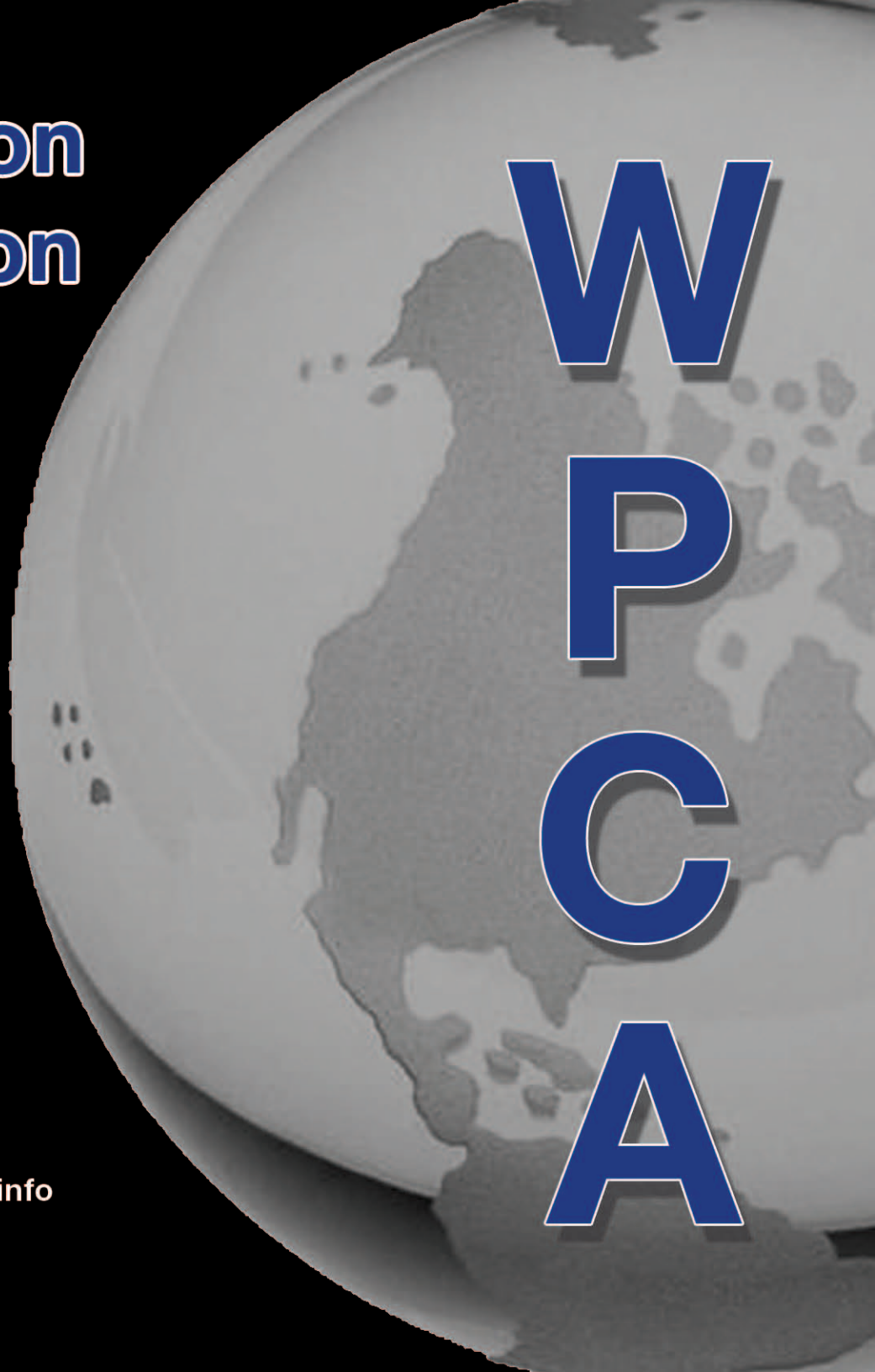
Worldwide Pollution Control Association



Duke Energy Seminar

September 3 – 5, 2008

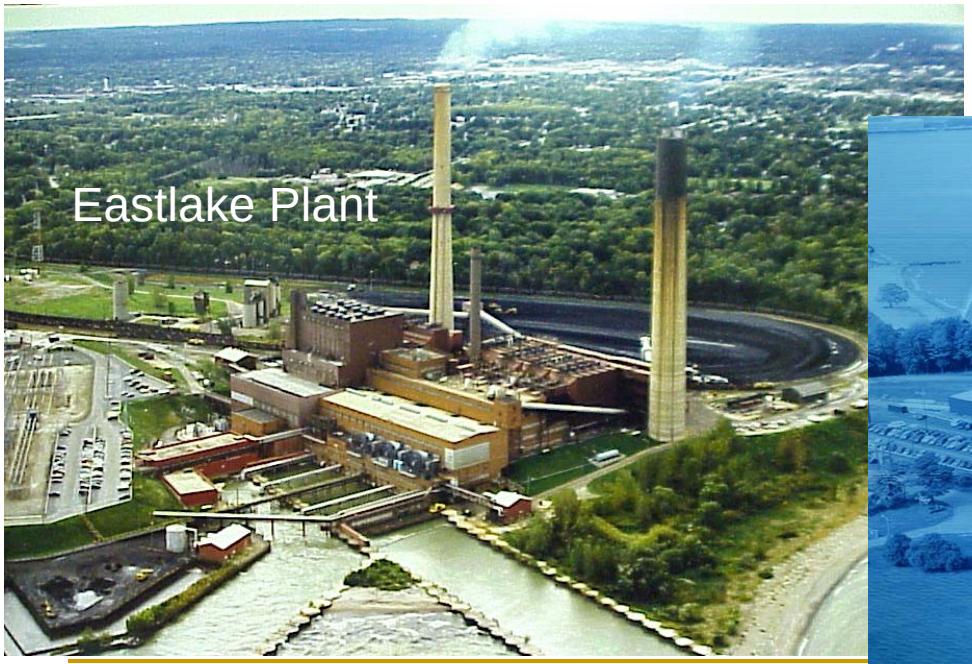
Concord, NC

WPCA

Vist our website at www.wpca.info

Pulsed Detonation Technology Application at

FirstEnergy

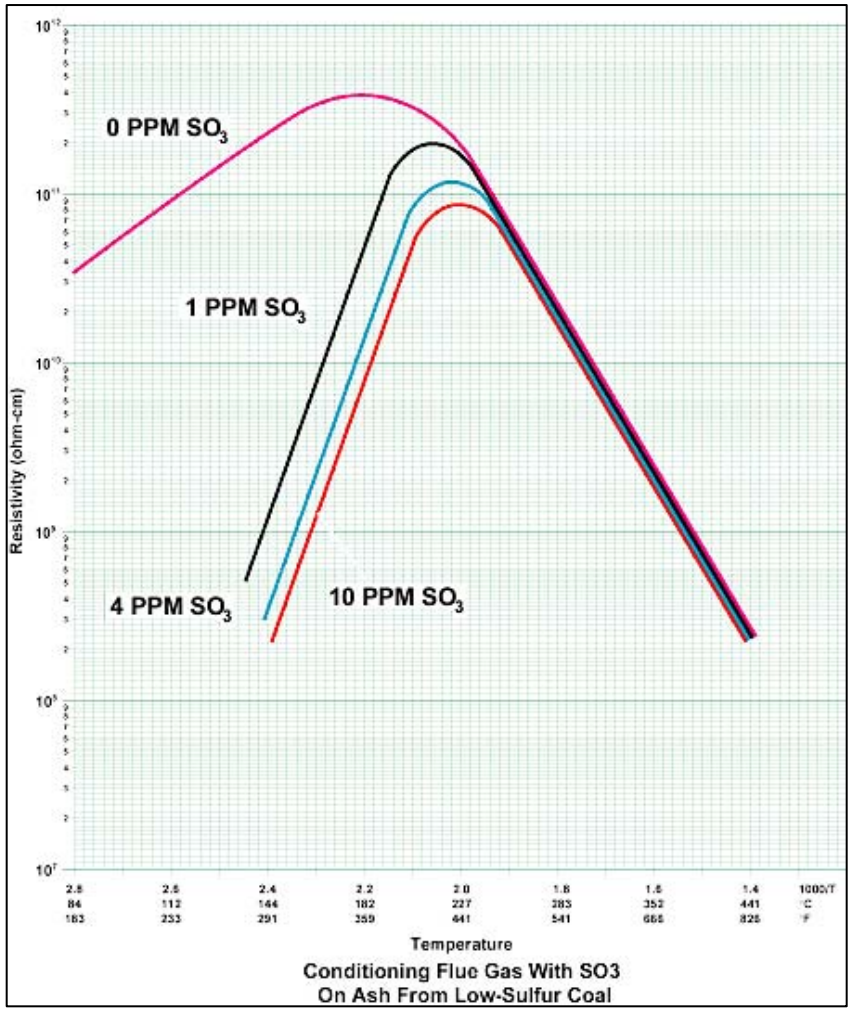


Impulse Cleaning Background

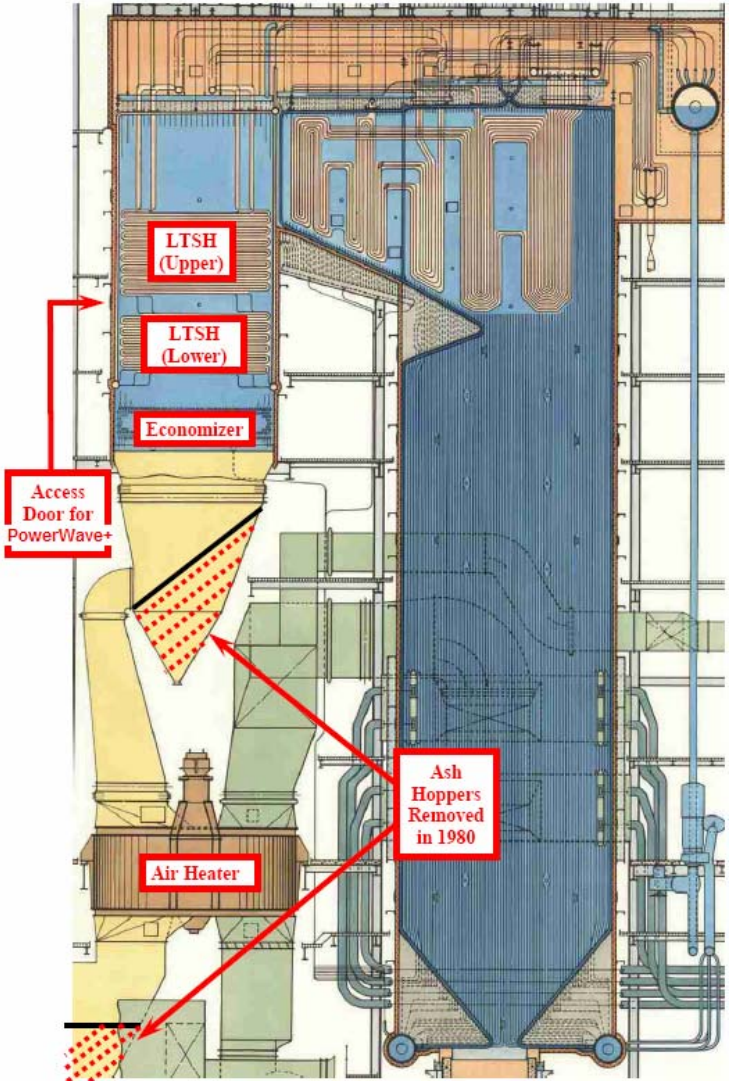
- High magnitude/energy shock impulses
- Multi-directional penetration of wave
- Non-line of site cleaning
- Deeper penetration of stronger pressure waves
- Size allows for multiple installation points with minimal intrusion
- Online, Pro-active cleaning method

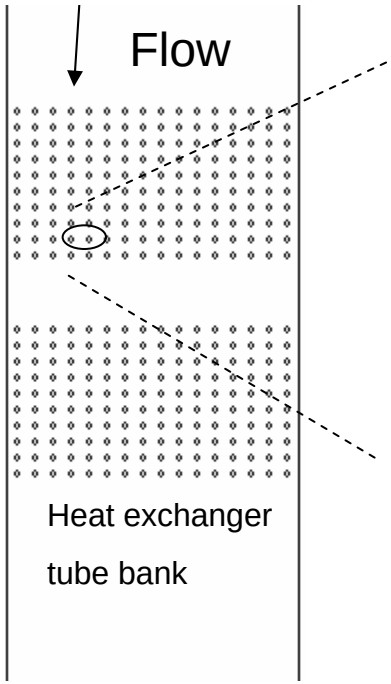
Powerwave+ (PD-5) Progression into FirstEnergy

- **Potential solution to EL4 elevated ESP inlet gas temperatures.**
  - **Ash platenization w/in the LTSH elements reduced heat transfer performance.**
  - **Goal to reduce APH gas outlet temps, currently 360-410 degrees F.**
  - **Improve ESP collection efficiency by reducing ash resistivity.**
- **Project moved to Ashtabula 5.**

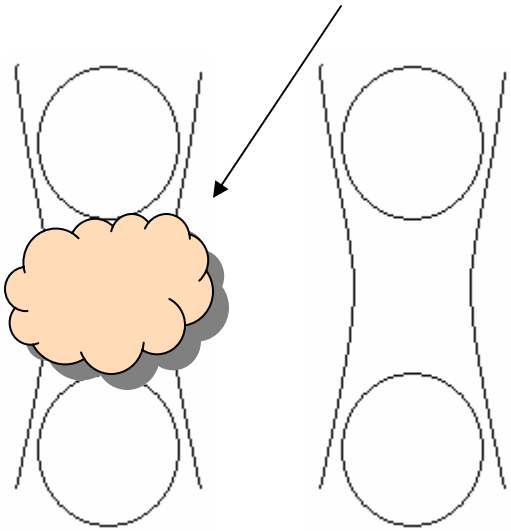


Layout and Problem: Eastlake 4





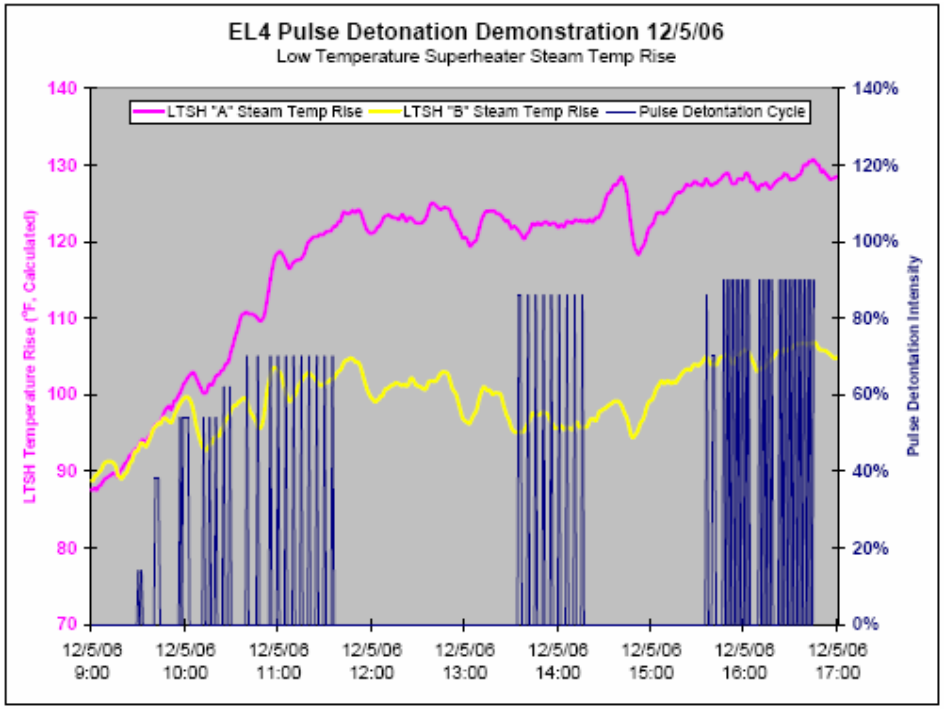
Slag completely fills vertical gaps between all tubes



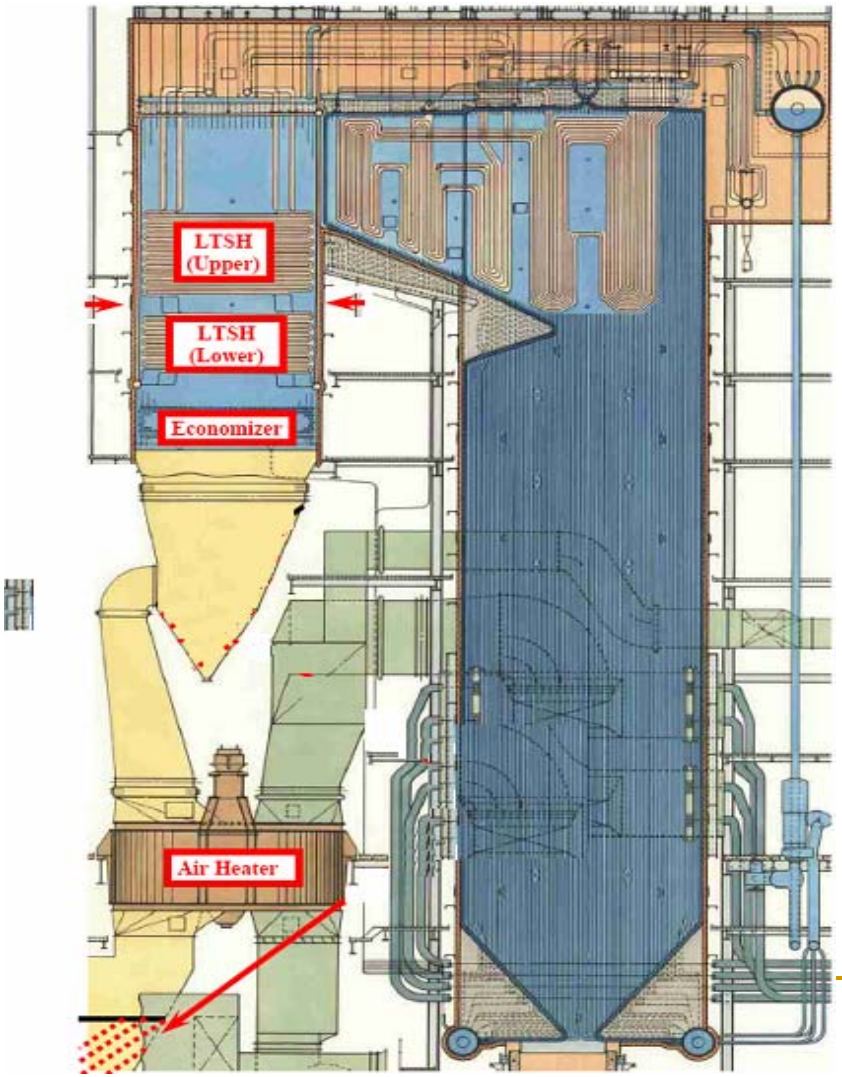
- Burning PRB coal leads to platenization and plugging in back passes of the boiler

EL4…Did it work?

- Noticeable improvement in the air heater gas inlet temperature.
- Rise in “C”-side may be attributed to plugging of A and B sides.
- Over 20 degree increase in steam outlet temp across SH LTSH.
- Difficult to grasp a boiler performance improvement w/ the missing hoppers.
- Moved to Ashtabula as an EPRI TC project.



"AT" Boiler Layout and Problem

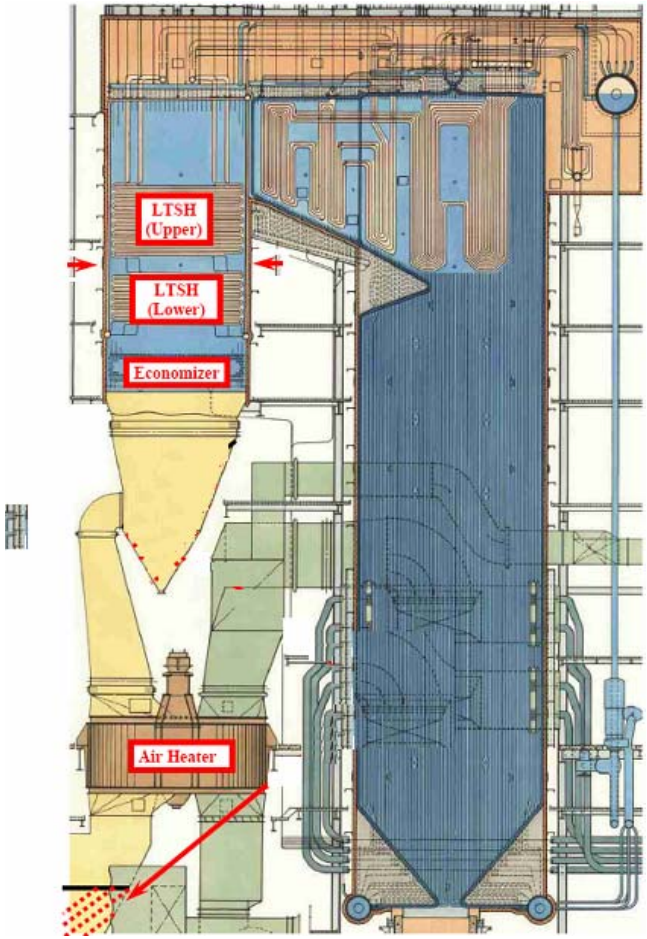


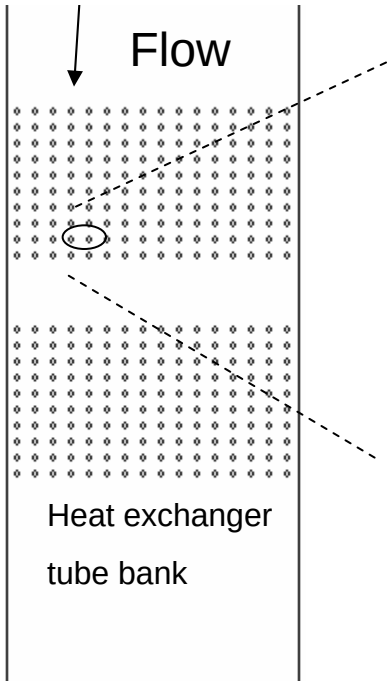
Twin Furnace, CE Boiler designed to burn eastern bituminous coal

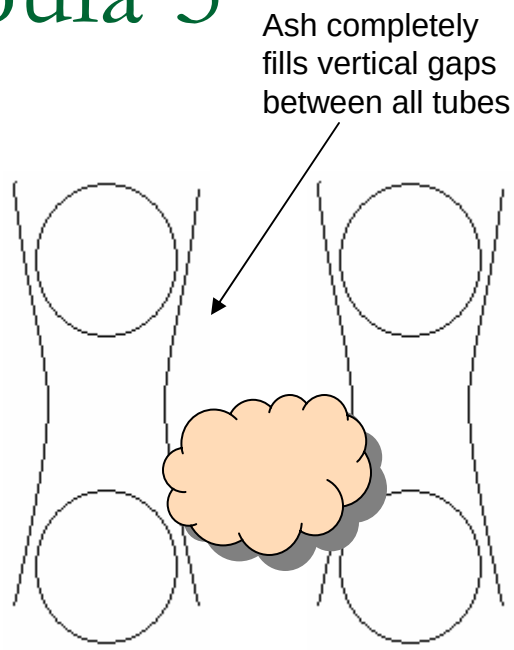
Switched to PRB coal lead to platenization and pluggage in back passes of the boiler

- Economizer, staggered fin-tube arrangement.
- Annual cleaning outage.

Layout and Problem: Ashtabula 5







- Burning PRB coal leads to platenization and plugging in back passes of the boiler

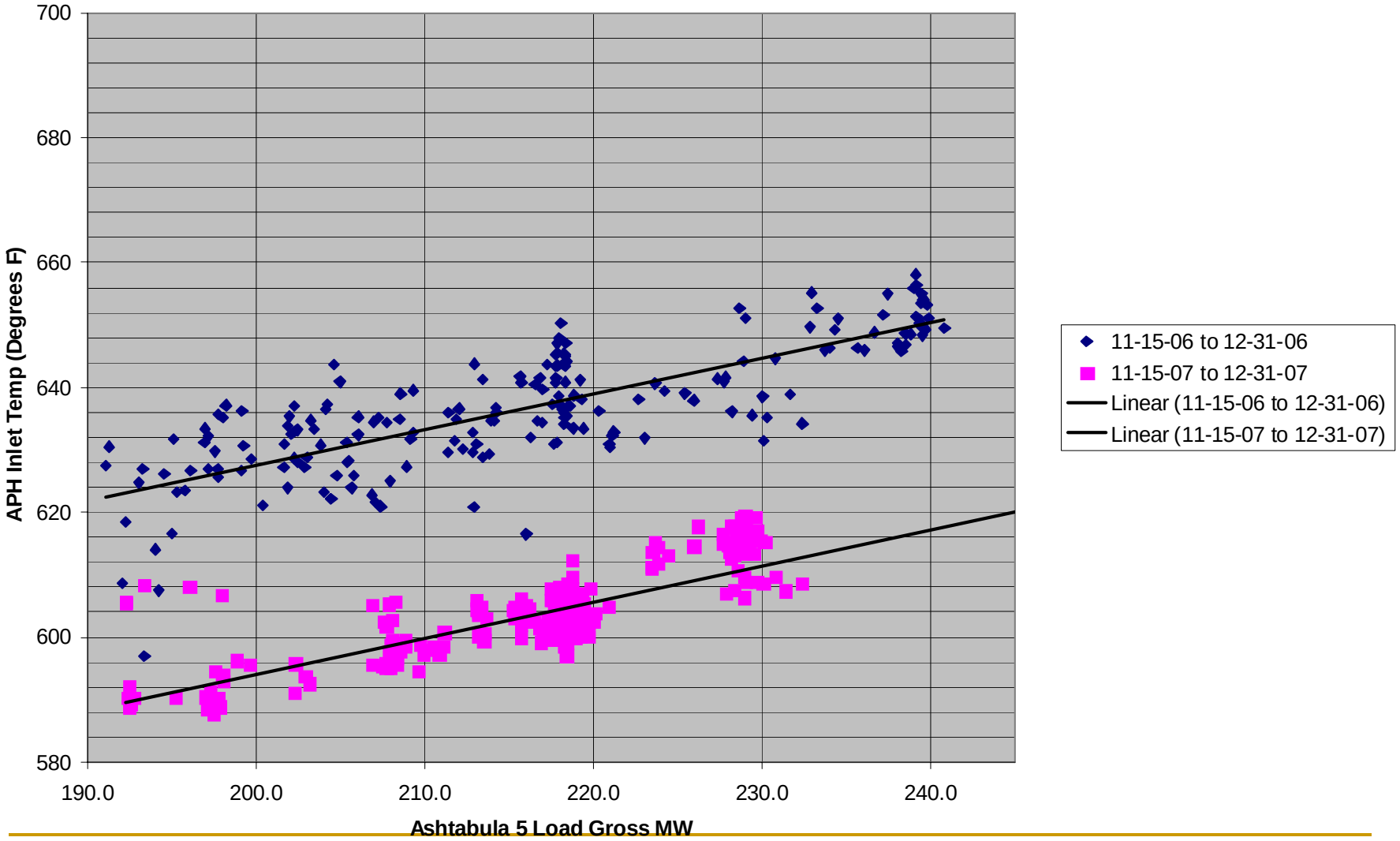
Trial for Ashtabula

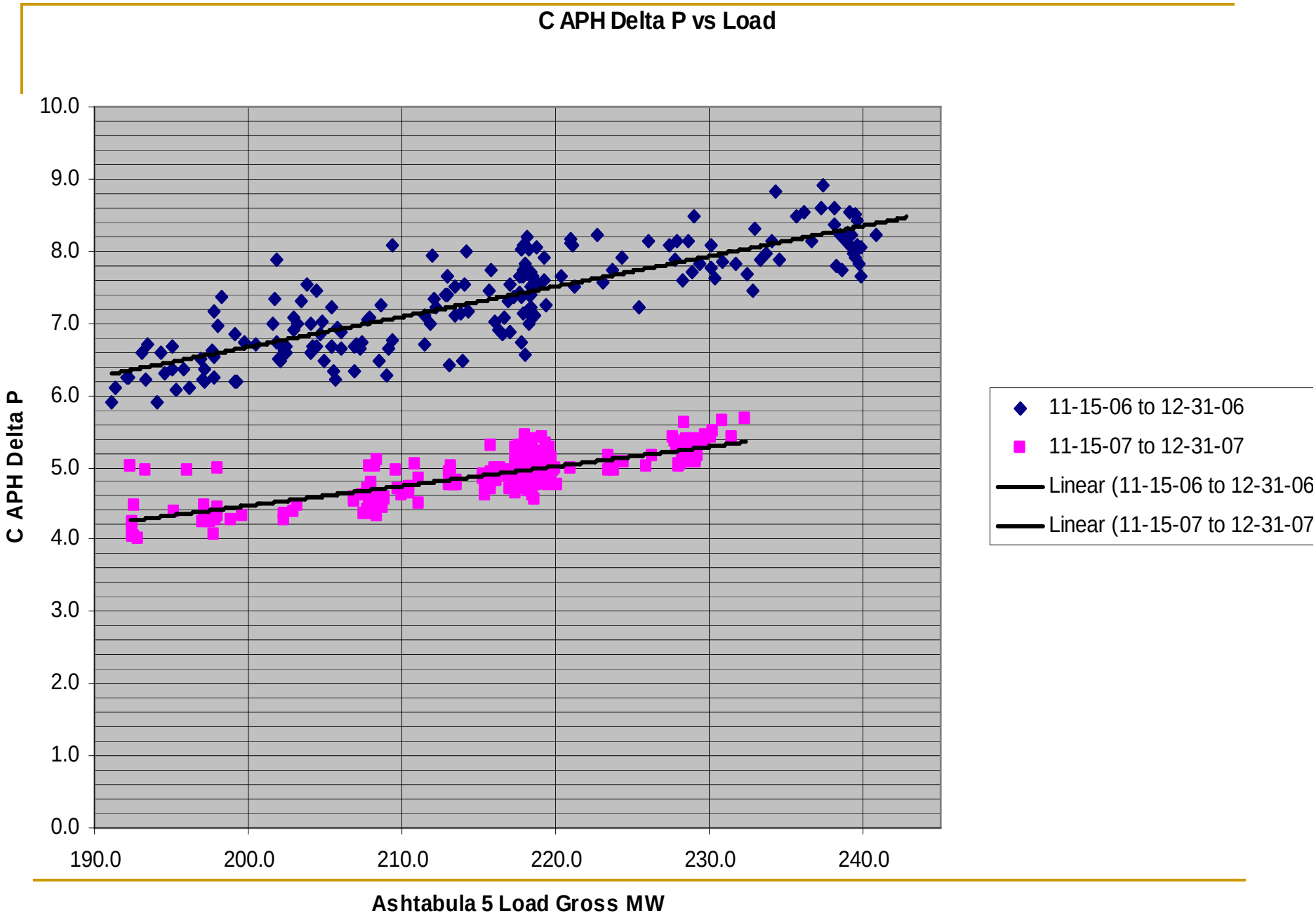
- AT5 is a sister unit to EL4.
- AT5 Economizer and APH hoppers still in service.
- LTSH fouling and some ESP performance issues.
- Boiler fouling required an annual cleaning outage.
- 2-Day trial showed signs of success.

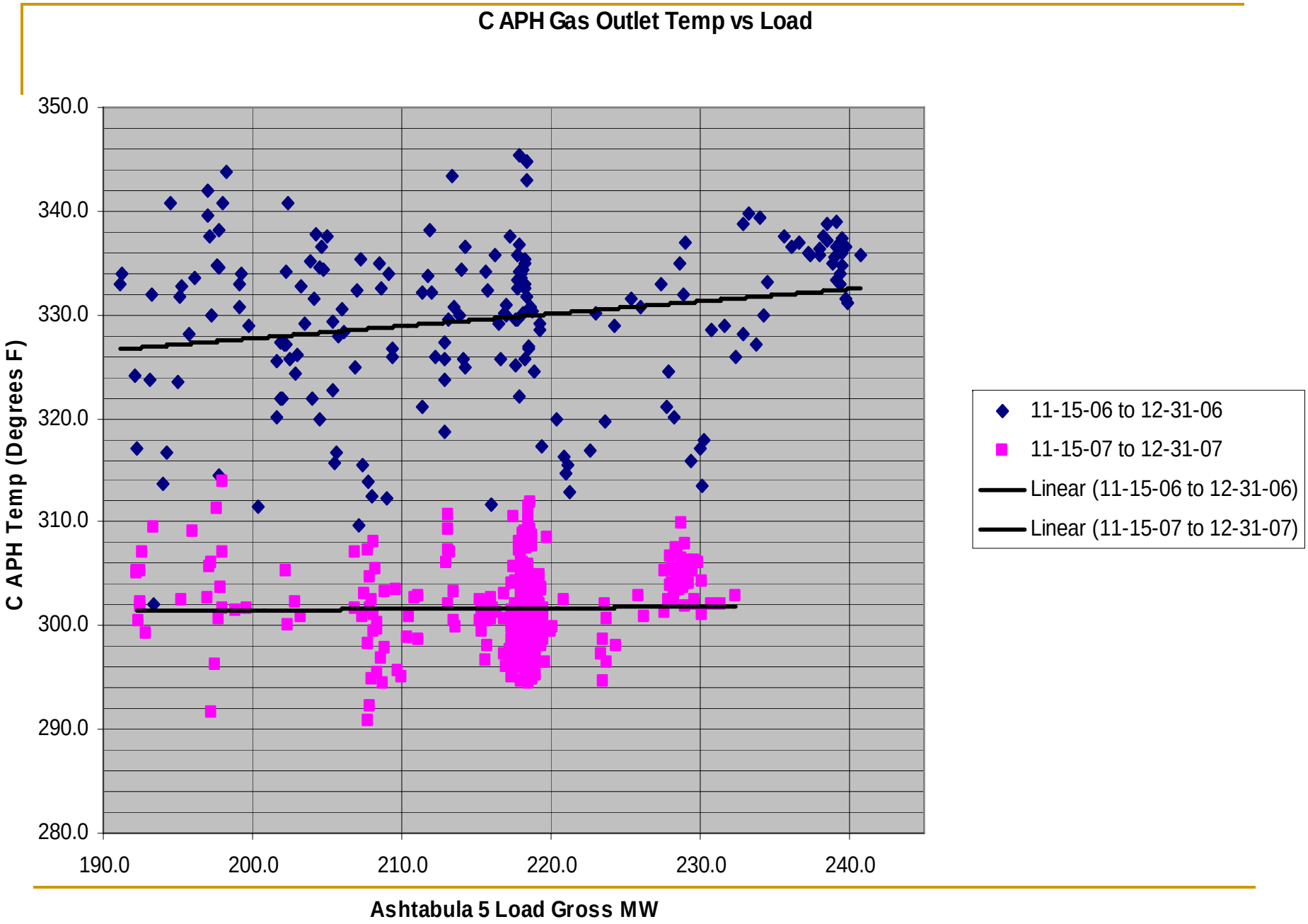
PowerWave+ Installation (EPRI TC)

- RH Boiler test Jan 2007, on a dirty boiler (trial)
- 6 Units installed in March 2007, Inspection Outage & in service April 2007
- Two units installed above Upper LTSH
- Two units installed above Lower LTSH
- Two units installed above Economizer

View of PowerWave+ Unit from Inside Boiler


APH Gas Inlet Temp vs Load
APH Inlet Temp (Degrees F)
700
680
660
640
620
600
580
190.0
200.0
210.0
220.0
230.0
240.0
Ashtabula 5 Load Gross MW
11-15-06 to 12-31-06
11-15-07 to 12-31-07
Linear (11-15-06 to 12-31-06)
Linear (11-15-07 to 12-31-07)


C APH Delta P vs Load
C APH Delta P
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
190.0
200.0
210.0
220.0
230.0
240.0
Ashtabula 5 Load Gross MW
11-15-06 to 12-31-06
11-15-07 to 12-31-07
Linear (11-15-06 to 12-31-06
Linear (11-15-07 to 12-31-07


C APH Gas Outlet Temp vs Load
C APH Temp (Degrees F)
350.0
340.0
330.0
320.0
310.0
300.0
290.0
280.0
190.0
200.0
210.0
220.0
230.0
240.0
Ashtabula 5 Load Gross MW
11-15-06 to 12-31-06
11-15-07 to 12-31-07
Linear (11-15-06 to 12-31-06)
Linear (11-15-07 to 12-31-07)

Results

- Internal inspections have shown the boiler to be maintaining cleanliness
- Average air heater outlet gas temperatures have remained below 320 deg F
- Average air heater differential pressure drops have remained below 6 in. H2O
- APH Delta P sustained all year.
- Permanent installation during 2008 scheduled outage.

Summary

- Currently have 6 units installed at First Energy. Have been installed and operating since March 2007.
- Have visually noticed a cleaner back pass since they have been installed and have not had problems with buildup since came online.
- Would not request a Spring cleaning outage.
- ESP Gas inlet temperatures and ash resistivity are down. Boiler efficiency is up.