

GOS4POP GEO Initiative Implementation Plan

1. Executive summary

Full Title: Global Observation System for Persistent Organic Pollutants

Acronym: GOS4POPs

Category: existing GEO Initiative

Overview

GOS4POPs initiative started in the 2017-2019 Work Programme of the Group on Earth Observations (GEO) as a follow up to program established by Task HE-2 in the program 2009-2011. GOS4POPs further develops a global observation system for persistent organic pollutants (POPs) and supports the achievement of the goals of GEOSS and other on-going international programs (e.g. Global Monitoring Plan (GMP) of the Stockholm Convention on POPs, European Monitoring and Evaluation Programme, EMEP) and conventions (i.e., Stockholm Convention and UNECE-LRTAP).

GMP4POPs initiative is aimed at i) increased availability and quality of Earth observation data and information needed to track these chemical pollutants and anticipated changes in the environment on the basis of chemical production and use restrictions; ii) harmonization of metadata production, archiving and sharing among networks; and iii) development of advanced services in support of the policy mandate and effectiveness evaluation of the Stockholm Convention on Persistent Organic Pollutants. The scope is whole Earth.

Therefore, the activities of the GOS4POPs in the first (2017-2019) Work Programme focused on the preparatory phases (an inventory of existing networks and available data (with a specific focus on newly listed POPs for which no data were available), filling the gaps by piloting a new global aquatic monitoring network, assessing quality and intercomparability of data received from various sensors and monitoring networks, and assessment of long-term-trends in available data).

A base for an effective and sustainable global system for monitoring persistent organic pollutants (POPs) concentrations in core media supporting the effectiveness evaluation of the Stockholm Convention over time has been developed during the last decade. The mandate for the effectiveness evaluation is Article 16 of the Stockholm Convention and decisions SC-5/18 and SC-7/25. The first phase of the global monitoring plan (GMP) for POPs was implemented between 2005 and 2009 and covered the 12 initially listed POPs (aldrin, dieldrin, endrin, heptachlor, chlordane, mirex, toxaphene, hexachlorobenzene, polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins and dibenzofurans). The first monitoring reports using data collected over the period 1998-2008, have been published in 2009 and provided a baseline against which concentrations in core matrices will be studied over the long-term. In the second phase of the GMP (2010-2015), a particular attention was given to gathering baseline data for the ten new POPs listed in the Stockholm Convention in 2009 (hexabromobiphenyl, penta- and octa-brominated diphenylether, pentachlorobenzene, lindane, α - and β -hexachlorocyclohexane, chlordecone, PFOSs) and 2011 (endosulphane), to filling existing regional data gaps and supporting sustainability of on-going monitoring activities to enable assessment of how POPs concentrations evolved since the first monitoring reports. The results have been archived in the central GMP Data Warehouse (DWH) built for strengthening regional POPs monitoring systems supporting the effectiveness evaluation, and capacity building in regions where monitoring coverage is limited or lacking.

Nevertheless, new POPs added to the Stockholm Convention in 2013 (hexabromocyclododecane), 2015 (polychlorinated naphthalenes, pentachlorophenol, hexachlorobutadiene) and 2017 (dekabromodiphenylether, short-chain chlorinated paraffins, hexachlorobutadien) are posing additional challenges including new consideration of the monitored core matrices, development and standardisation of sampling and analytical methods, further development of the GMP DWH to

support data collection and analysis and setting up the baseline levels for these compounds. All of these will require close collaboration of existing monitoring programmes.

With the above in mind, the Initiative on the Global Observation System for Persistent Organic Pollutants (GOS4POPs) is aimed to: i) increase the availability and quality of Earth observation data and information needed to track these chemical pollutants and anticipate changes to the environment; ii) harmonize metadata production, archiving and sharing networks; and iii) develop advanced services in support of the policy mandate through Stockholm Convention on Persistent Organic Pollutants.

The way to attain the above objectives is by i) further development and adoption of advanced sensors for monitoring pollutants; ii) better preparing, archiving and sharing metadata; iii) creating advanced web services for using and discovery information from metadata and data; and iv) updating web services for policy makers.

Planned Activities

Activities of the GOS4POPs in the next 2020-2022 GEO Work Programme should include finalizing the updates GMP Data Warehouse to host newly listed POPs, supporting the 3rd collection of global data, and providing advanced services to the Regional Organization Groups (ROGs) and the Global Coordination Group (GCG) in their tasks of producing regional and global reports in support of the effectiveness evaluation of the Stockholm Convention measures.

The work is divided into six tasks and since the Initiative runs in 6 years cycles, there is a midterm point now. The activities proposed for the following (2020-2022) period under the GOS4POPs Initiative will further improve and strengthen the Global Monitoring Plan for POPs by including newly listed POPs (2015 and 2017) into existing and newly developed monitoring networks, by extension of the GMP Data Warehouse, and by allowing for more efficient data sharing and access to historical and newly collected data sets.

The activities under GOS4POPs will run through the following Tasks:

Task 1: Analysis of current monitoring programmes, data infrastructures and archived information on POPs, with a special attention to newly listed POPs – completed first phase, continuous updates;

Task 2: Increasing availability and quality of data by supporting further development of monitoring programmes, harmonization of applied sensors, standardisation of the analytical procedures, joint interpretation of available information and production of metadata following standards – on-going, see annex II for published papers;

Task 3: Upgrading the GMP DWH to include new POPs – will be completed in the next period;

Task 4: Design, development and implementation of core services supporting adopted procedures of the 3rd Global Monitoring Report (harmonized data collection) – will continue in 2019-2020;

Task 5: Design, development and implementation of tools supporting data accessibility, presentation and interpretation – will be completed before the 2021 COP;

Task 6: Testing and updating of services and tools - release of Third Monitoring Report in 2021.

The objective of Task 1 is to analyse the state of the art of the POPs monitoring programmes and data infrastructures to discover data gaps, strengths and weaknesses that will affect further development of the GMP Portal carried out in Task 3. Task 2 will provide harmonized information and metadata to be exported to GEOSS. Tasks 4 -6 will support implementation of the 3rd Global Monitoring Report for effectiveness evaluation of the Stockholm Convention on POPs. Tasks 4 will support harmonized data collection enabling analyses and reports on trends of POPs in the environment and human tissues. Task 5 will create specific tools allowing policy makers and stakeholders to explore and use key information. Task 6 will serve to test and update services and tools to satisfy emerging needs of the effectiveness evaluation of the SC (new POPs, matrices, global reports) through the end of the GEO Work Plan.

Three to five years are necessary to make the GMP DWH fully operational and ready to support the third global data collection campaign (Task 1 to 5). Remaining time will serve to make adjustments and to better calibrate services on policy maker and stakeholders requirements and needs (Task 6).

Point of Contact

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2. Purpose (3 pages)

The proposed **GEO Initiative GOS4POPs firstly introduced in the 2017-2019 Work Programme** had a strong foundation in the outcomes of the previous **GEO Task HE-02 C2** implemented in over a decade that established sources of data in networks, engaged stakeholders and supported information sharing for the Stockholm Convention. The **GOS4POPs** further develops and provides new services for stakeholder engagement, and alignment with the GEO priorities and objectives.

The need for the GOS4POPs Initiative was timely in 2016 as the Global Monitoring Plan under the Stockholm Convention (GMP) runs in the 6-year cycles. The 1st GMP regional and global monitoring reports were presented to the Conference of Parties (COP) of the Stockholm Convention in 2009. The regional reports from the 2nd phase were presented to the COP in 2015 (the global report in 2017), and the 3rd GMP phase initiated in 2016 will be completed by presenting the GMP regional reports to the COP in 2021 and the global report in 2023.

As the GMP is implemented in the 6-year cycles (the 3rd phase will be completed with the Regional report in 2021 and the Global report in 2023), the **GOS4POPs will also continue in the updated form in the next (2020-2022) GEO Work Programme**. Long term and high precision observations and analysis of cycles of such pollutants in the different domains of the Earth system are required to better quantify sources and sinks; understand the impact on environment and human health and address their minimization/elimination.

GMP network has a clear policy mandate from the Stockholm Convention. Article 16 of the Stockholm Convention on Persistent Organic Pollutants requires that periodic assessment and evaluation of the effectiveness of measures adopted by the Convention to eliminate or significantly reduce POPs releases into environment. To this regard the Global Monitoring Plan (GMP) was established to collect comparable, harmonized and reliable information on POP levels in core environmental matrices (air, human tissues (breast milk/blood), and water). United Nation Environment Programme (UNEP) is also assisting developing countries that are Parties to the Convention to work in close collaboration with experienced laboratories as strategic partners in generating high quality POPs data. The Data Warehouse that has been developed by the Stockholm Convention Regional Centre in the Czech Republic through the RECETOX Centre and the Institute of Biostatistics and Analyses (IBA) of Masaryk University (MU), Brno, compiles and archives primary and aggregated (in cases where no primary data is made available) data including metadata.

Main objectives for the implementation of the GOS4POPs are:

- To increase the availability and quality of Earth observation data and information needed to track persistent organic pollutants and anticipate changes in the global environment; - new datasets for 2014-2019
- To harmonize metadata production, archiving and sharing for POP networks;
- To develop advanced services in cooperation with UNEP and WHO to support policy mandate through Stockholm and LRTAP Conventions.

The outputs therefore are new datasets for samples collected by in-situ means, updated GMP Datawarehouse for storage, archiving and sharing broader range of data, advanced data presentation and data interpretation tools based on updated technical guidelines for broader participation of stakeholders and information uses.

Services presented in the GMP DWH have been used by Parties of the Stockholm Convention, governments, IGOs, NGOs, the scientific community and the civil society. In fact, GMP DWH is embedded in the process of the Stockholm Convention and has been used in an operational manner since 2015.

3. Background and Previous Achievements (3 pages)

Background

The GMP4POPs Initiative was introduced in the 2017-2019 GEO Work program. It originates from the former Task HE-02 "Tracking Pollutants" established as a part of the 2009-2011 Work Plan implemented until 2017. HE-02 task developed a coordinated global observation network for mercury and POPs. The Task was meant to support the international conventions on toxic compounds (i.e. Stockholm Convention (SC), UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP)) and on-going international programmes (e.g. UNEP Mercury Program, Global Monitoring Plan (GMP) of SC on POPs, European Monitoring and Evaluation Programme (EMEP)).

The Task HE-02 included two major outputs:

The Global Mercury Observation System (GMOS – www.gmos.eu), a worldwide observation system for the measurement of atmospheric mercury in ambient air and precipitation samples, which includes ground-based monitoring stations, shipboard measurements over the Pacific and Atlantic Oceans and European Seas, as well as aircraft-based measurements;

The GMP network to report baseline data for the various POPs (including the eleven new POPs listed in the SC in 2009, 2011, and 2013) in core matrices (air, human milk and blood, water) through collaboration of the most important regional and global monitoring programmes as Global Air Passive Sampling (GAPS), Monitoring Networks (MONET), European Monitoring and Assessment Programme (EMEP), Arctic Monitoring and Assessment Programme (AMAP), UNEP/WHO Biomonitoring Programme, and present them in the joint GMP Data Warehouse (www.pops-gmp.org and www.genasis.cz). This network developed a Data Warehouse for storage, analyses and visualization of data registered for an access through the GEOSS portal.

Data warehouse needs to react to the changes occurring in decision making under the Stockholm Convention and therefore respond to addition to further chemicals, adaptations of guidance document and generation of relevant information and service for stakeholders.

Previous Achievements

The outcomes of GOS4POPs Initiative (2017-2019) after the first two years include:

- The inventory of existing monitoring programmes was performed including the inventory of monitored substances with respect to substances newly added to Annexes of the Stockholm Convention (with support of the ERA PLANET H2020 ERA NET and the IGOSP project);
- Two joint meetings of the GMP Global Coordination Group, the GMP Regional Organizing Groups and the GMP experts were organized in 2017 and 2018 to prepare the updated GMP Guidance document for the 3rd phase of the GMP;
- The updated GMP Guidance document was prepared (with support of the ERA PLANET H2020 ERA NET and the IGOSP project) to be submitted to the COP in 2019;
- Several studies were performed to assess existing programmes for their uncertainties (Holt, E. et al.: Using long-term air monitoring of semi-volatile organic compounds to evaluate the uncertainty in polyurethane-disk passive sampler-derived air concentrations. *Environmental Pollution* 2017, 220, 1100-1111) and previously collected data for long term trends (Kalina et al.: Passive Air Samplers As a Tool for Assessing Long-Term Trends in Atmospheric Concentrations of Semivolatile Organic Compounds. *Environmental Science & Technology* 2017, 51(12), 7047-7054, Kalina, J. et al.: Characterizing Spatial Diversity of

Passive Sampling Sites for Measuring Levels and Trends of Semivolatile Organic Chemicals. Environmental Science & Technology 52 (18), 10599-10608) (with support of the ERA PLANET H2020 ERA NET and the IGOSP project);

- More studies are on-going evaluating performance and intercomparability of various sensors used in the networks as well as intercomparability of the large monitoring networks (with support of the ERA PLANET H2020 ERA NET and the IGOSP project);
- A pilot phase of the new global aquatic monitoring programme (AquaGAPS) was initiated with a support of the European Structural and Investment Funds in the Czech republic;
- The joint meeting the GMP Global Coordination Group, the GMP Regional Organizing Groups, PIs of the GEF capacity building projects and the UNEP/SSC representatives was organized in 2019 to discuss the sustainability of the monitoring programmes, the gaps and future needs.

Challenges and Lessons learned

As the GMP is implemented in the 6-year cycles (the 3rd phase will be completed with the Regional report in 2021 and the Global report in 2023), the **GOS4POPs will also continue in the updated form in the next (2020-2022) GEO Work Programme**. Long term and high precision observations and analysis of cycles of such pollutants in the different domains of the Earth system are required to better quantify sources and sinks; understand the impact on environment and human health and address their minimization/elimination.

A base for an effective and sustainable global system for monitoring persistent organic pollutants (POPs) concentrations in core media supporting the effectiveness evaluation of the Stockholm Convention over time has been developed during the last decade. The mandate for the effectiveness evaluation is Article 16 of the Stockholm Convention and decisions SC-5/18 and SC-7/25. The first phase of the global monitoring plan (GMP) for POPs was implemented between 2005 and 2009 and covered the 12 initially listed POPs (aldrin, dieldrin, endrin, heptachlor, chlordane, mirex, toxaphene, hexachlorobenzene, polychlorinated biphenyls, polychlorinated dibenzo-p-dioxins and dibenzofurans). The first monitoring reports using data collected over the period 1998-2008, have been published in 2009 and provided a baseline against which concentrations in core matrices will be studied over the long-term. In the second phase of the GMP (2010-2015), a particular attention was given to gathering baseline data for the ten new POPs listed in the Stockholm Convention in 2009 (hexabromobiphenyl, penta- and octa-brominated diphenylether, pentachlorobenzene, lindane, α - and β -hexachlorocyclohexane, chlordecone, PFOSs) and 2011 (endosulphane), to filling existing regional data gaps and supporting sustainability of on-going monitoring activities to enable assessment of how POPs concentrations evolved since the first monitoring reports. The results have been archived in the central GMP Data Warehouse (DWH) built for strengthening regional POPs monitoring systems supporting the effectiveness evaluation, and capacity building in regions where monitoring coverage is limited or lacking.

Nevertheless, new POPs added to the Stockholm Convention in 2013 (hexabromocyclododecane), 2015 (polychlorinated naphthalenes, pentachlorophenol, hexachlorobutadiene) and 2017 (decabromodiphenylether, short-chain chlorinated paraffins, hexachlorobutadiene) are posing additional challenges including new consideration of the monitored core matrices, development and standardisation of sampling and analytical methods, further development of the GMP DWH to support data collection and analysis and setting up the baseline levels for these compounds. All of these will require close collaboration of existing monitoring programmes.

With the above in mind, the proposed Initiative on the Global Observation System for Persistent Organic Pollutants (GMP4POPs) is aimed to: i) increase the availability and quality of Earth observation data and information needed to track these chemical pollutants and anticipate changes to the environment; ii) harmonize metadata production, archiving and sharing networks; and iii) develop advanced services in support of the policy mandate through Stockholm Convention on Persistent Organic Pollutants.

Evidence of achievements:

Three face-to-face meetings of the GMP GCG (the GOS4POPs Steering Committee) together with the ROGs and invited experts were organized in Brno between 2017-2019 which defined the expected progress of GOS4POPs:

The expert meeting on 7-9 November, 2017

set a timeline for updated GMP guidance document and its presentations for adoption (2019 - COP9 and 2021 - COP10). Adding new chemicals into the guidance was discussed together with challenges, availability of methods, and adaptation of the GMP DWH for effectiveness evaluation and data collection (2019-2020). Chemical groups (added to the original 12 groups and 11 additions from 2009, 2011 and 2013) listed as of 2015 and 2017 include hexachlorobutadiene, pentachlorophenol with its salts and esters, polychlorinated naphthalenes, decabromodiphenyl ether and short-chain chlorinated paraffins. Chemicals under review expected for listing in 2019 are dicofol, pentadecafluorooctanoic and perfluorohexane sulfonic acids with related compounds.

The GCG meeting on 30 May - 1 June, 2018

considered the outcomes of the process for revision and updating of the GMP guidance document, implementation of the GMP-3 for air monitoring, human milk survey, water monitoring and presentation of regional activities and provided directions for further revisions of the guidance document as well as for the regional strategies for GMP-3 for data identification, generation and use. The guidance for further development of the GMP DWH was also provided: The GMP data warehouse was designed to support the work of the ROGs in collecting, processing and analysing data for the purpose of developing the regional monitoring reports. Only data that have been validated and approved by the ROGs (and used for the development of the monitoring reports) are included in the GMP DWH. Data compilation (and subsequent analysis and assessment within the reports) is conducted in accordance with the six year evaluation cycle for the GMP and the next one comprises period of data covering 2014-2019 inclusive. The GMP DWH should include tools for electronic data collection, standardized data structure and code lists as well as visualization tools. Data providers are those identified by ROGs and data are reported either as annually aggregated or as primary data (and later aggregated in GMP DWH). To enable data work, the updated GMP DWH management console will be available as mid 2019. The GMP-2 data visualization will remain unchanged until GMP-3 will be published. All data from the third phase will be password protected until publication (spring 2021). After the publication of regional monitoring reports public access to the GMP DWH will be enabled (spring 2021). Available visualization tools will include those that had been used in GMP-2 (spatial distribution, data availability, summary statistics, time series, and data exports - either figure and/or maps or real data exports) to which other tools could be added to expand the scope of the analysis. Updated DWH will also comprise better referencing and provide literature sources for the data along with web links to original sources as available. This information will be included among other metadata and included in the GMP data warehouse.

4. Relationship to GEO Engagement Priorities and to other Work Programme Activities (3 pages)

The GOS⁴POPs or the GWP DWH aligns well with GEO guidelines such as open data and operational services to end-users, without much engagement from the GEO community (there is almost no overlapping between the national representatives to the Stockholm Convention and those to GEO). But the action on POPs is not irrelevant to GEO priorities - on the contrary, it contributes to SDG 3 'Good Health and Well-being', SDG 6 'Clean Water and Sanitation' and a few other Sustainable Development Goals.

Meanwhile, GOS⁴POPs fills the gap of in-situ data in GEO. The GEO Secretariat the Programme Board consider solutions on how to make Initiatives like GOS⁴POPs relevant to and engaged with the GEO Community.

The GEOSS Strategic Plan 2016-2025 is based on three strategic objectives: (a) advocacy of EO as the foundation of environmental information; (b) engagement with stakeholders to address every-day societal challenges, and (c) delivery of critical data, information and knowledge to inform decision-makers. Along these lines, the contribution from this Initiative will be realized through the:

- endorsement of full and open access to EO data;
- promotion of the use of key data management principles, as well as common standards and interoperability arrangements;
- encouragement and actions for increased contribution of regional resources directly to GEOSS Data-CORE and Copernicus data portal;
- engagement with key stakeholders to identify the needs in observations, and environmental and socio-economic data analyses, which can yield advances in many Societal Benefit Areas (SBAs);
- broadening of the GEOSS and Copernicus user base through well-targeted dissemination and exploitation actions;
- ensuring access to data, information and knowledge, while increasingly promoting interoperability among multiple sources of data; and deliver the tools, knowledge and services suitable for intelligent exploitation by user communities;
- showcasing concrete collaborative schemes relying on integration of regional capacities and skills towards addressing specific challenge priorities.

Key Foundational Tasks necessary to complete the activity are:

- GD-1 Advancing GEOSS Data Sharing Principles, p129-132
- GD-2 GCI Operations (including access to Knowledge), p132-133
- GD-7 CGI Development (includes development of Data Management Guidelines), p140-143
- GD-9 GEO Knowledge Base Development, p143-145

Many of the activities are done in conjunctions with GMOS flagship, This collaboration is supported by the H2020 ERA NET project ERA PLANET/IGOSP and the H2020 project E-SHAPE.

The visibility of GOS⁴POP is not very high in GEO during the 2017-2019 period, although GMP DWH has been providing operational services to the Stockholm Convention. This could be partly attributed to the lack of representatives on POPs in GEO Member delegations. GOS⁴POP would like to work with the GEO Secretariat to raise the visibility through various means including blog posts on the GEO website, showcases at GEO Symposia and data accessibility in the GEOSS Platform.

5. Stakeholder Engagement and Capacity Building (2 pages)

Masaryk University (RECETOX) will collaborate with UNEP and WHO in implementation of activities supporting implementation of the 3rd Global Monitoring Report development over the period of 2017-2021 and of the global report until 2023. They also develop and endorse at the global level common standards to be adopted for metadata. UNEP and GEF will contribute to building necessary capacities in eligible developing countries. EC, EMEP, AMAP, LEC, and FURG will participate by delivering consistent air data in line with data collection standards adopted. NILU, MSC-EAST and Max Planck Institute will contribute to data analysis and modelling. UNEP, WHO, AMAP will support the biomonitoring efforts. Remaining partners will contribute to development of new sensors for improved coverage.

The users are national contact points of the Stockholm Convention on POPs and other (Basel, Rotterdam, Minamata) conventions and other responsible personnel at the national levels, members of the GMP Global Coordination Group, members of the GMP Regional Organizing Groups, Secretariat of the Stockholm Convention and UNEP, WHO, GEF, COP delegates and others. Many of them are involved in the management board (UNEP) and steering committee (GCG) or are active participants of the process (NCPs, ROGs, Expert Group). Others are engaged through the data collection, effectiveness evaluation, COP presentation and general availability of data.

Engagement with relevant user communities and other stakeholders is of crucial importance for this Initiative, making sure its objectives are in tune with the real-world problems and its results provide adapted solutions. GOS4POPs will share the outcomes, lessons learned and conclusions from a series of roundtable meetings designed to identify stakeholder needs and promote collaboration between science and policy. The roundtables will seek to build up a stakeholder dialogue with exemplary sector-specific user communities to incorporate feedback loops for the products of this Initiative, as well as to develop improvements of existing POP data workflows.

The reports from the Global Coordination Group and the Regional Organization Groups meetings will provide a summarized overview of shared experiences and provide insights and exchange of ideas on highly relevant issues concerning policy, local/regional stakeholders and networks.

This Initiative will continue to contribute in different steps of the policy implementation and evaluation process of the Stockholm and LRTAP Conventions. Main foreseen contributions are:

- To provide up-to-date information on POPs concentrations and trends in the atmosphere, aquatic ecosystems and in humans for science and policy use;
- To support regions in developing and/or improving capacities for monitoring and assessment of POPs;
- To facilitate capacity building and transfer of knowledge to developing countries;
- To cooperate with UNEP, governments, NGOs and stakeholders in effectiveness evaluation of measures adopted to achieve the goals set by the Stockholm Convention.

The GMP4POPs Initiative will include capacity building and technology transfer activities based on the long-term experience and available capacity (i.e. RECETOX international summer schools organized on the annual bases, workshops and web-based seminars) of the RECETOX Centre serving as the Regional Centre of the SC for Capacity building and Technology Transfer focused on:

- Sustainability of monitoring activities in the regions with limited capacity supported through partnership with strategic partners;
- Capacity building for sampling and analysis of POPs in core media and training provided in regions with limited monitoring capacity;
- Capacity building and training to assist regions in implementing new features of the GMP and filling existing data gaps;

- Capacity building for successful implementation and application of the GMP DWH for the GMR3.

6. Governance (2 pages)

Governance

GOS⁴POPs is led by the Czech Republic through Masaryk University, the RECETOX Centre, in cooperation with UNEP Stockholm Convention secretariat (co-lead) with contribution from Australia, Brazil, Canada, China, EC, Germany, Italy, Japan, Norway, Russian Federation, Slovenia, Sweden, UK, USA and UNEP, WHO, World Bank (Global Environmental Facility - GEF). The initiative is governed by a Management Board and supported by a Steering Committee. In addition, a team of the equivalence of 10 people full time in RECETOX work for GOS⁴POPs.

Organizational structure

The Management Board of the Initiative was established to assure an efficient management and good communication with policy makers and stakeholders at regional and national levels. It comprises lead and co-lead of the initiative and key staff for the software and tools development, data management, IT services and communication with the stakeholders.

Instead of setting up a separate Steering Committee, GOS⁴POPs uses the Global Coordination Group (GCG) for the Global Monitoring Plan of the Stockholm Convention since the beginning of the first implementation period to provide scientific guidance, review, control, and evaluate proper implementation of all activities. The GCG consists of two representatives of each GMP Regional Organization Group (i.e. each UN region), and is supported by the BRSC Secretariat.

Project coordinator and supporting organization

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Supporting Organization: Masarykova Univerzita – RECETOX Centre (www.recetox.muni.cz) and United Nations Environment Programme (UNEP) - Secretariat of the Basel, Rotterdam and Stockholm Conventions (www.brsmeas.org)

Communication with partners and participants

Communication of the Initiative will be organized, developed and reinforced to maximize audience and societal benefits. Communication strategy: the existing one is carried through bodies of UNEP in the Global Monitoring Plan implementation - Regional Organization Groups and Global Coordination Group comprising main partners and stakeholders. This communication is organized at a minimum twice a year and informs on the progress, data, new tools available in the initiative and frames the issues in a political perspective other than research. The communication strategy targets to remove doubts, clarify timelines, and strengthen all the participants in raising the visibility of the outcomes and major findings.

Monitoring and evaluation

this is done by steering committee on the basis of deliverables/milestones that present the outputs of tasks and activities therein. Takes place at least once per year. All Deliverables will be reported to the GEO PB/Secretariat.

Risk assessment

Risk identification is done by the data management team and co-leads reviewing strategic and policy documentation, gathering information, or analyzing the validity of assumptions on which GOS⁴POPs is conceived.

The following major risks can be considered along the implementation:

- Lack of management or ineffective Management Structure
- Lack of communication/reporting
- Lack of monitoring
- Delay in implementation

Risk mitigation plan and required resources

Information on identified risks is transferred to the Project Manager and a regular review of the risk register that includes the list of identified risks is performed during the project meetings. Risk analysis is the evaluation of the identified risks to determine the likelihood/probability and impact of each identified risk and to establish a risk rating. The approach to handle each significant risk will be selected after the Initiative's risks have been assessed. There are essentially four techniques or options for handling risks:

- Avoidance - application of tasks to avoid the risk event
- Mitigation – application of tasks to reduce the probability and/or impact of the risk to an acceptable level
- Transfer – Transferring the risk simply gives another party responsibility for its management; it does not eliminate it. Transferring liability for risk is most effective in dealing with financial risk exposure.
- Acceptance – If the identified risk is acceptable or no suitable response strategy has been identified, monitor and control this risk to ensure that the likelihood and impact remains on a low level.

For all identified risks, the various handling techniques will be evaluated in terms of feasibility, expected effectiveness, cost and schedule implications and the effect on the system's technical quality and performance.

Risk management procedures

The GOS4POPs quality management processes will include the following:

- Quality planning – Identify which quality standards are relevant to the Initiative and determine how to satisfy them. Define quality objectives and the quality management organisation.
- Quality assurance – Apply the planned, systematic quality activities to ensure that the project employs all processes needed to meet requirements.
- Quality control – Monitor specific project results to determine whether they comply with relevant quality standards and identify ways to eliminate causes of unsatisfactory performance.

7. Resources (1 page)

Resources needed for implementation of GOS4POPs (estimated to be 15 MEur for 6 years of the GMP implementation period) include costs related to:

- data generation through the monitoring networks (EMEP, GAPS, MONET, FURG,...) and biomonitoring campaigns, i.e. personal, consumable and other direct and indirect costs related to logistics, sampling (including sampling equipment and consumables) and analysis of samples,
- organizing the global network for harmonized data collection, i.e. setting up the Global Coordination Group (also a steering committee) and Regional Organization Groups, updating the GMP Guidance document, secretariat, support for meetings and travels, planning and organizing campaigns,
- development and maintenance of the advanced data collection, evaluation, handling, management, analysis, interpretation and presentation tools (including necessary

- hardware, office space and personnel) and necessary services to provide a support to the GCG, ROGs, and national contact points and experts in the GMP campaigns,
- collecting and harmonizing metadata and making them available,
- collecting, harmonizing, analyzing, interpreting, and presenting data, developing the regional and global reports, linking available data do GEO

Resources for implementing GOS4POPs in 2020-2022 include (details provided in tables):

- national resources (in kind and cash) of contributing countries (the Czech Republic, Norway, Canada, Brazil, Australia, Japan, China and others) to support regional and global monitoring networks (EMEP, GAPS, MONET, LAPAN and others) and their data warehouses (personnel costs, office spaces, laboratories, equipment),
- European structural and investment funds (2017-2021) supporting building a sustainable infrastructure for data handling in the Czech Republic (facilities, equipment, servers and computers, personnel),
- EU H2020 ERA NET: The European network for observing our changing planet (ERA-PLANET, 2016-2020) aimed to strengthen the European Research Area in the domain of Earth Observation in coherence with the European participation to GEO and Copernicus (33% of EU top-up fund and 66% of member states, cash and in-kind). Within ERA PLANET the IGOSP project specifically supports GOS4POPs,
- EU H2020: EUROGEOS project (2019-2023) will develop a pilot on GOS4POPs,
- medium-sized GEF projects on building capacity for implementation of the GMP in the UN regions of Africa, Asia, Latin America and Pacific Islands (training and capacity building for sampling, sample analysis, data handling and interpretation, travel and personnel costs),
- UNEP projects supporting development of the GMP DWH, regional and global networks,
- in-kind resources for staff time of the BRS secretariat, members of the GMP Regional Organization Groups and the Global Coordination Group, national contact points and experts working with data, their office space, and equipment.

Considering already secured and expected resources, we expect some 7-8 MEur to be mobilized for a following period, the annual budget will be around 2.5 MEuro for the 2020-2022 period.

The initiative depends on in-kind contributions from UNEP/BRS secretariat, but also Masaryk University/RECETOX developing and managing data warehouses. It also relies on in-kind and cash national contributions for the monitoring programmes, their data, experts, national contact points, ROGs and GCG. An important issue are resources to maintain availability of data from the less developed regions. Discussion about possible future GEF projects is on-going.

An establishment of the EFSRI infrastructure is planned as one of the pillars supporting the long-term sustainability of this initiative.

This initiative is rather oriented to policy and decision making stakeholders including local and regional authorities than to commercial sector. Data sets generated represent a global policy benefit. However, some minor contributions from the private sector should be acknowledged (companies using monitoring data for the environmental impact assessment, for instance).

8. Technical Synopsis (2 pages)

The Stockholm Convention has to go through the effectiveness evaluation procedure every 6 years to prove it is an effective tool to reduce levels of persistent organic pollutants (POPs) in environment and humans. As an important component of the effectiveness evaluation, the Global Monitoring Plan (GMP) for POPs provides a harmonized framework for the collection of comparable monitoring data on POP levels in core environmental matrices (air, human tissues (breast milk/blood), and water) - and this information is a principal data set with a rich metadata content on site, temperature, time and a range of parameters and concentration levels.

Data sets available at GMP data warehouse www.pops-gmp.org come from major national, regional and global monitoring programmes, including Arctic Monitoring and Assessment Programme (AMAP); European Monitoring and Evaluation Programme (EMEP); Global Atmospheric Passive Sampling (GAPS) Programme; Monitoring Network (MONET) Programme, Latin American Atmospheric Passive Sampling *Network* (LAPAN) and cover a time span from 1970s (in some locations) to 2014 right now. Data are openly and freely accessible in the data browser at www.pops-gmp.org once the validation process and preparation of regional reports is completed.

Data sets must be validated by the Regional Organization Groups of the five UN regions and the repository and visualization data warehouse compiles and archives primary and aggregated data including metadata. The GMP DWH was launched in 2014 with a particular focus on standardizing sampling and analytical methods, integrating baseline data for new POPs into the system and curating data from heterogeneous sources.

New datasets should to be imported until mid 2020 include information on the original as well as newly listed POPs collected from multiple data providers in all UN regions during 2015-2020 monitoring period. Establishment of the new monitoring networks in areas with identified data gaps is expected. Additional historical datasets can be identified and made available as well. Harmonized data sets are a base for drafting (by ROGs) the Regional monitoring reports to be presented to the COP in 2021, and the Global report (drafted by GCG) to be submitted to the COP in 2023. These reports are an important source for an effectiveness evaluation of the Stockholm Convention.

9. Data Policy (2 pages)

The initiative works with data which are generated by partner data providers and have to be validated by ROG members. Key/core datasets comprise sets of 28 POPs data in ambient air, human tissues (breast milk and maternal blood) and surface water (for more water-soluble POPs).

New datasets should embed information on the original as well as newly listed POPs collected from multiple data providers in all UN regions during 2015-2020 monitoring period. Additional historical datasets can be identified and made available as well. A set of GEOSS Data Core will be produced and published. The core comprises Spatial distribution, Data availability, Summary statistics and Time series analysis and map layers.

The following attributes are embedded in the multi-modular GMP DWH:

- Fully parametric data sheets - harmonized data and information structure to improve the quality of information reported from particular monitoring activities, supporting their broader comparability;
- Standardized data structure, handling and outputs - the GMP DWH is designed to work with data from a wide range of heterogeneous sources, such as national monitoring programmes or large international monitoring networks, without compromising incoming information;
- Compatibility check - GMP DWH contains only completed and validated data records;

- Regional data repositories contain automatic tools for storage, archiving of both primary and aggregated data – usability of all interfaces will be tested;
- Multilayer data validation procedure - compatible data records stored in the GMP DWH are considered by members of the respective regional organization group and validated for further use in the publication;
- Data visualization presents data in a uniform format;
- Public access to the data is granted once the validation process and preparation of regional reports is completed.

Full adherence to the GEOSS Data Sharing and Data Management Principles will be secured and interoperability with the GCI will be ensured.

ANNEXES

I. Acronyms and abbreviations

AMAP	Arctic Monitoring and Assessment Programme
CEE	Central and Eastern Europe
COP	Conference of the Parties
DDD /DDE	Metabolites of DDT
DDT	Dichlorodiphenyltrichloroethane
dl-PCB	Dioxin-like PCB
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe
GAPS	Global Atmospheric Passive Sampling Survey
GCI	GEOSS Common Infrastructure
GEF	Global Environment Facility
GMP	Global Monitoring Plan
HCB	Hexachlorobenzene
HCHs	Hexachlorocyclohexanes
HBB	Hexabromobiphenyl
IADN	Integrated Atmospheric Deposition Network
LRT	Long Range Transport
LRTAP	Long Range Transboundary Air Pollution
MSCE-East	Meteorological Synthesizing Centre-East
NGOs	Non-Governmental Organisations
OCPs	Organochlorine Pesticides
PBDEs	Polybrominated diphenyl ethers
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo- p-dioxins
PCDF	Polychlorinated dibenzofurans
PCP	Pentachlorophenol
PFOS	Perfluorooctane sulfonate
POPs	Persistent Organic Pollutants
RECETOX	Research Centre for Environmental Chemistry and Ecotoxicology
ROGs	Regional Organization Groups for the Global Monitoring Plan
SCCPs	Short-chain chlorinated paraffins
SOP	Standard Operating Procedure
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
WHO	World Health Organization

II. Key scientific references

Report on existing monitoring networks and data available for the 3rd Phase of the Global Monitoring Plan (Deliverable of the IGOSP project of the ERA PLANET H2020 ERA NET)

Holt, E. et al.: Using long-term air monitoring of semi-volatile organic compounds to evaluate the uncertainty in polyurethane-disk passive sampler-derived air concentrations. *Environmental Pollution* 2017, 220, 1100-1111.

Kalina et al.: Passive Air Samplers As a Tool for Assessing Long-Term Trends in Atmospheric Concentrations of Semivolatile Organic Compounds. *Environmental Science & Technology* 2017, 51(12), 7047-7054,

Kalina, J. et al.: Characterizing Spatial Diversity of Passive Sampling Sites for Measuring Levels and Trends of Semivolatile Organic Chemicals. *Environmental Science & Technology* 52 (18), 10599-10608)

III. CV of Project Leader

Prof. Jana Klánová is full professor of Masaryk University (MU) in Brno, Czech Republic, and director of the RECETOX Centre (www.recetox.muni.cz) which is the Regional Centre of the Stockholm Convention for Capacity Building and Technology Transfer in Central and Eastern Europe, and the research infrastructure included in the Czech Roadmap of Large Research Infrastructures as well as the ESFRI Roadmap. Her research interests are fate of chemical compounds in the environment, transport and transformation processes, human exposure pathways, and environmental determinants of health. She published more than 170 refereed international journal articles with more than 3500 citations (h index of 34). She is a member of the international Expert Group of advisors supervising implementation of the Global Monitoring Plan under the Stockholm Convention, and the leading partners GOS4POPs Initiative in the previous period. She was a principal investigator of the projects of the EU Structural Funds and Framework Programmes including HORIZON 2020, EU InterReg, AMVIS/KONTAKT, NATO, UNEP/GEF, UNIDO, and others. She is currently a management board member of the ERA-PLANET ERA NET as well as newly established Human Biomonitoring for Europe (HBM4EU) Joint Programme project under H2020.

IV. Timeline for Stockholm Convention Global Monitoring Plan in the 3rd phase of POPs data collection

C. Milestones and timelines for the development of 3rd GMP phase monitoring reports

Milestones	1 st ½ 2019	2 nd ½ 2019	1 st ½ 2020	2 nd ½ 2020	May 2021	2 nd ½ 2021	1 st ½ 2022	2 nd ½ 2022	2023
Meetings of the COP	COP9				COP10				COP11
Air monitoring activities									
Human monitoring									
Updating of Guidance after listing new POPs	to COP				to COP				
Meetings of the global coordination group (GCG)		X		X		X		X	
Meetings of the ROGs	X		X		X				
ROGs to check availability of existing programmes for GMP Phase 3									
ROGs to identify additional programmes to fill the geographic gaps									
ROGs to identify programmes to contribute baseline for new POPs									
GCG to evaluate further needs for capacity enhancement									
Establish arrangements to receive data sets									
ROGs to establishing drafting team									
ROGs collecting all data and information to be used for drafting									
ROGs to evaluate quality of data sets and process data									

ROGs to finalize the first draft of the regional monitoring reports									
Draft regional monitoring report submitted for regional comments									
ROGs to revise the regional reports according to comments									
Finalization of the regional monitoring reports and submission to SSC									
Reports considered and welcomed at COP 10									
GCG to develop the global monitoring report									to COP
Full effectiveness evaluation by the EEG									to COP
GMP global report and second EE report considered at COP-11									

A.

V. Policy mandate

The RECETOX Centre of Masaryk University (a lead partner of the GOS4POPs Initiative) has been officially endorsed by the Conference of Parties of the Stockholm Convention in 2009 as the CEE Regional Centre for Capacity Building and Technology Transfer. As such, it has closely collaborated with the Secretariat of the SC, Global Coordination Group, Regional Organization groups and the GMP Expert Group on preparation and implementation of the first and second GMP campaigns including development and operation of the GMP data warehouse.

The documents below (official COP documents and documents of the Secretariat of the SC, Global Coordination Group, Regional Organization groups and the GMP Expert Group) demonstrate that RECETOX was given a mandate to develop and maintain the GMP data warehouse, summarize major technical solutions and tasks and indicate that a linkage of GMP with the GEO activities was required since the beginning.

2010: UNEP-POPS-GMPEG.2-2.En.pdf (para 69)

It is also important to identify potential users of the data base, such as members of the global coordination group and regional organization groups, as well as potential useful outputs/products e.g. maps. On a more general level, the users of the monitoring reports will also use the data repository. The rights of entering/submitting data should also be identified clearly from the beginning. Data are collected by the ROGs for the preparation of the regional reports, and as such the ROGs will also be submitting data for inclusion in the database. **The link of the GMP activities with the GEOSS initiative will provide visibility and a larger opportunity for the general public to have access to these data.**

Following documents describe development of the GMP data collection, management and presentation systems and practical solutions.

2011: UNEP-POPS-GMPCG.11-2.En.pdf (part 4)

34. Practical solutions to data handling should consider the major attributes of the GMP, in particular its cost-effectiveness, feasibility and sustainability. Data comparability is an essential factor to be taken into account when handling the data for the GMP regional reports. The existing organizational structure put in place for the implementation of the GMP (ROGs and the coordination group) should be considered, along with lessons learned from other data storage facilities.

35. The approach to data storage should thus be simple and practical, considering the cost effective approach within the plan, by starting from an elementary electronic repository for collection of data endorsed by the regions and published in the regional reports, which could be further developed and enhanced with more advanced functionalities and tools.

36. It was highlighted that both search tools and data processing and analysis capabilities should be embedded within such system, while attention should be paid to inter-operability, including possibilities for links with other similar systems. The issue of data ownership was discussed, and the need for procedures to obtain access to copyrighted data. In a first step, the system could include only the data that are publically available in the GMP reports, with further data being added at later stages.

37. The example of the GENASIS system used to handle data for the Central and Eastern Europe region was given. It is based on a combination of expert knowledge and validated data from regular monitoring programmes. Linking to additional information sources provides potential for

complex assessment of anthropogenic impacts in the environment and ecological and human health risks.

64. Data will be collected, stored and evaluated using of the GENASIS Expert system of the RECETOX.

84. Conclusions: The regional reports and the data therein constitute a repository of valuable information that can serve as a useful resource for policy makers and researchers and are available on the Convention website in the Secretariat's role of acting as a clearing house for information on POPs. The GMP should strive for a simple and feasible step-by-step approach to data storage and handling, including data search and analysis tools considering the cost effective aspects of the plan.

UNEP-POPS-GMPCG.12-3.En.pdf

GMP and Genasis tools will be used for data collection from the established programmes such as MONET, GAPS and WHO. Data from UNEP/GEF projects will be uploaded to the GMP data capture tool and incorporated into the regional report.

Other data from the region will be collected using an agreed upon harmonised template similar to that of the GMP.

Evaluation of readily available data sets according to the data quality criteria and selection of data Evaluation of the regional data will be conducted by the ROG members according the established guidelines and considered appropriately.

Data from the region will be stored at the ROG platform and the Regional node to be setup by RECETOX. The ROG platform was established during phase one of the GMP, but there is need to increase the size of the platform to accommodate more data that will be produced during the second phase.

Further, training will be required for all ROG members to be able to use the platform and the regional node for data storage and sharing.

UNEP-POPS-COP.6-INF-32.English.pdf, part V. GMP data handling strategy (page 6):

Ms. Katarina Magulova presented the outcomes and conclusions and recommendation of the expert meeting held in Brno on the GMP data handling strategy. In addition, information on cost assessment for the establishment and operation of the GMP data warehouse based on two offers received from NILU and RECETOX.

COP6 decision: Takes note of the report of the meeting of the global coordination group and regional organization groups and welcomes the conclusions and recommendations of the global coordination group

UNEP/POPS/COP.8/21/Add.1 recommendations:

Efforts should continue toward ensuring comparability and consistency in monitoring data at the global level. The regional and global monitoring reports should be broadly shared and the GMP data warehouse should be maintained to support GMP data handling and to provide on-line access to up-to-date POPs monitoring data.

UNEP-POPS-COP.8-INF-38.English.pdf

<http://chm.pops.int/Implementation/GlobalMonitoringPlan/MonitoringReports/tabid/525/Default.aspx>

p. 11: A major focus of the second phase of the GMP has been to provide support to the regional organization groups (ROGs) with enhanced harmonized data handling for the collection, processing, storing and presentation of their data. A GMP data warehouse currently supports data handling and assists the regional organization groups and the global coordination group in producing the regional and global monitoring reports. All monitoring data obtained in the frame of the GMP are publically available and represent a valuable resource for both policy makers and researchers worldwide.

Recommendation: Efforts towards ensuring comparability and consistency in monitoring data at the global level should continue. The regional and global monitoring reports should be broadly shared

and GMP data warehouse should be serviced and supported to support data handling in the frame of the GMP and to provide access to up-to-date POPs monitoring data.

p. 23, para 19: In addition to the regional and global monitoring reports, international and global databases such as EBAS (<http://ebas.nilu.no/>) and the GMP data warehouse (<http://www.pops-gmp.org/visualization-2014/>) are important in compiling and making monitoring data accessible to international and national policy makers, to modelers for assessing fate and transport, and to the general public. These databases provide a long-term, publicly-available repository for these data. Recommendation: Databases need to be maintained and updated to ensure data quality, consistency and compatibility among databases, data continuity, and ease of access.