Sorbent Enhancement Additive Mercury Capture Technology

Hot Topic Hour 04.11.13

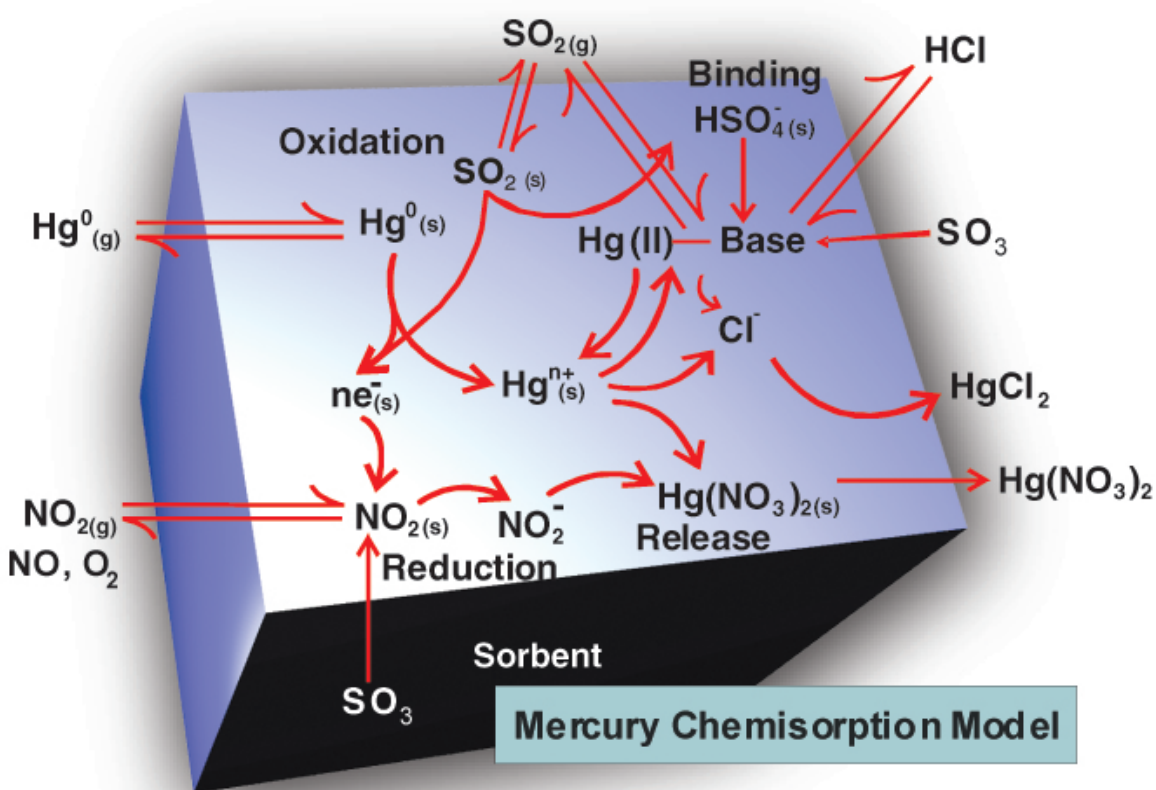
Marcus Sylvester
VP Sales
Midwest Energy Emissions Corp

Plant Considerations
Hg Control Program Goals

* Meet Hg Capture Levels (MATS Rule)
* Program Economics - Lowest "Total" Cost Program
* Minimize impact to fly ash/gypsum sales
* Ability to adjust to high variability of Hg content
* Least Balance of Plant Effects

ME2C
Midwest Energy Emissions Corp

Mercury–Sorbent Interactions



The UND- EERC's chemisorption model for mercury–flue gas interactions with sorbents is both descriptive and predictive.

Based on years of CATM research and empirical data, it shows the interactions involved in mercury capture by sorbents. Understanding ***competing*** flue gas interactions is critical.

ME2C
Midwest Energy Emissions Corp

ME2C Total Mercury Control Program

* **Patented (2 Chemical) approach to Mercury Capture**
  * (Key Patents #'s – 7,435,286; 8,168,147; & 8,312,822)

* **Sorbent Enhancement Additives** (Front End)
  * Proprietary Chemicals
  * Designed to Promote and Protect activated sites
  * Distribute chemical throughout furnace system

* **Sorbent** (Back End)
  * Proprietary Chemicals
  * Provide active capture sites for mercury adsorption
  * Protect activated capture sites

ME2C
Midwest Energy Emissions Corp

Challenging Scenarios for Hg Capture

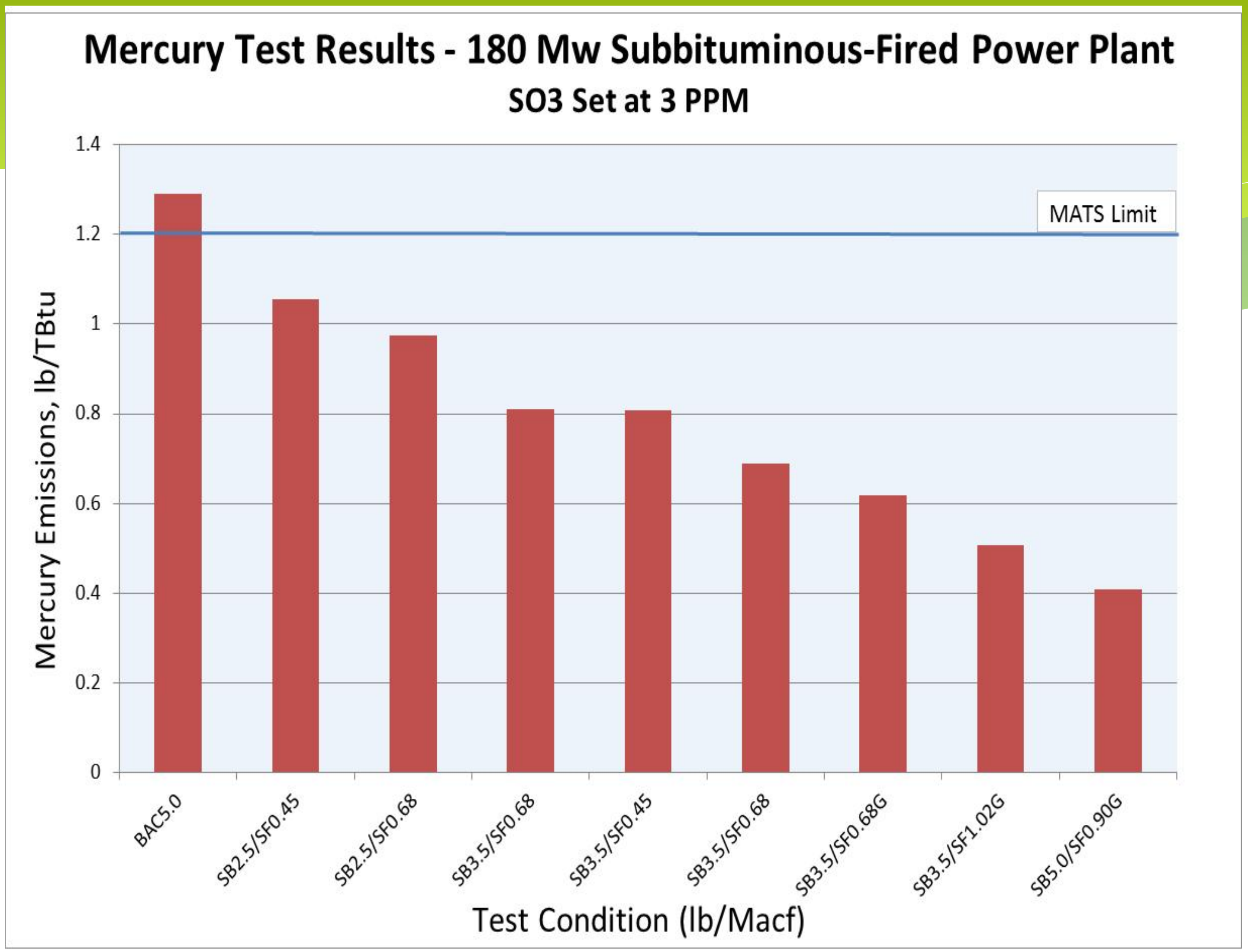
* Case #1 – SO_3 Injection for Fly Ash Resistivity
* Case #2 – Highly Variable Hg Concentration
* Case #3 – APC Design Challenges

Midwest Energy Emissions Corp

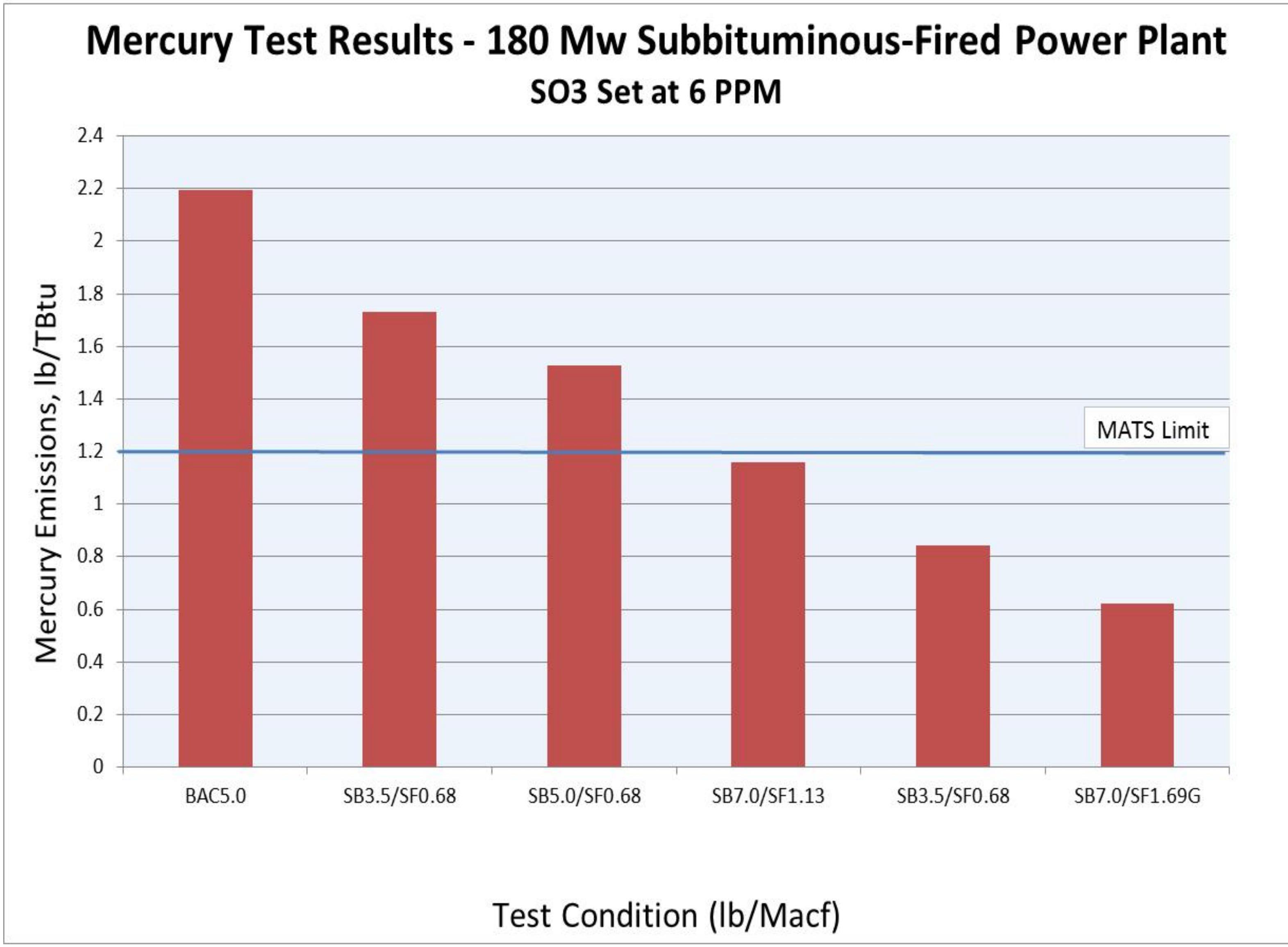
Case #1 - Challenges

* SO_3 Injection for Fly Ash Resistivity
* ESP Loading (Opacity Derates)
* Program Economics

ME2C
Midwest Energy Emissions Corp



ME2C
Midwest Energy Emissions Corp


Mercury Test Results - 180 Mw Subbituminous-Fired Power Plant
SO3 Set at 6 PPM
Mercury Emissions, lb/TBtu
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
MATS Limit
BAC5.0
SB3.5/SF0.68
SB5.0/SF0.68
SB7.0/SF1.13
SB3.5/SF0.68
SB7.0/SF1.69G
Test Condition (lb/Macf)

Case #1 - Summary

* ME2C Program Able to Meet MATS in presence of SO3
  * 0 ppm, 3 ppm, 6 ppm, & 12 ppm
* Reduced Material Loading on ESP – 50%
  * No Opacity Derates
  * Potential to lower SO3 injection rate
* Reduced Program Costs by 40%

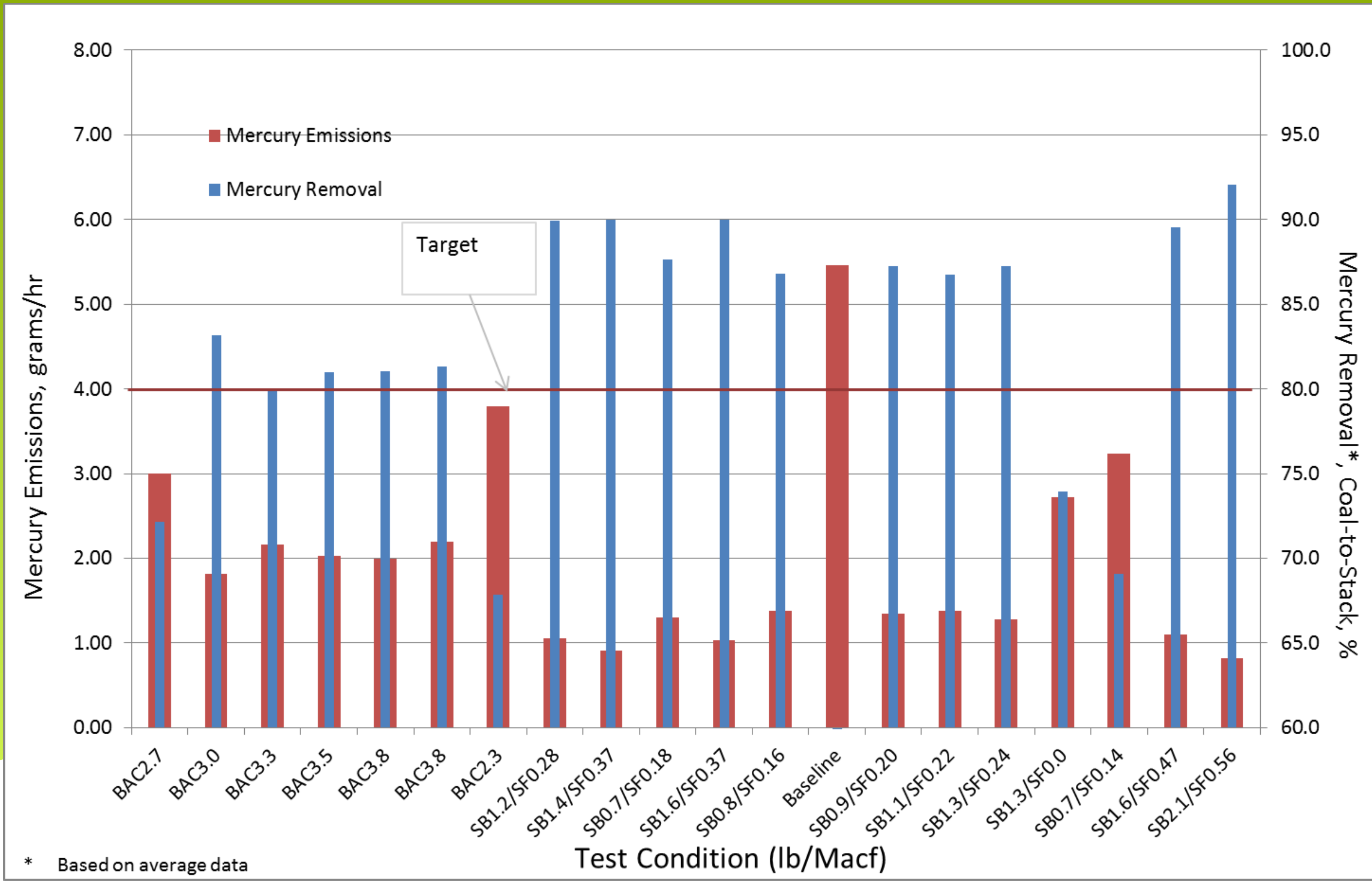
ME2C
Midwest Energy Emissions Corp

Case #2 - Challenges

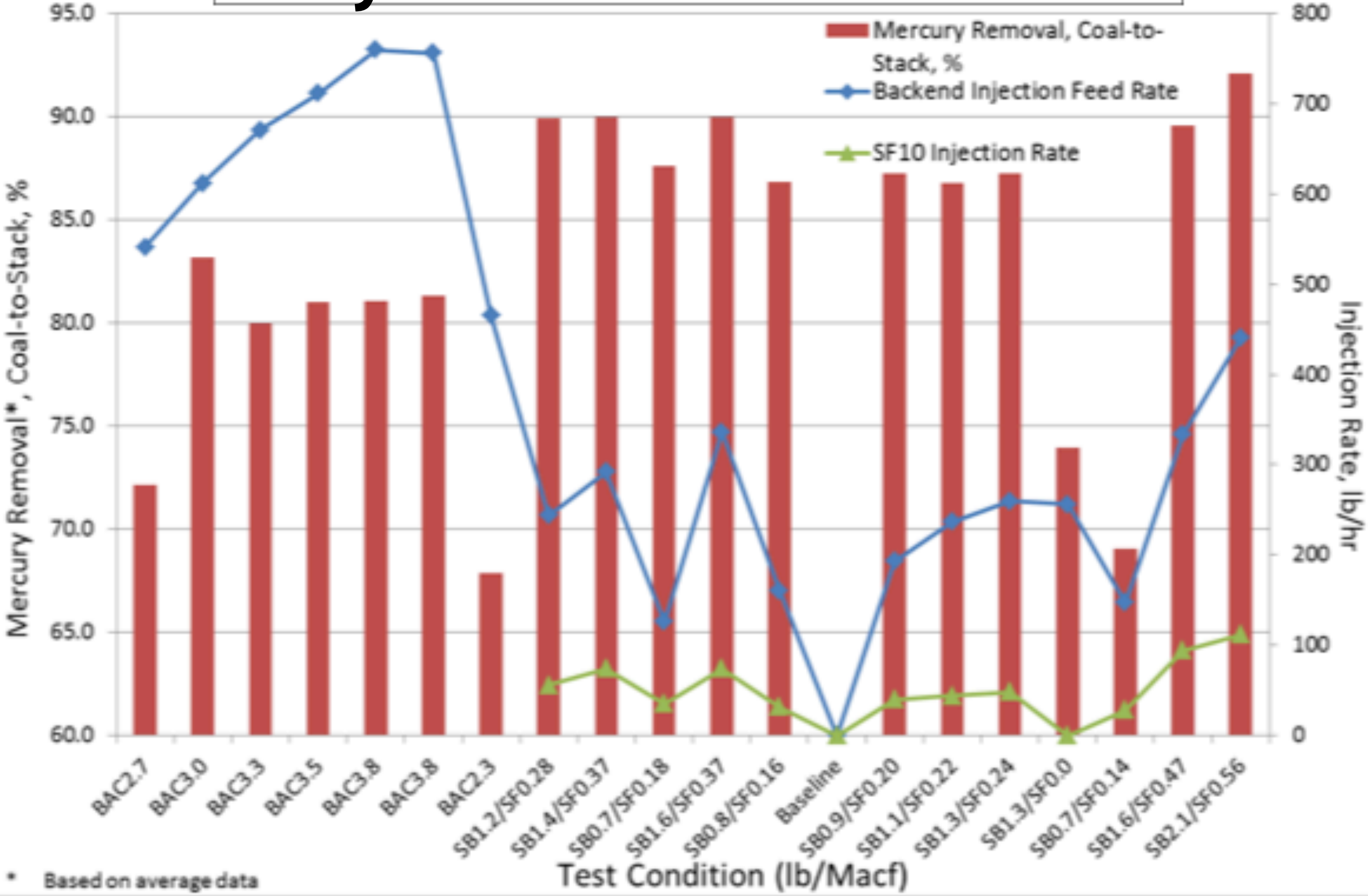
* Coal Mercury Concentration Levels
* Opacity Concerns (ESP Loading)
* APH Corrosion (Localized)
* Fly Ash Sales
* Program Economics – too high

ME2C
Midwest Energy Emissions Corp

Case #2 - Mercury Reduction



Mercury Test Results – Feed Rates



* Based on average data

Case #2 - Summary

* Coal Mercury Concentration
    * (0.06 – 0.15 ppm)
* ESP Loading
    * Injected Material Reduced by 66%
* Fly Ash Sales
    * Reduced LOI from ~1.6% to ~0.9%

* Program Economics
    * Reduced Program Costs by 49% ($2,500,000 savings)

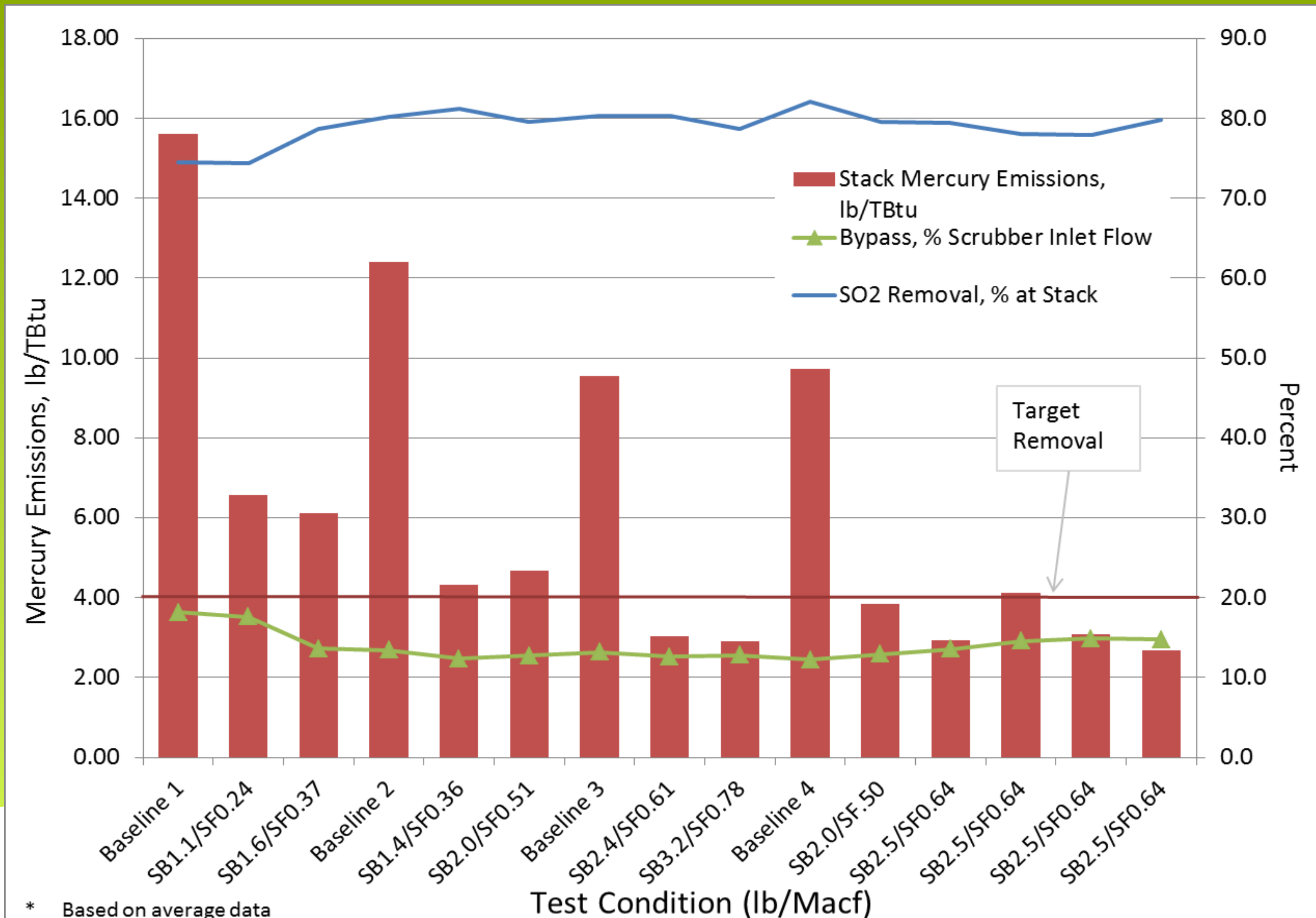
Midwest Energy Emissions Corp

Case #3 - Challenges

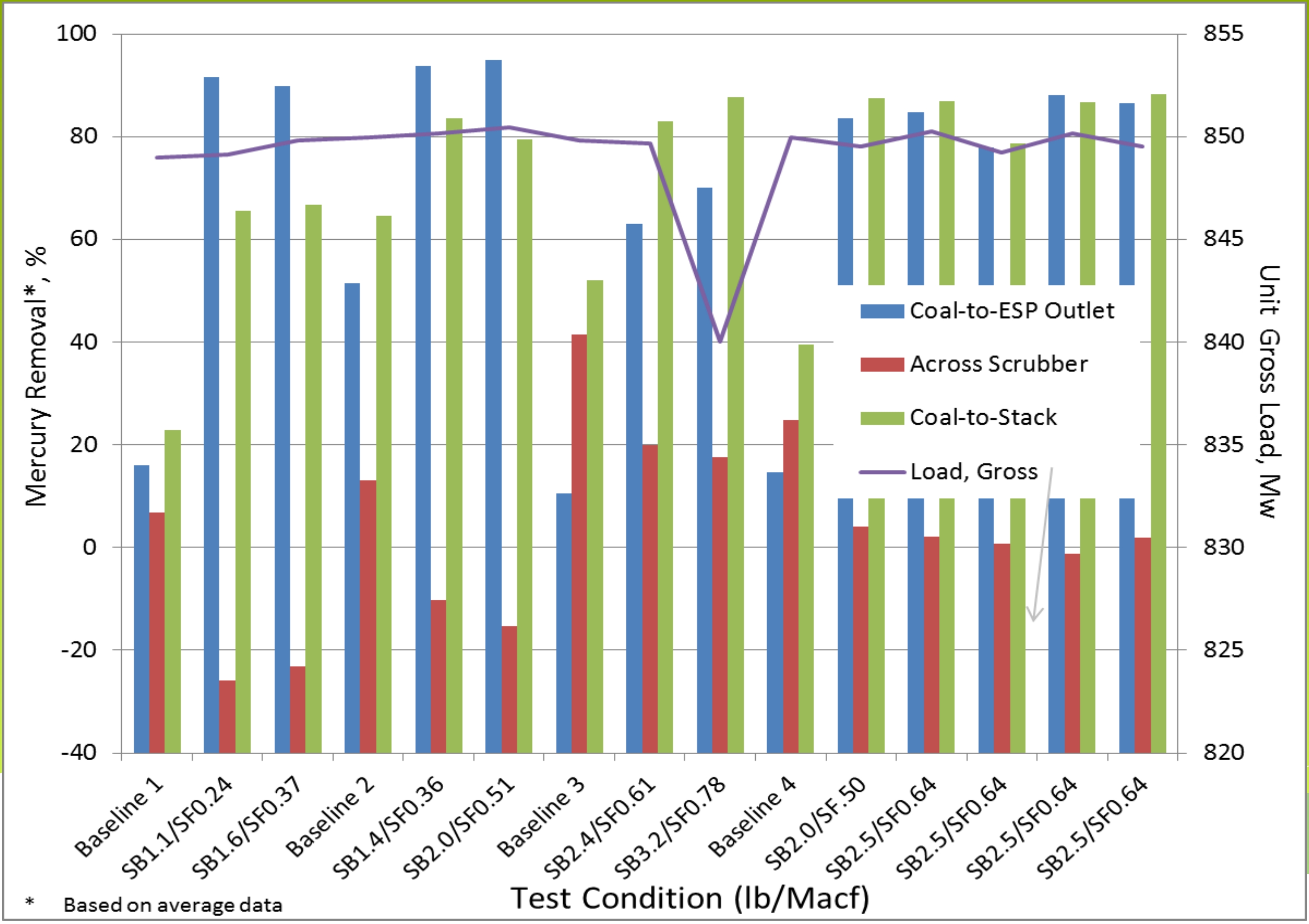
* Lignite Blend
* Coal Mercury Concentration Levels
* Scrubber Bypass Operation
* Complex APC Design

Midwest Energy Emissions Corp

Mercury Test Results – Scrubber Bypass



Mercury Test Results Across APC Devices

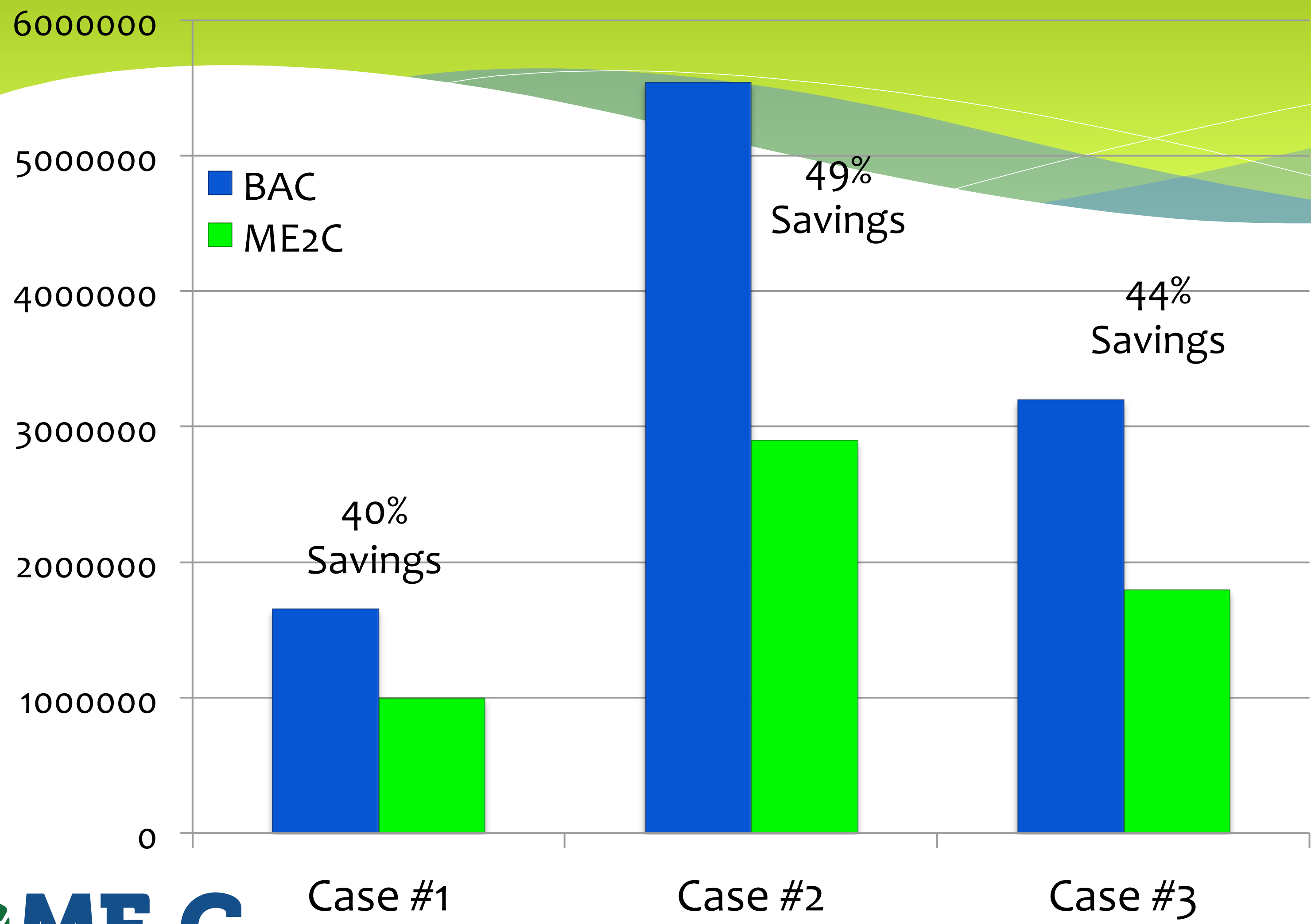


Case #3 - Summary

* Unit was able to achieve MATS Compliance
* Dose Rate was Low – ***Superior Economics***
* Incoming Hg Concentrations not a problem
* Scrubber Bypass is key – must remove in ESP

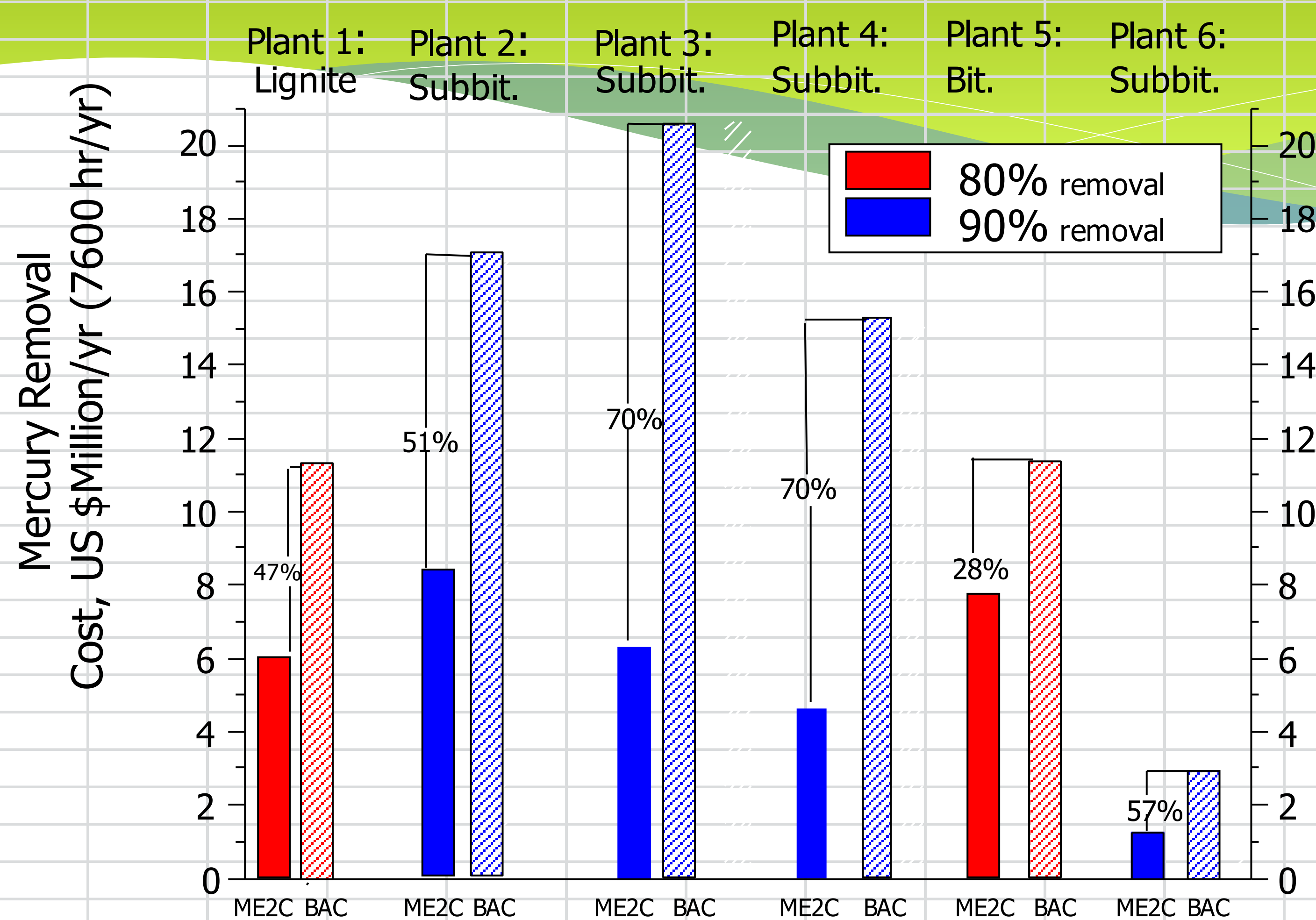
Midwest Energy Emissions Corp

Program Economic Summary



ME2C
Midwest Energy Emissions Corp

Economic Summary
ME_2C vs. Brominated Activated Carbon (BAC)



Midwest Energy Emissions Corp

ME2C
Program Summary

* Most Cost Effective Program
  * (~40 - 50% savings over BAC)
* Capture Rate over >92% Achieved
* Fly Ash/Gypsum Sales Preservation
* Ability to Respond to Coal Concentration Variations
* No Balance of Plant Impacts

ME2C
Midwest Energy Emissions Corp

Thank You

Marc Sylvester

msylvester@midwestemissions.com

(480) 235-0974

Midwest Energy Emissions Corp