

Asia Pacific Mercury Monitoring Network (APMMN) Workshop
22 – 23 June 2015
Minamata, Japan

HEAVY METAL DEPOSITION MONITORING ACTIVITIES IN MALAYSIAN METEOROLOGICAL DEPARTMENT (METMALAYSIA)

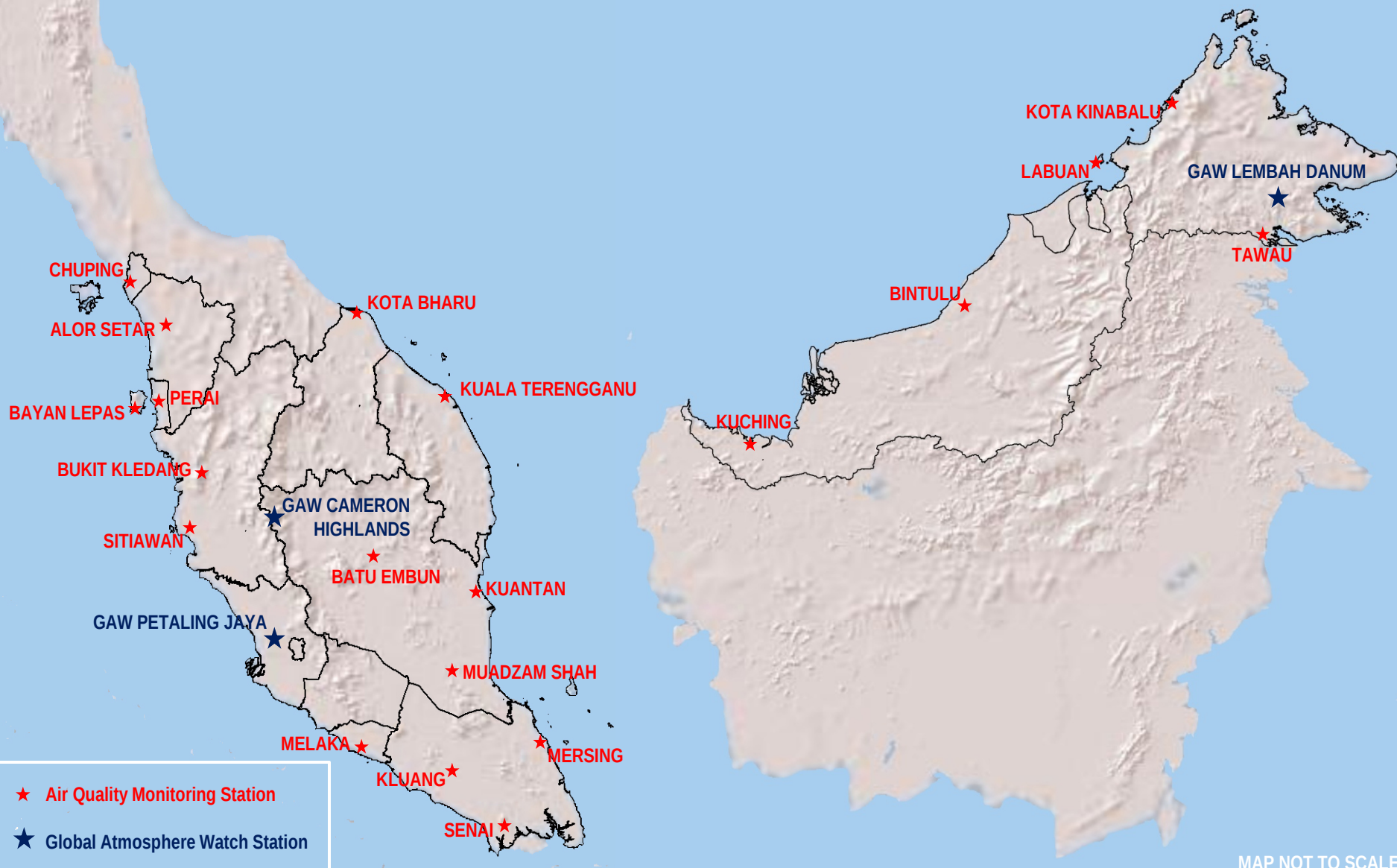
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OUTLINE

- Introduction to Atmospheric Science Division of MetMalaysia
- Air Quality Monitoring Activities
- Malaysia as WMO GAW/EANET Member Country
- Instrumentation and Parameter monitored
- Results and Analysis
- MetMalaysia joining APMMN
- Collaboration with Local & International Scientific Community.

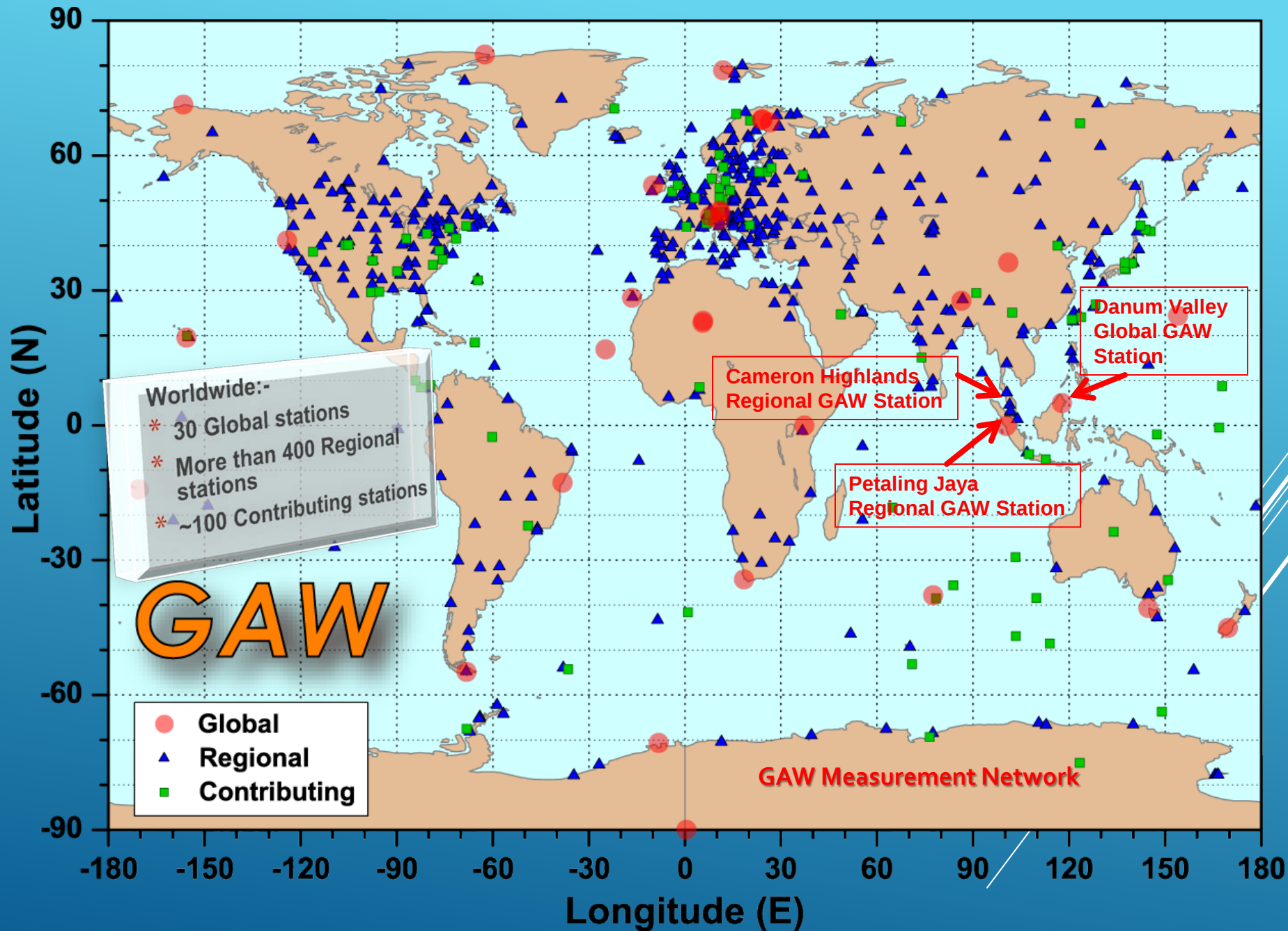
Air Quality Monitoring Activities

Air Quality Monitoring Stations Network



1. Malaysia through MetMalaysia has joined the World Meteorological Organization Global Atmosphere Watch (WMO GAW) network as one of the Member Country.
2. MetMalaysia is also a member of the East Asia Acid Deposition Monitoring Network (EANET)

- ▶ MetMalaysia has participated in the world wide network of GAW program since 1989 and will continue to play an active role in this international network for many more years.
- ▶ MetMalaysia has established a GAW Global Station in Sabah since November 2003, to fulfil as a national, as well as international obligation in addressing the environmental issues such as trans-boundary haze, acid deposition, climate variability, climate change and stratospheric O₃ depletion.
- ▶ At the same time, MetMalaysia is also operating two other GAW regional stations, one in Cameron Highlands and the other in Petaling Jaya. The new regional station is projected to be established in the north east coast of Peninsula Malaysia later this year.



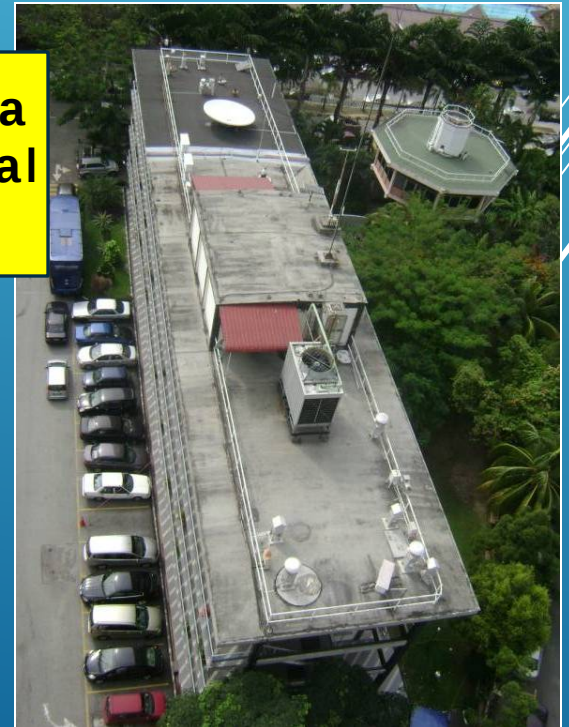
Danum Valley GAW Global Station



Cameron Highlands GAW Regional Station



Petaling Jaya GAW Regional Station



**METMALAYSIA is part of
the EANET network**

East Asia Acid Deposition Monitoring Network (EANET) Monitoring Sites



Participating Countries

- Cambodia
- China
- Indonesia
- Japan
- Lao P.D.R.
- **Malaysia**
- Mongolia
- Myanmar
- Philippines
- Republic of Korea
- Russia
- Thailand
- Viet Nam

Malaysia has participated in EANET activities since January 2001.

Instrumentations and parameter monitored



Air Quality Monitoring Activities

NO.	GAW FOCAL AREAS	TYPE OF INSTRUMENT	Danum Valley	Cameron Highlands	Petaling Jaya
1.	Aerosol - Aerosol Load - Back Scattering Coefficient - Absorption Coefficient - Aerosol Optical Depth	- High Volume Air Sampler (TSP & PM-10) and Tapered Element Oscillating Microbalance (TEOM) - Nephelometer - Multi Angle Absorption Photometer (MAAP) - Precision Filter Radiometer (PFR)	✓ ✓ ✓ ✓	✓	✓
2.	Greenhouse Gases - Carbon Dioxide (CO₂) - Methane (CH₄) - Nitrous Oxide (N₂O) - Sulphur Hexafluoride (SF₆)	- Lo Flo Mark II CO₂ Analyzer & Flask Sampling - Flask Sampling - Flask Sampling - Flask Sampling	✓ ✓ ✓ ✓		
3.	Reactive Gases - Surface Ozone (O₃) - Carbon Monoxide (CO) - Nitrogen Oxides (NO_x) - Sulphur Dioxide (SO₂) - Hydrogen (H₂)	- O₃ Analyzer - CO Analyzer & Flask Sampling - NO_x Analyzer - SO₂ Analyzer - Flask Sampling	✓ ✓ ✓	✓ ✓ ✓ ✓	
4.	Ozone Total Column Ozone	Brewer Spectrophotometer			✓
5.	UV Radiation	Brewer Spectrophotometer			✓
6.	Precipitation Chemistry	- Ecotech Wet Only Rainwater Sampler - Acid Precipitation Sampler (APS)	✓	✓ ✓	✓ ✓

The Monitoring Activities at Atmospheric Monitoring Stations Network in Malaysia

INSTRUMENTATION	PARAMETER	DATA TYPE
Wet-Only Sampler/ APS	Wet fallout: pH, EC, Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺ , NH ₄ ⁺ , oxalate, acetate, formate, <u>mercury</u> , copper, iron, manganese, nickel, lead, zinc, cadmium	▪ Weekly
Anderson Precipitation Sampler (APS)	Dry fallout: Dust, Ca ²⁺ , Mg ²⁺ , <u>mercury</u> , copper, iron, manganese, nickel, lead, zinc	▪ Monthly
High Volume Sampler (TSP&PM10)/ Tapered Element Oscillating Microbalance (TEOM)	Total suspended particulate (TSP) concentration / Particulate Matter (PM-10) concentration	▪ Minutes ▪ Hourly ▪ Daily
Brewer Ozone Spectrophotometer	Total Column Ozone & SO ₂ , DUV, UV-B, AOD	▪ Daily
Passive Sampler	SO ₂ , NH ₃ , NO ₂ , HNO ₃ , Oxalic acid	▪ Weekly ▪ Monthly
Filter Pack	SO ₂ , NH ₃ , HNO ₃ , HCl, Cl ⁻ , NO ₃ ⁻ , SO ₄ ²⁻ , Na ⁺ , K ⁺ , Ca ²⁺ , Mg ²⁺ , NH ₄ ⁺	▪ Weekly
Multigas Analyzer	NO, NO ₂ , NO _x , SO ₂ , CO, O ₃	▪ Hourly
LoFlo Mark2 CO ₂ Analyzer	CO ₂	▪ Minutes
Nephelometer	Aerosol scattering coefficient	▪ Minutes
Multi Angle Absorption Photometer (MAAP)	Black carbon concentration, Aerosol absorption coefficient	▪ Minutes
Precision Filter Radiometer (PFR)	Aerosol optical depth (AOD)	▪ Minutes
Ozonesonde (twice a month)	Vertical ozone profile	▪ Minutes
Persistent Organic Pollutants (POPs) PUF disk sampler	Persistent organic pollutants (POPs)	▪ Monthly
Flask sampling	CO ₂ , CH ₄ , CO, H ₂ , N ₂ O, SF ₆ , Delta 13C, Delta 18O	▪ Weekly

SOURCE OF HEAVY METAL

- ▶ Particulate matter originated from natural and anthropogenic sources. This pollutants can be transported from transboundary or local sources.
- ▶ Heavy metal are emitted into the atmosphere by the industries, power plants, quarry, transportation, volcanic activities, soil erosion, forest fires etc,
- ▶ Wet and dry deposition is the main mechanism for the removal of the particulate matter including heavy metal from the atmosphere.

Wet Deposition & Dry Deposition Sampler



Ecotech Wet Only Sampler

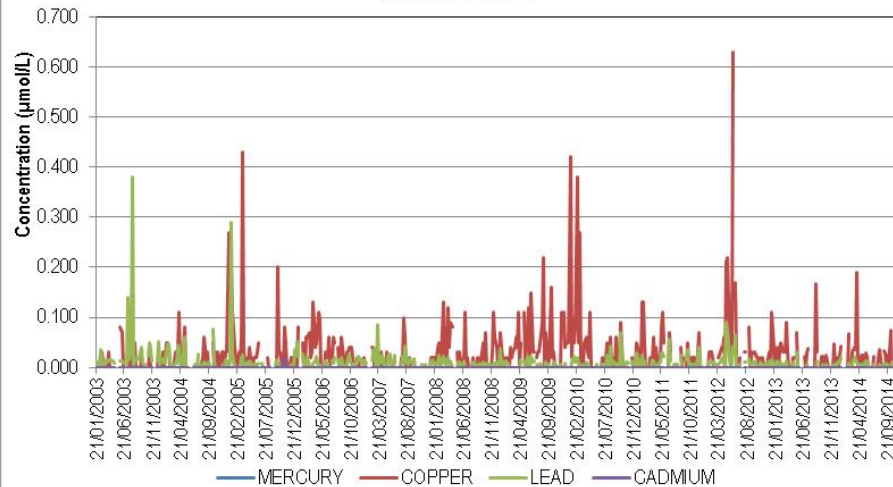


Acid Precipitation Sampler (APS)

Analysis and Result

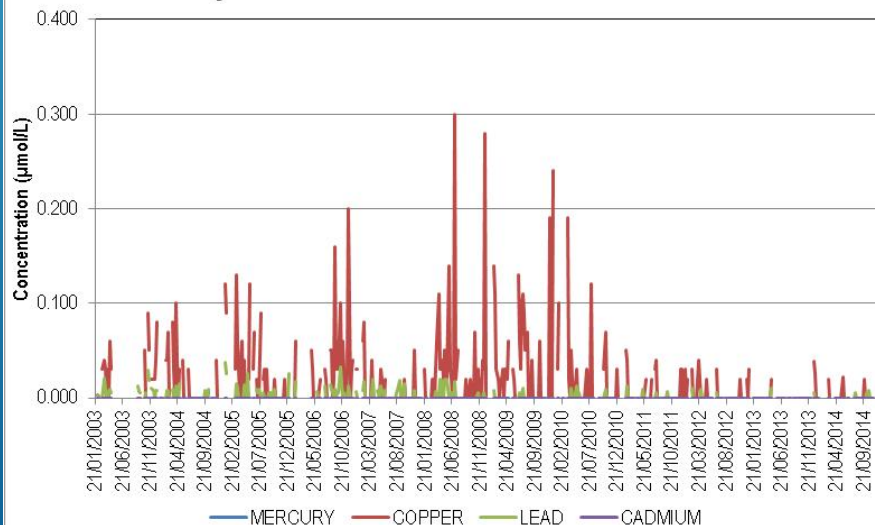
Data Analysis From 2003- 2014

Weekly Concentration at Petaling Jaya Station 2003-2014

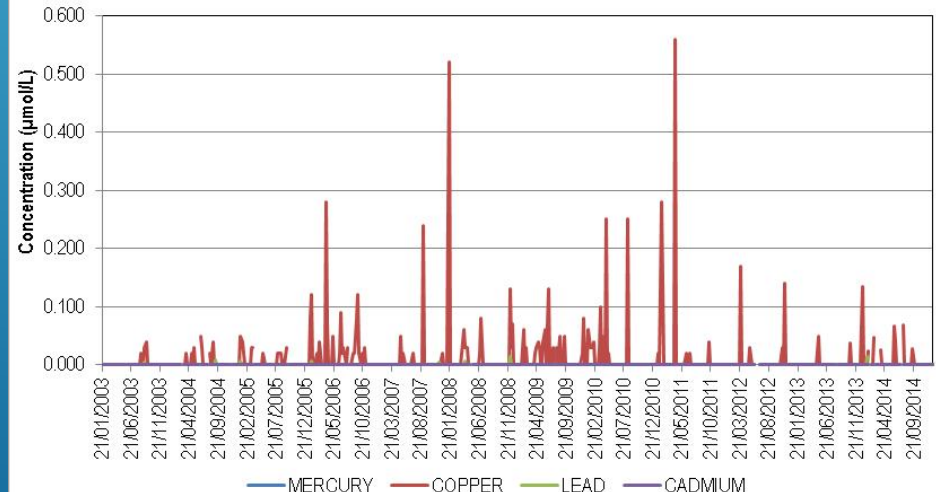


**URBAN &
INDUSTRIAL SITES**

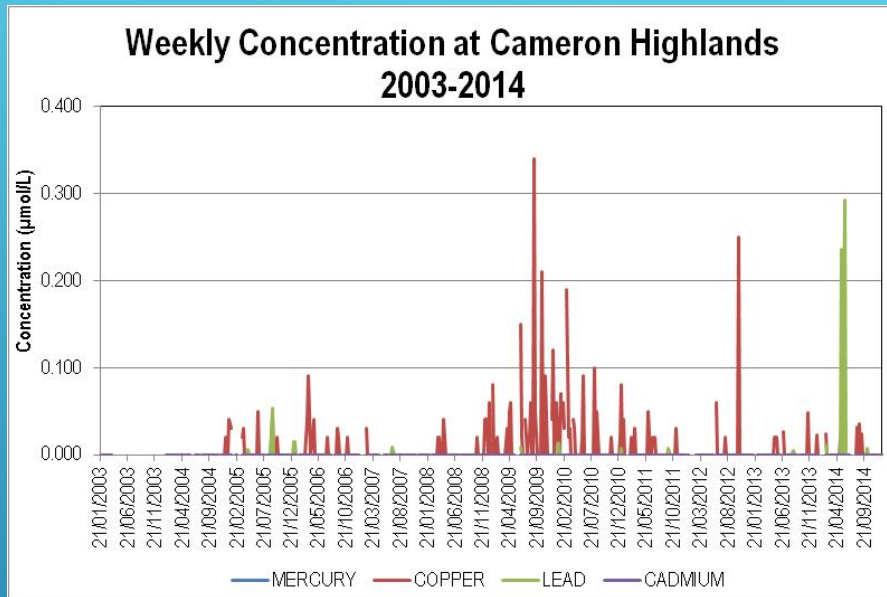
Weekly Concentration at Perai Station 2003-2014



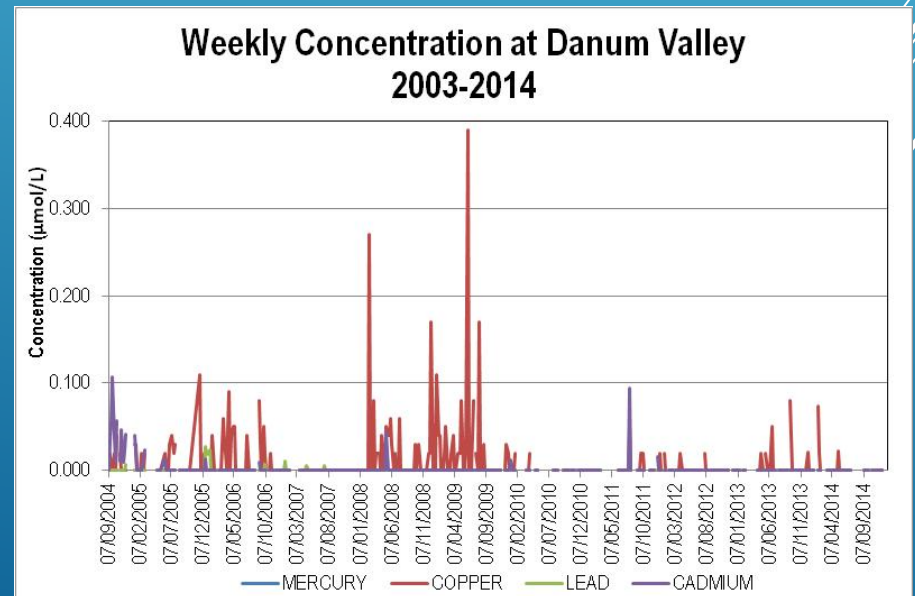
Weekly Concentration at Kuching Station 2003-2014



Rural Site



Background Site



Conclusion

The selected element (mercury, copper, lead and cadmium) were collected and analyzed in 3 urban/industrial sites (Petaling Jaya, Perai and Kuching) and 2 remote sites (Cameron Highlands and Danum Valley) from 2003-2014 and can be concluded as follows:-

- The Detection Limit for Copper is $0.02 \mu\text{mol/L}$; Lead $0.005 \mu\text{mol/L}$, Cadmium $0.009 \mu\text{mol/L}$ and Mercury $0.005 \mu\text{mol/L}$
- The element of Mercury is non-detectable (Detection Limit $<0.005 \mu\text{mol/L}$) throughout the years (2003-2014) for all stations.
- ▶ Cadmium can be detected in GAW Danum Valley Site and the value ranged from 0 – $0.1 \mu\text{mol/L}$.
- ▶ Copper is the main heavy metal element found in rainwater samples and the value ranged from 0 - $0.60 \mu\text{mol/L}$.
- ▶ Lead was found only in urban /Industrial sites such as Petaling Jaya and Perai stations and it ranged from 0 - $0.38 \mu\text{mol/L}$.

MALAYSIA PARTICIPATION IN APMMN ?

- ▶ For many years MetMalaysia has participated in several international network which are important to Malaysia and will continue to play an active role in supporting the meteorological environmental programme in the region.
- ▶ Heavy metal such as copper, arsenic, lead, mercury, cadmium etc. are among the important heavy metals which are monitored continuously through wet /dry deposition in 23 air quality/GAW stations since 1990s.
- ▶ MetMalaysia and other relevant agencies would like to participate in this network, subject to an approval. It's no doubt that by joining this network Malaysia especially MetMalaysia and DOE will benefit greatly in terms of data sharing, exchange of information, research, human capital development and technical knowledge.

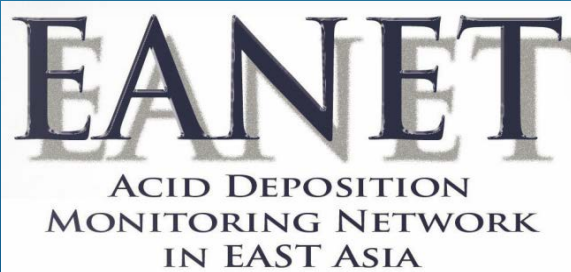
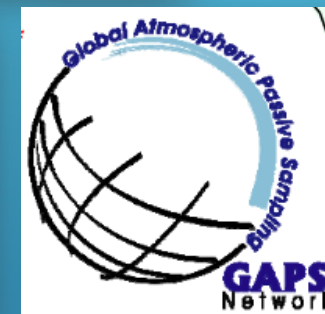
Collaboration With Local & International Scientific Community



World Ozone and Ultraviolet
Radiation Data Centre



WMO Global Atmosphere Watch
World Data Centre for Aerosols



WMO Global Atmosphere Watch
World Data Centre
for Greenhouse Gases

Thank You

