

# Pennsylvania Regulatory Concepts Related to the Control of Mercury From Coal-fired Electric Generating Units



---

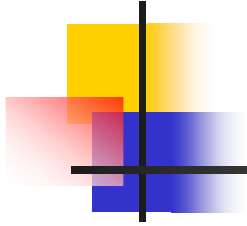
AQTAC/CAC/Mercury Group Briefing  
February 22, 2006



# General Outline

---

- Mercury Emissions Overview.
- Legal Background and Petition for Rulemaking Process.
- Recap of Mercury Rule Workgroup Meetings.
- States' Mercury Laws, Regulations, Proposals and Recent Mercury Developments.
- Mercury Rule Concepts.
- Next Steps.



# Mercury Emissions Overview



# What is Mercury?

---

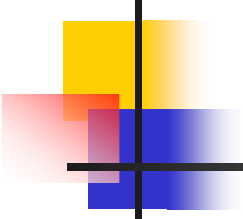
- Naturally occurring element.
- Enters the atmosphere through
  - natural events and
  - anthropogenic activities.
- Persistent, bioaccumulative, and a neurotoxin



# Types of Mercury (Hg)

---

- Elemental ( $\text{Hg}^0$ ) – residence time up to 1 year and can be transported over long distances.
- Ionic ( $\text{Hg}^{++}$ ) – residence time a few days and deposited near the source.
- Organic (methylmercury) – formed by biological processes after Hg deposits from air to water.



# Mercury Loading to Surface Water Bodies

---

- Direct deposition.
- Runoff from impervious surfaces within the watershed.
- Runoff from pervious surfaces within the watershed.
- Soil erosion over total watershed.
- Direct diffusion (vapor phase) into surface water.
- Internal transformation in surface water.



# Fish Advisories in Pennsylvania for Hg

---

- Delaware River Basin – 8 waterways.
- Lake Erie Basin- 3 water bodies.
- Susquehanna River Basin – 38 waterways.
- Ohio River Basin – 29 waterways.
- Potomac River Basin – 2 waterways.



# Health Effects

---

- Low dose prenatal methyl mercury exposure associated with poor performance on neurobehavioral tests in young children.
- About 600,000 children born in U.S. could have neurological problems because of prenatal methyl mercury exposure.
- Methyl mercury is also known to be toxic to adults causing permanent damage to the brain, kidneys, and cardiovascular system.





# Summary of Health Effects

---

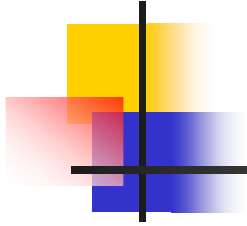
- Concern associated with the emissions of mercury results primarily from impacts on surface water.
- Inorganic mercury in water bodies can be converted to MeHg which readily bioaccumulates through the aquatic food chain.
- Consumers located at the top of the food chain can be exposed to elevated dietary levels of MeHg.
- Primary concern appears to focus on exposure of the fetus or nursing infant to MeHg ingested by its mother.
- Epidemiological studies suggest that low level MeHg exposure can have neuropsychological impacts during development.



## Hg Emissions from Coal-fired Electric Generating Units (EGUs) in PA

---

- Thirty-six coal-burning power plants in Pennsylvania.
- In 2003 emitted a total of 3.392 tons.
  - 7.5% of national total.
  - Third to Texas and Ohio.



# Legal Background and Petition for Rulemaking Process



# Legal Background on Hg Regulation

---

- Section 112(n)(1)(A) requires EPA to conduct study of hazards related to emissions from EGUs.
- EPA fulfills this duty with its 1998 “Report to Congress”
  - Findings
  - Management Alternatives
  - Research Needs
- NRDC sued EPA because the Report to Congress did not recommend regulatory action.



# December 20, 2000 Finding

---

- Under Section 112(n)(1)(A) EPA finds that the regulation of EGUs under section 112 to be “appropriate and necessary.”
- Appropriate because largest source of Hg emissions and significant health hazards.
- Necessary because no other CAA provision adequate to address hazards.
- Finding added EGUs to Section 112(c) list for regulation under Section 112(d).



# Clean Air Mercury Rule (CAMR)

---

- Signed on March 15, 2005.
- Published on May 18, 2005.
- Regulate under Section 111 not Section 112
- Actual emissions in 2000 – 48 tons.
- First phase of Hg reductions is 22 tons in 2010. (i.e., “co-benefit” reductions.) (PA – 1.78 tons.)
- Second phase of Hg reductions is an additional 11 tons in 2018. (PA - .702 ton.)
- Total reduction is 33 tons or 69%.
- Overall cap of 15 tons.



# EPA's "Appropriate and Necessary" Revision

---

- Signed on March 15, 2005.
- Published on March 29, 2005.
- Revise "appropriate and necessary" finding because regulation under Section 112 is neither appropriate nor necessary.
- After CAIR no Hg public health hazard.
- Hg can adequately be regulated under Section 111(b) for new and 111(d) for existing sources.
- Delist EGUs.
- Establish cap-and-trade program as "best system of emission reduction."



# Pennsylvania Lawsuits Challenging Revision of Finding and CAMR

---

- Rulemakings do not adequately regulate a potent neurotoxin such as Hg.
- CAMR is not the “control technology” approach contemplated under the hazardous air pollutant provisions of Section 112 of the CAA.
- CAMR disadvantages electric generating units burning bituminous and anthracite coals with the most stringent requirements established for units burning waste coal.





# Reconsideration Actions

---

- PA and others filed petitions for reconsideration on revision action and CAMR.
- EPA granted reconsideration petitions on certain aspects of both final actions.
- EPA took comments on those aspects.
- It is anticipated that EPA will take final action no later than May 2006.



## CAMR v. CAMR Reconsideration NSPS Limits

---

- PC[Bitum.]  
0.021 lb Hg/GWh
  - PC [Subitum.] Wet FGD  
0.042 lb Hg/GWh
  - PC [Subitum.] Dry FGD  
0.078 lb Hg/GWh
  
  - Lignite  
0.145 lb Hg/GWh
  - IGCC  
0.020 lb Hg/GWh
  - Coal Refuse  
0.0014 lb Hg/GWh
- PC [Bitum.]  
0.020 lb Hg/GWh
  - PC [Subitum.] Wet FGD (>25"  
H2O Precip.) 0.066 lb Hg/GWh
  - PC [Subitum.] Wet FGD (<25"  
H2O Precip.) 0.097 lb Hg/GWh
  - PC [Subitum.]Dry FGD (>25" H2O  
Precip.) 0.066 lb Hg/GWh
  - PC [Subitum.]Dry FGD (<25" H2O  
Precip.) 0.097 lb Hg/GWh
  - Lignite Coal Fired  
0.175 lb Hg/GWh
  - IGCC  
0.020 lb Hg/GWh
  - Coal Refuse Fired  
0.0010 lb Hg/GWh



## CAMR v. CAMR Reconsideration NSPS Limits

---

- In EPA's proposal, bituminous limit is 4.76% more stringent.
- Subbituminous limits are 57.14% less stringent and 24.36% less stringent, respectively.
- Lignite is 28.57% less stringent.
- Coal refuse is 28.57% more stringent.
- There is no change with IGCC.



# Petition for Rulemaking

---

- On Aug. 9, 2004, Citizens for Pennsylvania's Future filed a petition with the Environmental Quality Board (EQB) on behalf of various organizations "requesting action to reduce the high emissions of mercury to the air from Pennsylvania's electric utilities."
- At January 18, 2005, EQB meeting, the Department is granted a 120-day extension to complete its report on the petition for rulemaking, which would allow DEP to conduct an analysis of EPA's final mercury rule, scheduled for release by March 15, 2005.



# Rulemaking Petition Process

---

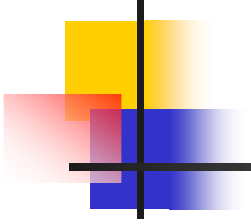
- On May 18, 2005, DEP completed its report on the PennFuture petition and concluded that neither the group's suggested rule nor CAMR are best for Pennsylvania. However, DEP found that a comprehensive approach to mercury control should be considered, and we recommended development of a regulatory approach to mercury emissions control in Pennsylvania.



# Rulemaking Petition Process

---

- On Aug. 16, 2005, EQB approved DEP's recommendation to develop a Pennsylvania-specific regulation to reduce emissions from coal-fired electric generating units.
- DEP also commits to a Hg Rulemaking Public Involvement process to consult with a diverse group of public and private sector individuals, including representatives of the petitioners, industry and trade associations.



# Recap of Mercury Rule Workgroup Meetings



# Public Involvement Process

---

- Convened a Workgroup of diverse public and private sector individuals including representatives of petitioners, industry and trade association.
- Discussed key information relevant to a “state-specific” mercury regulation.
- Obtained recommendations on the technical aspects of the proposed rulemaking, including control levels, testing, monitoring, recordkeeping and reporting, and compliance schedules.
- Discussed the available background information on mercury emissions, deposition and control technology as well as the costs and benefits of the regulation.





# Public Involvement Process

---

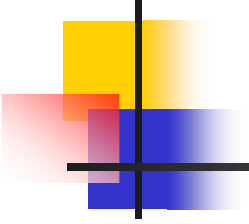
- The federal Clean Air Mercury Rule (“CAMR”) for new and existing coal-fired EGUs is effective in Pennsylvania.
- The EQB directed the PADEP to develop a Pennsylvania-specific mercury rule for EGUs.
- The State Plan for existing EGUs is due to the U.S. Environmental Protection Agency (EPA) Region III by November 17, 2006; the State Plan must be at least as stringent as the CAMR.
- Mercury removal will be attained through differing strategies dependent on the specific combustion unit and fuel mix.
- PADEP staff will draft the mercury rule in consultation with the Workgroup/AQTAC/CAC.
- The Workgroup/ AQTAC and CAC will consider the proposed rule prior to submission to the EQB.



# Public Involvement Process

---

- Four meetings were held - Oct. 14, 2005; Oct. 28, 2005; Nov. 18, 2005; and Nov. 30, 2005.
- The primary objectives of the public involvement process were to discuss key information relevant to a state-specific mercury regulation and obtain recommendations on the technical aspects of the proposed rulemaking, including control levels, testing, monitoring, record keeping and reporting, and compliance schedules.
- Each meeting provided an opportunity for technical presentations and open discussion for the Workgroup members.
- All material posted on web at:  
[http://www.dep.state.pa.us/dep/deputate/airwaste/aq/regs/Mercury\\_Rule.htm](http://www.dep.state.pa.us/dep/deputate/airwaste/aq/regs/Mercury_Rule.htm)

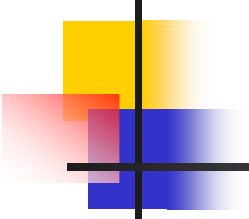


# Mercury Rule Workgroup

## October 14, 2005

---

- First meeting provided an overview of the mercury related issues.
- Welcoming remarks were made by Tom Fidler (DEP), Roger Westman (AQ/TAC), and Susan Wilson (CAC).
- Mercury Rule Workgroup process was presented by Joyce Epps
  - Included preliminary time schedule leading to adoption of a final regulation.

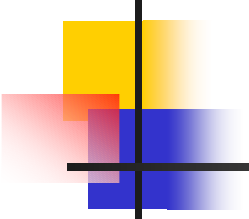


# Mercury Rule Workgroup

## October 14, 2005

---

- Dr. James Lynch presented an overview of mercury and deposition in Pennsylvania.
- Dr. Leonard Levin presented a report on the atmospheric fate and transport of mercury.
- Raymond Chalmers presented a summary of the U. S. EPA's Clean Air Mercury Rule.
- Robert Reiley presented a summary of other states' mercury rules and legislation.
- All Workgroup members were provided an opportunity to discuss his/her concerns related to the mercury program.

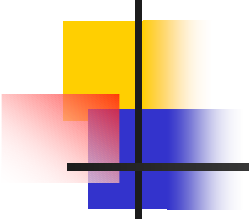


# Mercury Rule Workgroup

## October 28, 2005

---

- Dr. John Bell presented an evaluation of the potential health effects of mercury from combustion sources.
- Dr. Donald McGraw presented information on the health effects of mercury.
- Wick Havens presented information on utility emission reductions under the CAA.
- Aaron Frey presented information on fish advisories in Pennsylvania.
- Dr. Terrence Sullivan presented information concerning the impacts of mercury emissions from coal-fired power plants on local deposition and health risk.

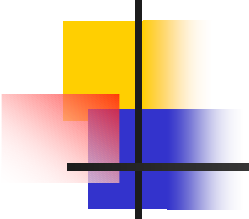


# Mercury Rule Workgroup

## November 18, 2005

---

- Thomas Hewson presented information on the economic impact of mercury regulations on Pennsylvania power plants.
- Samuel Napolitano discussed the mercury co-benefits of the EPA CAIR.
- Dr. Mark Cohen discussed local and regional deposition impacts of atmospheric mercury emissions.
- Dr. Leonardo Tresande discussed the health and economic consequences of mercury pollution particularly as they relate to the developing brains of fetus and children.

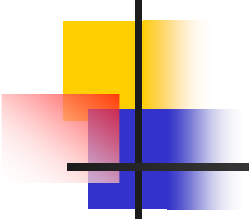


# Mercury Rule Workgroup

## November 18, 2005

---

- Thomas Feeley presented a report on the mercury technology research and development efforts of the Department of Energy.
- John Sale presented information concerning the impact of modified boiler control settings on mercury emissions.
- David Foerter provided an overview of the availability of mercury control technology.
- Dr. Michael Durham discussed the use of sorbent technology to control mercury emissions.
- Dr. Sid Nelson discussed sorbent technologies.



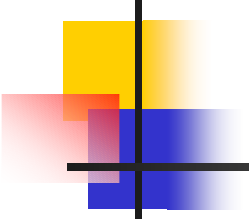
# Mercury Rule Workgroup

## November 30, 2005

---

- Susan West Marmagas presented information on mercury's impact on the health of children.
- William Becker presented background information on the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials mercury model rule.
- Richard Ayres explained the background and provided details on the STAPPA/ALAPCO mercury model rule.



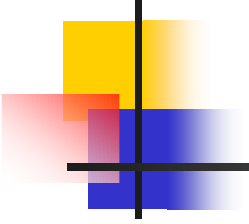


# Mercury Rule Workgroup

## November 30, 2005

---

- Charles McPhedran presented the control option recommended by the mercury petitioners.
- Applies to coal-fired boilers over 25 MW
- Requires emission not exceed 3.0 mg/MW-hr or that reduction efficiency be at least 90%.
- Compliance by 3 years from final rule.

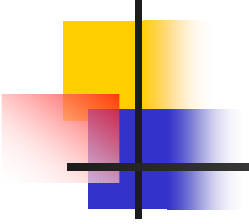


# Mercury Rule Workgroup

## November 30, 2005

---

- Frank Burke presented the control recommendation of the Pennsylvania Coal Association.
- Implement CAMR with interstate trading.
- Provide a practical definition of hotspots.
- Expand mercury deposition network.
- Promote the development of mercury-specific control technology.

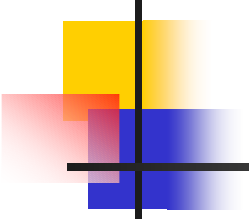


# Mercury Rule Workgroup

## November 30, 2005

---

- Felice Stadler discussed the preferred control option of the National Wildlife Federation.
- Supports petitioners position.
- Eliminate trading option.
- Require controls sooner than CAMR.

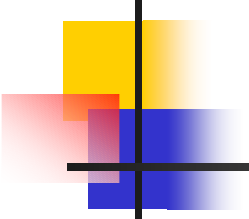


# Mercury Rule Workgroup

## November 30, 2005

---

- Eugene Trisko presented the recommendation of the United Mine Workers.
- Recommends DEP propose several options including the adoption of CAMR Phase I.
- Defer judgment on Phase II
  - Reconvene Workgroup in 2008-9
- Accept CAMR Phase II as a default to comply with EPA requirements.

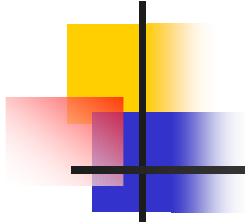


# Mercury Rule Workgroup

## November 30, 2005

---

- The Workgroup held an open conversation to provide all members an opportunity to discuss the control options.
- Many members support the adoption of CAMR.
- Other members support the controls recommended by the petitioners.
- A few members did not have a position on control requirements.



# States' Mercury Laws, Regulations, Proposals and Recent Mercury Developments



# Other States' Actions on Hg

---

- Final Hg Action

- Wisconsin
- Connecticut
- New Jersey
- Massachusetts

- Pending Hg Regulatory Action

- Illinois
- Maryland
- Indiana
- Virginia
- North Carolina
- Michigan

- Legislative Action

- Ohio
- New Hampshire
- Minnesota
- Illinois
- New York
- Montana
- Maryland



# State-by-State Comparison

---

- CT

- 90% control or 0.6 lb per trillion Btu (whichever is less stringent) by 2008 (statute).

- MA

- 85% capture or 0.0075lb/GWh by 1/1/2008; 95% capture or 0.0025 lbs/GWh by 10/1/2012 (regulation).

- MN

- Achieved a 70% reduction in emissions of mercury from 1990 levels by 2005 . Governor Pawlenty called for legislation to reduce mercury emissions from power plants by 90% in a timeframe ahead of CAMR timeline

- IL

- The proposal would require reduction of emissions by an average of 90% or 0.0080 lb/GWh across entire fleet of plants by July 1, 2009. Each individual plant must achieve at least a 75% reduction or 0.0096 lb/GWh by 2009, and 90% reduction or 0.0080 lb/GWh by January 1, 2013.





# State-by-State Comparison

---

- NJ
  - 90% reduction in emissions or 3 mg/MWh by 12/15/2007 (regulation); 5-year extension available if multi-pollutant control is being installed on all units
- NC
  - 64% reduction in Hg by 2013; recommendations for additional reductions due in 2005 (statute).
- WI
  - 40% reduction by 2010; 75% reduction by 2015 (regulation). Goal of 80% reduction by 2018 (regulation).
- NH
  - Cap of 50 lbs/year after federal compliance dates; cap of 24 lbs/year four years later.



# State-by-State Comparison

---

## ■ MD

- 80% control or 2.4 lb per trillion Btu (whichever is less stringent) by 2010.
- 90% control or 1.2 lb per trillion Btu (whichever is less stringent) by 2015.

## ■ VA

- The control period is January 1 thru December 31 of each year.
- The Hg budgets for EGUs are (i) 0.592 tons for each control period in 2010 through 2014 and (ii) 0.234 tons for each control period in 2015 and thereafter.
- A new unit set-aside budget is included consisting of 5.0% for each control period in 2010 through 2014 or 3.0% for each control period in 2015.



## Preliminary Results from Steubenville Hg Deposition Source Apportionment Study

---

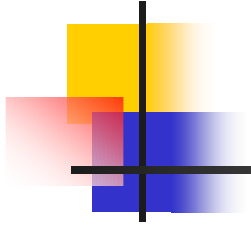
- Research conducted by Matt Landis, Gary Norris, and David Olson in collaboration with the University of Michigan.
- The Steubenville mercury deposition study began in 2003 and continues until end of 2006.
- The Steubenville site was chosen because it was anticipated to be impacted by coal combustion.
- The study was intended to apportion the contributions between local, regional and global sources.
- Preliminary conclusions were drawn using the data collected during 2003 and 2004.



## Preliminary Results from Steubenville Hg Deposition Source Apportionment Study

---

- The initial assessment indicates that approximately 70% of Hg wet deposition at Steubenville site is attributable to local/regional fossil fuel (coal and oil) combustion sources.
- This conclusion contradicts the earlier EPA assessments done for CAMR, which indicated a much lower local/regional source contribution to Hg deposition.
- EPA estimated that on average 8% of domestic Hg deposition estimated to be from domestic EGU coal combustion.
- Results would also appear to contradict EPRI's claim of reactive gas mercury conversion to elemental Hg after exiting the boiler stack.



# Mercury Rule Concepts



# Information Development Process

---

- Hg Emissions from EGUs.
- Hg Control Technologies for EGUs.
- Health Effects from Hg.
- Impacts on Pennsylvania's Electrical System and Economic Competitiveness.



# General Principles Related to Draft Mercury Rule Concepts

---

- No trading of Hg emission allowances.
- Achieve greater reductions in Hg than EPA's CAMR.
- Maximize the Hg reduction co-benefits from other SO<sub>2</sub> and NO<sub>x</sub> emission control programs such as CAIR.
- Discourage fuel switching from bituminous coal.
- No adverse impact on the capacity and reliability of power generation.



# Conceptual Approach

---

- Applicability - Any coal-fired EGU with a nameplate capacity of 25 MW or more.
- Each EGU would be required to meet –
  - a numerical emission standard or minimum control efficiency and
  - an annual emission limit in ounces of Hg emitted.





# Exception

---

- The owner or operator of an existing EGU that enters into an enforceable agreement for the shutdown and replacement with Integrated Gasification Combined Cycle (IGCC) would be exempted from compliance with the Phase 1 Hg emission standards and Phase 1 annual emission limit requirements.



# Compliance Deadlines

---

- Phase 1 (January 1, 2010)
  - Initial level for numerical emission standard or control efficiency, **and**
  - an annual emission limit by unit.
- Phase 2 (January 1, 2015)
  - More stringent emission standard or control efficiency, **and**
  - annual emission limit by unit.



# Phase 1 and 2 Emission Standards

---

- Existing EGU units
  - Pulverized Coal (PC)-Fired
  - Circulating Fluidized Bed (CFB)
- New EGU standards apply at construction for:
  - IGCC
  - PC-Fired
  - CFB



# Emission Standards for New EGUs

---

- PC-Fired - output based emission standard of 0.011 lb/GWh or 90% capture efficiency.
- CFB - output based emission standard of 0.0014 lb/GWh.
- IGCC - output based emission standard of 0.0048 lb/GWh or 95% capture efficiency.



# Phase 1 Existing EGU Standards

---

- PC-Fired - output based emission standard of 0.024 lb/GWh or 80% capture efficiency.
- CFB - output based emission standard of 0.0058 lb/GWh or 95% capture efficiency.



# Phase 2 Existing EGU Standards

---

- PC-Fired - output based emission standard of 0.012 lb/GWh or 90% capture efficiency.
- CFB - output based emission standard of 0.0058 lb/GWh or 95% capture efficiency.



# Annual Emission Limits

---

- Established for each EGU on ounces per year basis.
- Based on CAMR allocation distribution methodology using three highest years within years 2000-2004 EGU's heat-input.
- CFB unit emission limit in Phase 1 is same as Phase 2.
- Provides regulatory assurance for Pennsylvania to meet the EPA CAMR Hg budgets.



# Phase 1 Emission Standards Compliance Options

---

- Unit-by-unit basis.
- Emissions averaging among the units at a specific facility.
- Compliance Presumption – cold-side ESP and wet FGD where 100% bituminous coal is fired.
- Alternative emission standard/compliance schedule.





# Phase 2 Emission Standards Compliance Options

---

- Unit-by-unit basis.
- Emissions averaging among the units on a facility.
- Compliance Presumption – cold-side ESP, wet FGD and SCR where 100% bituminous coal is burned.
- Alternative emission standard/compliance schedule.



# Annual Emission Limit Compliance Components

---

- Allocate to each EGU an available amount of non-tradable allowances based on CAMR caps.
- Set aside for New Source EGUs (5%).
- Same CFB allocation for both Phases.
- Each affected unit shall draw up to the available amount of allowances based on their actual emissions for compliance with the annual emission limit.
- Owner/operator of EGU may petition Department for additional allowances for compliance.
- Order of preference for additional allowances.

# Order of Preference for Additional Allowances



---

- EGUs which are CFBs combusting 100% waste coal or bituminous coal.
- EGUs combusting 100% bituminous coal, which is controlled by SCR, cold side ESP, wet FGD, and Hg-specific control technology;
- EGUs combusting 100% bituminous coal, which is controlled by SCR, cold side ESP, and FGD
- EGUs combusting 100% bituminous coal, which is controlled by wet FGD Hg-specific control technology;
- EGUs combusting 100% bituminous coal, which is controlled by Wet FGD
- EGUs operating with other air pollution control technologies and measures to control emissions of air contaminants including Hg.



# Other Requirements

---

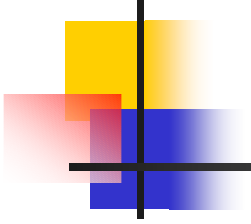
- Monitoring Requirements
  - Similar to CAMR
- Testing Requirements
  - Similar to CAMR
- Recordkeeping and Reporting Requirements
  - Similar to CAMR



# Anticipated Results

---

- Pennsylvania Hg reductions beyond CAMR for Phase 1
  - approximately 29%
- Pennsylvania Hg reductions beyond CAMR for Phase 2
  - approximately 36 %



# Next Steps



## Next Steps

---

- Follow-up Meeting with AQTAC/CAC on specific regulatory language
- Place proposal on the regulatory calendar
- Present to EQB for action



# Tentative Mercury Rule Timeline

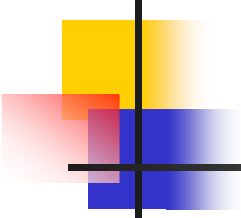
March 6 & 13	AQTAC/CAC meetings scheduled concerning mercury concepts/draft regulation
May 3	Submit proposed mercury rulemaking to EQB for consideration
May 17	EQB Action on the proposed rulemaking
Late June	Publish Notice of Proposed Rulemaking in the Pa. Bulletin





# Tentative Mercury Rule Timeline

July	Three public hearings in Southeast, Southcentral and Southwestern PA
July/August	Summarize public comments/develop final-form regulations. Meet with AQTAC/CAC/Workgroup to discuss final-form mercury regulation
September/October	EQB considers final-form mercury regulation
November	Independent Regulatory Review Commission Meeting
November	Publish final mercury rulemaking. Submit State Plan to EPA Region III



# Questions?

