The NADP-MDN Atmospheric Mercury Initiative

Monitoring Atmospheric Mercury Species to Estimate Mercury Dry Deposition

http://nadp.sws.uiuc.edu/mtn/

Eric Prestbo – NADP Vice-Chair - Tekran

David Gay* – NADP-MDN Program Coordinator

Martin Risch –NADP NOS Chair - USGS

David Schmeltz – EPA Clean Air Markets Division

Tim Sharac – EPA Clean Air Markets Division

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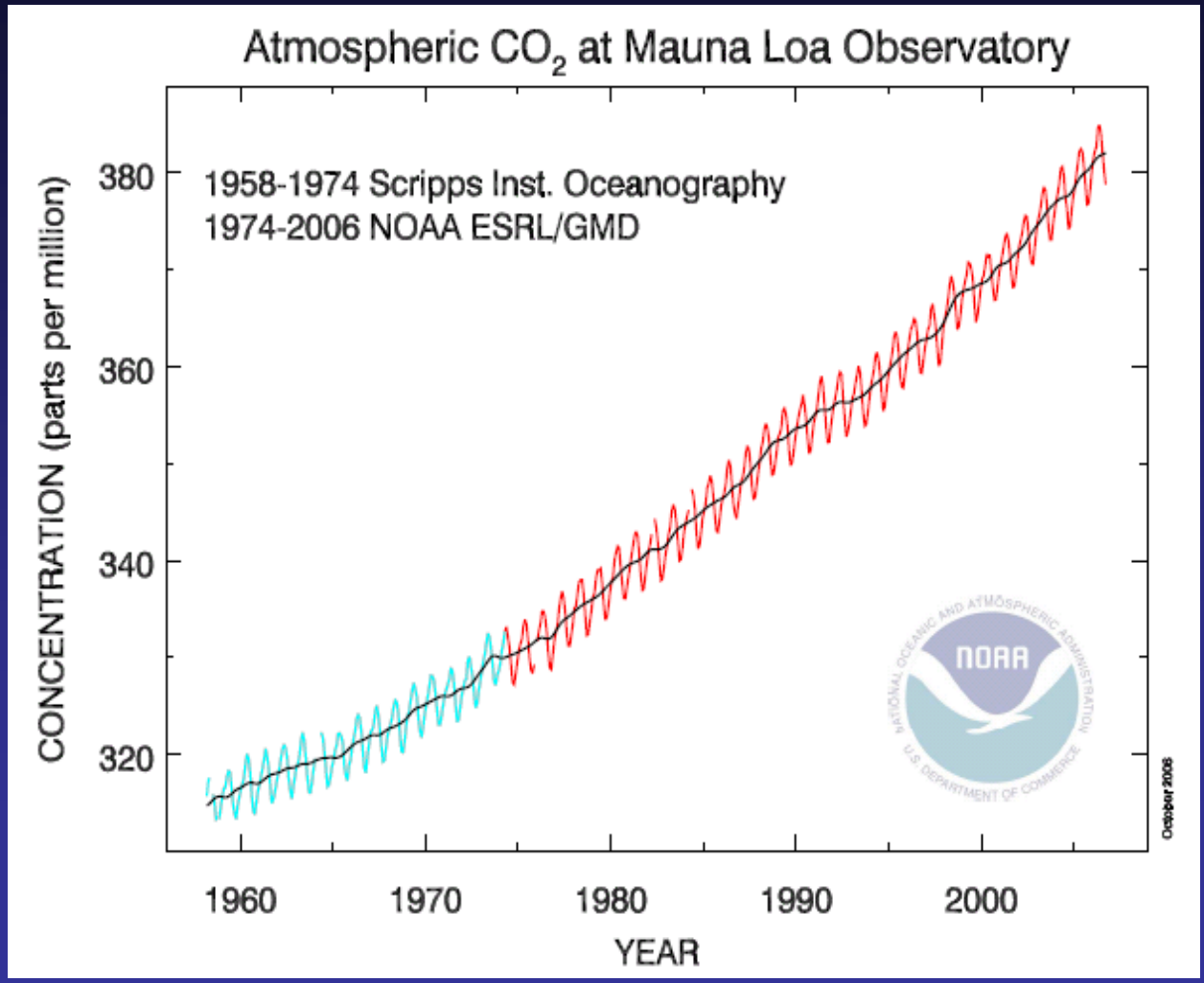
Regulations + Monitoring = Accountability

The protection of the environment has often been deemed successful when there is a regulatory driver and complimentary monitoring component.

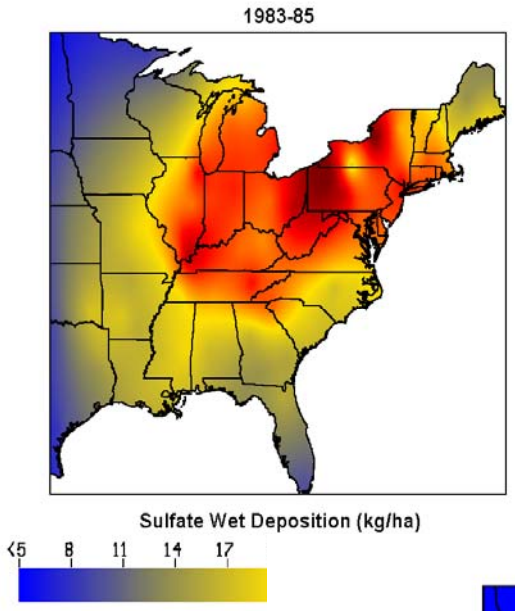
The next few slides illustrate both planned and unplanned success and yet to be realized success of the monitoring + regulations equation

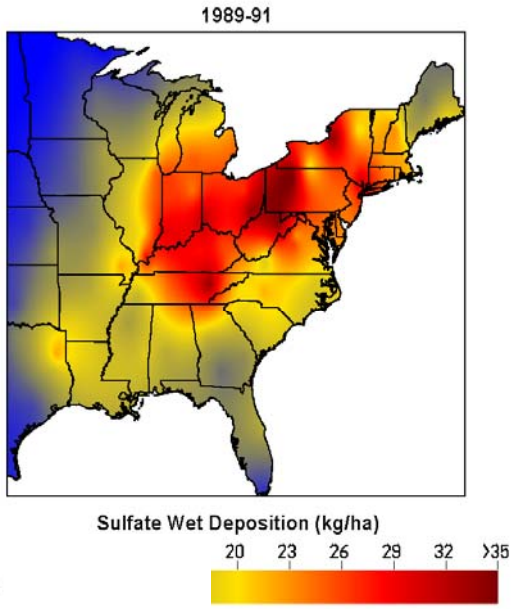
Prime example of high quality monitoring

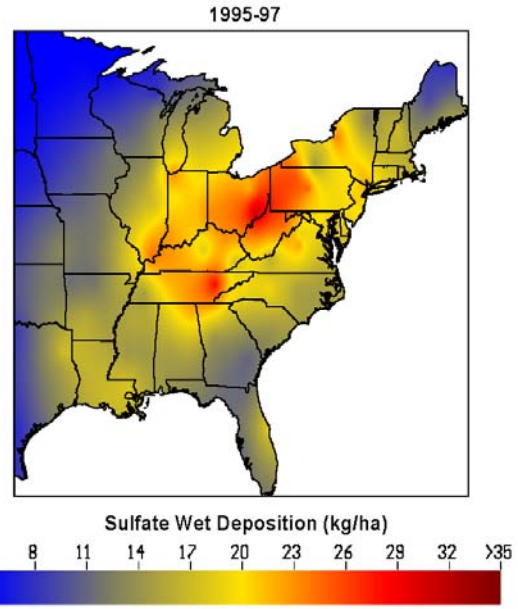
Lacking a regulatory driver means observation of change has yet to be realized for global CO_2



Success!
1990 CAAA + NADP SO_4 Deposition







Figures courtesy of
Jim Lynch and
Van Bowersox

Unanticipated success due to economic collapse in Eastern Europe

Total Gaseous Mercury at Swedish West Coast 1979 to 2002

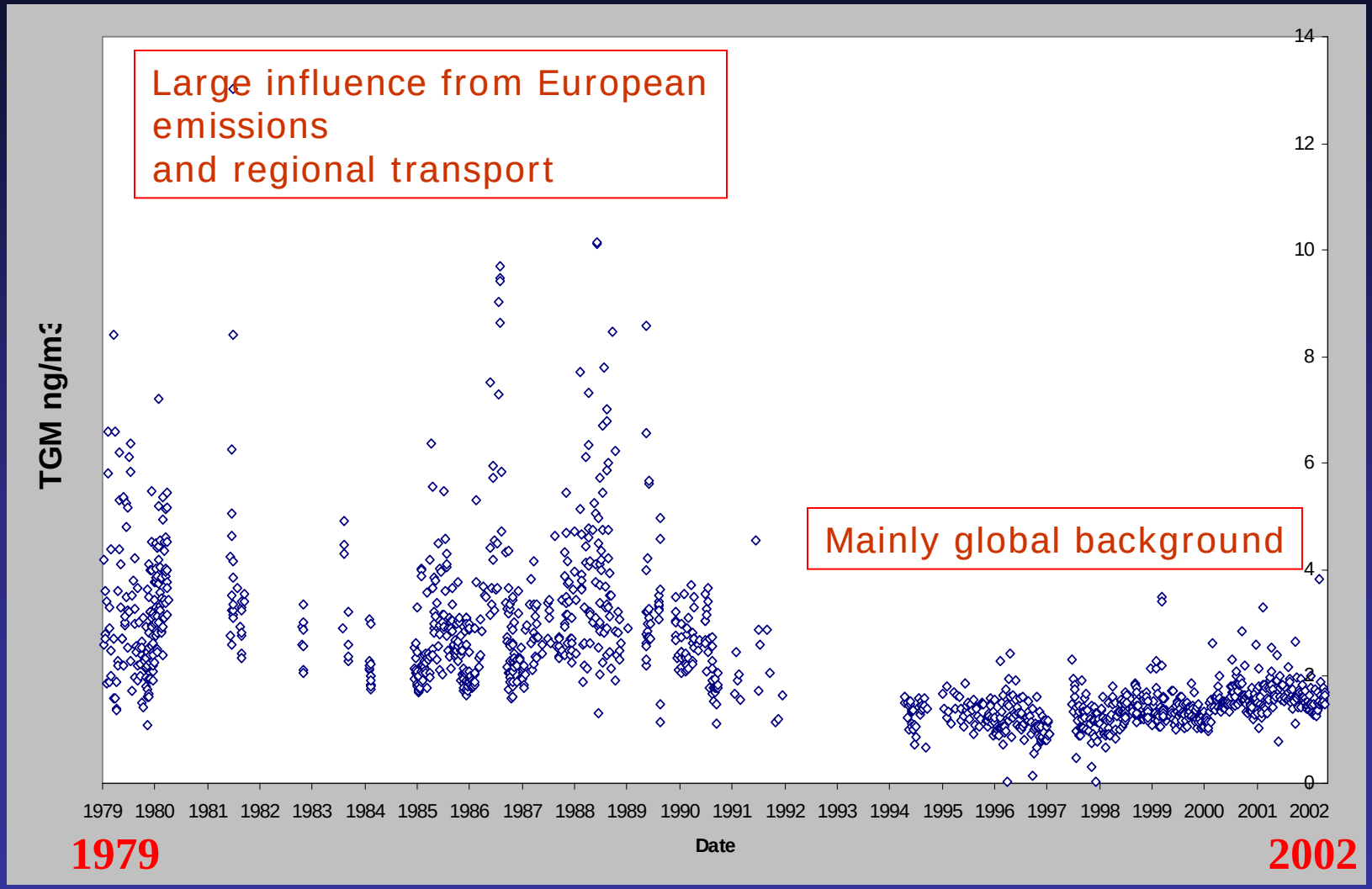
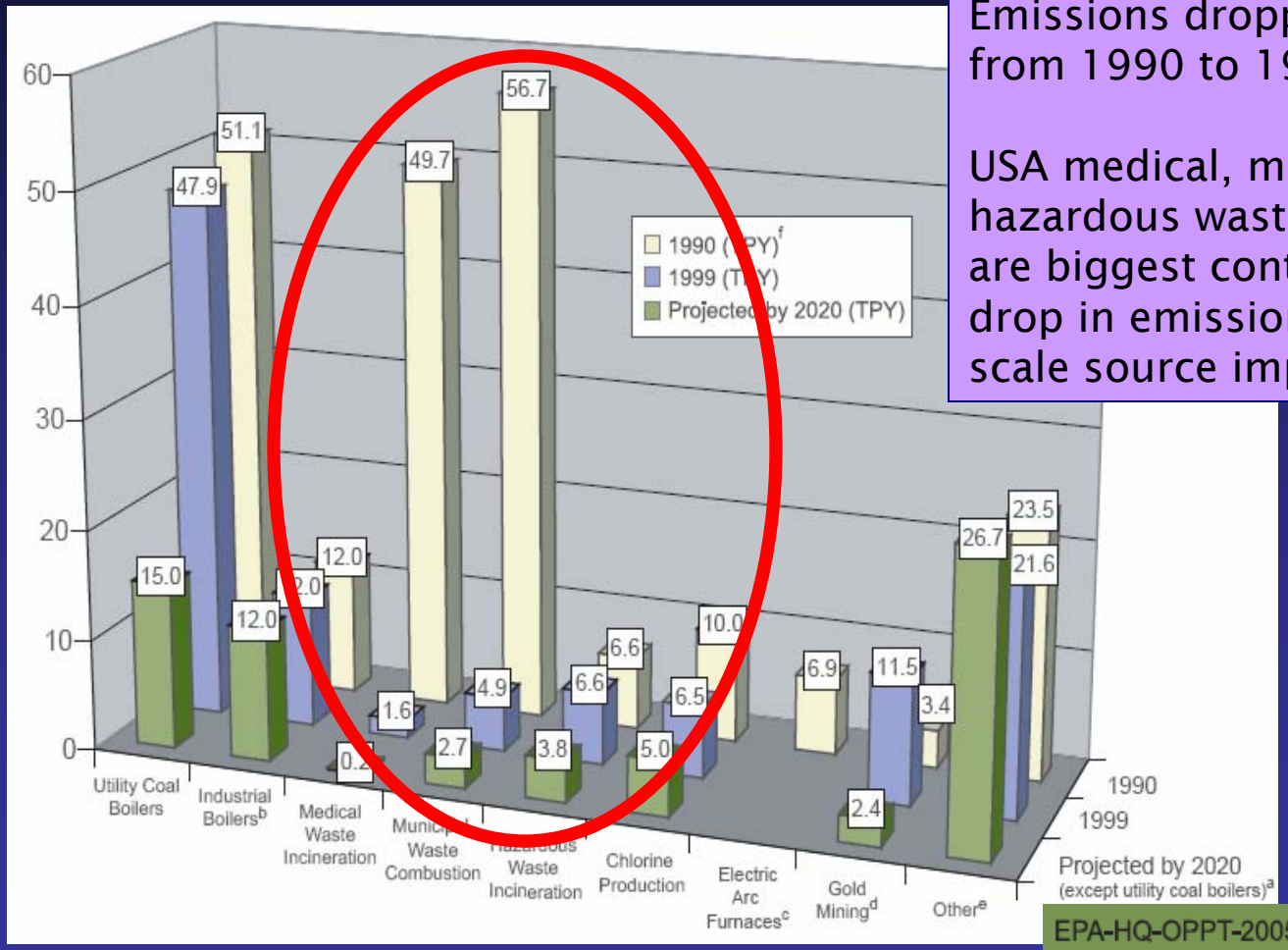


Figure Courtesy of Dr. John Munthe, IVL, Sweden (john.munthe@ivl.se)

Largely missed opportunity to monitor success of regulation of medical and municipal waste incineration

No monitoring = No assessment of local scale impact reduction



Emissions dropped ~50% from 1990 to 1999

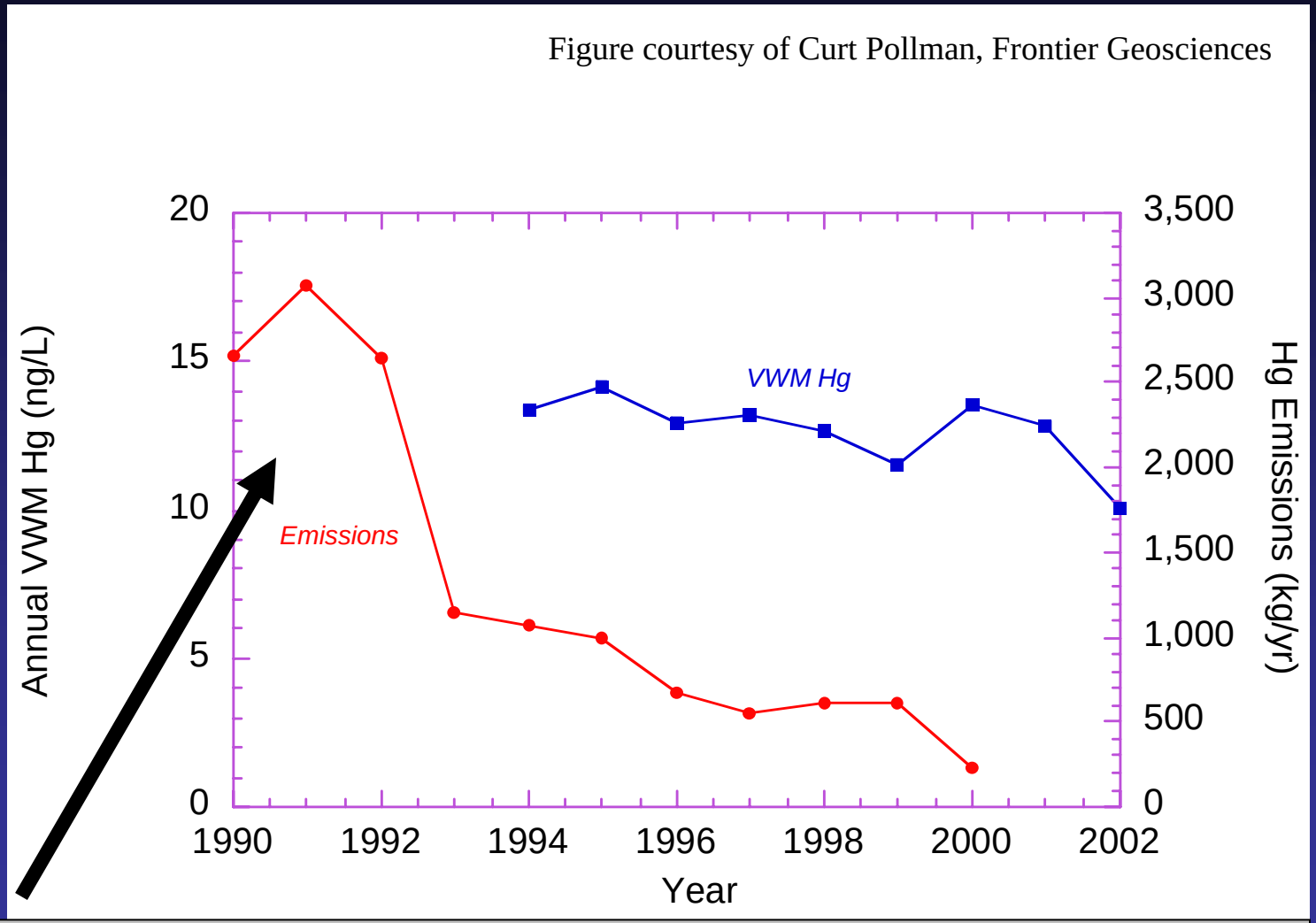
USA medical, municipal and hazardous waste incineration are biggest contributor to drop in emissions and local-scale source impacts.

EPA-HQ-OPPT-2005-0013

http://www.epa.gov/mercury/roadmap/htm

Maximum Hg emission period was missed in South Florida (MDN-FL11)

Figure courtesy of Curt Pollman, Frontier Geosciences



Comment: Oxidized mercury emissions were overwhelmingly from medical and municipal waste incineration. What would we give now to have some air and deposition measurements in S. Florida from 1985-1993?

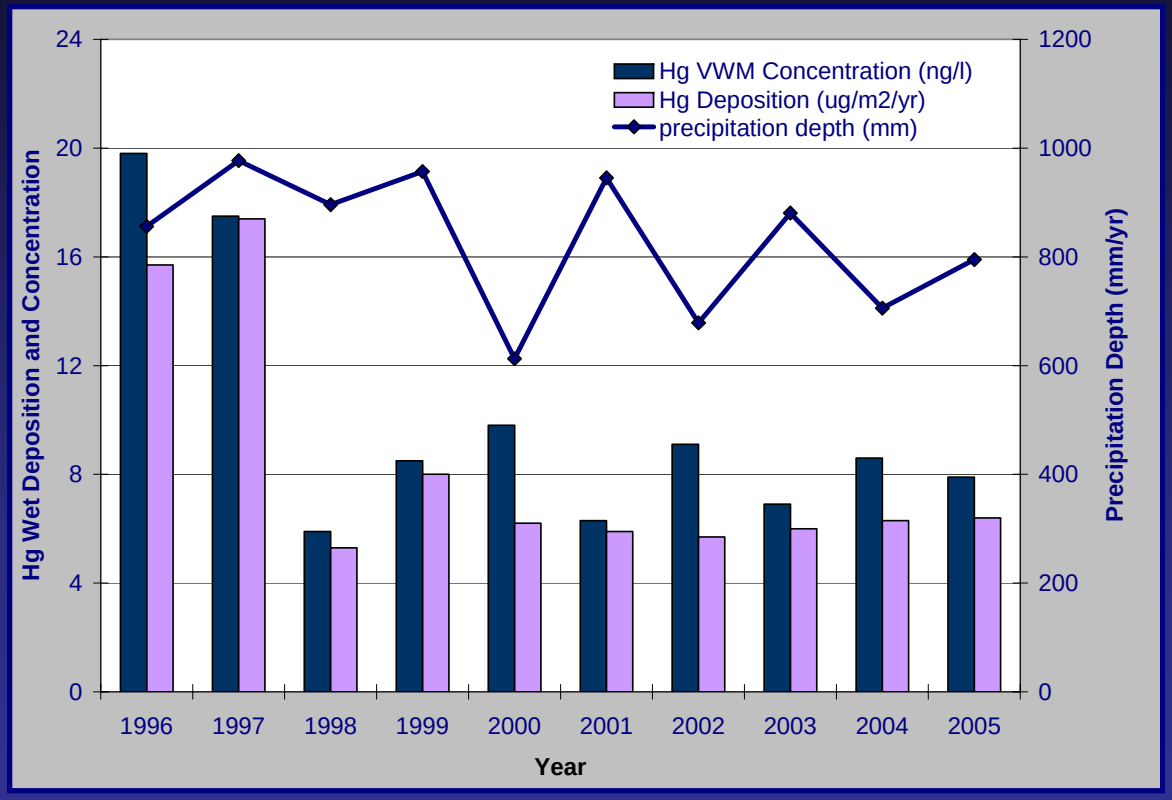
Example of unplanned local scale monitoring assessment

Interpretation is straightforward when Hg emissions decrease is large and abrupt

NADP-MDN Site
WA18, Seattle, USA

Abrupt decrease after 1997 due to closure of several medical waste incinerators (MWI) in Seattle (scale = 20km)

Pre-1997 Hg deposition in Seattle was not dominated by Asian and global sources!

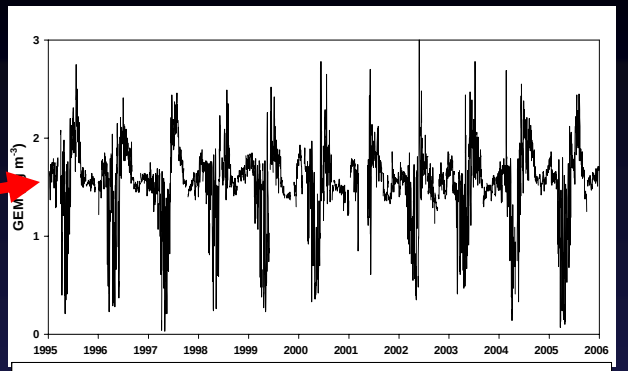


Prestbo et al., (2006) *Proceeding of the Int. Conf. on Mercury as a Global Pollutant*, www.mercury2006.org

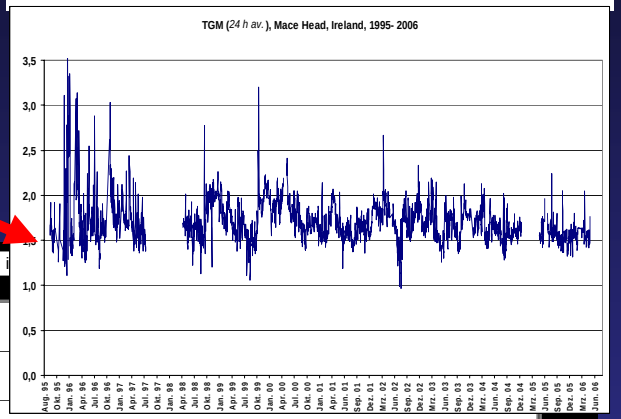
Continuous monitoring has lagged behind emission source changes creating uncertainty in assessment of trends

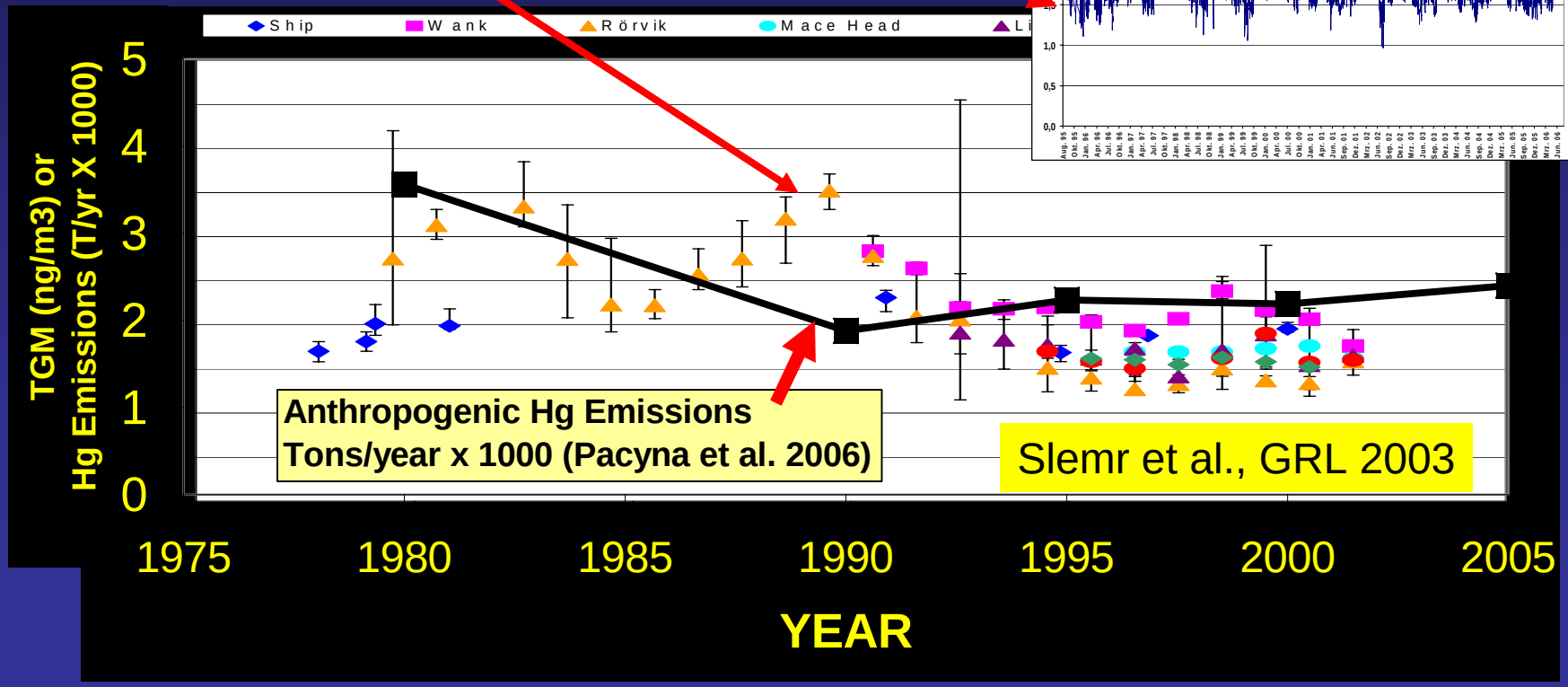
Regional, not global source emission reductions may better explain drop in signal at Rörvik in S. Sweden

Alert, Nunavut
Steffan et al.
GEM 1.5 ng/m^3



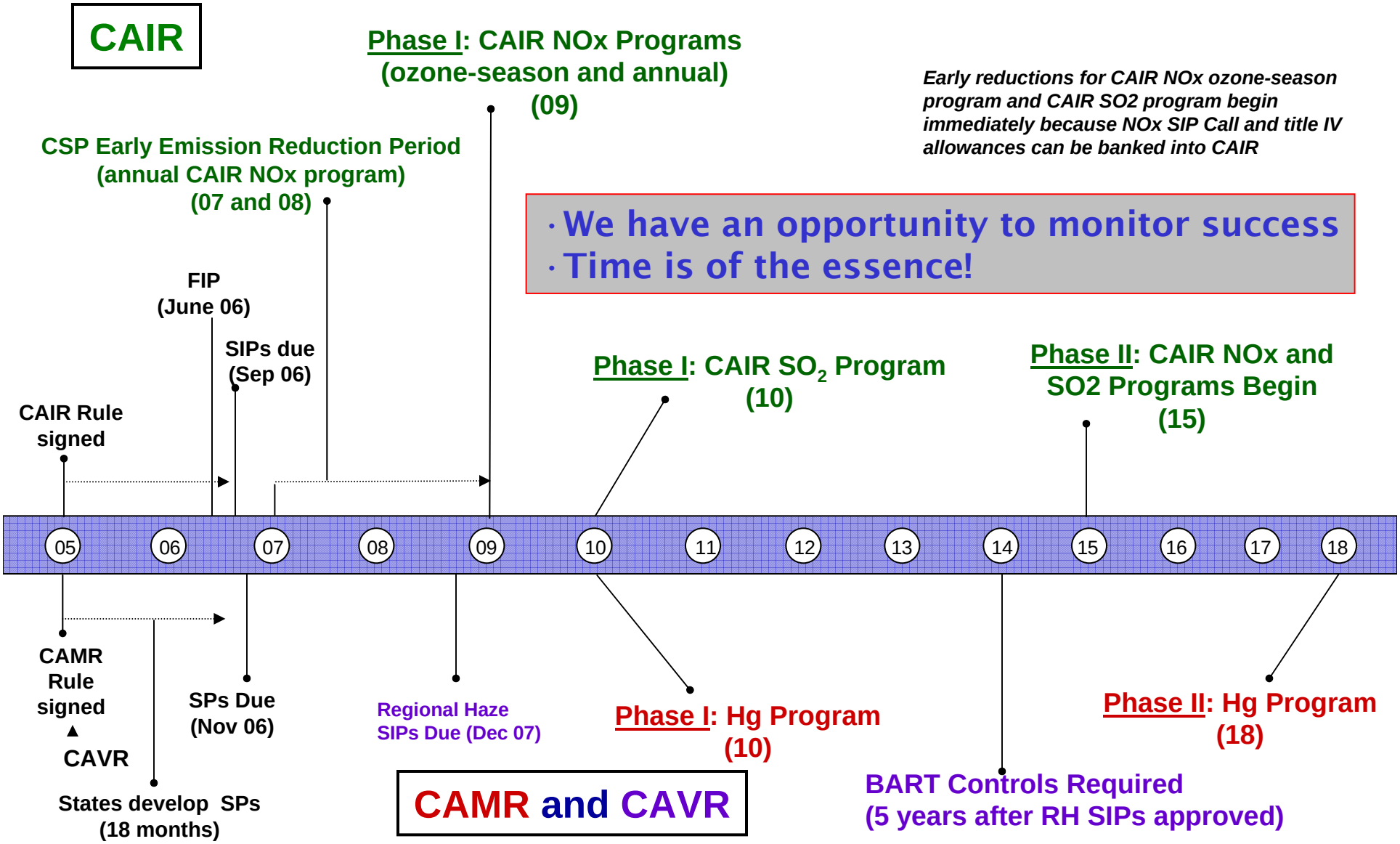
Mace Head, IR
Ebinghaus et al.
TGM 1.5 ng/m^3





CAIR, CAMR, CAVR Implementation Timeline

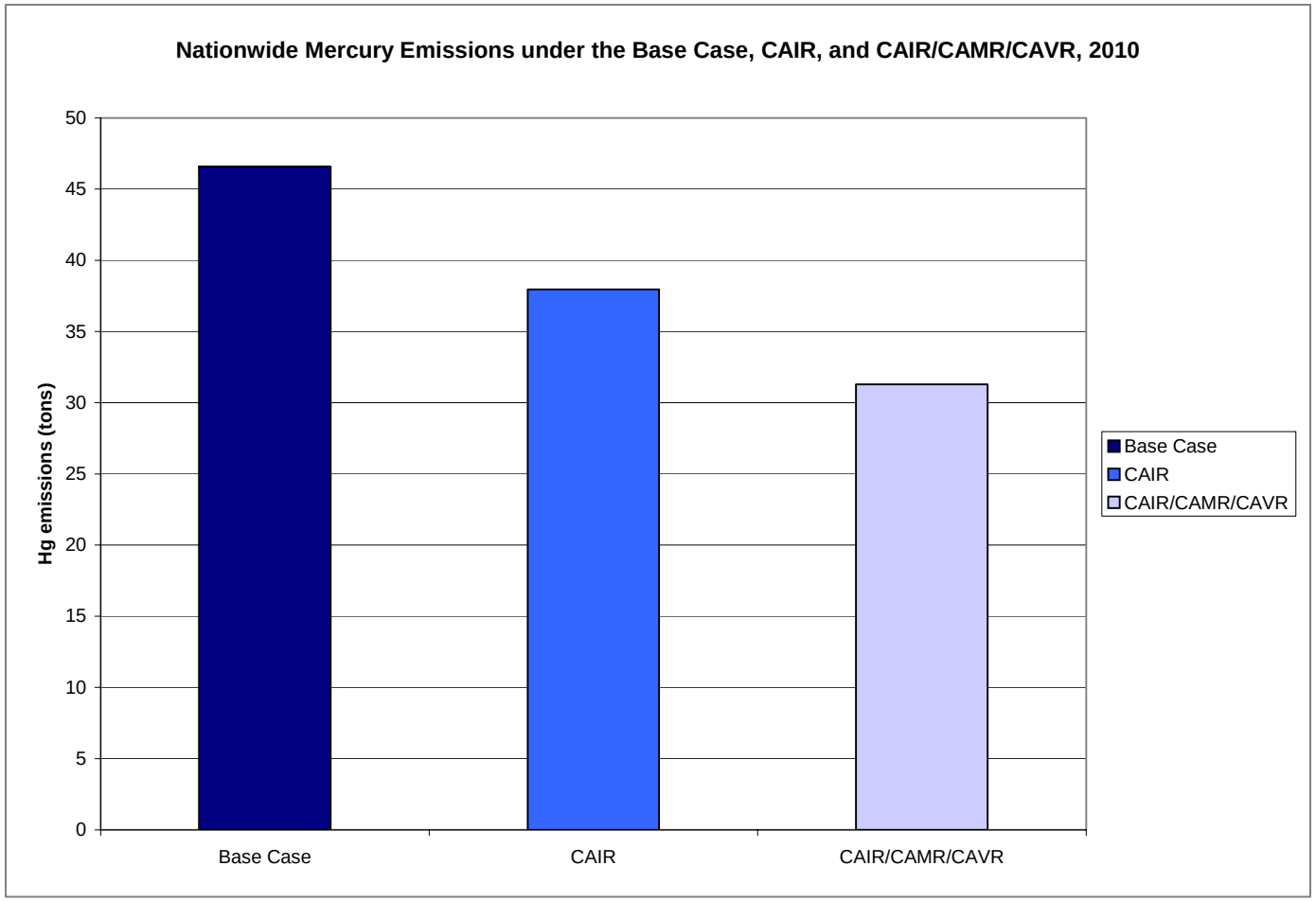
NOTE: More stringent State regulations will be in effect sooner!



Source: USEPA

CAIR and State Regulations will result in co-benefit mercury reductions by 2010

AGAIN - More stringent State mercury regulations may make this drop larger

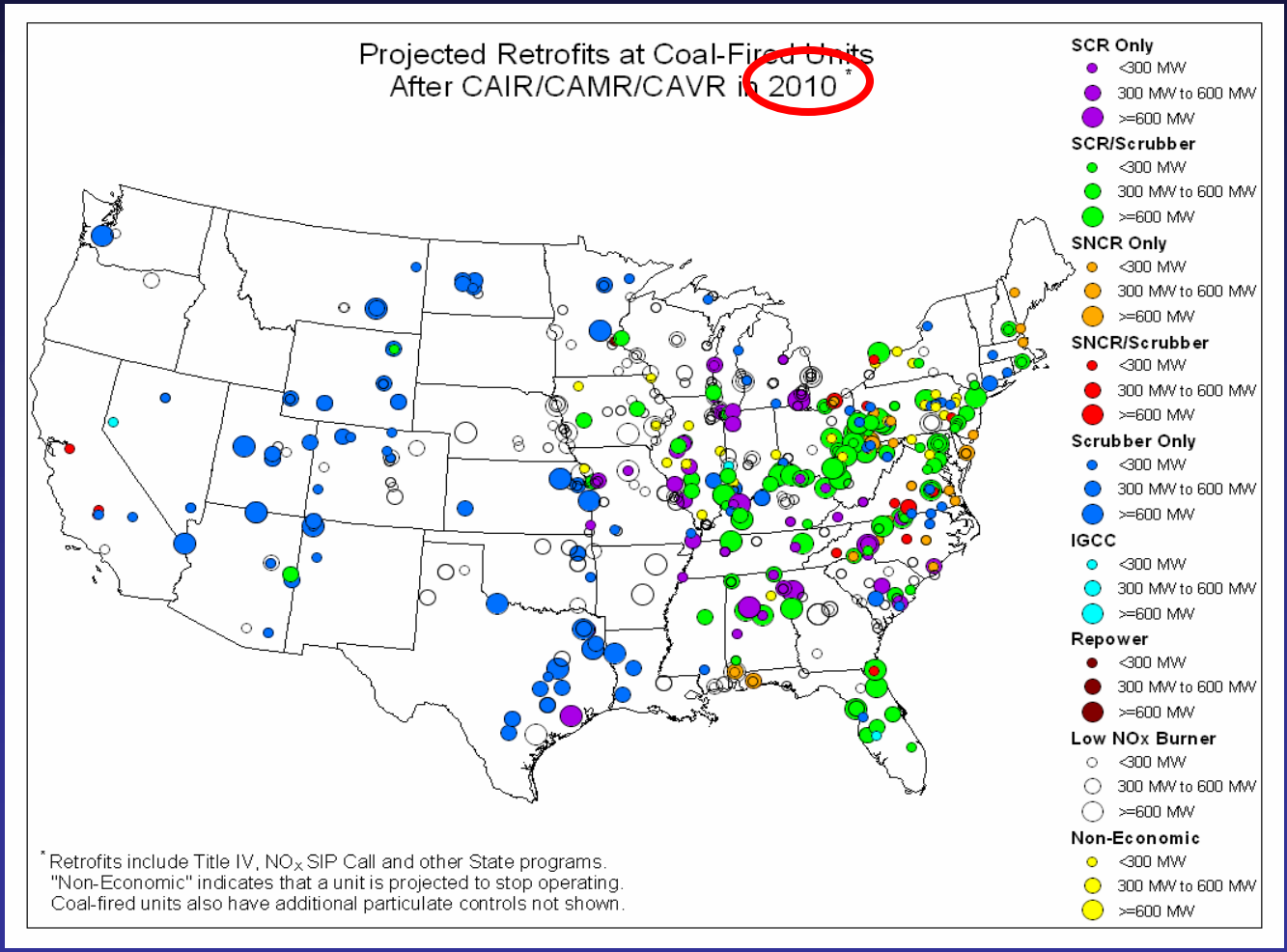


Here is the predicted drop in mercury emissions over the next 3 years – we must begin now

Source: USEPA

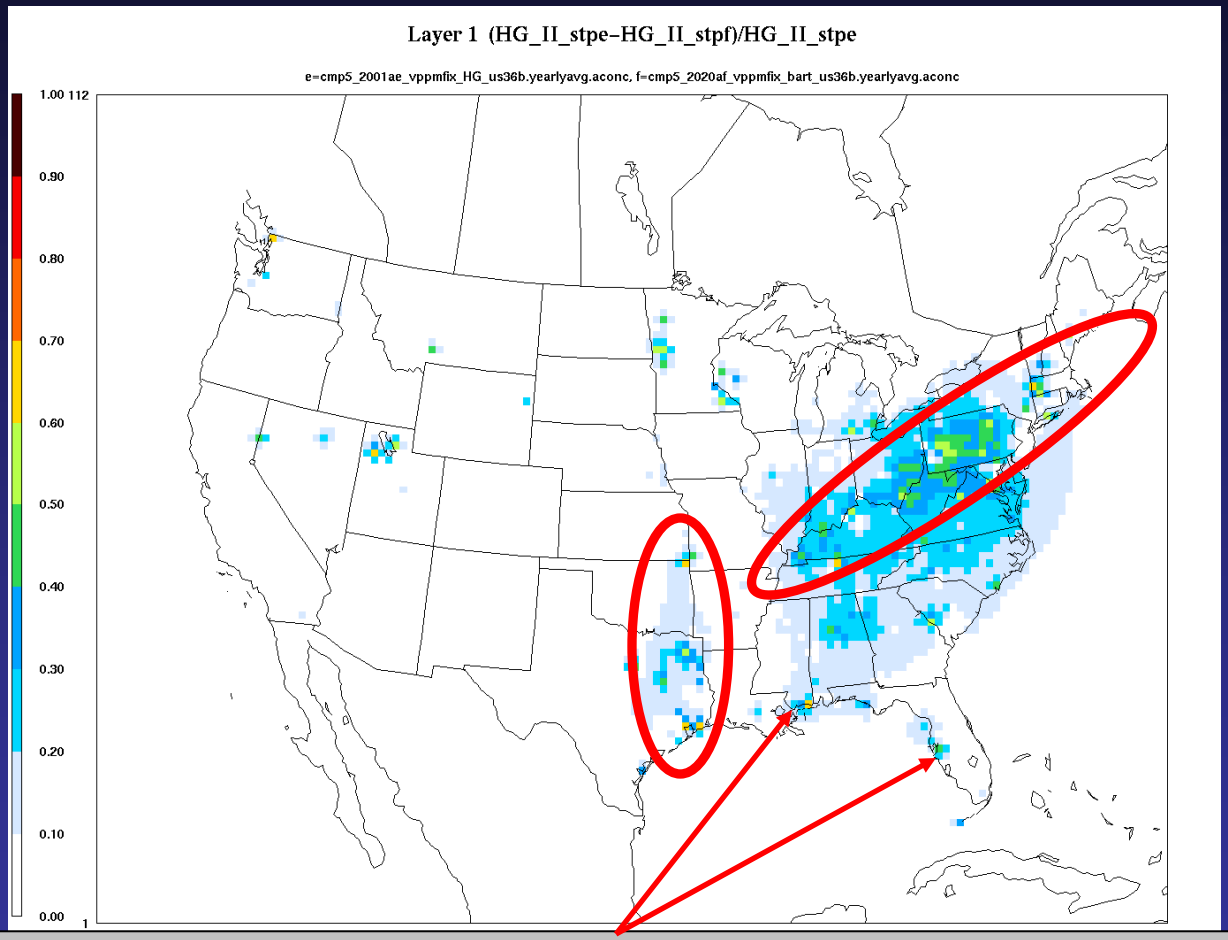
CAIR will result in the installation of wet-scrubbers, which will remove SO2 and the water soluble Hg(II) present in flue gas.

This is especially true in the high density Ohio River Valley source region where the biggest change in signal is predicted by economic and air chemistry models



Source: USEPA

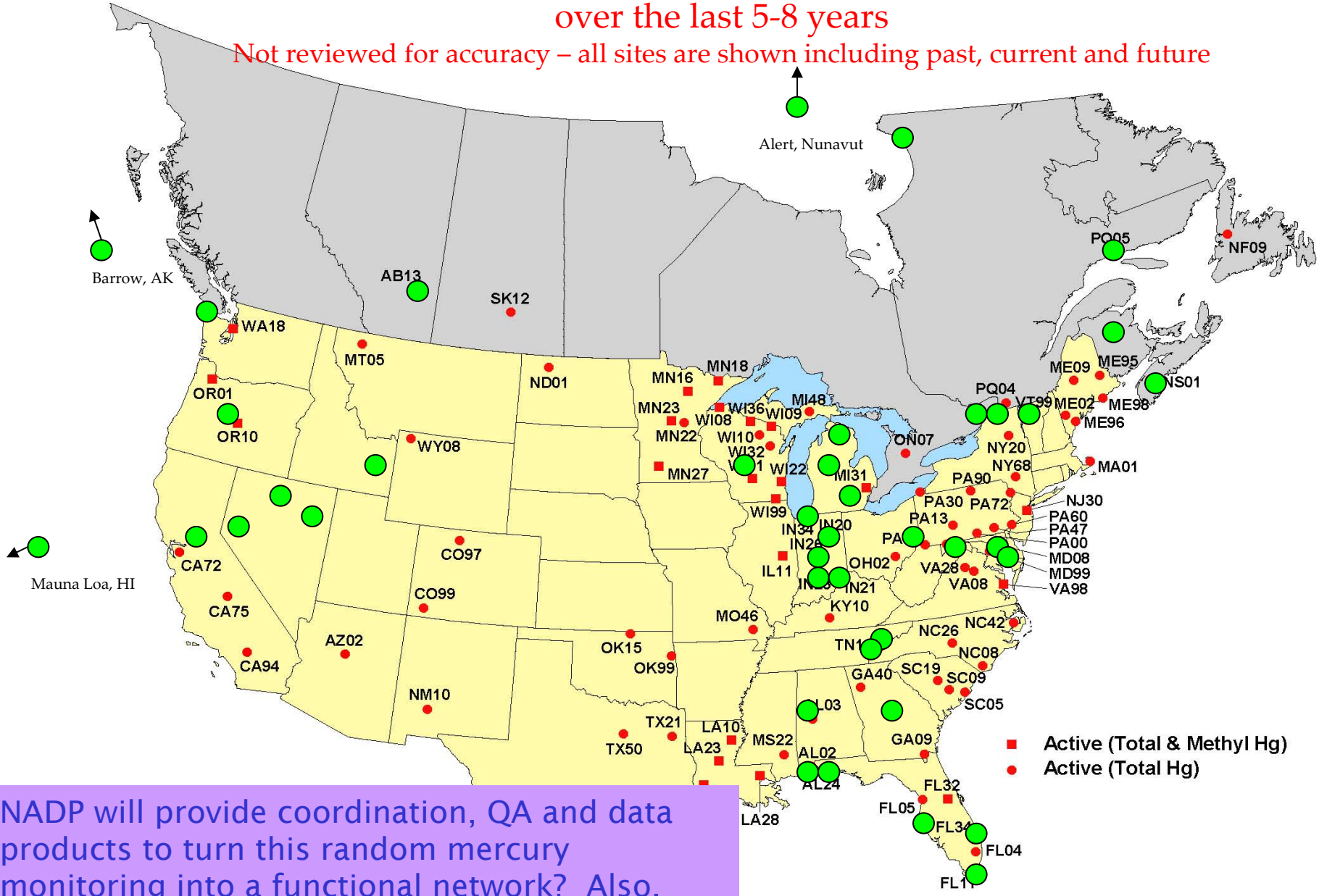
CMAQ estimated fractional decrease in RGM from 2001 base to 2020 due to CAIR, CAMR and all other expected mercury source decreases (Figure courtesy of Russ Bullock, NOAA on assignment to EPA)



Comment: Thus first tier atmospheric Hg monitoring sites should be in locations where regulatory impact will be greatest and occur the soonest. Although sites that can evaluate a predicted deposition gradient or are regionally and globally representative are critical too.

Approximate Location of Mercury Speciation Measurements over the last 5-8 years

Not reviewed for accuracy – all sites are shown including past, current and future



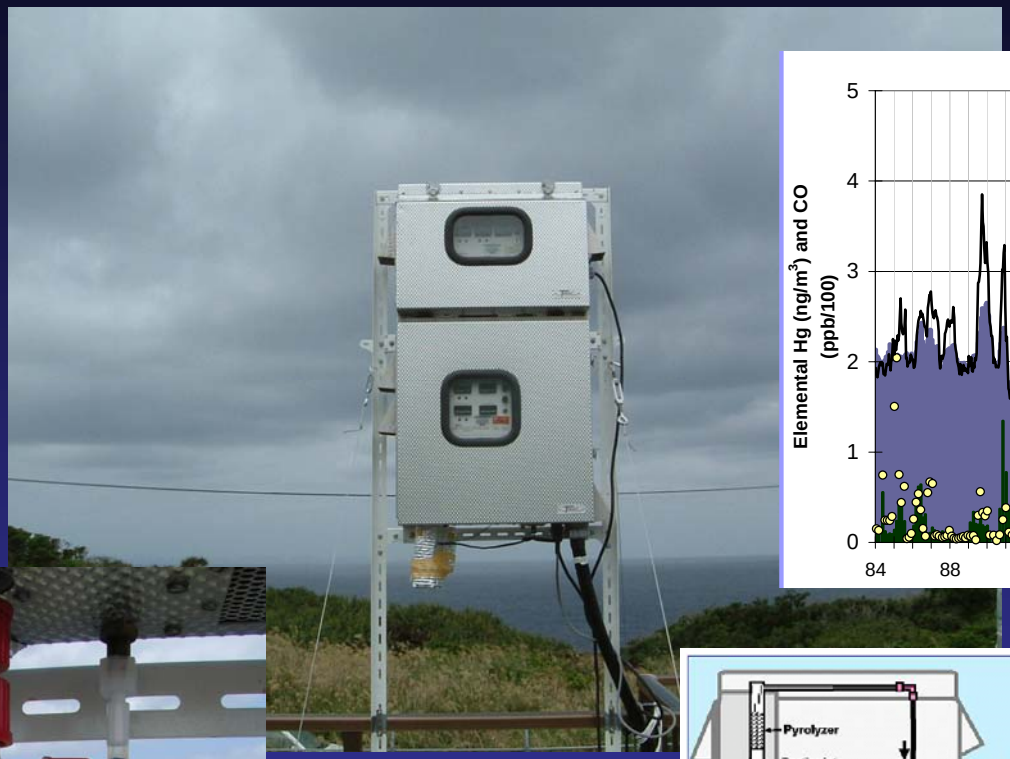
NADP will provide coordination, QA and data products to turn this random mercury monitoring into a functional network? Also, accept historical data for QA review and posting

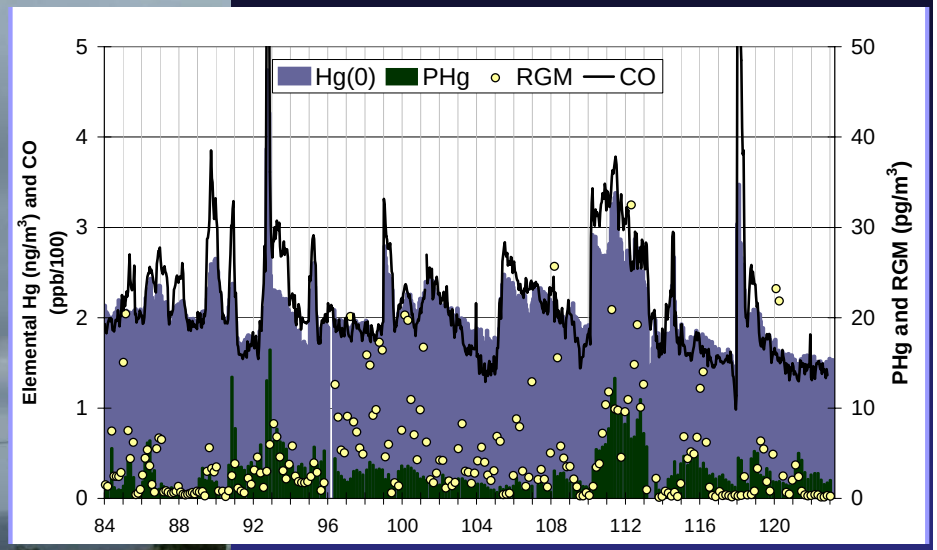
Atmospheric Mercury Initiative Objectives

- Measure concentrations of wet deposition flux (MDN), Hg species, meteorology and land cover variables to provide data for provisional estimate of dry deposition flux.
- Immediate priority will be on areas with a strong impact from local and regional Hg sources expected to change due to regulations
- Longer term will include a mix of local, regional, remote continental and globally source influenced site locations.

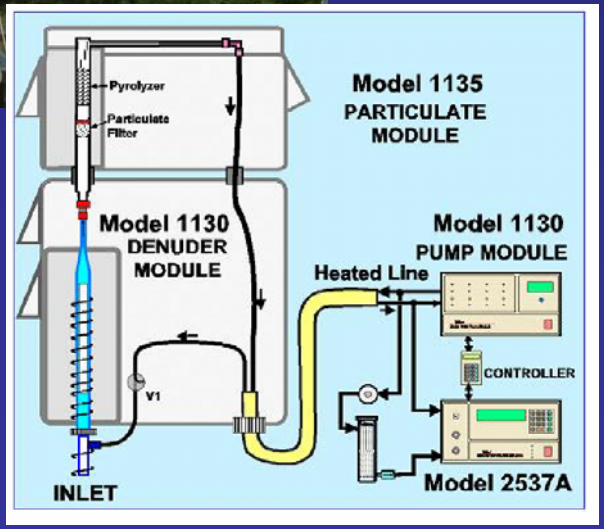
Tekran Automated Continuous Mercury Speciation System & QA-Manual Method

High temporal resolution needed to observe local to regional mercury species enhancements





Tekran Automated Speciation System



Why NADP?

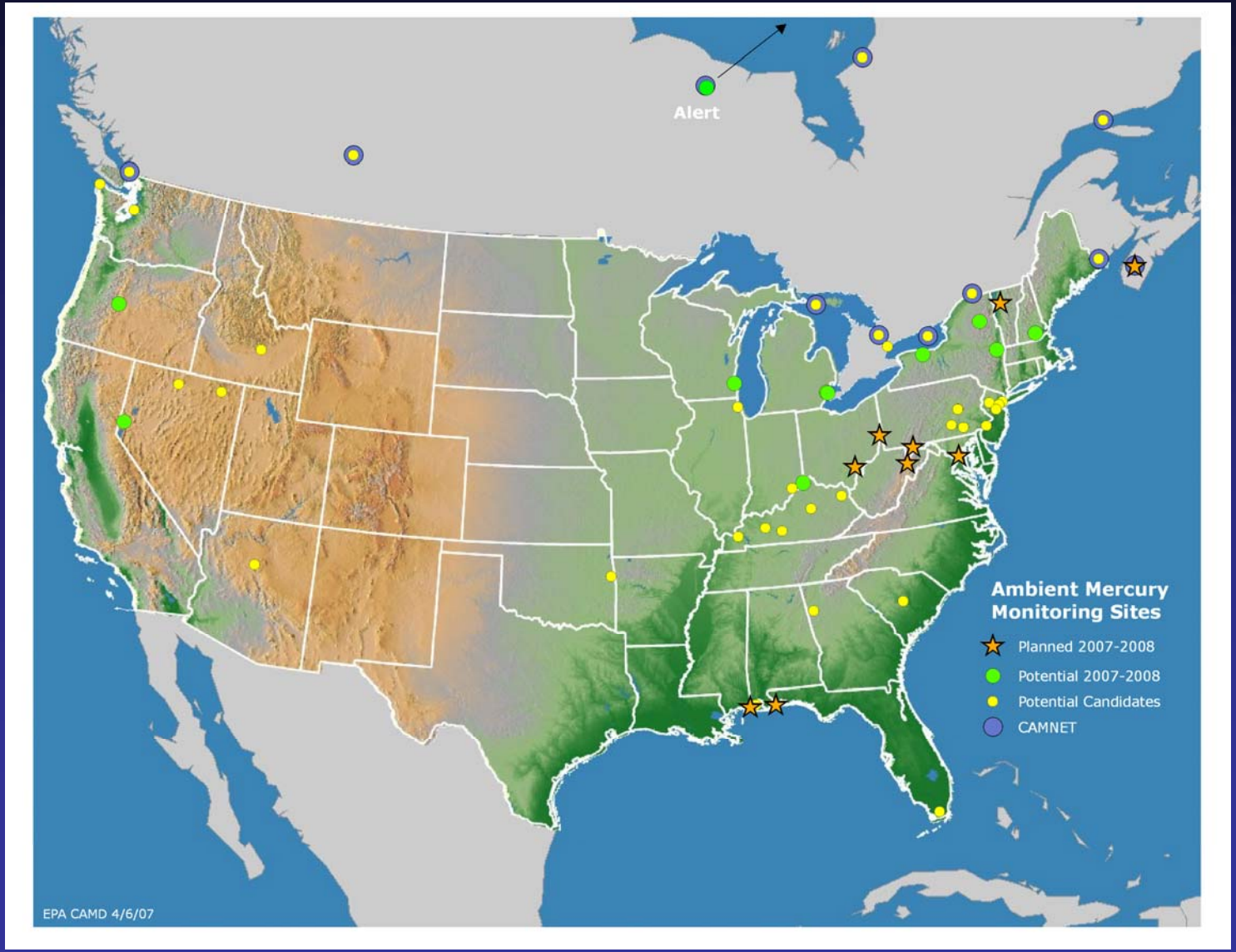
NADP STRENGTHS

- standardized methods and operations
- internal and external quality assurance
- proven data management capability and timely data product web access.

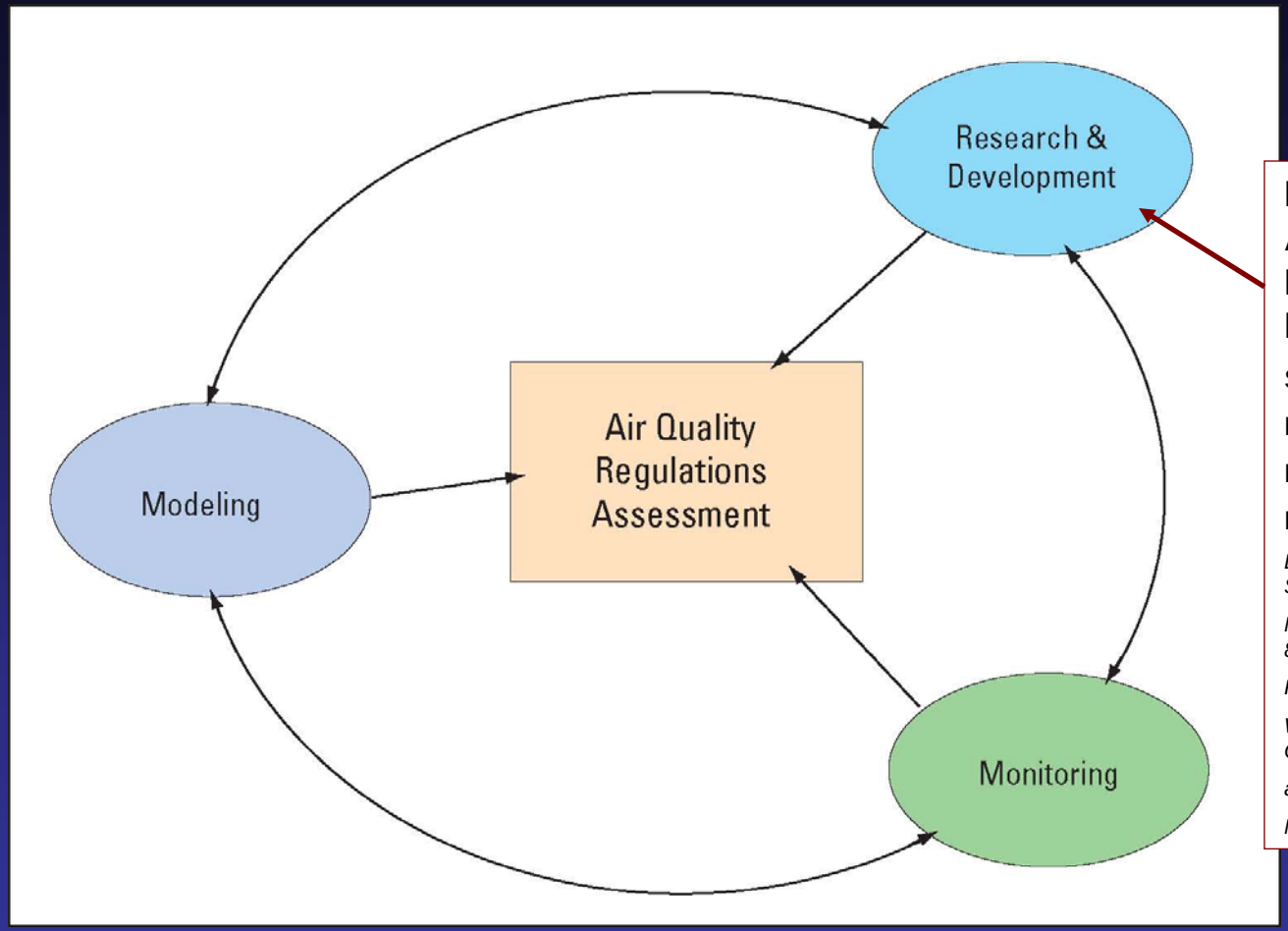
Comment: These functions are being accomplished through an open peer-review process in collaboration with atmospheric mercury scientists, and federal and state agencies

Candidate 2007-8 NADP Atmospheric Hg Network Sites

Harmonized – Quality Assured – Data on Web



Mercury Regulation Perspective



Estimation of Dry Deposition of Atmospheric Mercury in Nevada by Direct and Indirect Methods

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ERIC M. PRESTBO,‡ AND

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Frontier Geosciences, 414 Pontius Avenue North, Seattle,

Washington, 98109, and Department of Atmospheric, Oceanic

and Space Sciences, University of Michigan, Ann Arbor,

Michigan, 48109

Comment: The NADP Atmospheric Mercury Monitoring Advocates realize we are just one component. We are entirely dependent on high quality R&D and modeling advancements. It is critical that all three of the above functions are of equal importance.

Atmospheric Mercury Initiative

Back to NADP

A New NADP Initiative

A special meeting to consider a proposed new NADP initiative was held on May 1, 2006, in advance of the NADP spring meetings in Riverside, CA. The initiative was presented by the Mercury Dry Deposition Working Group (David Gay - NADP/Asst. Coordinator for Toxics, Eric Prestbo - MDN science advisor, Martin Risch - NADP/Network Operations Subcommittee, David Schmeltz - USEPA Office of Air and Radiation) and would complement the existing MDN, which measures wet-only mercury deposition.

The initiative seeks to measure event-based mercury wet deposition, air concentrations of mercury in its gaseous and particulate forms, and meteorological and land-cover variables needed for estimating dry deposition fluxes. The goals are:

- facilitate the calculation of wet, dry, and total deposition;
- provide data for evaluating predictive and diagnostic models and for assessing source-receptor relationships; and
- build a data set for analyzing spatial and temporal trends.

The initiative proposes a national network of monitoring stations with a broad range of classifications, including: rural, suburban, and urban; near-source/high-emission; sensitive ecosystem; and regionally representative. Stations would follow standard operational procedures, based on methods developed from USEPA and other research efforts. Data would be quality-assured and accessible online from the NADP Web page.

On June 27, 2006, a second meeting was held in Chicago, IL. The focus of this meeting was development of guiding principles for monitoring atmospheric mercury. Please see the minutes and notes from this meeting, along with the current draft of the guiding principles for monitoring atmospheric mercury.

How NADP Handles Initiatives

The NADP Quality Management Plan includes a guide (Appendix D) for the presentation of new initiatives. This guide requires a plan that addresses 12 specific points covering purpose, operations, staffing needs and costs, funding, appropriateness to the NADP mission, etc. The NADP Executive Committee evaluates these plans and approves or rejects initiatives. A 12-point plan has been drafted for the mercury initiative. The plan has not been finalized and comments and suggestions are welcome (contact David Gay: dgay@uiuc.edu or 217-244-0462).

Special Meeting Announcement

April 9-10, 2007
Burlington, VT
More information

Planning Documents

- Network Summary, *(pdf)*
- Meeting Minutes, 1 May 2006 *(pdf)*
- Meeting Minutes, 27 June 2006 *(pdf)*
- Draft Guiding Principle *(pdf)*
- Network Location Decisions *(pdf)*

NADP Documents

- Executive Committee Motion *(pdf)*
- Draft 12 point plan *(pdf)*
- Quality Management Plan, Appendix D *(pdf)*

Operation Documents

- Draft Field SOP
- Draft Data Validation SOP

Presentations

- NADP Inititative December 2006 *(pdf)*
- NADP Working Group, at Fall 2006 NADP meeting *(pdf)*

Network Locations

- Map
- Table of Site Characteristics

Available Data

- Beltsville, MD
- Grand Bay NERR, MS
- Athens, OH
- Western Maryland
- Canaan Valley, WV

http://nadp.sws.uiuc.edu/mtn

NADP-AMI Network Activities for 2007-8
Where are we going?

1. Survey of “best practices” and write SOP for atmospheric Hg speciation with colleagues
2. Data stream web-based products and management
3. NADP admin. and cost structure
4. Develop and internal and external quality assurance program
5. Site location criteria mapping
6. Planning, Communication and Advocacy

Harmonized Method Justification

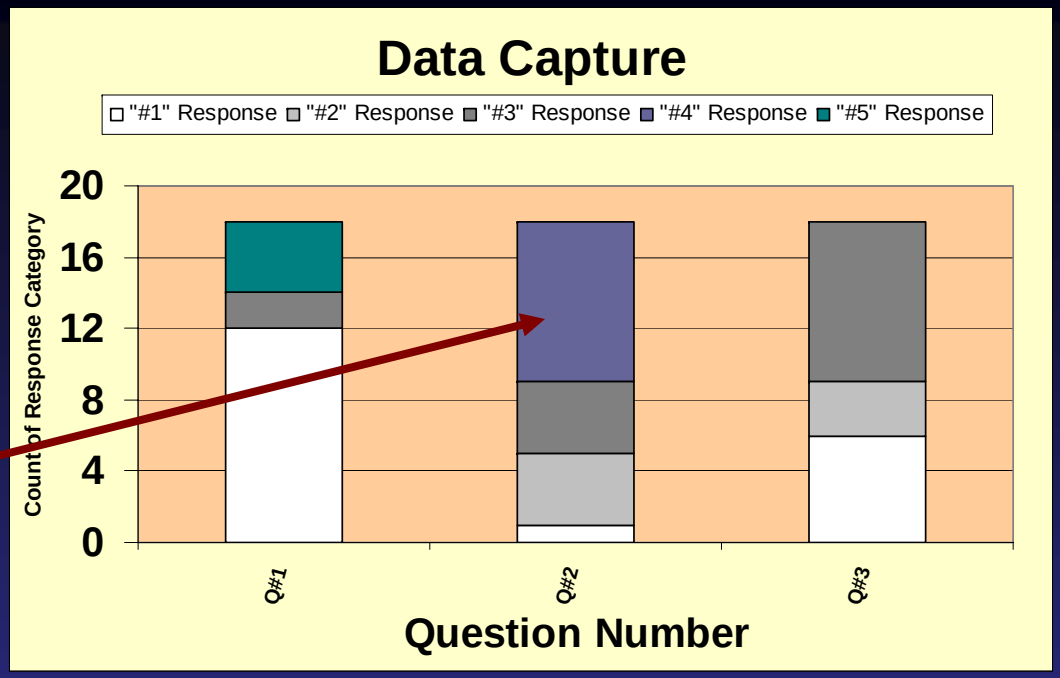
- At MDN Atm-Hg workshops the Scientists and representatives of EPA, Environment Canada, NOAA, USGS and States have indicated that a standard method is a critical need
- Harmonization of current methods provides ability to compare data between sites
- Aspmo et al., (2005) atmospheric Hg speciation intercomparison study calls for standard methods and reference standards for RGM and Hg_p
- SOPs and QAPPs required for government funded projects

List of Participants and Responses

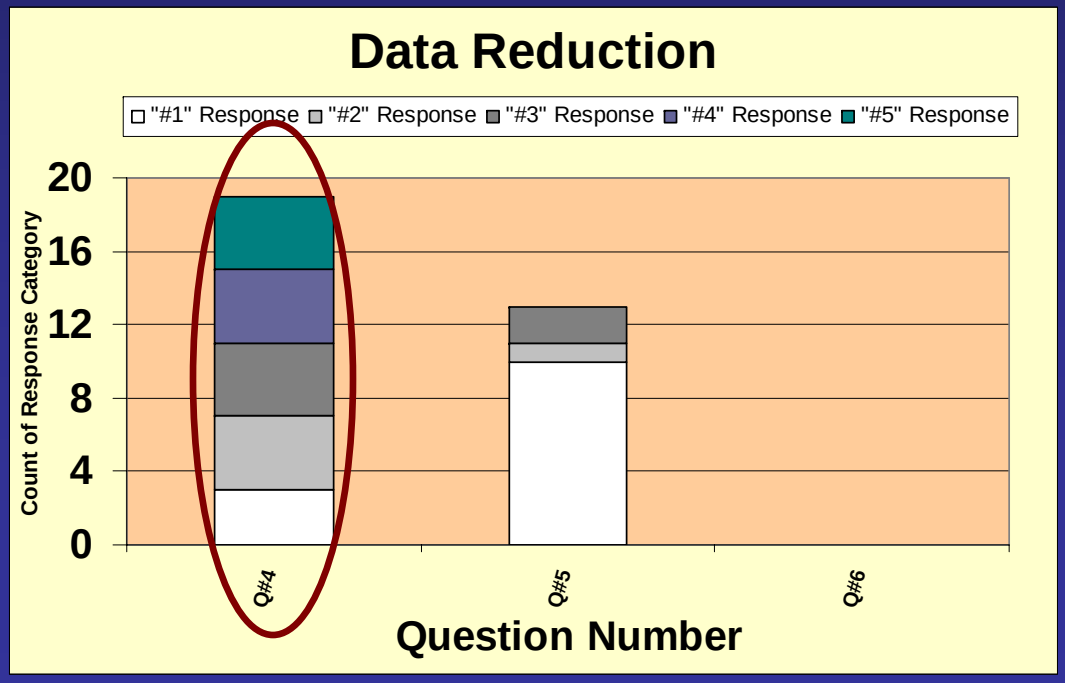
Participant List	Affiliations	Complete	Participant List	Affiliations	Complete
Matt Landis	EPA	X	Charles Pietarinen	NJDEP	X
Sandy Steffen Rob Tordon Laurier Poissant	Environment Canada	X X .	Dirk Felton	NYSDEC	X
Mark Castro	U Maryland	X	Tom Holson	Clarkson University	X
David Krabbenhoft Mark Olson	USGS	X	Charles Driscoll	Syracuse University	X
Eric Miller, ERG	Ecosystems Research, Inc.	X	Robert Talbot	University of New Hampshire	X
Steve Brooks	NOAA	X	Eric Prestbo	Frontier Geosciences	X
Jerry Keeler	U Michigan		Gary Gill	Battelle Marine Sciences Lab	X
Eric Edgerton	Atmospheric Research, Inc.	Expected	Xinbin Feng	Chinese Academy of Sciences	X
Mae Gustin	U Nevada-Reno	X	George Allen	NESCAUM	N-E
Gary Conley	Ohio University		Bruce Louks	Idaho DEQ	N-E
Winston Luke	NOAA	See NOAA	Ronnie Watkins	Alabama DEM	2537
Rob Mason	U Connecticut		Tom Atkeson	Florida DEP	N-E
Ralf Ebinghaus Christian Temme	GKSS-Germany	2537	Susan Zimmer-Dauphinee	Georgia DEP	
Nicola Pirrone	CNR-Institute for Atmos.	X	Melvin Schuchardt	Illinois EPA	
Torunn Berg Kristine Aspmo	Norwegian University of Science and Technology		Sean Alteri Andrea Keatley	Kentucky Div. of Air Quality	
John Munthe Ingvar Wängberg	IVL Sweden	partial	Philip Frazier	Louisiana	
Christophe Ferrari	Laboratoire de l'Environnement	N-E	Amy Robinson	Michigan	N-E
Dan Jaffe Phil Swartzendruber	U Washington-Bothell	X	Nick Lazor	Pennsylvania DEP	
Jamie Schauer	U Wisconsin	See USGS	Kevin Watts	South Carolina DHEC	
Mike Abbott	Idaho National Laboratory	X	Robert Brawner	Tennessee	
Frank Schaedlich	Tekran	X	Bruce Rodger Mark Allen	Wisconsin DNR	2537
Alan VanArsdale	US EPA				

Best Practices Questionnaire Responses

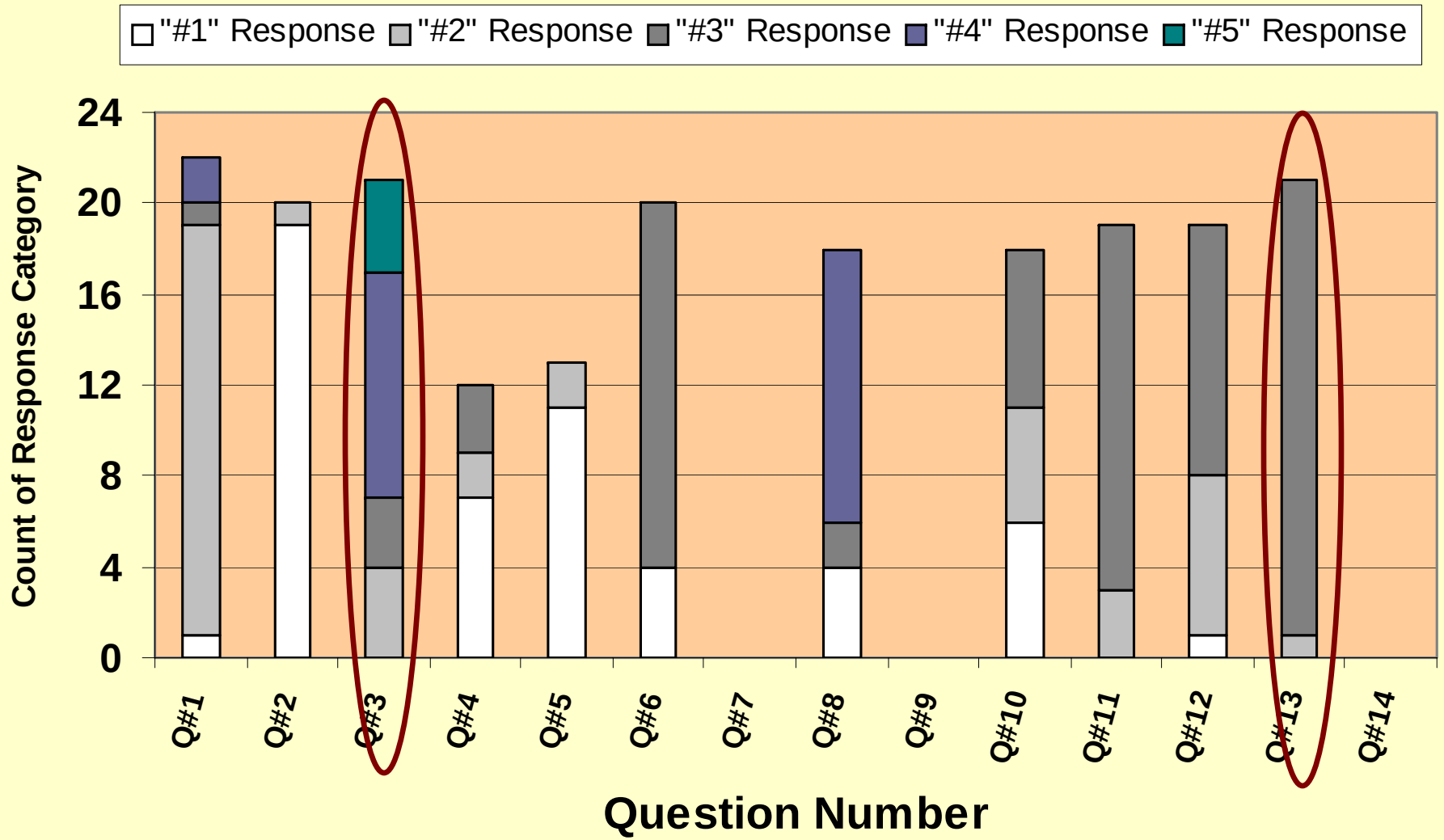
- Q2 – Remote Data Access?
  - Data logger
  - Computer
  - Computer + data logger
  - Go to site to download



- Q4 – Data Reduction Method?
  - Manually, line-by-line
  - Tekran Combine Program
  - Combine + other program
  - Custom Program
  - Other



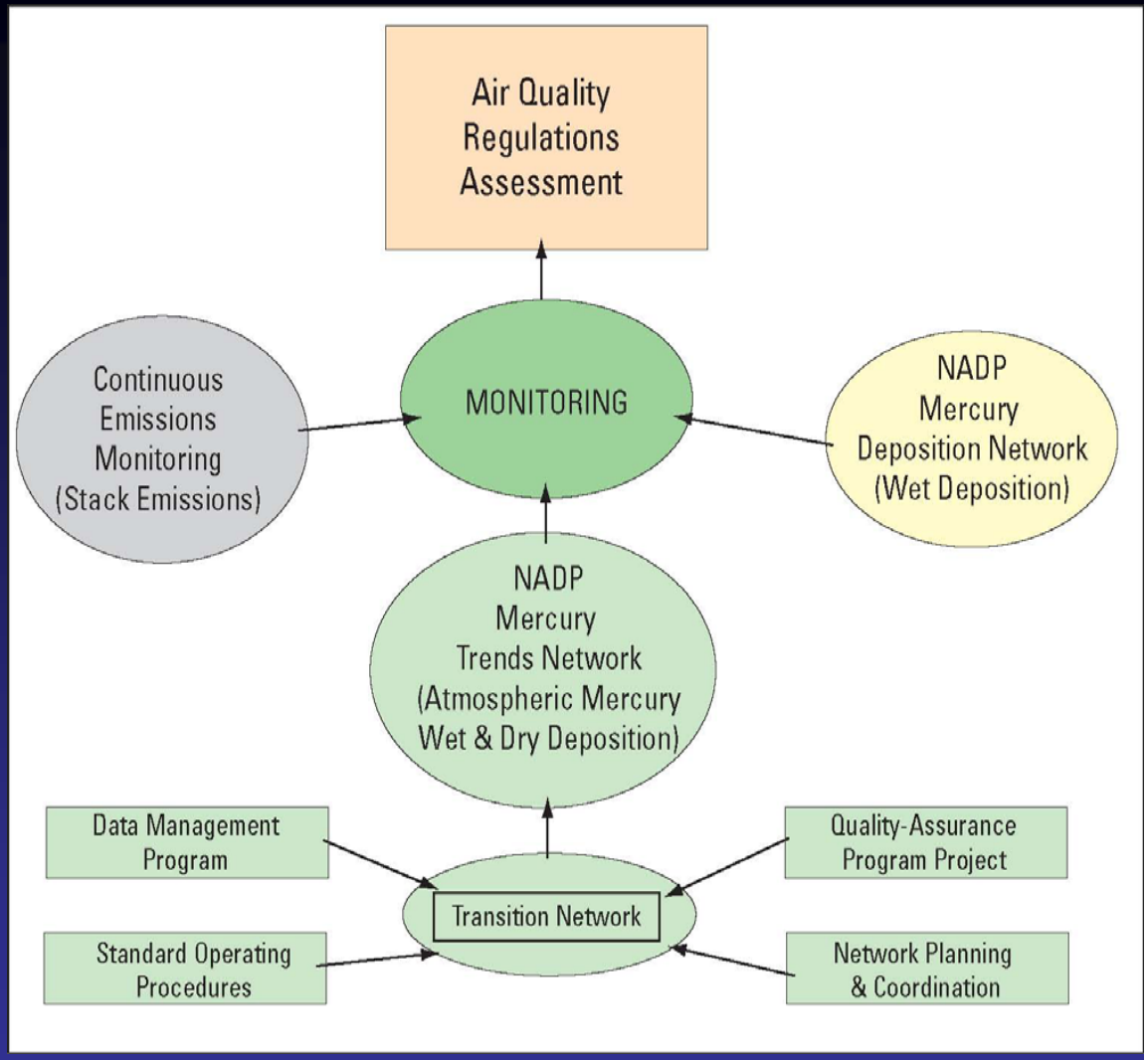
Tekran 2537 Air Flow Path Integrity



- Q3 – flow meter calibration – monthly, quarterly, yearly, never
- Q13 – Quartz Fluorescence Cell Cleaning – Only when needed as a result of troubleshooting

CONCLUSION

Monitoring schematic for CAMR & States regulatory assessment



Comment: The combination of emission and air concentration measurement and wet and dry deposition flux completes the atmospheric fate and transport assessment. The CEM bubble is as complex as the others but not detailed in this diagram.