

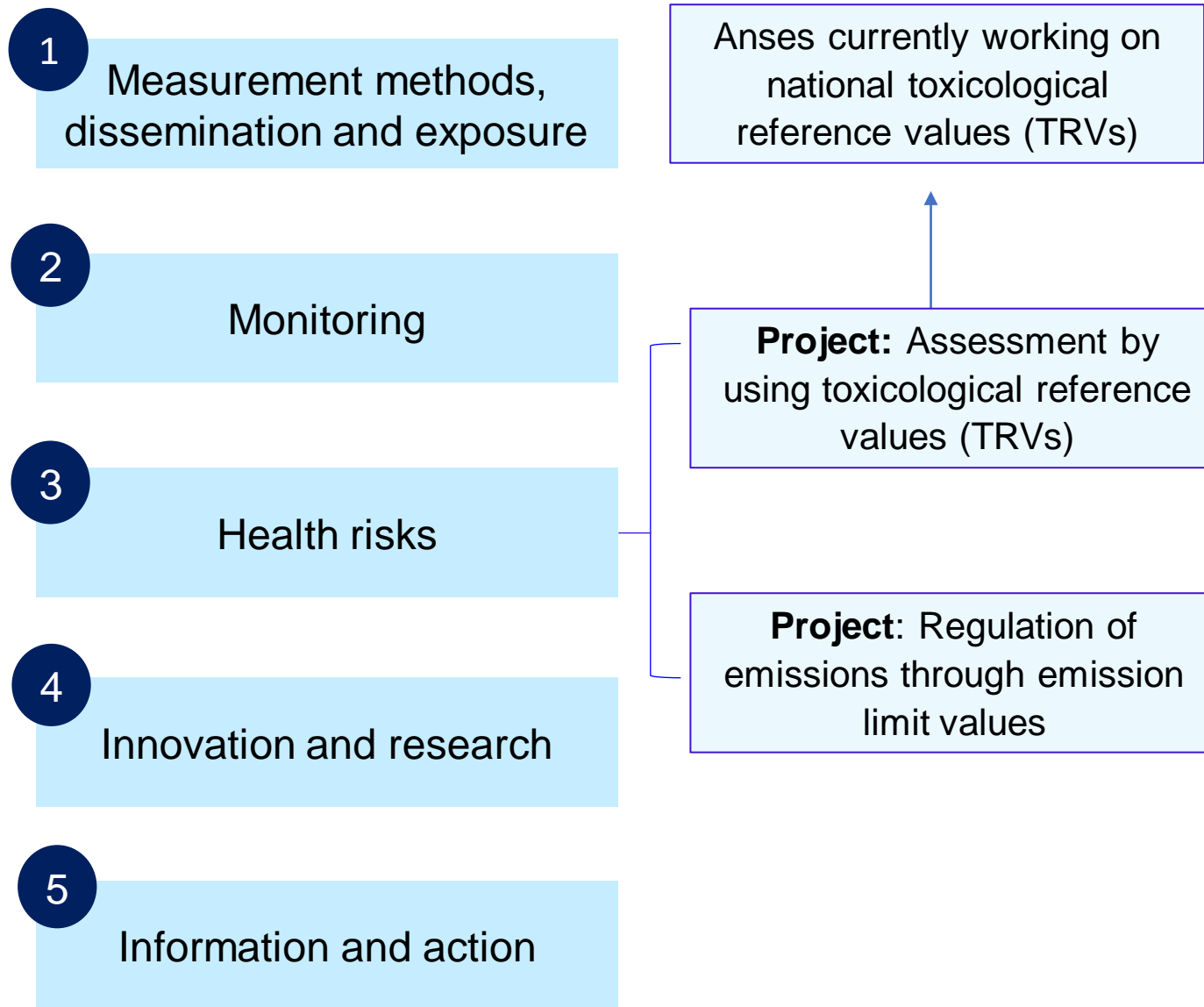
Proposal of emission limit values for per- and polyfluoroalkylated substances (PFAS) based on the study of toxicological reference values (TRVs)

5TH PFAS INTERNATIONAL CONGRESS ON PFAS, 18th June 2025

Interministerial Action Plan on PFAS



Axis



Interministerial Action Plan on PFAS



Axis

- 1 Measurement methods. dissemination and exposure
- 2 Monitoring
- 3 Health risks
- 4 Innovation and research
- 5 Information and action

1

Difficulty to define clear levels of sufficient treatment of PFAS



2

Disparity in the employment of technical and financial means to manage PFAS pollution



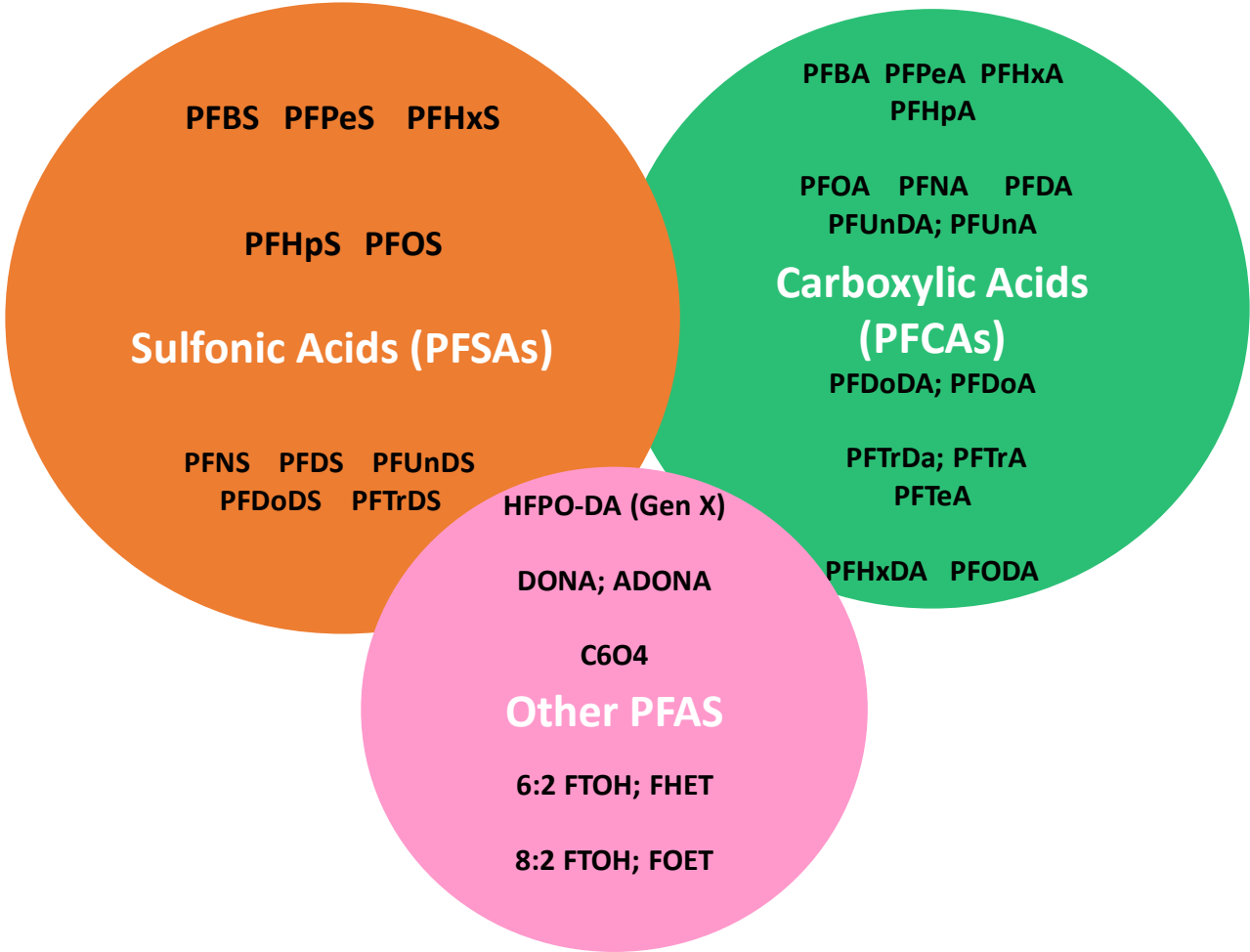
SYPREL's objective: study the levels of treatment considering health risks and technico-economical data

Selection of Substances of Interest

1 Substances mentioned on the ministerial order of June 20th 2023

2 Other substances: trifluoroacetic acid (TFA) (persistent. resistant to treatment by activated carbon). abundant in liquid discharges

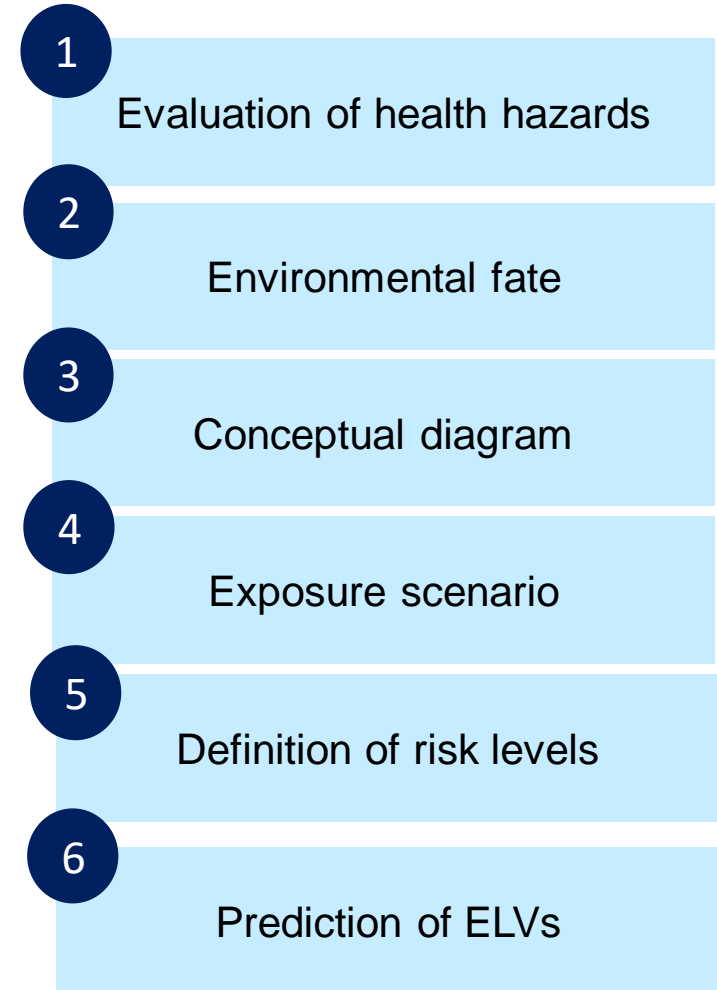
29 Substances



Technical Guidelines



Steps of the assessment



National reference for the establishment of ELVs for industrial facilities for environmental permits

Inventory and Selection of TRVs

Definition of TRVs: values used to quantify the health risk after exposure to a toxic agent.

Types of Effects

- Threshold TRVs
- Non-Threshold TRVs

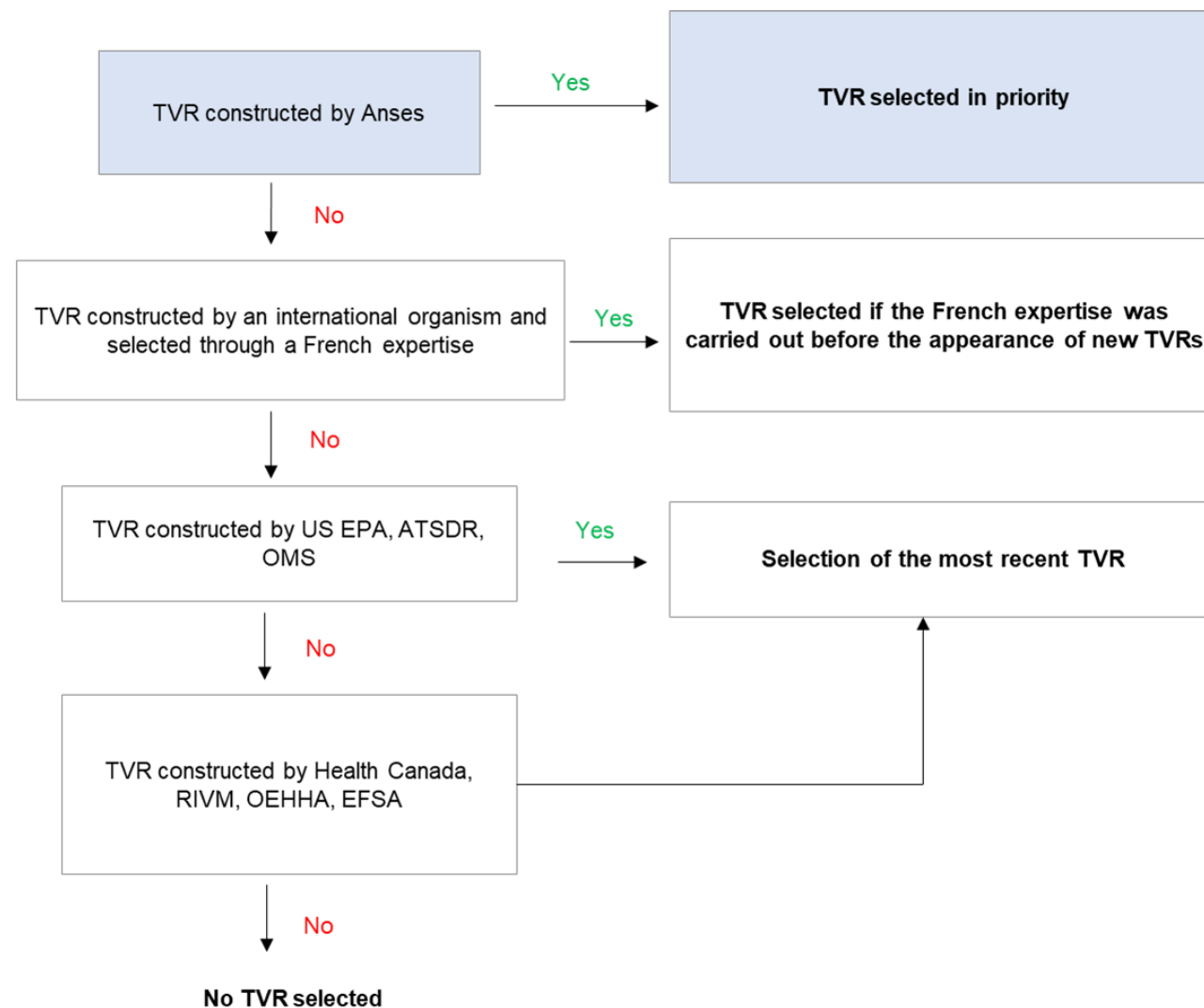
Duration of Exposure

- Acute : hours → days
- Chronic : ≤ 1 year

Exposure routes

- Inhalation
- Ingestion
- Cutaneous

Procedure for the Selection of TRVs



Results of TRVs Inventory

Main results:

- Several TRVs for ingestion;
- No TRVs for inhalation;
- No TRVs for cutaneous route;
- Several PFAS without any TRVs.

PFAS without any available TRVs:

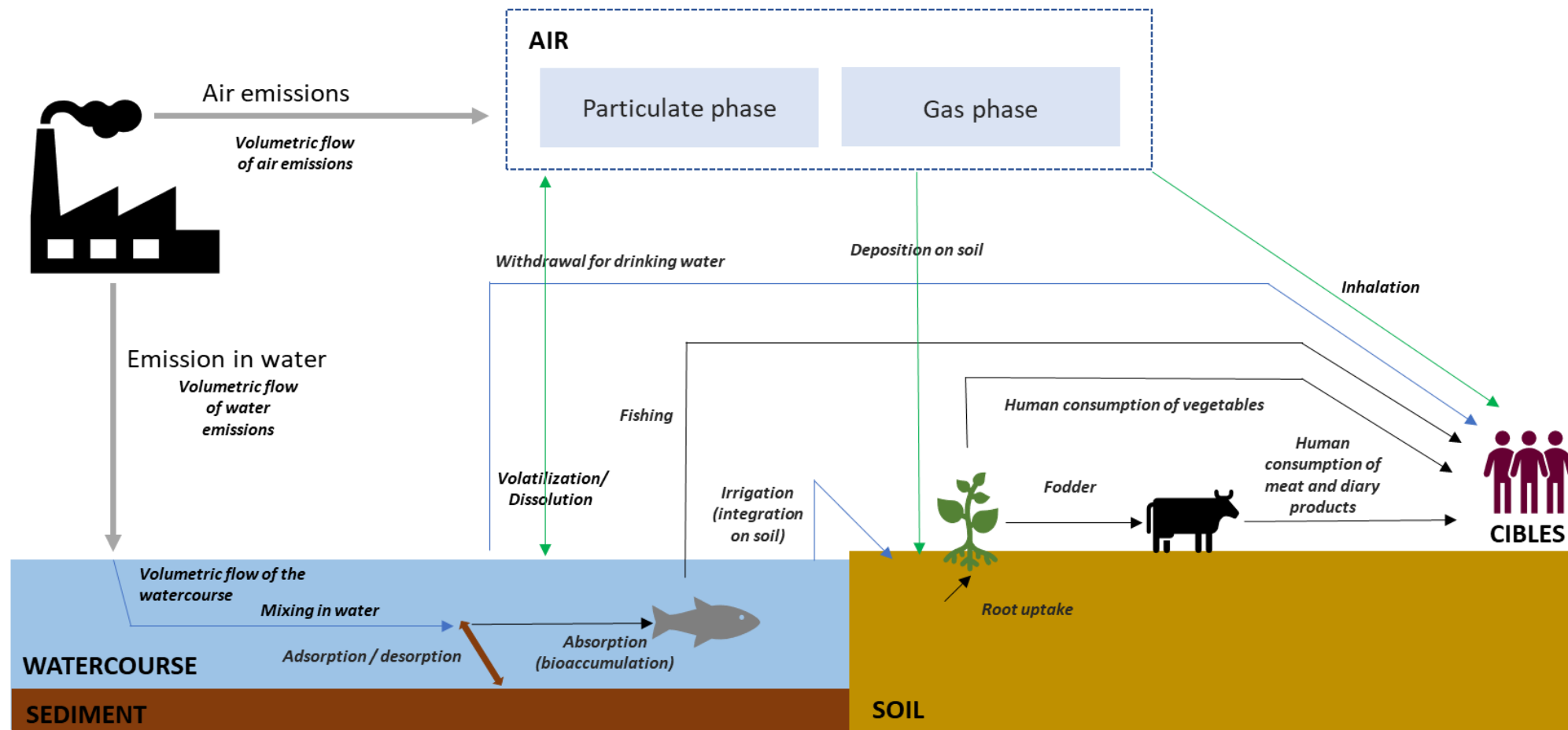
PFPeS. PFHpS. PFUnDS. PFDoDS. PFTrDS. PFTeA ; PFTeDA. PFHxDA. PFODA. Gen X. DONA. C6O4. FHET. FOET.

→ No health risk assessment possible: substances not taken into account for the deduction of ELVs

Examples of TRVs

| Substance | TRV - Chronic exposure | | | | |
|-------------|------------------------|----------|-------------|---|--|
| | Type of TRV | Value | Unit | Target for critical effect | Source |
| PFBA | Threshold VRT | 0.024 | mg/kg/d | Hepatic effects: increase in absolute and relative liver mass and hypertrophy | Anses (2017) |
| PFOA | Threshold VRT | 0.000003 | mg/kg/d | Skeletal alterations in adult offspring | ATSDR (2021) and Washington DOH (2021) |
| | Non-threshold TRV | 2600 | 1/(mg/kg/d) | Kidney cancer | OEHHA (2023) |
| PFOS | Threshold VRT | 0.000002 | mg/kg/d | Delayed eye opening (F1) and transient weight loss | ATSDR (2021) |
| | Non-threshold TRV | 15.6 | 1/(mg/kg/d) | Hepatocellular tumors and pancreas in males | OEHHA (2023) |
| TFA | Threshold TRV | 0.05 | mg/kg/d | Effects on development | EFSA (2017) |

Full Conceptual Diagram



- Emissions from primary source
- Transfers from air
- Transfers from water
- Transfers in the food chain
- Transfers between watercourse and sediment

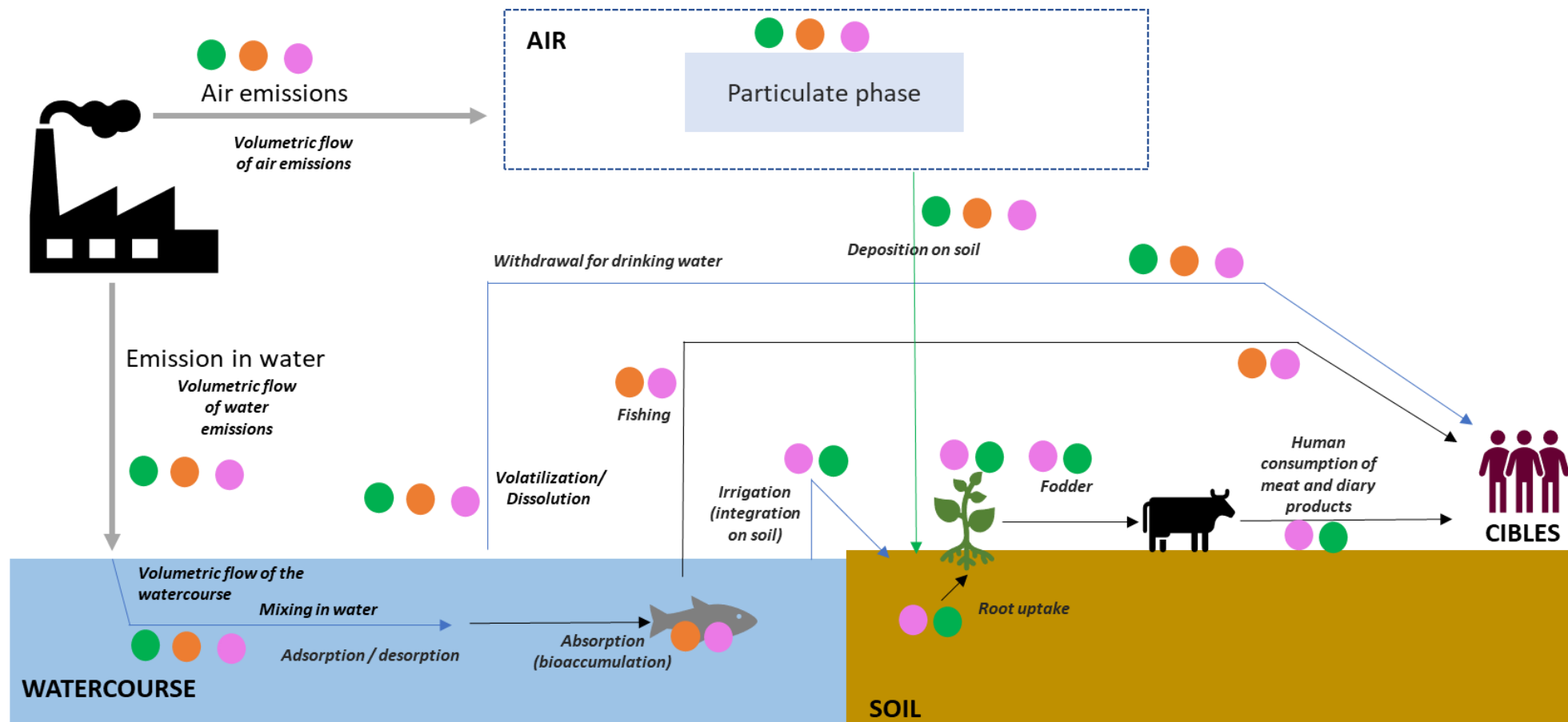
Hypothesis for Simplification of the Conceptual Diagram

- No TRV for inhalation.
- EFSA data. 2020: 70% exposure to PFAS (70% of exposure) via foodstuffs (ingestion).
- EFSA data 2020: PFASs exposure mainly linked to ingestion of fish ingestion and PCFAs exposure mainly linked to the ingestion of dairy products.



- Exposure via inhalation not taken into account.
- PCFAs considered for ingestion of dairy products and ingestion of water.
- PSFAs considered for ingestion of fish and ingestion of water.
- Other families of PFAS considered for both ingestion of fish and dairy products + drinking water.

Simplified Conceptual Diagram



- Emissions from primary source
- Transfers from air
- Transfers from water
- Transfers in the food chain
- Transfers between watercourse and sediment

- **PFCAs:** PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFUnA, PFDODA, PFDoA, PFTTrDA, PFTTrA
- **PFSA:** PFBS, PFHxS, PFOS, PFDS
- **Autres PFAS:** TFA

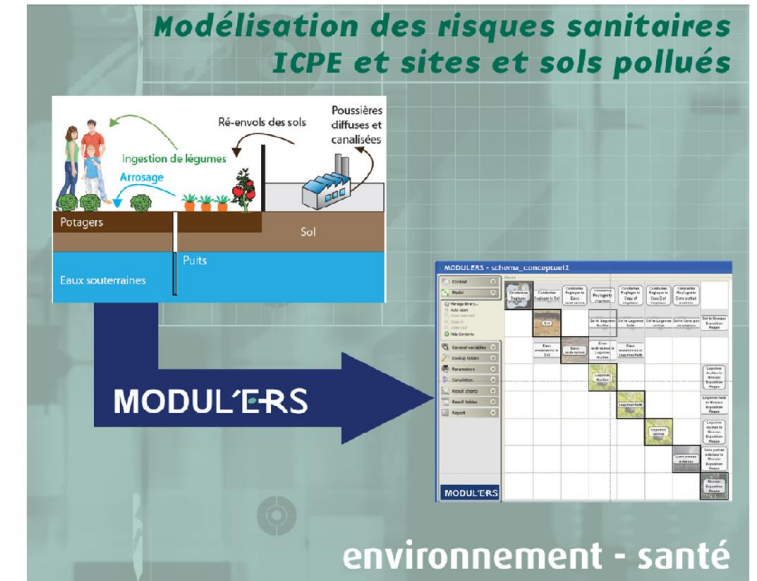
Definition of Risk Levels and Modeling of Environmental Concentrations

Circular of August 9th 2013, relating to the prevention and management of health risks for industrial facilities

- Threshold effects \rightarrow Hazard quotient (HQ) < 1
- Non-threshold effects \rightarrow Individual excess risk (IER) $< 10^{-5}$

Extrapolation for 70% exposure (EFSA)

- Threshold effects \rightarrow Hazard quotients (HQ) < 0.7
- Non-threshold effects \rightarrow Individual excess risks (IER) $< 7 \times 10^{-6}$



Modeling by using equations from
MODULERS

Hypothesis for the Exposure Scenario

| | Process | Description |
|--|------------------------------|---|
| Sources and exposed environmental compartments | Source of emissions | Facility with liquid discharges with constant characteristics |
| | Dilution of discharges | Increasing scale of dilution factors: <ul style="list-style-type: none">• F20• F100• F500• F1000 |
| Pollutant transfers | Mixing of PFAS in water | Homogeneous and complete mixing of the PFAS. |
| | Uptake of PFAS by fish gills | 100% bioavailability |
| | PFAS accumulation in soils | Inputs through irrigation and atmospheric deposition over 30 years |
| Exhibition | Water consumption | All water consumed contains PFAS (not abated during potabilization) |
| | Food (fish. dairy products) | All the fish and dairy products consumed contain PFAS |
| | Target characteristics | Child aged between 1-3 years old |

Hypothesis for the Exposure Scenario and Technico-economical Analysis

| Substance | Modelled concentrations in water (ng/L) |
|------------------|---|
| PFPeA | 3500 |
| PFBA | 10000 |
| PFHxA | 3500 |
| PFHpA | 160 |
| PFOA | 0.06 |
| PFNA | 20 |
| PFDA | 160 |
| PFUnDA ; PFUnA | 77 |
| PFDoDA ; PFDoA | 77 |
| PFTTrDA ; PFTTrA | 77 |
| PFBS | 440000 |
| PFHxS | 30 |
| PFOS | 0.05 |
| PFDS | 57 |
| TFA | 260000 |

Compatibility of environmental concentrations with current and projected quality standards in the European Union

| Substance | Regulatory value | |
|-----------|---|---|
| | Environmental quality standard for surface water - Annual average. EU 2013 (ng/L) | Environmental quality standard for biota. EU 2013 (µg/kg) |
| PFOS | 0.65 ✓ | 9.1 ✓ |

Technico-economical analysis

Industrial feedback : maximum performances of treatment with activated carbon allow concentration in discharges of a value of 100 ng/L to be obtained.

Hypothesis for the Exposure Scenario and Technico-economical Analysis

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*Extrapolation by using
dilution factors*



Initial values for establishment of
ELVs



Evaluation of current regulation
targeting PFAS



Technical and economic
constraints



Final ELVs

Proposal of ELVs - Initial values for establishment of ELVs

| Substance | Predicted concentration in water (ng/L) | F20 (ng/L) | F100 (ng/L) | F500 (ng/L) | F1000 (ng/L) |
|-----------------------|---|----------------|-------------|-------------|--------------|
| PFPeA | 3500 | 70000 | 350000 | 1700000 | 3500000 |
| PFBA | 10000 | 140000 | 700000 | 3500000 | 7000000 |
| PFHxA | 3500 | 70000 | 350000 | 1700000 | 3500000 |
| PFHpA | 160 | 3200 | 16000 | 81000 | 160000 |
| PFOA | 0.06 | 1 | 6 | 30 | 60 |
| PFNA | 20 | 390 | 1900 | 9700 | 19000 |
| PFDA | 160 | 3200 | 16000 | 81000 | 160000 |
| PFUnDA ; PFUnA | 77 | 1500 | 7700 | 39000 | 77000 |
| PFDoDA ; PFDoA | 77 | 1500 | 7700 | 39000 | 77000 |
| PFTrDA ; PFTrA | 77 | 1500 | 7700 | 39000 | 77000 |
| PFBS | 440000 | 8800000 | 44000000 | 220000000 | 440000000 |
| PFHxS | 30 | 570 | 2900 | 14000 | 29000 |
| PFOS | 0.05 | 0.9 | 5 | 20 | 50 |
| PFDS | 57 | 1100 | 5700 | 28000 | 57000 |
| TFA | 260000 | 5300000 | 26000000 | 130000000 | 260000000 |

Proposal of ELVs - Evaluation of Current Regulation targeting PFAS

Caption

Regulatory reference values

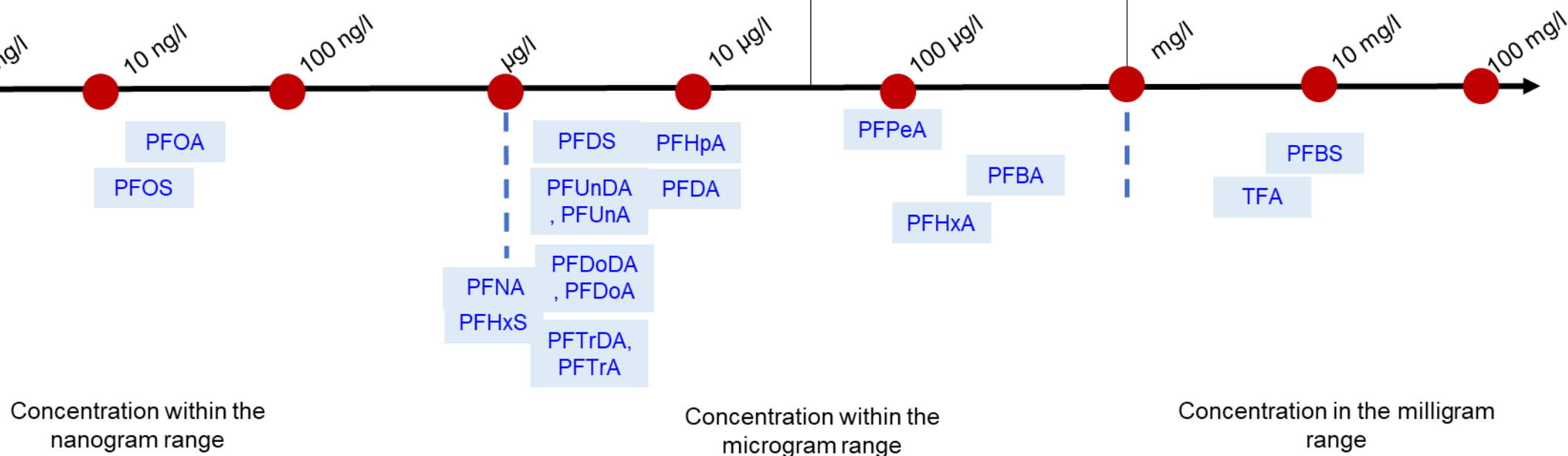
Order of the concentration value predicted for compatibility with health, based on the choice of regulatory TRV

PFOS EQS surface water (0.65 ng/l)

ELV F20 = 13 ng/L
ELV F100 = 65 ng/L

PFOS ELV MO 02/02/98 (25 µg/l)

AOX/EOX ELV MO 02/02/98 (1 mg/l)



Proposal of ELVs for an Ordinary Facility

| Substance | CAS Number | Proposed ELV for a plant (ng/L) | Proposed ELV for a plant (ng/L) |
|------------------------|------------|---------------------------------|---------------------------------|
| PFPeA | 2706-90-3 | 100000 | 0.1 |
| PFBA | 375-22-4 | 100000 | 0.1 |
| PFHxA | 307-24-4 | 100000 | 0.1 |
| PFHpA | 375-85-9 | 1000 | 0.001 |
| PFOA | 335-67-1 | 100 | 0.0001 |
| PFNA | 375-95-1 | 400 | 0.0004 |
| PFDA | 335-76-2 | 1000 | 0.001 |
| PFUnDA; PFUnA | 2058-94-8 | 1000 | 0.001 |
| PFDoDA; PFDoA | 307-55-1 | 1000 | 0.001 |
| PFTTrDA; PFTTrA | 72629-94-8 | 1000 | 0.001 |
| PFBS | 375-73-5 | 250000 | 0.25 |
| PFHxS | 355-46-4 | 500 | 0.0005 |
| PFOS | 1763-23-1 | 100 | 0.0001 |
| PFDS | 335-77-3 | 1000 | 0.001 |
| TFA | 76-05-1 | 1000000 | 1 |

Proposal of ELVs for a Facility Located in a Sensitive Zone

| Substance | N° CAS | ELV (ng/L) | ELV (mg/L) |
|-----------|-----------|------------|------------|
| PFOA | 335-67-1 | 1.2 | 0.0000012 |
| PFOS | 1763-23-1 | 0.9 | 0.0000009 |

Main take-aways and outlook

Emission threshold values consider:

- health risk management criteria for the general population;
- existing regulations;
- technico-economic constraints associated with effluent treatment and analyses.

An efficient application of these threshold values must consider:

- PFAS background concentrations in the environment;
- other parameters (volumetric and mass flows, pH, temperature, etc.);
- existing quality standards and an acceptable level of health risk.

Current Anses work to elaborate new TRVs → Potential update of the study to come