

**Report of the third Training Workshop on “Emission inventory preparation / scenarios / atmospheric transport modeling workshop” under the Malé Declaration
Bangkok, Thailand, 28 January to 1 February 2008**

Background

Capacity Building has been one of the major priority areas identified during consultations on the Phase III implementation of the Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia. Accordingly, two training workshops on emission inventory, emission scenario and modeling were held in 2006(3rd – 8th July) and 2007(26th – 2nd March) respectively. The third follow up training was held at the Asian Institute of Technology, Thailand from 28th January – 1st February 2008. The agenda of the workshop is enclosed in Annexure 1.

Participants

There were seventeen participants from all eight Male’ Declaration participating countries, were from the Government Agencies dealing with the environment and of meteorology. The resource persons were from Stockholm Environment Institute - York (SEI-Y), International Institute for Industrial Environmental Economics (IIIEE), Institute for Environment and Sustainability (European Commission), and the Swedish Meteorological and Hydrological Institute (SMHI). The list of participants and resource persons is provided in Annexure 2.

Presentations

Day 1: January 28

The first day of the training began with participant’s introduction, their experience in emission inventory activities and their expectations from the workshop. The first presentation (Annexure 3) was by Mr. Mylvakanam Iyngararasan, Head, Early Warning, UNEP RRC.AP, with brief background information on the Male’ Declaration and its objectives.

Since most of the participants were new to the training, a brief review of the previous workshop was provided by Mr. Harry Vallack, SEI-Y, with emphasis on the emission inventory worksheets. The presentations are given in Annexure 4A and the emission inventory worksheets, manuals and tools are given in Annexure 4B

The afternoon session had a presentation on the major findings of emission inventory work carried out since the 1st workshop by the participants from Bangladesh, Pakistan, Nepal and Sri Lanka. India and Iran presented the emission inventory work done in their country, summarizing the data collected from a variety of sources in terms of absolute values/percentage shares of the pollutants and their sources. The participants also highlighted the challenges faced by them in getting data and information, especially in the form required to be input into the emission inventory worksheet. The need for institutionalizing the expertise within the country for assurance of long term sustainability was a common concern. The presentations by the respective countries are attached as Annexure 4C.

During the last session of the day, Mr. Vallack presented the major amendments made to the Malé' emission inventory workbook since the last workshop, given in Annexure 4D. Following were the details of the changes that need to be focused on

- The need for new Particulate Matter emission factors to be entered into each country's existing workbook in order to improve their 2000 inventory
- The need to transfer summary data into stand alone 'graph' workbook after updating the inventory and providing a copy of this edited workbook to UNEP RRC.AP to upload in the IIAS.
- Need to use the new version (2.4) of the Malé Inventory Workbook for any future inventories.

This was followed by a presentation on the importance of Quality Control and Quality Assurance (QA/QC), primarily meant for transparency, accuracy, completeness, consistency and comparability of the inventories of the Emission inventory work. The

presentation is enclosed as Annexure 4 E. Mr. Vallack detailed the QA/QC checks and priorities which was followed by familiarizing with the new version of the workbook. The exercises helped the participants become familiar with the Emission Inventory worksheets.

Day 2: January 29

On the second day, morning session started with a presentation on “Global Emissions of Air Pollutants and Greenhouse Gases’ by **Dr. John van Aardenne**, from the Climate Change Unit, Joint research center, European Commission. The main objective was to find out the differences between the EDGAR Emission Inventory and the Malé Declaration Emission Inventory worksheets in terms of data collection, emission factor, emission sources, etc. Emissions of selected countries such as Sri Lanka, Nepal, and Pakistan were presented and compared. The details are attached in Annexure 4F.

Next, Mr Vallack delivered a presentation on the methodology for accounting emissions from Large Point Sources (LPS). He explained the need for a separate methodology for LPS and the data required. The presentation and two LPS exercises taken from the previous workshops are attached as Annexure 4G.

Each country was advised to prepare a report along with the computation of their inventory in the style and format as that presented by Zimbabwe (Annexure 4H).

Day 3: January 30

The third day started with a session on Emission Scenarios by Mr. Lars Strupeit from IIIIEE, University of Lund, Sweden. He briefly summarized the contents of previous two training workshops and then provided an overview of the types of emission scenarios and its role within the air quality management cycle. He then associated its relevance with Integrated Assessment Modeling (IAM) and other components of the IAM, such as Emission Inventories. The presentation is attached as Annexure 5A.

Next, Mr Strupeit explained about the necessity of conducting energy scenarios in order to estimate emission levels arising from fuel combustion. In order to provide better insight into the energy scenario, he presented a case study conducted by the International Energy Agency and published in the World Energy Outlook 2007 about the energy scenarios for India in 2030. Additionally, he emphasized that future levels of energy demand and fuel mix are highly sensitive to expected rates of economic growth and exogenous factors like world energy prices. He also focused on the following:

- Outlining methods and approaches to build energy and emission scenarios
- Explaining the key factors that determine vehicle ownership and its use
- Presenting synthesized relations between energy prices, energy demand and the composition of the fuel mix
- Explaining approaches to model the change of technology over time and the inherent impact of this change on emission factors.
- Providing insight on modeling to show the effects of policy intervention on emissions.

The presentation is attached as Annexure 5B.

During the afternoon session, Mr. Strupeit conducted a hands-on exercise where participants were asked to build the energy and emission scenarios of India for the year 2030. The exercise was based on IEA energy data for the year 2000 and attendants were supposed to calculate future demand and emission levels for SO₂ and NO_x as a function of key parameters, such as GDP growth, anticipated changes in fuel mix, and the penetration and effectiveness of emission control measures. The introductory slides to this session are attached in Annexure 5C.

Day 4: January 31

The participants continued working on the exercise on emission scenarios, based on the guidance given on Day 3. Subsequently, four teams presented their results from the exercise, followed by a discussion of the findings.

In the afternoon, Dr. Magnuz Engardt from SMHI, gave an overview of dispersion models, attached as Annexure 6A. He discussed about their use, the input data needed and sources of errors in the models. This was followed by a lecture on trajectories, which is used to find the origin or the destination of an air-mass, attached as Annexure 6B. After a general description of trajectories, Dr. Engardt introduced the participants to the HYSPLIT trajectory model. The participants continued to work on the trajectory model.

Day 5: February 1

On the last day, Dr. Engardt discussed in detail about the dispersion models. He clarified the difference between, Gaussian, Lagrangian and Eulerian models and highlighted the suitability of models at different scales. He clarified that Gaussian model is used for local applications while Lagrangian and Eulerian models are used on scales from local to continental and global. Dr. Engardt also portrayed the connection between Trajectories and Lagrangian dispersion/chemistry models. The benefits and drawbacks of the more complex, Eulerian models, especially MATCH model in particular, were also discussed. The presentation is attached as Annexure 6A and 6B.

During the afternoon session, all the country representatives, presented trajectory calculations valid for their monitoring stations. Presentations are attached as Annexure 6C. The seasonality of the transport pattern to the monitoring stations was, in many cases, clearly evident.

Dr. Johan Kuylenstierna, SEI-Y, presented the update on the Integrated Assessment Model (IAM) being developed for the Malé Declaration, named as Integrated Information and Assessment System (IIAS). Dr. Johan was assisted by Ms. Pwint Phyu Aung from UNEP RRC.AP. The progress in the development of the model was presented and its current functionalities were demonstrated. The IIAS serves as a way to integrate the different Malé Declaration activities, conduct further research and provide additional information. Dr. Johan demonstrated the use of IIAS, by presenting the example of sulphur deposition in South Asia, which was done using the EDGAR database on emissions and the MATCH model. He showed that this approach could be used for the

other pollutants also for risk assessments, and therefore helpful in investigating various sub-regional and national scenarios. The presentation is attached as Annexure 7.

Evaluation of the training

There was active involvement of the participants in the workshop and emphasis was given to practicing the concepts, with over fifty percent of the time spent on exercises and case studies. On the last day of the workshop, an evaluation form was filled in by the participants, given in Annexure 8. The evaluation showed that the participants were satisfied with the training. The main suggestion was on having appropriate length and timings for the training, and to spend more time on modeling and impact assessment.