National Atmospheric Deposition Program: Mercury Programs

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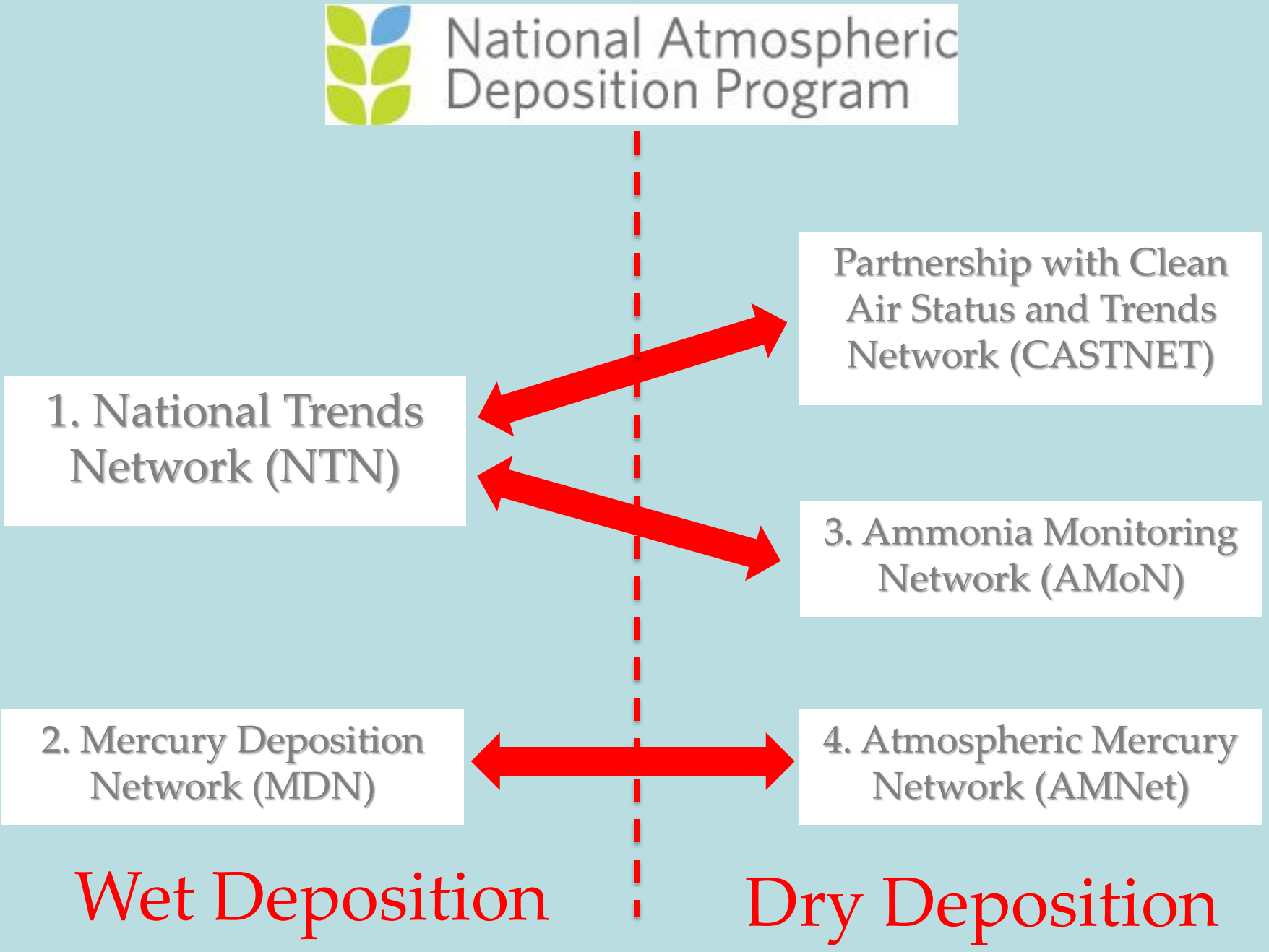
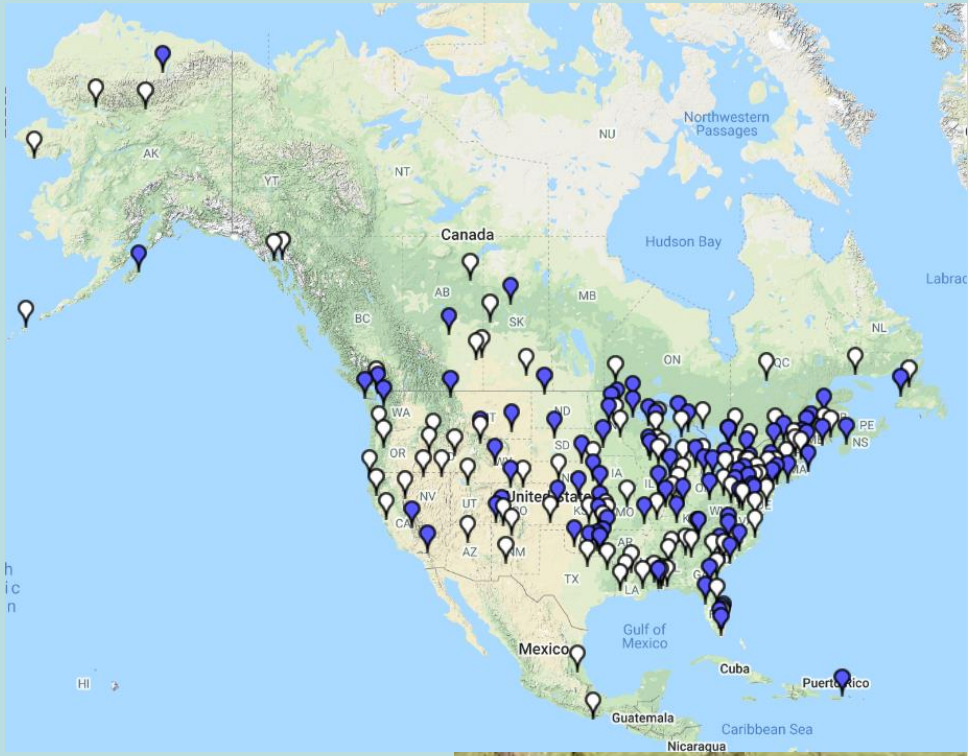
National Atmospheric Deposition Program

Quick Overview of NAPD Operations

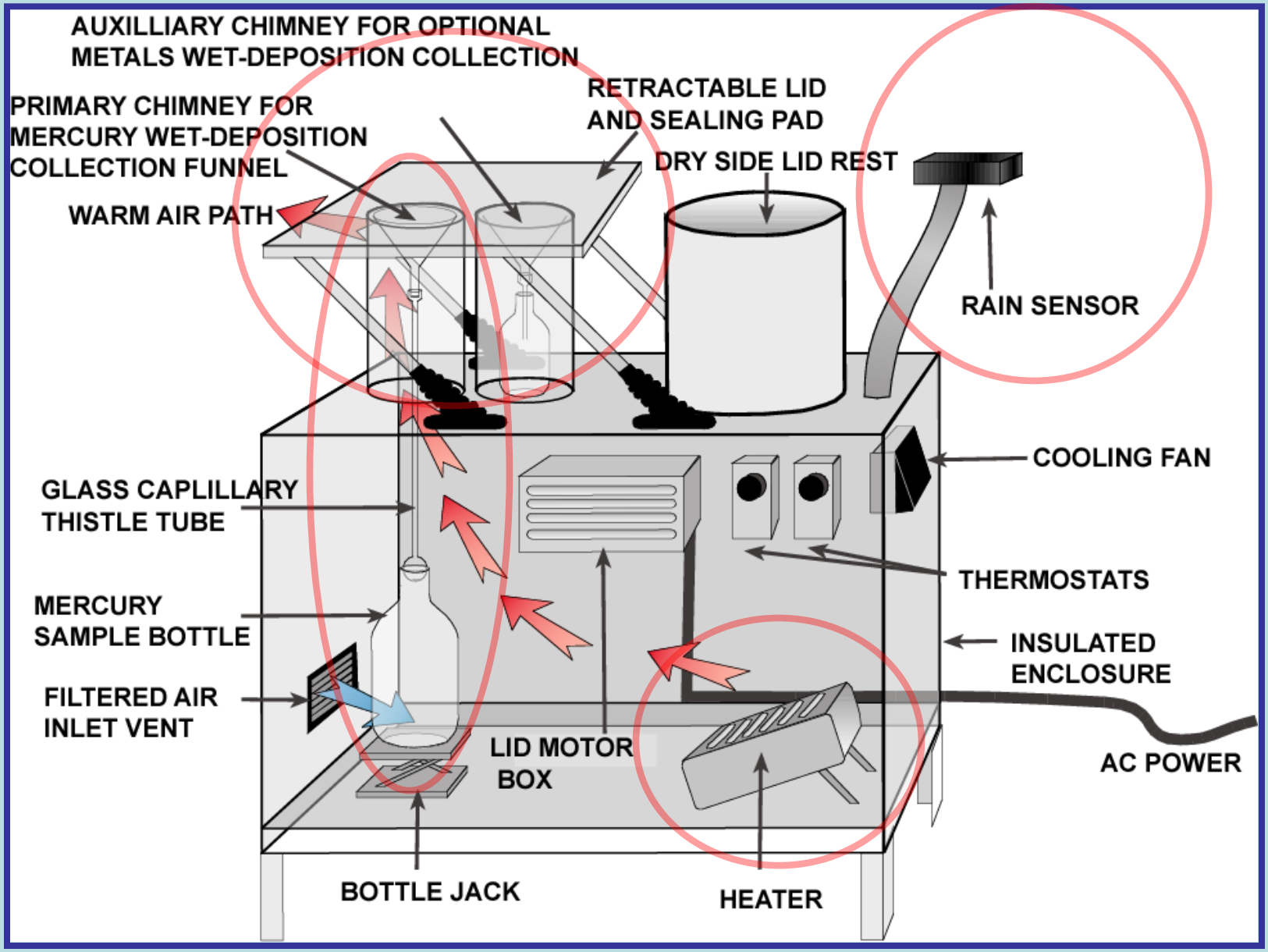

National Atmospheric Deposition Program
Partnership with Clean Air Status and Trends Network (CASTNET)
1. National Trends Network (NTN)
3. Ammonia Monitoring Network (AMoN)
2. Mercury Deposition Network (MDN)
4. Atmospheric Mercury Network (AMNet)
Wet Deposition
Dry Deposition

Mercury Deposition Network (MDN)

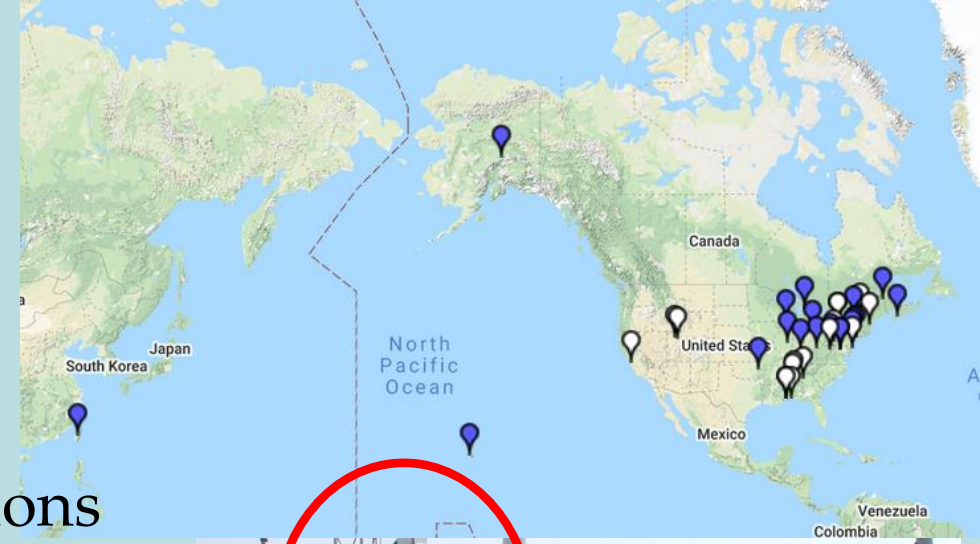


- Collects one-week precipitation-only samples MDN wet-dry collector
- Measures precipitation with a separate gage
- Analyses
  - Total Mercury
  - Methyl Mercury
  - Other options
- since 1996, currently 84 sites
- 90,000 observations of total Hg

Wet Deposition Collection

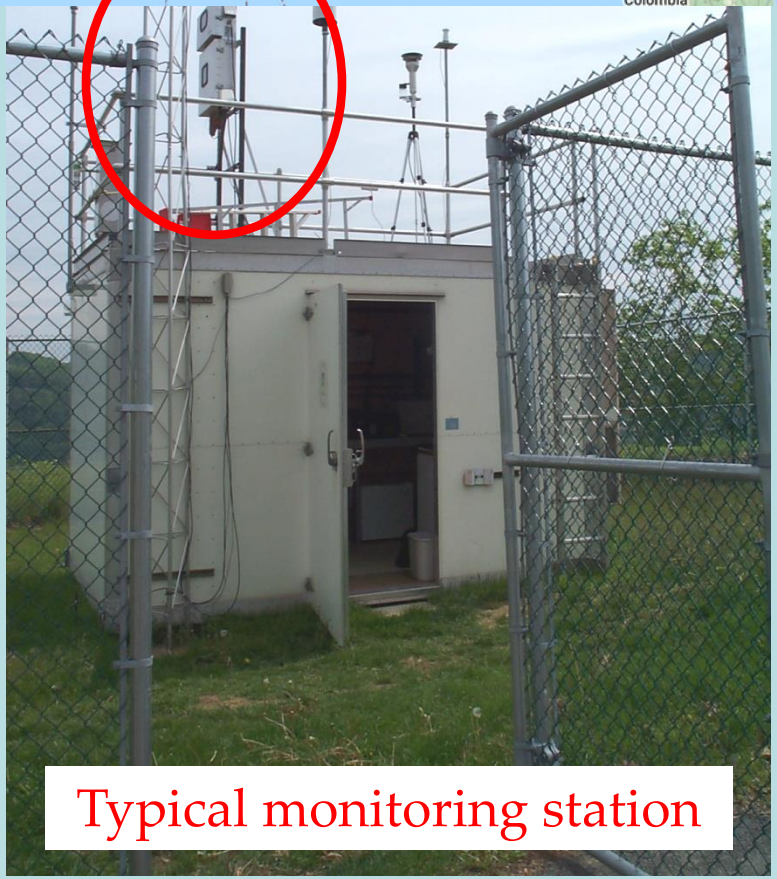


Atmospheric Mercury Network (AMNet)



- Gaseous mercury concentrations (speciation)
  - GEM
  - GOM
  - $PBM_{2.5}$
- estimate of dry deposition flux
- Since 2008, currently 15 sites

  (2 GEM only)
- 800,000 observations at 24 sites

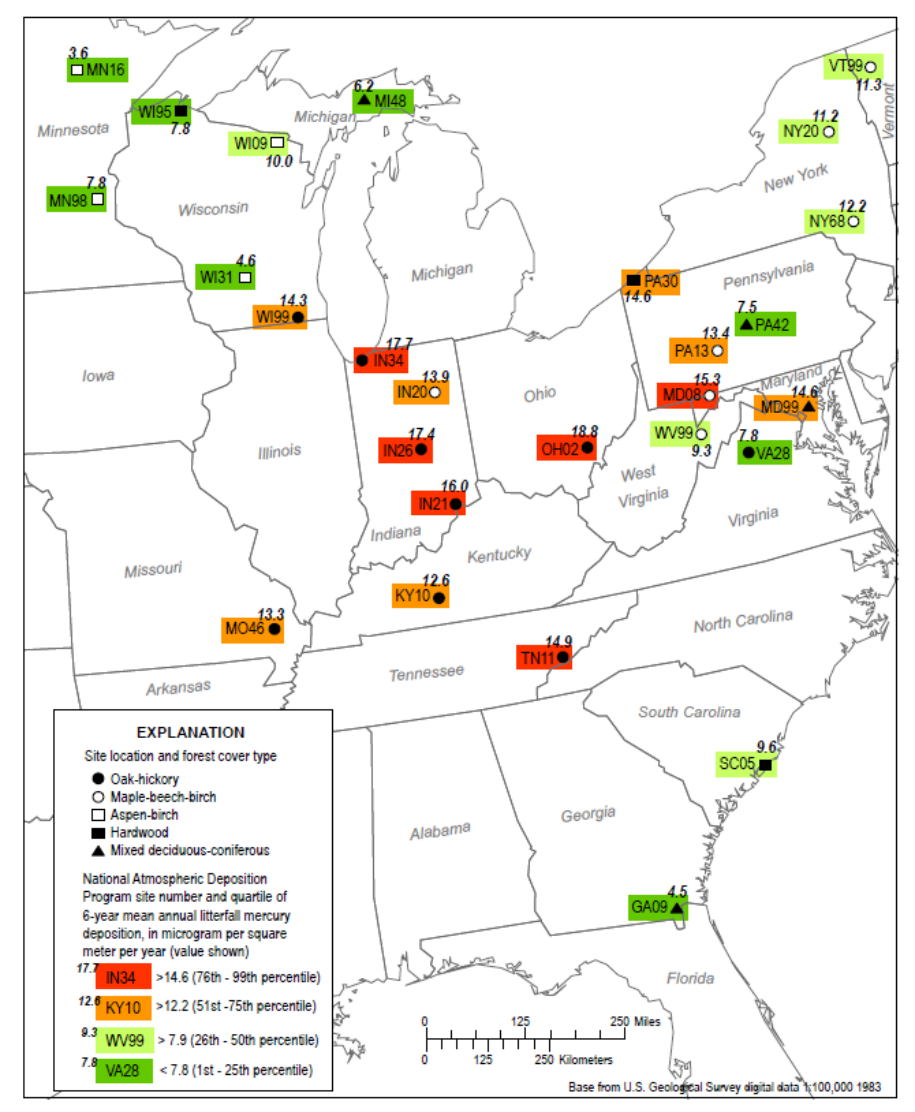


Typical monitoring station

Operating AMNet Sites

Mercury Litterfall Network (trial network)

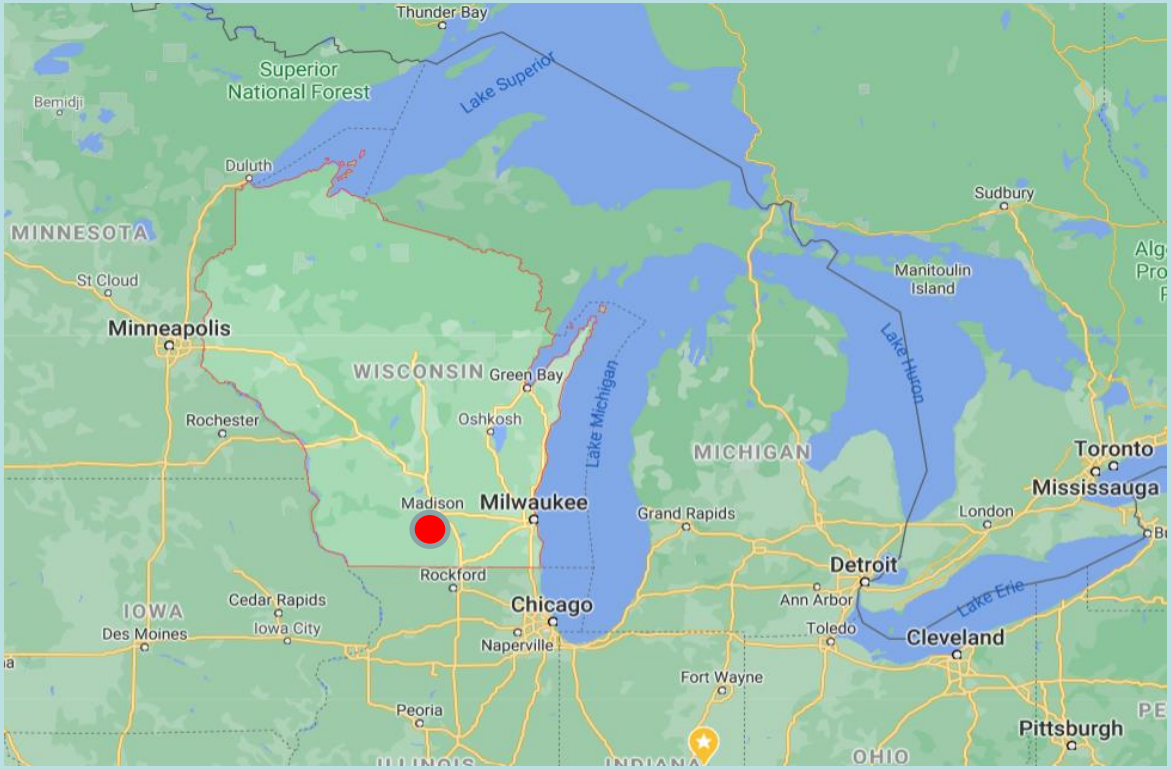
- Total and Methyl mercury concentrations (µg/gram biomass)
- estimate of dry mass flux
- Since 2007 (most years), currently ~20 sites
- Currently not a full network, but a trial
- Data not yet available from NADP



NADP New Situation

- NADP was moved from the University of Illinois to the University of Wisconsin in 2018
- All laboratory and data functions are within the Wisconsin State Laboratory for Hygiene now.

Stovall Building
University of Wisconsin
Madison



Quick Overview of Data Specifics

MDN Data Specifics

- Number of samples: ~87,000
- Current status: 1996-
  March, 2020
- Valid (A,B), and
  Invalid (C); both available
- Free for download:

http://nadp.slh.wisc.edu/data/MDN/weekly.aspx

NOTE CODE:

Code	Description	Quality Rating (QR) code
e	Extended sample time (> 8days)	B
d	debris present	B
m	missing information	B
z	site operations problems	B
h	sample handling problems	B
i	low volume sample (1.5 mL ≤ sample volume < 10 mL) (Hg conc. data are reported but they are less certain than samples with a sample volume of at least 10 mL	B
b	bulk sample (sample exposed the whole time)	C
v	Rain gage indicates precipitation occurred but the sample volume was less than 1.5 mL, or the sample volume was less than 10% of indicated rain gage precipitation amount.	C
u	undefined sample (sample exposed for at least 6 hours without precipitation)	C
f	serious problems in field operations that compromise sample integrity	C
l	laboratory error	C
c	contamination of sample	C
p	no precipitation data from either the rain gage or the sample volume	C
n	no sample submitted	C

Variables

MDN DATA FIELDS

SITE CODE: 2-letter state or province designator followed by a two digit number.

START DATE: (mm/dd/yyyy hh:mm), GMT

END DATE: (mm/dd/yyyy hh:mm), GMT

RGPPT: Precipitation amount as measured by the rain gage in millimeters. Trace amounts are indicated by -7.00 and missing amount by -9.00.

SVOL: Sample Volume, ml. Missing amounts are indicated by a -9.00.

SUBPPT: Rain gage precipitation amount, if available, in mm. If the rain gage value (RGPPT) is missing, the precipitation amount in mm is calculated from the net sample volume caught in the sample bottle. A value of 0.127 is inserted for Trace sample types. Missing amounts are indicated by a -9.00

HGCONC: Total mercury concentration reported by the lab in ng/L. Missing amounts are indicated by a -9.00

HGDEP: Total mercury deposition, ng/m_2 . The product of SUBPPT and HGCONC. Missing amounts are indicated by a -9.00

Quality rating (QR) CODE:

A	fully qualified with no problems
B	valid data with minor problems, used for summary statistics
C	invalid data, not used for summary statistics
-	no sample submitted for this time period

SAMPLE TYPE:

W	wet sample, measurable precipitation ($\geq$ 0.01 in.) on the rain gauge (RG) or net bottle catch (BC) $\geq$ 1.5 mL if RG data are missing. Concentration and deposition data are reported unless the QR Code is C.
D	dry sample The RG measured a 0 precipitation amount net, or if the RG is missing, the BC < 1.5 mL . No concentration data are reported and are indicated by a -9.00. RGPPT, SUBPPT, and HGDEP are set to zero.
T	trace sample, used when the rain gage detects that an unmeasurable amount of precipitation occurred. No Hg concentration or depositions are shown. SUBPPT is set to 0.127 mm
--	unknown sample type. Precipitation amount is unknown.

AMNet Data Specifics

- Number of samples: 800,000
- Current status: 2008-
  March 2020
- Valid (A,B), and
  Invalid (C); invalid data not available
- Free for download

http://nadp.slh.wisc.edu/data/AMNet/

Table 3. AMNet Data Flags Assigned by Quality Assurance Screening Criteria.

Data Flag*	Description	Mercury Species
null	Data meets criteria used in the automated scripts	All
A1	|(Air cartridge $bias_i$ – Air cartridge $bais_{i+1}$)/Air cartridge $bias_i$| > 0.10 for 24 consecutive hours	GEM
A2	|(Air cartridge $bias_i$ – Air cartridge $bais_{i+1}$)/Air cartridge $bias_i$| > 0.15 for 24 consecutive hours	
B0	Baseline voltage < 0.01V	All
B1	Baseline voltage < 0.05V, or Baseline voltage > 0.25V	
B2	|Baseline $voltage_i$ – Baseline $voltage_{i+1}$| > 0.01V	
B3	Baseline deviation > 0.10V for 5 consecutive readings	
B5	Baseline deviation > 0.20V	
C0	|($Calibration_i$ – $Calibration_{i+1}$)/$Calibration_i$| > 0.10	
C1	|(Calibration cartridge $bias_i$ – Calibration cartridge $bais_{i+1}$)/Calibration cartridge $bias_i$| > 0.10	
C2	|(Calibration cartridge $bias_i$ – Calibration cartridge $bais_{i+1}$)|/Calibration cartridge $bias_i$ > 0.20	
C5	|($Calibration_i$ – $Calibration_{i+1}$)/$Calibration_i$| > 0.05	
E0	First GEM from each cartridge	GEM
E1	GEM < 1.00 ng/m^3 for same cartridge	
E5	|(GEM_i – GEM_{i+1})/GEM_i| > 0.50 for same cartridge	
F1	72 hours < Time between calibrations < 144 hours	All
F2	Time between calibrations > 144 hours	
G0	GOM = 0 pg/m^3 for more than 24 hours	GOM
G1	Cycle(H) < 0.70 x GOM, or Cycle(I) > 0.20 x GOM, or Cycle(J) > 0.10 x GOM	
G2	GOM < 0 pg/m^3	
L1	GEM cycles < 24 before desorption	GOM $PBM_{2.5}$
L2	GEM cycles <> GEM $cycles_{previous}$	
M2	Status = M2 (multiple peaks)	All
M3	Status > M2 (multiple peaks)	
NP	Status = NP (no peak)	GEM
OL	Status = OL (overload)	All

* Data Flags in Red indicate invalid data.

Variables

National Atmospheric Deposition Program

Atmospheric Mercury Network (AMNet)

Field	Data Type	Description
SiteID	Char(4)	Site Identifier
CollStart	dateTime	Date/Time of Collection Start
CollEnd	dateTime	Date/Time of Collection End
CollTime	Integer	Collection Time, Minutes
PBM	Decimal	Average Particulate Bound Mercury concentration, picograms/m^3. Missing or invalid values are represented by -9.
PBMVal	Char(1)	PBM Validity A or B = valid, C= invalid
GOM	Decimal	Average Gaseous Oxidized Mercury (GOM), picograms/m^3. Missing or invalid values are represented by -9.
GOMVal	Char(1)	GOM Validity. A or B = valid, C= invalid
GEM	Decimal	Average Gaseous Elemental Mercury (GOM), nanograms/m^3. Missing or invalid values are represented by -9.
GEMValPct	Decimal	Per cent valid GEM measurements
GEMVal	Char(1)	GEM Validity. A or B = valid, C= invalid

Measurements are corrected to standard conditions of 0 degrees Celsius and 1 atmosphere of pressure.

Developing Automated Dry Dep System

- *Estimates* of weekly dry deposition
- Further use of AMNet data
- Automated system, using NWS weather observations
- Following Env Canada and the work of Zhang et al.
- Automated weekly estimates of GOM, PBM, with GEM to follow
- To line up with MDN wet deposition

Quality Assurance of Data

- All Data…
  - Three levels of review
    - In the laboratory (not AMNet)
    - By the data management team
    - By the Program Office as final data
  - Full time QA professionals
  - Interlaboratory comparison program
  - Annual external laboratory audits
  - NADP QA Subcommittees

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