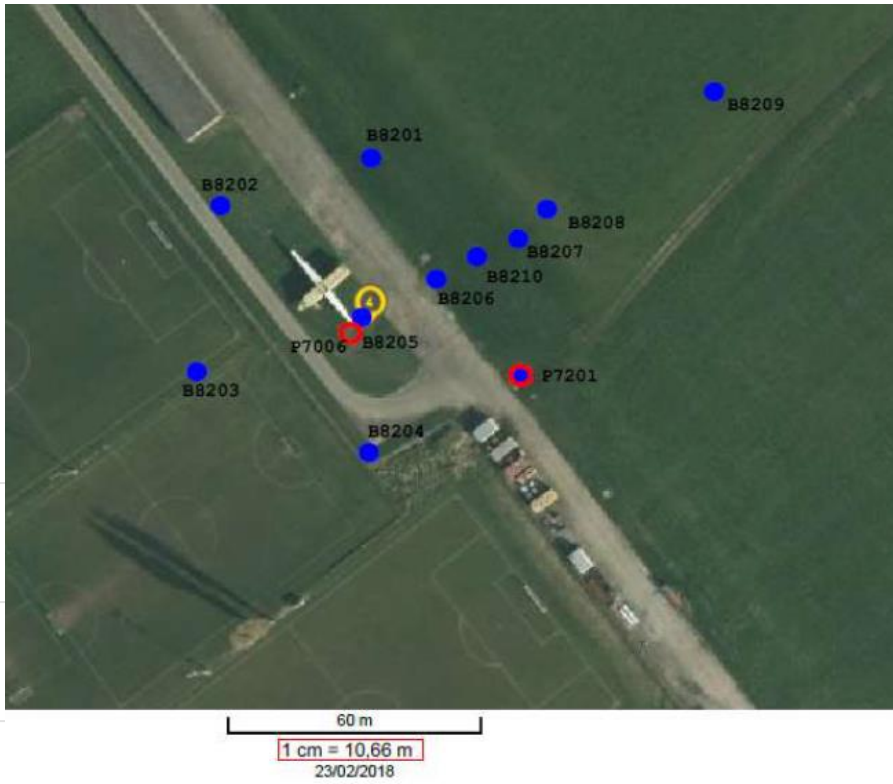


Results groundwater (in µg/L)

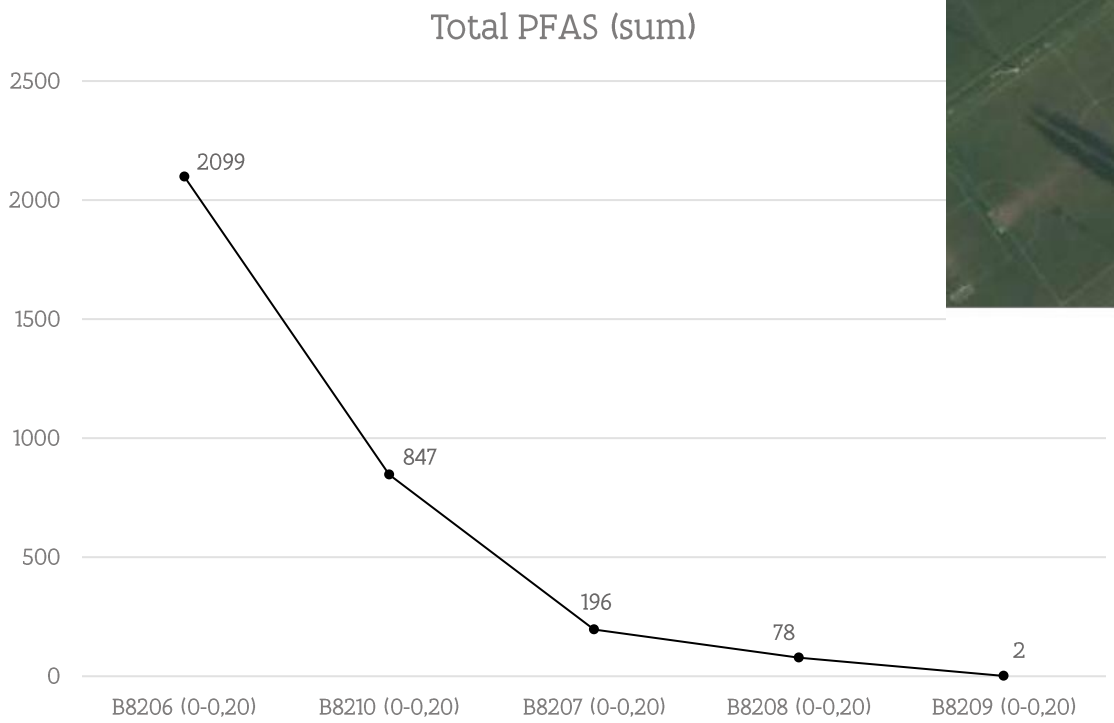


Additional measurements

On 2 sites (fire fighting training grounds):
elevated conc in soil up to
40 - 100m from source



Conc in soil (µg/kg dm)



Web links:

Report 1 - PFAS in soil & groundwater in Flanders

Report 2 – PFAS in soil & groundwater in Flanders Phase 2

Implementation of PFAS in soil policy

Conclusion:

Especially on fire fighting training grounds
we found soil & groundwater contamination with PFAS

FUTHER ACTIONS:

→ **Guidelines** :
- for fire brigades
- for soil experts on excavated soil (web link)

! PFAS must be analyzed when soil is excavated (>250 m^3) on risk sites !

→ **Criteria for excavated soil - Soil remedition criteria – Background values** (see next slide)

→ **Study on human exposure routes** (integrated approach) (see next slide)

→ **Liability:** Are the fire brigades responsible? Is this fair?

⇒ Do we need to adapt soil legislation
for **emerging contaminants & diffuse pollution?**

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 : 8 µg PFOS / kg dm
for construction purposes: 70 µg PFOS / kg dm

in guidelines on PFAS in excavated soil (web link)

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)

S-Risk
contaminated Sites RISK Assessment

Soil remediation criteria PFOS and PFOA

PFOS Land use type	I/II nature / agriculture	III residence	IV recreation	V industry
Human tox (µg/kg dm)	3,1	204,6	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			

PFOA Land use type	I/II	III	IV	V
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			

Background values for PFAS in soil

Study commissioned to VITO

45 sampling sites selected

top layer (0-20cm) analyzed for:

- soil characteristics (pH, %clay, %C, Al, Fe)
- PFAS
- brominated flame retardants
- plasticizers (bisphenol A, …)
- pesticides (chlorpyrifos, boscalid, glyfosaat, …)

⇒ Define soil remediation criterium for land use type nature/agriculture (I/II)
⇒ Revise criteria for free use of excavated soil

PFAS action plan for Flanders – an integrated approach

Coordination of all actions related to PFAS:

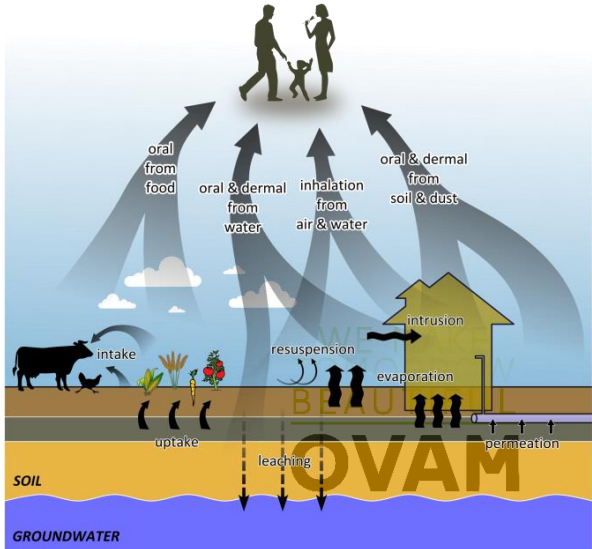
- monitoring surface/groundwater/drinking water quality
- licensing policy
- management of materials & waste
- management of contaminated soils

Research project to start 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



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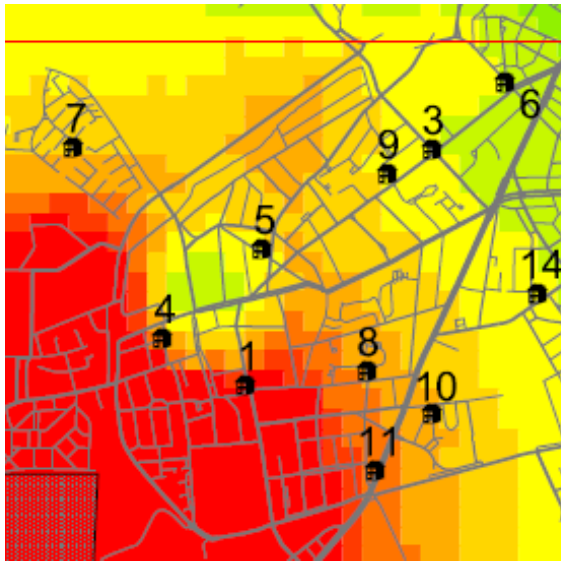
Action line 2

An approach for diffuse soil contamination



What is ‘diffuse soil contamination’?

Diffuse soil contamination:

- Soil contamination due to small activities in the past, no record kept
- From dispersed sources: atmospheric deposition, flood events, agricultural inputs, …
- Covering large areas, difficult to demarcate

↔

- Local contamination point sources

  linked to a **known source** or risk activity

⇧

Soil Decree

↳ **Many cases have not been treated until now**

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Development of a policy on diffuse soil pollution

Why? There are **risks** in the **short** & **long** term for human health, for further spreading, for (soil) ecosystems, biodiversity

Legal uncertainties
e.g. when interfering with contamination from known sources

To provide **information** on soil & groundwater quality to owners/users

To **preventing** more diffuse soil contamination

How? A project was started with following objectives:

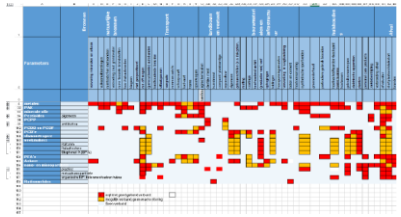
1. to **inventory** all available data:
   - possible sources and contaminating substances
   - existing measurement data
   - supporting data (e.g. emission data, cartographic data)
2. to assess the potential **impact** and extent of the problem
3. to make a **proposal for a policy**, including a prioritization

⇒ commissioned to Arcadis nv
Nov 2018 – Sept 2020

ARCADIS

Results - Inventory of data

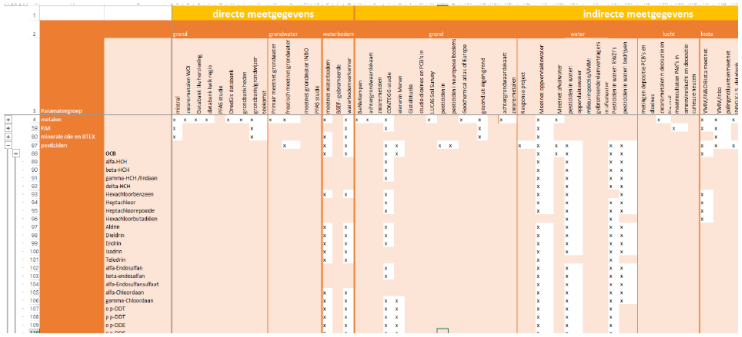
- Sources / substances



- **Measurement data**: list of data bases

  accessible?
  conclusions regarding diffuse soil contamination?

  direct: soil / groundwater / sediment
  indirect: soil / water / manure / biota / air & deposition / human biomonitoring /other



- **Supporting data**

  emission data: e.g. data on the sale & use of pesticides, ...
  cartographic data: e.g Ruimtemodel VITO, inventory asbestos roofs, agricultural land uses, ...

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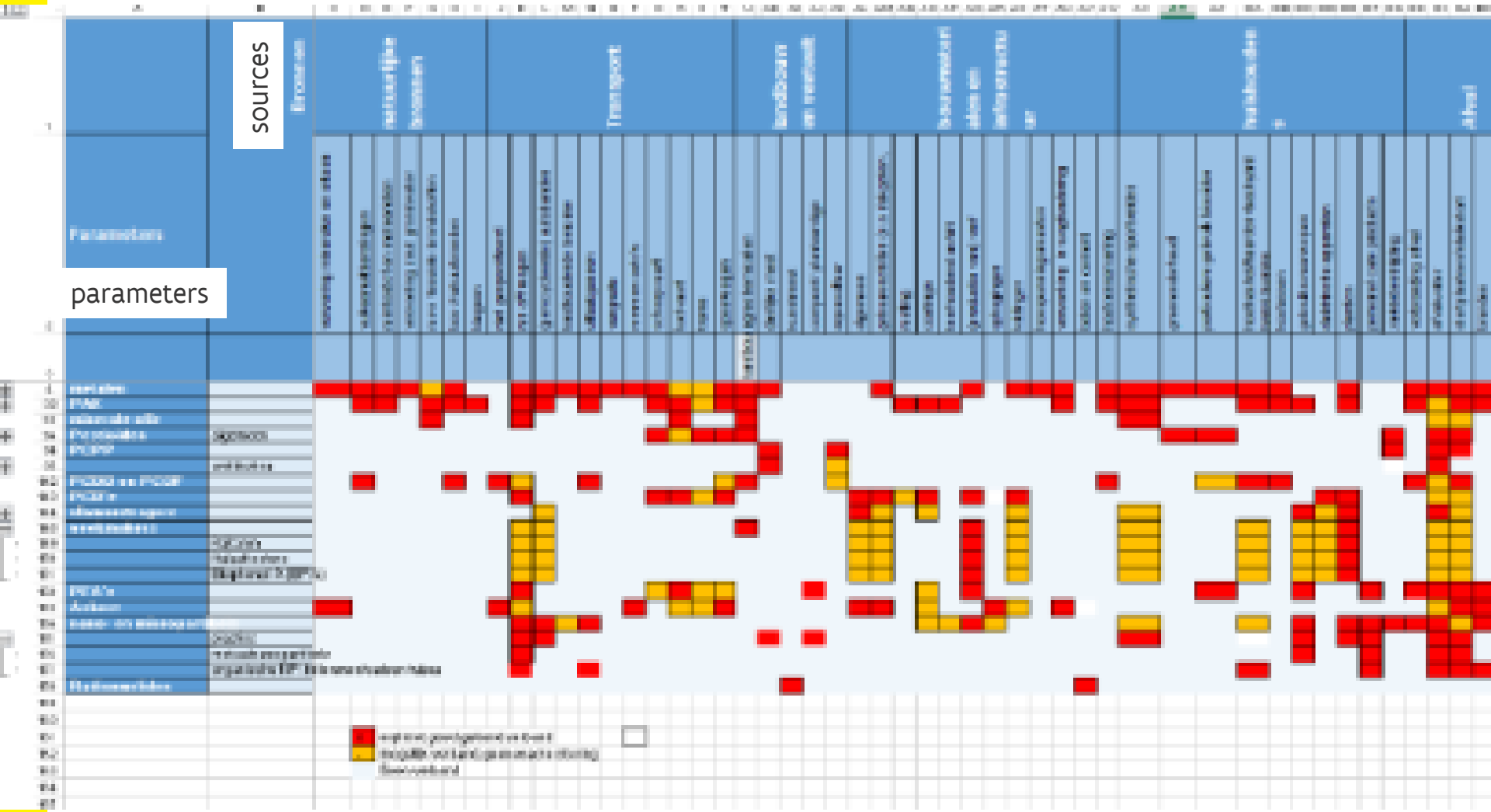


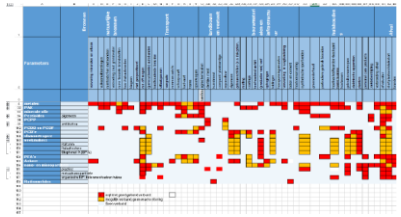
clear, well-known relation

possible relation

no relation

Results - Inventory of data

- Sources / substances



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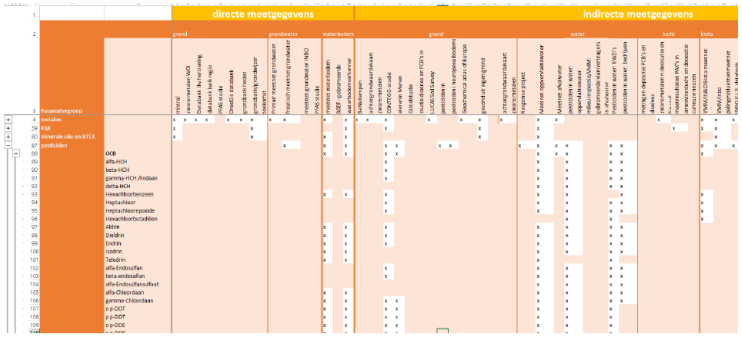

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Results - Impact

Qualitative assessment
of the impact of each source:

- significant
- moderate
- limited

Criteria used:

- expected **soil conc** (measurement data/emission data)
- size of the potentially affected **area**
- potential effects of the **substances** (→ persistence, ...)
- potential exposure of **receptors**

Sources are divided into **categories**

Primary source	transfer routes to the soil	suspected area	secondary source
Waste			
Transport			
Agriculture			
Building mat. & infrastructure			
Households & services			
Industry			
Energy			
Other			

Results - Impact

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of the impact of each source:

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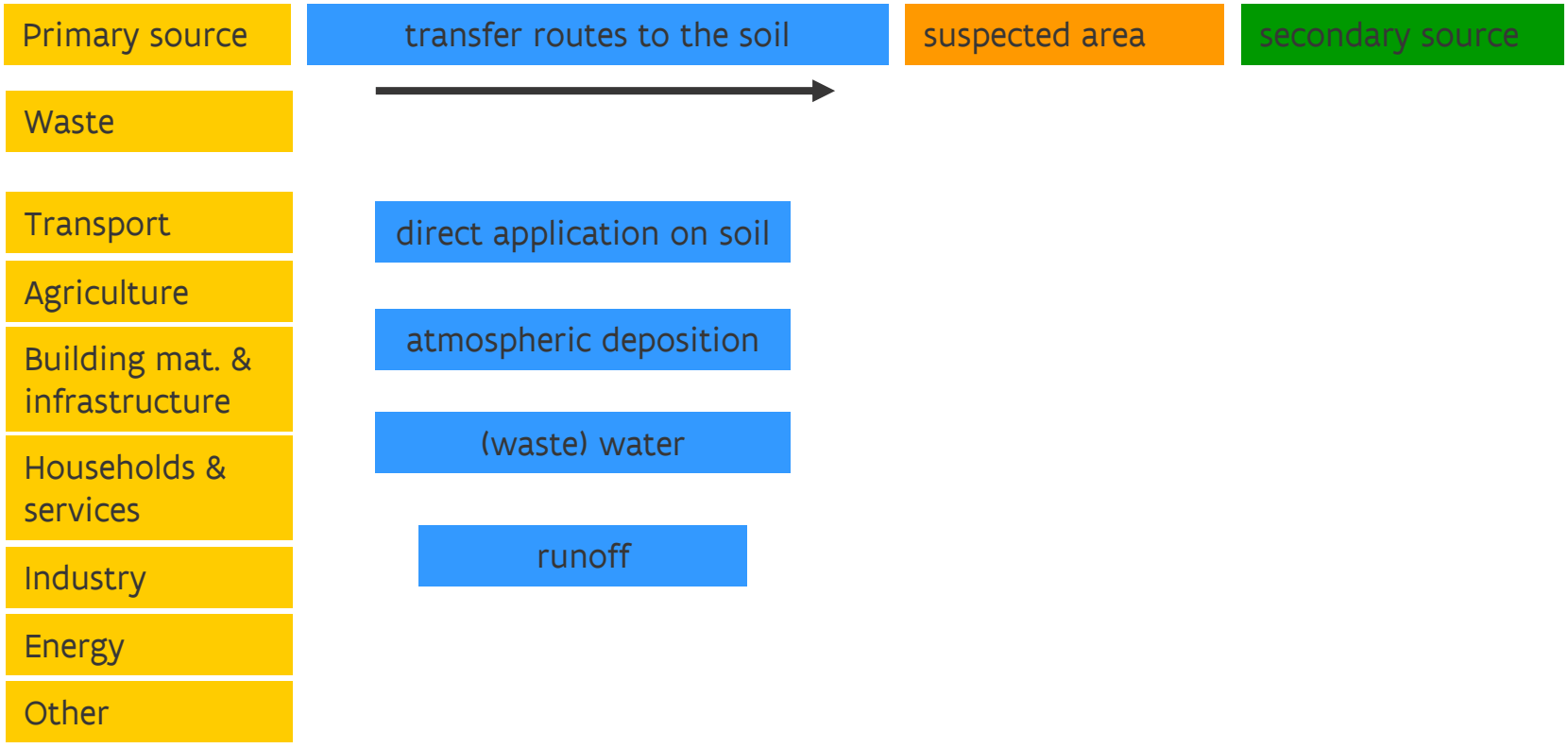
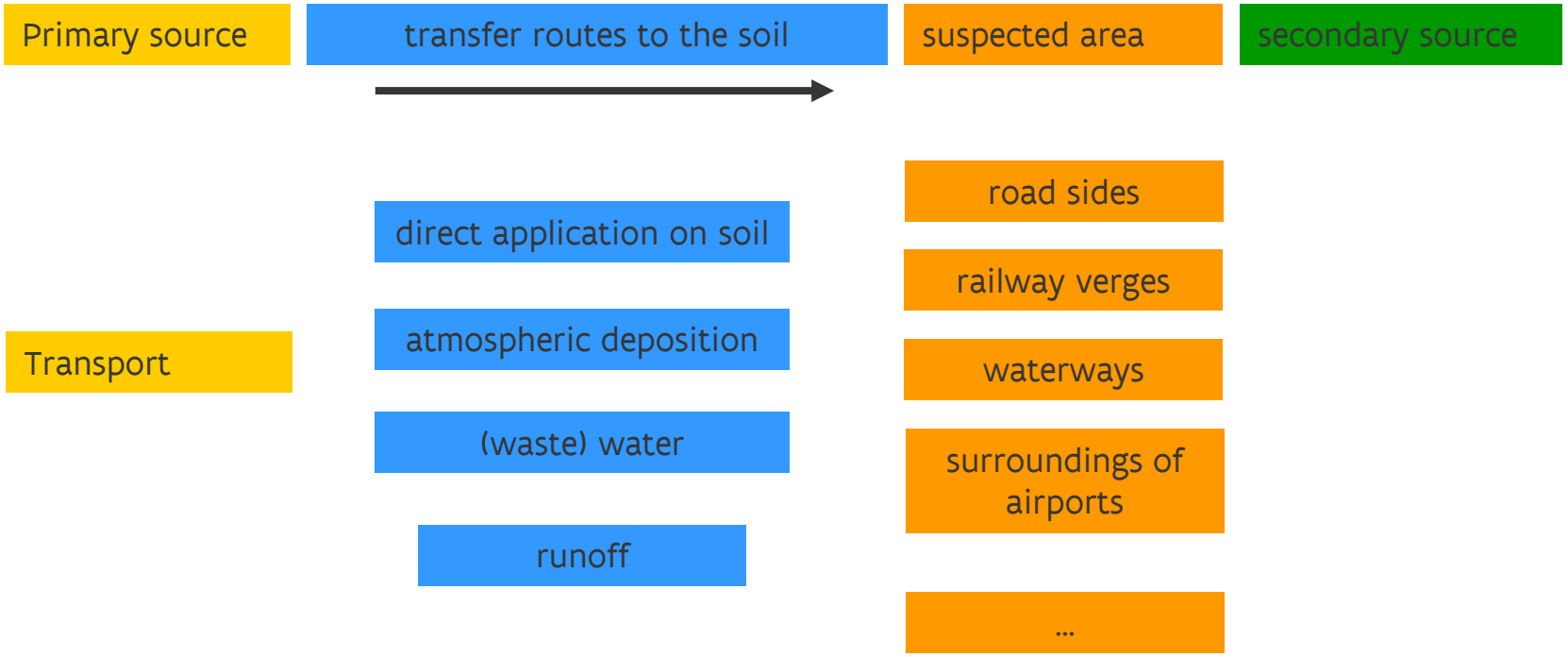
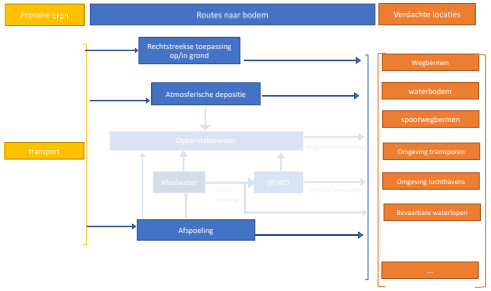


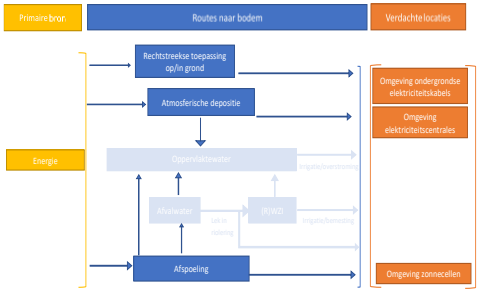
Results - Impact

Example: **Transport**



Results - Impact





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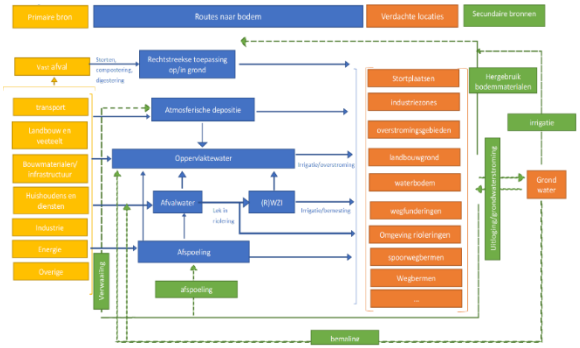

Conceptual site model
for diffuse soil contamination

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Results - Impact

A table with detailed information for each **category**

Suspected area	Info about location	Receptors	Parameters	Most important sources	Impact	Evidence	Knowledge gaps & uncertainties	Possible ways to find more evidence
…								
…								

Results - Recommendations for policy

→ On data & monitoring:

well-targeted measuring campaigns for validation & verification by categories → sectors

→ On legislation:

- proposal for adjustments of legal instruments – a workshop is planned
- **international comparison**, in collaboration with Common Forum

→ On communication (e.g. by the soil certificate), prevention and awareness raising

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Outlook towards the future

Conclusions and plans for the future

An outcome of project 'diffuse soil contamination':
prioritization of most relevant measuring campaigns
→ substances
→ emerging contaminants

⇒ Exploratory and well-targeted measuring campaigns are very useful

⇒ International collaboration
e.g. soil remediation standards: RIVM & VITO
e.g. CF questionnaires on diffuse soil contamination

EmConSoil → ENSOR 2021
→ website: documents, ...
→ other initiatives, ...

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Thank you for your attention

Questions?