

Academia's Role for Sound Chemicals Management: Stockholm Convention and International Panel on Chemical Pollution

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Tokyo, November 14, 2008

Overview

- ◆ **Introduction: Problem**
- ◆ OECD Tool for Overall Persistence (Pov)
and Long-Range Transport Potential (LRTP)
- ◆ International Panel on Chemical Pollution
- ◆ Some additional thoughts...

The Stockholm Convention on Persistent Organic Pollutants (I)

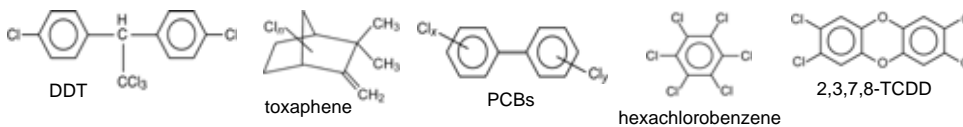
- ◆ Entry into force: May 17, 2004
- ◆ 152 signatories (2008)



chm.pops.int

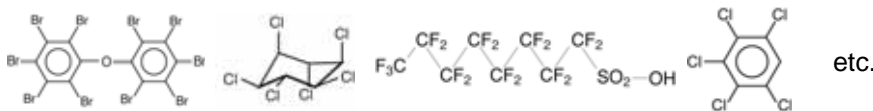
The Stockholm Convention on Persistent Organic Pollutants (II)

- ◆ Initial set of chemicals: „dirty dozen“



- ◆ Additional chemicals under consideration:

- ▶ PBDEs, HCHs, PFOS, PeCB, SCCP, HBB, chlordecone



- ▶ endosulfan  – also HBCD?

The Stockholm Convention on Persistent Organic Pollutants (III)

- ◆ POPs criteria in Annex D:
 - Persistence: 40 d (water), 180 d (sediment, soil)
 - LRTP: various types of evidence; $t_{1/2,air} > 2$ d
 - Bioaccumulation: $BCF > 5000$, $\log K_{ow} > 5$
 - Toxicity: various types of evidence
- ◆ POP Review Committee
 - Review of chemicals proposed for inclusion in Annexes A, B, C of the convention
 - Meetings in fall every year (October 2008: POPRC-4)

The Stockholm Convention on Persistent Organic Pollutants (IV)

- ◆ Conference of the parties: COP4 (2009)
- ◆ Convention important international legal agreement
- ◆ Also: convention creates needs for **scientific input**

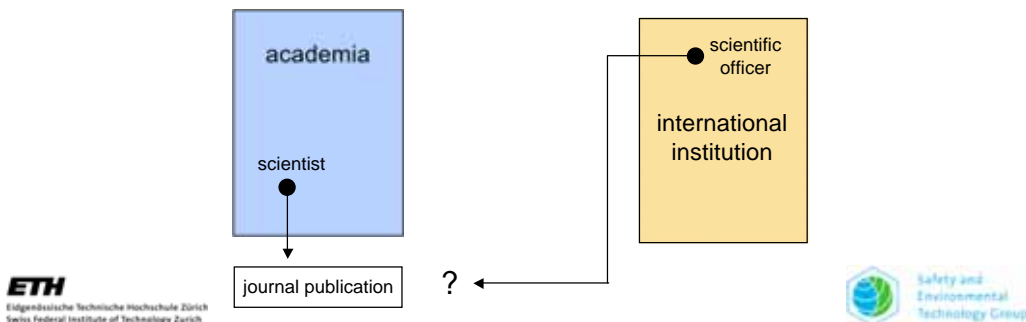


Transfer of Knowledge: Obstacles

- ◆ Information not available because needs of users do not overlap with interest/objectives of scientists
- ◆ Scientists not aware of needs of users
- ◆ „Format mismatch“
 - Scientists not aware that users may not search for journal articles
 - Scientists do not have capacity to present results in different format – additional effort that is not appreciated by academic environment!

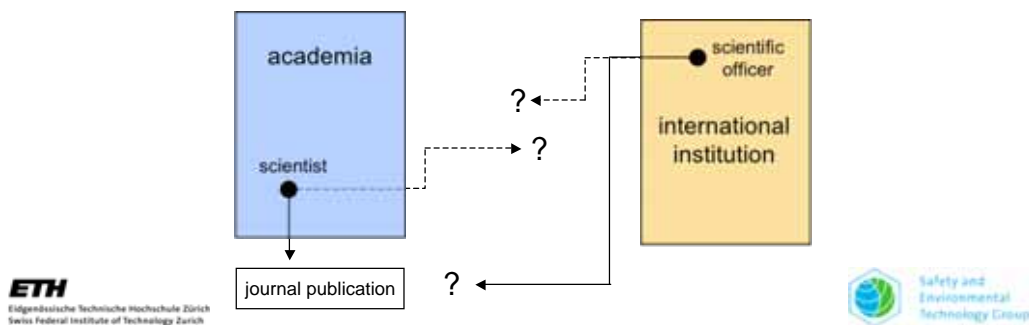
Transfer of Knowledge: Solutions

- ◆ Mismatch of objectives and needs not a „failure“ ...
- ◆ ... but a consequence of different inherent structure of academic science and politics/administration



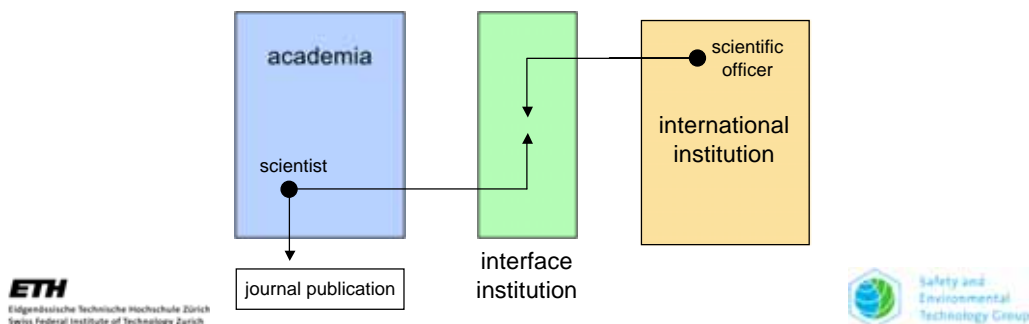
Transfer of Knowledge: Solutions

- ◆ Mismatch of objectives and needs not a „failure“...
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Transfer of Knowledge: Solutions

- ◆ Mismatch of objectives and needs not a „failure“...
- ◆ ... but a consequence of different inherent structure of academic science and politics/administration
- ◆ **Possible solution:** institutional interface



Overview

- ◆ Introduction: Problem
- ◆ **OECD Tool for Overall Persistence (Pov) and Long-Range Transport Potential (LRTP)**
- ◆ International Panel on Chemical Pollution
- ◆ Some additional thoughts...

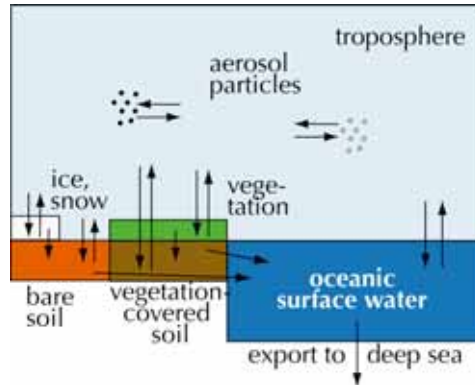
Background of the OECD Tool (I)

- ◆ October 2001: OECD/UNEP workshop in Ottawa

«	Unclassified	ENV/JM/MONO(2002)15
	Organisation de Coopération et de Développement Economiques Organisation for Economic Co-operation and Development	09-Aug-2002
		English - Or. English
	ENVIRONMENT DIRECTORATE JOINT MEETING OF THE CHEMICALS COMMITTEE AND THE WORKING PARTY ON CHEMICALS, PESTICIDES AND BIOTECHNOLOGY	
ENV/JM/MONO(2002)15 Unclassified	Cancels & replaces the same document of 25 July 2002	
	OECD SERIES ON TESTING AND ASSESSMENT No. 36	
	REPORT OF THE OECD/UNEP WORKSHOP ON THE USE OF MULTIMEDIA MODELS FOR ESTIMATING OVERALL ENVIRONMENTAL PERSISTENCE AND LONG-RANGE TRANSPORT IN THE CONTEXT OF PBTS/POPS ASSESSMENT	

Multi-Media Models

- ◆ Convenient analytical framework for the investigation of environmental processes



Background of the OECD Tool (II)

- ◆ October 2001: OECD/UNEP workshop in Ottawa
- ◆ Recommendations:
 - ➔ Provide „guidance for users on model applicability and fitness for purposes”
 - ➔ Model intercomparison studies should be conducted
 - ➔ „A core set of multimedia models should be available and accessible at no cost to the public.”
- ◆ “Expert Group for the Follow-up to the OECD/UNEP Workshop on Multimedia Models” established in 2002

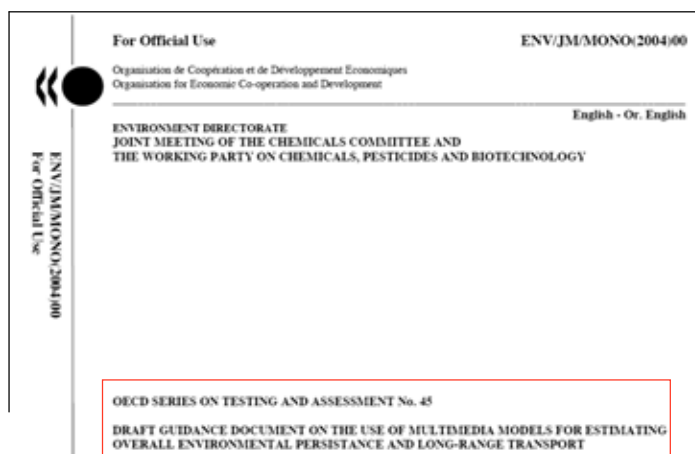
OECD Model Comparison Expert Group

- ◆ Robert S. Boethling, United States Environmental Protection Agency, USA
- ◆ Mark Bonnell, Environment Canada, Gatineau, Canada
- ◆ Kathrin Fenner, EAWAG, Dübendorf, Switzerland
- ◆ Anne Christine Le Gall, INERIS, France
- ◆ Andreas Beyer, Jörg Klasmeier, Michael Matthies, University of Osnabrück, Germany
- ◆ Matthew MacLeod, Martin Scheringer, Maximilian Stroebe, ETH Zürich, Switzerland
- ◆ Donald Mackay, Trent University, CEMC, Canada
- ◆ Tom McKone, Lawrence Berkeley Laboratory, California, USA
- ◆ David Pennington, Joint Research Centre, Ispra, Italy
- ◆ Bernd Scharenberg, Fed. Environment Agency, Berlin, Germany
- ◆ Noriyuki Suzuki, Nat. Institute for Env. Studies, Tsukuba, Japan
- ◆ Dik van de Meent, RIVM, Bilthoven, The Netherlands
- ◆ Frank Wania, University of Toronto, Canada



Work of the Expert Group

- ◆ Guidance document, published in 2004:



Work of the Expert Group

- ◆ Guidance document, published in 2004
- ◆ 1st model comparison study, published in 2005:

Comparing Estimates of Persistence and Long-Range Transport Potential among Multimedia Models

KATHRIN FENNER,[†]
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MATTHEW MACLEOD,[§]
MICHAEL MATTHIES,^{||}
THOMAS MCKONE,[§]
MAXIMILIAN STROEBE,[‡]
ANDREAS BEYER,[‡] MARK BONNELL,^{*}
ANNE CHRISTINE LE GALL,[®]
JÖRG KLASMEIER,^{||} DONALD MACKAY,[°]
DIK VAN DE MEENT,[×]
DAVID PENNINGTON,⁺
BERND SCHARENBERG,[◇]
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Swiss Federal Institute for Environmental Science and

process descriptions) affect the results for P_{ov} and LRTP. Using a set of 3175 hypothetical chemicals covering a broad range of partition coefficients and degradation half-lives, we systematically analyze the P_{ov} and LRTP results obtained with nine multimedia models. We have developed several methods that make it possible to visualize the model results efficiently and to relate differences in model results to mechanistic differences between models. Rankings of the hypothetical chemicals according to P_{ov} and LRTP are highly correlated among models and are largely determined by the chemical properties. Domains of chemical properties in which model differences lead to different results are identified, and guidance on model selection is provided for model users.

Introduction
High persistence and long-range transport potential are

Environ. Sci. Technol. **39**, 2005, 1932–1942

Work of the Expert Group

- ◆ Guidance document, published in 2004
- ◆ 1st model comparison study, published in 2005
- ◆ 2nd model comparison study, published in 2008:

PAPER www.rsc.org/jem | Journal of Environmental Monitoring

Estimating overall persistence and long-range transport potential of persistent organic pollutants: a comparison of seven multimedia mass balance models and atmospheric transport models[†]

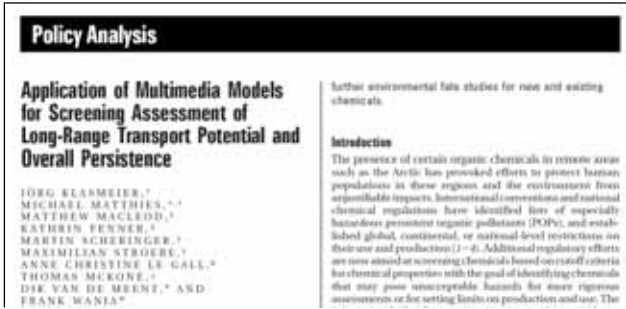
A. Hollander,^{ab} M. Scheringer,^{bc} V. Shatalov,^d E. Mantseva,^d A. Sweetman,^e M. Roemer,^f A. Baart,^g
N. Suzuki,^h F. Wegmann^c and D. van de Meent^{ab}

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First published as an Advance Article on the web 12th August 2008
DOI: 10.1039/b803760d

J. Environ. Monit. **10**, 2008, 1139–1147

Work of the Expert Group

- ◆ Guidance document, published in 2004
- ◆ 1st model comparison study, published in 2005
- ◆ 2nd model comparison study, published in 2008
- ◆ Use of reference chemicals for identification of P_{ov} and LRTP, published in 2006:



The image shows the cover of a scientific paper titled "Application of Multimedia Models for Screening Assessment of Long-Range Transport Potential and Overall Persistence". The cover is divided into two main sections. The left section contains the title, authors' names (JÖRG KLÄRMAYER, MICHAEL MATTHIES, MATTHEW MACLEOD, KATHRIN FERNER, MARTIN SCHEERINGER, MAXIMILIAN STRODER, ANNE CHRISTINE LE GALL, THOMAS MUKONE, DIK VAN DE MEENT, and FRANK WANIAT), and the ETH logo. The right section contains the title "Policy Analysis" and an "Introduction" paragraph. To the right of the paper cover, the journal information "Environ. Sci. Technol. 40, 2006, 53–60" is displayed. Below the journal information is the logo for the "Safety and Environmental Technology Group".

Policy Analysis

Application of Multimedia Models for Screening Assessment of Long-Range Transport Potential and Overall Persistence

JÖRG KLÄRMAYER,¹
MICHAEL MATTHIES,^{2,*}
MATTHEW MACLEOD,³
KATHRIN FERNER,⁴
MARTIN SCHEERINGER,⁵
MAXIMILIAN STRODER,⁶
ANNE CHRISTINE LE GALL,⁷
THOMAS MUKONE,⁸
DIK VAN DE MEENT,⁹ AND
FRANK WANIAT¹⁰

Introduction

The presence of certain organic chemicals in remote areas such as the Arctic has provided efforts to protect human populations in these regions and the environment from undesirable impacts. International conventions and national chemical regulations have identified lists of especially hazardous persistent organic pollutants (POPs), and established global, continental, or national level restrictions on their use and production (1–6). Additional regulatory efforts are now aimed at screening chemicals based on ratelimit criteria for chemical properties with the goal of identifying chemicals that may pose unacceptable hazards for more rigorous assessments or for setting limits on production and use. The

Environ. Sci. Technol. **40**, 2006, 53–60

ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Safety and Environmental Technology Group

An Unexpected Step

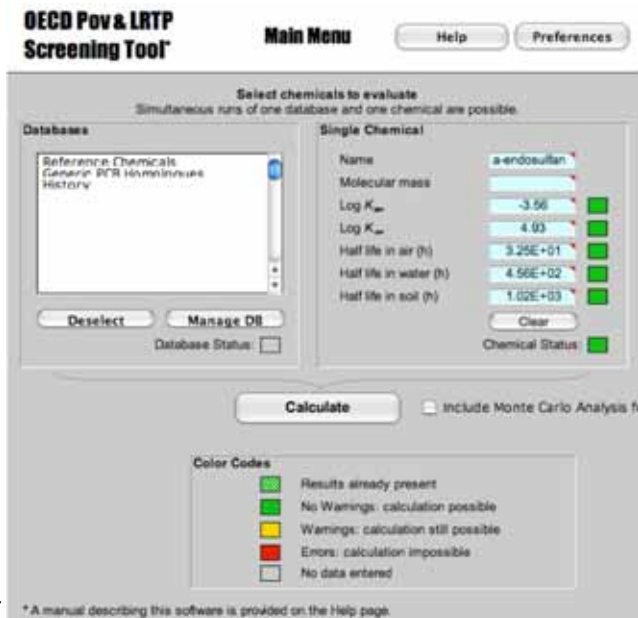
- ◆ Spirit of good collaboration and trust
- ◆ Impact of expert group stronger than of single scientists
- ◆ **Endorsement of a consensus model**
- ◆ Model developed in 2004, funding from Germany and Switzerland via OECD
- ◆ Since 2008, **model available** from OECD website:
<http://tinyurl.com/66q47j>

The Tool: User Interface and Input Data

- ◆ Left: databases
- ◆ Right: single chemical

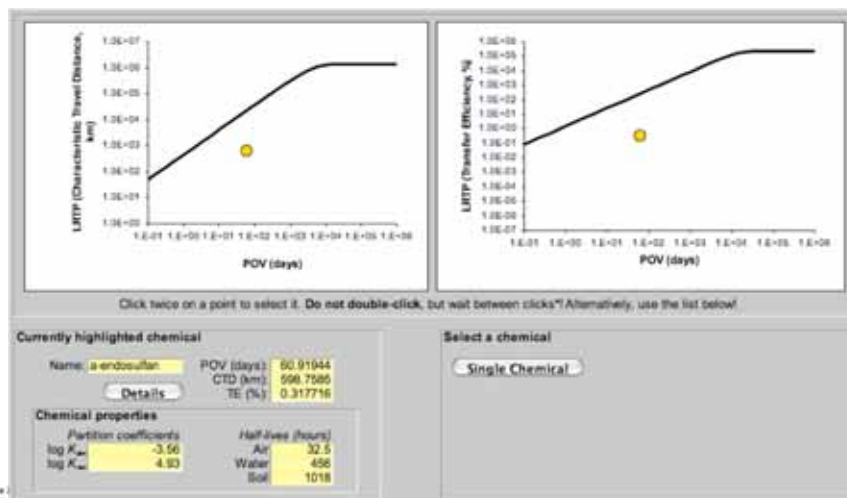
- ◆ Chemical property data required:
 - ◆ $\log_{10} K_{aw}$
 - ◆ $\log_{10} K_{ow}$
 - ◆ degradation half-lives
 - air
 - water
 - soil

F. Wegmann et al.,
Environ. Model. &
Software **24** (2009),
228–237



OECD Tool: Results

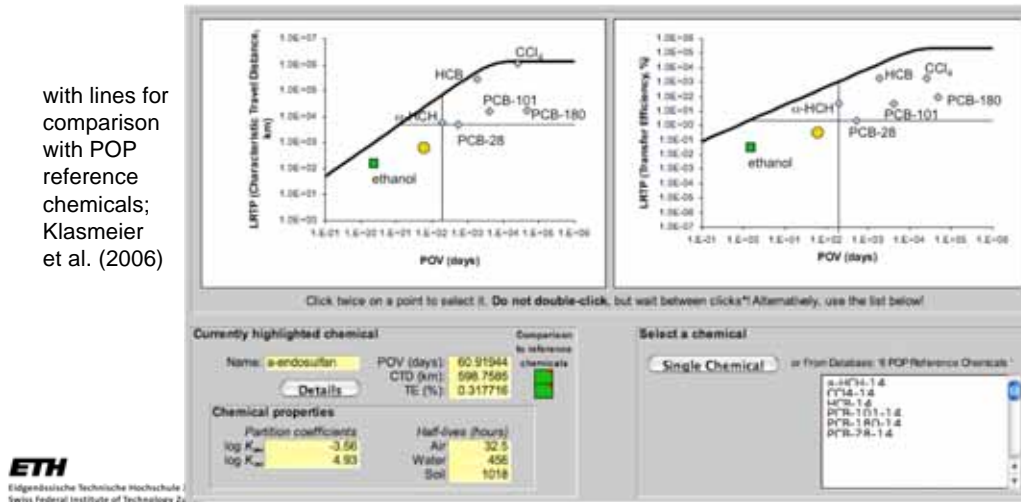
- ◆ Left graph: Characteristic Travel Distance (CTD) vs. P_{ov}
- ◆ Right graph: Transfer Efficiency (TE) vs. P_{ov}



OECD Tool: Results

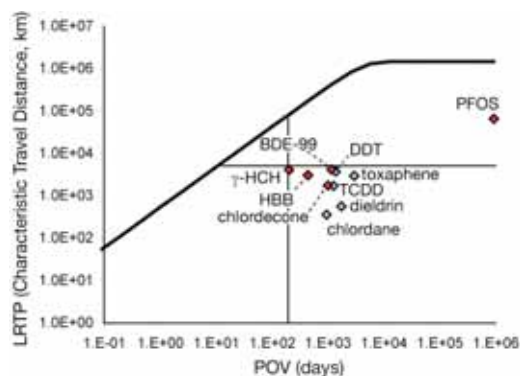
- ◆ Left graph: Characteristic Travel Distance (CTD) vs. P_{ov}
- ◆ Right graph: Transfer Efficiency (TE) vs. P_{ov}

with lines for comparison with POP reference chemicals; Klasmeyer et al. (2006)



Results for POP Candidates 2006

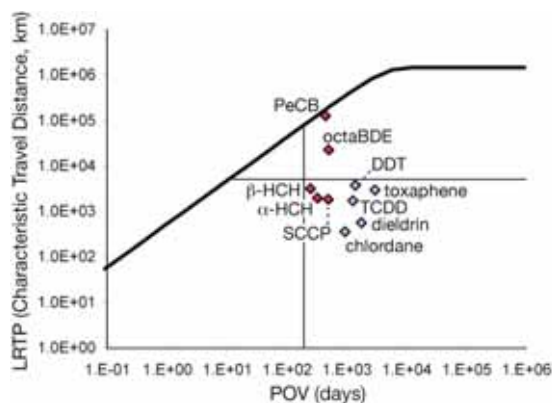
- ◆ Penta-BDE, γ -HCH, hexabromobiphenyl, chlordecone, PFOS
 - penta-BDE, γ -HCH, HBB, chlordecone: lower P_{ov} and higher LRTP than the group of DDT, toxaphene, dieldrin, chlordane, TCDD
 - PFOS: higher P_{ov} and CTD



report available from ETH Zürich:
<http://www.sust-chem.ethz.ch/downloads>

Results for POP Candidates 2007

- ◆ α -HCH, β -HCH, PeCB, octa-BDE, SCCP
 - ➔ lower P_{ov} and in some cases higher LRTP than the group of DDT, toxaphene, dieldrin, chlordane, TCDD



report available
from ETH Zürich:
<http://www.sust-chem.ethz.ch/downloads>

with lines for comparison with reference chemicals

Conclusions OECD Tool

- ◆ The Tool is a ...
 - ➔ ... lasting outcome of the work of the OECD expert group
 - ➔ ... platform for screening-level assessment of POP candidate chemicals

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- ◆ **International Panel on Chemical Pollution**
- ◆ Some additional thoughts...

Is Chemical Pollution Serious on a Global Scale?

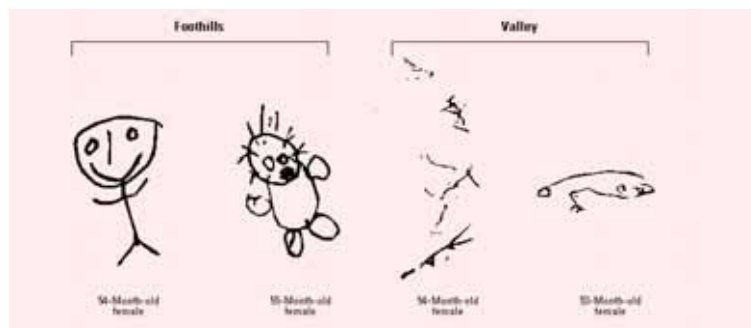
- ◆ Need to set priorities among different environmental problems:
 - ➔ Climate change
 - ➔ Biodiversity loss
 - ➔ Water scarcity
 - ➔ ...

Is Chemical Pollution Serious on a Global Scale?

- ◆ Need to set priorities among different environmental problems:
 - ➔ Climate change
 - ➔ Biodiversity loss
 - ➔ Water scarcity
 - ➔ Chemical pollution
- ◆ On a global and long-term scale, chemical pollution may affect the hormonal/sexual and intellectual development of a large number of humans.

Is Chemical Pollution Serious on a Global Scale?

- ◆ Effects on **intellectual development**: Example
- ◆ Children in Mexico, exposed to pesticides



What are the Problems to be Adressed?

- ◆ Chemical property data and findings on exposure and effects **not harmonized**.
- ◆ **High uncertainties** limit a science-based treatment of transboundary chemical pollution.
- ◆ **Support and funding** for measuring chemical properties, compiling emission inventories, conducting monitoring programs, performing modeling studies still **too low**.
- ◆ **Existing organizations limited** in their resources or their geographical or thematic scope.

Examples ...

- ◆ Emission inventories



Source: T. Kukharchyk, Belarus



- ◆ Pesticide stockpiles



Source: UN News
Pesticide cans in a
dump in Mali

- ◆ Risk-benefit assessment of DDT usage



Source: WHO
DDT indoor
residual
spraying

Tasks of the IPCP

- ◆ Provide scientific support for politics
 - ➔ **Compile** and **evaluate existing results** of research into large-scale chemical pollution
 - ➔ Provide **evaluated results** for decision makers: IPCP reports on priority topics
- ◆ Encourage political support for science
 - ➔ **Create awareness** among policy makers; support funding
 - ➔ Put **emphasis** on fields not part of the scientific mainstream, e.g. chemical property measurements

IPCP Declaration

- ◆ Describes IPCP initiative, open for signature, see www.ipcp.ch
- ◆ Supported by about 100 scientists from 35 countries

Initiative to establish an International Panel on Chemical Pollution, IPCP

The production of chemicals is an important source of economic welfare and chemical products provide a multitude of benefits for modern societies. However, many chemicals also enter the environment and chemical pollution will remain a major environmental issue in many regions of the world. **To reduce levels of pollution and ensure safe production, use and disposal of chemicals, large scientific, technical and political efforts will be required. To address this need, we propose to establish an International Panel on Chemical Pollution, IPCP.** The main task of this panel will be to provide support for decision makers dealing with pollution problems and the assessment and management of chemicals, both at the national and international level and based on the state of the science. (...)

IPCP Overview

◆ Description of IPCP objectives and context

International Panel on Chemical Pollution

Science and Policy

Science and Policy

Initiative for an International Panel on Chemical Pollution (IPCP)

Martin Scheringer^{1*}, Heidlore Fiedler², Noriyuki Suzuki³, Ivan Holoubek⁴, Cornelius Zetzsch⁵ and Åke Bergman⁶

¹Gruppe für Umwelt- und Sicherheitstechnologie, Institut für Chemie- und Bioingenieurwissenschaften, ETH Hönggerberg, HCI G 127, 8093 Zürich, Switzerland

²UNEP Chemicals Branch, DTIE International Environment House, 11–13, Chemin des Anémones, 1219 Châtelaine (GE), Switzerland

³Exposure Assessment Research Section, Research Center for Environmental Risk, National Institute for Environmental Studies,

16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan

⁴Masaryk University, RECETOX, Kamenice 126/3, 62500 Brno, Czech Republic

⁵BayCEER, Universität Bayreuth, Forschungsstelle für Atmosphärische Chemie, Dr. Hans-Frisch-Str. 1-3, 95448 Bayreuth, Germany

⁶Department of Environmental Chemistry, Stockholm University, 10691 Stockholm, Sweden

* Corresponding author (scheringer@chem.ethz.ch)

DOI: <http://dx.doi.org/10.1065/espr2006.09.347>

At the 2006 Dioxin Conference in Oslo, an *Open Meeting* was held on Managing risks of global POPs contamina-

public and policy makers, that research in priority areas such as measurements of chemical properties and monitoring pro-

Environ. Sci.
Pollut. Res.
13, 432–434
(2006)

Organization of the IPCP (I)

◆ IPCP is a **global network** of scientists from

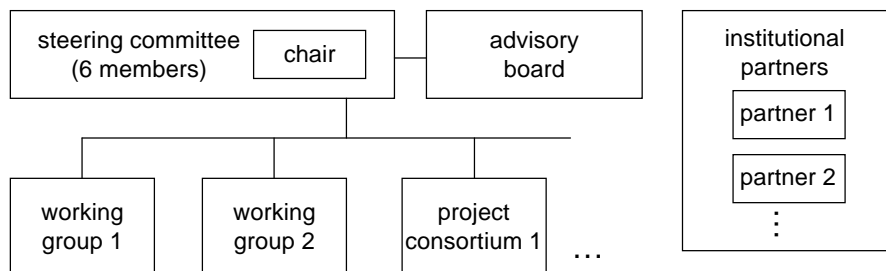
- ➔ chemistry
- ➔ toxicology
- ➔ ecotoxicology
- ➔ engineering
- ➔ epidemiology
- ➔ medicine
- ➔ ...

◆ Focus of IPCP work is on ...

- ➔ ... **scientific evaluation** of pollution problems
- ➔ ... **fostering research** needed to improve chemicals assessment
- ➔ ... **delivering** this scientific input to policy makers

Organization of the IPCP (II)

- ◆ **Bodies:**
 - Steering committee and chair
 - Working groups and project consortia
 - Advisory board
 - Institutional partners



Organization of the IPCP (III)

- ◆ **Partners** for collaboration and information exchange:
 - Scientific societies such as SETAC, IUPAC, ACS, EuCheMS, SOT, ...
 - Strategic Approach to International Chemicals Management (SAICM)
 - International conventions
 - International institutions
 - National governments
 - Industry associations
 - ...

Starting Points of IPCP Work (I)

- ◆ Working groups:
 - ➔ around 10 members, including chair or co-chairs
 - ➔ focusing on selected priority topics, example:
IPCP WG on Biomonitoring and Human Exposure
(chair: G. Becher, Norway)

- ◆ Prepare **reports** or **guidance documents** on priority topics
 - ➔ Show scientific consensus, uncertainties, disagreement, needs for further research
 - ➔ Delivered to governments and all interested parties, available to the public from IPCP web site

Starting Points of IPCP Work (II)

- ◆ Regional networks
 - ➔ addressing specific needs of a region
 - ➔ organizing scientific exchange and collaboration within the region
 - ➔ using IPCP as a platform to present the situation in the region to other regions, countries, IPCP partners, ...

- ◆ Individual projects and activities
 - ➔ Summer schools organized/supported by IPCP members
 - ➔ ...

Conclusions IPCP

- ◆ IPCP initiative still in its initial stage
- ◆ Legal status for IPCP by end of 2008
- ◆ Broad scope; high flexibility due to working group structure

www.ipcp.ch

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Why is This Process so Complicated?

“Applied Science”?

Applied Science?

- ◆ Scientific support of the implementation of the Stockholm Convention is not applied science.
- ◆ Scientific results will be „applied“ in a practical context ...
- ◆ ... but:
 - ➔ it is **not clear** what type of result will be needed, what kind of measurement or modeling technique should be used, etc.
 - ➔ **goals** of relevant research still have to be defined
 - ➔ **new** methods, concepts, techniques have to be developed, which will involve fundamental research

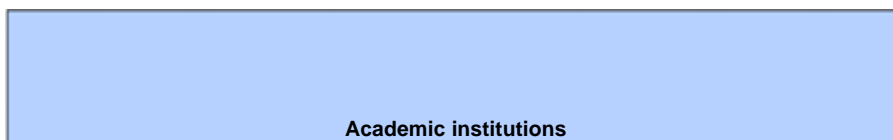
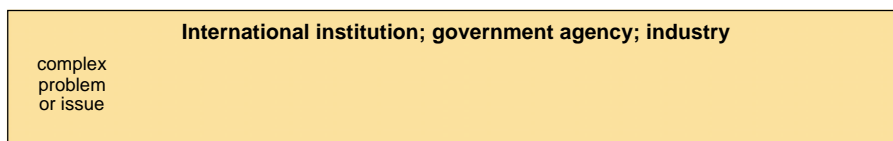
Applied Science? Example

- ◆ Research into Climate Change:
 - ➔ Highly important in many **applied** contexts (technology, economy, ecosystem management, agriculture, health, ...)
 - ➔ IPCC reports – and interprets – results from **fundamental** research in physics, chemistry, ...



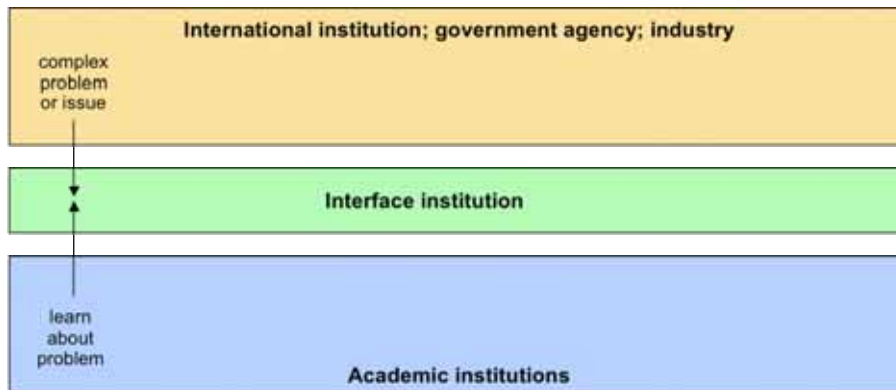
Scientific Input for Societal Problem Solving

- ◆ Model for interaction between science and politics:



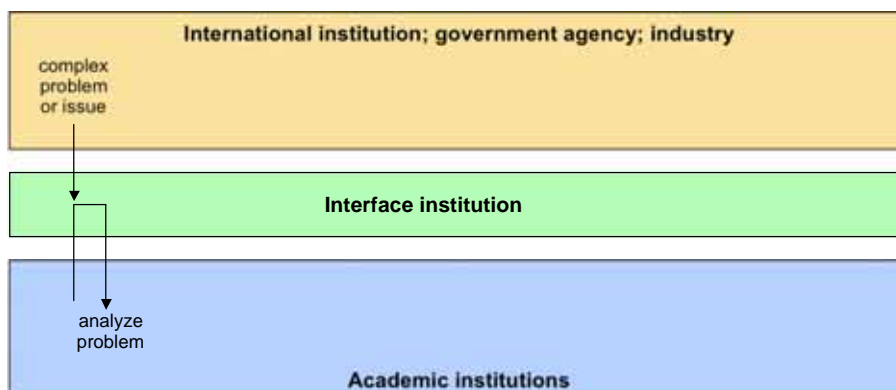
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◆ Model for interaction between science and politics:

