

Worldwide Pollution Control Association

WPCA/LG&E and KU

Coal-fired APC Environmental Seminar

May 23-24, 2017

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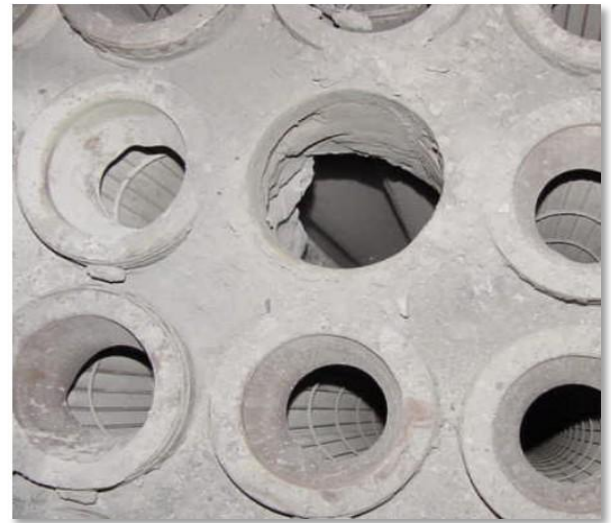
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WPCA/LG&E Seminar

Pulse-Jet Fabric Filter O&M

Mike Allen-BHA







Baghouse Refurbishment

Estimated price off-line 500 MW
boiler bag change out:

Pulse Jet: \$1.2 to \$1.8
million installed

Reverse air: \$1.0 to \$1.25
million installed

**Filter bag replacement is the highest bag house maintenance
cost**

TWO PRIMARY FABRIC FILTER CONCERNS

DIFFERENTIAL PRESSURE!
(Derate)

and/or

PM Emission!

Common Upsets Causing Fabric Filter DP Issues

Upset Condition	Fabric Filter Effects
Tube leaks	High pressure drop from moisture carry-over, leading to constant cleaning
Material handling system failure	High hopper levels leading to high pressure drop from re-entrainment and filter abrasion/failure-also potential for heat excursion from hopper fires
Cleaning system failure	High pressure drop
Dew point excursions from pre-fabric filter equipment failure	High pressure drop from moisture condensation and chemical degradation of fabric/premature corrosion of support cages in pulse-jet-style units
SCR system upsets leading to high ammonia slip	High pressure drop from sticky dust created by ammonia levels, leading to constant cleaning

Fabric Characteristics & Suitability for Power Generation Applications

	Polypropylene	Polyester	Acrylic	Fiberglass	Aramid	PPS	P84 ***	Teflon® ***
Max. Continuous Operating Temp.	170° F (77° C)	275° F (135° C)	265° F (130° C)	500° F (260° C)	400° F (204° C)	375° F (190° C)	500° F (260° C)	500° F (260° C)
Abrasion	Excellent	Excellent	Good	Fair*	Excellent	Good	Fair	Good
Energy Absorption	Good	Excellent	Good	Fair	Good	Good	Good*	Good
Filtration Properties	Good	Excellent	Good	Fair	Excellent	Excellent	Excellent	Fair
Moist Heat	Excellent	Poor	Excellent	Excellent	Good	Good	Good	Excellent
Alkaline Dust	Excellent	Fair	Fair	Fair	Good	Excellent	Fair	Excellent
Mineral Acids	Excellent	Fair	Good	Poor**	Fair	Excellent	Good	Excellent
Oxygen (>15%)	Excellent	Excellent	Excellent	Excellent	Excellent	Poor	Excellent	Excellent
Relative Cost	\$	\$	\$\$	\$\$\$	\$\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$	\$\$\$\$\$\$

Bag house refurbishment

Change out approach

Primary decision: on-line or off-line change out?

- The bag change out can occur while the boiler is shut down
- If sufficient and compartmentalization and isolation exists, the change out can occur while the boiler is on-line
- If not then bags must be changed out off-line
- There are advantages and disadvantages of both approaches

Bag house refurbishment

Change out off-line

Pros

- **Speed** – Access to all compartments at the same time
- **Safety** – No challenges with radiant temperature from other compartments or potential gas stream leaks
- **Thoroughness** – Simultaneous leak testing and pre-coat of entire system with ability to start-up and shut-down fans
- **Control** – Ability to control airflow through entire system at even loading during start-up
- **Predictability** – Improved bag life predictability with all filters having same start-up date
- **Uniformity** – Unit starts up at overall lower pressure drop, allowing less cleaning required to maintain pressure drop

Cons

- **Time** – Outage sufficient for completion of entire unit; lost production

Bag house refurbishment

Change out on-line

Pros

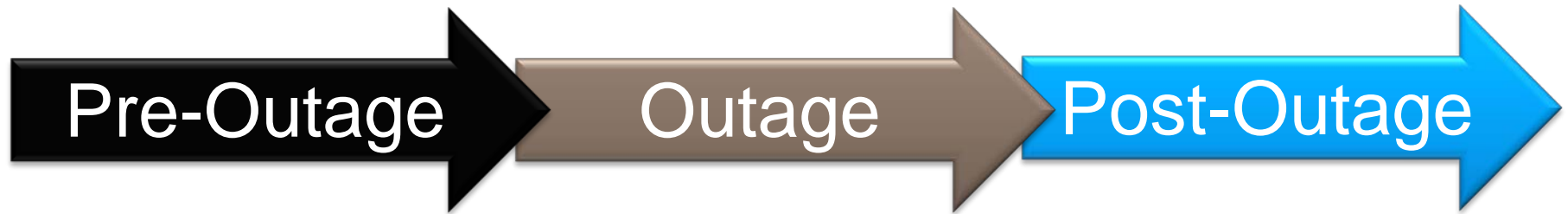
- **Time** – No boiler shut down required
- **Staging** – Minimize challenge associated with staging materials for several compartments

Cons

- **Safety** – Potential issues with compartment isolation and heat
- **Non-Uniform** – Uneven loading to compartments with new filters leading to possible bleed-thru/blinding
- **Velocity** – Potential high velocity leading to abrasion issues in newly re-bagged compartments
- **Duration** – Slower schedule, takes longer to complete entire unit
- **Start-Up** – Challenge to properly leak test and pre-coat individual compartments

Bag house refurbishment

Phases of change out



Inspect	Clean	Pre-coat
Plan	Remove	Start-up
Purchase	Position	Monitor
Schedule	Install	Sample
Receive	Verify	Test
Stage	Leak test	Inspect
	Demobilize	Record

Bag house refurbishment

Basic material procurement

Pulse Jet	Reverse air
Filters	Filter bags
Cages (100% or spares)	Tensioning (100% or spares)
Door seal	Door seal
Labor	Labor
Pulse valve/solenoid parts	Clamps if required
Leak detection materials	Leak detection materials
Pre-coat	Pre-coat

- Depending on outage needs, additional equipment such as cranes, air compressors, welders, scaffolding, and ventilation may be required
- Lead time of purchased and rented material must meet outage schedule

Bag house refurbishment

Pre-outage Inspection

- Outage duration and staffing is based on assumed productivities
- Productivity is directly impacted by the internal condition of the equipment
- To minimize “surprises,” inspecting the bag house or at least a small number of compartments is recommended
- A pre-outage inspection can identify:
 - Filter bag “stuck” on cage
 - Corroded blow pipes connections
 - Accumulation of particulate
 - Damage to tube sheet
 - Corrosion damage to access doors
 - How many people fit into a compartment
 - Other issues that require lead time to address

Bag house refurbishment

Clean air plenum access-space restrictions



Pre-outage inspection can identify
access limitation

Bag house refurbishment

Clean air plenum access



What equipment is necessary to lift hatches and material?

Bag house refurbishment

Pulse valves and solenoids



Prior to outage, identify faulty diaphragm and solenoid valves

Bag house refurbishment

Blow pipe corrosion



Corrosion can cause blow pipe connections to seize

Bag house refurbishment

Door seal

Pre-outage inspection helps identify extra work scope and materials

Leakage at access doors causes corrosion

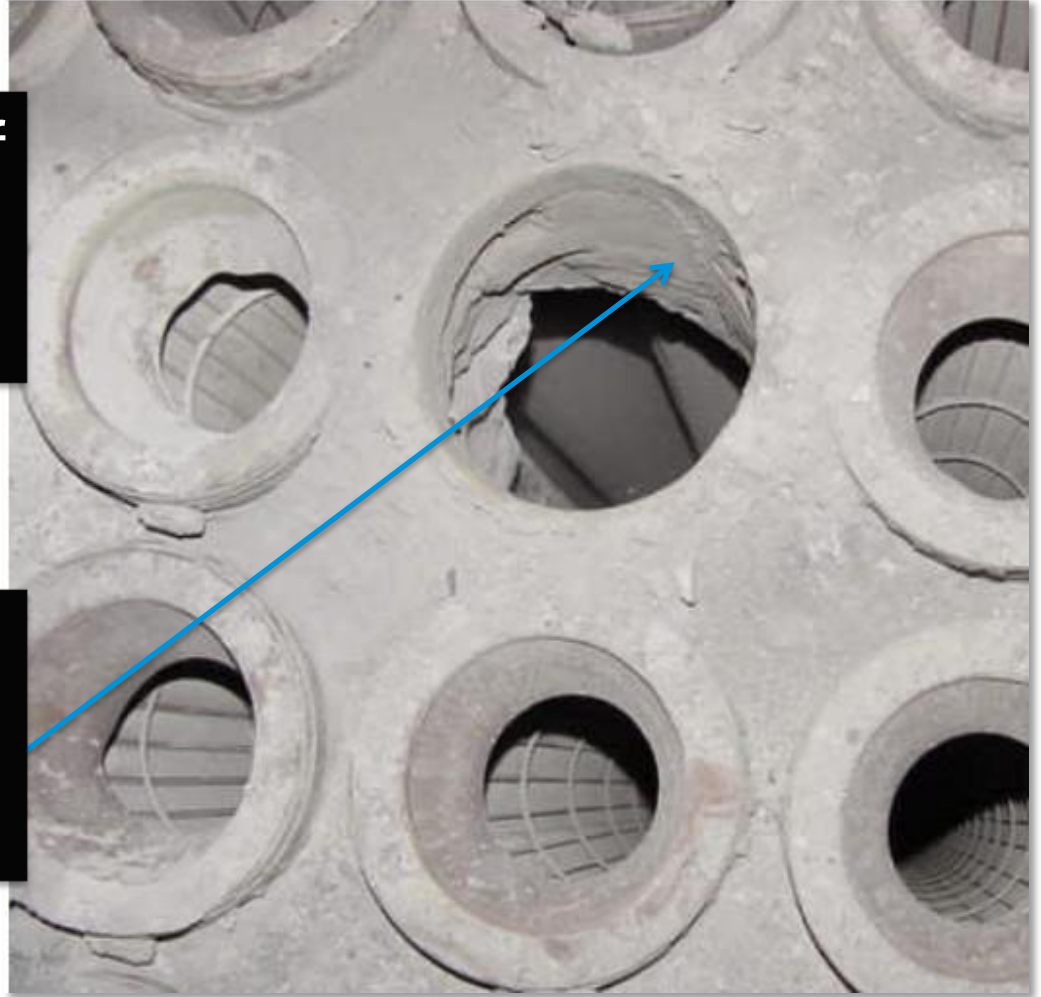


Bag house refurbishment

Know what is in store for the crew

Deposits on bottom of
tube sheet hamper
bag removal

Unknown conditions
can destroy outage
schedules



Bag house refurbishment

Outage activities



Outage activities

Bag house refurbishment

Hopper clean out



Hoppers should be cleaned out and the outlet plugged to exclude debris

Bag house refurbishment

Staging new materials



- To expedite outage, stage material near work station

Bag house refurbishment

Filter/cage removal

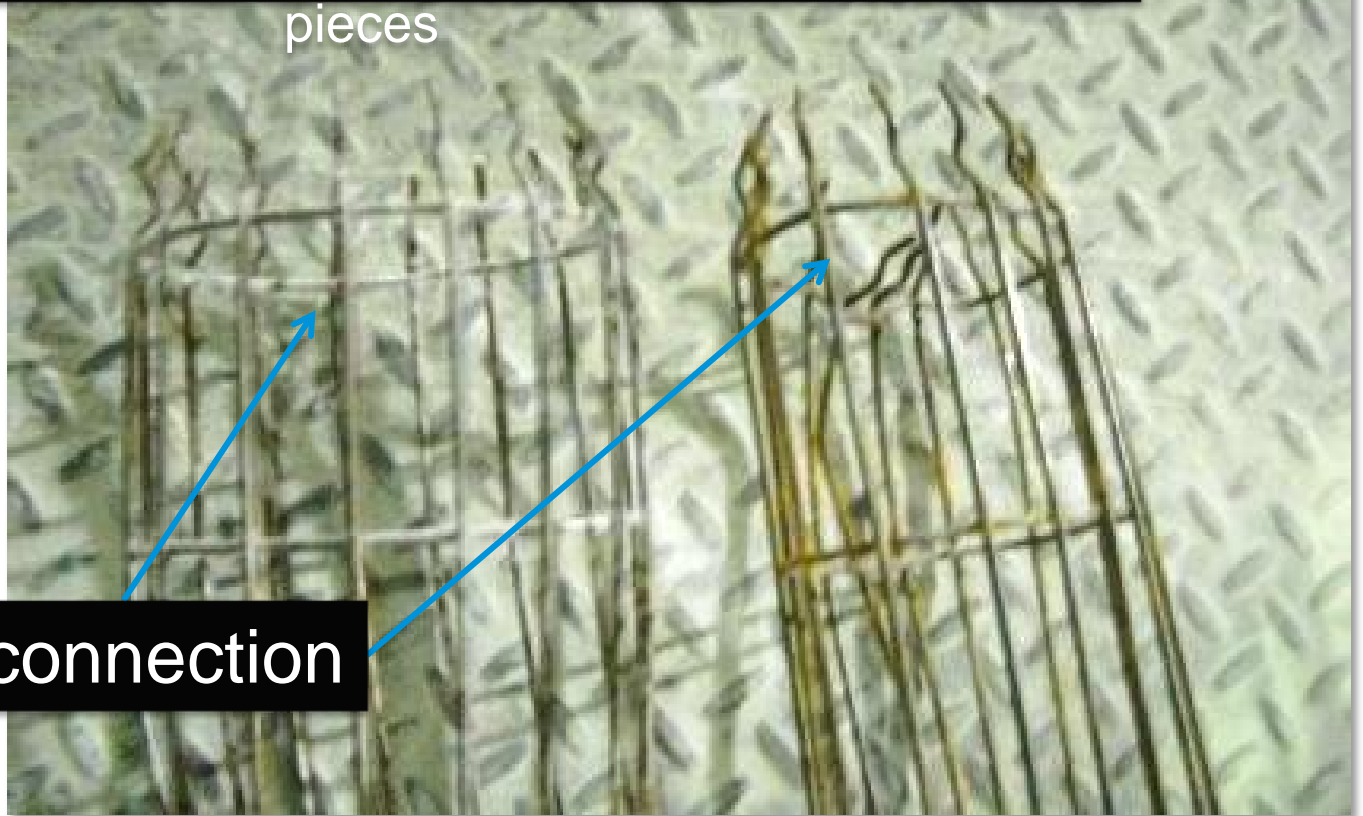


At the beginning of an outage, bags and cages are removed from the tube sheet

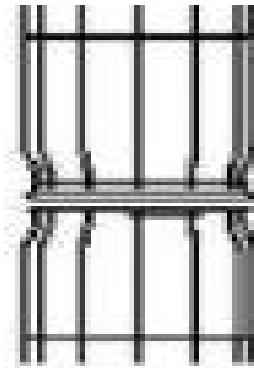
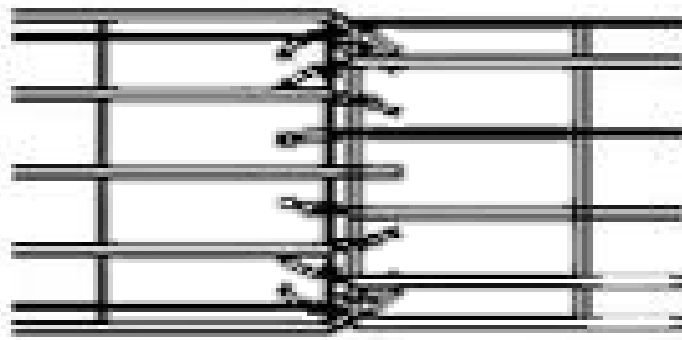
Bag house refurbishment

Two-and three-piece cages

Depending on headroom available and overall bag length, support cages may be furnished in one, two, three or more pieces



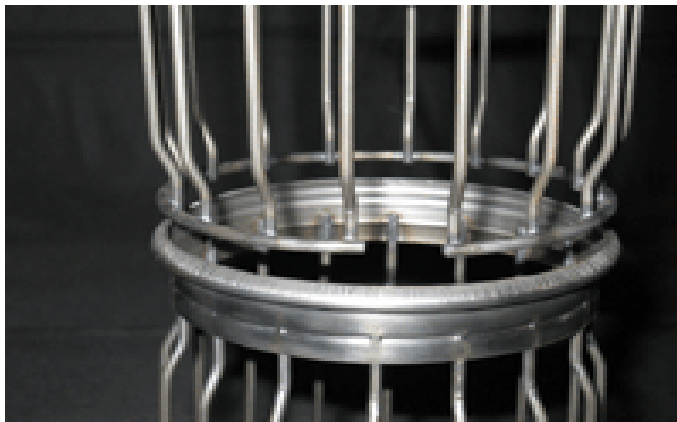
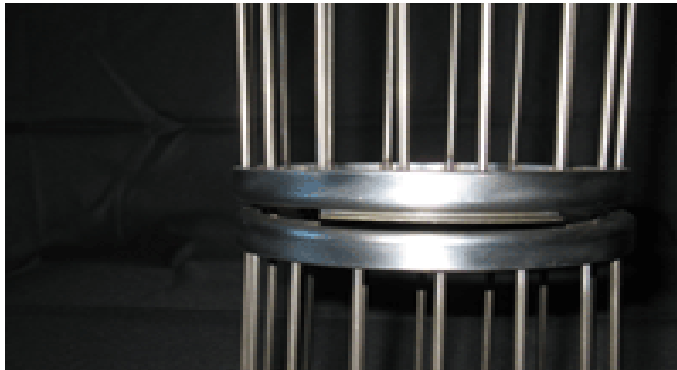
Used cage connection



LOCKING CLAMP



CONNECTING COLLAR



Bag house refurbishment

Leak testing bag installation

- **Prior to releasing a compartment, the filter bag installation shall be leak tested**
- **A leak test will identify:**
 - Damaged bags
 - Tube sheet leaks
 - Loose clamps
 - Improperly installed filter bags
- Problems identified can be repaired before the compartment is turned back over to operations

Bag house refurbishment

Leak testing bag installation

During leak test, a powder that fluoresces in black light is distributed into the compartments



Powder collects around air leaks