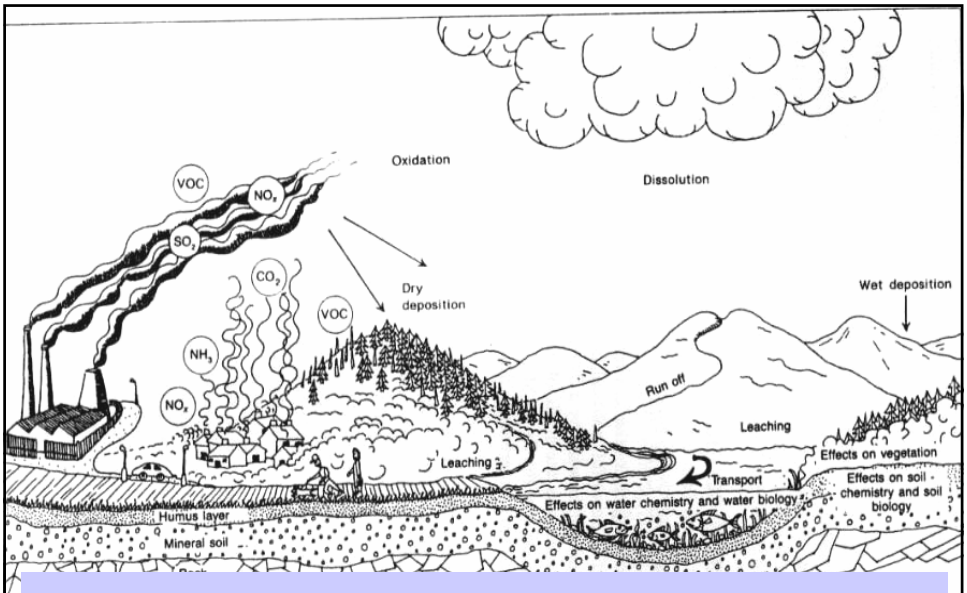
Analytical Methods for Wet Deposition Monitoring

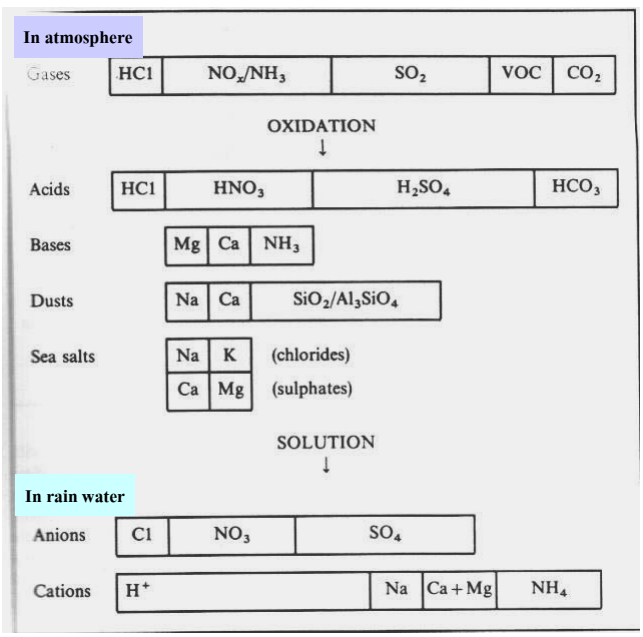
by
Hathairatana Garivait

Prepared for the Third Country Training Program on
"Acid Deposition Monitoring and Assessment"

February 19, 2004
Environmental Research and Training Centre, Pathumthani.



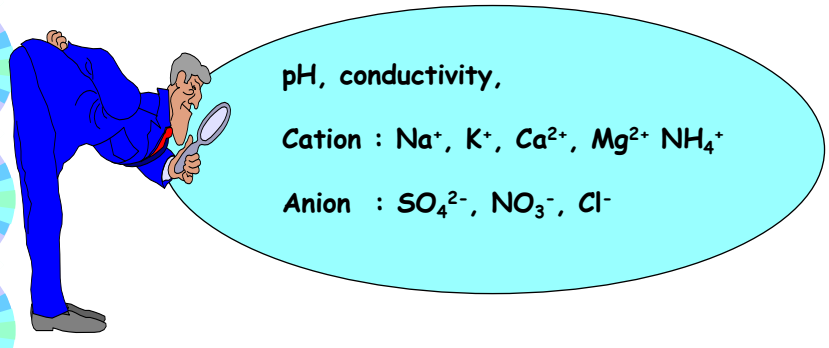
Wet deposition
= conc. of chemical species in precipitation x amount of precipitation

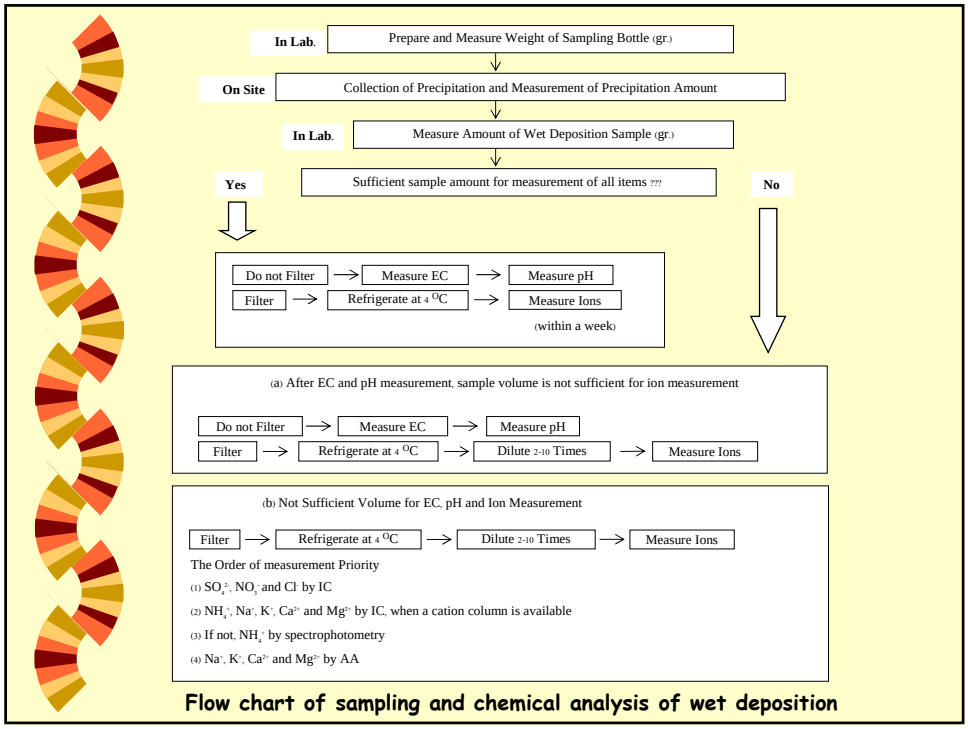


Relationships between atmospheric and rain chemistry

Analytical Methods

Measurement parameters :





Flow chart of sampling and chemical analysis of wet deposition

Analytical Methods

Procedure Suggested for Rainwater Major Constituent Analysis

Analysis	Instrumental Method
Electric Conductivity	Conductivity Cell
pH	Glass electrode (preferably with the Electrode of non-leak inner cell)
Chloride, Nitrate, Sulfate, Nitrite, Fluoride, Phosphate	Ion Chromatography (preferably with suppressor) Spectrophotometry
Ammonium	Ion Chromatography Spectrophotometry (Indophenol blue)*
Sodium, Potassium, Calcium, Magnesium Ions	Ion Chromatography Atomic Absorption / Emission Spectrometry
Heavy Metals, Aluminum Mercury	Atomic Absorption Spectrometry with Graphite Furnace, ICP Emission Spectrometry, ICP/MS, Mercury Analyzer With a cold Trap
Organic Acids	Ion Chromatography

* Not recommended if the biocide, thymol, is used in sample collection.

Analytical Methods

Parameters	Method of Measurement
Electric Conductivity	Conductivity cell (TOA,model CM40)
pH	Glass electrode (TOA,model HM30V)
Chloride, Nitrate, Sulphate	Ion Chromatography (Dionex DX100) (with suppresser)
Sodium, Potassium, Calcium, Magnesium and Ammonium	Ion Chromatography (Dionex DX100) (with suppresser)

The pH of a precipitation sample

Varies between 3.0 and 7.5 pH units

pH measurement

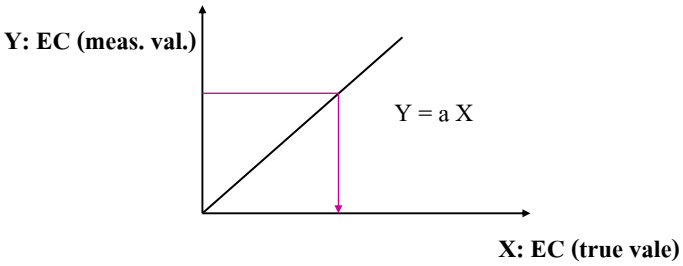
1. Calibrate the pH meter with the standard buffer solutions
   at a pH of 6.86 (7.0), to set the intercept of the pH response
   at a pH of 4.01 (4.0), to adjust the slope control of the pH response
2. Keep the temperature of the samples at 25^{o}C in the water bath.
3. Place the sample solution in a clean plastic or glass vessel
   to cover the sensing elements of the electrode.
4. Rinse and wipe drops off the electrode with filter paper,
   immerse it in the sample vessel and swirl the sample gently
   for a few seconds.
5. Allow the electrode to equilibrate and measure the pH of the sample
   until a constant value is obtained.
6. Record the pH value (to 0.01 unit) and the temperature of the sample.

Electric Conductivity

- The electric conductivity of a solution can be measured directly using a conductivity bridge with a measuring cell.
- The conductivity varies with the temperature of the solution and is proportional to the concentration and the species of free ions present in the solution.
- Since the conductivity also depends on the electrode area and its spacing, the measuring apparatus has to be calibrated with KCl solution of known concentration and conductivity to obtain the cell constant or to adjust the meter.
- Conductivity is measured at $_{25}$oC in units of uS/cm.
- The conductivity range of precipitation samples is $_{5\text{-}1000}$ uS/cm

Conductivity of KCl solution at 25°C

Concentration (M)	Conductivity (uS/cm)
0.0001	14.9
0.0005	73.9
0.001	146.9



Ions determination by Ion Chromatography

(5 Cations and 3 Anions)


2004 2 10


2004 2 10


CATION
MOBILE PHASE
22 mN H_2SO_4
CATION
2£ mN H_2SO_4
44 ml (1N) / 2000 ml
2000 ± 0·6 ml
Whatman
2004 2 10


2004 2 10


SAMPLE1
SAMPLE2
SAMPLE3
SAMPLE4
SAMPLE5
SAMPLE6
STD4 1.0 ppm
STD5 1.5 ppm
AQ4
CSTD3
AQ5
AQ6
AQ1
AQ2
AQ3
STD1 0.1 ppm
STD2 0.3 ppm
STD3 0.5 ppm
2004 2 10


Thank you for your kind attention
2004 2 11