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on Acid Deposition Monitoring Network in East Asia
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Consideration of recommendations for improvement of QA/QC activities

1. Introduction

Quality Assurance and Quality Control (QA/QC) plays a critical role in acid deposition monitoring as well as for other environmental measurements and it is especially important to know that through QA/QC activities monitoring data satisfy to specified levels of reliability with necessary information on measurement methods.

QA/QC Programs were adopted at the First Session of the Interim Scientific Advisory Group (ISAG) in October 1998 and revised at the Second Session of ISAG in March 2000. There are some documents on QA/QC programs for EANET, and they cover all QA/QC activities for all the components of the measurement/analysis system, i.e. the field (sampling sites), laboratory, data management and data reporting processes.

According to the QA/QC Programs, the National Center in each participating country is required to prepare and implement the national QA/QC programs including appointment of the national QA/QC manager, guide for the preparation of SOPs at relevant organizations/laboratories. The activities for QA/QC of sampling organizations and chemical analysis laboratories include preparation of SOPs and participation in QA/QC activities should be conducted by the National Center.

The "Strategy on EANET Development(2006-2010)"(EANET/IG 8/7/1 rev), which was adopted by the Intergovernmental Meeting at its 8th Session in November 2006, proposed the some activities on evaluation of QA/QC activities. This report summarized the current status of QA/QC activities and suggested possible recommendations for improvement of QA/QC activities in EANET.

2. QA/QC Activities in EANET

QA/QC programs cover all QA/QC activities of NC, the National Centers and the sampling/chemical analysis organizations. The National Centers and the sampling/chemical analysis organizations need to execute various QA/QC activities. The fundamental matters including the national QA/QC programs are as follows;

- Development of national QA/QC programs
- Clear assignment of responsibility
- Standard operating procedures(SOPs)
- Data quality objectives(DQOs)
- Inter-laboratory comparison projects
- Audit to sites and laboratories

(1) Development of national QA/QC programs

Each participating country should develop its own QA/QC programs, taking into consideration national conditions. The items to be covered in the national QA/QC programs are listed in Technical Documents.

Most of the laboratories didn't meet whole sets of requirements in other activities provided QA/QC programs. To refine EANET activities in participating countries, it is quite important to establish special QA/QC programs for promoting these activities at the national level, including proper documentation on the QA/QC procedures and regulation of each relevant entity.

(2) Clear assignment of responsibility

In the National Center of each participating country, one or two (Malaysia) national QA/QC manager were appointed and their name were reported to the Secretariat.

In the sampling and/or chemical analysis organizations, personnel in charge of data management and reporting and their supervisor were appointed. Their names have been reported through the national monitoring plan of each country.

(3) SOPs

SOPs are the procedures used in all the processes of the monitoring system, i.e. in the field, laboratory, and data management area. Each sampling and chemical analysis organization (laboratory) should make effort to prepare SOPs that meet the actual conditions of respective organizations, taking into account of the Technical Manuals and the national QA/QC programs. Major items that should be included in SOPs are listed in the Technical Document.

Through the inter-laboratory comparison project on wet deposition in 2006, questionnaire on data report including SOPs was submitted to NC. There were 22 answers out of 31 laboratories participating the project on wet deposition. The result are presented in Figure 1. Half of the laboratories have already prepared SOPs for chemical analysis.

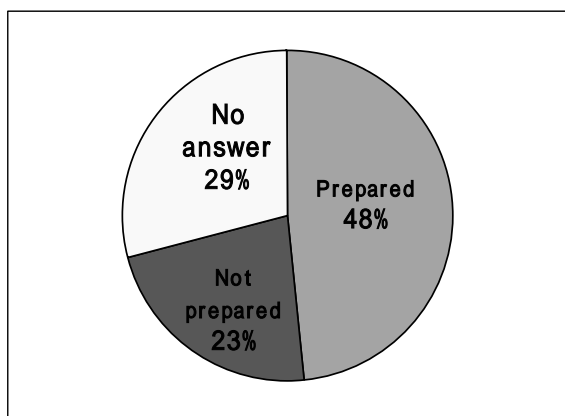


Figure 1
The result of questionnaire on SOPs

(4) Data Quality Objectives (DQOs)

In EANET the required DQO values on accuracy, precision, precipitation and completeness are defined as shown in Table 1. The participating countries are expected to make efforts to meet these DQOs.

Table 1 Data quality objective values (Required accuracy, precision, precipitation and completeness)

Accuracy	Precision	Precipitation	Completeness
±15%	15%	>90%	>80%

For reviewing the accuracy of chemical analysis, inter-laboratory comparison project has been conducted once a year. The results of the present project were evaluated in terms of the excess of the DQOs value. The flag "E" was put to the data that exceed DQOs by a factor of 2 (±15%~±30%), and the flag "X" to the data exceeding DQOs by a factor of over 2 (<-30% or >30%). The inter-laboratory comparison surveys were carried out 7 times, and the overall percentages of flagged data, "E" and "X" respectively, are shown in Figure 2.

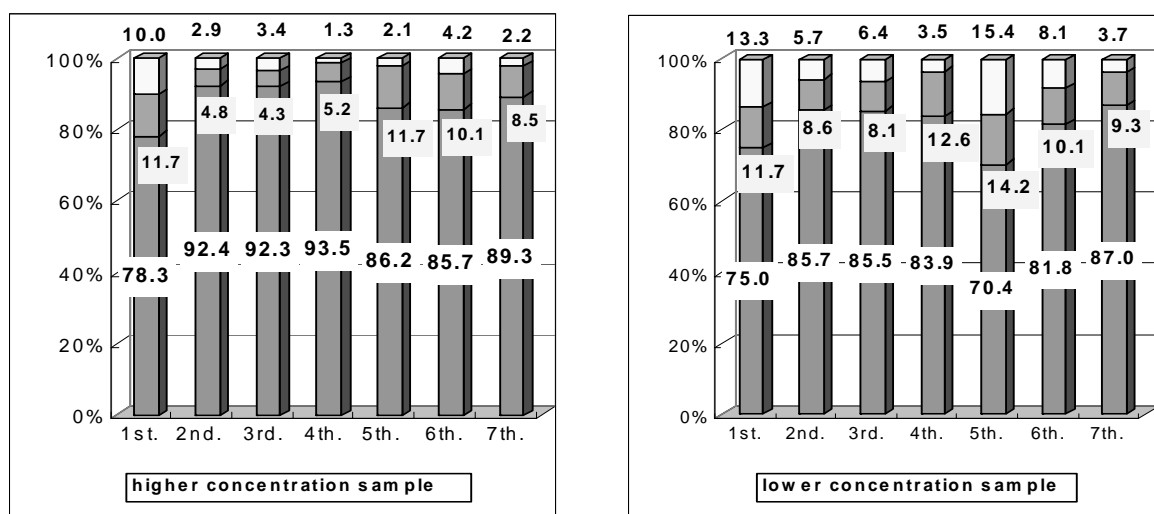


Figure 2 Overall comparisons of 1st to 7th inter-laboratory comparison projects

DQOs on detection limits and determination limits are also defined in EANET. Maximum, average and minimum values of determination limits in each participating laboratory are shown in Figure 3, based on the results of the inter-laboratory comparison project 2006. Dotted line indicates DQOs on determination limits. Average values are almost the same as the values of DQOs, however this results shows some laboratories could not achieve the determination limits of DQOs.

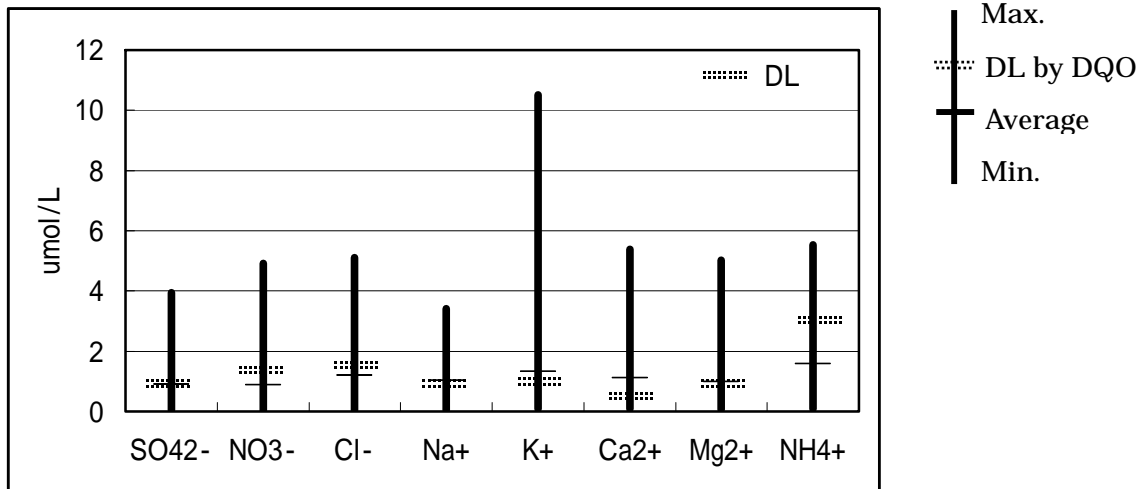


Figure 3 Ranges of the determination limits of each laboratories

(5) Inter-laboratory comparison project

The inter-laboratory comparison project is a round-robin test of common lots of simulated rainwater, which involves all analytical laboratories for the EANET monitoring. The purposes of this project are to evaluate the analytical systems through the evaluation of analytical results, analytical instruments and their operating condition and other relevant and appropriate practices. The inter-laboratory comparison surveys on wet deposition were carried out 9 times from 1998 to 2006 with participating of 24 to 31 laboratories in the thirteen countries. The surveys on dry deposition were 2 times from 2005, that on soil were 8 times from 1999, and that on inland aquatic environment were 7 times from 2000 to 2006. Figure 4 shows the number of participating laboratories in each year.

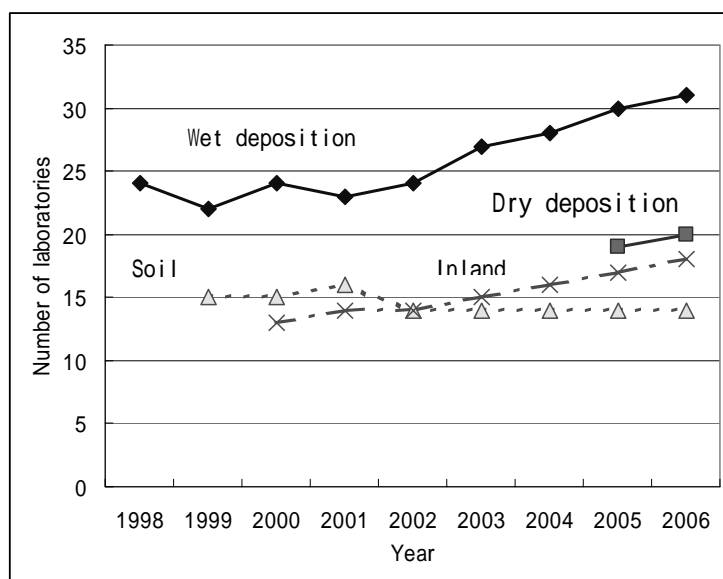


Figure 4 The number of participating laboratories

Some international monitoring programs and networks (WMO, EMEP, and ICP-Waters) conducted their intercomparison projects in opened manner to provide the opportunity for other laboratories to evaluate their own performance. Some laboratories in EANET joined these programs and NC has encouraged participating laboratories to join them.

(6) Audit to sites and laboratories

Audit to sites and laboratories has been conducted in Japan once/two years, but there are no reports on audit system in other EANET countries.

However, some laboratories in Indonesia, Philippines and Viet Nam have already been certified by ISO 9000(Quality Management Systems) or ISO/IEC 17025(The Competence of Testing and Calibration Laboratories) and some are now constructing these systems. These systems have not only the audit system of all the procedures including in site and laboratories, but also SOPs and other documentation.

3. Improvement of QA/QC activities in EANET

Considerable developments have been made in the first five years of the regular operation. In previous chapter, only fundamental matters were discussed. It is indeed important to encourage these fundamental activities.

- i) Each participating country should develop its own QA/QC programs with the documents in accordance with the improvement of QA/QC activities.
- ii) In order to improve DQOs on inter-laboratory comparison project, some recommendations for improvements have been proposed and described in the reports. Each participating laboratory is expected to refer these recommendations in daily analysis.
- iii) Preparation of SOPs is the first step for constructing QA/QC programs and the most important activities to obtain the stable analytical precision and accuracy of the measurement in each laboratory. NC distributed the SOPs of ADORC written in English at STM8 for the reference of preparation of SOPs in each laboratory. Each participating laboratory is expected to prepare it's own SOPs with reference of this materials.
- iv) Audit system to sites and laboratories conducted by National Center or respective organization is very effective to check the sampling and analysis procedures based on the technical manuals and this system means check cycle of PDCA cycle on QA/QC activities. Recently some participating laboratories have been certified by the management system, ISO 9000 or ISO/IEC 17025. These management systems are very useful tools for understanding the audit and documentation system.

However, there are many other detail items for QA/QC activities, e.g. sampling and analytical procedures, data managing, and this kinds of information were not reported and not clear to network, and so more efforts are encouraged to be made to settle the remaining problems in EANET region.

For more clarification of QA/QC activities, it is important to exchange information between NC and

participating countries through technical missions etc. and to consider the appropriate procedures for improvement of QA/QC activities in EANET.