The Global Monitoring Plan on Persistent Organic Pollutants, a tool to evaluate the effectiveness of measures undertaken under the UNEP Stockholm Convention on POPs.

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Brief introduction to POPs

Scientific questions relevant to policy

The UNEP Stockholm Convention on POPs

The Global Monitoring Plan on POPS and the Effectiveness Evaluation of the SC

Closing remarks
Brief introduction to POPs

POPs are artificial chemicals (with very minor exceptions) that are

**Persistent**

Resist degradation and can be in the atmosphere from days to years and in other media for decades

**Volatile**

By their physical properties can be in the gas phase on aerosol and travel long distances, be deposited and revolatilized

**Bioaccumulative and bioamplified**

Accumulate in bodies over time and concentrate along food chains

**Toxic**

Cause adverse effects to humans and the environment (endocrine disruption, cancer, others)
Currently listed POPs

**Pesticides**: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, toxaphene; chlordecone, alpha hexachlorocyclohexane, beta hexachlorocyclohexane, lindane, (HCH) pentachlorobenzene;

**Industrial chemicals**: hexachlorobenzene, polychlorinated biphenyls (PCBs); hexabromobiphenyl, hexabromodiphenyl ether and heptabromodiphenyl ether, pentachlorobenzene, perfluorooctane sulfonic acid, its salts and perfluorooctane sulfonyle fluoride (PFOS), tetrabromodiphenyl ether and pentabromodiphenyl ether; (PBDE)

**By-products**: hexachlorobenzene; polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDD/PCDF), and PCBs. alpha hexachlorocyclohexane, beta hexachlorocyclohexane and pentachlorobenzene.
Major modes of transport of perfectly persistent, hypothetical chemicals defined by their partitioning properties $\log K_{\text{AW}}$ and $\log K_{\text{OA}}$, calculated with the Globo-POP model assuming 10 years of steady emissions into air. [Wania et al., 2006]
Draft conceptual figure showing pathways for POPs transport
Sediment cores USGS White Rock Lake, Dallas
Levels of sum DDT (sum of p,p’-DDE and p,p’-DDT) in mothers milk from Stockholm, Sweden (source: GMP Global Monitoring Report 2009)
Levels of sum PCB (6 congeners) in mothers milk from Stockholm, Sweden
Source GMP Global Monitoring Report 2009
Approximate Time lags

substance to market 2-5 years
substance to problem 5-10 y
market to problem 10-20 y
problem to regulation 20-30 y
regulation to effect 5-10 y
exposure to effect 10-20 y
Scientific questions relevant to policy

Observational evidence

Measurements in Air,:  
  
  Active samplers. Accurate, and measure gas and particle phase,  
  Costly, high maintenance and intermittent (can miss episodes)  

  Passive samplers: semi quantitative, continuous, low cost  
  Do not measure particle phase

Atmospheric transport modelling:  What fraction of the observed concentrations  
are from local or remote origins, what is the impact of LRT on local concentrations

Multimedia modelling.  POPs models must not only simulate the behaviour of  
pollutants in the atmosphere, but they must also simulate the exchange between the  
atmosphere and other environmental media (such as water, soil, snow, ice, and  
vegetation) and the transport and transformations that occur in those other media.

Impact of Climate Change on POPs pathways

Impacts on Health and Ecosystems.  
Stochastic effects, (no lower threshold)  
Timelags (exposure - effect),  
Dose response are for single pollutants and one end-point, exposure to mixtures and  
multiple endpoints are difficult to deal with
The UNEP Stockholm Convention on POPs


Article 1: Objective: “the objective of this Convention is to protect human health and the environment from persistent organic pollutants.”
The UNEP Stockholm Convention on POPs

The convention has a procedure to identify and list POPs. When a POP is listed, it is included in the following Annexes:

- Annex A, elimination of intentional use
- Annex B, control of unintentional releases
- Annex C, exemptions

The Convention has an innovative approach in Article 16 on Effectiveness Evaluation.

Three components are the base for EE:

- Reports submitted by Parties on actions undertaken
- Information compiled by the secretariat on activities under the SC
- The Global Monitoring Plan
The Global Monitoring Plan on POPs under Article 16 of the SC

The GMP was established in 2001 and decided to focus on two Core Media:

- **Air**
- **Human tissue** (breast milk and blood)

**Human tissues**

UNEP Chemicals in cooperation with the WHO has organized a number of campaigns to obtain breast milk samples on a global basis.

Some countries (e.g., Sweden, Germany), have established long term stable monitoring of POPs in breast milk.

**Air**

A number of stable long term measuring networks exist.

Passive sampling networks have been established under the GMP.
The Global Monitoring Plan on POPs under Article 16 of the SC


Marlisch et al., Dioxin2010, San Antonio, TX
The Global Monitoring Plan on POPs under Article 16 of the SC

Existing monitoring networks of POPs in AIR

Source: HTAP 2010 report section C chapter 2
**Figure 3:** DF analysis of HCB levels in Zeppelin air [pg/m$^3$] from 1993 – 2006. Measured data, seasonal cycles and trend line is presented.

**Please note:** The concentration axis is given in logarithmic scale (ln).

Source: H.Hung et al Arctic Monitoring and Assessment Program (AMAP) 2009
**Figure 4:** DF analysis of PCB levels in Zeppelin air [pg/m$^3$] from 1993 – 2006. Measured data, seasonal cycles and trend line is presented.

**Please note:** The concentration axis is given in logarithmic scale (ln).

Source: H. Hung et al, Arctic Monitoring and Assessment Program (AMAP) 2009
The Global Monitoring Plan on POPs under Article 16 of the SC

The Global Atmospheric Passive Sampling Network

GAPS – Global Context

Global Atmospheric Passive Sampling Network

- ~55 sites since 2005
- Monitoring (reporting to GMP)
- Surveillance (new priority chemicals)

GAPS Network:
www.ec.gc.ca/rs-mn/default.asp?lang=En&n=22D58893-1

Source: Environment Canada 2012
The Global Monitoring Plan on POPs under Article 16 of the SC

Outline of one of the types of Passive sample
Example of data on g-HCH from GAPS in 2005 and 2006, Source T. Harner Environment Canada
The Global Monitoring Plan on POPs under Article 16 of the SC

Monitoring Network established in Spain under the GMP
Closing remarks

Scientific questions relevant to policy

Observational evidence

PAS do provide interesting and useful information but are difficult to calibrate (effects of temperature and wind) thus “internal” seasonal and congener fractions are more robust than absolute values comparisons.

Could anyone come up with a passive sampler that is able to deal with aerosol, particles? Able to measure airflow?

It would be interesting to develop “Observation simulators” that reproduce the behaviour of different samplers (located on a concentration file generated by a model) and could be used to compare models with measurements.
Closing remarks

Scientific questions relevant to policy

Long Range Transport modelling

Simulation of congener mixtures

Local/regional/global

Effects of CC on LRT and of POPs on CC impacts

Multimedia modelling (atmosphere/ocean/land/ice/biota)

Relation with observations, potential of Machine Learning and KDD

Impact modelling

Metabolic timelags
Mixtures
Multiple endpoints
Closing remarks

POPs are a relevant Public health and Environmental issue and provide also a particularly stimulating theoretical environment in the sense that they require an integration of scientific disciplines, temporal and spatial scales in a coherent frame.

The control of releases requires a coordinated approach integrating multiple social and industrial sectors.

Their capacity to move in air and water imposes a geographical integration, where national borders are quite irrelevant.

And in that sense they present a suggestive blueprint of a global cooperative strategy to deal with the future.
More information at:

The UNEP Stockholm Convention on POPs
www.pops.int

Arctic Monitoring and Assessment Programme AMAP
www.amap.no

Background Air Monitoring of Persistent Organic Pollutants in East Asian Countries

Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe EMEP
www.emep.int

Global Atmospheric Passive Sampling Survey GAPS

Integrated Atmospheric Deposition Network IADN

World Health Organization human milk survey WHO
www.who.int

Task Force on Hemispheric Transport of Air Pollution
www.htap.org
Thank you for your attention

On a friday afternoon!