REINHOLD ENVIRONMENTAL Ltd.

2018 APC & Wastewater Round Table & Expo Presentation

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Pulse Jet Fabric Filter: Lessons Learned

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PPL companies

Reinhold APC/PCUG Conference July 2018

PJFF Lessons Learned AKA…….

Background

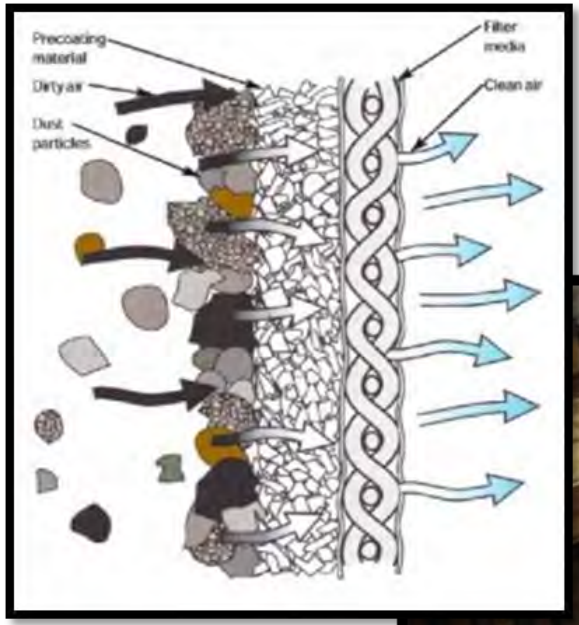
- High Sulfur Illinois Basin Coal
- 11 PJFFs in service (2010-2016)
- 2 casings
- 1 OEM
- Detuned ESPs upstream of PJFFs

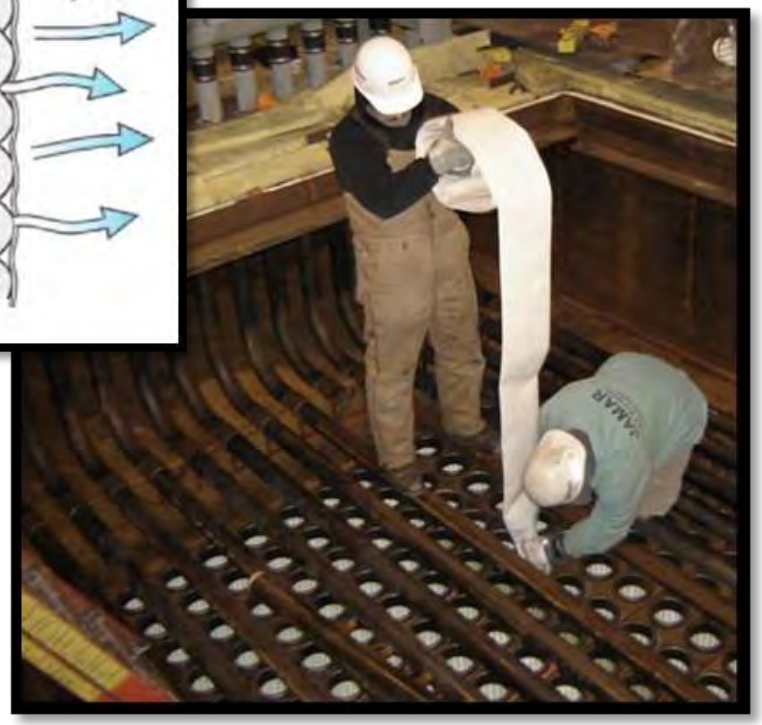
Baghouse Design

- Oversized
- PJFF penthouse access
- Maintenance
  - Overhead cranes
  - Hopper access
- MOT temperature

Filter Bag Design

- Expanded PTFE membrane
- Woven fiberglass
- Top snap band
- 26’-9” length
- Split cage reinforced wear cuff
- 43,800 hours (min) bag life





Fleet Management

- PJFF guideline
- Bag testing pricing agreement
- Baghouse maps
- Fleet process map development
- Fleet bag purchases & spares
- PJFF parameter optimization

Fleet PJFF Guideline Highlights

- Fleet history
- Unit-specific operating conditions
- PJFF monitoring
- Bag purchasing/spares
- Bag testing
- Roles/responsibility
- Maintenance

Bag Testing

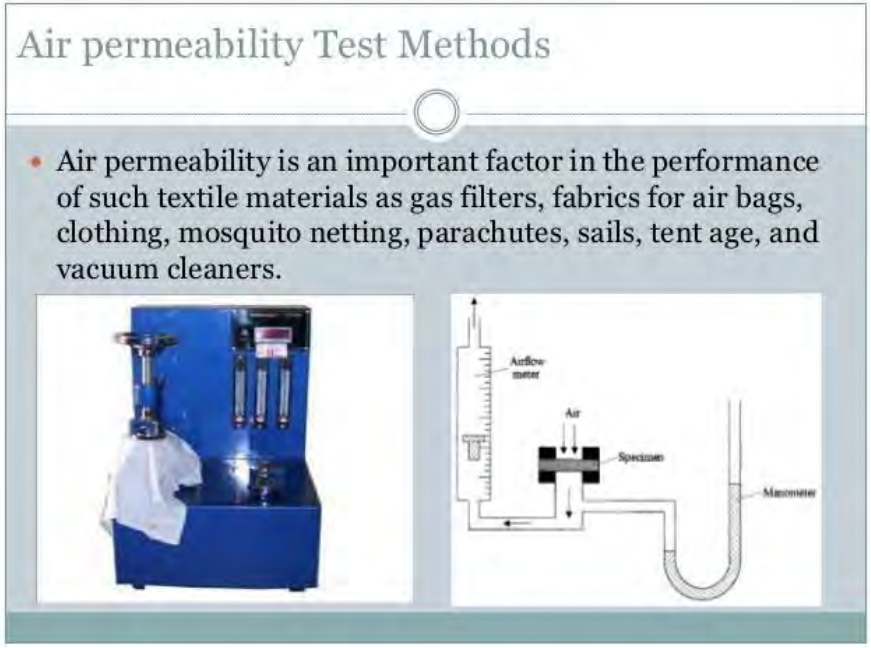
- 3-year price agreement
- Test intervals
- Testing parameters (well-documented)
  - Visual
  - Fabric construction analysis
    - As received & washed
  - Permeability
  - Fabric tensile strength
  - Dust pH
  - Microscopic analysis
  - Dust particle sizing
  - Other as needed test
    - FTIR
    - Organic /inorganic analysis

Bag Testing

- Generic testing schedule (3 bags/casing)

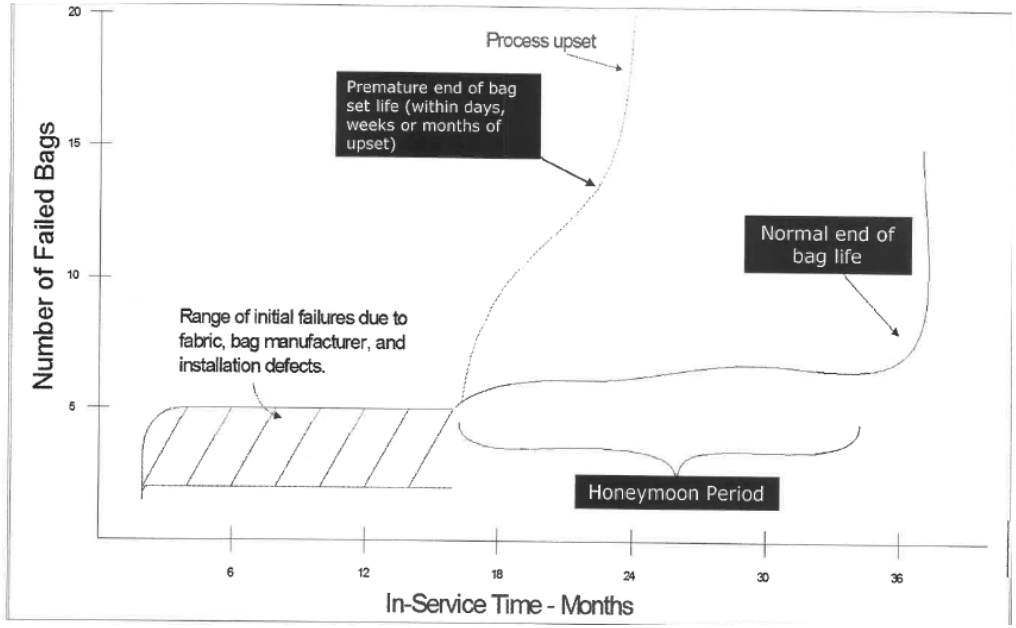
LG&E-KU Bag Testing Interval								
Months of Service	Year1		Year 2	Year 3	Year4		Year5	
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8
	6mo	12mo	24mo	36mo	48mo	54mo	60mo	66mo

- Testing Changes
  - 2-year outage schedules
  - Test results
  - Casing dP
  - Inspections



Bag Testing: Performance Point Development

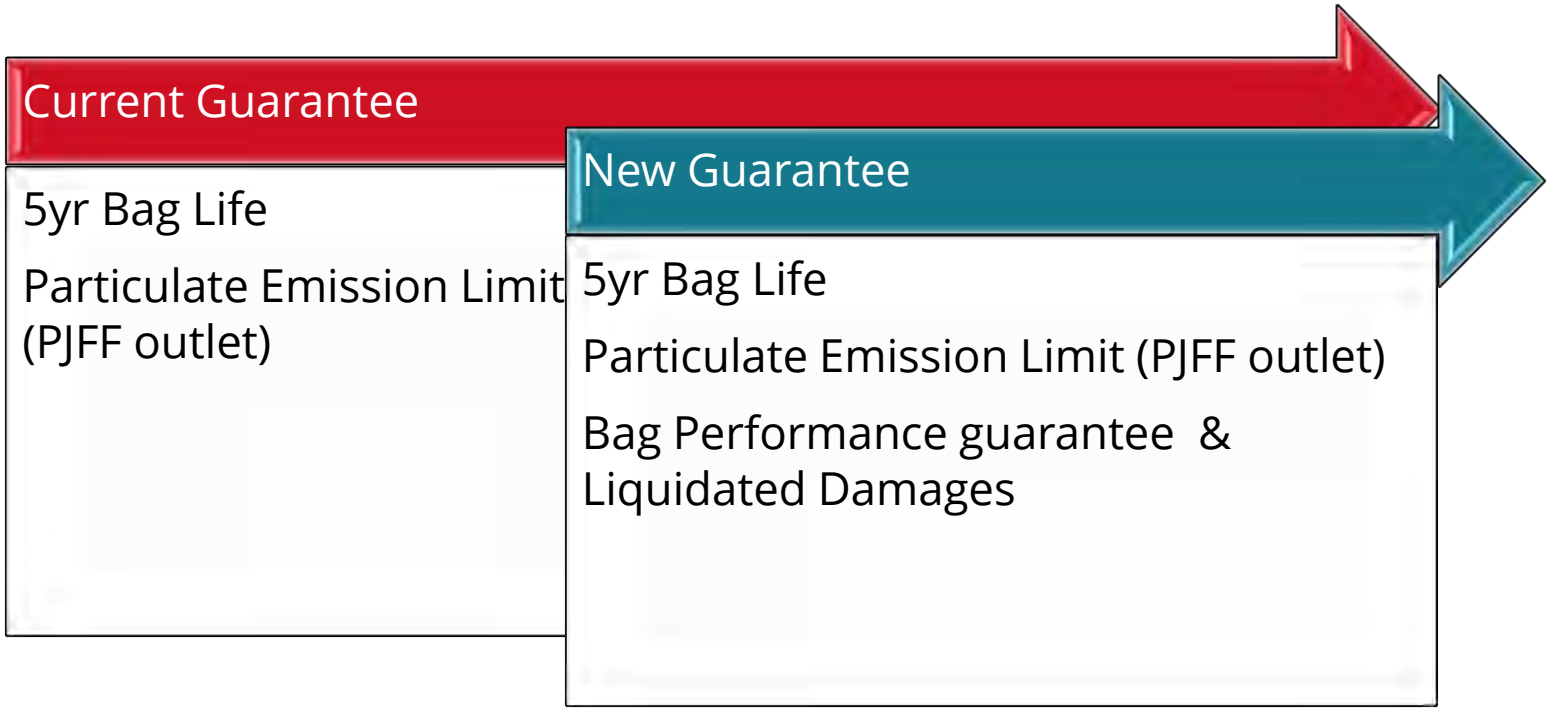
- ~~Rule Of Thumb – 100K Pulses~~
- ~~Published performance limits~~ (PTFE lined fiberglass bags)
- ~~Seek recommendations~~
  - ~~OEM~~
  - ~~Bag Testers~~
- Trial & Error
  - Slow process
  - Performance points
    - Permeability: 2.5cfm<
    - Mullen Burst: 500psi<
    - Endurance: 2500 folds<



Spares: Fleet vs. Plant

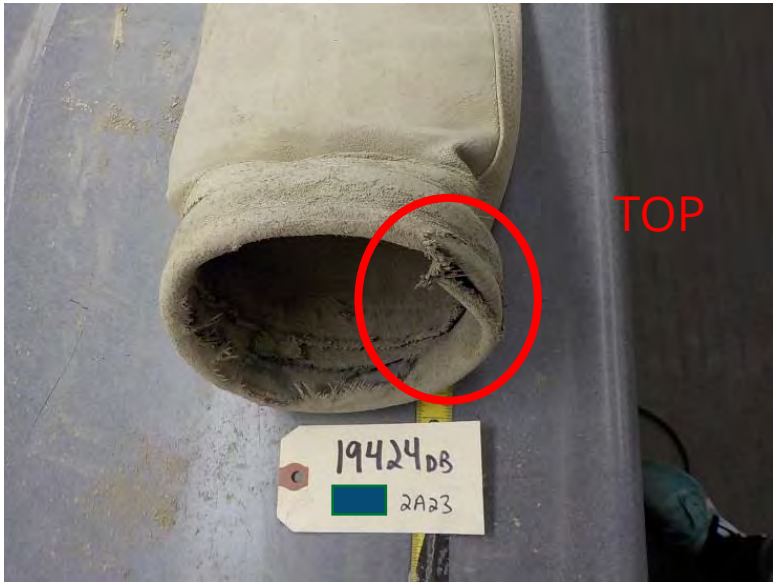
- Are they needed?
- Long-term storage options
- How many should we keep?
- Spare bag/cage anagement
  - Who keeping up with the inventory?
  - Who's making sure bags are tested?

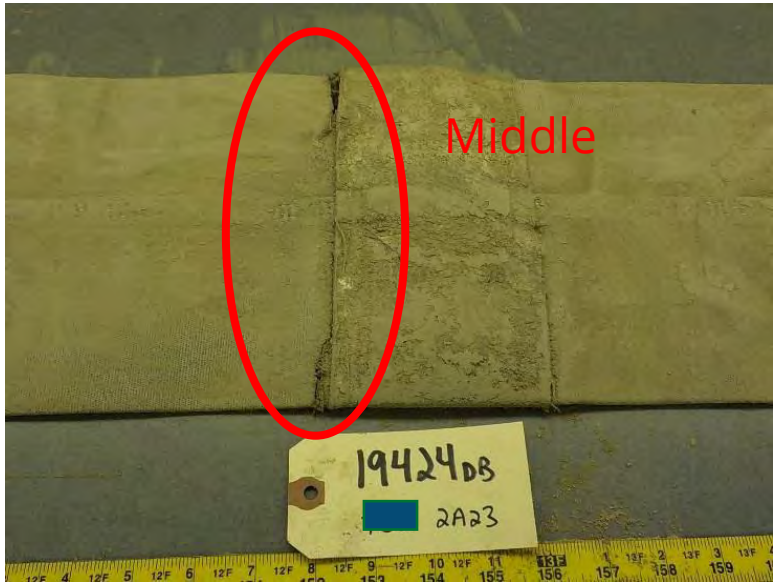
Bag Purchasing/Spares



Maintenance

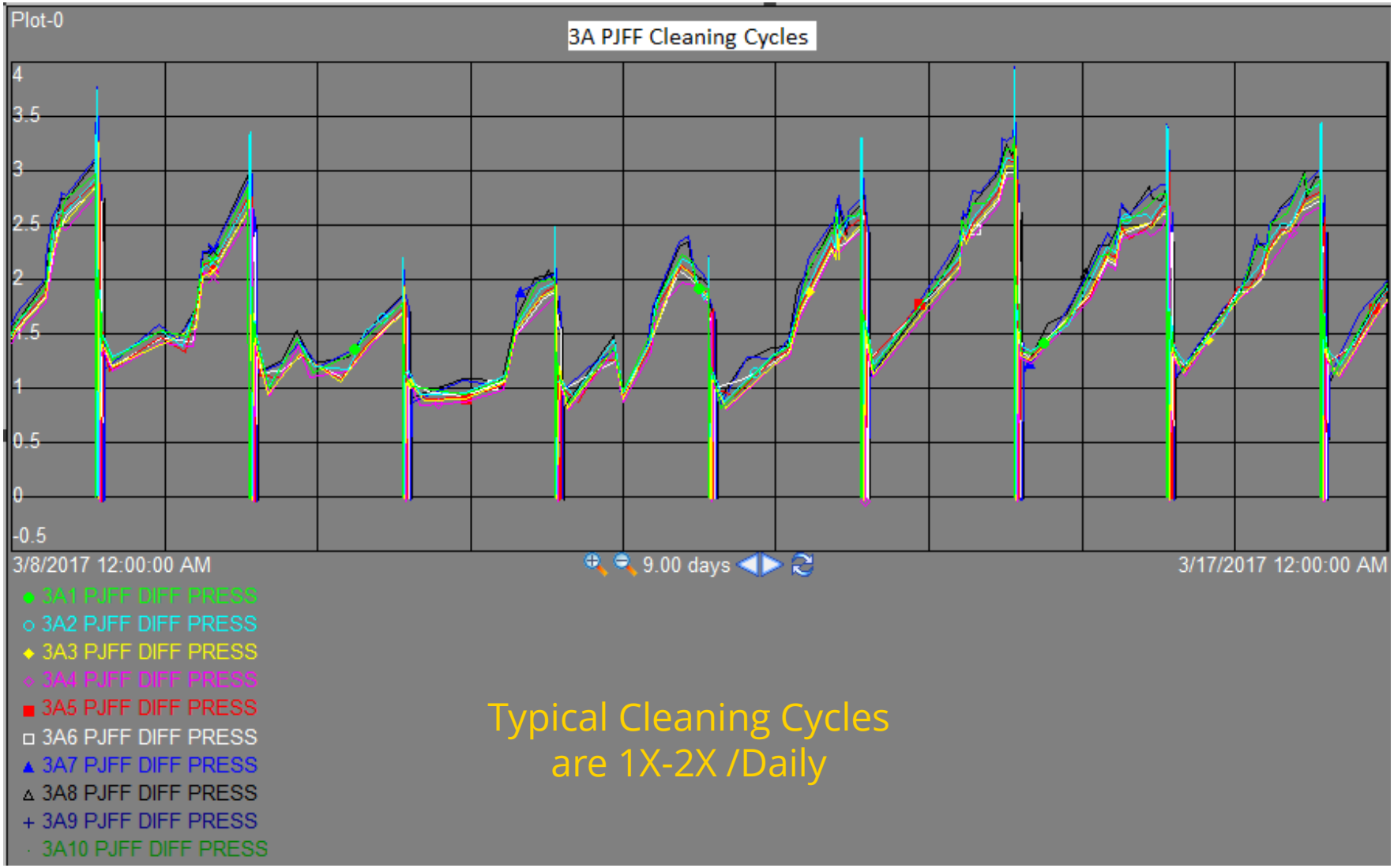
UV Leak Detection



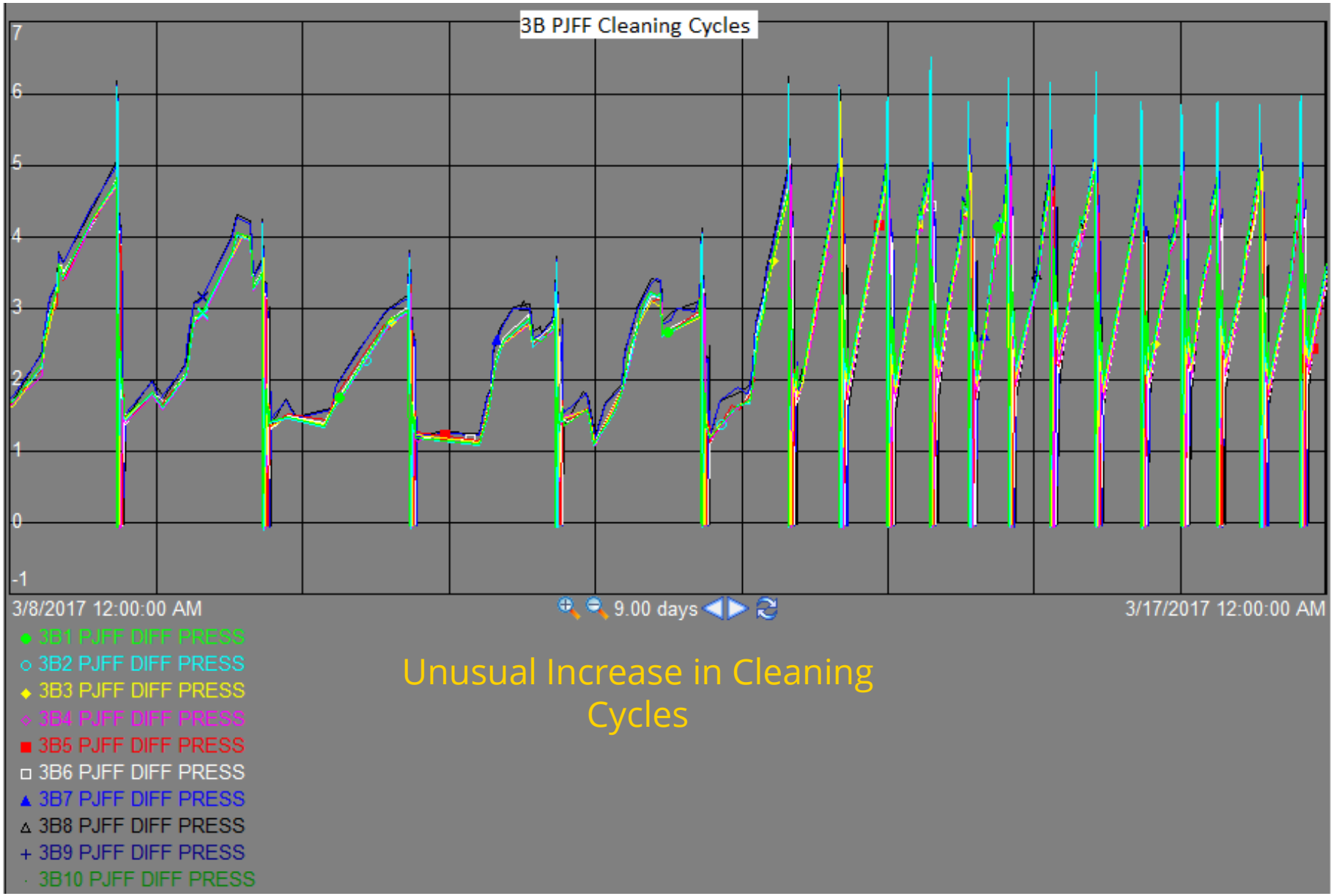


- Sent bags for autopsy
  - — High air velocity in compartment
- Ash rock build-up from previous hopper fire

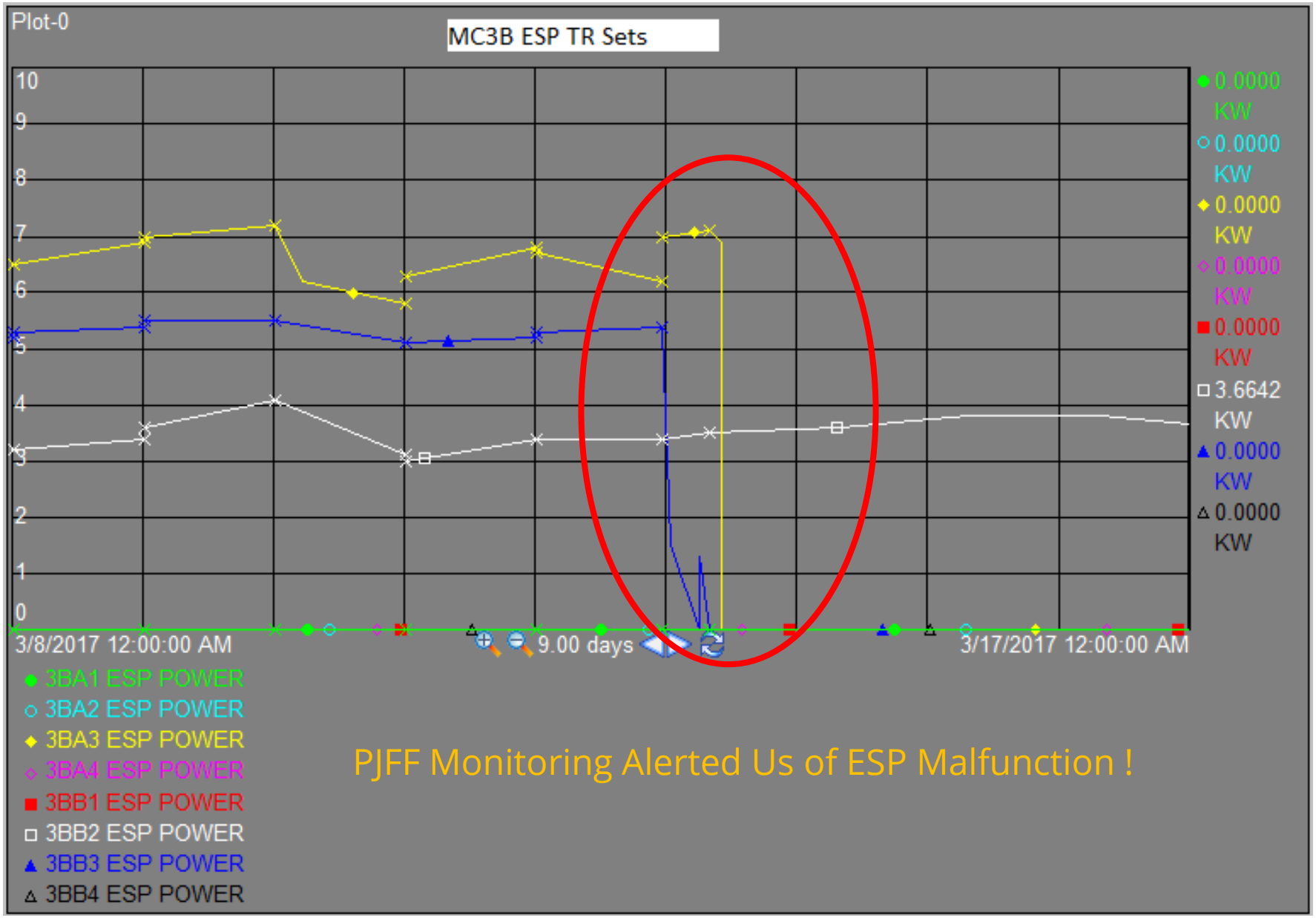
PJFF Monitoring



Typical Cleaning Cycles
are 1X-2X /Daily



Unusual Increase in Cleaning Cycles

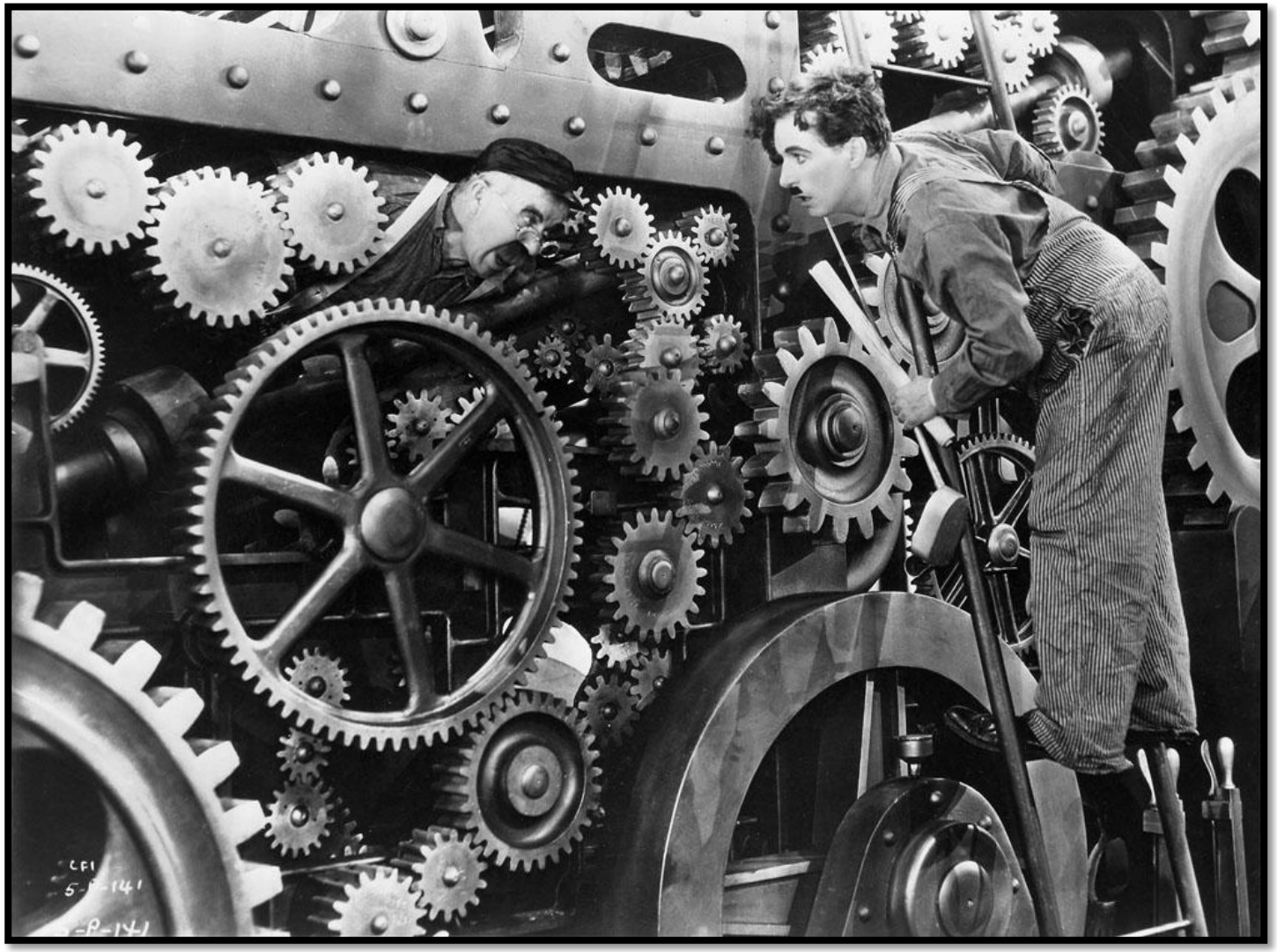

Plot-0
MC3B ESP TR Sets
10
9
8
7
6
5
4
3
2
1
0
0.0000 KW
0.0000 KW
0.0000 KW
0.0000 KW
0.0000 KW
3.6642 KW
0.0000 KW
0.0000 KW
3/8/2017 12:00:00 AM
9.00 days
3/17/2017 12:00:00 AM
3BA1 ESP POWER
3BA2 ESP POWER
3BA3 ESP POWER
3BA4 ESP POWER
3BB1 ESP POWER
3BB2 ESP POWER
3BB3 ESP POWER
3BB4 ESP POWER
PJFF Monitoring Alerted Us of ESP Malfunction !

Where Are We Now?

PJFF Efficiency & Parameter Optimization

- Differential pressure
- Particulate matter
- Mercury (Hg)
- Ash/hydrated lime/PAC ratio
- Ash hopper cleaning
- Bag pulsing frequency
- Baghouse monitoring systems
- ESP tuning
- Inspections

What's Next?



Refining Our Understanding of the Process

- How do the PJFFs fit in our AQCS?
- What are the impacts downstream?
- When do we make adjustments to our PJFF parameters?

Questions?