Stockholm Convention
Regional Centre for Capacity Building
and the Transfer of Technology

Stockholm Convention
on persistent organic
pollutants (POPs)

Global Monitoring Plan Data Warehouse Overview

version 3

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Stockholm Convention Regional Centre in the Czech Republic and
Research Centre for Toxic Compounds in the Environment
Masaryk University, Brno, Czech Republic
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Abbreviations

AMAP	Arctic Monitoring and Assessment Programme
COP	Conference of the Parties (to a Convention)
DDD	Metabolite of DDT
DDE	Metabolite of DDT
DDT	Dichlorodiphenyltrichloroethane
dl-PCB	Dioxin-like PCBs
ECD	Electron capture detector
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
GAPS	Global Atmospheric Passive Sampling Survey
GC	Gas chromatography
GCG	Global Coordination Group for the Global Monitoring Plan
GEF	Global Environment Facility
GENASIS	Global Environmental Assessment Information System
GMP	Global Monitoring Plan
GMP DWH	Global Monitoring Plan Data Warehouse
HBB	Hexabromobiphenyl
HCB	Hexachlorobenzene
HCHs	Hexachlorocyclohexanes
HPLC	High performance liquid chromatography
HRMS	High resolution mass spectrometer
LOD	Limit of detection
LOQ	Limit of quantification
LRMS	Low resolution mass spectrometer
LRTAP	Long Range Transboundary Air Pollution Convention (UNECE)
MS	Mass selective detector
ND	Not detected
NGOs	Non-governmental organizations

OC	Organochlorine
OCP	Organochlorine pesticide
PBDEs	Polybrominated diphenyl ethers
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-p-dioxins
PCDF	Polychlorinated dibenzofurans
PCP	Pentachlorophenol
PFOS	Perfluorooctane sulfonate
POPs	Persistent organic pollutants
PUF	Polyurethane foam
QA/QC	Quality assurance and quality control regimes
RECETOX	Research Centre for Toxic Compounds in the Environment
ROGs	Regional organization groups for the Global Monitoring Plan
SOP	Standard operating procedure
TEF	Toxic equivalency factor
TEQ	Toxicity equivalents
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
WHO	World Health Organization
XAD	Styrene/divinylbenzene-co-polymer resin

Introduction

This training document holds and shares a necessary background to/with any stakeholder in relation to the development of and implementation of the Global Monitoring Plan including important documents such as GMP Guidance Document and its updates, decisions of the Conferences of the Parties, regional monitoring reports and reasons why uniform data structure is necessary.

Moreover, article 16 of the Stockholm Convention requires that Parties establish arrangements to provide itself with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C as well as their regional and global environmental transport, and this document shows ways how to reach comparable monitoring data and what procedures of data management are necessary in order to preserve a maximum of available information and metadata.

In addition, a part of the training document also describes the principles, scope and purpose of the Global Monitoring Plan Data Warehouse and provides the user with a quick orientation – how to access it and where to find documents, services, help desk, and additional web services related to the data warehouse.

Further, the authors of this training document would like to bring attention to additional short complementary material – GMP DWH Overview Factsheet – showing the key information in a handy two page document. Finally, GMP Overview document is a first of the set of four training materials prepared to support use of the Global Monitoring Plan electronic tool. The additional documents are Tools in the GMP DWH, User guide for decision makers and User guide for data providers.

Finally, this document was jointly developed by the by the Stockholm Convention Regional Centre in the Czech Republic through the Research Centre for Toxic Compounds in the Environment and the Institute of Biostatistics and Analyses, Masaryk University, Brno, Czech Republic to follow development of activities and tools available under the Global Monitoring Plan.

Background Information

Good understanding of the mandates and background documentation significantly eases the work with the Global Monitoring Plan Data Warehouse. The following chapter therefore identifies requirements and arrangements for the Global Monitoring Plan (GMP) as they are set by the Stockholm Convention text, related decisions on the GMP and Effectiveness Evaluation as well as by the available supporting documentation.

Convention text

All the steps described in the training documents are designed to support the implementation of the Article 16 (on Effectiveness evaluation):

1. Commencing four years after the date of entry into force of this Convention, and periodically thereafter at intervals to be decided by the Conference of the Parties, the Conference shall evaluate the effectiveness of this Convention.

2. In order to facilitate such evaluation, the Conference of the Parties shall, at its first meeting, initiate the establishment of arrangements to provide itself with comparable monitoring data on the presence of the chemicals listed in Annexes A, B and C as well as their regional and global environmental transport.

These arrangements:

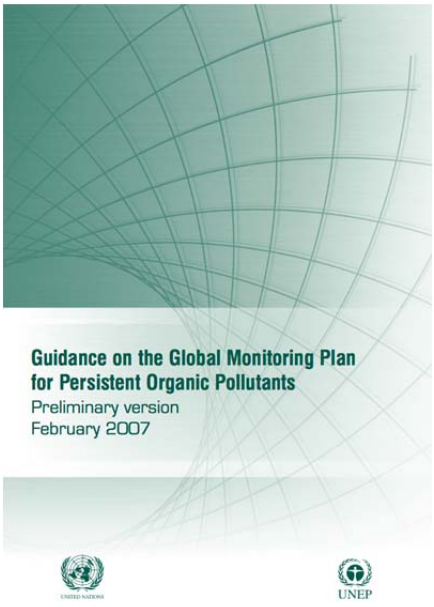
(a) Should be implemented by the Parties on a regional basis when appropriate, in accordance with their technical and financial capabilities, using existing monitoring programmes and mechanisms to the extent possible and promoting harmonization of approaches;

(b) May be supplemented where necessary, taking into account the differences between regions and their capabilities to implement monitoring activities; and

(c) Shall include reports to the Conference of the Parties on the results of the monitoring activities on a regional and global basis at intervals to be specified by the Conference of the Parties.

Supporting documentation for the implementation of the GMP

Following the first meeting of the Conference of the Parties several decisions were adopted over time in relation to the Effectiveness Evaluation and Global Monitoring Plan. These decisions constitute further source documents defining scope, timeline, procedures and organization infrastructure. Based on the decisions SC-1/13 and SC-2/13 the experts in the ad hoc technical group on the Global Monitoring Plan prepared for 2007 two important documents:



1. **Implementation Plan for the Global Monitoring Plan for Persistent Organic Pollutants** adopted by decision SC-3/19, see the document UNEP/POPS/COP.3/23/Rev.1
2. the first draft of the **Guidance Document on the Global Monitoring Plan for POPs** (set by the document UNEP/POPS/COP.3/INF/14)

Please note that both documents are continuously updated.[1]

The updates of the Guidance are carried out to provide a maximum of comparable information in all regions, to increase comparability and consistency of data, and to broaden core media, as necessary, reflecting the most recent development in listing chemicals into Annexes. Finally, the updates also set an uniform regime for the preparation of the regional monitoring report.

Guidance Document is a practical document describing in detail technical arrangements and requirements for collection, analysis and reporting of monitoring information including statistical considerations of generated data on POPs.

The objective of GMP monitoring activities is to generate data on levels of POPs in core media:

- ambient air,
- human milk and human blood,
- surface water for water-soluble POPs (PFOA, salts and PFOS)

Which POPs are to be monitored?

Those in Annexes of the Stockholm Convention; however, a detailed list of chemicals including their congeners, isomers, degradation products or parent compounds that bring most comprehensive information are described in Chapter 2 (Table 2.2) of the most recent version of the Guidance Document on the Global Monitoring Plan for POPs as reproduced in Annex 1 to this training material.

Organizational arrangements

Finally, the same decision, SC-3/19 also set organizational arrangements for the Global Monitoring Plan – a coordination mechanism for the GMP: Regional Organization Groups (ROGs) and the Global Coordination Group under the GMP (GCG)

This decision was updated in 2009 by the decision SC-4/31 who updates the terms of reference and membership of both groups and specifies further their task. In a summary, the Regional Organization Groups are responsible for coordinating regional monitoring activities, communicating with all stakeholders and writing regional monitoring report. The Global Coordination Group assists the Secretariat in coordinating and overseeing the implementation of the Global Monitoring Plan and produces the global monitoring report every six years. The first global report was produced in 2009 (see document UNEP/POPS/COP.4/33), the second report will be prepared in early 2016.

[1] The most recent version of the Guidance document is available in UNEP/POPS/COP.7/INF39.

Summary

Mandate for work is given by Article 16 of the Stockholm Convention to collect comparable, harmonized and reliable information on POP levels in core environmental matrices (air, human tissues (breast milk/blood), and water) and provide itself with organizational arrangements implementing the task on a regional basis.

Relevant decisions of the Conferences of the Parties on the GMP and Effectiveness Evaluation set the organizational and institutional framework for GMP (i.e. SC-3/19).

Supporting documentation such as the Guidance Document on the Global Monitoring Plan for POPs or Implementation Plan for the Global Monitoring Plan for Persistent Organic Pollutants define scope, timelines and reporting requirements to be fulfilled under the GMP.

The Guidance on the Global Monitoring Plan for Persistent Organic Pollutants (the most recent version is found in UNEP/POPS/COP.7/INF/39) is a practical document defining sampling of core matrices (air, human breast milk, blood) and chemicals that are to be sampled including their isomers, congeners or degradation products. It also gives more details for statistical processing of POPs data/information as well as defines a structure for regional reports.

Need for electronic tools

The first set of five regional reports under the Global Monitoring Plan were prepared in 2008 and distributed in .pdf format to Parties and considered by the COP 4 in May 2009. It was found very difficult to work with information contained in them due to difference of approaches, content and scope. Therefore, a wide team of authors[2] performed a critical review of the first GMP regional reports (reports issued in 2008–2009) on their qualitative attributes, i.e. range of reported chemicals and sampling frequency of reported concentration levels in 2011 and early 2012 with a aim to improve future GMP data collection campaigns, associated data management and processing, including data storage and presentation.

Compounds and parameters found in the first set of GMP regional reports were sorted by their relation to the Stockholm Convention into four groups:

1. Original 12 POPs included in the Stockholm Convention in 2001, their congeners, isomers and degradation products determined in the GMP Guidance (version 2007);
2. Additional 10 POPs included into the SC in 2009 and 2011 and specified in the updated GMP Guidance;
3. All other compounds, their sums and toxic equivalents related to the Stockholm Convention but not specified in any of the GMP Guidance documents;
4. Compounds found in the GMP regional reports but not related to the Stockholm Convention.

The classification strictly followed scope of the Stockholm Convention and the GMP Guidance document and their amendments in time.

Out of 171 various parameters identified in the reports (including concentration levels on congeners, isomers, transformation products, various summations and toxic equivalents – TEQ), however only 65 of them were related to 12 original Stockholm Convention POPs and 10 additional POPs (or "new POPs" – these added to annexes of the Stockholm Convention in 2009 and later); further 84 parameters were congeners, various sums and toxic equivalents, often not correctly identified, and remaining 22 did not have any relation to the Stockholm Convention at all.

As shown above, the review of the content revealed serious challenges related to data identification and standardization. The reports suffered from the lack of standardized taxonomy for POPs, their isomers, transformation products and summations which were frequently used. Heterogeneity of the data is further enhanced by reporting various toxic equivalents (TEQ) (based on WHO TEF values from various years) rather than concentrations of the individual PCDDs, PCDFs and PCBs congeners. Unclear identification of units, time and spatial scales of the reported

[2] Klánová J., Dušek L., Borůvková J., Hůlek R., Šebková K., Gregor J., Jarkovský J., Kohút L., Hřebíček J., Holoubek I.The initial analysis of the Global Monitoring Plan (GMP) reports and a detailed proposal to develop an interactive on-line data storage, handling, and presentation module for the GMP in the framework of the GENASIS database and risk assessment tool. Masaryk University, Brno, Czech Republic, 2012. pops-gmp.org/index.php?pg=gmp1--full-report-to-download

concentrations as well as insufficient specification of aggregated data belong to other frequently identified drawbacks that significantly limit subsequent use of such values in subsequent analyses. Therefore, comparability among collected data set was a challenge.

To improve that situation and as a follow up to the critical review, a proposal for a new electronic data capture system (data warehouse), suitable for the next GMP reports was also prepared. The proposal contained standardization of already obtained GMP data (based on fully parametric data sheets and code lists), database for archiving and processing of available POPs data (and those obtained in the future) and online data visualization system. The architecture of the system includes centralized data management, database customized for POPs concentration data and its standardized superstructure allowing comparison of former and future GMP data collection campaigns, and thereby quantification of time trends.

The data reporting model also involves compiling and archiving primary GMP data within a "regional data repository" in the GMP DWH for each of the five regional organization groups. In addition, the GMP DWH compiles and archives aggregated data, including supplementary data, in cases where no primary data is made available. Such electronic system would also contain statistical and analytical tools that would allow work with available data, their filtration/selection, addition, and identification of any changes over time through both robust statistical tools as well as through presentation platform. In addition, the electronic system would be also secured and adaptable to changes in scope of the monitoring activities and automatic data processing and would also correspond to the latest development of tools suitable for work with large data sets. All the above would significantly speed up any work as well as decision making that would be based on a sound science. Implementation of this solution would also open data sets to broader pool of stakeholders (data providers, monitoring experts, as well as decision makers and experts involved in the effectiveness evaluation) and increase visibility of these important activities.

This proposal was considered, amended and agreed by the Regional Organization Groups and Global Coordination Group for GMP members meeting with experts held in Brno in June 2012 and in Geneva in October 2012. Subsequently, the establishment of such data warehouse was also required by the updated Guidance on the GMP (Chapter 6.5.2 GMP data storage), adopted at the 6th meeting of the Conference of the Parties to the Stockholm Convention in Geneva in May 2013[3].

The chapter 6.5.2. suggested a data reporting model that involves compiling and archiving primary GMP data within a "regional data repository" in each of the 5 UN Regional Groups. In addition, regional data centres and a single (electronic) GMP "data warehouse" would be established to compile and archive aggregated data, data products and results, including supplementary data that would be used in the Stockholm Convention effectiveness evaluation. The proposal described above met also all these suggestions and is described in greater detail in the chapter GMP data warehouse principles and even in a greater detail in the documents on GMP tools and two user guides (practical documents supporting the work with GMP tools).

[3] Document number UNEP/POPS/COP.6/INF/31 and in the decision SC-6/23

Summary

Experience with GMP1 and regional reports in pdf files resulted into a need for a new, modern, (electronic) tool that would allow users benefit fully from information linked to collected POPs concentrations, avoid loss of data sets due to lack of standardization in nomenclature or unclear data structure and would allow assessment of time trends on harmonized and comparable data sets in core matrices of the Stockholm Convention and thus fulfil requirements of article 16.

The new system would contain the following components:

- Electronic data collection
- Standardized parametric data structure
- Standardized predefined code lists
- Visualization tools

GMP DWH overview

Global Monitoring Plan for Persistent Organic Pollutants (POPs) under the Stockholm Convention (GMP DWH) is an online tool developed for handling, storage, approval and visualization of POPs monitoring data generated in the frame of the Global Monitoring Plan (GMP) worldwide on the basis of the decision by the COP SC-6/23. The tool comprises two main parts – data repository and visualization portal. In addition, tools for statistical processing and analyses as well as presentation modules and export tools are available to users.

The system is based on hierarchical structure of data fields of standardized parameters with predefined content in all ontology dimensions necessary for future data processing (values, units, measurement method, LOQ, description of data aggregation, etc.). Such a hierarchical structure reduces the risk of the loss of any reported data to a minimum and standardization of data collection procedure/format is expected to facilitate the retrospective control of already reported data (earlier GMP records reported until 2008 inclusive).

Objective and attributes

The concept and development of the electronic Global Monitoring Plan Data Warehouse (GMP DWH) was endorsed by the decision of the Conference of the Parties to the Stockholm Convention SC-6/23 at its 6th meeting in May 2013 on the basis of expert recommendations contained in the updated document “Guidance on the Global Monitoring Plan for Persistent Organic Pollutants” (Chapter 6.5.2 GMP data storage, UNEP/POPS/COP.6/INF/31) adopted by the same decision.

Goal of the Global Monitoring Plan Data Warehouse is to provide long-term reliable and cost-effective information and services to global community, support POPs monitoring activities and data management under the Stockholm Convention and offer tools for collection, storage, organization, comparison, analysis, and evaluation of performance in relation to monitoring programs on POPs. The objectives of the online GMP DWH are therefore twofold:

- provide user friendly tools for storage and analyses of data from international monitoring activities under the Global Monitoring Plan of the Stockholm Convention on Persistent Organic Pollutants and make POPs data visualization available for regions and programs who require support in data management, and
- contribute to the effectiveness evaluation of the Stockholm Convention by compiling and visualizing results of global monitoring activities on POPs.

In addition, the GMP DWH has also been designed to address challenges associated with heterogeneity of information collected in environmental monitoring programmes. Lacking data standards, incompleteness of archived datasets and insufficient statistical power are the most significant limits in functionality of some monitoring networks. In line with identified challenges, the GMP DWH would contain the following four components:

- Electronic data collection
- Standardized parametric data structure
- Standardized predefined code lists
- Visualization tools

Furthermore, the GMP DWH proposal was also optimized to inherently incorporate data management; such complex functionality necessarily requires a multi-modular structure. The following attributes are therefore 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 – automatic tools for storage, archiving of both primary and aggregated data;
- 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 – presentation of data in a uniform format;
- Public access to the data once the validation process and preparation of regional reports is completed.

In addition, the tools in the GMP DW also contain options to check and correct data entry/record should need be. This function can retro-actively correct, validate and link already reported GMP data to another dataset in subsequent time and thus extend available time series. All validated POPs data (complete data set) would constitute a robust GMP database – a centralized storage – that would be a storage pool for the subsequent GMP data collection.

Structure of the GMP DWH

The Global Monitoring Plan Data Warehouse structure has been designed to incorporate state of the art knowledge and expertise in building knowledge-based infrastructures. It encompasses data input, storage, processing (compiling and archiving) of both primary data as well as aggregated data, including supplementary data in cases where no primary data is made available. The system holds data on POPs in four core matrices: air, human milk, human blood, and water. By respecting the requirements of uniform and harmonized data presentation, all outputs of the GMP DWH are shown on the visualization portal (http://www.pops-gmp.org/visualization-2014/).

The system is based on standardized data forms – standardized coding, data formats, metadata coding and consistency of records over time. Integration and analysis of data (concentration

values) is facilitated by a model defining a strict hierarchy of entities – i.e. – chemicals as nomenclature class, pairs "observation-measurement" as content classes. In addition, a robust set of statistical methods for processing time series is in place to provide the following information: baseline contamination level, uncertainty analyses, spatial extrapolations, effect size estimates, time trend identification and quantification.

The GMP DWH is therefore composed of three layers as shown in Figure 1 below:

- Data layer for data import, online data collection, data standards (code lists) and archiving;
- Core layer for data management, validation, recoding, transformation, and background for data services (GIS, analytical and statistical tools, data processing, workflow);
- Presentation layer for visualization, presentation tools and web services.

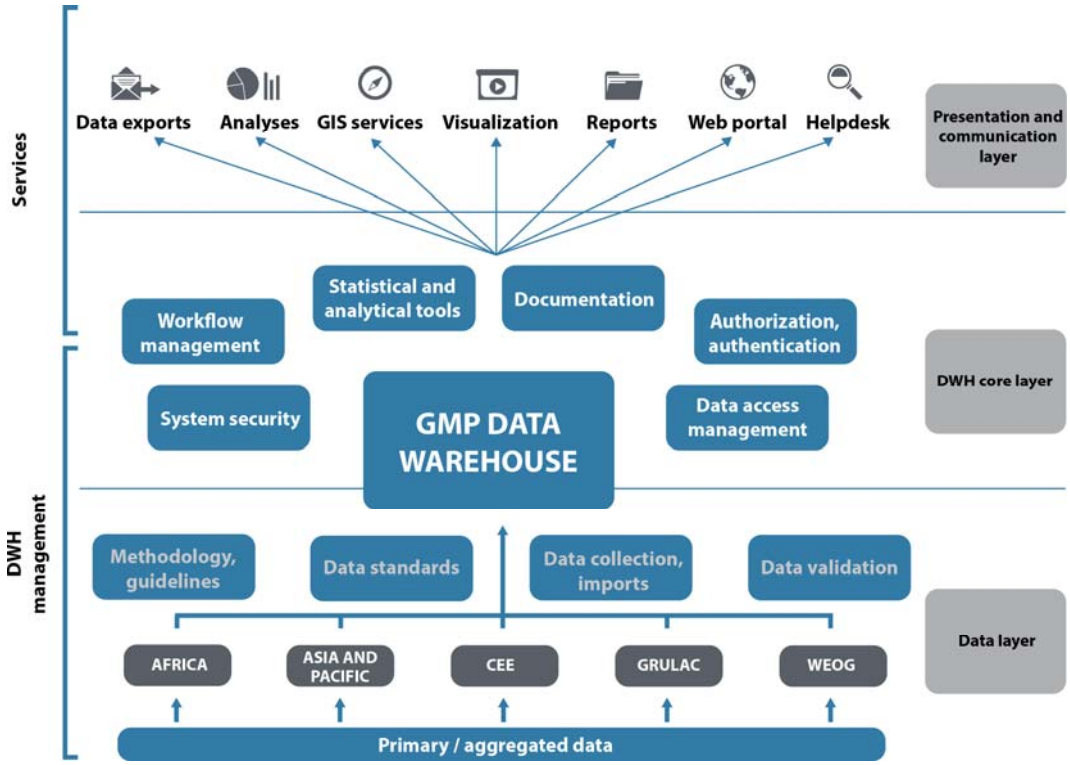


Figure 1 – Scheme of the GMP DWH layers

Data structure

GMP DWH implements four individual data collection branches; each branch is designed for one GMP core matrix (air, milk, blood and water)[4]. Data are collected, stored, processed and visualized independently across branches however some data visualization tools of the GMP DWH are capable to show data of various matrices combined (i.e. data coverage-based reports such as data availability or overview for statistical analyses).

All four data collection branches contain three common key items in relation to data:

[4] In line with the GMP Guidance document (UNEP/POPS/COP.6/INF/31, version 2013).

- Site
- Sampling attributes
- Measurement

While the **key data structure** remains identical for each branch, range and content of each key item differ slightly depending on a branch/ individual matrix. More details are shown in table in Annex 2 and discussed in greater detail in the document "User guide for data providers and users".

The following list identifies important parameters of the GMP DWH data structure that must be reported in a fully standardized and parametric way. These parameters are geographical identification and time of reported data, "measurement – value – unit" chain and details on data aggregation (if applied). Figure 2 shows the hierarchical data structure and links between components of each concentration value inserted into the GMP DWH.

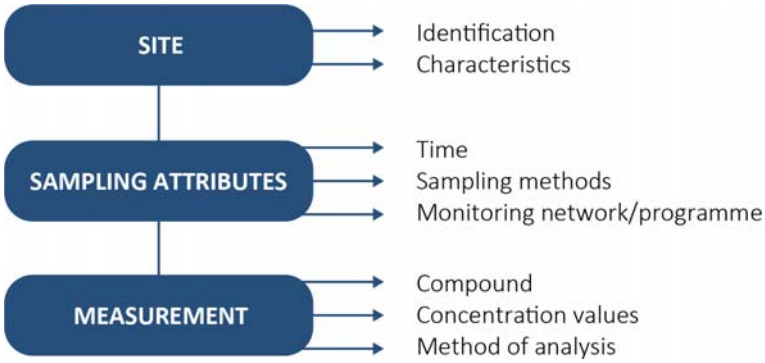


Figure 2 – Key data structure in the GMP DWH

The following list highlights the most important GMP DWH data fields and information items, which are required as obligatory:

- Contact identification of the data administrator responsible for data insertion into GMP DWH;
- Identification of site reported
- identification of any type of spatial aggregation (if used);
- Selection from a predefined set of reported chemicals (POPs);
- Indication of analytical method used, including a corresponding LOQ;
- Identification of units used for the set of reported concentration values;
- Description of time aggregation (if used);
- Definition of variability (an obligatory field for aggregated data).

In addition, data templates available in the system allow for a direct and immediate data validation during the data insertion process. The system highlights obligatory data fields through automated electronic queries. Each (completed/filled) record must contain all required information, i.e., relevant unit as an obligatory attribute to any inserted concentration value, otherwise the record would not be saved/archived. In case of the prepared excel spreadsheets for semi-automatic data transfer, the obligatory fields are featured in each spreadsheet.

Scope and content

As of January 2015, the Global Monitoring Plan Data Warehouse (GMP DWH) contains information on POPs concentrations in ambient air, human tissues (breast milk) and water for water-soluble POPs (perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyl fluoride) collected by a range of monitoring programs listed below and validated by the regional organization groups of the five UN regions until 2014 inclusive. These data are presented also in the regional monitoring reports. However, please note that all data presented in the regional monitoring reports were NOT made available by the monitoring programmes for inclusion into the GMP DWH. The content of the online tool is therefore not complete.

GMP Data Providers/ Contributors to the GMP DWH

Existing monitoring programmes validated by the Regional Organization Groups contribute to the GMP DWH and show they aggregated values in the visualization module. The text below provides a list of monitoring programs (national or international, or surveys) that currently provided data to Global Monitoring Plan Data Warehouse:

Data on ambient air:

Information is provided from programs monitoring ambient air by both active and passive sampling. AMAP, EMEP, GAPS, GAPS-GRULAC, GMP-UNEP, China National POPs Monitoring Project, Košetice, LAPAN, MONET, and TOMPS provided data to GMP DWH.

Data on human milk:

UNEP/WHO Human Milk Survey and China National POPs Monitoring Project

Data on water monitoring:

Ocean cruises are the predominant source of information. The cruises cover international waters and therefore the sites are not attributed to any region. Data collected during the listed 17 ocean research cruises are shown in the GMP DWH: Alcor (Kirchgeorg et al. 2010), Amundsen (Benskin et al. 2012), ANTXXVII/1 (Zhao et al. 2012), ANTXXVII/2 (Zhao et al. 2012), ANTXXV (Ahrens et al. 2010), ARK-XXIV/3 (Zhao et al. 2012), Endeavor (Benskin et al. 2012), Ga 442 (Theobald et al. 2011), Ga 446 (Theobald et al. 2011), Malaspina (González-Gaya et al. 2014), Maria S. Merian 2007 (Ahrens et al. 2009), Maria S. Merian 2008 (Kirchgeorg et al. 2010), Oden 2005 (Benskin et al. 2012), Oden 2007 (Benskin et al. 2012), Polarstern 2007 (Ahrens et al. 2009), Polarstern 2008 (Ahrens et al. 2010), Snow Dragon (Cai et al. 2012). In addition, passive sampling of fresh/river/estuarine water occurred in Africa, WEOG, GRULAC and Asia.

Please note that not all data shown in the regional monitoring reports were made available by the monitoring programmes for inclusion into the GMP DWH. There may be more programmes and long-term monitoring activities ongoing or newly established in various regions. These activities may possess valuable data, if interested in being involved in the GMP implementation, please contact the relevant Regional Organization Group and also notify a Programme Officer at the Stockholm Convention Secretariat (Katarina Magulova / Ana Priceputu).

Work with GMP DWH

A typical GMP DWH user would be predominantly using the visualization portal of the GMP DWH that offers the following visualization options for the selected data and their analysis:

- Spatial distribution of available data in map
- Tables on data availability over time or over range of parameters
- Summary statistics for a chemical/parameter on a site or group of sites
- Time series analysis for a chemical/parameter on a site – in a chart or table
- Data exports in the form of map, chart, table or in CSV, PDF or PNG format

Additional information

The GMP DWH was has been developed by the Stockholm Convention Regional Centre in the Czech Republic through the Research Centre for Toxic Compounds in the Environment and the Institute of Biostatistics and Analyses, Masaryk University, Brno, Czech Republic, under the guidance of the GMP Global Coordination Group, and based on Chapter 6 of the Guidance.

Summary

Global Monitoring Plan Data Warehouse (GMP DWH) is an online tool developed for handling, storage, approval and visualization of POPs monitoring data generated in the frame of the Global Monitoring Plan (GMP) worldwide on the basis of the decision by the COP SC-6/23. The tool comprises two main components – data repository and visualization portal. It is adapted to handle data from four matrices (air, human milk, water and blood) and various sources – international, subregional or national long term monitoring activities. The data warehouse is based on hierarchical structure of data fields of standardized parameters with predefined content. Data structure is based on key components: site-sampling attributes-measurement. Currently, the GMP DWH contains information from three out of four core matrices – air, human milk and water.

Quick orientation on the website

Goal of this chapter is to supply a quick overview on the content of the publicly available website pops-gmp.org and thus allow easy orientation of users on this site. The portal was jointly developed by the by the Stockholm Convention Regional Centre in the Czech Republic through the Research Centre for Toxic Compounds in the Environment and the Institute of Biostatistics and Analyses, Masaryk University, Brno, Czech Republic to follow development of activities and online tools available under the Global Monitoring Plan.

The chapter and the website are divided into these sections:

- Critical review and pilot proposal of online tool for GMP POPs data collected until 2008 (and further referred to as "GMP1")
- GMP data warehouse (further referred to as "GMP DWH")
- Other information

GMP 1

This section of the website contains a review of available Global Monitoring Plan (GMP) data on persistent organic pollutant (POPs) concentrations that were found in regional GMP reports prepared pursuant to decision SC-3/19. Environmental matrices – ambient air, breast milk and human blood – serve as core media to evaluate effectiveness of the measures adopted by the Stockholm Convention pertaining to the decision SC-2/13 on the effectiveness evaluation and relevant Guidance document to the GMP. Core part of the review focuses on data available for 12 initial POPs (including their recommended congeners, isomers and degradation products) that were mandatory to report in the first GMP collection campaign in 2008 and identifies other reported data on POPs that could be used in the future data collection campaigns. The analysis also comprises assessment of reported data variability, reliability and completeness. A full report is available to download.

In addition, an online visualization tool was developed to facilitate search over and work with the reported GMP data (first proposal). The browser provides easily accessible information on performance of monitoring programmes in individual countries and/or regions sorted by matrices, time, and compounds. Only annually aggregated concentration values are shown and range of data are until 2008 inclusive. The information shown are data from all regional monitoring reports, first phase.

The tool also shows a six step validation procedure for ambient air monitoring data identifying data sets suitable for time trends analysis, and a view of inter-regional variability: statistical evaluation of reported background atmospheric concentrations.

GMP DWH

The GMP DWH part of the website is an online tool Global Monitoring Plan Data Warehouse (GMPDWH) for handling, storage, approval and visualization of POPs monitoring data generated in the frame of the Global Monitoring Plan (GMP) worldwide on the basis of the decision by the COP

SC-6/23. The tool comprises two main parts – data repository and visualization portal. The former is a complex system for data storage, archiving and analysis built on TrialDB, an online web-based information system with a central data repository to collect relevant POPs data in a matching data structure. Data repository is equipped with and communication interface able to insert data individually, semi-automatically or through MS Excel sheets. The site contains code lists and other system documentation is available online http://dwh.pops-gmp.org. The data repository is for authorized users only due to data workflow.

Data visualization was prepared for easy browsing and inspection of available data records, from their input into the database to their export for final publication in a report. The tools available in the visualization portal were designed to facilitate browsing of data records, their inspection, and compilation of monitoring reports by individual ROGs and by the GCG. The data visualization shows data stored in the GMP DWH. In addition, a whole range of other stakeholders may also wish to use presentation outputs and download charts, maps and summary tables. Most of the displayed visualization outputs are available for download/export as MS Excel sheets and/or graphic files (SVG, PNG, PDF).

The visualization tool is available at http://www.pops-gmp.org/visualization-2014/. At present, the visualization tool is for authorized users only; it will become publicly available once the reports are considered and formally approved by the Conference of the Parties (May 2015).

Other information

Other information on the portal provides links to source materials on the Stockholm Convention website – in particular for chemicals covered and supporting guidance materials. In addition, it also contacts to the portal and data warehouse helpdesk and supporting team.

Summary

The website pops-gmp.org provides information in three parts – critical review and pilot proposal of online tool for POPs data collected until 2008, online tool for handling, storage, approval and visualization of global POPs monitoring data: Global Monitoring Plan Data Warehouse (GMP DWH), and other information. The purpose of the website is to provide user-friendly access to the POPs monitoring data to all stakeholders and the broad public.

Access

As requested in consultations by the Stockholm Convention secretariat and experts and members of the ROG and GMP, the portal pops-gmp.org is accessible from anywhere with internet connection, however, some of its parts have different rules of access.

Majority of the website is publicly accessible – that is valid in particular for the sections GMP1 on data analysis related to 12 original POPs (http://pops-gmp.org/index.php?pg=gmp1) and their visualization (http://www.pops-gmp.org/visualization/), and sections containing supporting documentation (http://pops-gmp.org/index.php?pg=background). The website is customized to

function on all standard internet browsers (Internet Explorer, Mozilla Firefox, Google Chrome) and it is always adapted to the most recent versions.

Two parts are currently (January 2015) password protected and access is granted to authorized users only (data providers, ROG members and their consultants, BRS secretariat and GMP DWH supporting team). These two parts are – data repository and visualization for GMP2 (visualization 2014 – http://www.pops-gmp.org/visualization-2014/).

Each authorized user was provided with ID and password by the helpdesk in 2013 or early 2014. Access page is shown in Figure 3 below.

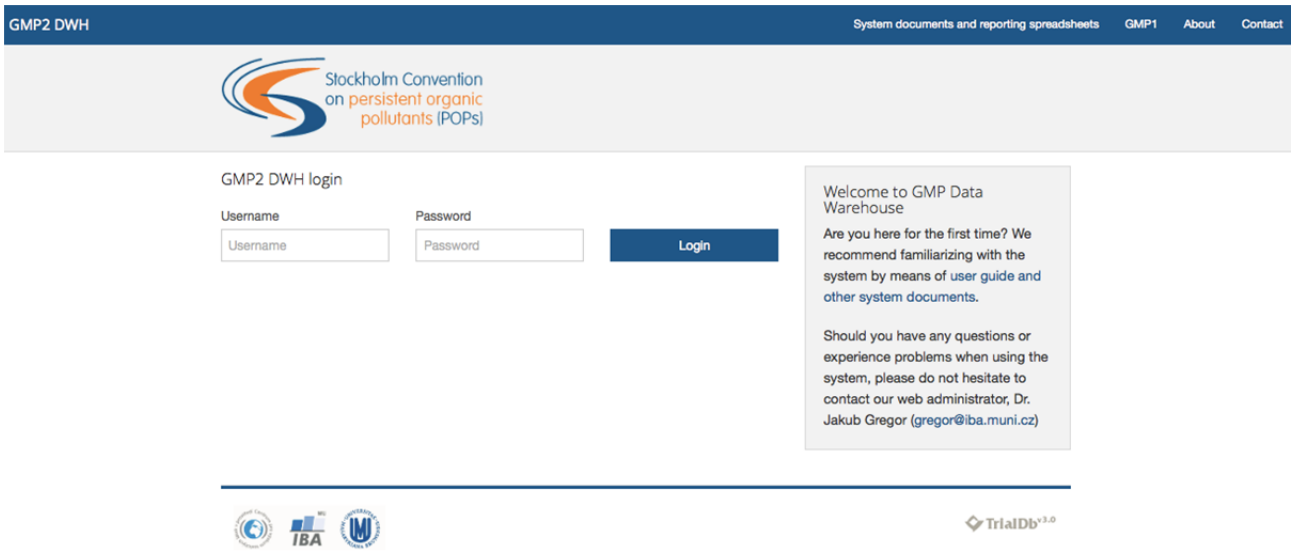


Figure 3 – Access page to the GMP DWH Data Repository

Reasons for these restrictions for data repository are data flow and requirements for data validation embedded in the data archiving system in order to maintain high data standards, data structure and harmonized information, and for visualization 2014 it depends on the approval by regional groups.

It was always planned that data visualization would be publicly available, however validation by experts needs to take place first. Public access to the visualization of POPs data collected until 2014 inclusive will be granted once the information is approved by the regional organization groups and final regional reports covering data collection until 2014 are published. All this occurred between March and May 2015. Since May 7, 2015, the Data Visualization is publicly available: http://www.pops-gmp.org/visualization-2014.

Summary

The electronic tool for Global Monitoring Plan – GMP DWH – is only accessible online via Internet on www.pops-gmp.org. Standard web browsers are to be used (Internet Explorer, Mozilla Firefox, Google Chrome) and their most recent versions are recommended. Part of the website is with restricted access (related to data input). Since May 7, 2015, the Data Visualization is publicly available: http://www.pops-gmp.org/visualization-2014.

Annex 1: POPs to be monitored in GMP core matrices

Table containing compounds to be analyzed in the GMP framework in samples of core matrices (reproduced from Guidance material, document UNEP/POPS/COP.7/INF/39, table 2.2).

	Compounds to be Monitored			
	Air	**Human Milk**	**Human Blood**	**Water**
Initial POPs				
Aldrin	Aldrin	Aldrin	Aldrin	Water has not been recommended as a core matrix for the lipophilic and nonpolar initial twelve POPs; therefore, analysis of surface waters is not recommended
Chlordane	*cis*- and *trans*-chlordane; and *cis*- and *trans*-nonachlor, oxychlordane	*cis*- and *trans*-chlordane; and *cis*- and *trans*-nonachlor, oxychlordane	*cis*- and *trans*-chlordane; and *cis*- and *trans*-nonachlor, oxychlordane	
DDT	4,4'-DDT, 2,4'-DDT and 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, 2,4'-DDD	4,4'-DDT, 2,4'-DDT and 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, 2,4'-DDD	4,4'-DDT, 2,4'-DDT and 4,4'-DDE, 2,4'-DDE, 4,4'-DDD, 2,4'-DDD	
Dieldrin	Dieldrin	Dieldrin	Dieldrin	
Endrin	Endrin	Endrin	Endrin	
HCB	HCB	HCB	HCB	
Heptachlor	Heptachlor and heptachlorepoxide	Heptachlor and heptachlorepoxide	Heptachlor and heptachlorepoxide	
Mirex	Mirex	Mirex	Mirex	
PCB	ΣPCB_6 (6 congeners): 28, 52, 101, 138, 153, and 180	ΣPCB_6 (6 congeners): 28, 52, 101, 138, 153, and 180	ΣPCB_6 (6 congeners): 28, 52, 101, 138, 153, and 180	
	PCB with TEFs* (12 congeners): 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, and 189	PCB with TEFs* (12 congeners): 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, and 189	PCB with TEFs* (12 congeners): 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, 169, and 189	
PCDD/PCDF	2,3,7,8-substituted PCD/PCDF (17 congeners)	2,3,7,8-substituted PCD/PCDF (17 congeners)	2,3,7,8-substituted PCD/PCDF (17 congeners)	
Toxaphene	Congeners P26, P50, P62	Congeners P26, P50, P62	Congeners P26, P50, P62	

POPs listed at COP-4				
	Air	Human Milk	Human Blood	Water
Chlordecone	Chlordecone	Chlordecone	Chlordecone	
α-HCH	α-HCH	α-HCH	α-HCH	
β-HCH	β-HCH	β-HCH	β-HCH	
γ-HCH	γ-HCH	γ-HCH	γ-HCH	
Hexabromobiphenyl	PBB 153	PBB 153	PBB 153	
Pentachlorobenzene	PeCBz	PeCBz	PeCBz	
c-penta BDE c-octa BDE	BDE 47, 99, 153, 154, 175/183 (co-eluting) Optional: BDE 17, 28, 100	BDE 47, 99, 153, 154, 175/183 (co-eluting) Optional: BDE 100	BDE 47, 99, 153, 154, 175/183 (co-eluting) Optional: BDE 100	
PFOS[6]	PFOS, NMeFOSA, NEtFOSA, NMeFOSE, NEtFOSE (linear and sum of PFOS)	PFOS (linear and sum of PFOS)	PFOS (linear and sum of PFOS)	PFOS (linear and sum of PFOS)
POPs listed at COP-5				
Endosulfan	α-, β-endosulfan; and endosulfan sulfate	α-, β-endosulfan; and endosulfan sulfate	α-, β-endosulfan; and endosulfan sulfate	
POPs listed at COP-6				
HBCD	α-HBCD, β-HBCD, γ-HBCD	α-HBCD, β-HBCD, γ-HBCD	α-HBCD, β-HBCD, γ-HBCD	α-HBCD, β-HBCD, γ-HBCD

Annex 2: GMP DWH database structure and list of parameters

Table contains overview of the database structure in the GMP DWH.

Air	**Human milk**	**Human blood**	**Water**
• Site ID (number) • Site name (text) • Longitude (number) • Latitude (number) • Region (code list) • Country (code list) • Site type (code list) • Potential source type (code list) • Year (number) • Start of sampling (number) • End of sampling (number) • Sampling frequency (code list) • Largest gap (number) • Type of sampling (code list) • Type of passive sampling (code list) • Recalculation (code list) • Calibration description (text) • Monitoring programme/network (text) • Chemical – group (code list) • Parameter (code list) • Method (code list) • LOQ (number) • No. of values (number)[A] • No. under LoQ (number)[A] • Value (number)[P] • Value (mean) (number)[A] • Value (median) (number)[A] • Minimum (number)[A] • Maximum (number)[A] • 5th percentile (number)[A] • 95th percentile (number)[A] • SD (number)[A] • Laboratory (text)	• Site ID (number) • Site name (text) • Region (code list) • Country (code list) • Year (number) • Start of sampling (number) • End of sampling (number) • Type of sample (code list) • Monitoring programme/network (text) • Chemical – group (code list) • Parameter (code list) • Method (code list) • LOQ (number) • No. of values (number)[A] • No. under LoQ (number)[A] • Value (number)[P] • Value (mean) (number)[A] • Value (median) (number)[A] • Minimum (number)[A] • Maximum (number)[A] • 5th percentile (number)[A] • 95th percentile (number)[A] • SD (number)[A] • Laboratory (text)	• Site ID (number) • Site name (text) • Region (code list) • Country (code list) • Year (number) • Start of sampling (number) • End of sampling (number) • Blood source (code list) • Fraction (code list) • Monitoring programme/network (text) • Chemical – group (code list) • Parameter (code list) • Method (code list) • LOQ (number) • No. of values (number)[A] • No. under LoQ (number)[A] • Value (number)[P] • Value (mean) (number)[A] • Value (median) (number)[A] • Minimum (number)[A] • Maximum (number)[A] • 5th percentile (number)[A] • 95th percentile (number)[A] • SD (number)[A] • Laboratory (text)	• Site ID (number) • Site name (text) • Region (code list) • Country (code list) • Surface water type • Longitude (number) • Latitude (number) • Region (code list) • Country (code list) • Ocean or sea (code list) • Site type (code list) • Discharges (code list) • Year (number) • Start of sampling (number) • End of sampling (number) • Sampling frequency (code list) • Largest gap (number) • Type of sampling (code list) • Depth – minimum (number) • Depth – maximum (number) • Temperature (number) • Salinity (number) • Monitoring programme/network (text) • Chemical – group (code list) • Parameter (code list) • Method (code list) • LOQ (number) • No. of values (number)[A] • No. under LoQ (number)[A] • Value (number)[P] • Value (mean) (number)[A] • Value (median) (number)[A] • Minimum (number)[A] • Maximum (number)[A] • 5th percentile (number)[A] • 95th percentile (number)[A] • SD (number)[A] 1. Laboratory (text)

[A] – the item is valid for aggregated data reporting only
[P] – the item is valid for primary data reporting only