MUNI | RECETOX

Stockholm Convention
Regional Centre

Regional Case Study: Strengthening regional capacity to produce reliable POPs monitoring data in the Central and Eastern Europe

by Kateřina Šebková, for RECETOX, SCRC Czech Republic, the RECETOX RESEARCH INFRASTRUCTURE and Regional Organizational Group under the Global monitoring Plan of the Stockholm Convention for EEG

RECETOX, FACULTY OF SCIENCE, MASARYK UNIVERSITY, CZECH REPUBLIC

Strengthening Capacity to Better Produce and Use POPs Monitoring Data, Global NIP project 10785 webinar series, online, 29 October 2026

RECETOX in Brief

The RECETOX is a leading Czech research institute covering a broad range of basic and applied research on toxic compounds in the environment and their effect on human health.

Functions of RECETOX:

- Research activities
- Education programmes
- Open-Access Research Infrastructure
- Science to Policy and Society platforms (National Centre for Toxic Compounds, **Stockholm Convention Regional Centre for Capacity Building and the Transfer of Technology**)
- Application of research results

RECETOX
Faculty of Science
Masaryk University
Brno, Czech Republic







Why do we monitor chemicals in the environment?

Why do we need to measure chemicals in the environment and human exposure to them?

- Objective of the chemical MEAs: to protect the environment and human health from exposure to POPs (Stockholm Convention) and mercury (Minamata Convention)
- Parties have to implement the MEAs = need to put relevant measures in place to achieve the objective and minimize risks to its environment and population = need to know whether the target chemicals are present and what are the levels
- Parties are obliged to put in place their National Implementation Plans (Art 7 - SC) or action plans (ASGM and emissions for MC) and also report on their activities (Art 15 - SC, Art 21 - MC)
- Effectiveness evaluation of SC (Art 16) and MC (Art 22)

How to measure chemicals in the environment and human exposure to them?

- need a procedure
- need methods (guidance and SOPs and instrumentation)
- need tools - to analyze samples, to work with data…
- need trained people and experts

collaboration between science and policy
communication of the work, visibility and broader use

Steps in arranging POPs monitoring (or any chemical monitoring)

1. **Design of the campaign (one-off) or regular (long-term) monitoring** including method applied and timeline such as “before-during-after” remediation or “quarterly” or long-term activity (10 years) or pilot studies or risk assessment surveys
2. **Sample collection** - well established methods (active, passive, in collaboration with local partners), Standard operating procedure for sampling available (and accredited), capacity building/trainings - videos, paper descriptions, online help line of experts etc
3. **Chemical analysis of the samples** - accredited laboratory
4. **Data reporting** - QA/QC, blanks, interpretation, modeling, report to dedicated repository/ database/report or in line with the requirements of each regulatory instrument

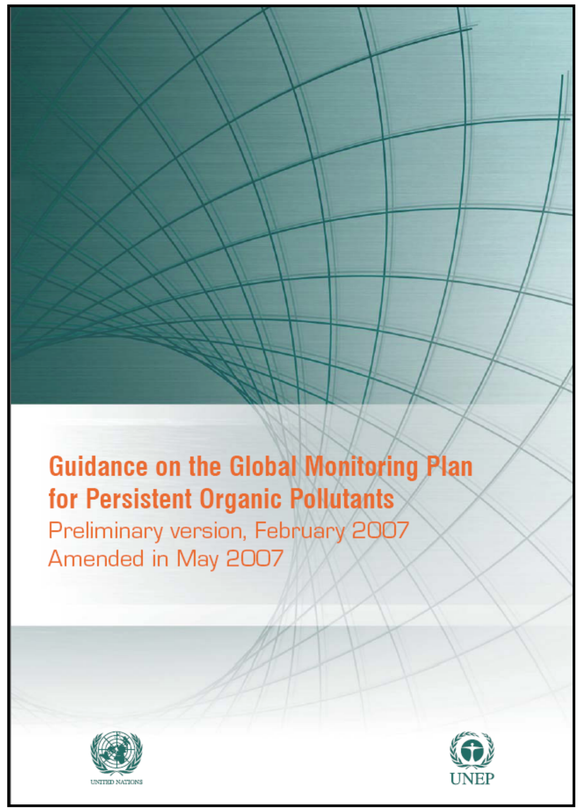
Arrangements for POPs Monitoring under the Stockholm Convention on Persistent Organic Pollutants (POPs)

- Objective: to protect environment and health from exposure to POPs
- Monitoring activities are organized on the basis of Convention text: **Article 16 - Stockholm Convention on POPs "…**provide a harmonized organizational framework for the collection of **comparable monitoring data on the presence of POPs from all regions, in order to identify changes in their concentrations over time, as well as on regional and global environmental transport**."

- the arrangements is a **framework** called the **Global Monitoring Plan for Persistent Organic Pollutants** with expert arrangements and technical guidelines.
- Outcomes of GMP (regional and global reports) are used as key input into the effectiveness evaluation of the Stockholm Convention and have a potential to be used also elsewhere - data and trends (i.e. Convention on Biological Diversity and Montreal-Kunming targets, FAO reports, WHO work, SDG targets implementation)

Stockholm Convention - Global Monitoring Plan - range

Technical background



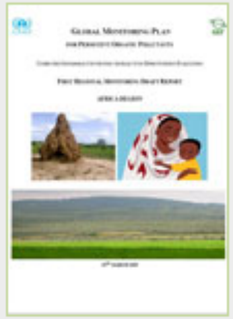
Stockholm Convention POPs
Included in UNEP First Global Monitoring Report (2009)[6] [Entry-into-force May 2004]
Aldrin
Chlordane
Dichlorodiphenyltrichloroethane (DDT)
Dieldrin
Endrin
Heptachlor
Hexachlorobenzene (HCB)
Mirex
Polychlorinated biphenyls (PCBs)
Polychlorinated dibenzo dioxins/furans (PCDD/Fs)
Toxaphene
Included in UNEP Second Global Monitoring Report (2017)[7] [Listed May 2009/2011/2013]
Chlordecone
Endosulfan
Hexabromobiphenyl (HxBB-153)
Hexabromocyclododecane (HBCD)
Hexachlorocyclohexanes (HCHs)
Pentachlorobenzene (PeCB)
Perfluorooctanesulfonic acid (PFOS)
Polybrominated diphenyl ethers (PBDEs)
New' Persistent Organic Pollutants [Listed May 2015/2017/2019]
Decabromodiphenyl ether (BDE 209)
Dicofol
Hexachloro-1,3-butadiene (HCBD)
Pentachlorophenol (PCP)
Perfluorooctanoic acid (PFOA)
Polychlorinated naphthalenes (PCNs)
Short-chain chlorinated paraffins (SCCPs)

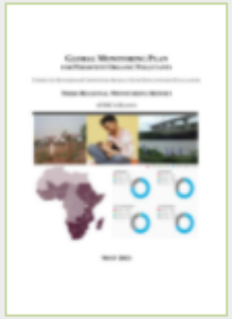
- key document (2007) - regularly updated
- defines **scope** - chemicals, **core media** - air, human breast milk/blood, water, **procedures:** sampling procedures, analytical techniques, data handling, harmonization and comparability

Outputs of the POPs Global Monitoring Plan

periodic regional monitoring reports and the global report - prepared every 6 years in line with GMP cycle

Regional Monitoring Report for Africa





Regional Monitoring Report for Asia and the Pacific





Annex

Annexes

Regional Monitoring Report for Central and Eastern Europe





Annex

Annexes

Core media for GMP

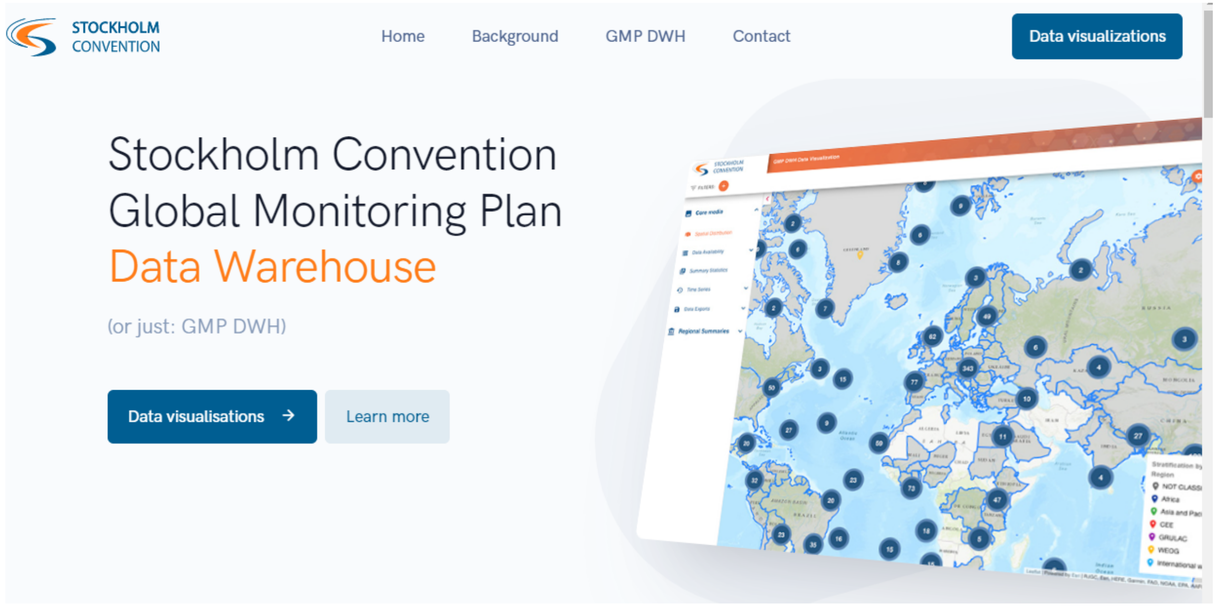
Air, human tissues (blood, milk)

Water – PFOS, PFOA, PFHxS

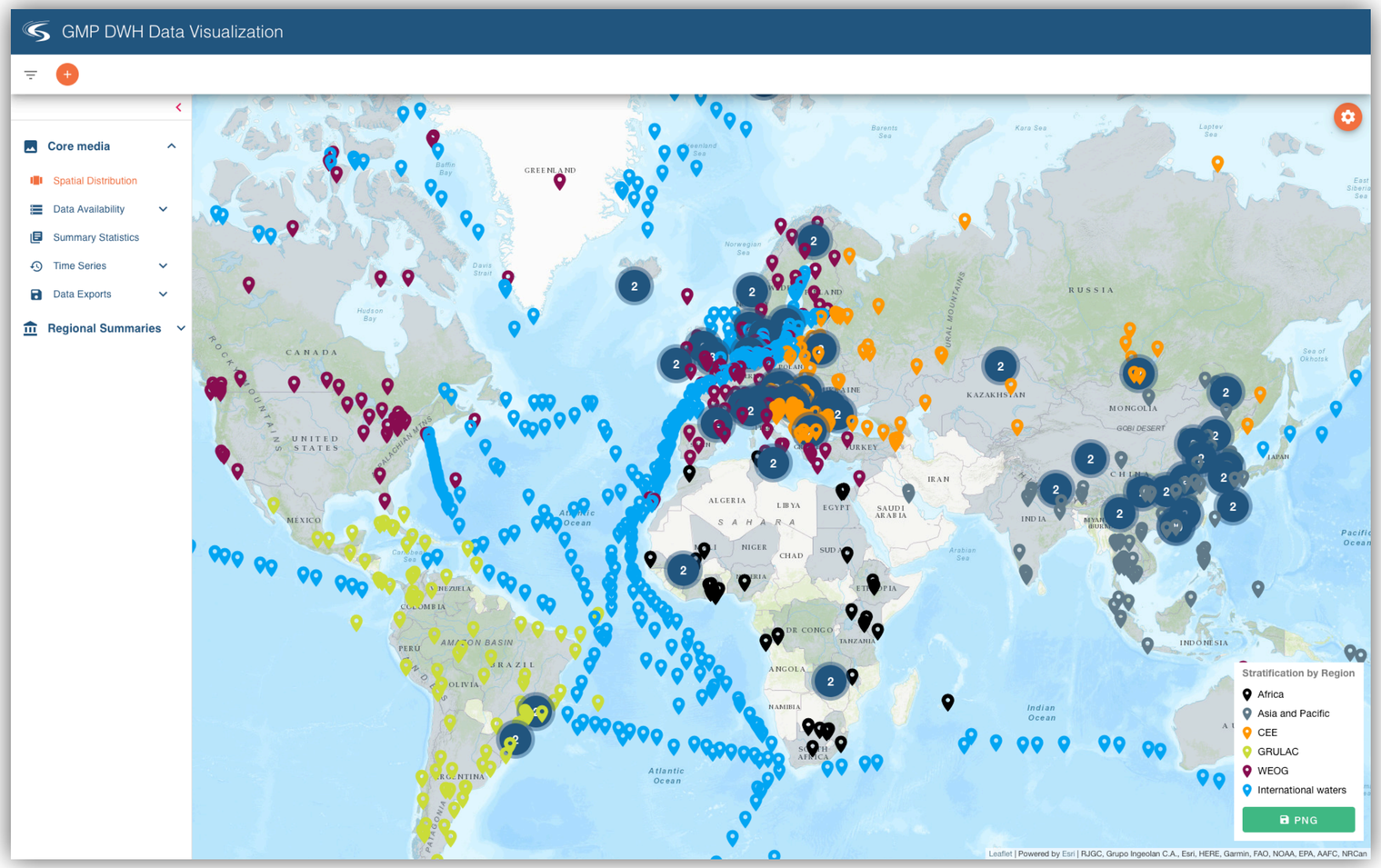
Other media - biota, soil, water for other than PFAS, food/ feeds…

UNEP/POPS/COP.11/INF/38, http://chm.pops.int/tabid/525

GMP DataWarehouse, https://www.pops-gmp.org/



GMP DWH: Data Repository and Visualizations



FORMAT: 5 modules

- Spatial distribution
- Data availability
- Summary statistics
- Trend analysis
- Data exports

CONTENT

4 core media
30 listed chemicals (POPs)
314 chemical parameters
111 monitoring networks/projects
126 countries
779 sites + a total of 1159 water sites and ocean cruises
time range: 1967-2021/2

GMP DWH is developed and operated by the RECETOX Research Infrastructure

visit : https://www.pops-gmp.org

MUNI | RECETOX

Case of the Czech Republic
RECETOX activities in the context

MUNI | RECETOX

Czech Republic POPs monitoring background

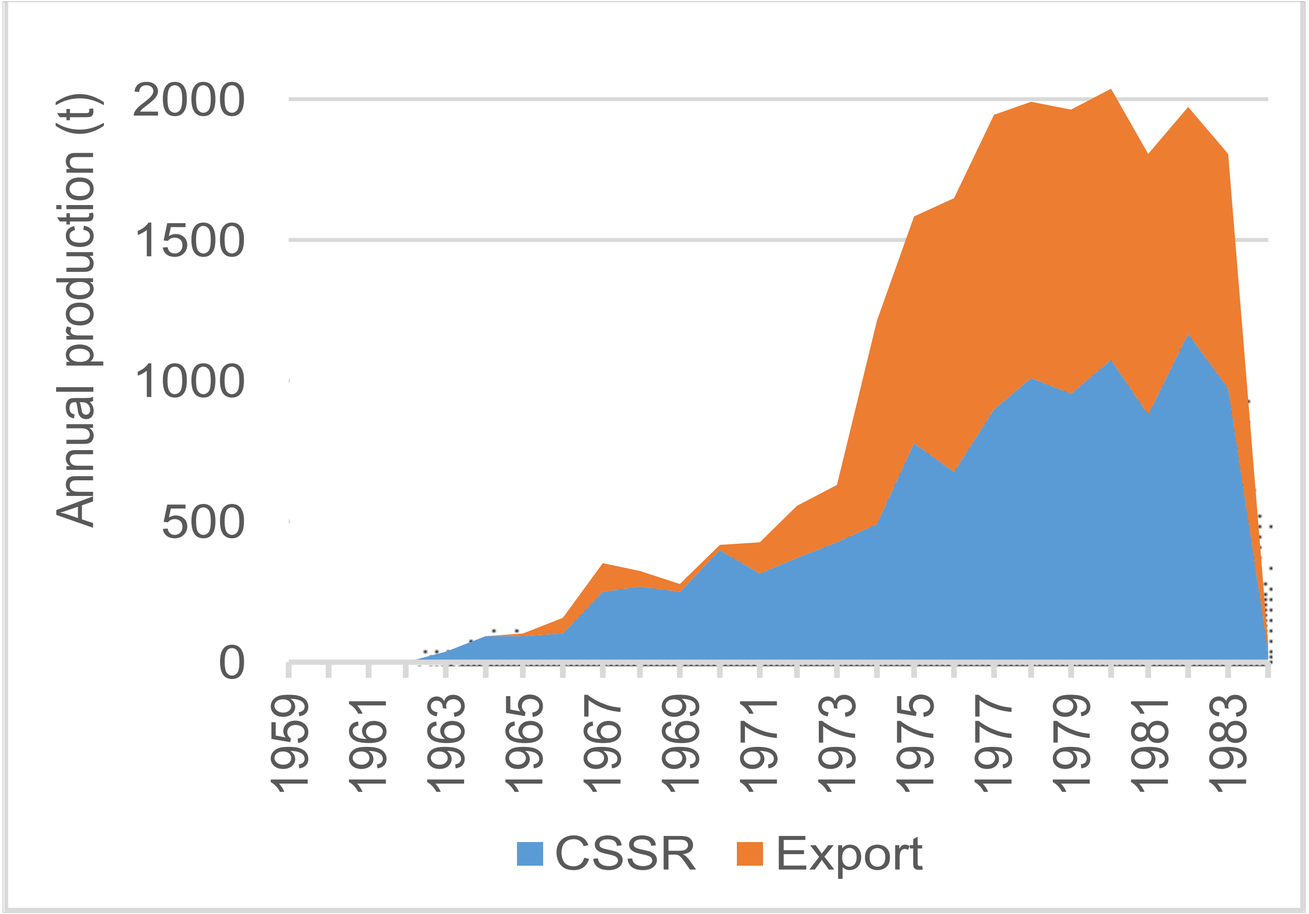
- chemical industry significant + use and production of POPs in the country
- significant environmental pollution (up to 1990s - one of causes of change of the national policy system)
- sensitivity to environmental issues

= establishment of policy and technical framework including monitoring programs to trace POPs in the environment and humans nationally

History of PCB production and use in former Czechoslovakia

- PCBs were produced in Chemko Strážské factory (eastern Slovakia) from 1959
- A total of 21482 tonnes were produced, of which 7000 – 8500 tonnes were used in the area of today Czech Republic
- PCBs were banned in 1984 in Czechoslovakia

- Phase-out/remediations started post 1995
- management governed by EU regulation/ standards
- national activities - human exposure - since 1994
- register of contaminated sites (post 2005)
- national PRTR (one of the first in Europe) since 2001 - pilot, 2005

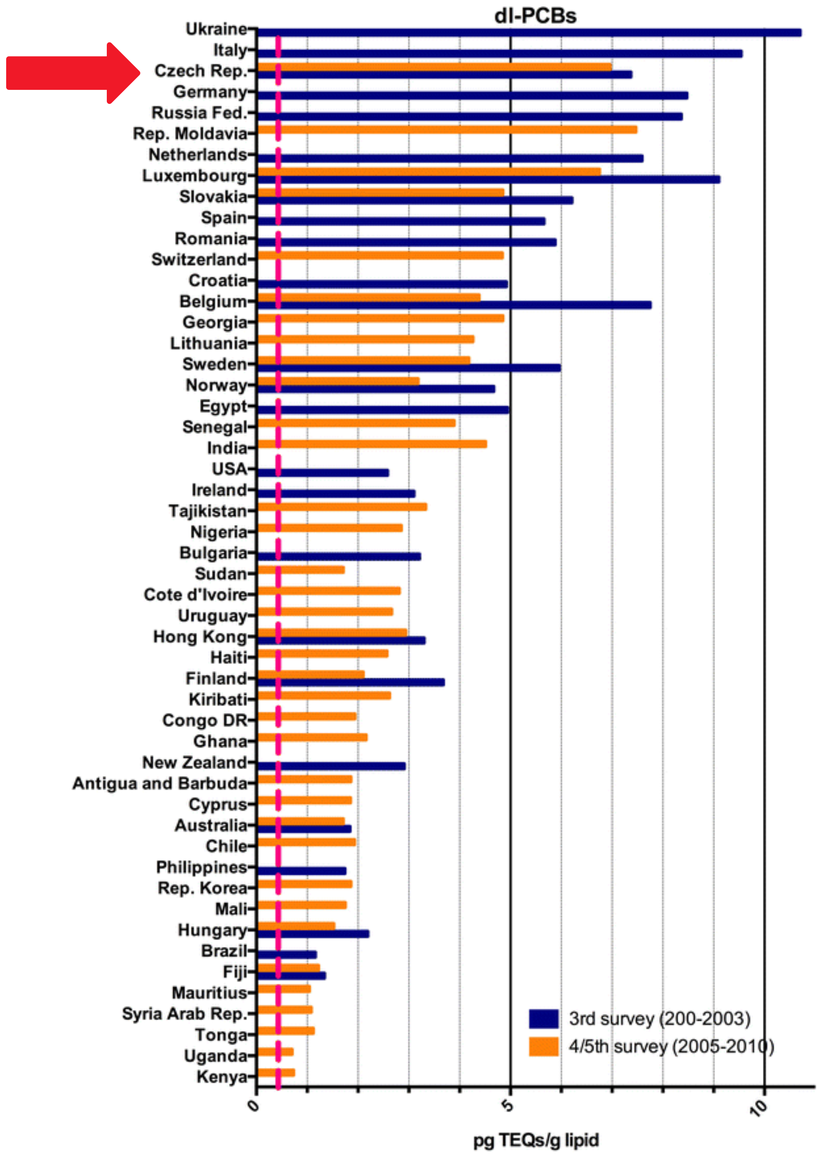


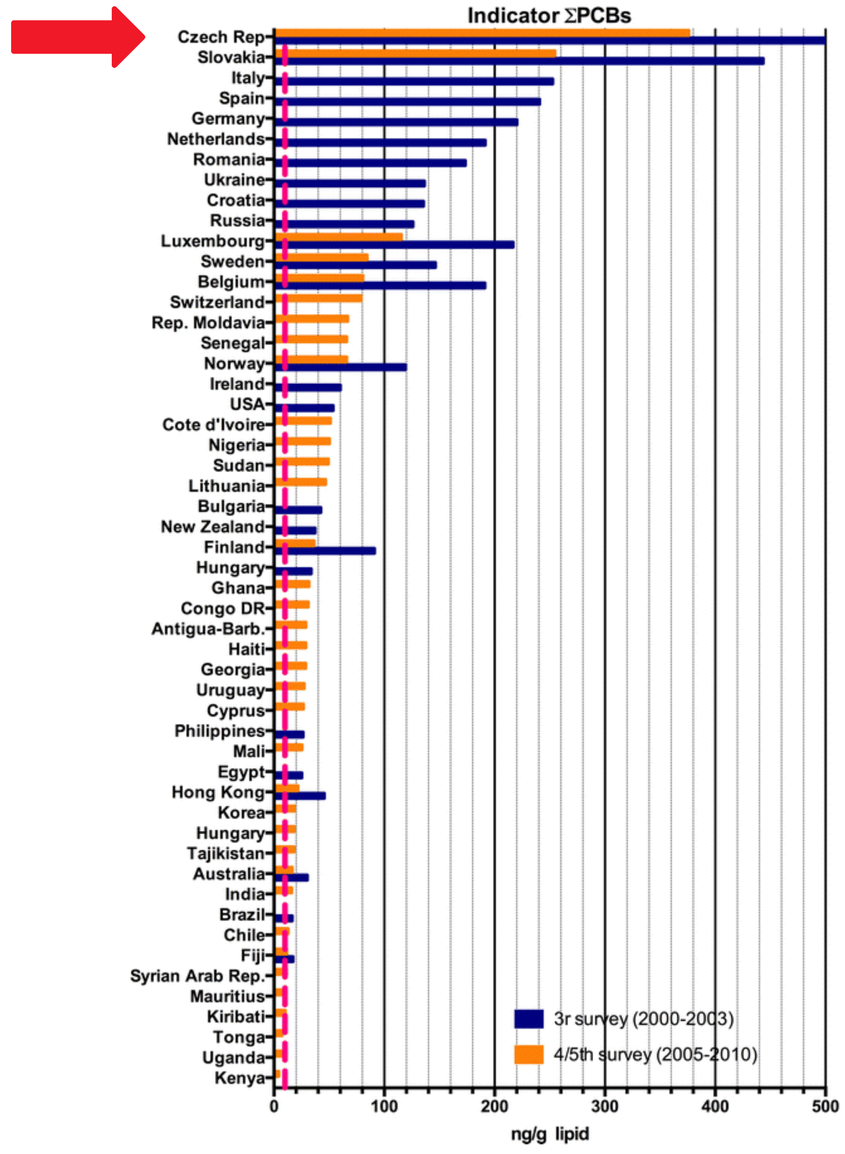
Annual PCB production in former Czechoslovakia according to final location of PCB use. Data from Holoubek et al. (2006).

MUNI | RECETOX

Holoubek et al. The National Implementation Plan for Implementation of the Stockholm Convention in the Czech Republic; Brno, 2006

Czech population - one of the most PCB-contaminated populations in the world





Results of the WHO/UNEP surveys for DL-PCBs in TEQs (pg/g lipid) and indicator PCBs in ng/g lipid in pooled human milk samples from different countries in 2000-2003 (blue), and 2005-2010 (orange).

From van den Berg et al. (2017). *WHO/UNEP global surveys of PCDDs, PCDFs, PCBs and DDTs in human milk and benefit–risk evaluation of breastfeeding. Archives of Toxicology, 91: 83–96 (2017)*

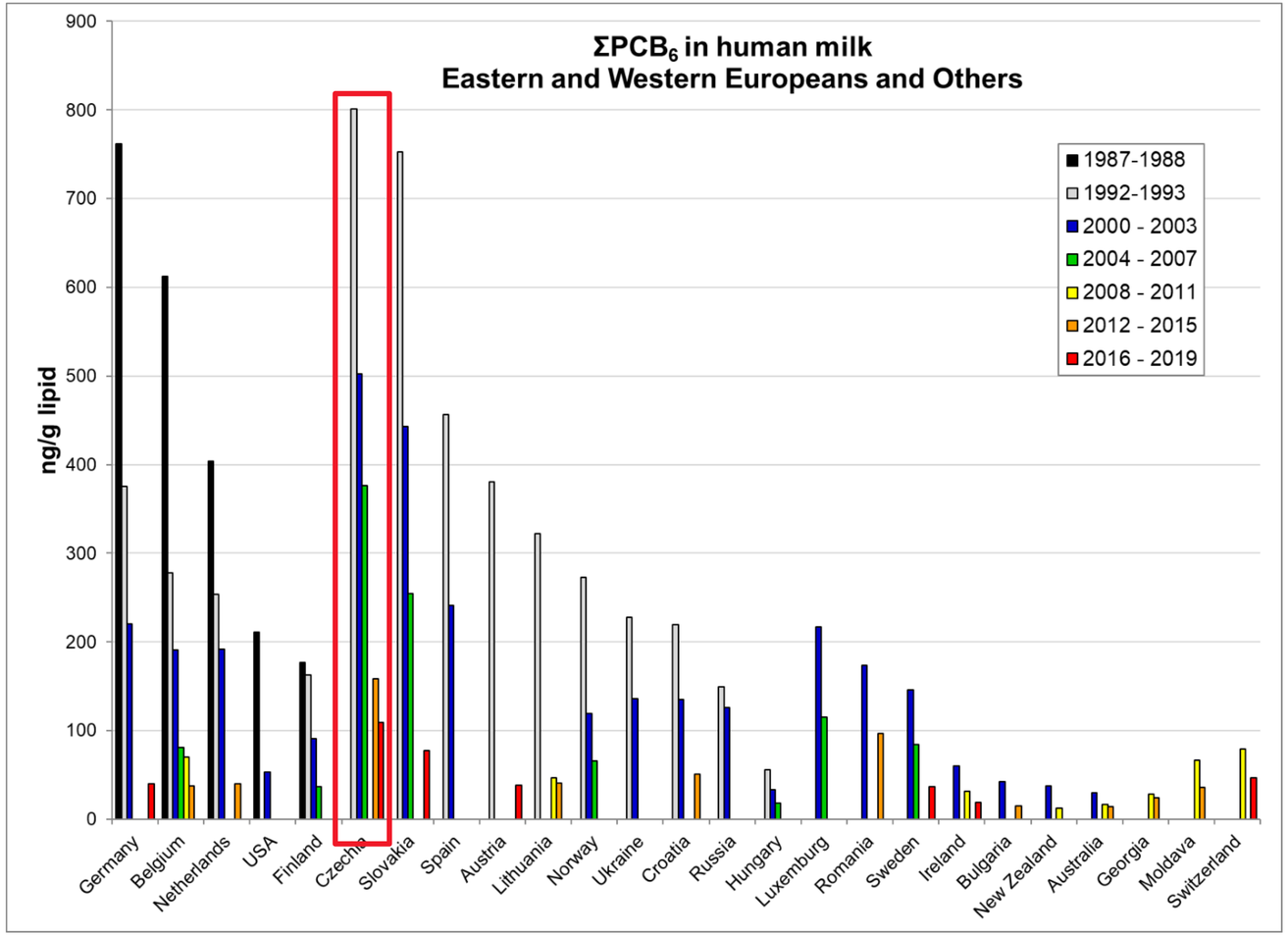
MUNI | RECETOX

Czech Republic POPs monitoring in brief

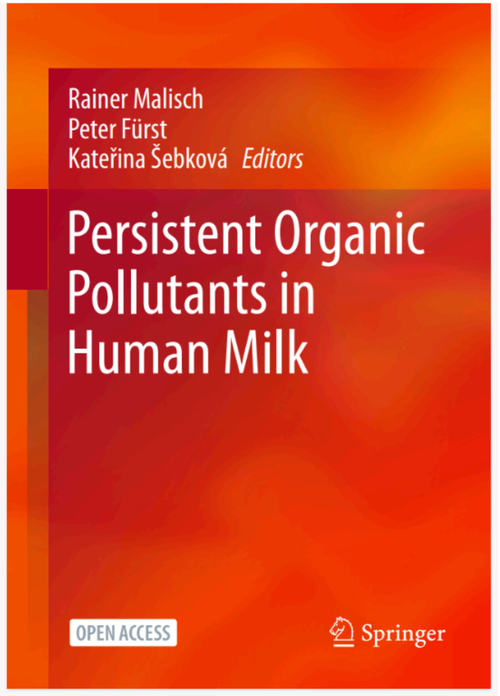
- chemical industry significant + use and production of POPs in the country
- significant environmental pollution (up to 1990s - one of causes of change of the national policy system)
- sensitivity to environmental issues

- Ministry of Environment established in 1991
- regulatory POPs monitoring (selected POPs) since 1995 (EMEP),
- human biomonitoring = exposure to toxic chemicals including selected POPs since 1994
- collaboration with researchers/regional infrastructure from 2005
- establishment of the National Centre for Persistent Organic Pollutants at RECETOX in 2005 - outcome of the first NIP
- air monitoring for POPs network - MONET region 2005-2011, optimized
- new sampling approaches, National POPs Monitoring Strategy since 2009
- reaction to EU regulatory frameworks - development of MONET Aqua, EIRENE network, sharing outputs of HBM4EU and PARC projects with non-EU countries

The human biomonitoring shows the decreasing tendencies/ trends in PCB levels in breast milk worldwide



Development of indicator PCB concentrations in human milk over time between 1987 and 2019 for 25 countries that participated two or more times in the WHO/UNEP-coordinated surveys.



Open access book!
published October 2023

download pdf or e-book at Springer
https://link.springer.com/book/10.1007/978-3-031-34087-1

From: Malisch, Fürst, Šebková (Eds.), 2023

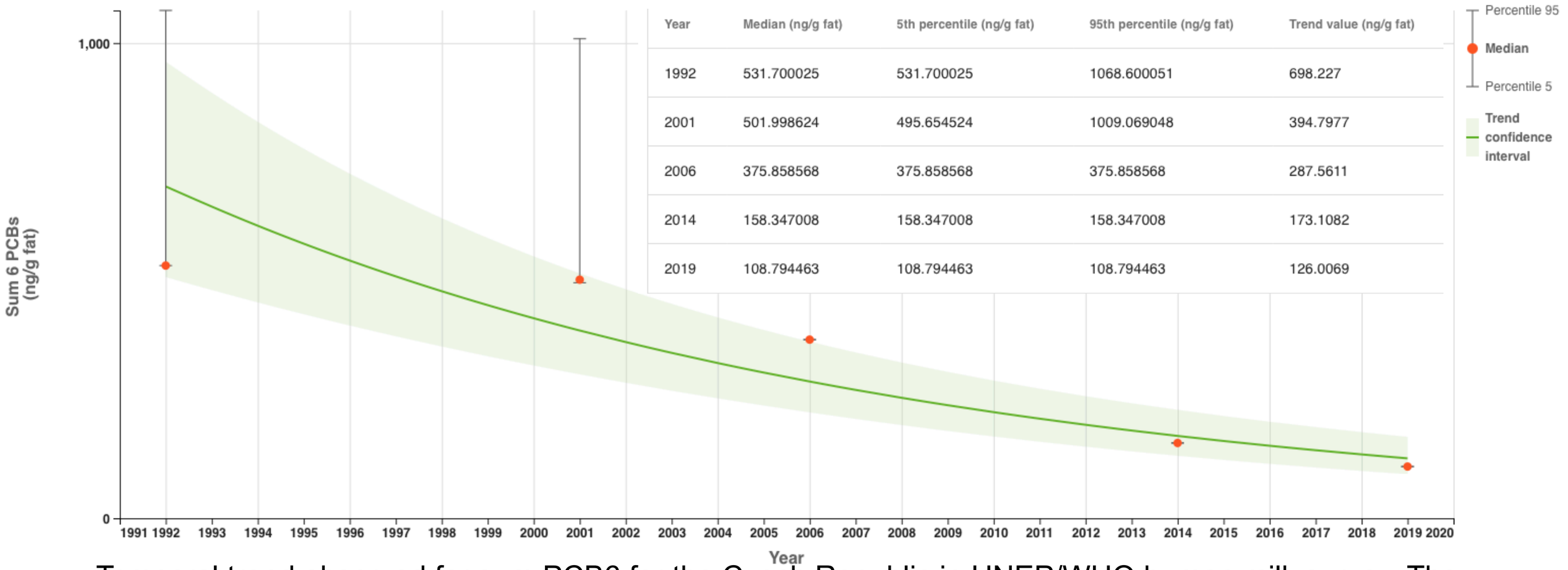
Malisch, Fürst, Šebková (Eds.)., 978-3-031-34085-7, Book title: Persistent Organic Pollutants in Human Milk, Springer 2023.

MUNI | RECETOX

CZ trends? YES, decreasing!
source: GMP DWH, milk (pooled), annually aggregated

Site: **Czech Republic** | Monitoring network: MILK - WHO | Matrix: Human milk | Parameter: Sum 6 PCBs (ng/g fat)

Year	Median (ng/g fat)	5th percentile (ng/g fat)	95th percentile (ng/g fat)	Trend value (ng/g fat)
1992	531.700025	531.700025	1068.600051	698.227
2001	501.998624	495.654524	1009.069048	394.7977
2006	375.858568	375.858568	375.858568	287.5611
2014	158.347008	158.347008	158.347008	173.1082
2019	108.794463	108.794463	108.794463	126.0069



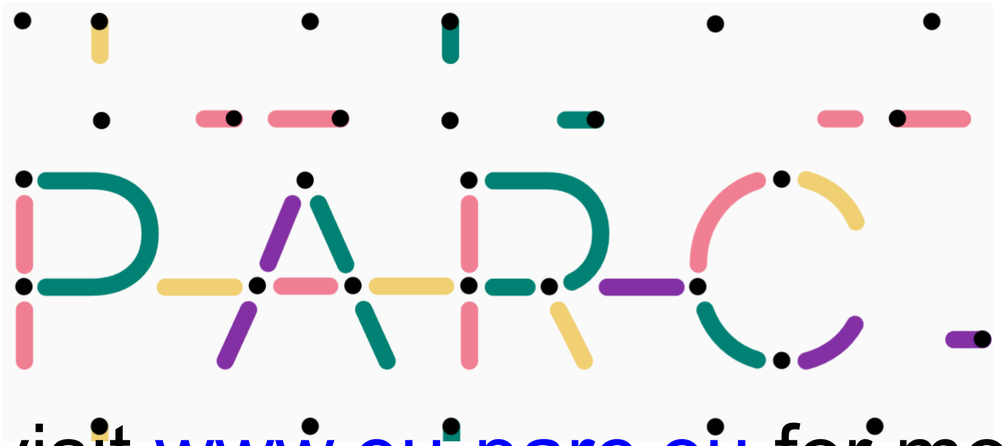
Temporal trend observed for sum PCB6 for the Czech Republic in UNEP/WHO human milk survey. The chart generated with the GMP Data Warehouse-Data Visualization http://www.pops-gmp.org/

Scientific support to national chemicals management

- **National Centre for Toxic Compounds in the Environment at RECETOX** – in place for 25 years: main role – transfer of science into policy and to stakeholders
- **its role - also acts as "Czech Chemical Agency"** and risk assessment body
- **Main focus**: international chemical agreements on chemical exposures + environment and health protection - horizontal, overarching coordination
- **NC**: governed by inter-ministerial Council : communicating to and from sectoral ministries
- **Specific outcomes**: contributions to EU Partnerships (PARC and Digital Twin), pan-European infrastructure network EIRENE (env-health issues, coordinated by the RECETOX, membership in EU Roundtable on Chemical strategy to sustainability, Zero pollution action plan
- **wider scope of work:** technical assistance provide by the SCRC, strategic partnership with UNEP, WHO and BRS = use of RECETOX capacities globally

Simultaneously, EU framework activities - with new tools or tools under development

- The European Union's Chemicals Strategy for Sustainability – towards a toxic-free environment (published in October 2020)
- EU Partnership for Chemical Risk Assessment (PARC), for 7 years, to start in May 2022 - building on HBM4EU project outcomes
- pan European infrastructure supporting environment and health research - EIRENE (10 years)
- Cohort surveys harmonization - EHEN cluster - building on HBM4EU
- Health and Environment Research Agenda (2020-2030)
- EU new regulation One substance one assessment (OSOA) - obligation to conduct EU harmonized surveys (see European Chemicals Agency)
- WHO Human biomonitoring partnership



visit www.eu-parc.eu for more

MUNI | RECETOX

Regional Approach to the POPs monitoring Eastern European Region and “+ 4”

support to the region provided through research activities and also by the SCRC Czech Republic hosted by RECETOX in collaboration with RECETOX`s Research Infrastructure:

research projects

regular trainings

MONET networks

information systems: GENASIS and Global Monitoring Plan Data Warehouse (GMP DWH)

and EIRENE network (pan-European research infrastructure)

Note: +4 are countries of the Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) covered by the technical assistance from SCRC Czech Republic)

MUNI | RECETOX

Environmental impacts of conflicts studied in Europe

- APOPSBAL, EU framework project in ex-Yugoslavia countries (2003-5) coordinated by the RECETOX
- passive sampling of air, sampling of soil, identification of contaminated sites and their remediation - ongoing in many countries to date

APOPSBAL

Assessment of the selected POPs (PCBs, PCDDs/Fs, OCPs) in the atmosphere and water ecosystems from waste materials generated by warfare in former Yugoslavia

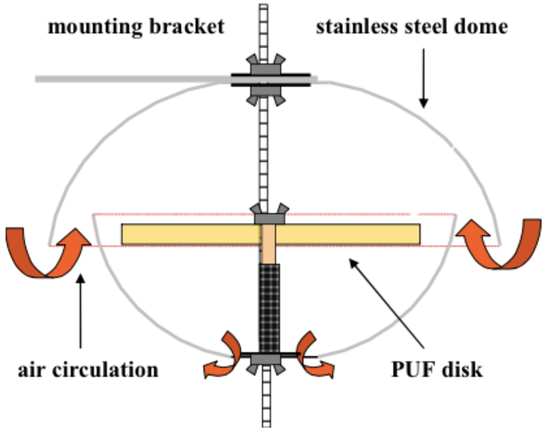


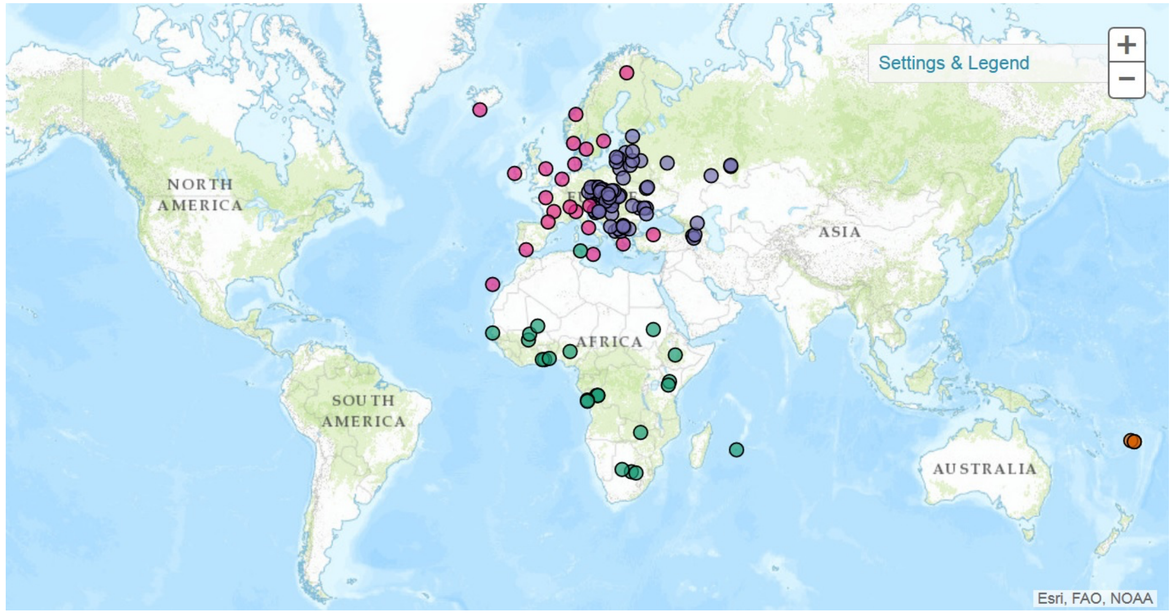




MUNI | RECETOX

AIR - MONET





MONET, MOnitoring NETwork, is a monitoring program operated by the RECETOX in collaboration of the SCRC and the RECETOX Research Infrastructure, Masaryk University in Brno, Czech Republic since 2005.



aims at detection of environmental contaminants (toxic chemicals)
spreads over the three continents - Europe, Africa and Asia.
Ambient air sampling is done by **passive samplers with PUF disks**

sampling records (protocols) and SOP provided to partners with sampling materials
training video for sample preparation + sampler handling - shown at COP2015, used since! Available in EN, FR, ES and RU

MUNI | RECETOX

New global network tracing POPs in water: Aqua MONET first results

Environmental Science & Technology

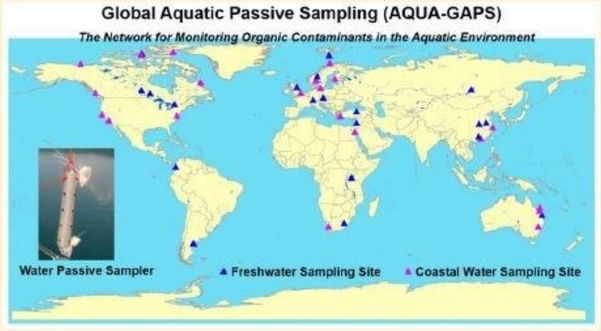
Feature

pubs.acs.org/est

Aquatic Global Passive Sampling (AQUA-GAPS) Revisited: First Steps toward a Network of Networks for Monitoring Organic Contaminants in the Aquatic Environment

Rainer Lohmann,[*,†] Derek Muir,[‡,§] Eddy Y. Zeng,[§] Lian-Jun Bao,[§] Ian J. Allan,[∥] Kenneth Arinaitwe,[⊥] Kees Booij,[#] Paul Helm,[▽] Sarit Kaserzon,[¶] Jochen F. Mueller,[¶] Yasuyuki Shibata,[○] Foppe Smedes,[∞] Manolis Tsapakis,[⊗] Charles S. Wong,[§,▲] and Jing You[§]

ABSTRACT: Organic contaminants, in particular persistent organic pollutants (POPs), adversely affect water quality and aquatic food webs across the globe. As of now, there is no globally consistent information available on concentrations of dissolved POPs in water bodies. The advance of passive sampling techniques has made it possible to establish a global monitoring program for these compounds in the waters of the world, which we call the Aquatic Global Passive Sampling (AQUA-GAPS) network. A recent expert meeting discussed the background, motivations, and strategic approaches of AQUA-GAPS, and its implementation as a network of networks for monitoring organic contaminants (e.g., POPs and others contaminants of concern). Initially, AQUA-GAPS will demonstrate its operating principle via two proof-of-concept studies focused on the detection of legacy and emerging POPs in freshwater and coastal marine sites using both polyethylene and silicone passive samplers. AQUA-GAPS is set up as a decentralized network, which is open to other participants from around the world to participate in deployments and to initiate new studies. In particular, participants are sought to initiate deployments and studies investigating the presence of legacy and emerging POPs in Africa, Central, and South America.



Aqua MONET

1) Aims to understand geographical distributions and temporal trends of organic contaminants, such as
- persistent organic pollutants (POPs) under SC
- polycyclic aromatic hydrocarbons (PAHs)
- novel flame retardants and other contaminants of emerging concern.

2) Provide information on levels and trends of POPs in the aqueous environment which are spatially and temporally comparable on a global scale

3) is ready to support POPs monitoring via RECETOX Research Infrastructure

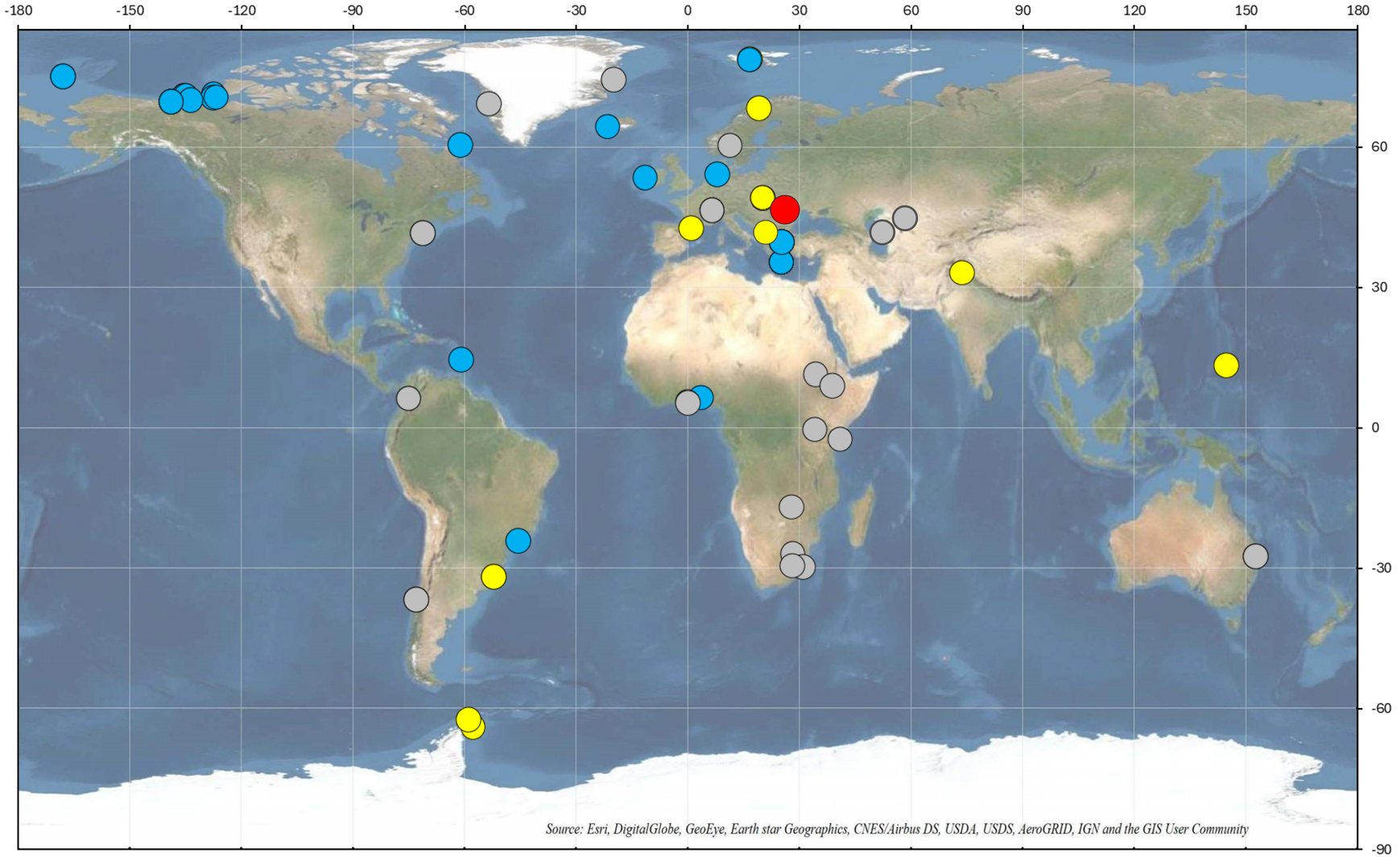
The paper presents outcome of feasibility study, samples were collected in freshwater in 2016 and freshwater and coastal water in 2016-17, 43 sites 62 exposed samples

MUNI | RECETOX

New sampling - Aqua MONET Aqua

Sites sampled since 2020

- 14 freshwater deployments (yellow)
- 42 marine deployments (blue)
- Sent to the sampling site destination (grey)



MUNI | RECETOX

Summer schools for experts, policy makers and technicians

- since 2005 at RECETOX premises in Brno
- lectures and hands-on in the laboratories
- annually 35-60 participants in person, 2020-22 online only
- different topic every year
- since 2007 work with UNEP to support GMP implementation (85 participants, all regions 2007-15)
- Ministry of Environment Czech Republic supported 50 participants over 15 years, predominantly CEE region (since 2010)
- Total more than 1500 participants over 22 years





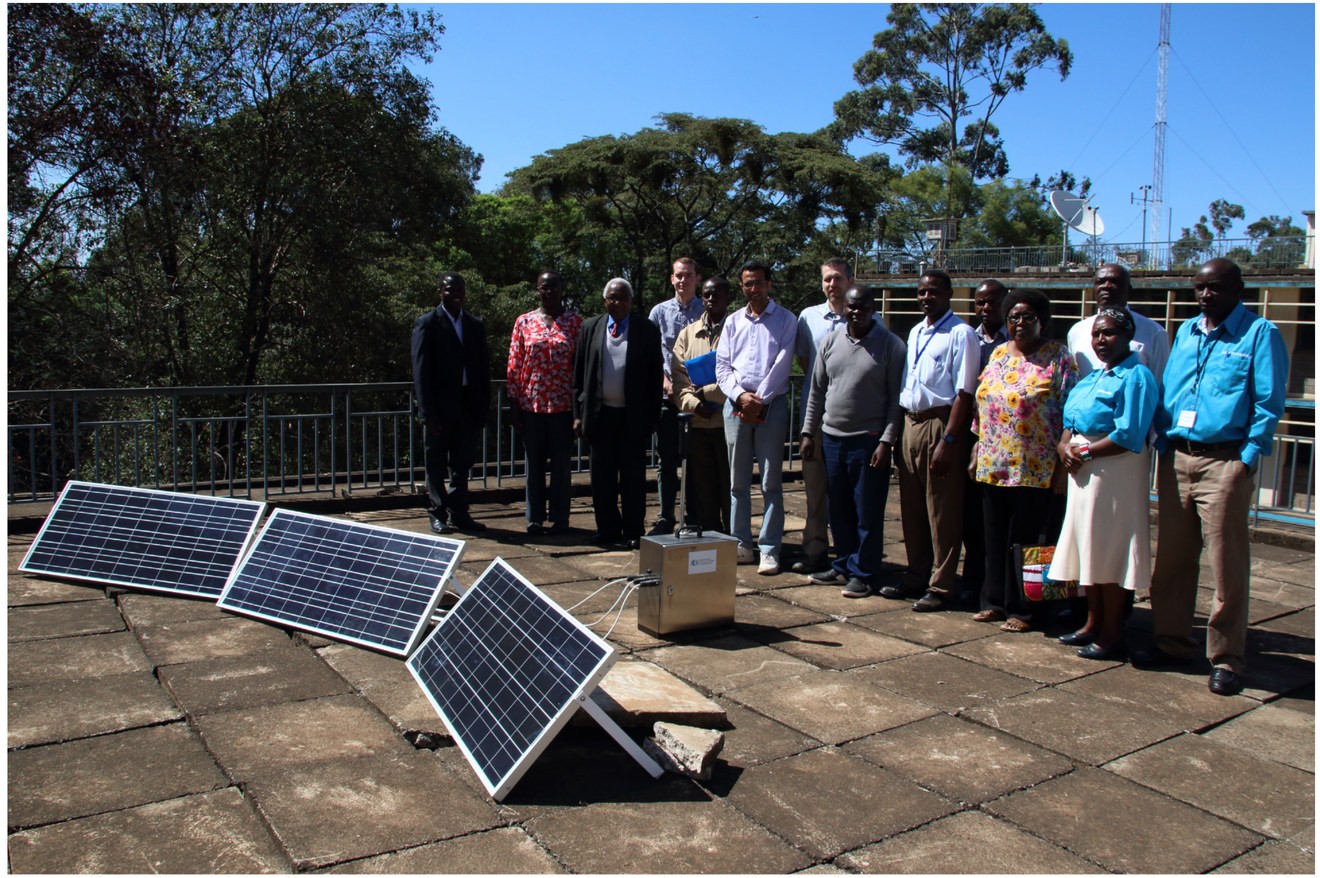






MUNI | RECETOX

Trainings made to measure… on sampling



- On sampling - we covered all core topics - air both passive and active sampling including sampler maintenance, storage and troubleshooting.
- A test sample by active sampler.
- In addition, standard operating procedures for sampling of air by passive samplers and active sampler were provided as well as training videos for sampling air and water were screened and provided to training participants on USB disks for later reference and use.
- Moreover, we sampled water in Nairobi and surroundings.

… or analysis



- Laboratory analyses also consisted of the maintenance of the instrument, set up of a analytical method, calibration and validation of the method and experimental run-ups of test samples. In addition, a session was also dedicated to the evaluation of results and QA/QC procedures implementation. The greatest emphasis was placed on the introduction and validation of the method to analyze brominated POPs.
- Objective of the training was: advance the work to cover also PBDEs, work with GCMS-troubleshooting and operational maintenance, calibration and validation of methods

Building capacities in countries of EE region

- Global Development, Review and Update of National Implementation Plans (NIPs) under the Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) with 7 countries
- **regional training+hands-on POPs monitoring - for 9 countries, 52 experts, 11-13 September 2024 at RECETOX Brno. Covered POPs monitoring, data management and assessment, FAIRification, regional strategy, renewal of in-country activities.**

- air sampling restarted (PAS in 2024) - Armenia, North Macedonia, Montenegro **NEW** in BiH Kazakhstan and Ukraine (re-start in 2026) - **first data on new POPs for those countries**
- water sampling - Aqua MONET **PFAS and beyond** - Moldova (Danube), North Macedonia (Ohrid), Albania (Skadar), Montenegro (Boka Kotor - seasonality)







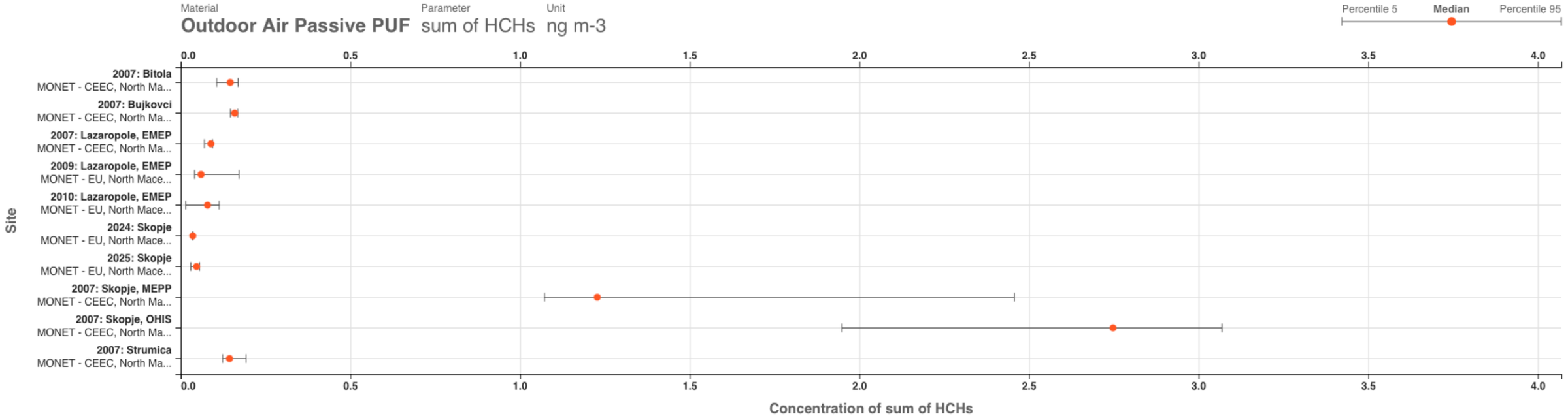
Now you know a bit more about “RECETOX” …

- want to know more?
- Brochures and leaflets or website www.recetox.muni.cz
- RECETOX Research infrastructure open access - https://www.recetox.muni.cz/en/services/for-users
- PARC materials and website www.eu-parc.eu
- EIRENE network (EU ESFRI infrastructure) - https://eirene.eu

Country case: POPs monitoring in the North Macedonia

- In 2007, Republic of North Macedonia took part in the Monitoring Network for the Central and Eastern European Countries (MONET-CEEC) project supported from the budget of the Central and Eastern European POPs Centre, RECETOX and national sources.
- As a tool for atmospheric POPs monitoring on the global and regional levels, Passive Air Samples (PAS) using polyurethane foam were applied.
- The main objective of this monitoring program was to evaluate whether the POPs actually were reduced or eliminated, which means that information on environmental levels of the chemicals categorized as POPs should enable detection of trends over time.
- Six sampling sites ranged from industrial to rural backgrounds, were defined. Soil samples were also collected from the air sampling sites - to see whether there is any cross-contamination
- results see next slide
- most contaminated sites are remediated (ongoing - OHIS)
- after the regional training in 2024 renewal of regular POPs monitoring of ambient air (NM national strategy prepared in 2023, covers selected POPs only in water and soil, air - only PAHs. Strategy not yet implemented)
- water for PFAS and other POPs via MONET Aqua - lake Ohrid - 2024+2025

POPs monitoring in the North Macedonia (2) - results (annually aggregated information), from GMP DWH



- most contaminated sites are remediated (ongoing - OHIS)
- after the regional training in 2024 renewal of regular POPs monitoring of ambient air
- water for PFAS and other POPs via MONET Aqua - lake Ohrid - 2024+2025
- NM Environmental Monitoring Strategy prepared in 2023, covers selected POPs only in water and soil, air - only PAHs. Strategy not yet implemented. Uses research infrastructure of RECETOX to get data
- in planning - case study/rapid risk assessment baseline for establishing new POPs in the recycling yard collecting WEEE and plastics that burned, site near Skopje airport and in the housing and grazing area.

Takeaways…

- It is important to have data about levels of banned chemicals in the environment and their trends or tendencies. These allow us to verify whether our management regulations work. You may not have all regulatory information in place, but NIP update project represents an opportunity to look for a baseline or first evidence of background levels of newly listed chemicals.
- Even if your country has not yet conducted POPs monitoring, you are not alone and you will not start from scratch. There are many relevant international, cross-regional or global research activities that you can join or benefit from nationally
- Chemical monitoring is resource intensive for everyone. Research infrastructures are potential partners providing expertise, harmonized procedures and framework to generate or support generation of your data that can be used in both research and decision making.
- Interested in collaboration? Contact us!

MUNI | RECETOX

Thank you for your kind attention!

katerina.sebkova@recetox.muni.cz

Acknowledgements

Jana Klánová, Ivan Holoubek, Pavel Čupr, Jiří Kalina, Katarína Řiháčková, Petra Přibylová, Rainer Malisch, Kevin White, Roman Prokeš, Petr Kukučka, Lisa Melymuk

RECETOX Research Infrastructure teams in core facilities: Trace Analytic Laboratories, environmental database systems including GMP DWH team

Ministry of the Environment of the Czech Republic