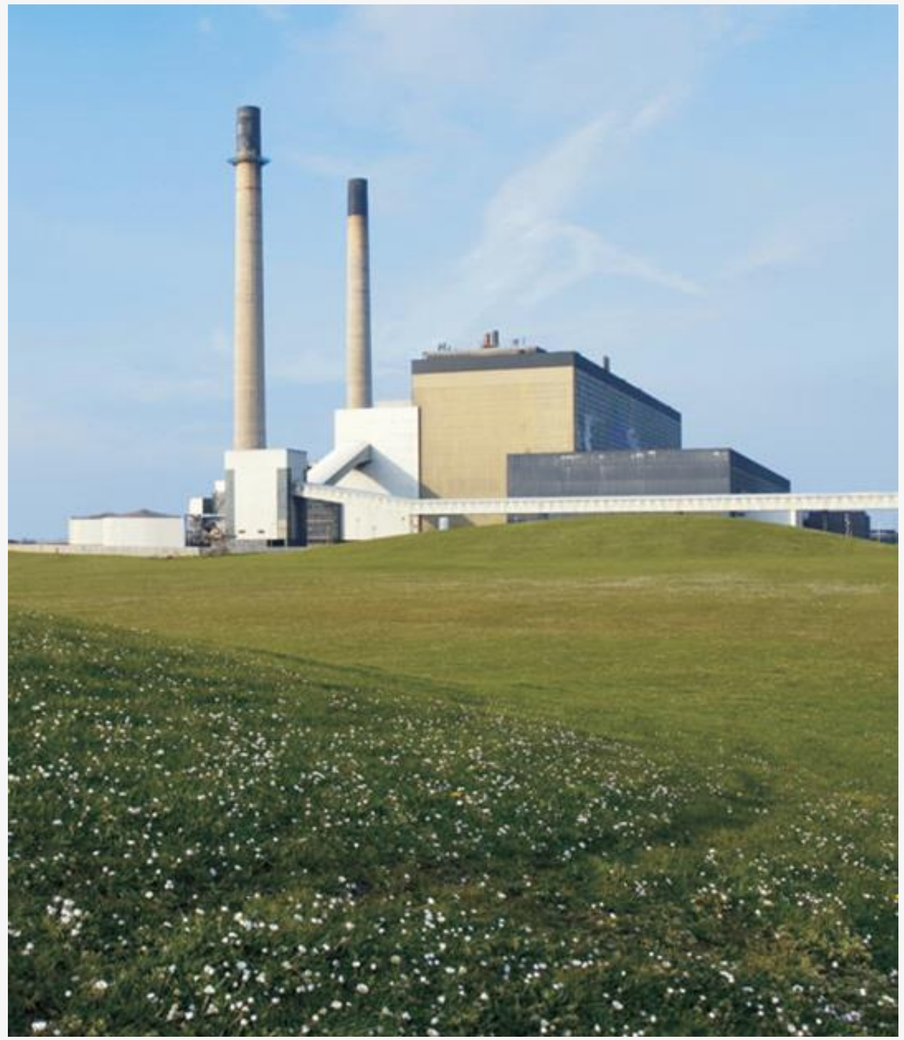
Nalco’s Metals Management Technologies



JOHN MEIER

Director of Marketing
Metals Management Group

02. US MATS Implementation

- Reduce Emissions Below 1.2 lb/TBtu
- Nalco has installed base of over 60 GW
  - ✓ *Have Performed over 100 demonstrations.*
  - ✓ *MerControl 8034 Plus & MerControl 7895*
- Most comply without ACI
  - ✓ *83.2% of China Power has SCR*
  - ✓ *Avoid SO_3 Interference*
  - ✓ *Avoid Particulate Impact*
  - ✓ *Avoid By-product Degradation*

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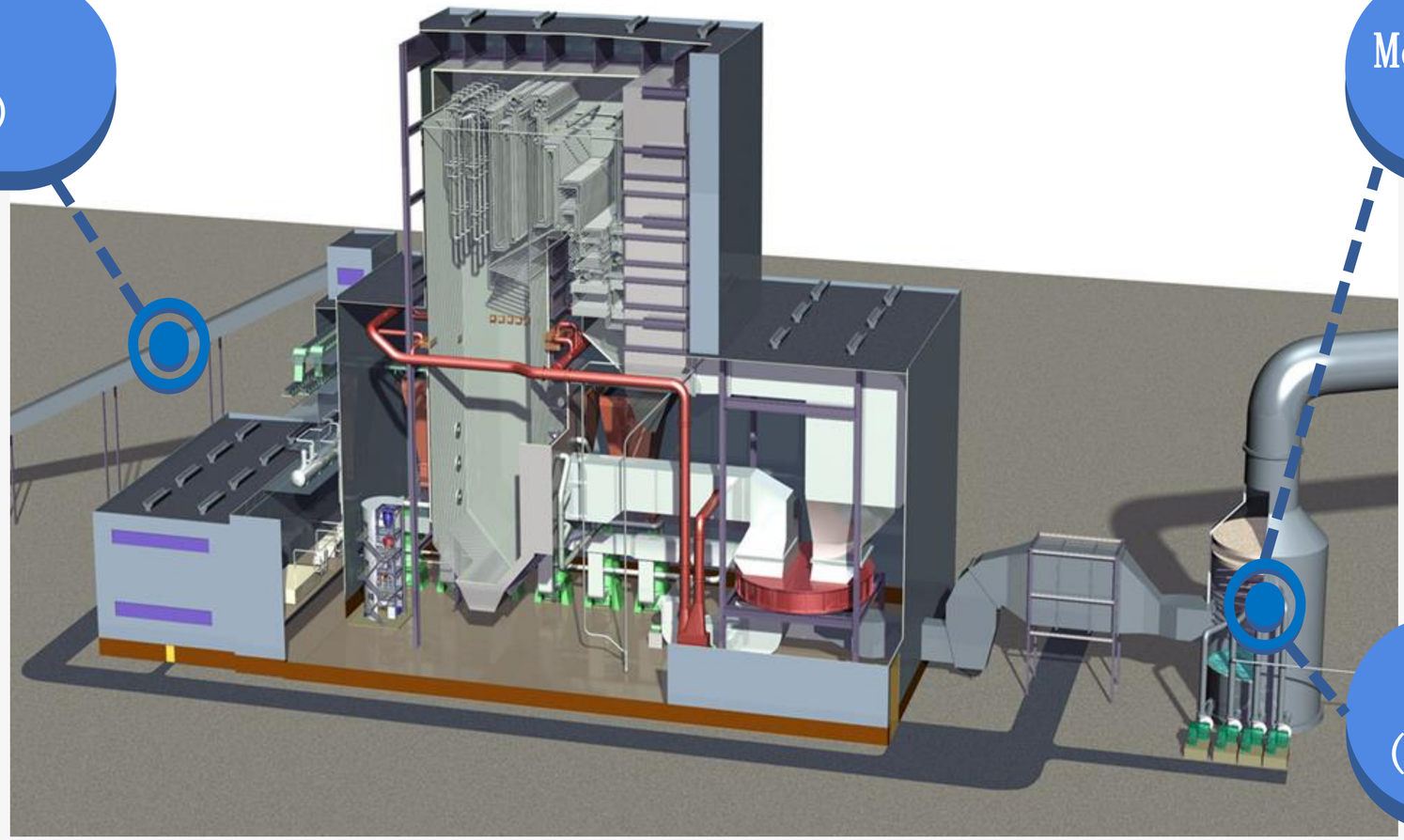
03. Metals Management Technologies

Fuel Additives
(MerControl 7895)



MerControl™ 8034 Plus
(Controls Reemission)

Nalmet™ 1689
(Wastewater Hg Control)

04. Mercury Capture Principles

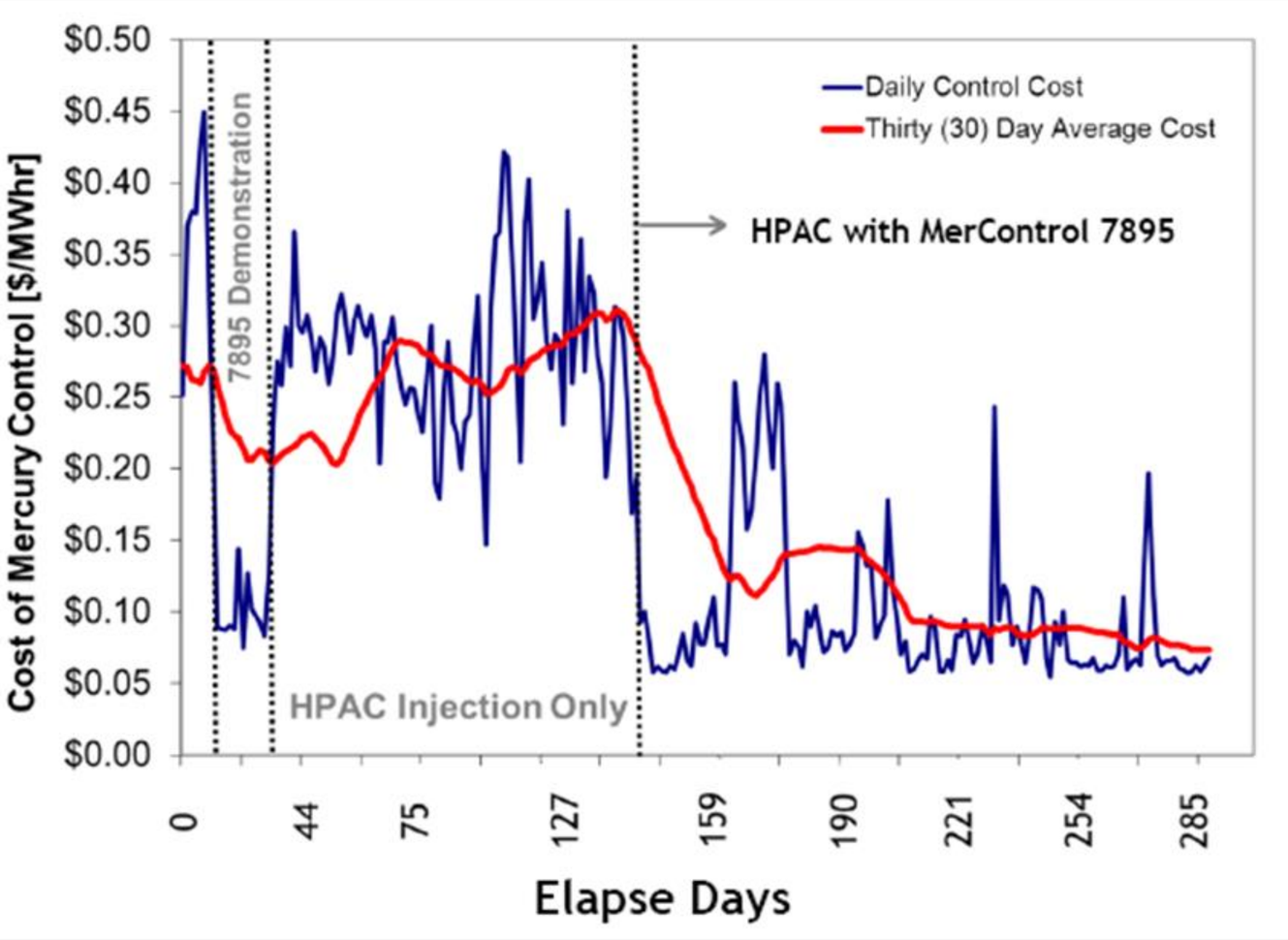
- All Mercury Control[1] Requires Oxidized Mercury
  - ✓ *Inherent Oxidation (Chlorine in Fuel, SCR)*
  - ✓ *Halogen Addition ($CaBr_2$)*
  - ✓ *Halogenated Carbon (Darco Hg-LH, etc.)*

Maximize Oxidation
(Maximize Co-Benefit)

- Now where does it go?
  - ✓ *Without Acid Gas Control*
    - ➢ *Particulate Formation (LOI/ACI, FF/ESP)*
  - ✓ *With Acid Gas Control (wFGD)*
    - ➢ *Scrubber Liquor*

[1]Typical coal-fired flue gas conditions.

05. Optimized Mercury Control



- Plant Configuration
  - ✓ *PRB, SCR, SDA, Fabric Filter, 580 MW*
- Overview
  - ✓ *Brominated Activated Carbon Alone*
  - ✓ *Changed to 7895 w/ ACI (Br Carbon)*

Condition	HPAC (lb/MMacf)	BA (ppmw)	$/yr
HPAC only	1.65		$1.45MM
HPAC+BA	0.25	28	$0.36MM
Savings			**$1.09MM**

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06. Mercury Capture Principles

- All Mercury Control[1] Requires Oxidized Mercury
  - ✓ *Inherent Oxidation (Chlorine in Fuel, SCR)*
  - ✓ *Halogen Addition (SCR + $CaBr_2$?)*
  - ✓ *Halogenated Carbon (Darco Hg-LH, etc.)*

Maximize Oxidation
(Maximize Co-Benefit)

- Now where does it go?
  - ✓ *Without Acid Gas Control*
    - ➢ *Particulate Formation (LOI/ACI, FF/ESP)*
  - ✓ *With Acid Gas Control (wFGD, SDA, CDS)*
    - ➢ *Scrubber Liquor, Solids, etc.*

Maximize Scrubber Efficiency

[1]Typical coal-fired flue gas conditions.

07. Mercury Reemission – MerControl 8034 Plus

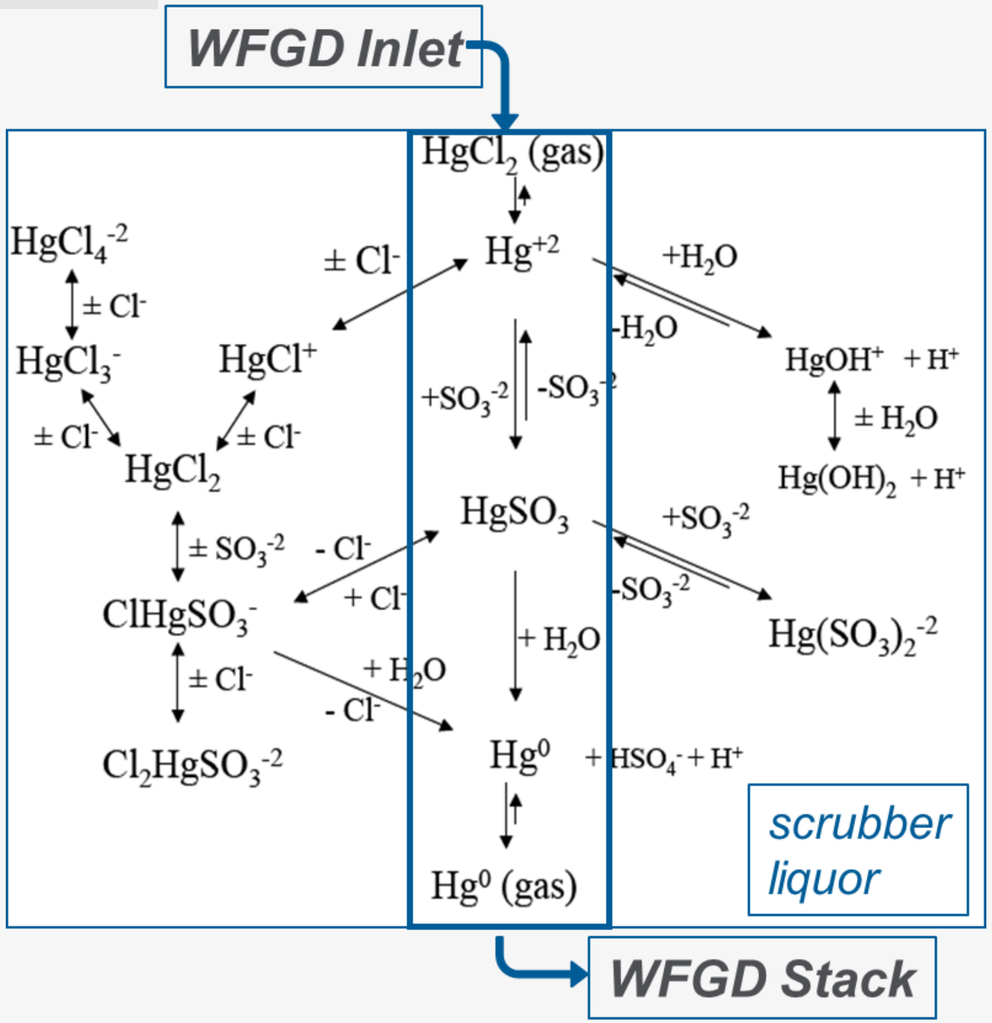
What is reemission?

- ✓ *Oxidized mercury (Hg) is soluble in water (4.8g/L at 68℉) and therefore can be removed from flue gas by a WFGD*
- ✓ *However, oxidized Hg can be reduced to elemental Hg within the WFGD. Elemental Hg is only slightly solubility in water (0.056 mg/L at 68℉). The result is lower Hg capture efficiency.*

MerControl 8034 Plus

- ✓ *Reduces mercury reemission up to 100%*
- ✓ *Consistently outperforms competitive technologies*
- ✓ *Reduces stack emissions without compromising gypsum quality.*
- ✓ *Patented technology*

08. Mercury Reemission – Chemistry



- Scrubber Operations impact magnitude.
- Some known variables include: pH, sulfite, oxidation, etc.
- Roughly 40% of US wFGDs have some level of mercury reemission.

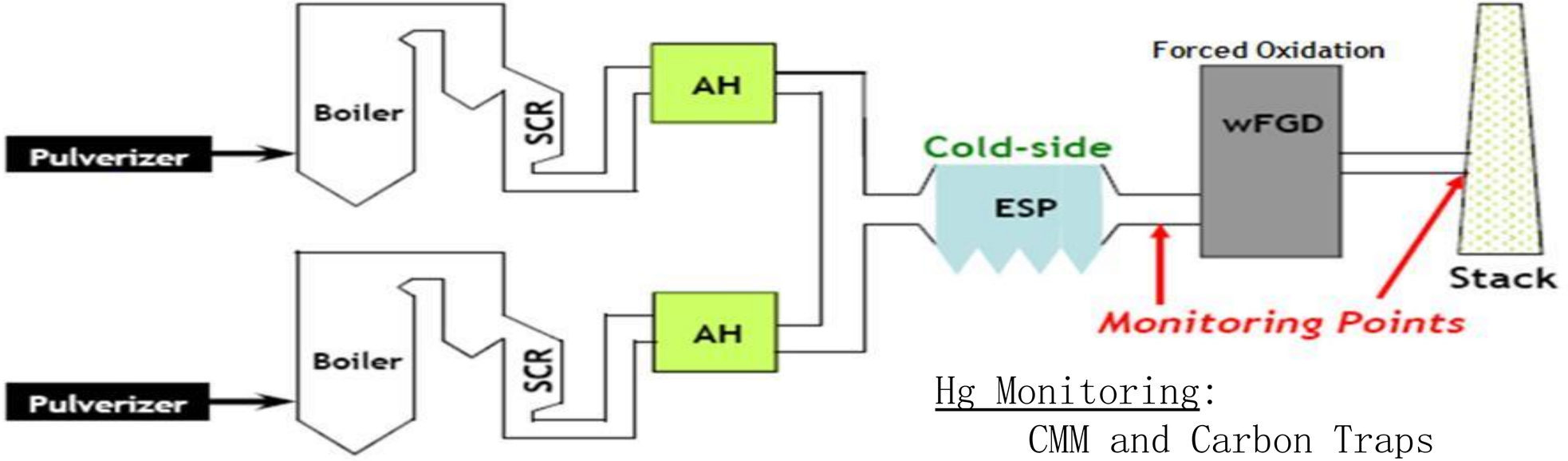
09. Hg Capture via SCR and WFGD *Multiple Boilers*

Site Description:

- Chlorine* = 1200 ppm (max = 1400)
- Mercury* = 0.05 ppm (max = 0.06)

*= AR value

- Full Load = Total 140 MWe
- Fuel = High Chlorine Bituminous
- AQCDs = SCR, cold-side ESP and w-FGD



Hg Monitoring:
CMM and Carbon Traps

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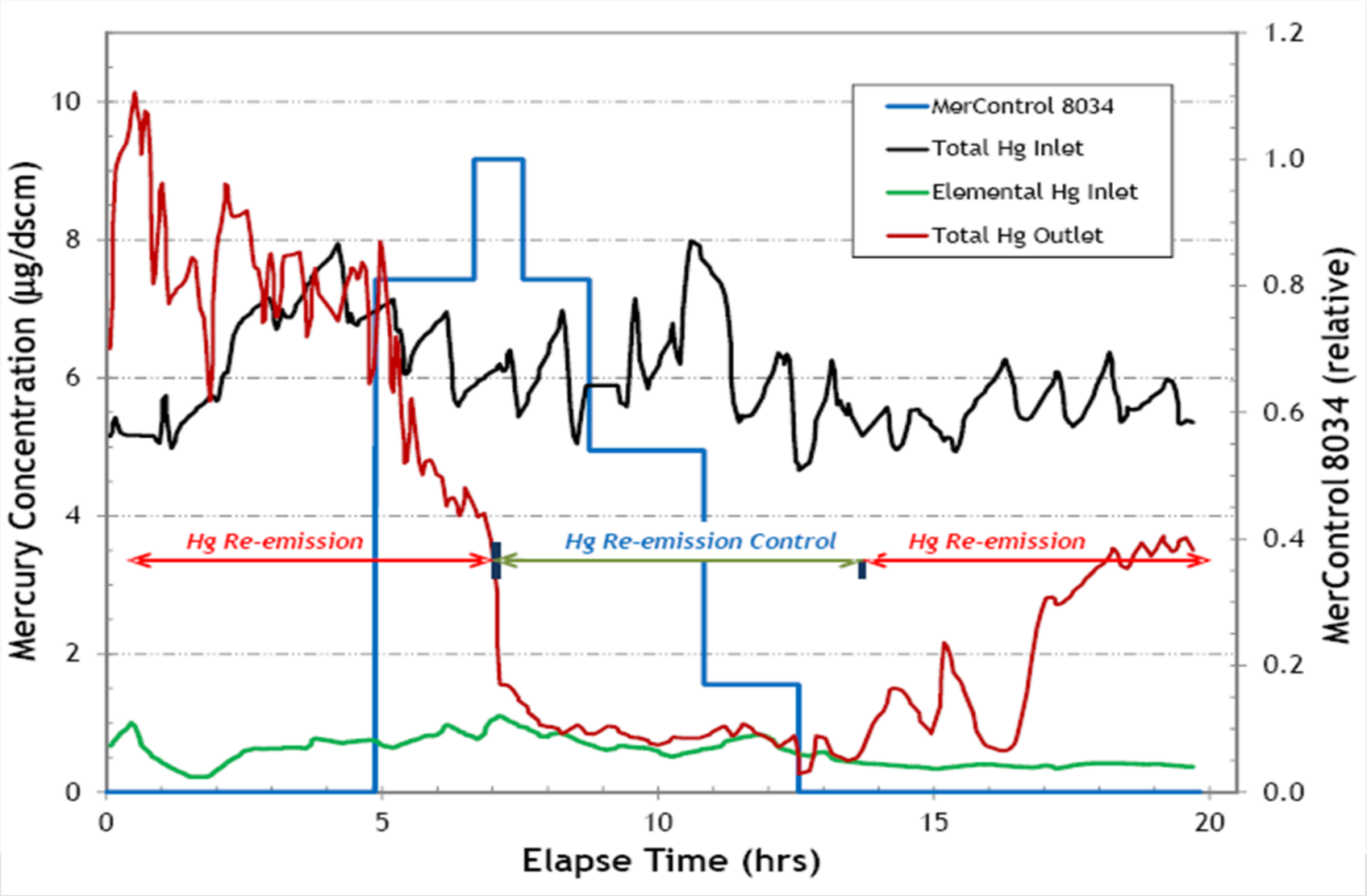
10. Hg Capture via SCR and WFGD *Multiple Boilers*



11. Hg Capture via SCR and WFGD *Multiple Boilers*

Performance:

Comparison	Elapse (Hrs)	Percent			
		Oxidation	Re-emission	Capture	wFGD Efficiency
Baseline	0-5	90.8 ± 3.3	99.4 ± 35.7	-27.6 ± 29.1	-30.9 ± 33.7
MerControl 8034	10-13.5	90.0 ± 2.4	11.3 ± 31.2	88.2 ± 3.2	98.0 ± 2.9
No additive	18-end	93.0 ± 0.4	30.9 ± 1.9	38.7 ± 4.4	41.6 ± 4.7

During periods of MerControl 8034 Technology application Hg re-emission was near *zero* and capture was *greater than 90%*.

12. Hg Capture via SCR and WFGD *Multiple Boilers*

Balance of Plant:

- Scrubber solids analyzed and pass TCLP leaching test
- No effects observed on SO_2 capture
- No effects observed on normal plant operation
- No effects observed on downstream equipment
- Gypsum quality not generally impacted (improvements have been observed). Dependent on unit operations.

13. Conclusions

- Maximize Co-benefit
  - ✓ *LOI*
  - ✓ *SCR*
  - ✓ *Acid Gas Scrubber*
- Understand Plant Operations/Limitations
  - ✓ *Load Profile*
  - ✓ *SO_3 Concentrations*
  - ✓ *Particulate & Acid Gas Removal Rates*
  - ✓ *By-Product Utilization*

Questions?

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