

The Fifth Senior Technical Managers' Meeting  
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The Network Center for the Acid Deposition Monitoring Network in East Asia

**Information on principal international  
Inter-laboratory Comparison Project  
(on wet deposition)**

September 2004

Acid Deposition and Oxidant Research Center

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## **1. INTRODUCTION**

The quality assurance and quality control is one of the important activities toward receiving and supply of reliable environmental monitoring data. The measurement data used for the environment assessment and regulation are required to be traceable to national or international standard. Moreover, because EANET information is supposed to be widely used for researches and public information not only in East Asia but outside, it is evidently significant to produce and provide reliable data.

Quality assurance and quality control (QA/QC) have to be implemented effectively through the establishment of organizational operation, technical learning/training, and control of maintenance for the instruments.

The interlaboratory comparison is one of the most important items for QA/QC activities for the analytical laboratory. The laboratories are supposed to provide their analytical data of commonly prepared test samples with being received an objective evaluation through the results of interlaboratory comparison tests.

Some international monitoring programs and networks conducted their Intercomparison projects in opened manner to provide the opportunity for other laboratories to evaluate their own performance. Based on request of Second session of the Scientific Advisory Committee (SAC2) the Network Center (NC) implemented in 2003 the Questionnaire on involvement of EANET laboratories into International comparison projects. As the result of followed discussion, the suggestion to prepare information on relevant projects for laboratories in participating countries was done by SAC3. For respond of this request the number of interlaboratory comparison projects regarding wet deposition implemented by principal networks and international organization are introduced in this report.

## 2.The summary of principal Inter laboratory comparison project on wet deposition

**Table 1 the comparison of laboratory inter-comparison project**

Network	WMO	NADP	EMEP	EANET
Operation	QA/SAC Americas	USGS	CCC at NILU	Network center (ADORC)
Frequency	2/year (Apr.,Oct.)	1/2weeks (reported every 5 months)	1/year (Jul.)	1/year (Dec.)
Number of participating laboratory	70 – 80	8	60-70	27(2003)
Term of analysis	2 month	not decided	3months	2.5month
Parameters	10 pH, EC SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , F <sup>-</sup> Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> Mg <sup>2+</sup> , NH <sub>4</sub> <sup>+</sup>	11 pH, EC, PO <sub>4</sub> <sup>2-</sup> , SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> Mg <sup>2+</sup> , NH <sub>4</sub> <sup>+</sup>	11 H <sup>+</sup> , pH, EC SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> Mg <sup>2+</sup> , NH <sub>4</sub> <sup>+</sup>	10 pH, EC SO <sub>4</sub> <sup>2-</sup> , NO <sub>3</sub> <sup>-</sup> , Cl <sup>-</sup> , Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>2+</sup> Mg <sup>2+</sup> , NH <sub>4</sub> <sup>+</sup>
Number of samples ( precipitation )	3	4	4	2
Volume	250 mL each	60 mL each	250 mL each	100 mL each
Number of analysis	3 each	3 each	3 each	3 each
DQOs		≤ ±2 F-pseudosigma (median)	≤ ±10-15% (expected value)	≤ ±15% (prepared value)
the way to report	electronically, or mail in the envelop	electronically, or mail in the envelop	electronically, or mail in the envelop	electronically, or mail in the envelop
Reporting form	MS EXCEL spreadsheet	MS EXCEL spreadsheet	MS EXCEL spreadsheet	MS EXCEL spreadsheet

DQOs : The Data Quality Objectives

**Table 2 the Unit used for the intercomparisons**

	WMO	NADP	EMEP	EANET
H <sup>+</sup> (ACID)	μ e/L		μ e/litre	-
pH	pH Unit	pH Unit	pH Unit	pH Unit
EC	μ S/cm	μ S/cm	μ S/cm	mS/m
SO <sub>4</sub> <sup>2-</sup> ,	mgS/L	mg/l	μ gS/ml	μ mol/mL
NO <sub>3</sub> <sup>-</sup> ,	mgN/L	mg/l	μ gN /ml	μ mol/mL
Cl <sup>-</sup>	mg/L	mg/l	μ g/ml	μ mol/mL
F <sup>-</sup>	mg/L	-	-	-
PO <sub>4</sub> <sup>2-</sup>	-	mg/l	-	-
Na <sup>+</sup>	mg/L	mg/l	μ g /ml	μ mol/mL
K <sup>+</sup>	mg/L	mg/l	μ g/ml	μ mol/mL
Ca <sup>2+</sup>	mg/L	mg/l	μ g /ml	μ mol/mL
Mg <sup>2+</sup>	mg/L	mg/l	μ g /ml	μ mol/mL
NH <sub>4</sub> <sup>+</sup>	mgN/L	mg/l	μ gN /ml	μ mol/mL
R1(%)	—	—	—	○
R2(%)	—	—	—	○

### 3.The principal inter laboratory comparison project on wet deposition

#### (1) WMO (WMO/GAW Laboratory Intercomparisons)

<http://wmo.ch/web-en/index.html>

<http://marble.asrc.cestm.albany.edu/qasac/>

#### (Summary)

The coordination of the intercomparisons has been conducted by **Quality Assurance Science Activity Center for the Americas (QA/SAC Americas)** using test samples prepared by the **Precipitation Chemistry Reference Laboratory (PCRL)** at the **Illinois State Water Survey (SWS)**.

Participants in the intercomparisons are currently sent three samples of simulated rainwater which contain concentrations of ions commonly found in acidic precipitation.

A participant not in the GAW program would be accommodated by the QA/SAC Americas.

The new protocol decided by the Scientific Advisory Group for Precipitation Chemistry (**SAG-PC**) has started from 2001. The program is conducted twice a year.

#### (Participants in the intercomparison)

73 laboratories were participated on the 30th WMO-GAW Acid Rain Performance Survey (2004A).

**(Sample )**

- **The three samples are already diluted to the proper concentration for analysis.**
- **If a participant find it necessary to dilute a sample in order to complete the analysis of a parameter with a high concentration, then the dilution should be made with distilled water of the highest quality available.**
- **Analyze the sample (and the distilled water, if used) using each laboratory's standard procedure for natural rain water samples.**  
**Repeat the tests 3 times for each sample and report the (blank corrected) arithmetic mean of the 3 analysis runs.**

**(Submission of the reports)**

- **Several types of media, including e-mail, secure ftp, floppy disk and paper form are allowed.**
- **Minimum detection limit (MDL) for each parameter, the analysis method, sample analysis results are required to fill in the form (MS Excel spreadsheet).**
- **Send the results as a flat ASCII file. The preferred formats are text files(.txt) and comma separated value files (.csv).**

**(2) NADP/NTN** (<http://nadp.sws.uiuc.edu/>)

Quality assurance support for the **National Atmospheric Deposition Program/National Trends Network (NADP/NTN)**, which is a nationwide network of precipitation monitoring sites, is provided by **the U.S. Geological survey (USGS)**.

[http://bqs.usgs.gov/precip/project\\_overview/index.htm](http://bqs.usgs.gov/precip/project_overview/index.htm)

[http://bqs.usgs.gov/precip/project\\_overview/interlab/ilab\\_intro.htm](http://bqs.usgs.gov/precip/project_overview/interlab/ilab_intro.htm)

United States Department of the Interior

U.S.GEOLOGICALSURVEY, Denver Federal Center, Office of water Quality,

Branch of Quality Systyem

The network is a cooperative effort between many different groups as follows:

- 1) United states Government Agency (5)
  - the State Agricultural Experiment Stations
  - U.S. Geological Survey
  - U.S. Department of Agriculture
  - U.S. Environmental Protection Agency(USEPA)
- 2) Universities and Schools (59)
- 3) State & local Agencies (35)

- 4) native American (9)
- 5) Industry (Company) (15)
- 6) Other Research Groups (16)
- 7) International (2)

Environment Canada-Meteorological Service of Canada

The Canadian National Atmospheric (NatChem) database And Analysis system

The NADP/NTN has grown from 22 stations at the end of 1978, our first year, to over [200 sites](#) spanning the continental United States, Alaska, and Puerto Rico, and the Virgin Islands.

### **(Summary)**

Five external quality-assurance programs are operated by **the USGS for the NADP/NTN**.

- 1) Intersite Comparison Program, 2) Sample Handling Evaluation (Blind –Audit Program),
- 3) **Interlaboratory Comparison Program**, 4) Field Audit Program, and 5) Collocated Sample Program.

This program of the **Interlaboratory Comparison Program** was started 1997. Though only major laboratories in North America participated in this program for the first time, ADORC and NILU joined in this program on June 1999 to compare major laboratory's data quality around the world. And eight laboratories are participating in this program now.

The objectives of the interlaboratory comparison program are:

- (1) to verify the quality of chemical analyses of precipitation samples determined by the Central Analytical Laboratory (CAL)
- (2) to estimate the analytical precision of participating laboratories, and
- (3) to determine if statistically significant differences exist among the analytical results of participating laboratories.

### **(Participants in the intercomparison)**

Eight laboratories are currently participating in the study:

- Illinois State Water Survey, Central Analytical Laboratory (CAL) in Champaign, Illinois
- Meteorological Service of Canada (MSC) in Ontario, Canada
- MACTEC, Inc. in Gainesville, Florida
- Ministry of Environment and Energy (MOEE) in Ontario, Canada
- Shepard Analytical (SA) in Simi Valley, California
- **Acid Deposition and Oxidant Research Center (ADORC) in Niigata-shi, Japan**
- Norwegian Institute for Air Research (NILU) in Kjeller, Norway

- New York State Department of Environmental Conservation Bureau of Air Quality Surveillance (NYSDEC) in Albany, New York

**(Sample)**

Samples from the following sources are used in the interlaboratory comparison program:

- (1) **Ultrapure deionized-water samples** prepared by the U.S. Geological Survey.
- (2) **Standard reference samples** with certified U.S. National Institute of Standards and Technology (NIST) traceable values, prepared by High Purity Standards.
- (3) Excess **natural wet-deposition samples** collected at NADP/NTN sites and prepared by the CAL.

[Table 3](#) shows information for the solutions used in the Interlaboratory Comparison Program. In 1994, synthetic wet-deposition samples prepared by the USGS replaced two synthetic wet-deposition matrices from the U.S. Environmental Protection Agency formerly used in previous years. Target values for all standard reference solutions used in the interlaboratory-comparison program are listed in [Table 4](#). A total of **104 samples** are distributed to each laboratory as part of the interlaboratory comparison program on an annual basis.

Of the 104 samples, 52 are aliquots of natural precipitation bottled by the CAL. Natural wet-deposition samples collected at NADP/NTN sites that have volumes greater than 750 mL are selected randomly by the CAL for use in the interlaboratory comparison program. The aliquots are bottled in **60-mL** and **125-mL high density polyethylene bottles** and shipped in chilled, insulated containers to the USGS in Denver, Colorado. Natural samples are kept refrigerated and shipped to participating laboratories within 10 days of receipt by the USGS.

Samples used for the interlaboratory comparison program are shipped by the USGS to the eight participating laboratories **every 2 weeks**. Each laboratory receives the same four samples in a given mailing. All samples are labeled with a sample number to ensure that laboratory personnel cannot determine the type of sample (natural or synthetic) or the target analyte concentrations in the samples until the chemical analyses are performed.

**(Submission of the report)**

Participating laboratories provide analytical results to the USGS on a regular basis. The data are presented in **control charts** and tables on this website. Each laboratory's data are only accessible by the individual laboratory and the USGS. The control charts are used to identify potential systematic error that might be affecting the quality of a laboratory's data. Consistent,



acceptable laboratory performance is indicated when the data remain within the control limits on the control charts.

**Table 3.** Solutions used in the field audit program, sample handling evaluation program, and interlaboratory comparison program

<b>Solution Name</b>	<b>Agency that prepared the solution</b>	<b>Remarks</b>
CALNAT <sup>c</sup>	Illinois State Water Survey Central Analytical Laboratory (CAL)	Natural wet deposition samples collected at NADP/NTN sites and bottled by the CAL
Ultrapure <sup>a,b,c</sup>	U. S. Geological Survey	Deionized water with a measured resistivity greater than 16.7 MΩ
SP1 <sup>b,c</sup> SP2 <sup>a,b,c</sup> SP3 <sup>a</sup> SP5 <sup>b,c</sup> SP97 <sup>b,c</sup> SP98 <sup>b,c</sup>	High Purity Standards  U. S. Geological Survey	National Institute of Standards and Technology (NIST) certified reference solutions prepared by High Purity Standards and diluted by the USGS

a :Solution used in the Field Audit Program

b: Solution used in the Sample Handling Evaluation Program

c: Solution used in the Interlaboratory Comparison Program

(Last Updated: March 2003)

**Table 4. Target values for solutions used in the U.S. Geological Survey Interlaboratory Comparison Program**

[pH, in units; specific conductance, in microsiemens per centimeter at 25 degrees Celsius; <dl indicates values less than detection limit; significant figures vary because of differences in laboratory precision; Ca<sup>2+</sup>, calcium; Mg<sup>2+</sup>, magnesium; Na<sup>+</sup>, sodium; K<sup>+</sup>, potassium; NH<sup>4+</sup>, ammonium; Cl<sup>-</sup>, chloride; NO<sub>3</sub><sup>2-</sup>, nitrate; SO<sub>4</sub><sup>2-</sup>, sulfate]

Solution	milligrams per liter								pH units	microsiemens per centimeter
	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	NH <sub>4</sub> <sup>+</sup>	Cl <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	pH*	Specific conductance*
Ultrapure <sup>a,b</sup>	<dl	<dl	<dl	<dl	<dl	<dl	<dl	<dl	<b>5.60</b>	<b>1.1</b>
SP1	0.460	0.092	0.420	0.076	0.68	0.590	2.10	3.850	<b>4.42</b>	<b>29.4</b>
SP2	0.460	0.070	0.360	0.06	0.56	0.450	3.00	2.334	<b>4.52</b>	<b>23.9</b>
SP5	0.575	0.168	0.454	0.083	0.71	0.720	2.55	4.510	<b>4.32</b>	<b>35.54</b>
SP97	0.130	0.019	0.024	0.019	0.29	0.056	1.18	1.140	<b>4.77</b>	<b>11.4</b>
SP98	0.016	0.038	0.208	0.061	0.12	0.234	0.57	2.428	<b>4.41</b>	<b>21.37</b>

\* Bold highlight indicates that the value is the calculated median from analyses submitted by laboratory participants during 2003.

Specific conductance and pH values are not certified by the National Institute of Standards and Technology for stock solutions. ( Last Updated: May 2004)

**(3) EMEP** (<http://www.nilu.no/projects/ccc/index.html>)

EMEP is a scientifically based and policy driven program under the [Convention on Long-Range Transboundary Air Pollution](#) for international co-operation to solve transboundary air pollution problems.

**(Summary)** - - - - from EMEP/CCC-Report 8/2003

Interlaboratory comparisons are organized by **the Chemical Co-ordinating Centre (CCC)** at the **Norwegian Institute for Air Research (NILU)**.

<http://www.nilu.no>

<http://www.nilu.no/projects/ccc/reports.html>

So far twentyone intercomparisons have been arranged from 1988 to 2003.

36 different laboratories in European countries are performing chemical analysis of air and precipitation samples within EMEP (Co-operative Programme for Monitoring and Evaluation of Long-range Transmission of Air Pollutants in Europe). Since the measurement programme is based on individual national networks, the participating laboratories apply different sampling and analytical methods. Most of the methods used are described in the manual for sampling and chemical analysis (EMEP, 1996).

**(Participants in the intercomparison)**

The samples for the twentieth intercomparison (2003) (Table5) were prepared and distributed to 71 laboratories in July 2002. In addition to the European participants, two laboratories in North America received samples as a part of the co-operation between EMEP and the North American networks for acid deposition. Also 19 laboratories within the measurement programme ICP-Forest and 16 laboratories participating in various other measurement programmes were invited to participate in the nineteenth intercomparison. Tables 5a and 5b give the names of the participating laboratories together with the numbers used when presenting the results in tables and figures.

**Table 5a EMEP laboratories participating in the nineteenth laboratory intercomparison. The numbers in front of the names are used in tables and figures.(2002)**

Austria	( 1)	Umweltbundesamt Zweigstelle Sud, Klagenfurt
Canada	(26)	Meteorological Service of Canada, Toronto
Croatia	(35)	Meteorological and Hydrological Service of Croatia
Czech Republic	( 3)	Czech Hydrometeorological Institute, Praha
Denmark	( 4)	National Environmental Research Institute. Air Pollution Laboratory
Estonia	(38)	Estonian Environmental Research Centre, Tallinn
Finland	( 5)	Finnish Meteorological Institute. Air Quality Department
France	( 6)	Laboratories Wolff
Germany	( 7)	IfE Leipzig GmbH, Umweltlabor
Germany	( 8)	Umweltbundesamt, Messtelle Schauinsland
Hungary	(10)	Institute for Atmospheric Physics
Iceland	(11)	Idntæknistofnun Islands (Technological Inst. of Iceland)
Ireland	(12)	Met. Eirann, Dublin
Ireland	(37)	Environmental Protection Agency, Dublin
Italy	(13)	C.N.R. Istituto Inquinamento Atmosferico
Latvia	(33)	Air Pollution Observation Laboratory
Lithuania	(32)	Atmospheric Pollution Research Laboratory, Institute of Physics, Vilnius
Netherlands	(14)	National Institute of Public Health and Environmental Protection (RIVM)
Norway	(15)	Norwegian Institute for Air Research (NILU)
Macedonia	(40)	Hydrometeorological Institute, Skopje
Poland	(16)	Institute of Meteorology and Water Management, Warsaw
Poland	(39)	Environmental Monitoring Laboratory, Institute of Environmental Protection
Portugal	(17)	Direccao Regional do Ambiente e Recursos Naturais do Alentejo, Sines
Romania	(18)	Research and Engineering Institute for Environment
Russian Federation	(22)	Institute of Global Climate and Ecology
Slovakia	(31)	Slovak Hydrometeorological Institute
Slovenia	(36)	Hydrometeorological Institute of Slovenia

Spain	(19)	Centro Nacional de Sanidad Ambiental
Sweden	(20)	Swedish Environmental Research Institute (IVL), Gothenburg
Switzerland	(21)	Swiss Federal Laboratories for Materials Testing (EMPA)
Turkey	(34)	Refik Saydam Institute, Ankara
United Kingdom	(23)	AEA Technology, National Environmental Technology Centre
United States of America	(27)	Illinois State Water Survey
Serbia and Montenegro	(24)	Rep. Hydrometeorological Institute of Serbia

**Table 5b Participating laboratories outside the EMEP network.**

Germany	(104)	Hessige Landwirtschaftliche
Germany	(105)	Universität des Saarlandes
Sweden	(106)	IVL Svenska Miljöinstitutet AB, Aneboda
Finland	(107)	The Finnish Forest Institute
Germany	(109)	Institut für Bondenkunde und Waldernährung der Universität, Göttingen
Germany	(110)	Thüringer Landesanstalt für Landwirtschaft (TTL), Jena
Finland	(111)	Finnish Forest Research Institute, Vantaa Research Centre
Germany	(112)	Niedersächsische Forstliche Versuchsanstalt (NVF)
Germany	(113)	Landesforstanstalt Eberswalde, abt. Waldökologie
Italy	(114)	C.N.R. Istituto Italiano di Idrobiologia
Germany	(115)	Bayerische Landesanstalt f. Wald- und Forstwirtschaft
Switzerland	(116)	Institute for Applied Plant Biology
Germany	(118)	Forstliche Versuchs-und Forschungsanstalt
Germany	(119)	Landesumweltamt (LUA)
Germany	(120)	Landwirtschaftliche Untersuchungs- und Forschungsanstalt (LUFA)
Germany	(121)	Landesamt für Natur und Umwelt
Italy	(126)	APPA Laboratorio Biologico Provinciale
Italy	(130)	Universita degli Studi Siena
China	(131)	Chongqing Institute of Environmental Science and Monitoring
Belarus	(133)	Institute for Problems of Natural Resources Use and Ecology
China	(135)	Hunan Research Institute of Environmental Protection Science
China	(136)	Guangzhou Research Institute of Environmental Protection
Germany	(137)	UST Umwelt-Systemtechnik GmbH, Gera
China	(138)	Guizhou Research Institute of Environmental Protection Science, Guiyang
Italy	(140)	C.N.R. Istituto di Ricerca sulle Acque

**(Sample)**

Four kinds of samples were prepared for the precipitation which consist of deionized water, containing known amount of sulphate, nitrate, ammonium, strong acid, magnesium, sodium, chloride, calcium, and potassium. (Table 6)

**Table 6 Samples distributed for the nineteenth interlaboratory test.(2002)**

A.	5 synthetic samples for determination of SO <sub>2</sub> , consisting of 0.3% H <sub>2</sub> O <sub>2</sub> absorbing solution and containing different concentrations of sulphuric acid. One of the samples was an unidentified blank.
B.	6 KOH-impregnated Whatman 40 filters, comprising 1 blank and 8 filters to which different amounts of sulphuric acid have been added.
C.	4 synthetic samples for determination of NO <sub>2</sub> consisting of sodium nitrite diluted in water.
J.	6 Whatman 40 filters impregnated with 3% oxalic acid, comprising 2 blank and 4 filters to which different amounts of ammonium salt solution have been added.
<b>G.</b>	<b>4 synthetic precipitation samples, containing SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, NH<sub>4</sub><sup>+</sup>, H<sup>+</sup>, Na<sup>+</sup>, Mg<sup>2+</sup> and Cl<sup>-</sup>, and Ca<sup>2+</sup> and K<sup>+</sup>.</b>

**(Submission of the reports)**

Most of the laboratories had returned their results to the CCC within one month after the deadline given as 15 September 2002. A total of 59 laboratories have returned their results. This includes **34 EMEP-laboratories, 14 ICP-Forest laboratories and 11 other laboratories.**

The participating laboratories received **the theoretical (expected) values** shortly after CCC had received the results. The laboratories were then asked to compare their results with the expected ones, and give corrected values if obvious mistakes e.g. misprints had occurred. A few corrections were reported. In those cases the corrected values are used in this report. In accordance with the decision of the Steering Body of EMEP, the results are presented in such a way that the different laboratories are identified. Tables 6a and 6b give the names of the participating laboratories together with the numbers used when presenting the results in tables and figures.

**( Data handling and evaluation)**

The results for the samples are presented in the tables in decreasing order together with the number of the laboratory. **The expected (theoretical) value, the number of results, the arithmetic mean value, the median, the standard deviation and the relative standard deviation in percent** are also given.

After the first statistical run with all results included, the calculation was repeated with the outliers excluded. **The outliers (unused)** are defined as the results more than two standard deviations from the mean value in the first run.

#### (4) EANET

##### Acid Deposition Monitoring Network in east Asia

##### Network Center of EANET (Acid Deposition and Oxidant research Center)

<http://www.adorc.gr.jp/eanet.html>

<http://www.adorc.gr.jp/sec.html>

##### (Summary)

The inter-laboratory comparisons for wet deposition, inland aquatic environment and soil are carried out from 1998 , 2000 and 1999 respectively.. All comparisons are implemented by the network center of EANET.

##### (Participants in the intercomparison)

Regarding to the inter-laboratory comparisons the wet deposition, 27 laboratories from 12 countries in which have 47 sites in total, participated on the project 20003.

**Table 7 Participants in the interlaboratory comparison in EANET(2003)**

Nation	Laboratory
CHINA (4)	-Zhuhai Environmental Monitoring Station -Environmental Monitoring Station of Xiamen -Xi'an Environmental Monitoring Station -Chongqing Institute of Environmental Science
INDONESIA (2)	-Meteorological and Geophysical Agency (BMG) -Center for Environmental Impact Control Facilities (PUSARPEDAL) , Environmental Impact Management Agency (BAPEDAL),
JAPAN (8)	-Hokkaido Institute of Environmental Sciences (Japan) -Ito Kogai Research Co. Ltd.( Tokyo) -Nagano Research Institute for Health and Pollution -Gifu Prefectural research Institute of health and Environmental Science -Kochi Prefectural Environmental Research Center -Shimane Prefectural Institute of Public Health and Environmental Science -Okinawa Research Institute of health and Environment -Acid Deposition and Oxidant Research Center (ADORC)
Republic KOREA (1)	-National Institute of Environment Research (NIER)
MALAYSIA (1)	-Environment Section,Division of Environmental Health,Department of Chemistry
MONGOLIA (1)	-Central Laboratory of Environmental Monitoring, National Agency for Meteorology, Hydrology and Environmental Monitoring, Ministry of Nature and Environment
PHILIPPINES (1)	-Environmental Management Bureau (EMB), Department of Environment and Natural Resources (DENR)

RUSSIA (2)	-Limnological Institute of the Russian Academy of Sciences/Siberian Branch(RAS/SB) -Primorskii Environmental Monitoring Center of Roshydromet (Laboratory for Monitoring of Atmosphere and Soil Pollution)
THAILAND (4)	-Environmental Research and Training Centre (ERTC), -Pollution Control Department (PCD), Ministry of Science Technology and Environment (MOSTE) -Meteorological Observation Division, Thailand Meteorological Department (TMD) -Chemistry Department, Science Faculty, Chiangmai University (CMU)
VETNAM (1)	-Institute of Meteorology and Hydrology (IMH), Hydrometeorological Service of Viet Nam(HMS)
CAMBODIA (1)	-Department of Pollution Control, Ministry of Environment
Rao PDR (1)	-Environment Quality Monitoring Center, Environment Research Institute, Science Technology and Environment Agency

**(Sample)**

Two kinds of artificial rainwater samples (of both higher concentration and lower concentration) were distributed to the laboratories (See Table 8). The information on the analytical precision and accuracy on individual parameters can be obtained through the statistical treatment of submitted analytical data of 100 times diluted samples

**Table 8 Outline of artificial rainwater samples**

Artificial rainwater samples	Amount of each sample	Container	Number of samples	Note
No.031 (higher concentration) No.032 (lower concentration )	Approximately 100ml	Poly-propylene bottle 100ml	One bottle each	Known amount of reagents are dissolved in deionized water

Before the measurement, each laboratory should accurately dilute distributed samples by 100 times under the specified procedure.

Parameters to be measured and analyzed are as follows:

pH, Electric Conductivity (EC), concentrations of sulfate, nitrate, chloride, sodium-ion, potassium-ion, calcium-ion, magnesium-ion and ammonium.

Analytical methods and data checking procedures that are specified in the "Technical Manual for Wet Deposition Monitoring in East Asia" and "Quality Assurance/Quality Control (QA/QC) Program for Wet Deposition Monitoring in East Asia". Analytical methods specified in the manual are described in Table 9.

**Table 9 Analytical methods specified in the manual**

Parameter	Analytical method
pH	Glass electrode
EC	Conductivity Cell
SO <sub>4</sub> <sup>2-</sup> NO <sub>3</sub> <sup>-</sup> Cl <sup>-</sup>	Ion Chromatography Spectrophotometry
Na <sup>+</sup> K <sup>+</sup> Ca <sup>2+</sup> Mg <sup>2+</sup>	Ion Chromatography Atomic Absorption/Emission Spectrometry
NH <sub>4</sub> <sup>+</sup>	Ion Chromatography Spectrophotometry (Indophenol blue)

**(Submission of the report)**

The two kind of artificial samples are shipped to the participated laboratories in December. Dead line of the report is middle of March. The expected values are informed at the Senior Technical Managers' meeting held in September.

**(Data handling and evaluation )**

The reported data from all laboratories are evaluated after statistical calculation such as average, Minimum (Min.), Maximum (Max.), Standard deviation (S.D.), and Number of data (N). Outlying data, which are apart from the Average greater than a factor of 3 of S.D. were not included for this calculation.

The Data Quality Objectives (DQOs) of data was specified for every constituent as  $\pm 15\%$  by the QA/QC program of the EANET. In this report, analytical data on the artificial rainwater samples were compared with the prepared value/concentration and evaluated by the excess of DQOs value: the flag "E" was put to the data that exceed DQOs by a factor of 2 ( $\pm 15\% \sim \pm 30\%$ ), and the flag "X" was put to the data that exceed DQOs more than a factor of 2 ( $< -30\%$  or  $> 30\%$ ). A set of data for each sample was evaluated for calculated **ion balance (R<sub>1</sub>)**, and **comparison between calculated and measured electrical conductivity (R<sub>2</sub>)** by comparing the allowable range for R<sub>1</sub> and R<sub>2</sub>. The flag "I" for R<sub>1</sub> and the flag "C" for R<sub>2</sub> show a poor ion balance data sets, and a poor conductivity agreement data sets respectively.

These results is reported in the Report of the Inter-laboratory Comparison project on wet deposition every year.