Where should we monitor Hg in Canada?

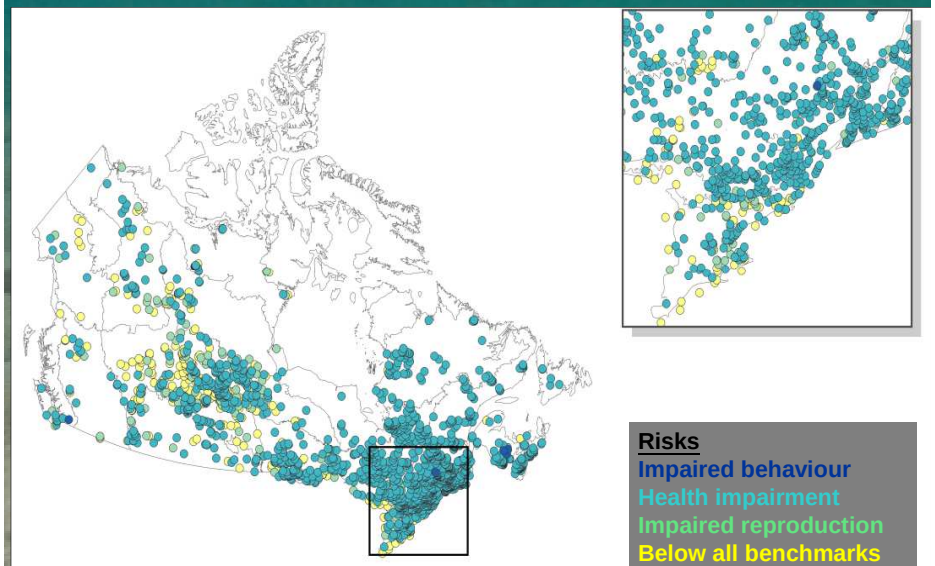
Atmospheric monitoring is undertaken to address several different goals:

1. Input levels of mercury to ecosystems

2. Ambient levels resulting from domestic and regional emission sources

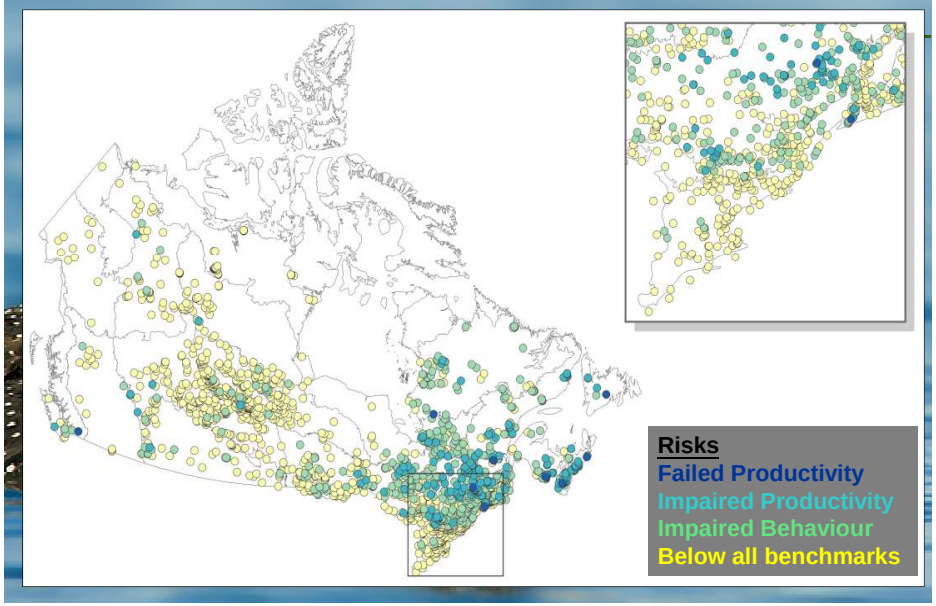
3. Transboundary transport of mercury into Canada

Ecosystem impacts: Fish eating fish



Mercury is a risk to Iconic Canadian bird

The Common Loon

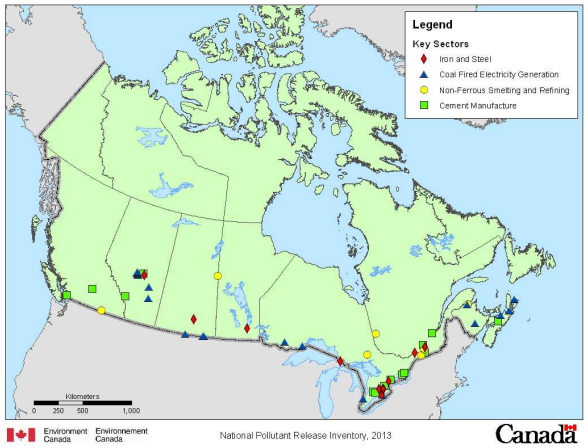


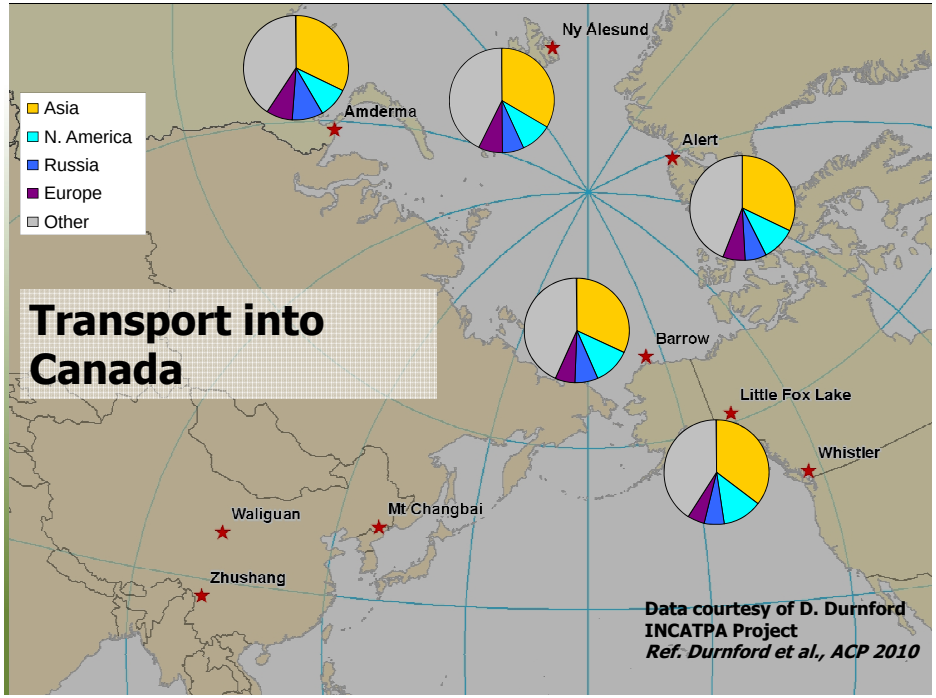
Canadian Anthropogenic Emissions

- Canadian emitters from the four most important industrial sectors
- Contribute > half of Canada's emissions.

Sectors

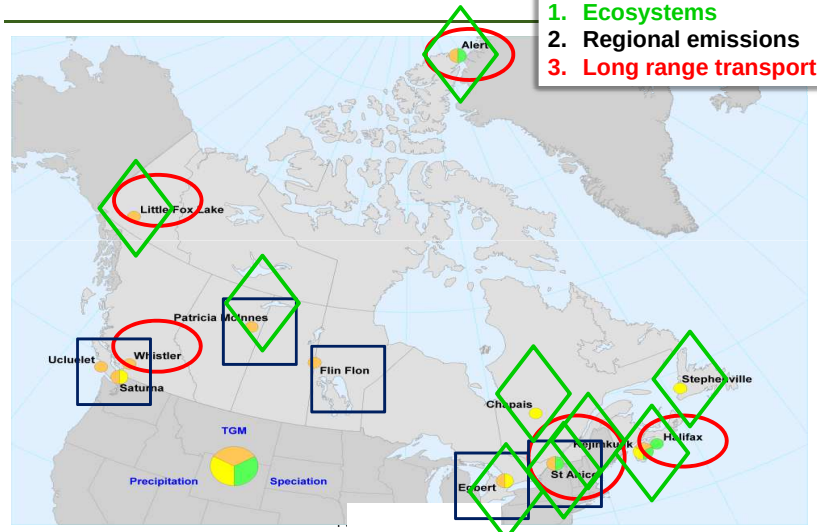
- Iron and steel production
- Coal-fired power plants
- Non-ferrous metals processing
- Cement production and processing





Air Monitoring today in Canada

1. Ecosystems
2. Regional emissions
3. Long range transport



Environment and Climate Change Canada | Environnement et Changement climatique Canada

Canada

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- Greg Skelton

Environment Canada | Environnement Canada

Canada

Mercury-2016 workshop
26-29 July 2016 Bangkok, Thailand

Introduction of Mongolia

Enkhmaa Sarangerel
National Agency for Meteorology and Environment Monitoring

Content are

1. **General information of Mongolia**
2. **About NAMEM and Environmental Monitoring Network of Mongolia**

General information of Mongolia (1)

Mongolia is located in the central part of Asia between $41^0$35”-$52^0$06” of altitude and $87^0$47”-$119^0$57” of longitude Neighbouring with Russia along 3485km in the north, with China 4676.9km in the south. Mongolian territory 1564.1 thousand square km of land.

General information of Mongolia (2)

Average altitude – 1580m above sea level
-the highest point – 4653m,
-the lowest point – 532m

The capital city Ulaanbaatar – 1350 m

General information of Mongolia (3)

- Temperature:

-Average annual temperature are around 8.5^{o}C in the Gobi desert region and -7.8^{o}C in the high mountainous areas.

-The extreme minimum temperature is -31.1^{o}C to -52.9^{o}C in January,

-The extreme maximum temperature is +28.5^{o}C to +42.2^{o}C in July.

General information of Mongolia (4)

- Precipitation:

-The annual precipitation amount is low averaging 200-220mm

-from less 50 mm per year in extreme South (Gobi desert region)

-to about 400 mm per year in limited areas in the North.

-Most precipitation occurs in June, July, August

- Driest months are from November to March

General information of Ulaanbaatar city

- Area: 4700 km^2
- Population: half of total (as of 2015)
- Average temperature: +2.2^{0}C
- Annual precipitation: 242.7 mm
- Relative humidity: 69%

Pollution sources in Ulaanbaatar city

1.Mobile sources:

- 350.000 vehicles

2.Stationary sources:

- 3 coal fired thermo power plants ,
- more than 370 heat only boilers (HOB)

3.Area sources:

- 180000 traditional and private houses (coal used)

4. Household waste -800-850.000 tons/year

Coal and fuel consumption in Ulaanbaatar city

1. Coal consumption: Mongolia is rich by coal reserves and coal is main source of electricity and heat production.

- The 3 power plants consume approximately 5 million tons of coal for energy production
- heat only boilers (HOB) burn an annual average of 300.000 tons of coal
-Ger house's consume are 600.000 tons per year of coal /winter season for cooking and heating

2. Fuel consumption:

-Diesel -350.191ton/year (in Mongolia)

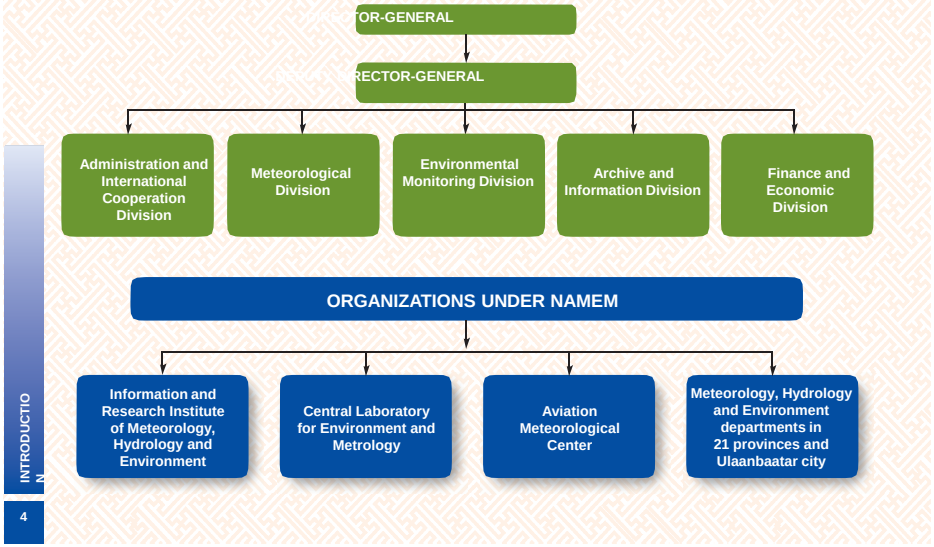
-Benzene-232.950 ton/year (In Mongolia)

National agency of meteorology and environmental monitoring

Main goal of the service: to provide weather and climate forecasts and warning for the protection of human life and its property from a natural disasters and the enhancement of the national socio-economic development of the country

NAMEM is responsible for environmental monitoring of water, air, soil quality, acid deposition, radiation dose rate, yellow dust to control the environmental quality

Organizational structure of NAMEM

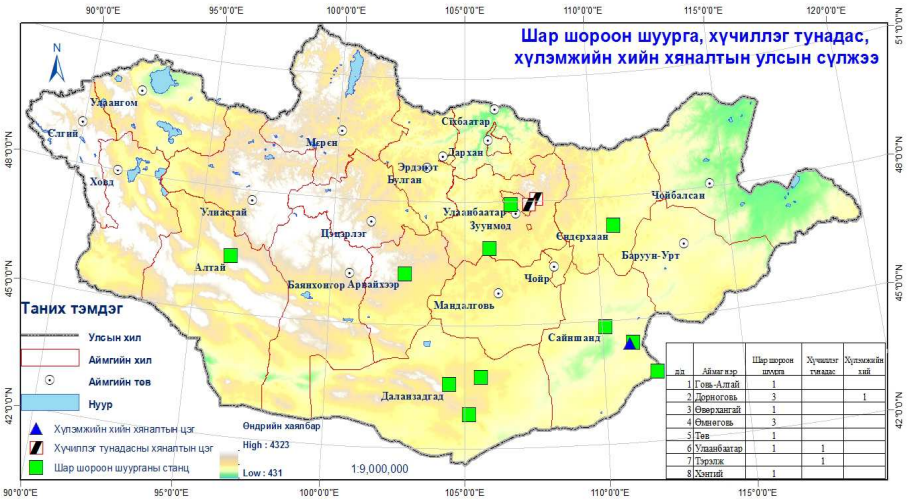


Air quality network in Mongolia

Surface water quality network in Mongolia

Radiation doze rate station in Mongolia

Yellow dust, acid deposition, GHG network in Mongolia



Wet deposition monitoring site

Mongolia has been participating in EANET since 1998 with start of activities during the preparatory phase.

Urban site- Ulaanbaatar

Longitude 106° 54' E,
Latitude 47° 55' N,
Altitude 1275m asl

Remote site - Terelj

Longitude 107° 29' E,
Latitude 47 ° 59' N,
Altitude 1550 m asl

Dry Deposition Monitoring site

Remote site - Terelj

Urban site- Ulaanbaatar

Dry & Wet Deposition Monitoring Plan

Monitoring site	Items	Monitoring interval	Monitoring parameters
Terelj Ulaanbaatar	Wet deposition	Daily Daily (May to October)	pH, EC, SO_4^{2-}, $NO_3^-$$Cl^-$, NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}
Terelj Ulaanbaatar	Dry deposition	Biweekly Weekly (May to October)	Gases: SO_2, HNO_3, HCl, NH_3 Aerosol: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Na^+, K^+, Ca^{2+}, Mg^{2+}

Training and awareness

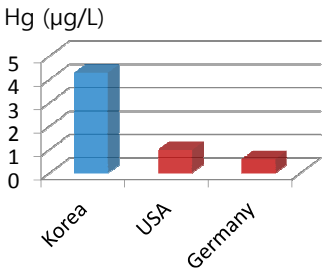
Wet Deposition and Watershed Transport of Mercury in South Korea

07. 27. 2016

Seunghee Han
Gwangju Institute of Science and Technology (GIST)
Gwangju, Korea

General Issues in Korea

- Downwind area of China
- Seafood consumption rate is high
- 26% of Korean population has higher mercury levels than US guidelines



Outlines

- Wet deposition monitoring activities in South Korea
- Wet deposition monitoring related programs in South Korea
- Plans

➢ University monitoring sites

Seoul (population 10,000,000):

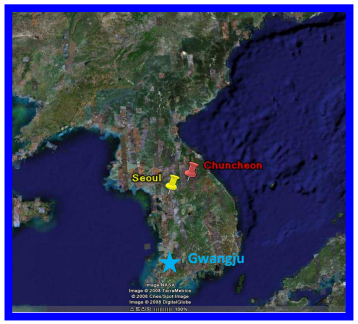
- Seoul National University

Chuncheon (population 280,000)

- Gangwon National University

Gwangju (popuation 1,500, 000)

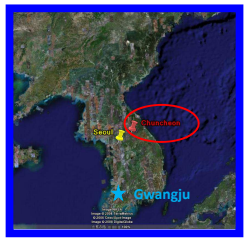
- Gwangju Institute of Science and Technology (GIST)

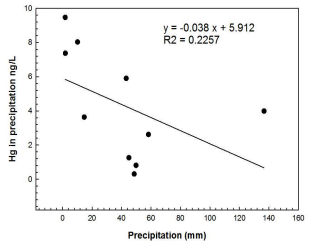


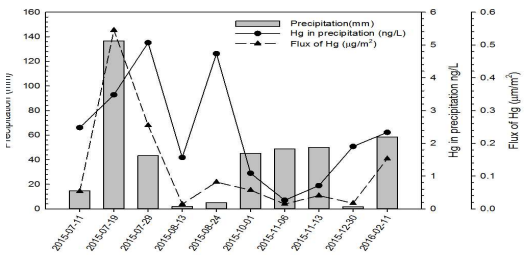
➢ NIER monitoring sites

➢ Chuncheon, Gangwon province (*courtesy of Young-Ji Han*)

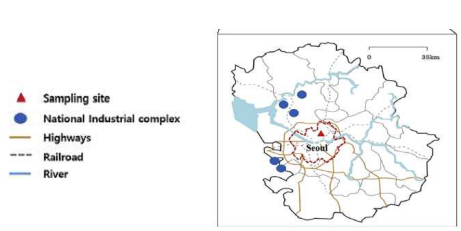
	Precipitation depth (mm)	VWM Hg (ng/L)	Flux (μg/m²)
2008 (12 month)	1210	4.2	5.1
2009 (12 month)	1314	3.5	4.6
2010 (12 month)	1020	1.1	1.7
2011 (12 month)	362	1.2	1.0
2012 (7 month, Jan-Jul)	711	0.6	0.8
2015 (8 month, Jul-Feb)	405	2.4	2.3

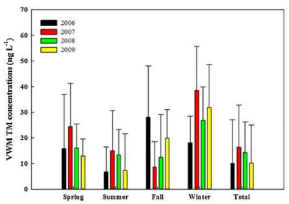


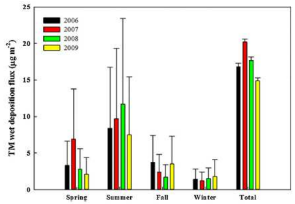


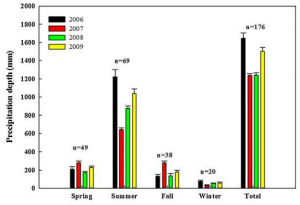


➢ Seoul (*Seo et al., 2012, 2015, Atmospheric Environment)*









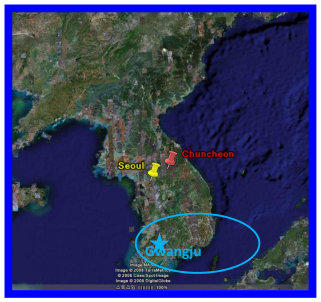
1) Seasonal variations in TM wet deposition and flux
2) Relative contributions of GOM and PBM scavenging to Hg wet deposition
3) Identifying source areas contributing to the high TM wet deposition using a LPDM

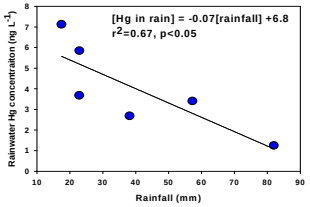
➢ Gwangju, Cheonnam province

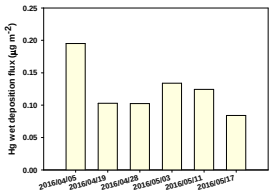
Sampling period : April 2016 – present

Model: MDN 00-125-4

	Starting	Ending	Temp	Precipitation	Hg
			℃	mm	ng/L
1	2016-04-05	2016-04-13		57	3.4
2	2016-04-19	2016-04-27	26.7	82	1.3
3	2016-04-28	2016-05-03	26.7	38	2.7
4	2016-05-03	2016-05-11	33.3	23	5.9
5	2016-05-11	2016-05-17	34.4	17	7.1
6	2016-05-17	2016-05-25	33.9	23	3.7
			31.0	241 (total)	3.1 (VWM)







➢ Summary

Site	Country	Year	Precipitation (mm)	VWM Hg (ng L^{-1})	Flux (μg m^{-2})
Bekkai, Hokkaido* (remote)	Japan	2003	1117	5.2	5.8
Kashima, Fukushima (urban)			1599	6.3	10.1
Matsuura, Nagasaki (urban)			2317	7.6	17.6
Seoul**	Korea	2006	1645	10.1	16.6
		2007	1235	16.3	20.1
		2008	1242	14.3	17.8
		2009	1502	10.2	15.3
Chuncheon	Korea	2008	1210	4.2	5.1
		2009	1314	3.5	4.6
		2010	1020	1.1	1.1
		2011	362	1.2	0.4
Gwangju	Korea	2016 (Apr-May)	240	3.1	0.7

*Sakata and Marumoto, 2005; ** Seo et al., 2015

Wet deposition related programs in South Korea

Project Title	Period	Purposes	Funding agency	Participating organization
National mercury monitoring program (water)	2013-2015 2016-2020	Establish nationwide Hg monitoring program (parameter, frequency, site..etc) Preliminary study	Department of Environment (DE)	Korea Environment Corporation EH R&C Gwangju Institute of Science and Technology
Assessment for the fate of mercury in lake ecosystems	2015-2017	Predict responses of MeHg accumulation in fish to the atmospheric deposition changes	Korea Environmental Industry & Technology Institute (KEITI)	대구대학교 DAEGU UNIVERSITY Texas A&M AgriLife Research Gwangju Institute of Science and Technology

1. Nationwide mercury monitoring program

Fate Assessment

- Responses of aquatic ecosystem to the atmospheric mercury deposition

Temporal Trends

- Identification of temporal trends of Hg deposition

	Target area	Medium	Parameter	Frequency
Fate	Baekrok Lake, Hanra Mountain	Sediment	Hg, MeHg, radioisotopes for dating	1/5 year
	Five lakes	Water	Hg, MeHg, sulfate, DOC, nitrate, phosphate, pH, temp, DO, conductivity	3/ year (1~2, 5~6, 8~9)
				2/ year (5~6, 8~9)
		Sediment	Hg, MeHg, particle size	2/ year (5~6, 8~9)
		Food web	Hg, fork length, C/N stable isotopes	1/ year (5~6)
		Atmos	Wet Hg deposition	1/ year (2016.10~)
Temporal trends	Five rivers	Water	Hg, MeHg, sulfate, DOC, nitrate, phosphate, pH, temp, DO, conductivity	3/ year (1~2, 5~6, 8~9)
		Sediment	Hg, MeHg, particle size	2/ year (5~6, 8~9)
		Fish (6 species)	Hg, fork length, C/N stable isotopes	1/ year (5~6)

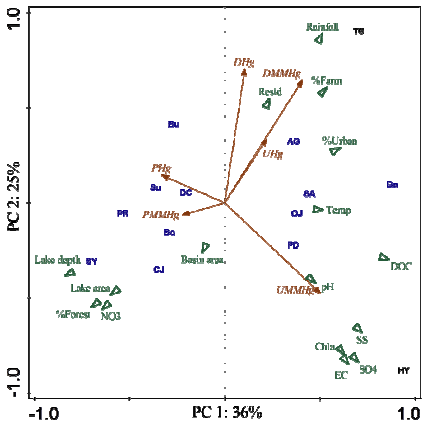
1. Nationwide mercury monitoring program

Reservoir name	TSI(chl-a)[a]	TS	Limiting factor
Paldang	54	Eutrophic	Zooplankton grazing
Chungju	38	Oligotrophic	Light
Paro	35	Oligotrophic	Light
Daecheong	52	Mesotrophic	Phosphorus
Soyang	49	Mesotrophic	Phosphorus
Okjeong	44	Oligotrophic	Light and phosphorus
Boryeong	47	Mesotrophic	Phosphorus
Hoeya	59	Eutrophic	Zooplankton grazing
Buan	42	Oligotrophic	Light and phosphorus
Sueo	48	Mesotrophic	Phosphorus
Togyo	35	Oligotrophic	Light
Banwol	56	Eutrophic	Zooplankton grazing
Angye	46	Mesotrophic	Light and phosphorus
Seonam	54	Eutrophic	Zooplankton grazing

1. Nationwide mercury monitoring program

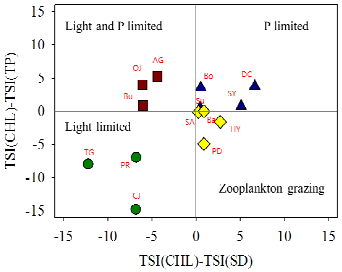
	Sample collection date	Sample #	UHg	DHg	PHg	UMMHg	DMMHg	PMMHg
		n	ng L^{-1}	ng L^{-1}	ng g^{-1}	pg L^{-1}	pg L^{-1}	ng g^{-1}
Paldang	Sept. / 2015	5	0.45±0.15	0.25±0.034	44±26	29±4.8	11±0.94	4.0±0.86
Chungju	Sept. / 2015	5	0.33±0.044	0.23±0.026	29±5.1	96±16	9.0±2.7	25±3.8
Paro	June / 2013	6	0.85±0.14	0.26±0.034	567±102	20±2.2	8.4±2.1	11±0.10
Daecheong	Sept. / 2015	5	0.24±0.024	0.13±0.049	44±10	13±5.8	7.2±4.3	2.3±0.60
Soyang	Oct. / 2014	5	0.40±0.098	0.25±0.018	54±29	10±2.3	6.3±0.78	1.3±0.54
Okjeong	June / 2013	5	1.1±0.19	0.36±0.065	91±15	28±15	8.0±2.3	2.5±1.6
Boryeong	July / 2014	4	0.22±0.020	0.13±0.059	64±28	19±2.4	11±4.0	5.7±1.1
Hoeya	July / 2014	5	0.62±0.12	0.24±0.016	14±3.9	80±27	13±2.9	2.5±0.89
Buan	July / 2014	5	0.63±0.061	0.31±0.019	168±22	14±1.2	10±1.2	2.1±0.01
Sueo	Sept. / 2013	3	0.68±0.051	0.34±0.054	115±1.0	16±7.1	3.3±0.26	4.3±2.3
Togyo	Aug. / 2013	5	0.99±0.11	0.58±0.078	136±11	65±8.0	31±7.4	11±0.20
Banwol	July / 2015	3	0.74±0.046	0.22±0.040	35±0.40	18±2.4	12±3.6	0.40±0.08
Angye	Sept. / 2015	3	0.21±0.051	0.18±0.049	16±1.1	51±7.1	25±0.28	14±3.6
Seonam	Sept. / 2015	3	0.63±0.20	0.16±0.067	53±15	50±5.9	15±3.3	4.0±0.30

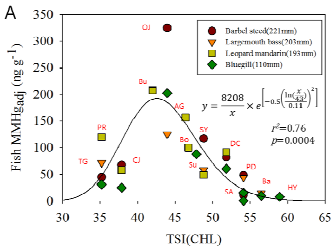
1. Nationwide mercury monitoring program

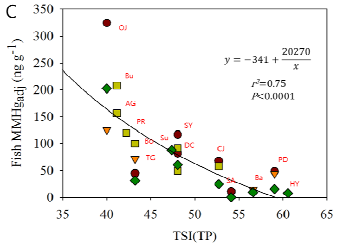


Sampling period: June 2013 - September 2015
Sample number: 70 samples

1. Nationwide mercury monitoring program



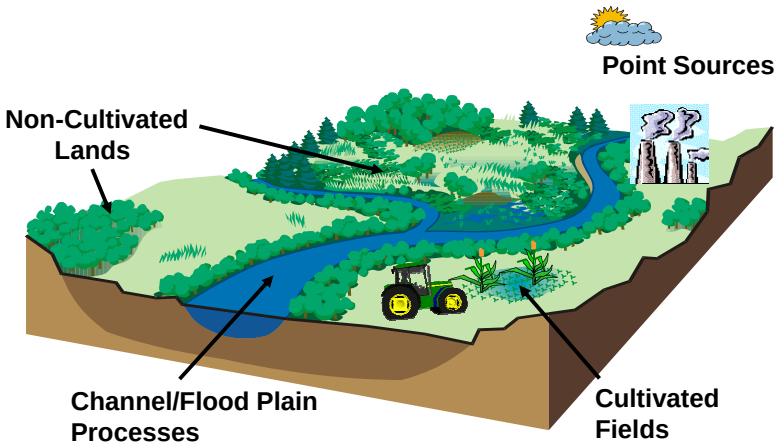




Sampling period: June 2013 - September 2015
Sample number: 70 samples

2. Assessment for the fate of Hg in lake ecosystems

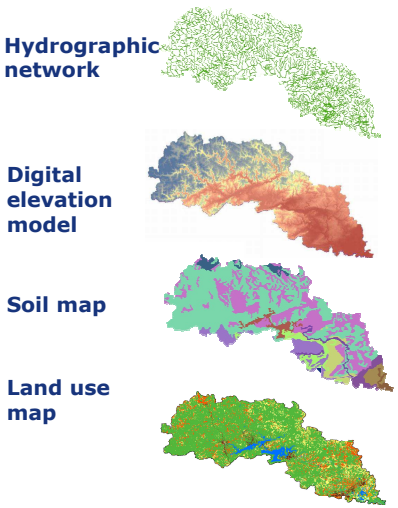
Soil & Water Assessment Tool (SWAT)

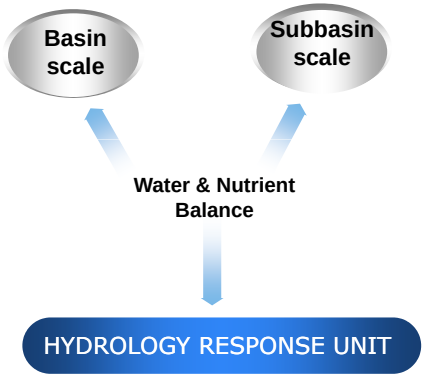


Courtesy of Jaehak Jeong

2. Assessment for the fate of Hg in lake ecosystems

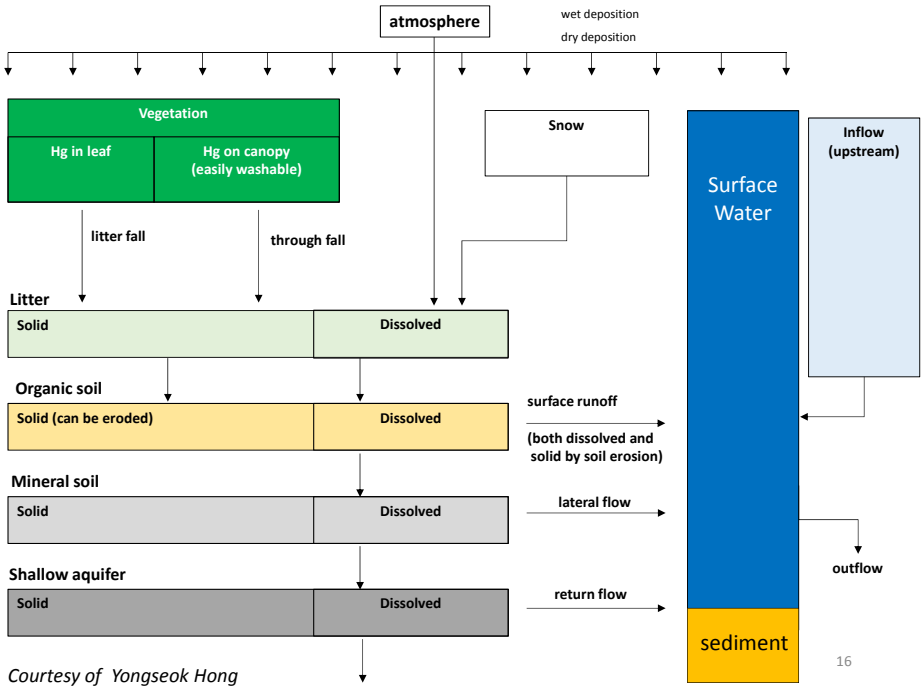
Data Layers and Model Construction





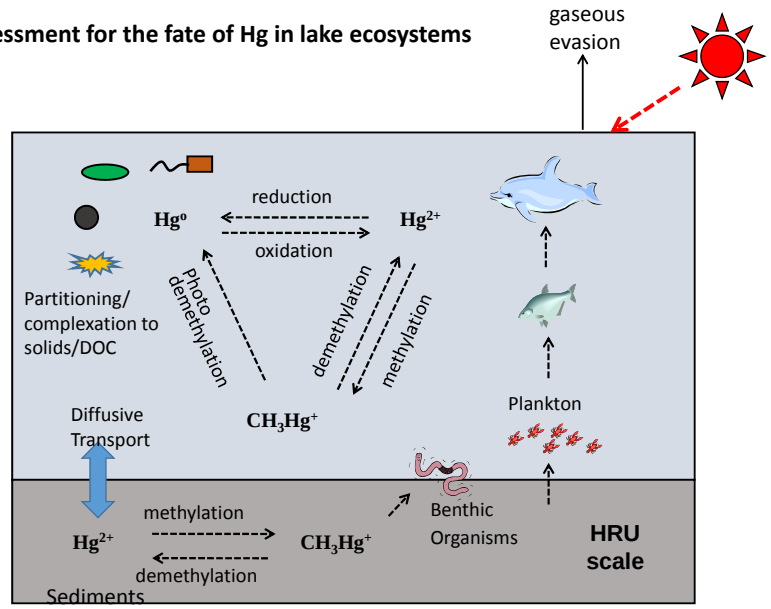
Courtesy of Jaehak Jeong

TEXAS A&M AGRILIFE RESEARCH



Courtesy of Yongseok Hong

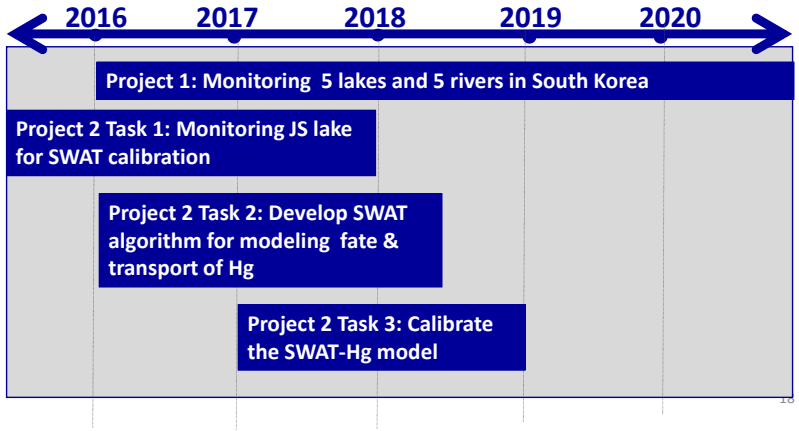
2. Assessment for the fate of Hg in lake ecosystems



Courtesy of Yongseok Hong

Future Plans

1. Monitoring and source identification of wet deposition of Hg
2. Apply wet deposition flux of Hg to statistical interpretations of the nationwide monitoring data for identifying methylation-related factors
3. Apply wet deposition flux of Hg to SWAT-Hg model for simulating fish MeHg in response to atmospheric Hg reduction



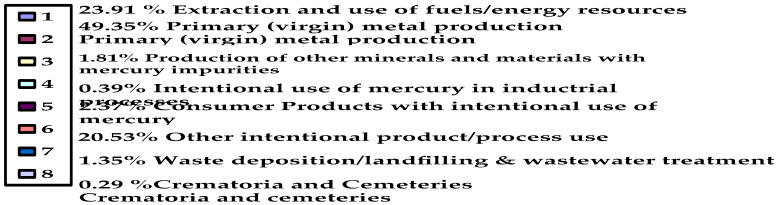
Special thanks to:

Yongseok Hong in Daegu University

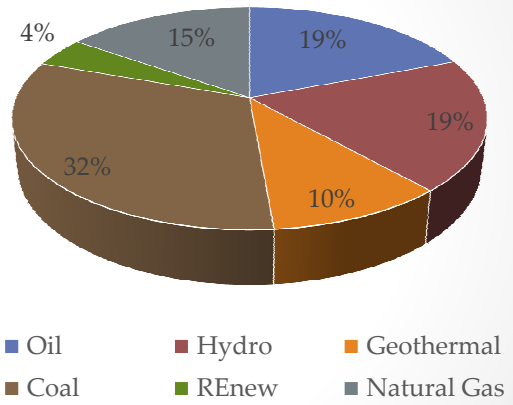
Jaehak Jeong in Texas A&M University

Young-Ji Han in Gangwon National University

Mercury Monitoring in the Philippines and other Air Concentrations



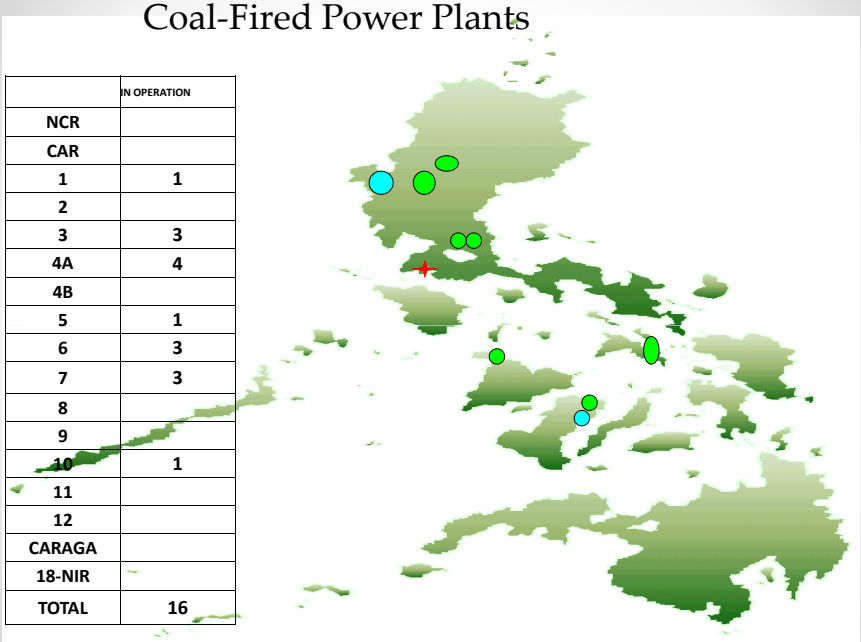
2015 POWER GENERATING CAPACITY (MW) PHILIPPINES		
	MW	%
Oil	3610	19%
Hydro	3600	19%
Geothermal	1917	10%
Coal	5963	32%
REnew	813	4%
Natural Gas	2862	15%
TOTAL	18765	100.00 %
SOURCE: DOE		



SOURCE:http://www.doe.gov.ph/sites/default/files/pdf/energy_statistics/power_statistics_2015_summary.pdf

Coal-Fired Power Plants

	IN OPERATION
NCR	
CAR	
1	1
2	
3	3
4A	4
4B	
5	1
6	3
7	3
8	
9	
10	1
11	
12	
CARAGA	
18-NIR	
TOTAL	16



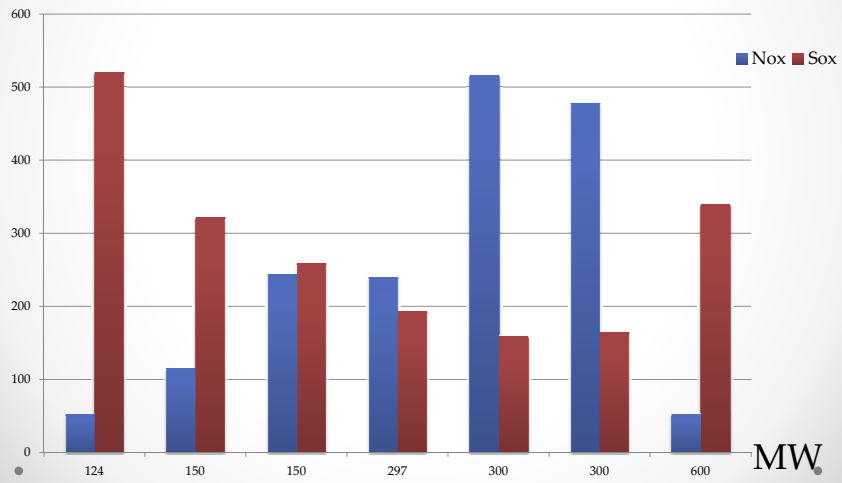
30 MW Coal-Fired Thermal Power Plant

PARAMETER	30 MW mg/Ncm	STANDARDS mg/Ncm
MERCURY	0.008	5
Sulfur Oxides (as SO2)	354	700
Nitrogen Oxides (as NO2)	205	1,000
Carbon	26	500

300 MW Coal-Fired Power Plant

PARAMETER	300 MW mg/Ncm	STANDARDS mg/Ncm
MERCURY	0.0028	5
Sulfur Oxides (as SO2)	1,361	1,500
Nitrogen Oxides (as NO2)	702	1,000
Carbon Monoxide	2	500

Mercury Emissions Below the DENR Standard



Coal Specification/APCD

	30 MW	300 Mw
Coal Type	bituminous	bituminous
% sulfur		0.9
Ash content		16.9
APCD	Electrostatic precipitators	Electrostatic precipitators

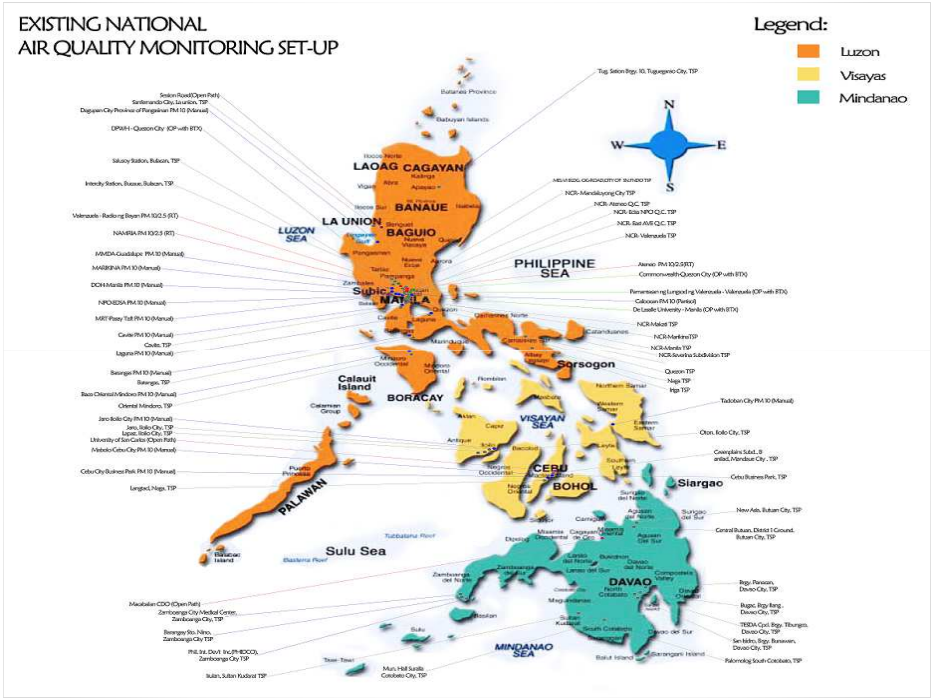
- Coal analysis for most tests were 0.9 to 1.0 % S
- 50 % of stack installations are with air pollution control devices
- Compliance standards differ with new and existing sources
- Determine compliance for coal-fired plants with high content of sulfur

Automated Monitoring

Tekran 2537 Mercury Monitoring
March 2015

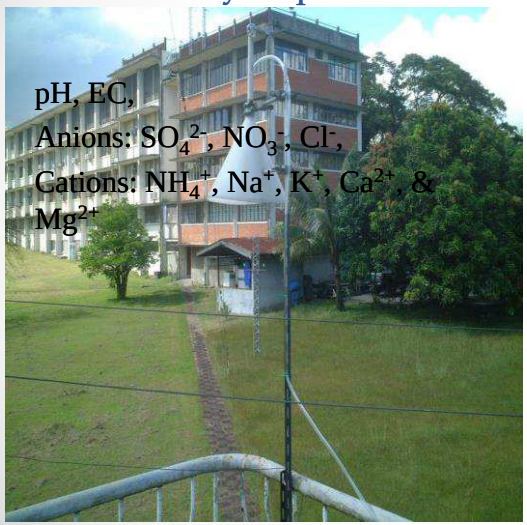
Gaseous Elemental Mercury, ng/cu.m.

EXISTING NATIONAL
AIR QUALITY MONITORING SET-UP



EANET

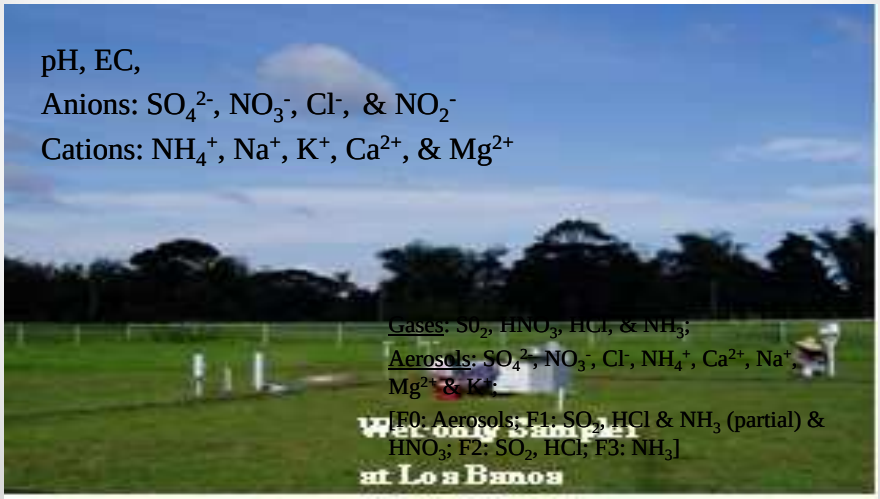
Wet/Dry Deposition Monitoring - Urban



pH, EC,
Anions: SO_4^{2-}, NO_3^-, Cl^-,
Cations: NH_4^+, Na^+, K^+, Ca^{2+}, & Mg^{2+}

Gases: SO_2, HNO_3, HCl, & NH_3;
Aerosols: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca^{2+}, Na^+, Mg^{2+} & K^+;
[F0: Aerosols; F1: SO_2, HCl & NH_3 (partial) & HNO_3; F2: SO_2, HCl; F3: NH_3]

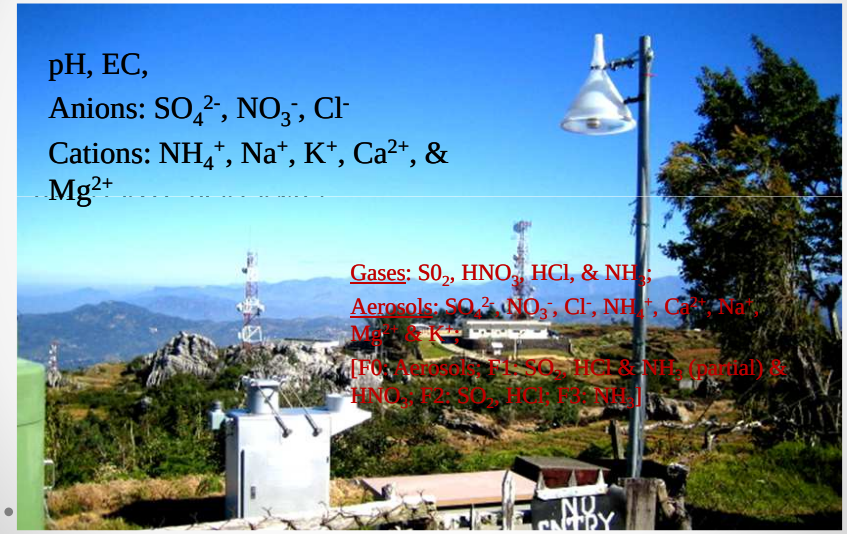
Wet/Dry Deposition Monitoring - Rural



pH, EC,
Anions: SO_4^{2-}, NO_3^-, Cl^-, & NO_2^-
Cations: NH_4^+, Na^+, K^+, Ca^{2+}, & Mg^{2+}

Gases: SO_2, HNO_3, HCl, & NH_3;
Aerosols: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca^{2+}, Na^+, Mg^{2+} & K^+;
[F0: Aerosols; F1: SO_2, HCl & NH_3 (partial) & HNO_3; F2: SO_2, HCl; F3: NH_3]

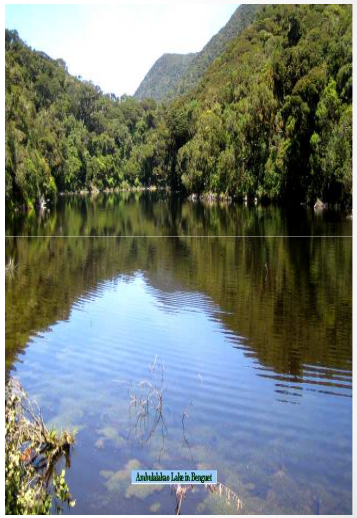
Wet/Dry Deposition Monitoring - Remote



pH, EC,
Anions: SO_4^{2-}, NO_3^-, Cl^-
Cations: NH_4^+, Na^+, K^+, Ca^{2+}, & Mg^{2+}

Gases: SO_2, HNO_3, HCl, & NH_3;
Aerosols: SO_4^{2-}, NO_3^-, Cl^-, NH_4^+, Ca^{2+}, Na^+, Mg^{2+} & K^+;
[F0: Aerosols; F1: SO_2, HCl & NH_3 (partial) & HNO_3; F2: SO_2, HCl; F3: NH_3]

Inland Monitoring



Catchment Area

- **Bayabas: closed forest, continuous flow through a year**

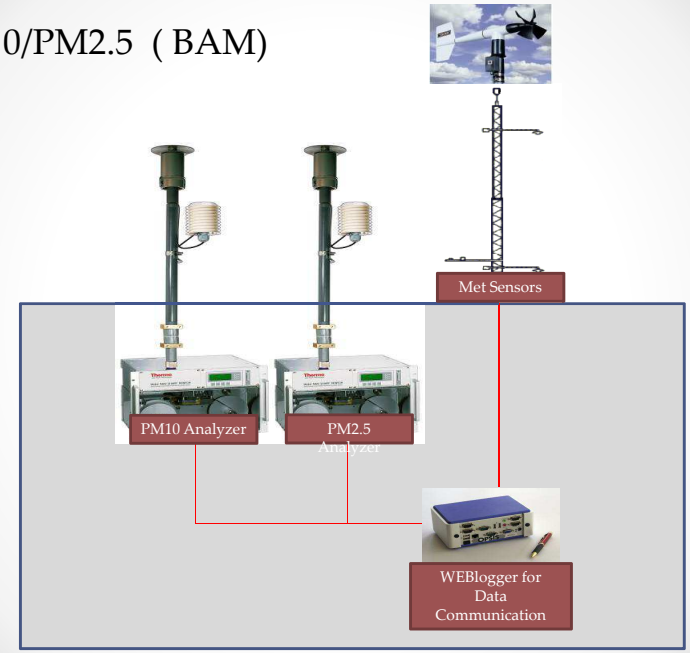
Status of EANET/non-EANET Air Concentration Monitoring (1/2

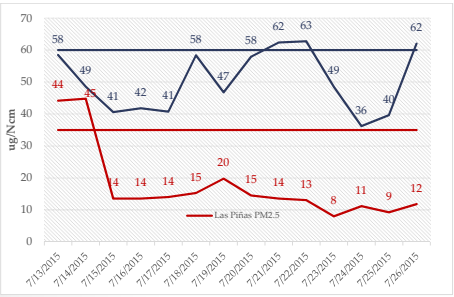
Total number of Air Concentration monitoring sites		Responsible Organization
EANET site	4	National Government (EMB-DENR)
non-EANET site	18	National Government (EMB-DENR (Real time-automatic) /criteria+ PM10/2.5
	9 + 27	National Government (EMB-DENR PM 10 manual/reference method/continuousPM10/2.5
	9	TSP manual/reference method
Total	**74**	

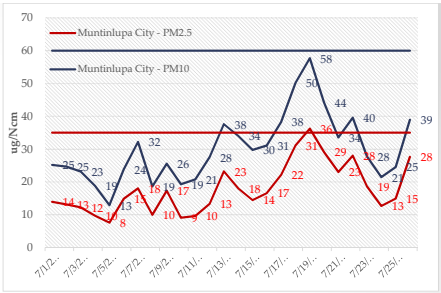
Monitoring parameters	Number of sites	Time resolution
SO_2	21	minute
NO_x	21	minute
O_3	21	minute
PM_{10} (SPM)	37	minute
$PM_{2.5}$	37	minute

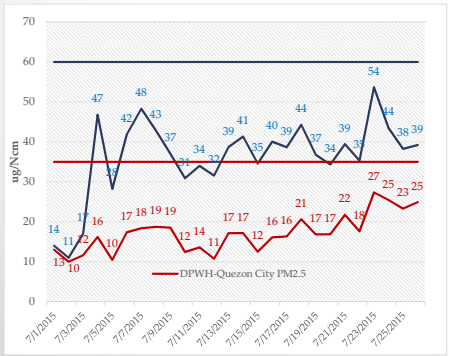
(open path- DOAS (O3, NO2, SO2, BTX), TEOM (PM10/2.5), CO

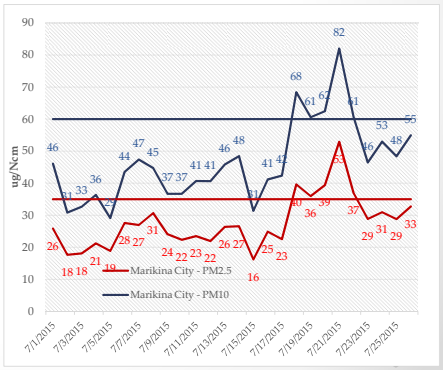
PM10/PM2.5 (BAM)











VIETNAM ENVIRONMENTAL ADMINISTRATION (VEA)
CENTRE FOR ENVIRONMENTAL MONITORING (CEM)
Website: http://www.quantracmoitruong.gov.vn/

MERCURY MONITORING IN VIETNAM

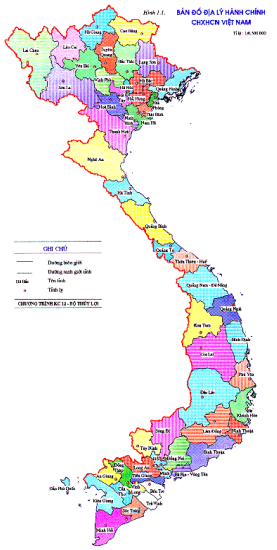
Centre for Environmental Monitoring,
Vietnam Environmental Administration

Bangkok, July 2016

CONTENTS

GENERAL INTRODUCTION OF VIETNAM

INTRODUCTION OF Vietnam



- Located at the Southeast of Asia
- Area: 333.000 km2
- Population: 91,2 million
- Urban population: 33,1 %
- Rural population: 66,9 %

The increase of industrial zones (2)

According to statistics in 2014: more than 280 industrial zones; 174 industrial zones in operation.

SOURCES OF MERCURY

Industries with mercury emissions to the environment

In Vietnam, some mercury sources are found as below:

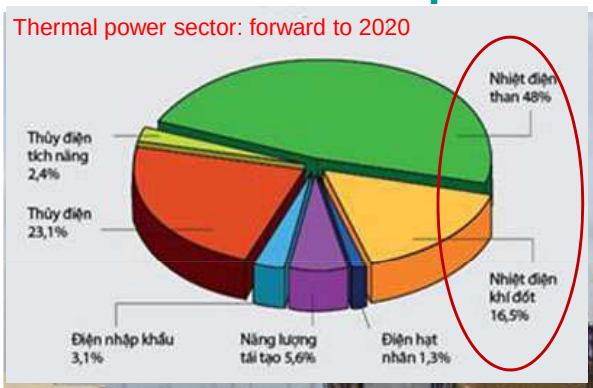
- *Coal fired thermal power plants*
- *Cement factories/plants*
- *Steel production plants*
- *Waste incinerator*
- *Gold mining*
- *Other sources:* Oil refinery, thermometer, Compact fluorescent lamp, dentistry, electric components, metallurgy, e-waste, landfill, chemistry…
- In Vietnam, currently, Hg has not been managed well and strictly.

1. Cement Industry

In 2014, Vicem has produced 16.5 million tons of clinker and 18.46 million tons of cement, Production increase over 2013: 0,7% and 10,3% respectively

3. Thermal power sector

Thermal power sector: forward to 2020



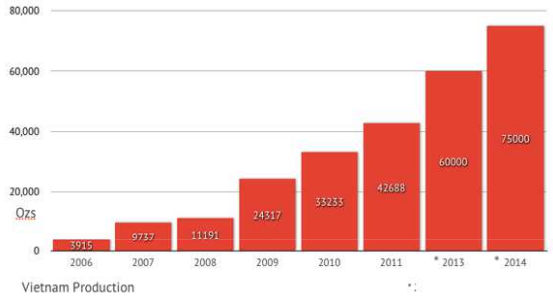
The consumption of coal:

-2015: needed 23 million tons

- 2020: need up to 67 million tons

- 2030: about 150 million tons

2. Gold mining



Gold mining production increased every year

RESULTS OF MERCURY SURVEYS (2009)

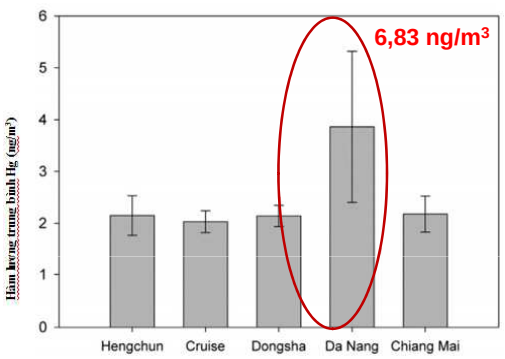
- Cement production:
  - Mercury was discovered in cement with small content (0.02 – 0.08 mg/kg)
- Iron and steel production:
  - Mercury was also discovered in coke coal (0.032 – 0.384 mg/kg)

MERCURY MONITORING IN VIETNAM

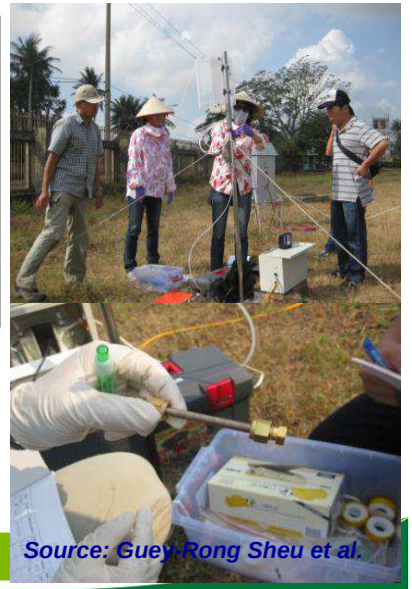
Mercury monitoring activities in Vietnam

- **2010:** Joint the 7-SEA program.
- **2012**: workshop in Taiwan.
  - 01 automatic station for air quality monitoring in Hanoi *(including Hg parameter)*.
- **2013**: Workshop in EPA, Washintong DC.
- **2014**: Vietnam has joined the Asia-Pacific Mercury Monitoring Pilot Network.
  - 01 wet sampler in Hanoi *(for Hg analysis)*.
- **2015**: Pilot of mercury monitoring for Coal Power Plants
- **2016**: workshop in Taiwan and Thailand.

High Level of Hg in Air have found at Da Nang

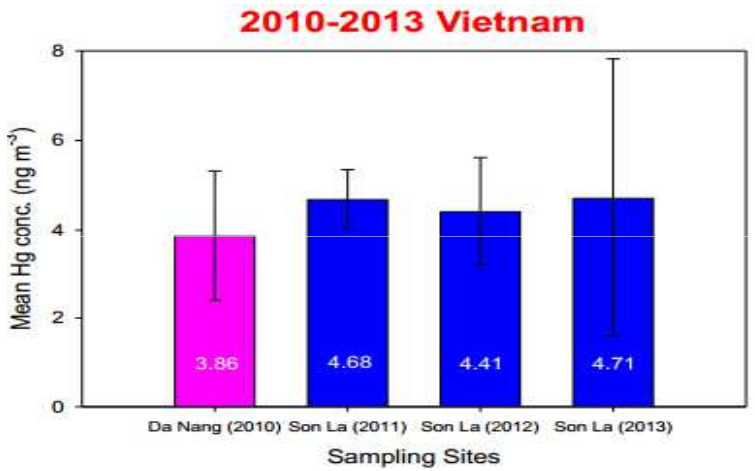


Mercury level in Da Nang within the international cooperation project with Taiwan 7-SEA in 2010 compared to other city



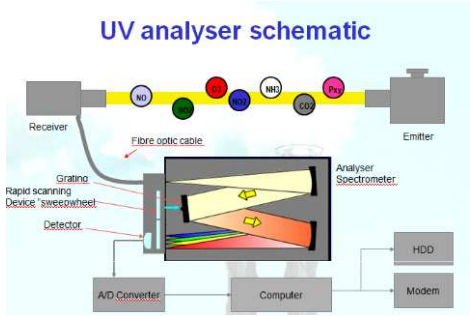
Source: Guey-Rong Sheu et al.

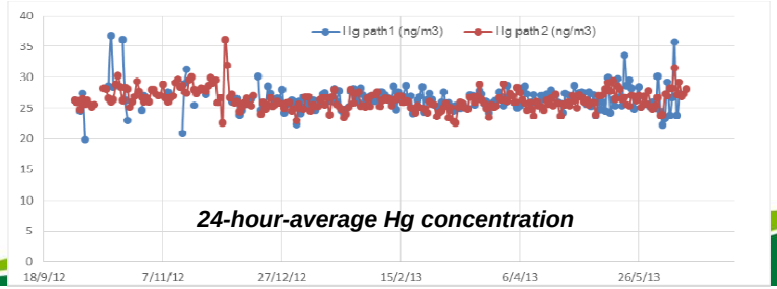
Son La (2010 – 2013): Level of Hg in Air



Source: Guey-Rong Sheu et al.

Automatic station for air quality monitoring in Hanoi



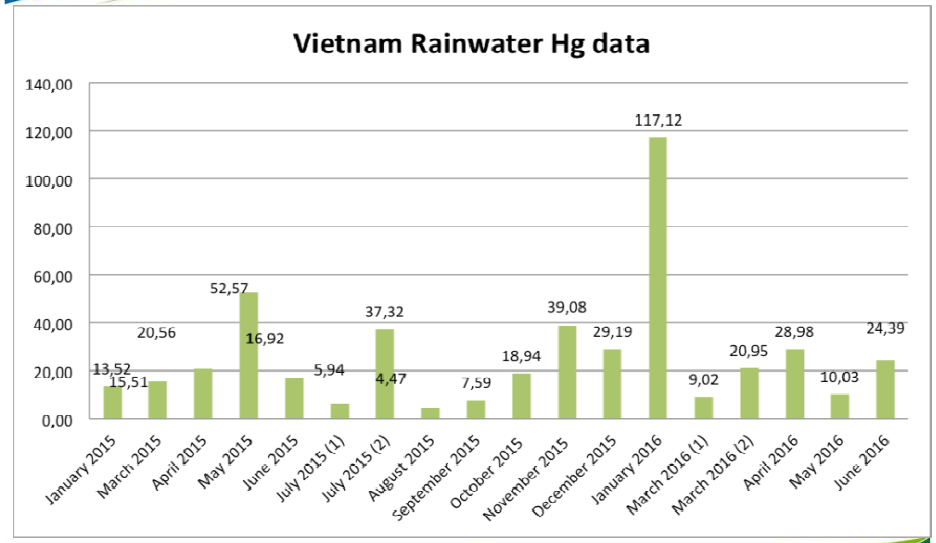


24-hour-average Hg concentration

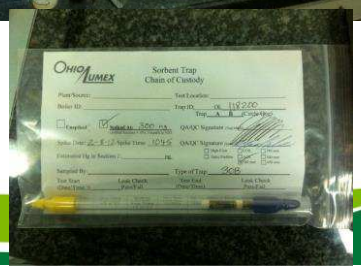
Updated atmospheric mercury level in Hanoi

Location: building No.556, Nguyen Van Cu, Gia Lam, Hanoi
(North of Vietnam)

The wet samples are send to National Central University (NCU) of Taiwan for mercury analysis



Mercury monitoring activities



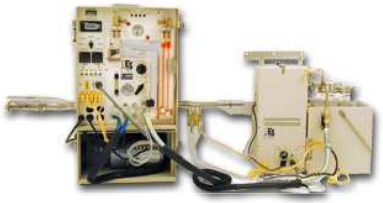
UNEP supported instrument for sampling and analysis Hg for CEM in 2015
(Apex Instruments - Model XC-260)

Mercury monitoring activities

Equipment checking before sampling

Mercury monitoring follow US EPA 30B

Mercury monitoring follow US EPA 29



Updates on current mercury monitoring from emission sources

- Monitoring and emission control activities (2016):

- CEM carry out manual monitoring Hg emission from waste incineration follow Vietnam Technical Regulation (QCVN 02; QCVN 30; QCVN 61). US EPA 29 has been used as a standard method for heavy metal sampling and analysis.
- Mercury particle bound phase range from N.D to 0.3 ng/Nm^3 in which close to Vietnam Technical Regulation.

Incineration type	Number of sample	Concentration (mg/Nm3)	Duration
Municipal waste	05	Nd-0.2	From Jan 2016
Hospital waste	02	0.2-0.3	From Jan 2016
Industrial waste	03	0.1-0.3	From Jan 2016

Updates on current mercury monitoring from emission sources

- Monitoring and emission control activities (2016):

- CEM is collaborating with Pollution Control Dept (PCD) in order to monitoring of Hg emission from 03 thermal coal power (TCP) plants. This activities will be completed in August 2016.
- Total 84 samples will be collected for total Hg analysis which include flue gas, fly ash and coal powder samples. Flue gas samples will be collected by both of US EPA 29 and US EPA 30B.

Hai Phong TCP plant

Mong Duong 2 TCP plant

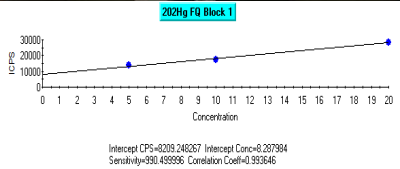
Ninh Binh TCP plant

Updates on capacity building of mercury monitoring for CEM - VEA

Updates on equipment capacity for mercury monitoring

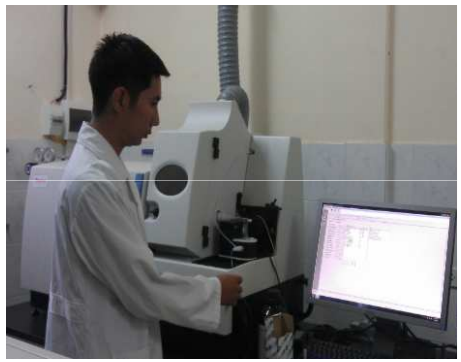
Equipment	Method	Quantity
Wet deposition sampler	APMMN SOP	01 sampler (USEPA sponsor)
Isokinetic sampler	US EPA 29	03 sampler
Mercury on-site sampling and analysis (Apex Ainstruments)	US EPA 30A	01 MODULE (US MOFA sponsor)
AAS	US EPA 29	01 analyzer
ICP-MS	US EPA 200.8	02 available
Mercury analyzer (SMS 100)	US EPA 1631	01 available

Updates on capacity building of mercury monitoring for CEM - VEA



Laboratory analysis of Mercury in water and flue gas matrix samples (2016)

Updates on capacity building of mercury monitoring for CEM - VEA



ICP-MS

PLAN FOR THE FUTURE

PLAN FOR THE FUTURE

- Raising awareness about the risk of Hg pollution;
- Participating in the Asia-Pacific Mercury monitoring network activities;
- Designing National Mercury monitoring network;
- Capacity building of sampling and analytical mercury equipment for CEM, for example training staffs, developing methodology of sampling and analysis when equipment are available;
- Set up a mercury atmospheric monitoring program (dry and wet) in Vietnam include manual and continuous approach;
- International collaboration for academic exchange and technical supporting;
- QA/QC guarantee in sampling, analysis and data processing
-

Update on APMMN in Indonesia

Ministry of Environment and Forestry
Republic of Indonesia
2016

Mercury Monitoring In Indonesia

Mercury monitoring conducted by Environmental Monitoring Center (EMC) 2012-2014

- To know how the total mercury concentration level in water at the several lake and sea in Indonesia (15 lakes & seas priority)
- Method of mercury analysis: JIS methode (Cold vapour) and measured with Mercury Analyser

- The results showed concentrations of total mercury in water at several lake in Indonesia were below of the method detection limit (MDL < 0,0004 mg/L) and also below the water pollution standard quality in Indonesia PP. No 82 year 2001 (**0,002 mg/L**)
- The concentrations of Total Hg in sea water in some location detected but still below than sea water standard quality (Ministry decree no 51 year 2004) **0,003 mg/L.**

Mercury Monitoring in ASGM Hotspot

(conducted by MEMR, MoH, MOEF)

No	Location	River Water	Sludge	Clean water	Ambient air	Soil	Biota
		BM: 0,002 mg/L	BM: 0,13 mg/Kg	BM: 0,001 mg/dL	BM: -	BM: 6,6 mg/Kg	BM: 0,40 mg/Kg
1	Province A						
2	Province B						
3	Province C						
4	Province D						
5	Province E						
6	Province F						
7	Province A						
8	Province G						
9	Province H						
10	Province C						
11	Province I						
12	Province J						

Standards:
- River water : Government Regulation No. 82 Year 2001
- Clean Water : Monistry of Health Regulation No. 416 Year 1990
- Biota:
  Provisional Standards for Mercury in Fish" (notification for Ministry of Health and Welfare, Japan in July of 1973)
- Sediment:
  Canadian Sediment Quality Guidelines for Threshold Effect Level (TEL)
- Soil:
  Canadian Soil Quality Guidelines for the Protection of Environment and Human Health (Residential/Parkland)

Status of Network Pilot Sites

- This sampler was first handed over to Pusarpedal (EMC-MOEF), then handed over to Assistant Deputy on Hazardous Substances Management (MOEF)
- On May 2015, EMC handed over the sampler operational to Directorate of Hazardous Substances Management.



Final Installation

The initial phase of the instalation carried out on:

- Date : Monday, June 15, 2015
- Time : 01:32 pm
- Location : On the roof of B Building at the Ministry of Environment and Forestry Office, Kebon Nanas, East Jakarta
- Coordinates : S: 06 ° 13,994' E: 106 ° 52,643'
- Weather conditions : Sunny, Clear sky

- Note:
  - The location is close to several industrial estates (Pulogadung Industrial Estate, Nusantara Berikat Industrial Estate), which is about 10-25 KM.
  - The location is close to the highway
  - The distance to the nearest ASGM area (Pongkor, Bogor) approximately 90-100 KM

Final Installation

Total Hg in Rainwater

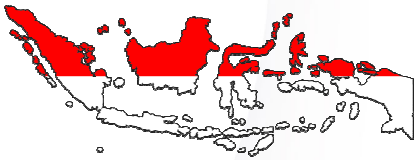
Site	Sample	Date	Hg Conc.
	Label	Analyzed	(ng/L)
Indonesia	05-01-2016	05/25/2016	12,93
Indonesia	12-01-2016	05/25/2016	21,42
Indonesia	26-01-2016	05/25/2016	9,09
Indonesia	02-02-2016	05/25/2016	8,78
Indonesia	09-02-2016	05/25/2016	9,48
Indonesia	08-03-2016	05/25/2016	6,19
Indonesia	15-03-2016	05/25/2016	5,28
Indonesia	29-03-2016	05/25/2016	6,46
Indonesia	05-04-2016	05/25/2016	15,01

Installation and Operation Problems

1. Lack of information when the sampler given to Directorate of Hazardous Substances Management
2. Sampling activities has not been perfect
3. Restructurisation in the MoEF caused changes to the duties and functions in some units
4. The new organizational structure → takes time to coordinate with other units and to adjust the work and budget system's

Future Plan

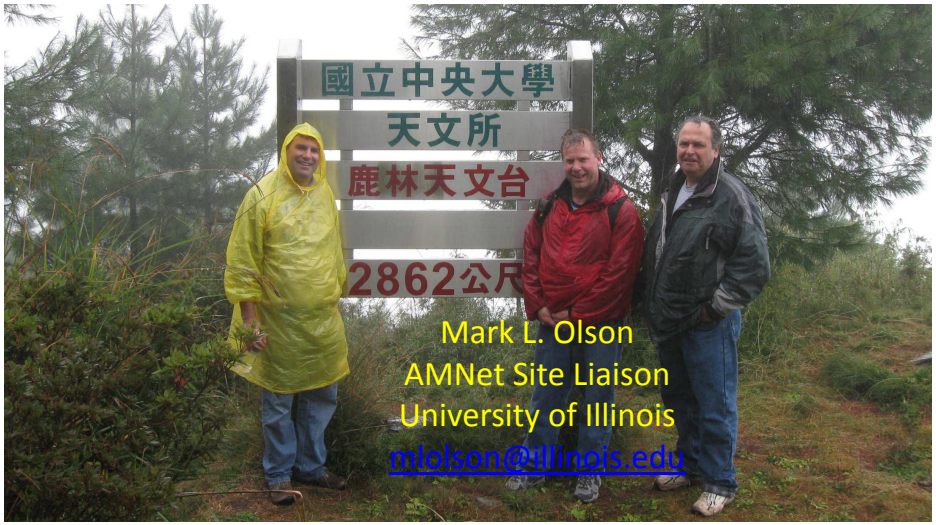
- Improve/re-formulate the internal mechanism in operating the sampler
- Shipping next batch of sample
- Maintainance
- Linking the data with other environmental monitoring data
- Publishing the data



Thank You...
Khob Khun Krap...
Terima Kasih...

GDA1

Asia-Pacific Mercury Monitoring Network Workshop



Mark L. Olson
AMNet Site Liaison
University of Illinois
mlolson@illinois.edu

投影片 1

GDA1 who are those two fat old guys on the right?
Gay, David A, 2016/7/23

Differences between Gaseous Elemental and Speciation Mercury Measurements

Outline
-Automated advantages/disadvantages
-Requirements for automated analysis
-Overview of AMNet
-Basics of operation
-Data usage
-Instrument comparison

Automated vs. Manual Elemental Analysis

Automated

Advantages
-High resolution
-identify Point Sources
-No lab required

Disadvantages
-Expensive
-Argon may be required

Manual

Advantages
-Identify Hot spots
-Inexpensive up front

Disadvantages
-Lab required
-Shipping sample

Atmospheric Mercury Speciation

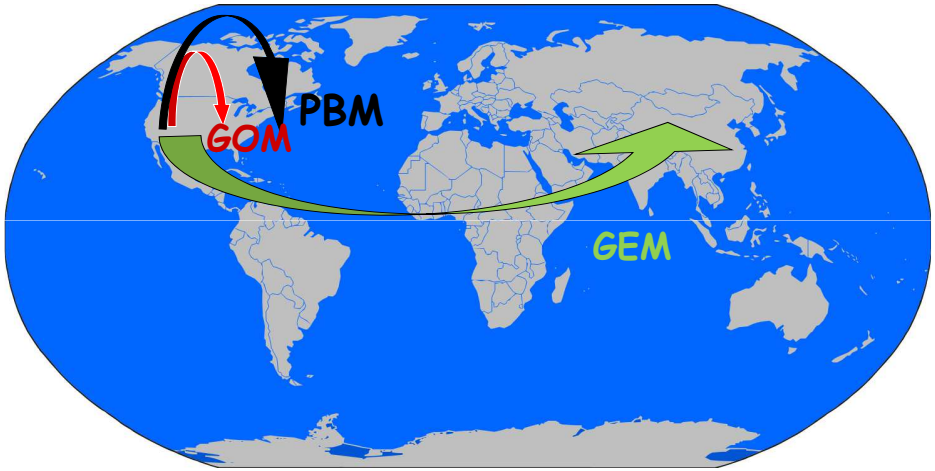
- Types of mercury in ambient air:
  - Elemental mercury: Hg^0, (GEM)
  - Reactive (ionic) mercury: HgII, RGM, Hg^{2+}, (GOM) GDA3
  - Particulate bound mercury: Hg^P, TPM, (PBM)
- Different forms of gaseous Hg have very different behaviors
  - GOM and PBM are water soluble GDA2 entering aquatic ecosystems
- Forms can interconvert in the atmosphere

投影片 4

GDA2 might mention that these are the forms removed in wet deposition meassurements; i e what we are measuring in APMMN
Gay, David A, 2016/7/23

GDA3 also might use a defenition of the GOM/GEM/PBM acronyms.
Gay, David A, 2016/7/23

Residence time and transport



GDA5
GGDA7

Requirements for Automated Analysis

Elemental

- Real time results
- 5 minute values
- $ 45,000 USD
- One day a month
- Variable siting

Speciation

- Elemental plus
- GOM and PBM Hourly
- $ 125,000 USD
- One day a week GDA4
- Open area siting

投影片 6

GDA4 is this an estimate for time you will spend there right?
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GDA5 i might add in a slide after this
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GDA6 advantages of the speciation automation

you can do dry deposition estimates hourly, you can do speciation back trajectories on a much more rich dataset

you can see cahnges over a much shorter time
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GDA7 and on the same slide

disadvantages
tempramental
lots of calibrations and problem detection, plenty of missing data, expensive, need stable power, supplies and add in the rough costs, roof top installation, and all the rest

this slide is analygis to your advantages and disadvantages of GEM previsouly
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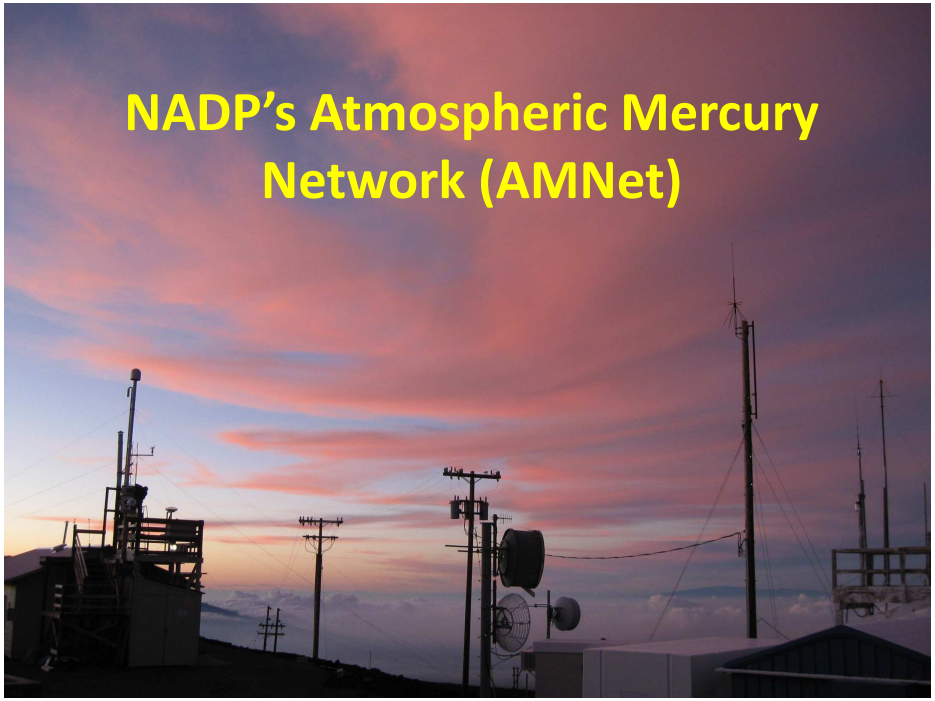
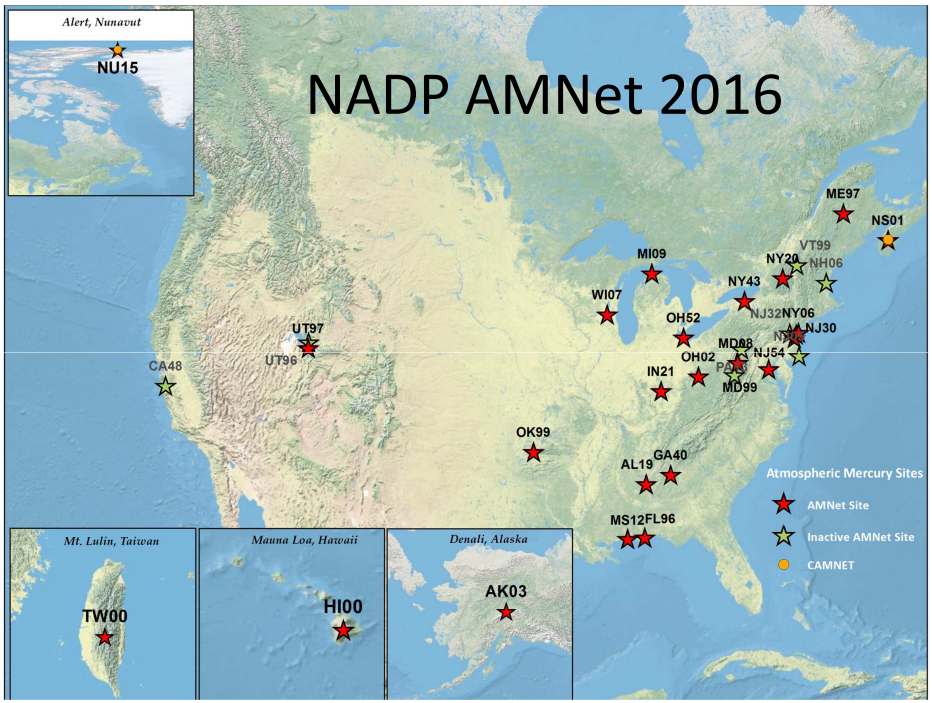


Atmospheric Mercury Network (AMNet)

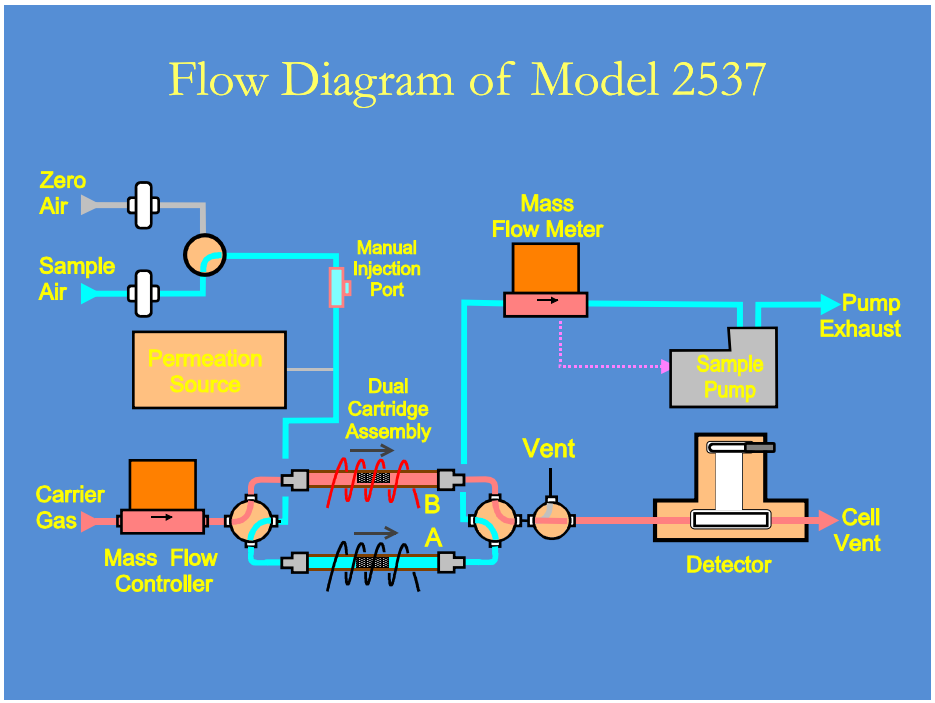
- Initiative started in 2006
- Gained NADP network status in 2009
- Measure dry deposition of Hg species
- Currently 23 sites
- Collect real time data
- Consistent Quality Assurance
- Provides Web accessible data



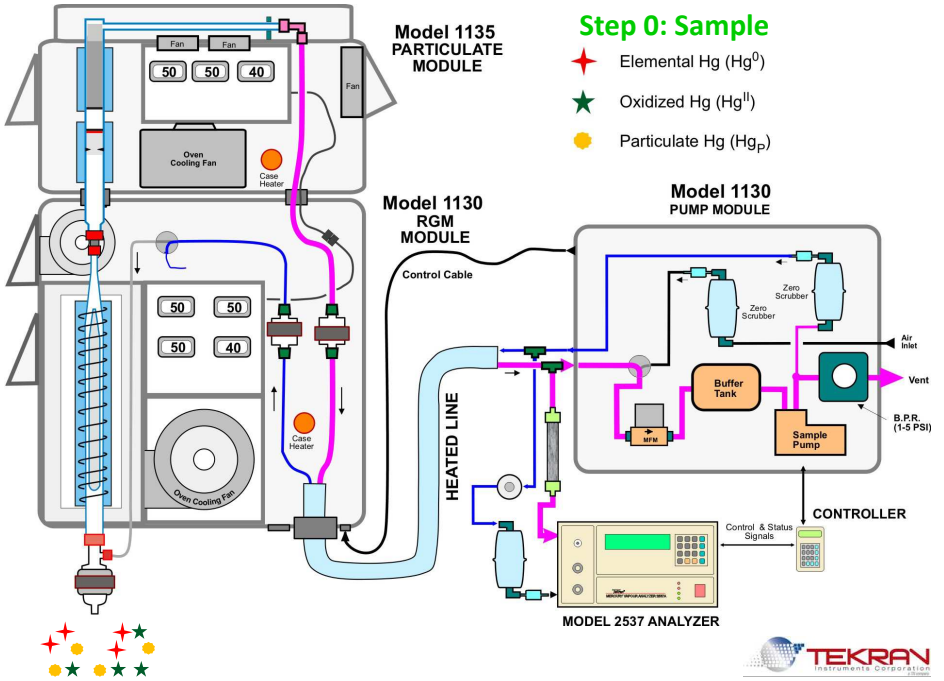
The Tekran Speciation Instrument

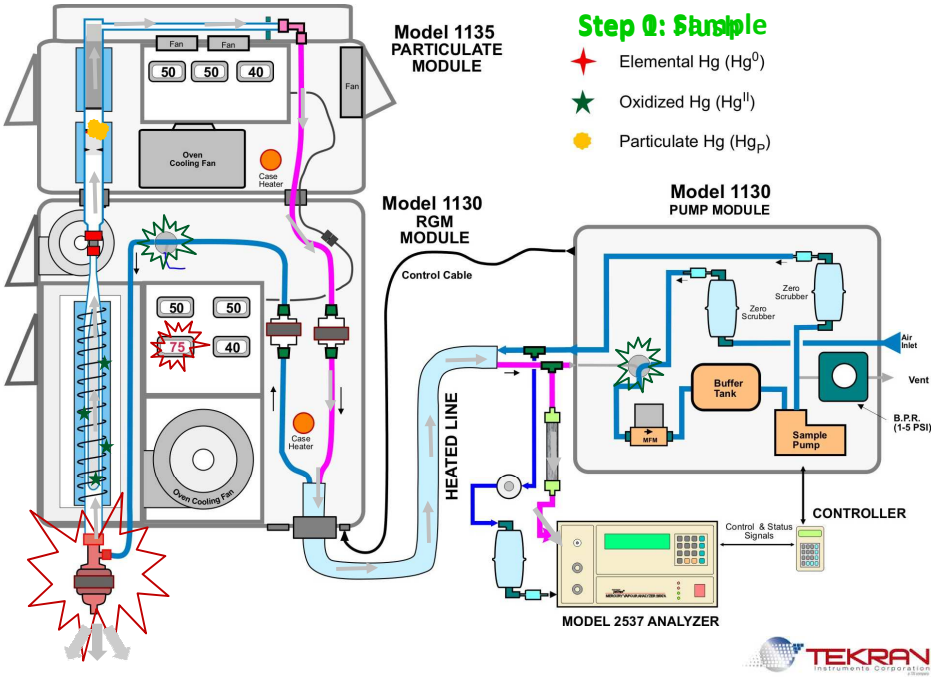
The Tekran Instrument

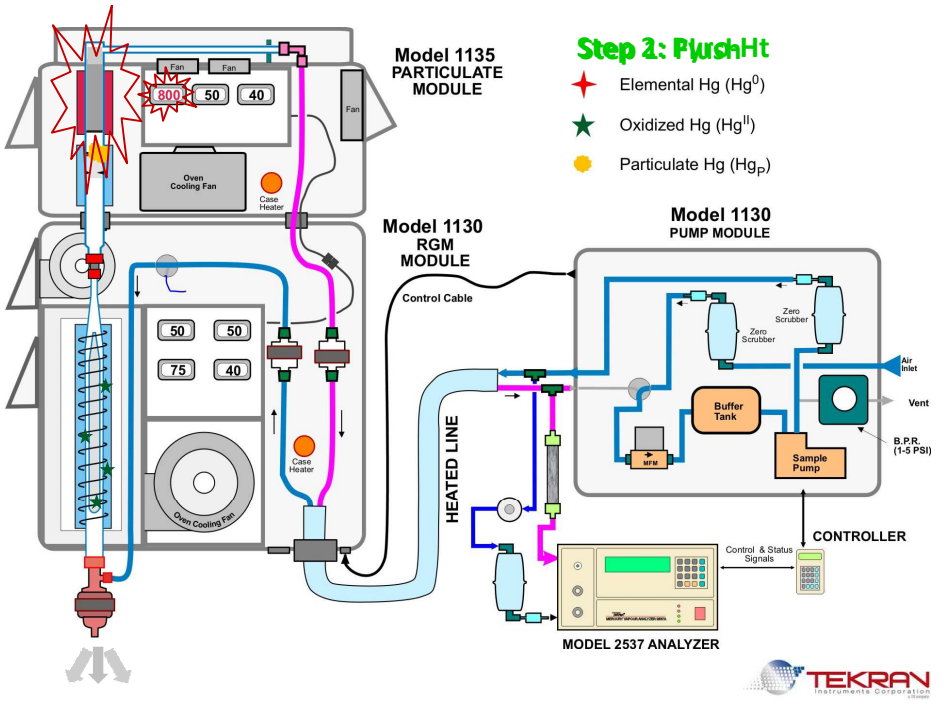
- 2537 Elemental Hg Analyzer
- 1130 Gaseous Oxidized Mercury
- 1135 Particulate Bound Mercury

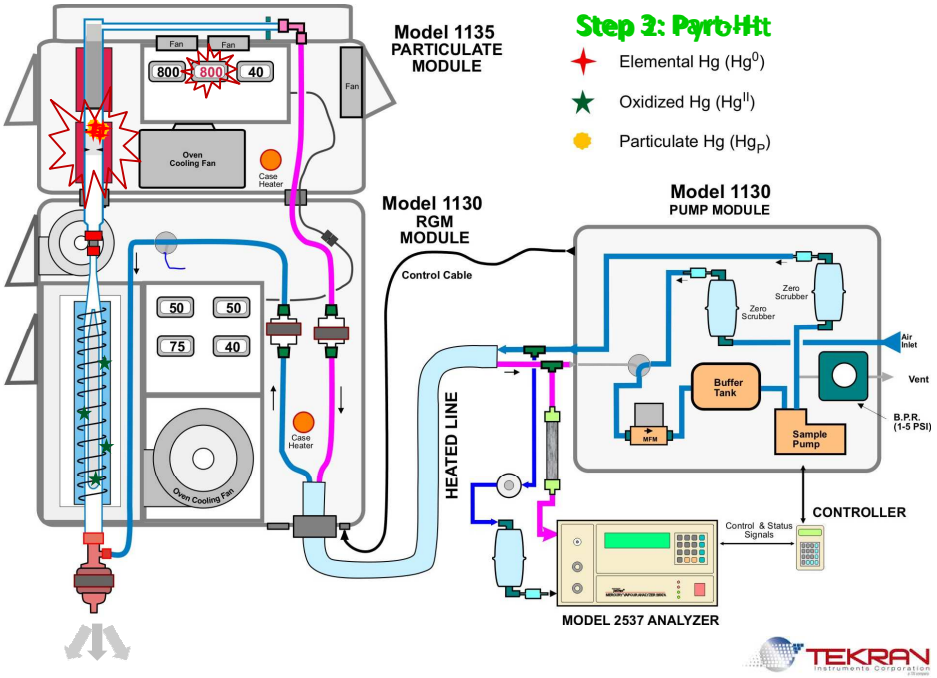


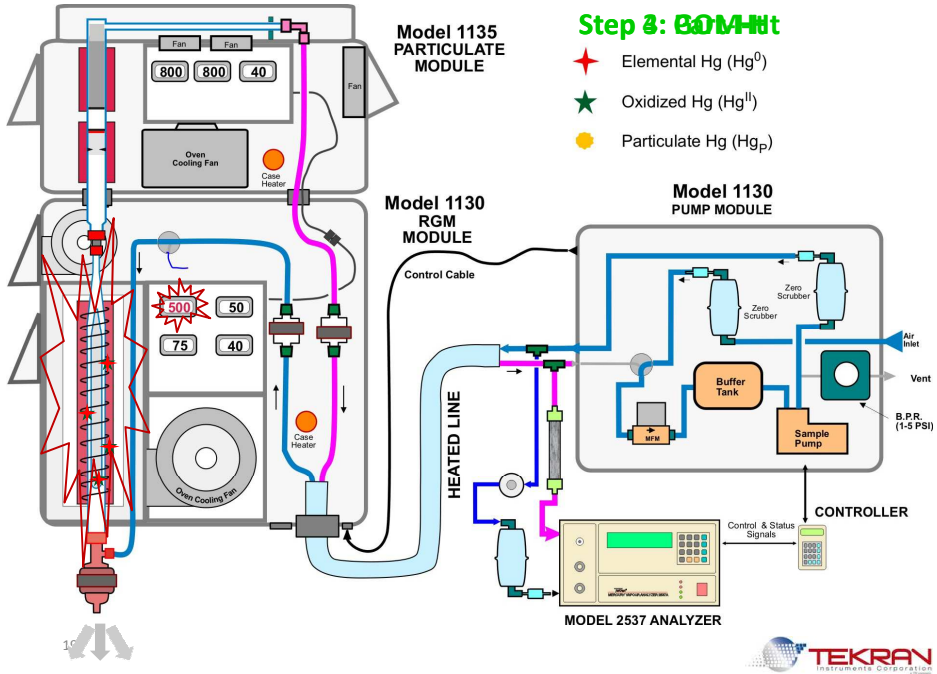
Animation of Mercury Species Collection and Analysis

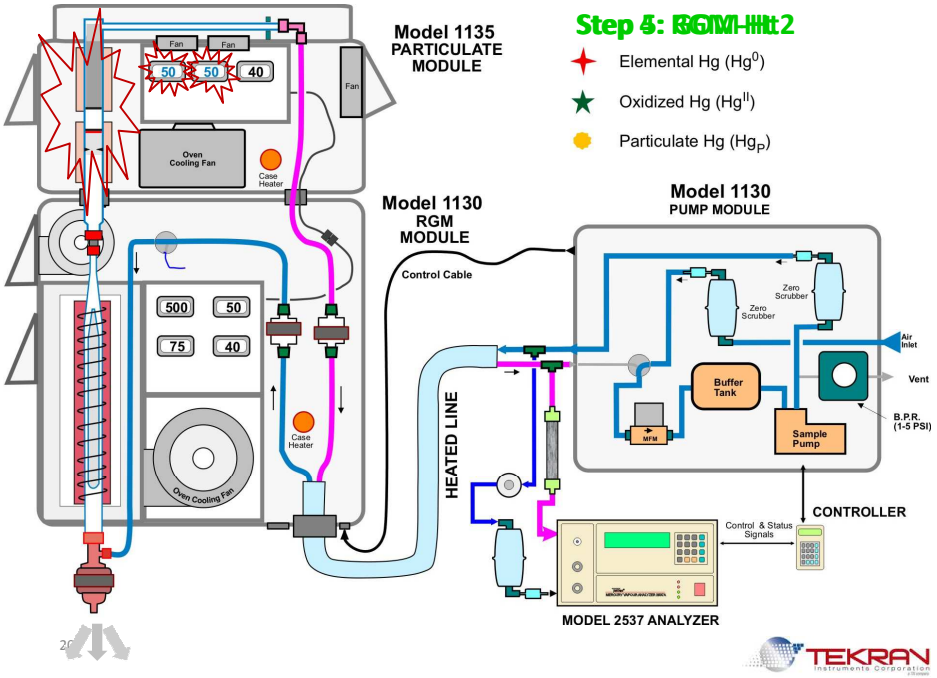


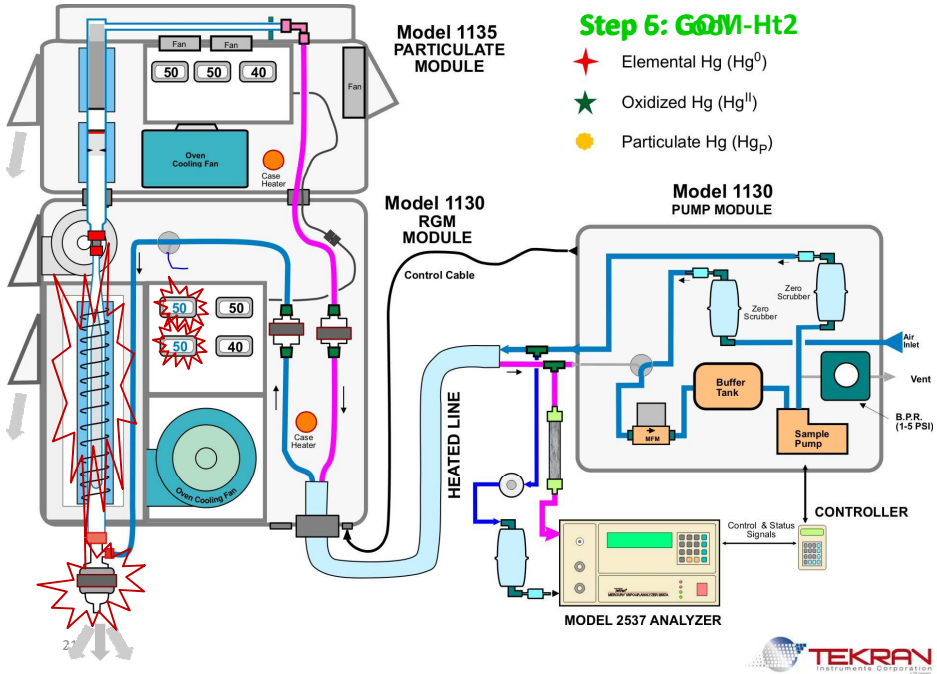


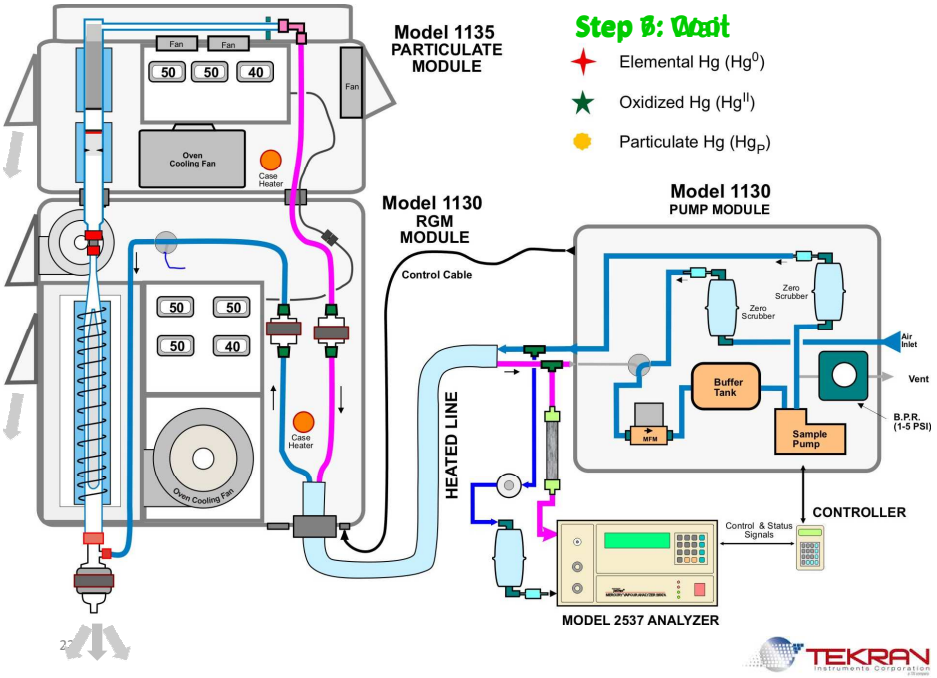


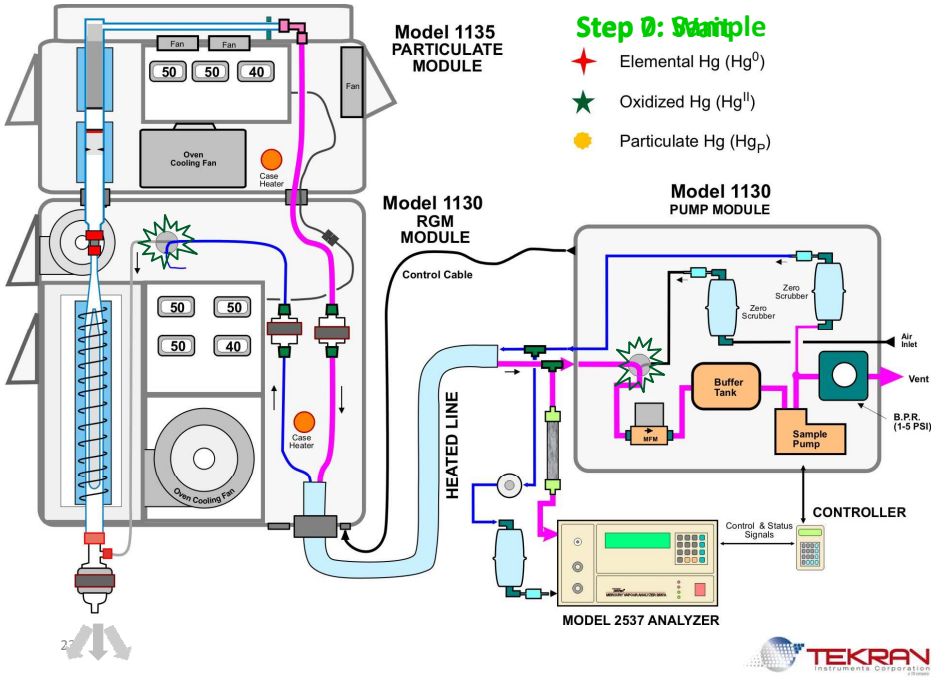

Step 3: Part-Ht
Elemental Hg (Hg0)
Oxidized Hg (HgII)
Particulate Hg (HgP)
Model 1135 PARTICULATE MODULE
Model 1130 RGM MODULE
Model 1130 PUMP MODULE
Control Cable
HEATED LINE
MODEL 2537 ANALYZER
CONTROLLER
Control & Status Signals
Buffer Tank
Sample Pump
Zero Scrubber
Air Inlet
Vent
B.P.R. (1-5 PSI)
Oven Cooling Fan
Case Heater
Fan
800
40
50
75


Step 4: RGM-Ht
Elemental Hg (Hg0)
Oxidized Hg (HgII)
Particulate Hg (HgP)
Model 1135 PARTICULATE MODULE
Model 1130 RGM MODULE
Model 1130 PUMP MODULE
Control Cable
HEATED LINE
MODEL 2537 ANALYZER
CONTROLLER
Control & Status Signals
Buffer Tank
Sample Pump
Zero Scrubber
Air Inlet
Vent
B.P.R. (1-5 PSI)
Oven Cooling Fan
Case Heater
Fan
500
50
75
40


Step 5: RGM-Ht2
Elemental Hg (Hg0)
Oxidized Hg (HgII)
Particulate Hg (HgP)
Model 1135 PARTICULATE MODULE
Model 1130 RGM MODULE
Model 1130 PUMP MODULE
Control Cable
HEATED LINE
MODEL 2537 ANALYZER
CONTROLLER
Control & Status Signals
Buffer Tank
Sample Pump
Zero Scrubber
Air Inlet
Vent
B.P.R. (1-5 PSI)
Oven Cooling Fan
Case Heater
Fan
50
40
500
75


Step 6: Cool-Ht2
Elemental Hg (Hg0)
Oxidized Hg (HgII)
Particulate Hg (HgP)
Model 1135 PARTICULATE MODULE
Model 1130 RGM MODULE
Model 1130 PUMP MODULE
Control Cable
HEATED LINE
MODEL 2537 ANALYZER
CONTROLLER
Control & Status Signals
Buffer Tank
Sample Pump
Zero Scrubber
Air Inlet
Vent
B.P.R. (1-5 PSI)
Oven Cooling Fan
Case Heater
Fan
50
40

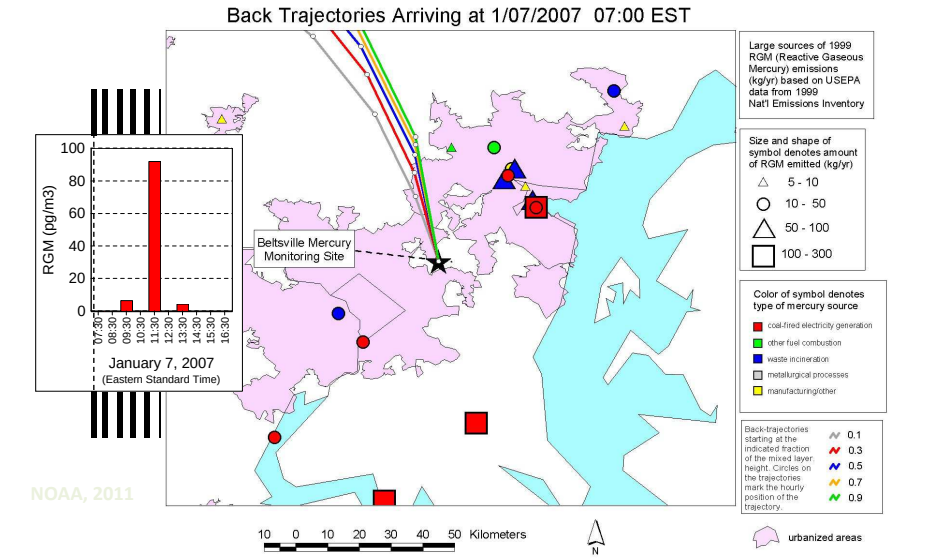




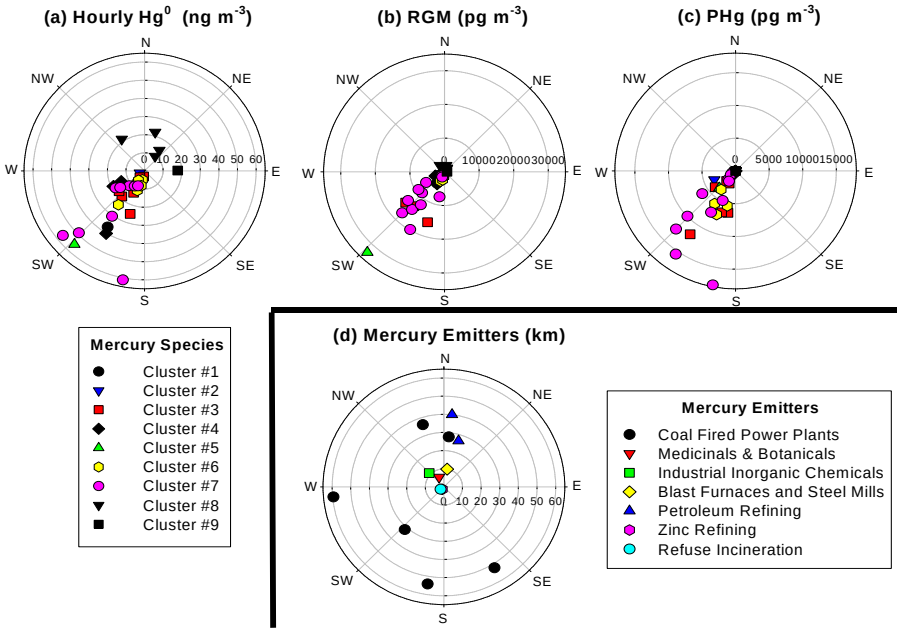
Operational Costs

- Personnel – ½ to 1 person day per week
  - Excludes travel time
- Consumables
  - Argon = $900/year (assuming $150/tank)
  - Supplies and Chemicals = $200/year
  - Replacement parts = $2000/year

Impacts of mercury emitting sources



Sometimes, we see evidence of local and regional "plume" impacts



投影片 27

GDA8 this is a GREAT slide. i didnt even think of the other ones

can you add in the estimated prices of the LUMEX and GARDIS? that would be good for them to know

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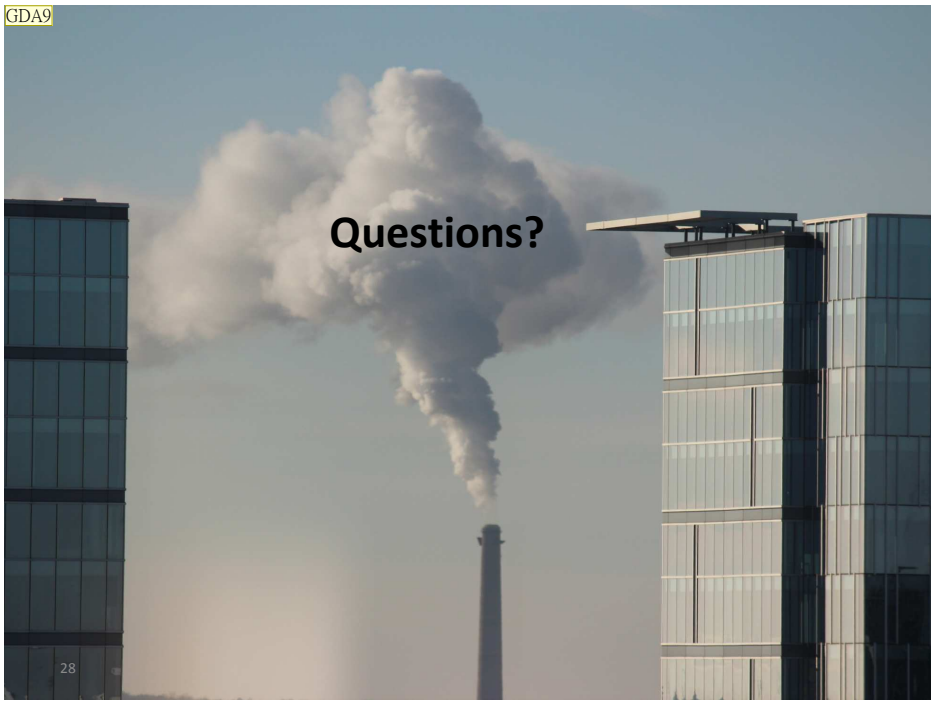
GDA8

Automated Elemental Analyzers

	Gardis - 7	Lumex 915	Tekran 2537X
Detection (ng/m3)	0.1	100	0.1
Range (ng/m3)	400	200,000	?
Flow Rate (L/min)	0.1 – 1.0	10	0.7 – 1.5
Time (min)	0 - 166	Direct	2 – 60
Power	AC or 12 VDC	AC or 12 VDC	AC
Calibration	External	Annual Factory	Internal
Collection	Gold trap	Direct	Gold Trap
Detection	AA	AA	CVAFS
Communication	Remote	USB	Remote
Carrier gas	Ambient air	Ambient air	Argon
Closest Representative	Lithuania	Russia	Thailand

GDA9



投影片 28

GDA9

i think it is good.

specially following Kohjiis presentation on the manual method. puts it into perspective

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