



Project Summary

Multimedia Approaches to Assessment and Management of Hazardous Air Contaminants

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The chief goal of the NATO/CCMS Denver workshop was to broaden the perspective of air pollution professionals in workshop session dialogue. A further goal was to provide an opportunity for air pollution research and control experts to share information on risk assessment and management, addressing multimedia aspects of contamination. The final report identifies the theme, structure, and major points of workshop discussion, and presents recommendations for consideration by national policymakers.

The workshop was attended by about 60 people representing nations both within and outside the Alliance. These countries included the United States, the Federal Republic of Germany, Italy, the Netherlands, Sweden, Canada, and Japan. Experts from each of the participating nations were involved as presenters, panel members, and session leaders. Dr. Michael Berry, U.S. Environmental Agency, and Ms. Christa Morawa, Federal Environmental Agency, Federal Republic of Germany, were overall co-chairs of the workshop.

The workshop used lead as a paradigm for examining difficulties and successes in reducing human exposure to a hazardous contaminant. Following a presentation that summarized the current consensus on scientific opinion regarding lead exposure and effects, a series of case studies was presented. These studies illustrated various countries' experiences in managing lead contamination. The workshop also considered the problems in assessment and management posed by compounds where scientific evidence of health and

environmental hazards is less certain than in the case of lead. Other workshop sessions focused on methods for multimedia assessment and management.

At the conclusion of the workshop, the participants discussed proposed recommendations to national authorities. These recommendations concerned comparability and coordination of methods research to quantify uncertainty in risk assessment methodologies, environmental education, more effective means of communicating risk to the public, and organizational and legislative structures more responsive to the need for integrated management across all media.

In addition to the individual presentations, panels, and general discussions, microcomputer demonstrations of REFEREE, an EPA-developed bibliographic database management system, and pMAP™, a geographic information system, were available. Supplementary materials contributed by presenters were also available onsite or by order.

This Project Summary was developed by EPA's Environmental Criteria and Assessment Office, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Overview and Recommendations

Overview

In 1984, with the successful conclusion of a series of air pollution pilot studies initiated and sponsored by NATO/CCMS, the member nations recommended that

the information exchange developed during the preceding 15 years be continued. A 5-year program of annual workshops, focusing on topical aspects of air pollution control, was suggested and adopted as follow-up to the international air pollution research and control expertise fostered by the pilot studies.

The first follow-up workshop was held in Lindau, Federal Republic of Germany, on October 7-9, 1985, and it dealt with advanced techniques for air pollution measurement.

During the 2-1/2 day Denver workshop, 22 presentations were made. They included a keynote address by John Spengler of Harvard University, who outlined the dimensions of the problem of multimedia, multiple exposure environmental contamination. The first session, "Defining the Challenge," opened with a summary of the scientific consensus on lead, by David E. Weil, U.S. Environmental Protection Agency. This was followed by five case studies in multimedia management of lead. Magnus Piscator of the Karolinska Institute, Sweden, was chair of this session.

The case studies presented several approaches to assessing and managing specific instances of lead contamination. The speakers were Paul Ciriello, U.S. Environmental Protection Agency; Ian von Lindern, TerraGraphics; Gen Ohi, University of Tokyo; Erich Weber, Federal Republic of Germany; and Sergio Facchetti, Joint Research Center, Varese, Italy.

Following the examination of the challenges presented by environmental contamination with an element whose hazardous effects are well documented, Rolf Hartung of the University of Michigan presented an overview of the very difficult problems decision-makers and scientists face when they must deal with compounds where data on dose rates and dose-response are unclear. The uncertainty surrounding many such compounds presents an unusually strong challenge.

Air, water, and soil are *interdependent* compartments of the environment, yet are often dealt with in an *independent* manner. The workshop stressed the need to consider all media in evaluating the scientific information available for any pollutants identified, and to take the multimedia aspects of environmental contamination into account for risk assessment and risk management. The workshop also recognized the challenge to protect the total environment, including but not exclusively public health, by making and administering legislation and

regulations — often defined as single-medium, but just as importantly, analyzed and evaluated in terms of cross-media effects.

Session Summaries

To illustrate the problems and the challenge in developing a multimedia risk assessment/risk management model, the workshop employed the case study method, using lead as a paradigm. David Weil of the U.S. Environmental Protection Agency summarized the outcome of the recent, detailed scientific assessment regarding the exposure and health effects of lead.

Lead is known to be a multimedia pollutant to which people are exposed through air, food, water, soil, and dust; it is estimated that each American has an average daily consumption of about 100 micrograms. Most of the atmospheric emissions (approximately 90%) in the past resulted from the combustion of leaded gasoline. However, that percentage is expected to drop significantly as EPA's Lead Phasedown in Gasoline program takes full effect in January, 1988. The EPA's assessment also concluded that the onset of health effects of concern can be observed at blood lead levels of 15-20 $\mu\text{g}/\text{dl}$ in young children and at levels as low as 10-15 $\mu\text{g}/\text{dl}$ in fetuses. Based upon evaluation of this data, the EPA is now considering revision of the National Ambient Air Quality Standard (NAAQS) for lead to protect as many young children as possible (e.g., 99.5%, as was done in setting the current NAAQS for lead) from exceeding a blood lead level of 15-20 $\mu\text{g}/\text{dl}$. Whether or not revising the standard to this level will be sufficient to protect fetuses from achieving blood lead levels of 10-15 $\mu\text{g}/\text{dl}$, given the relatively greater lead exposure of young children than pregnant women (and, hence, their fetuses), is under investigation at this time.

In summing up the session on lead pollution, the chair of the session concluded that a continuing decrease in lead emission into the air is demonstrated in all cases, but that total accumulation will still (slowly) increase and remedial measures towards soil and dust pollution should be taken.

Another session considered methods of multimedia assessment. Compared to "data rich" pollutants such as lead and sulfur and nitrogen oxides, information for new hazardous pollutants often is lacking or incomplete. Establishing a dose-response curve for these compounds is therefore extremely uncertain. The

complexity of the relationships is also indicated with the use of varying parameters: 1) dose rate, 2) duration of exposure, 3) intensity of response, 4) incidence of response, and 5) severity of response. Other uncertainties include the extrapolation to other species, from short- to long-term exposure, from high dose to low dose, and from one substance to a combination of substances. He recommended intensified efforts to state assumptions and uncertainties explicitly. In the discussion following the presentations, it became clear that for carcinogenic substances the inherent uncertainties are smaller than for other toxic pollutants. The European approach in preparing and separating promoter from initiator carcinogens was recognized. Participants supported the statement that toxicological tests supplying accurate predictive results should be established before decisions regarding protection levels are made by policymakers.

The chair of the session on multimedia assessment methods, began by discussing factors of importance for planning and interpretation of population surveys. The importance of the selection of specific chemical compounds as suitable exposure indicators was shown. Examples were given for arsenic, cadmium, and mercury. Depending on metabolic processes, speciation of chemical substances is of critical importance to the evaluation of survey data. For example, arsenic and mercury can appear in one form in an environmental medium, but differently in human urine.

The final methods session dealt with national strategies for managing multimedia contaminants.

In the Federal Republic of Germany, environmental problems still have largely to be solved within the usual compartments of air, water, and soil. A number of activities have been started that aim at introducing cross-media ideas, such as a recently initiated soil protection program.

In Italy, a massive accidental release of dioxin at Seveso focused worldwide attention on the lack of information about health and environmental effects of dioxins and other persistent multimedia contaminants. The subsequent research response has clearly demonstrated that TCDD and other dioxins are widely occurring multimedia contaminants produced from a number of sources, whose relative importance varies according to time and place.

For Japan, a comparison was made between conditions existing in 1961 and in the early 1980's. Due to emission

controls in the years after 1967 such as the Basic Law for Environmental Pollution Control and the Air Pollution Control Law, air pollution concentrations have been drastically reduced in the major cities and nationwide. Environmental pollutants are monitored on a continuous basis.

In the Netherlands, a multimedia assessment is made for each chemical compound to be regulated. In the beginning, only air quality criteria documents were prepared. Since 1985, multimedia also include food, drinking water, and occupational health factors.

The U.S. government agencies are still structured to address single-purpose, problem-oriented programs. The single-medium statutes and policies of the past have worked well under the circumstances. That stage has been outgrown, however, and there is a need to take a more comprehensive look at environmental management in the future. Clean air and water are visible, and cross-media approaches are a more abstract concept; the holistic approach involves complex ideas.

The final workshop session was co-chaired by Michael Berry and Christa Morawa. The major discussion in this session was a review of the issues that had been addressed throughout the workshop. The participants made a number of comments and suggestions to produce a set of proposed recommendations, summarized below.

1. Decision-makers, in assessing and managing the problems associated with hazardous air contaminants, must remain cognizant of the multimedia implications to development of control strategies and strive to harmonize and coordinate methods to mitigate environmental harm across air, water, biota, and soil media.
2. Decision-makers, in assessing and managing the problems associated with hazardous air contaminants, must recognize, acknowledge, and understand the limitations of authorities restricted to a single medium. Efforts should be expended to regulate and mitigate, from a multimedia perspective, the environmental insult.
3. NATO countries should emphasize their commitment to support research in quantifying uncertainties in the risk assessment methodologies. Furthermore, member countries should be especially attentive to communicating risk to the public and to public acceptance of the risk

assessment process and results derived therefrom.

4. NATO member countries need to cooperate in the development of integrated simulation techniques which can assist in the multimedia risk assessment process. Multimedia models must be easy to use, yet flexible enough to cover a broad range of environmental problems. If at all possible, they should be designed in a modular fashion to provide the widest application. It is further recommended that a follow-on effort to the current NATO/CCMS pilot study be considered for developing and validating such models.
5. NATO countries should actively seek and support environmental education curricula for elementary school, secondary school, and college and university students. Furthermore, public outreach programs to increase the awareness of environmental problems and protection, to include scientific discussion as well as general approaches, should be pursued. In the educational process, particular attention should be given to knowledge of the risk assessment process.

6. Member countries should strive during the next few years to develop close cooperation and coordination among governmental bodies in the scientific pursuit of environmental risk assessment. Two kinds of integration must be emphasized: integration across media and integration among policymakers and researchers. Member countries are encouraged to develop experimental multimedia programs.

7. Member countries use the NATO/CCMS pilot study structure as a mechanism to recommend, select, and plan for joint research. Alternatively, informal contacts developed through the NATO/CCMS experience may be used to begin bilateral agreements. Results of investigations should be published in standard NATO format (English and French languages) and the NATO/CCMS structure should be used as a clearinghouse for research results. Periodically, NATO/CCMS should publish a bibliography of available reports, and also a summary of international research in the planning stage.

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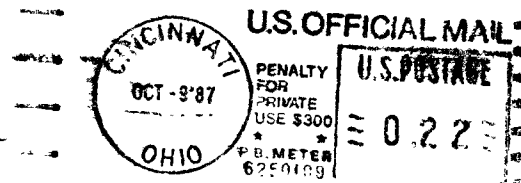
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