

Impact of Mercury Regulations on Pennsylvania Coal-Fired Powerplants



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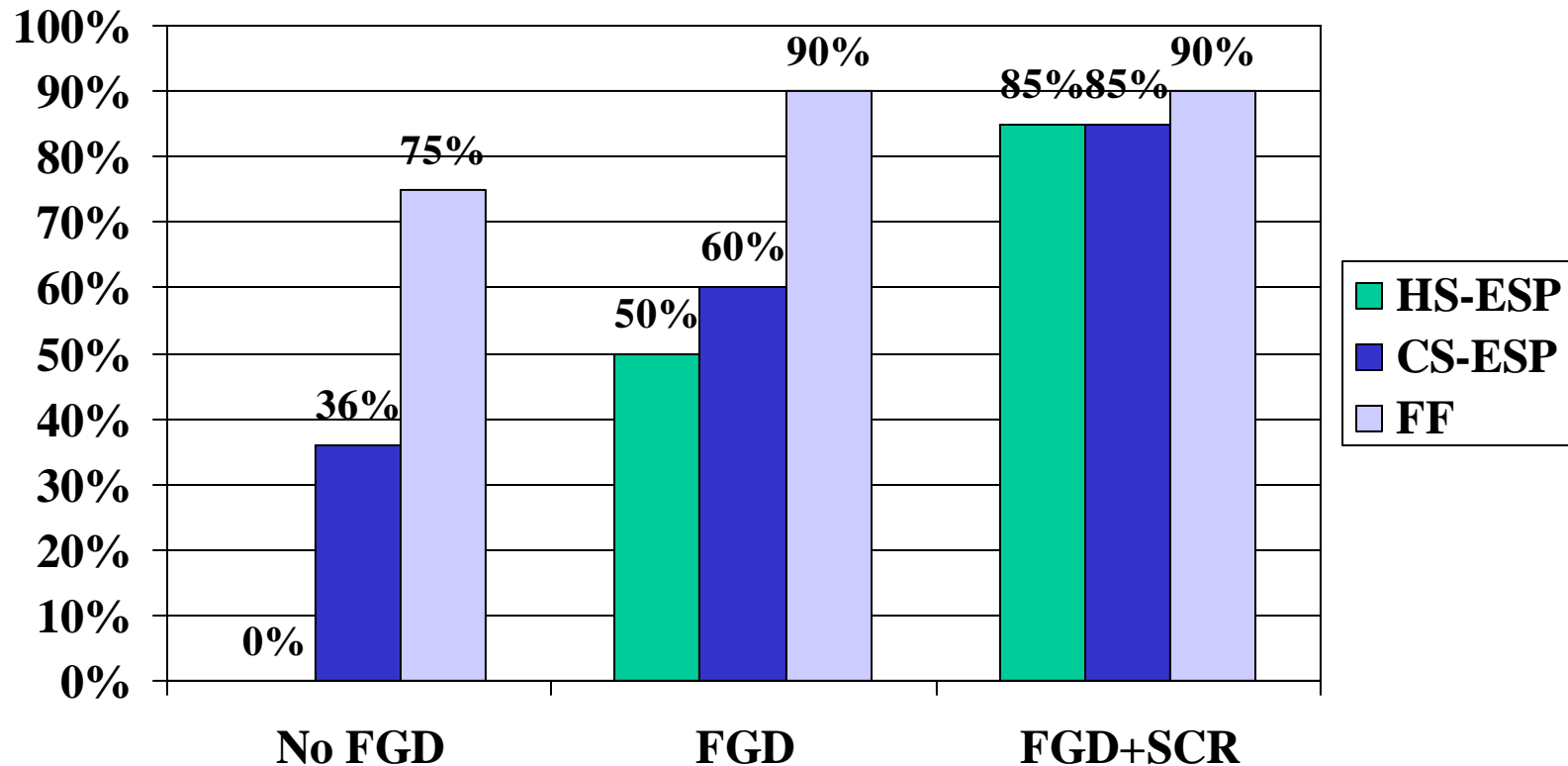
November 18, 2005

EVA/MCH 2005 Study



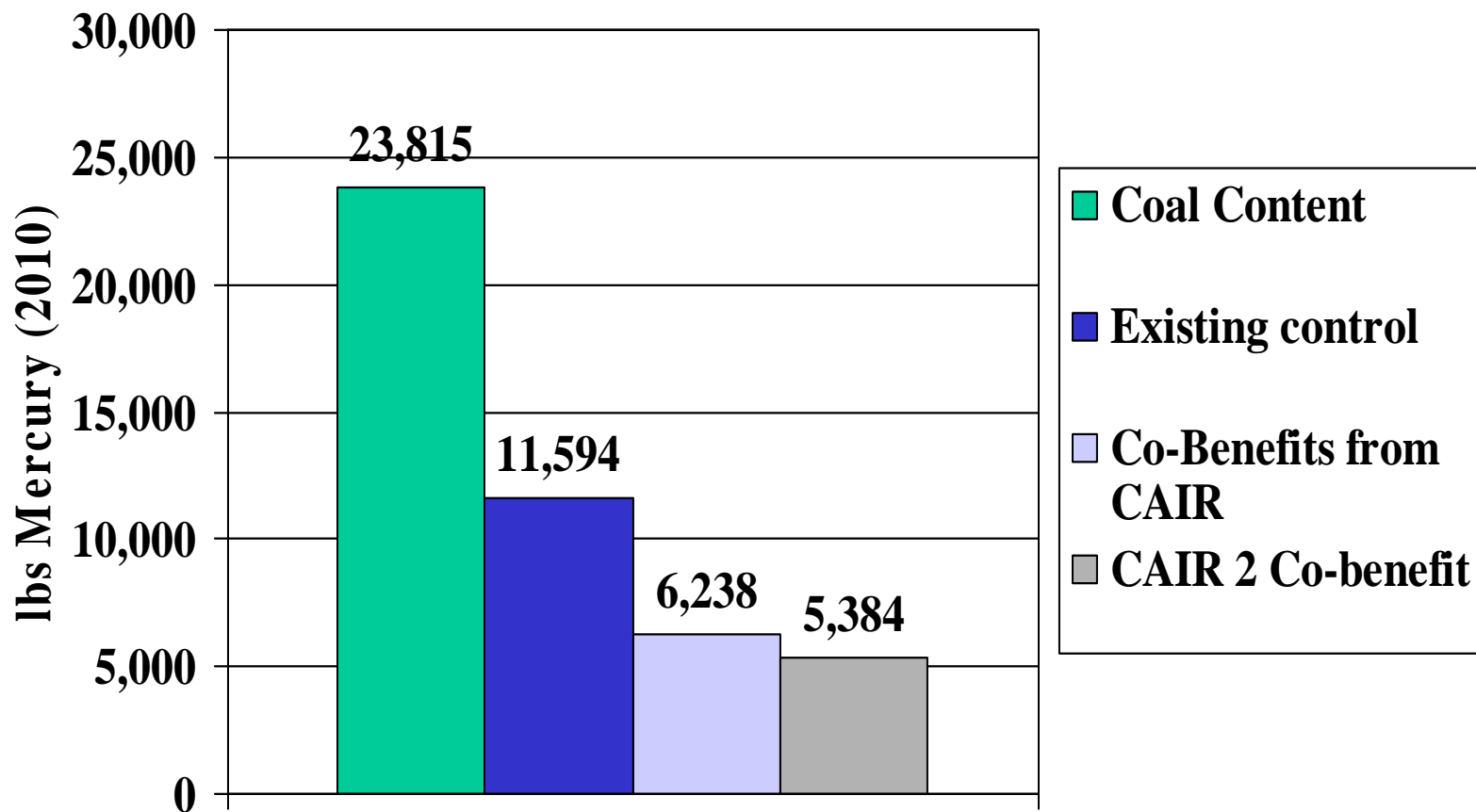
- Identified mercury removal performance of existing powerplant controls
- Projected cost and performance of likely 2010 commercial mercury control options
- Identified 2010 compliance strategies and cost for two scenarios-
 - CAMR Phase 2 emission cap (1,404 lbs: Pennsylvania) with in-state trading
 - 90% Incremental reduction (vs. 1999 rate) or technology forcing limitation

Mercury Removal from Existing Emission Control Configurations- Bituminous Coal



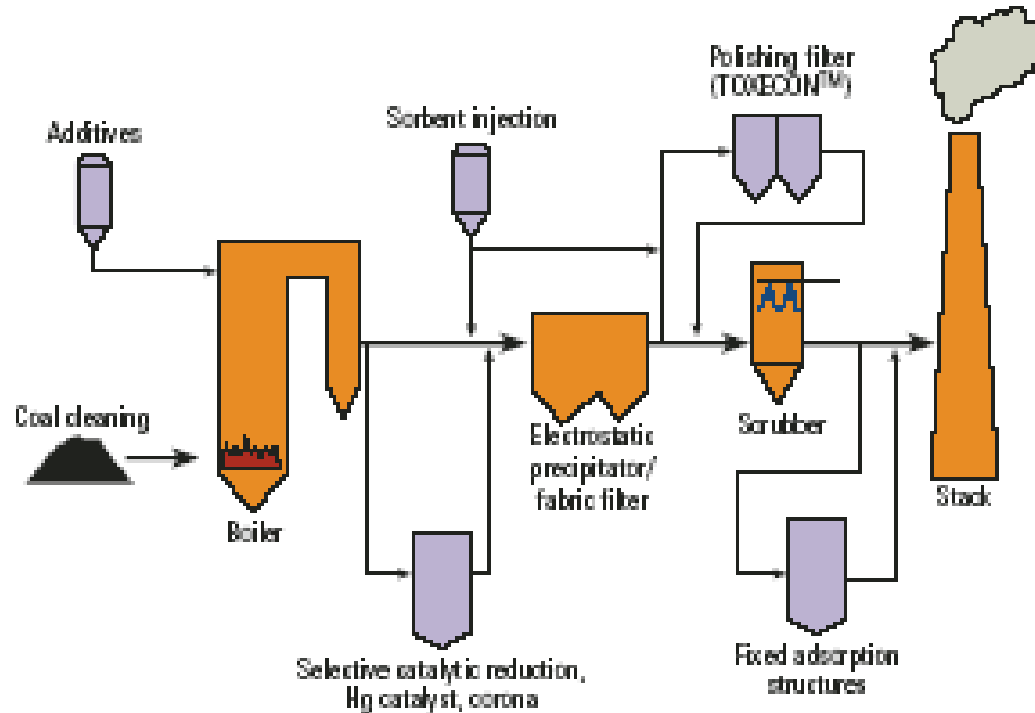
Source: January 3, 2005 Consensus Response by Utility Air Regulatory Group

Pennsylvania Powerplant Mercury Emissions- 2010

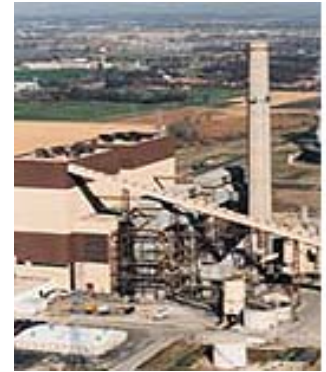


EPA Mercury Rule sets 2010 state cap at 3,560 lbs, 2018 cap at 1,404 lbs

1. Many options. An overview of power plant mercury (Hg) control options. Source: EPRI



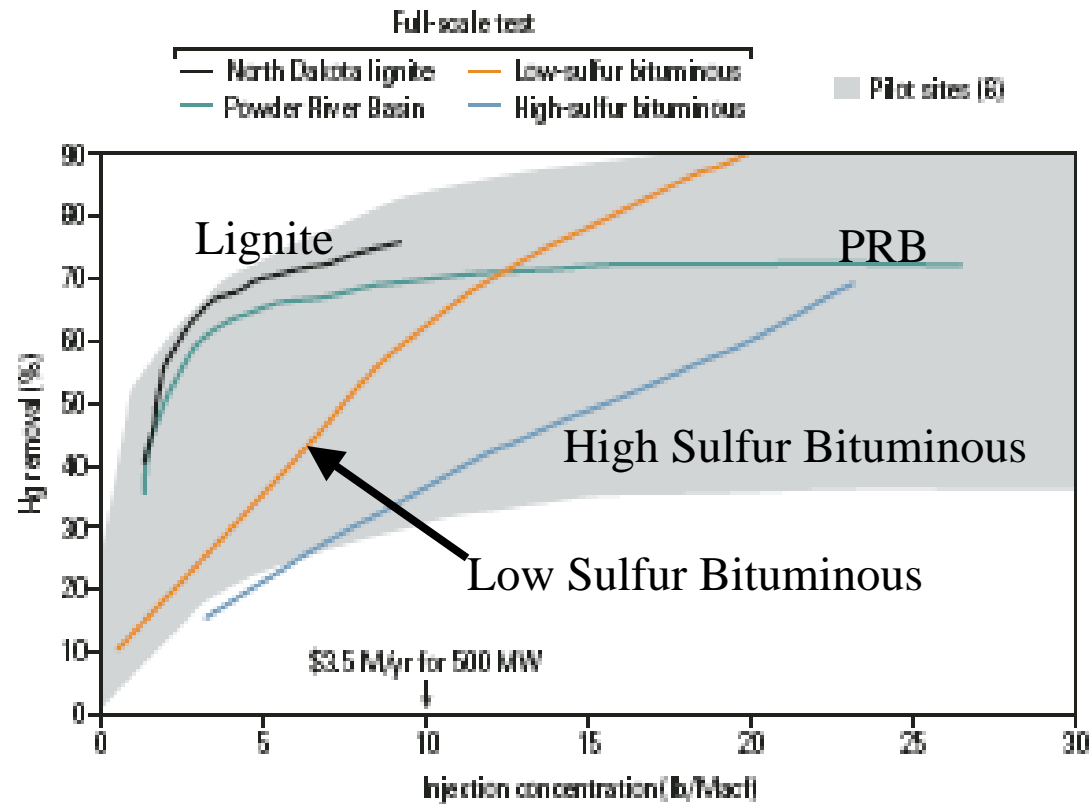
Bituminous Coal Mercury Control Options



- Activated Carbon Injection (ACI)
 - Existing ESPs
 - ACI with Small ESP (<250 SCA) based upon Yates powerplant demonstration test: 30-40% increased removal capped at 60% total reduction even with high carbon injection (>12 lb/Macf)
 - ACI with large ESP (>250 SCA) based upon Pleasant Prairie demonstration: 60% reduction
 - Assume that 35% of ash will no longer be sold and must be landfilled @\$28/ton



3. Activated carbon injection (ACI). In ACI field tests at sites with large electrostatic precipitators, mercury (Hg) removal efficiencies varied from 90% at a unit firing low-sulfur eastern bituminous coal to 60 to 70% at units firing PRB coal and North Dakota lignite. *Source: EPRI*

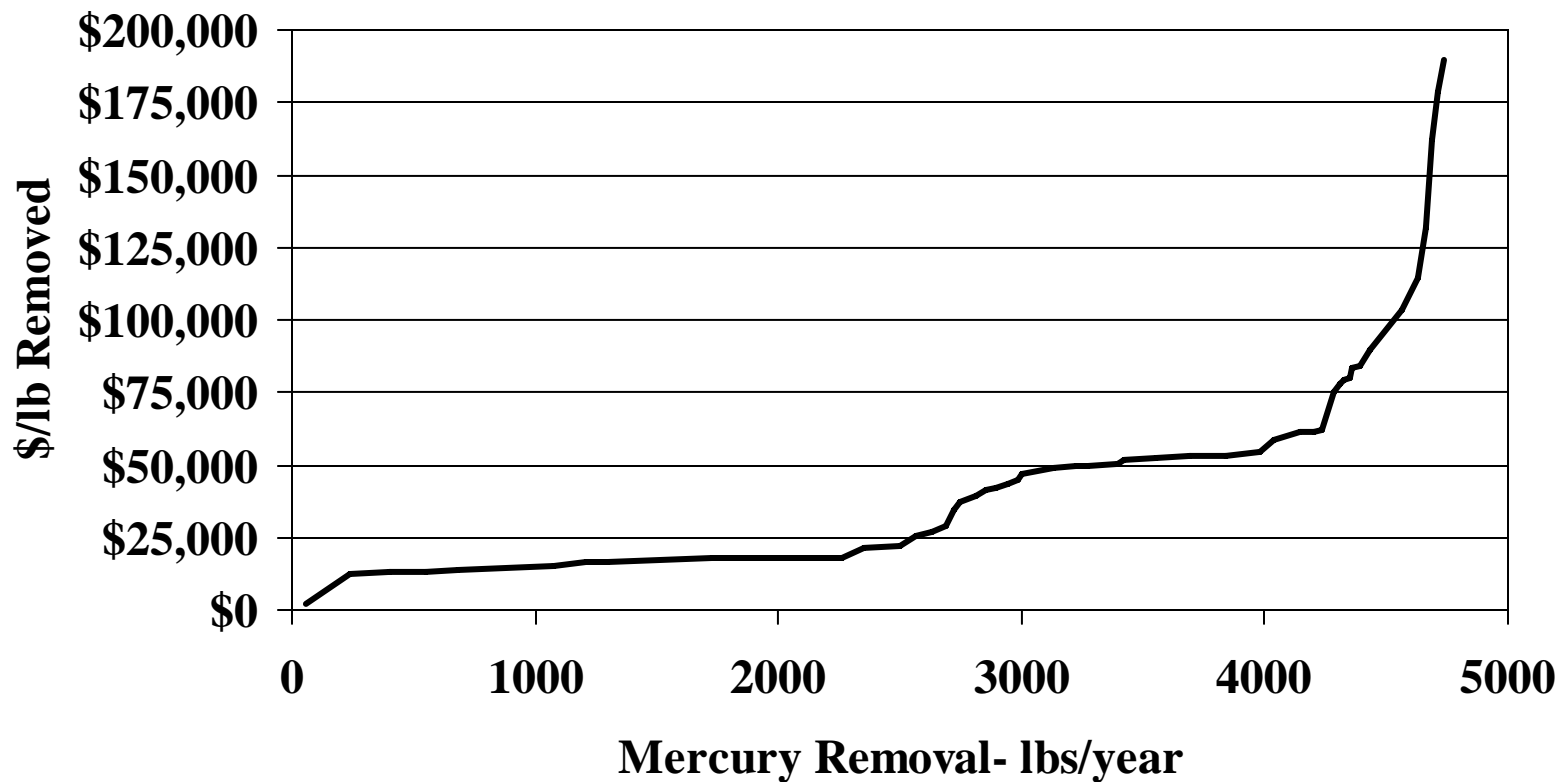


Bituminous Coal Mercury Control Options

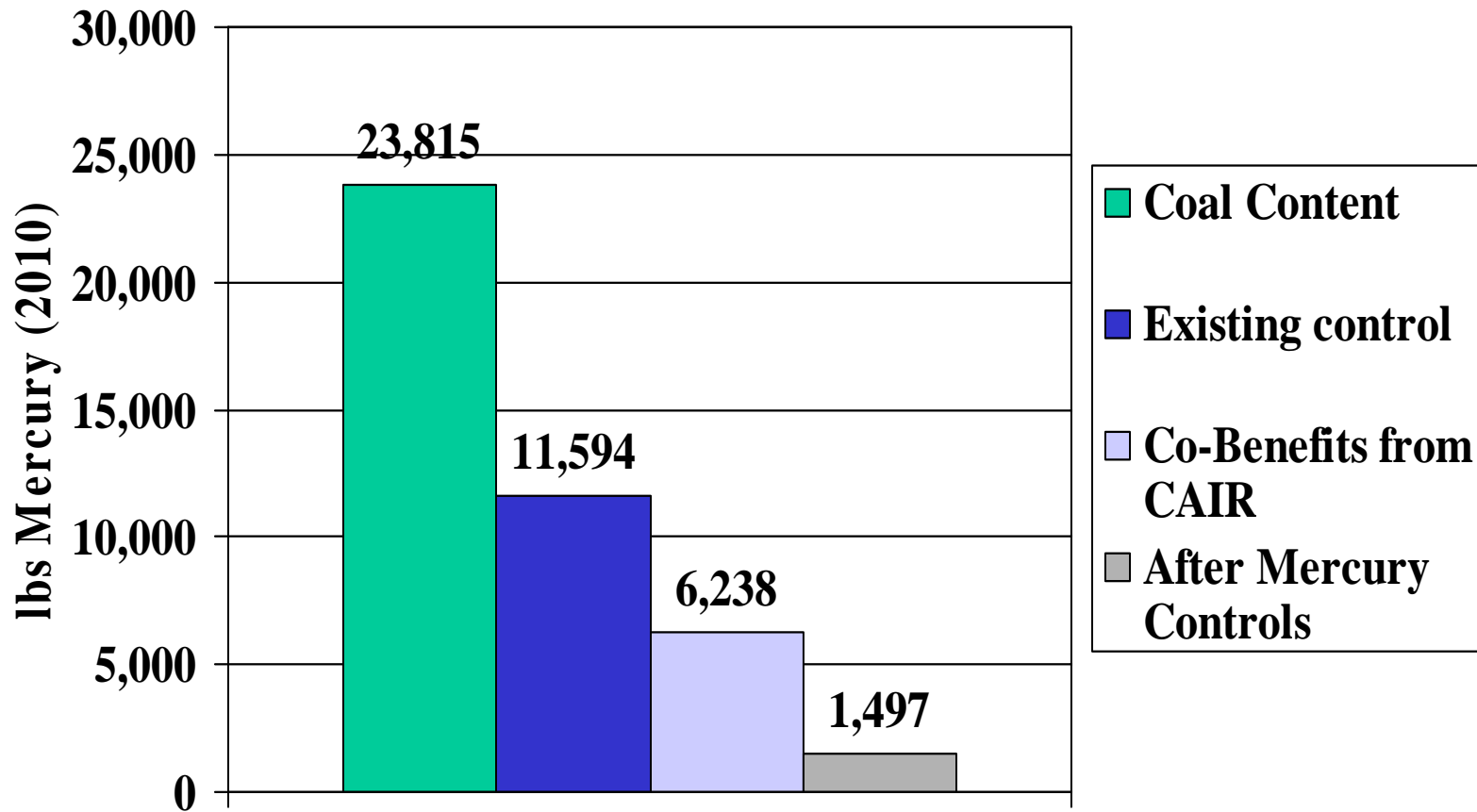
- Activated Carbon Injection (ACI)
 - COHPAC/TOXECON
 - Performance based upon demonstration at Gaston: 86% with ACI rate of 1.5 lbs/Macf
 - Requires new capital investment for a polishing fabric filter
 - Some promising approaches under development- more R&D needed
 - New halogenated sorbents



Pennsylvania Mercury Removal Costs



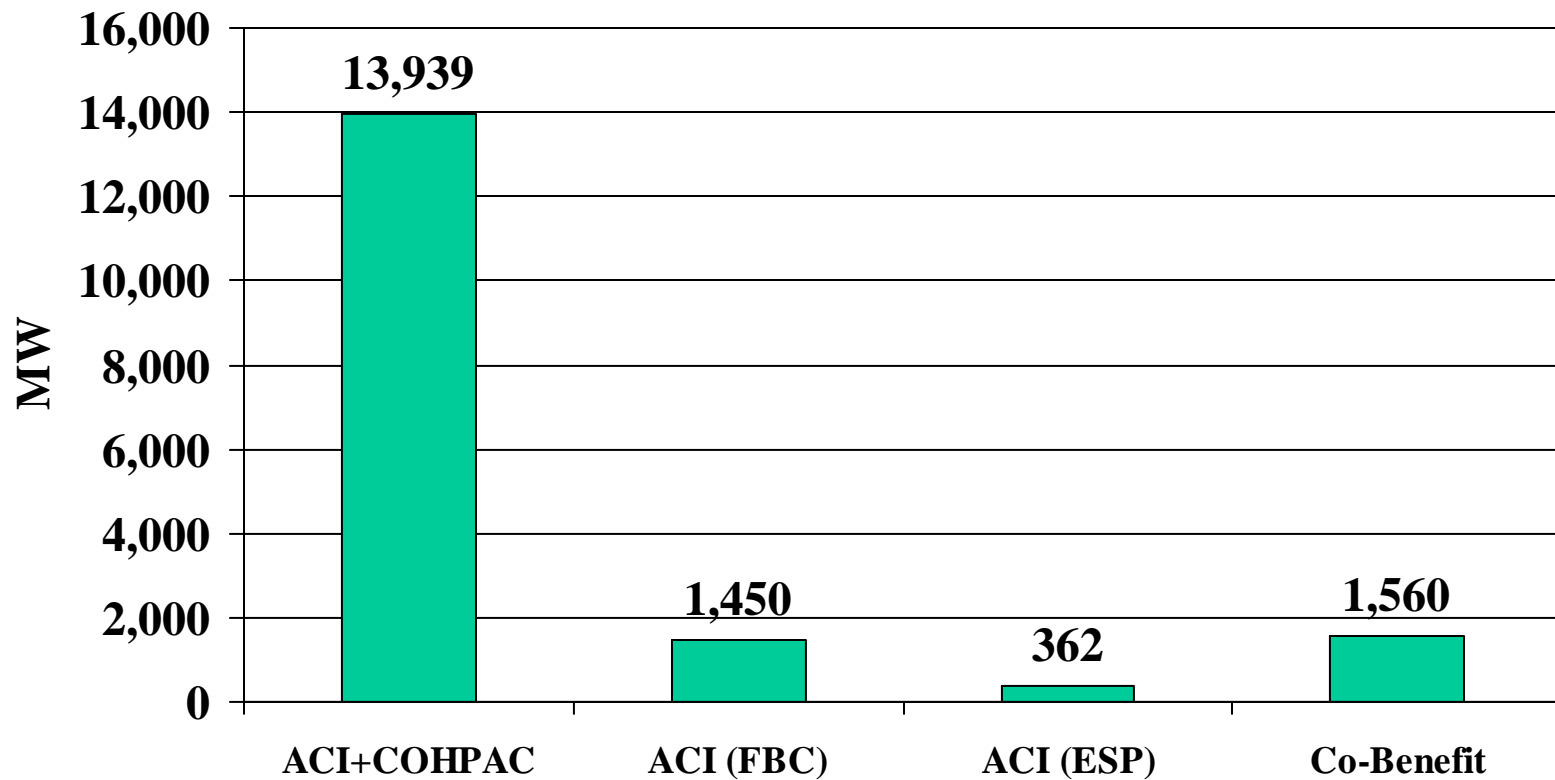
Pennsylvania Powerplant Mercury Emissions- 2010



EPA 2003 TRI data PA powerplant emissions of 6,827 lbs

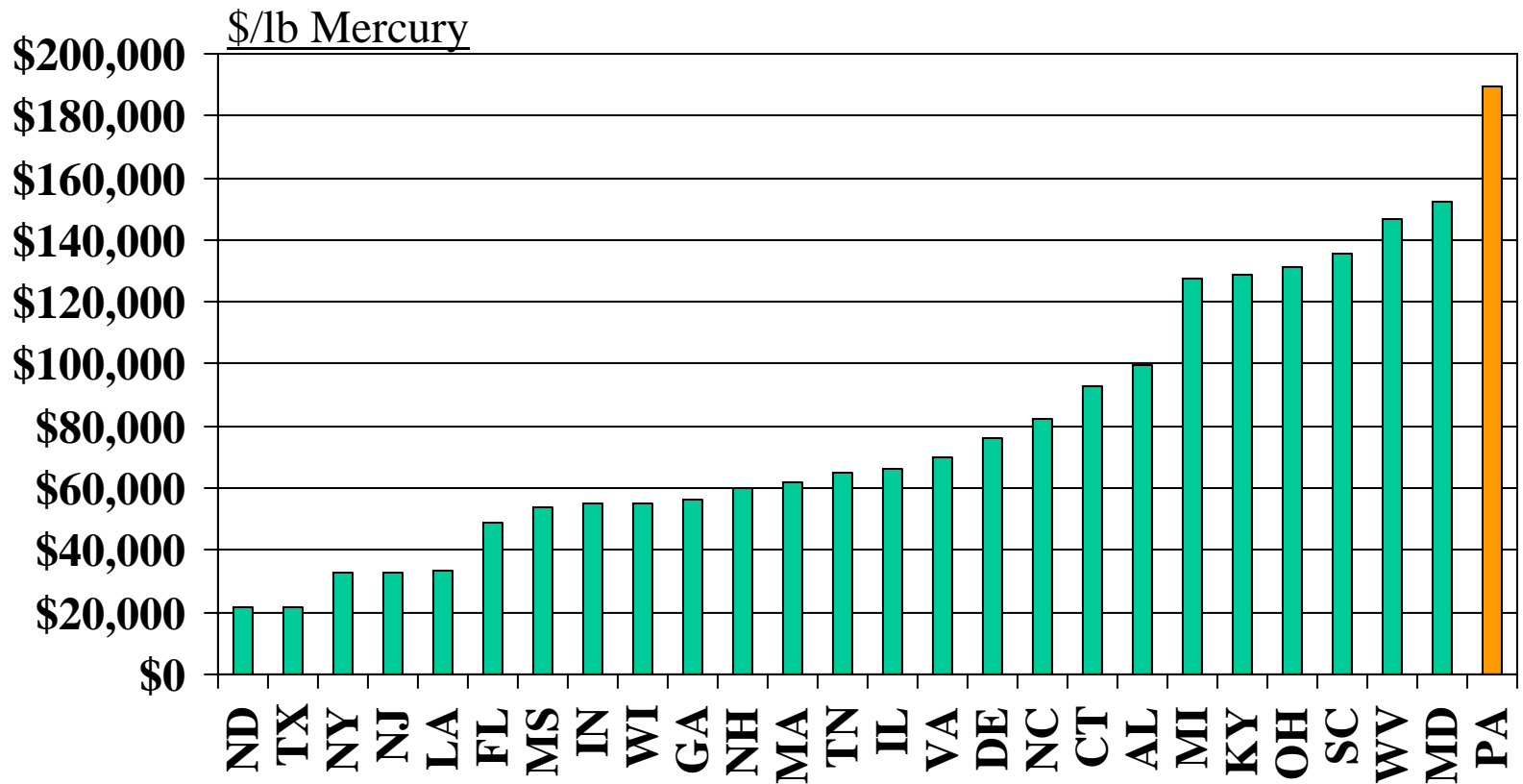
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2010 Pennsylvania Compliance Strategies



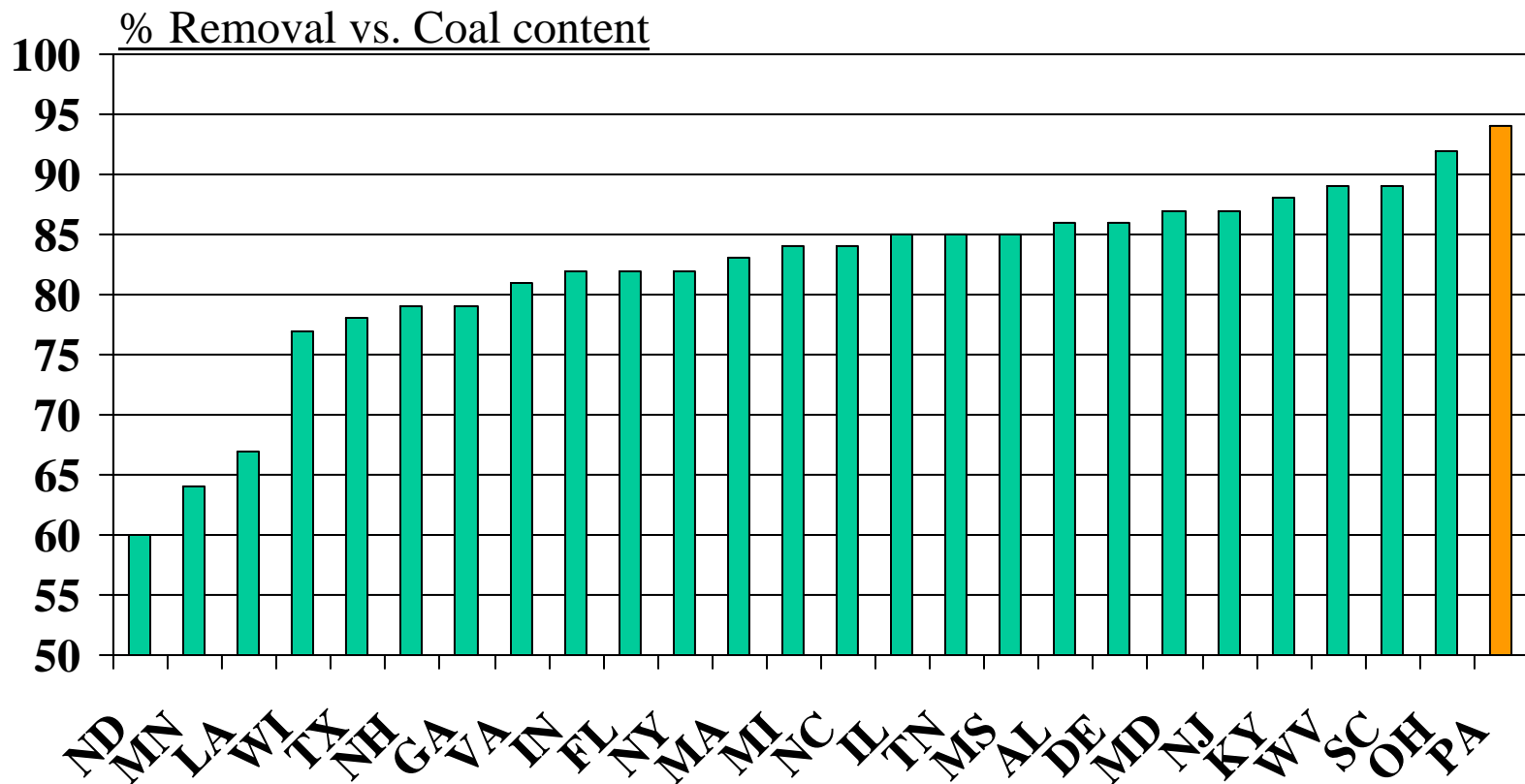
Pennsylvania

Highest Marginal Mercury Removal Cost



Pennsylvania

Highest % Removal Requirement to reach 15 Ton Emission Cap (2010 Baseline)



Study Findings



- Unable to achieve Phase 2 CAMR cap with existing mercury control measures alone
- \$1.0 Billion in capital investment in mercury-specific controls
- \$180 Million/year in annual compliance costs
- Places 330-1,200 MW of coal-fired capacity at risk for accelerated retirement
 - Would trigger additional investment of \$200-\$750 million to replace lost capacity
 - Replace 1.8-6.1 TWh of lost generation with higher cost replacement power
- Setting stricter target earlier forces reliance on early mercury control technology