JOINT RESEARCH CENTRE
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Harmonization of Sampling and Analysis Methods for Heavy Metals Workshop

EMISSIONS AND AIR POLLUTION BY HEAVY METALS – RECENT EUROPEAN ASSESSMENTS.

FROM THE PERSPECTIVE OF THE EUROPEAN ENVIRONMENT AGENCY

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This presentation aims to address matters related to air emissions and air pollution by heavy metals from the perspective of the European Environment Agency (EEA). It is discussed how the scientific community, various organizations, conventions and programmes support the activities on these matters. Examples of research projects at NILU that relate or support to activities within EEA in this field are presented.

The EEA main mission is to deliver timely, targeted, relevant and reliable information to policy-makers and the public for the development and implementation of sound environmental policies in the European Union and other EEA member countries. In other words, the Agency aims to transform environmental data from the member countries into aggregated and directly relevant information at the European level.
To achieve its mission, the EEA has three instrumental pillars for their work: 1) Networking, 2) National monitoring to European environmental reporting, and 3) European Reference Center on environmental information.
The assessment activities at the Agency is along the DPSIR-framework (*Drivers-Pressures-State-Impact-Response*) which is building upon a conceptual OECD model which facilitates studies on interrelated factors that impact on the environment. In the future, the Agency intends to put more effort on the former and latter aspect, that is the driving forces (*i.e. causes*) and the responses (*i.e. measures*) to improve the value of the assessments in terms of policy support.
The EEA activities involve intensive co-operation with the countries and with various international environmental agencies and organizations. Thus, the Agency is building upon the work of existing institutions and attempts to co-ordinate related activities to avoid duplication of work in environmental data collection, analysis and reporting. These activities are coordinated in EIONET (*European Environment Information and Observation Network*), the networking pillar of the EEA activities. Further, the Agency seeks to bring together in compatible formats the available environmental data on heavy metals from individual countries as a basis for integrated environmental assessments. Hence, activities related to harmonization of sampling and analysis methods for heavy metals, directly supports and qualifies to the efforts within the Agency to compile high-quality as well as comparable datasets.

The Agency has established eight European Topic Centers to support EIONET activities within certain environmental areas. Two of these are essential in relation to activities within ambient air pollution by heavy metals. The goal of the European Topic Center on Air Quality (ETC/AQ) is to support the Agency in all its tasks as far as air quality is involved. Similar, the European Topic Center on Air Emissions (ETC/AE) support the Agency on matters related to emissions by amongst other, heavy metals. To obtain information outside the European Union, Phare Topic Links have been established in cooperation between the Agency and the EC Phare Programme to provide harmonized information on matters related to air emissions and air quality from non-EU member states in Central Europe.

One of the key activities at the EEA is to provide information in support of relevant legislation within EU on air pollution by heavy metals[1]. The so-called "Framework" Directive was adopted in September 1996 (*Council Directive 96/62/EC on Ambient Air Quality Assessment and Management*). Annex 1 of the Framework Directive contains a list of 13 priority pollutants that have to be taken into account within ambient air quality assessment and management. Regulations for the 13 priority pollutants are laid down in the daughter Directives to the Framework Directive. The Commission has launched a process of broad participation to prepare the daughter Directives, including member states, NGOs, industries as well as scientific and technical groups. A steering group of national experts have set up working groups to collect available data and information in member states about the pollutants of interest. One of the tasks of these working groups is to prepare the independent "position papers" and to propose elements of the future Directives[2].

An important element of these Directives is reporting of measured ambient air concentrations to the Commission, particularly in case of exceedances of air quality limit values, often in terms of statistics. In addition, under the Exchange of Information Decision, Member States exchange primary data. All these data are reported to the European database Airbase, operated by the ETC-AQ, and accessible on the internet (http://www.etcaq.rivm.nl/databases/airbase.html).

Clearly, when attempting to understand and control air pollution by heavy metals, knowledge about the sources is needed. The EEA collects and stores national reported emission data in the CORINAIR database that is held at UBA-Vienna. The Agency further has a close cooperation on emissions with EMEP[3], that is responsible for collecting national emission data under the Convention on Long Range Transboundary Air Pollution. These national emission data are essential to monitor implementation of environmental strategies or international agreements on emission reductions. Since the EEA has the task to merge data from various countries and to process them in a usable format targeted for policy-makers, certain aspects concerning the inventories are required and need to be fulfilled. In particular it is desirable that the data are representative, reliable, comparable, transparent, timely and complete.

First of all, considering the current status of European emission data for heavy metals in general, it is quite clear that considerable efforts and progress have been made over the last few years. Last year, 19 Parties reported data on heavy metals to EMEP for the reference year 1997, and a total of 32 out of 44 Parties had reported data on heavy metals for at least one year. Within the Convention, the priority metals have been

[1] See Abstract by D. Johnstone on "European legislation on HMs"

[2] See Abstract by P. Bruckmann on "Assessment of arsenic, cadmium and nickel compounds – conclusions and recommendations for the EU position paper"

[3] See Abstract by M. Williams on "The role of EMEP in the Transboundary Heavy Metal Problem"

Mercury, Cadmium and Lead, while the previously mentioned daughter Directives focus on Lead (adopted), Arsenic, Cadmium and Nickel (in preparation), and Mercury (in preparation).

A central tool for the countries when preparing their national emission inventories is the Joint CORINAIR/EMEP emission inventory guidebook. The emission data for heavy metals are requested by many different users, hence the demand on the countries to submit data is fairly extensive. A few of the typical desires commonly heard from various communities or "users" are mentioned in the following. Atmospheric modelers that aims to quantify source-receptor relationships tend to express the need for data on matters related to uncertainties, natural emissions, point source information and parameters, area sources and physical-chemical state of the heavy metal in question[4]. Policy makers – in addition to the aspects previously highlighted by the EEA – will tend to emphasize trends in emission data as basis for assessing the historical and future situation. Furthermore, emissions by source category are essential to develop plans for further reductions in heavy metal air pollution. This should be in accordance with economists that would like to address the cost-efficiency of various control measures. And obviously, the accuracy of the data is important to propose the right measures in cost terms.

As mentioned, substantial activities are undertaken outside and within the EEA to improve the emission data for heavy metals. At the last year meeting of the EEA EIONET together with the UN-ECE Task Force on Emissions, 38 countries were represented. Several issues on how to improve the emissions of heavy metals in particular were on the agenda. At this meeting, a special session was arranged on emissions of heavy metals and POPs (*Persistent Organic Pollutants*). In the chairman report to the steering body of EMEP, several actions were proposed. The countries were requested to report emission data on SNAP (*Source Nomenclature for Air Pollution*) level 2 that have a higher source category resolution than SNAP level 1. Secondly, the need for expansion of the guidebook in relation to heavy metal coverage was highlighted. This was followed up within the work plans at the individual meetings of the various expert panels, responsible for future developments of individual chapters of the guidebook. Further, the need to improve the emission inventory guidebook on matters related to the different technologies across the UN-ECE region was highlighted.

Another important meeting in this context was the WMO/EMEP/UNEP workshop on modeling of atmospheric transport and deposition of persistent organic pollutants and heavy metals in November 1999. First of all, issues related to modelers demand concerning the emission data for heavy metals were clearly expressed and presented to the working group on emissions - in particular as seen from the perspective of the EMEP MSC/E center in Moscow, responsible for the transboundary modeling of heavy metals in Europe. Among the other issues, there was a general recommendation to strengthen efforts that could reduce and quantify the uncertainties in heavy metal emission estimates, for example through an increased emphasis on matters related to quality assurance and quality control when preparing national inventories. It was also recognized that although there is an increased awareness to avoid duplication of efforts, cooperation and harmonization should continue to improve the use of resources. Finally, some concrete recommendations for the improvement of the emission inventory guidebook were proposed.

[4] See Abstract by A. Ryaboshapko on "HM modeling: requirements to monitoring networks and to emission inventories"

It is clear that various research institutes contribute to an increased understanding of air pollution and emissions of heavy metals through various research projects. The Norwegian Institute for Air Research (NILU) has about twenty years of experience on atmospheric emission inventories for heavy metals. The first European inventory for heavy metals was prepared by Jozef Pacyna in 1983, and covered 16 trace elements from 12 source categories. Since then numerous studies have been completed. Currently, there are two ongoing projects within EU DG XII on Mercury. One is focusing on Mercury in the Mediterranean sea region (MAMCS), coordinated by Nicola Pirrone[5]. The other is the "Mercury Over Europe" project, coordinated by John Munthe[6]. Within these two projects, a joint European emission inventory is now being prepared together with NILU with particular emphasis on speciated Hg-emissions (Hg^{2+}, Hg(p) and Hg^{0}). Further, there are also some current efforts at NILU to estimate costs associated with various control options for emission reductions. NILU has also been contracted recently to establish global heavy metal emission inventories. This seems like a natural extension of previous studies, due to the first-hand experience and a more open policy on environmental issues in general within the industries. NILU is also about to start up a new INTAS project that includes emission inventories for heavy metals for the New Independent States, together with scientists in Russia, Belarus, Denmark and Uzbekistan. Historically, the data availability has been poor from the former Soviet Union, but today significant contributions have been made from research groups in Belarus and Russia that facilitates a better spatial coverage of the total European emissions of heavy metals.
The data being estimated and collected within various research projects have also been made available to the EMEP MSC/E center in Moscow to support their modeling activities. As such, various research projects at NILU, TNO and other institutes have at least temporally filled a gap for countries that have not been able to report their emissions of heavy metals. The experience that is being made is also brought forward through participation within expert panels of the Task Force on Emission Inventories (and Projections) that are responsible for future improvements of the joint CORINAIR/EMEP emission inventory guidebook. However, so-called expert estimates should not substitute the national officially submitted data to the EEA and EMEP. This is because the national experts should have a more detailed knowledge about relevant technologies and emitting activities within their respective countries. Hence, it is important to continue to encourage member states to report their heavy metal emissions in compliance with international agreements to obtain the most reliable data.

As a summary, it is clear that considerable progress have been made over the last few years on emissions and air pollution by heavy metals. These efforts – outside and within EEA – supports the activities of the Agency in their effort to bring forward relevant information into assessments useful for policy making. Existing knowledge gaps at the European level furthermore call for a coordinated approach which is facilitated by the EEA and the Topic Centers, the EMEP centers as well as relevant institutions, programmes and organizations.

[5] See Abstract by N. Pirrone on "Intensive measurements of atmospheric mercury in the Mediterranean region"
[6] See Abstract by J. Munthe on "Atmospheric Mercury in Europe – measurement techniques, time trends and geographical patterns"