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VIEWPOINT

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Identifying the Research and Infrastructure Needs for the Global Assessment of Hazardous Chemicals Ten Years after Establishing the Stockholm Convention

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The Stockholm Convention (SC) on Persistent Organic Pollutants (POPs) is a global treaty under UNEP with the objective to protect human health and the environment from hazardous, long-lasting chemicals. Ten years after the adoption of the Convention on May 22, 2001, an expert meeting organized by the RECETOX Centre was held in Brno, Czech Republic, with the support of the American Chemical Society and the European Association for Chemical and Molecular Sciences. The aim of the workshop was to identify gaps, challenges, and research needs associated with the global assessment of hazardous chemicals. Recognizing that significant but insufficient progress has been made toward the World Summit on Sustainable Development (WSSD) 2020 goal on chemicals management through existing programs, the participants identified the following priority areas:

I. SOURCE CONTROL

Cost-effective exposure reduction requires control of the key emission sources of hazardous chemicals that include surprisingly large but poorly documented stocks of "primary" as well as "secondary" sources. Recent evidence indicates that stockpiles of wastes and poorly controlled "recycling" of disposed products are an ongoing source increasingly important for exposure assessments. As many countries currently lack the capacity to control POPs, it is important to ensure that compliance with the SC is not achieved by relocating banned POPs from developed countries to countries lacking capacity.

II. GLOBAL SCALE TRANSPORT

POPs are characterized by their ability to disperse and exert effects far from their sources. Their potential to be transported on regional and global scales is affected by their formation/usage/disposal patterns and their properties, and is linked to atmospheric and oceanic circulation patterns. Understanding how pollutants spread therefore requires linking source control to knowledge on physicochemical processes, transport models, and monitoring data. A helpful step forward was establishment of the Global Monitoring Plan (GMP), however, experience shows that to ensure coherent information flow, the global community needs to further link all existing instruments.

III. PERSISTENCE

Compound degradation influences the persistence and hence the long-term concentrations of chemicals and yet there is a dearth of information about degradation rates and pathways. Improved understanding of these processes can be achieved by linking laboratory scale experiments with mass balance models to assess degradation of chemicals while they undergo multimedia global transport. Knowledge on half-lives and degradation pathways will facilitate the estimation of source−receptor relationships and control strategies under a variety of global change scenarios.

IV. MONITORING TOOLS

A range of new and/or improved techniques is needed to strengthen our ability to address chemicals of global concern with improved spatial and temporal resolution including (a) advanced and cost-effective sensors capable of providing *quasi-real time* concentrations at different latitudes; (b) flux-based techniques to improve the quantitative assessment of the relative importance of primary and secondary sources; and (c) screening methods for foodstuffs, bioavailability determinations, and effect-based assessment.

V. FUTURE TRENDS AND SCENARIOS

Although the production and use of many hazardous chemicals has been banned, ongoing commitments to exposure reductions are constrained by uncertainties in (a) the extent and hence impact of past control measures including numerous exemptions; (b) the extent and impact of new control measures; and (c) concentration changes due to global climate change. Integrated measurement and modeling strategies are required to build the scientific platform to allow policy makers to assess cost-effective strategies for reducing the environmental and human risk.

VI. GLOBAL MONITORING PLAN

While the GMP, a key element to the Effectiveness Evaluation of the SC, critically depends on reliable temporal trend data, the network reporting data for the GMP is currently an unsustainable, short-term "proof of concept" project. It has been shown to be a workable model that can fulfill Article 16 requirements; however, it needs sustained long-term support to achieve its function. It is envisaged that the established core international network of contributors be strengthened and further capacitated to enable the synergistic use of international joint research infrastructure together with partners from developing countries.

VII. GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS (GEOSS)

To improve the flow of monitoring data to the environmental and health communities, the GMP has been incorporated in the revised (2012−2015) work plan of the GEOSS. Among the priority actions in the "Societal Benefit Area" of health is to (a) implement a global monitoring plan, (b) evaluate the effectiveness of international efforts to reduce POP releases, and (c) interlink existing information systems for environmental and health

monitoring. Unlike former priority actions, the latter one is awaiting implementation as the information system hosting GMP data is nonexistent. Such a system is, however, needed to enhance our understanding of environmental factors affecting human health.

VIII. CAPACITY BUILDING

Institutional knowledge and the technical ability to participate in the conventions are critical, and yet lacking in many countries. Fulfilling this need requires global collaboration between those whose capacity needs development and those who are able to assist. Capacity requires building in a stepwise manner over the short- and long-term by (a) establishing top-quality joint infrastructure; (b) providing open access for experts within/outside the network; and (c) securing long-term funding to support participants from developing countries.

IX. LIMITING ADVERSE EFFECTS

Evidence is mounting of adverse effects of pollutants on human and ecological health. Such effects are particularly apparent in sensitive environments, such as the polar regions. Studies have confirmed the association between exposure to environmental pollutants and depressed immunity, increasing vulnerability to infectious diseases. Whereas the SC has achieved success with a chemical-by-chemical approach in the past, new approaches to minimize harm from hazardous chemicals are needed in addition to chemical screening and risk management. Chemical alternatives assessment, supported by green chemistry and preventive engineering approaches, should be promoted.

X. SCIENCE TO SERVE POLICY NEEDS

Recalling the Rio Declaration on Environment and Development, Agenda 21, and the Johannesburg Plan of Implementation of the WSSD, new research strategies should be proposed, in the view of the authors, to address societal needs and produce policy-relevant knowledge, providing coherent frameworks for globally coordinated approaches to management of hazardous chemicals (including POPs). Coordinating across all priority areas identified in this declaration will produce key benefits.

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