UNEP/MED WG.580/5

Lessons learned and options for future projects

July 2025

This report is written under the GEF/UN Environment "Mediterranean Sea Programme (MedProgramme): Enhancing Environmental Security" (2019-2025) and reflects the collaborative efforts of various stakeholders working towards the shared goal of improving environmental security in the Mediterranean region. This program is the first GEF programmatic multi-focal area initiative in the Mediterranean Sea, aimed at operationalizing actions that address transboundary environmental stresses, strengthen climate resilience, and enhance water security while improving the health and livelihoods of coastal populations.

MedWaves, as one of the Regional Activity Centres established under the UNEP/Mediterranean Action Plan (UNEP/MAP), plays a vital role in supporting the member countries of the Barcelona Convention. With a mandate to assist Contracting Parties in fulfilling their commitments under both the Barcelona and Stockholm Conventions, MedWaves focuses on promoting sustainable consumption and production patterns, as well as fostering a circular economy to combat the generation of persistent organic pollutants (POPs).

The MedProgramme builds upon the successful partnership between UNEP/MAP, the GEF, and the 22 contracting parties to the Barcelona Convention. It encompasses a series of interconnected components designed to move towards a healthy Mediterranean with productive and biologically diverse marine and coastal ecosystems. Under Component 1, MedWaves specifically engages in Child Project 1.1, which targets the reduction of pollution from harmful chemicals, including POPs and mercury, in Mediterranean hotspots.

The findings and recommendations in these reports are intended to inform and guide stakeholders in their efforts to enhance environmental security in the Mediterranean. This report has been written by an external consultant who was hired following public procurement. He has been in close contact with the MedWaves project manager for the MedProgramme. However, it does not necessarily represent the views of all stakeholders involved in the MedProgramme and should be interpreted within the context of ongoing discussions and evolving research in the field of environmental management.

Dr. Roland Weber

Lindenfirststr. 23; 73527 Schwäbisch Gmünd, Germany

Roland.Weber10@web.de

https://www.researchgate.net/profile/Roland-Weber-2

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Abbreviations and Acronyms

BAT	Best available techniques
BAT-AELs	BAT-associated emission levels
BFR	Brominated flame retardant
BREF	BAT Reference document
c-DecaBDE	Commercial Decabromodiphenyl ether
CAS	Chemical Abstracts Service
CoC	Chemicals of Concern
CPs	Chlorinated paraffins
CDW	Construction & demolition waste
decaBDE	Decabromodiphenyl ether; BDE-209
DP	Dechlorane Plus
EPS	Expanded polystyrene
EU	European Union
FR	Flame retardant
GEBs	Global Environmental Benefits
GEF	Global Environment Facility
GFC	Global Framework on Chemicals
GGKP	Green Growth Knowledge Partnership
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
HBCD(D)	Hexabromocyclododecane
HIPS	High impact polystyrene
MAP	Mediterranean Action Plan
MCCPs	Medium-chain chlorinated paraffins
NIP	National Implementation Plan
NSO	National statistical office
ODS	Ozone depleting substances
OPFR	Organophosphorus flame retardant
PBDEs	Polybrominated diphenyl ethers
PCDD	Polychlorinated dibenzo-p-dioxin
PCDF	Polychlorinated dibenzofuran
PFASs	Per- and polyfluorinated alkylated substances
PFHxS	Perfluorohexane sulfonic acid
PFOA	Perfluorooctanoic acid; Perfluorooctanoate
PFOS	Perfluorooctane sulfonic acid; Perfluorooctane sulfonate
PFOSF	Perfluorooctane sulfonyl fluoride
POPRC	Persistent Organic Pollutants Review Committee
POPs	Persistent Organic Pollutants

PPG	Project Preparation Grant
PUR	Polyurethane
PVC	Polyvinyl chloride
Q&A	Question and Answers
SCCPs	Short-chain chlorinated paraffins
SCPRAC	Regional Activity Centre for Sustainable Consumption and Production
t	Tonnes; metric tons
TOP assay	Total Oxidizable Precursor assay
UNEP	United Nations Environmental Programme
UNEP/MAP	United Nations Environmental Programme Mediterranean Action Plan
UV-328	2-(2H-benzotriazol-2-yl)-4,6-ditertpentylphenol
XPS	Extruded polystyrene

1 Introduction

The GEF/UN Environment Mediterranean Sea Programme (MedProgramme): Enhancing Environmental Security (2019–2025) is the first Global Environment Facility (GEF) programmatic, multi-focal area initiative specifically designed for the Mediterranean region. It aims to reduce major transboundary environmental stresses affecting coastal and marine ecosystems, while simultaneously enhancing climate resilience, improving water security, and safeguarding human health and livelihoods. The MedProgramme is built upon a strong partnership between UNEP/MAP, the GEF, and the 22 Contracting Parties to the Barcelona Convention. It consists of eight interlinked Child Projects structured under four thematic components: (1) Reduction of Land-Based Pollution, (2) Enhancing Sustainability and Climate Resilience in the Coastal Zone, (3) Protecting Marine Biodiversity, and (4) Knowledge Management and Programme Coordination. Through this integrated framework, the MedProgramme operates in ten beneficiary countries—Albania, Algeria, Bosnia and Herzegovina, Egypt, Lebanon, Libya, Montenegro, Morocco, Tunisia, and Turkey—working across focal areas including Biodiversity, Chemicals and Waste, Climate Change Adaptation, and International Waters.

Within this regional context, MedWaves, the UNEP/MAP Regional Activity Centre for Sustainable Consumption and Production, plays a central role in implementing activities under Component 1, Child Project 1.1. This Child Project specifically targets the reduction of pollution from Persistent Organic Pollutants (POPs) and mercury, focusing on land-based sources of hazardous chemicals in Mediterranean hotspots.

MedWaves is primarily responsible for pilot activities, with an emphasis on raising awareness, promoting the phase-out of mercury-containing devices, supporting national policy and regulatory development, and identifying sustainable alternatives. These actions complement the work of other partners addressing related pollution issues such as wastewater and nutrient loading under parallel Child Projects.

During the Fifth Project Steering Committee Meeting of Child Project 1.1, participants recognized the value of reflecting on implementation experiences and explicitly requested MedWaves to provide a written report on lessons learned and options for future projects. This document responds directly to that request. It compiles the main insights gained during project execution, with a focus on country-level implementation and outlines key challenges, achievements, and strategic considerations to inform the design and effectiveness of similar interventions moving forward.

2 New industrial POPs activities

2.1 Inventories

A major lesson emerging from the project implementation—particularly in relation to PFOS, and HBCD and other POPs—is that inventories cannot be treated as stand-alone exercises. An inventory is not merely a list or a number to be reported; it is a strategic starting point that must lead directly to action.

2.1.1 Need of a quick inventory to have sufficient time for implementation action for phase-out exempted POPs

For the phase-out of the POPs in the Child 1.1 project (2019-2024), inventory information would have been needed early in the project implementation best in the first year (2019) latest in 2020 that sufficient time for implementation of the elimination would have been available (2020 to 2024). This is especially true for HBCD where global phase out and production stop was in 12/2021 and the stop of exemption for the Mediterranean area in 2019 which was also stressed in the PPG report (Planeting 2018)[1]. So for HBCD, phase out plans would have been required already at the start of the project and would need to have been developed in the PPG phase that they could be implemented in the first project year. However the project report on inventories (MedWaves 2025)[2] show that for Tunisia still assessment for HBCD (and PFOS use) was ongoing in 2022 (mean after global HBCD production stopped 12/2021) and the difficulty to get information resulted in a meeting in September 2022 with 42 stakeholders/institutions for better information gathering (MedWave 2025)[2].

Furthermore, the analytical results only came end of 2024 (for Tunisia 12/2024 (Ramboll 2024a)[3]; Lebanon 10/2024 (Ramboll 2024b)[4] and Morocco (Ramboll 2024c)[5]) which for HBCD is 5 years too late and also for SCCP is after the expiring of exemption 12/2023 and therefore also too late.

In addition to analysis, information should have been required from the supply chain. For EPS/XPS the producer of insulation foam know what flame retardant is used in particular if a POP is listed already for more than 3 years and also for the importer of master batches to produce EPS the flame retardant additive have to be listed in the Material Safety Data Sheet (MSDS). Therefore, with an appropriate frame for HBCD listed 2013, the producer and user of EPS/XPS should have known and likely have known what BFR is used and if substitution is happening and until when substitution could be completed and what support is needed from the project. However, as mentioned above there were challenges with communication with stakeholders in e.g. Tunisia until even 2022. One

[1] Planeting (2018) Proposal for the Prevention of New POPs and Mercury - MedProgramme – Child project 1.1. Final Report.

[2] MedWave (2025) Inventories for PFOS foams, HBCD Polystyrenes for Morocco, Tunisia, and Lebanon, and SCCP for Lebanon. Summary Report February 2025 UNEP/MED WG.580/5

[3] Ramboll (2024a) RESULTATS ANALYTIQUES ET CONTEXTE JURIDIQUE POUR LES ECHANTILLONS DE LA TUNISIE. Decembre 2024

[4] Ramboll (2024b) ANALYTICAL RESULTS OF POPs SAMPLES FOR LEBANON. October 2024

[5] Ramboll (2024c) RESULTATS ANALYTIQUES POUR LES ECHANTILLONS DU MAROC Decembre 2024

challenge for transparent information on chemicals in products is that Tunisia still has not implemented the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) but Draft legislation, based on the 6th revised edition of the GHS (GHS Rev.6) was drafted in 2016, including a draft law, a draft decree and a draft order (arrêté) and no further information on follow-up activities has been provided (UNECE 2023)[6]. Morocco and Lebanon are not mentioned in the UNECE report in 2023 as countries with GHS implementation (UNECE 2023)[6] but Lebanon had some GHS capacity building activities after the Beirut port explosion 08/2020 where a large amount of fertilizers stored for years at the port exploded (ILO and UNITAR 2022)[7] and according of industry information, GHS is implemented in Morocco (MarCoPack 2025)[8]. The implementation of GHS is one cornerstone for chemical management and for having robust information on chemicals and chemicals in mixtures which could have facilitated at least the HBCD project part .

2.1.2 Information on the presence of POPs need to have a robust base and collaboration and robust field-based validation are essential

For avoiding the use of PFOS (and other POP PFAS) in firefighting foam a robust inventory of firefighting foams in a country or at least of the major users and stocks of firefighting foam is essential. The inventory of firefighting foams in Tunisia showed that there is large potential for phase-out with an estimated AFFF foam amount of 418914 L suspected to contain PFOS and the related estimate PFOS content of 19212 kg. Plus an additional amount of 102200 L of fluoroprotein foam. However only 10 firefighting foams have been analysed for Tunisia and 14 firefighting foams for Morocco and these foams have been analysed only for PFOS[3] although also PFOS precursor need to be analysed and a TOP (Total Oxidizable Precursor) assay for understanding if a foam contain PFOS related substances/precursors which can make the largest share and is known since several years to be relevant for determining POP-PFASs in firefighting foams (Mumtaz et al. 2019[9]; Fan et al. 2021[10]) but was not requested for the analysis by the consultancy responsible for the monitoring (Ramboll) sampled and analysed 2024 (Ramboll 2024b)[4]. Furthermore PFOA has been listed as POP in 2019 and PFHxS has been listed as POP in 2022 and therefore would have been required to be analysed in 2024 to determine if a firefighting foam contain POP-PFASs. For the 3 firefighting foam samples in Lebanon a broader set of PFAS have been analysed including PFOA and PFHxS and also some

[6] UNECE (2023) Information compiled by the secretariat of the GHS Sub-Committee. Last updated in November 2023. https://unece.org/sites/default/files/2023-11/GHS%20implementation%20by%20country_2023-11.pdf

[7] ILO and UNITAR (2022) Implementation of the GHS, preventing chemical accidents, and strengthening occupational safety and health: A joint project from ILO and UNITAR https://www.ilo.org/projects-and-partnerships/projects/implementation-ghs-preventing-chemical-accidents-and-strengthening

[8] MarCoPack (2025) Labeling of Chemicals in Morocco. https://marcopack.com/en/labeling-of-chemicals-in-morocco/

[9] Mumtaz M, Bao Y, Liu L, Huang J, Cagnetta G, Yu G. (2019) Per-and polyfluoroalkyl substances in representative fluorocarbon surfactants used in Chinese film-forming foams: levels, profile shift, and environmental implications. Environmental Science & Technology Letters. 6(5), 259-264.

[10] Fan X, Bao Y, Mumtaz M, Huang J, Yu G. (2021) Determination of total oxidizable precursors in foam surfactants and foam contaminated water based on UV-activated persulfate oxidation. Science of the Total Environment. 763, 142943.

precursor but also these samples where not subjected to a TOP Assay (Ramboll 2024a)[3]. (see Section 2.3 on monitoring and analysis).

Inventories that are built without full participation from national actors—and without direct visits to the sites—are at best estimates and at worst misleading. Remote assessments by consultants cannot replace in-person validation, stakeholder interviews, and contextual understanding. For example for firefighting foams all major stakeholders need to be considered. This is e.g. described in the Stockholm Convention inventory guidance documents within. For firefighting foams some major stakeholders and owners might be challenging to approach like refineries or large oil storages or the military. This requires meetings with these groups and information to develop mutual understanding and information on the relevance of the activity as a base for collaboration. The importance of close cooperation with key stakeholders for a PFOS inventory has already been described for the Mediterranean region in the NIP update of Turkey and has been highlighted as a basis for the development (Kuruku et al. 2015)[11].

This is similarly true for mercury: for example, healthcare facilities may report having removed mercury thermometers, while still keeping old stocks in storage rooms “just in case.” Without field visits, such discrepancies go unnoticed.

Moreover, involving local actors builds ownership, fosters institutional memory, and helps ensure that the data collected is not only accurate but also understood and used by the people who need it most—those making decisions about procurement, waste handling, and regulation.

2.1.3 An inventory without a plan is an incomplete exercise

Consider the case of PFOS in firefighting foams. These foams were already present and new foams containing PFOS were not relevant in/after 2022 where PFOS production stopped. Therefore the major avoidance would have been the stop of use of PFOS in stocks. Simply identifying that “X liters” of PFOS-containing foams exist in stock provides no actionable guidance unless it is immediately followed by a plan addressing:

- How those foams will be phased out or destroyed
- What alternatives will be used
- How new procurement will be controlled to avoid recurrence
- What interim safety measures will be applied during storage and use

In Tunisia, as in many countries, the focus of inventory work should not be on collecting a number for the sake of reporting to conventions such as the Stockholm (or Minamata) Conventions. Rather, targeted risk management and elimination strategies would have been required to avoid the use of PFOS foam in stocks.

[11] Korucu MK, Gedik K, Weber R, Karademir A, Kurt-Karakus PB. (2015) Inventory development for perfluorooctane sulfonic acid (PFOS) in Turkey: challenges to control chemicals in articles and products. Environmental Science and Pollution Research. 22, 14537-45.

2.1.4 Quantities change over time so inventories should be dynamic

The quantities in use or stocks of POPs are not static. They may be consumed over time (as is the case of firefighting foam), exported, or disposed of (often in an non environmentally sound manner in the North African region with a lack of BAT destruction capacity). A one-time inventory becomes obsolete in the absence of regular updating. Countries must therefore view inventories as dynamic processes, supported by:

- Monitoring systems to track the evolution of stocks and flows
- Digital tools for data collection and management
- Institutional mandates for regular reporting and updating

For instance, knowing the total tonnes of foams with PFOS in use across a national firefighting facilities system is important, but that figure changes as foams are used. Similarly for SCCPs in lubricants or fatliquoring. Unless this data is updated and analyzed periodically, the national picture becomes quickly outdated.

One option to address this issue are dynamic material and substance flow analysis (MFA/SFA) which when selecting appropriate service life and Weibull function (Brunner and Rechberger 2016)[12]. This has been used already 10 years ago for national inventories of HBCD in EPS/XPS (Li et al. 2016)[13]. The MFAs/SFAs of POPs in different use sectors are also recommended in some Stockholm Convention inventory guidance documents (UNEP 2019[14]; UNEP 2021[15]).

2.1.5 Inventories should be linked to policy instruments

A critical lesson is that inventories must feed directly into policy and legal instruments. A national inventory, for example, should inform:

- A National Action Plan for phase-out
- Waste management protocols for storage and disposal of legacy stocks
- Legislative bans on import and trade
- Options for destruction

[12] Brunner PH, Rechberger H. (2016) Handbook of material flow analysis: For environmental, resource, and waste engineers. CRC press.

[13] Li L, Weber R, Liu J, Hu J. (2016) Long-term emissions of hexabromocyclododecane as a chemical of concern in products in China. Environment International. 91, 291-300.

[14] UNEP (2019). Guidance on preparing inventories of short-chain chlorinated paraffins (SCCPs) (Detailed guidance). Secretariat of the Basel, Rotterdam and Stockholm conventions, Geneva.

[15] UNEP (2021). Draft guidance on preparing inventories of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants. Secretariat of the Basel, Rotterdam and Stockholm conventions, United Nations Environment Programme, Geneva.

2.1.6 A lifecycle approach is needed

Ultimately, inventories must be part of a lifecycle approach to chemicals management. This means looking beyond where the chemicals are now (stockpiles) to understanding:

- Where they came from (supply chains)
- How they are used (applications and exposures)
- How they will be replaced (alternatives and technologies)
- How they will be eliminated (disposal and destruction plans)

This lifecycle thinking is essential for compliance with international conventions but also for protecting human health and the environment in a sustainable manner.

The elimination of the use of POPs especially those with exemptions (which was the core of the project, innovative and sustainable) is a priority. However the disposal of the waste coming out of the stocks of the past 40 years use of these POPs has also a high priority and should have been considered in the project at least for future planning of the management of these stockpiles.

Especially after it would became clear that GEB could not be reached by just avoidance, elimination and destruction consideration should have been developed.

2.2 The need for sectoral approach in future over substance fragmentation

The project focussed on the three POPs with exemption and relevant use at the time of project development. Also at the time of project development in 2017, all three POPs were still produced in high volumes (Planeting 2018)[1]. Therefore the project focused on these three distinct substances listed under the Stockholm Convention and related major use in the region: PFOS in firefighting foams, Hexabromocyclododecane (HBCD) in expanded and extruded polystyrene (EPS/XPS) used in insulation panels, and Short-Chain Chlorinated Paraffins (SCCPs) primarily used in PVC-based products. This design had the highest probability to achieve a high avoidance of POPs even exceeding the proposed avoidance of 400 tonnes GEBs. However the project limited the ability to produce a comprehensive, actionable roadmap within sectors and value chains. During the duration of the project (2019 to 2025) more new industrial POPs have been listed used as additive in plastics mainly in the industrial sectors building/construction, electrical and electronic equipment (EEE), transport and textiles (GGKP 2024)[16]. Each of the three selected POPs presents unique technical, regulatory, and operational challenges with exemptions for further use. Each is embedded in a different value chain: PFOS in a range of uses focusing on firefighting systems in the project, HBCD exclusively exempted for insulation foams within the construction and building materials sector, and SCCPs with a wide range of exemptions including a major use in plastics and polymer manufacturing with a major use in PVC used in different applications (only toys where not exempted). The project targeted three countries — Lebanon, Morocco and Tunisia — with each country focusing two of these substances and SCCPs were considered exclusively in Lebanon.

[16] GGPK (2024) Sectoral Guidance for Inventories of POPs and Other Chemicals of Concern in Buildings/Construction, Electrical and Electronic Equipment, and Vehicles.

One lessons from the implementation of Child Project 1.1 is the recognition that the approach taken—focussing on the avoidance on POPs— has neglected the total lifecycle of the POPs and to include to develop at least a plan to manage the POPs in current stocks and waste which for PFOS and for HBCD is a much larger amount compared to the POPs coming new on the market. Also an innovative additional consideration could have been to avoid other POPs which were at the time of the project already evaluated by the POPs Reviewing Committee (POPRC) such as MCCPs, Dechlorane Plus (DP) and UV-328 and were used in the same major use sectors as the SCCP and HBCD (plastics in buildings, transport and transport).

An approach could have been to select one or two industrial sector per country and tackle all relevant POPs within that sector, providing a more coherent and strategic focus. For instance, the project could have concentrated entirely on the construction sector in one country, covering both HBCD, SCCPs and DecaBDE (listed in 2017 and also exempted for a polyurethane (PUR) insulation foam), thereby building a detailed sectoral map, engaging relevant stakeholders comprehensively (manufacturers, importers, regulatory authorities, waste handlers), and designing targeted phase-out or substitution strategies. This would have allowed for the development of national guidelines, integration into building codes or procurement policies, and potential replication in other countries. One reason that this approach was not chosen was that it was not clear if DecaBDE was used in PUR foam and if then the amount was considered small. Also it was not clear to which extent SCCPs was used in building materials since the major PVC used e.g. in windows and frames are not plasticized.

However, such a sectoral approach on assessment of the presence of POPs in the major sectors and related stocks would be a basis for their appropriate management in future (see recommendations).

2.3 Sampling and analysis

Another key lesson from the implementation of Child Project 1.1 relates to the design, coordination, and execution of sampling and chemical analysis activities. While the intention behind the sampling effort was valid—to generate a broad overview of POPs presence across several countries and sectors—the methodological approach was fragmented, ultimately limiting the depth, comparability, and usability of the results. The decision to prioritize geographic coverage over analytical depth led to a sampling strategy that collected only a few samples per POP, aiming to map a national landscape rather than develop a representative or statistically robust dataset for any single sector, site, or matrix. While this created a visual "map" of POPs presence, it did not provide the analytical foundation necessary to guide risk assessment, regulatory decisions, or targeted interventions.

2.3.1 Lack of robust analysis and improper interpretation

However only 10 firefighting foams have been analysed for Tunisia and 14 firefighting foams for Morocco and these foams have been analysed only for PFOS[3] although also PFOS precursor need to be analysed and a TOP (Total Oxidizable Precursor) assay for understanding if a foam contain PFOS related substances/precursors which can make the largest share and is known since several years to be relevant for determining POP-PFASs in firefighting foams (Mumtaz et al. 2019[17]; Fan et al. 2021[18]) but was not requested for the analysis[4]. Furthermore, PFOA has been listed as POP in 2019 and PFHxS has been listed as POP in 2022 and therefore would have been required to be analysed in 2024 to determine if a firefighting foam contain POP-PFASs. For the 3 firefighting foam samples in Lebanon a broader set of PFAS have been analysed including PFOA and PFHxS and also some precursor but also these samples where not subjected to a TOP Assay (Ramboll 2024a)[3]. (see Section 2.3 on monitoring and analysis).

There are monitoring approaches for PFAS for firefighting foams including screening for total fluorine content and TOP assay for PFASs which were recently included in the round table on POPs research needs and opportunities in African countries facilitated by the Green Growth Knowledge Partnership (GGKP 2025). In this online round table for Africa Professor Jun Huang[19] from Tsinghua University in China which hosts the Basel and Stockholm Convention

The analytical report of Ramboll for Lebanon[4] did wrong conclusions on exceeding regulatory limits when interpreting measurement results:

a. In the measurement of PFAS in firefighting foam the regulatory limits of the EU of mg/kg were translated to ng/ml.[4] However this should be µg/ml. Due to this mistake the report concludes that regulatory limits have been exceeded by the measured foam.
b. In the measurement of SCCP in PVC samples in Lebanon the report concludes "*According to the acquired data it is only possible to say that company 86 amply exceeds this limit concentration, and the product from Cobopol T1 is also above the limit of compliance*"[4]. However both concentrations in the pellets (608 µg/g and 11.2 µg/g) were considerably below the Stockholm Convention POPs limit of 1% (10,000 µg/g) or the unintentional trace contaminant limit of the EU of 0.15% (1,500 µg/g) which were mentioned as the benchmarks.

This indicates that the consultant of Ramboll writing the report lack knowledge of interpreting monitoring data and made wrong conclusions.

[17] Mumtaz M, Bao Y, Liu L, Huang J, Cagnetta G, Yu G. (2019) Per-and polyfluoroalkyl substances in representative fluorocarbon surfactants used in Chinese film-forming foams: levels, profile shift, and environmental implications. Environmental Science & Technology Letters. 6(5), 259-264.

[18] Fan X, Bao Y, Mumtaz M, Huang J, Yu G. (2021) Determination of total oxidizable precursors in foam surfactants and foam contaminated water based on UV-activated persulfate oxidation. Science of the Total Environment. 763, 142943.

[19] https://scholar.google.com/citations?user=SoM0e_AAAAAJ&hl=en

2.3.2 Analysis of samples should include the developing of monitoring capacity in the project countries

The analysis of POPs have only been done in laboratories outside the project countries[20] and therefore still the project countries do not have the capacity to analyse these major POPs. However sending samples abroad does not have the potential for scale up and are also not sustainable since project countries are not able to detect these POPs by own laboratory capacity. If selected project countries (Lebanon, Morocco and Tunisia) would have been capacitated to analyse these POPs in national laboratories then monitoring of these POPs could have been extended beyond the analysed samples limited by budget allocated for monitoring in the project. Equipment necessary for the analysis of these POPs are available in some of the project countries. E.g. the National Institute of Research and Physico and Chemical Analysis in Tunisia possess a LC-MS which would have been appropriate to analyse PFASs. Furthermore it was stressed by a member of the institute at the Tunisia POP monitoring workshop that they are highly interested to develop PFAS analysis. In addition to monitoring of PFAS in firefighting, other highly relevant matrices could then be monitored in the country or even region in particular ground water, surface water, irrigation water and drinking water where PFAS pollution can be a large risk for large share of population (e.g. Liu et al. 2021[21] ; Andrews and Naidenko 2020[22]) also in Africa but with limited data for a few countries (e.g. Groffen et al. 2021[23]; Rapoo et al. 2025[24]). The monitoring approach taken in the project did not result in sustainable monitoring support in the project countries and a very minor sample coverage (see below Section 2.3.3) which would have been avoided by developing capacity in selected project countries.

This approach also failed to account for key operational and technical constraints. There was no unified plan in place from the outset regarding which laboratories would perform the analyses, how sample transport would be managed across borders, or how quality assurance would be guaranteed across different countries and laboratories. The individuals conducting the sampling were not the same as those conducting the laboratory analysis, and different teams were mobilized in each country. While this decentralized model allowed for local engagement and practical access to facilities, it also increased the likelihood of inconsistencies in sample collection methods, chain of custody, and documentation. These issues are compounded when sampling involves different matrices (e.g., solid building materials, foams, PVC, liquid foams), as each requires different handling protocols and may

[20] For a range of analysis a laboratory from Montenegro was used for the analysis which also belong to the region and MedWave. However for PFAS analysis this laboratory focussed only on analysis of PFOS and might have been limited in the scale of PFAS substances

[21] Liu L, Qu Y, Huang J, Weber R. (2021) Per-and polyfluoroalkyl substances (PFASs) in Chinese drinking water: risk assessment and geographical distribution. Environmental Sciences Europe. 33, 1-2.

[22] Andrews DQ, Naidenko OV. (2020) Population-wide exposure to per-and polyfluoroalkyl substances from drinking water in the United States. Environmental Science & Technology Letters. 7(12), 931-936.

[23] Groffen T, Nkuba B, Wepener V, Bervoets L. (2021) Risks posed by per-and polyfluoroalkyl substances (PFAS) on the African continent, emphasizing aquatic ecosystems. Integrated Environmental Assessment and Management. 17(4):726-32.

[24] Rapoo SM, Thaoge-Zwane ML, Okonkwo JO. (2025) Distribution pattern, source apportionment, and health risk assessment of per-and polyfluoroalkyl substances in drinking water treatment plants in South Africa. Environmental Toxicology and Chemistry. vgaf136.

have different limits of detection (LOD) and limits of quantification (LOQ). This variability undermines the comparability of results across substances, countries, and sectors. Also for PFAS in samples of two countries (Morocco and Tunisia)[3,5] only PFOS was analysed while in Lebanon a wide range of PFAS were analysed[4] in a different laboratory.

2.3.3 Limited sample size of analysed samples

The amount of samples measured were quite limited for several matrices. For example, in the case of SCCPs in Lebanon, only three samples were collected, which is insufficient to characterize the sector or validate any conclusions. Such a limited dataset cannot support broader assessments or inform national-level strategies. Moreover, without a statistically significant number of samples or a clear post-analysis plan, the value of the data is largely illustrative rather than instructive. Examples of national monitoring have already been published at the time the monitoring where executed including a study of monitoring products on the Chinese marked (n=124 samples) (Chen et al. 2021)[25] or monitoring a certain product group like monitoring SCCP/MCCPs in polyurethane (PUR) spray foams in Netherlands (n=24) (Brandsma et al. 2021)[26] available at the time where monitoring where conducted. In addition, the Stockholm Convention guidance on monitoring POPs in products (UNEP 2017[27] and update in UNEP 2021[28] including then SCCPs/MCCPs) proposes strategies on monitoring POPs in products and recycling with a pre-screening approach or cheap pyrolysis GC/MS method which can be used for qualitative and semi-quantitative screening of POPs in plastic products including CPs (UNEP 2021[28]; Ramungul et al. 2023[29]). Such a semiquantitative screening can cheaply screen dozens of samples which can be sufficient to clarify the presence of CPs as additives.

2.3.4 From monitoring results to action

The project lacked a predefined mechanism to translate the results of sampling and analysis into concrete actions. Although reports were shared with countries, no subsequent steps—such as sector-specific risk communication, regulatory review, or substitution planning—were activated once the results were available. This reveals a structural flaw: sampling should not be an isolated activity. It must be embedded within a broader framework that connects data generation to decision-making, resource mobilization, and stakeholder engagement.

[25] Chen C, Chen A, Li L, Peng W, Weber R, Liu J. (2021) Distribution and emission estimation of short-and medium-chain chlorinated paraffins in Chinese products through detection-based mass balancing. Environmental Science & Technology. 55(11), 7335-7343.

[26] Brandsma SH, Brits M, de Boer J, Leonards PE. (2021) Chlorinated paraffins and tris (1-chloro-2-propyl) phosphate in spray polyurethane foams–A source for indoor exposure?. Journal of hazardous materials. 416, 125758.

[27] UNEP (2017) Draft Guidance on Sampling, Screening and Analysis of Persistent Organic Pollutants in Products and articles - Relevant to substances listed in Annexes A, B and C of the Stockholm Convention on Persistent Organic Pollutants from 2009 to 2015.

[28] UNEP (2021). Draft guidance on sampling, screening and analysis of persistent organic pollutants in products and recycling. Secretariat of the Basel, Rotterdam and Stockholm conventions, UNEP, Geneva.

[29] Ramungul N, Boontongkong Y, Viwatthanasittiphong P, Chuayrueng N, Temtanapat Y, Koonhorm S, Ausavanonkulporn A. (2023) Circular economy without chemicals controls? Evidence of recirculated toxic plasticizers in flexible PVC products. Journal of Environmental Exposure Assessment. 2(1), 2.

In future initiatives, several improvements are necessary:

- Define clear objectives for sampling from the outset: Is the goal to identify hotspots, assess compliance, estimate exposure, or plan interventions?
- Standardize protocols across countries and matrices to ensure comparability, including consistent LODs, LOQs, and QA/QC procedures.
- Select a limited number of targeted locations or sectors, but invest in deeper and more representative sampling within them.
- Ensure early identification and coordination with capable laboratories, including logistical planning for transport and handling.
- Design post-analysis actions in parallel with the sampling plan, ensuring that results lead directly to regulatory, operational, or awareness-raising interventions.
- Use mixed models: while a single firm or lab cannot conduct all sampling due to geographic limitations, coordination and training across national teams must be improved to maintain consistency.

Ultimately, the lesson is clear: sampling is only as valuable as the decisions it enables. Without strategic planning, coordination, and follow-up, data collection becomes a disconnected exercise that fails to influence real-world environmental or health outcomes.

2.4 Theoretical Estimations vs. Verifiable Prevention — Clarifying the Meaning of "POPs Prevented"

One of the stated goals of the project was the prevention of approximately 650 tonnes of new POPs (PFOS, HBCD and SCCP), a figure that appears ambitious and impactful. This estimation was considered that it could be verified based on a theoretical modelling approach using an accounting tool developed by Wool. While this tool provides a useful framework for standardized reporting, particularly in alignment with multilateral environmental agreements, it does not always reflect the actual volume of chemicals safely disposed of, neutralized, or directly substituted on the ground. Even more if any disposal has been done.

In practice, beyond the legislative changes and awareness-raising activities, the project did not implement large-scale enforceable substitution programs in most countries or disposal operations. This creates a significant gap between theoretical prevention and verifiable action. Without concrete activities—such as verified replacement of POP or POPs-containing materials or actual collection and destruction—it becomes difficult to credibly substantiate the claim that 650 tonnes were "prevented". While policy and regulation are critical pillars of POPs management, quantifiable prevention must be tied to traceable interventions, especially when figures of this magnitude are being reported to international bodies and funders.

This highlights the urgent need for greater transparency and consistency in how prevention is defined and reported. Future projects should establish clear methodologies from the outset, linking expected impacts to specific interventions and including provisions for third-party verification or measurable indicators. Reporting large prevention figures based solely on theoretical models—without field validation or tangible outputs—risks undermining credibility, especially when communicating results to policy-makers, funders, or affected communities. Integrating both policy achievements and physical outcomes will be essential to ensuring future claims are both accurate and meaningful.

3 Mercury

3.1 Lessons learned from activities on mercury

Flexibility in Project Scope and Adaptation to National Contexts Are Essential for Relevance and Impact

An important lesson from the implementation of Child Project 1.1 is the critical need for flexibility in project design and execution, particularly when working across multiple countries with different regulatory baselines and implementation timelines. The case of Tunisia offers an example of both early national leadership and the challenges posed when projects continue to operate under static initial scopes, despite evolving national circumstances.

Tunisia had already made significant progress in phasing out mercury in healthcare settings well before the MedProgramme activities began. Since 2018, the country has enforced legislation banning mercury thermometers and other mercury-containing medical devices, aligning fully with the objectives of the Minamata Convention and even surpassing the MedProgramme's proposed timelines, even if Tunisia has not yet ratified the Minamata Convention. This early and proactive action not only demonstrates Tunisia's commitment to environmental health but also showcases its capacity for national-scale policy enforcement.

In parallel, Tunisia had already implemented awareness-raising campaigns targeting healthcare workers and facility managers. These efforts, carried out independently at the national level, contributed to the institutional culture change necessary to sustain mercury-free practices in hospitals and clinics. As a result, when the project attempted to launch similar awareness campaigns, it quickly became evident that such activities were redundant in the Tunisian context. Continuing with pre-planned activities—such as promoting the elimination of mercury thermometers when they were no longer purchased or used—demonstrated a lack of responsiveness to local realities.

Acknowledging this, three alternative activities were proposed in an attempt to redirect efforts toward more meaningful interventions. However, none of these new lines were approved. These included:

1. Expanding public outreach to engage the general population in mercury awareness.
2. Promoting amalgam recovery in dental clinics.
3. Health risk assessment.

While these options could have brought added value—especially by addressing areas not yet regulated or by expanding the stakeholder base—the project's inflexible administrative structure did not permit such adjustments.

However, in the case of Tunisia, three alternative activities were eventually approved, demonstrating that constructive engagement with national authorities can lead to more relevant and impactful project outcomes. These activities were:

a) The development of a framework regulation to update national legislation concerning mercury management and disposal;

b) The elaboration of a national inventory of mercury releases into the environment, providing a broader understanding of emission sources beyond the healthcare sector;

c) The preparation of a report on the management of mercury-contaminated waste and the identification of environmental hotspots across the country.

These three reports were formally approved by the Project Steering Committee (COPIL), serving as concrete examples of how collaboration with national stakeholders can generate meaningful outputs when the project structure allows for flexibility and adaptive planning. Tunisia's experience confirms that when countries are actively engaged, and project frameworks are responsive to their evolving needs and priorities, it becomes possible to pivot toward more strategically aligned and technically valuable interventions. This underscores the importance of maintaining dialogue mechanisms and adaptive management tools throughout the project cycle.

However, inventories conducted during the project were not followed by any verification or disposal action. Although data was collected on existing mercury-containing equipment, no update or clarification was received regarding whether these stocks were eliminated or managed safely. This lack of follow-through underscores the disconnect between data generation and action, a recurrent theme throughout the project.

Furthermore, although a Health Risk Assessment (HRA) was submitted to the Ministry of Health, no feedback was provided. The absence of institutional response limited the ability to integrate health risk data into strategic planning or policy refinement, effectively reducing the potential impact of this output.

Another key limitation of the project lies in the absence of a standardized methodology for quantifying the amount of mercury reduced or prevented—particularly in terms of measurable units such as metric tons. While the initial project scope envisioned the recovery of up to 2,000 mercury thermometers and aimed to prevent approximately 300 tonnes of mercury containing equipment prevented from entering the environment, it remains unclear how this target was calculated, and no formal method was applied to monitor progress against it.

This lack of quantifiable indicators has serious implications: although it is widely accepted that legislative measures and hospital-level enforcement have contributed to reduced mercury exposure, the inability to translate these actions into concrete environmental impact figures makes it difficult to rigorously evaluate project effectiveness. Moreover, without such data, it becomes challenging to communicate success clearly to national authorities, donors, and international stakeholders, or to compare achievements across countries participating in the MedProgramme.

3.2 Recommendations derived from mercury activities

From this experience, several critical recommendations emerge:

- **Incorporate flexibility mechanisms** into project design to allow for adaptive management and real-time responsiveness to national progress and emerging needs.

- **Conduct contextual assessments early in the implementation phase**, and adjust activity scopes accordingly to avoid redundancy and increase relevance.
- **Facilitate approval processes** for new activities that better align with evolving realities on the ground.
- **Ensure follow-up mechanisms** for inventories and assessments, with dedicated planning for disposal, substitution, or policy action.
- **Establish metrics and methodologies** for estimating pollution reduction impacts (e.g., in tons of mercury avoided) to allow for consistent reporting and accountability.
- **Improve institutional communication pathways**, particularly with ministries and national agencies, to ensure uptake and integration of technical outputs.

Tunisia's example highlights a core tension in multi-country programs: while centralized planning is necessary for coordination, localized implementation requires flexibility, adaptation, and context sensitivity. Recognizing and responding to this dynamic is critical for ensuring that environmental interventions remain relevant, effective, and genuinely impactful.

4 General matters and some conclusions

4.1 Early and Realistic Co-Design with Countries and Alignment with Institutional Procurement Capabilities

A critical lesson from the implementation of Child Project 1.1 is the necessity of involving national institutions and stakeholders from the earliest stages of project conception—not only in identifying priorities and objectives but also in designing feasible, country-specific implementation plans that align with the institutional capacities and legal frameworks of the executing agency, in this case, MedWaves.

Too often, project objectives—such as the substitution of mercury thermometers or the procurement of specific equipment—are defined without a full understanding of the real-world limitations imposed by public procurement procedures, the legal status of the executing body, and the regulatory needs of the participating countries. In this project, although thermometer substitution was initially promoted, it later became apparent that MedWaves, as a public institution, lacked the legal capacity to directly purchase and distribute medical equipment, leading to unfulfilled expectations and missed opportunities for impactful action.

This disconnect highlights the need to build projects "from the ground up": engaging directly with the institutions present on the ground, understanding their roles, infrastructure, and capacities, and mapping their contributions against the requirements of the Basel, Rotterdam, and Stockholm (BRS) Conventions, as well as the broader MedProgramme objectives. A collaborative design process, where project ideas are co-developed with national authorities and key implementing partners, ensures stronger national ownership and helps avoid technical or legal feasibility issues later in implementation.

At the same time, institutional constraints must be made explicit from the outset. Project designers must take into account the legal responsibilities and contractual limitations of project managers and implementing agencies. While the ambition to deliver comprehensive technical solutions is valid, promising activities that cannot legally or operationally be executed—such as direct substitution of medical devices—creates credibility risks, both for the executing institution and for the broader programme.

4.2 Limitations in procurement

Also, under the current procurement framework, MedWaves is limited to awarding minor service contracts up to a ceiling of €13,990. While this threshold may be sufficient for small-scale engagements, it becomes a major constraint when technical needs expand during implementation—such as when countries request the analysis of additional firefighting foams or the inclusion of other POPs beyond PFOS. Because of this fixed cap, project managers are unable to adjust contracts to accommodate emerging priorities, even when such adaptations would significantly enhance the quality and completeness of the outputs. This illustrates how rigid procurement ceilings, if not matched with flexible planning mechanisms or alternative contracting strategies, can directly limit the scientific depth, national relevance, and adaptability of project activities. These limitations must be considered in the early stages of project design and budgeting to avoid unintended underdeliver or gaps in implementation.

This experience underscores the importance of realistic, transparent planning, rooted in both the national context and the institutional framework of delivery partners. Future projects must ensure that expectations are aligned with legal mandates and operational capabilities, and that flexible implementation mechanisms are built into the project structure to accommodate the diverse realities of participating countries.

4.3 Some Conclusions

Inventories are not the end goal—they are the starting line for meaningful action. Whether dealing with mercury in hospitals or PFOS in firefighting foams, the core lesson is the same: knowing the numbers means little unless they inform disposal, substitution, regulation, and prevention. Countries must resist the urge to treat inventories mainly as reporting obligations and instead embed them into operational, regulatory, and financial planning. Only then can they become powerful instruments for lasting change.

Future interventions should prioritize depth over breadth. By focusing on one sector at a time, and addressing all POPs relevant to that sector within a specific country context, projects will be better positioned to generate concrete, scalable outcomes, informed policy recommendations, and tested technical solutions. Such an approach not only enables more meaningful national engagement but also lays the groundwork for regional harmonization and sustained impact.

5 Recommendations and options for future projects

The competitive advantage of MedWave is its strategic position of being located in Europe and facilitating project in the Mediterranean region including the important North African countries and some important Middle East countries. These countries benefit from modern policy making of Europe on circular economy, chemical and waste legislation, sustainable consumption and production policies including green and sustainable chemistry developments. Sustainable Consumption and Production is Sustainable Development Goal 12 and is a driver of changing societies for the better. This is a corner stone of the center and its original name defining its role as a regional hub for The Regional Centers in the Mediterranean are key institutions under the Mediterranean Action Plan (MAP) that focus on environmental protection and sustainable development in the region. Additionally it is one of the Stockholm Convention Centers and has lead e.g. the activity to bring in chemicals in plastics as a major issue into the Stockholm Convention. Also here the center is well position at the heart of two conventions – the Stockholm Convention and the Barcelona Convention - which can give impulses to each other and MedWave can pick-up international policies from each of the conventions and fertilize the other convention. This was the case of plastics which was already addressed in the Barcelona Convention as a protocol and only became high on the agenda of Basel and Stockholm Convention in 2019. MedWave/SCPRAC played a crucial role in this by writing and submitting the INF document on POPs and other chemicals of concern in plastics[30] and achieved that globally regional centers were encouraged to work on chemicals in plastics. This finally resulted in the development of the publication "Chemicals in Plastics – A Technical Report"[31] which became then INF document in the development of the Plastic Treaty. And also now has the Barcelona Convention already adopted in 2023 "*On plastic pollution, the Contracting Parties agreed on the need for a comprehensive approach that addresses the full lifecycle of plastic in the context of ongoing global negotiations on legally binding instrument on plastic pollution, including in the marine environment*"[32] ahead of the development of the Plastic Treaty which could not agree on key issues and a convention text at the INC 5 meeting in Seoul in November 2025 and will likely have further challenges to adopt on major issues like a comprehensive approach that addresses the full lifecycle of plastic at the next meeting. So this will likely be another opportunity for MedWave to promote a more holistic approach of the Barcelona Convention when implementing the most likely less ambitious upcoming Plastic Treaty in the Mediterranean in future and possibly give positive impulses to the global Plastic Treaty.

Similarly the MedWave center is strategically positioned to extend POPs to other chemicals of concern due to the frame of the Land-Based Sources (LBS) Protocol to the Barcelona Convention going beyond POPs including other chemicals of concern which are toxic and persistent. There was also a recent commitment of the Barcelona Convention Parties to the implementation of the Global Framework on Chemicals adopted at the 5th International Conference on Chemicals Management (ICCM5, 25-29 September 2023), recognizing linkages and potential synergies with their obligations

[30] UNEP (2019) Plastic and toxic additives, and the circular economy: the role of the Basel and Stockholm Conventions. UNEP/CHW.14/INF/29/Add.1 and UNEP/POPS/COP.9/INF/28/Add.1

[31] UNEP (2023)

[32] UNEP MAP (2023) Barcelona Convention COP23 commits to a green transition in the Mediterranean https://www.unep.org/unepmap/fr/news/press-release/barcelona-convention-cop23-commits-green-transition-mediterranean-adopts-ambitious-measures

under the LBS Protocol to the Barcelona Convention[32]. Also UNEP evaluate the links and synergies of the Stockholm Convention implementation and the implementation of the GFC[33].

5.1 POPs phase out projects by avoiding further use and time considerations for such projects

The avoidance of POPs used and the phase out of POPs with exemptions is a useful implementation approach. However, from the experience of the activities of avoiding POPs in the Child 1.1 project, it needs to be considered that such projects, if a POP is only exempted for 5 years, require a quick development and a quick and strategic inventory that there is still sufficient time to implement the phase out of the respective POP before the exemption expires. One bottle neck is already the time needed to develop the respective GEF full-sized project or program which can take years including the Project Preparation Grant (PPG) phase. For such projects the inventory bases need to be developed in the PPG phase which was also the attempt of Child 1.1 project and also the vague inventory information. Normally there are certain inventory attempts or at least robust estimates for calculating Global Environmental Benefits (GEBs). However for phase-out projects the time-window in the implementation phase might be small as in the case for HBCD in the current project. If such a short time window exist, the detailed information for implementation need to be developed within the PPG phase or this POP cannot be selected for the phase-out plan.

Furthermore information from the stakeholders including the supply-chain should be gathered already in the PPG phase especially when knowing that the deadline for phase-out is already early in the project as for HBCD.

Additionally there should also be a component on the entire life cycle of the respective POPs and not only focusing on the phase out but also considering end-of-life management and at least to compile information on disposal of these POPs and POPs in products. By this also a flexible modification of the project implementation would be possible if the time of exemption has expired and avoidance GEBs are not possible anymore by achieving the GEBs then by disposal of waste of the respective POP.

5.2 Implementation of GHS in the Mediterranean region and improved chemical transparency

One major bottleneck of a quick assessment of the respective exempted POPs in the Child 1.1 project was the lack of information in the use of these chemicals in imports, production processes and the supply chain. One important improvement of this situation would be the implementation of GHS in the Mediterranean countries not yet having implemented GHS. Such a project would be in the frame of implementing the Global Framework on Chemicals (GFC) in the region (GHS is a Target of GFC) as recently acknowledged as an upcoming issue by the Barcelona Convention[32]. The implementation of GHS also contributes to the implementation of the Stockholm Convention by improving the traceability of POPs and can be regarded as a synergy of GFC and Stockholm Convention implementation[33].

[33] Weber R (2025) Initial considerations on how Stockholm Convention NIPs could guide chemicals and waste management through a sectoral approach, contributing to synergies between chemicals and waste MEAs, including the Global Framework on Chemicals. Report for UNEP Chemicals and Health Branch.

5.3 Managing POPs, other chemicals of concern and plastics in major use sectors

The Global Environment Facility (GEF) and GFC stressed the importance to work with sectors and supply chains for effective project implementation. Also, the Stockholm Convention recently developed a sectoral guidance on POPs including electrical and electronics equipment (EEE), the transport sector and the construction sector (GGKP 2024)[16]. Additionally, textile is a user of industrial POPs and other chemicals of concern (CoC). At the same time these sectors are major uses of plastic consuming about 1/3 of all plastics produced in Europe. Therefore these 4 sectors are of particular relevance of managing POPs/CoC and plastics. Therefore, it is recommended to further look into project opportunities in these 4 sectors to address POPs, other CoCs and plastics. Some of these CoCs are listed in other international conventions and could be addressed in a synergistic manner (GGKP 2024)[16].

In addition to plastics, the three product/waste sectors transport, WEEE and buidings/construction contain also large resources in particular metals but also other materials like wood and glass which are key for recycling of these sectors towards a circular economy. Improvement of waste management including regulatory frames and sorting also can result in the overall improvement of resource recovery from these sectors. MedWaves countries need to improve their recycling efforts and wisely set higher recycling rates for metals and plastics but also for wood and glass in their national plans which are all present in some of the three sectors in relevant amount. Therefore, improved management and recycling of the wastes from these three sectors can not only contribute to improved recycling rates of plastics but also for metals in all three sectors and for the construction sector can contribute also to wood recycling and to glass recycling (also for the transport sector). Furthermore, the valuables like metals can help to partly finance the management of the waste of these sectors including POPs and plastics.

5.3.1 Transport sector

The transport sector is currently of particular interest since the EU Commission is planning an update of the vehicle directive and requiring a recycled plastic share of 25% for new vehicles (EU Commission 2023)[34] which was recently reduced to 20% by the European Parliament reduced recycling quota for new vehicle plastics for the start to 20% and only after 10 years want to reach the 25%. (European Parliament 2025)[35]. Furthermore the sector contain large resources relevant for circular economy.

It could be beneficial to facilitate, within relevant projects, the implementation of EU policies and guidance documents on circular economy in the transport sector and ELVs across Mediterranean countries, including the management of plastics, POPs, and other CoCs in ELVs.

[34] EU Commission (2023) Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on circularity requirements for vehicle design and on management of end-of-life vehicles, amending Regulations (EU) 2018/858 and 2019/1020 and repealing Directives 2000/53/EC and 2005/64/EC. Brussels, 13.7.2023 COM(2023) 451 final 2023/0284 (COD).

[35] European Parliament (2025) Circular economy: new EU rules to make the automotive sector more sustainable. Press Releases 07-07-2025. https://www.europarl.europa.eu/news/en/press-room/20250707IPR29462/circular-economy-new-eu-rules-to-make-the-automotive-sector-more-sustainable

5.3.2 Managing POPs, other CoCs, plastics and resources in buildings and construction

The building and construction sector is one of the most chemical-intensive sectors downstream of the chemical industry (UNEP 2021)[36]. POPs are particular present in plastic in building and construction are (e.g. HBCD, PBDEs, SCCPs, PCB, PFOA) or other chemicals of concern (CoCs) like lead in paints or F-gases in insulation foams (UNEP 2021a; UNEP 2024a). The knowledge of the frequency of the use of these POPs in building materials is however quite weak and only for HBCD in EPS/XPS which has been used with high frequency in EPS/XPS, an inventory and identification is relatively simple while for other POPs more data are needed (Weber 2024). The service lives of buildings and construction materials are several decades up to a century and possibly longer (Li *et al.* 2016[37]; UNEP 2021)[36]. Therefore, a large share of the plastic materials and foams with POPs additives used the past 70 years is still in use in buildings and construction and will need to be managed in future. The same is true for other chemicals or materials of concern like certain phthalates or asbestos. The environmentally sound management of CDW containing POPs and other CoC is paramount in order to ensure that the impacts of legacy chemicals on human health and the environment are minimized. Identification and inventory of material stocks in the built environment containing chemicals of concern is the first step, which enables the environmentally sound dismantling. In order to increase material recycling and to avoid re-introduction of chemicals of concern into secondary raw materials, research and development of technologies for sound recycling and separation of building products that contain chemicals of concern should be advanced (UNEP 2021)[36]. Furthermore several countries in the Mediterranean region faced destruction of buildings by wars or earth quakes giving the management of CDW even a higher and more urgent relevance.

The European Union has developed strategies and documents for the management of CDW towards a more circular economy like the EU Construction and Demolition Management Protocol (EU Commission 2016[38]; EU Commission 2018[39]; EU Commission 2024[40]).

It could be beneficial to facilitate, within relevant projects, the implementation of EU policies and guidance documents on CDW across Mediterranean countries, including the management of plastics, POPs, and other CoCs in CDW.

5.3.3 Electrical and electronic equipment

In 2022, 62 million tonnes of waste electrical and electronic equipment (WEEE; e-waste) were generated containing more than 15 million tonnes of plastic (average plastics in EEE/WEEE is ~25%) and WEEE volume is expected to further increase to 82 million tonnes by 2030 (Forti Baldé *et al.*

[36] UNEP (2021) Chemicals of Concern in the Building and Construction Sector. Geneva 5 May 2021. https://wedocs.unep.org/bitstream/handle/20.500.11822/35916/CoCBC.pdf

[37] Li L, Weber R, Liu J, Hu J (2016) Long-term emissions of hexabromocyclododecane as a chemical of concern in products in China. Environ Int. 91, 291-300. https://doi.org/10.1016/j.envint.2016.03.007

[38] European Commission (2016). EU Construction and Demolition Management Protocol. https://ec.europa.eu/docsroom/documents/20509/

[39] European Commission (2018). Guidelines for the waste audits before demolition and renovation works of buildings. EU Construction and Demolition Waste Management. https://ec.europa.eu/docsroom/documents/31521/

[40] European Commission (2024) EU Construction & Demolition Waste Management Protocol including guidelines for pre-demolition and pre-renovation audits of construction works. Updated edition 2024 https://op.europa.eu/en/publication-detail/-/publication/d63d5a8f-64e8-11ef-a8ba-01aa75ed71a1/language-en

2024)[41]. While the quality and value of the WEEE plastic may be high, the recycling rates are often low due to the presence of legacy additives listed as POPs (e.g. PBDEs, HBCD, Dechlorane Plus) in WEEE plastic and the complexity of the EEE plastic mixtures which need to be separated before recycling (UNEP 2024[42]).

WEEE plastic contain a range of POPs including POPs which are still produced and used (SCCPs/MCCPs, DecaBDE, UV-328) and also some legacy POPs where production has stopped but which are present in EEE that is still in use (c-OctaBDE, c-PentaBDE, Dechlorane Plus, PCBs). Furthermore, EEE/WEEE contain other chemicals of concern including certain e.g. heavy metals and F-gases (GGKP 2024)[16]. These POPs and other chemicals of concern need to be managed at the end-of-life in an environmentally sound manner with destruction of plastic containing POPs or removal of other CoCs and pollutants and recycling of the clean plastic fractions to contribute to a more circular economy (UNEP 2024)[42].

The management of WEEE is of high importance for the Mediterranean countries considering related environmental pollution with informal recycling of WEEE including the risk of food contamination (Weber et al. 2018[43]; Petrlik et al. 2022[44]) resource recovery and circular economy. The European Commission recently evaluated the Waste Electric and Electronic Equipment (WEEE) Directive[45] and will soon improve the regulatory frame for better recovery of WEEE and improved circular economy (European Commission 2025)[46].

It could be beneficial to facilitate, within relevant projects, the implementation of EU policies and guidance documents on circular of WEEE across Mediterranean countries, including the management of plastics, POPs, and other CoCs in WEEE.

[41] Baldé CP, Kuehr R, Yamamoto T, et al. (2024). Global E-waste Monitor 2024. International Telecommunication Union (ITU) and United Nations Institute for Training and Research (UNITAR) Report.

[42] UNEP (2024) Guidance on best available techniques and best environmental practices relevant to the polybrominated diphenyl ethers (PBDEs) and Dechlorane Plus (DP) listed under the Stockholm Convention on Persistent Organic Pollutants (Draft under review by Parties).

[43] Weber R, Herold C, Hollert H, Kamphues J, Blepp M, Ballschmiter K (2018) Reviewing the relevance of dioxin and PCB sources for food from animal origin and the need for their inventory, control and management. Environ Sci Eur. 30:42. https://rdcu.be/bax79

[44] Petrlik J, Bell L, DiGangi J, Allo'o Allo'o SJ, Kuepouo G, Ochola GO, Grechko V, Jelinek N, Strakova J, Skalsky M, Drwiega YI, Hogarh J, Akortia E, Adu-Kumi S, Teebthaisong A, Carcamo M, Beeler B, Behnisch P, Baitinger C, Herold C, Weber R. (2022) Review: Monitoring of Dioxins and PCB in Eggs as Sensitive Indicator for Environmental Pollution and Contaminated Sites and Recommendations for Reducing and Controlling Releases and Exposure. Emerg. Contam. 8, 254-279 https://doi.org/10.1016/j.emcon.2022.05.001

[45] European Commission (2025) Final Report: Study supporting the evaluation of Directive 2012/19/EU on waste electrical and electronic equipment (WEEE). https://environment.ec.europa.eu/publications/final-report-study-supporting-evaluation-directive-201219eu-waste-electrical-and-electronic_en

[46] European Commission (2025) Circular Economy: New evaluation looks at how to improve WEEE Directive News article 2 July 2025. https://environment.ec.europa.eu/news/circular-economy-evaluation-looks-how-improve-weee-directive-2025-07-02_en

5.3.4 Textiles

The textile sector is the third largest use of plastics globally in particular polyester/PET compromising 60% of all textiles. The current status of recycling and circular economy of textiles is low with a recycling rate of less than 10%. The European Commission developed a EU strategy for sustainable and circular textiles (EU Commission 2022)[47].

It could be beneficial to facilitate, within relevant projects, the implementation of EU policies and guidance documents on circular economy of textiles across Mediterranean countries, including the management of POPs, and other CoCs.

5.4 Strengthening regulatory frame for POPs, chemicals and waste

One bottle neck of a better chemical and waste management including POPs in many of the Mediterranean countries is the regulatory frame for POPs, general chemical management and waste management towards circular economy.

The European Union has developed a robust POPs regulation, chemical regulation like REACH and detailed waste management regulations including regulatory frames for major sectors like ELV, WEEE or general waste management. The EU has also developed BAT Reference documents (BREFs) for major industrial sources which define BAT and also the BAT-associated emission levels (BAT-AELs) represent the emission levels achievable by using the best available techniques (BAT) within a specific industrial sector.

It would be interesting to explore projects that facilitate the implementation of regulatory frameworks, such as the POPs Directive and BAT guidance documents, in Mediterranean countries—particularly in relation to the management of plastics, POPs, and other CoCs in WEEE.

5.5 Improving the laboratory capacity in the region for selected POPs

For the Child 1.1 project the analysis of POPs have not been conducted in the project countries but samples were shipped out to laboratories in other countries. However Mediterranean countries need to have certain monitoring capacity for POPs especially high volume POPs like SCCPs/MCCPs HBCD or PBDEs and for POPs which are threatening drinking water and food like PFASs and PCDD/PCDF. In the recent workshop in Tunisia organised by MedWave, the interest of the country with high participation and long Q&A session became obvious (MedWave 2025)[48]. Additionally it could be seen that there is also interest from EU countries to support POP monitoring capacity in North African countries.[49]

MedWaves could facilitate such match making and capacity building between laboratories/institutions in Europe and Mediterranean countries.

[47] European Commission (2022) EU strategy for sustainable and circular textiles. https://environment.ec.europa.eu/publications/textiles-strategy_en

[48] MedWave (2025) MedProgramme – POPs monitoring Workshop Tunisia (May 2025) https://www.youtube.com/playlist?list=PLWTuuVWF9TcfwJwRyAxb7S8Neh7MG4-DF

[49] After the workshop the national laboratory of Tunisia and a national laboratory of Spain concluded on a cooperation to establish PFAS analysis

5.6 Building capacity in material and substance flow analysis

For the assessment of waste flows including POPs and resources, material and substance flow analysis (MFA/SFA) is a valuable tool for the science community and for policy makers. There is a lack of robust MFA/SFA in Mediterranean countries in which we implemented activities and a lack of capacity to develop MFA/SFA. The building of capacity for MFA/SFA and develop robust MFA/SFAs for the major sectors (EEE/WEEE, transport/ELV and buildings/CDW) and related plastics, POPs/CoCs and resources could be an interesting task/project.

5.7 Improvement of resource management and access to knowledge materials

The knowledge generated needs to be disseminated. Reports, documents, and workshop videos were created, and it is essential that these materials are distributed and preserved after the project ends. The website should maintain these resources for as long as they remain useful.

It is inconceivable that the MedProgramme website is still not accessible to the public in 2025. This has consequences, such as the fragmentation of knowledge and the absence of a central platform to showcase what has been produced during the programme—as well as previous knowledge.

However today they cannot be accessed on the MedWave website. One example is the "20 Case Studies on How to prevent the use of toxic chemicals frequently found in the Mediterranean Region"[50] This publication cannot be found anymore on the MedWaves website, but "Error 404" occur from the google link[51]. It is still available from other websites like the Technical University Denmark[52] or on Researchgate[53]. Similarly, the publication "Toxic Additives in Plastics: Hidden Health Hazards Linked to Common Plastic Products"[54] which is a contemporary topic. It is not any more accessible on the MedWaves website (Error 404)[55] but only from the website of a co-author organisation IPEN[56]. None of this material is available on the UNEP/MAP website either. This problem can occur on other platforms as well, so we must ensure it doesn't happen on the MedProgramme website. The same goes for the workshop videos: right now, they are only on the MedWaves YouTube channel and not on the MedProgramme website. As a result, there is no single, global view of the programme and the knowledge produced remains fragmented for access to interested audience.

Because Medprogramme is such a broad initiative, it's important to provide relevant & structured information on outcomes in one place. That way, someone who visits the site for one topic may discover others, creating valuable interlinkages and promoting knowledge-sharing.

[50] Weber R, Fantke P, Hamouda AB, Mahjoub B. (2018) 20 Case Studies on How to prevent the use of toxic chemicals frequently found in the Mediterranean Region. Report of the Regional Activity Centre for Sustainable Consumption and Production (SCP/RAC) for the EU SwitchMed project.

[51] https://www.medwaves-centre.org/fr/archives-des-nouvelles/generiques/harmful-toxic-chemicals-are-hyper-present-in-our-live-scp/rac-prov

[52] https://backend.orbit.dtu.dk/ws/portalfiles/portal/163013878/Weber_2018.pdf

[53]https://www.researchgate.net/publication/344775760_20_case_studies_on_how_to_prevent_the_use_of_toxic_chemicals_frequently_found_in_the_Mediterranean_Region

[54] SCP/RAC (2020) Toxic Additives in Plastics: Hidden Health Hazards Linked to Common Plastic Products. https://www.ipen.org/sites/default/files/documents/plastics_and_additives_final-low-o-en.pdf

[55] https://www.medwaves-centre.org/en/news-archive/general/toxic-additives-in-plastics-hidden-hazards-linked-to-common-plastic-products

[56] https://www.ipen.org/PlasticsToxicAdditives#media