

ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC

**REPORT OF THE EXPERT GROUP MEETING
ON EMISSION MONITORING AND ESTIMATION**

27-29 January 1999, Niigata, Japan

I. ORGANIZATION OF THE MEETING

1. The Expert Group Meeting on Emission Monitoring and Estimation, organized by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and hosted by the Ministry of Foreign Affairs and the Environment Agency of Japan, Niigata Prefecture and City of Niigata, was held in Niigata, Japan from 27 to 29 January 1999.

1. Attendance

2. The Meeting was participated by experts from four countries of Northeast Asia, namely, China, Japan, Mongolia and Republic of Korea. Experts from five countries of the Southeast Asia, namely, Indonesia, Malaysia, the Philippines, Thailand and Viet Nam, also participated. It was attended by the representatives of the Asian Development Bank (ADB), the Commission for Environmental Cooperation (CEC), the European Monitoring and Evaluation Programme (EMEP), the United Nations Environment Programme/the International Environmental Technology Centre (UNEP/IETC).

2. Opening statements

3. The Meeting was opened on behalf of ESCAP by Mr. U.Wai Lin, Environmental Affairs Officer, Environment Section, Environment and Natural Resources Development Division, ESCAP through his opening address. Mr. Wai Lin emphasized the importance of this Meeting in the context of the Regional Project on Technical Assistance for Environmental Cooperation in North East Asia, and expressed thanks and gratitude to the Ministry of Foreign Affairs, the Environment Agency of Japan, Niigata Prefecture and City of Niigata for hosting the Meeting. He also expressed deep appreciation to the Asian Development Bank (ADB) for the strong support provided toward the regional project and requested for the Bank's continued support for strengthening environmental cooperation in Northeast Asia.

4. Mr. Yutaka Yoshida, Councilor of the Minister's Secretariat, the Environment Agency of Japan, in his opening statement, gave his thanks to the experts for their participation in the Meeting. Mr. Yoshida expressed his expectation for the experts to take the initiative in sharing their experience, expertise and information, particularly by Japanese ones, on emission monitoring and estimation. He stated that the Environment Agency of Japan is pleased to support the effort towards improvement of air quality in Northeast Asia and other Asian sub-regions in cooperation with the ESCAP Secretariat and other international organizations. It was followed by Mr. Ikuo Hirayama, Governor of Niigata Prefecture, with his welcoming statement. He emphasized that Niigata Prefecture, based on the serious experience on environmental pollution problems, had been making significant effort to solve the environmental problems in the Prefecture, and to lend the support to the international activities to tackle global environmental problems. In this connection, he noted the Prefecture's active support of activities leading towards the establishment of Acid Deposition Monitoring Network in East Asia (EANET). It had also been supporting bilateral environmental cooperation in particular, by dispatching experts to the China-Japan Friendship Environmental Protection Centre. Mr. Hirayama also stated that he strongly appreciated the ESCAP in

organizing the Meeting, because of the important role of international organizations in addressing global environmental issues. Mr. Hiroshi Kumagai, City Treasurer of Niigata City, made a welcome statement on behalf of the Mayor of City of Niigata. He explained that City of Niigata was surrounded by two big rivers and was known as the aqua-city with beautiful nature. To protect these assets, the city had been making much effort to promote recycling and harmonize people's lifestyle with nature. It had also been conducting international environmental protection activities, e.g., with Harbin City, China, which is a sister city of Niigata City. He hoped that the Meeting would have very fruitful outcomes for protection of air quality in East Asia.

5. Dr. Prodipto Ghosh, Senior Environment Specialist, Office of Environment and Social Development, ADB, highlighted the ADB's deep appreciation for the organization of this Meeting and expectation for the fruitful outcomes of the Meeting.

3. Election of officers

6. The Meeting elected the following persons as the Chairperson, the Vice Chairperson and the Rapporteur of the Meeting.

Chairperson: Dr. Kentaro Murano, Senior Researcher, National Institute for Environmental Studies (Japan)

Vice Chairperson: Dr. Supat Wangwongwatana, Director, Air Quality and Noise Management Division, Pollution Control Department, Ministry of Science, Technology and Environment (Thailand)

Rapporteur: Dr. Jun-Seok Cha, Senior Researcher, Air Quality Research Department, National Institute of Environmental Research (Republic of Korea)

4. Adoption of agenda

7. The Meeting adopted the following agenda:

- 1 Opening of the Meeting
- 2 Election of officers
- 3 Adoption of the agenda
- 4 Overview of the emission monitoring and estimation activities in Northeast Asia and other parts of the world
- 5 Emission monitoring
- 6 Emission estimation
- 7 Future activities to improve emission monitoring and estimation in East Asia
- 8 Study tour
- 9 Consideration and adoption of the report

II. OVERVIEW OF THE EMISSION MONITORING AND ESTIMATION ACTIVITIES IN NORTHEAST ASIA AND OTHER PARTS OF THE WORLD

(Item 4 of the agenda)

8. Mr. Wai Lin, ESCAP provided an overview of the activities carried out under the framework of the Regional Project on Technical Assistance for Environmental Cooperation in North East Asia, initiated in 1996 with the support of ADB. The main objective of this project was to promote regional cooperation for environmental protection in the participating countries of Northeast Asia. The project consisted of the implementation of sixteen activities, which included six technology demonstration and on-site workshops, four expert meetings, the development of four project profiles and two project review meetings. He noted that after the Final Review Meeting in May 1998, two more additional value-added activities were carried out, namely the Expert Group Meeting to Review the Draft Outline of Training Manual on Pollution Reduction in Coal-Fired Power Plants, which was held in October 1998 in Ulaanbaatar, Mongolia, and the other was this Niigata Expert Group Meeting on Emission Monitoring and Estimation. As a follow-up to the project, four new subproject proposals were under consideration for support by ADB. In response to a question raised, it was clarified that the fourth Meeting of Senior Officials endorsed the establishment of a regional clearinghouse and data center to coordinate comparability of monitoring equipment, analytical methods, calibration practices, sampling methods, presentation and analysis of data, and the development of a network of ambient air quality monitoring stations. The Meeting was informed that the Republic of Korea had agreed to host the proposed center at the National Institute of Environmental Research (NIER) in Seoul; the function of this center to be further elaborated.

9. Mr. Mike Woodfield, Chairman of the UN/ECE Task Force on Emission Inventories (TFEI) briefly reviewed the historical development of the Convention on Long-Range Transboundary Air Pollution (LRTAP) and its structure. He noted that the TFEI was initiated in 1991. He described the EMEP/CORINAIR Atmospheric Emission Inventory Guidebook and the substantial expert network, which supports it. The Guidebook is a tool to assist member states, whatever their stage of development, to estimate and report their emissions. The Guidebook was first published in 1996 and is revised yearly. It is a comprehensive source of reference, including emission factors, abatement technologies and other relevant information contributed by more than sixty experts from twenty-three countries.

10. He invited ESCAP and its member countries to use the guidebook, join the expert network, to benefit from the European experience and to promote inter-regional coordination. He emphasized the importance of coordination with standardization organizations, particularly ISO TC 146, and promotion of public awareness of emissions.

11. Dr. Andrew Hamilton, CEC introduced the North American Agreement on Environmental Cooperation (NAAEC), and the Commission for Environmental Cooperation (CEC) for encouraging trilateral cooperation among three countries (Canada, Mexico and the United States) in addressing transboundary and international pollution issues. Two of the Commission's major mechanisms are the Sound Management of Chemicals, and the Continental Pollutant Pathways initiatives. The primary focus

of the Continental Pollutant Pathways initiative was on pollutants released to, formed within, or transported by, the atmosphere. Most attention was given to air pollutants that were likely to be transported across international boundaries. The Sound Management of Chemicals initiative has provided a mandate for developing North American Regional Action Plans (NARAPs) for DDT, chlordane, PCBs and mercury. He emphasized that the issues related to both the Continental Pollutant Pathways and the Sound Management of Chemicals initiatives were likely to be cross-media issues involving air, land, water and biota. He also emphasized the need to promote collaboration in the measurement, monitoring and assessment of persistent and toxic substances. In response to the questions raised, he elaborated on the process for identifying priority chemicals, for regional action under the program.

III. EMISSION MONITORING

(Item 5 of the agenda)

12. Dr. Ghosh of ADB noted that ADB had been actively supporting the Regional Project on Technical Assistance for Environmental Cooperation in North East Asia in the previous several years. He stated that, in line with its strategic objectives of environmental protection and promotion of regional cooperation, ADB was considering to participate in the next stage of the regional environmental cooperation project in Northeast Asia, in association with other bilateral, national, and multilateral organization. In response to a question raised, he clarified that in his view ADB would be pleased to carefully consider a request to support a similar regional project in Southeast Asia, if it was officially requested by some regional bodies, similar to the Senior Officials Meeting in Northeast Asia.

13. Mr. Shusheng Liu from China introduced present status of emission monitoring activities, including institutional arrangements, emission monitoring activities from heavily polluted sources routine and supervision monitoring, and emission control activities highlighting the estimated emissions of various pollutants in 1995 and 2000. He identified the lack of a strong legal framework for emission monitoring, economically feasible monitoring equipment, financial resources and skillful staff etc. as major constraints. To overcome such constraints, he suggested the promotion of regional collaboration for case studies, collaboration among governments, and increased financial support for emission monitoring. In response to the questions raised, he clarified that all the emission monitoring data were collected and filed by the National Environmental Monitoring Center. He also explained that the work was underway to develop emission permits at provincial level.

14. Dr. Kozo Ishida from Japan described the institutional arrangements for air pollution control, emission monitoring and air pollution control activities for stationary and mobile sources with detailed explanation of monitoring methods. He highlighted some technical and administrative constraints, such as different certification systems in various countries. He proposed the establishment of an internationally applicable certification system, to hold an international training workshop on emission monitoring techniques to promote capacity building and disseminate technical information. He also proposed the development of a technical manual for emission monitoring, and stated that the Japan Environmental

Technology Association would like to participate in and contribute to such a training workshop and act as the coordinator to prepare a preliminary draft of the technical manual with support from the participants of this Meeting.

15. Mr. Munkhtuvshingyn Ganbat from Mongolia briefly highlighted the institutional arrangements for environmental administration, ambient air quality monitoring activities, the present status of emission monitoring of power plants and the vehicle inspection program. He noted that even though power plants should install emission monitoring equipment, they had yet to do so due to financial constraints. He further informed that based on emission measurement through a pilot project, the Ministry of Nature and the Environment had issued emission permits for SO_x, NO_x and dust emissions for the power plant No. 3. He stressed that emission monitoring was at an initial stage in Mongolia and they were encountering significant constraints including a lack of necessary equipment, skillful personnel, a legislative framework such as emission standards, and financial resources.

16. Dr. Jun-Seok Cha from the Republic of Korea introduced the institutional arrangements for environmental administration in the Republic of Korea, emission monitoring with emphasis on stack emission transmission system in Yochon. He noted that there were some limitations of transmission systems such as the loss of data caused by inconsistency transmission protocols, difficulty in expansion of the system, and comparability problem. To overcome these limitations, he emphasized the need to prepare standard specifications for hardware and software for transmission equipment and host computers, and the importance of computer-related education.

17. Mr. Achmad Gunawan Widjaksono from Indonesia described the institutional set-up of the Environmental Management Agency (BAPEDAL) and its functions, emission monitoring activities through questionnaire surveys, emission control activities such as pollutant standard index (PSI) of USEPA. He noted that the major training needs related to both technical and management aspects. Technical aspect included the introduction of new technologies for air pollution control, analysis of emission standards, the development of technical guidelines etc. Management aspects included advanced training for air pollution control, covering monitoring of stationary and mobile emission sources, reporting procedures and compliance issues of regulations.

18. Mr. Mohd Famey Yusoff from Malaysia briefed the meeting on legislative and institutional arrangements for environmental management and the present status of the ambient air quality monitoring program. For the ambient air quality monitoring, 38 automated Continuous Air Quality Monitoring (CAQM) stations with telemetry capability had been established, and data were evaluated in the form of Air Pollutant Index (API) values. Air pollution control in Malaysia had been developed as an integrated approach by using emission standards for air pollution control and air quality management based on acceptable ambient air quality. He emphasized that the major constraints were the lack of training mostly on the technical aspects such as measurement and sampling techniques, and, management and analysis of data. He also stressed the importance of public awareness on air pollution problems.

19. Mr. Emmanuel M. Gutierrez from the Philippines briefly introduced the institutional arrangements, emission monitoring activities in the National Capital Region (NCR), emission estimation and control activities. He noted that implementation of emission monitoring varied from region to region depending upon the needs, strategy, funding, available facilities and mandates of emission abatement programs of the regions concerned. NCR had the largest number of personnel and facilities, but these were still insufficient for emission monitoring. Industrial emission monitoring in NCR was conducted during plant inspections, initially using visual determination of smoke opacity. He stated the major constraints were a lack of legal framework such as the establishment of the clean air act supported by appropriate industrial emission limits. Lack of equipment and limited industrial emission data were also considered among major constraints.

20. Dr. Supat Wangwongwatana from Thailand introduced, in his presentation, emission monitoring activities, Government measures to reduce air pollution from stationary sources and motor vehicles. He highlighted an automatic computerized internet-based reporting system to receive telemetrically transmitted emission monitoring reports from major point sources. He emphasized the need for emission monitoring at major sources, especially concerning continuous emission monitoring system (CEMs).

21. Dr. Nguyen Hoang Yen from Viet Nam explained the legislative and institutional arrangements for environmental management, ambient air quality and emission monitoring activities, emission estimation activities, and major constraints that they were facing in Viet Nam. She stressed the shortcomings in enforcing emission monitoring, particularly for old factories that were both economically and technically very weak. She also emphasized the need to strengthen laboratories for environmental monitoring at all levels, in particular, at local-level. To overcome these constraints, she identified the need for legal provisions, standard setting, training at all levels, and financial resources specifically for environmental protection.

22. During discussions on problems, and constraints of emission monitoring, Dr. A. Bakar Bin Jaafar of Alam Sekitar Malaysia Sdn Bhd (ASMA), an ESCAP resource person, briefed the privatization of both environmental and source monitoring program in Malaysia. He highlighted the cost-effectiveness and high performance of such an approach initiated by the government of Malaysia, and recommended others to consider similar program. He also highlighted that the data generated had benefited not only regulatory bodies but also various industries and the public. The established database may also be used to validate any estimation of emission data.

23. The Meeting noted a proposal to develop a regional environmental database on emission monitoring. In this connection, some attempts, such as a regional environmental database by ADB project and by RAINS ASIA were introduced.

24. The Meeting also noted a proposal by the Japanese expert for technical manual was discussed. The Meeting generally welcomed the initiative by Japan and considered that such an attempt could be a useful step. In this regard, the importance of inter-regional exchange of information and cooperation was

stressed. It was suggested that the manual might include (i) various types of instrumentation; (ii) standardization procedures such as that developed by ISO TC 146; (iii) data transfer protocols; (iv) QA/QC activities; and (v) training. It was pointed out that standardization seems to be difficult, considering the different instrumentation in the countries of the region. It was pointed out that the manual could also deal with emission factors.

25. Based on the experience gained in Europe, the Meeting proposed the following steps to develop the manual:

- (i) comparison of data among countries of the region and the identification of similarities and differences;
- (ii) review of measurement methods and the quality of data generated in the region; and
- (iii) development of a manual to assure comparable and, good quality of data.

IV. EMISSION ESTIMATION

(Item 6 of the agenda)

26. Dr. Wesley Foell, RMA, and Mr. Collin Green, NREL, made a presentation on RAINS ASIA project with emphasis on emission module, and clarified/responded to the questions and comments raised. Dr. Foell emphasized that the RAINS ASIA model was a tool for policy analysis, e.g. for identification of priority areas, sectors, and/or sources. He also stressed that RAINS was an integrated model starting from energy scenario through impact on ecosystem. He pointed out that RAINS could contribute to the emission monitoring and estimation, e.g. by using it for evaluation of emission factors and design of monitoring systems.

27. Mr. Liu from China made a presentation on emission estimation activities in China. In his presentation, he informed the Meeting that SO₂ emissions were estimated annually by local environmental protection bureaus (EPB) and that emissions from power plants and other large stationary sources were estimated in China. For area sources, estimations were calculated using emission factors. He pointed out that estimation of other air pollutants, such as TSP and NO_x were more difficult.

28. Dr. Yutaka Tonooka from Japan outlined the Japanese approaches to estimate the emissions of pollutants. He noted that Japan employed both top down and bottom up approaches. The bottom up approach was conducted, based on the survey of a huge number of emission sources. He noted that the Environment Agency of Japan carried out a survey on NO_x, HC and particulate matter (PM) and estimated nation-wide amounts of SO_x, NO_x and dust emissions. He also noted that the emission of ammonia and volatile organic compounds (VOCs) had been carried out on a research basis.

29. Mr. Ganbat outlined the emission estimation activities in Mongolia by stating that the first attempt had been made in 1994 with a simple method. He proposed a case study on emissions estimation,

as well as on bilateral basis with EC, USAID, JICA, etc., of Mongolia under the framework of environmental cooperation in Northeast Asia. He also suggested to develop a relatively simple guidebook, taking into account the guidebook developed in Europe and other experiences that could be applied further in other countries in the region with conditions similar to Mongolia.

30. Dr. Cha from Korea presented the emission estimation activities in Korea and methodologies, including the institutional structure used for emission estimation and the estimated amounts of emissions. He noted that NIER was developing new emission estimation method (direct method) and certified formats to enable more detailed and precise estimation. He also pointed out the importance of developing software /hardware for emission estimation, the inclusion of VOCs and so on.

31. Mr. Gunawan from Indonesia introduced emission estimation activities for SO₂, NO_x and PM in Jabolabek area. He showed a concentration map of SO₂ from all sources and described the attempt to assess future conditions with selected countermeasures.

32. Mr. Yusoff from Malaysia reviewed his country's emission estimation activities, including the institutional structure and estimation processes for both stationary and mobile sources. Information on emissions was obtained from large scale industries through licenses, and relevant government agencies, for smaller industries by questionnaires. Estimations were made by using emission factors. He pointed out the usefulness of local and international training programs, the need for emission factors to meet local conditions, and improvement in information collection processes can further improve emission estimation program in Malaysia.

33. Ms. Clarissa Cabacang from the Philippines provided detailed information on the estimation of carbon dioxide emission from energy sources carried out in the Philippines based on the IPCC methodologies. She pointed out that default values were used for emission factors. She stressed that the Philippines had been promoting demand side management as well as use of renewable energy to limit GHG emissions from the energy sector.

34. Dr. Supat presented the emission estimation activities in the past several years in Thailand, including the legal and institutional arrangements for emission estimations, several attempts such as emission using IPCC methodologies, SO₂ emissions using RAINS ASIA model. He also explained the database for industrial and traffic emissions and computerized display system.

35. During the discussion following the presentations from Northeast Asian countries, intensive discussion was held on the priority of pollutants. It was proposed by Dr. Tonooka to establish the first priority for SO₂ and NO_x and the second for VOCs and NH₃. While estimation of VOCs was more difficult than SO₂, and NO₂, it was suggested that European experiences could be gained from the EMEP CORINAIR Atmospheric Emission Inventory Guidebook. While some cations such as Ca²⁺ were also important, it was pointed out that Ca²⁺ had been taken into account in the modelling works.

V. FUTURE ACTIVITIES TO IMPROVE EMISSION MONITORING AND ESTIMATION IN EAST ASIA

(Item 7 of the agenda)

36. The Meeting agreed that the following list of activities that could be considered in the implementation of the project, especially in the Northeast Asian countries:

- Collection and analysis of existing emission estimation data from the participating countries;
- Case studies to learn more about emission estimation methodologies;
- Development of guidelines or guidebooks for emission estimation and monitoring and an establishment of a regional task force of experts for this purpose;
- Studies on locally specific emission factors to meet local conditions;
- Development of an institutional framework, e.g. regional task force, for further promotion of the follow-on project;
- Consideration of the possibilities for broadening the geographical perspective of these activities by involving the Southeast Asian countries.

37. The Meeting discussed the priority of target pollutants for emission monitoring and estimation. Experts agreed that PM should be among the first priority list, but it was pointed out that it is technically difficult to obtain meaningful emission data of particulate matter (PM). The meeting concluded that the first priority for emissions monitoring and estimation is SO₂ and NO_x. The second priority is PM. The third priority for both monitoring and estimation is NH₃ and VOCs. The level of project funding by available resources will determine the ultimate number of pollutants to be considered in the project and the effort devoted to each of the pollutants.

38. The Meeting appreciated and welcomed the generous willingness of the Government of Japan to make a significant contribution to develop guidelines or guidebooks for emissions monitoring and estimation. The preparation of such guidebooks would enhance and accelerate the work of the subregional Clearinghouse Centre, located at the National Institute for Environmental Research (NIER) in the Republic of Korea, in its work to help build capacities in the individual countries. It would also contribute to the development of a truly regional human resource base.

39. The Meeting felt that a carefully chosen set of case studies would aid capacity building in emission monitoring and estimations at the national level. Parallel to the development of these case studies, work would be initiated on the development of the guidelines or guidebooks. The two parallel tracks will reinforce each other and address the different needs among the various countries in the region. The process could be gained by a task force of experts.

40. The Meeting stressed the importance of developing guidebooks for the purpose of capacity building for emissions estimation. Guidebooks for emissions monitoring are also a high priority. These guidebooks, however, should not be interpreted as an attempt to standardize methods but as tools to

facilitate the comparability of data. It was further emphasized that the guidebooks would enable flexible approaches to emissions estimation, taking into account the variations between countries in the region with respect to data availability, technical skills and equipment variability.

41. The Meeting proposed that the guidebooks for emission monitoring and estimation should be developed through a regional cooperative effort of a team of experts from the participating countries identified by the task force.

42. The Meeting noted that the projects endorsed by the senior officials are being considered seriously by ADB. At present, the proposals for follow-on projects are at a formative stage. The representative from ADB expressed interest in hearing the suggestions from the participating countries regarding the scope of the follow-on project including suggestions as to how the proposal from the Japanese government to develop guidebooks for emissions monitoring and emissions estimation could complement and enhance the ADB's activities in the follow-on project. The outcome of this Meeting would be helpful in the formulation of the follow-up project. The ADB representative was hopeful of being able to give more information regarding the potential budget and scope of the follow-on project at the Meeting of Senior Officials in Kobe, Japan in February 1999.

43. The ESCAP secretariat noted that the report of this meeting would be submitted forthwith to the participants of the upcoming meeting of Senior Officials in time for the participants to prepare for the forthcoming meeting of Senior Officials.

VI. STUDY TOUR

(Item 8 of the agenda)

44. The Meeting undertook a study tour to observe emission monitoring activities at Higashi Niigata Thermal Power Plant and the centralized telemeter system for emission monitoring as well as air quality monitoring, operated by Niigata Prefecture. The Meeting expressed its gratitude to the people in Higashi Niigata Thermal Power Plant and Niigata Prefecture for their kind arrangements for the study tour.

VII. ADOPTION OF THE REPORT

(Item 9 of the agenda)

45. The Meeting considered and adopted the report of the Meeting on 29 January 1999. The Meeting expressed deep appreciation to the Ministry of Foreign Affairs and the Environment Agency of Japan, Niigata Prefecture and City of Niigata for hosting this important meeting, and in particular, for their generous hospitality.