

22 May 2025, Tunis, Tunisia



UNEP/MED WG.580/5

NARRATIVE REPORT

Determination and monitoring
of persistent organic pollutants

ORGANIZED BY:

MEDWAVES AND
THE TUNISIAN MINISTRY OF THE ENVIRONMENT
UNDER THE GEF/UNEP MEDITERRANEAN SEA
PROGRAMME



1.1
Reducing Pollution
from Harmful Chemicals
and Wastes in Mediterranean
Hot Spots and Measuring
Progress to Impacts



Plan d'action pour
la Méditerranée
Convention de
Barcelone



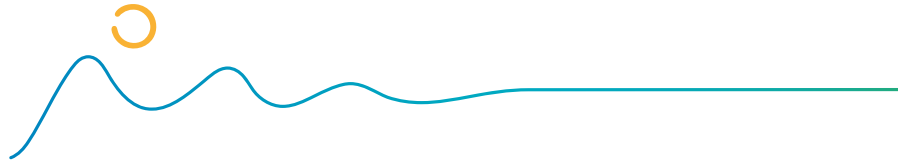
MedWaves
the UNEP/MAP Regional
Activity Centre for SCP





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SUMMARY

01

On 22 May 2025, the Tunisian Ministry of Environment, in collaboration with MedWaves—the Regional Activity Centre of the Mediterranean Action Plan (MAP) of UNEP—organized a national workshop titled “Determination and Monitoring of Persistent Organic Pollutants (POPs)” as part of the implementation of the MedProgramme. This regional initiative, funded by the Global Environment Facility (GEF), aims to reduce land-based pollution, improve coastal resilience and biodiversity, and support environmentally sound chemical and waste management in ten Mediterranean countries.

Held at the Royal ASBU Hotel in Tunis, the workshop provided a collaborative platform for 68 participants including national institutions, ministries, research bodies, NGOs, civil society, and international organizations. The goal was to strengthen national capacities in understanding, monitoring, and managing POPs, in alignment with the Stockholm Convention and other international environmental frameworks.

The agenda included expert-led sessions covering: the nature and global importance of POPs, human biomonitoring, food contamination, environmental sampling in air and water, and challenges in managing POP-containing waste. International experts such as Dr. Kei Ohno Woodall (UN Secretariat of the Basel, Rotterdam and Stockholm Conventions), Dr. Rainer Malisch, Dr. Begoña Jiménez, Dr. Pierre Hennebert, and Dr. Roland Weber delivered high-level presentations based on recent scientific research and international best practices.

The workshop’s objectives were to raise awareness among national stakeholders, introduce international standards for POPs monitoring, showcase real-world case studies, and promote inter-institutional cooperation for improved surveillance and policy coordination. It also aimed to identify regulatory and technical gaps hindering POPs management in Tunisia and recommend practical solutions.

Expected outcomes included: enhanced technical knowledge of POPs detection and analysis; reinforced collaboration among public authorities, laboratories, and waste managers; creation of a national expert network on chemical pollution; and increased political support for proactive strategies, including circular economy approaches.

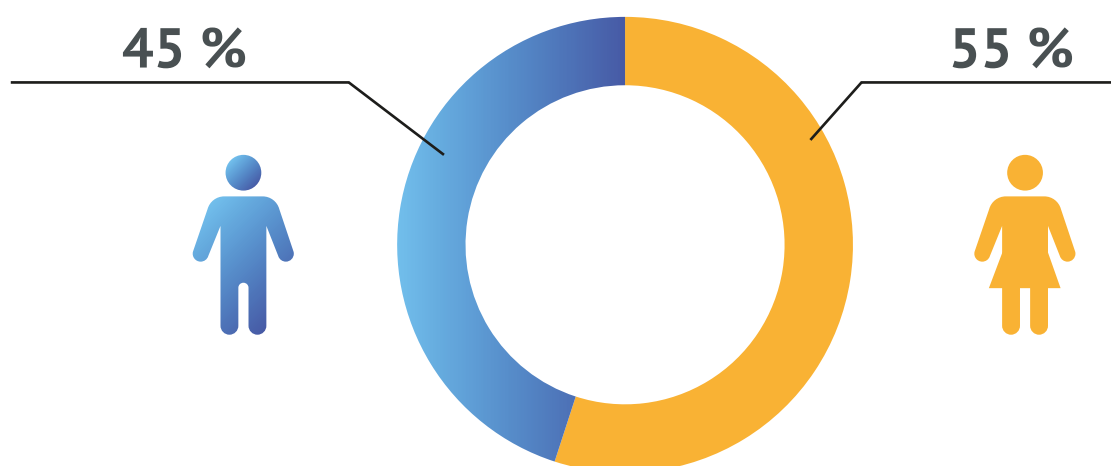
This workshop marked a critical step in Tunisia’s national efforts to fulfill its environmental commitments and to protect both human health and ecosystems from the impacts of hazardous pollutants.

The workshop brought together stakeholders involved in chemicals and persistent organic pollutants (POPs) management in Tunisia, including representatives from relevant authorities, environmental institutions, and industrial sectors such as agriculture, waste management, and manufacturing.

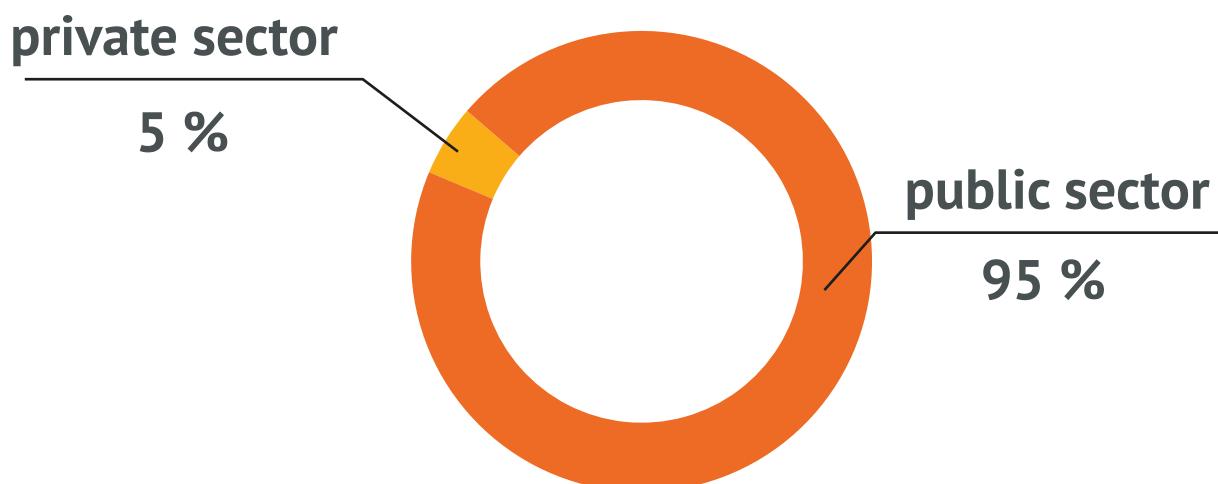
68 Participants



Participation by gender



Participation by sector



The workshop in Tunisia was organized by the ministry of the environment in collaboration with MedWaves, one of the Regional Activity Centers established under the UNEP/Mediterranean Action Plan. Since 2009, MedWaves has also supported the implementation of the Stockholm Convention—an international treaty involving 180 countries aiming to eliminate the production and use of persistent organic pollutants (POPs), which are highly toxic and harmful to both human health and the environment.

MedWaves is mandated by both the Barcelona and Stockholm Conventions to assist Contracting Parties in meeting their obligations, particularly by promoting sustainable consumption and production practices, and advancing the transition to a circular economy.

As part of its responsibilities under Output 1.3 of Child Project 1.1, titled “Long-term POPs Reduction through Pilot Activities on New POPs Alternatives”, MedWaves leads initiatives to showcase practical alternatives to newly listed POPs. This involves supporting Mediterranean countries in adopting environmentally sound substitutes that reduce reliance on hazardous chemicals.

The Tunis workshop brought together 68 participants, including representatives from national and local public institutions, NGOs, international organizations, technical experts, and private sector actors. Organizations such as the BRS Secretariat, MedWaves, KEMI, E.P.FIRE, and the Finnish Environment Institute were also in attendance.



INTRODUCTION

02

On May 22, 2025, Tunisia hosted a high-level workshop on Persistent Organic Pollutants (POPs), held under the MedProgramme framework by MedWaves and in collaboration with the Tunisian Ministry of Environment. This event aimed to enhance national understanding and capacity on POPs surveillance and management in alignment with the Stockholm Convention, an international treaty focused on reducing and ultimately eliminating the release of these toxic substances.

The workshop opened with welcoming remarks from the organizers, followed by a session led by Dr. Kei Ohno (BRS Secretariat), introducing participants to the fundamentals of POPs, the objectives of the Stockholm Convention, and the importance of global monitoring efforts. The second session, presented by Mr. Youssef Zidi, provided an overview of the current situation regarding POPs in Tunisia, emphasizing national challenges and progress.

Throughout the day, the agenda covered multiple aspects of POPs monitoring and control across various environmental and biological matrices. These included human biomonitoring and food contamination (Dr. Rainer Malisch), water and air quality assessments (Dr. Begoña Jimenez), and waste management practices (Dr. Pierre Hennebert). Special attention was given to the “Guidance on Sampling, Screening and Analysis of Persistent Organic Pollutants in Products and Articles,” presented by Dr. Roland Weber, offering practical case studies and methodologies for field application.

The workshop concluded with an open discussion on key takeaways, national priorities, and next steps to strengthen Tunisia’s efforts in implementing sustainable monitoring frameworks. It brought together 68 participants, including public authorities, NGOs, international experts, and industry representatives.

By fostering dialogue and knowledge exchange, this workshop contributed significantly to national and regional efforts aimed at phasing out POPs and promoting safer alternatives for the health of people and the environment.



OPENING

03

The workshop was opened by **Mr. Jordi Moles**, representing MedWaves, who welcomed participants and emphasized the importance of regional collaboration in addressing the challenges posed by persistent organic pollutants (POPs).

In his opening remarks, Mr. Moles highlighted the strategic role of Tunisia within the framework of the MedProgramme and praised the country's commitment to implementing actions aligned with the Stockholm Convention. The ceremony underscored the significance of this gathering in fostering technical exchange, building institutional capacities, and raising awareness of the impacts of toxic chemicals across the region.

Thanks to the joint efforts of the Tunisian Ministry of Environment, MedWaves, and international partners such as UNEP/MAP, the BRS Conventions Secretariat, and the GEF project, this workshop brought together key stakeholders and experts to strengthen dialogue, promote experience-sharing, and explore practical solutions. Mr. Moles concluded by reaffirming that collective progress in chemical management can only be achieved through sustained cooperation and shared responsibility among all actors involved.



WORKSHOP DEVELOPMENT

04

SESSION 1 - INTRODUCTION TO POPS

DR. KEI OHNO, BRS

*SECRETARIAT OF THE BASEL, ROTTERDAM, AND
STOCKHOLM CONVENTIONS*

The presentation by Kei Ohno Woodall, from the Secretariat of the Basel, Rotterdam and Stockholm Conventions, offers an in-depth overview of Persistent Organic Pollutants (POPs), their global impact, and the efforts made under the Stockholm Convention to monitor, reduce, and eliminate them. POPs are toxic organic compounds known for their persistence in the environment, ability to bioaccumulate in living organisms, long-range environmental transport, and adverse effects on human health and ecosystems.

The Stockholm Convention, adopted in 2001, aims to eliminate or restrict the production and use of POPs. It addresses both intentionally produced chemicals, such as pesticides and industrial chemicals, and unintentionally produced ones like dioxins and furans. The Convention includes three core annexes: Annex A for elimination, Annex B for restriction, and Annex C for the reduction of unintentional releases.

Key provisions of the Convention include:

- Article 3 and 4: Prohibit the production, use, import, and export of listed POPs unless exemptions are granted.
- Article 5: Mandates the reduction of unintentional POPs releases through Best Available Techniques (BAT) and Best Environmental Practices (BEP).
- Article 6: Requires parties to manage POPs stockpiles and waste in an environmentally sound manner, in accordance with Basel Convention guidelines.
- Article 16: Establishes a framework for periodic effectiveness evaluations, based on monitoring data, national reports, and compliance information.



To evaluate the Convention's impact, a robust Global Monitoring Plan (GMP) was developed, focusing on long-term trends in POPs levels across core media: air, human tissue (blood, breast milk), and water. The evaluation process is structured around the Effectiveness Evaluation Committee, the Global Coordination Group (GCG), and Regional Organization Groups (ROGs), which include experts from five UN regions.

The GMP has undergone several phases:

- GMP-1 (2009): Submitted the first global and regional monitoring reports.
- GMP-2 (2017): Expanded monitoring coverage and refined methodologies.
- GMP-3 (2023): Delivered the third round of monitoring data, showing progress in the reduction of legacy POPs and establishing baseline trends for newer ones.
- GMP-4 (ongoing): Aims to further refine understanding and assess the impact of regulatory actions.

As of May 2025, a total of 37 POPs are listed across Annexes A, B, and C, including:

- 16 pesticides such as DDT, aldrin, and endosulfan.
- 17 industrial chemicals like PFOS, PFOA, PCB, and flame retardants.
- 7 unintentionally produced POPs (U-POPs), including dioxins (PCDD/PCDF), furans, and PCBs.

The presentation emphasizes the success of the Convention in reducing environmental and human exposure to legacy POPs. Monitoring data indicate a declining trend in air concentrations and human milk levels of many POPs, especially in regions with stringent regulations. However, for newer POPs, while some show a downward trend, others still exhibit stable or rising levels, underlining the need for continued vigilance and action.

Data from GMP-3 revealed specific regional trends:

- In Africa, there has been a consistent decline in airborne concentrations of DDT, endosulfan, and PCBs from 2008 to 2020.
- Human milk studies conducted between 2000 and 2019 show a decrease in levels of PCDD/PCDF and PCBs.
- Surface water sampling in countries like Vietnam, Samoa, and Ecuador indicates early signs of declining PFOA and PFOS levels.



PASSIVE AIR SAMPLING SITES

The presentation also highlights the role of modeling in understanding long-range transport of POPs, citing the case of TCPP, a flame retardant found in both air and seawater, and its modeled environmental behavior under typical emission scenarios.

Addressing industrial POPs presents unique challenges due to complex value chains, regulatory discrepancies, and traceability issues. These chemicals often involve multiple manufacturers and users, making identification and monitoring more difficult. Barriers include limited resources, inconsistent labeling, lack of digital tracking, and fragmented regulatory landscapes.

To overcome these challenges, several identification and labeling systems are being explored globally, such as:

- ISO 11469 for plastics in Argentina,
- Digital chemical identifiers in Japan,
- CE marking and Digital Product Passports in the EU,
- PCB equipment tagging in Canada.

The Stockholm Convention continues to adapt through updated technical guidelines, evolving exemption procedures, and strategic partnerships. The GMP benefits from cooperation with networks such as the Arctic Monitoring and Assessment Programme (AMAP), the Global Atmospheric Passive Sampling Network (GAPS), and monitoring initiatives in Africa, Europe, and Asia.

In conclusion, the presentation underscores that while notable progress has been achieved in curbing POPs pollution, particularly for legacy chemicals, persistent challenges remain. The Convention's effectiveness relies heavily on sustained political will, coordinated monitoring, adequate funding, technical innovation, and strong stakeholder engagement. As the world moves toward a toxic-free environment, continuous assessment and adaptation under the Stockholm Convention remain essential.



SESSION 2 - SITUATION OF POPS IN TUNISIA

YOUSSEF ZIDI

*DIRECTOR OF THE INDUSTRIAL ENVIRONMENT -
MINISTRY OF THE ENVIRONMENT*

The presentation by Youssef Zidi, Director of Industrial Environment at Tunisia's Ministry of the Environment, offers a comprehensive overview of Persistent Organic Pollutants (POPs) and Tunisia's efforts under the Stockholm Convention.

POPs are toxic, long-lasting organic compounds that accumulate in living organisms, travel long distances, and pose serious health and environmental threats. The Stockholm Convention, adopted in 2001 and ratified by Tunisia in 2004, aims to protect human health and the environment by eliminating or restricting POPs.

The Convention's core objectives include:

- Eliminating or restricting production, use, import, and export of listed POPs,
- Reducing unintentional releases,
- Managing POP-containing wastes and stockpiles,
- Supporting developing countries with technical and financial assistance.

Tunisia has identified several categories of POPs, including pesticides, industrial chemicals, flame retardants, and substances used in coatings and waterproofing. The country has conducted two national inventories and assessed its capacity to manage POPs. It has also launched public awareness campaigns and training initiatives.

Tunisia has actively participated in the first two phases of the Global Monitoring Plan (GMP) and is preparing for the third. National sampling campaigns included matrices like air, water, fish, olive oil, eggs, and butter, and provided comparative insights with other African nations. Additional surveillance included PFOS and HBCD through analysis of 46 samples from foam, sediment, water, and plastics.



On elimination, Tunisia exported over 1,200 tonnes of PCB-contaminated equipment and 1,800 tonnes of pesticide POPs for safe disposal, with plans for 400 more tonnes to be removed in collaboration with the MedProgramme.

Legislative progress includes draft laws on the sound management of PCBs and bans on POP imports. A national cooperation project is also underway to strengthen the capacities of stakeholders implementing the Convention.

Overall, Tunisia demonstrates strong commitment to POPs management through surveillance, elimination, regulation, and international cooperation.



SESSION 3 - MONITORING OF POPS IN HUMAN BIOMONITORING

SESSION 4 - MONITORING OF POPS IN FOODSTUFFS

DR. RAINER MALISCH

FORMERLY CVUA FREIBURG, GERMANY

Dr. Rainer Malisch's presentation provided an extensive overview of the global and regional efforts to monitor Persistent Organic Pollutants (POPs), focusing on their detection in human milk and foodstuffs under the Stockholm Convention. His work, based on decades of collaborative research, emphasizes the significance of human biomonitoring in assessing environmental exposure to POPs and informing global policy.

1. Human Biomonitoring and Human Milk as a Key Matrix

The Global Monitoring Plan (GMP) guidance documents recommends three key matrices: air, water [for PFAS] and human milk/blood. The WHO/UNEP-coordinated exposure studies with participation of over 80 countries performed between 2000 and 2019 focus on human milk.

These studies highlight the effectiveness of pooled sampling from mothers in different countries, providing both cost-efficient and statistically reliable results. The analytes investigated include classic POPs such as DDT, PCBs, and dioxin-like compounds (PCDD/PCDF), as well as brominated flame retardants (PBDEs, HBCDD), perfluorinated compounds (PFOS, PFOA), and emerging contaminants like short- and medium-chain chlorinated paraffins (SCCPs, MCCPs).

2. Stockholm Convention and Global Monitoring Plan (GMP)

The Stockholm Convention aims to protect human health and the environment by eliminating or reducing POPs. Article 16 mandates periodic effectiveness evaluations, supported by data from the Global Monitoring Plan. These evaluations rely on human biomonitoring as a pillar, alongside environmental sampling and food monitoring.

The GMP Data Warehouse, hosted by RECETOX (Czech Republic), stores global data on POP levels, enabling comparative and temporal trend analysis.

3. Key Messages from the Monitoring Results

Key Message A – Efficiency and Global Reach

The GMP human milk program is globally recognized for its robust methodology and accessibility, producing high-quality data for 30 POPs listed until 2019.



Key Message B – Chemical Ranking

It is a unique characteristic among the core matrices of the GMP that results for the full set of 32 POPs of interest available for samples of the 2016-2019 period. This allows to draw conclusions on the relative importance (“ranking”) of chemicals. The most prevalent contaminants were DDT and chlorinated paraffins. In 2016–2019, Median concentrations of PCBs were about an order of magnitude lower than the CP concentrations, of PBDEs, HCB and other POPs typically under 10 ng/g lipid.

Key Message C – Regional Variation

Concentrations varied significantly between countries and UN regions. For example, Africa showed some of the highest DDT concentrations (up to 23,500 µg/kg lipid), with Tunisia reporting moderate levels. Other POPs, such as beta-HCH and PCDD/PCDF (dioxins), also exhibited regional trends reflecting industrial use, climate, and dietary practices.

- DDT: 96 ng/g lipid
- PCB: 53 ng/g lipid
- Beta-HCH: 8.1 ng/g lipid
- PBDEs: 0.77 ng/g lipid
- HBCDD and PBB 153: < 0.5 ng/g lipid
- PFOS and PFOA: 20.4 and 18.6 ng/L, respectively.

Key Message D – Time Trends

Long-term trends show substantial decreases in POP levels over the last two decades:

- DDT: –58%
- beta-HCH: –84%
- HCB: –57%
- PCBs: –70%
- PFOS: –48%
- PCDD/PCDF: –48%

These declines are attributed to regulatory action, international treaties, and reduced usage. However, chlorinated paraffins (CPs), especially MCCPs, showed increasing trends, underlining the need for stronger regulations. Unlike older POPs, these are still used in various industrial applications and pose growing risks.



A comprehensive overview of the data collected from 2000 to 2019 can be found in the open-access book *Persistent Organic Pollutants in Human Milk* (Malisch, Fürst, Sebkova; Springer, 2023), which consolidates the findings from the WHO/UNEP-coordinated exposure studies.

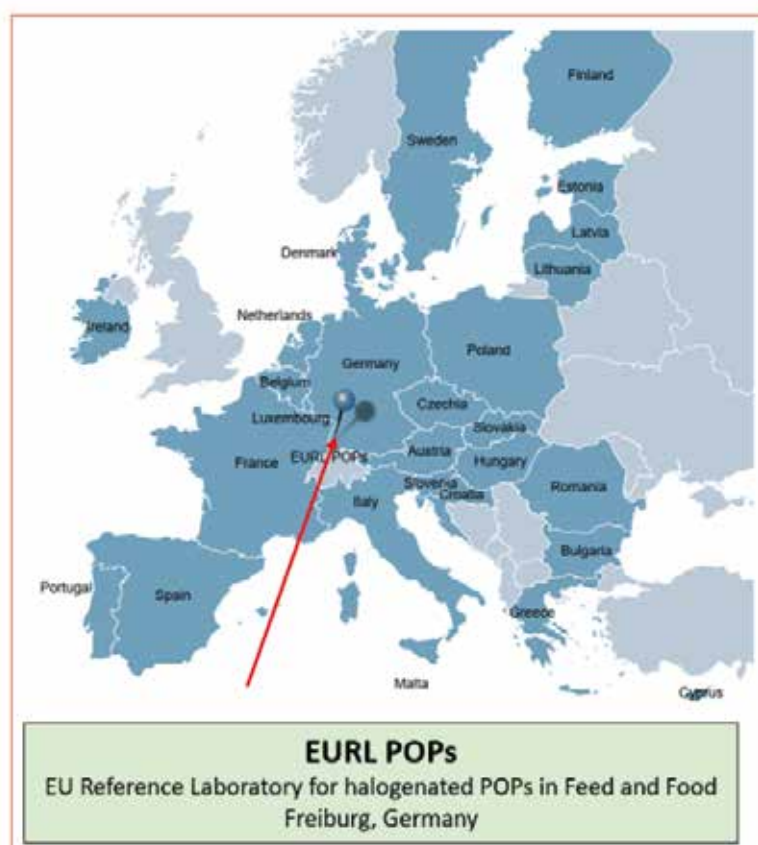
4. Monitoring in Foodstuffs and EU Involvement

Malisch also presented the role of the EU Reference Laboratory (EURL) for POPs, which is responsible for overseeing the analysis of chlorinated POPs (such as PCDD/PCDFs, PCBs, PCNs, and PCAs), brominated POPs (including PBDEs and HBCDDs), and fluorinated POPs (PFAS). The analysis of organochlorine pesticides in food of animal origin falls under the mandate of the EURL for Pesticides in Animal-Origin Food (EURL AO). Both laboratories are hosted by CVUA Freiburg. These EURLs play a crucial role in coordinating interlaboratory comparisons and quality assurance activities, including the development of guidance documents for key analytical methodologies.

For instance, EFSA has set a tolerable weekly intake of 4.4 ng/kg body weight for four PFAS compounds and concluded that parts of the European population exceed this TWI, which is of concern. Therefore, the European Commission set EU maximum levels for these compounds in food.

5. Analytical Standards and Future Recommendations

Ensuring accuracy and comparability, laboratories follow validated protocols, use certified reference materials, and engage in proficiency testing. Recommendations include:

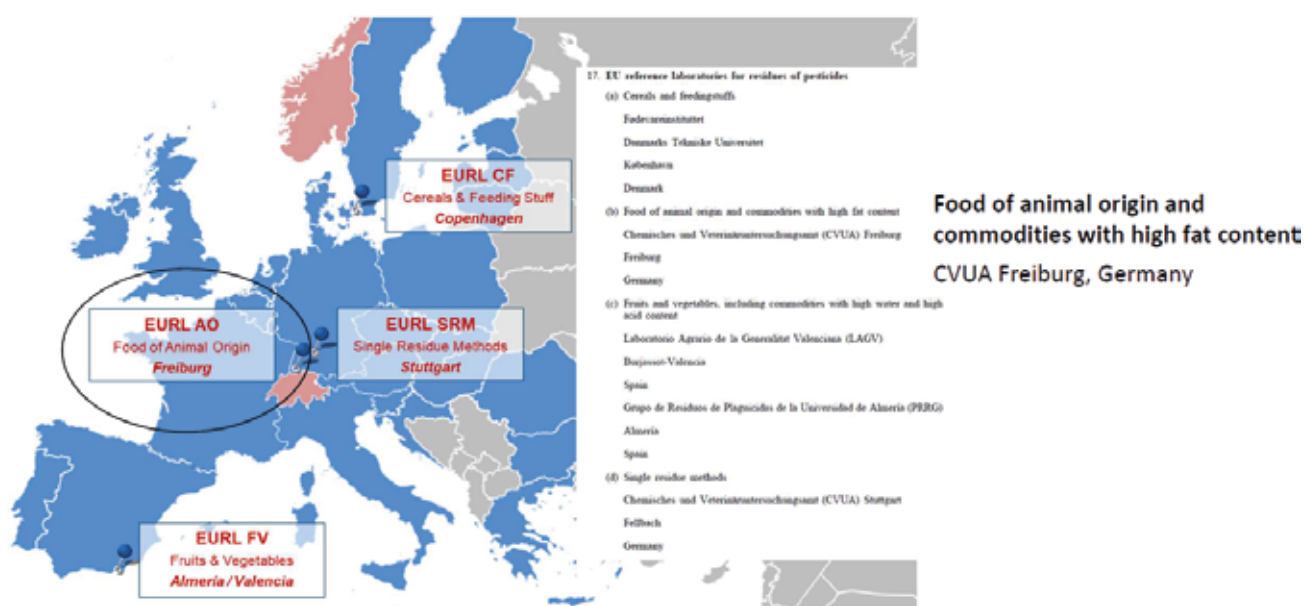


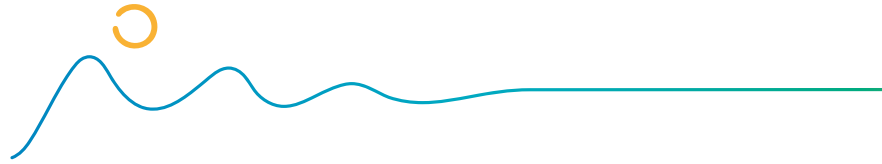
- Improvement of analytical methods for CPs and PFAS in specific guidance documents
- Harmonization of protocols and quality control criteria
- Expanded surveillance of newly listed and proposed POPs

Conclusion

Dr. Malisch's presentation underscored the critical importance of human milk biomonitoring as a tool to assess the effectiveness of the Stockholm Convention. It offers a reliable, cost-effective way to evaluate exposure, supports global policy-making, and highlights both progress and emerging threats in POP regulation. The need for sustained monitoring, capacity-building, and global collaboration remains essential to protect future generations from POP-related risks.

EU Reference Laboratories for Residues of Pesticides





SESSION 5 - MONITORING OF POPS AND PFAS IN WATER

DR. BEGOÑA JIMÉNEZ

SENIOR RESEARCHER - SPANISH NATIONAL RESEARCH COUNCIL

Begoña Jiménez, a leading scientist from the Spanish National Research Council (IQOG-CSIC), presented an in-depth analysis of the monitoring of Persistent Organic Pollutants (POPs) and Per- and Polyfluoroalkyl Substances (PFAS) in various aquatic environments, from rivers in Spain to the world's oceans.

The presentation began with an overview of POPs and PFAS, both of which are synthetic chemicals characterized by persistence, toxicity, bioaccumulation, and long-range transport. She outlined the evolution of regulatory frameworks, highlighting the inclusion of PFOS (2009), PFOA (2019), and PFHxS (2022) in the Stockholm Convention annexes.

Jiménez emphasized the analytical challenges associated with PFAS detection due to their low environmental concentrations (often at sub-trillion levels), ubiquity in laboratory materials, and rapidly evolving regulatory standards. Effective detection demands high sensitivity, standardized procedures, and robust quality control.

The core of the presentation was divided into two case studies:

1 - Continental Waters: The Duero Basin in Spain

Over ten years, 39 sampling campaigns were conducted at four river sites. PFOS, PFOA, and PFHxS were the target compounds. Results revealed:

- The highest PFAS levels occurred near industrial and urban areas.
- A temporal decline in PFOS levels was observed, reflecting the impact of regulatory bans.
- However, 51% of water samples exceeded the EU's Environmental Quality Standard (EQS) for PFOS (0.65 ng/L).
- Sources included wastewater treatment plants, paper and metal industries, and hazardous waste facilities.

2 - Ocean Waters: Global Monitoring

Data from global ocean expeditions, including the Malaspina 2010 campaign, provided baseline PFAS concentrations across major ocean basins. Key findings:



- PFAS levels were generally higher in the Atlantic, followed by the Pacific and Indian oceans.
- Surface waters showed higher carboxylic acid concentrations (e.g., PFOA), while sulfonates (e.g., PFOS) were more abundant at depth.
- Coastal proximity, ocean currents, and human activities influenced concentration patterns.

Looking forward, Jiménez introduced the PANTOC expedition, planned for June–July 2025 in the Mediterranean Sea. This multidisciplinary campaign will monitor PFAS, OPEs, PCBs, dioxins, and other POPs in air, water (surface to 2000 m), sediments, and the surface microlayer using state-of-the-art techniques.

In conclusion, the presentation highlighted the need for continued international collaboration, advanced analytical methodologies, and comprehensive monitoring to evaluate the effectiveness of environmental policies and protect aquatic ecosystems from POPs and PFAS pollution.



SESSION 6 - MONITORING OF POPS IN AIR

DR. BEGOÑA JIMÉNEZ

SENIOR RESEARCHER - SPANISH NATIONAL RESEARCH COUNCIL

Dr. Begoña Jiménez from the Spanish National Research Council (IQOG-CSIC) presented an in-depth review of the long-term monitoring of Persistent Organic Pollutants (POPs) in ambient air across Spain, in line with the objectives of the Stockholm Convention. The goal of the Convention is to eliminate or reduce the release of POPs, protecting human health and the environment.

The Spanish POPs Monitoring Program (SPM-POPs) was established in 2008, using Passive Air Samplers (PUF-PAS) across both urban and background locations. The program covers a wide geographical area, operating in collaboration with the Spanish Meteorological Agency (AEMET) and research institutions such as CSIC and CIEMAT.

The target compounds include unintentionally produced POPs (PCDD/Fs), industrial chemicals (PCBs, PBDEs), and agricultural pesticides (DDTs, endosulfan, HCHs, HCB, and PeCB). Sampling is conducted seasonally (four times per year) at each site. Advanced analytical techniques such as gas chromatography–mass spectrometry (GC-MS and GC-HRMS) are used for detection and quantification.

Key findings include:

Higher concentrations of most POPs were recorded in urban sites compared to background areas, notably for PCBs, PBDEs, PCDD/Fs, DDTs, and HCHs.

HCB, PeCB, and endosulfan showed no significant difference between urban and rural locations.

Average concentrations varied significantly by compound, with PCBs and DDTs being among the most abundant.

Seasonal variations were significant for DDTs, endosulfan, HCB, PeCB, and PCDD/Fs. Winter typically showed higher levels for many POPs due to meteorological and emission factors.

In terms of temporal trends, the study observed:

- Decreasing concentrations of endosulfan, PCBs, and PCDD/Fs over time, reflecting the effectiveness of regulatory measures.
- Increasing trends for HCHs and PBDEs, suggesting continued emissions or re-emission from historical use.

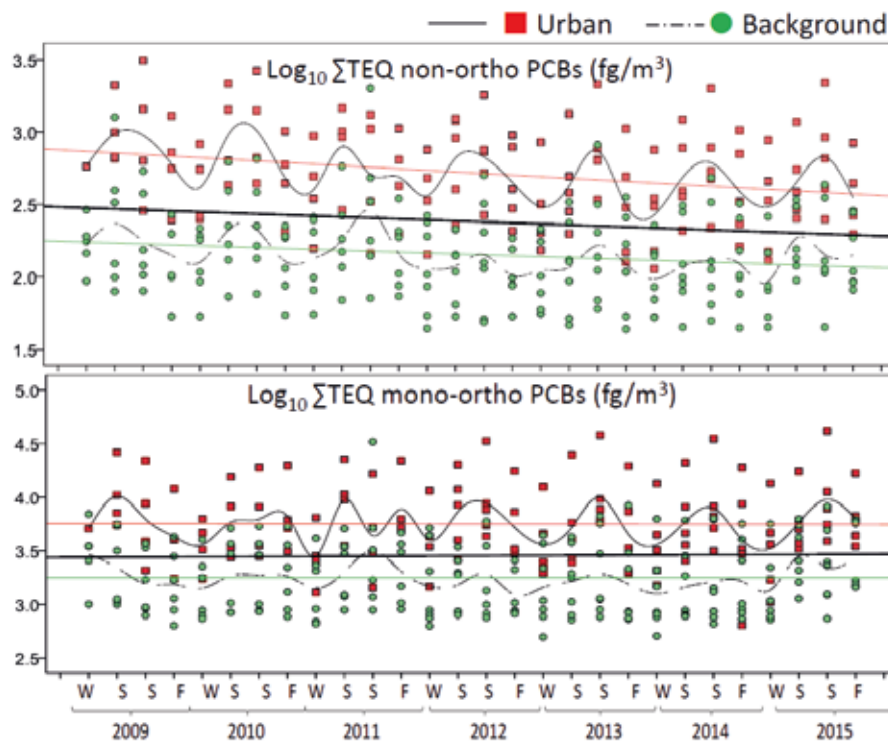


● For dioxins and dioxin-like PCBs, concentrations have reached very low levels, converging between urban and rural sites, confirming the success of national and international regulatory efforts.

Jiménez emphasized the need for continued long-term monitoring to better understand the fate of airborne pesticides and to detect trends in POP concentrations. She also highlighted the importance of considering re-emission, new sources, and long-range atmospheric transport in interpreting data.

The presentation concludes that sustained monitoring programs are essential to evaluate the effectiveness of the Stockholm Convention and to guide further regulatory and policy actions.

Temporal trends dl-PCBs





SESSION 7 - IMPLEMENTATION OF THE STOCKHOLM CONVENTION: CHALLENGES AND LESSONS LEARNED WITH FOCUS ON INDUSTRIAL POPs

DR. ROLAND WEBER (Online)

INTERNATIONAL CONSULTANT, POPS ENVIRONMENTAL CONSULTING

Dr. Roland Weber's presentation addressed the key challenges, progress, and lessons learned in implementing the Stockholm Convention, with a focus on industrial POPs (Persistent Organic Pollutants). His analysis draws on nearly two decades of global efforts, highlighting successes and gaps, particularly in developing countries and economies in transition.

The Stockholm Convention, established in 2001, aims to eliminate or restrict POPs to protect human health and the environment. Industrial POPs—such as PCBs (polychlorinated biphenyls), PFAS (per- and polyfluoroalkyl substances), chlorinated paraffins, brominated flame retardants, and unintentionally produced dioxins and furans—pose complex regulatory and technical challenges.

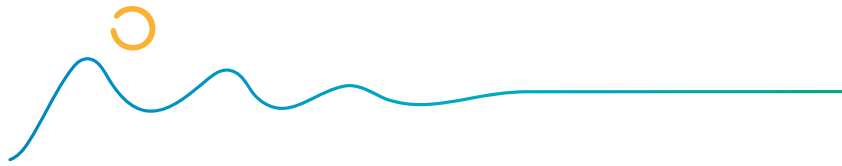
Key Implementation Challenges

Weber emphasized that while the Convention has made significant progress in phasing out certain POPs (like DDT and aldrin), industrial POPs remain a serious and growing concern. These substances are often used in complex supply chains, making their identification, substitution, and elimination difficult. Common challenges include:

- **Lack of awareness and transparency** in industrial sectors.
- **Limited technical capacity** to detect and analyze POPs.
- **Inadequate enforcement** of regulations and labeling standards.
- **Weak inventories** and tracking systems for industrial POPs, especially PCBs and PFAS.

The PCB Elimination Deadline

One of the Convention's critical targets was the **elimination of PCB use in equipment by 2025 and their environmentally sound disposal by 2028**. However, Weber warned that many countries will miss this deadline due to insufficient progress. He pointed out that large amounts of PCB-contaminated transformers and capacitors remain in use or in storage, especially in developing regions.



Brominated Flame Retardants and PFAS

Weber highlighted the growing attention toward brominated flame retardants (e.g., PBDEs, HBCDD) and PFAS, which are widely used in electronics, textiles, and packaging. He called for urgent global action, noting:

- Their persistence and mobility in the environment.
- The lack of effective recycling or destruction technologies.
- Continued production and use despite listing in the Convention.

He also emphasized the importance of pollution prevention and called for a shift toward non-toxic, circular economies.

Good Practices and Recommendations

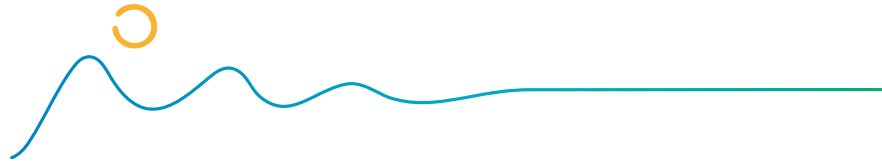
Despite challenges, Weber showcased good practices from some countries and agencies. These include:

- Development of detailed POPs inventories and digital tracking tools.
- Enforcement of Extended Producer Responsibility (EPR) schemes.
- Public procurement policies favoring POP-free products.
- Investment in high-temperature incineration and other POPs destruction technologies.

He recommended stronger global cooperation, technical assistance, and funding—especially through the Global Environment Facility (GEF)—to help low-income countries meet their obligations.

Conclusion

Weber concluded that the Stockholm Convention has been instrumental in creating a global framework for POPs control. However, successful implementation—particularly for industrial POPs—requires urgent action on monitoring, inventories, regulation, and financing. A comprehensive lifecycle approach, involving both producer responsibility and international support, is essential to achieve a toxic-free future.



SESSION 8 - MONITORING AND MANAGEMENT OF POPS IN WASTE – KEY INSIGHTS

DR. PIERRE HENNEBERT **CONSULTANT WASTE AND CIRCULAR ECONOMY**

Pierre Hennebert's presentation, delivered during the POPs workshop in Tunis on May 22, 2025, focused on the **monitoring and management of Persistent Organic Pollutants (POPs) in waste**, especially from electrical and electronic equipment (WEEE), end-of-life vehicles, construction materials, and non-food packaging. His talk highlighted detection strategies, technical challenges, and organizational frameworks under the principles of the **Extended Producer Responsibility (EPR)**.

1. POPs in Plastics and Waste Streams

Hennebert explained that many plastic products—especially in electronics, vehicles, and construction—contain brominated and chlorinated flame retardants, which are POPs. These are typically used in concentrations ranging from 5% to 15% (50,000–150,000 mg/kg). Detecting these compounds is essential before recycling.

2. Detection Techniques

The presentation detailed how field X-ray fluorescence (XRF) can detect total bromine content, serving as a proxy for identifying brominated flame retardants. This fast, non-destructive technique helps screen materials before more specific laboratory analysis. However, POPs are distributed asymmetrically—most samples contain low levels, but a few are extremely high, skewing averages. This reinforces the need for targeted sampling and separation of highly contaminated fractions.

3. Challenges of POPs Distribution

Statistical analyses show that flame retardants are not evenly distributed across waste products. A small number of particles account for the majority of POP mass. Therefore:

- Sorting is crucial to remove these high-concentration particles.
- Raising collection rates is more impactful than lowering regulatory concentration limits.
- Representative sampling is vital to assess contamination accurately.

Hennebert used binomial distribution modeling to demonstrate that to reliably detect rare high-POP particles (e.g., 0.35% of waste), a sample size of over 28,000 particles may be needed.



4. Waste Management Strategies

According to UNEP guidelines, POP-containing waste should undergo irreversible destruction, primarily through high-temperature incineration or cement kiln co-processing. Waste must be packaged, labeled, and transported correctly. Storage in landfills is not recommended.

Separation can be achieved through:

- Manual sorting
- Density separation technologies (e.g., Galloo's continuous flotation system)
- Advanced screening for bromine/chlorine/fluorine content

5. Extended Producer Responsibility (EPR)

The presentation strongly advocated for EPR as the most viable financing and governance model. Under EPR:

- Producers fund the collection, transport, treatment, and destruction of waste.
- Non-profit Producer Responsibility Organizations (PROs) manage these activities under government oversight.
- Goals include high collection rates, POP separation, and environmental safety.

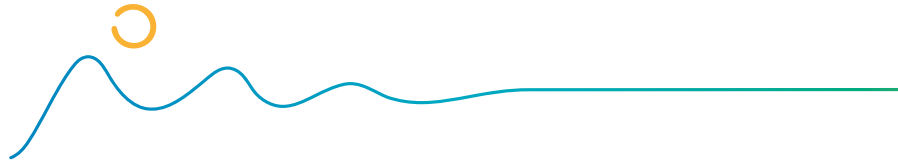
In Tunisia, Hennebert suggested forming multi-stakeholder working groups by sector to build EPR systems aligned with international best practices.

6. Conclusion

Proper POP waste management requires:

- Separate collection and sorting systems
- Reliable detection methods
- Destruction via certified incineration
- Financial and regulatory structures grounded in EPR
- Public-private collaboration and technical training

Hennebert's work offers a roadmap for integrating circular economy principles with strict POP control, ensuring both resource recovery and environmental safety.



DISCUSSIONS

05

During the POPs workshop held in Tunis, experts presented a wide range of insights, covering regulatory frameworks, environmental and human monitoring, industrial and waste-related challenges, and strategic solutions for effective implementation of the Stockholm Convention. The following synthesis outlines the core messages and cross-cutting findings, structured by thematic axis.

1. Regulatory Frameworks and Strategic Implementation

Dr. Kei Ohno Woodall opened the session by presenting the architecture of the Stockholm Convention, its core articles, and the monitoring structure built around the Global Monitoring Plan (GMP). The legal framework emphasizes the elimination of intentionally produced POPs, control of unintentional releases, sound waste management, and national reporting obligations. However, as highlighted by Dr. Roland Weber, the implementation faces practical barriers—especially with industrial POPs like PCBs, PFAS, and flame retardants. Many countries, including Tunisia, are unlikely to meet the 2025 target for PCB elimination due to limited inventories and weak enforcement. Both speakers stressed the need for improved coordination, robust monitoring, and resource mobilization to meet the Convention's commitments.

2. Human and Environmental Monitoring

Dr. Rainer Malisch and Dr. Begoña Jiménez presented comprehensive data from global and national biomonitoring campaigns. Dr. Malisch focused on human milk studies conducted in over 80 countries, demonstrating decreasing trends for legacy POPs such as DDT, HCB, and PCBs—evidence of the Convention's effectiveness. Nevertheless, newer substances like chlorinated paraffins and PFAS are emerging as persistent concerns.

Dr. Jiménez, in two complementary sessions, presented water and air monitoring results. In Spanish river basins, PFOS concentrations frequently exceeded EU thresholds near urban and industrial sites. Meanwhile, long-term air monitoring showed high levels of PCBs, DDTs, and PBDEs in urban zones, with only a partial decline in certain compounds. The data confirmed significant seasonal and spatial variability, underscoring the importance of continued sampling to understand transport dynamics and exposure risks.

3. Industrial POPs and Policy Gaps

Roland Weber's session emphasized that while agricultural POPs are gradually declining due to regulation, industrial POPs present greater challenges due to their complexity in products, lack of transparency in supply chains, and minimal labeling requirements. He highlighted poor progress in managing PCB stockpiles and the absence of adequate recycling and destruction capacity for PFAS and brominated flame retardants. He advocated for global solutions including stronger inventories, better traceability, and international funding to support developing countries.



4. POPs in Waste and Producer Responsibility

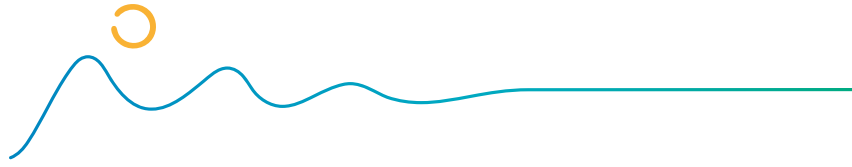
Pierre Hennebert addressed the issue of POPs in plastic waste—especially from electronics, vehicles, and construction. His findings revealed that POPs are highly concentrated in a small fraction of materials, meaning effective detection and separation are essential. He stressed the importance of using field screening techniques like XRF to detect brominated compounds before recycling. More importantly, he proposed Extended Producer Responsibility (EPR) as a practical and sustainable governance model to manage POP-contaminated waste. EPR systems, coordinated by non-profit Producer Responsibility Organizations (PROs), would ensure financing, traceability, and compliance with environmental standards. Hennebert recommended Tunisia engage stakeholders to co-design EPR schemes for critical waste sectors.

Conclusion: Converging Priorities for Action

Across all sessions, a common message emerged: while measurable progress has been made in reducing legacy POPs, the growing complexity of industrial chemicals, combined with inadequate enforcement and technical infrastructure, presents an urgent challenge. There is a strong consensus on the need for:

- Enhanced national inventories and traceability systems
- Strengthened biomonitoring and environmental surveillance
- Public-private collaboration through EPR and circular economy models
- Continued international cooperation and funding support

The Tunis workshop highlighted both Tunisia's commitment and the shared responsibility of the global community to move toward a toxic-free future under the Stockholm Convention.



CONCLUSIONS

06

The Tunis workshop provided a vital platform for sharing knowledge, experiences, and challenges related to the implementation of the Stockholm Convention. Through expert presentations and discussions, participants explored the full spectrum of POPs-related issues—from regulatory obligations and biomonitoring strategies to industrial challenges and waste management solutions. The workshop highlighted significant progress in reducing legacy POPs but also revealed growing concerns around emerging substances like PFAS and chlorinated paraffins. A recurring message was the urgent need for stronger national inventories, effective monitoring systems, and sustainable financing mechanisms such as Extended Producer Responsibility. Tunisia's active participation in global monitoring initiatives and its commitment to the Convention were acknowledged as positive steps. Moving forward, collaborative efforts, technical support, and policy innovation will be essential to meet international targets and protect both human health and the environment. The workshop concluded with a shared resolve to reinforce regional cooperation and accelerate POPs elimination efforts.



AGENDA

07

Time	Sessions	Speakers
8:30 - 9:00	Welcoming and registering guests	
9:00 - 9:15	Welcome speech	- Ministère de l'Environnement - Représentant de MedWaves
9:15 - 9:45	Session 1 : Introduction to POPs - Introduction to POPs - Importance of detection - Global monitoring programme	Dr. Kei Ohno, BRS
9:45 - 10:00	Session 2 : Situation of POPs in Tunisia	M. Youssef Zidi
10:00 - 11:00	Session 3 : Monitoring of POPs in human biomonitoring Session 4 : Monitoring of POPs in foodstuffs	Dr. Rainer Malisch
11:00 - 11:30	Coffee break	
11:30 - 12:15	Session 5 : Monitoring of POPs and PFAS in Water	Dr. Begoña Jimenez
12:15 - 13:30	Lunch break	
13:30 - 14:00	Session 6 : Monitoring of POPs in Air	Dr. Begoña Jimenez
14:00 - 15:00	Session 7 : Implementation of the Stockholm Convention: Challenges and Lessons Learned with Focus on Industrial POPs	Dr. Roland Weber (en ligne)
15:00 - 15:30	Coffee break	
15:30 - 16:30	Session 8 : Monitoring and Management of POPs in Waste - Key Insights - Waste electrical and electronic equipment, end-of-life vehicles, building materials, non-food packaging - Management according to the principle of extended producer responsibility	Dr. Pierre Hennebert
16:30 - 17:30	Discussion: Questions, conclusions and next steps	Debate open to all participants

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PHOTOS

08



LIST OF PARTICIPANTS

09



Atelier "Détermination et surveillance des polluants organiques persistants"

22 Mai 2025, Hotel Royal ASBU - Tunis

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