Energy Savings & Cost Reduction Through Intelligent Sootblowing & Maintenance

Fall 2023 Western Canada BLRBAC Meeting
Richmond, BC, CANADA - Nov 15, 2023

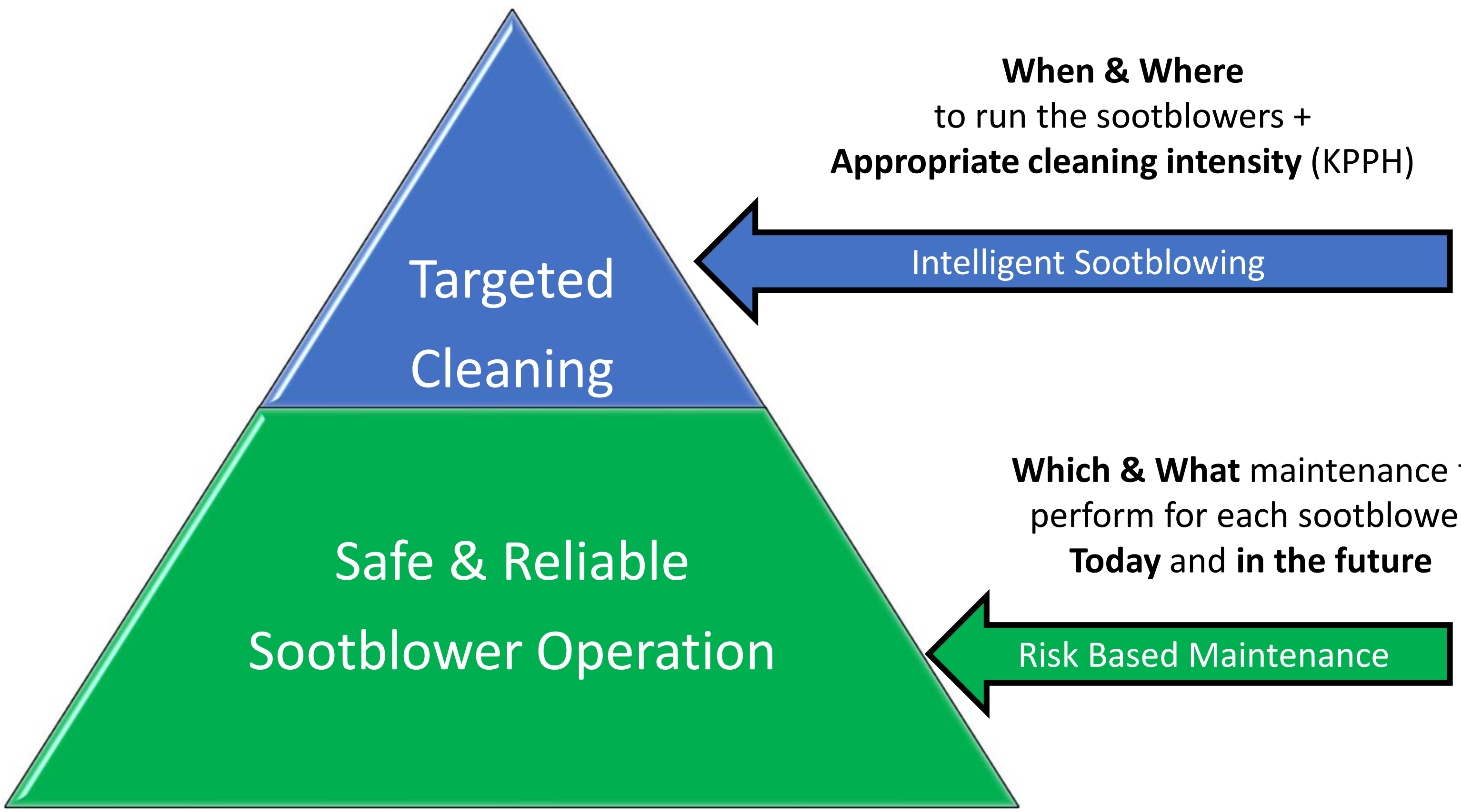
6 Sootblower Related Challenges Facing Pulp mills in North America

Better Sootblowing

1. Overcleaning (*tube failure/wasting steam*) & Undercleaning *(heavy fouling)*
2. Aging sootblower equipment
3. High quantity of sootblowers, making it harder to maintain them
4. Retiring experienced personnel
5. Lack of trained maintenance team
6. Competing budget & resources

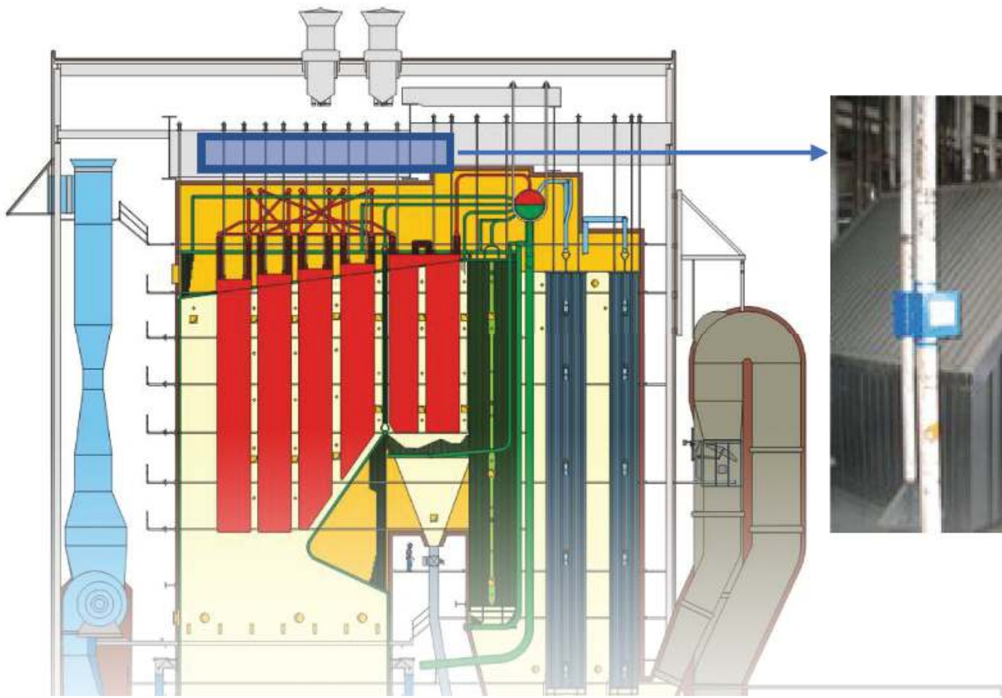
Better Maintenance

Increase Throughput & Reduce Operating Costs



HOW SMART Clean Works

- Easy to install
- Targeted cleaning
- Accumulation measurement



SMARTClean™

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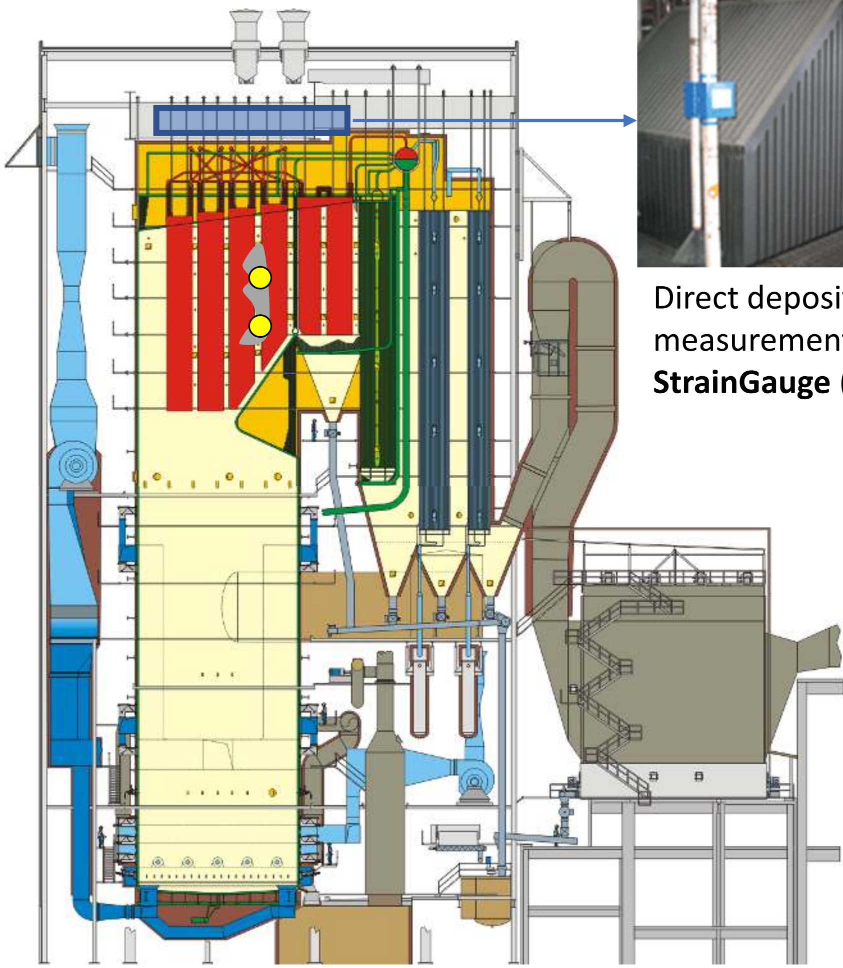
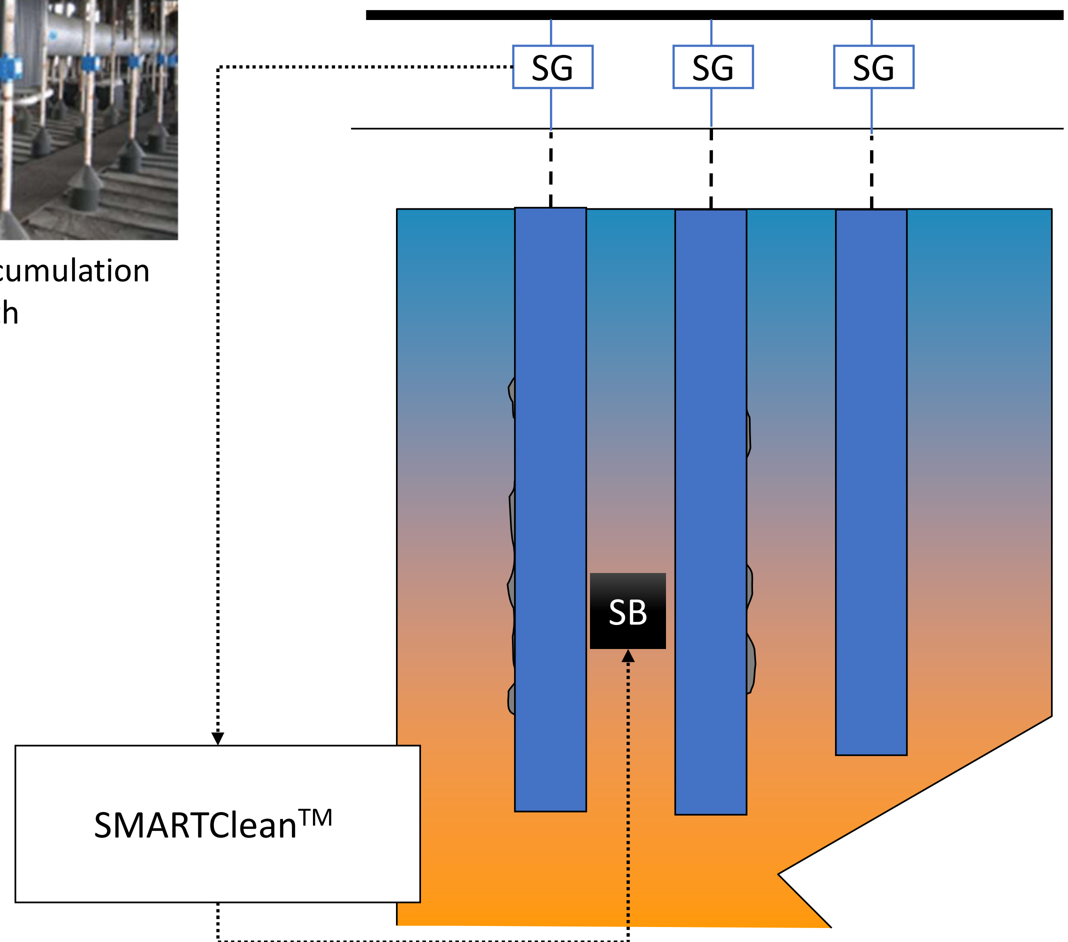
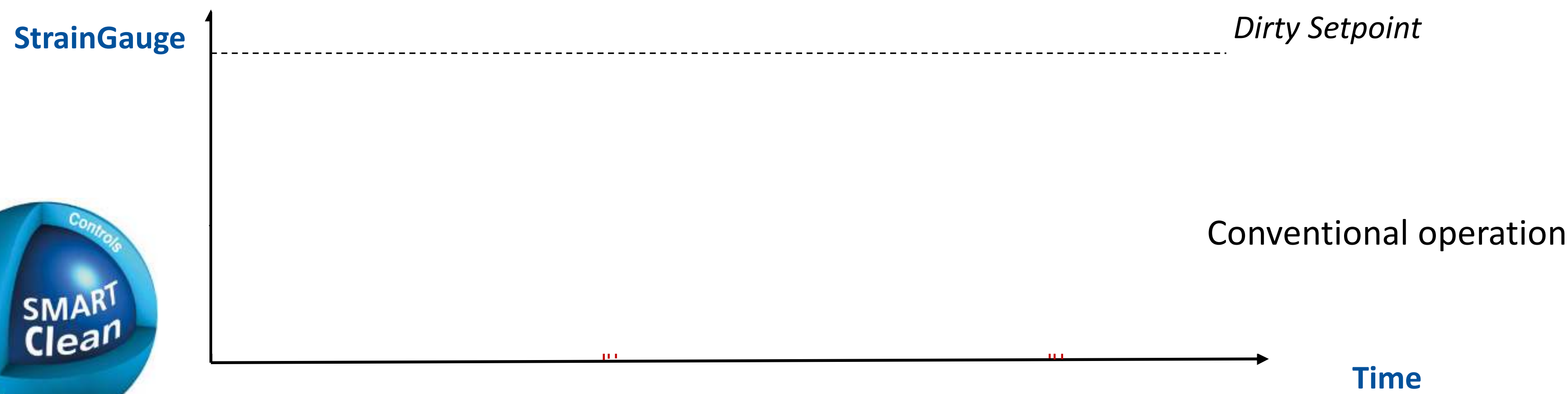


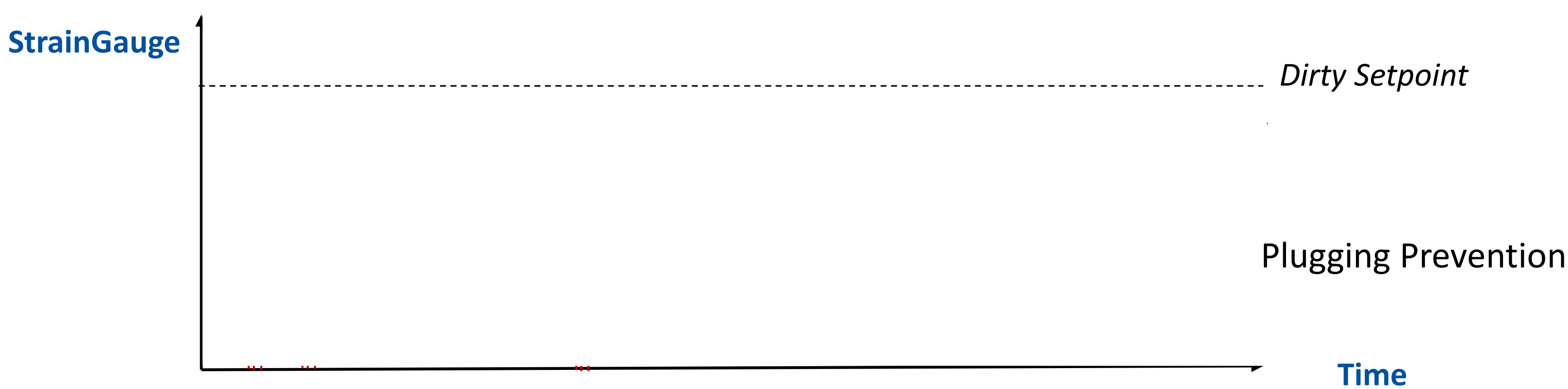
Direct deposit accumulation measurement with **StrainGauge (SG)**



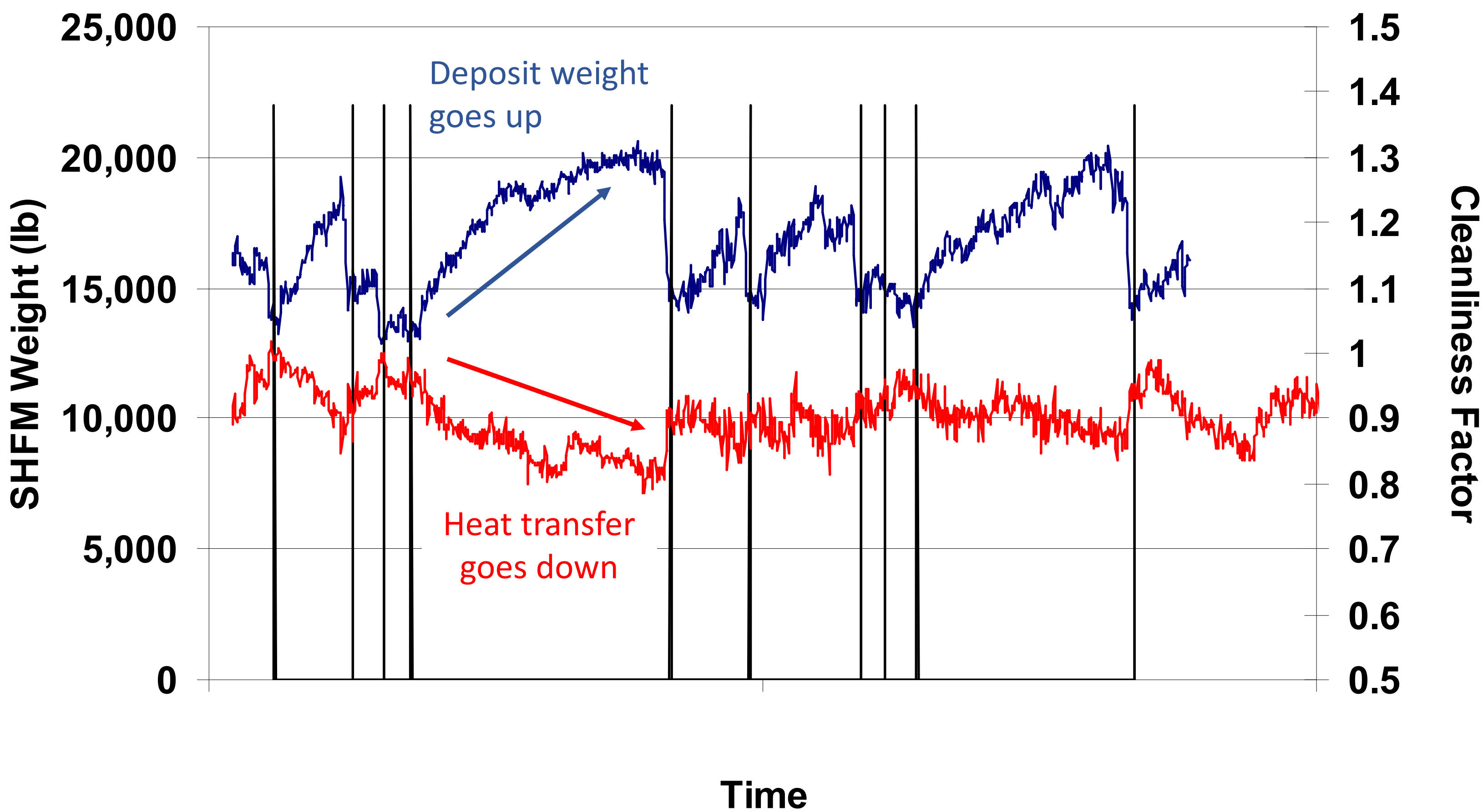
SMART CLEAN: How do we save steam & prevent plugging



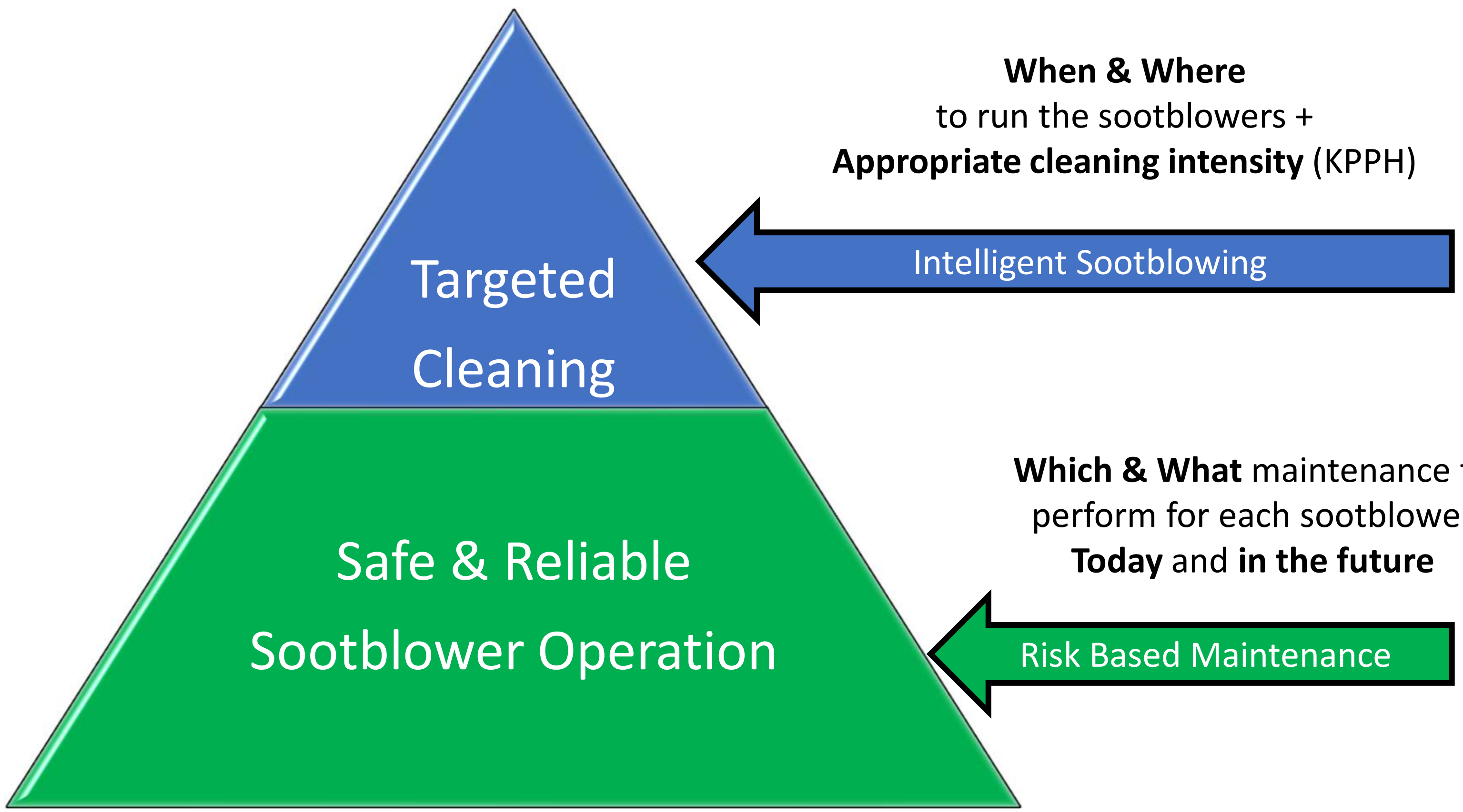
High rate of deposit accumulation is a good indicator that the boiler is about to plug. It requires specific sootblowing strategy to prevent it.



Superheater Section



Increase Throughput & Reduce Operating Costs



MAINTENANCE APPROACH

Risk and Condition Based Maintenance

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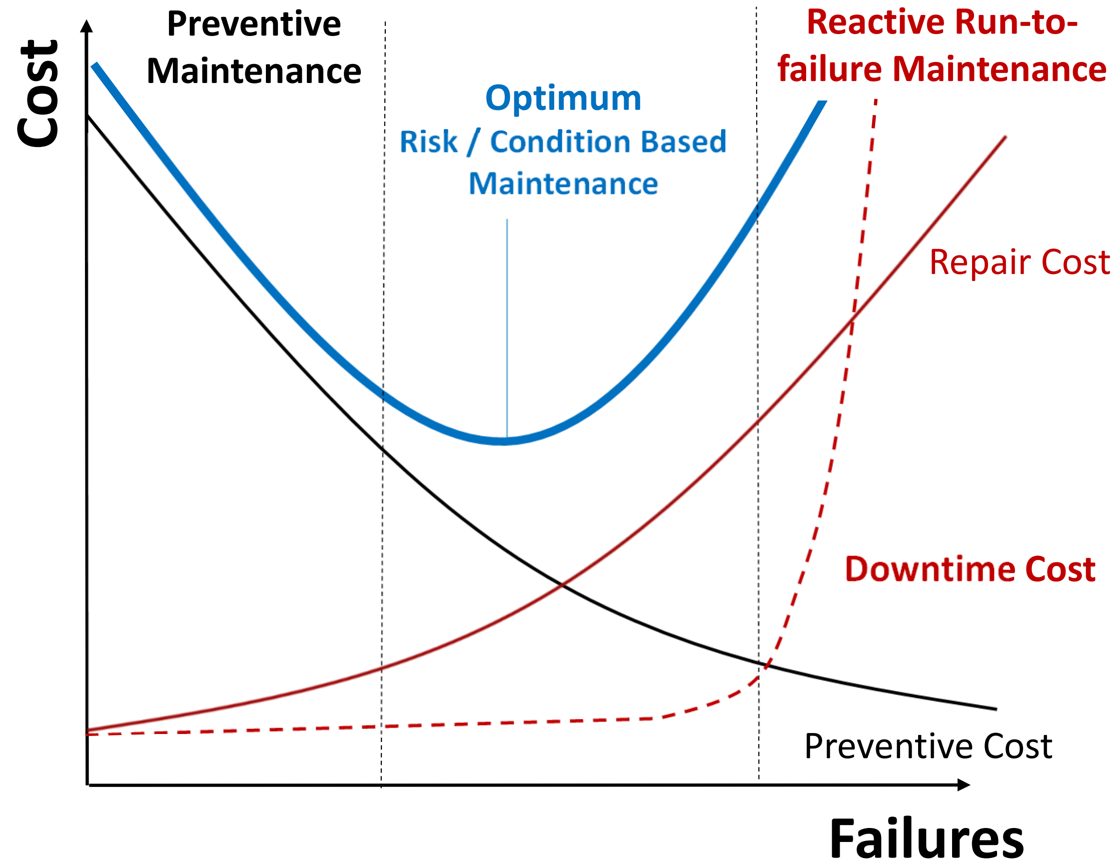
Maintenance

- Sootblower is NOT a “precision equipment” that needs a costly *preventive maintenance.*
- But *reactive run-to-failure maintenance* is also a bad choice – High repair / downtime costs & Unsafe Operations.
- Risk & Condition Based maintenance is the most appropriate approach – It reduces operating costs, downtime, and failures.



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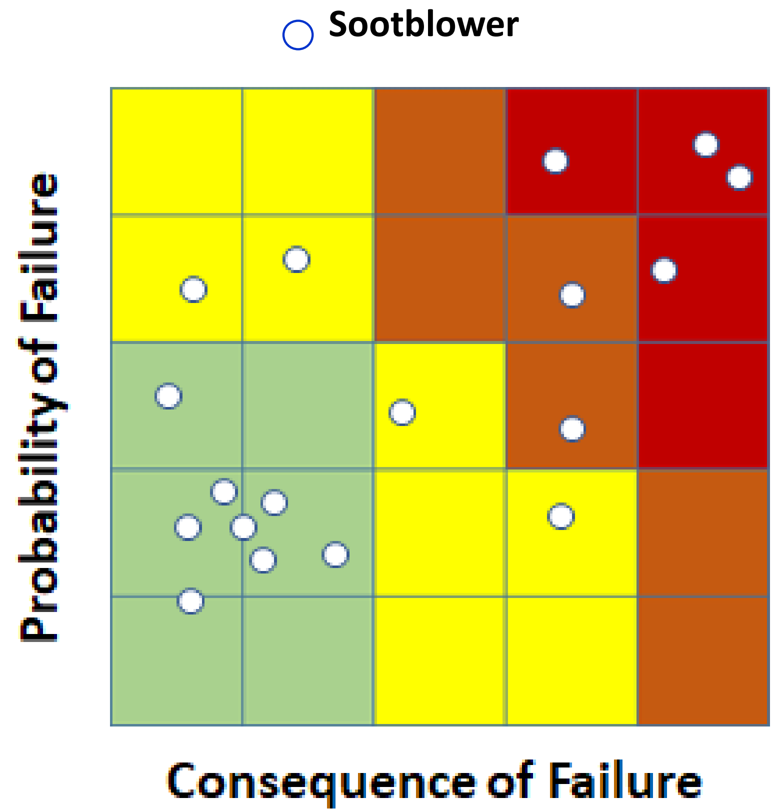
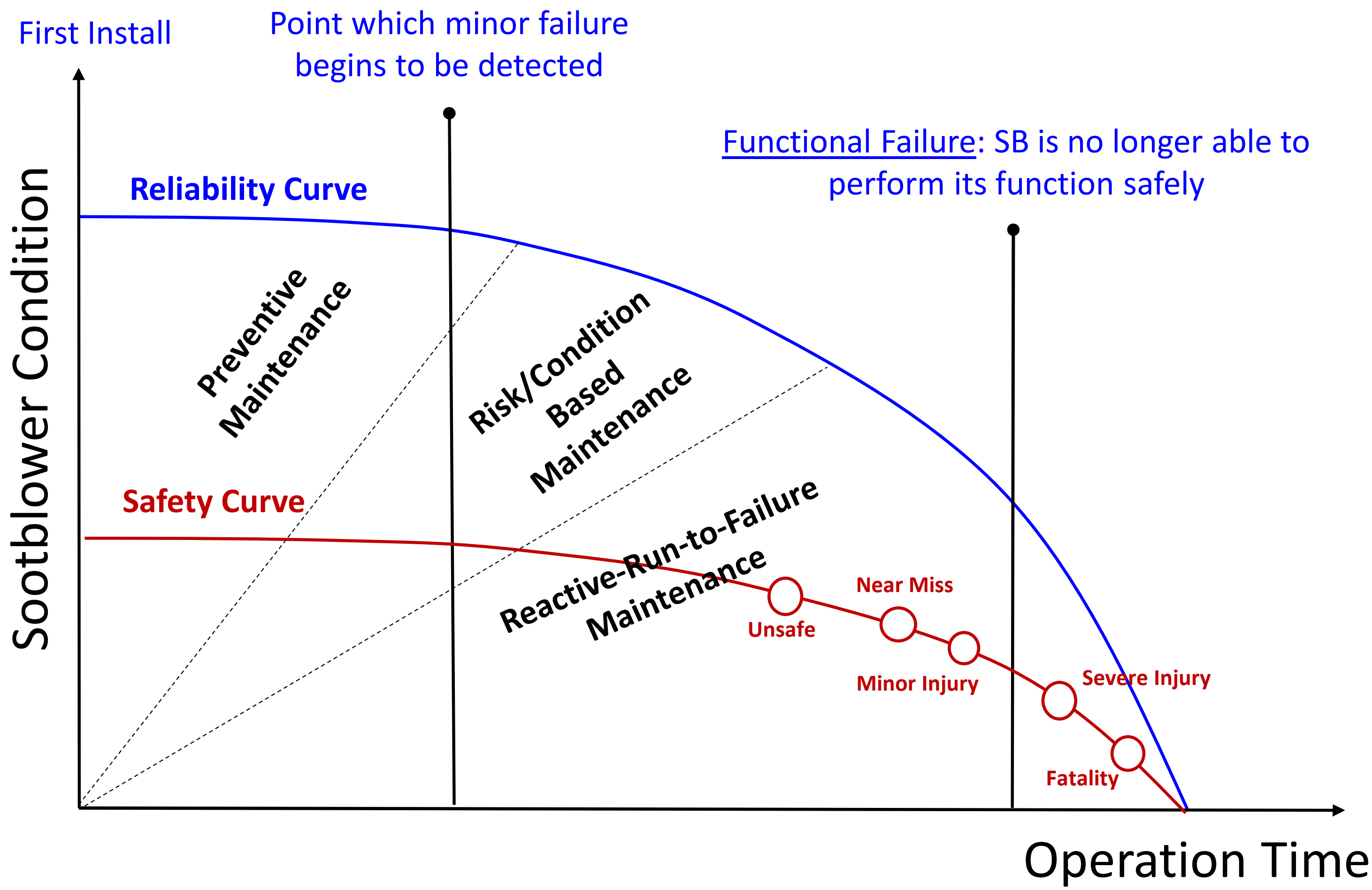
Risk & Condition Based Inspection (RBI)

- RBI assesses the probability of failure (PoF) and the consequence of failure (CoF) associated with each sootblower

- The key success factor to maintain a large quantity of sootblowers under limited maintenance resources is **<u>to know your risk and maintenance priority</u>**!

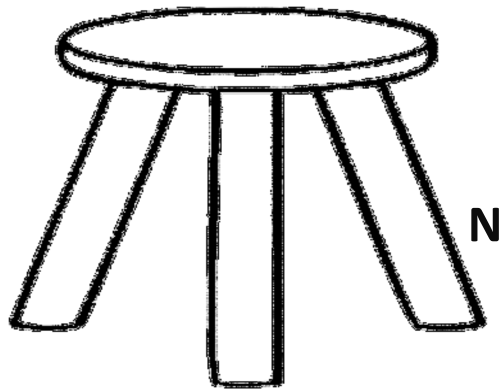


Equipment Reliability



RBI – Three-Legged Stool

Risk-Based Inspection



Walkdown (Visual Inspection)

Non-Destructive Examination (NDE) of tubes

Real-time Monitoring (Sensors)

1. Cycle count & time
2. Motor Current
3. Steam Pressure
4. Steam Temperature
5. Vibration

Problem with traditional NDT Strategy

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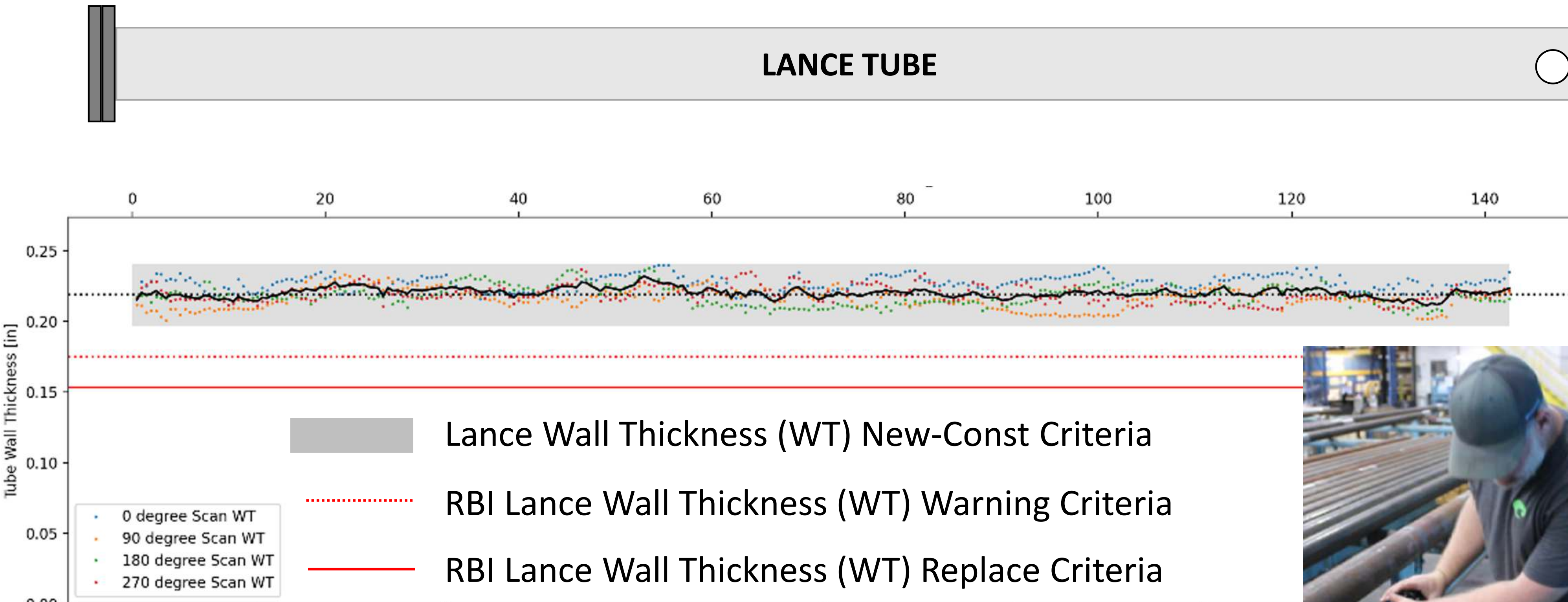
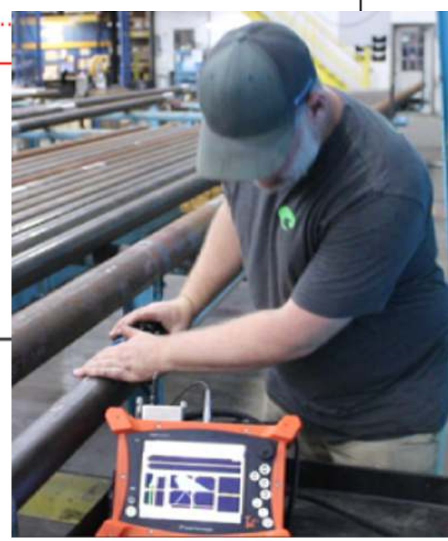
- Many pulp mills choose to pass the responsibility for the scope of lance & feed tube inspection to their NDE contractor
  - Few contractors understand bending stress calculation-based inspection
- Inspection data is evaluated against requirements of codes for new construction (e.g., ASME), and NOT post-construction codes for operating equipment
  - This often leads to inappropriate and expensive repair/replace decisions

NEW-Construction Code Vs POST-Construction Code

- Inspection scope driven by grid- and time-based approach, rather than one based on risk evaluation
  - Costly, time-consuming, and unnecessary yearly NDE inspection for **ALL** tubes

New-Construction vs Post-Construction Criteria





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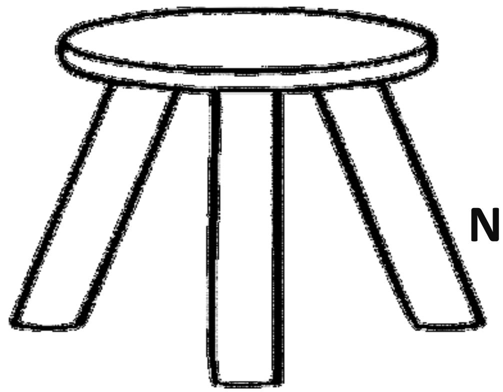

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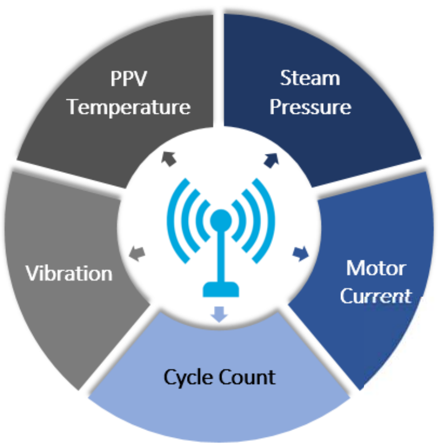
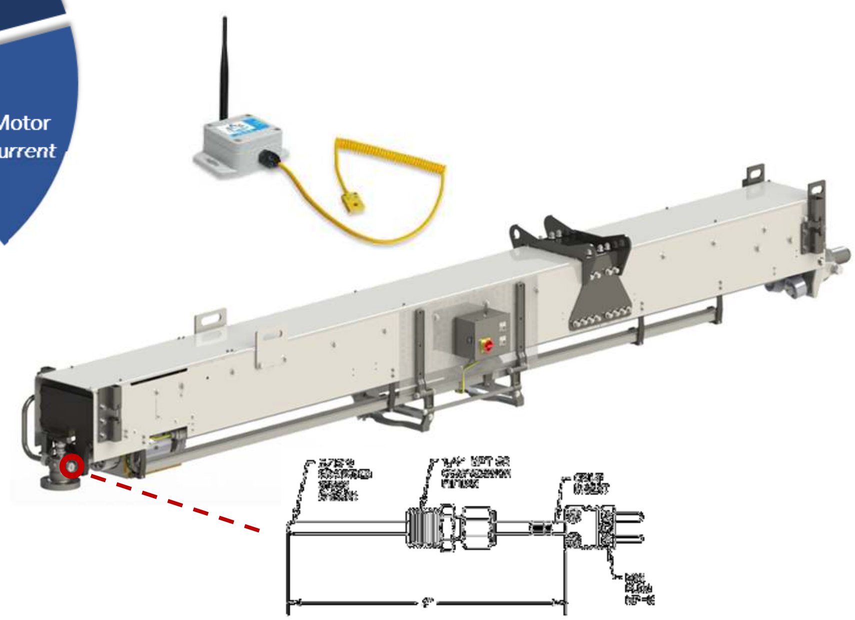
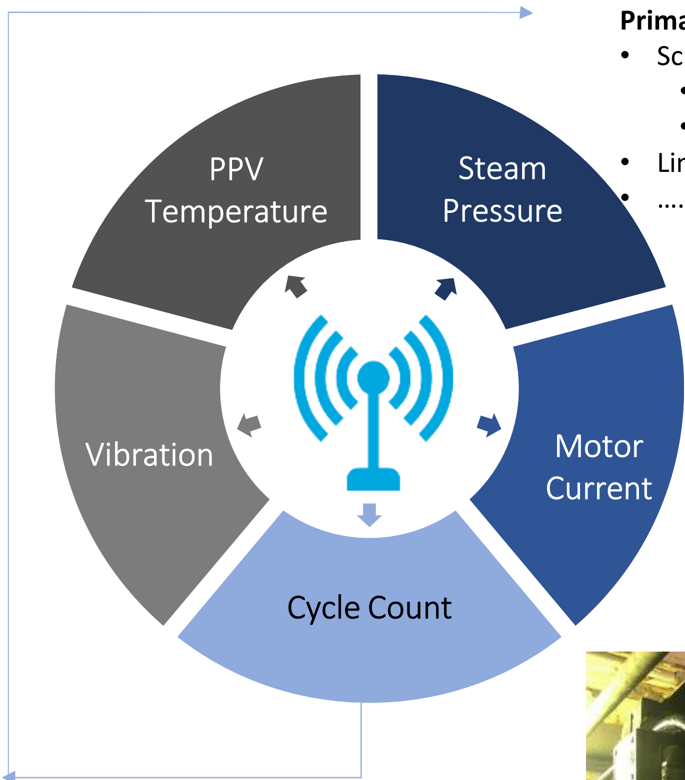
Multipoint Sensors

What we deliver : Wireless Multipoint sensors to detect problem that cannot be visually observed
Result : Early problem detection and prevent costly repair



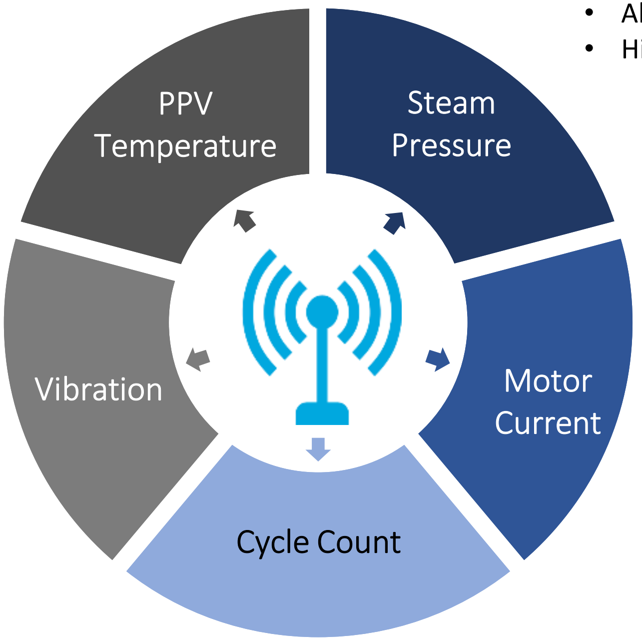


CI Sensors

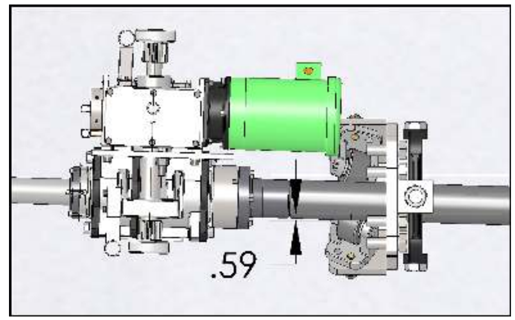


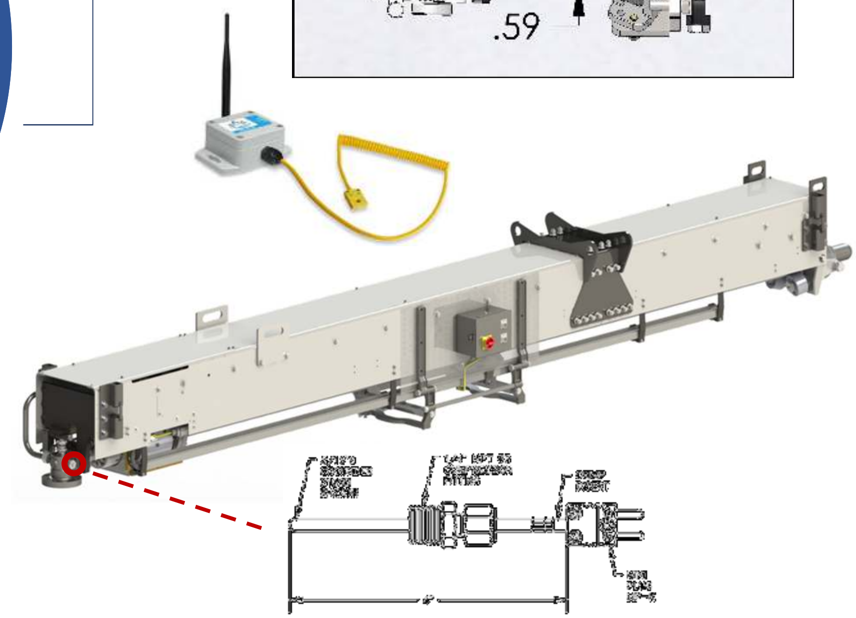
Primary Detection
- Scheduled basic maintenance
  - Lubrication
  - Feed tube rotation
- Limit switch malfunction
- ……

CI Sensors



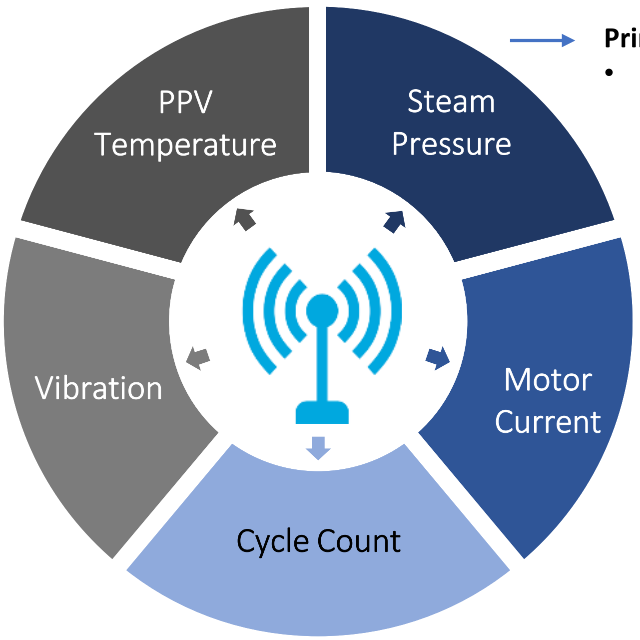
Primary Detection
- Abnormal Stress
- Hindrance
  - Plugged wallbox
  - ….



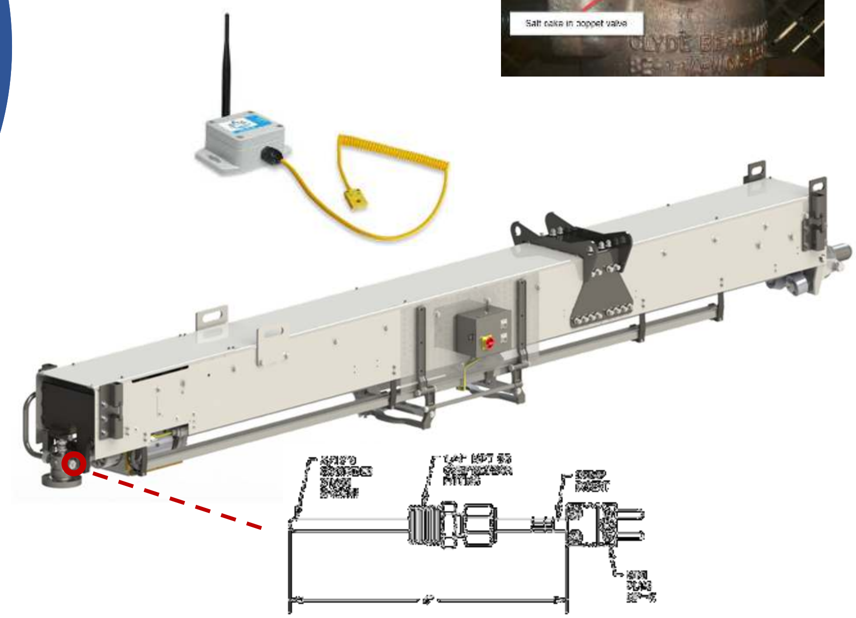


- Normal Loading is Max 83MPa (12ksi)
- Misalignment 15 mm, the stress went up to **634 Mpa** (**92 ksi) stress** near flange weld

CI Sensors



Primary Detection
- Steam flow anomaly
  - Insufficient cooling / cleaning
  - Nozzle tip blown off
  - Poppet valve plugging
  - …



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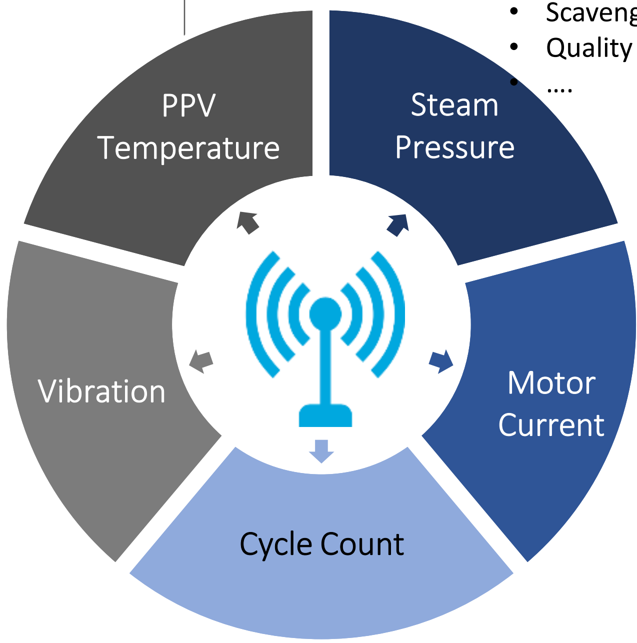
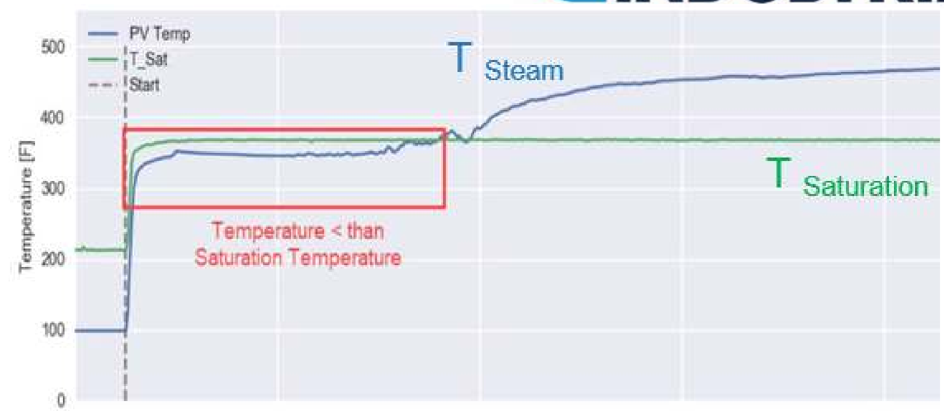
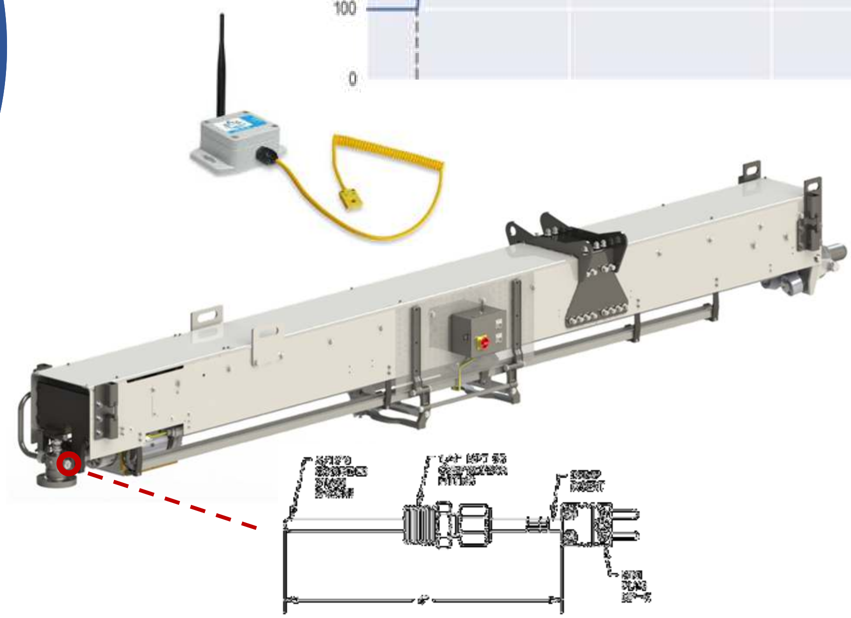


Primary Detection
- Poppet valve leak
- Scavenging air malfunction
- Quality of steam
- ....





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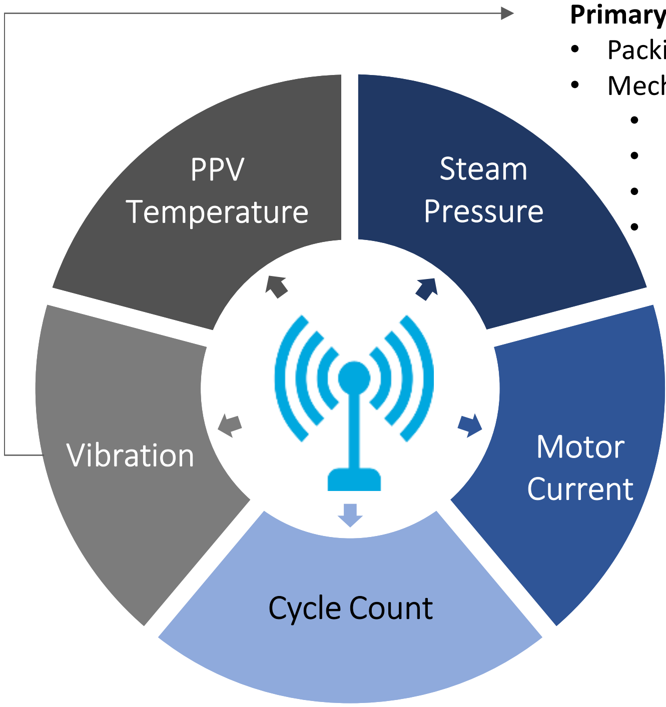
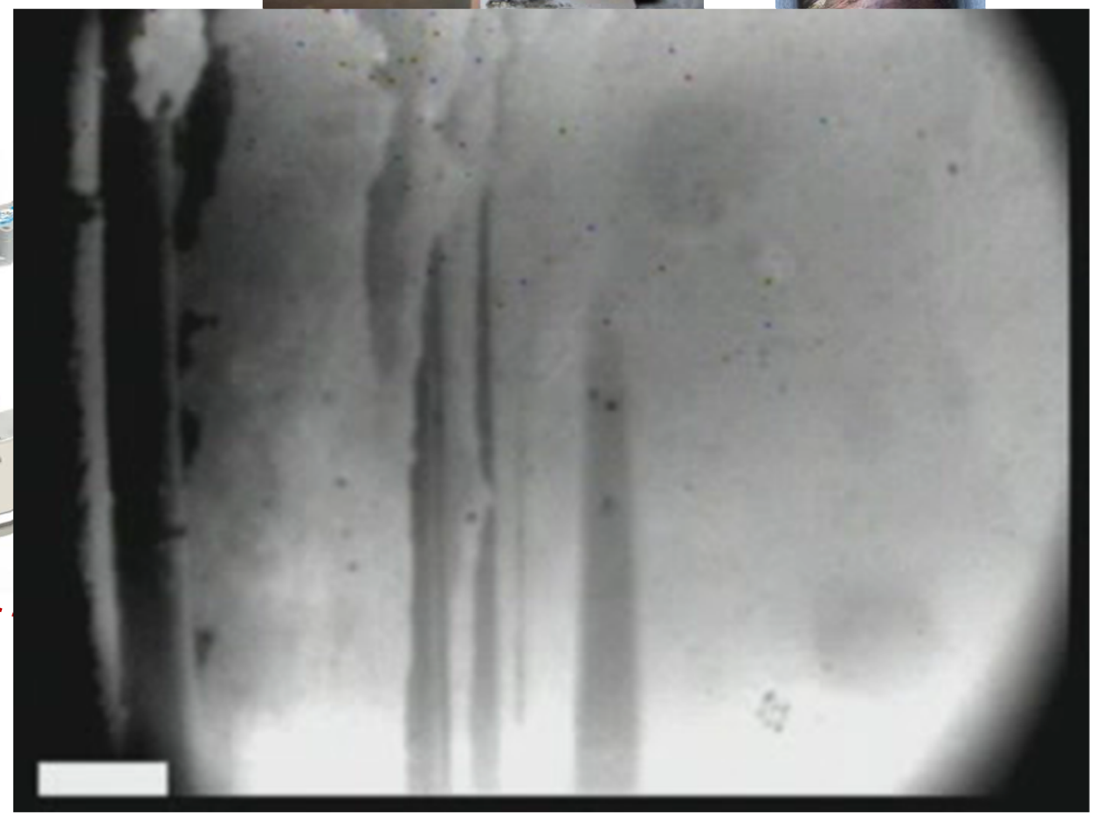


Primary Detection
- Packing leak
- Mechanical issues
  - Misalignment
  - Bent lance tube
  - Scored feed tubes
  - .....



RBI – Three-Legged Stool

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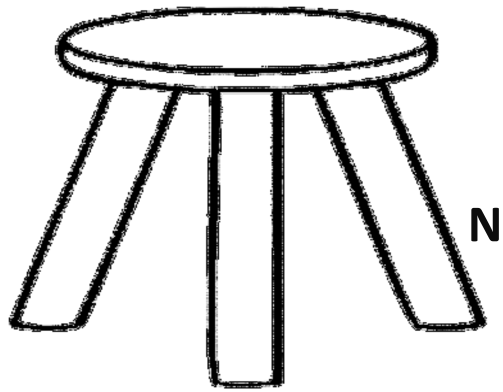
Risk-Based Inspection



Walkdown
(Visual Inspection)

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(Multi-Point Sensor)

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Walkdown – Systematic Visual Inspection

Key success factor: Know what and where to look during the walkdown

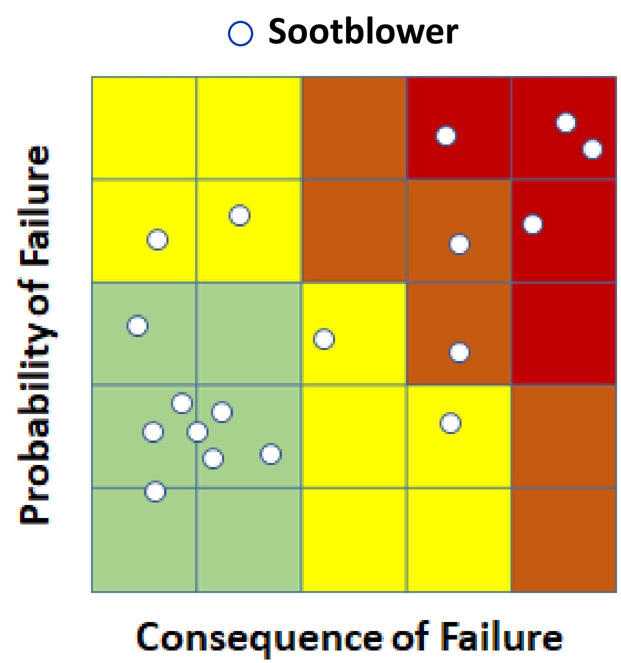
- As part of the FTO program, an experienced Clyde Industries inspector will visit the mill twice a year for the visual inspection
- Mill's new maintenance team is encouraged to shadow our experienced inspector and use it as a training opportunity.

- Indicates that the ***limit switch*** is malfunction or is not set properly, causing the ***gearbox*** to hit the front backstop
- ***Limit switch*** is about $100, but if this issue is not corrected, you will a gearbox with a much shorter service life.

Three Key Takeaways

1. It is costly to overclean *(tube failures/wasting steam)* and underclean *(heavy fouling / pluggin)* – **Intelligent Sootblowing with targeted cleaning** prevents both overcleaning & undercleaning.

2. The key success factor to maintain a large quantity of sootblowers under limited maintenance resources is ***to know your risk and maintenance priority***!



3. FTO Program uses ***Risk & Condition Based Maintenance*** to reduce operating costs, downtime, and failure

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