Regional Cooperation to Track Atmospheric Mercury: The Asia-Pacific Mercury Monitoring Network (APMMN)

2016 Asia Pacific Mercury Monitoring Network Meeting
Bangkok, Thailand

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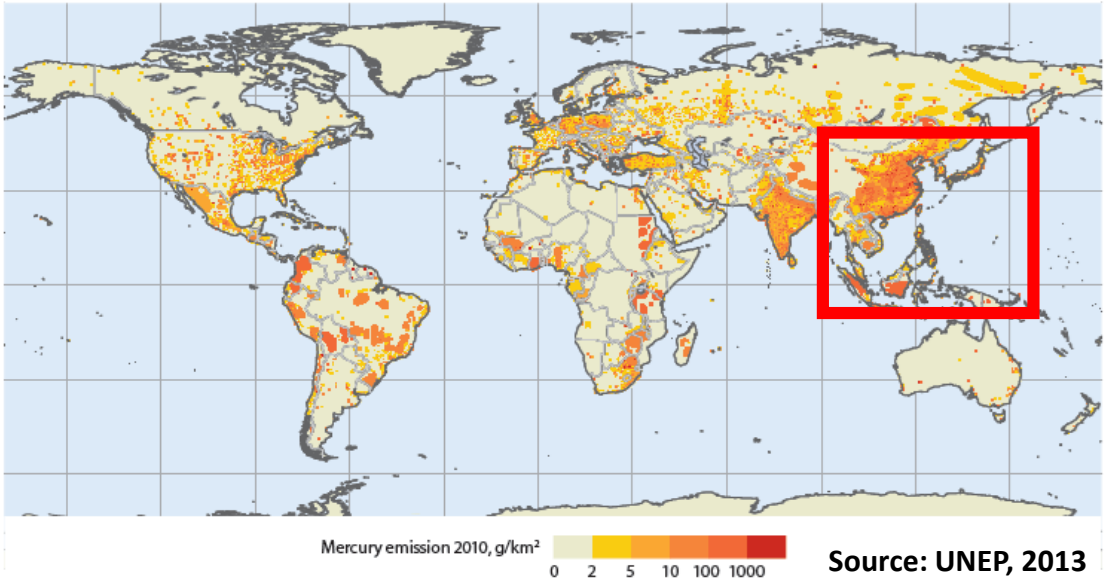
July 2016

Outline

- Why do we need an Asia-Pacific Mercury Monitoring Network?
- Approach to network development
- What progress have we made?
- The future

Why do we need an Asia-Pacific Mercury Monitoring Network?

Asia is the largest source of mercury emissions

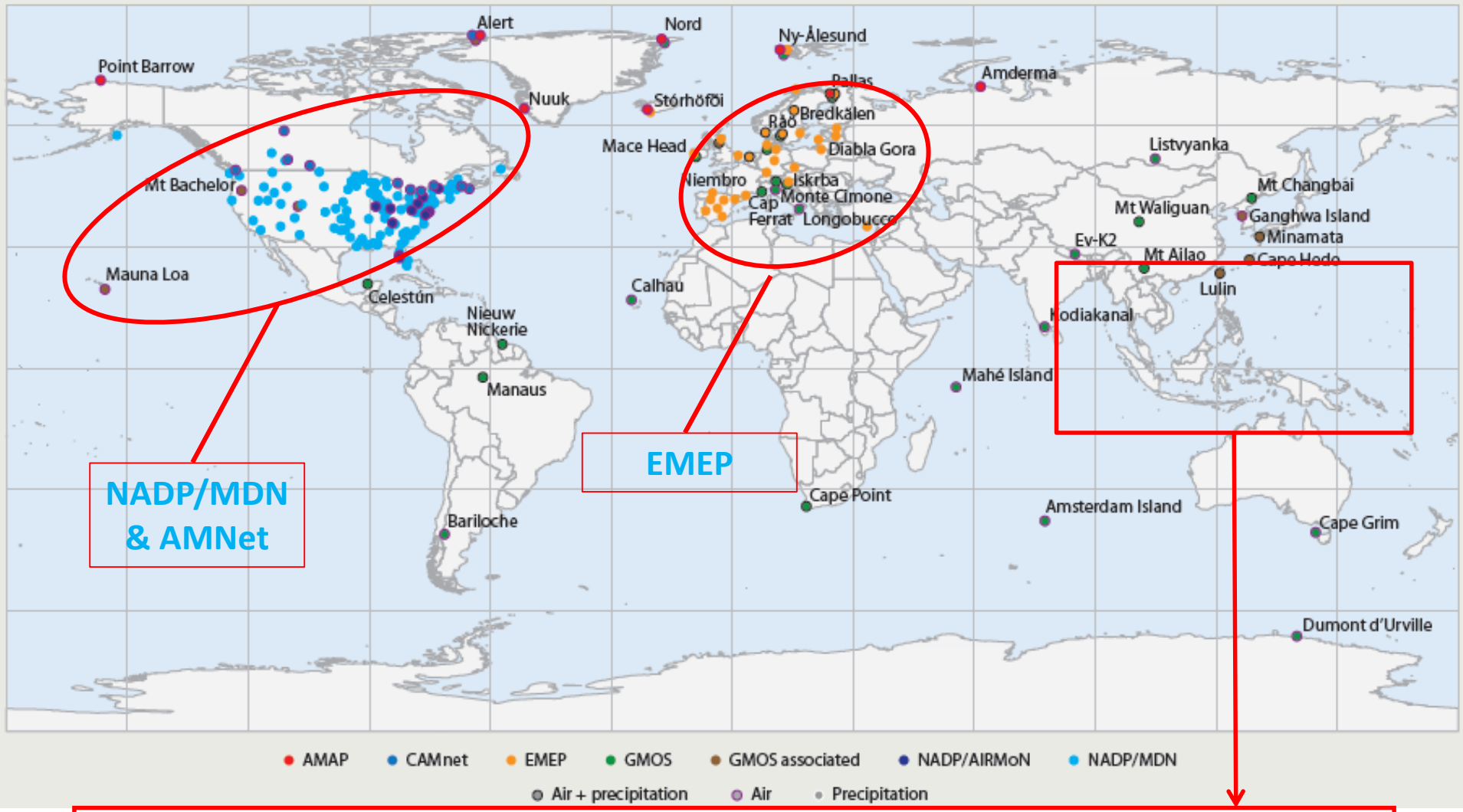


Source: UNEP, 2013

Region*	Emission (range), tonnes**	%
Australia, New Zealand & Oceania	22.3 (5.4 - 52.7)	1.1
Central America and the Caribbean	47.2 (19.7 - 97.4)	2.4
CIS & other European countries	115 (42.6 - 289)	5.9
East and Southeast Asia	777 (395 - 1690)	39.7
European Union (EU27)	87.5 (44.5 - 226)	4.5
Middle Eastern States	37.0 (16.1 - 106)	1.9
North Africa	13.6 (4.8 - 41.2)	0.7
North America	60.7 (34.3 - 139)	3.1
South America	245 (128 - 465)	12.5
South Asia	154 (78.2 - 358)	7.9
Sub-Saharan Africa	316 (168 - 514)	16.1
Undefined (global total for emissions from contaminated sites)	82.5 (70.0 - 95.0)	4.2
Grand Total	**1960 (1010 – 4070)**	**100**

Country	Emissions (tonnes)
Cambodia	3.9
China	575.2
Indonesia	78.2
Japan	17.2
Korea	7.1
Laos	1.3
Malaysia	6.1
Mongolia	6.9
Philippines	33.1
Singapore	0.9
Taiwan	5.5
Thailand	14.9
Vietnam	11.6

Few long-term atmospheric mercury measurements made in the region



Currently, there is no long-term or background atmospheric Hg monitoring activity in SE Asia; few measurements in East Asia; limited accessible data; no regional network

Minamata Convention will be in force soon

- Controls on all lifecycle stages of mercury
- Currently, 128 signatories; 28 ratifications
- Monitoring provisions and planning activities for effectiveness evaluation

7th session of the Intergovernmental Negotiating Committee on Mercury (INC 7) 10-15 March 2016 | Jordan

What’s our approach to network development?

The Mercury Cycle

Mercury is emitted to the atmosphere.

Mercury is deposited in rain and snow and as gases and particles.

Mercury accumulates in lakes, reservoirs, and forests.

Mercury is transported through watersheds and converted to methylmercury.

Methylmercury bioaccumulates in food webs.

A comprehensive and integrated multi-media monitoring network is needed

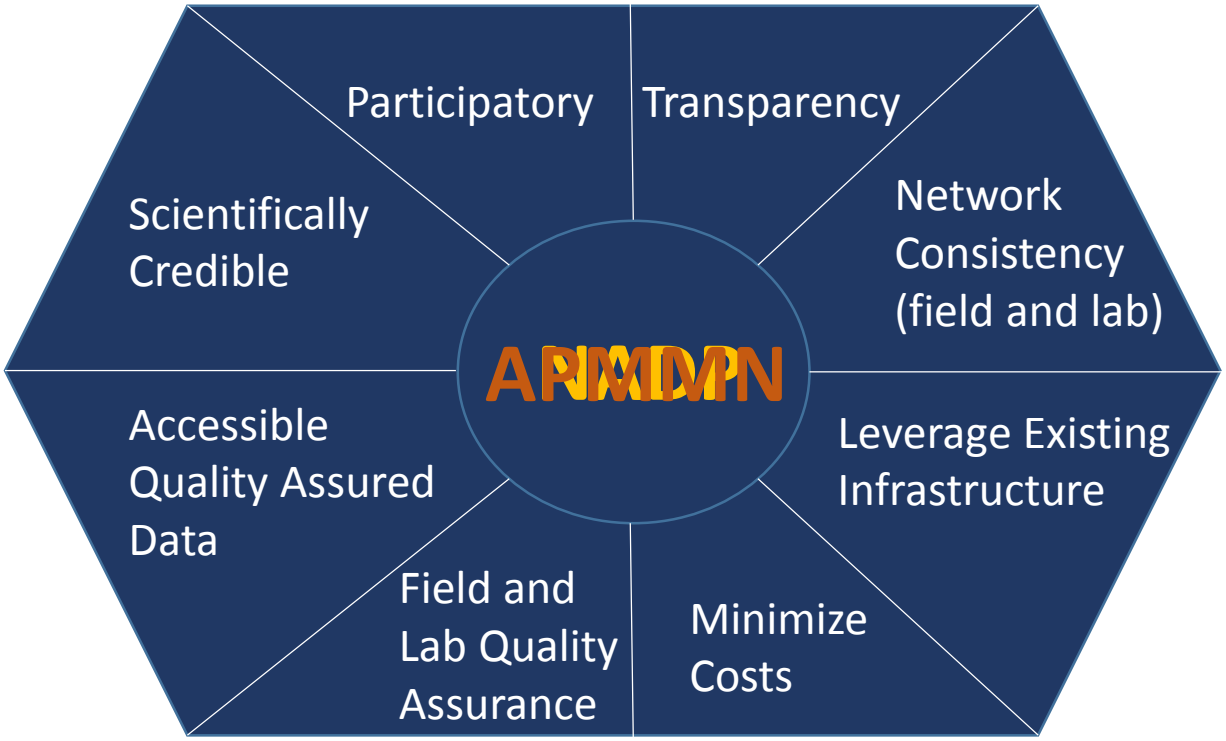
- **Our initial focus is mercury in precipitation**
  - Loadings to ecosystems
  - The atmosphere is the first place to identify changes in emissions of mercury

- Lots of monitoring experience; many experts regionally/globally

- We have an opportunity to help
  - Improve monitoring coordination
  - Assist countries with limited experience and capabilities (capacity building)

Network principles

- Based on the National Atmospheric Deposition Program ~40 years of cooperative, long-term monitoring



What progress have we made?

Who is involved?

Network regional planning and training workshops 2012-2015

Ministries and Agencies

- Bangladesh DOE
- Cambodia MOE
- Canada ECC
- Indonesia MOEF
- Japan NIMD, NIES, MOEJ
- Korea NIER
- Laos MONRE
- Malaysia MMD
- Mongolia NAMEM
- Myanmar MOECAF
- Philippines EMB
- Sri Lanka MMDE
- Taiwan EPA
- Thailand MONRE/DEQP, ERTC, PCD
- United States EPA, NOAA
- Vietnam VEA/CEM

Academic, Monitoring, and NGO

- Gwangju Institute of Science and Technology, Korea
- India Institute of Technology
- Kangwon National University, Korea
- National Atmospheric Deposition Program
- National Central University, Taiwan
- Sans Frontiere Progres
- University of Illinois

★ APMMN Workshop location (US not shown)

Milestones 2012-2015

2012 Identified key data gaps in the region and articulated a need for a coordinated network to monitor mercury transport and deposition

2013 Agreed to develop a standardized pilot network to monitor mercury in rainwater and in air; established a network Science Advisory Group (SAG) to guide network activities

2014 Developed and adopted APMMN SOPs to monitor mercury in rainwater

Established three mercury wet deposition pilot sites; central mercury analytical lab at National Central University, Taiwan

2015 Expanded network sites and partners; further developed network infrastructure; hired a network site liaison; website

2016 Expanded lab, launch monitoring and technology center; plans for monitoring atmospheric mercury concentrations; training

Network goal and objectives

- Goal
  - Systematically monitor wet deposition and atmospheric concentrations of mercury in a network of stations throughout the Asia-Pacific region

- Objectives
  - Determine the status and trends in concentrations of ambient mercury species, and wet, dry, and total atmospheric deposition of mercury
  - Develop a robust dataset for regional and global modeling
  - Assist partner countries in developing monitoring and assessment capacity
  - Share data and monitoring information

Where are we?

- A 3-year pilot network for wet Hg deposition monitoring; sites in Indonesia, Thailand, and Vietnam
  - Using APMMN SOPs based on NADP/MDN and adapted to regional conditions
  - Sample collection started 9/2014
- Samples shipped to National Central University of Taiwan for Hg analysis
- Data reported back to operating country
- U.S. led capacity building and site operator training workshops
- Transition to fully-operational wet network anticipated by 2017

Wet network profile

- The Science Advisory Group developed and approved the Mercury Wet Deposition Network Field Standard Operating Procedures V.2.0. *APMMN* (2014)

NCON Model
MDN 00-125-2

NADP-style
Aerochem 301

Taiwan-style
MIC

Sampler: Automated wet only precipitation collection systems (goal one or two)

Sampling Frequency: One week

Sampling Schedule: Sample bottles and glassware are changed every Tuesday

Chemical Analysis: Cold vapor atomic fluorescence spectroscopy (CVAFS) at National Central University, Taiwan

Mercury Forms: Total mercury wet deposition and precipitation concentrations

Site Locations: Regionally representative; rural, urban, and suburban areas with estimated high levels of mercury emissions and deposition; and sensitive ecosystems

Asia Pacific Mercury Monitoring Network

Phase 1
Wet Deposition Sites

- Operating
- Sampling Splits
- K Affiliated Network (domestic)
- Pending (waiting equipment)
- Initial Interest/Acceptance

Central Laboratory (NCU)

Asia Pacific Mercury Monitoring Network

Phase 1 & 2 Wet Deposition Sites

- Operating
- Sampling Splits
- (K) Affiliated Network (domestic)
- Pending (waiting equipment)
- Initial Interest/Acceptance

Central Laboratory (NCU)

Planned

The near future

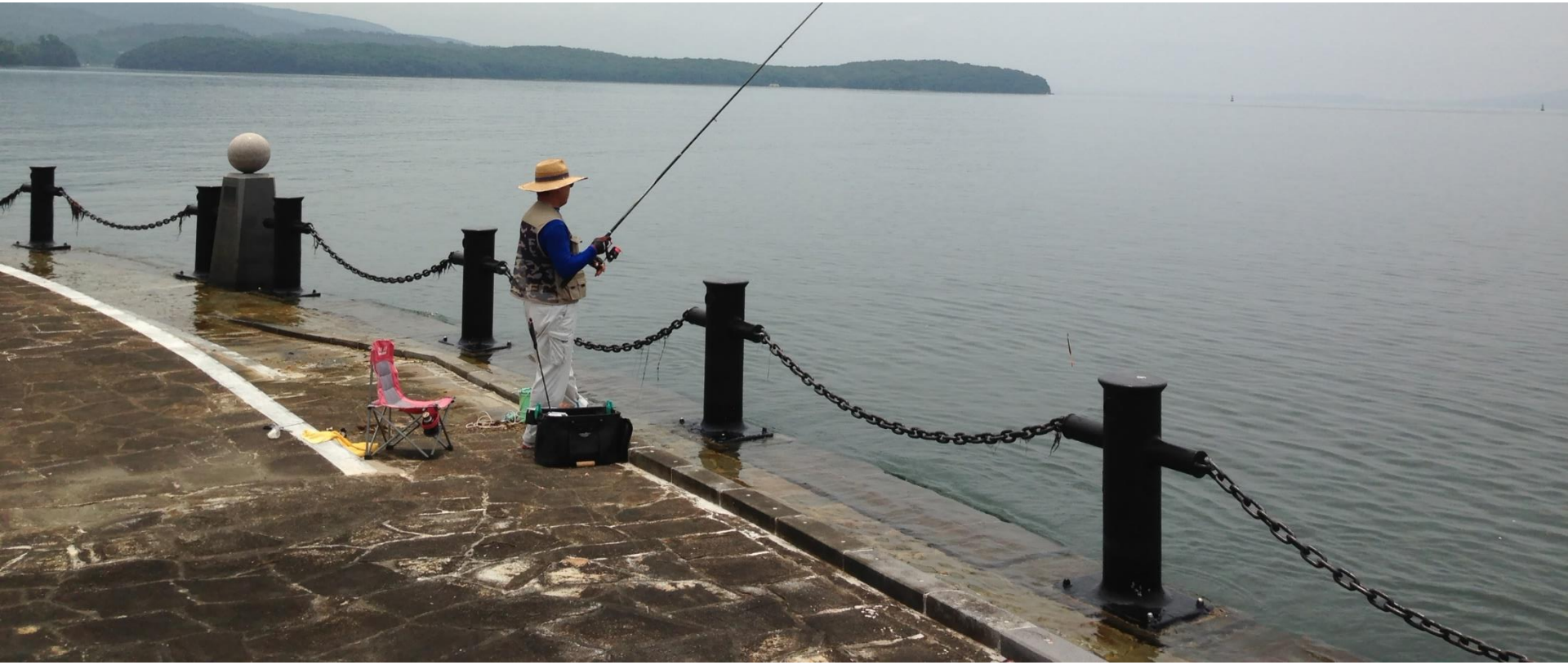
1. **Bring in new partners and expand existing wet network**
   - Procure and deploy new mercury wet deposition collectors

2. **Continue training and network organizational development**
   - Annual Partners Meeting and training, site visits
   - Launched the APMMN “Program Office” - Joint Center for Environmental Monitoring and Technology, June 2016, NCU, Taiwan

3. **Network atmospheric mercury monitoring stations**
   - Explore networking operating atmospheric mercury monitoring systems into one harmonized network in the Asia Pacific region
   - Tekran Operators Workshop in Japan

4. **Data acquisition, management and distribution**
   - Assist Taiwan in developing a database; update website where data will be distributed
   - Invite monitoring stations and data streams into APMMN (e.g., Korea, Japan)

Summary: The Asia-Pacific Mercury Monitoring Network (APMMN) is…

- A group of countries, agencies, academics and monitoring groups
- Making measurements of mercury
  - Wet deposition
  - Concentrations in gaseous and particle bound forms
- Using the same instruments and standard operating procedures across Asian countries and consistent with NADP
- Sharing data to solve the mercury problem

Thanks!