Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia

Report of the

Malé Declaration emission inventory preparation, scenarios and atmospheric transport modeling workshop

03 – 08 July 2006
UNEP RRC.AP, Thailand

REPORT

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3-8 July 2006, UNEP RRCAP, AIT, Bangkok, Thailand

C O N T E N T S

LIST OF ACRONYMS

ABC	Atmospheric Brown Cloud
AIT	Asian Institute of Technology
AQM	Air Quality Management
CAFE	Clean Air for Europe
CPCB	Central Pollution Control Board
HYSPLIT	HYbrid Single-Particle Lagrangian Integrated Trajectory
IEA	International Energy Agencies
IIAM	Integrated Information and Assessment Modeling
IIIEE	International Institute for Industrial Environmental Economic
IPCC	Intergovernmental Panel for Climate Change
IVL	IVL Swedish Environmental Research Institute
MATCH	Model of Atmospheric Transport and Chemistry
MISU	Department of Meteorology- Stockholm University
MoC	Monitoring Committee
NIA	National Implementing Agency
NOAA	National Oceanic and Atmospheric Administration
Pak- EPA	Pakistan Environmental Protection Agencies
QA/AC	Quality Assurance / Quality Control
SEI	Stockholm Environment Institute
Sida	Swedish International Cooperation Development Agency
SOPs	Standard Operating Procedures
UNEP RRC.AP	United Nations Environment Programme Regional Resource Center for Asia and the Pacific
VISIONS	Integrated Vision for a Sustainable Europe

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Report on Training Programme

1. Introduction

A training workshop on emission inventory preparation, scenarios generation, and atmospheric transport modeling, and integrated information and assessment modeling (IIAM) was conducted on 3 - 8 July 2006 at UNEP Regional Resource Centre for Asia and the Pacific (RRCAP), Asian Institute of Technology (AIT), Bangkok, Thailand, under the framework of Program "Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia". The training workshop was aimed at capacity building in eight Malé Declaration countries for studying the air pollution issues, especially transboundary transport of air pollutants, its potential impacts, and consequently enabling them to design science-based, integrated policy options to mitigate the adverse effects of air pollution. Thus, the workshop was designed to provide a technical hands-on training to the participants from Malé Declaration countries on compilation of emissions inventories of major regional air pollutants, generation and analysis of various scenarios, atmospheric transport/transfer/deposition modeling, and design of integrated approach to abate impact of air pollutants, in particular those species that lead to acidification. There were 27 participants in the workshop: from 8 Malé Declaration countries (Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, Sri Lanka) and from other collaborating institutions; SEI, IIIEE, SMHI, UNEP RRC.AP. List of participant is enclosed (annex 1)

2. Opening Session

This session was attended by all 27 participants, Mr. Surendra Shrestha, UNEP regional director for Asia and the Pacific, and Mr. R. Rajamani, regional facilitator for Malé Declaration. The session started with a brief introduction of the participants.

Mr. Mylvakanam Iyngararasan (UNEP) briefly introduced the Malé Declaration programme, its phases, components, and Phase III and plan for the coming days that included impact assessment of transboundary air pollution among other activities. He outlined the plan for the training workshop; compilation of emission data, scenario generation, atmospheric transport/deposition modeling and integrated information and assessment modeling (IIAM).

Mr. Johan Kuylensteirna (SEI) highlighted the capacity building as the aim of the training workshop, and presented the schedule for the week-long workshop. The workshop was basically divided into four components: compilation of emission data, understanding of driving forces in Malé Declaration countries and generation of

various scenarios, atmospheric transport/transformation/deposition modeling, and development of an integrated information and assessment model (IIAM) for examining the management options for air pollution transboundary transport of acidifying species thereby develop policies to mitigate air pollution problems. Finally, he asked the participants to be interactive during the training workshop and provide feedbacks.

Mr. R. Rajamani briefly presented the evolution of Malé Declaration and progress it has made since its commencement in 1998, i.e., a successful completion of Phase I and Phase II. He highlighted its uniqueness as a major regional environmental initiative, first of its kind in the developing world, and also emphasized that a rather important work is being done within Malé Declaration. In addition to the data collected within Malé Declaration framework, he suggested of exploiting the ambient air quality data collected by various government agencies. He mentioned that it would be worth considering impacts of air pollution on soil, crop health, animal health to be included in future plan. He suggested that the Malé Declaration should be considered as a complementary programme to Project Atmospheric Brown Clouds (ABC), and should be linked to it. It is essential to analyze and evaluate the impacts of the air pollution control measures being taken, Mr. Rajamani suggested. Finally, he asked all participants for two-way interactive participation during the workshop. He advised them for active participation so as to make use of the lectures, training exercises, sharing knowledge and experiences among participants to the fullest extent, and enhance their capability.

Mr. Surendra Shrestha, UNEP Regional Director for Asia and the Pacific, welcomed all participants, and appreciated involvement of Mr. Rajamani and technical support and advice from SEI and SMHI since the beginning of the programme. He pointed out that south Asia is a dynamic and diverse region which must focus on achieving sustainable growth through sustainable use of resources. Mr. Shrestha emphasized the need of sound scientific basis for air pollution management, and said that we have been developing science, capacity in Malé Declaration countries and aiming at providing information for integration of science into policy design. He talked about the importance of participation and ownership of participating countries in the programme for effective continuation and functioning of this important initiative. He also stressed on uniqueness of this regional initiative and informed that other region in Africa and South America are replicating Malé Declaration to address regional air pollution issues. Finally, the Regional Director advised the participants to make the workshop as a capacity building opportunity, and looked forward to a continued cooperation.

3. Training Programme

The training programme was basically divided into four components;

i. Compilation of emission inventory data
ii. Need and scope of scenarios for air pollution
iii. Atmospheric transport/transformation/deposition modeling
iv. Integrated information and assessment modeling (IIAM)

i. Compilation of Emission Inventory Data

*Mr. Harry Vallac*k (SEI) briefly showed the evidences that the substances emitted into the atmosphere such as sulphur dioxide, nitrogen oxides, ammonia, non-methane hydrocarbon compounds and particulate matter from numerous human activities and natural processes are the cause of many environmental problems including adverse effects to human health, crops, animals and ecosystems, acidification of ecosystems, eutrophication, air quality degradation, visibility reduction, damage to buildings and structures, ozone layer depletion and climate change. Mr. Valllack explained emission inventory and the need of better emission inventory data for various purposes such as modeling of transport and deposition and effects of air pollutants, help define priorities and set objectives for reducing emissions, assessing the potential impacts of different reduction strategies etc. The participants were provided with a comprehensive workbook "The Malé Declaration Emission Inventory Excel workbook". They were trained over two days by providing hands-on exercises on entering the emission activities data from different sectors, such as combustion in the industries, transport, agriculture etc., first using the dummy data to make them familiar with the workbook and later with the country specific data. Each participant was very enthusiastic in learning emission compilation. The workbook is one of the significant developments within the Malé Declaration programme. The participants were also provided with the information about the international, regional emission inventory approaches, such as IPCC, North American and European initiatives.

ii. Scenarios Development

Mr. Philip Peck (IIIEE) introduced the terminologies, and purpose of and process of scenarios development for air pollution management, and provided various examples from Europe and other continents. He explained the role of scenarios in education and public information, science and research, and strategic planning and decision support. He also explained the nature of driving forces and data required for scenarios development, and their level of integration. The comprehensive information on the process of scenario generation was provided. He refereed time and again to the IPCC greenhouse gases emission scenarios, as well as scenarios for clean air for Europe (CAFE), World Energy scenarios (IEA), integrated vision for a sustainable Europe (VISIONS), Swedish experience of NO_x reduction. The participants were given a task of creating a vision of an Asian Megacity for the year 2026 and describe how to get there utilizing a concept of backcasting approach. Each group worked on the task finding major forces, such as technological, natural, scocietal, political, economic forces, contrasting past, present and future and presented their analysis, which gave a good feeling of scenario generation.

iii. Atmospheric Modeling

Mr. Manuz Engardt (SMHI) briefly mentioned about the need and importance of atmospheric modeling, and its compliment to measurements. The atmospheric modeling is useful in mapping remote regions (areas without measurements), environmental assessments, checking emission inventories, understanding processes in the atmosphere, and providing much needed data to impact assessment models (health, acidification etc.). Mr. Engardt provided several examples of the outputs of MATCH model, in particular deposition of acidifying species in Sweden and South Asia. He provided a brief overview on kinds of models, data and uncertainties in modeling, performance checking of a model, the basic concepts of meteorology and atmospheric dispersion modeling, types of models (Box, Gaussian, Lagrangian,

Eulerian models etc.), MATCH model and showed the Chernobyl accident modeling using MATCH model as an example. The participants were also introduced to HYSPLIT model (available online at NOAA's website) for air mass trajectories computations, and trained to use the model for their respective sites in Malé Declaration countries. They were very much interested and keen to use this facility.

iv. Integrated Information and Assessment Model (IIAM)

Mr. Johan Kuylenstierna (SEI) and Ms. Pwint (RRCAP) presented the IIAM that is being developed at UNEP RRCAP, its purpose, its various components, its link to the MATCH model, use of transfer coefficients, its outputs, and asked for the participants' suggestion and cooperation for its future development such as collection of the relevant data in the Malé Declaration countries, inclusion of other pollutants such as ozone and $PM_{2.5,}$ impacts such as crop yield losses, corrosion, health etc.. As of now, IAAM includes only acidifying pollutants and their deposition, and thereby calculates the risk areas using the ecosystem sensitivity maps. Participants have realized the promise of using this integrated model in the assessment of impacts, and policy making process.

4. Outcomes

1. **Emission Inventory:** The Male Declaration air pollutant emissions inventory manual (draft) accompanied by a workbook (Excel) for compilation of activity data and computation of emissions of major air pollutants.
2. **Scenarios:** A comprehensive manual for the development of emission scenarios for air pollution prevention and control in South Asia, and Policy options for air pollution prevention and control in South Asia.
3. **Atmospheric Modeling:** Introduction of MATCH model for atmospheric transport/transformation and deposition, and HYSPLIT model for air mass trajectory computation.
4. **IIAM**: An integrated information and assessment model (IIAM) and Users' Manual.
5. Successful completion of first emission inventory workshop, a capacity building training.

5. Evaluation and Comments from Participants

All participants were provided with the questionnaire for the evaluation of the training workshop and provide their comments and feedbacks on contents, methodology used in the workshop as well as logistics provided to them. The summary of the evaluation is presented in annex 2. Overall, 50% of the participants rated the training workshop as "Excellent", other half rated it as "good", and none for "Average" or "Unsatisfactory". Attachment 3.

6. Email Forum

The participants demanded of the establishment an electronic discussion forum to facilitate the technical discussions on emission inventory, scenario, and modeling. UNEP RRCAP has been established as email discussion forum. Participants can send their technical concerns to the following email, which will automatically be distributed to all participants:

MD_IIAS@rrcap.unep.org

This forum is dedicated to providing timely solutions for the technical issues faced by the Male' Declaration expert network on IIAS, emission inventory, scenario, and modeling. Members of the Malé Declaration network are encouraged to email to this discussion forum frequently and raise your technical issues or provide prompt answers to the issues raised by others in the network.

7. Work Plan until Next Workshop

The participants have been asked to continue working on emission inventory compilation, and verify the assumptions made, check for mistakes in workbook, make a list of missing activity data and find them if possible, replace the international activity data and emission factors with better local data, and document the changes made in the workbook. Each participating country will write a report on main findings of the inventory compilation activities, share the problems through the email forum, summarize the findings, and make a presentation in next workshop in January or February of 2007.

Likewise, participants are asked to collect the relevant data so that the knowledge gathered in compiling scenarios using the international methods during the workshop can be tailored to the Malé Declaration Countries, and explore the possibilities how policy options can be systematically considered in the South Asian context to help decision making on controlling and preventing emissions.

Regarding the modeling, MATCH model will be installed at RRCAP as a first step. MATCH model will be run at RRCAP or at SMHI to meet the requirements/demands of the participating countries. Participants from each country have been asked to utilize the availability of HYSPLIT model, and compute the backward air trajectories for year 2000 for Malé Declaration sites, gain the knowledge on influence of various possible airflow regimes to Malé Declaration sites.

The IIAM for Malé Declaration countries requires substantial inputs and advices from the participants so that it can be improved to make it useful for the Malé Declaration countries. The next phases of the IAAM development are aimed at determining national ecosystem assessments, investigating national scenarios, and inclusion of other pollutants and impacts.

Attachment 1: List of Participants

Attachment 2: Training Programme

Attachment 3: Summary of the evaluation of workshop

Attachment 4: Presentation

I: Compilation of Emission Inventory Data

II: Scenarios Development

III : Atmospheric Modeling

IV: Integrated Information and Assessment Model (IIAM)