

# REINHOLD ENVIRONMENTAL<sup>®</sup>



## **2023 Reinhold/PCUG Round Table Presentation**

Cohosted by Duke Energy and Vistra in The Westin Hotel,  
Cincinnati, OH on June 26-27, 2023

All presentations posted on this website are copyrighted by **REINHOLD ENVIRONMENTAL<sup>®</sup>** (RE). Any unauthorized attempts to print, to download, to modify, to incorporate into other presentations, to link to other websites or to obtain copies for any other uses than the training of attendees to RE Conferences is expressly prohibited unless approved in writing by RE or the original presenter. RE does not assume any liability for the accuracy or contents of any materials in this library which were presented and/or created by persons who were not employees or subcontractors of RE.



# Improving Plant Performance with Reliable, Low Cost DSI System Retrofits

## 2022 NO<sub>x</sub> RT

Mark Thomas

## Background & Perspective

- 33 Years of Utility Power Plant Experience
  - Cincinnati Gas & Electric > Cinergy > Duke Energy
  - Mark Thomas & Associates Consulting since 2011
- 24 Years of SO<sub>3</sub> Mitigation Experience
- 18 Years of SCR & Catalyst Experience
- DSI System Design, Testing & Performance Evaluations, O&M
- Used Most Available Reagents
  - Calcium (Hydrated Lime, Limestone, Cao)
  - Sodium (Trona, Sodium Bicarbonate, SBS) (Wet & Dry)
  - Magnesium Slurry
- Various Injection Processes & Locations
  - Wet & Dry
  - Furnace to FGD Inlet
  - Fuel Additives
- Work with but Independent from any Sorbent or DSI System Provider

# Performance Improvement Objectives

- Minimize Sorbent Utilization
- Maximize Target Pollutant Capture
  - SO<sub>3</sub>, SO<sub>2</sub>, HCl, Hg
- Maximize Reliability & Consistent Operation
- Minimize Maintenance
- Maximize Flexibility for BOP Co-Benefits

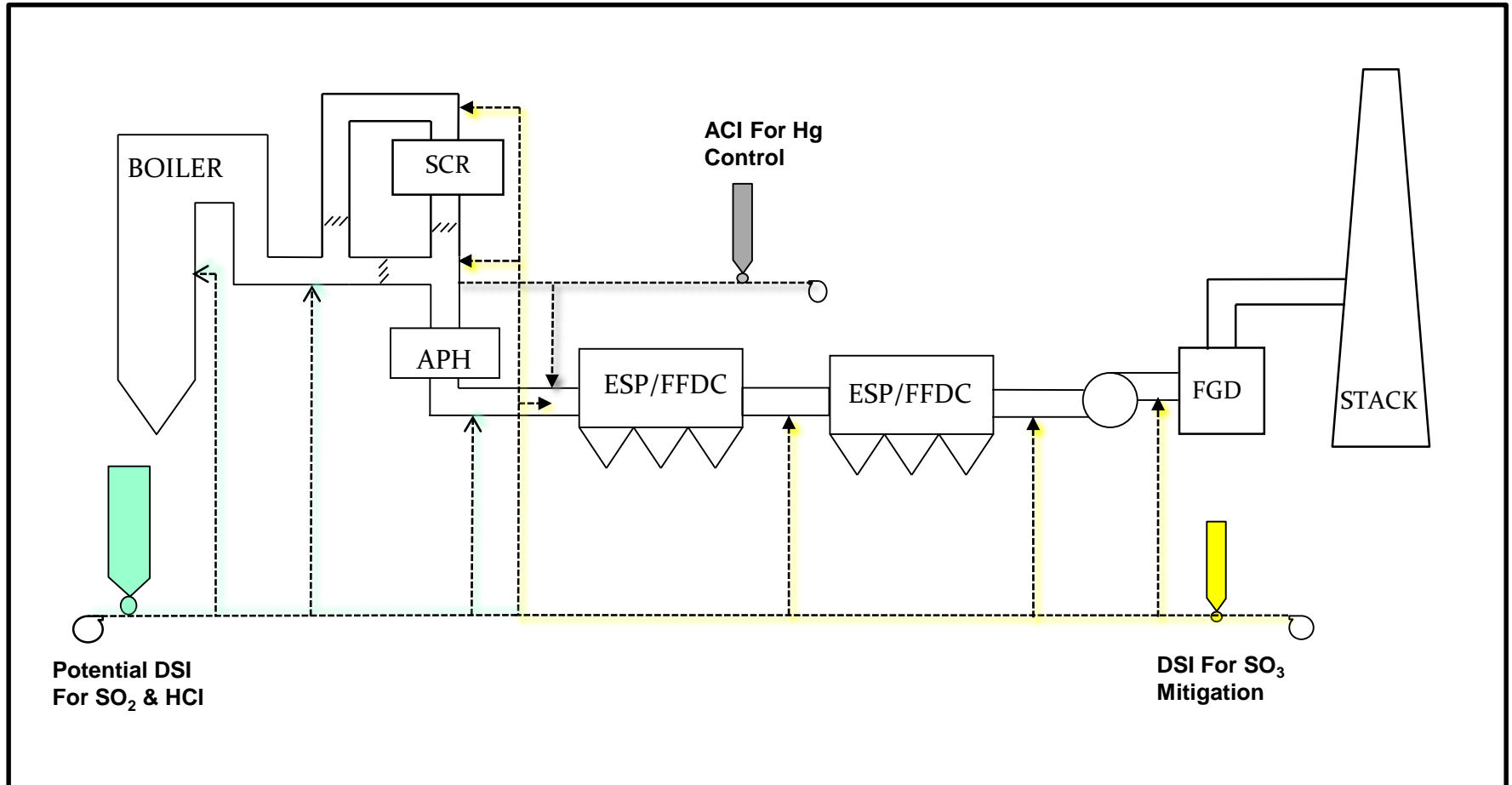
# Potential Balance of Plant Benefits

- SCR Min Load Operation
  - Reduced ABS Formation
  - Reduced Catalyst & Rectifier Deposits
- APH
  - Reduce APH Pluggage & Corrosion
  - Heat Rate Improvements
- MATS / Hg Control
- FFDC
  - Bag Protection
- ESP
  - Improve Capture

# Minimize Potential Negative BOP Impacts

- SCR Catalyst Impacts
- APH Pluggage Potential
- Fly Ash Impacts
  - Na, Ca, Cl, C/LOI
  - Sorbent Layout in duct
- ESP
  - Ash resistivity
  - Perf Plate Pluggage (Trona)
  - Uneven Sorbent Loading
- FFDC
  - Uneven Sorbent loading, unprotected areas

# POTENTIAL DSI & ACI INJECTION LOCATIONS



# Need For Cost Effective New & Retrofit Solutions

- Cost Savings Generally Desirable
- Some plants have nearer term closure dates
- Can use cost savings to add redundancy / flexibility
- Can use cost savings to improve other plant systems

# Overview of Cost Effective DSI Retrofits

- Improved Feed System
- Distribution & Splitting for Added Injection Locations
- Improved Dispersion & Mixing
- Convey & Unloading Air Quality

This presentation will focus on options that work and are cost effective.

# DSI FEED SYSTEMS – STANDARD DESIGN



# DSI FEED SYSTEM - SIMPLIFIED

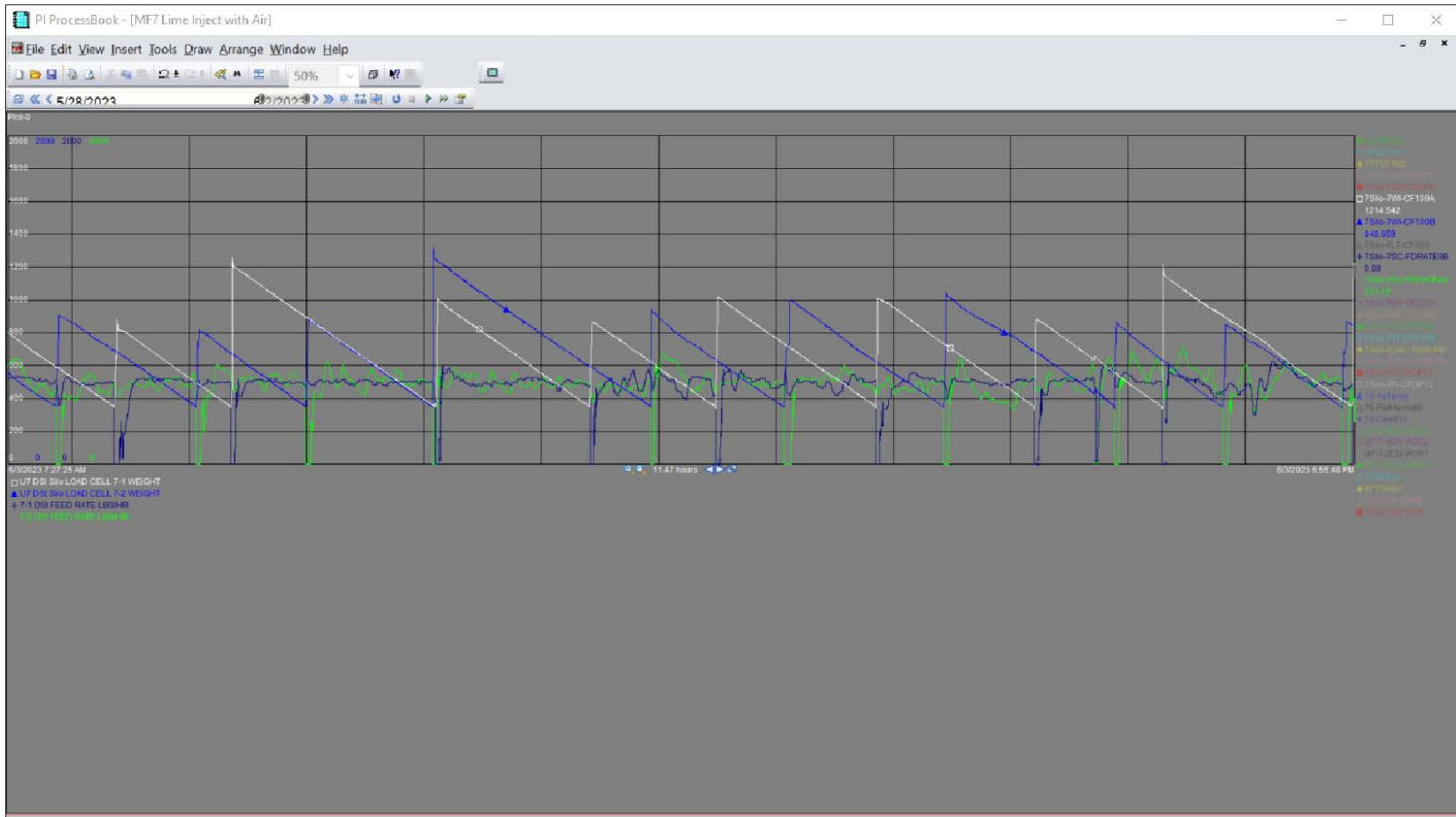
Single Feeder  
Vent to Top of Silo  
No Cartridge Filters  
No Aeration in Weigh Bin



# DSI FEED SYSTEM IMPROVEMENTS

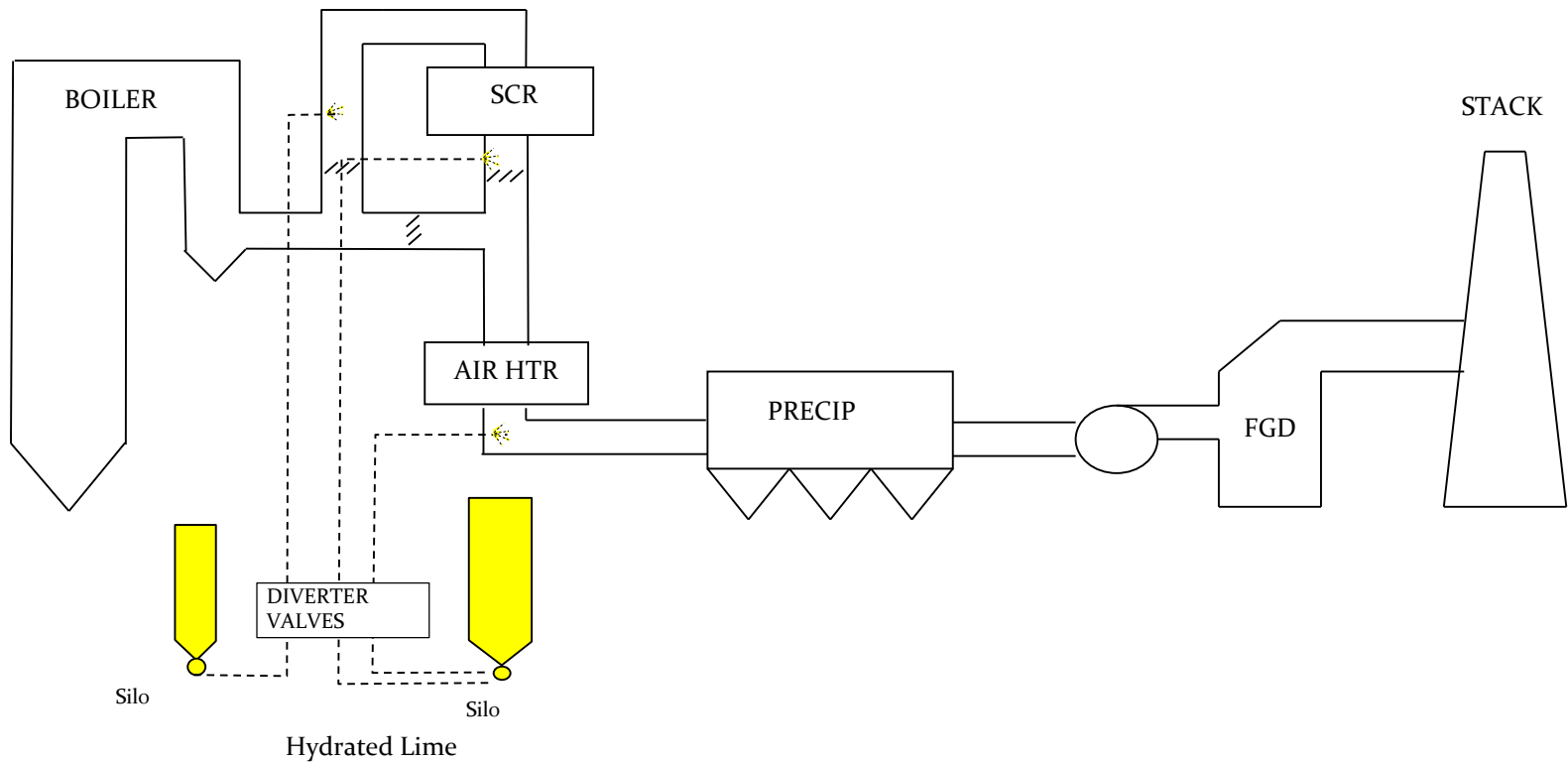
- Longer Fill Cycles
- Smoother LIW Signal
  - No Interference from filter cleaning and blinding
  - Vent line maintains constant pressure
- Reduced Maintenance on Rotary Airlocks
- Self Clearing Clear Vent Line
- Hose Connections for ease of inspections & cleaning

# Simplified DSI Feed – Consistent Feed



# DSI DISTRIBUTION & SPLITTER SYSTEMS

- Multi Point Injection
  - Requires cost effective but high performing lances and feed systems



# Additional DSI System Advancements

- Use of Diverter Valves to feed alternate Injection Sites
  - Can be swap quickly to alternate injection grid location
  - Can be used to achieve redundancy for more critical application

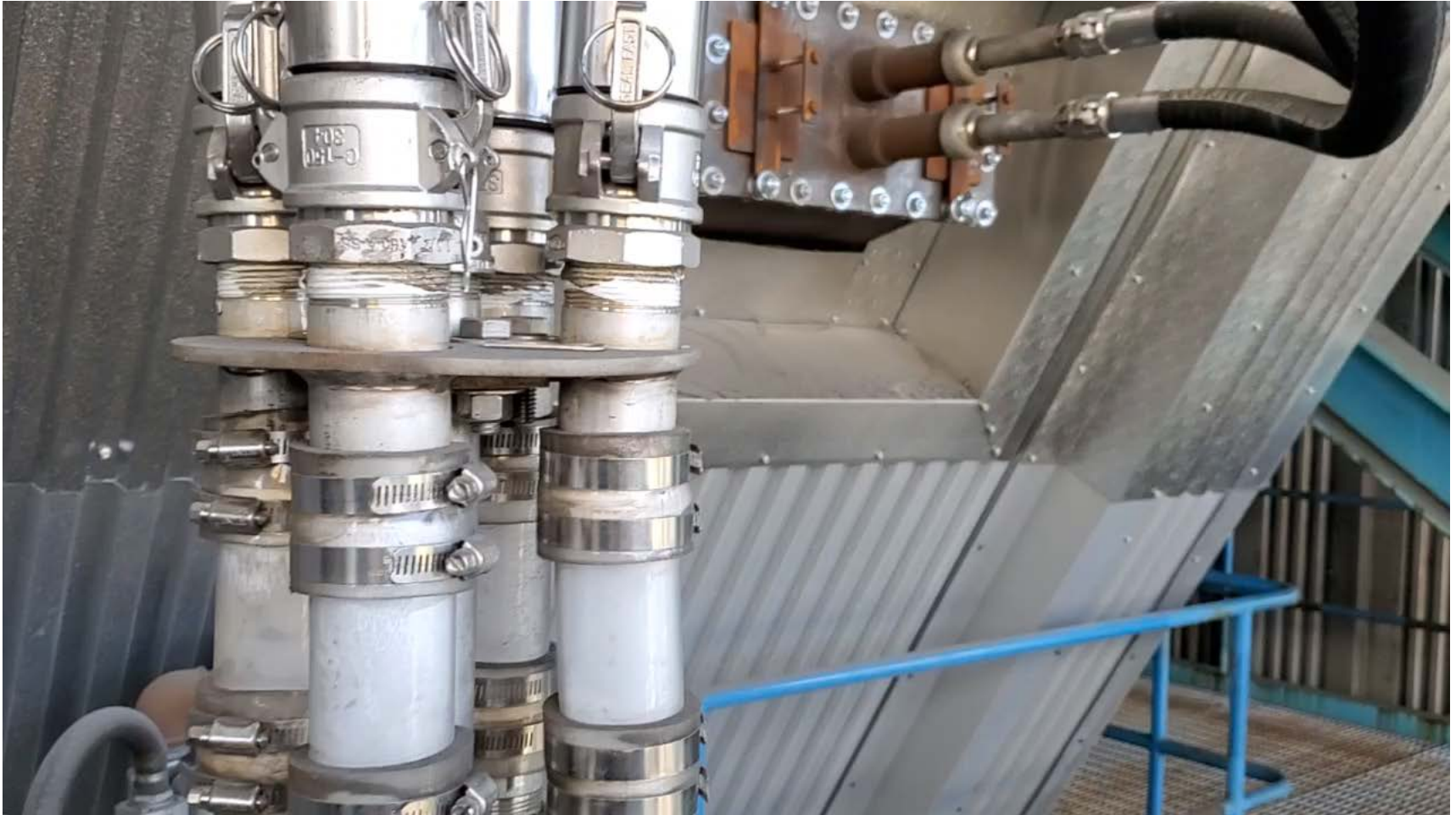


# SPLITTER DESIGN WITH INTEGRAL SIGHT GLASSES

- Cost Effective
- Provides ability to easily see relative flows to each lance
- Splitter body less prone to surface rust & product clinging
- Easy to clean and replace sight glass



# SPLITTER DESIGN WITH INTEGRAL SIGHT GLASSES

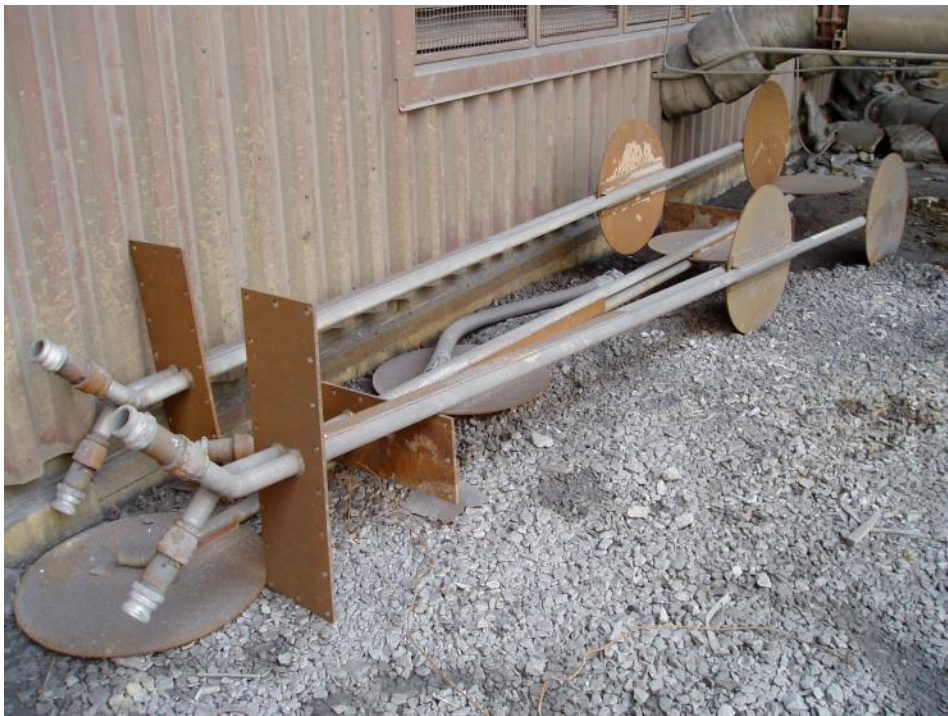


# SPLITTER DESIGN WITH INTEGRAL SIGHT GLASSES



# Additional Early Generation Advanced Lances

## 2004 Trona & Lime Lances

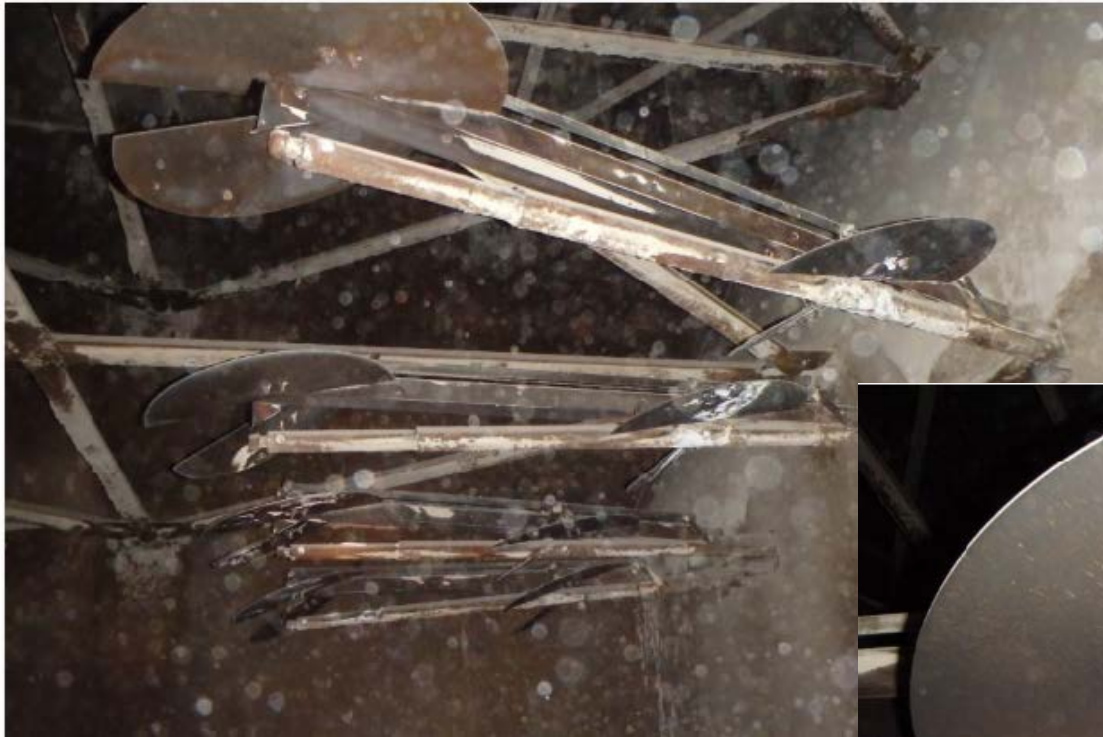


## 2005 Trona Lances



# Continued Development of Advanced Lances

## 2013 Lime Lances with Independent Adjustable Plates



# Continued Development of Advanced Lances

## 2016 Lances



## 2017 Lances



# Continued Development of Advanced Lances

## 2018 DSI Lances – Adjustable Mix Plates & View Ports



Note: Lance removal requires no tools

# Continued Development of Advanced Lances

Current Lances – 36” Dia Adjustable Mix Plates



Note: Lance removal requires no tools

# Continued Development of Advanced Lances

Current Lances – Adjustable Mix Plates & View Ports



Note: Lance removal requires no tools

# Slow Motion Video of Dispersion



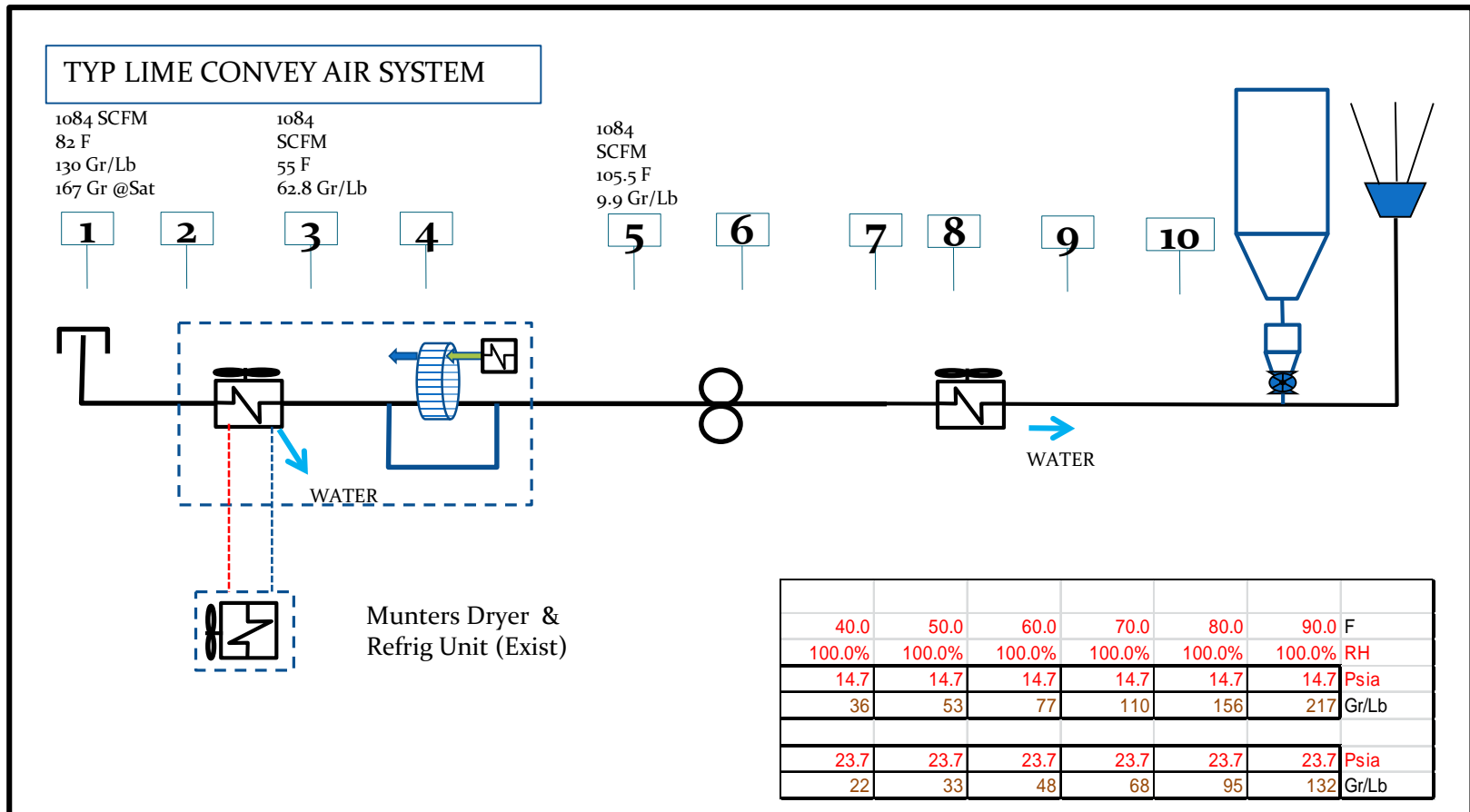
# Benefits from Advanced Lance Designs

- Significantly Improved Dispersion
  - Currently up to 42 “ Diameter Mixing Plates
- Reasonable Fabrication Cost
- Easy install thru rectangular ports
  - Existing ports can be used - require internal mixer attachment
- Not need internal scaffolding for installation or maintenance
- Designed to be easily modified for future improvements
- Can install multiple lances in same port at different elevations
- Can be installed in any orientation

# Benefits from Advanced Lance Designs

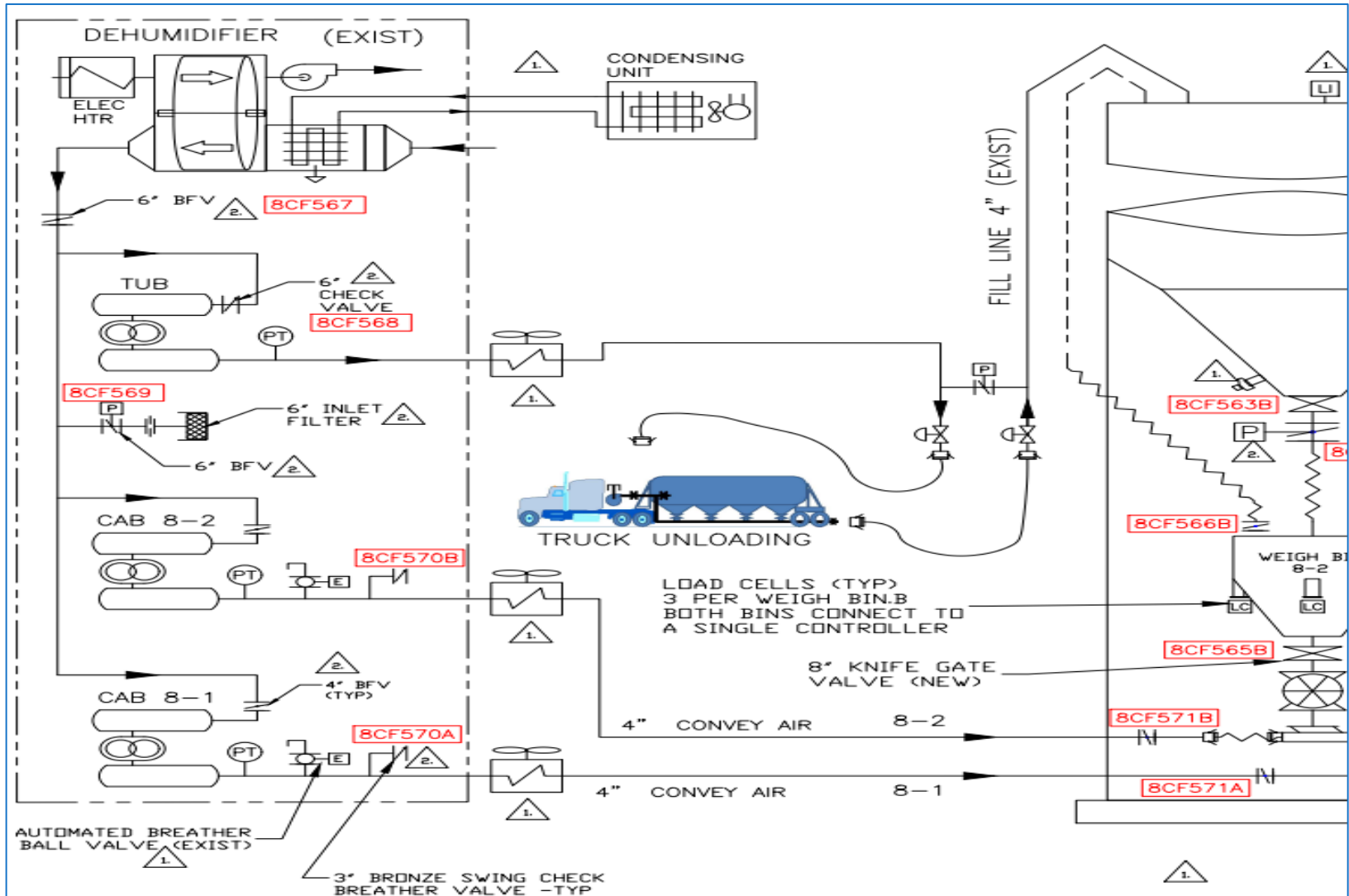
- Designs can be customized for specific applications
  - Plate Tilt & (Rotation) Adjustable from duct exterior or interior
    - Can evaluate performance realtime
    - Can evaluate pressure drop
    - Can adjust to minimize erosion patterns on lances or on erosion induced by mixing plates
- Maintenance for lance checks drastically simplified.
  - Lance tube removal requires no tools
  - Can be removed and replaced in a few minutes
  - Lance tube protected from corrosion and excessive heat

# AIR QUALITY IMPROVEMENTS USING DEHUMIDIFICATION SYSTEM



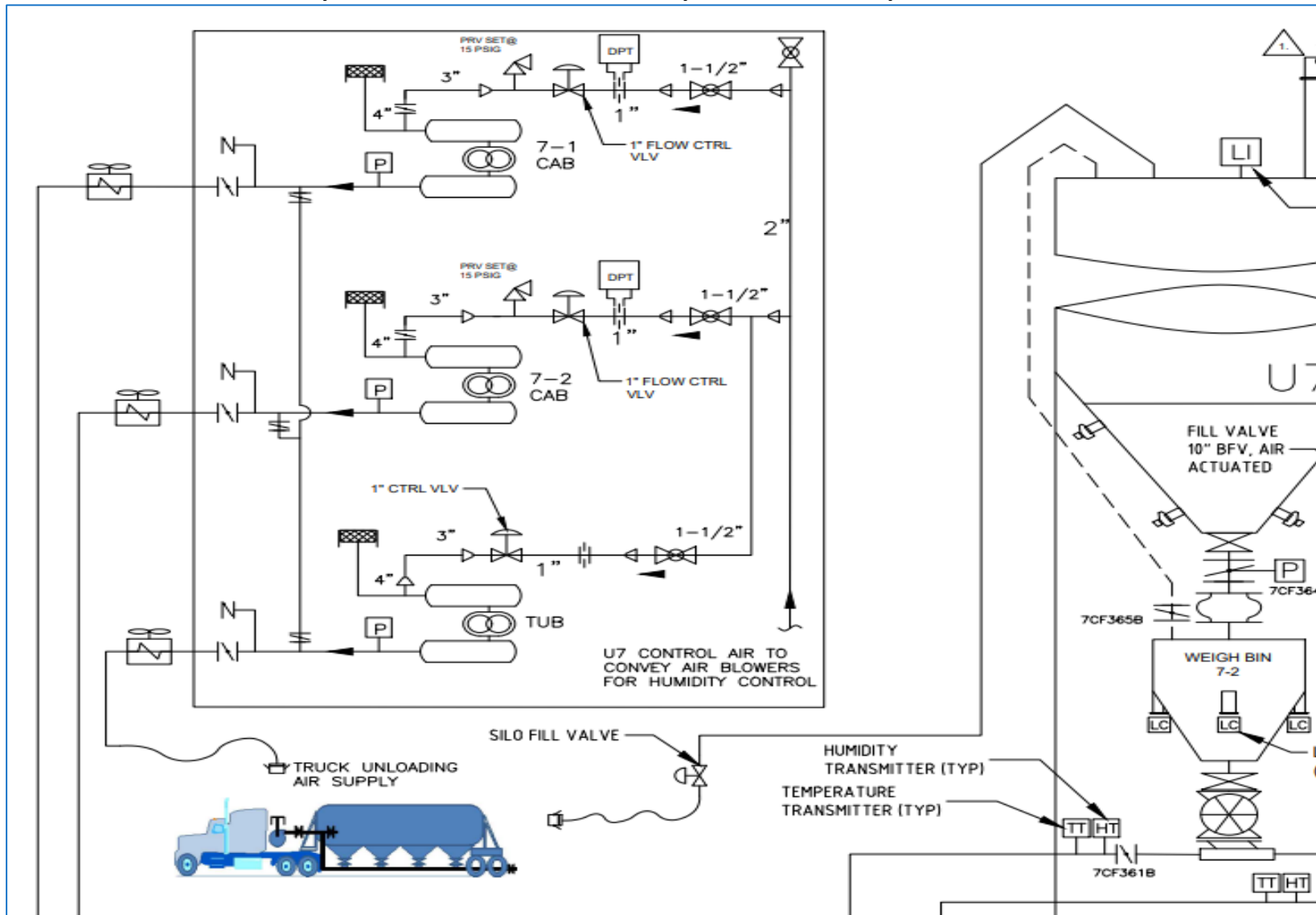
# AIR QUALITY IMPROVEMENTS BY REPURPOSING EXISTING EQUIPMENT

- Can Repurpose Truck Unloading Dryer Systems



# AIR QUALITY IMPROVEMENTS BY REPURPOSING EXISTING EQUIPMENT

- Use Excess “Dry” Air to Reduce Convey Air Humidity



# Advancements Continue

- Thorough assessments important
- Know your current and possible future objectives
- Integrated/ Holistic Approach Critical
- DSI Experience varies significantly
- Past experience critical but past conclusions can be misleading

# Conclusion

- Cost Effective Options Exist
- Site Specific Evaluations
- Consider Used Equipment
- Look for Potential Balance of Plan & Impacts Benefits



# QUESTIONS?