

The Eleventh Senior Technical Managers' Meeting
on the Acid Deposition Monitoring Network in East Asia
2-3 September 2010, Niigata, Japan

Progress report on revision of the technical manual on wet deposition monitoring

Secretariat of the Expert Group
on Revision of the Technical Manual
on Wet Deposition Monitoring

I. Background

1. The IG9 approved the establishment of the Expert Group on Revision of Technical Manual on Wet Deposition Monitoring together with other Task Forces and Expert Groups based on the recommendation of the SAC7. The task forces and expert groups have enabled more effective implementation of the scientific activities of the Strategy on EANET Development (2006-2010) in collaboration with the NC and the Secretariat of EANET.
2. SAC7 appointed Prof. Hiroshi Hara as the Chairperson of the Expert Group on Revision of Technical Manual on Wet Deposition Monitoring and the NC for EANET as the secretariat.
3. The first and second meetings of the Expert Group were held at ADORC on 2 - 3 October 2008 and on 1-2 October 2009, respectively.

II. Activities

II-1. Approved Terms of Reference (TOR) of the Expert Group

4. At the IG10 (2008), the TOR was approved as the following contents:
 - To identify the technical and administrative problems associated with wet deposition monitoring encountered in the EANET operation since the beginning of the preparatory-phase operation
 - To evaluate differences in the measurement techniques of other regional monitoring programs and modify the current EANET procedures if necessary for comparability of the measurements
 - To discuss advances in the measurement techniques in long-term monitoring and intensive studies, and modify such techniques in an appropriate manner for the EANET Technical Manual
 - To produce a revised Technical Manual on Wet Deposition Monitoring

II-2. Members

5. The members of the Expert Group are as follows:

Prof. Hiroshi Hara (Chairperson)	Tokyo University of Agriculture and Technology, Japan
Mr. Izumi Noguchi	Hokkaido Institute of Environmental Sciences, Japan
Dr. Tsuyoshi Ohizumi	ACAP
Ms. Bulgan Tumendemberel	Office of National Security Council, Mongolia
Dr. Joon Young Ahn	National Institute of Environmental Research, Republic of Korea
Dr. Hathairatana Garivait	Environmental Research and Training Center, Thailand
Dr. Dave Mactavish	Science and Technology Branch, Environment Canada
Ms. Leong Chow Peng	Malaysia
Mr. Shinji Nakayama	ACAP

II-3. Major discussions at the first meeting of the Expert Group

6. The major discussions of the first meeting are summarized as follows:

- The revised manual should, as far as possible, harmonize with procedures in the WMO Manual for the GAW Precipitation Chemistry Programme and EMEP manual for sampling and analysis.
- The recommended procedures for siting of sites should apply to the other monitoring activities of EANET.
- The revised Technical Manual shall contain more precise information regarding snow sampling as requested by the Task Force on Monitoring Instrumentation.
- The revised Technical Manual shall include a list of useful websites in the Appendix.
- In view of the importance of meteorological data for assessment of acid deposition, the meeting agreed that the revised Technical Manual shall further stress the importance of the measurements, the need to follow the WMO siting criteria for the meteorological instruments and the importance of regular calibration.
- The current Data Quality Objectives (DQOs) for EANET could be further improved and decided to follow the format of the WMO Data Quality Objectives for Global Atmospheric Watch Programme (GAW).
- The importance of preparation of SOPs for all elements of operation by the national monitoring centers should be stressed. The NC was requested to compile the SOPs of all countries and make them available to all countries.

- It was decided to include additional items on determination of HCO₃, fluoride, nitrite, phosphate and organic acids in the analytical methods, new QA/QC items namely data validation, inter-laboratory comparison program and meta data, and include an appendix with suggestions for improvement based on the inter-laboratory comparison results and a list of suppliers and manufacturers.
7. A draft Table of Contents (revised) was prepared as the guide for the revision of the contents of the manual. Lead authors and Members to revise each chapter were assigned by the Chairperson.
8. It was concluded that more research activities are needed to identify ways to improve wet deposition monitoring. The research results will be useful for formulating better procedures for analysis or modification of the present criteria for ion balance. Some of the research projects proposed are:
- i) HCO₃ Index experiment
 - ii) An intercomparison project for field operations (reference method)
 - iii) Organic acids

II-4. Major discussion at the second meeting of the Expert Group

10. The main discussions of the second meeting are summarized as follows:
- Contribution to acidification of rain water by organic acid and analytical methods to measure organic acids in rainwater were included in the content. Since energy situation in Asia is changing, organic compounds and organic acids will play an important role in the wet deposition. Developed analytical method and sample treatment and preservation of organic acids should be described.
 - There was the difference in required criteria for R1 between EANET manual and WMO manual. EANET manual has set more strict criteria for R1 than WMO manual, data quality has been improving year by year and most of the data sets are high quality. Since the current criteria are sufficient for current analytical capability of EANET, it was decided to be kept the current criteria, as it was.
 - There were differences in DQOs completeness between EANET manual and WMO manual. In WMO manual, %PCL was higher and %TP was lower than EANET manual. Since there is currently no serious problem in the criteria, the criteria was decided to be kept as it was.
 - EMEP flag system can describe a lot of meanings with only single code. It was proposed to modify the flag system and data reporting form harmonizing with procedures in EMEP manual.
 - It was proposed to identify the problems of outliers for inter-laboratory comparison program,

and the revised description to improve QA/QC be added in the technical manual.

- There are some grades of water quality in analytical procedure. It is necessary to define again the quality class of water we ordinarily use.

II-5 Major discussion at SAC

11. Major comments and discussion on SAC8 (2008) include the following:
 - To revise the first bullet of the draft TOR, to “To identify the technical and administrative problems associated with wet deposition monitoring encountered in the EANET operation since the beginning of the preparatory-phase operation”
 - It was suggested that the revised Technical Manual should include some guidelines to review the evaluation methods for quantities with low data completeness.
12. SAC8 noted the recommendation of the Expert Group to carry out the following research activities:
 - i) Theoretical and experimental development of the method for assessing hydrogen carbonate
 - ii) A field inter-comparison with a specific reference sampler
 - iii) Determination of organic acids for improving the ion balance and evaluation of major compounds to control the acidity
13. SAC8 approved the draft table of contents of the Technical Manual on Wet Deposition Monitoring (revised) and requested the Expert Group to further develop the manual.
14. Major comments and discussions on SAC9 (2009) included the followings:
 - Clarification was made on three research projects, namely: HCO_3^- index experiment, inter-comparison project for the field operation (reference method), and analysis of organic acids.
 - It was informed that the final draft of the technical manual would be submitted to the SAC10 for consideration and possible adoption.

Technical Manual on Wet Deposition Monitoring

Draft Table of Contents

1. Introduction
 - 1.1 Background
 - 1.2 Objectives of wet deposition monitoring
 - 1.3 Outline of the manual for monitoring wet deposition
2. Making plan
 - 2.1 Monitoring sites
 - 2.1.1 Minimum distance to emission and contamination sources
 - 2.1.2 Local criteria
 - 2.1.3 Site relocation
 - 2.2 Monitoring frequency and measurement parameters
 - 2.2.1 Monitoring frequency
 - 2.2.2 Measurement parameter
3. Sampling
 - 3.1 Precipitation sampling
 - 3.1.1 Facilities at the site
 - 3.1.2 Sample collection system
 - 3.2 Snow sampling
 - 3.3 Measurement of precipitation amount
 - 3.4 Sample preservation
4. Site operation
 - 4.1 Making sampling schedule for on-site operation
 - 4.2 Preparation for site operation
 - 4.2.1 Measurement of precipitation amount
 - 4.2.2 Sample preservation
 - 4.3 Checking the site condition
 - 4.4 Replacement of sample bottles
 - 4.5 Checking and maintenance of routine instruments and record devices
 - 4.6 Field blank
 - 4.7 Record of on-site operation and sample documentation
 - 4.8 Sample shipment to chemical analysis laboratory
5. Laboratory preservation
 - 5.1 Introduction
 - 5.2 Cleaning and preparation of collection vessel
 - 5.3 Transport of the collection vessel to the collector

- 6. Chemical analysis
 - 6.1 Introduction
 - 6.2 Quality of chemicals and water
 - 6.2.1 Purity of chemicals
 - 6.2.2 Purity of water
 - 6.2.3 Laboratory treatment of samples
 - 6.3 Electric conductivity
 - 6.3.1 Background
 - 6.3.2 Apparatus and equipment
 - 6.3.3 Reagent solution and consumable materials
 - 6.3.4 Calibration and standardization
 - 6.3.5 Measurement procedure
 - 6.3.6 Calculation
 - 6.3.7 Quality control and precision and bias
 - 6.4 pH measurement
 - 6.4.1 Background
 - 6.4.2 Apparatus and equipments
 - 6.4.3 Reagents solution and consumable materials
 - 6.4.4 Calibration of pH meter
 - 6.4.5 Measurement procedure
 - 6.4.6 Calculation
 - 6.4.7 Maintenance of pH electrode and data quality check by the relation with electric conductivity
 - 6.5 Anion determination by ion chromatography
 - 6.5.1 Background
 - 6.5.2 Apparatus and equipment
 - 6.5.3 Reagent and solution
 - 6.5.4 Measurement procedure
 - 6.5.5 Calculations
 - 6.5.6 Quality control and precision
 - 6.6 Hydrogen carbonate determination method
 - 6.6.1 Background
 - 6.6.2 Apparatus and equipment
 - 6.6.3 Reagents solution and consumables
 - 6.6.4 Measurement procedure
 - 6.6.5 Calculations
 - 6.6.6 Quality control and precision
 - 6.7 Fluoride determination method
 - 6.7.1 Background
 - 6.7.2 Apparatus and equipment
 - 6.7.3 Reagent solution and consumable materials

- 6.7.4 Measurement procedure
- 6.7.5 Calculations
- 6.7.6 Quality control and precision
- 6.8 Nitrite determination method
 - 6.8.1 Background
 - 6.8.2 Apparatus and equipment
 - 6.8.3 Reagents solution and consumable materials
 - 6.8.4 Measurement procedure
 - 6.8.5 Calculations
 - 6.8.6 Quality control and precision
- 6.9 Phosphate determination method
 - 6.9.1 Background
 - 6.9.2 Apparatus and equipment
 - 6.9.3 Reagents solution and consumable materials
 - 6.9.4 Measurement procedure
 - 6.9.5 Calculations
 - 6.9.6 Quality control and precision
- 6.10 Organic acids determination method
 - 6.10.1 Background
 - 6.10.2 Apparatus and equipment
 - 6.10.3 Analytical condition
 - 6.10.4 Reagent solutions and consumable materials
 - 6.10.5 Measurement procedure
 - 6.10.6 Calculation
 - 6.10.7 Quality control and precision
- 6.11 Cation determination by ion chromatography
 - 6.11.1 Background
 - 6.11.2 Apparatus and Equipment
 - 6.11.3 Reagents solution and consumable materials
 - 6.11.4 Measurement procedure
 - 6.11.5 Calculations
 - 6.11.6 Quality control and the precision of the analysis
- 6.12 Ammonium ion determination by spectrophotometry
 - 6.12.1 Background
 - 6.12.2 Apparatus and equipment
 - 6.12.3 Reagent solution and consumable materials
 - 6.12.4 Measurement procedure
 - 6.12.5 Calculations
 - 6.12.6 Quality control and precision
- 6.13 Metal determination by atomic absorption/emission spectrometry
 - 6.13.1 Background
 - 6.13.2 Apparatus and equipment

- 6.13.4 Regent solution and consumable materials
- 6.13.5 Measurement procedure
- 6.13.6 Calibration
- 6.13.7 Quality control and precision and bias
- 7. QA/QC
 - 7.1 Classification of data
 - 7.1.1 Reporting data
 - 7.1.2 Controlled data by individual country
 - 7.2 Data checking
 - 7.2.1 Statistical test
 - 7.2.2 Ion balance and conductivity balance check
 - 7.2.3 Data completeness
 - 7.2.4 Analytical precision
 - 7.3 Data flags
 - 7.4 Data validation
 - 7.5 Inter-laboratory Comparison Program
 - 7.6 Meta data
- 8. Data reporting
 - 8.1 Data reporting form
 - 8.1.1 Information about sites, sampling, shipping, laboratory operation
 - 8.1.2 Chemical analysis
 - 8.1.3 Measurement results and flags
- 9. Overall QA/QC
 - 9.1 Introduction
 - 9.2 Data quality objectives (DQOs)
 - 9.3 Standard operating procedures (SOPs)
 - 9.4 Data quality assessment
 - 9.4.1 Sampling precision
 - 9.4.2 Quality control of laboratory measurements
 - 9.5 Site performance audit
 - 9.6 Laboratory audit
 - 9.7 Preliminary quality assurance of obtained data sets
 - 9.8 External quality assurance program
 - 9.9 Training
- Appendix 1 Major items to be included in SOPs in wet deposition monitoring
- Appendix 2 List of useful web sites