

Worldwide Pollution Control Association

Duke Energy Seminar
September 3 – 5, 2008
Concord, NC



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W
P
C
A

Fabric Filter Maintenance for Performance

Getting the most out of your
baghouse and filter media

Nick Macsata

ALSTOM

Agenda

Overview

System Optimization & Filter Media

Field Inspections & Laboratory Analysis

Discovering Problems Early

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Overview – System Optimization

Baghouse system – A pollution control device for capturing particulate matter

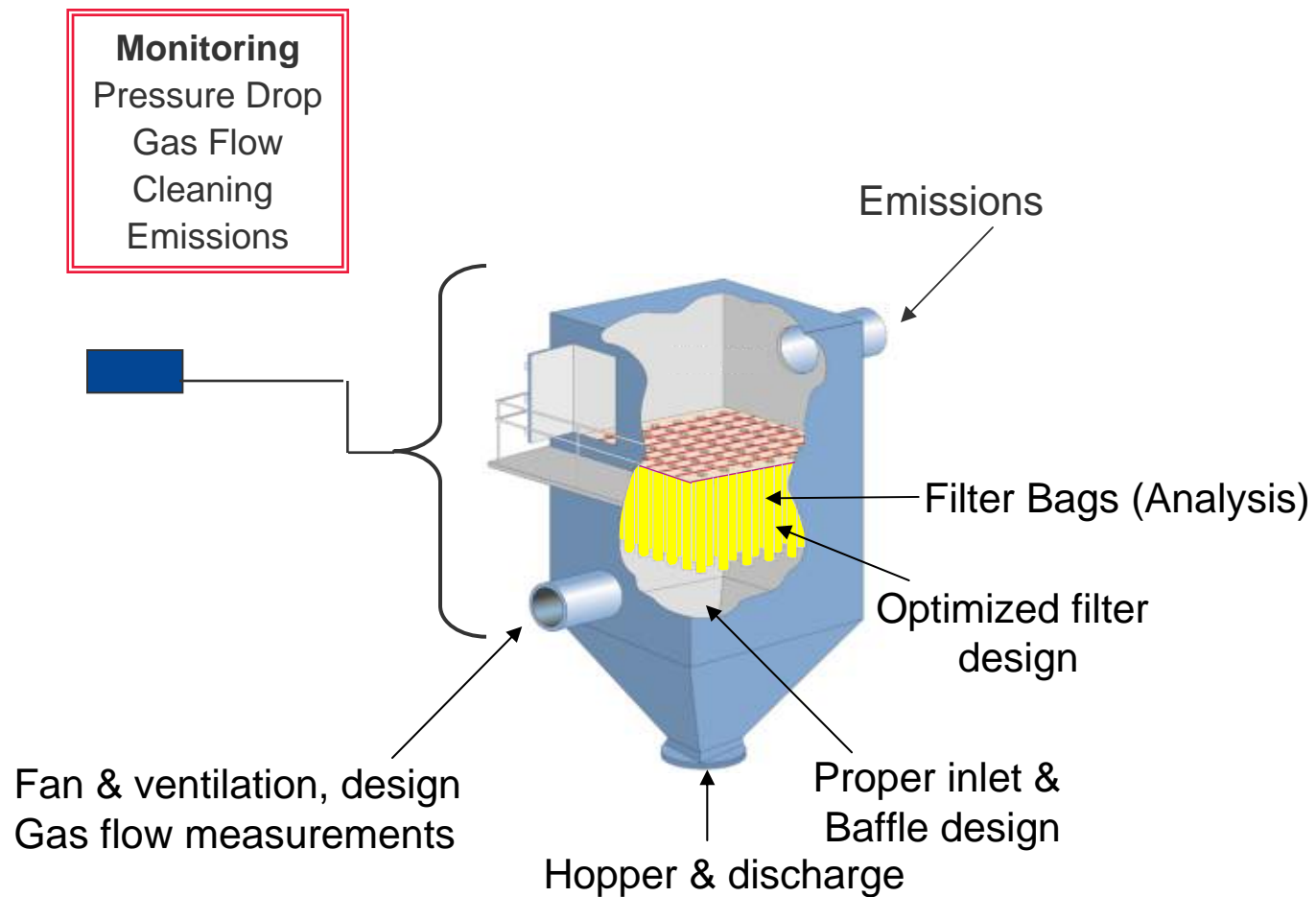
Consists of housing

Inlet and outlet ductwork

Filter media

Instrumentation & controls

Baghouse System



Filter Media Is the “Heart of the Baghouse”

Filter media selection effects

System pressure drop → power production

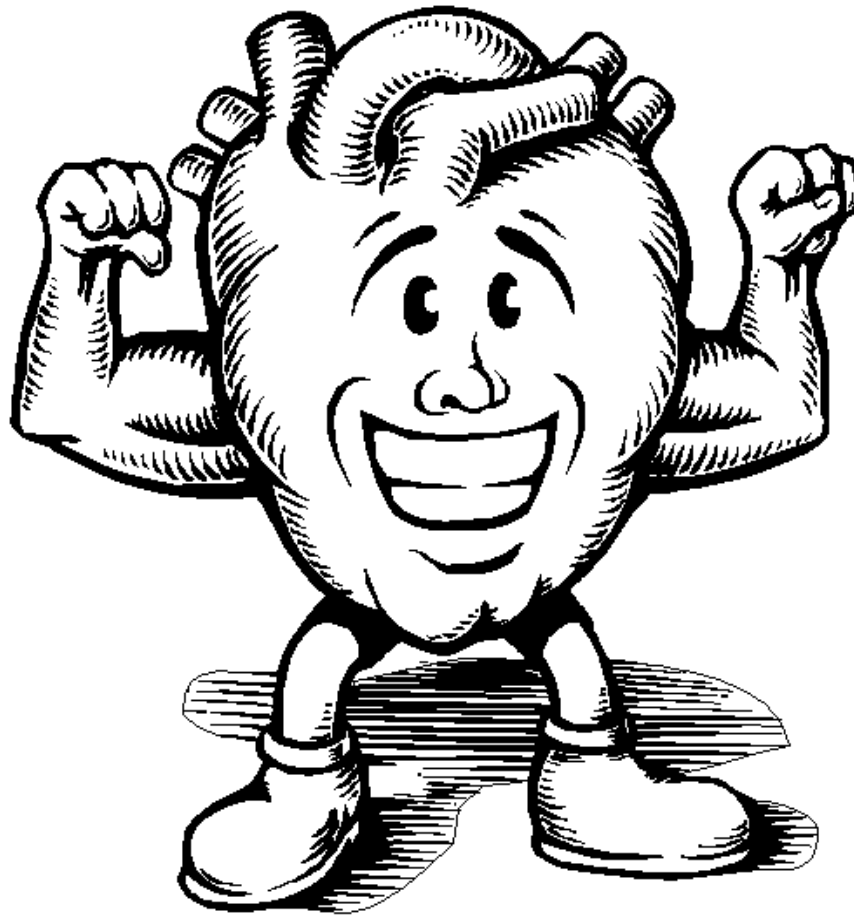
Particulate emissions

Cleaning energy

Bag life

Total annualized operating costs

How healthy is your baghouse heart?



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Agenda

Overview

System Optimization & Filter Media

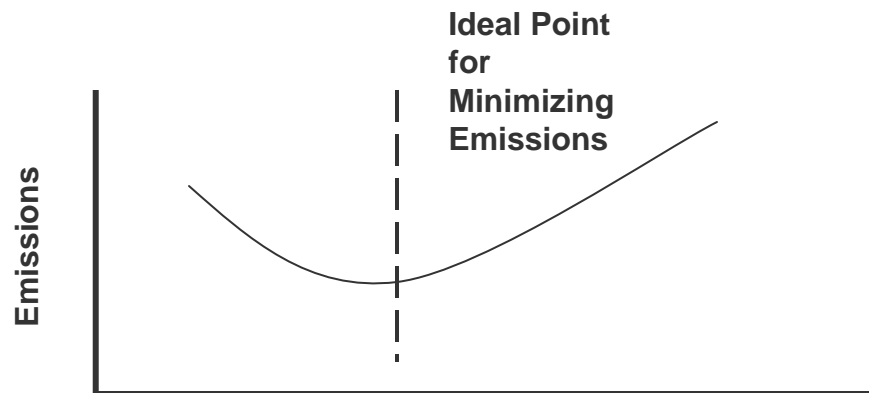
Field Inspections & Laboratory Analysis

Discovering Problems Early

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System Optimization – Getting the Lowest Annualized Cost w/o Emissions Problems



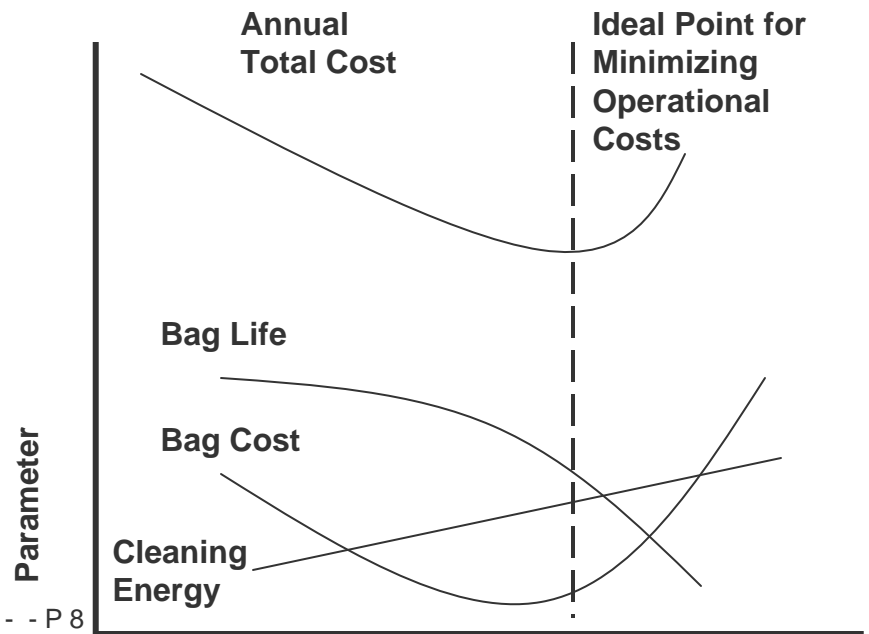
System Optimization:

Bag Life

Emissions

Gas Flow/Throughput

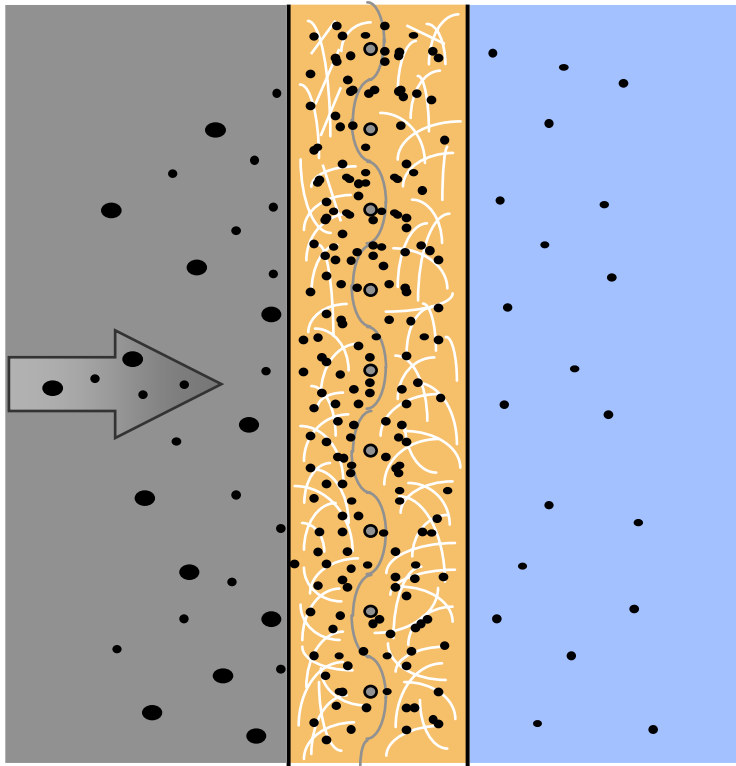
Lifecycle Costs



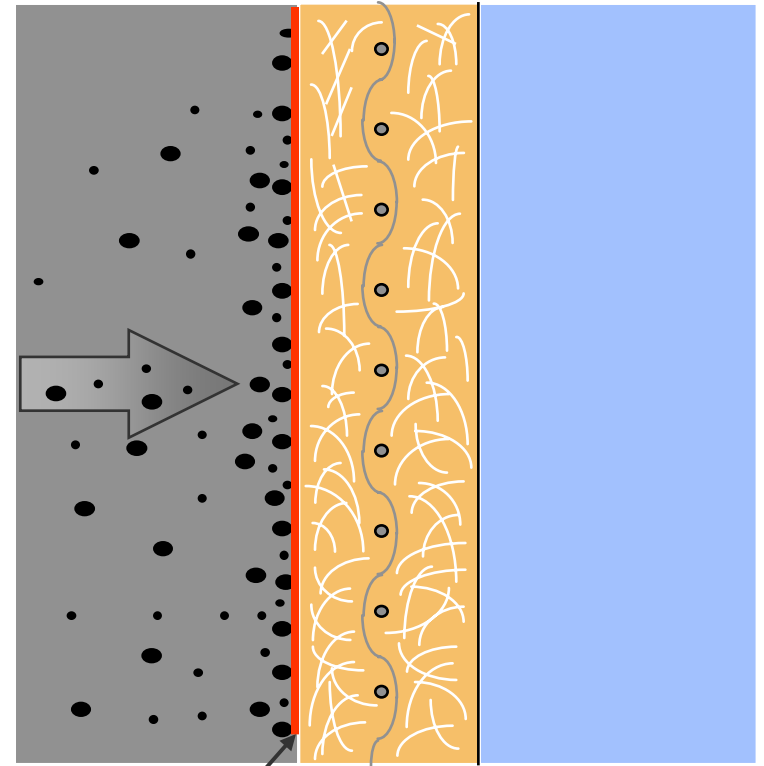
- - P 8

Depth vs. Surface Filtration – Filtering Mode

Conventional Media



Membrane Media

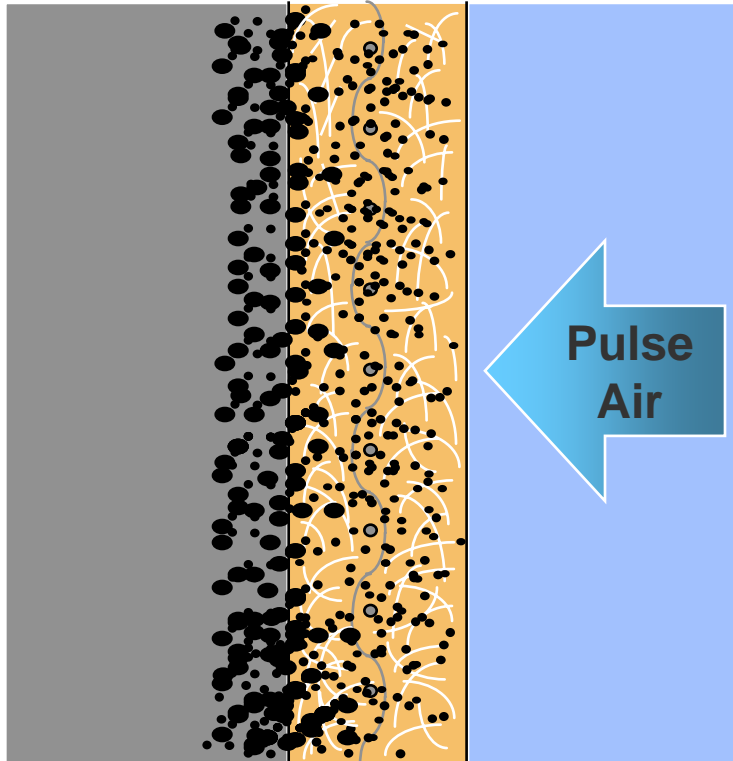


**Depth filter media
e.g. PPS felt**

Membrane

Depth Filtration - Cleaning Mode

Conventional Media

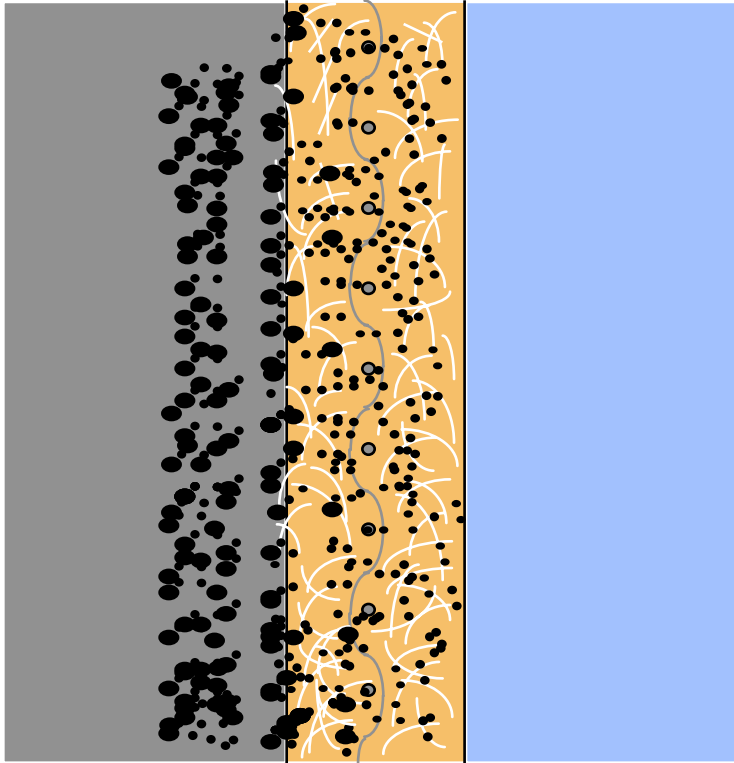


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Cleaning Mode

Conventional Media

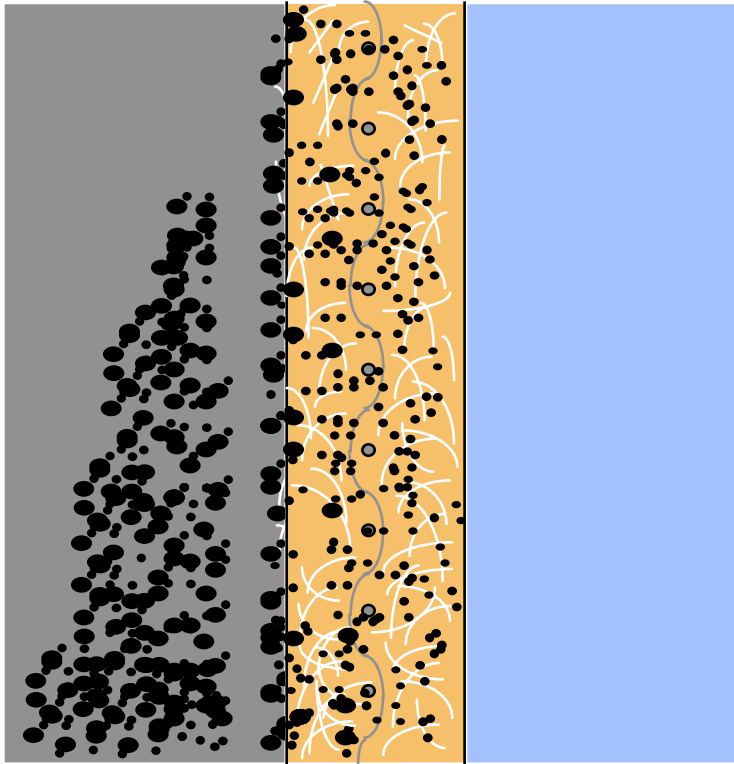


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Cleaning Mode

Conventional Media

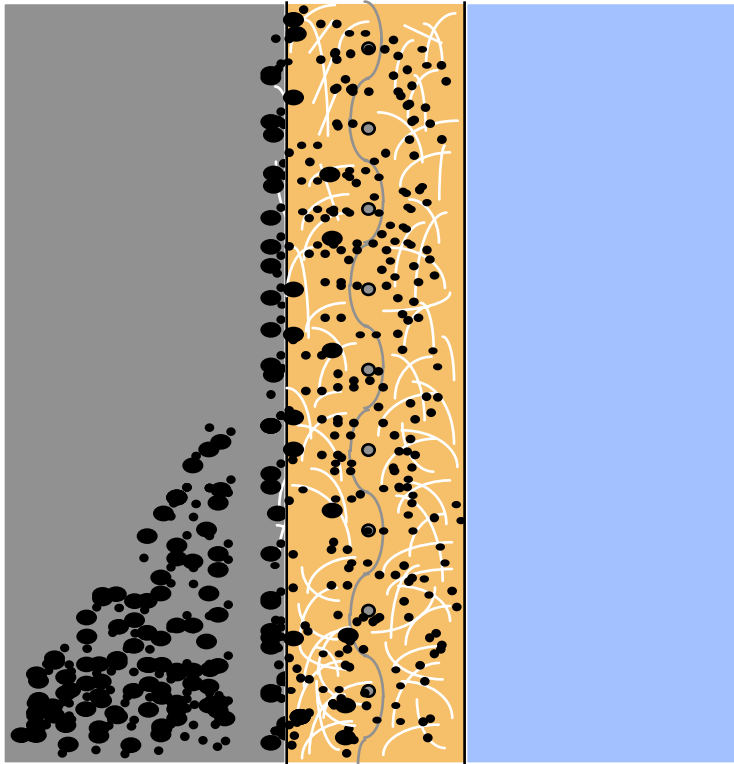


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Cleaning Mode

Conventional Media

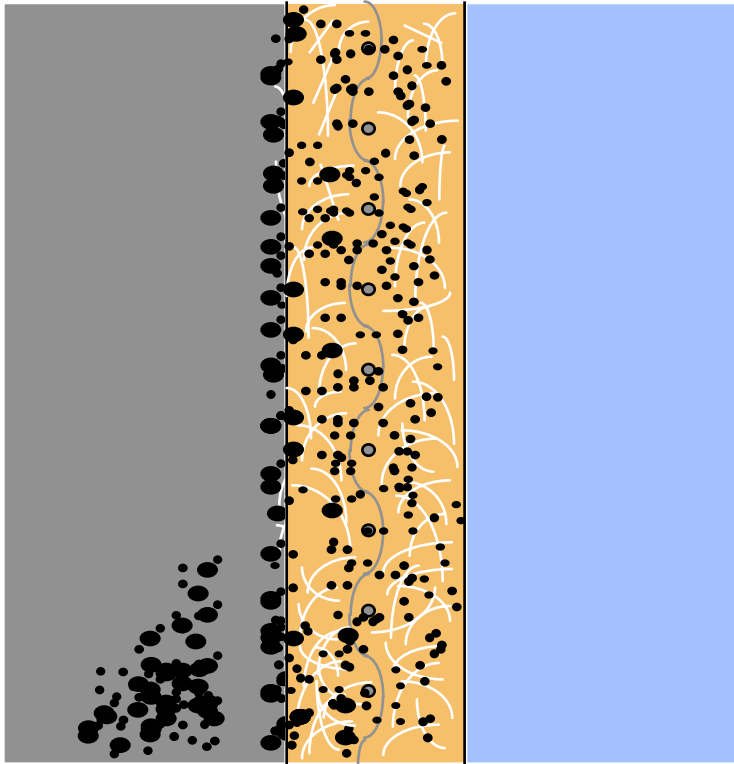


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Cleaning Mode

Conventional Media

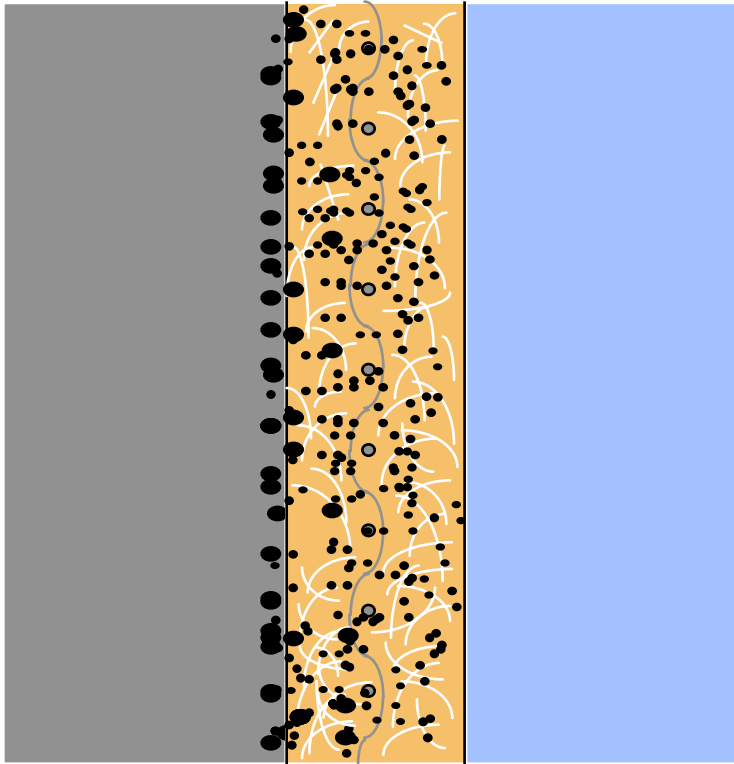


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Cleaning Mode

Conventional Media

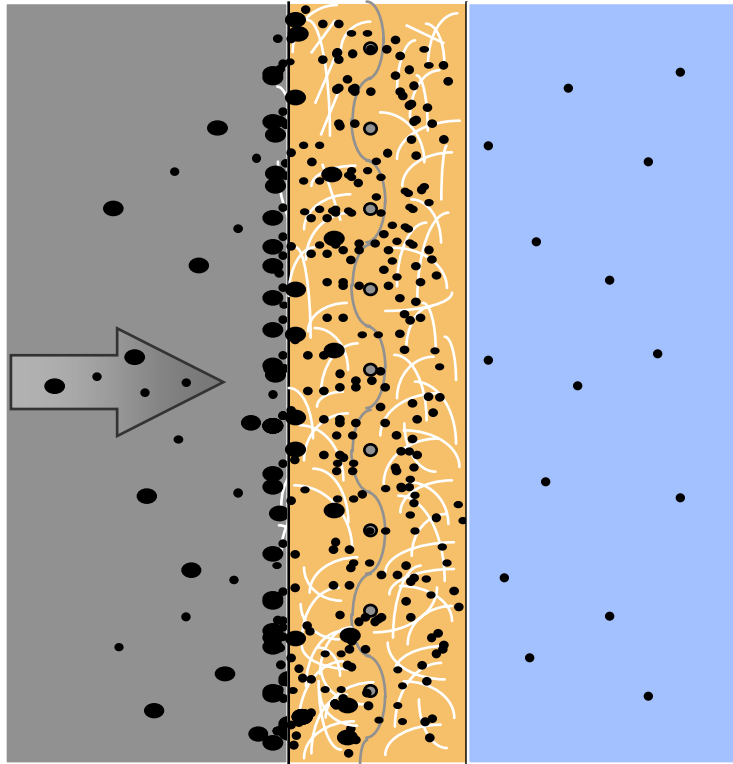


**Depth filter media
e.g. PPS felt**

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Depth Filtration - Filtering Mode

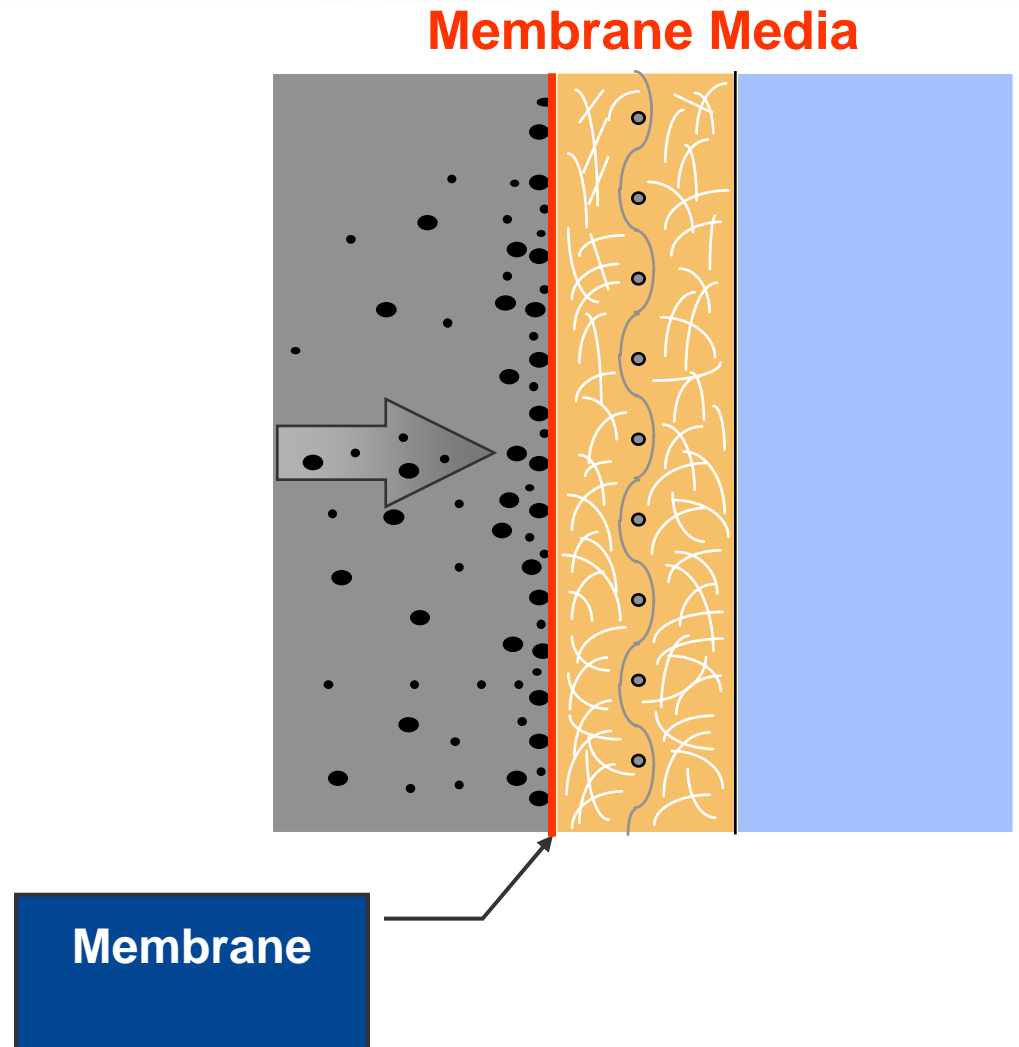
Conventional Media



**Depth filter media
e.g. PPS felt**

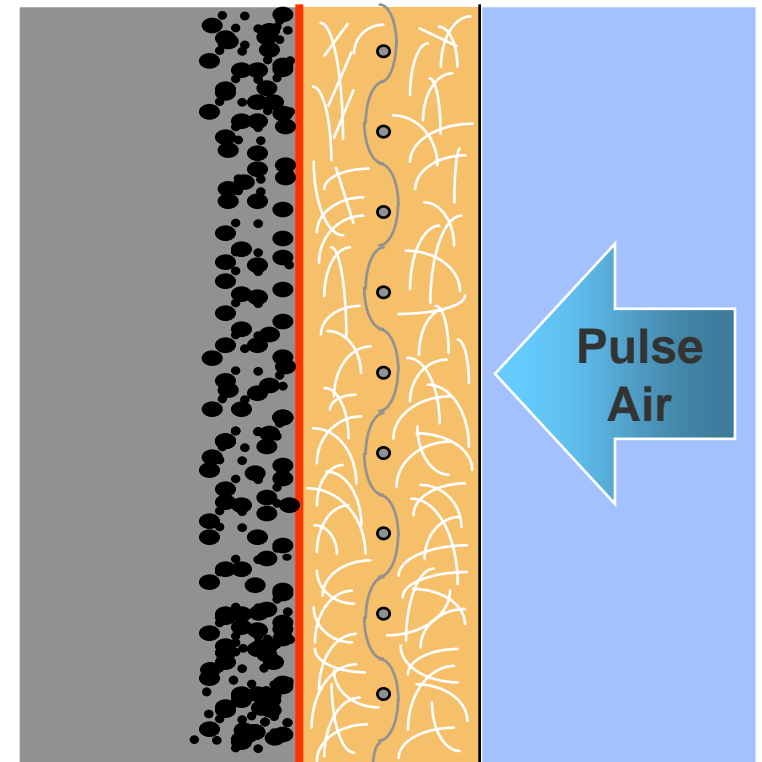
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Surface Filtration – Filtering Mode



Surface Filtration - Cleaning Mode

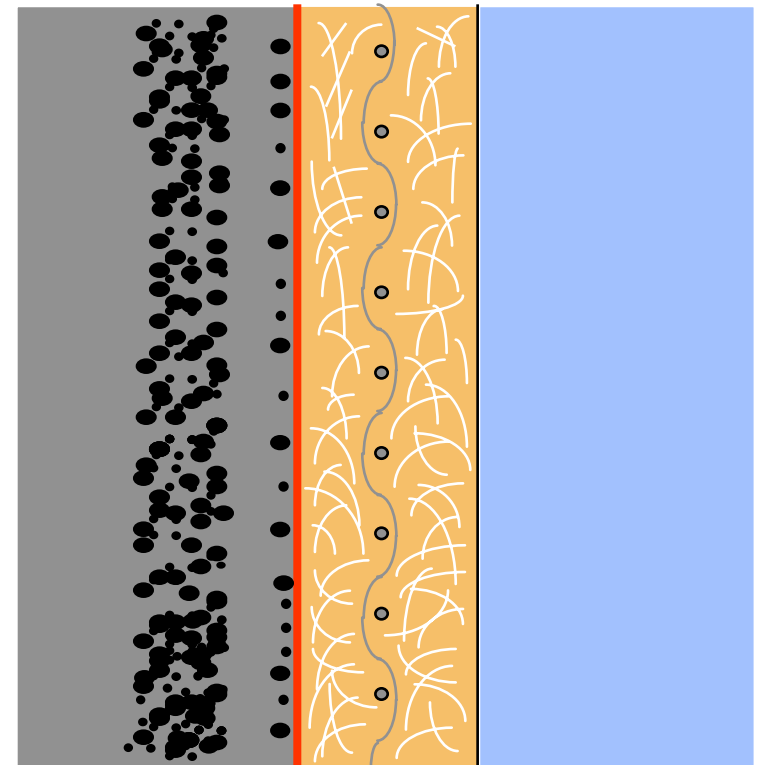
Membrane Media



Membrane

Surface Filtration - Cleaning Mode

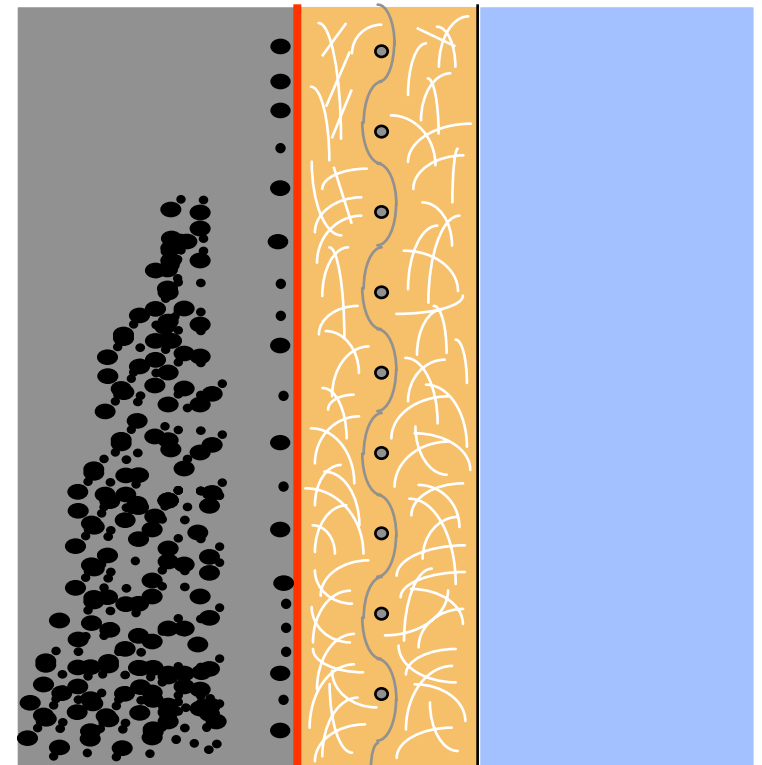
Membrane Media



Membrane

Surface Filtration - Cleaning Mode

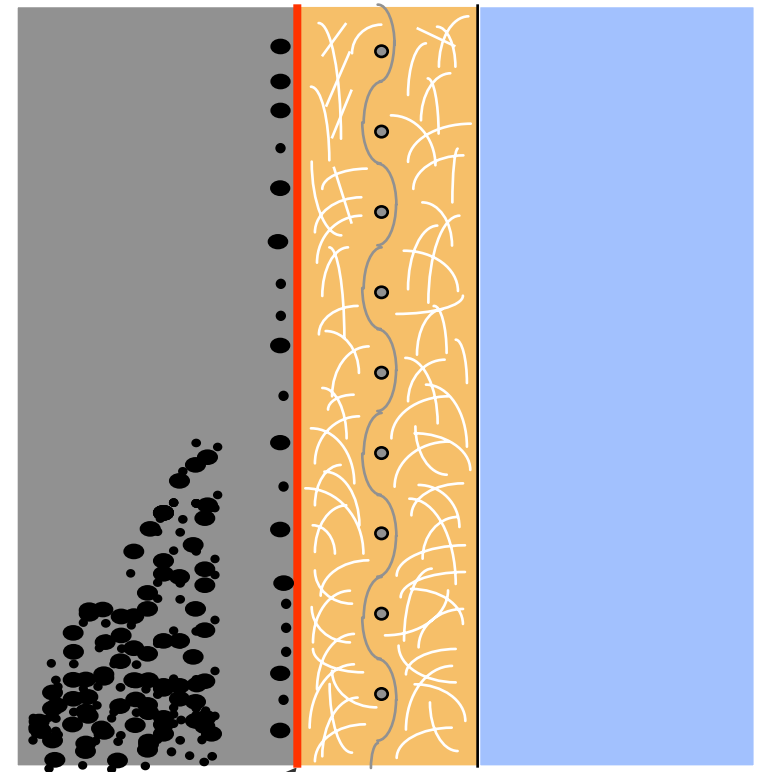
Membrane Media



Membrane

Surface Filtration - Cleaning Mode

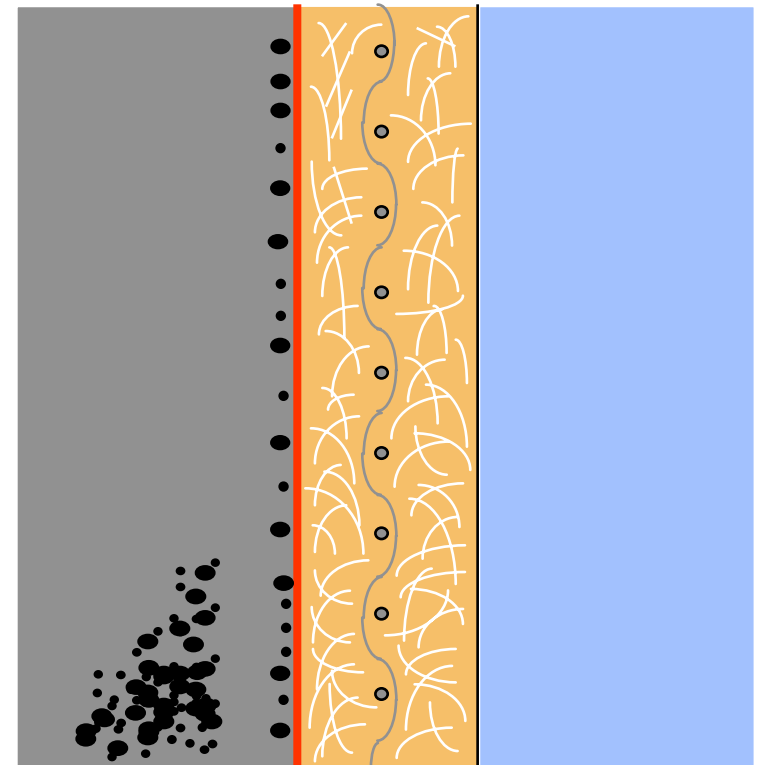
Membrane Media



Membrane

Surface Filtration - Cleaning Mode

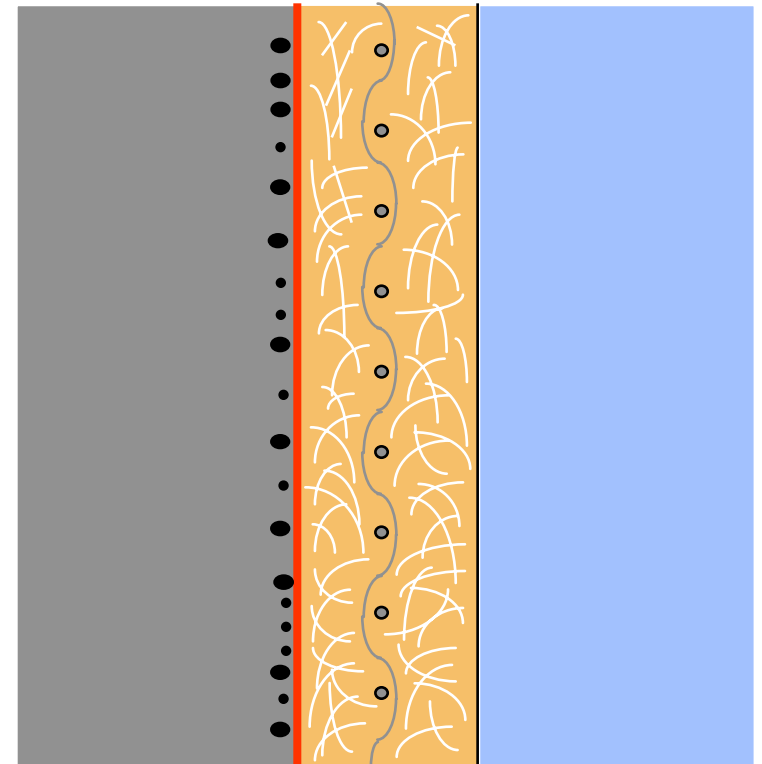
Membrane Media



Membrane

Surface Filtration - Cleaning Mode

Membrane Media



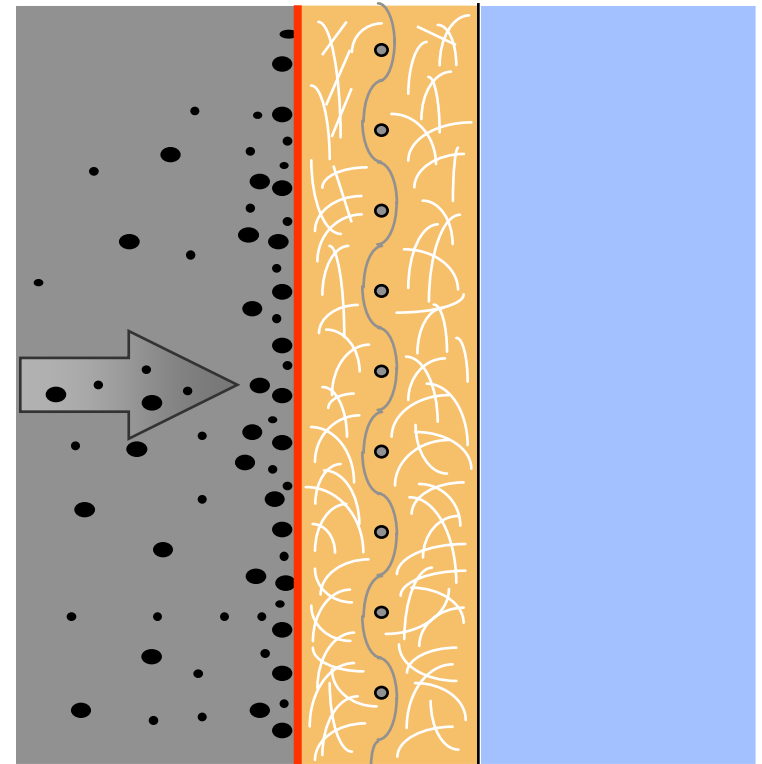
Membrane

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Surface Filtration - Filtering Mode

Membrane Media



Membrane

How & Why Does a Filter Bag Fail?

Some examples include:

Mechanical (fatigue or abrasion)

Thermal

Chemical (acid attack/oxidation/hydrolysis)

Blinding (high DP)

Poor Quality

Bad Installation

Operational problems (fires/mist/etc)

Filter Bag Life

Ideally, a bag would eventually fail from fatigue

Fatigue is related to cycles and applied loads

Cycles are cleaning cycles

Loads are forces from DP and cleaning energy

An optimized filter media would operate at a low DP with low cleaning energy

Agenda

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Field Inspection & Laboratory Analysis

Discovering Problems Early

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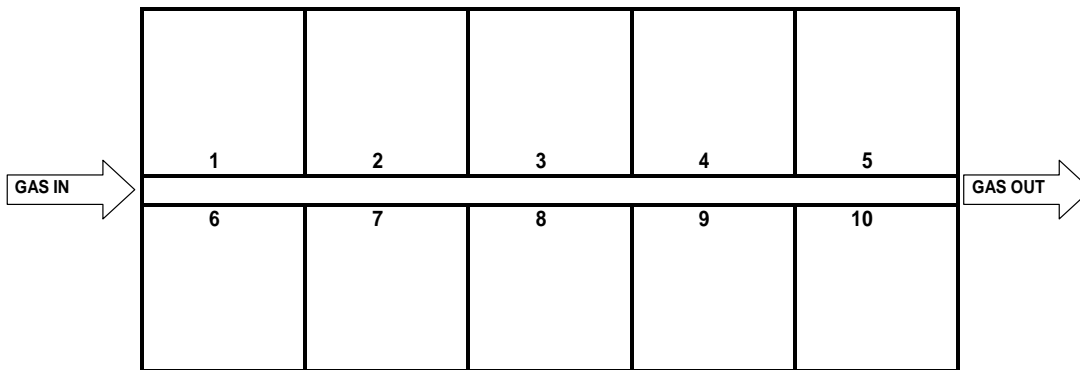
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Field Inspection/Lab Analysis: Your “Annual Physical”

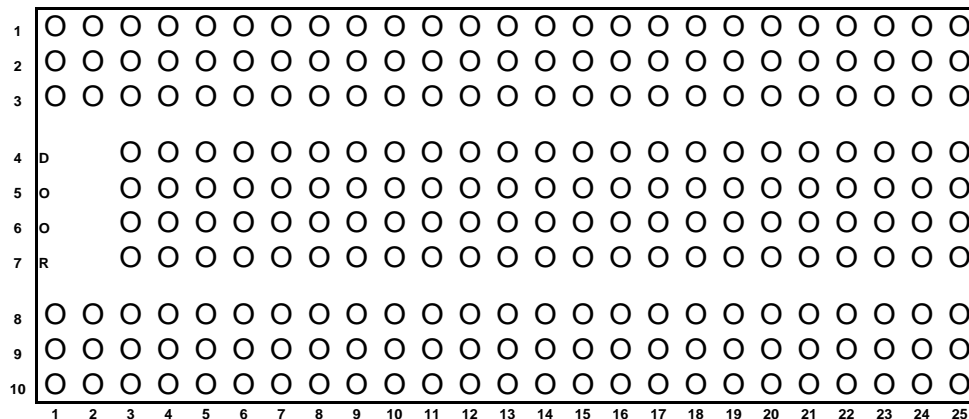


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Value of Field Inspection



Compartment Configuration



Tubesheet Configuration

Weekly

- Cleaning System
- Dust removal system
- Instrumentation

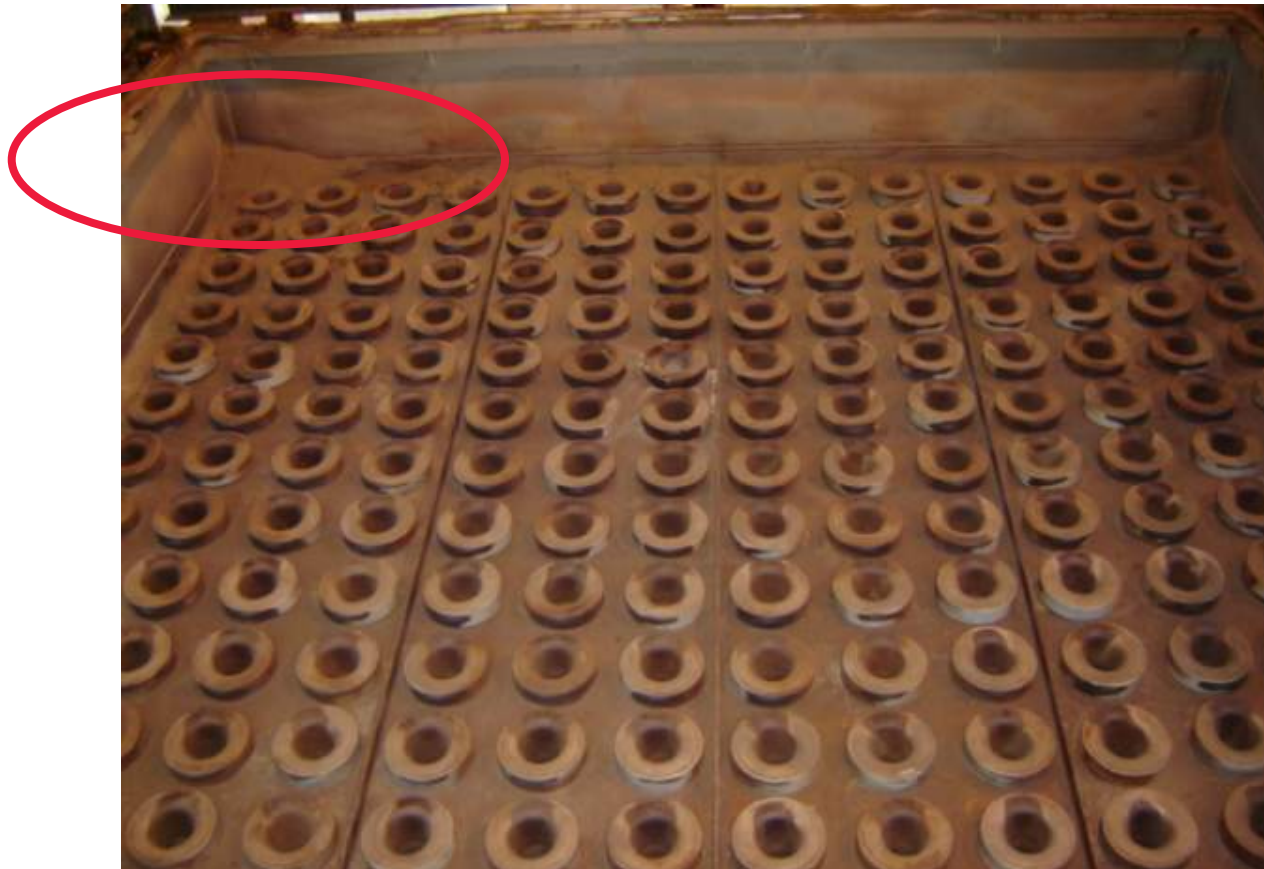
During compartment outage

- Access doors
- Clean Air Plenum
- Hopper

Annual or extended outage

- Ductwork
- Dampers
- Pulse Jet Valves

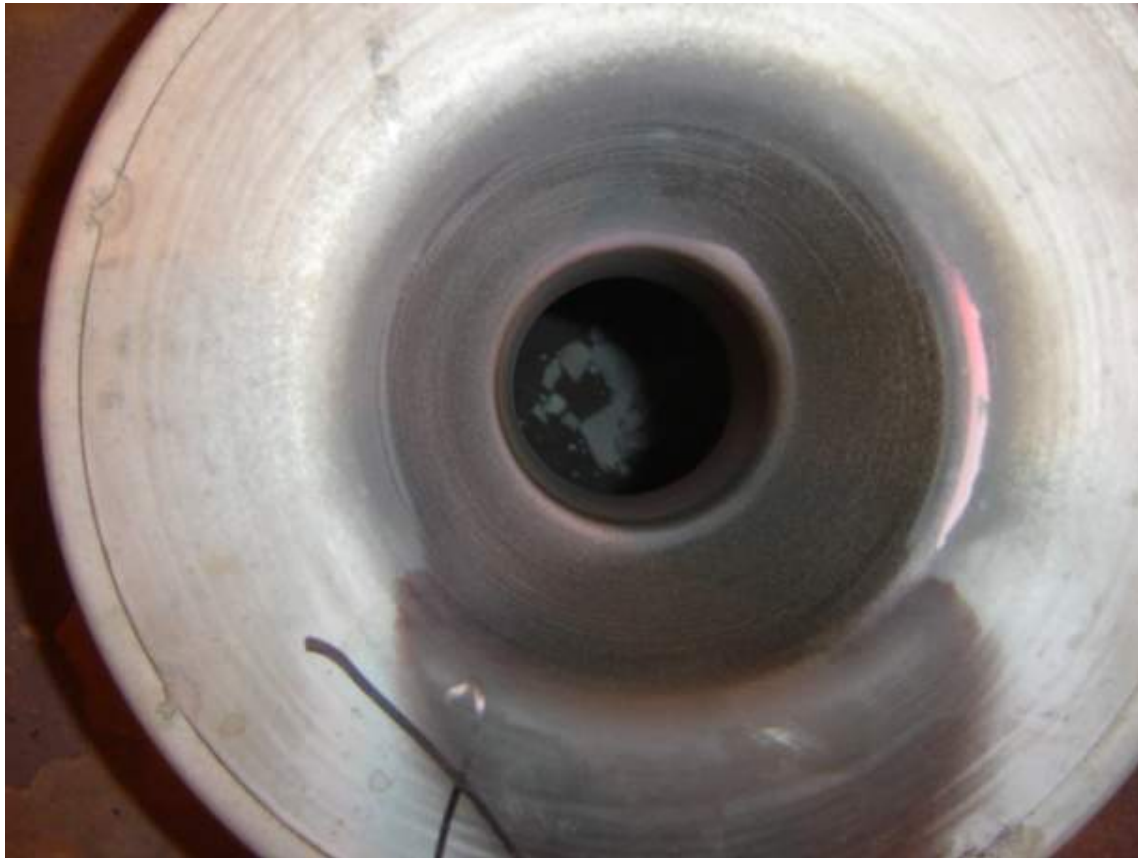
Ash Build up in Corners



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Bag Full of Ash



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Wear From Misaligned Blowpipe



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Missing Section of Blowpipe



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Severe Corrosion and Ash Build up in Corner



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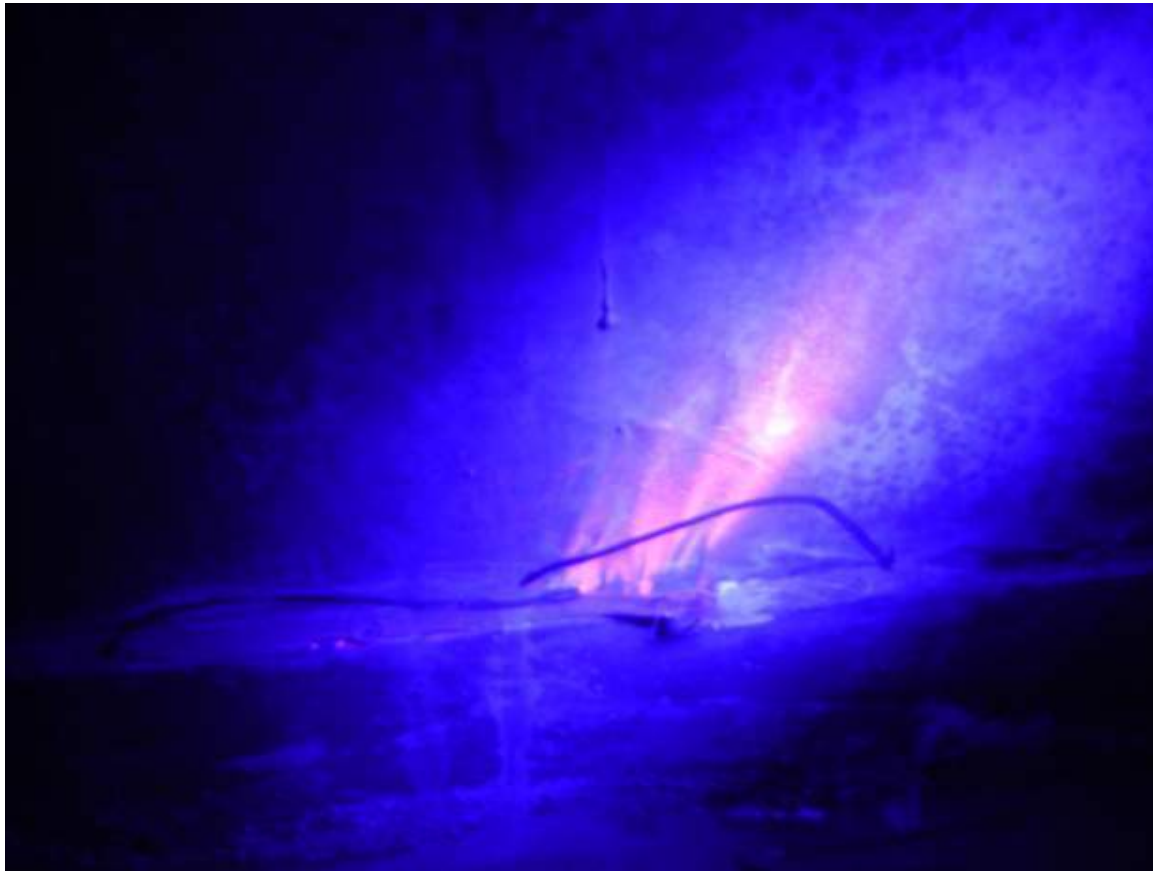
Hole in Tubesheet Visible After Vacuum Cleaning



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Leak at Weld Clean Air Plenum (Under UV Light)



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Filter Bag Laboratory Analysis

Visual testing, including microscopic testing

Permeability testing
Strength testing } **Trend monitoring**

Thermal analyses

Physical & chemical testing of particulate

It's important to know the compartment and bag location

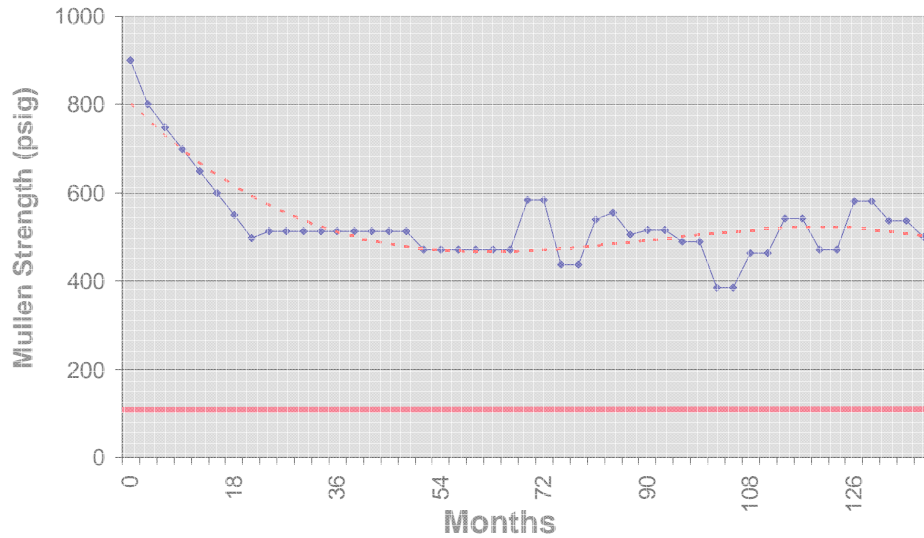
Value:

Determine failure mode

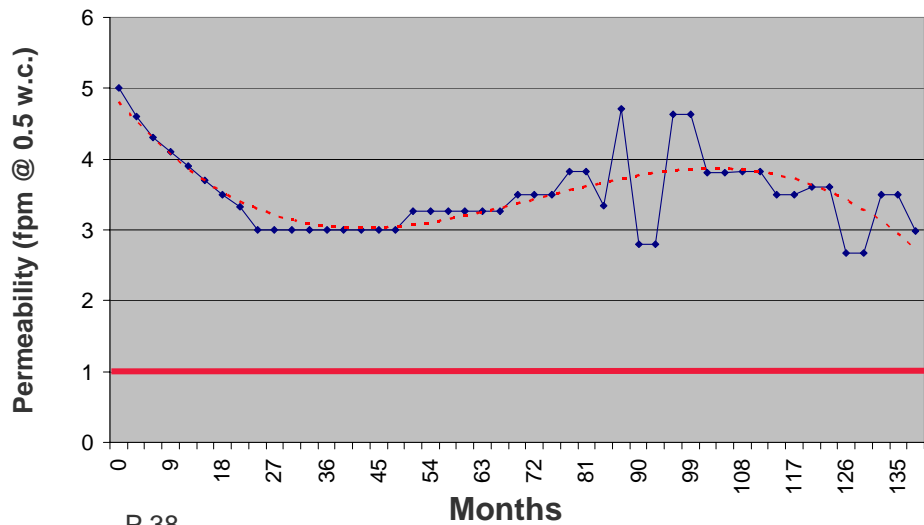
Project your operation (e.g., filter bag life)

Help you plan for outages

Filter Bag Analysis – Value of Trending



Filter Bag Strength Trend



Filter Bag Flow Trend

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Reducing the Cost of Baghouse O & M

Evaluating system operations:

Enables optimization of the cleaning system

Minimize total cost of O & M

Field inspections:

Identify operational issues

Reduce costs of O & M

Laboratory analysis

Insight on bag failures

Improved bag life

What else can be done?

Instrumentation for early discovery of problems

Agenda

Overview

System Optimization & Filter Media

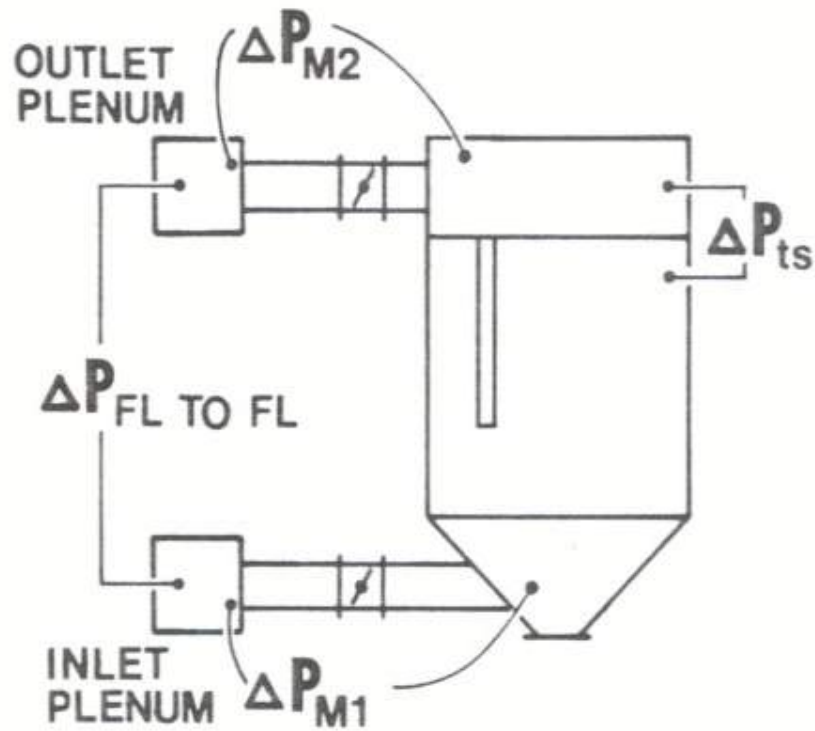
Field Inspection & Laboratory Analysis

Discovering Problems Early

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System Optimization - Pressure Drop (ΔP)



Components of Baghouse ΔP :

Flange to Flange ΔP (ΔP_{FL-FL})

Mechanical ΔP (ΔP_{M0})

Tubesheet ΔP (ΔP_{ts})

System Optimization – Flange to Flange ΔP

Data trends allow for detailed analysis

Can indentify bag blinding

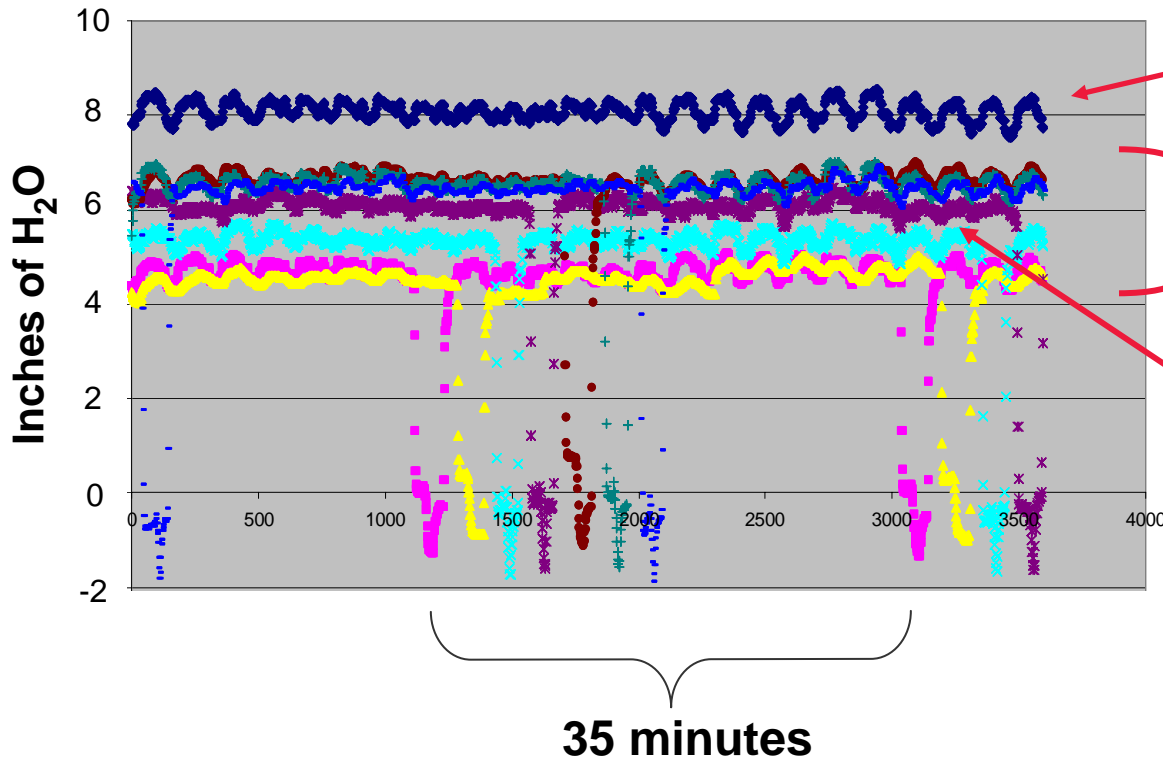
From process upsets or end of bag life

Can evaluate effects of fuel changes

Changes in cleaning frequency or DP

Opportunity to evaluate different cleaning strategies

Data Analysis Is Key to Optimization



Flange – to Flange ΔP

Compartment ΔP provides insight:

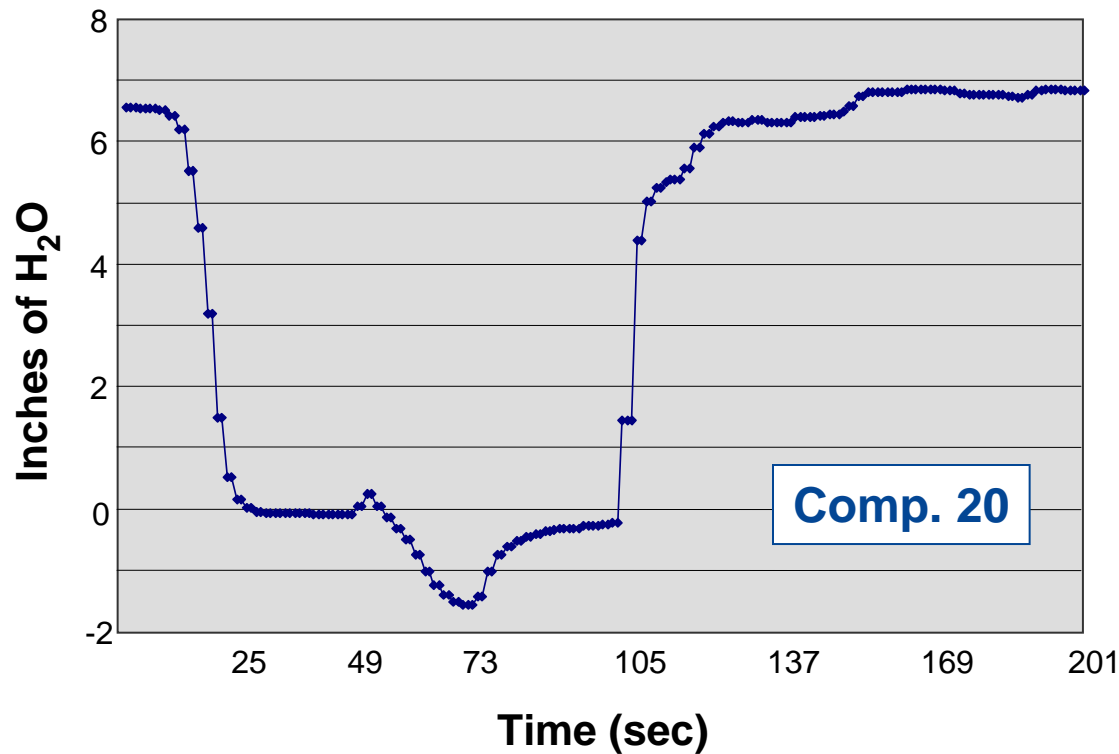
Variation in ΔP amongst compartments

Some compartments are taking more flow

Cleaning frequency

Instrumentation is critical for data collection

Frequent Data Collection Enables Detailed Analysis



Damper operation

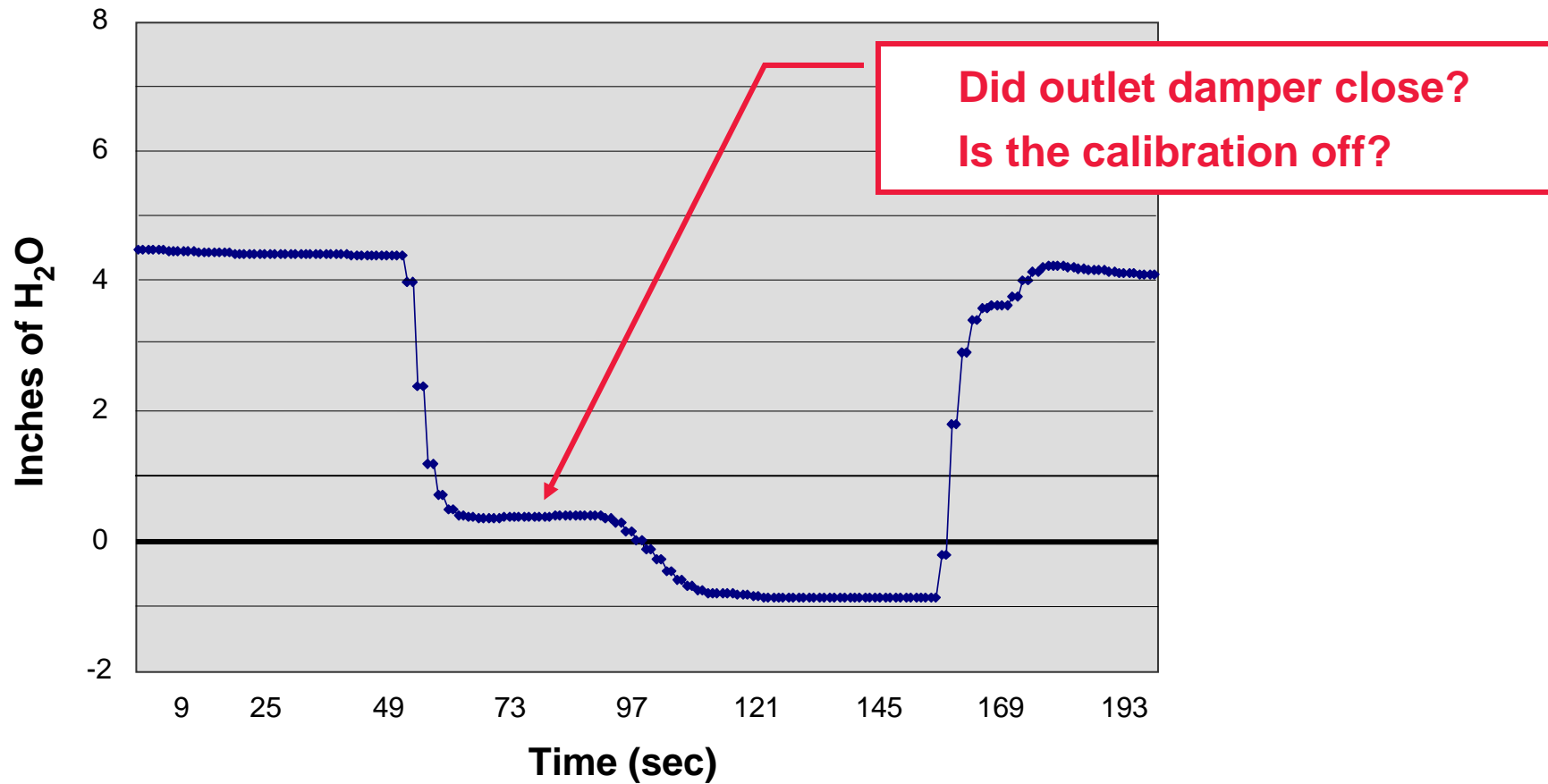
Settle time

Reverse gas on

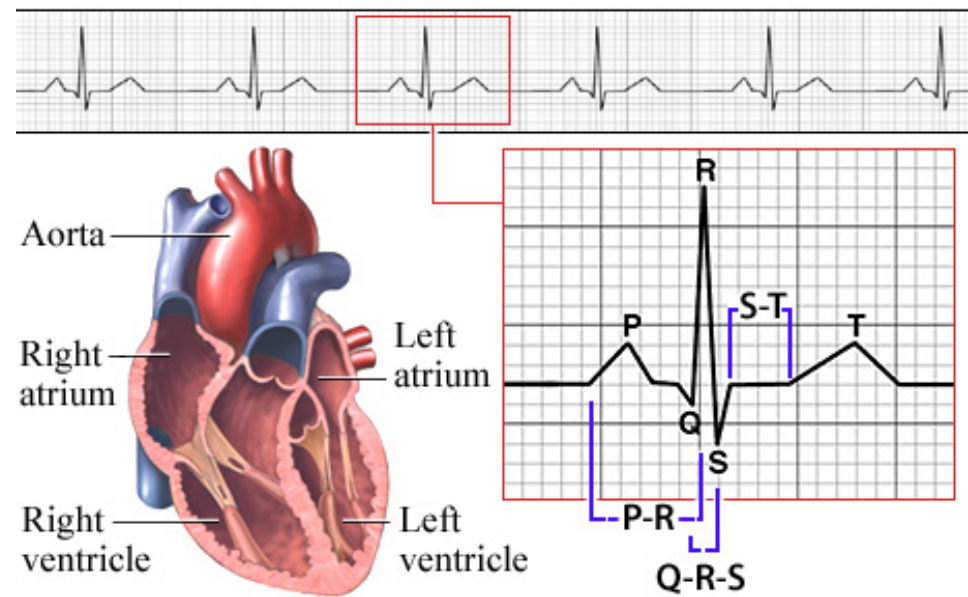
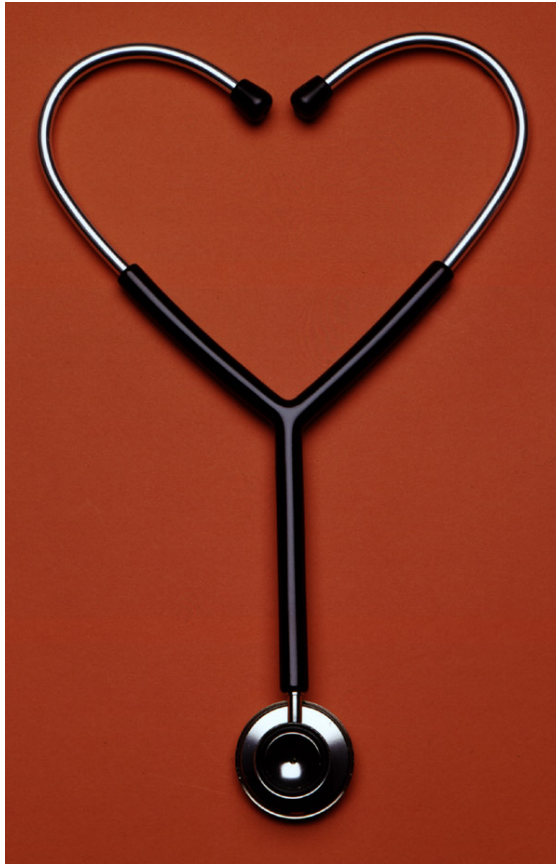
Settle time

Terminal and residual DP
(i.e. cleaning effectiveness)

Frequent Data Collection Enables Discovery



Which would you prefer?



Particulate Emissions – Monitoring Technology

Particulate Monitors Can Be Used As:

Maintenance Tool

Analytical Tool



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Particulate Emissions – Maintenance Tool

Single Monitoring Point

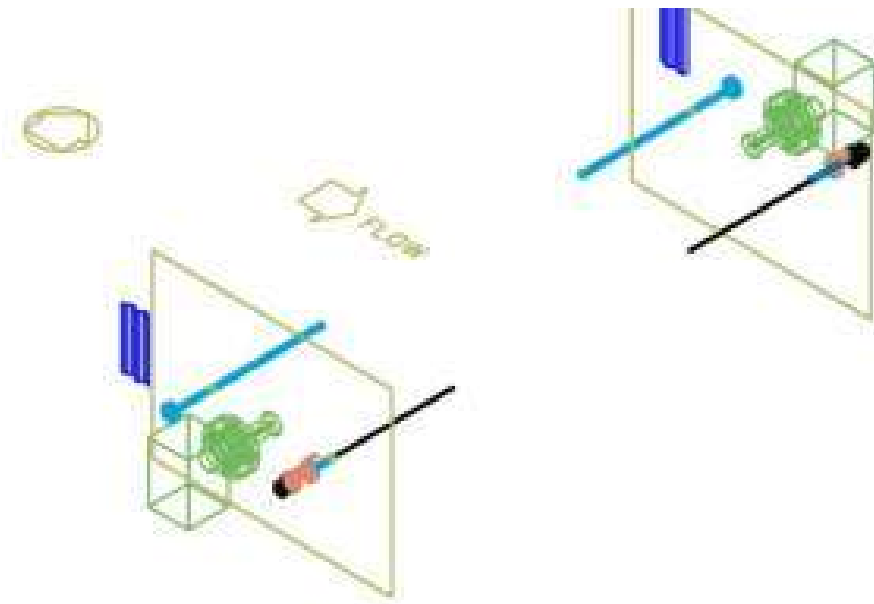
Common Outlet of Baghouse

Multiple Monitoring Points

Outlet of Each Individual Compartment

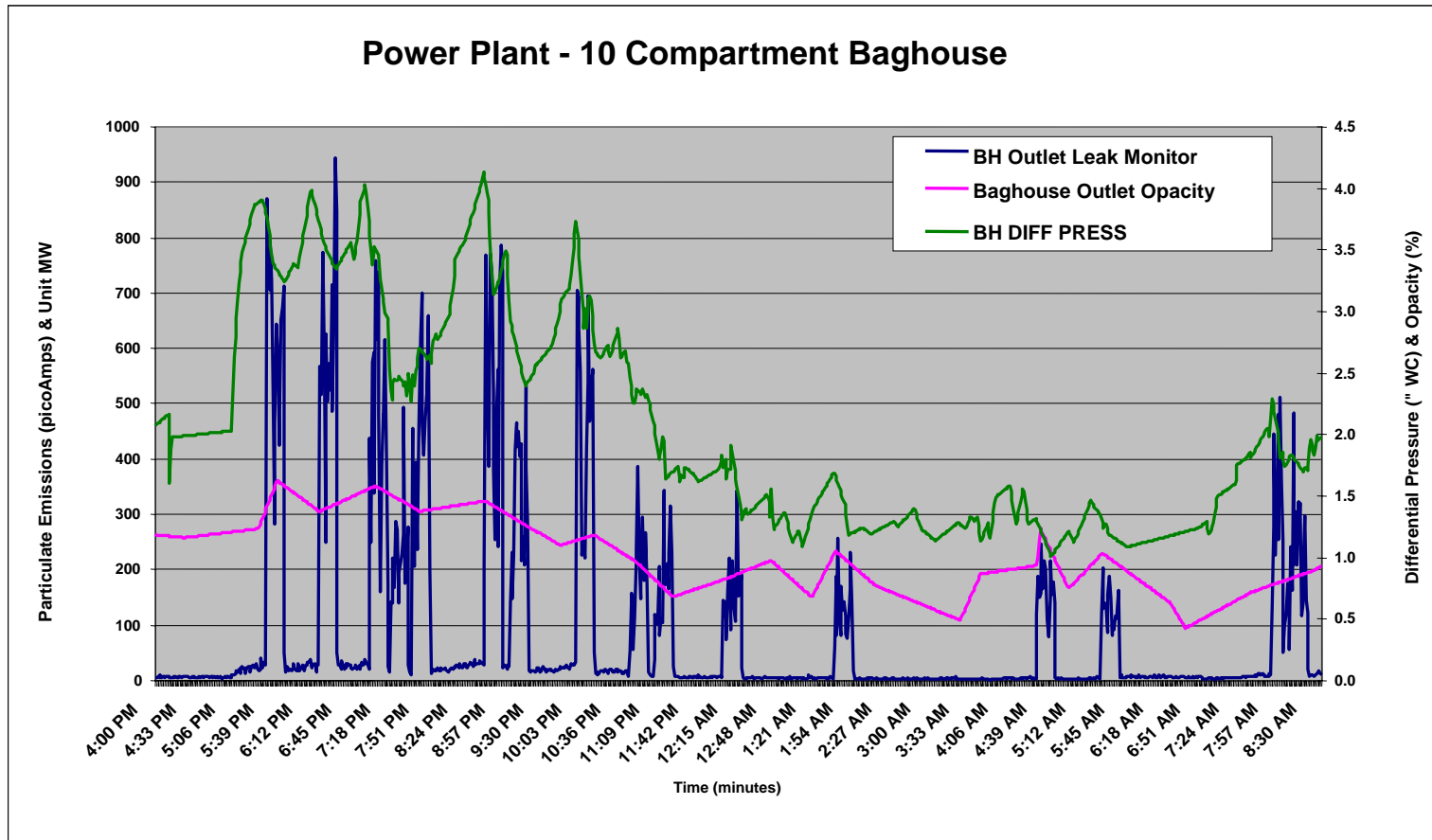
Particulate Emissions – Monitoring Technology

Common Outlet of Baghouse – Typical Installation



Particulate Emissions – Maintenance Tool

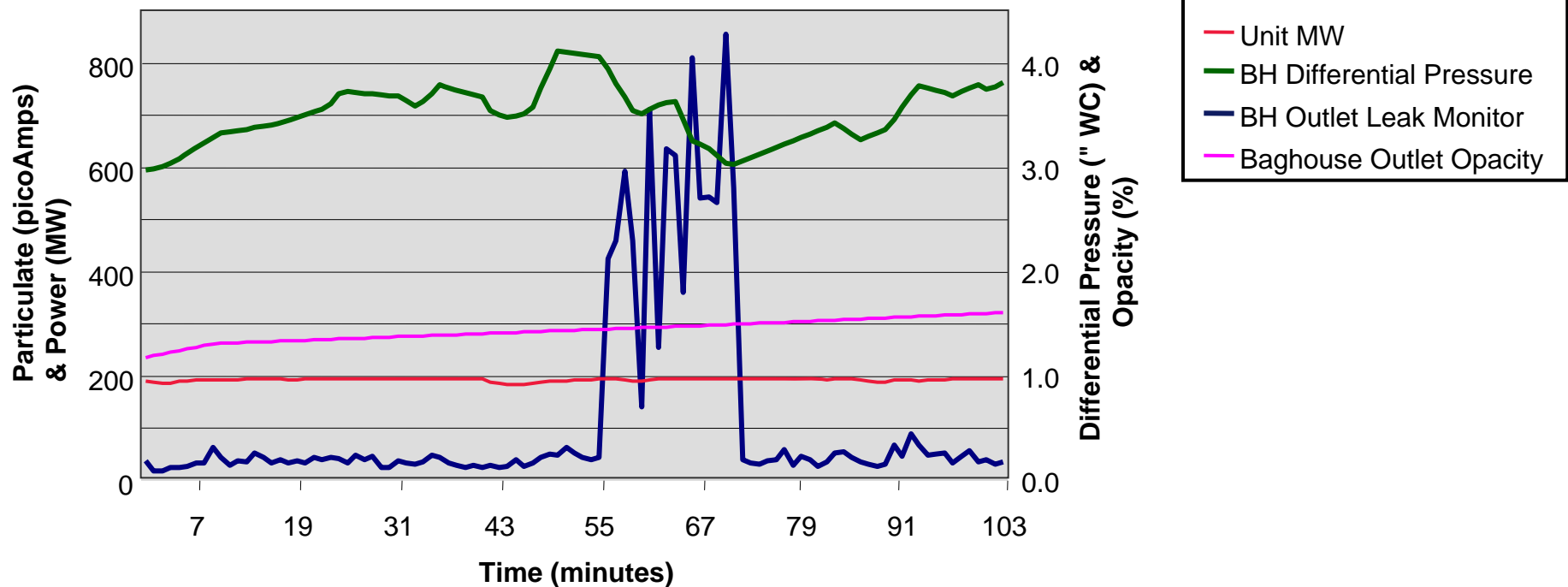
Common Outlet of Baghouse – Pressure Drop, Opacity, and PM Emissions



Particulate Emissions – Maintenance Tool

Common Outlet of Baghouse – Particulate, DP and Opacity

Single Cleaning Cycle



Particulate Emissions – Maintenance Tool

Benefits of Particulate Monitoring at High Resolution?

Early Detection of a Problem

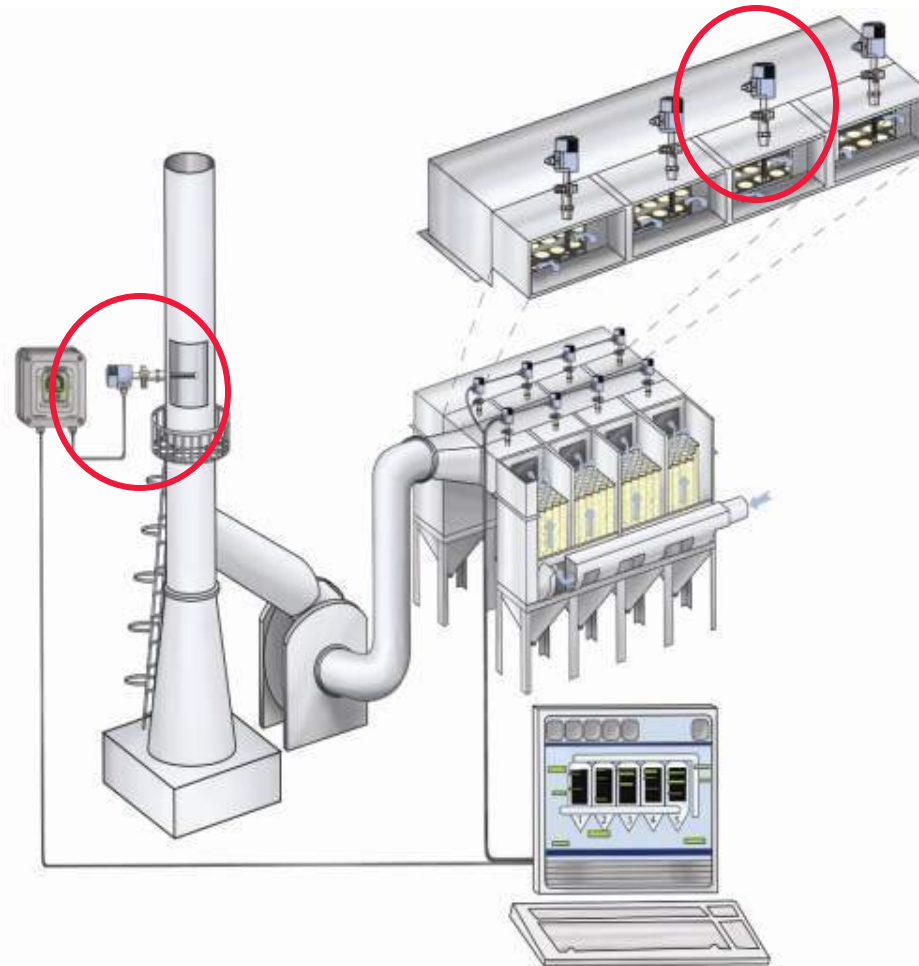
Optimize Maintenance

Lowest Material, Labor and Down-time

Proactive



Particulate Emissions – Monitoring Technology

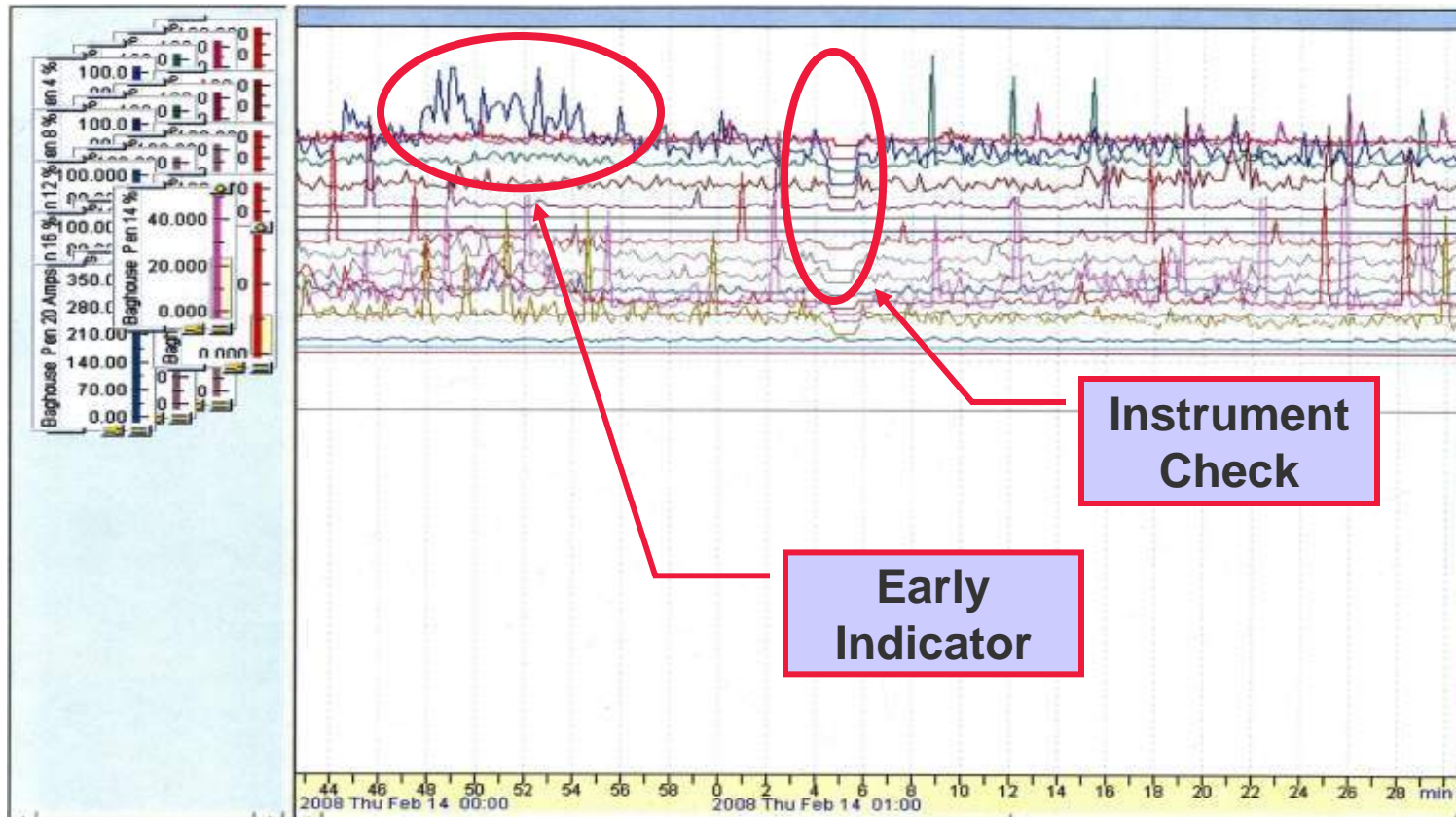


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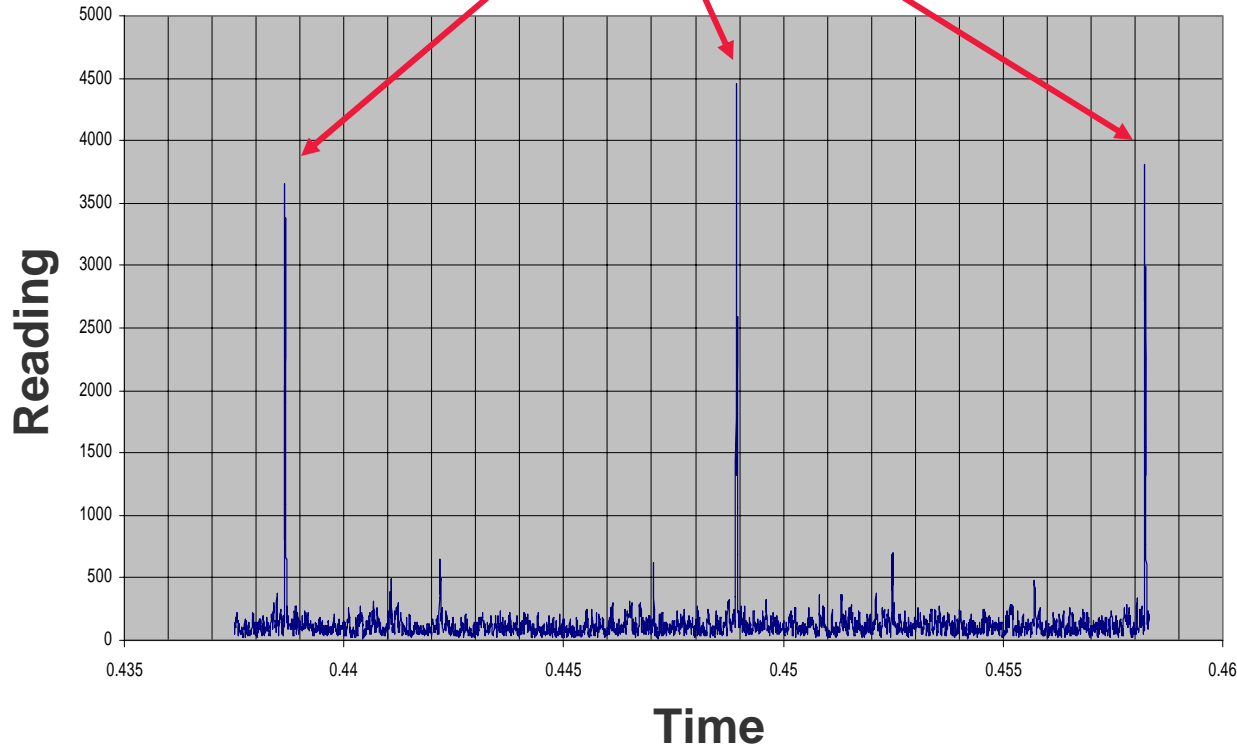
Particulate Emissions – Maintenance Tool

Outlet of Each Individual Compartment



System Optimization – Particulate Emissions

Using the Particulate Monitor
Leaking bag(s) in this row

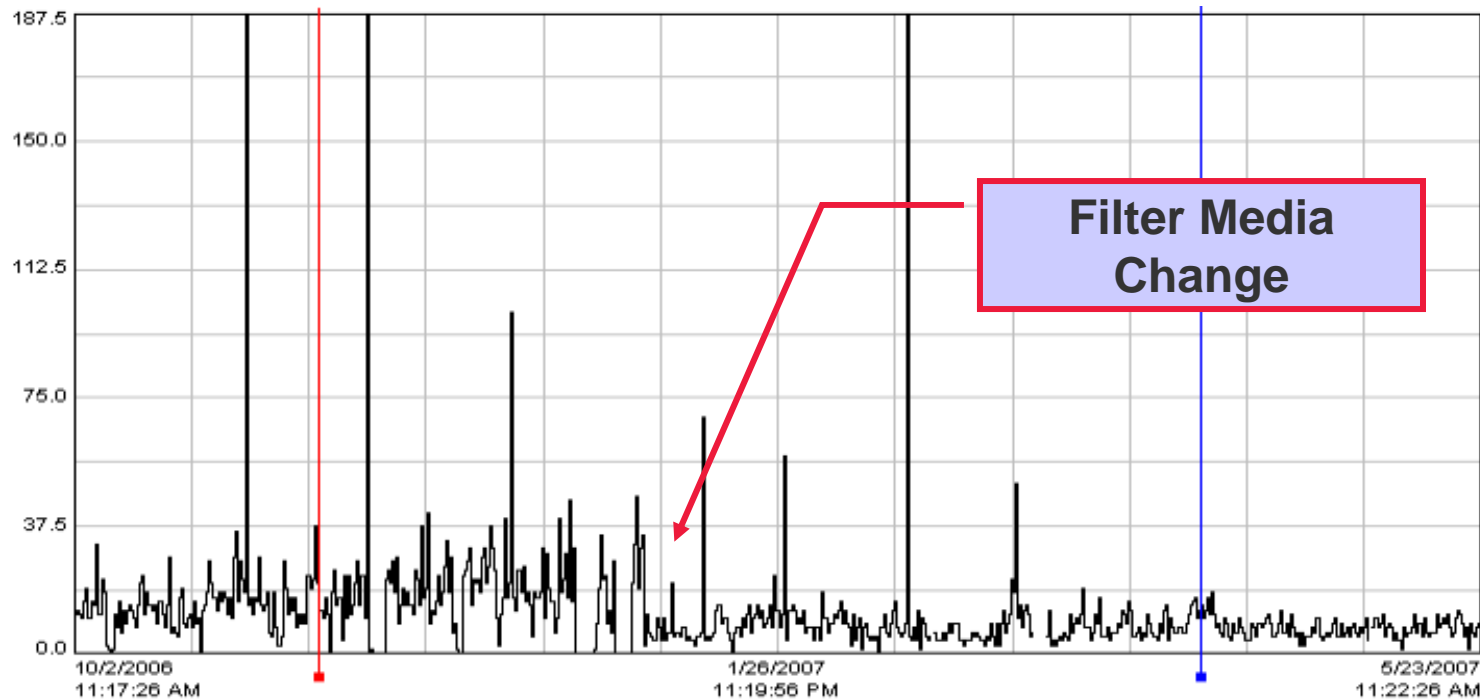


**Membrane Media
On-Line cleaning mode**

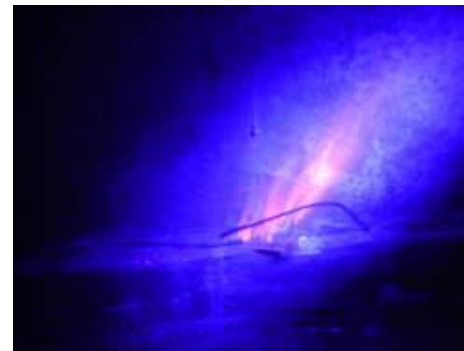
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Particulate Emissions – Analytical Tool

Outlet of an Individual Compartment – New Media



Particulate Emissions – Maintenance Tool

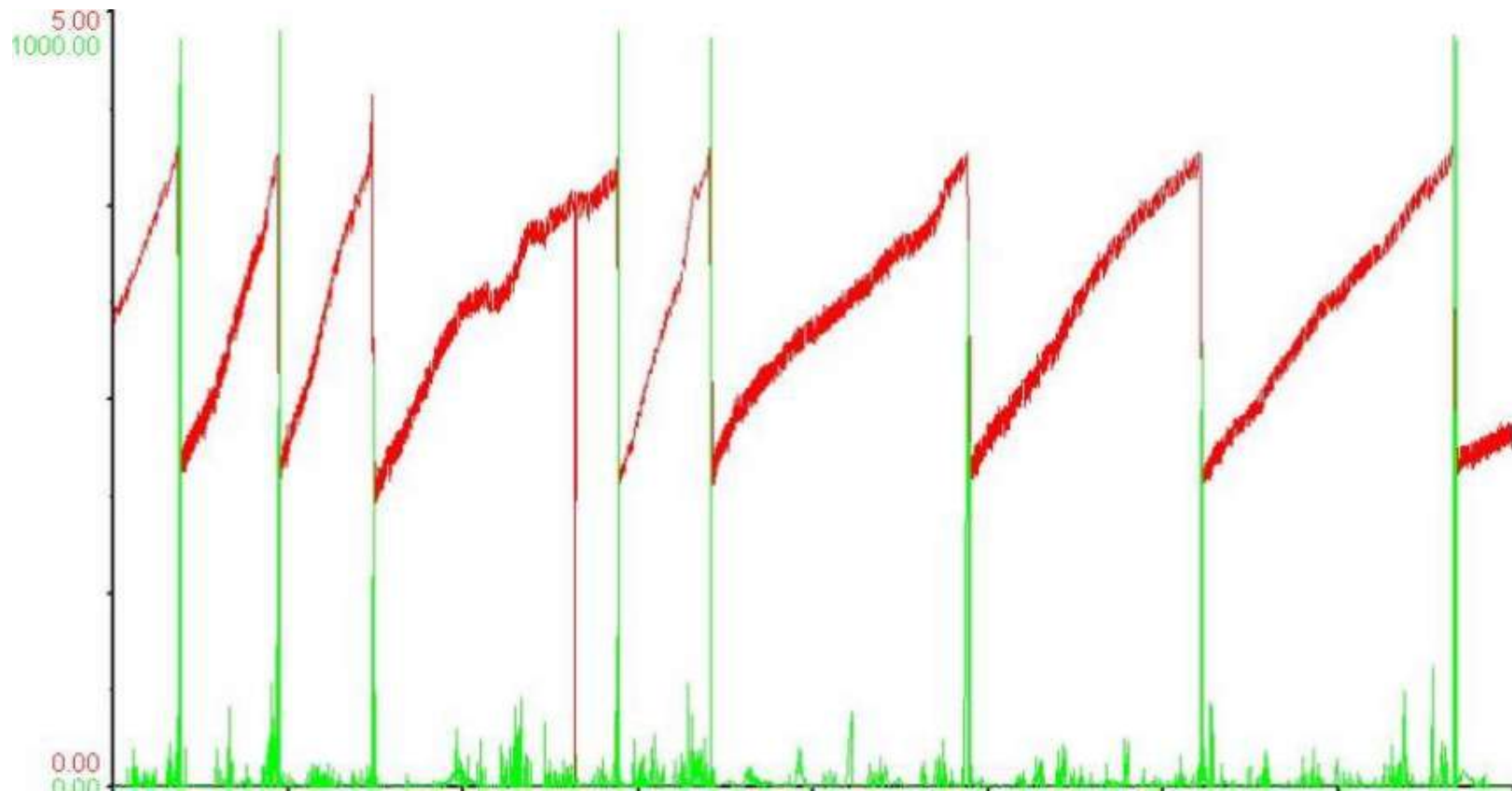


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Particulate Emissions – Maintenance Tool

Outlet of an Individual Compartment Micro Fractures in Tubesheet



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Optimize Baghouse O & M

Monitoring in Real Time, High Resolution is an Essential Tool to Assist in Optimizing the baghouse

Advanced Analysis:

Tool to Enhance Baghouse Operation

Maximum Performance for Minimal Costs

Maintenance:

Early Detection of Problems

ProActive



Fabric Filter Maintenance for Performance

Questions and Answers

Thank You



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