

HgCEMS for EGU MATS and PC MACT Compliance

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by

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A Presentation Promoting Provocation

1. EGU MATS and PC MACT Compliance –*enough time?* - **NO!**
2. Are Sorbent Trap Systems –Economic Choice – **NO!**
3. Are EPA Proposed RATA tolerances Reasonable – **NO!**
4. Example data.
5. Conclusions

U.S. EPA EGU MATS and Cement MACT

Hg must be really low ~ 1.5 ug/m³ for EGUs (<150 ppt v/v basis)

- EPA Electric Generating Unit Mercury and Air Toxic Standards (MATS) promulgated January 2012
- Targeted MATS Pollutants and limits

Pollutant	Existing Source Std.	New Source Std.
Mercury	1.2 lbs/T-BTU	0.35 lbs/T-BTU
PM	0.03 lbs/M-BTU	
HCl	0.002 lbs/M-BTU	

**Deadline for Compliance –
April, 2015**

- The EPA Portland Cement MACT
- Targeted MACT Pollutants and limits

Pollutant	Existing Source Std.	New Source Std.
Mercury	55 lbs/MM tons clinker	21 lbs/MM tons clinker
THC	24 ppmvd	24 ppmvd
PM	0,07 lbs/ton clinker	0.02 lbs/ton clinker
HCl	3 ppmvd	3 ppmvd
Organic HAP (Alternative to THC)	12 ppmvd	12 ppmvd

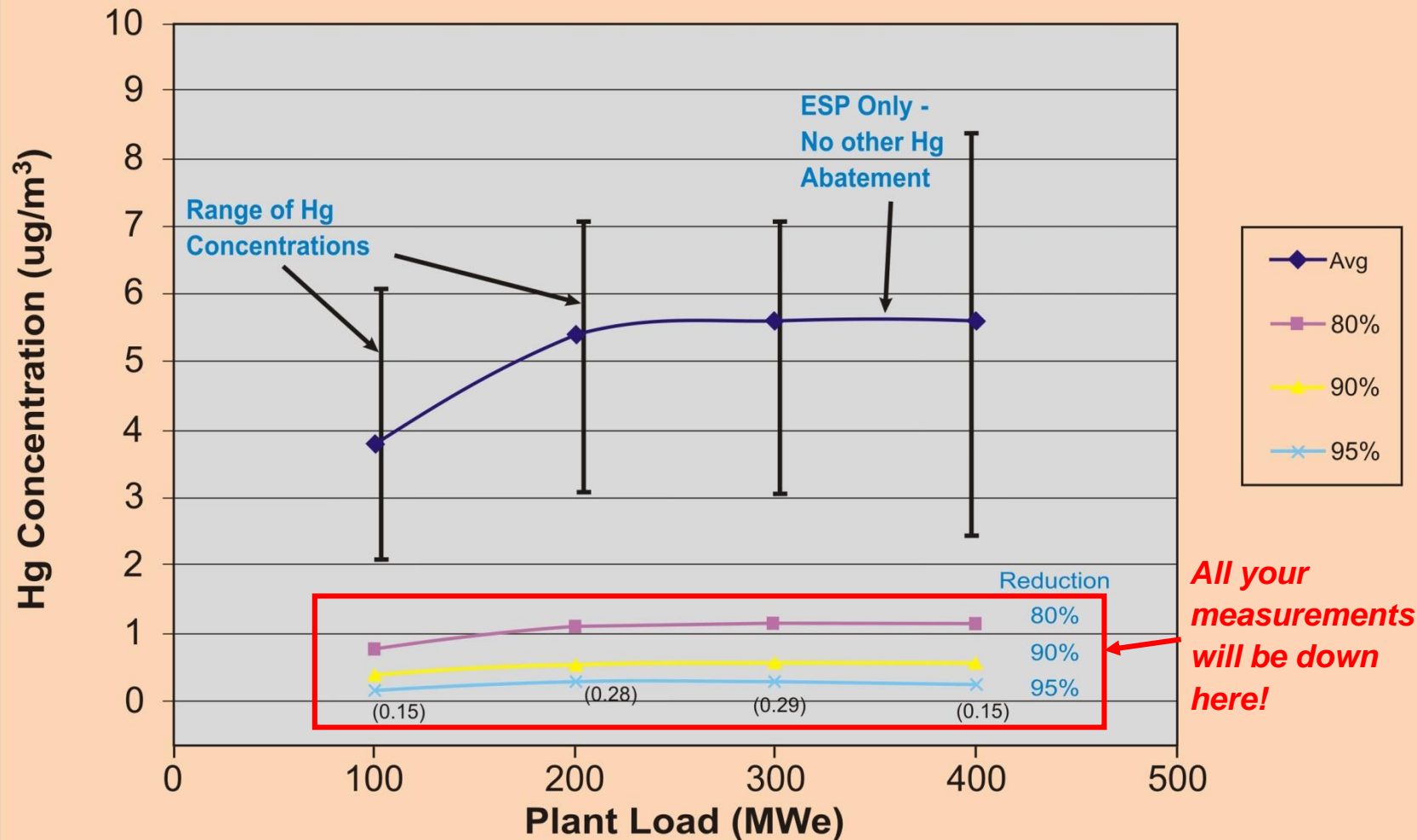
**Deadline for Compliance –
September, 2015**

Impact of Regulations

1. New Air Pollution Control Strategies
2. New or Improved Monitoring Technologies
3. Proof of Performance of 1 & 2
4. Compliance Monitoring and Reporting
5. Control Systems Performance Monitoring and Optimization
6. Plant Retirements

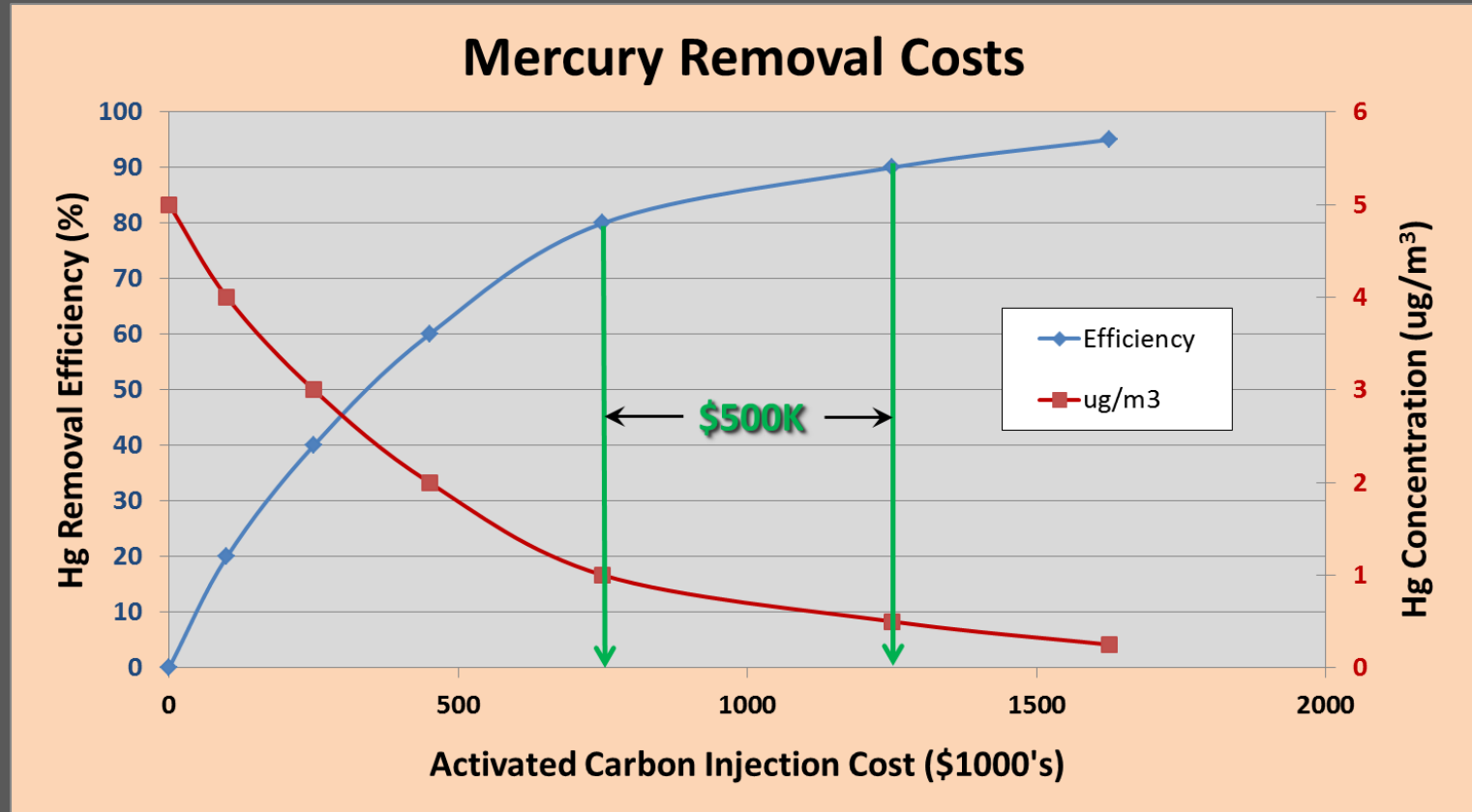
We are still in the learning process – and compliance deadlines on upon us!

Example Hg Emissions Targets - Coal - Fired Power Plant



Economics of Hg Removal - 500 MWe Plant

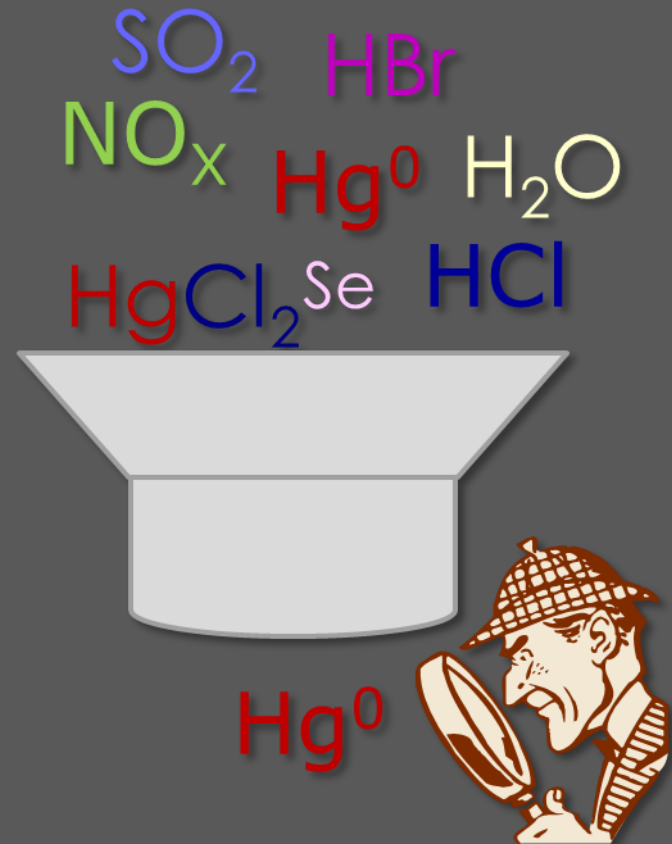
Accurate Measurement and Traceability are Critical



Reduction in Hg emissions from 80 – 90% using ACI costs an additional \$500K! (reduction from 1.0 to 0.6 $\mu\text{g}/\text{m}^3$)

Accurately Measuring pptv - Levels of Mercury in Flue Gas

- $1 \mu\text{g}/\text{m}^3 \text{ Hg} = 112$ parts per trillion (v/v)
- Many potential interferences and losses.
- Tekran R&D spent 1998 to 2003 understanding flue gas mercury reactions in the laboratory – and we're still learning
- Mercury appears in different species
 - Elemental - Hg^0
 - Ionic - Hg^{2+}
 - Particulate-bound - Hg^{P}
- Detectors can only measure Hg^0

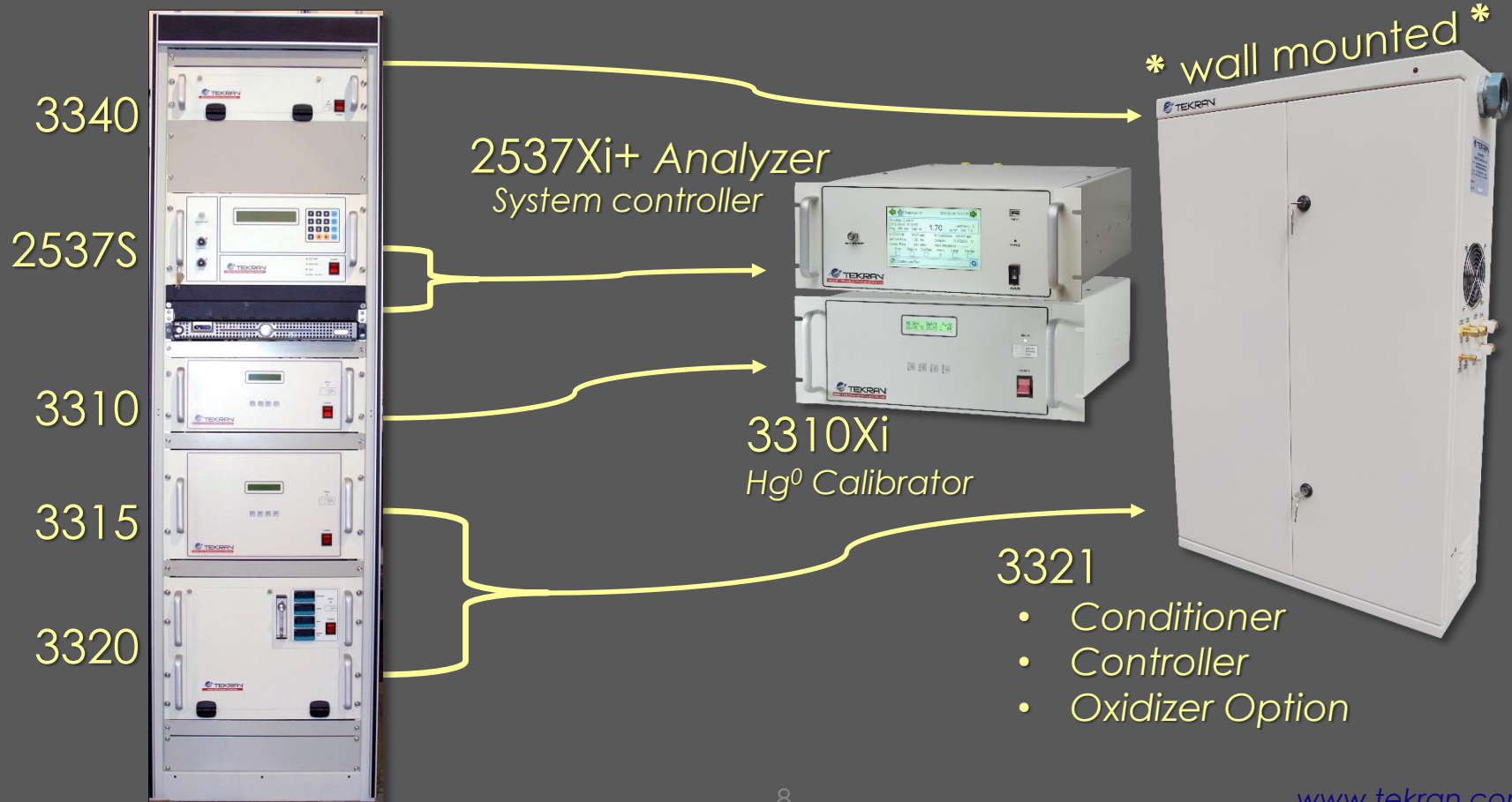


New 3300xi HgCEMS

Same trusted components with improved physical design

3300 HgCEM

3300Xi HgCEM



Tekran New Generation HgCEM System

3321 Sample Conditioner and Control Unit

Converter
Conditioner
Components



HgCl₂ Generator

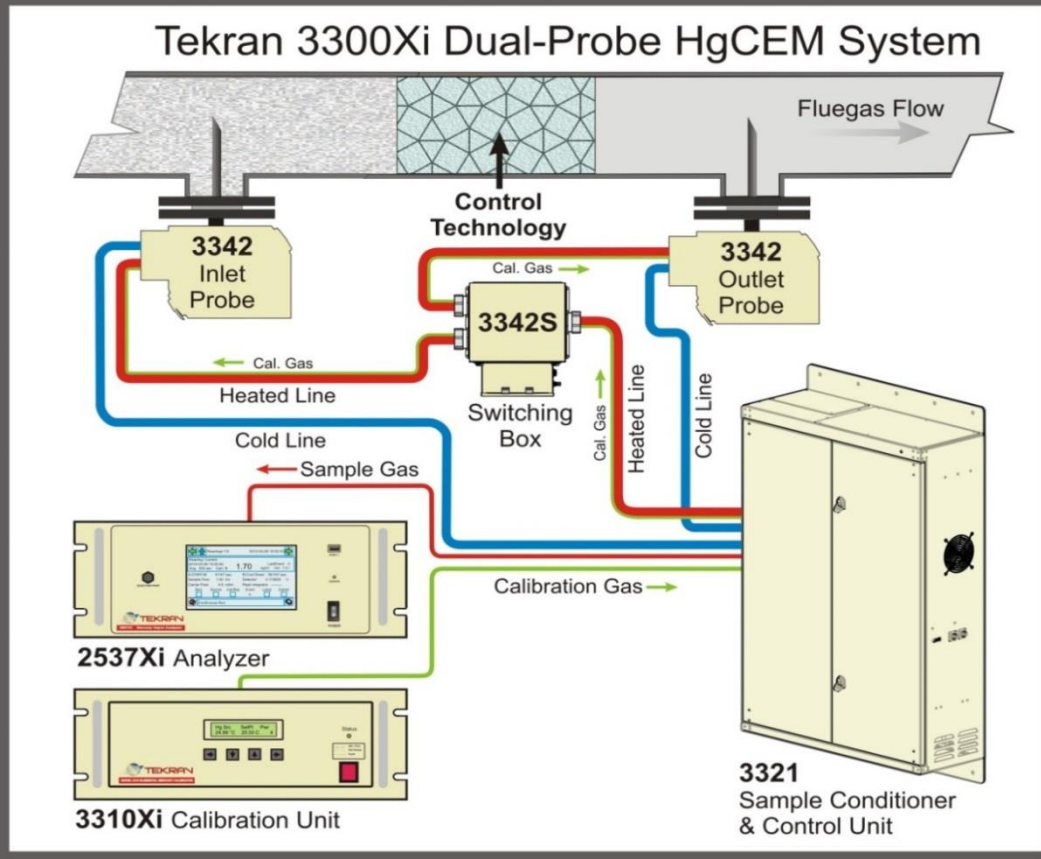
- Oxidizer Type
- Optional

- Modular Power Panel
- Modular Umbilical Heaters
- Probe Control Hardware
- Modular Electronics

Wall-mounted
- cabinet closed



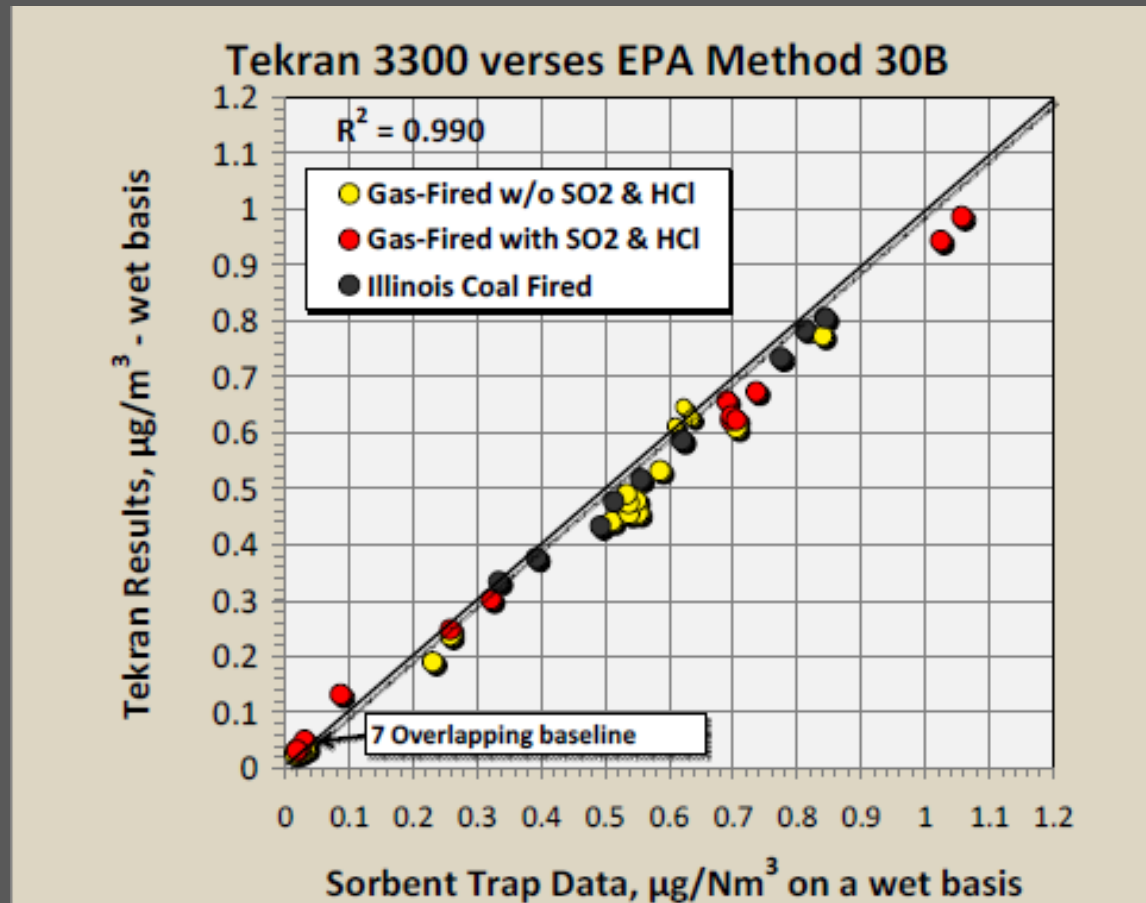
Tekran 3300Xi Dual Port Sampling



Applications:

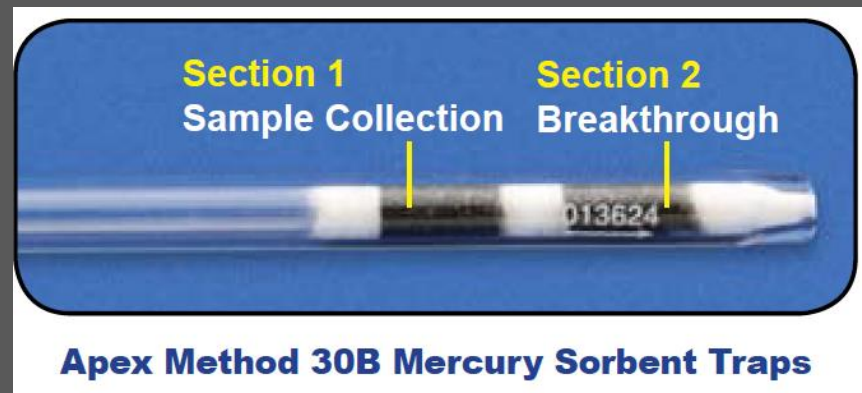
- Mercury control technology
 - Research and development
 - Acceptance testing at new installations
 - Optimization and performance monitoring
- Regulatory monitoring of multiple, close-proximity emissions stacks.

EERC Study Low-Level Measurements (funded by EPRI, ICCI, CATM)



Method 30B

- This method is only intended for use only under relatively low particulate conditions (e.g., sampling after all pollution control devices)
- This method is designed to measure the mass concentration of total vapor phase Hg in flue gas, including elemental Hg (Hg^0) and oxidized forms of Hg (Hg^{2+}), in micrograms per dry standard cubic meters ($\mu\text{g}/\text{dscm}$)
- Sorbent Traps have:
 - mineral wool section (intended for PM),
 - primary capture section,
 - secondary (breakthrough) capture section
 - final mineral wool section
- Hg^{P} that is captured in the trap is included in the analysis

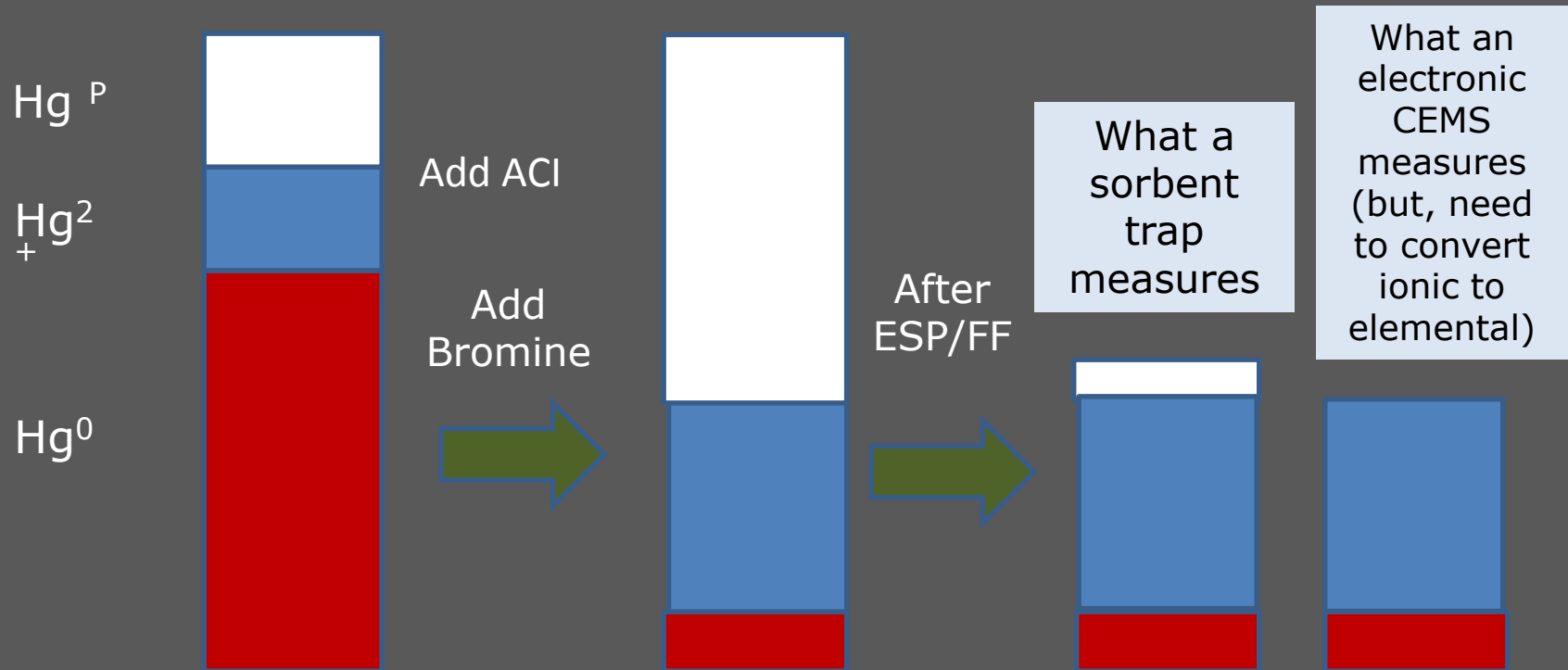


Andover Technology Partners

Why do plants use Activated Carbon Injection, Bromine, etc.?

ACI captures Hg^0 , Bromine helps oxidize Hg making it easier to capture on PM or in a scrubber.

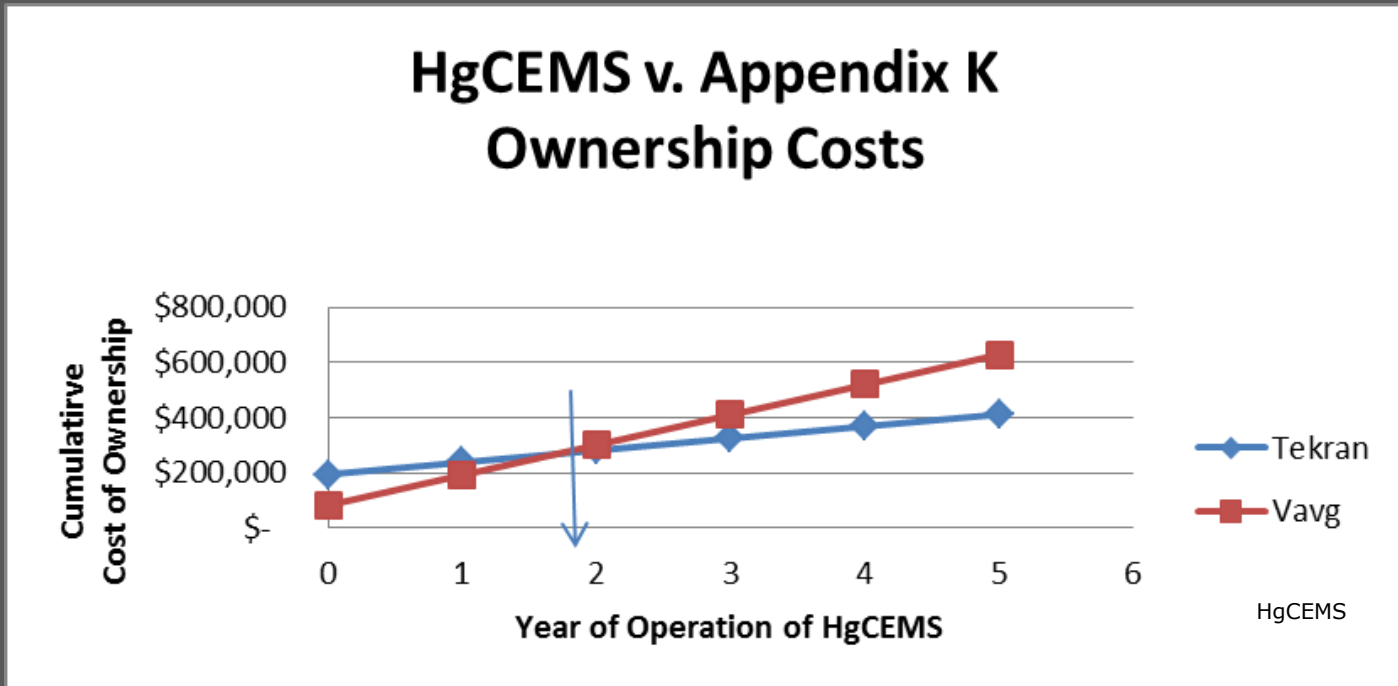
- Which increases the Hg content of the particulate!



The Electronic HgCEMS vs. Sorbent Trap

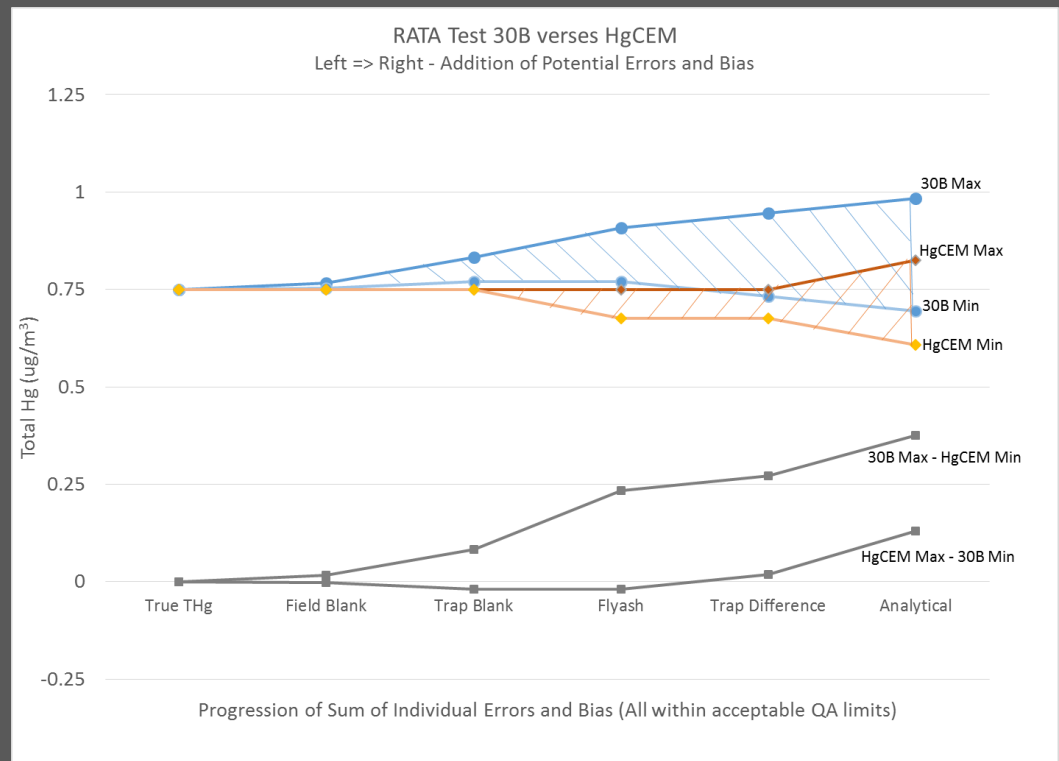
Feature	Electronic HgCEMS	Sorbent Trap
Capital Cost (including installation)	2+ times higher than Sorbent Trap	\$75-\$100K
Operations and Maintenance Costs (see next slide)	Lower than Sorbent Trap	-Requires routine retrieval and analyses of traps - Traps are consumables
Training and Complexity	Higher Level Training – more complex	-Comparatively simple to operate
Real-time feedback for Process and APCD	Valuable for “real-time” assessments and process feedback and control	- No capability for real-time feedback - data only available after days of exposure and analytical processing delays

The Electronic HgCEMS vs. Sorbent Trap Total Cost of Ownership

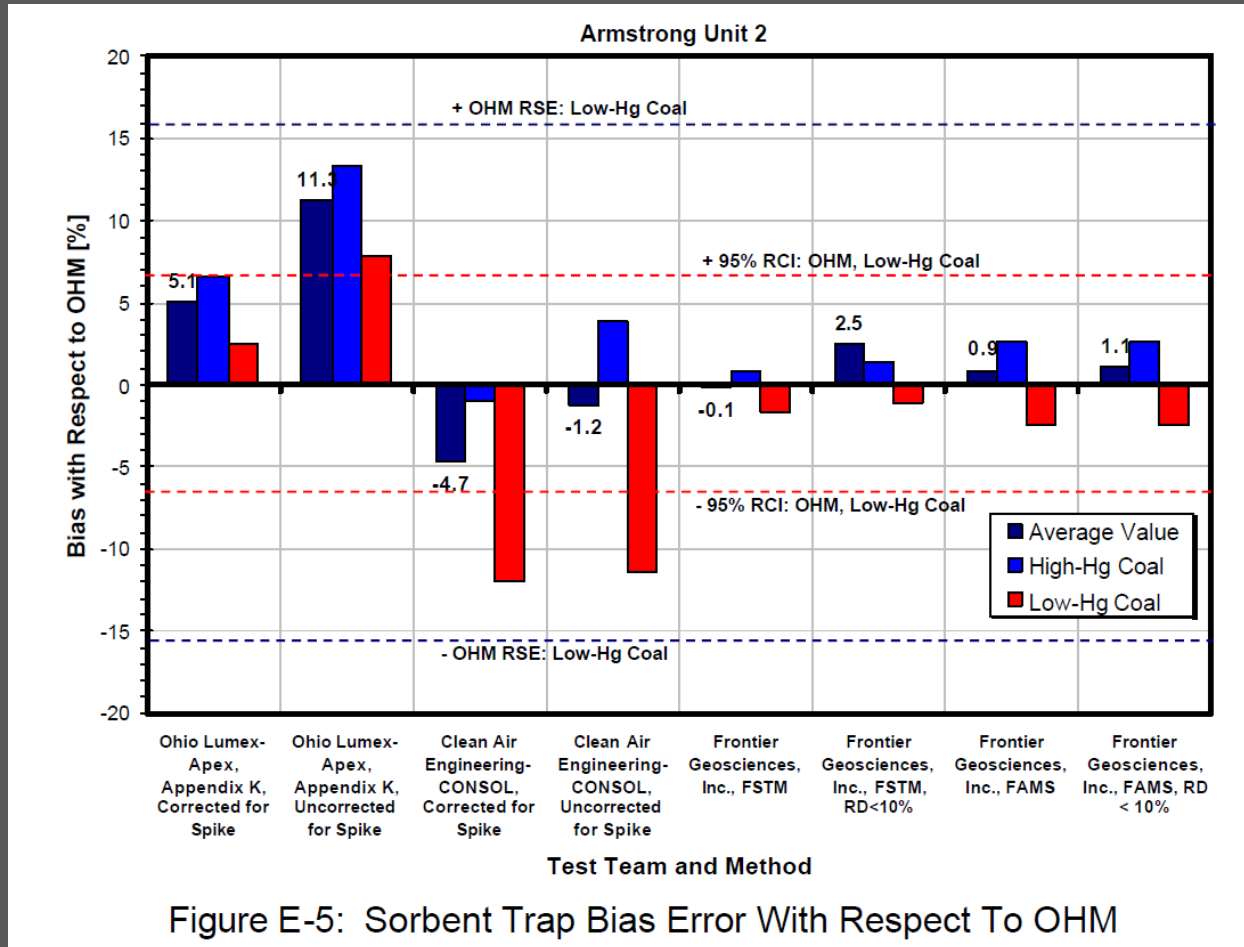


1. Sorbent Traps –no real-time perspective for Hg control
2. May overstate gaseous Hg emissions --Control \$ Impact?
3. Cost more to administer than Electronic HgCEM Systems
4. Still require Annual RATA

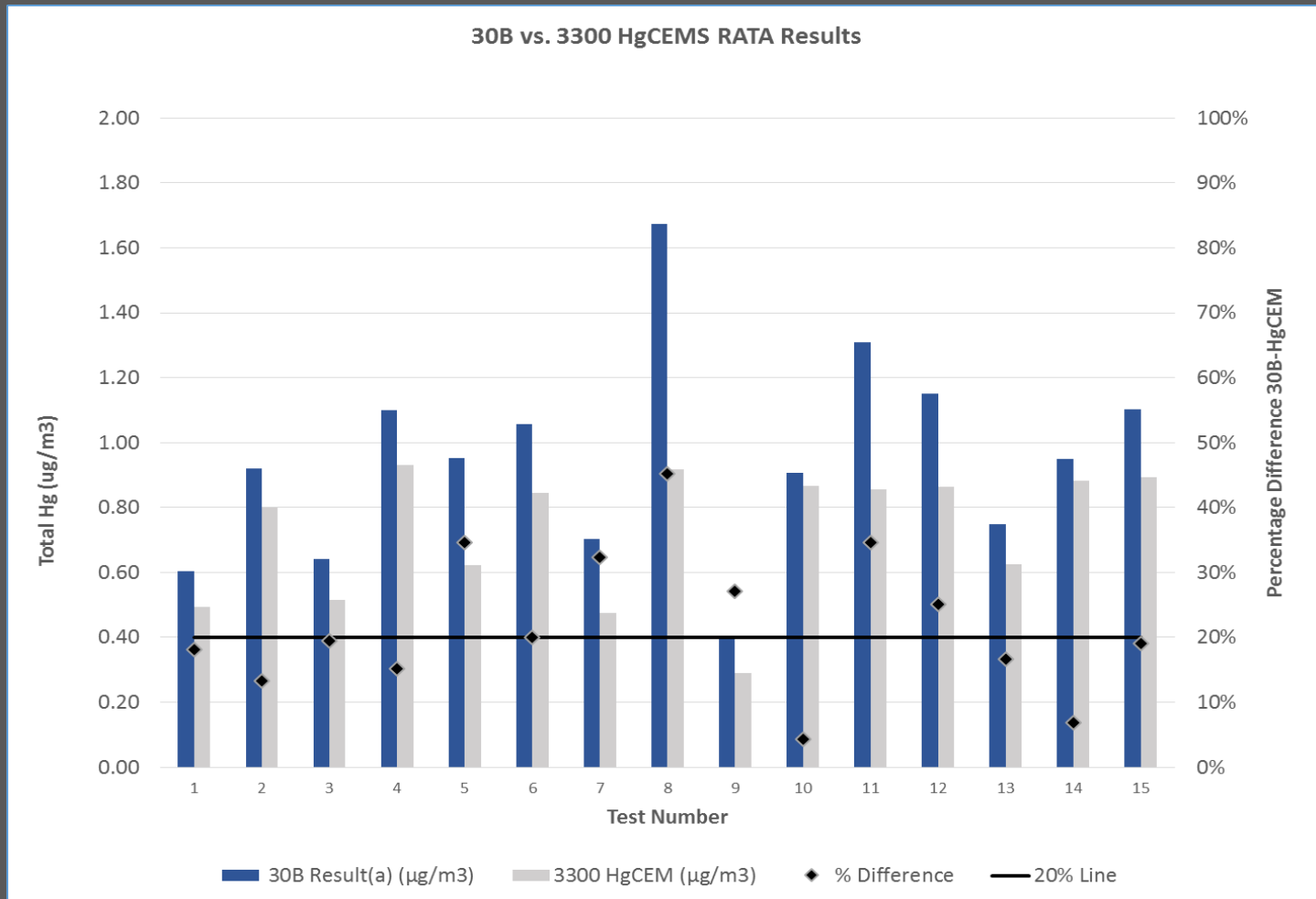
- The 30B mercury coming from field blank, trap blank and particulate are always positive and must always be included in the 30B Total Hg.
- For the HgCEM, mercury scrubbing by the flyash on the filter may cause a negative bias.
- Dual 30B trap difference and analytical for both can cause positive or negative bias.
- Worst case is 0.38 ug/m³ difference between methods that pass all QA criteria.



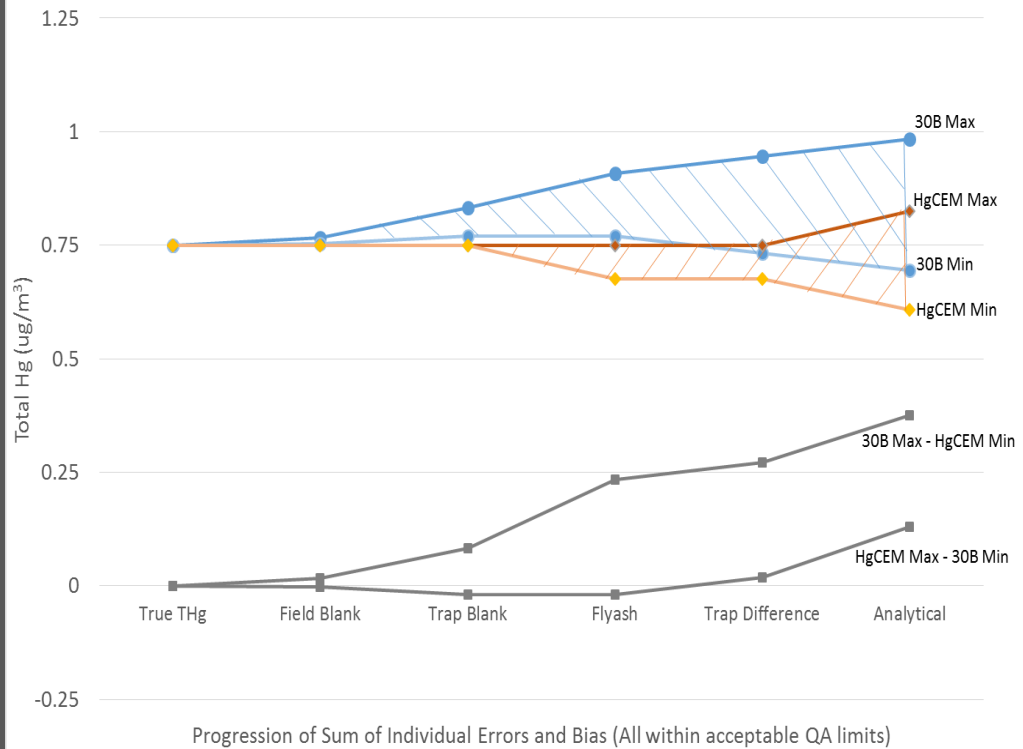
EPA Allegheny Armstrong Plant Comparison of Sorbent Trap Results



Comparative 30B and Electronic HgCEM System Measurements

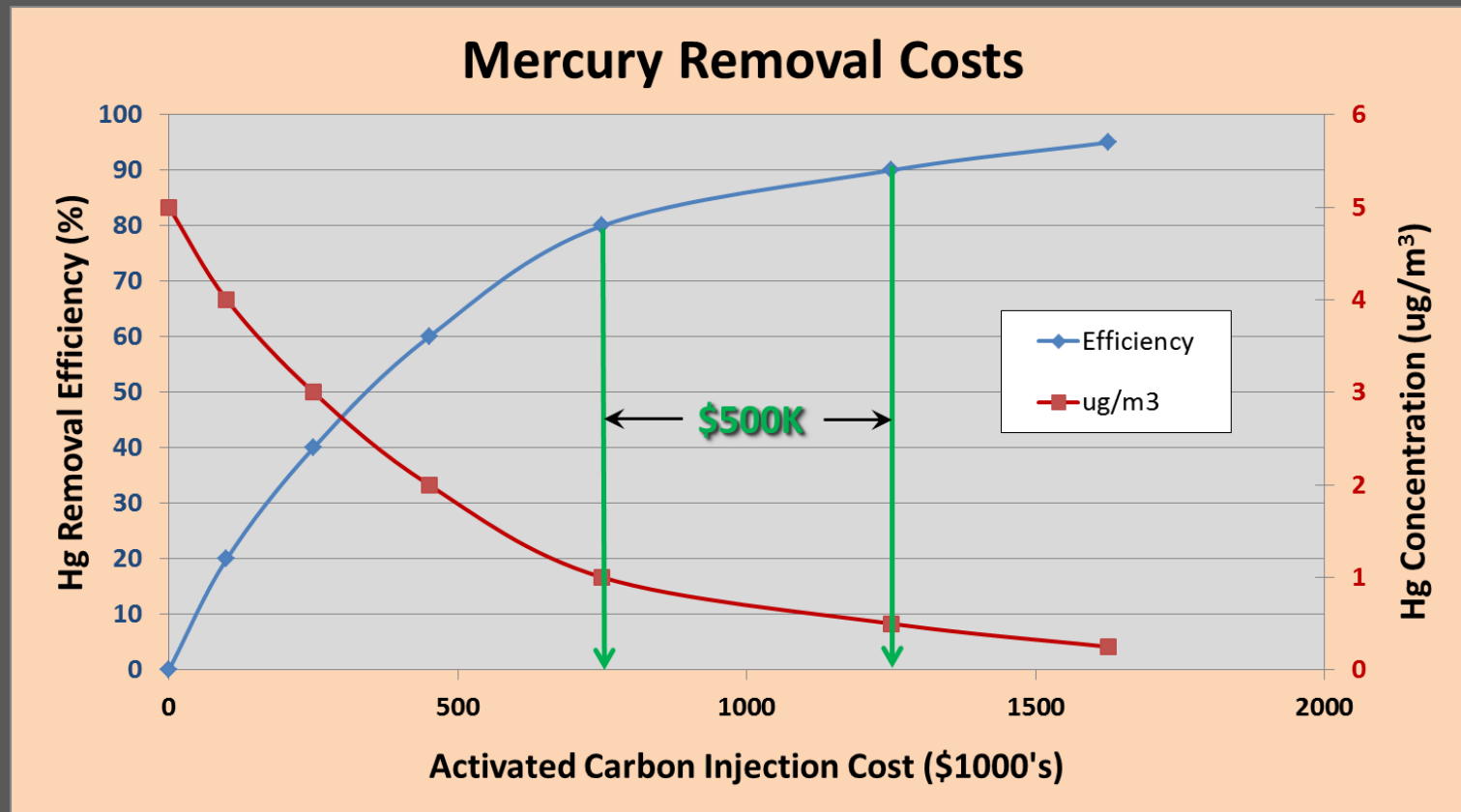


RATA Test 30B versus HgCEM
 Left => Right - Addition of Potential Errors and Bias



Economics of Hg Removal - 500 MWe Plant

Accurate Measurement and Traceability are Critical



Reduction in Hg emissions from 80 – 90% using ACI costs an additional \$500K! (reduction from 1.0 to 0.6 $\mu\text{g}/\text{m}^3$)

EPA PROPOSED RATA TOLERANCE UPDATES

17-February-2015

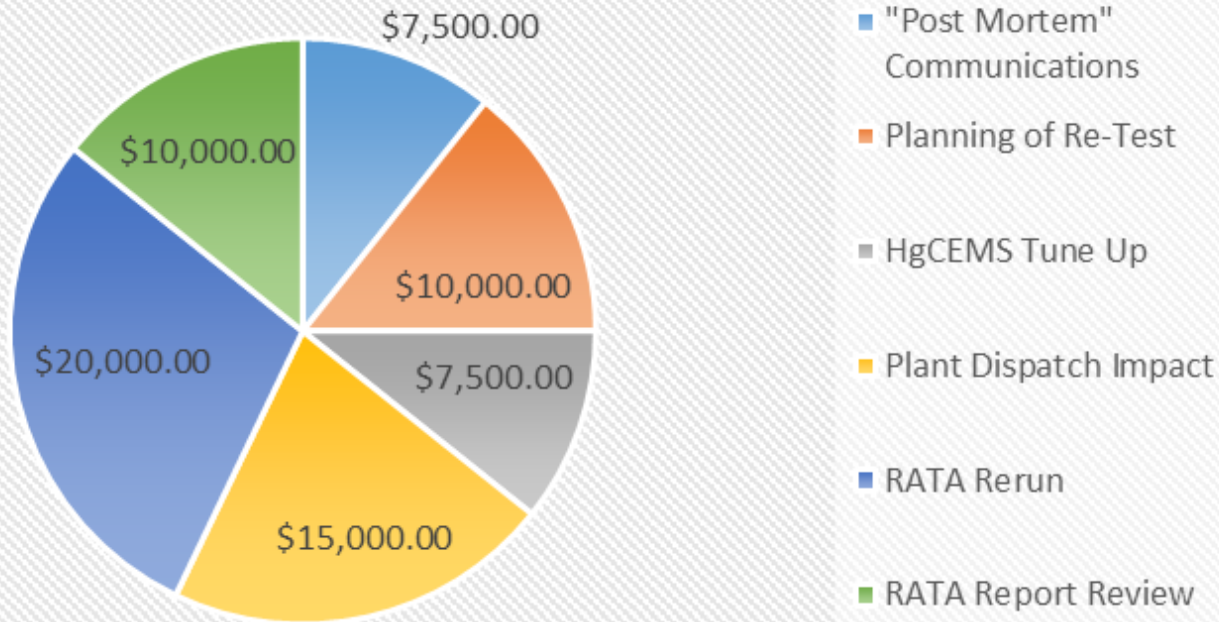
- If Hg Concentrations $>$ 50% of Emission Limit (i.e. $>$ ~ 0.75 $\mu\text{g}/\text{m}^3$) HgCEMS within **20%** of Method 30B
- If Hg Concentrations $<$ 50% of Emission Limit (i.e. $<$ ~ 0.75 $\mu\text{g}/\text{m}^3$) HgCEMS within **10%** of Emissions Limit (i.e. 0.15 $\mu\text{g}/\text{m}^3$)

Opinions –

- *above tolerances -not practical or based on current empirical information.*
- *Run off of “Top Ten” RATA testers on same stack would be insightful*

RATA "Do-Over" Dollars

RATA Rerun Expenses



Total Estimated Expense = \$70,000

Where Are We Now in the U.S.?

- New parameters to be measured including PM, Hg, HCl, THC
- Low-level measurements and Reference-Methods challenges and potential disconnects
- EPA Published Updates of EGU MATS 17-Feb-2015 – Federal Register – out for review.
- *We're all still learning.*
- EGU Compliance deadlines April 2015!
- PC MACT Compliance – Sept. 2015!

