

Developing an Open, Coordinated and Collaborative Atmospheric Mercury Monitoring Network in North America

NADP Atmospheric Mercury Initiative
<http://nadp.sws.uiuc.edu/mtn/>

Eric Prestbo* – Frontier Geosciences MDN Science Advisor

David Gay – NADP-MDN Program Coordinator

Martin Risch – USGS and NADP NOS Chair Elect

David Schmeltz – EPA Clean Air Markets Division

Tim Sharac – EPA Clean Air Markets Division

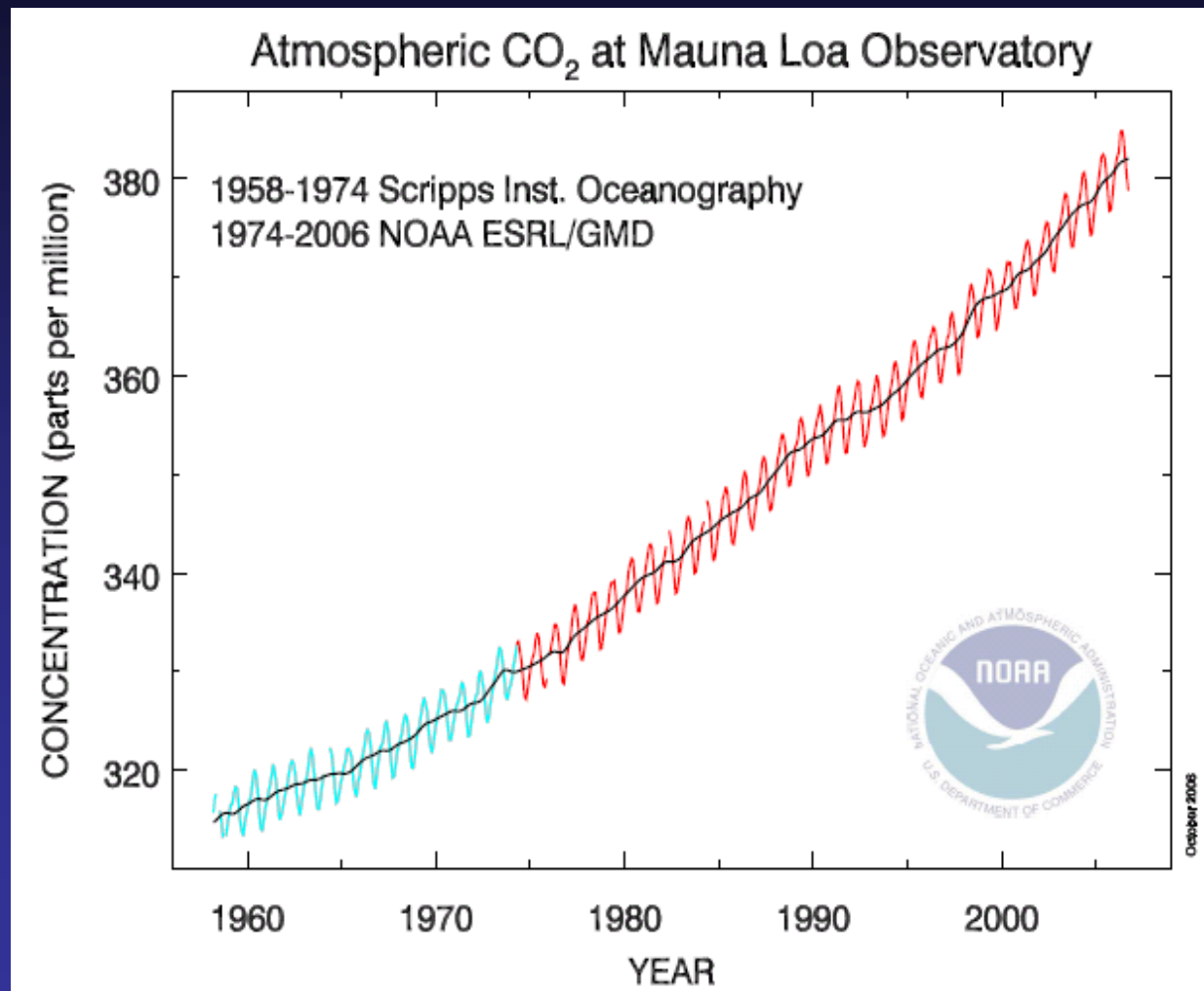
*Corresponding author – ericp@frontiergeosciences.com

Regulations + Monitoring = Accountability

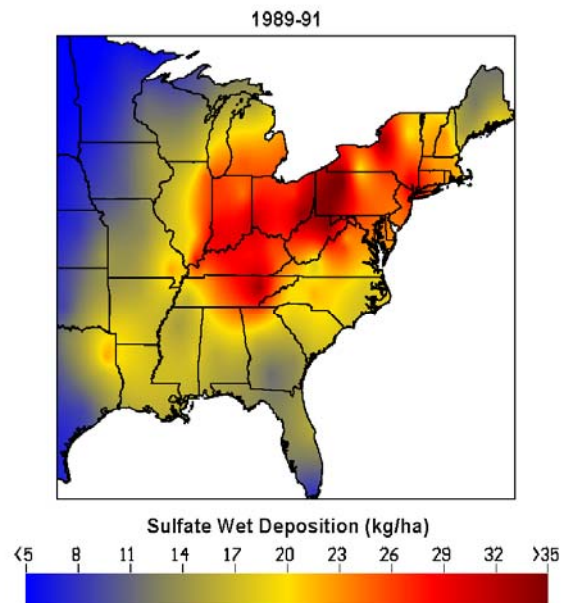
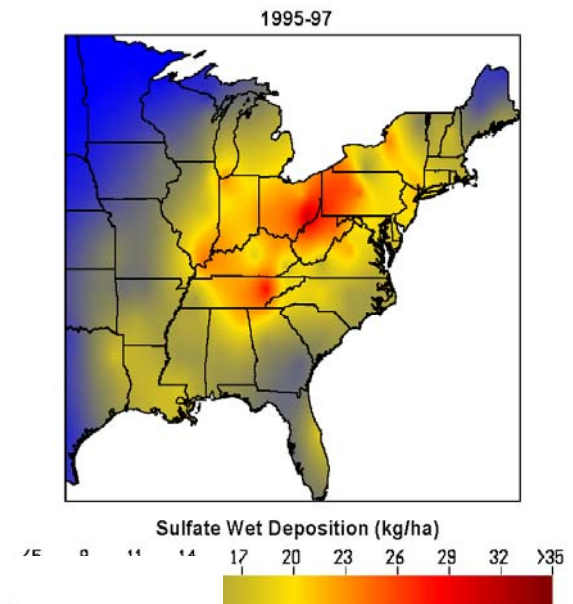
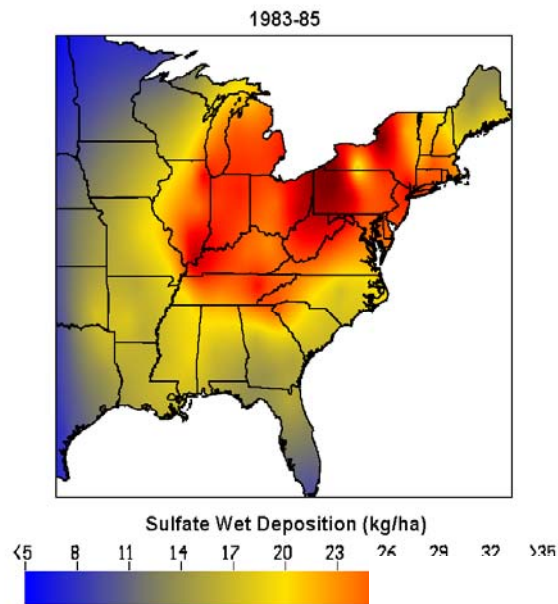
The protection of the environment has often been deemed successful when there is a regulatory driver and complimentary monitoring component.

Comment: 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 success
has yet to be realized for global CO₂



Success! - NADP SO₄ 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

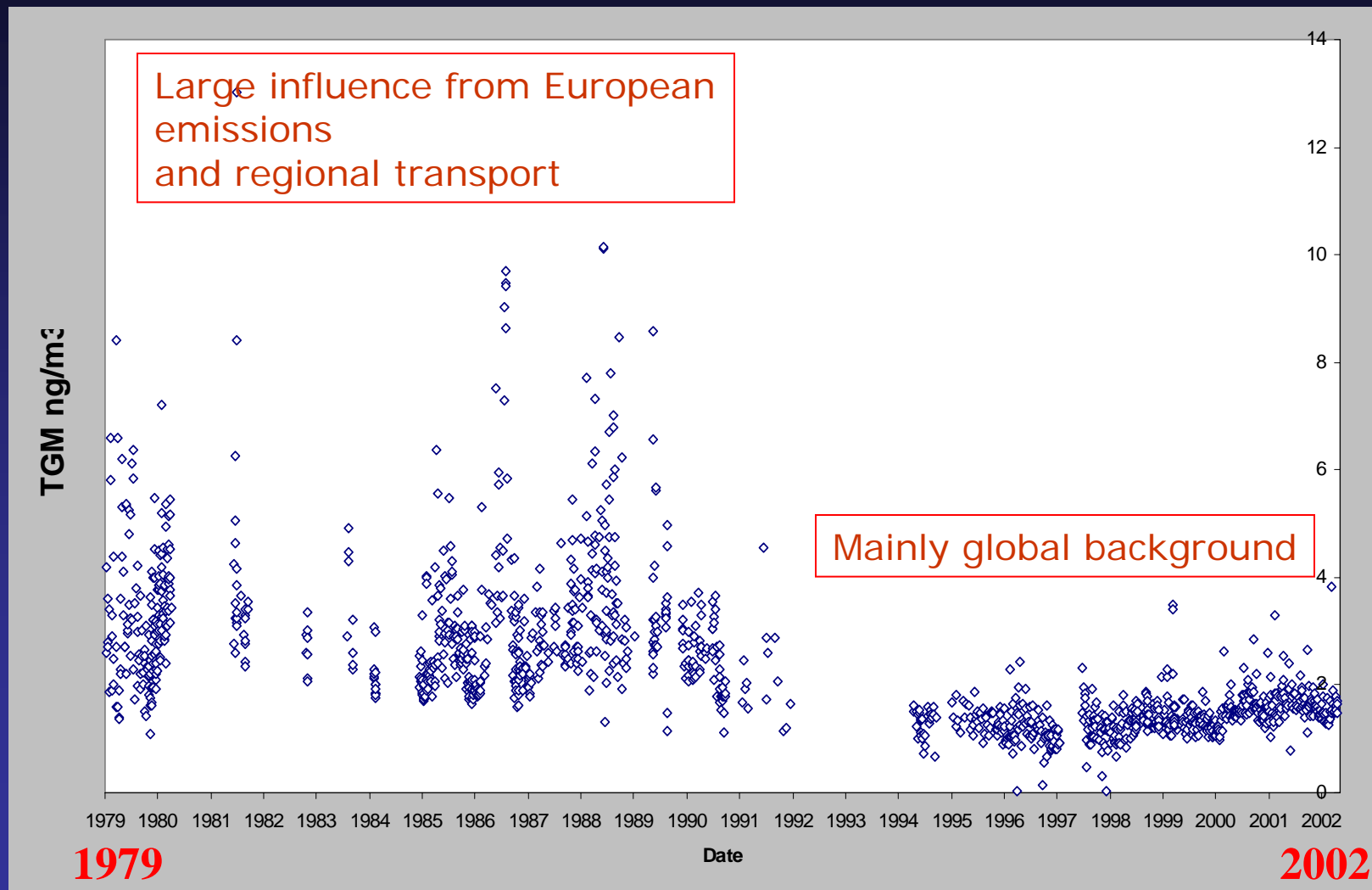
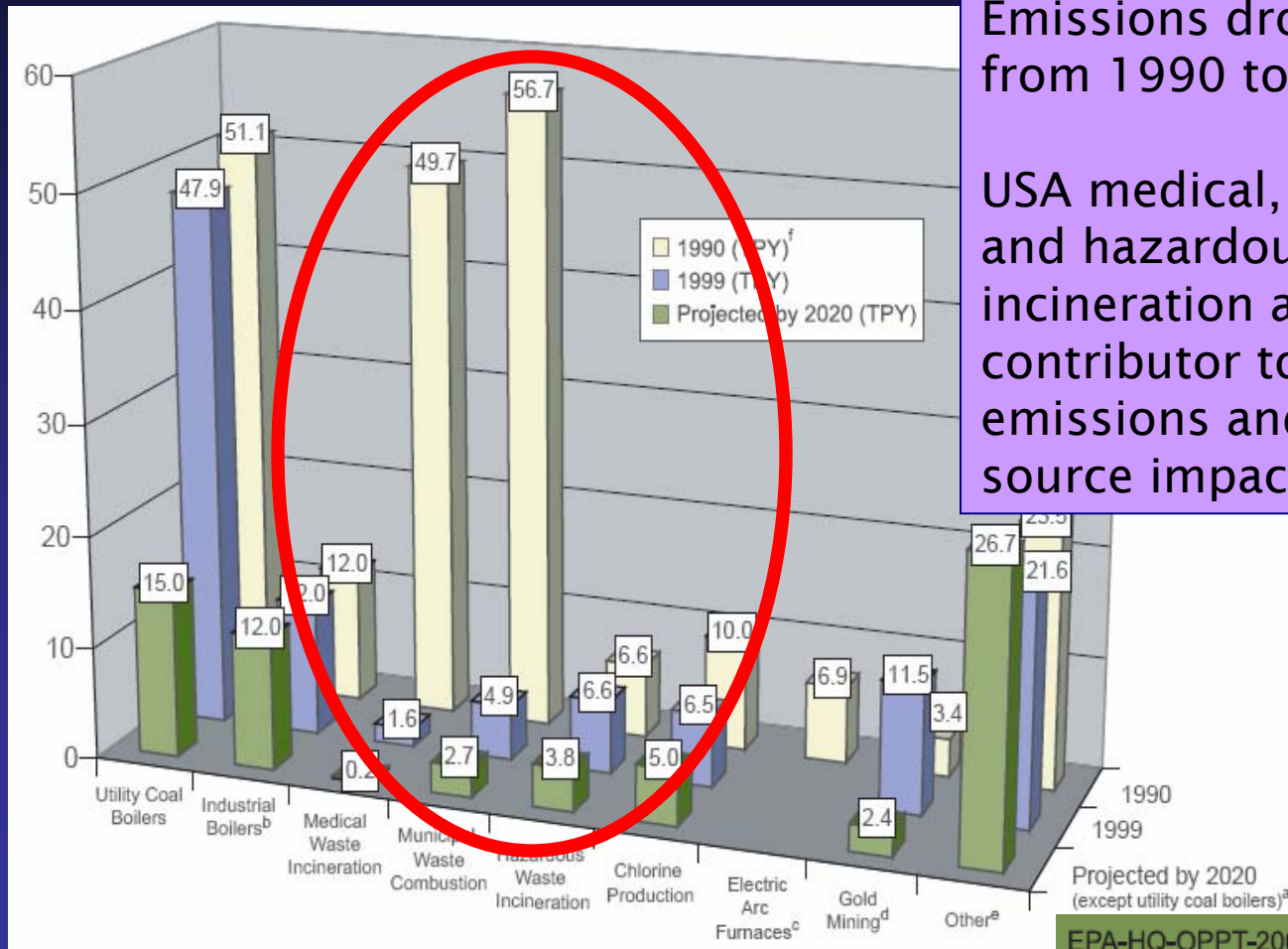


Figure Courtesy of Dr. John Munthe, IVL, Sweden (john.munthe@ivl.se)

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

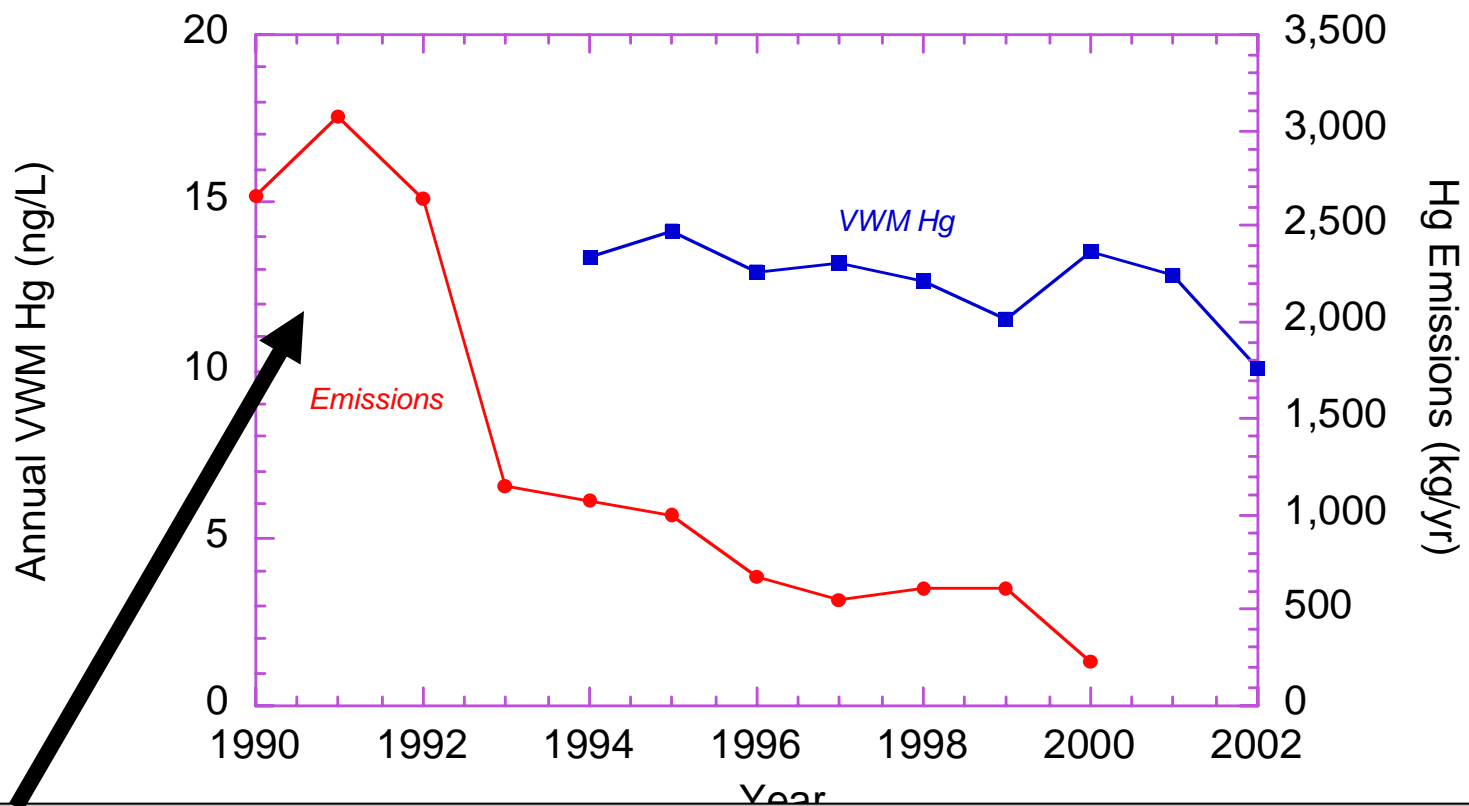
USA medical, municipal and hazardous waste incineration are biggest contributor to drop in emissions and local-scale source impacts.

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



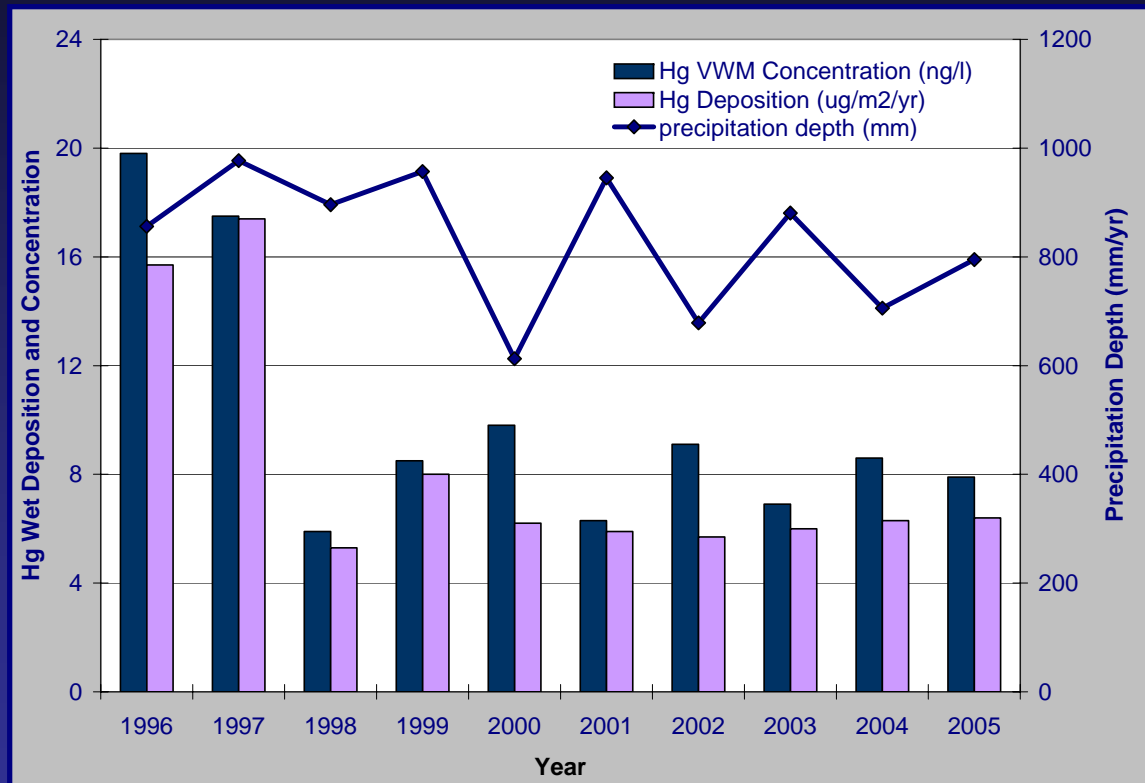
Comment: Emissions were overwhelmingly from medical and municipal waste incineration. What would we give now to have some air and deposition measurements in S. Florida from 1985-1993?

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!

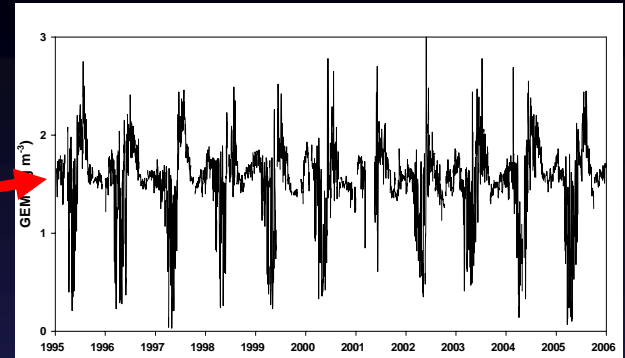


Prestbo et al., (2006) *Proceeding of the Int. Conf. on Mercury as a Global Pollutant*,
www.mercury2006.org

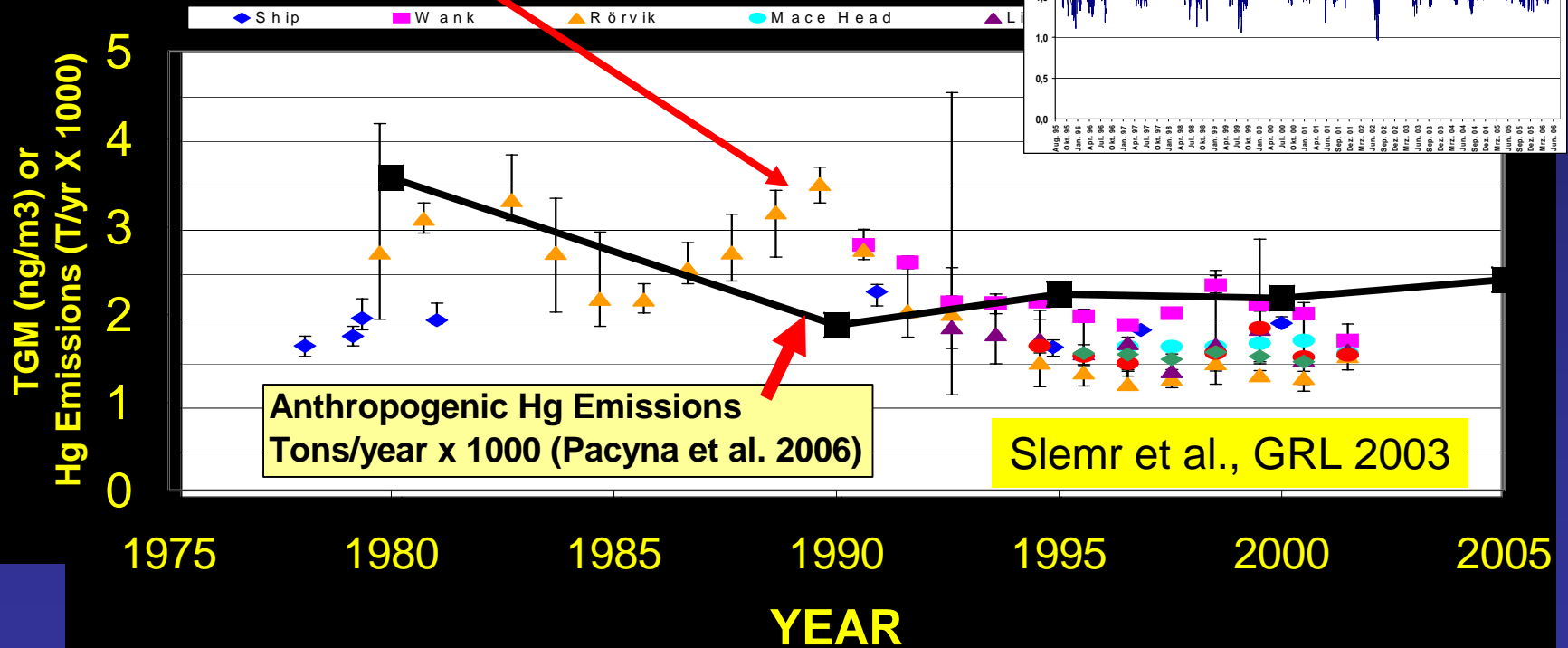
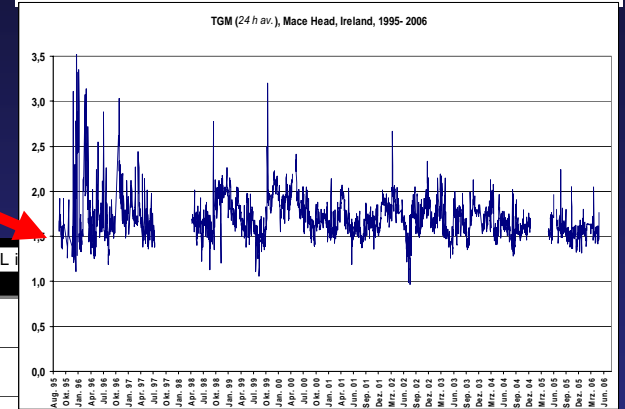
Continuous monitoring has lagged behind emission source changes creating uncertainty in assessment of trends

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/m³

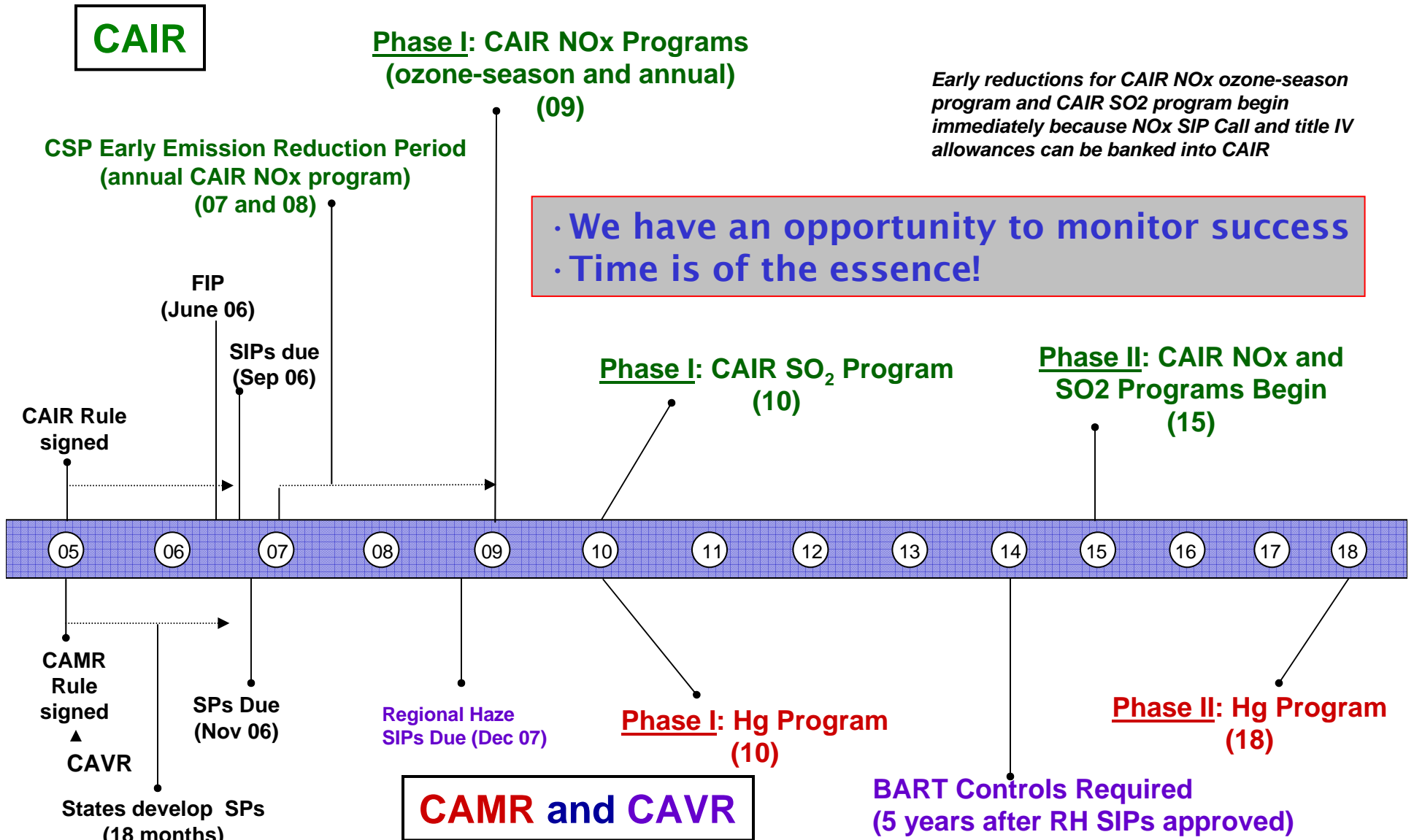


Mace Head, IR
Ebinghaus et al.
TGM 1.5 ng/m³



CAIR, CAMR, CAVR Implementation Timeline

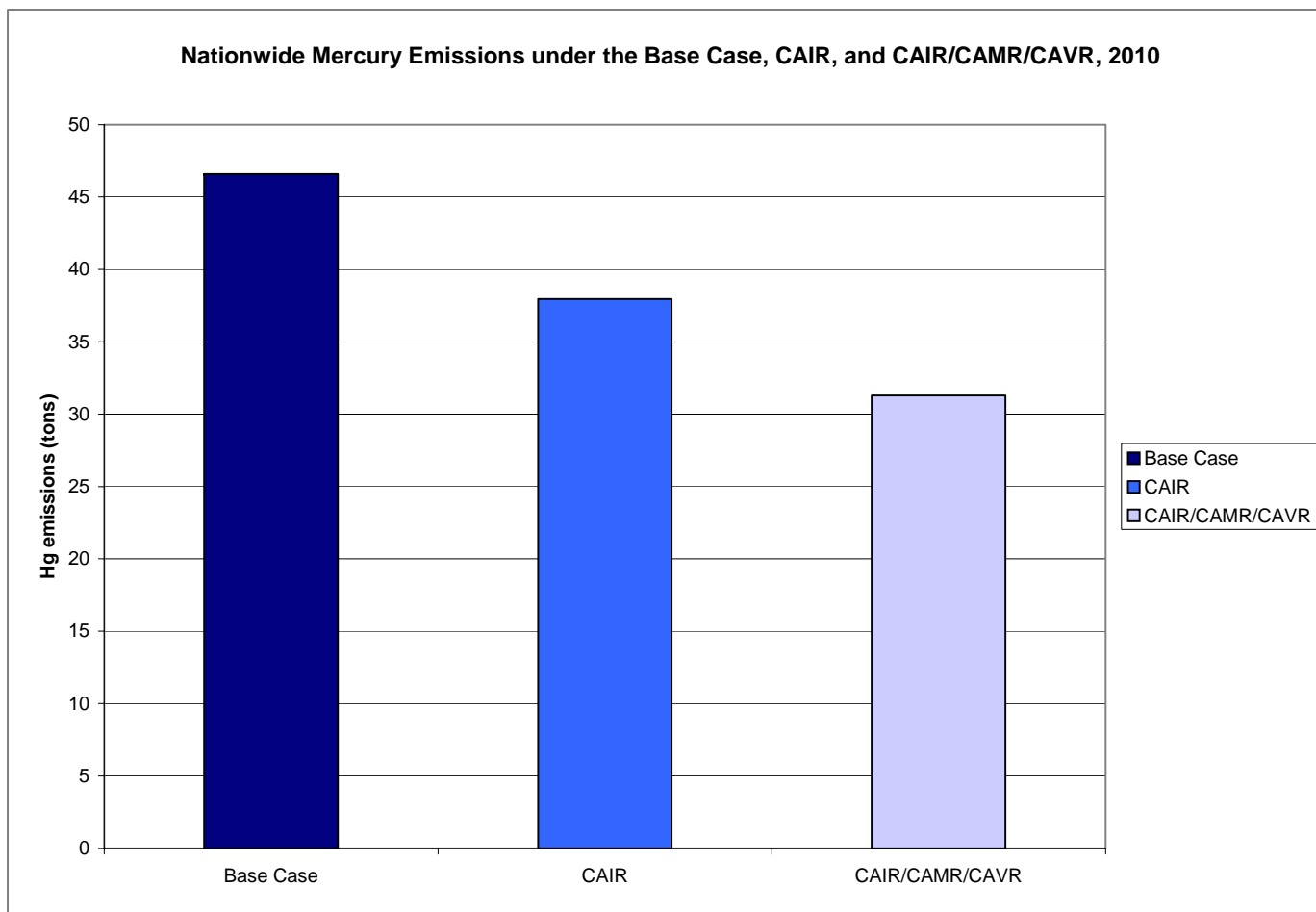
NOTE: More stringent State regulations will be in effect sooner!



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

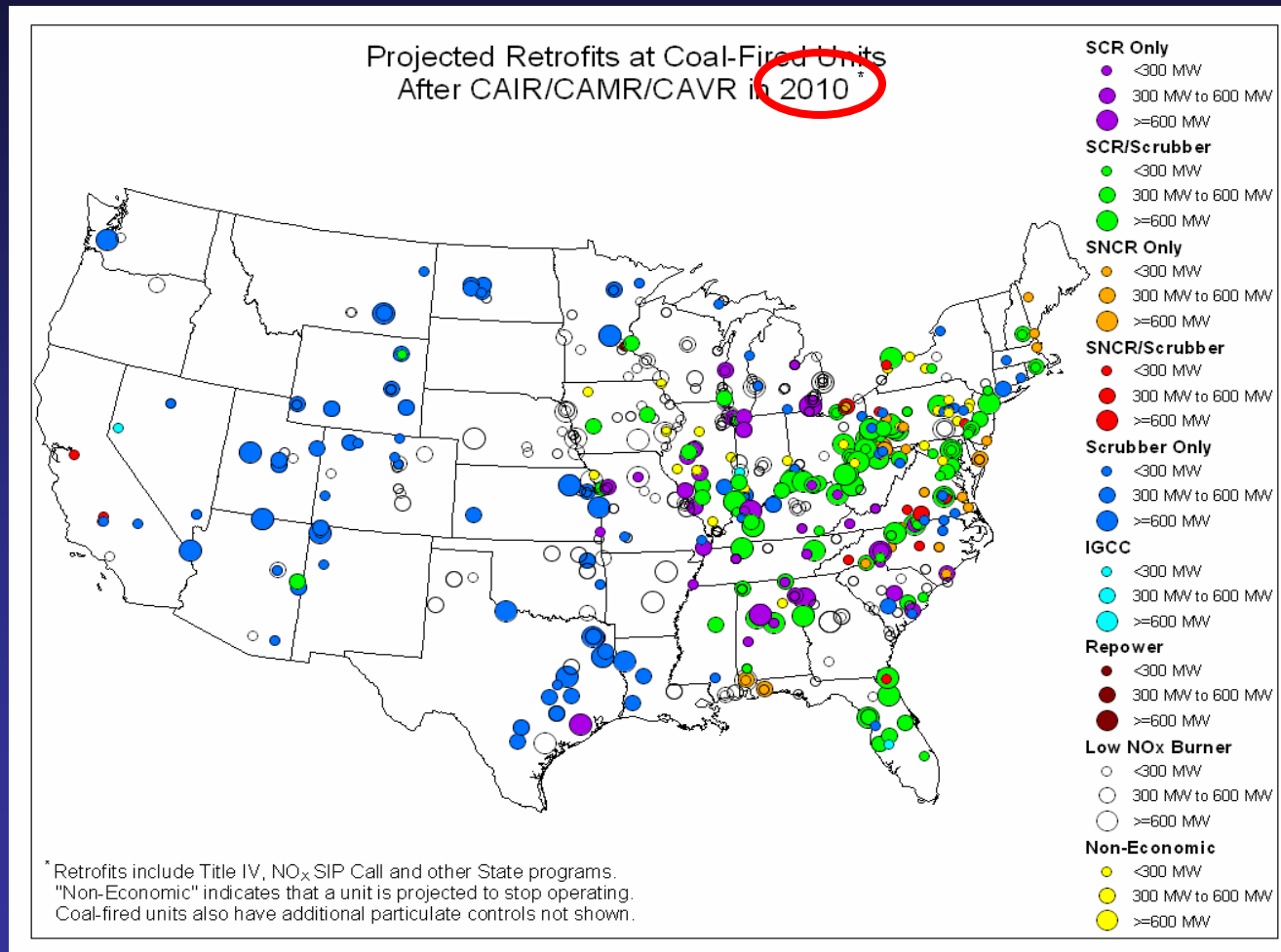


Comment: Here is the predicted drop in mercury emissions over the next 3 years - we must begin now

Source: USEPA

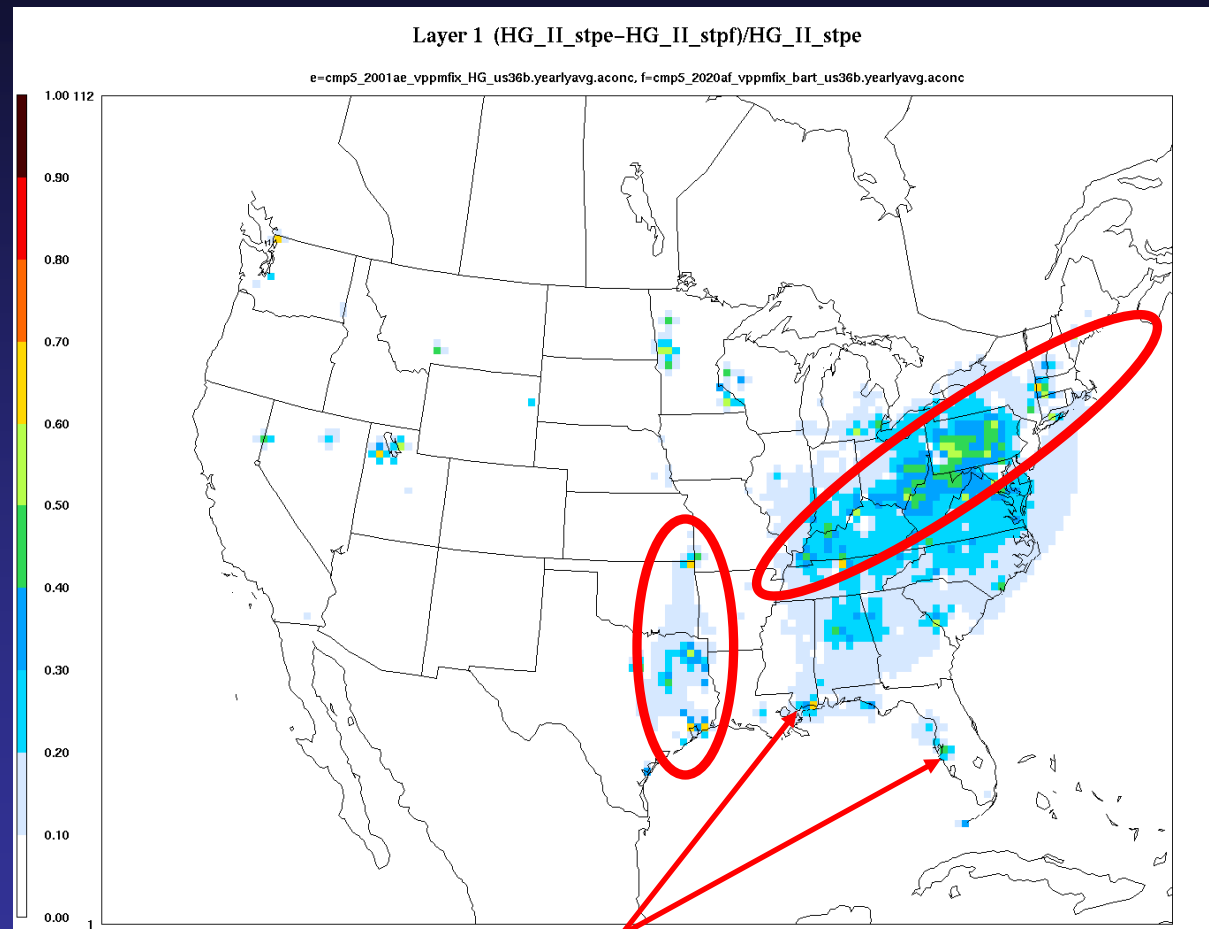
CAIR will result in the installation of wet-scrubbers, which will remove SO₂ and the water soluble Hg(II) present in flue gas.

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

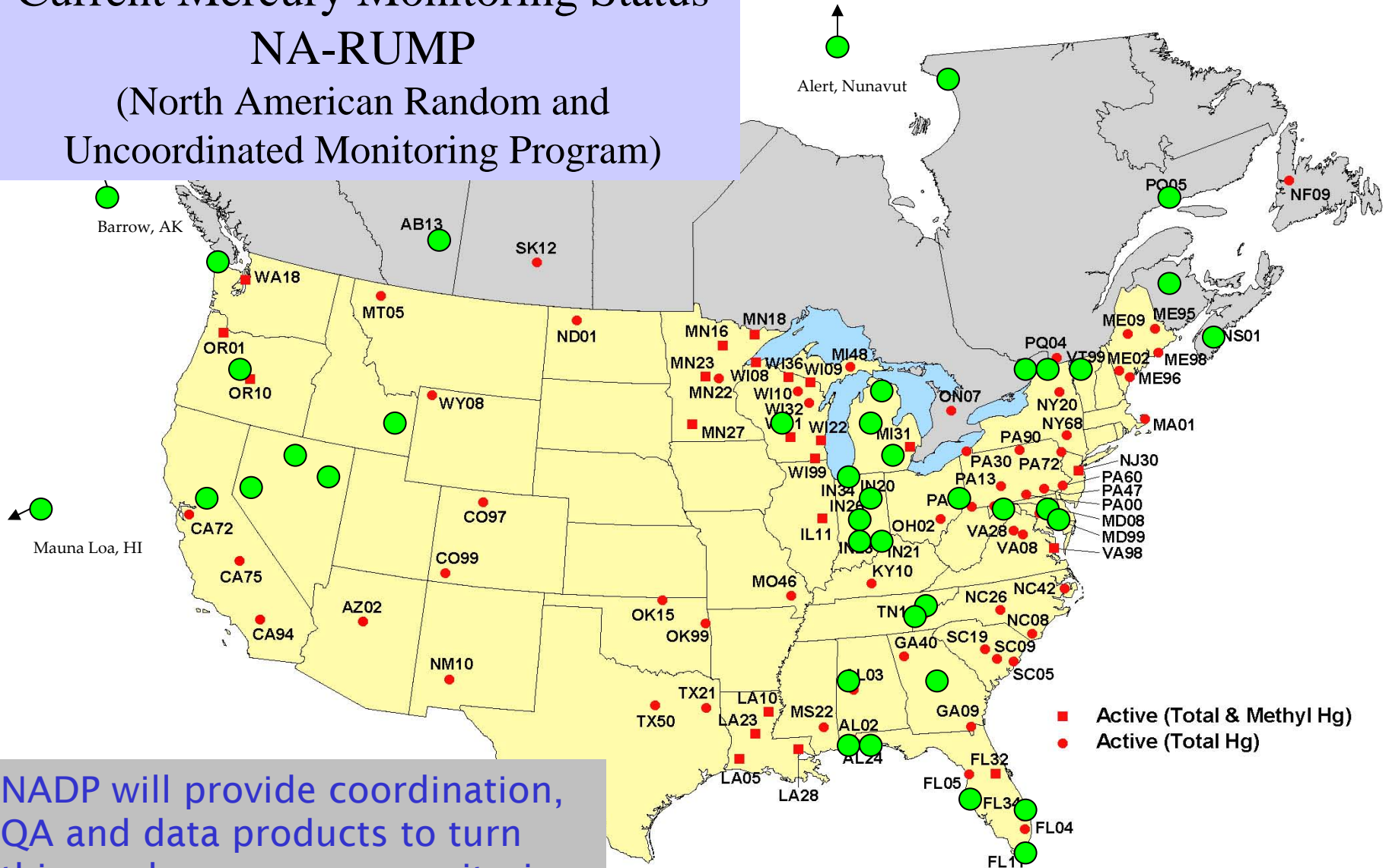
CMAQ estimated fractional decrease in RGM from 2001 base to 2020 due to CAIR, CAMR and all other expected mercury source decreases (Figure courtesy of Russ Bullock, NOAA on assignment to EPA)



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.

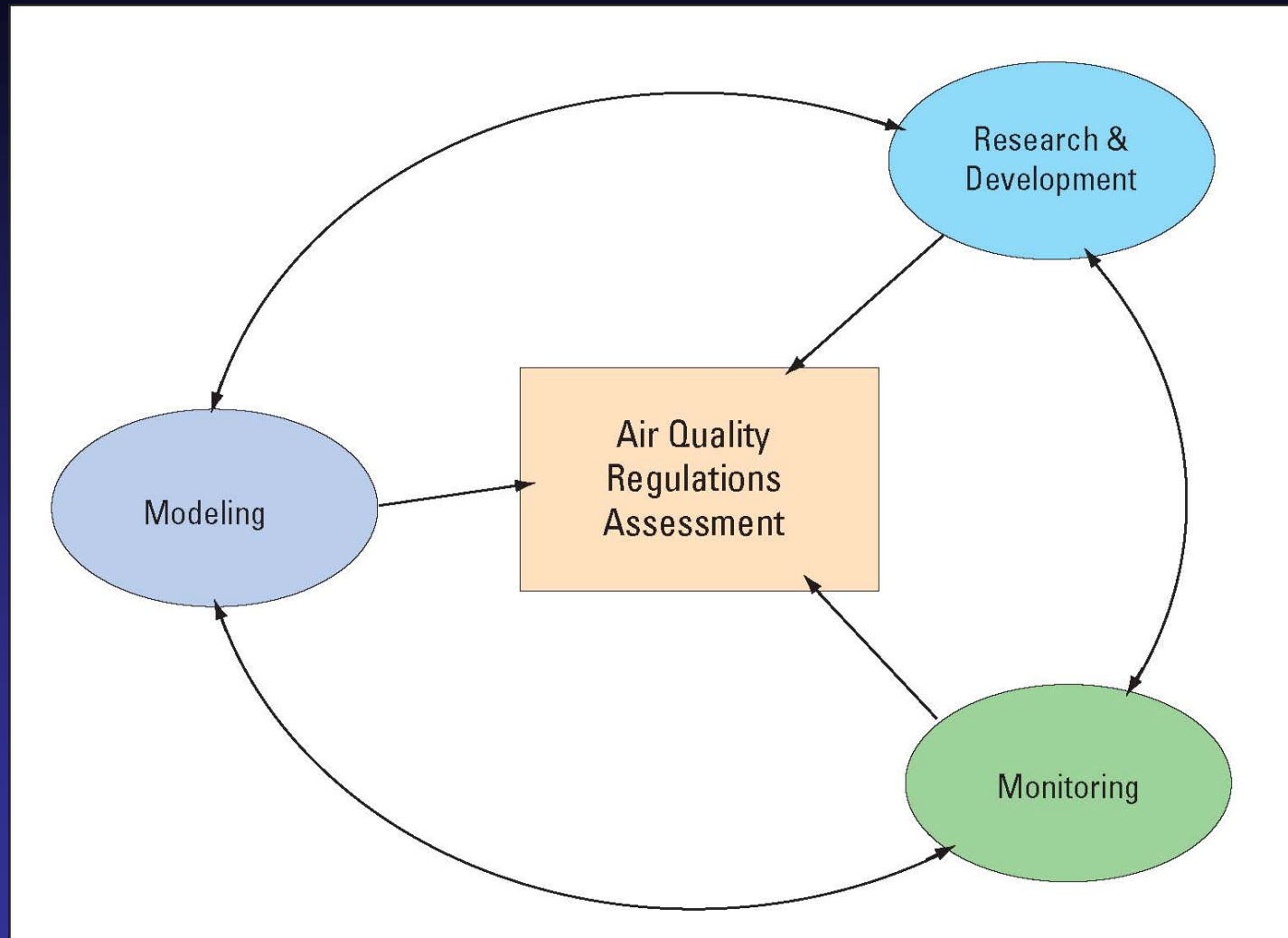
DRAFT – Approximate Long-Term Hg Speciation Site Locations
Not reviewed for accuracy – all sites are shown including past, current and future

Current Mercury Monitoring Status
NA-RUMP
(North American Random and Uncoordinated Monitoring Program)



NADP will provide coordination, QA and data products to turn this random mercury monitoring into a functional network?

Mercury Regulation Perspective



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.

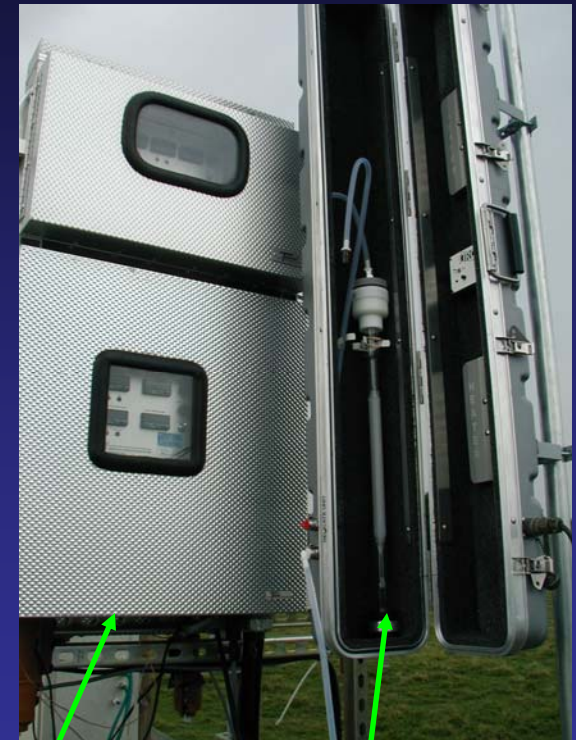
NADP STRENGTHS

- standardized methods and operations
- internal and external quality assurance
- data management and data products.

Comment: These functions will be accomplished through an open process in collaboration with atmospheric mercury scientists, and federal and state agencies

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 and URG manual mercury speciation methods. The methods use the exact same sample train and analytical method

Scientific Framework and Support

Two documents by scientists and policy makers that justifies development of an atmospheric mercury monitoring network

- SETAC “Monitoring the response to changing mercury deposition”
- EPA PBT Strategy for Mercury

and

- Environment Canada and the Canadian Atmospheric Mercury Network (CAMNet) is proving to be a strong collaboration

The NADP-Atmospheric Mercury Initiative aims to be inclusive and participatory

Richard Artz, NOAA ARL
Tom Braverman, U.S. EPA
Russ Bullock, U.S. EPA/NOAA
Steve Brooks, NOAA
Mark Castro, Univ. Maryland
Ashu Dastoor, Environment Canada
Eric Edgerton, Atmospheric Research
Mae Gustin, Univ. Nevada-Reno
Tom Holsen, Clarkson Univ.
Dan Jaffe, Univ. Washington-Bothell
Jerry Keeler, Univ of Michigan
Matt Landis, U.S. EPA ORD
Jerry Lin, Lamar Univ.
Eric Miller, Ecosystems Research, Inc.
Mark Olson, USGS
John Schakenbach, U.S. EPA
Sandy Steffen, Environment Canada
Christian Temme, GKSS
Rob Tordon, Environment Canada
Christian Seigneur, AER
Tim Watkins, U.S. EPA

Attendees at Science Consensus Workshop, NADP Network Info Meeting, and NADP Site Sponsor Meetings May - October 2006

(Please contact us if you
want to be involved)

Kevin Cavender, U.S. EPA-OAQPS
David Gay, NADP MDN
Rey Fortes, U.S. EPA-CAMD
Rick Haeuber, U.S. EPA CAMD
Chris Lehman, NADP QA
Eric Prestbo, Frontier Geosciences
Martin Risch, USGS-IN
David Schmeltz, U.S. EPA CAMD
Tim Sharac, U.S. EPA-CAMD

George Allen, NESCAUM,
Praveen Amar, NESCAUM
Jack Butler, Cherokee Nation
Tom Butler, Cornell University
Ryan Callison, Cherokee Nation
Linda Candelaria, Santa Ana
Rusty D. Day, NIST
Cari Furniness, North Carolina State Univ
Stephen Hartsfield, National Tribal Air Assoc
Maggie Kerchner, NOAA
Michael Kolian, US EPA
Preston Lewis, New York State DEC
Charles J Lippert, Mille Lacs Band of Ojibwe
Winston T. Luke, NOAA
Seth Lyman, Univ. of Nevada
Patrick Bart Malone, NYS DEC
Lisa McClain Vanderpool, US EPA Region 9
Paul Miller, NESCAUM
Kristi Morris, NPS
Todd Nettesheim, EPA GLNPO
Pam Padgett, US Forest Service
Bruce Rodger, Wisconsin DNR
Eli Scott, US Forest Service
John Sherwell, Maryland DNR
Alan VanArsdale, EPA Region 1
Peter Weiss, Univ of Washington-Bothell
Greg Wetherbee, USGS-BQS

NADP Atmospheric Mercury Initiative

How did we get here?

- Fall 2004 NADP Mtg. – Prestbo and Risch propose Mercury Dry Deposition Advisory Workgroup formation based on realization of huge data gap and high MDN sponsor interest (Workgroup: Prestbo, Risch, Gay, Padgett and Artz)
- 2005 NADP Spring Meeting – White paper presented and discussed by Advisory Working Group
- Summer 2005 NADP Exec. Comm. approved effort to proceed with a new initiative for mercury air and dry deposition monitoring
- Fall 2005 Workgroup developed detailed conceptual network design with critical review by EPA CAMD and EPA OAQPS
- Winter 2006 Advocates continue to develop work plan and budget – funded in Spring of 2006

ABOVE WERE UNFUNDED ACTIVITIES

NADP Atmospheric Mercury Initiative

What has been accomplished?

- 2006 - Organized and led two 1-day meetings with the purpose of providing information, input, and involvement.
- May 1, 2006—full day presentation and discussion of the NADP Atmospheric Mercury Initiative with invited NADP collaborators and potential stakeholders at the NADP Spring Meeting
- June 27, 2006—Full day presentation and discussion with invited group of expert atmospheric mercury measurement and modeling scientists to get critical review of *“Guiding Principles and Best Practices for Monitoring Atmospheric Mercury”*
- Also - July 8, 2006, NADP Executive Committee Update: Approval to continue Atmospheric Mercury Initiative was reinforced

FUNDED ACTIVITIES

NADP Atmospheric Mercury Initiative Supporting Documents

available at <http://nadp.sws.uiuc.edu/mtn/>

- Network Summary
- NADP New Initiative Draft 12-Point Plan for Atmospheric Mercury Monitoring
- Summary of Comments from May 1, 2006 Meeting on Preliminary 12-Point Plan
- Guiding Scientific Principles for Atmospheric Mercury Monitoring in North America
- Summary of Comments from June 27, 2006 Scientific Expert Meeting
- Network location criteria from 2005
- Executive Committee Motion

FUNDED ACTIVITIES



[Home](#) [AIRMoN](#) [MDN](#) [Search](#)
[Contacts](#) [Site Map](#) [Site List](#) [Data Access](#)

National Atmospheric Deposition Program



A New Initiative Being Considered by NADP

A special meeting was held on May 1, 2006, prior to the NADP 2006 Spring Meeting in Riverside, CA, to consider a proposed new NADP initiative. The initiative would establish a new NADP network, with a goal of monitoring atmospheric mercury species and mercury wet deposition events to facilitate total and dry deposition of atmospheric mercury for predictive-model evaluation, source-receptor assessments, and spatial-temporal trend analysis.

The proposed network would establish a national network of monitoring stations to collect event-based concentrations of total mercury in precipitation samples; concentrations of atmospheric mercury species from continuous-automated and manually-operated measuring systems; and meteorological measurements for computing mercury wet deposition and estimating mercury dry deposition. Data would be collected with standardized methods developed through USEPA research, quality-assured, and archived in the NADP on-line data base. The network would include locations that are regionally representative; rural, urban, and suburban; areas with high levels of mercury emissions and mercury deposition; and within sensitive ecosystems.

The initiative was presented by the Mercury Dry Deposition Working Group (specifically David Gay, NADP/MDN Coordinator; Eric Prestbo, MDN Science Advisor; David Schmeltz, U.S. EPA Office of Air and Radiation; and Martin Risch, NADP Network Operations Subcommittee) and would complement the existing Mercury Deposition Network.

The NADP [Quality Management Plan](#) includes a guide (Appendix D) for the presentation of new initiatives. This guide requires a document that addresses 12 specific points covering purpose, operations, staffing needs and costs, funding, appropriateness to the NADP mission, etc. The NADP Executive Committee is charged with evaluating and approving or rejecting the "12-point plan" for an initiative. In support of this new initiative, a [12 point plan](#) was developed to outline the specifics of the proposal for NADP. Any comments on the plan can be directed to the Working Group, or David Gay (dgay@uiuc.edu or 217.244.0462).

On June 27, 2006, a second planning meeting was held where guiding principles for the proposed sampling procedures were discussed. Please see the [minutes and notes](#) from this meeting.

Specific Challenge for NADP-AMI Advocates and Stakeholders

A collaborative multi-agency and multi-scientist process is time intensive and thus requires more resources in comparison to an the alternative single-agency “mercury czar” type of process

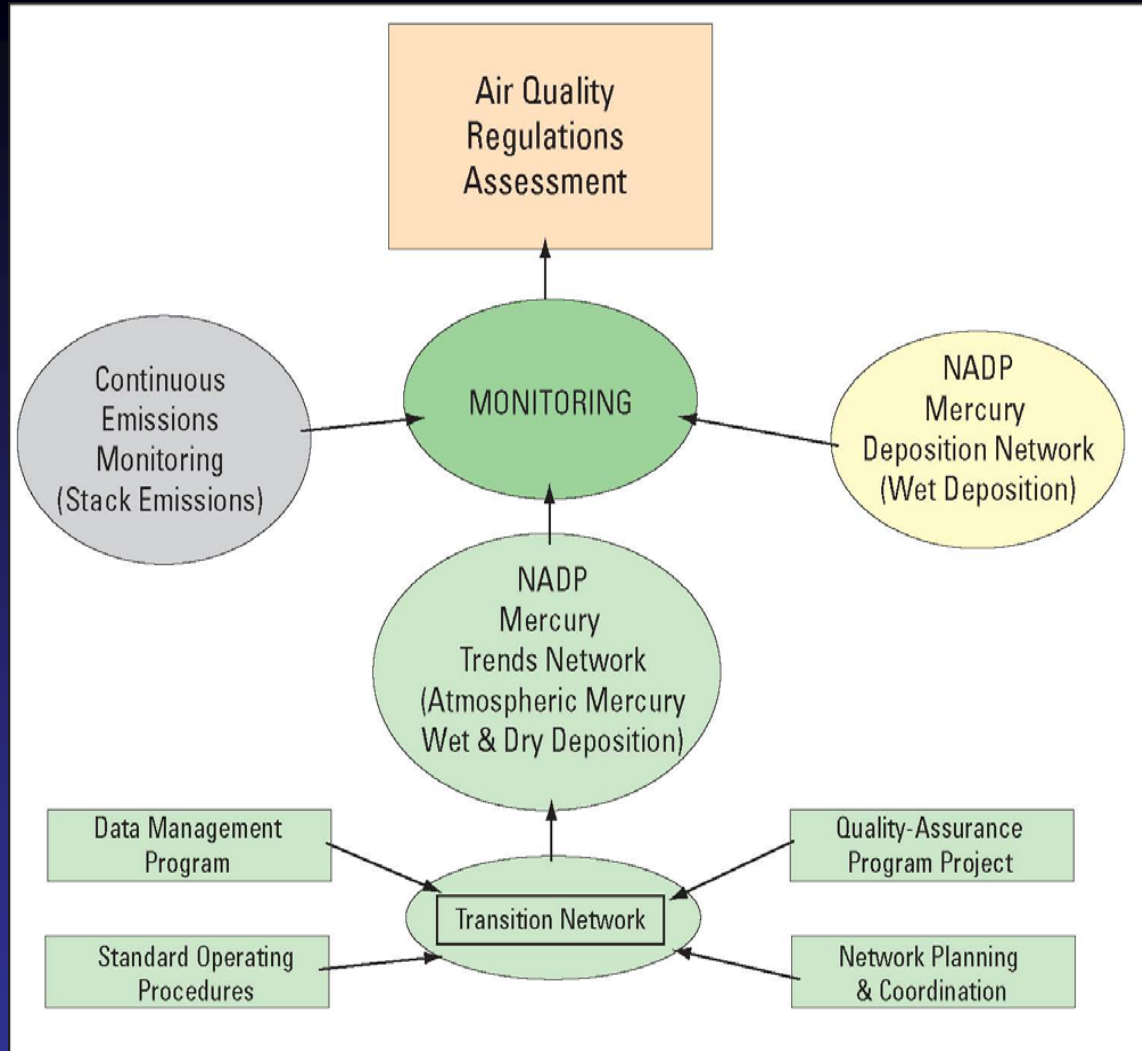
Comment: The former is highly preferred over the later. However, we must be cognizant of the old adage – too many cooks in the kitchen may spoil the broth.

NADP-AMI Network Activities for 2007

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

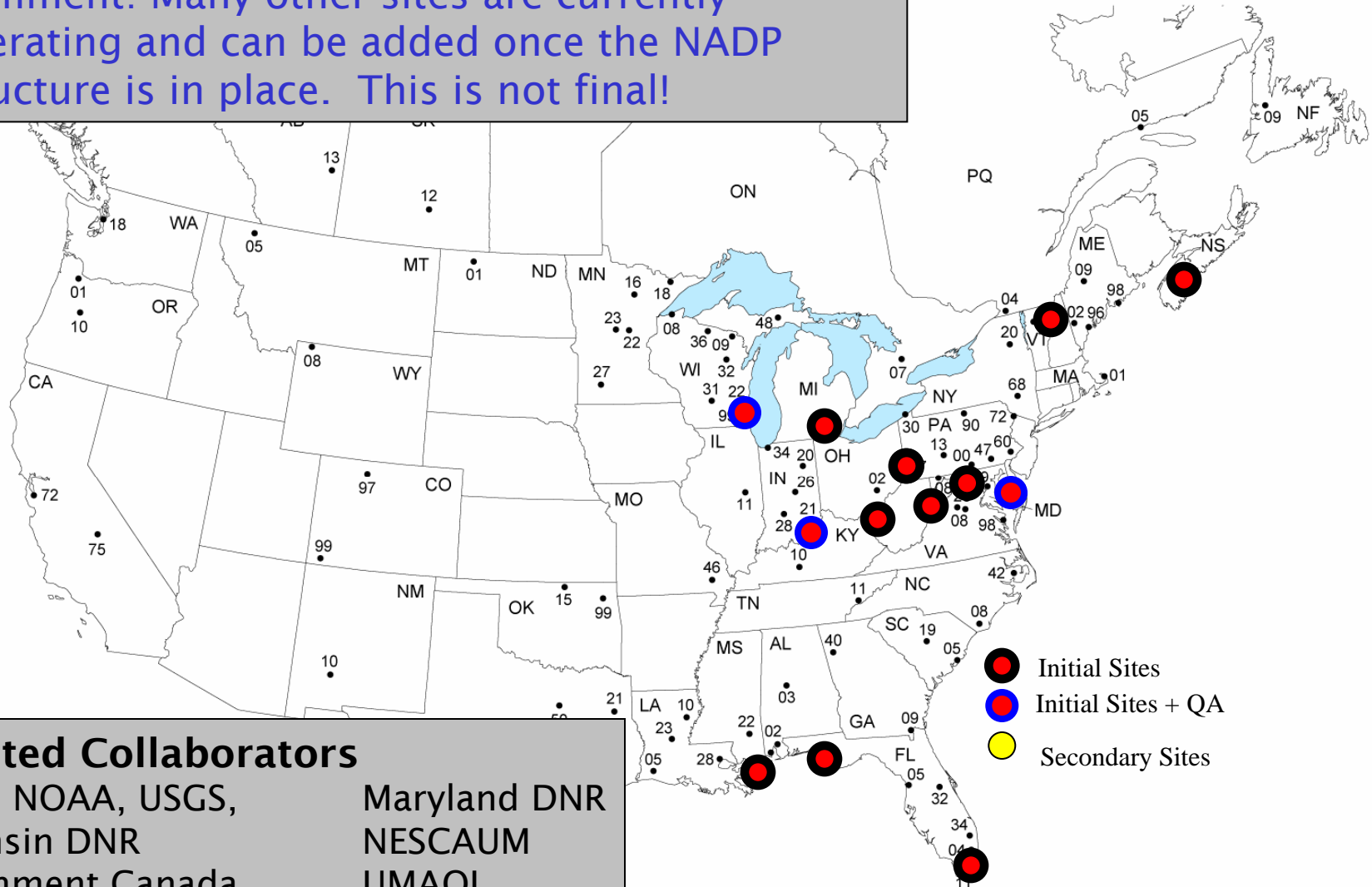
Monitoring schematic for CAMR and States regulatory assessment



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.

Candidate 2007 Atmospheric Hg Network Sites

Comment: Many other sites are currently operating and can be added once the NADP structure is in place. This is not final!



Expected Collaborators

USEPA, NOAA, USGS,
Wisconsin DNR
Environment Canada
ARA + S. Company
Ohio U. and Ohio EPA

Maryland DNR
NESCAUM
UMAQL
Indiana DEQ
Florida DEP

Goals for Fall 2007 NADP Meeting

- 8-10 site atmospheric Hg network
- All sites operating on final draft SOP
- Atmospheric Hg webpage with QA'd data
- Draft quality assurance plan
- Start of external QA program
- Historical Hg speciation data on NADP website