

REINHOLD ENVIRONMENTAL Ltd.



**2015 APC Round Table
& Expo Presentation**

July 13 & 14, 2015, in Atlanta, GA / Hosted by Southern Company

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Hydrated Lime DSI for **MORE THAN** MATS Compliance

Reinhold APC Round Table

July 14, 2015

Mitch Lund – Nol-Tec Systems

Carl Laird – Carmeuse Lime



Agenda

- Who is Carmeuse Lime?
- What Complements Hydrate DSI
- DSI Pollutant removal and Balance of Plant
- Case Study Overview

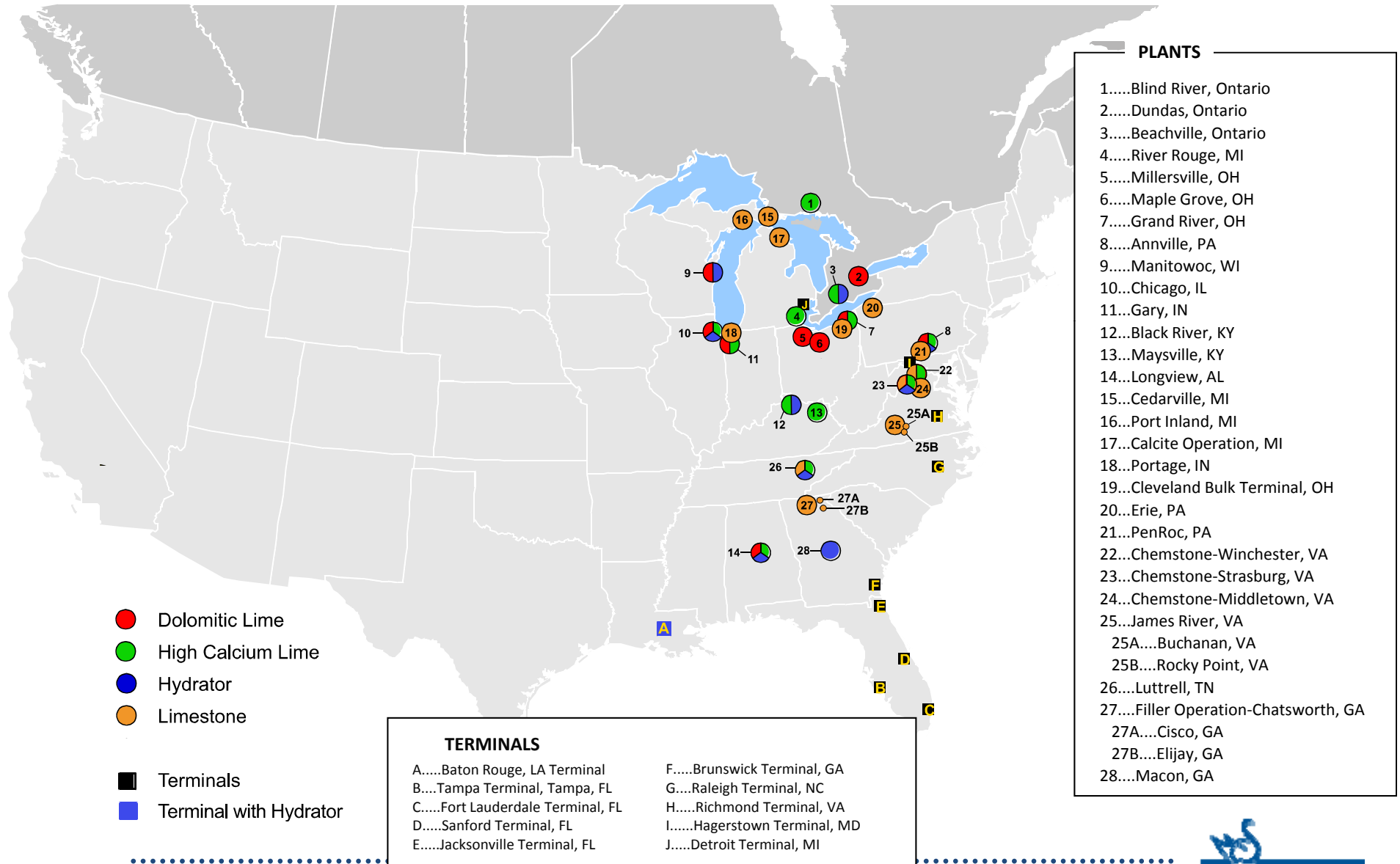
Who Is Carmeuse Lime?

Carmeuse Lime & Stone is one of the largest producers of lime products in North America:

- Carmeuse's North American operations were created through a series of acquisitions between 1992 & 2008
- Distributes nearly 7 million tons of lime products per year
- 28 Plants serving eastern U.S. and Canada
- Over 1,200 employees



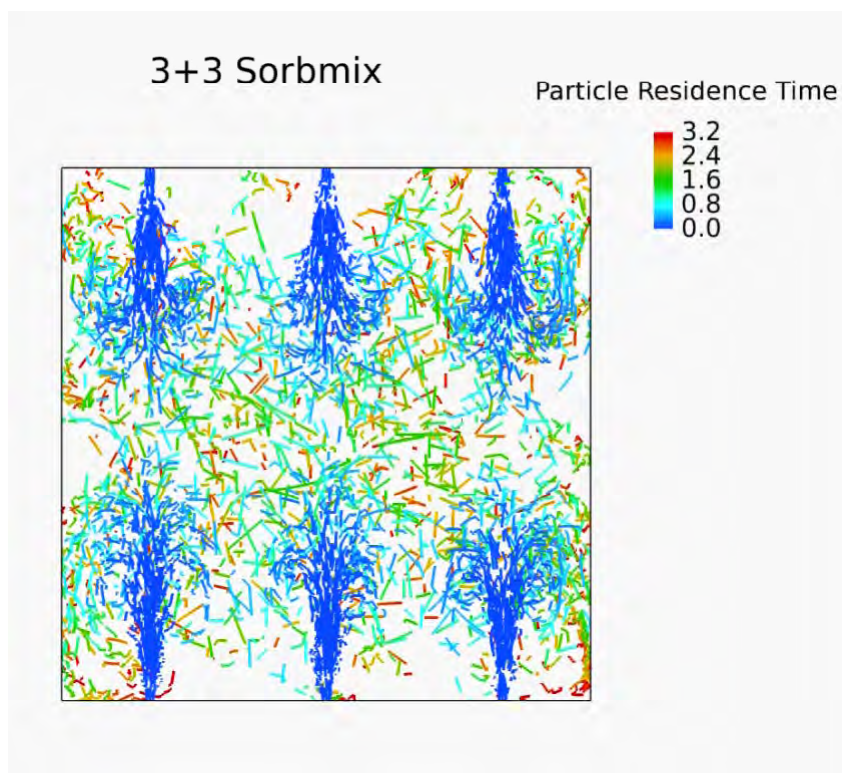
Carmeuse Lime & Stone Locations



What Complements Hydrate DSI – (Continued)

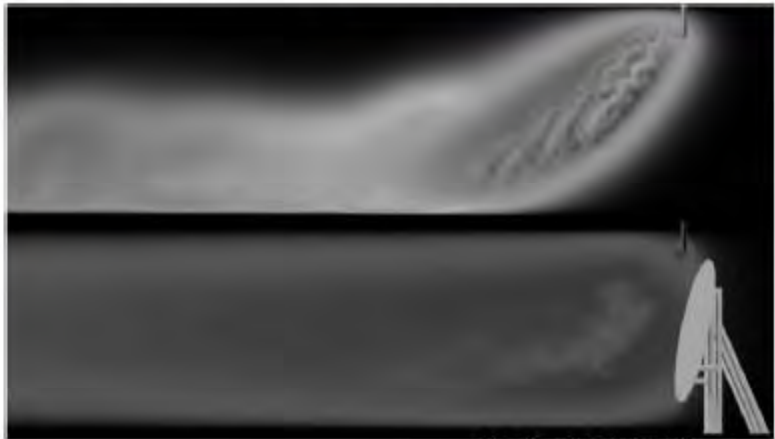
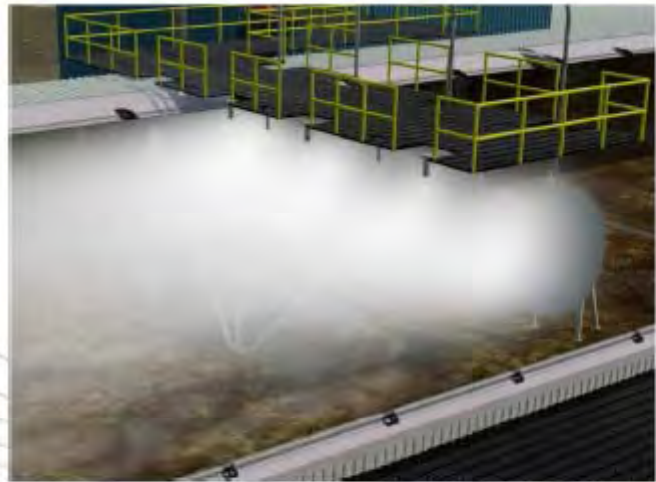
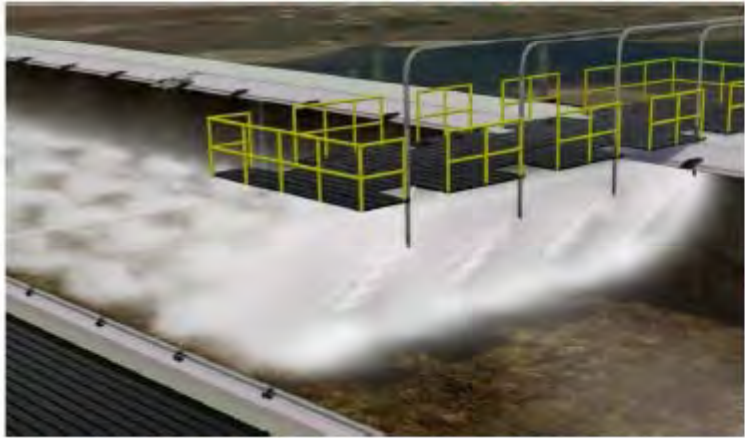
- In-duct Mixing

- Reduce cost – “Put the sorbent guys out of business”
- Potential of reduced number of injection lances
- Reduce sorbent usage: Up to 40% annual savings

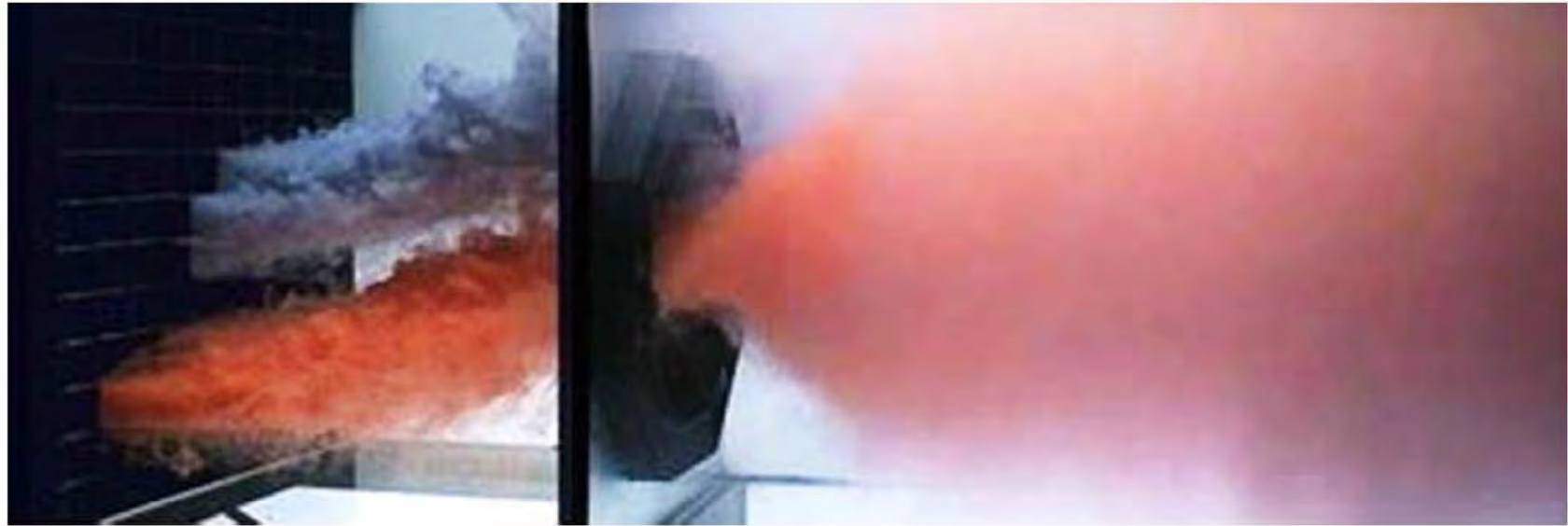


Delta Wings[®] – Babcock Power

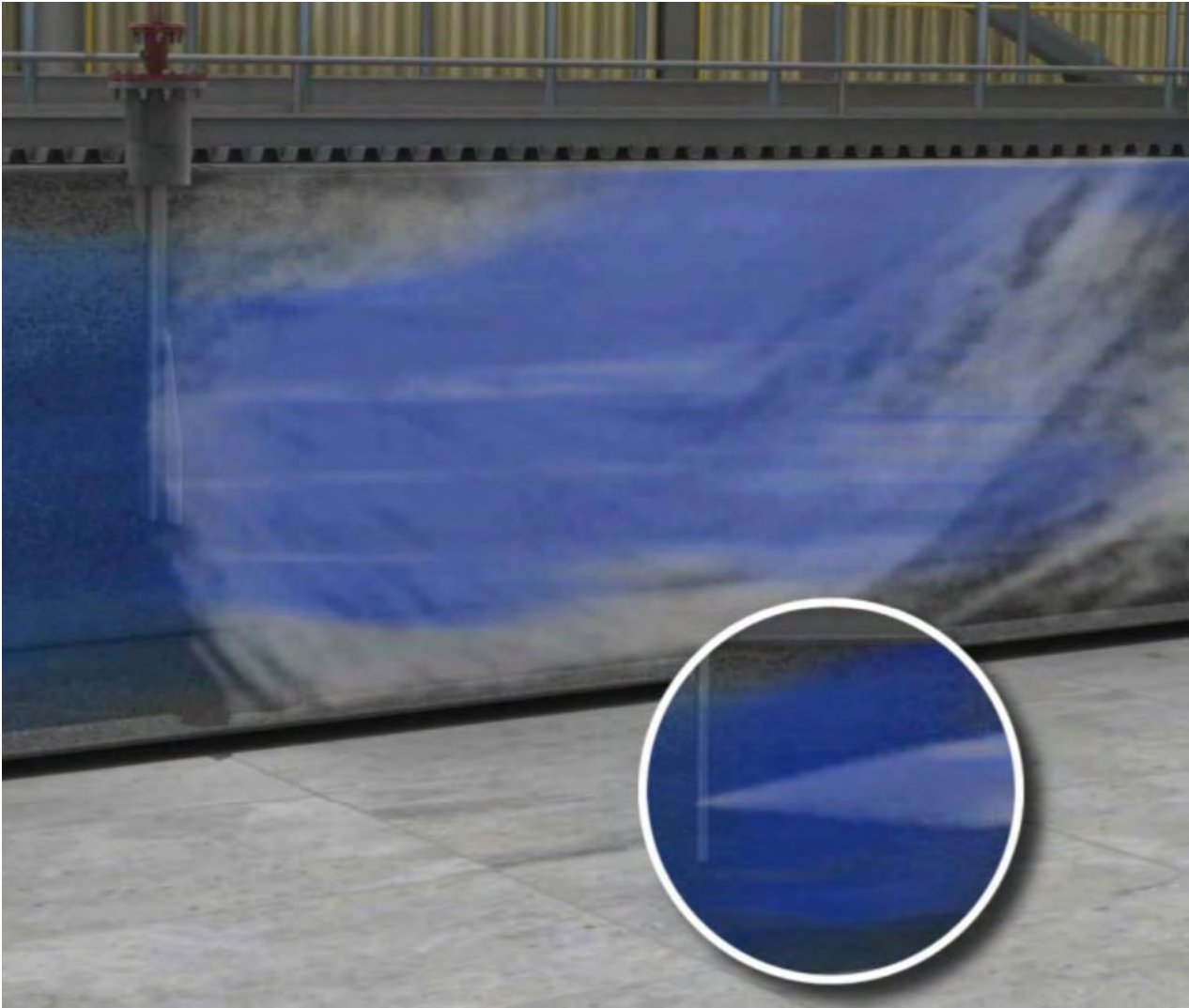
 Babcock Power
Delta Wing Technology



ADAir-Mixer™ - ADA-ES, Inc.



COBRA™ Lance - UCC

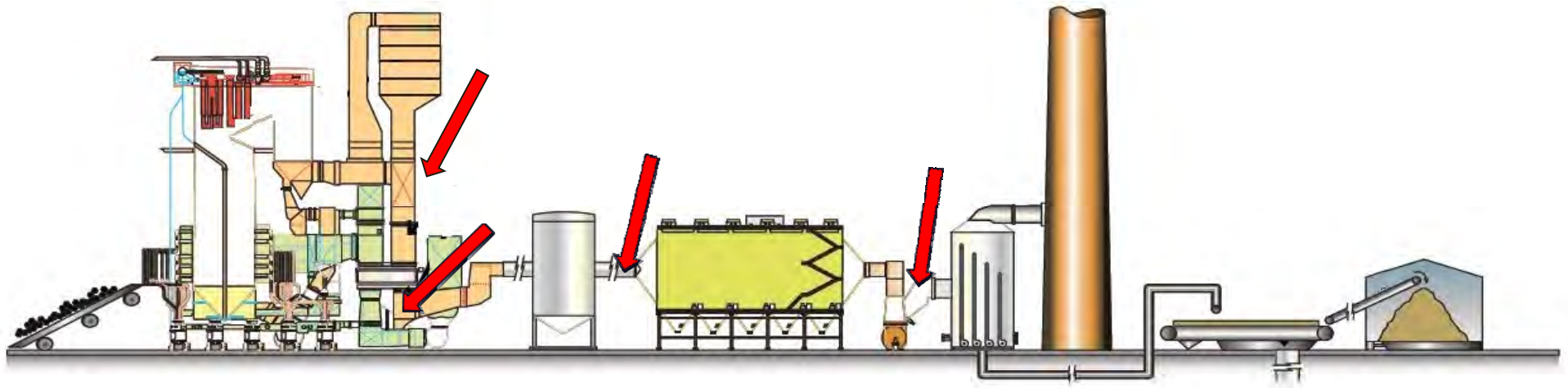


Hydrate DSI and BOP

SO₃, HCl, HF, and yes... SO₂

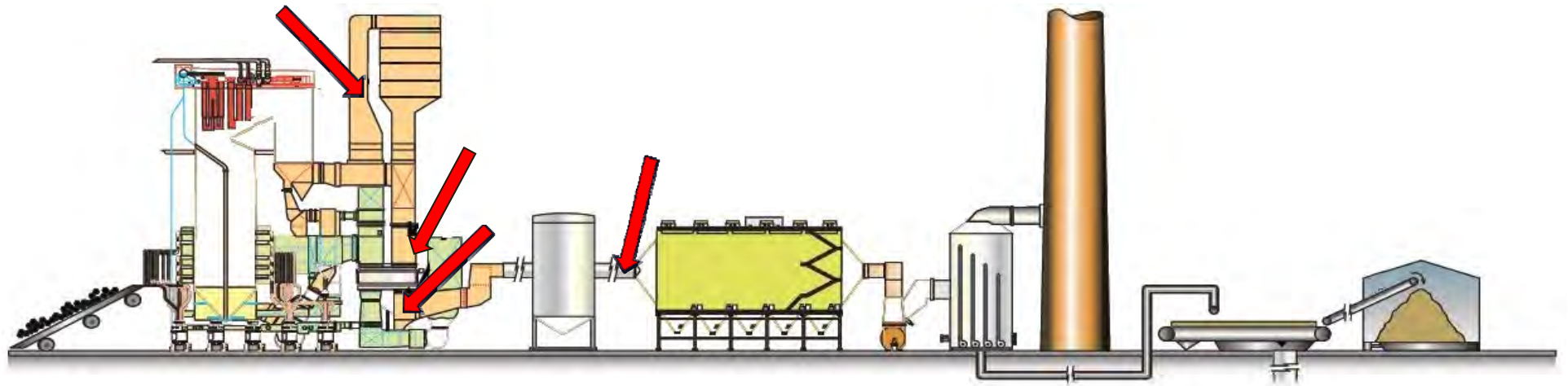


Hydrate DSI for SO₃ Control



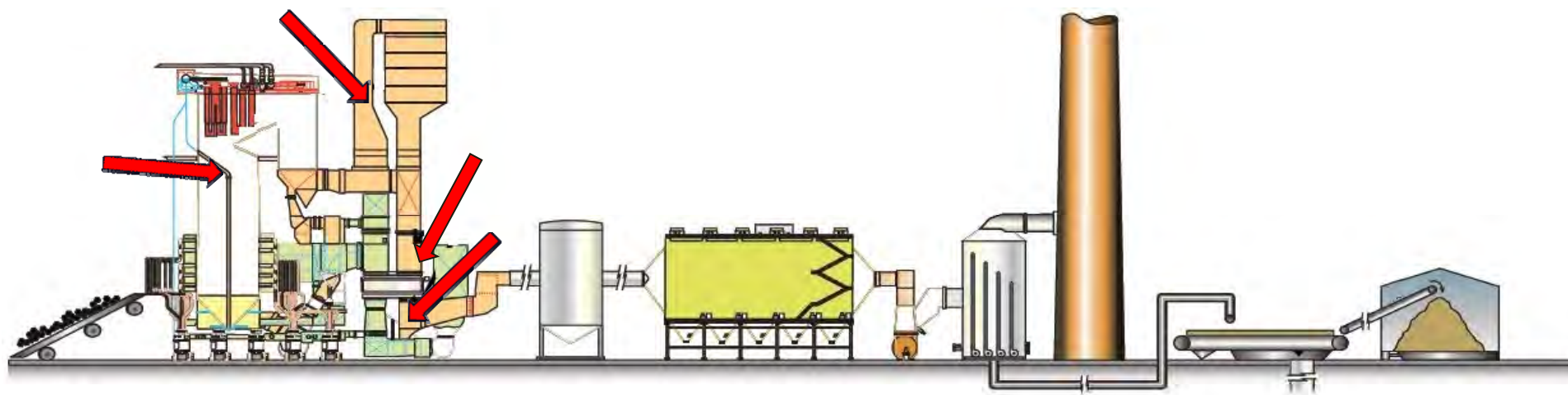
- **Benefits**
 - Not just for Plume Control
 - APH Pluggage
 - Duct Corrosion
 - PAC Injection

Hydrate DSI for HCl Control



- Benefits
 - MATS Compliance
 - wFGD waste water treatment
 - Reducing need to purge chlorides

Hydrated Lime for SO₂ reduction



- Benefits
 - State Compliance / Consent Decree
 - CSPAR / MATS
- *Typically* requires baghouse to be effective
- Duct Humidification Preferred – See Case Study
 - Offers increased SO₂ Removal and ESP performance

Other Balance of Plant Improvements

- Fuel Flexibility - wFGD & WWT
 - Remove HCl Pre-FGD
- Reduced AH Out Temps
 - Improve Heat Rate --- \$\$\$
 - ESP Performance Improvement
 - Hg Oxidation across APH
 - Increased Hg Removal Across ESP & FFDC
- No CO₂ Emissions Increase
 - Hydrate does not emit CO₂ when reacted
- No NO₂ Emissions Increase
 - Hydrate does not have negative impact on NO₂

A Few Case Studies



Full Scale Trial - One

Plant Description

- Pulverized coal-fired boiler
 - Less than 140 MW
 - Cold-side ESP
- Fuel
 - Central Appalachian bituminous (CAPP) coal
 - 1.2 # / MMBtu SO₂
 - 0.076 #/MMBtu HCl (Method 26a) (~65 ppm HCl)
- CEMS (opacity, NO_x, SO₂, Hg, and CO₂)

Full Scale Trial - One

HCl Mitigation Results

- FGT Grade Hydrated Lime

Too Much Feed!!

TABLE 2 - Plant One HCl Results

HCl Results (EPA Method 25A)			APH Inlet	APH Inlet	APH Outlet
	Baseline	Objective			
Sorbent Feed Rate (#/HR)	-	-	3800	7800	8400
Sorbent / Acid Gas Ratio (# / #)	-	-	2.3	4.7	5.1
HCl Results (#/MMBTU)	0.076	0.002	0.0063	0.0008	0.00003
% Removal	-	97.4%	91.7%	98.9%	99.96%
HCl Results (FT-IR)			APH Inlet	APH Inlet	APH Outlet
	Baseline	Objective			
Sorbent Feed Rate (#/HR)	-	-	3800	7800	8400
Sorbent / Acid Gas Ratio (# / #)	-	-	2.3	4.7	5.1
HCl Results (#/MMBTU)	0.111	0.002	0.0176	0.0017	0.001
% Removal	-	98.2%	84.1%	98.5%	99.1%

Full Scale Trial - Two

Plant Description

- Pulverized coal-fired boiler
 - Less than 200 MW
 - Baghouse
- Fuel
 - PRB Blended Coal
 - 0.6 # / MMBtu SO₂
 - 0.0035 #/MMBtu HCl (Method 26a) (~5 ppm HCl)
- CEMS (opacity, NO_x, SO₂, Hg, and CO₂)

Full Scale Trial - Two

HCl Mitigation Results

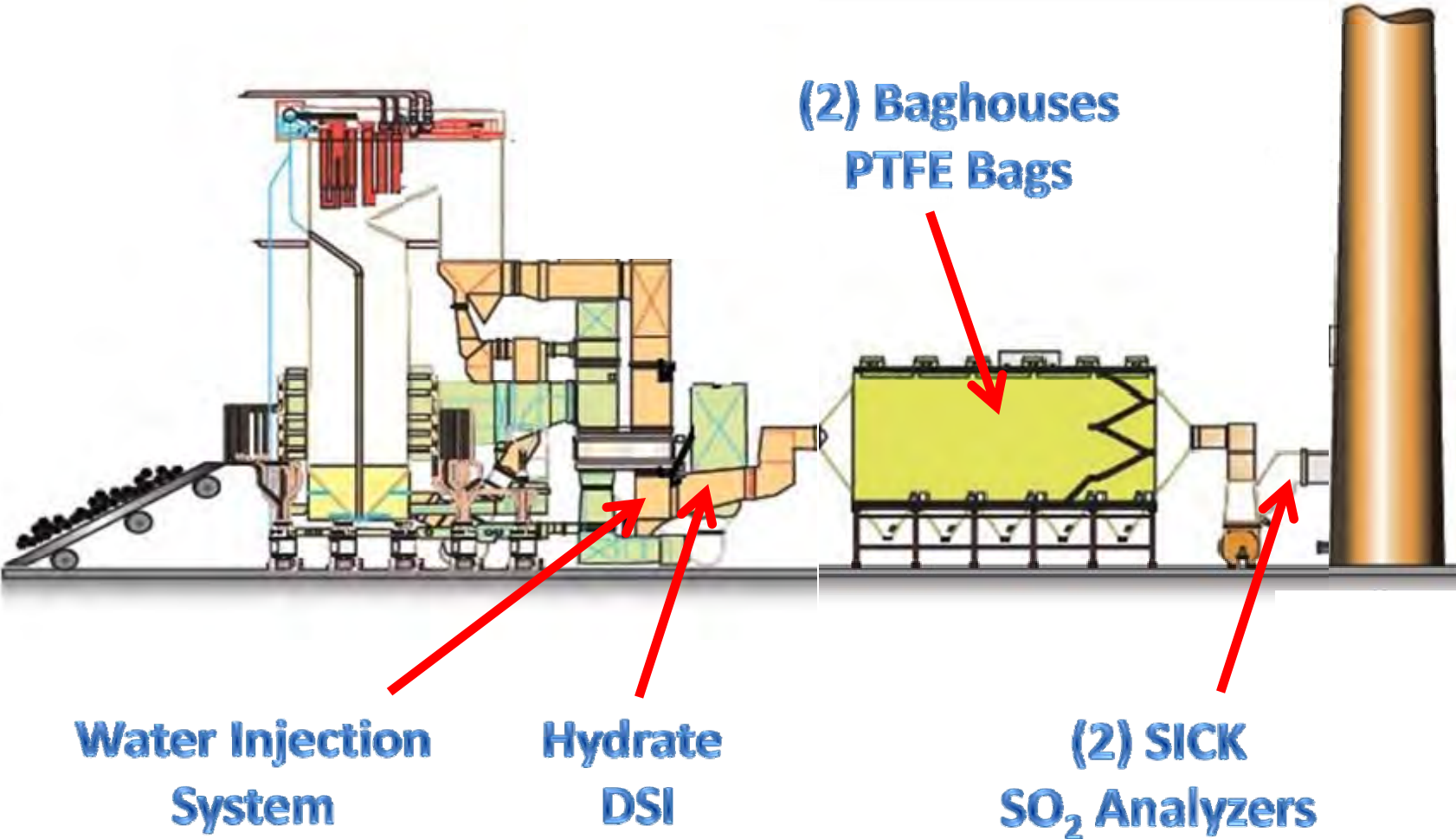
- FGT Grade Hydrate

Already In Compliance

Table 4 - Plant Two HCl Mitigation Results

HCl Results (EPA Method 26a)			APH Outlet	APH Outlet	APH Outlet	APH Inlet	APH Inlet
	Baseline	Objective					
Sorbent Feed Rate (#/HR)	-	-	920	2500	3380	1440	3540
Sorbent / Acid Gas Ratio (# / #)	-	-	0.71	1.95	2.60	1.12	2.77
HCl Results (#/MMBTU)	0.00350	0.002	-	-	0.00011	-	0.00011
% Removal	-	42.9%	-	-	96.9%	-	96.9%
HCl Results (FT-IR)			APH Outlet	APH Outlet	APH Outlet	APH Inlet	APH Inlet
	Baseline	Objective					
Sorbent Feed Rate (#/HR)	-	-	920	2500	3380	1440	3540
Sorbent / Acid Gas Ratio (# / #)	-	-	0.71	1.95	2.60	1.12	2.77
HCl Results (#/MMBTU)	0.00619	0.002	0.00039	0.00048	0.00048	0.00034	0.00034
% Removal		67.7%	93.7%	92.3%	92.3%	94.5%	94.4%

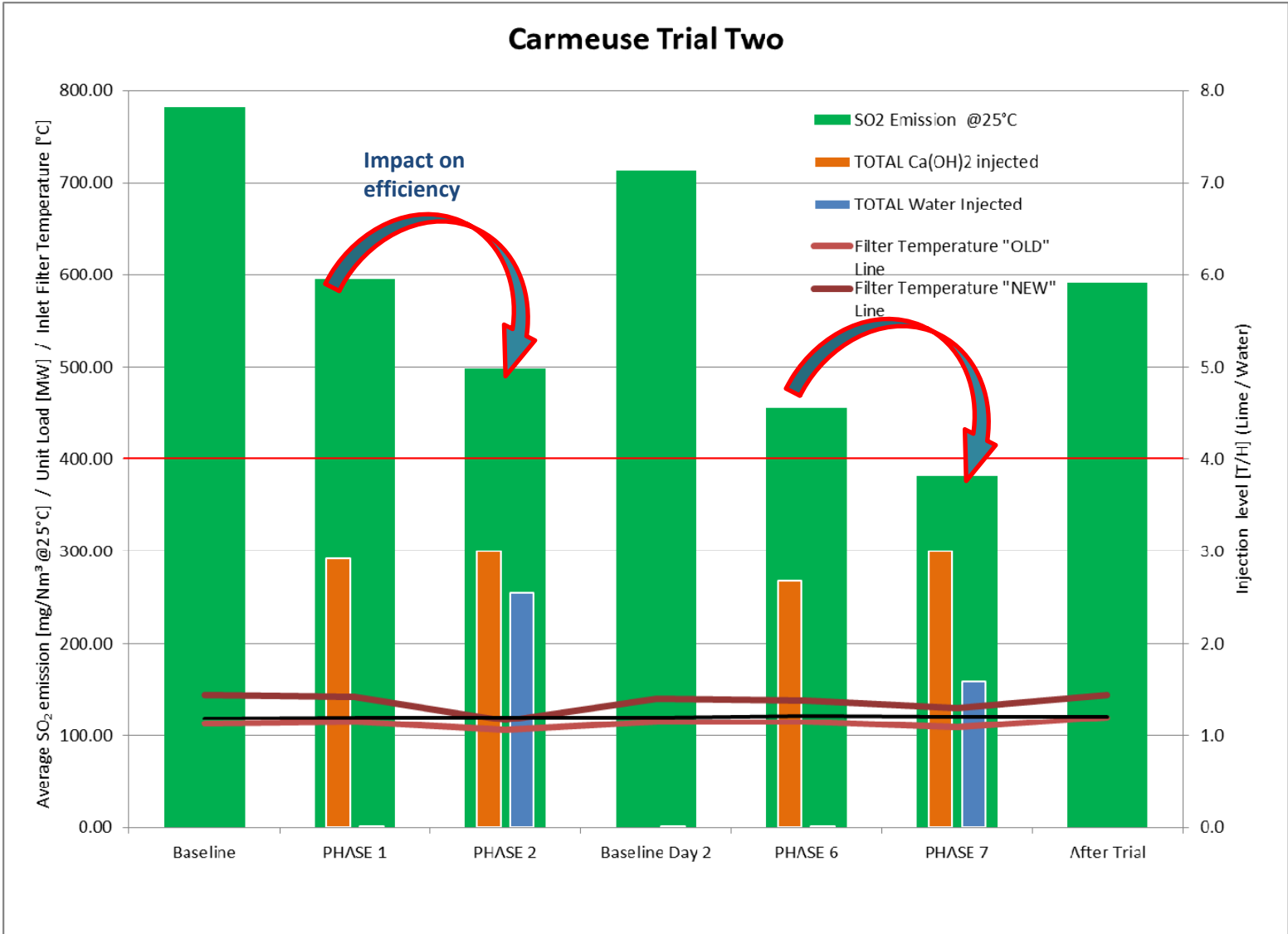
Full Scale Trial Three - Two Test Trial



Test One – *Start-up*

- 125 MW PCC
- 0.5-0.6% Sulfur Coal
- BH Temperature without water injection
 - 285-298°F
- BH Temperature with water injection
 - 240-266°F
- Water Injection Amount
 - ~420-630 GPH
- Total SO₂ removal
 - 36.1 - 46.5%
- SO₂ removal from Humidification
 - 10.4 - 12.3%

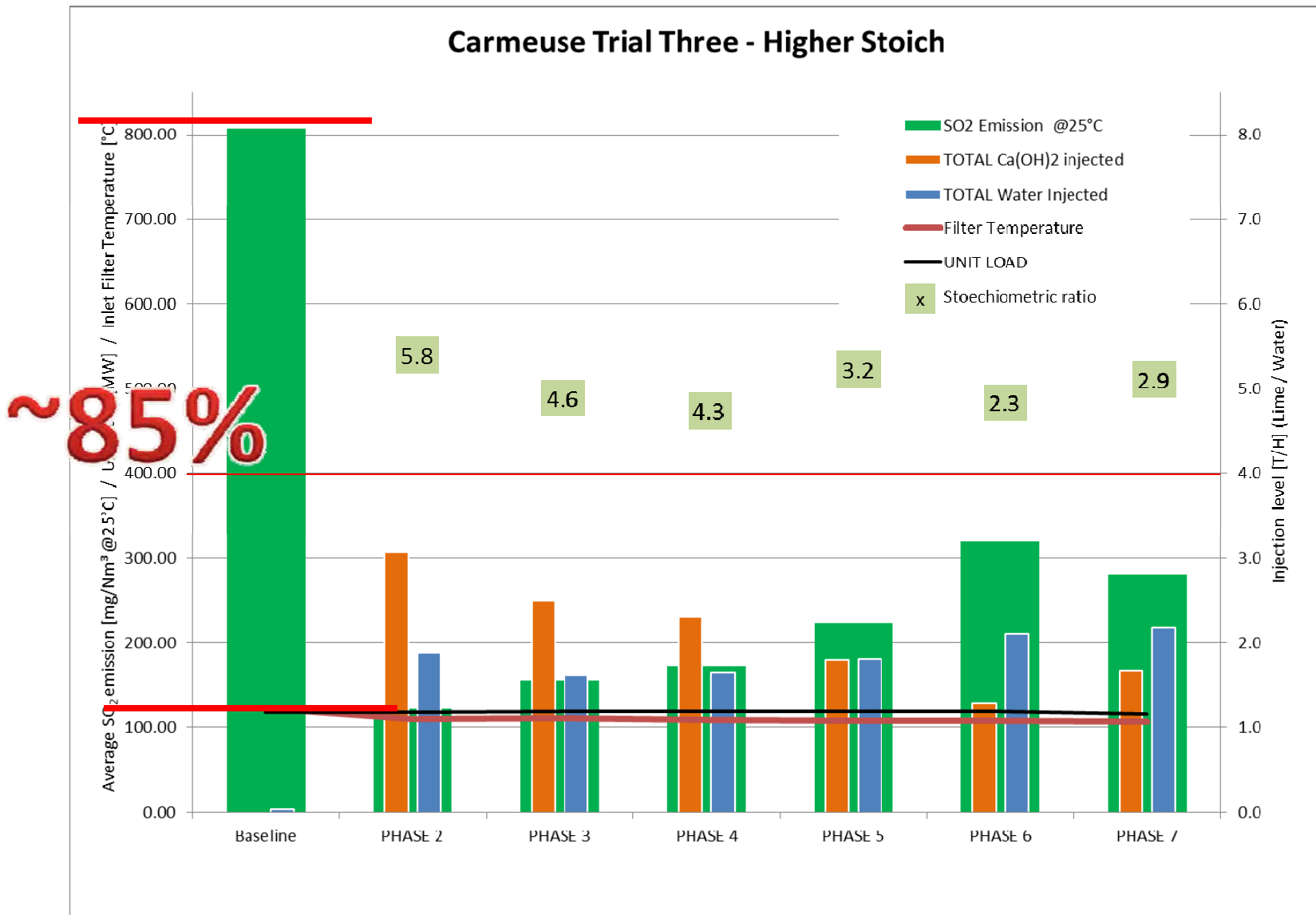
Test One – *Start-up*



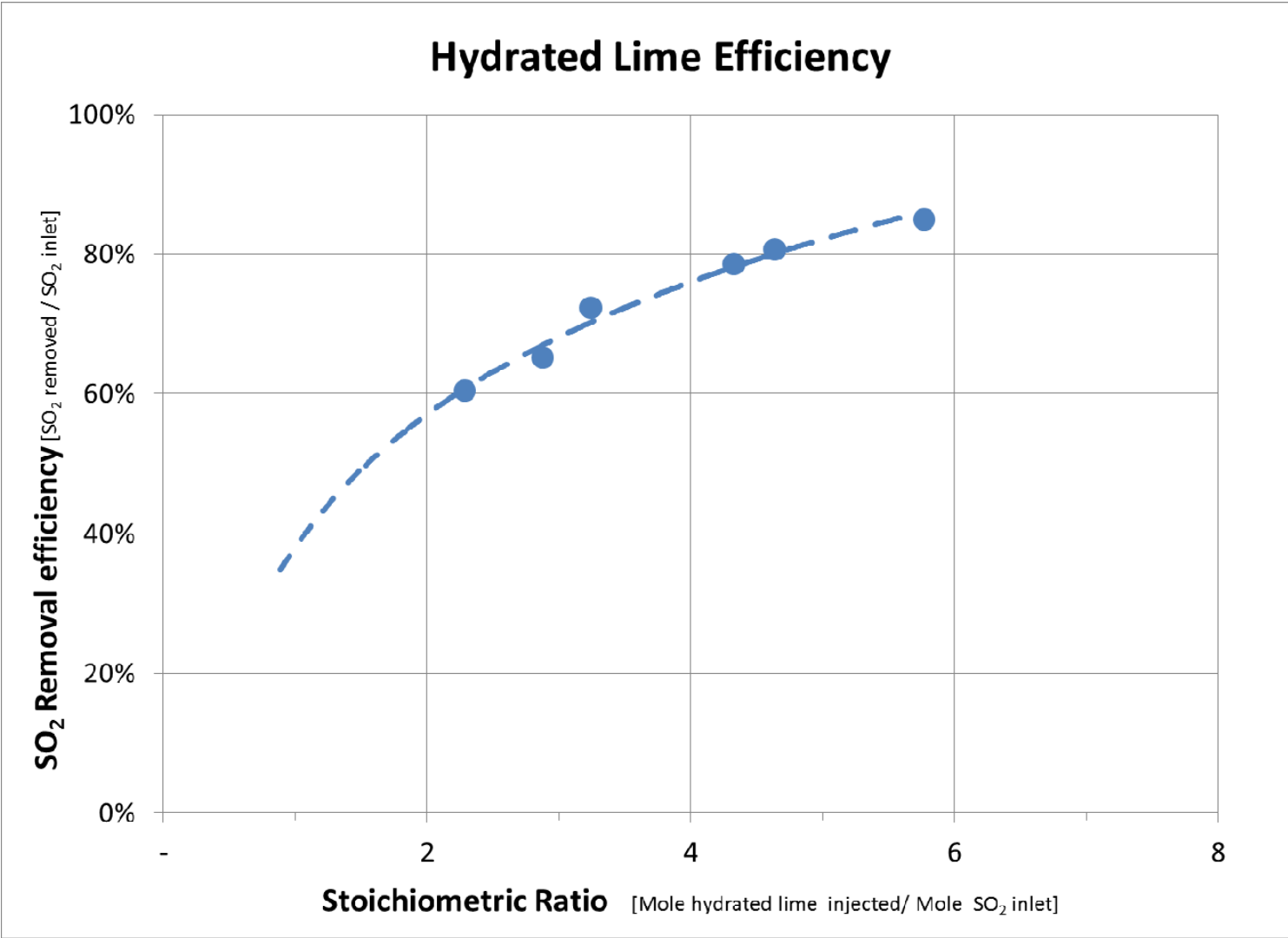
Test Two – *DSI Optimization*

- 125 MW PCC
- 0.4% Sulfur Coal
- BH Temperature without water injection
 - 265-288°F
- BH Temperature with water injection
 - 225-238°F
- Total Water Injection Amount
 - ~570 GPH
- Total SO₂ removal – after optimization
 - 60-85%
- SO₂ removal from Humidification
 - Not Measured

Test Two— *Optimized Water and Sorbent Injection*



Hydrate DSI Efficiency w/ Humidification





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