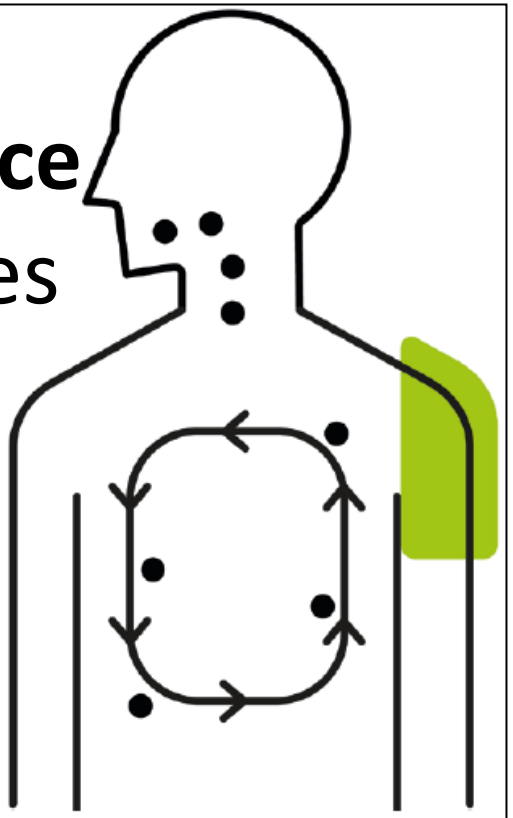
German Federal Institute for Risk Assessment

Highlights of the BfR International conference

PFAS – Challenges and Scientific Perspectives in Human Health Risk Assessment

October, 2025 in Berlin



Presented at the EFSA Workshop on latest advancements of PFASs risk assessment
by Jorge Numata (BfR) in Parma, Italy
17 Nov 2025

BfR PFAS conference 8-10 October, 2025

What has happened in the following areas since the EFSA 2020 PFAS opinion?

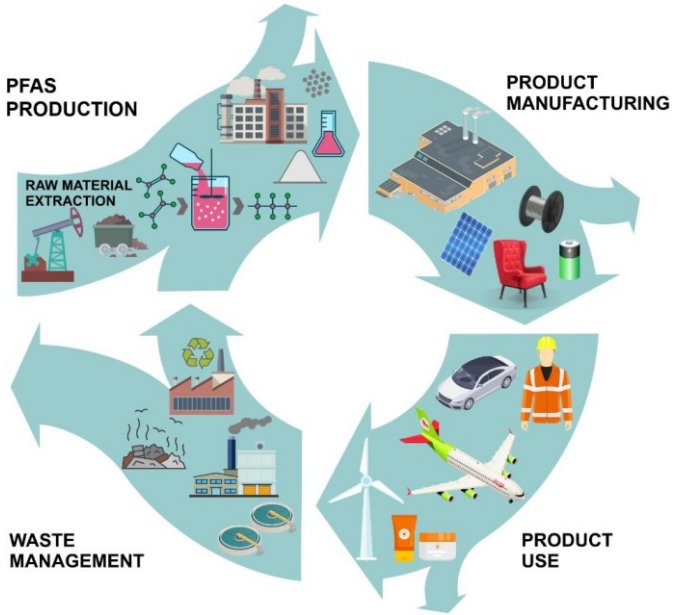
- **Targeted and Untargeted Analytical Methods**
- **External and Internal Exposure**
- **Toxicokinetics**
- **Toxicity**
- **In Silico Methods**
- **New Approach Methodologies**

Session I: The PFAS Situation on Assessment and Regulations	
12:30–13:00	**Background and State of Play on the PFAS Restriction** Dr Christian Unkelbach, Federal Institute for Occupational Safety and Health, Germany
13:00–13:30	**PFAS Everywhere?! Sources and Pathways of Human Exposure** Prof Dr Stuart Harrad, University of Birmingham, United Kingdom
13:30–14:00	**EFSA 2020: Risk Assessment and related Challenges** Dr Ron Hoogenboom, Wageningen University & Research, Netherlands

Background and State of Play on the PFAS Restriction

Dr Christian Unkelbach, Federal Institute for Occupational Safety and Health, Germany

- **EU REACH PFAS restriction aims to minimize environmental emmissions during manufacture, use and disposal**
- **Dossier background document update Aug25**
- **New use sectors considered incl. military, sealing, printing…**
- **Regulatory landscape increasingly emphasizing life-cycle analysis across sectors**



Picture Source: EEA Eionet Report - ETC/WMGE 2021/9

PFAS Everywhere?! Sources and Pathways of Human Exposure

Prof Dr Stuart Harrad, University of Birmingham, United Kingdom

- **For $EFSA_4$-PFAS, UK adult exposure mainly dietary, ~10X more than dust ingestion, followed by drinking water and air inhalation**
- **For infants, breast feeding major pathway. For toddlers, indoor dust likely exceeds diet, with drinking water and air inhalation minor contributors**
- **Precursors may be important. Volatile Me and EtFOSEs is an order of magnitude greater than for the $EFSA_4$ in special cases**
- **Under a high-end exposure scenario, 60-80% of PFOS body burden forecast to arise from precursors**

Session III: External Exposure	
16:30–17:00	**Challenges in External Exposure Assessment** Dr Christian Jung, BfR, Germany
17:00–17:30	**PFAS in Drinking Water – Toxicological Assessment, Regulation and Monitoring** Dr Alexander Eckhardt, German Environment Agency, Germany
17:30–18:00	**PFAS in Different Food Matrices** Dr Runa S. Boeddinghaus, Landwirtschaftliches Technologiezentrum Augustenberg, Germany

Session III: External Exposure

Picture: BfR

- **Jung: BfR MEAL total diet study shows low food concentrations in general, but isolated “hot spots” and uncertainties due to varying LOQs and left-censored data. Need for more sensitive methods and greater sampling density (more plant-based foods and other undersampled matrices).**
- **Eckhardt: EU Drinking Water Directive with 3 tiers: PFAS-20, EFSA4 and PFAS-total. This approach reflects a shift toward Σ parameters, aiming for Σ <50 ng/L**

Session II: Development and Application of Targeted and Untargeted Analysis	
14:30–15:00	**Target Analysis: New Developments in Matrices and Detection Limits** Dr Stefan van Leeuwen, Wageningen Food Safety Research (WUR), The Netherlands
15:00–15:30	**Untargeted Methods: Overview of Existing Methods** Dr Bernd Göckener, Fraunhofer Institute for Molecular Biology and Applied Ecology IME, Germany
15:30–16:00	**Untargeted Methods: Suitability to Determine PFAS in Human Blood?** Dr Dorte Herzke, Norwegian Institute for Public Health, Norway

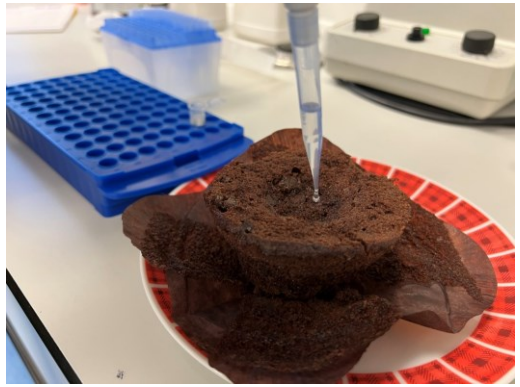
Session II: Development and Application of Targeted and Untargeted Analysis

- **Van Leeuwen: Rapid developments in analytics. Targeted analysis of more PFAS—moving from legacy to ultra-short chain, volatile, lipophilic and precursor PFAS. New methods quantify 57 PFAS in a single run for food and water. Sensitivity for feed LOQs should be improved.**
- **Goeckener emphasizes importance of untargeted methods—Extractable Organic Fluorine (EOF), Adsorbable Organic Fluorine (AOF), and Total Fluorine (TF).**
- **Herzke: Targeted PFAS analyses for blood explain the majority of PFAS in populations with background exposure. For highly exposed populations, untargeted methods appear to be necessary as well.**

Session IV: Internal Exposure	
09:05–09:35	**Temporal Development of Internal Exposure** PhD Greet Schoeters, University of Antwerp, Belgium
09:35–10:05	**Kinetics in Humans** PD Dr Klaus Abraham, BfR, Germany
10:05–10:35	**Sources, Fate and Exposure to Trifluoroacetic Acid (TFA)** Dr Finnian Freeling, German Water Centre, Germany

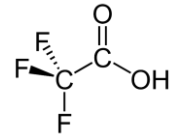
Session IV: Internal Exposure

- **Schoeters: Harmonized monitoring in Europe shows significant % of teens and adults exceed HBGVs for PFOS and EFSA-4. Pooled biobank samples show legacy PFAS declining but widely above HBGV in vulnerable groups. (Ultra)short-chain PFAS contribute to overall internal exposure.**
- **Abraham presents results of a self-experiment for kinetics of 15 labeled PFAS dosed in ethanol in muffins.**



Picture: BfR

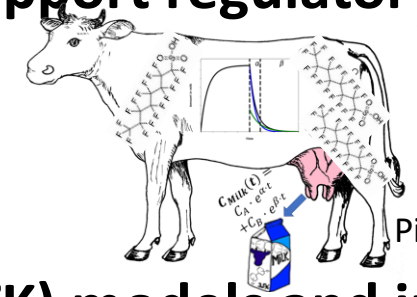
- **Freeling identifies potential dietary TFA exposure routes from edible plants that rival (or exceed) drinking water. TFA sources likely multiple. / Discussion point: We should avoid regrettable substitutes if TFA-producing pesticides are forbidden.**



Session V: In Silico Methods to Describe Toxicity and Toxicokinetics	
11:00–11:30	**Transfer Along the Path Feed-Animal-Food of Animal Origin** Dr Jorge Numata, BfR, Germany
11:30–12:00	**Understanding half-life variability using mechanistic kinetic modelling** Dr James Chan, Agency for Science, Technology and Research, Singapore
12:00–12:30	**In silico tools to model PFAS toxicity** PhD Periklis Tsiros, National Technical University of Athens, Greece

Session V: In Silico Methods to Describe Toxicity and Toxicokinetics

- **Numata: Experimentally-calibrated and model-based prediction of PFAS transfer into eggs, milk, offal and meat for many farm species. Support regulatory decisions by linking feed levels to MLs in food. ConTrans website.**



Picture: MRI/BfR

- **Chan: Combines physiologically-based toxicokinetic (PBTK) models and in vitro ADME assays to explain PFAS kinetics mechanistically in humans and lab animals. Risk ranking according to accumulation potential.**

- **Tsiros: Comprehensive quantitative structure-activity relationship (QSAR) and machine learning (ML) models for PFAS toxicity endpoints.**

Session VI: Toxicity	
14:00–14:30	**Animal Data and the Challenges in Human Health Risk Assessment** Senior Scientist Dr Louise Ramhøj, DTU National Food Institute, Denmark
14:30–15:00	**C8 Health Study and Veneto Cohort Study: Exposure and Health Impacts Assessment** Prof Tony Fletcher, London School of Hygiene and Tropical Medicine, United Kingdom
15:00–15:30	**Health effects of high PFAS drinking water exposure in Ronneby, Sweden** Prof Kristina Jakobsson, University of Gothenburg, Sweden

- **Ramhøj: Toxicological evidence from rodents clarifying effects on thyroid gland, development, immune system, liver and reproduction. Consistent with human epidemiology for PFOS, PFOA, PFNA, PFHpA.**
- **Fletcher & Jakobsson summarize multiple cohorts like C8 Panel (USA), Veneto, Ronneby, and Jersey Channel Is., showing correlation with effects like increased cholesterol, thyroid disease, and some cancers. Intervention studies in humans show that treatment with an anion exchange resin reduces PFAS (especially PFOS) in serum. The treatment is offered to suitable affected patients.**

Session VI: Toxicity	
16:30–17:00	**Epidemiological Data on the Most Sensitive Endpoint in Humans: Immunotoxicity** Prof Thorhallur I. Halldorsson, University of Iceland, Iceland
17:00–17:30	**Mode of Action on Immunotoxicity** Dr Macon Carroll, Oregon State University, United States of America
17:30–18:00	**Carcinogenic Hazard: PFOA and PFOS** PhD Frederica Madia, International Agency for Research on Cancer, France

Session VI: Toxicity

- **Halldórsson: Animal and human data strongly suggests long-chain PFAS affect immune system. But: effect size in rodent studies highly variable and epidemiological data noisy.**

- **Carroll: molecular and cellular mechanisms of immunotox: Disruption of B-cell proliferation, modulation of pathways like NF-kB, calcium signaling and PPARα activation.**

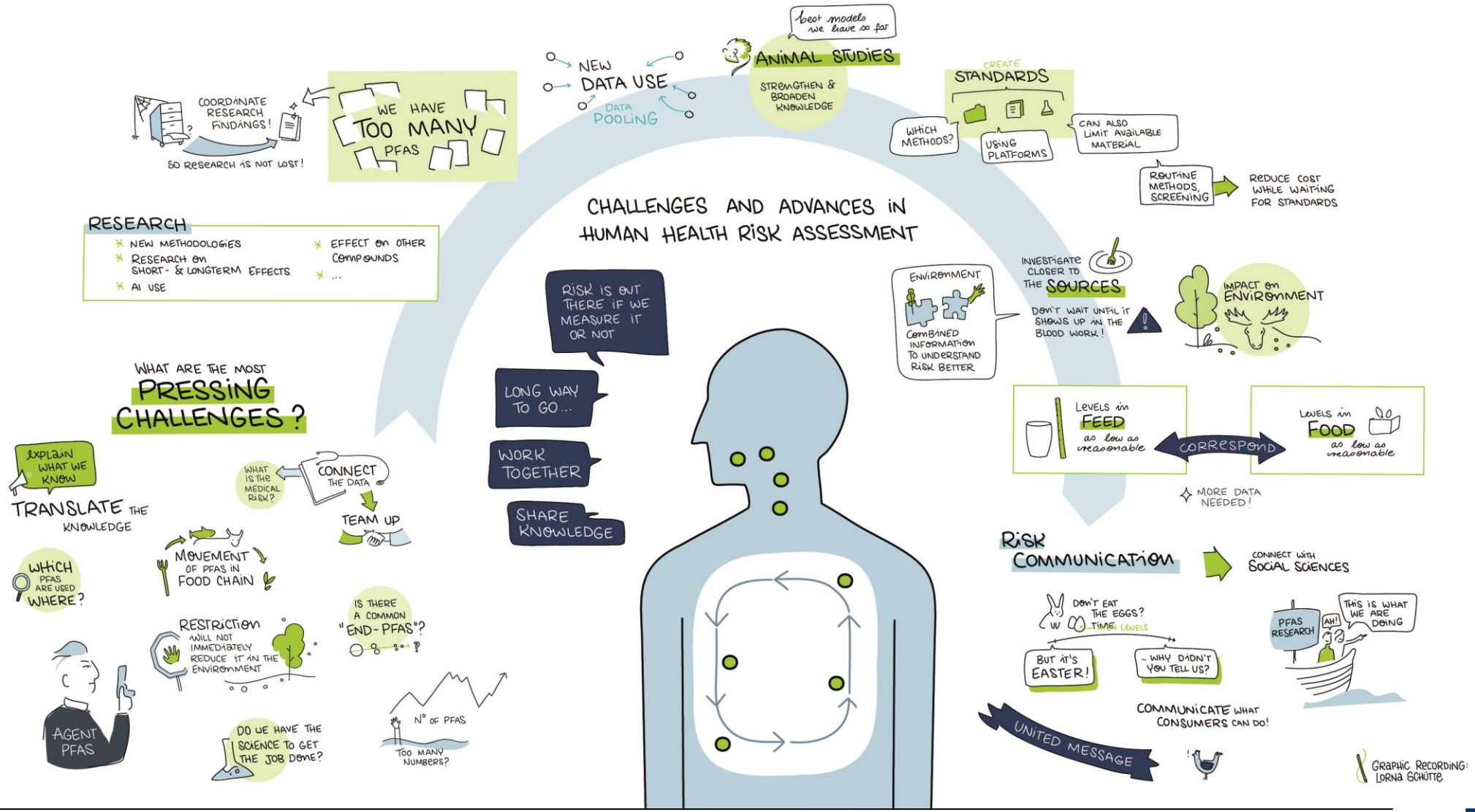
- **Madia: Carcinogenicity of PFAS (PFOA and PFOS): IARC classification based on human studies (limited evidence!), animal studies, and mechanistic studies.**

Session VII: Future Perspectives	
09:05–09:35	**Consideration of Potency Factors for the Human Health Risk Assessment** Dr Ron Hoogenboom, Wageningen University & Research, Netherlands
09:35–10:05	**The use of NAMs for PFAS risk assessment** Prof Dr Iseult Lynch, University of Birmingham, United Kingdom
10:05–10:35	**Challenges and data needs in PFAS Risk Assessment** Associate Professor Xenia Trier, University of Copenhagen, Denmark

Session VII: Future Perspectives

- **Hoogenboom: Critical view of current Relative Potency Factors (RPFs). Internal RPFs for decreased spleen and thymus weight (Bil et al. 2023) were not useful in deriving dose-response curves of EFSA 4-PFAS and antibody response to vaccination in (Abraham et al. 2020). Data still lacking to derive RPFs for the critical low-dose effect on the immune system.**
- **Trier emphasizes major gaps in analytical standards and toxicity data for the vast number (over 14,000) of PFAS. Accepting semi-quantitative and proxy data within risk frameworks when standards are lacking. Pragmatic use of all available evidence including NAM-generated using uncertainty analysis.**

Panel Discussion, graphical recording, by Laura Schütte



Thank you for your attention

You can download most conference presentations here:

https://www.bfr-akademie.de/english/archive/2025/pfas2025.html