REINHOLD ENVIRONMENTAL Ltd.

2015 NOx-Combustion Round Table & Expo Presentations

February 23 & 24, 2015, in Richmond, VA / Hosted by Dominion

SCR Operating Experience at Duck Creek Energy Center

Presented at:
The 2015 NOx-Combustion/PCUG Conference
At the Omni Richmond Hotel
February 23-26, 2015

Presented by:

Rich Sample
Engineering Programs Manager
Dynegy
richard.sample@dynegy.com

Brandon Potter
Plant Engineering Manager
Dynegy
michael.b.potter @dynegy.com

Jake Shelton
National Sales Manager
CoaLogix |SCR-Tech
jks@coalogix.com

Duck Creek

- Canton IL, 30 miles SW of Peoria, IL
- Commercial 1976
- 416MW gross
- 3,000,000 lb/hr
- 2400 psig
- Riley Drum Boiler
- Front wall fired
- Ball Tube Mills
- GE Turbine
- Wet Limestone Scrubber

Background

- 2003
  - SCR added to plant for NOx control
  - Single air heater
- 2007
  - Boiler
    - Dynamic classifiers
    - Burners
    - Boiler surfaces
    - External economizer
  - Turbine HP/IP dense pack

Background

- 2009
  - PRB Coal
  - Precipitator
  - Wet limestone scrubber
  - Stack
  - Axial ID fans
  - High efficiency LP turbines

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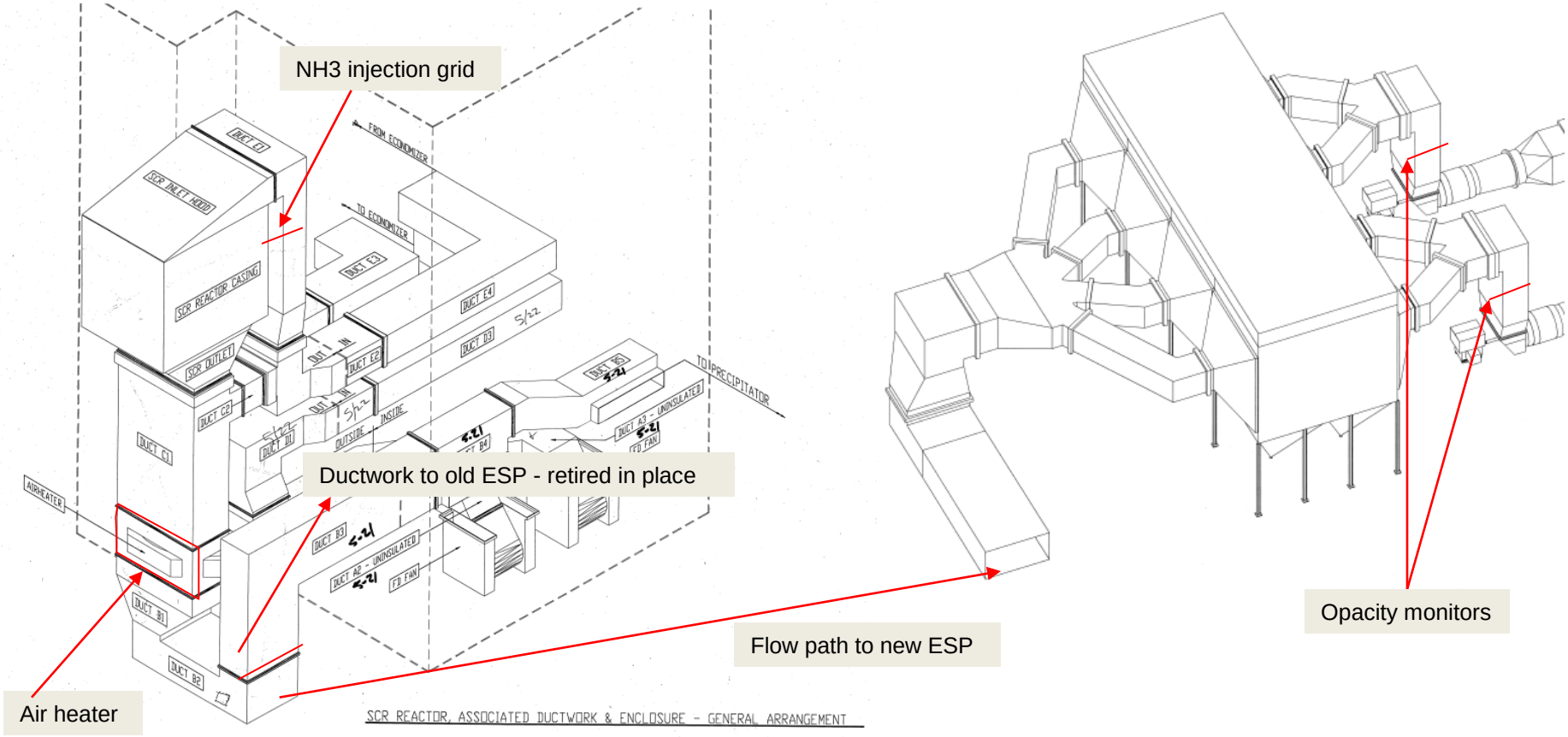
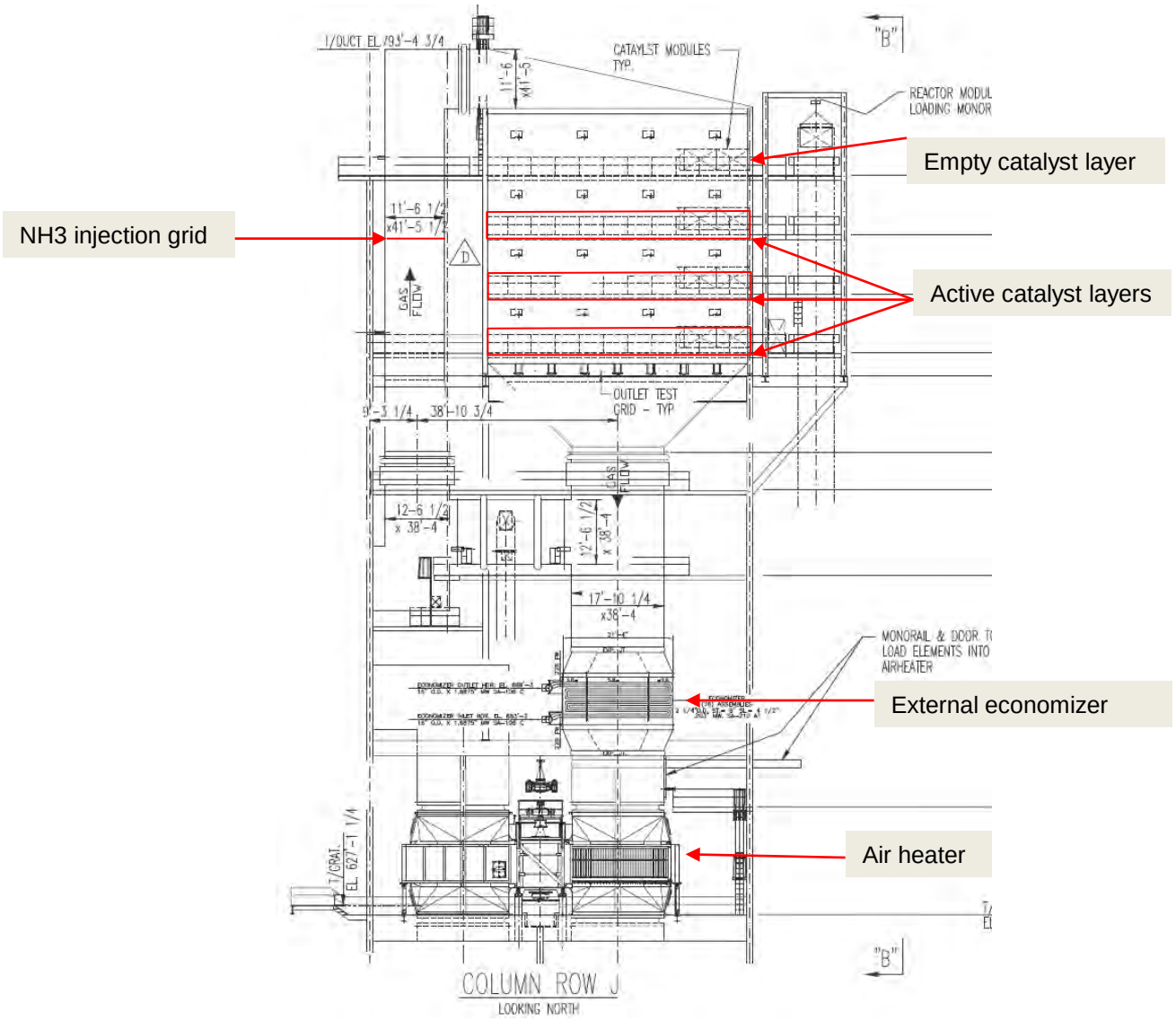
Duck Creek SCR

Equipment Arrangement



SCR Side View



Duck Creek – SCR Design

- Design Considerations
  - Based on Illinois basin coal
  - Size of reactor based on Edwards 3 @ 360GMW
  - Unit rating
  - PRB Fuel change
  - Gas Flow
- Significant Challenges
  - SCR has remained relatively unchanged
  - Face velocity at original design gas flow 17.9 ft/s
  - EPRI recommended is 17.0 ft/s max
  - PRB fuel face velocity is 22.2 ft/s
  - Increased ash volume

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LPA Screen Evolution

What is LPA?


CENTIMETERS
Cat. No. 09-016 Fisher Scientific Company
INCHES
10/21/2010


10/21/2010

Duck Creek LPA Screen 2007

Pleated Screen & Hopper Baffles

1.3% of Particles Escape Hopper

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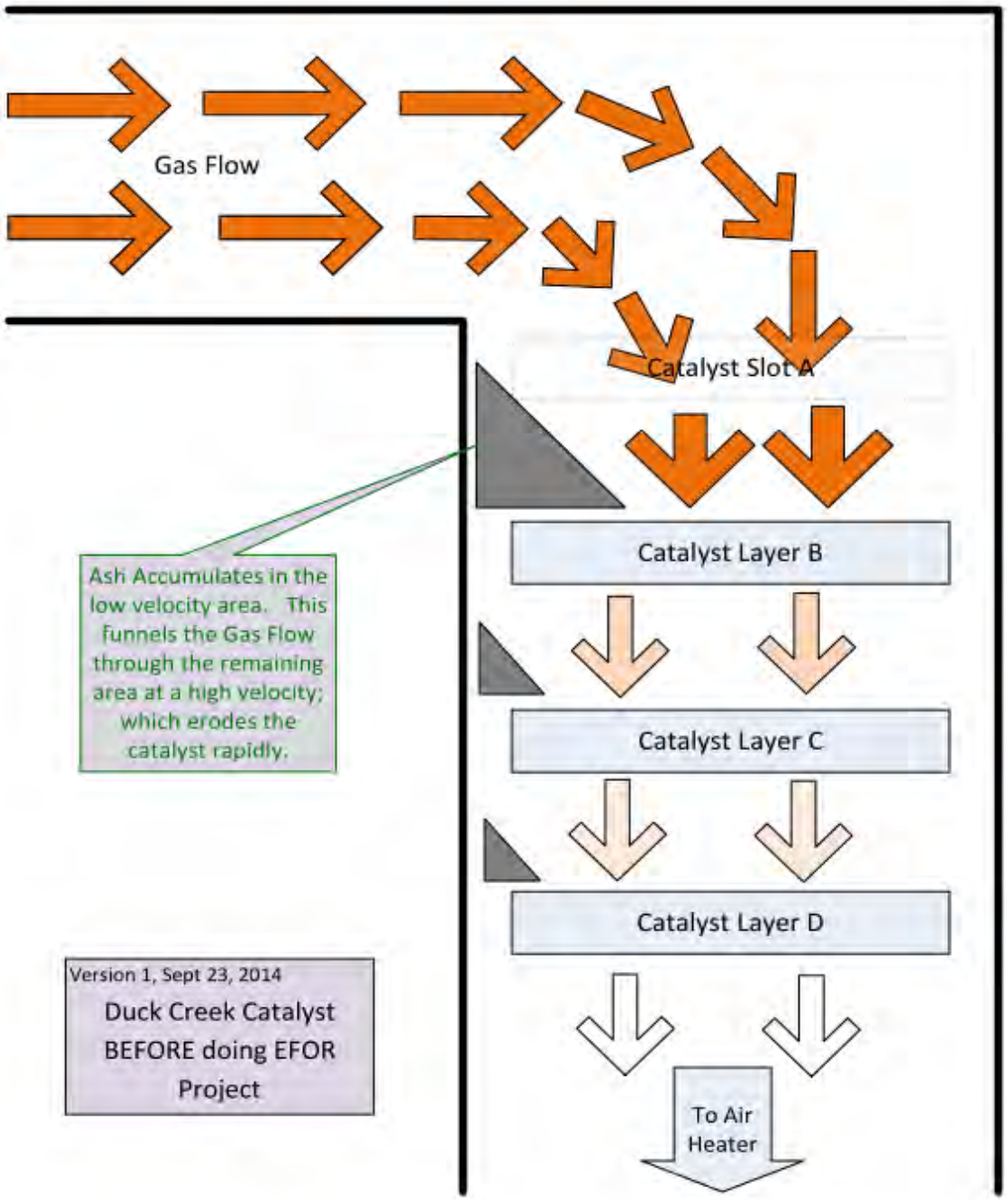
Module Pluggage & Damage

Stalactites and Pluggage

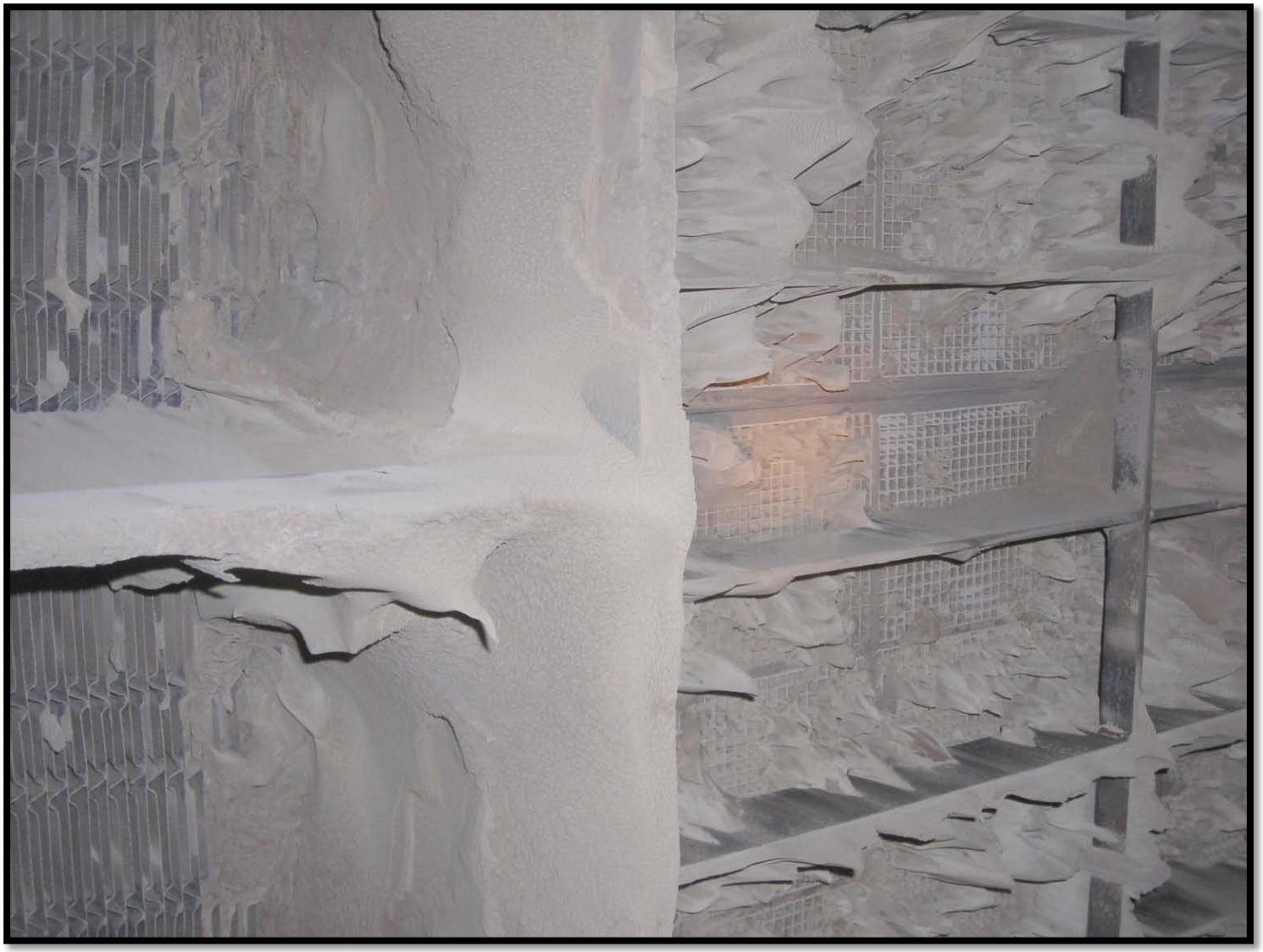
3 Rows of Modules Plugged

3 Rows of Modules Plugged


Gas Flow
Catalyst Slot A
Ash Accumulates in the low velocity area. This funnels the Gas Flow through the remaining area at a high velocity; which erodes the catalyst rapidly.
Catalyst Layer B
Catalyst Layer C
Catalyst Layer D
To Air Heater
Version 1, Sept 23, 2014
Duck Creek Catalyst BEFORE doing EFOR Project

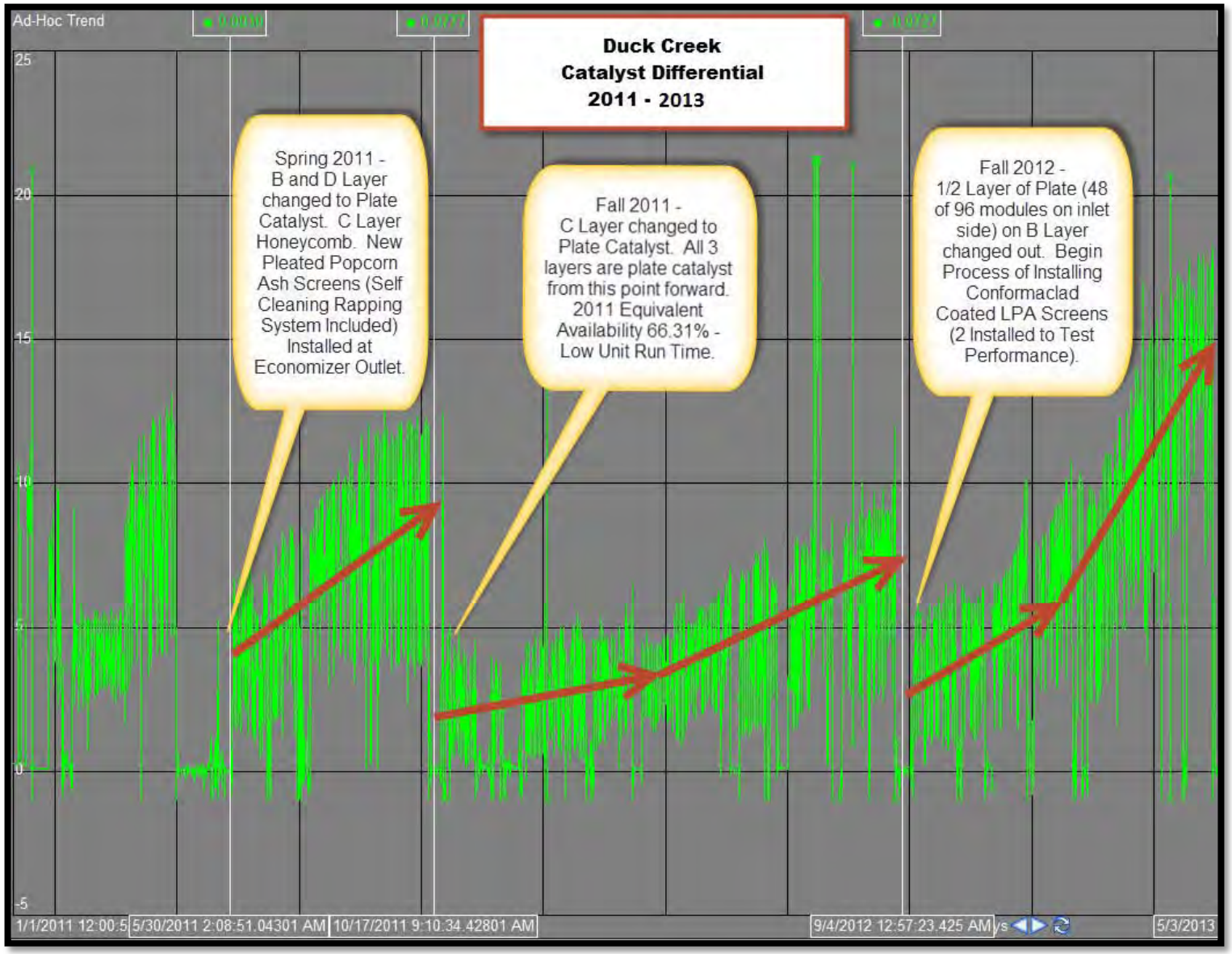
Catalyst Erosion

Plate vs. Honeycomb



Catalyst Erosion

Catalyst Replacement Cycle



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SCR Improvement Project

Scope Spring 2014

- Replace Catalyst Layer B & D
- Complete Installation of 24 LPA Screens
  - Coated with Conforma Clad
- Install Mega Sound Generator
- Install Ash Sweeper System

What is an Ash Sweeper?

Uses eruption of compressed air to move material

- Reservoir of compressed air discharges as an eruption into a storage or process vessel to promote flow and prevent material buildup
- Introduced ~1975, accepted across industry, around the world
- Common in power plants on coal bunkers and chutes
- Available as individual units *(one outlet per tank)*
- Or as multi-port system (*one tank serves several outlets)*

Individual Unit

Multi-Port Unit

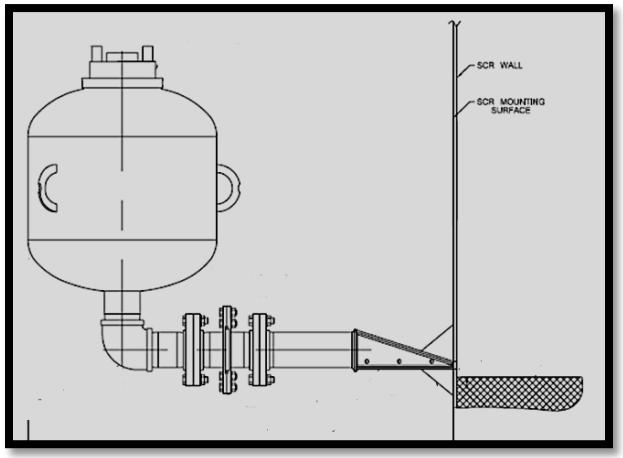
Air Requirements

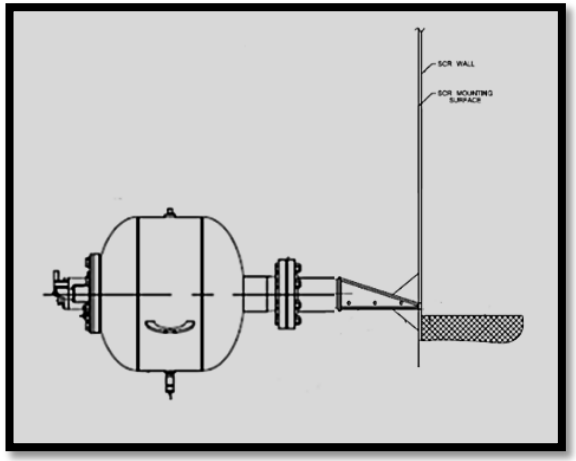
150 Liter Hurricane Air Cannon

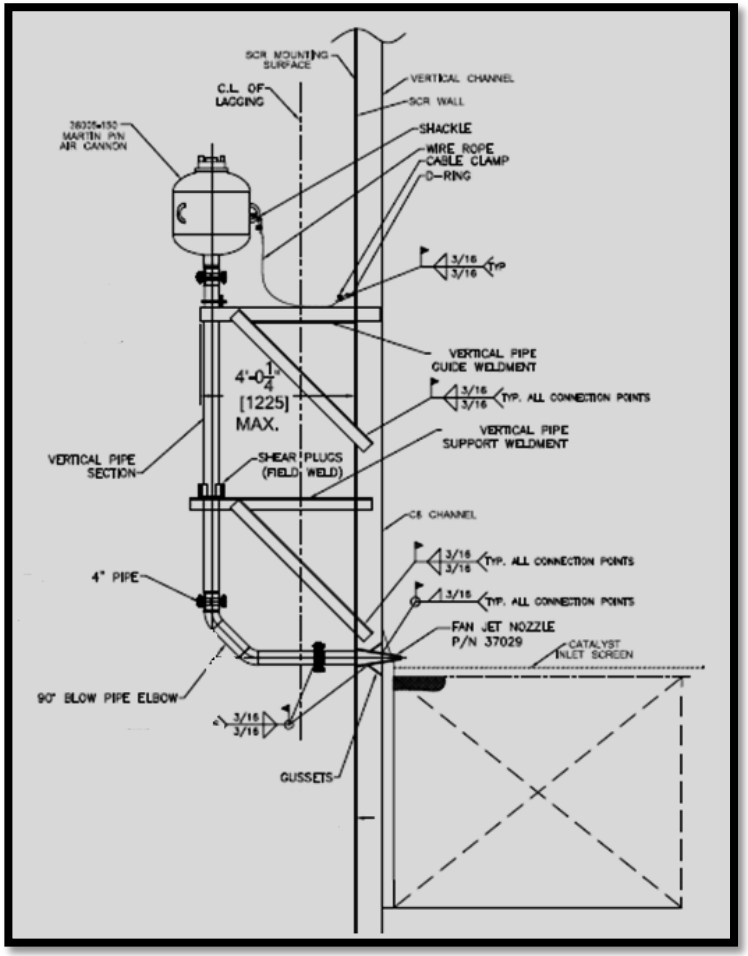
Air Pressure: 80 – 110 PSI

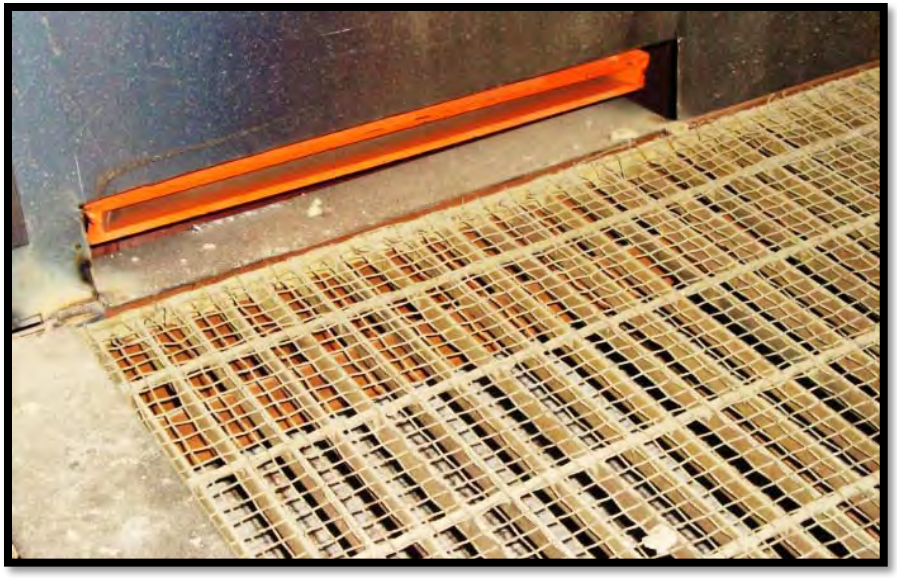
The typical operating cycle for Ash Sweeper Catalyst Cleaning System is to discharge each air cannon once ever 30 minutes. The 150 liter tank is then slowly re-filled during the 30 minutes between discharges. Each air cannon will average consuming 1.2 SCF per minute. A system consisting of ten (10) 150 Liter Hurricane Air Cannons will consume less than 12 SCF per minute.

Ash Sweeper Installation Illustrations





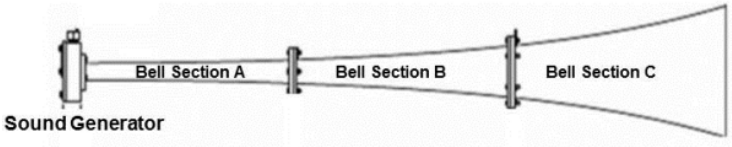

SCR MOUNTING SURFACE
C.L. OF LAGGING
VERTICAL CHANNEL
SCR WALL
SHACKLE
WIRE ROPE CABLE CLAMP
D-RING
3/16 3/16 TYP
VERTICAL PIPE GUIDE WELDMENT
4'-0 1/4" [1225] MAX.
3/16 3/16 TYP. ALL CONNECTION POINTS
VERTICAL PIPE SUPPORT WELDMENT
VERTICAL PIPE SECTION
SHEAR PLUGS (FIELD WELD)
C6 CHANNEL
3/16 3/16 TYP. ALL CONNECTION POINTS
4" PIPE
3/16 TYP. ALL CONNECTION POINTS
FAN JET NOZZLE P/N 37029
CATALYST INLET SCREEN
90° BLOW PIPE ELBOW
3/16 3/16
GUSSETS

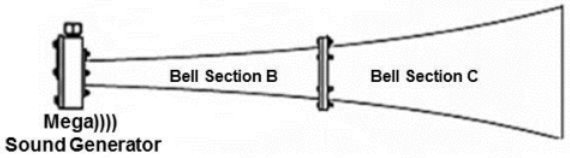


In this picture, you can see the transition from the flat seal plates to the inverted V seal plates.

D-75 Acoustic Cleaner

Mega 75 Acoustic Cleaners





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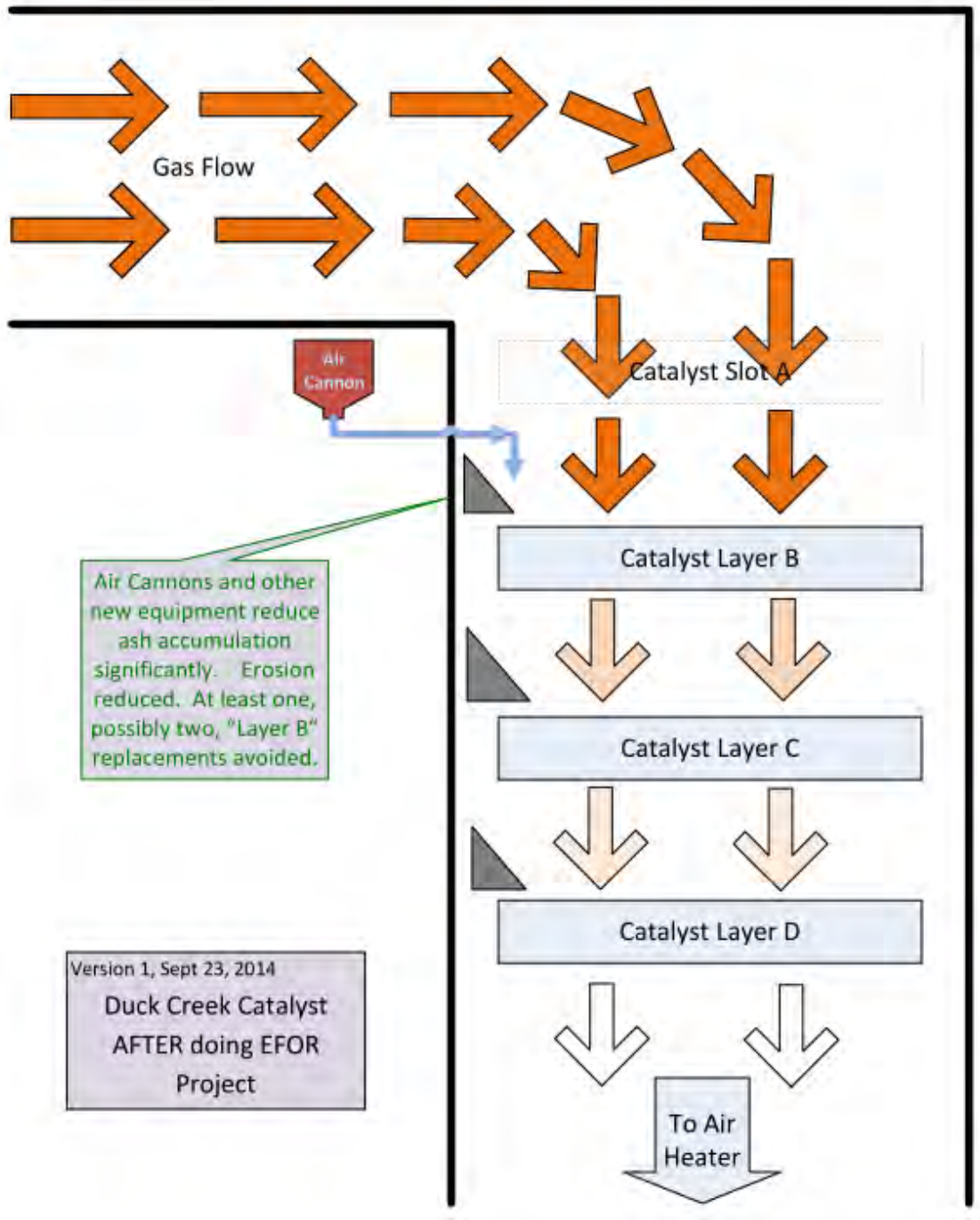
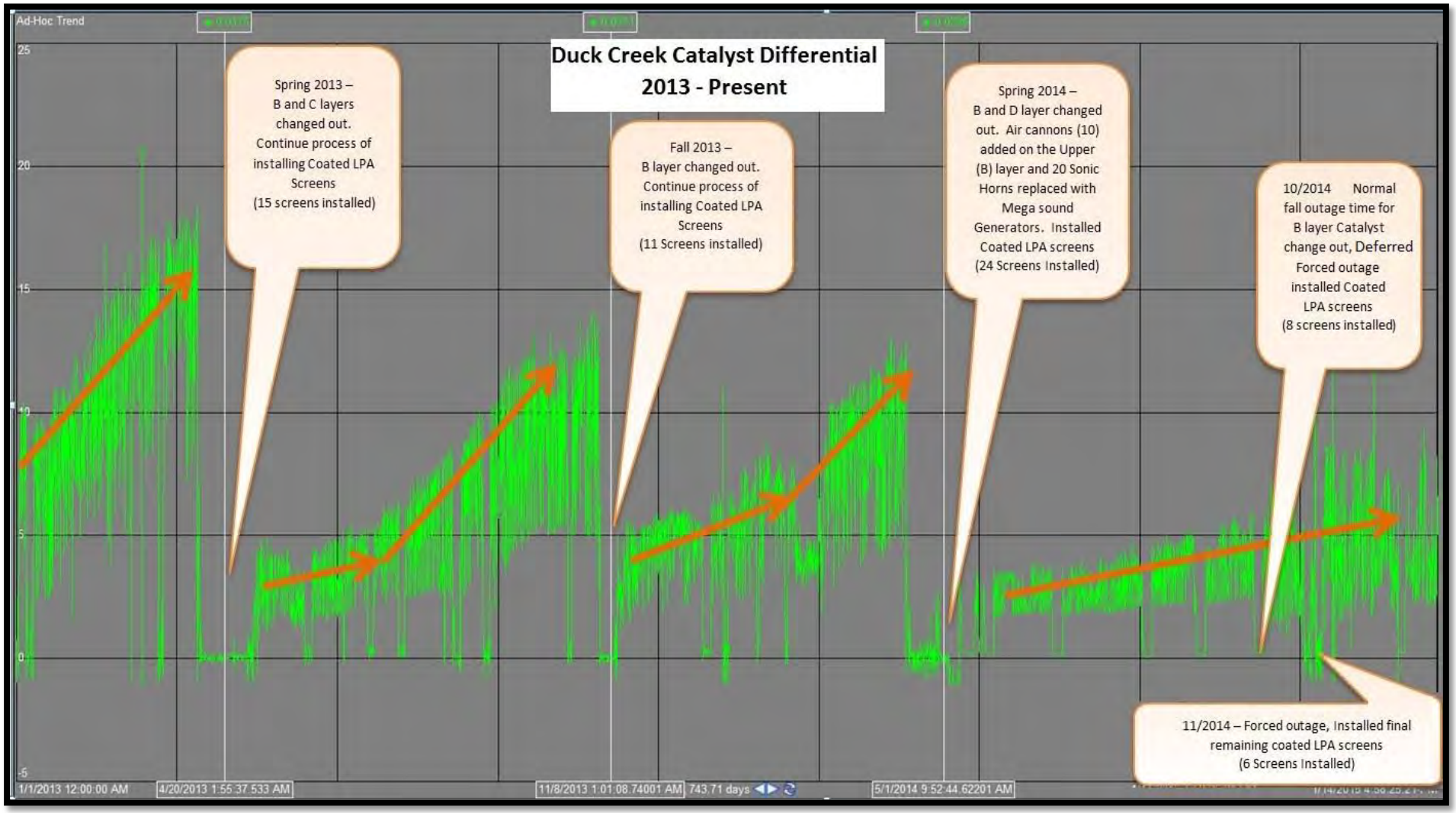
Results

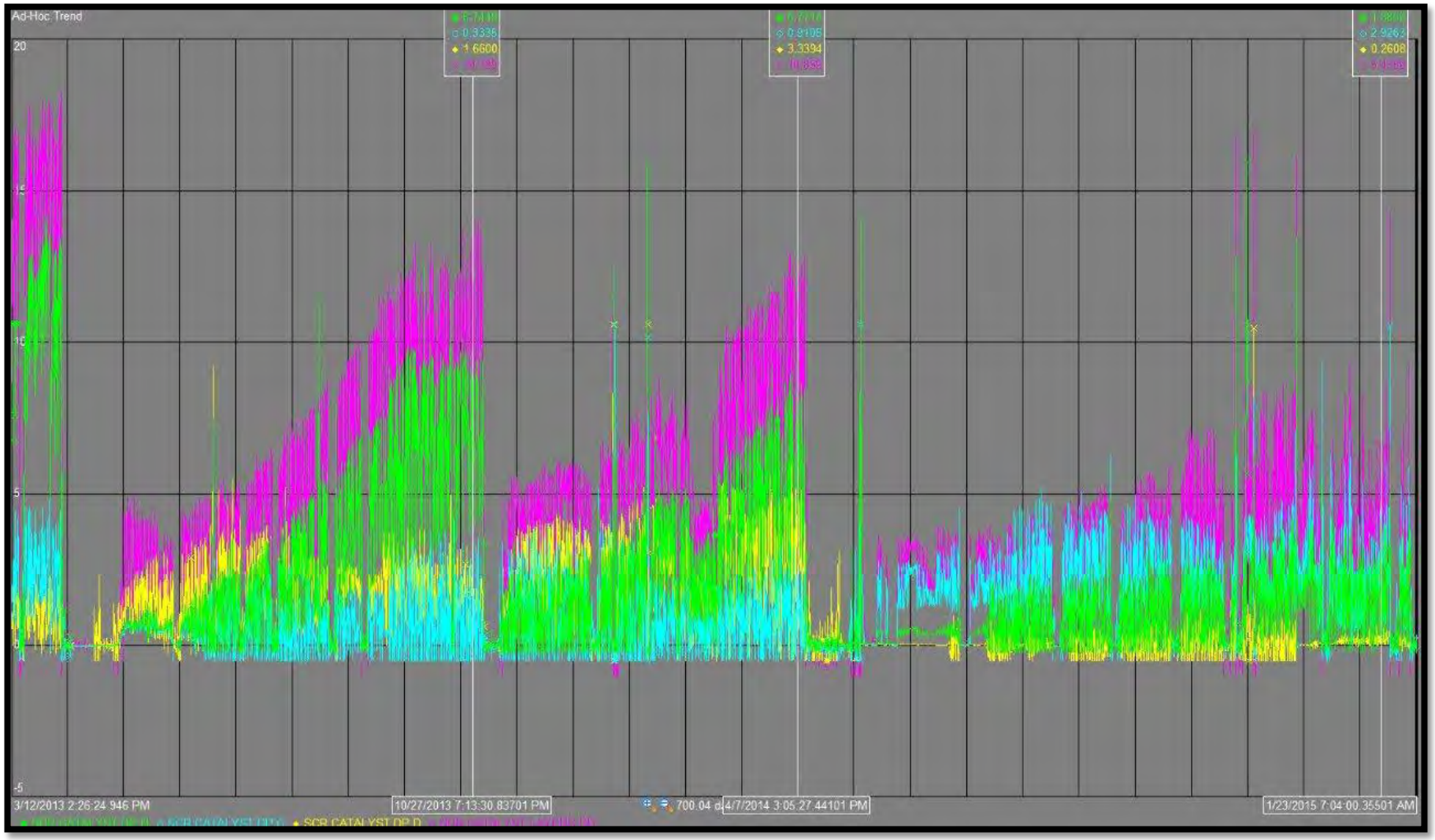

000885
2014.06.11
12:31:06
KANH-0532


Gas Flow
Air Cannon
Catalyst Slot A
Catalyst Layer B
Catalyst Layer C
Catalyst Layer D
To Air Heater
Air Cannons and other new equipment reduce ash accumulation significantly. Erosion reduced. At least one, possibly two, "Layer B" replacements avoided.
Version 1, Sept 23, 2014
Duck Creek Catalyst AFTER doing EFOR Project

Catalyst Replacement Cycle



Catalyst Replacement Cycle



Project Impacts

- Improved Gas Flow Through SCR
- Catalyst Life Extended
- One Layer of Catalyst Purchasing & Installation per Year
- Improves ID Fan Efficiency
- Reduces Ammonia Usage

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Questions?