REINHOLD ENVIRONMENTAL Ltd.

2016 APC-Wastewater Round Table & Expo Presentation

July 18 & 19, 2016 in Dearborn, MI / Hosted by DTE Energy

Case Studies: DSI and ACI System Retrofits for Improved Reliability and Performance

July 19, 2016

Presented by: Conner Cox

DSI/ACI System Issues

- Many Installed Equipment to Fit Budget or Schedule
  - Standard Packages
  - Little/No Engineering
- System Operation Complications
  - Plugging
    - Improper System Design
    - Too Many Bends
    - Incorrect Equipment Selection
  - Accelerated Wear
    - Improper Design Velocities
    - Incorrect Component Design
  - Corrosion

Retrofit Opportunities

- UCC has retrofit a total of 16 systems
- Typical Retrofit Opportunities
  - COBRA™ Lance
  - Splitter with/without Autopurge
  - CFD Modeling
  - Pneumatic Conveying Optimization
  - Instrumentation and Controls
  - Venting Arrangements
  - Silo Operation

Case Studies

- **Case Study 1**
  - (3) ACI Systems for Hg Removal
- **Case Study 2**
  - (2) Hydrated Lime Systems for SO_3 Removal
- **Case Study 3**
  - (1) Hydrated Lime for SO_3
  - (1) ACI System for Hg
- **Case Study 4**
  - (1) Trona System for SO_2 Removal

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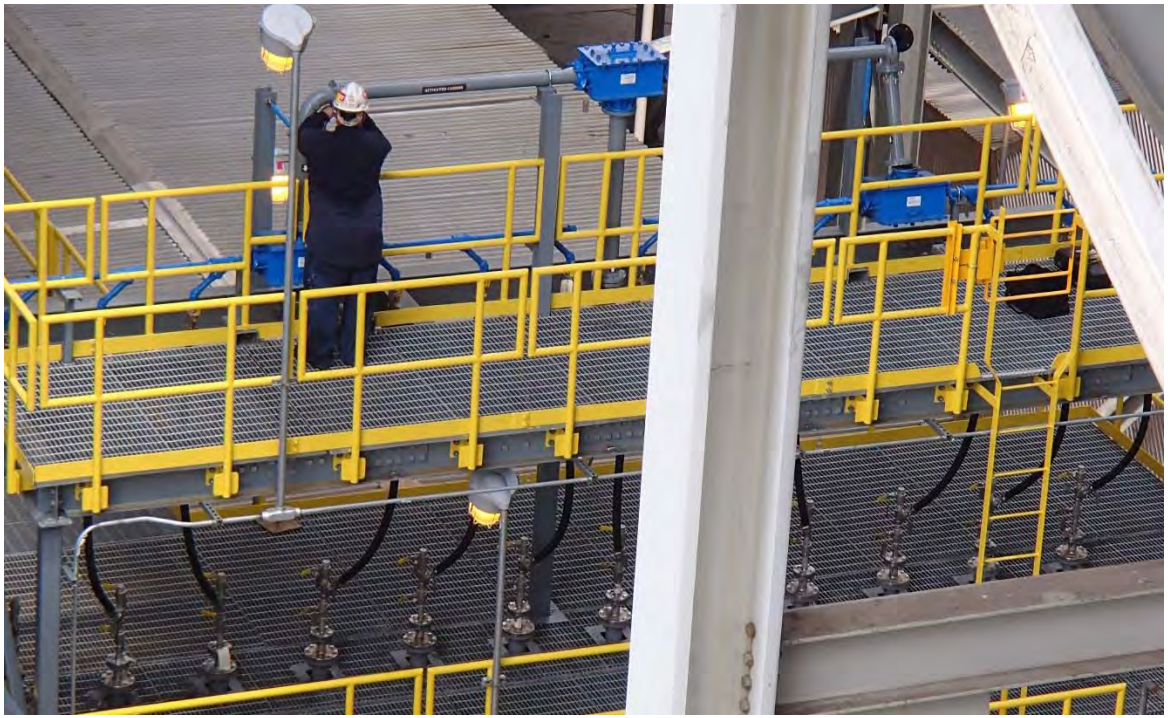
CASE STUDY 1
(3) ACI SYSTEMS FOR HG REMOVAL

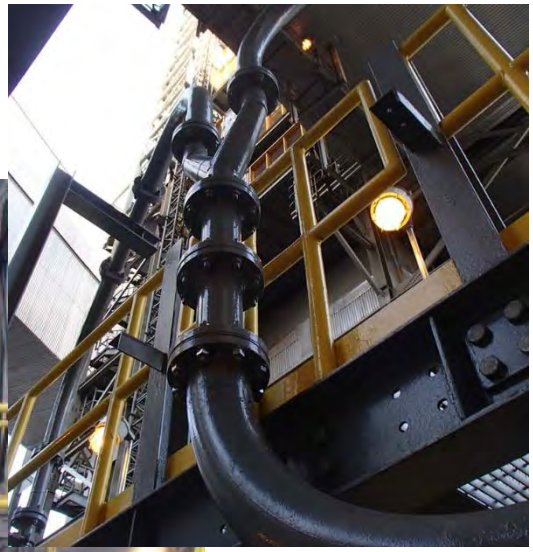
System Changes

- System Evaluation
  - Incorrect conveying velocities
  - Poor pneumatic system design
  - Inaccurate splitting
- System Equipment Changes
  - Blower adjustments
  - Eductor replacements
  - Splitter replacements
  - Improved venting arrangement

Splitting - Old



Splitting - New



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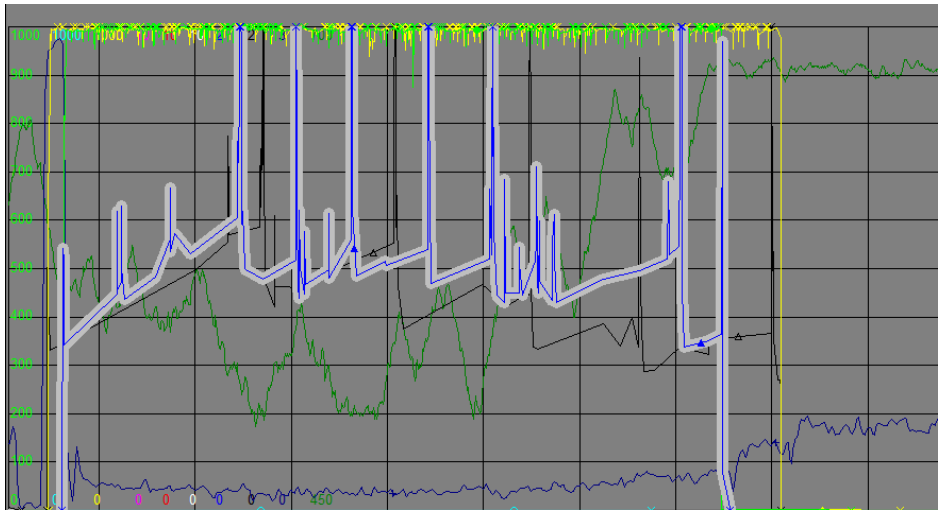
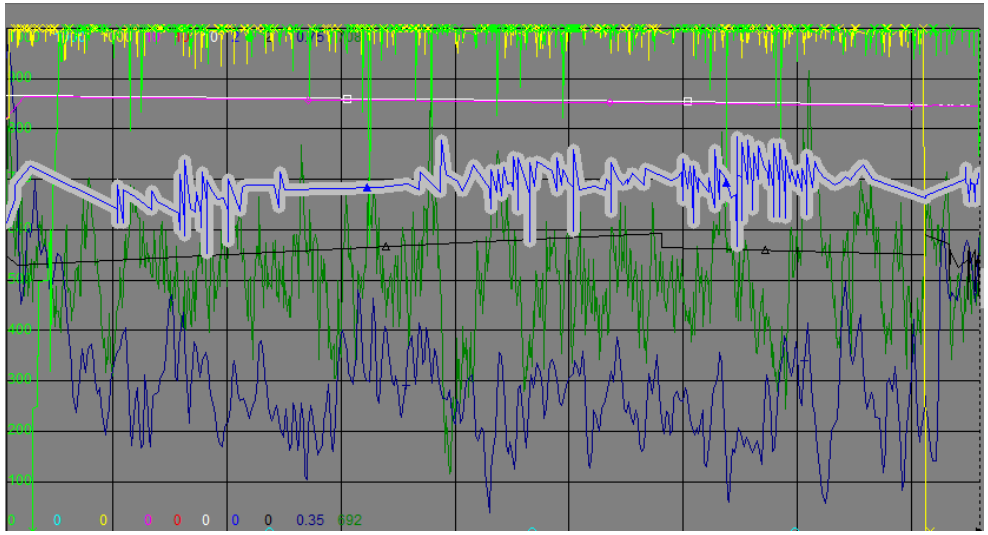
Pneumatics



- Original
  - 1000 lb/hr
  - Spiking causing shutdown



- New
  - 1000 lb/hr
  - Steady operation
    - 8 hours shown

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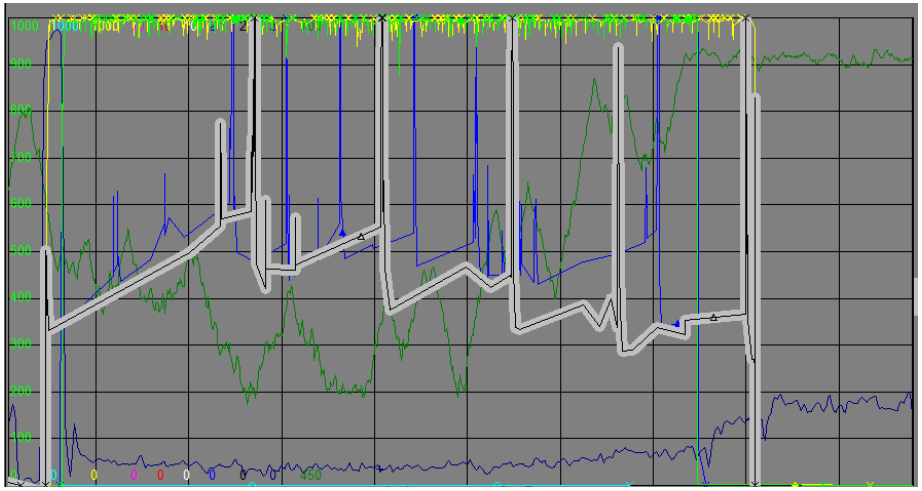
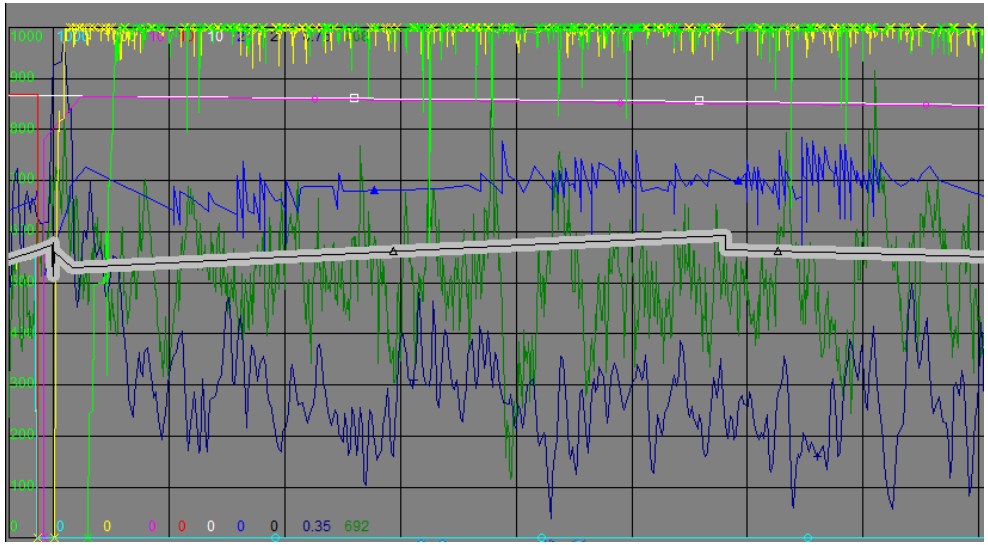
Pneumatics



- Original
  - 1000 lb/hr
  - Spiking causing shutdown



- New
  - 1000 lb/hr
  - Steady operation
    - 8 hours shown

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CASE STUDY 2
(2) HYDRATED LIME SYSTEMS FOR SO_3 REMOVAL

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System Changes

- System Evaluation
  - Poor distribution (CFD Modeling)
  - Plugging due to improper convey air handling
- System Equipment Changes
  - CFD Modeling
  - Condenser addition to dehumidification system
  - COBRA™ Lances
  - Splitter replacements

Splitter with Auto Lance Purge System

- **Splitter Includes Proprietary Insert and Static Mixer**
- **Purge Systems Prevents Soft Plug Formation**
  - Automatically purges lines daily
- **Clears Soft Plugs When Detected**
  - Automated push/pull logic to clear the soft line plug

COBRA™ Lances

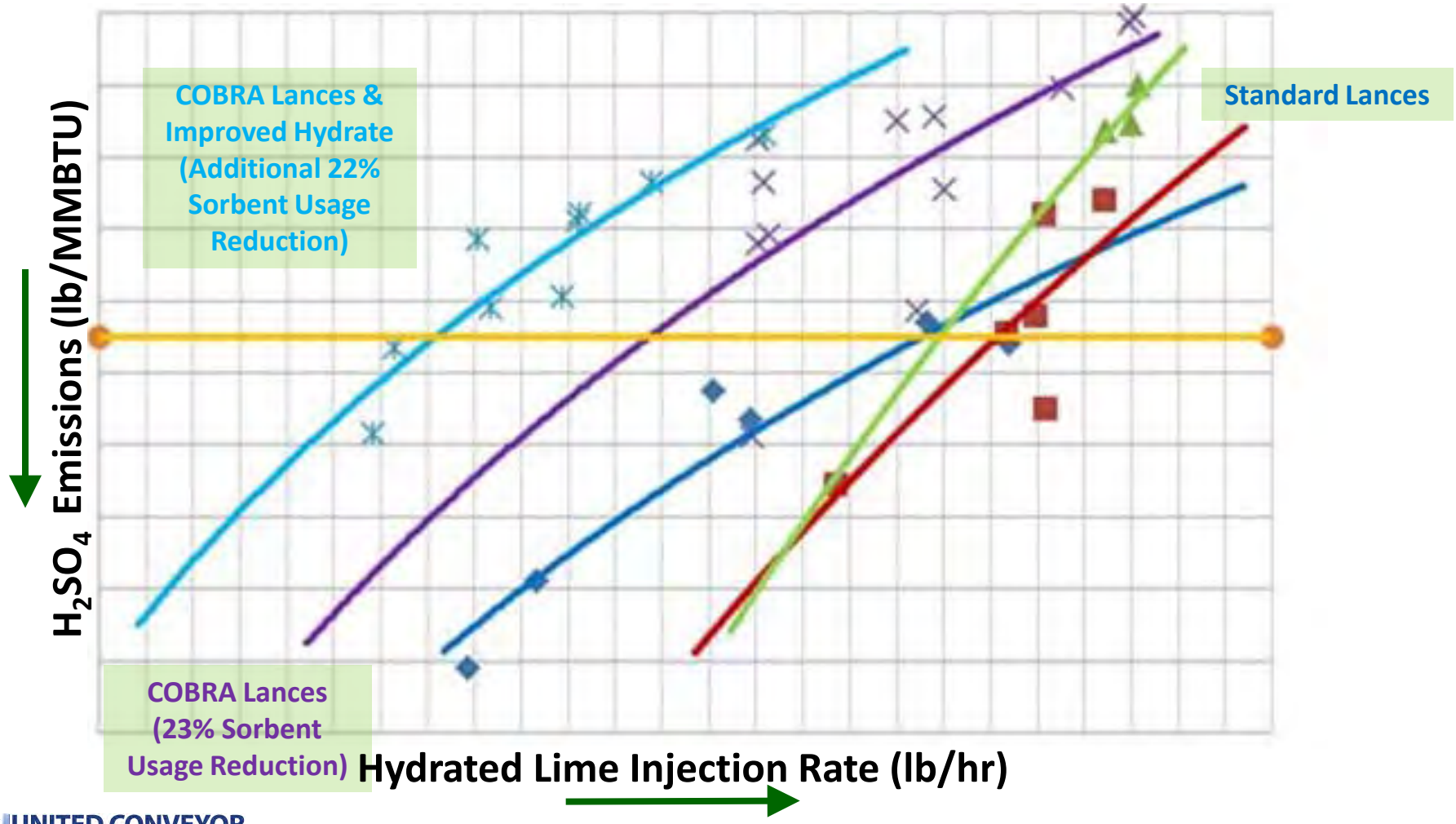
- Advantages UCC-patented COBRA Lance
  - Improved sorbent distribution on short residence time and “difficult” flue gas ducts
  - Allows less lances to be used
  - Optimizes sorbent usage

COBRA™ Lance Installation

COBRA™ Lance Installation

COBRA™ Lance Installation

COBRA Lance Performance



COBRA Lance Performance

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CASE STUDY 3
(1) HYDRATED LIME AND (1) ACI SYSTEM FOR SO_3 & HG REMOVAL

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Site Layout

DSI Silo Reused

ACI Silo Reused

Old Ash Silo Converted to DSI

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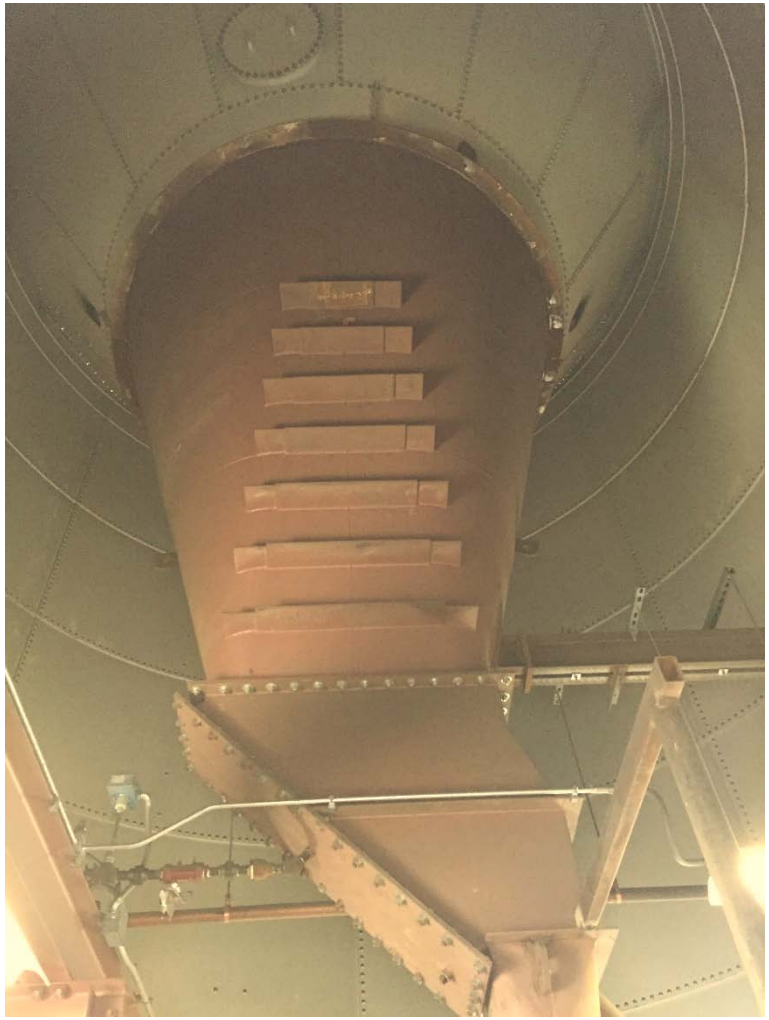
System Changes

- System Evaluation
  - Corrosion due to Improper Shutdown using Br-PAC
  - Little Storage for Hydrated Lime
  - Poor Dispersion
- System Equipment Changes
  - Gravimetric Feeders (ACI) and Weigh Bins (DSI)
  - Convert Ash Silo to Hydrated Lime System
  - Piping, Instrumentation and Controls
  - COBRA Lances
  - Silo Lining for Br-PAC Usage

Fly Ash Silo



- Silo Modifications
  - Changed to Chisel Bottom Concept
  - Included weigh bins, feeders, blowers, and dehumidifiers in silo skirt (previously unloading level)

DSI Modifications

- DSI System Modifications
  - Replaced weigh bins
  - Replaced fluidizing
  - Provided instrumentation and controls
  - Improved dispursion
    - COBRA Lance
  - Improved access

ACI Modifications

- ACI Modifications
  - Provided Gravimetric Feeders
  - Provided instrumentation and controls
  - Replaced corroded feeders, piping, and components
  - Lined silo in field

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CASE STUDY 4
(1) TRONA SYSTEM FOR SO_3 REMOVAL

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System Changes

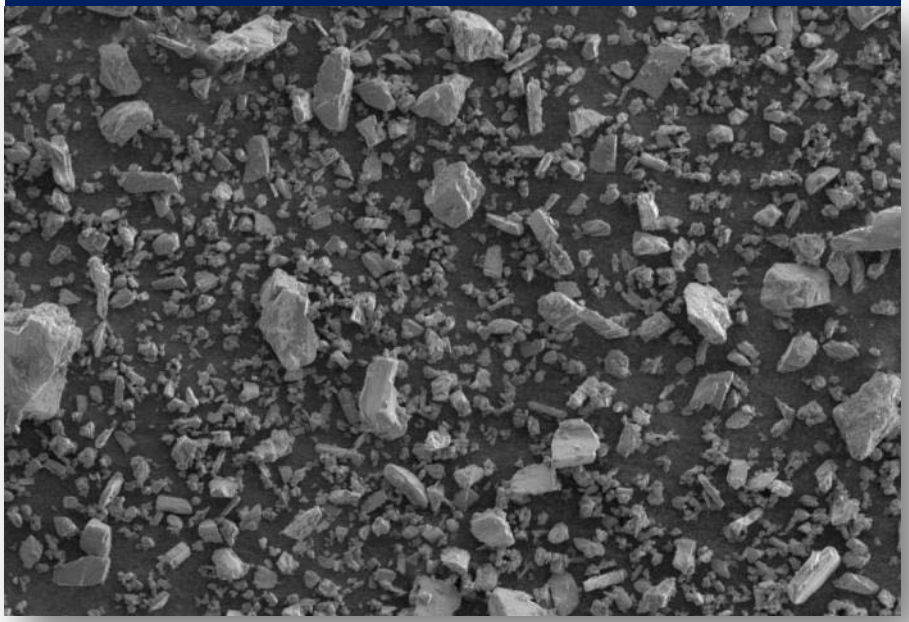
- System Evaluation
  - Inefficient Use of Unmilled Trona
- System Equipment Changes
  - Installed VIPER® Mills for particle size reduction

Case Study 1 – DSI System Description

- UCC VIPER Mills
- Plant since changed to hydrated lime injection, bypass mills

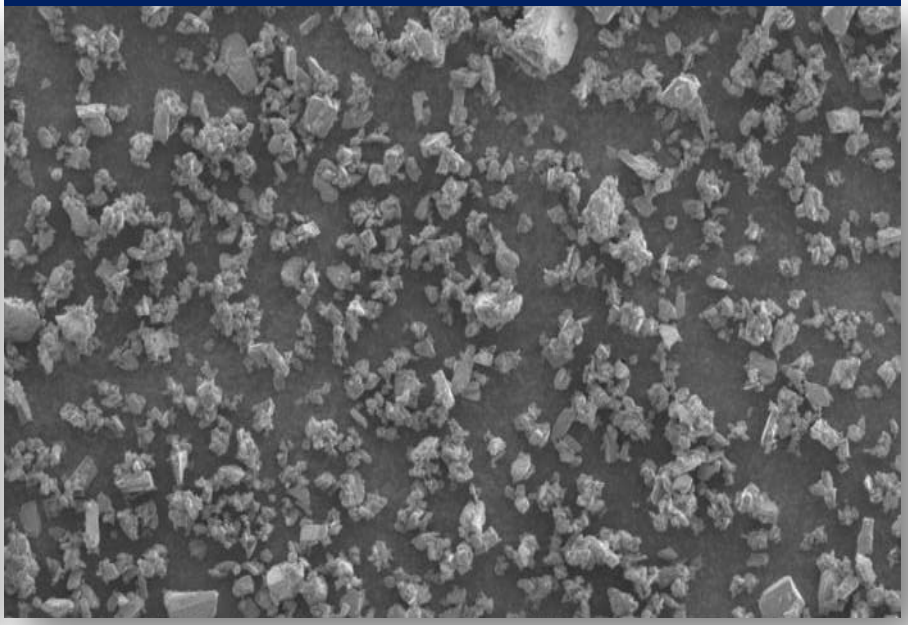
Trona Particle Size

Unmilled Trona



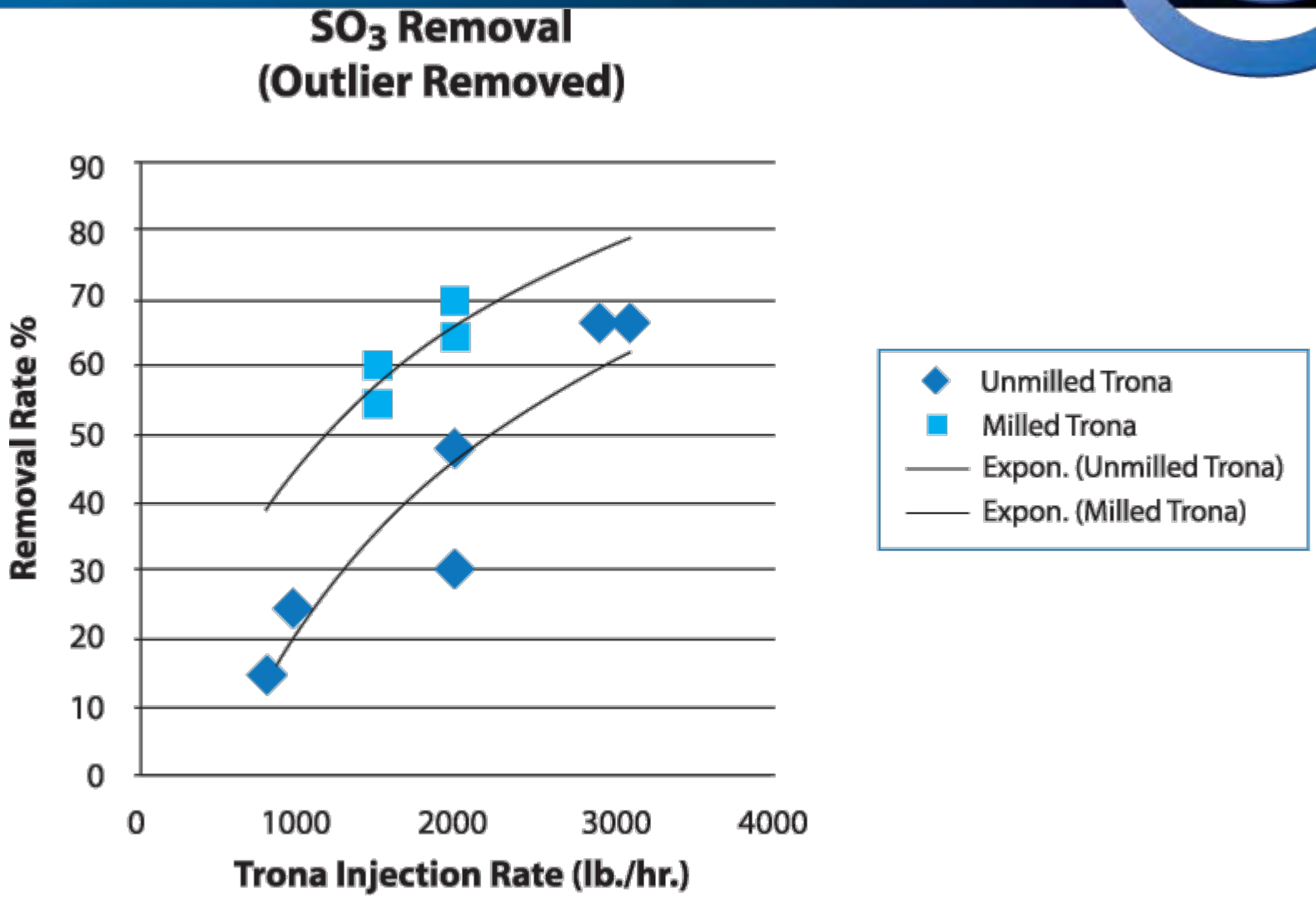
30-50 μm

Milled Trona



9 -15 μm

Test Results



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