Global Mercury Trade: Another Piece of the Puzzle

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Abstract: To contribute to both supply-side and demand-side reductions of mercury in the world economy.

To enhance our understanding of global mercury flows, uses and emissions by collecting, analyzing and better understanding trade statistics and related information regarding mercury and mercury compounds.

To analyze these statistics in order to draw relevant conclusions, and to determine whether it is useful to make efforts to improve the quality of the statistics.

The consensus of hundreds of stakeholders and experts who participated in the UNEP Global Mercury Assessment in 2002, resulting from a series of meetings and consultations, and clearly presented in the report's conclusions, was that countries around the world should make every effort to reduce – from the supply side as well as the demand side – the circulation of mercury in the economy and environment.

In virtually all studies that address the uses and supplies of mercury, researchers are hampered by an incomplete understanding of mercury trade and related movements around the world. In order to reliably address and reduce the circulation of mercury in the economy, we need to better understand these flows.

Since the author has been involved in recent work for both the European Commission and UNEP on this subject, this paper will summarize the data drawn from a number of databases that record mercury movements around the world in varying levels of detail, showing trade flows of mercury, certain organo-mercury compounds (e.g., phenyl mercuric acetate) or mercury compounds (e.g., mercuric chloride) and certain mercury containing products (e.g., mercuric oxide batteries) within and among various regions. Needless to say, the data raises a number of questions about the actual quantities and end uses of some of this mercury.

The paper will make some (occasionally surprising) observations about the large quantities of Hg that continue to be traded every year, about the large Hg flows between certain countries, about apparent foci of significant mercury trading activity, about the apparent continued use of large quantities of mercury in mercuric oxide batteries, etc. It will identify particular information gaps and data inconsistencies that should be addressed in the gathering of statistics. And it will argue that a more rigorous attention to the gathering and reporting of this data is critical to the global objective of reducing human and environmental exposure by reducing the circulation of mercury in the economy.

A Multidisciplinary Approach to Study the Impact of Mercury Pollution on Human Health and Environment: The EMECAP Project

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Abstract: A deep comprehension of environmental problems requires a systematic and multidisciplinary approach involving technical, biomedical and environmental issues, as well as social, economic and political information. The intrinsic heterogeneity of environmental and biomedical data makes difficult to establish an explicit correlation between them, thus entangling still more the environmental problem. A new multidisciplinary approach to manage environmental problems and support the safeguard of citizens health from mercury pollution is proposed by the EMECAP (European Mercury Emission from Chlor-Alkali Plants; Contract N° QLK4-CT-2000-00489) project. The project, which involved twelve partners from six European countries (Italy, Norway, Poland, Romania, Slovenia and Sweden), tested and validated this new methodology on three different Mercury Cell Chlor-Alkali (MCCA) Plants located in Italy, Poland and Sweden. The methodology includes innovative mercury monitoring devices,

biomedical and environmental methods and databases, a mercury dispersion model and a data mining software to investigate possible relationships among mercury emissions, environmental damages and onset of pathologies in human population living in the neighbourhood of mercury sources.

Key words: Mercury, Chlor-Alkali Plants, Mini-Analyser, Dispersion Model, Data Mining.

INTRODUCTION

The toxicity of mercury on humans is well known and widely recognized because of its effects on the central nervous system and on organs like kidney and liver. In particular, the effects of high doses of elemental mercury and methylmercury are well highlighted since many scientific studies have been carried out on mercury mine workers and on regular consumers of contaminated fishes[1]. Much less known are the effects that mercury can cause on humans at low concentration but for long period of exposure[2]. This lack of information clashes with the wide diffusion of many anthropogenic mercury sources which emit in the environment massive amount of the metal[3]. Moreover, the high volatility of the metal favours its dispersion in different environmental compartments with the consequent pollution of areas distant from the emission sources[4]. Mercury is emitted in the atmosphere by natural and anthropogenic sources but it has been assessed that about 70-80 % of the actual emissions in air have an anthropogenic origin[5]. In particular, the Mercury Cell Chlor-Alkali (MCCA) sector constitutes one of the most important anthropogenic metallic mercury source (about 15 % of the global)[6, 7]: this emphasises the importance of investigating possible direct relationships between mercury emissions, environmental damages and onset of pathologies in human population living in the neighbourhood of Chlor-Alkali plants. At present the MCCA plants spread all over the world with around 100 operating units in Asia, 60 in Europe, 45 in America and 17 in Africa. The EU production of chlorine by the mercury cell process still represents about 64 % of total capacity[8]. The process of risk management for environmental contaminants involves the integration of health effects and exposure data with social and economic information to define strategies to reduce or eliminate potential human health risks. The EMECAP project faced this problem and aimed to develop a new multidisciplinary approach to manage environmental problems and support the safeguard of citizens health from mercury pollution.

RESULTS AND DISCUSSION

The EMECAP project, which involved twelve partners from six European countries (Italy, Norway, Poland, Romania, Slovenia and Sweden), tested and validated the presented methodology on three different Mercury Cell Chlor-Alkali (MCCA) Plants located in Italy, Poland and Sweden (Fig. 1). This methodology includes innovative mercury monitoring devices, biomedical and environmental methods and databases, a mercury dispersion model and a data mining software to investigate possible relationships among mercury emissions, environmental damages and onset of pathologies in

human population living in the neighbourhood of mercury sources.

In particular, the following main activities were carried out:

1. Environmental issue: determination of atmospheric mercury concentration and emission from the selected MCCA plants;
2. Epidemiological issue: a quantification of the internal dose of mercury of the general population living or working close to the selected MCCA plants (low-exposed group) and to MCCA workers (high-exposed group) as compared to a control group from non-contaminated areas; an investigation of possible adverse or subclinical effects of the mercury exposure on kidney function or in terms of DNA damage or lipid peroxidation.
3. Technological issue:
   - Design and development of innovative mini-devices for atmospheric mercury monitoring;
   - Development of an improved diffusion dosimeter to measure mercury personal exposure level;
   - Development of a dispersion model to estimate current and future concentration and on-field mercury deposition of around anthropogenic mercury sources;
   - Development of a data mining software to collect and elaborate the obtained epidemiological and environmental data.

The used approach, though focused on Chlor-Alkali plants, has a more general value: it could be applied to the monitoring of mercury concentration over large areas around

Figure 1. The EMECAP pilot sites.

potentially polluting sites (incinerators, crematories, dumps, mining sites to be remediated or in remediation phase) and around small areas which, because of their destination (hospitals, schools, retirement home…), require particular attention.

CONCLUSIONS

The primary goal of the EMECAP project was to develop a new methodology and the basic technical means able to inform, in a direct and user-friendly way, decision makers and citizens on the possible risks for the human health caused by mercury exposure.

The vision is that a monitoring network, constituted by portable mini-analysers, measures in continous the mercury level over large areas while a dispersion model virtually extends these measurements to distant sites. The collected data are stored in environmental data-bases, while a smart software correlates the environmental data with epidemiological information and supplies information to the users on the potential level of risk for human health.

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