Mercury Control Requirements Under the Massachusetts Multi-Pollutant Power Plant Regulations

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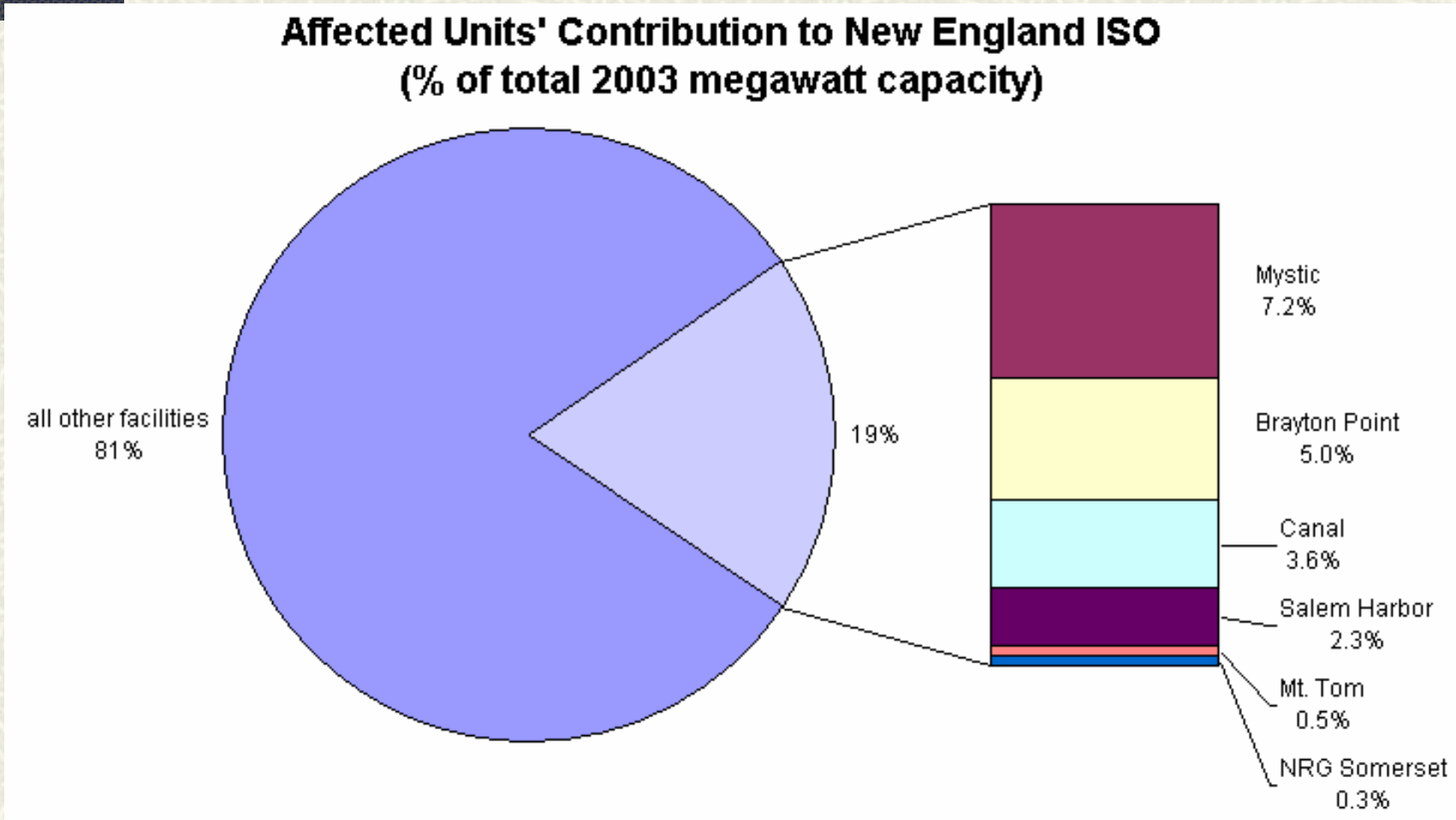
Presentation Overview

- **Background**
- **Summary of multi-pollutant aspects of the MA regulations:**
  - SOx/NOx/CO2/Hg
  - http://www.state.ma.us/dep/bwp/daqc/files/regs/7c.htm#29
- **Mercury components:**
  - Why mercury is a priority in MA
  - Baseline testing
  - Control feasibility report
  - Hg standards

Environmental Concerns Relating to Power Plants

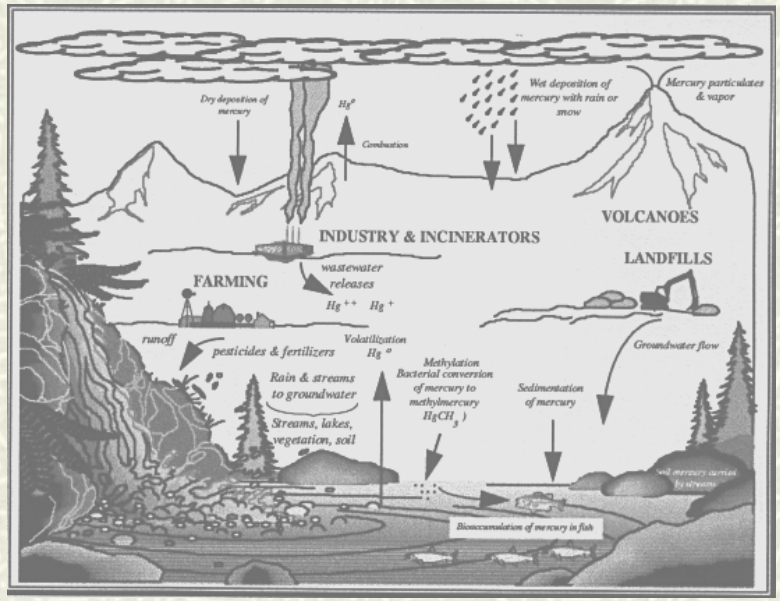
- Acid Deposition
- Climate Change
- Mercury
- Nitrification, Eutrophication
- Ozone
- PM 2.5
- Regional Haze
- Visibility

MW Capacity Context



Basis for Multi-pollutant Approach

- Efficiency: industry/agency
  - reg. development; capacity planning; implementation
- Regulatory certainty
- Integration:
  - Technology assessment
  - Cost assessment



Major Provisions of MA Power Plant Regulations

- **SO_2 Standard**
  - Phase 1: 6.0 lb/MWh; 2004-2006
  - Phase 2: 3.0 lb/MWh; 2006-2008
- **NO_x Standard**
  - 1.5 lb/MWh; 2004-2006
- **CO_2 Standard**
  - annual facility cap (2004-2006)
  - facility rate of 1800 lb CO_2/MWh; 2006-2008

SO_2/ NO_x / CO_2 Implementation

- **Compliance Flexibility**
  - Two compliance options - standard and repowering
  - Averaging within facility
  - Early reduction credit for SO_2 and use of SO_2 allowances
  - Off-site reductions for CO_2
  - Greenhouse gas banking and trading in development

Mercury

- **2001 Regulations did not set specific Hg standard. Established steps/timeline to develop standard.**
  - Collection of data on emissions: May 2001-August 2002
  - Completion of a Control Feasibility Report in 2002
  - Draft standards by 2003

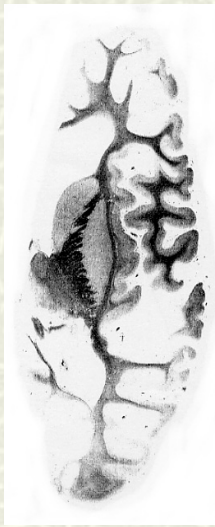
Heller's view

Why Target Mercury? (1)

1. Very Toxic
   - Children: 600,000 U.S. newborns per year at risk
   - Damages developing brain

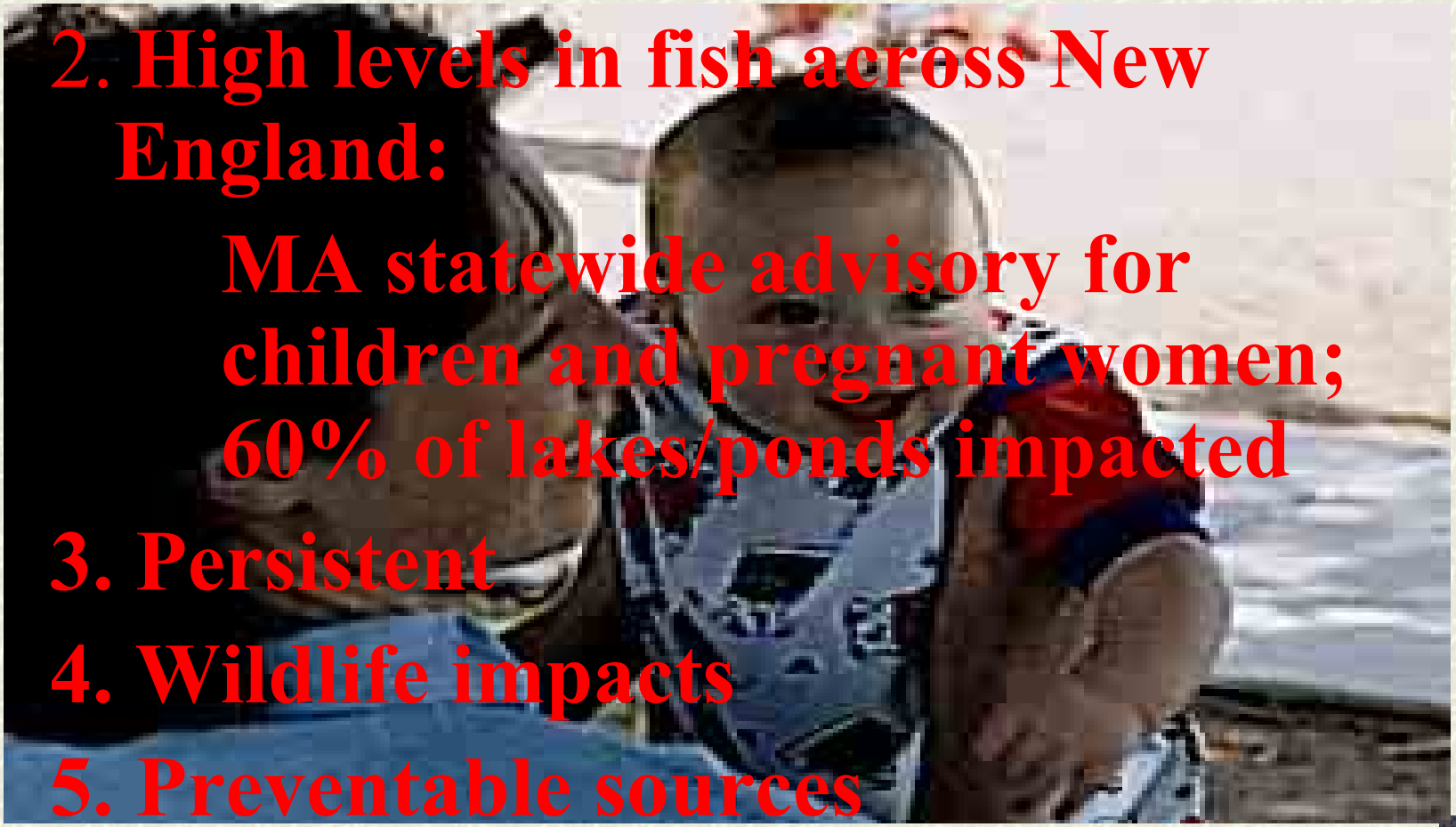
Control Brain

Mercury brain



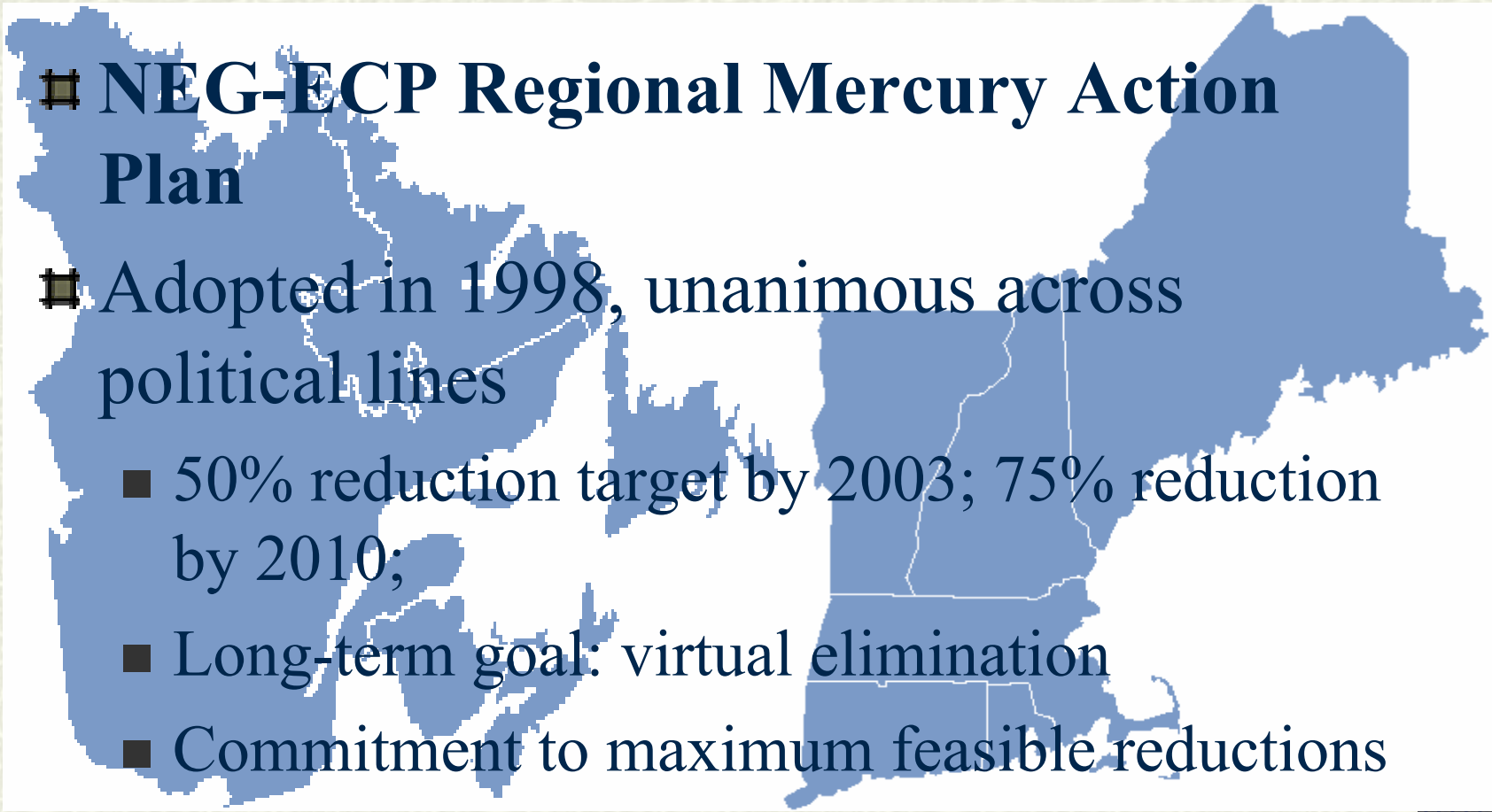
Horizontal section of right hemisphere of cerebrum Japan National Institute of Minamata Disease

Why Target Mercury? (2)



2. High levels in fish across New England:
   - MA statewide advisory for children and pregnant women; 60% of lakes/ponds impacted
3. Persistent
4. Wildlife impacts
5. Preventable sources

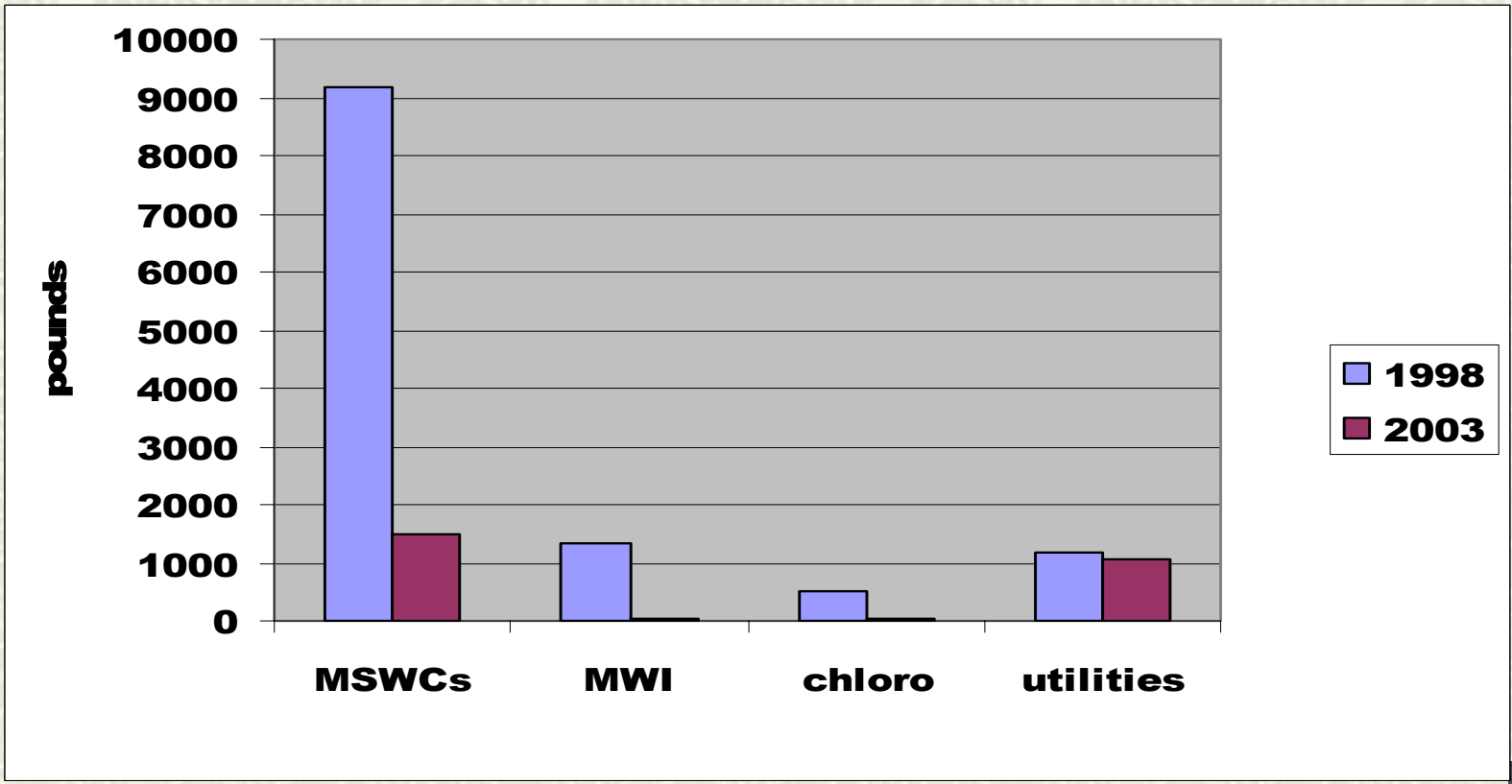
Policy Context and Commitments: Regional



- **NEG-ECP Regional Mercury Action Plan**
- Adopted in 1998, unanimous across political lines
  - 50% reduction target by 2003; 75% reduction by 2010;
  - Long-term goal: virtual elimination
  - Commitment to maximum feasible reductions

NEG-ECP Regional Mercury Action Plan: Progress

- >50% reduction achieved since 1998



NEG-ECP Utility Boiler Status

- Coal units about 10% overall regional capacity
  - baseline emissions estimates: 1,200 pounds per year (revised baseline vs. 1998 report (1,400))
- 03/04 Status:
  - Provincial reductions in NB/NS: fuel switching
    - Canada-wide Standards
  - MA regulations: announced May 24, 2004; 85% control 2008; 95% control 2012
  - CT legislation: 90% control, 2008; 2012 review
  - NH: caps proposed to legislature, Phase 1 (2008): 60% and Phase 2 (2011): 80% reduction in emissions from baseline

Policy Context and Commitments: State

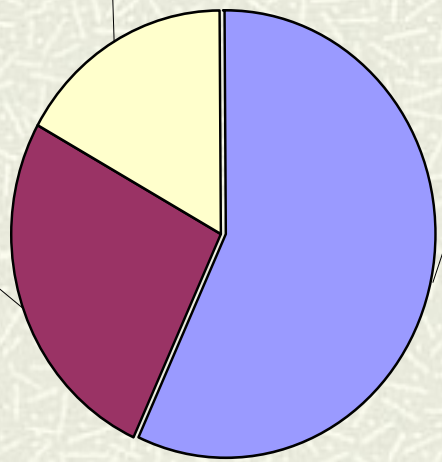
- MA Zero Mercury Strategy
  - Adopted in 2000 to advance state progress
  - Long-term goals: virtual elimination of discharges and use
  - Milestones as in regional plan
- Status: Overall state reductions >60%

MA 02 Hg Emission Estimates: Point Sources

Coal-fired Utilities
166 lbs./year
17%

Municipal Waste Combustors
558 lbs./year
57%

Sewage Sludge Incinerators
260 lbs./year
26%



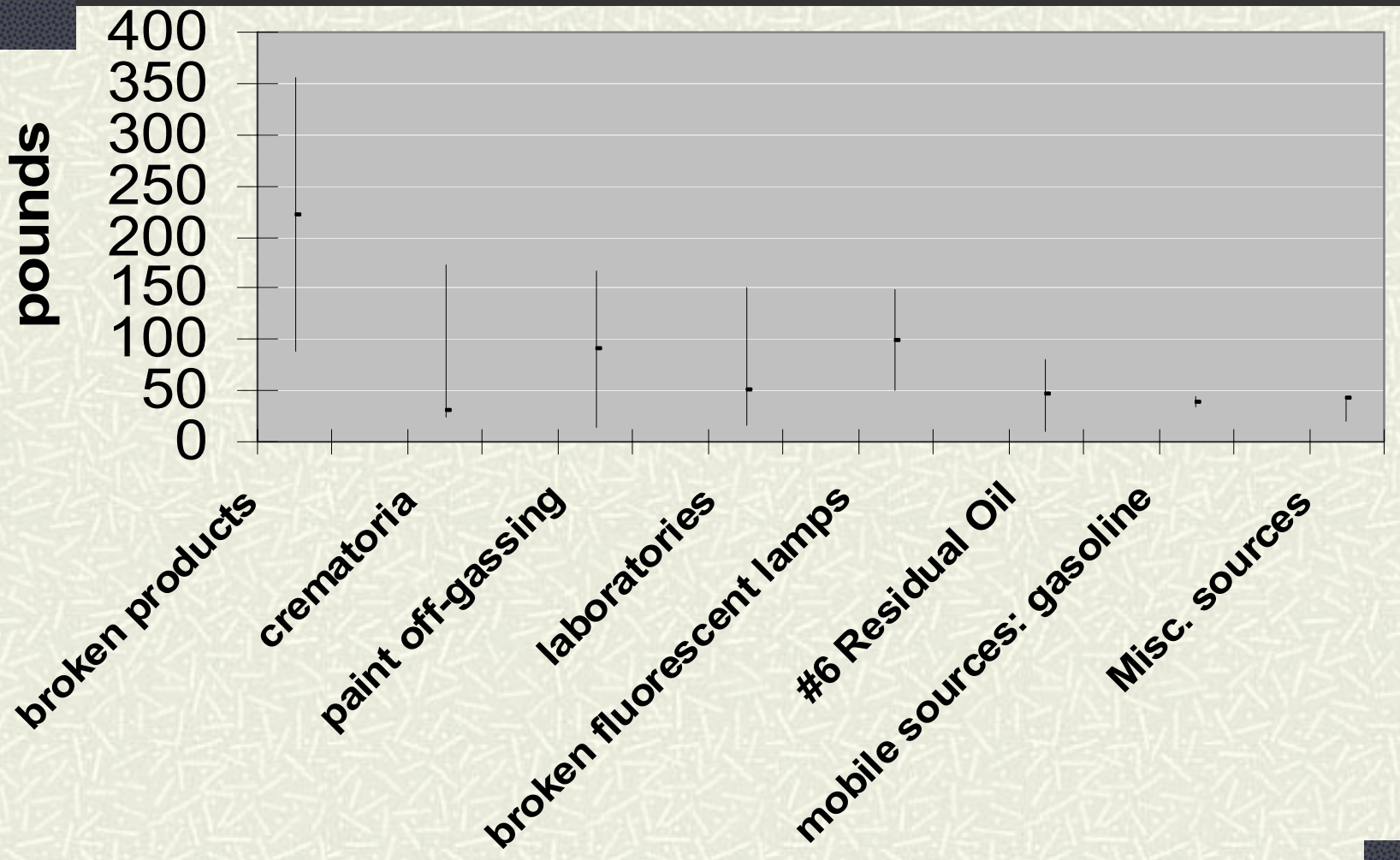
Control efforts: P2

- **Health care**
- **Products**

Control efforts

- **2000 regs. 3X more stringent vs. federal**
- **90-95% control achieved**
- **Source separation requirements.**

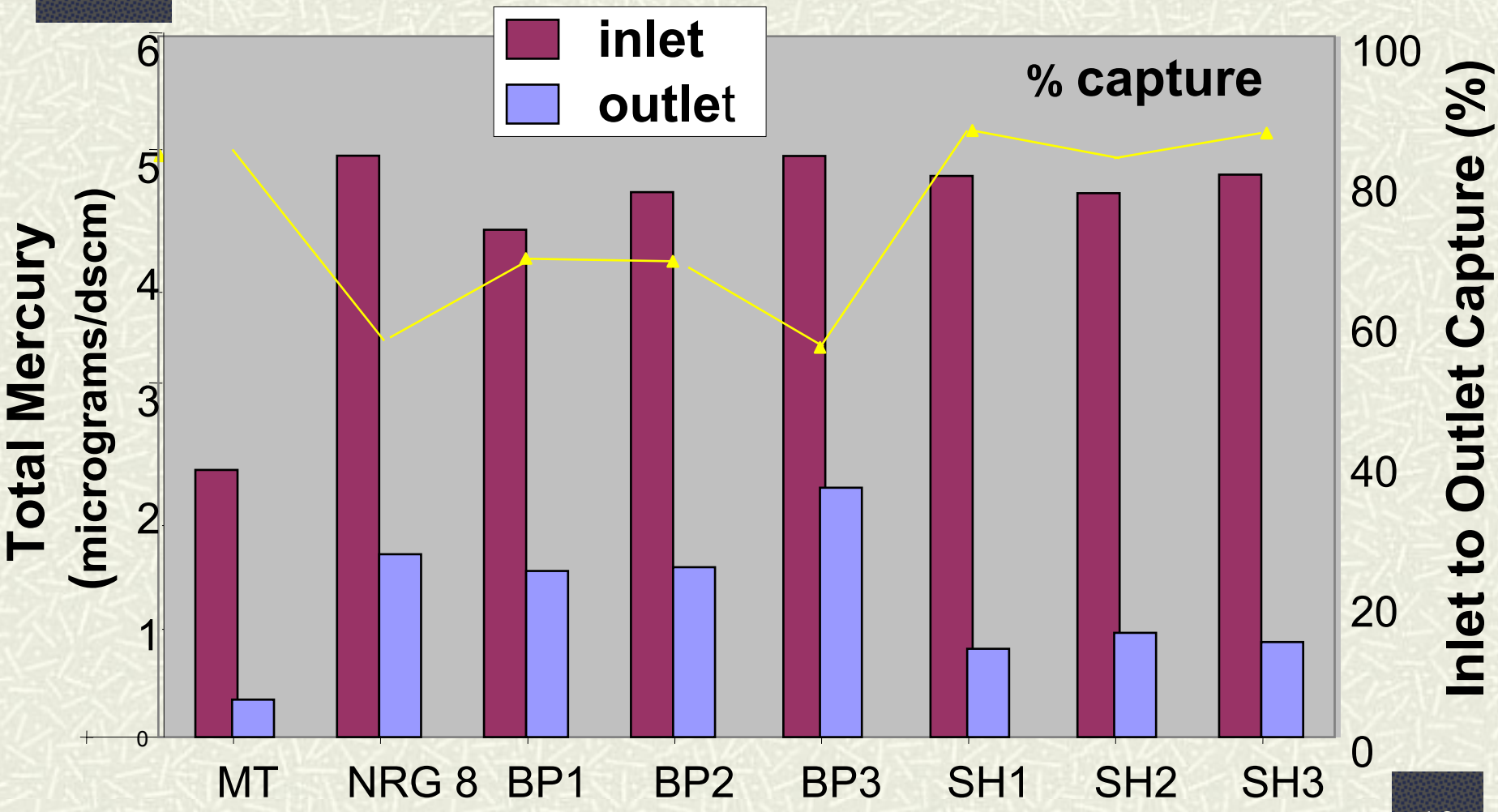
MA Hg 02 Emission Estimates: Area Sources



MA Utility Hg Status

- Emissions Testing
  - Sampling for concentration of mercury at inlet (pre-ESP) and outlet (stack) of 8 coal-fired units
  - Round 1: summer 2001
  - Round 2: winter 2001-2002
  - Round 3: summer 2002

Average Baseline Mercury Control by Unit: 60-90%



Mercury Control Feasibility Report – December 2002 (1)

- **Major conclusion: 85-90+% removal of flue gas Hg is feasible**
  - "Evaluation of the Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel" at http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#other

Control Feasibility Report: Technology Conclusions (2)

- **Hg controls are technologically feasible**
  - Some existing US power plant units are achieving up to 98% Hg removal
  - Some MA power plant units are already removing close to 90% of Hg
  - Controls to meet MA SO_2 and NO_x standards are expected to achieve Hg reduction co-benefits

Control Feasibility Report: Technology Conclusions (3)

- DOE field testing shows >90% Hg removal
- MA Municipal Waste Combustors are removing 90% of Hg; some ≥ 95% removal
- Extensive funding for research has resulted in Hg control technologies and promise of further advances

Control Feasibility Report: Economic Conclusions (4)

- **Hg controls are economically feasible**
  - Sorbent-based Hg controls costs are similar to historically accepted NOx control costs (mills/kMWh)
  - Multi-pollutant regs (like MA's) improve cost-effectiveness
  - Minor estimated added cost per typical household: $0.09-0.81 per year in MA
  - Enhance regulatory certainty and improve long-term capital planning

Standard Setting Process

- Stakeholder meetings: Aug/Sep/Oct 2002
- Feasibility Report: December 2002
- Stakeholder feedback on Feasibility Report and input: January 2003
- Release of proposed regulation for public comment & hearing: Fall 2003
- Revised Rule adopted: May 2004

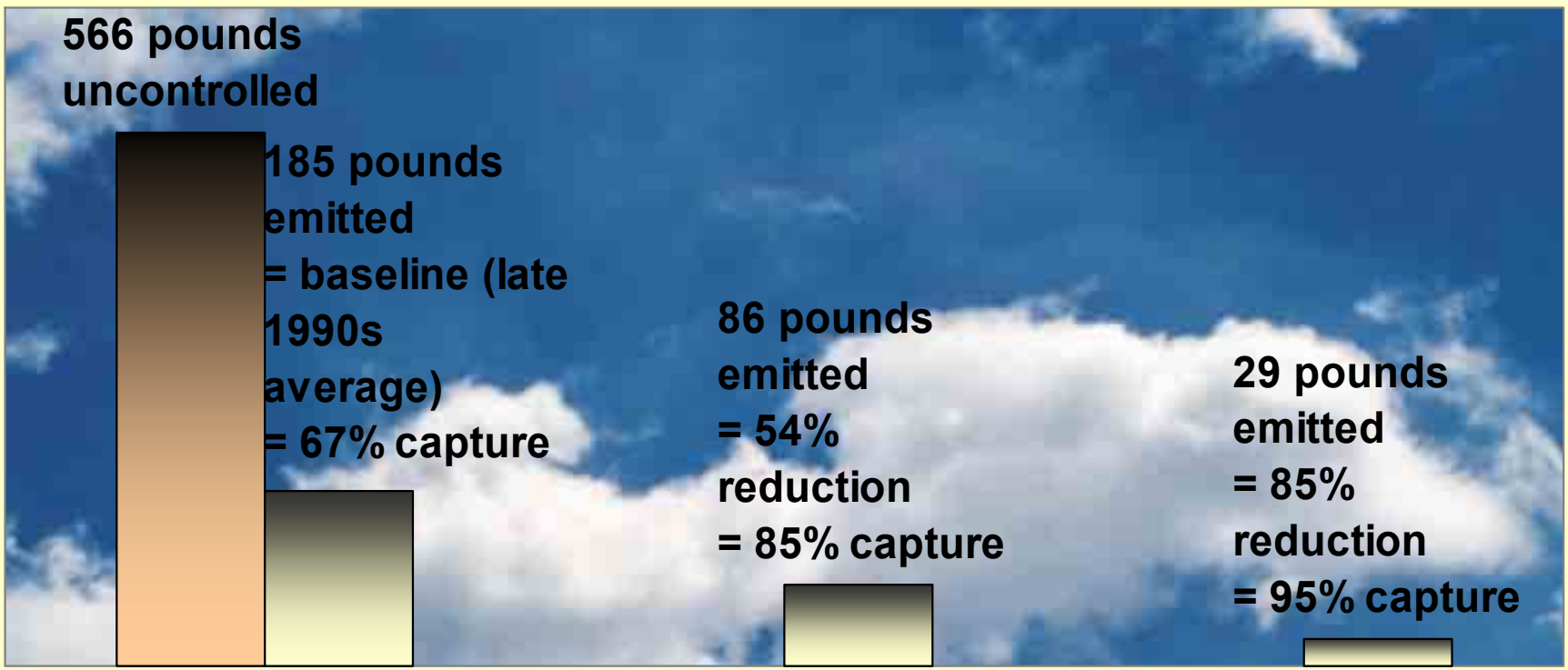
Major Elements of Standards (1)

CAPs 2001-2002 emissions and late 1990s heat input

Emission limits

- **O**utput-based and % control efficiency options
  - **Phase 1**: 85% or 0.0075 lb/GWh by 1/1/2008
  - **Phase 2**: 95% or 0.0025 lb/GWh by 10/1/2012

Baseline, Phase 1 and Phase 2 Mercury Emissions



Major Elements of Standards (2)

Demonstrating Compliance.

- Semi-quarterly stack tests until 1/1/2008
- CEMs required beginning 1/1/2008
- Averaging time of the standard
  - Rolling 12 month basis

Major Elements of Standards (3)

Compliance flexibility: alternative reduction options.

- Until 2010 for facilities shutting down
- Until Phase 2 for facilities that emitted less than 5 pounds in 2001
- Early and offsite (within same state region) reduction offsets allowed
  - 1:1: for air emissions
  - 10:1 for mercury collection programs

Major Elements of Standards (4)

Waste Issues.

- Facility mercury caps include mercury emissions due to on-site re-burn of ash and any off-site high temperature processing in Massachusetts (e.g., use of ash in cement kiln or asphalt batching plants)
- Standard: Emissions due to on-site re-burn of ash included

Conclusions

- Hg controls are technologically feasible
- Costs comparable or lower vs. other pollutants
- Phase 1: likely to be achievable via co-benefits
- Phase 2: targeted controls likely needed
  - sufficient lead time/ further technology innovation and optimization likely
- EPA proposal: inadequate

Credits

- **The following staff played important roles in developing the MA mercury standards for power plants:**
  - Sharon Weber (lead technical staff); C. Mark Smith; Nancy Seidman; Susan Ruch; Sue Ann Richardson; Gary Moran; Regina McCarthy; Marilyn Levenson; Barbara Kwetz; Azin Kavian; Eileen Hiney; Sonia Hamel; Jim Colman; Marc Cohen.

MA Regulations For Power Plants (310 CMR 7.29)

- Final Regulations; Response to Comments; Fact Sheet
  - http://www.state.ma.us/dep/bwp/daqc/daqcpubs.htm#regs
- Evaluation of the Technological and Economic Feasibility of Controlling and Eliminating Mercury Emissions from the Combustion of Solid Fossil Fuel
  - http://www.mass.gov/dep/bwp/daqc/files/mercfeas.pdf