DATABANK FOR LABORATORIES ANALYZING PERSISTENT ORGANIC POLLUTANTS

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Introduction

At the international level, multi-lateral environmental agreements contain provisions for providing measured data for evaluation of the effectiveness of the implementation of these conventions. As a response to the country needs for the analysis of persistent organic pollutants (POPs) under the Stockholm Convention[1], the Global Environment Facility (GEF) has granted to the United Nations Environment Programme (UNEP) through UNEP Chemicals the medium-sized project "Assessment of Existing Capacity and Capacity Building Needs to Analyse POPs in Developing Countries". The project started on 1 January 2005 and will run for two years[2]. Besides the GEF, the governments of Canada, Germany, and Japan contribute financially to the project.

This 2-year project addresses country needs for laboratory analysis of POPs, pursuant to the Stockholm Convention, and conditions necessary to conduct such analysis in a sustainable manner. The project focuses on the analysis of the 12 POPs listed in Annexes A, B, and C of the Stockholm Convention. The needs for POPs analysis under the Stockholm Convention mainly arise from three areas:

1. Effectiveness evaluation of the implementation the of Stockholm Convention (Article 16) as in the Global Monitoring on POPs guidance document (http://www.chem.unep.ch/gmn/GuidanceGPM.pdf);
2. Limit values for PCDD/PCDF (Article 5), for which the BAT/BEP Expert group suggested achievable levels in stack emissions (draft report UNEP/POPS/COP.1/INF/7 in the language version of interest at Meetings COP.1 on WebPage http://www.pops.int/documents/meetings/ and document);
3. Provisional limit values for "low POP content" (Article 6) for POPs wastes (solid/liquid technical matrices and stack emissions) as established in the Technical Guidelines on POPs as Wastes under the Basel Convention for the 12 POPs (for download, see http://www.basel.int/techmatters/index.html and follow language version).

The outcomes of this UNEP/GEF project include:

(1) A databank of operational laboratories worldwide according to their capabilities to analyze classes of POPs in different matrices. The data will be stored in a searchable and accessible databank;
(2) Recommended criteria for: (a) Sampling, identification, quantification of POPs (analytical data); (b) To operate POPs laboratories in a sustainable manner.

Three regional workshops were held during the second half of the year 2005 for African, Asian, Central and Eastern European, and Latin-American countries to determine, evaluate, and agree on technical and economic criteria to operate a POPs laboratory in a sustainable manner. The workshop reports are available *via* the internet from the project's WebPage. A questionnaire to collect information from existing laboratories worldwide has been proposed and was approved at these workshops. Until May 2006, about 150 filled questionnaires have been returned to provide detailed information from these laboratories.

An exploratory study in one pilot country will explore the feasibility of establishing a fully equipped regional laboratory in a developing country that may be able to analyze all twelve POPs, including PCDD/PCDF in relevant matrices.

Materials and Methods

The questionnaire as approved at the regional workshops has been used to collect information on existing laboratory capacity for the analysis of POPs in relevant matrices. The questionnaire exists in English and

Spanish languages and is available for download from the project's WebPage. The questionnaire has been sent to the official contacts for the Stockholm Convention - the Stockholm Convention Focal Points - as well as to managers of POPs laboratories known to UNEP through the project on the Global Monitoring of POPs.

Based on the questionnaire, a relational database programmed in Microsoft .NET platform has been established and is made available on the Web. The databank includes information for the following sections:

(1) Identity and General Description
(2) Personnel Analyzing POPs
(3) Activities, Equipment, and Qualifications (includes number of samples analyzed per matrix and POP per year, external cost of analysis, *etc.*)
(4) Quality Assurance Program
(5) Accreditation
(6) Inter-calibration Studies (year, type of study, organizer, and participant number)
(7) Indicative List of Most Important Publications

The databank is set-up for the 12 POPs presently listed in the Stockholm Convention, namely:

- POPs pesticides: Aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (which is also an industrial chemical and an unintentional by-product), mirex, toxaphene;
- Industrial chemicals: Polychlorinated biphenyls (PCB) – and HCB (listed under pesticides)
- Unintentional POPs: Polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/PCDF) – and PCB and HCB that are also listed elsewhere.

The relevant matrices include those for which either the Convention or technical guidelines have set limits or achievable levels, such as:
Effectiveness evaluation: the initial baseline evaluation will include ambient air and human milk or blood; future matrices would include bird's eggs, bivalves, and fish/marine mammals;
Limit values for BAT/BEP (for PCDD/PCDF only): stack emissions and effluents for pulp and paper mills;
"Low POP content": chemicals or products that may become wastes, solid residues from industrial processes, transformer oils.

Further, it was concluded that countries would see the need to analyze POPs in matrices such as: Food and feed, soil and sediments, vegetation, and water.

With information entered into the above-mentioned sections, the content of the databank can be searched by:

- Geographic location (country or region)
- Equipment present (*e.g.,* GC and various detectors including the method of extraction)
- Analytical methods applied (*e.g.,* EPA, ASTM, AOAC, EN, DIN)
- Minimum or range of samples analyzed per year
- Type of accreditation
- Participation in inter-calibration study

Searches can be combined and after each step of the search, a list of laboratories is compiled that match the criteria.

Results and Discussion

Until May 2006, 154 filled questionnaires from 64 countries were returned and have been entered into the databank, which is available on-line since the end of May 2006. Of these 89 laboratories are located in countries that are Party to the Stockholm Convention. Since the UNEP/GEF project addressed to developing countries, presently, there is more information available from laboratories in developing countries than from laboratories in developed countries. However, the databank is open for further entries. The present geographic snapshot looks as shown in Table 1.

Table 1: Overview on geographic distribution of POPs laboratories contained in the UNEP databank and number of laboratories located in countries that are Party to the Stockholm Convention

Region	No of Labs	No of Countries	No of Parties	No of Party Labs
Africa	28	10	7	24
Asia	29	13	9	22
CEE*	46	17	8	14
Europe	8	6	5	7
GRULAC**	42	17	10	22
North America	1	1	0	0
Total	154	64	39	89

* CEE = Central and Eastern Europe; ** GRULAC = Group of Latin-American countries

Table 2 shows that most laboratories analyze POPs pesticides and that analytical capacity for dioxin analysis is scarce in developing country regions such Africa and GRULAC. The relative high numbers for dioxin laboratories for Asia is due to (almost) complete coverage of PCDD/PCDF analytical capacity in the People's Republic of China (7 laboratories with HRGC/HRMS) and for the CEE Region with laboratories in the Czech Republic (3), Poland (4), and Serbia Montenegro (2).

Table 2: Overview on POPs analyzed in 154 laboratories

Region	Pesticides	PCB	PCDD/PCDF
Africa	20	15	1
Asia	25	22	14
CEE	43	43	14
Europe	7	8	7
GRULAC	34	24	4
North America	1	1	1
Total	130	113	41

Interestingly, at present, the matrices to be proposed for the effectiveness evaluation of the Stockholm Convention (under the Global Monitoring of POPs = GMP) are not commonly analyzed by the laboratories in developing countries (Table 3). Instead, emphasis is given to matrices such as water, soil or sediment (Table 4).

Table 3: Overview on GMP matrices analyzed (154 POPs laboratories evaluated)

Region	Ambient Air	Breast Milk	Blood	Bivalves	Bird's Eggs	Fish/Marine Mammals
Africa	0	12	9	8	7	17
Asia	16	8	7	13	6	17
CEE	14	11	8	11	8	21
Europe	5	6	5	4	5	8
GRULAC	5	7	4	12	6	14
North America	1	0	0	1	1	1
Total	41	44	33	49	33	78

Table 4: Overview on matrices analyzed (154 POPs laboratories evaluated)

Region	Stack Emission	Transfor-mer Oil	Resid-ues	Soil/ Sediment	Efflu-ent	Chemicals / Products	Veget-ation	Feed/ Food	Water
Africa	0	10	12	19	14	11	16	15	19
Asia	16	10	12	26	19	14	18	21	25
CEE	16	26	25	41	23	15	18	25	44
Europe	5	3	4	5	5	4	7	8	7
GRULAC	6	14	16	28	21	9	17	16	29
North America	0	0	0	1	0	1	1	1	1
Total	43	63	69	120	82	54	77	86	125

An important feature of the databank is its use not to only find laboratories that have the capacity to analyze POPs according to chemical and matrix but also to apply certain criteria as an indicator of expertise and quality of analysis. With the inclusion of information on accreditation and especially with successful participation in international intercalibration studies, users of the databank are able to identify laboratories that have recently participated in such studies in relevant matrices. In the section on intercalibration, the laboratories are asked to provide the organization that has coordinated the round robin, the year of participation as well as the matrix and the analyte. So far, the most common intercalibration studies include INTERCAL (by Bert van Bavel, Örebro University, Sweden) and FIOH (by Georg Becher, Norwegian Institute of Public Health, Norway).

Combining POPs and matrices with criteria on infrastructure, such as instrumentation and methods applied, on expertise such as participation in international round robins, so-called Tiers will be established so that laboratories with experiences in specialized analysis can be identified. With this tool, it is expected high quality data on concentrations of POPs in the environment, in humans, and in matrices of interest can be generated.

The databank is a living tool that will be updated as new information becomes available. Laboratories performing POPs analysis are invited to submit filled questionnaires for inclusion into the databank to make it globally applicable and useful for the implementation of the Stockholm and Basel Conventions.

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References

[1] Text of the Stockholm Convention on Persistent Organic Pollutants in six languages: http://www.pops.int/

[2] The project document and reports can be found: http://www.chem.unep.ch/pops/laboratory/default.htm