REINHOLD ENVIRONMENTAL Ltd.

2015 APC Round Table & Expo Presentation

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Evolution of the Hydrated Lime DSI System

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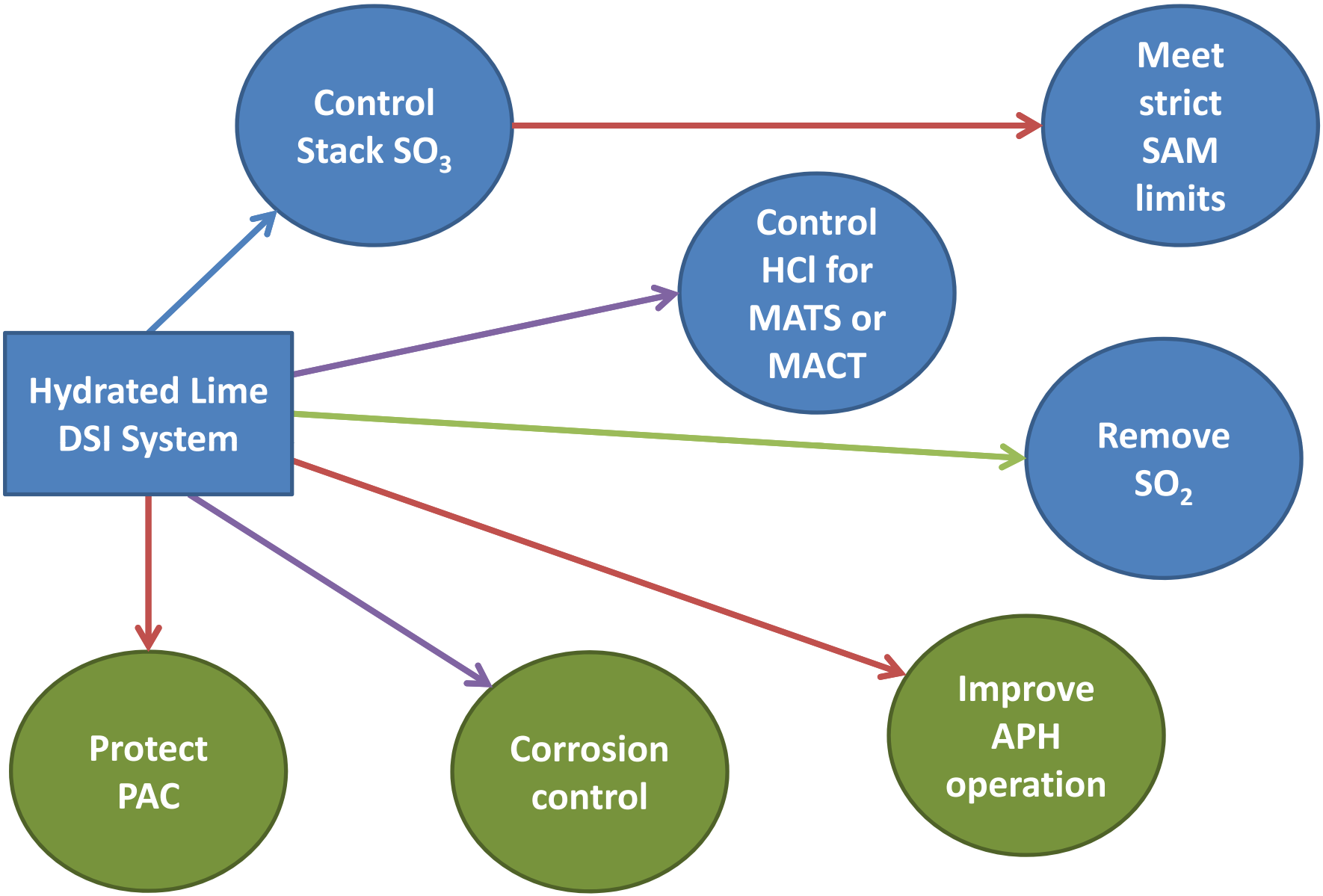
Workshop 11 - APC Conference - Atlanta

July 14, 2015

Discovering what's possible with calcium


Control Stack SO_3
Meet strict SAM limits
Control HCl for MATS or MACT
Hydrated Lime DSI System
Remove SO_2
Protect PAC
Corrosion control
Improve APH operation

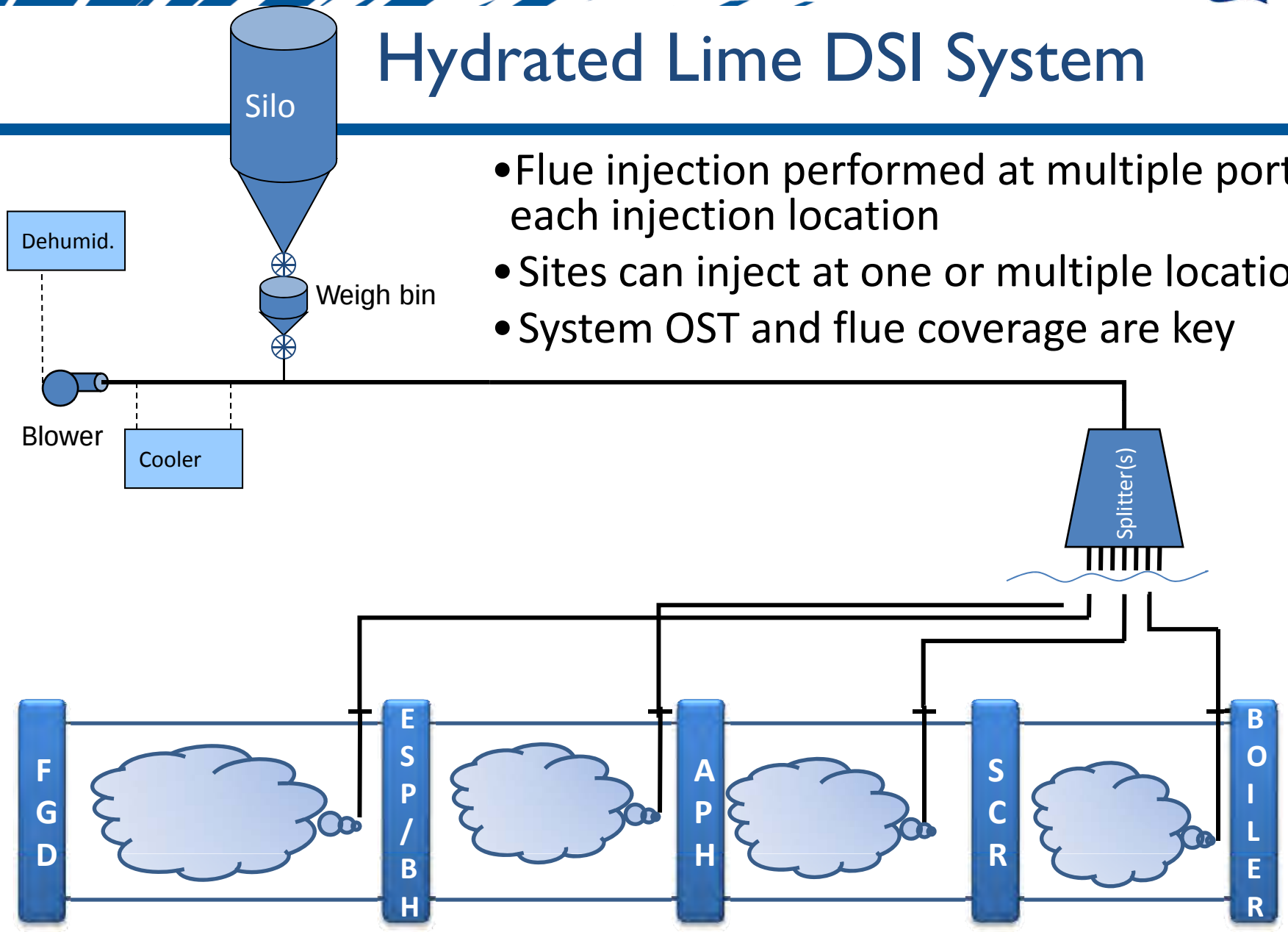
Understand Capabilities of DSI System

What are you playing: Defense or Offense?

- Hydrated lime
  - $/ton vs. $/ton of pollutant removed
- Feed system
  - Low cost system vs. cost effective system
- Mitigation plan
  - Understanding flue gas characteristics

Hydrated Lime DSI System

- Flue injection performed at multiple ports in each injection location
- Sites can inject at one or multiple locations
- System OST and flue coverage are key



Evolution of Hydrated Lime DSI

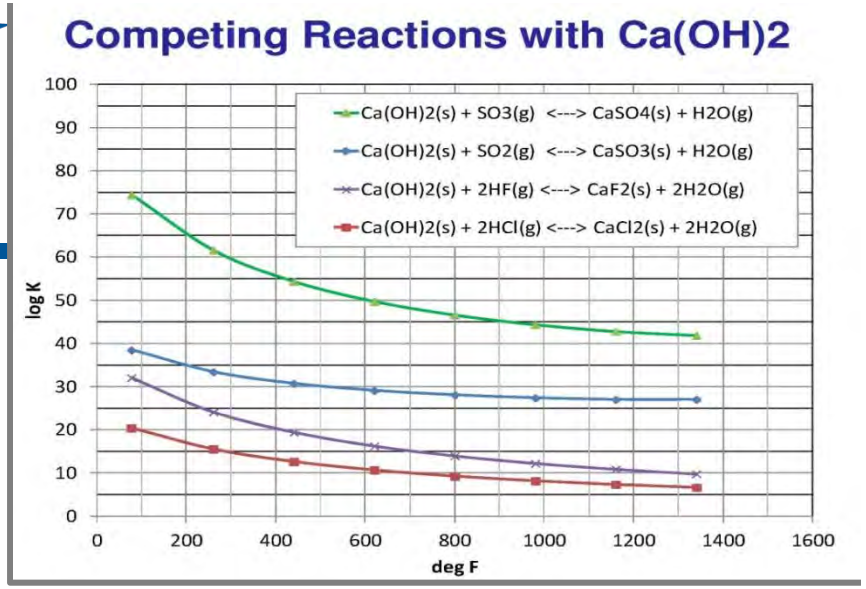
- First systems installed in 1990's
  - 'Manual' tests at TVA
  - Temporary then permanent
- Steep learning curve (2007-2010)
  - Plugging and scaling are prevalent
  - Problems with large, new systems
  - Trial systems also have issues
- Improved understanding of key factors (2009-2012)
  - DHUG
  - Keep hydrate in suspension
  - Control scale buildup
  - Better trial systems

Evolution of Hydrated Lime DSI

- **<u>Many sites are installing systems correctly at the start or have retrofitted improvements</u>**
  - DHUG a big part of it
- Pockets of problems remain
- Many advances aimed at improved On Stream Time and higher performance

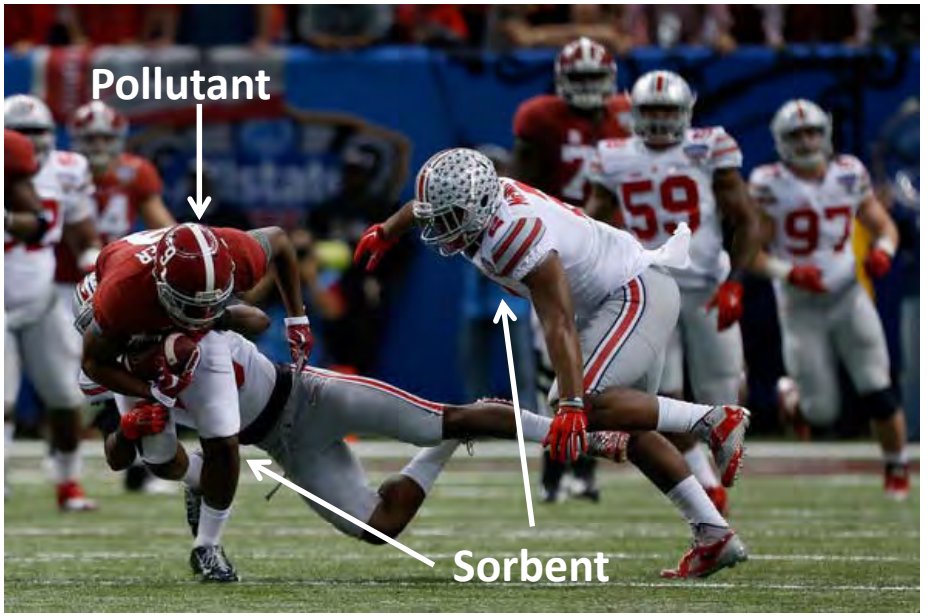
Reactivity & Removal

- Thermodynamic
  - $SO_3 > SO_2 > HF > HCl$



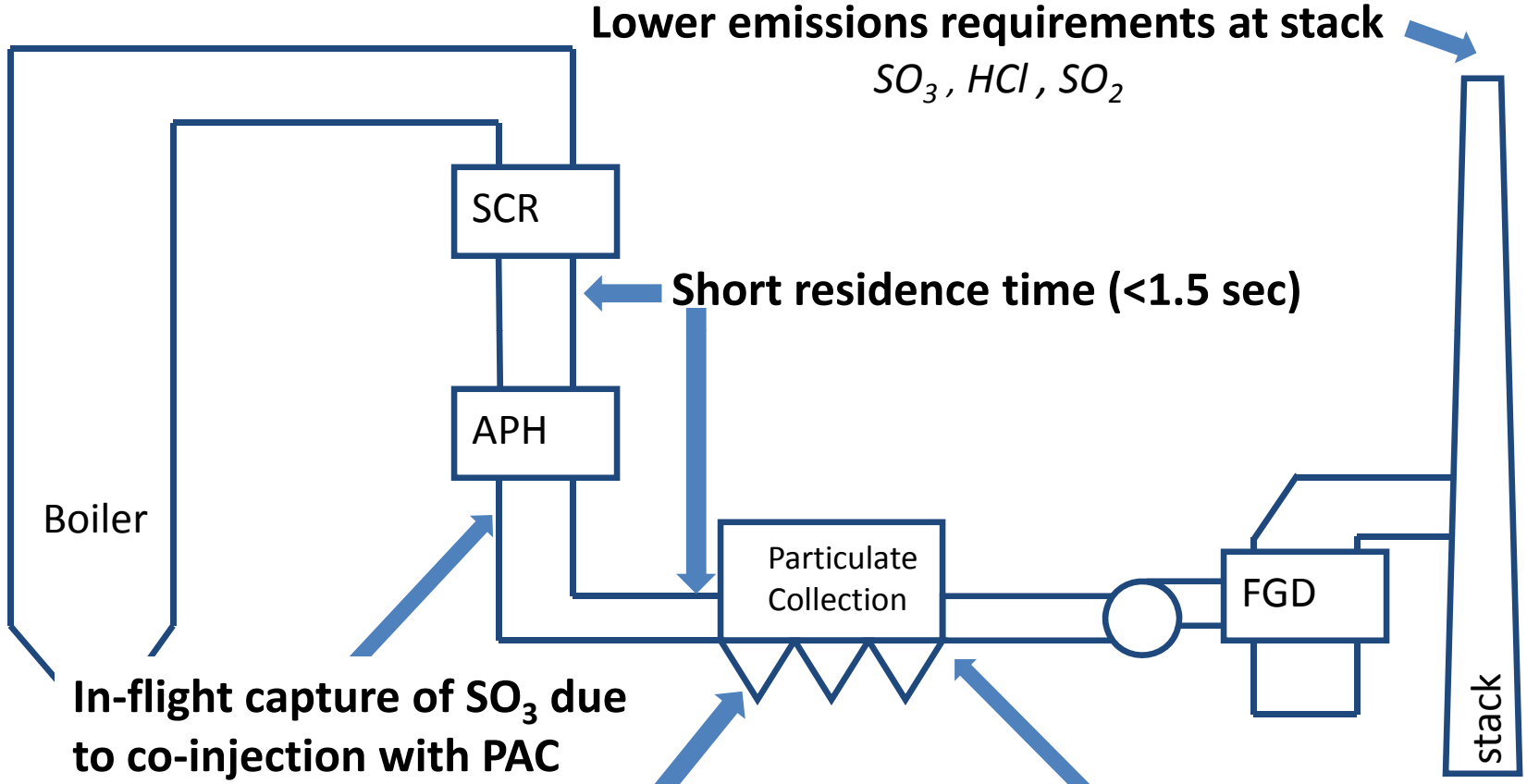
Benson, 2012 DHUG

- Kinetic
  - Maximize collisions
  - Hydrate D_{50} ~ 2-4 μm
  - Gas particles ~ 0.0003 μm

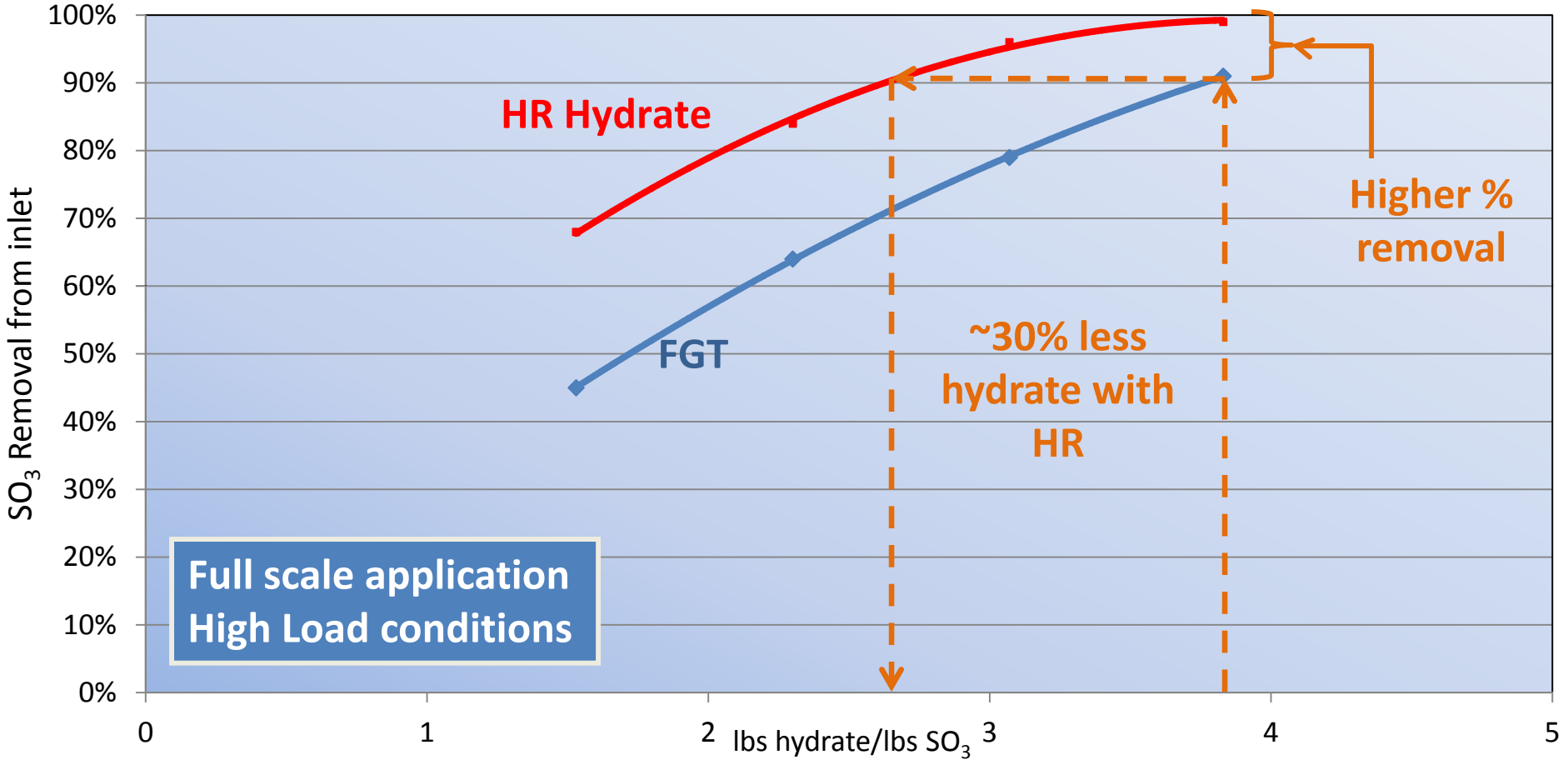


Bad Sorbent + Bad System

Market Needs for Higher Performing Hydrate



Full Scale Evaluation – SO_3 Removal - HR vs. FGT

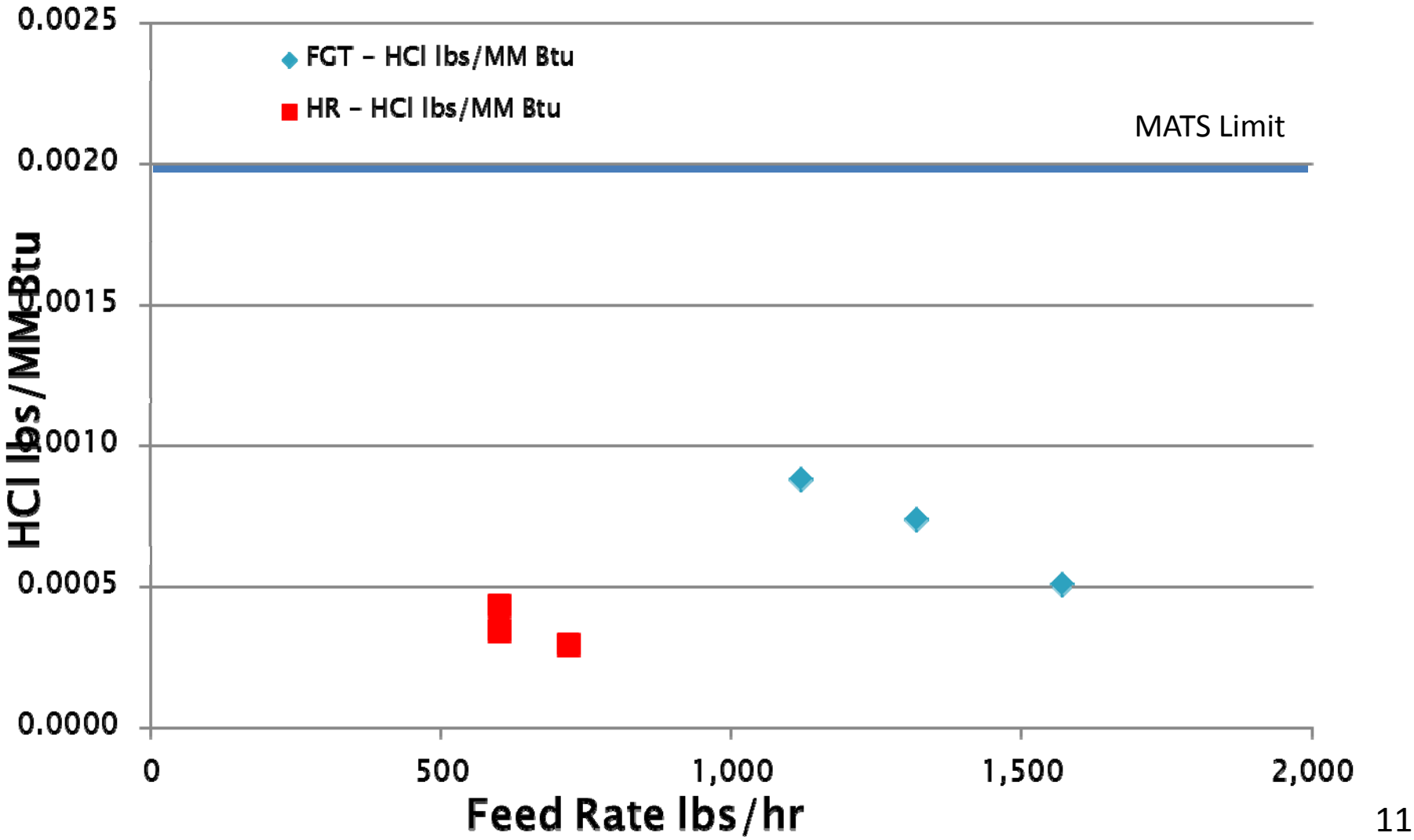


FGT hydrate gives good removal

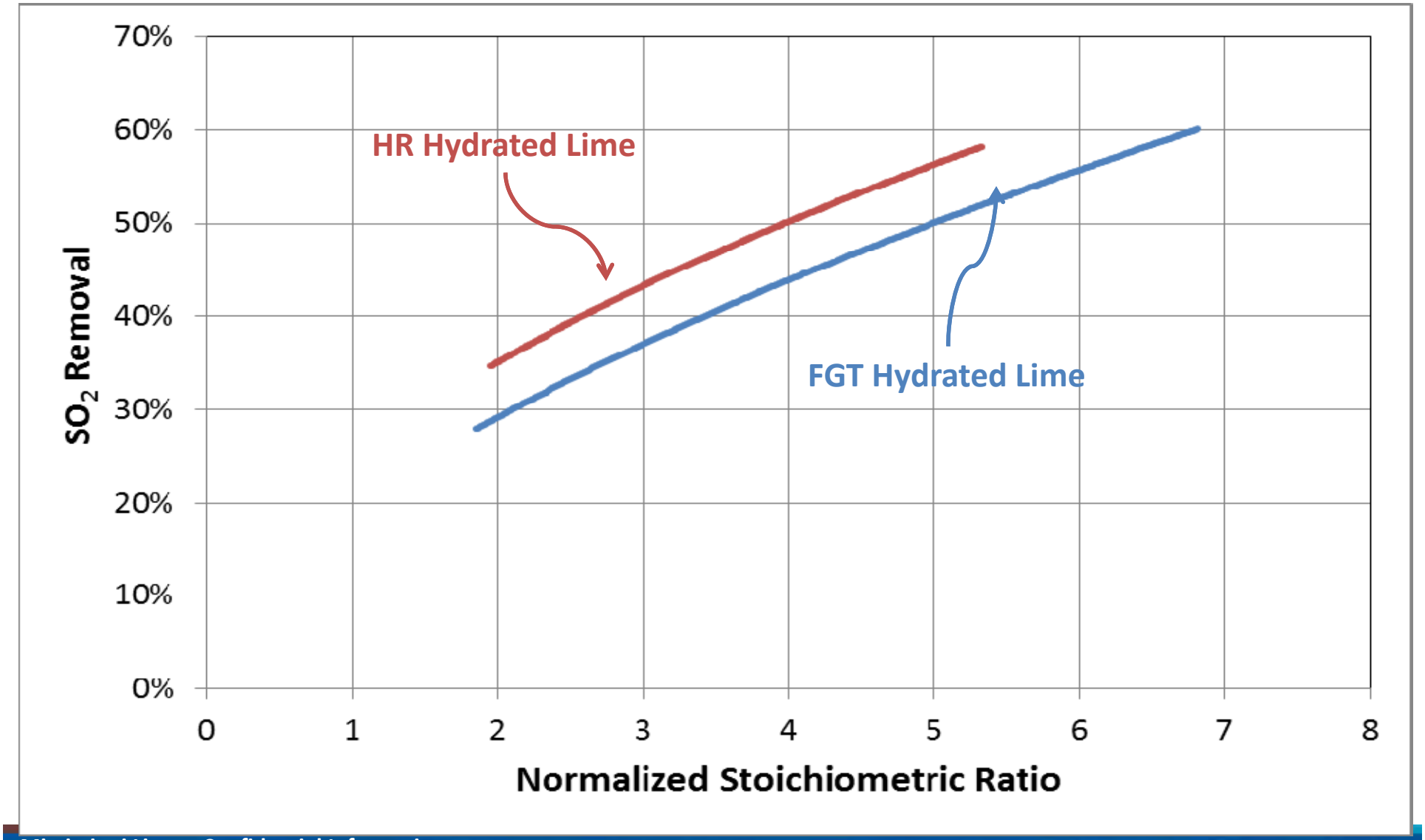
HR Hydrate offers better utilization or high level removal capabilities

Utility MATS for HCl with Hydrated Lime

(smaller unit < 300 MW, IBC)

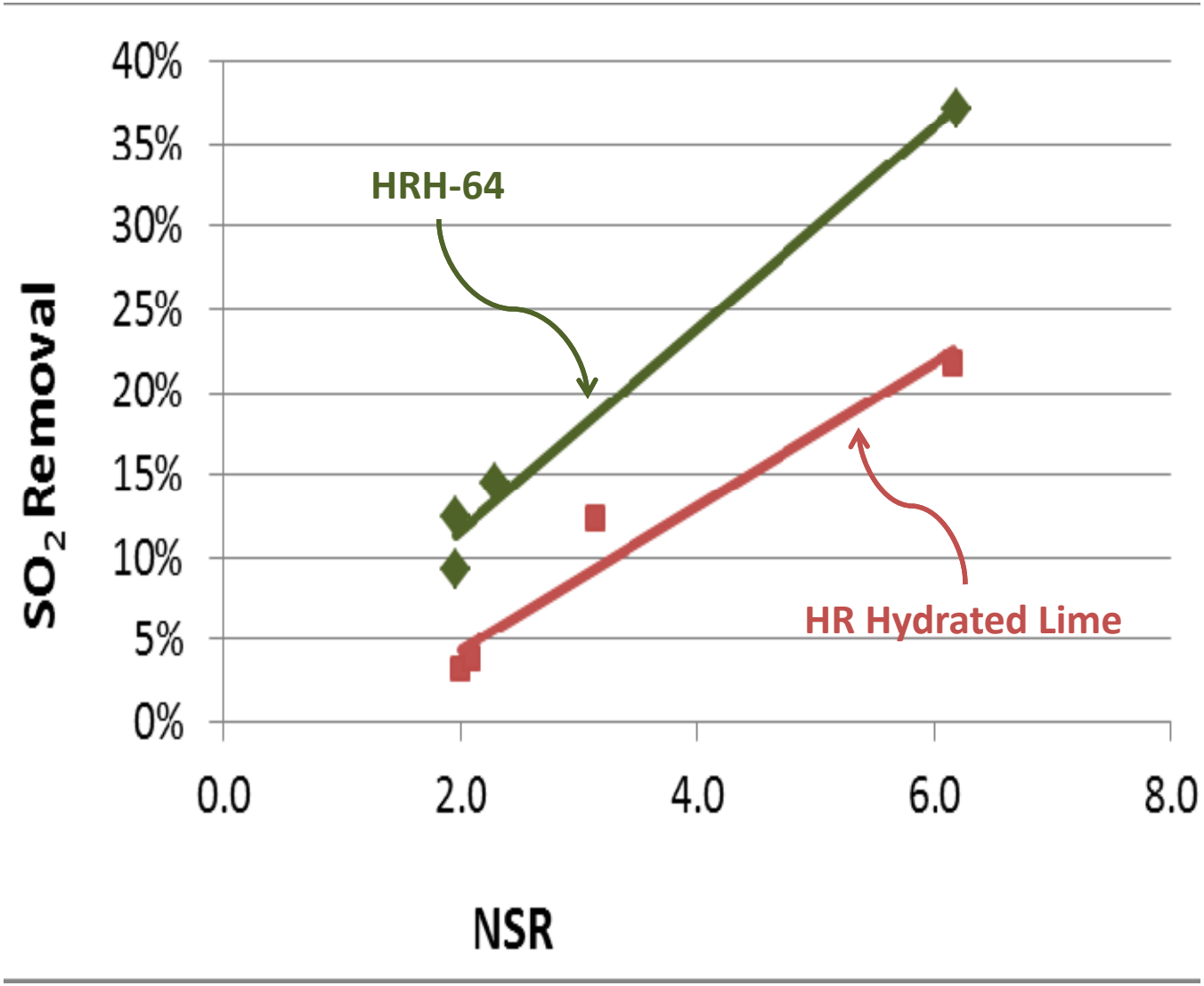


Hydrated Lime DSI for SO_2 Control



Pilot Plant SO_2 Reduction: HRH-64

- In-flight capture
- Poor conditions for SO2 reduction with hydrate
  - Temp ~320 F
  - Low moisture
- New product significantly improved over HRH



HRH-64: Industrial Boiler DSI

HRH

- HCl reduction
  - 90-95%
- SO_2 reduction
  - 8-15%

HRH-64

- HCl reduction
  - 97-99%
- SO_2 reduction
  - 20-44%

Inject post-Economizer

Stoichiometric ratio range of 1.5 – 3.0

Chad's slides

Cal's slides

Questions

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