



The Stockholm Convention, Global Monitoring Plan and its Implementation in Regional and Global Monitoring Reports

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Abstract

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global legally binding agreement focusing on the protection of health and the environment from negative impact of listed manmade chemicals, persistent organic pollutants. The Convention required the development and regular update of National Implementation Plans, periodic national reporting (Art. 15), and the establishment of other expert frameworks for the assessment of candidate chemicals (Persistent Organic Pollutants Review Committee [POPRC]). For the evaluation of the effectiveness (Art. 16) it was required to develop a mechanism to identify and compile and/or a mechanism capable of generating coordinated, harmonized, and validated information on changes in levels of its target chemicals over time. The Global Monitoring Plan (GMP) is the mechanism put in place in 2007 that so far produced three sets of regional monitoring reports containing current findings on POPs concentrations in individual UN regions and subsequently, three global reports synthesizing the available information on the global scale. POPs data reported by the Regional Organization Groups (ROGs) in these reports are key pillars and inputs into the effectiveness evaluation that periodically assesses outputs of measures adopted in the Stockholm Convention.

Activities under the GMP are governed by its implementation plan, supported by the technical Guidance on the Global Monitoring Plan and overseen by experts organized in the Regional Organization Groups and in the Global Coordination Group. As the Stockholm Convention expands its scope over time, it is necessary to continuously update the technical knowledge and guidance but also to ensure sustainability of POPs monitoring activities. Availability and continuity of

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long-term POPs monitoring programmes and their data is decisive for global decision-making.

Keywords

Stockholm Convention on Persistent Organic Pollutants · Global Monitoring Plan · Effectiveness evaluation · Core media · Regional Organization Group · Guidance on the Global Monitoring Plan for POPs · Conference of the Parties

1 Background Information on the Stockholm Convention

The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global legally binding agreement focusing on the protection of health and the environment from negative impact of listed manmade chemicals, persistent organic pollutants. The Convention was adopted in 2001 (UNEP 2001), entered into force in 2004 and during its nine decision-making meetings of the Conference of the Parties (COP) to the Stockholm Convention in 2005, 2006, 2007, 2009, 2011, 2013, 2015, 2018, and 2019 (UNEP 2001–2021) expanded the number of chemicals covered by the Convention from twelve chemicals listed initially to thirty as of early 2020 (see footnote 1–3 below).

These target POPs are classified into three groups defined by their use, however some of the chemicals fit into more than one of these three general categories:

- pesticides used in agricultural applications ¹
- industrial chemicals used in various applications ²
- chemicals generated unintentionally as a result of incomplete combustion and/or chemical reactions ³

The footnotes below show for each POP the name, abbreviation and indicate meetings of the Conference of the Parties at which the listing of the chemicals took place. Those shown in bold font are originally listed POPs at the adoption of the convention.

¹**aldrin**, **chlordane**, chlordecone (COP-4, 2009), **dichlorodiphenyltrichloroethane (DDT)**, dicofol (COP-9, 2019), **dieldrin**, endosulfan (COP-5, 2011), **endrin**, **heptachlor**, **hexachlorobenzene (HCB)**, gamma-hexachlorocyclohexane (γ -HCH, lindane) and by-products of lindane [α -hexachlorocyclohexane (α -HCH) and beta-hexachlorocyclohexane (β -HCH)] (COP-4, 2009), pentachlorophenol, its salts and esters (COP-7, 2015), **mirex**, **toxaphene**.

²tetra- and pentabromodiphenyl ethers (PBDE) (COP-4, 2009), hexa- and heptabromodiphenyl ethers (PBDE) (COP-4, 2009), decabromodiphenyl ether (COP-8, 2017), hexabromocyclododecane (HBCD) (COP-6, 2013), hexabromobiphenyl (COP-4, 2009), hexachlorobutadiene (COP-7, 2015), perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F) (COP-4, 2009), perfluorooctanoic acid (PFOA), its salts and PFOA-related compounds (COP-9, 2019), pentachlorobenzene (PeCB) (COP-4, 2009), **polychlorinated biphenyls (PCB)**, polychlorinated naphthalenes (PCN) (COP-7, 2015), short-chain chlorinated paraffins (SCCPs) (COP-8, 2017).

³**hexachlorobenzene (HCB)**, hexachlorobutadiene (COP-8, 2017), pentachlorobenzene (PeCB) (COP-4, 2009), polychlorinated naphthalenes (PCN) (COP-7, 2015), **polychlorinated biphenyls (PCB)** and **polychlorinated dibenzo-p-dioxins (PCDD) and dibenzofurans (PCDF)**.

The objective of the Stockholm Convention on POPs is to protect human health and the environment from POPs. Therefore, the Convention required the development and regular update of National Implementation Plans, periodic national reporting (Art. 15) and the establishment of other expert frameworks for assessment and listing of new chemicals, exemptions and Best Available Techniques/Best Environmental Practices (BAT/BEP). Furthermore, reviews on the progress in eliminating PCB, DDT, and other chemicals from production and use are required.

Moreover, to assess the outcomes of measures implemented, the Convention also contains requirements related to the collection of information on the presence and movement of target chemicals in the environment as well as harmonized and validated information on changes in their levels over time. Indeed, the Article 16 of the Stockholm Convention on effectiveness evaluation requires the Conference of the Parties to evaluate periodically whether the Convention is an effective tool in achieving the objective of protecting human health and the environment from persistent organic pollutants. Such evaluation is based a) on reports and other monitoring information that is comparable and covers the presence of listed POPs as well as their regional and global environmental transport, b) on information from the national reports under Article 15, and c) non-compliance information under Article 17, as stated in the paragraph 3 of the Article 16.

For the purposes of this compendium, we will focus only on the matters relevant to the POPs monitoring.

2 Development of Arrangements for POPs Monitoring

This section contains the steps and arrangements that lead to generation of the POPs monitoring reports under the Stockholm Convention describing data on POPs identified by the ROGs.

The Stockholm Convention text requires that at its first meeting the Conference of the Parties (COP) initiates the establishment of arrangements to provide itself with comparable monitoring data on the presence of listed POPs and further specifies criteria for the arrangements: to draw on existing knowledge and activities, to be organized regionally, and to regularly produce reports for consideration by the COP (UNEP 2001, paragraph 2 of Article 16).

Thus, at the first meeting in 2005, the COP adopted the “Proposal for arrangements to provide the Conference of the Parties of the Stockholm Convention with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C of the Convention” (UNEP 2005a, UNEP/POPS/COP.1/21, Annex II), decided to field test/pilot the proposed arrangements, and prepare a proposal for global monitoring plan (UNEP 2005b, decision SC-1/13) by drawing on additional materials (UNEP 2003).

At the next meeting in 2006, the COP endorsed that the first POPs monitoring report will provide baselines for further evaluations, air monitoring and human exposure through breast milk or blood serum used as core data, that POPs monitoring data are needed to cover all five UN regions, and that an establishment of strategic arrangements and partnership including with the health sector was required. Furthermore, that decision stipulated that the global monitoring plan under preparation should be practical, feasible, and sustainable, achieve global coverage, contain at least core representative data from all regions, be designed to go beyond the first monitoring report, and address long-term needs for receiving appropriate representative data in all regions (UNEP 2006, decision SC 2/13). In addition, the elaboration of a guidance document on standardization of monitoring approaches was also requested in UNEP 2006. A provisional ad hoc technical working group was given the task to prepare these documents and to coordinate the implementation of the preliminary global monitoring plan.

At its meeting in 2006, the COP agreed to complete the first effectiveness evaluation in 2009. This timeline meant that the first POPs monitoring reports needed to be available as well by 2009 at the latest.

Thus, the third meeting of the Conference of the Parties held in Dakar, Senegal in May 2007, considered the first draft of the Guidance on the Global Monitoring Plan for Persistent Organic Pollutants (UNEP 2007b) and adopted the amended Global Monitoring Plan for Persistent Organic Pollutants for Effectiveness Evaluation on a provisional basis (UNEP 2007a), and established regional organization groups and a global coordination group (UNEP 2007c, decision SC 3/19) to prepare the regional and global reports for consideration at the COP meeting in 2009. The work was driven by and based on the contributions of the Regional Organization Groups (ROGs) and their work identifying and compiling the best available information on levels of listed POPs in core media (ambient air and human milk and blood samples). The POPs data compiled by the ROGs are the result of the work of a number of strategic partners and monitoring programmes performing POPs monitoring at global, regional, and national scale including the World Health Organization (WHO), UN Environmental Programme-Global Environment Facility monitoring projects (UNEP-GEF), Arctic Monitoring and Assessment Programme (AMAP), Great Lakes of NA (*North America*), Northern Contaminants Programme (NCP), European Monitoring and Evaluation Programme (EMEP), Toxic Organic Micro-Pollutants network (TOMPs), Oskar, Helcom, Global Atmospheric Passive Sampling network (GAPS), Monitoring Network of ambient air by passive sampling (MONET), Latin American Passive Atmospheric Sampling Network (LAPAN), East Asia Network and others that provided the information to the ROGs to develop the first set of GMP regional reports. On the basis of the first set of regional POPs monitoring reports adjustments of the Global Monitoring Plan were adopted in 2009 as described in the next section.

3 Organizational Framework for POPs Monitoring and its Further Development

The fourth meeting of the COP to the Stockholm Convention confirmed the following three components as the pillars of the Global Monitoring Plan framework (UNEP 2009a): expert groups, updated technical guidance document on the Global Monitoring Plan and GMP Implementation Plan. All three components are described in more detail below:

3.1 Expert Groups

A global group is responsible for coordinating the activities at global and regional levels—*Coordination Group* (15 members, 3 per UN region). This group oversees global monitoring activities and is responsible for development of the global POPs monitoring report submitted to the effectiveness evaluation process in each phase. The mandate of the group has been updated after completion of the effectiveness evaluation (UNEP 2017a).

At regional level experts are organized in five *Regional Organization Groups* (ROG). Each UN region has one ROG consisting of six members elected by governments from the region. ROG members oversee and coordinate POPs monitoring activities in their region, are responsible for the preparation of the regional monitoring reports, and communicate with all regional stakeholders from governments, monitoring programmes, data providers, researchers, regional centres as well as with the Secretariats of the Basel, Rotterdam and Stockholm conventions (BRS Secretariat). The mandate of the ROG has been updated after completion of the effectiveness evaluation (UNEP 2017a).

3.2 Guidance Document

The second pillar is the *technical guidance document on the Global Monitoring Plan* that is continuously updated to gather current expert knowledge on POPs data generation and collection including selection of core matrices, sampling, sample processing, chemical analyses, statistical considerations as well as storage of data on POPs and their reporting (UNEP 2007b, 2009a and 2021b).

3.3 GMP Implementation Plan

The third pillar is the frequency and scope of preparing the regional reports that has been set to six-year intervals by the *GMP Implementation Plan* (UNEP 2009a, 2009b).

Over time, updates of the framework have taken place.

Firstly, with listing of the new industrial chemicals in 2009, *surface water* was added as additional core medium for hydrophilic POPs (perfluorooctanesulphonate—PFOS), as explained in the Chaps. 2 and 4 of the updated guidance document in 2013 (UNEP 2013c).

Secondly, at its sixth meeting in May 2013, the Conference of the Parties, by decision SC-6/23 on the GMP for the effectiveness evaluation, adopted the amended *GMP for POPs* (UNEP/POPS/COP.6/INF/31/Add.1) and the amended *implementation plan for the GMP* (UNEP/POPS/COP.6/INF/31/Add.2) (UNEP 2013a, 2013b). The implementation plan was further amended in 2017 (UNEP 2017d).

Thirdly, the Guidance document for POPs monitoring is also continuously updated due to the expansion of the scope of the Convention as well as by gathering more relevant experience and knowledge on scientific advances in sampling, analyses, interpretation, and storage of samples and data. At COP-10, the latest version of the updated Guidance (UNEP/POPS/COP.10/INF/42), which addresses the sampling and analysis of POPs added to the Convention in 2017 and 2019, was made available. The guidance also comprises a detailed chapter on POPs monitoring in human milk including the online version of the WHO sampling protocol (Annex 3) pertaining to the milk survey (UNEP/WHO 2009) described in detail in Chap. 1 (Fürst, 2023) and Chap. 2 (Malisch et al. 2023) of this part of the compendium.

4 Outputs of the Global Monitoring Plan

4.1 Regional and Global POPs Monitoring Reports

The GMP produces reports at every six years cycle (UNEP 2009a, 2009b). The interval length and timing has been further aligned with the effectiveness evaluation cycle by amendment to the implementation plan for the GMP (UNEP/POPS/COP.6/INF/31/Add.2) endorsed by the decision SC-6/23 at the sixth meeting of the COP in 2013 (UNEP 2013a).

The first set of regional POPs monitoring reports produced for COP4 in 2009 provided information on changes in concentrations of the 12 POPs initially listed in the Stockholm Convention (UNEP 2011a). The second set of regional POPs monitoring report endorsed in 2015 contained information on changes in concentrations and trends of the 12 POPs initially listed in the Stockholm Convention and information on baseline concentrations of the 11 substances newly listed in the annexes to the Convention in 2009, 2011, and 2013 (UNEP 2015). The third set of regional reports synthesize information from previous regional reports and covers both the full scope of the chemicals listed in the Convention as of 2019 and some candidate POPs. Due to longer time series, the ability to derive time trends for different listed POPs increases. These reports were published in spring 2021 (UNEP 2021a).

As demonstrated above, the scope of the regional report is gradually expanding and covers all POPs listed in the Stockholm Convention Annexes. The main focus of the report is the assessment of datasets in the core media—ambient air, human tissues (human breast milk or blood), and water for hydrophilic POPs, but other

media such as soil, biota, plants are also used to support interpretation of observed levels and their trends.

The reports have a uniform structure and contain a number of visual outputs, usually generated from the electronic data warehouse of the Global Monitoring Plan (GMP DWH). These maps, charts, and tables illustrated POPs data availability, time trends, or summary information at regional or global scale. See, for example, the report of Central and Eastern European Region (CEE report) in 2015 (UNEP 2015) or the second global report 2017 (UNEP 2017c).

Once regional reports are released, the Coordination Group prepares a global report synthesizing POPs monitoring information on levels, trends, and long-range transport at the global level on the basis of individual regional reports. The resulting global GMP report serves as key input into the effectiveness evaluation process. There were so far three sets of global reports produced—a pilot report in 2009, the second report in 2017 (UNEP 2017c) and the third report was produced for COP11 held in 2023 (UNEP 2023).

The regional and global monitoring reports are available at the homepage of the Stockholm Convention as shown in UNEP (2021a).

4.2 Improved Interoperability and Access to Global POPs Data in Electronic Format

After the first set of the regional reports was released in pdf format and experiencing the challenges in producing the first global report for the pilot effectiveness evaluation by compiling information contained in five separate regional reports produced in a different manner, a new user-friendly solution for POPs data management and visualization was sought/needed (UNEP 2011b). In preparation for the second effectiveness evaluation phase, the Stockholm Convention Secretariat has requested a content analysis of information available in the first set of regional POPs monitoring reports focusing on initial 12 POPs (GMP et al. 2014) and their conversion into a pilot online platform able to compiling and archiving GMP POPs data in regional data repository to support work of the regional organization groups and facilitate production of regional and global reports. Under the supervision of the GMP Coordination Group an online tool to compile, harmonize, archive, and visualize available POPs data was established at www.pops-gmp.org to help and improve the POPs data flow between and within the ROGs and facilitate the production of consistent reports from the data the ROGs have compiled.

The platform was developed in a strict conformity with Chap. 6 of the Guidance on the Global Monitoring Plan for Persistent Organic Pollutants relevant to data handling and respecting the scope and parameters and supplementary information for target chemicals in core matrices. Further improvements were made after the pilot and the electronic database and visualization platform, GMP Data Warehouse has been made operational during the second GMP phase, supporting the regional organization groups in the work for the assembling, processing, storing, and presentation of monitoring data for the second set of regional reports and the global report

in 2015 and 2017, respectively. Special focus was on interoperability, access, transparency, and QA/QC in stable, curated data repositories trusted by data providers.

Prior 2019, the GMP Data Warehouse was further developed, with new data visualization tools added to continue to assist the ROGs and the Coordination Group in producing the consistent regional and global monitoring reports in 2021 and beyond (GMP et al. 2020).

The global monitoring plan and the ROGs within their mandate produced significant POPs data compilations in the three phases to date. Experience shows that it is crucial to continue to network effectively with existing data repositories, avoid duplication, and adapt to changes in analytical and computing tools.

Currently, the GMP data warehouse ensures interoperability and cooperation between various data repositories and contains modules that avoid duplication of datasets and enhance transparency, access, and QA/QC standards. The datasets on the portal get updated every six years, in line with the timeline of preparation of regional reports.

Last but not least, the online visualization of the GMP data warehouse also constitutes a publicly available portal once the regional reports are endorsed and shows the largest global POPs datasets in core matrices including the human milk POPs data. POPs data reported by the ROGs are key pillars and inputs into the effectiveness evaluation that periodically assesses outputs of measures adopted in the Stockholm Convention.

5 Effectiveness Evaluation

As discussed above in the background section of this chapter, Article 16 uses the outputs of the Global Monitoring Plan, namely the global monitoring report as one key input into the review of information on whether the Stockholm Convention is effective in achieving its objective.

The first pilot effectiveness evaluation of the measures set by the Stockholm Convention was undertaken at COP4 in 2009, and the first full effectiveness evaluation cycle was completed at COP8 in 2017 (UNEP 2017b).

That effectiveness evaluation report in evaluating the Global Monitoring Plan provided the following conclusions and recommendations to the Stockholm Convention stakeholders in relation to POPs monitoring activities continuity, sustainability, and usefulness (UNEP 2017b):

It is of great importance that the global, regional and national programmes evaluating time trends of both POPs and other environmental pollutants in blood and/or milk continues. This data is needed to be able to follow the effectiveness of the Stockholm Convention and to see that regulations and other actions taken in order to reduce the exposure to POPs are purposive and efficient. The UNEP/WHO Human Milk Survey

(continued)

could be continued with timing better synchronized with the cycle of the effectiveness evaluation of the Stockholm Convention to enable the GMP to use the latest available data. Participation from more countries in this survey would increase its representativeness;

Monitoring should be continued and expanded for newly listed POPs to provide the information needed to assess changes over time. In order to be able to follow up on these substances over time, it is important to start monitoring these substances now. And, in addition to measuring the classic POPs, that are already regulated, it is important to also monitor possible substitution substances;

Archiving of human samples should be encouraged as a cost-effective means for conducting retrospective analysis for newly listed POPs, to generate baseline information and time trends for new pollutants as they are added to the Convention.

As quoted above, the effectiveness evaluation results also influence the direction and content/scope of activities under the Global Monitoring Plan. In the effectiveness evaluation the implementation of the GMP is weighted from the holistic perspective and on the capacity to fulfil the needs of the Stockholm Convention. As demonstrated above, the Global Monitoring Plan's continuous and sustainable implementation is a prerequisite for the effectiveness evaluation of the Convention.

Currently, a third effectiveness evaluation cycle started by establishing the Effectiveness Evaluation Committee to produce the documents for COP 11 in 2023 (UNEP 2019 (SC-9/17) and UNEP 2021a).

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