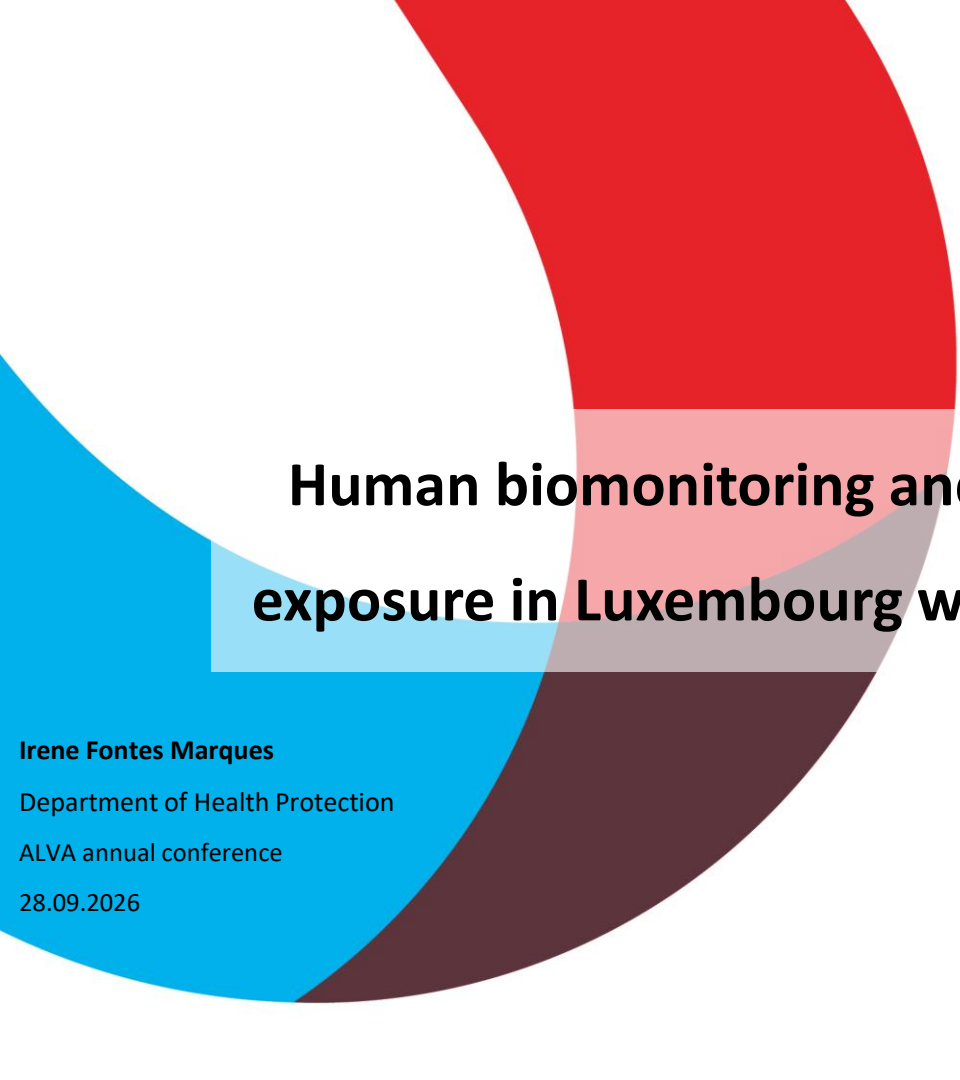




Human biomonitoring and risk assessment of PFAS exposure in Luxembourg within the PARC programme

Irene Fontes Marques

Department of Health Protection

ALVA annual conference

28.09.2026



LABORATOIRE NATIONAL DE SANTÉ



FORENSIC MEDICINE



NATIONAL CENTER OF
PATHOLOGY



NATIONAL CENTER OF
GENETICS (NCG)



ADMINISTRATION,
FINANCE AND
SUPPORT SERVICES



MEDICAL BIOLOGY



MICROBIOLOGY



HEALTH PROTECTION



HEALTH PROTECTION

Supports public health and health care for problems caused or aggravated by the environment:

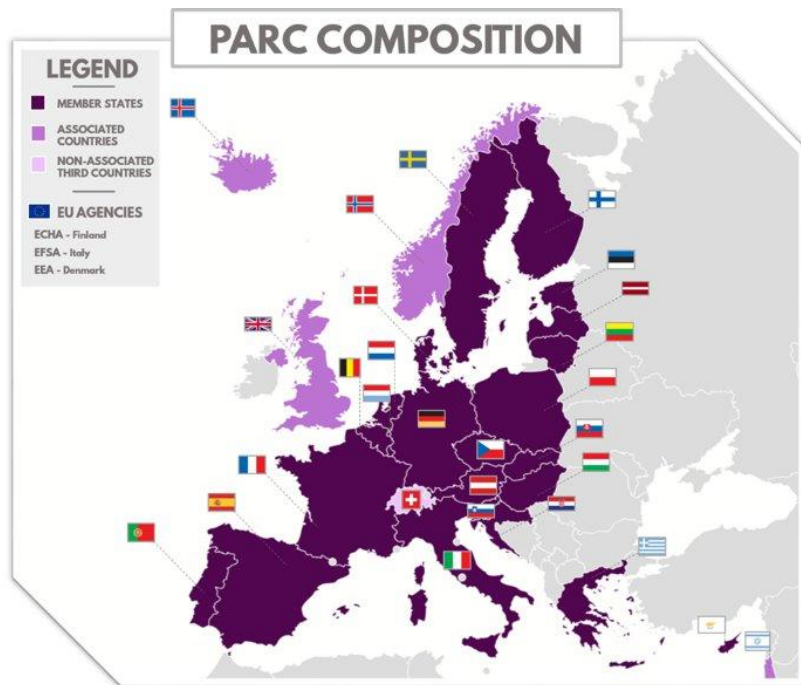
- Chemical and microbiological analyses of dust, air and surface samples
 - Human biomonitoring (HBM) in blood, urine, and hair samples
-
- National Service for Environmental Medicine at CHEM
 - **European science-policy programs** – epidemiological surveys that involve HBM and/or environmental/occupational exposure assessment



Partnership
for the
Assessment
of
Risks
from
Chemicals



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Project	Partnership for the Assessment of Risk from Chemicals (PARC)
Aim	To develop next-generation chemical risk assessment to protect human health and the environment.
Duration	7 years (2022-2029)
Funding	Co-funded 50% by EC and 50% by national governments
Collaborators	28 countries ≈ 200 institutions 3 EU authorities (ECHA, EFSA, and EEA*)
Coordinator	ANSES*

***ECHA**: European Chemical Agency; **EFSA**: European Food Safety Authority;
EEA: European Environment Agency; **ANSES**: French Agency for Food Safety,
Environmental Protection and Occupational Health



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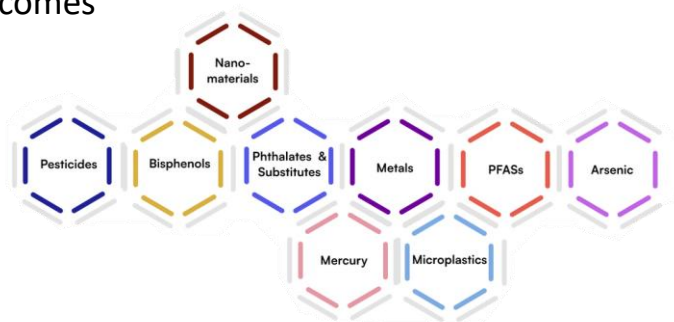
Aims to harmonize HBM surveys from the very start:

- **Unified SOPs:** identical field sampling, handling, and storage protocols before any samples are collected
- **Analytical methods:** laboratories must pass joint QA/QC
- Common core questionnaires & codebooks
- Aligned age groups & recruitment periods

Outcome → Comparable, high-quality data for robust risk assessment across Europe

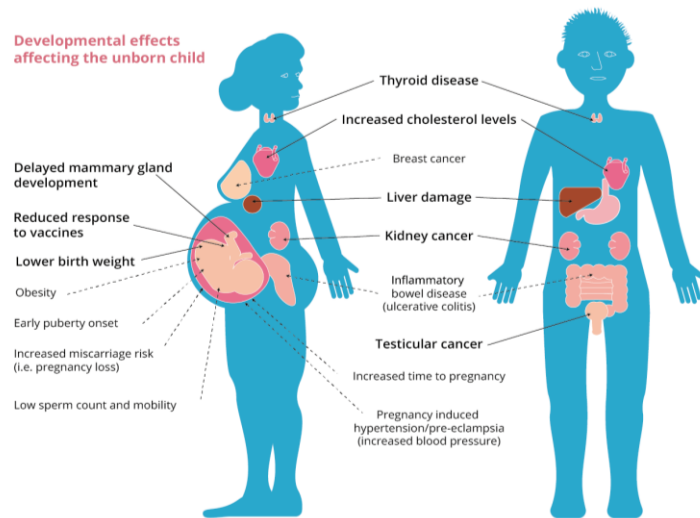
PFAS are a priority chemical group within PARC due to their persistence, widespread exposure and potential health impacts.

- Per- and polyfluoroalkyl substances (PFAS) are a large group of human-made chemicals that are persistent in the environment, widespread and bioaccumulative in humans and wildlife
- In humans, PFAS exposure has been associated with multiple health outcomes



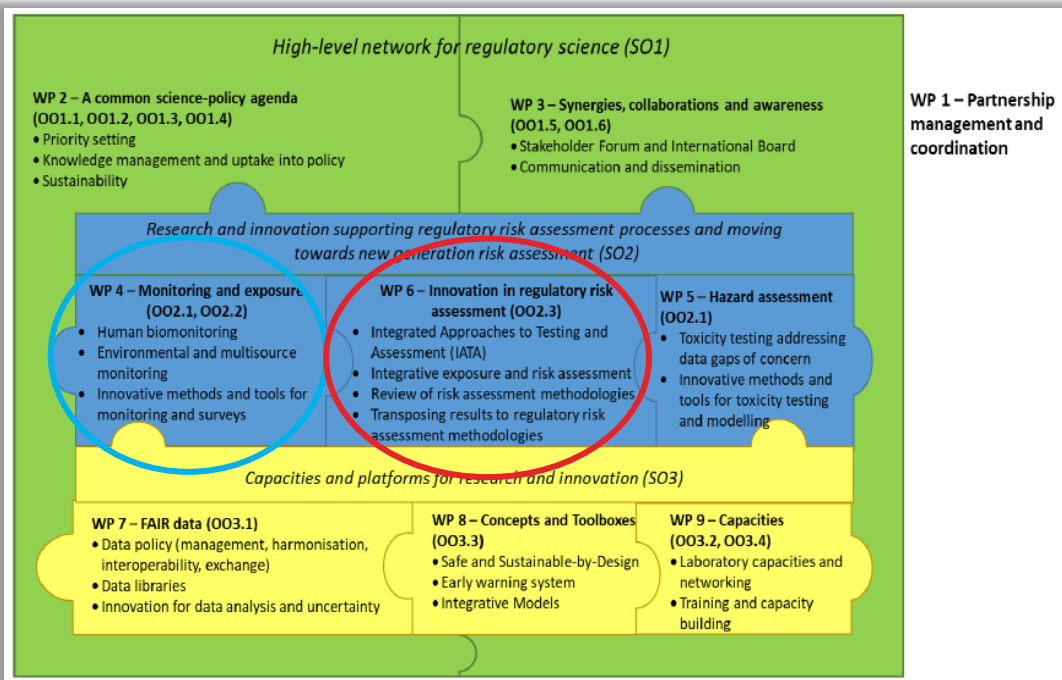
— High certainty
- - - Lower certainty

Developmental effects
affecting the unborn child



Health effects of PFAS in human health. Source: EEA

LNS contribution to PARC PFAS activities



4.1. HBM

- **Laboratory targeted analysis**
- **General population HBM**
- **Targeted studies:**
 - PFAS in mother-child (general population, early-life)
- **Occupational population HBM:**
 - Waste management survey
- **HBM-GV derivation**

4.2. Environmental monitoring

- **Indoor monitoring**

4.3. Innovative methods

- **Suspect screening**

6.2. Integrated approach for exposure and risk assessment

- **Aggregate exposure from multiple sources and routes**
- **Case study on PFAS-immunotoxicity on real-life mixtures and environmental burden of disease**



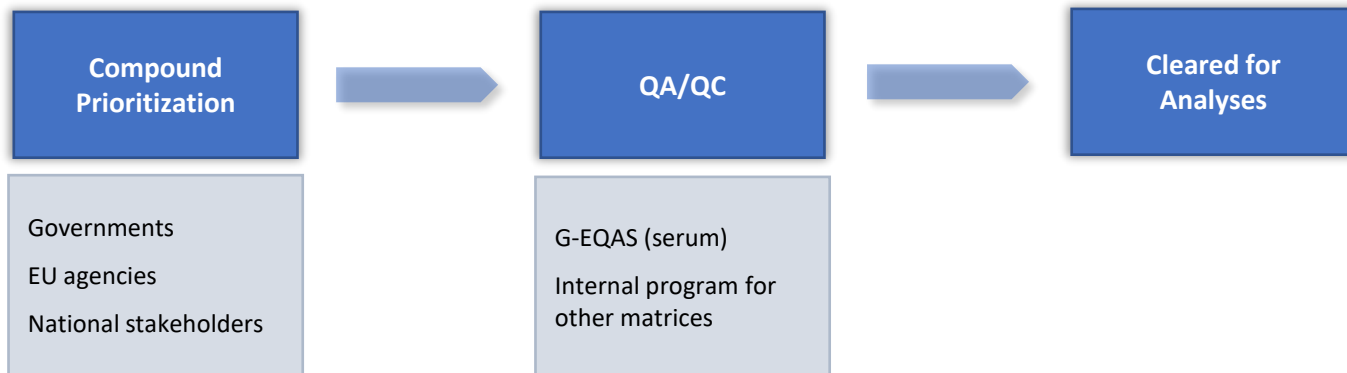
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WP 4

Monitoring and exposure

WP 4 – PFAS Laboratory targeted analysis & Suspect Screening



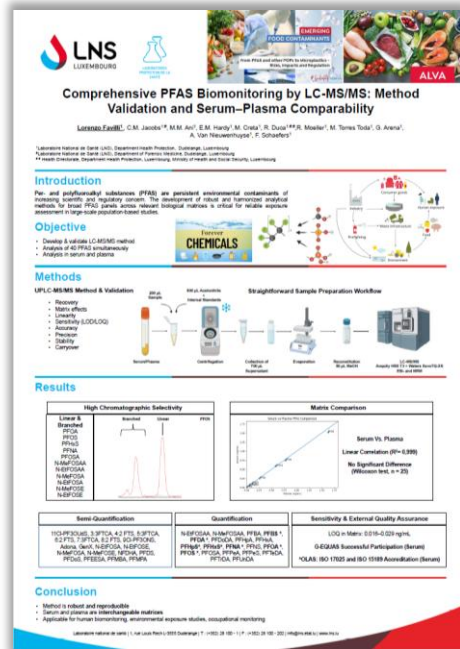
PFAS prioritized in PARC

Compulsory list: PFOA, PFOS, PFNA, PFHxS, PFDA, PFBS, PFHpS

Discovery list: 4:2 FTSA, 6:2 FTSA, 8:2 FTSA, 9CL-PF3ONS, PFHxA, PFHpA, PFDoDA, PFUnDA, PFPeA, PFBA, PFNS, EtFOSAA, MeFOSAA, Adona, Genx

Short-chain list: TFA, PFPrA, PFETs, PFPrS, PFPeS, PFHxA, PFPeA, PFBS

WP 4 – PFAS Laboratory targeted analysis & Suspect Screening



PFAS assessment at LNS

Blood serum: compulsory & discovery lists

- Passed PARC QA/QC program
- Method accredited at LNS

Urine: short-chain list

- PARC QA/QC program in late 2026

Other matrices (dust, water, milk) & Suspect Screening: currently sent to other PARC laboratories



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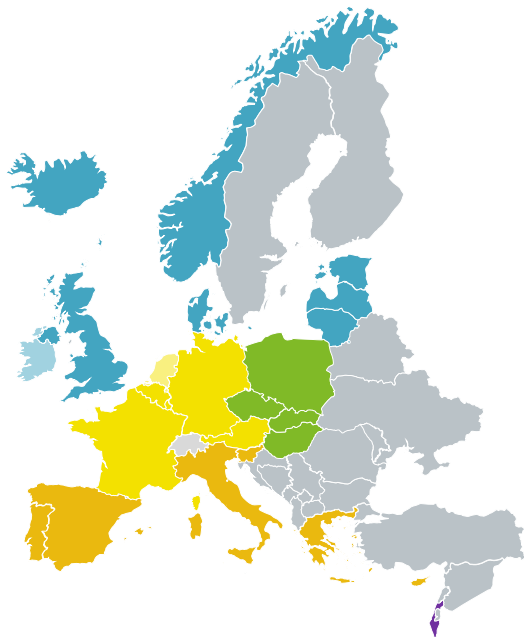
WP 4

Monitoring and exposure

HBM Surveys in the General Population

WP 4 – General population HBM & indoor monitoring

24 countries



Luxembourg: LëtZHBM (300 children and 300 adults)

300 CHILDREN (6-11y)



Biomarkers of exposure to

- Plasticizers: bisphenols, phthalates, and DINCH
- Metals
- Pesticides
- PFAS
- Flame retardants
- Mycotoxins

Biomarkers of effect

- Renal markers
- Oxidative stress

300 ADULTS (18-39y)



Biomarkers of exposure to

- Plasticizers: bisphenols, phthalates, and DINCH
- Metals
- Pesticides
- PFAS
- Flame retardants
- Mycotoxins

Biomarkers of effect

- Thyroid hormones
- Metabolic markers
- Neurotoxicity
- Oxidative stress
- Immunotoxicity

300 RESIDENCES

Environmental samples



- Indoor settled dust
- Indoor air
- Drinking water

PFAS: blood, urine, dust, and water

WP 4 - Targeted studies: PFAS in breast milk and infant health

8 countries



Luxembourg: LëtzhBM Early-life Survey (240 mother-child pairs)

	Pregnancy 3 rd trimester	Birth	1-2 months	6 month
Mother	  		     	  
Child		 	   	   
	Sampling at CHL/CHEM		Sampling at home, by LNS	



PFAS: blood, urine, milk



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WP 4

Monitoring and exposure

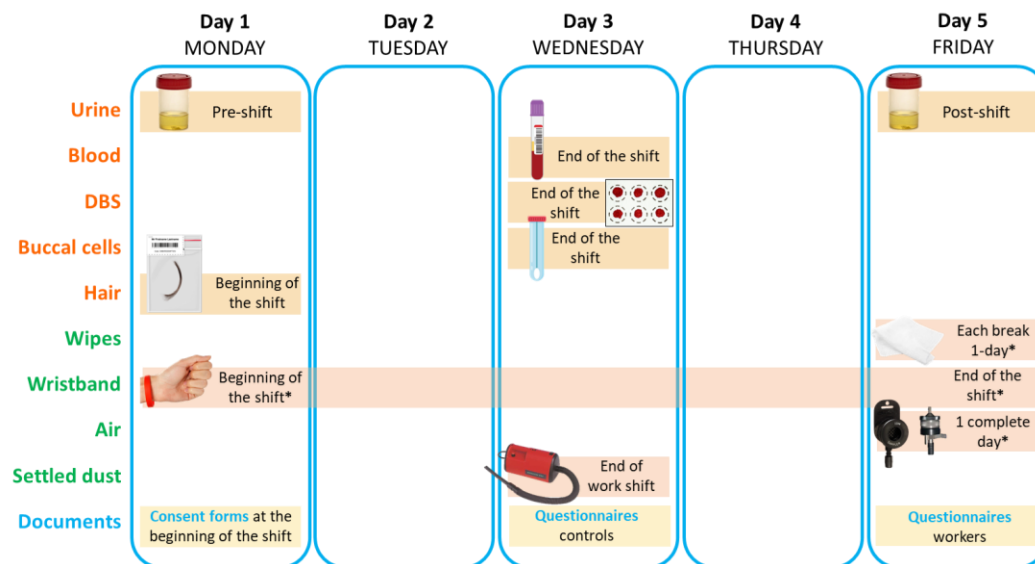
HBM Surveys in Occupational Population

WP 4 - Occupational population HBM: Waste Management Survey

13 countries



Luxembourg: 58 participants, 4 companies (29 workers / 29 controls)



PFAS: blood

WP 4 – HBM Surveys: Examples of questions to be addressed

- Current exposure levels & time patterns

- Geographical comparisons

- Exposure determinants

- Association with health effects

- Are workers exposed to PFAS when handling waste?

- Which working conditions explain exposure variability?



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WP 4 - Human Biomonitoring Guidance Values Derivation (HBM-GVs)

What are HBM-GVs?

- Values up to to which, according to current knowledge, no adverse health effects are to be expected when considering individual substances
- Obtained from animal and/or human available literature
- Support risk assessment and regulatory decision-making

LNS contribution:

- Led the scoping document on PFAS





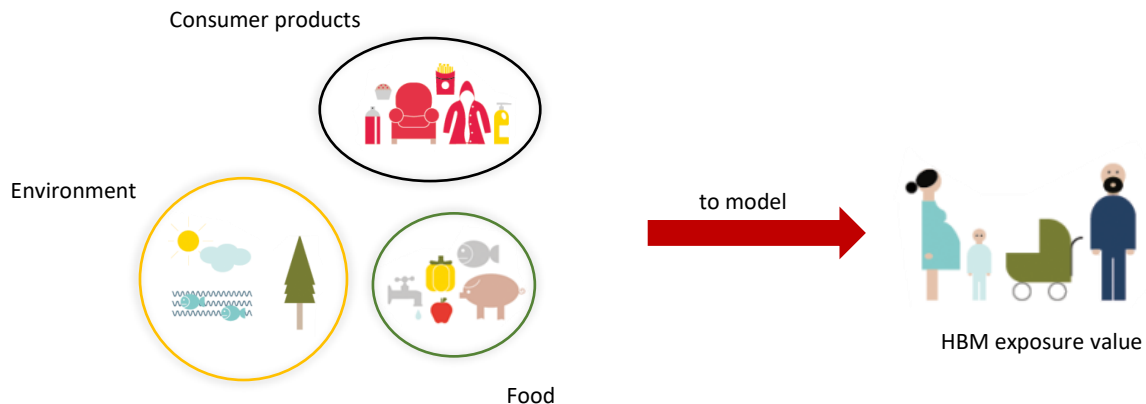
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WP 6

Innovation in regulatory Risk Assessment

WP 6 - Aggregate exposure from multiple sources and routes



Aggregate exposure: Exposure from multiple sources (i.e., water, air, dust, diet, consumer products etc.) and/or from multiple routes (ingestion, inhalation, dermal contact).

WP 6 - Case study on PFAS-immunotoxicity

Real-life mixture risk assessment: to perform harmonized mixture risk assessment using individual HBM data within the relevant case studies

PFOA, PFOS, PFNA, PFHxS, PFDA, PFBS, PFHxS, 4:2 FTSA, 6:2 FTSA, 8:2 FTSA, 9CL-PF3ONS, PFHxA, PFHpA, PFDoDA, PFUnDA, PFPeA, PFBA, PFNS, EtFOSAA, MeFOSAA, Ado, Genx, TFA, PFPrA, PFETs, PFPrs, PFPeS, PFHxA, PFPeA, PFBS, PFOS, PFNA, PFHxS, PFDA, PFBS, PFHpS, 4:2 FTSA, 6:2 FTSA, 8:2 FTSA, 9CL-PF3ONS, PFHxA, PFHpA, PFDoDA, PFUnDA, PFPeA, PFBA



HBM exposure value
&
risk assessment

Environmental burden of disease (Health Impact Assessment): to calculate attributable burden of environmental risk factors (e.g., DALYs) in harmonized way using individual HBM data

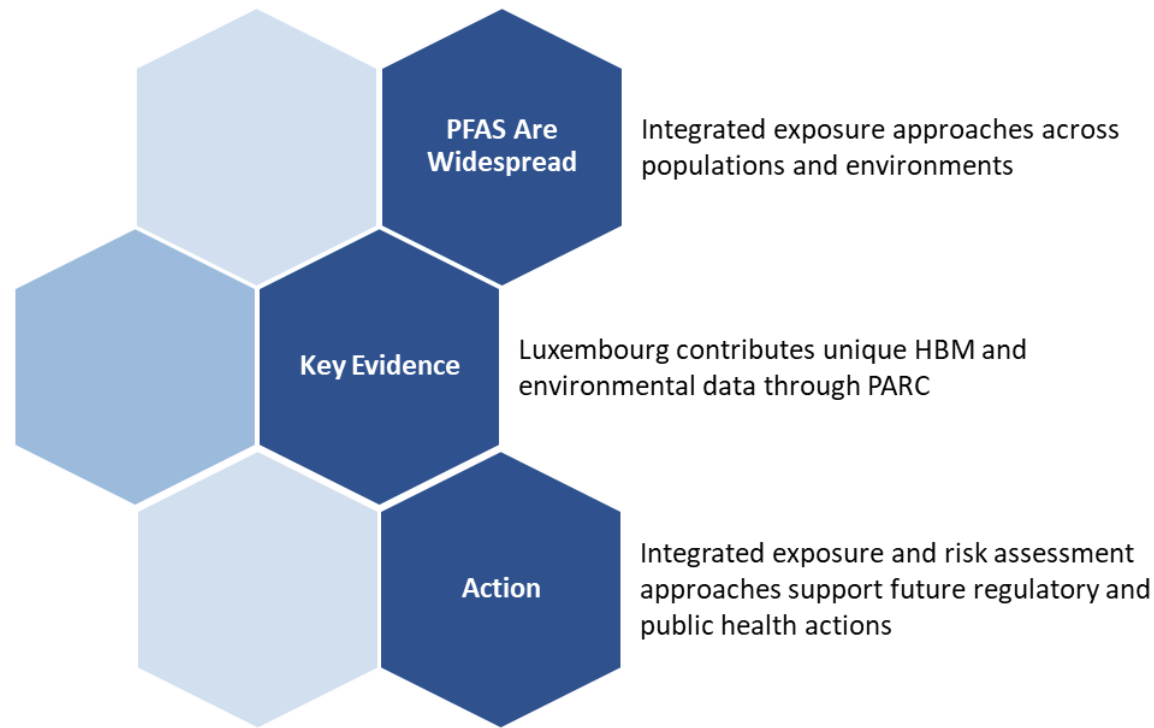




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Conclusions



Human biomonitoring provides the evidence needed to protect current and future generations.

Questions?

