REINHOLD ENVIRONMENTAL Ltd.

2013 APC Round Table & Expo Presentation

July 8-9, 2013, in St. Louis, MO / Hosted by Ameren

Mist Eliminators: O&M

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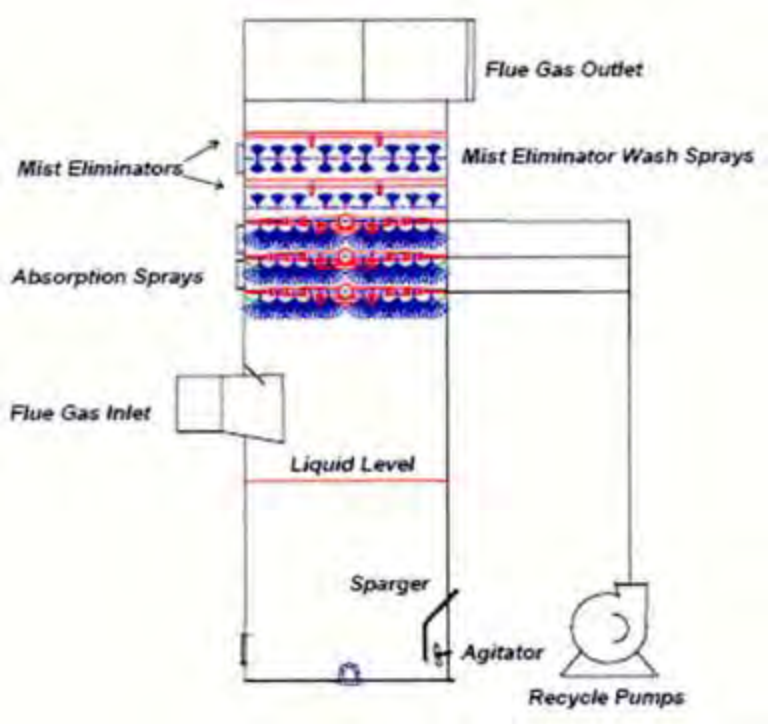
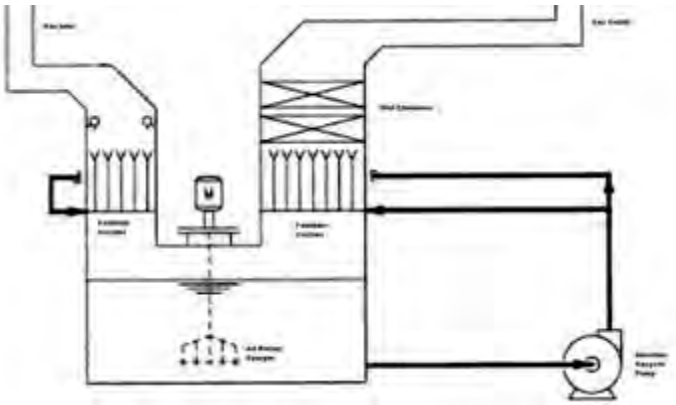
Senior Consultant
RE Consulting

If you have a question during this presentation, raise your hand and we will discuss it rather than waiting until the end of the presentation

Background - Location





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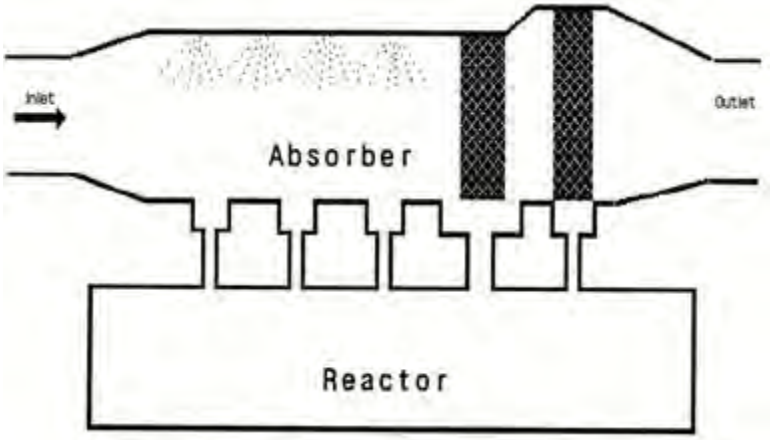

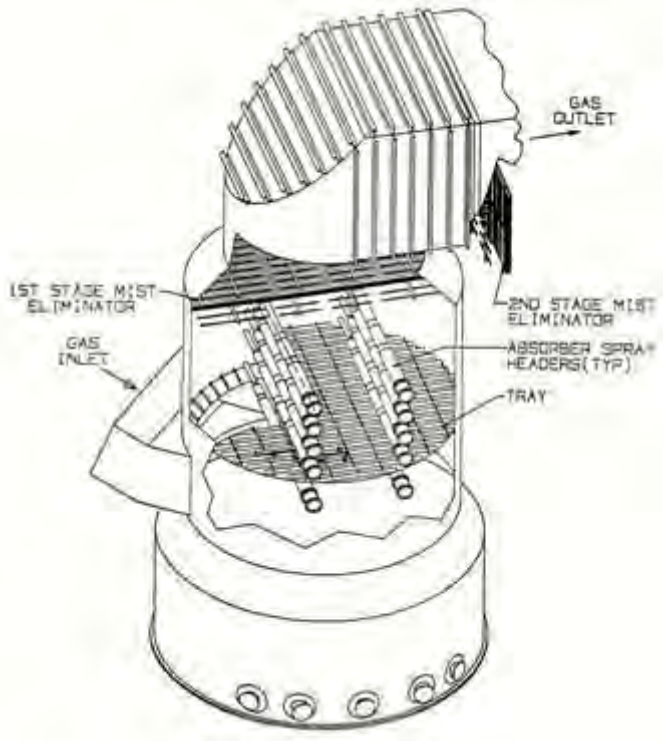

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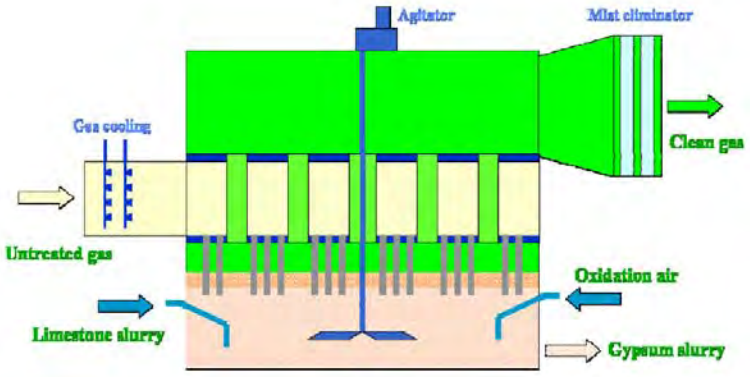
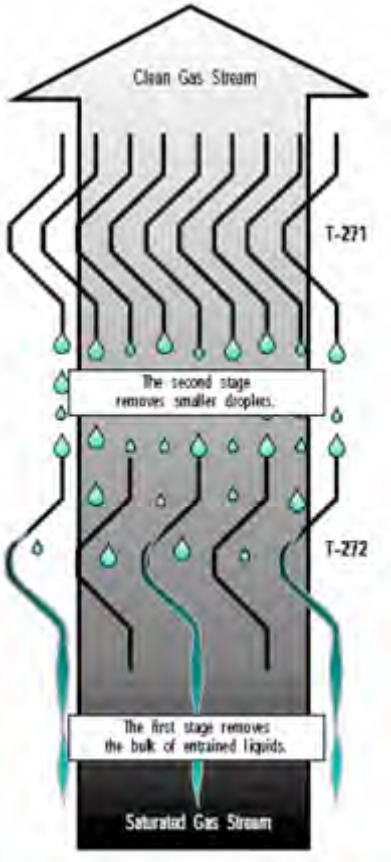
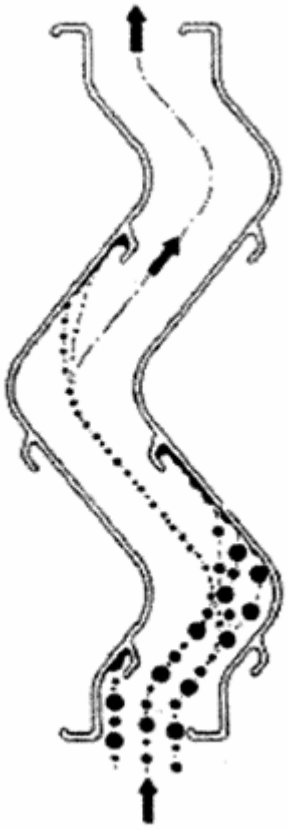


Background - Layout



Background – Theory of Operation



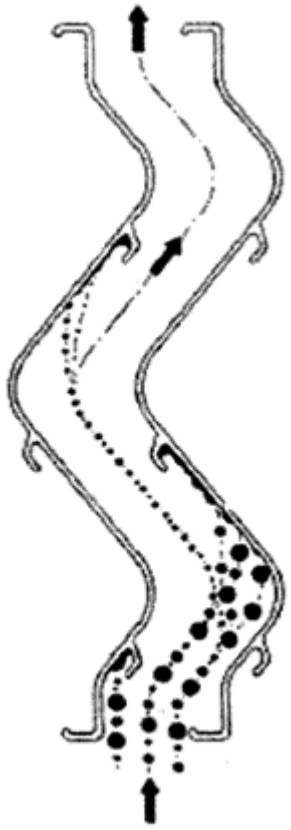
Background – Theory of Operation

Vertical Gas Flow

The liquid draining on the blade surface is moving countercurrent to the gas flow and will be re-entrained if the gas velocity is too high.

Gas velocity is limited to

10 – 13 FPS



Horizontal Gas Flow

The liquid draining on the blade surface is moving at a 90 degree angle in relation to the gas flow, so it is not as likely to be re-entrained by a high gas velocity.

Gas velocity as high as

25 FPS

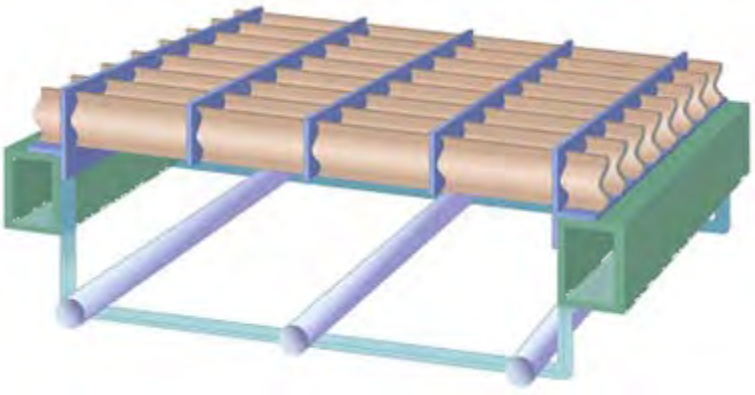
Background – Theory of Operation

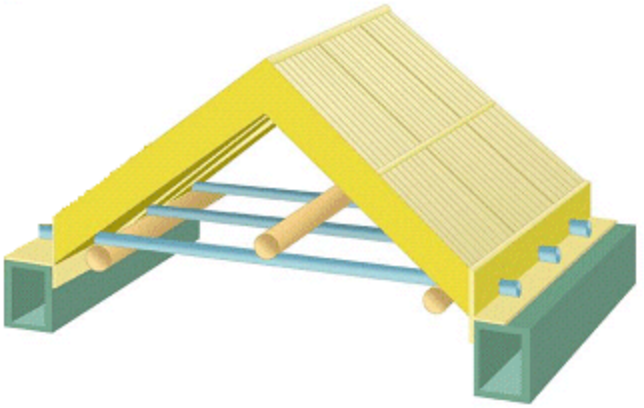
Three Pass Mist Eliminator

Two Pass Mist Eliminator

Vertical Flow Two Pass Blades

Background - Variations





Achilles' Heel??

- With the current design of a large single FGD tower with no bypass, I feel that the mist eliminators may pose one of the biggest risks for a forced outage of the unit.

The Problem – Physical Failure

- There have been instances where mist eliminator panels have fallen out. There are two categories that these failures fall into:
  - Failure caused by high temperature
  - Failure caused by mechanical design

The Problem – Physical Failure

- If there is a cause of higher than normal gas temperature (air heater failure, slurry recycle pumps trip, etc.), non metallic mist eliminator materials may reach their softening point and the panels melt, sag, and fall out.

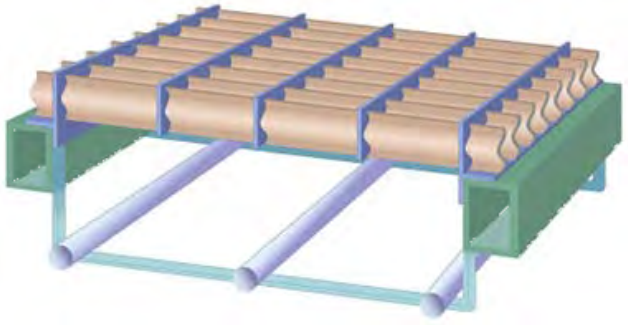
The Problem – Physical Failure

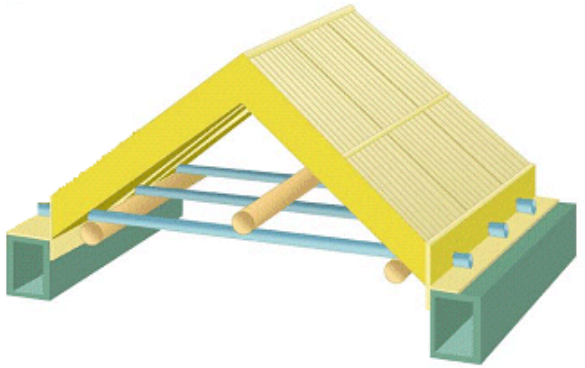
- What will overheating damage look like?
  - It will depend on the material
    - Metal
    - FRP
    - Thermoplastics

Scale Formation Leads To Mechanical Failure

The Problem – Physical Failure

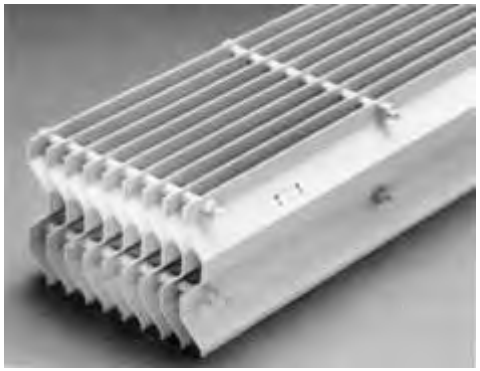
- If the panels are not properly secured to the support beams, they can shift or the ends break and they fall out.





The Problem – Physical Failure

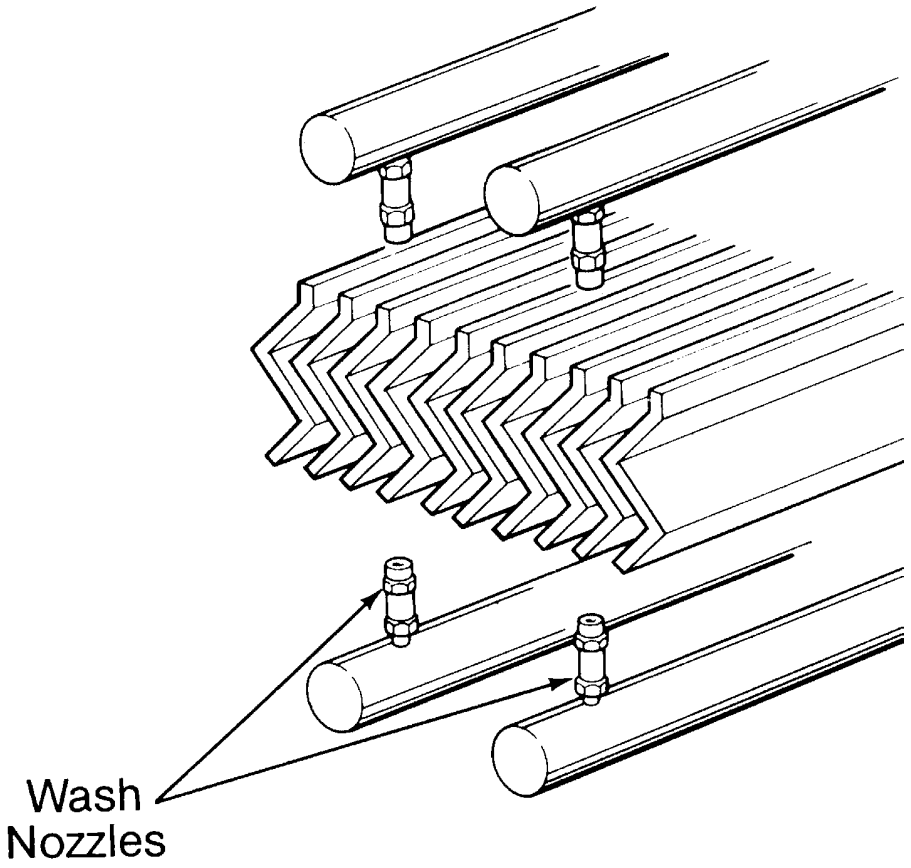
The method of attaching the blades to each other to form the panels is critical. If the attachments are not strong enough or spaced too far apart, the blades will vibrate and flutter. This can cause the blades to crack and the panel can fall apart.



The Problem – Scale Formation

The Solution

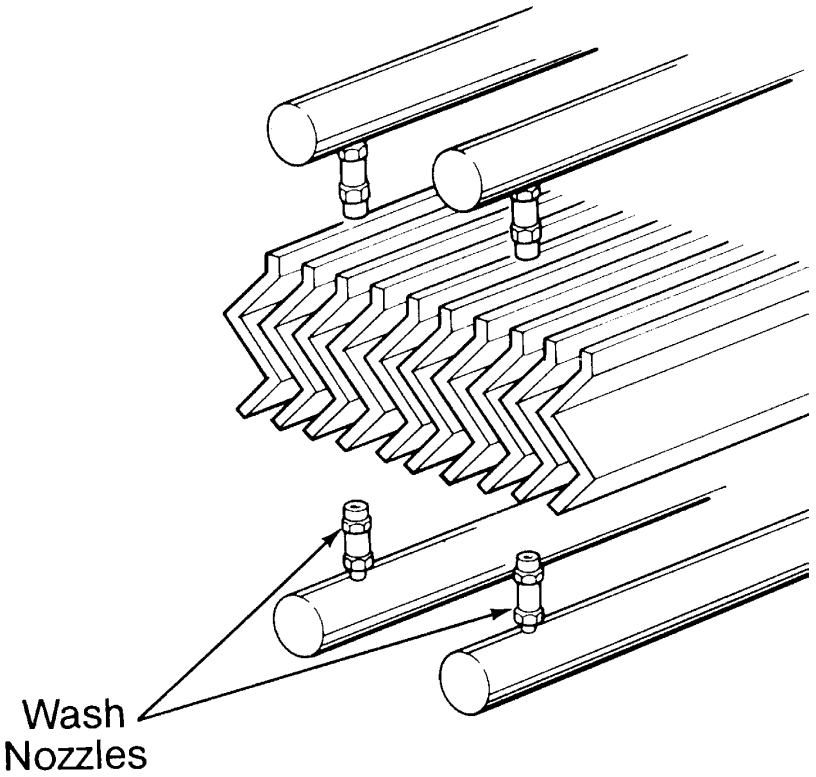
- All FGD vendors supply a mist eliminator wash system as part of their design.



The Only Effective Mist Eliminator Wash System

What You Really Have

- A “keep the blades wet and the liquid collecting on them diluted below calcium saturation so scale doesn’t form” system.



What That Really Means

- You must constantly be in a proactive mode of keeping scale from forming on the blades rather than being in a reactive mode of trying to wash it off after it forms because you can't wash all of it off with the system you have.

What That Means

- The wash water needs to be as fresh (unsaturated with calcium) as possible.
- Each blade needs to be washed as often as possible.
- An “in-situ forced oxidized” tower has less problems.
- Adding a scale inhibitor to the wash water may need to be considered.

ME Wash Water

- Use as much “service water” or other fresh water as the water balance will allow.
- Add “process water” only as needed to maintain the level in the ME Wash Water Tank.

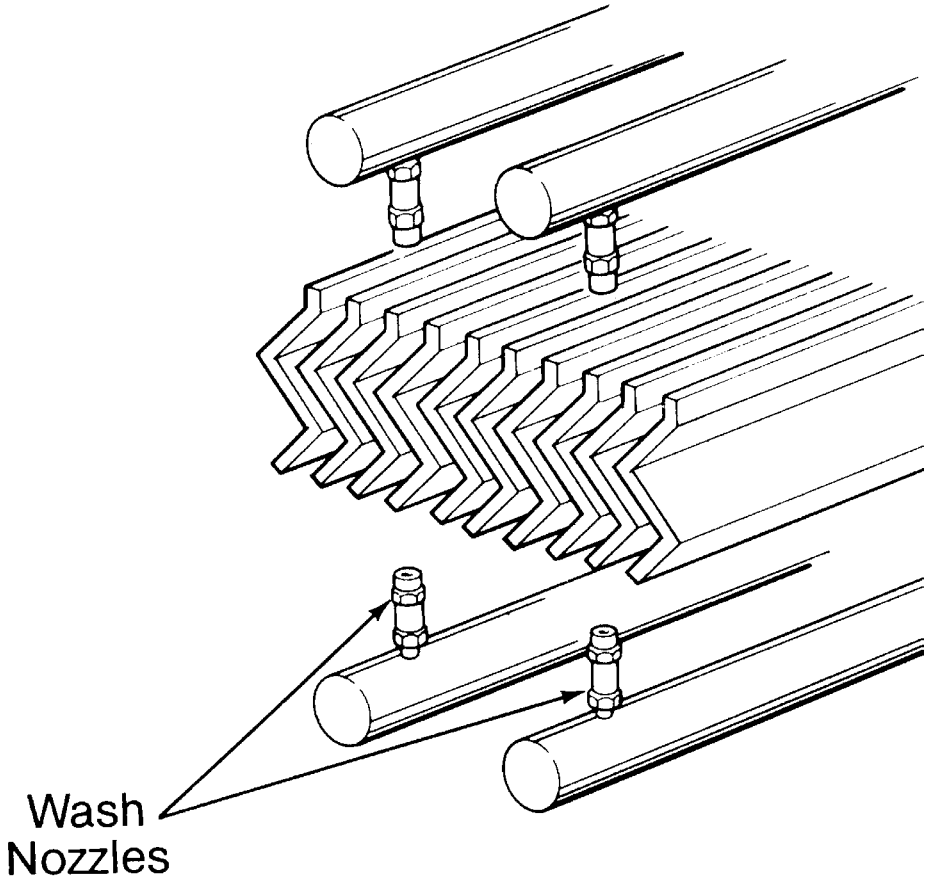
Wash Cycles

- Most designs only wash one portion of one side of a mist eliminator at a time.
- If possible, always be washing something.

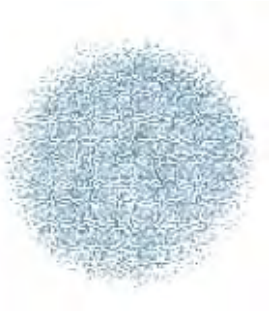
Wash Cycles

- If the water balance will only allow you to wash each section for 8 minutes every hour:
  - **It is better to wash for 1 minute every 8 minutes**
  - **Than to wash for 2 minutes every 15 minutes**
  - **Than to wash for 4 minutes every 30 minutes**
  - **Than to wash for 8 minutes every 60 minutes**

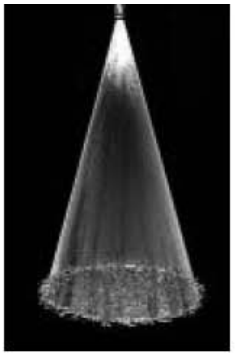
Wash Nozzle Considerations



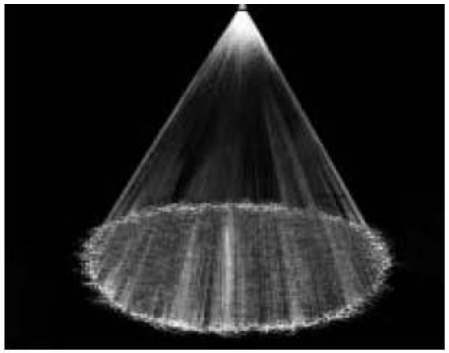
Wash Nozzle Pattern



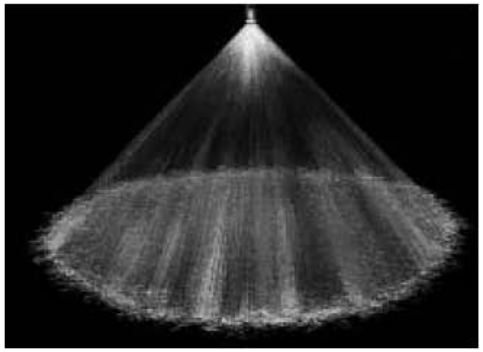
Spray Pattern Angle



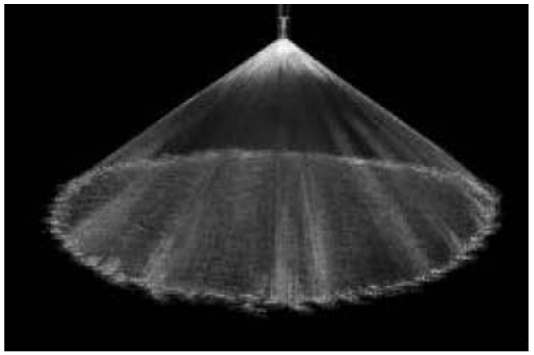
Full Cone 30° (NN)



Full Cone 60° (N)



Full Cone 90° (M)



Full Cone 120° (W)

APS Side by Side Comparison

Figure 2. Test Installation at APS's Cholla Station, Unit 2: Materials (left to right) Polysulfone, FRP, Stainless Steel, Polypropylene

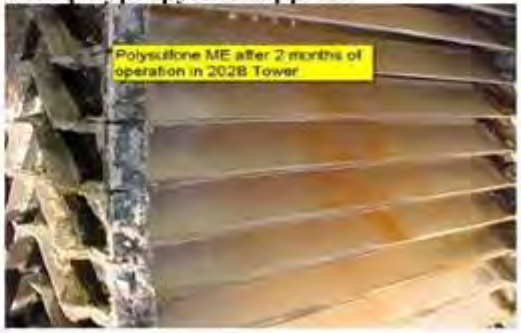
APS Side by Side Comparison

Figure 3. Polypropylene mist eliminator

Figure 5. Stainless steel mist eliminator

Figure 4. FRP mist eliminator from

Figure 6. Polysulfone mist eliminator with polypropylene supports



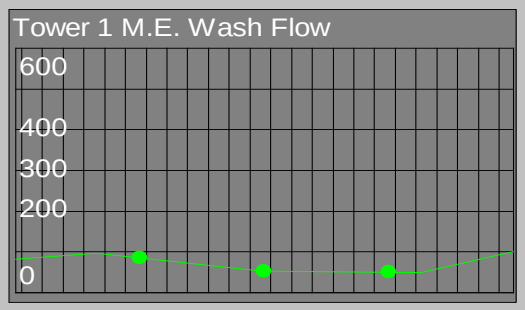
What Should I Look At During An Outage To Determine If I Need To Replace Components During The Next Outage

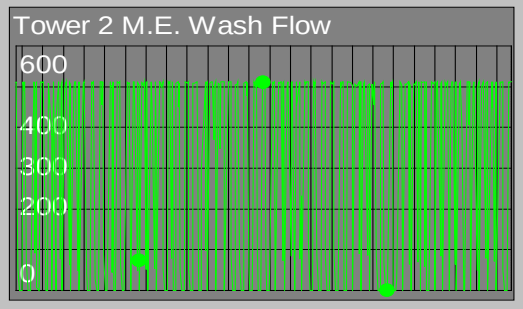
- Metal
- FRP
- Thermoplastics

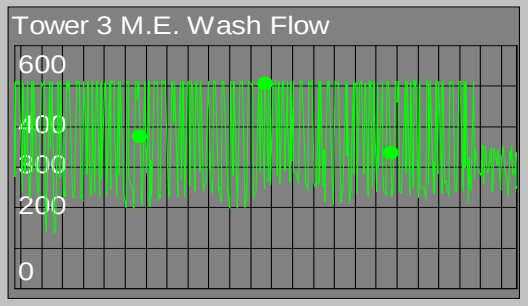
Using DCS System Data to Troubleshoot ME Wash System Problems

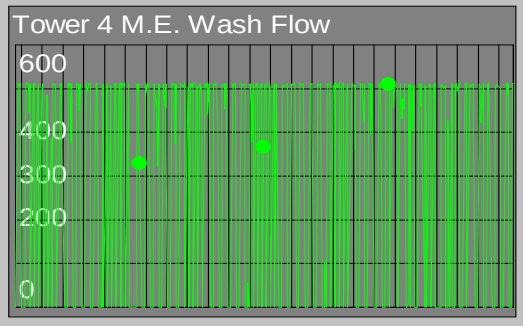
Quadrant Valves Not Opening

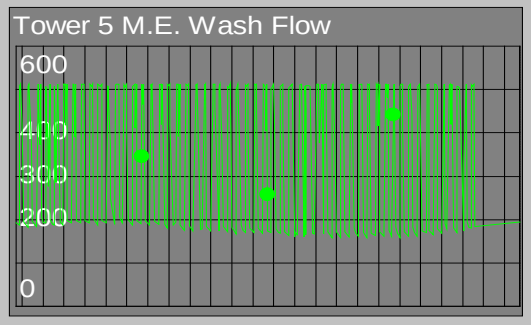
Leaking ME Wash Valves?

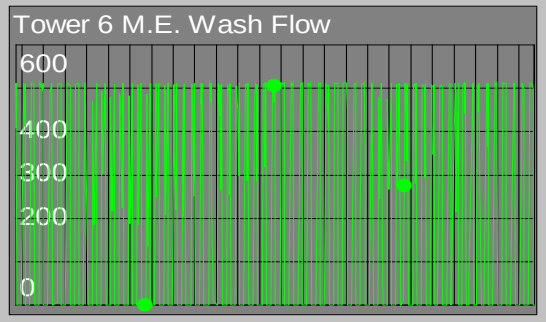




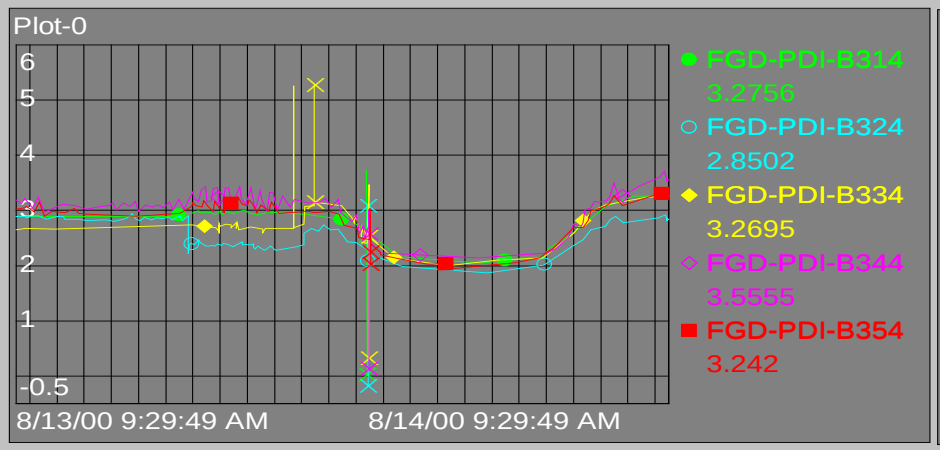


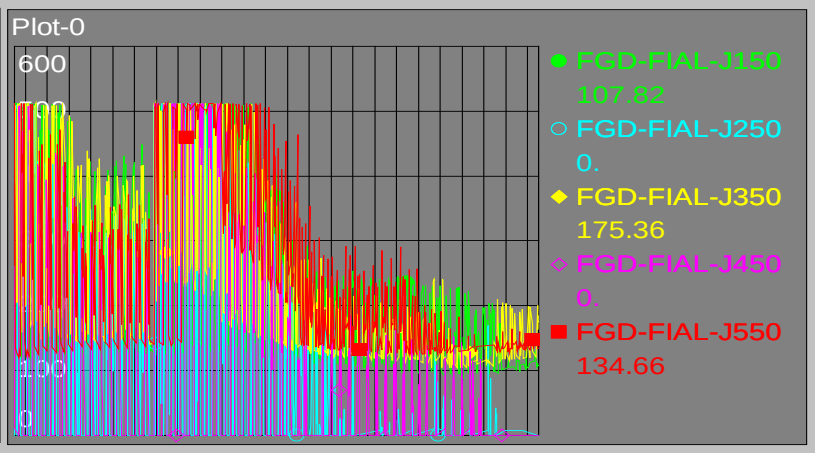




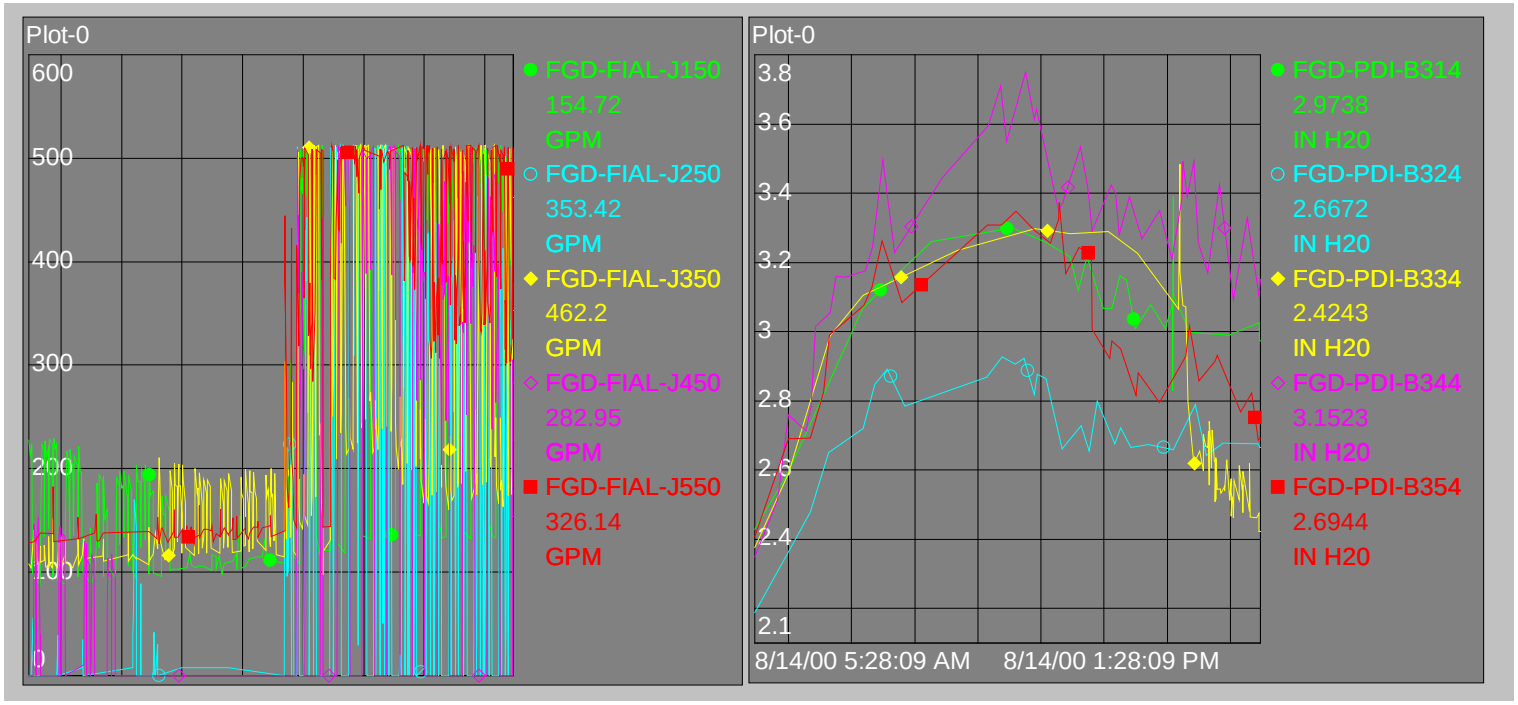


Asiatic Clams Plugging ME Wash Pump Suction Strainer – Part 1

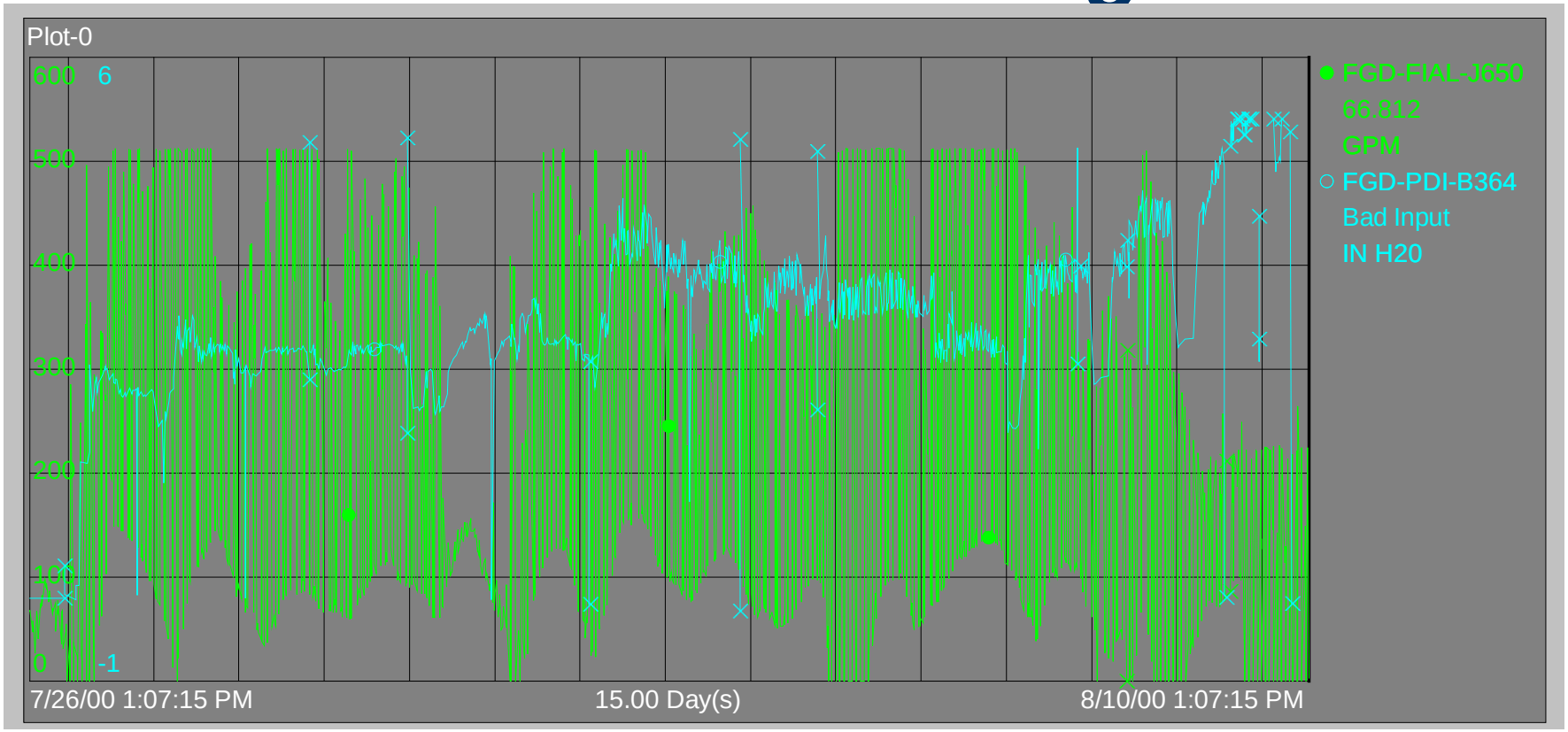




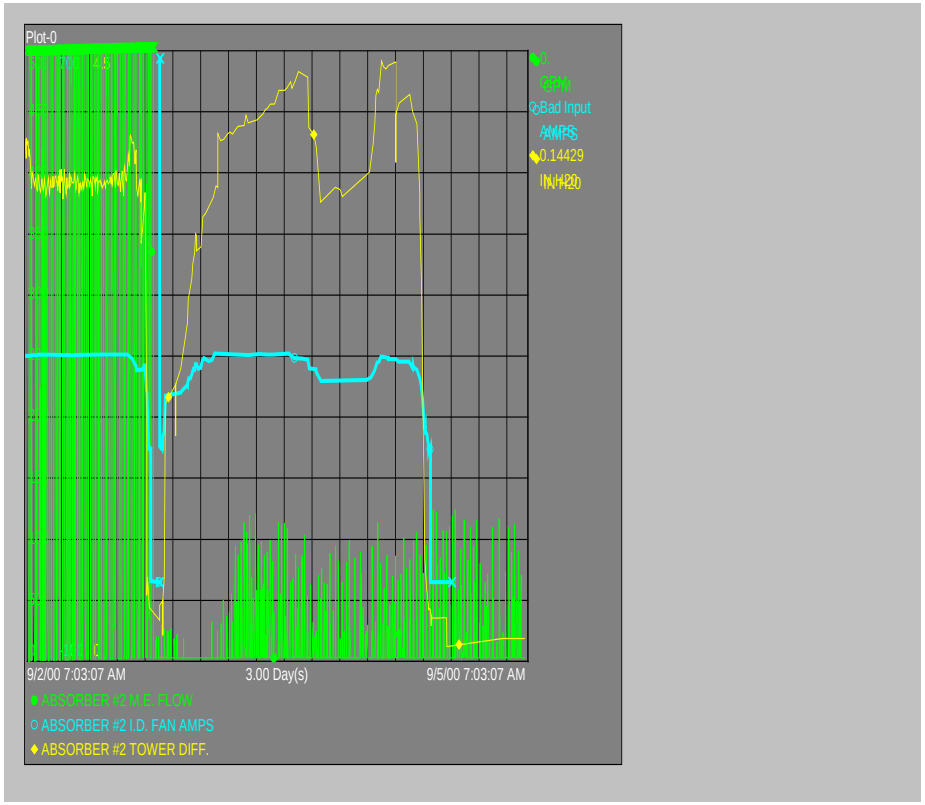
Asiatic Clams Plugging ME Wash Pump Suction Strainer – Part 2



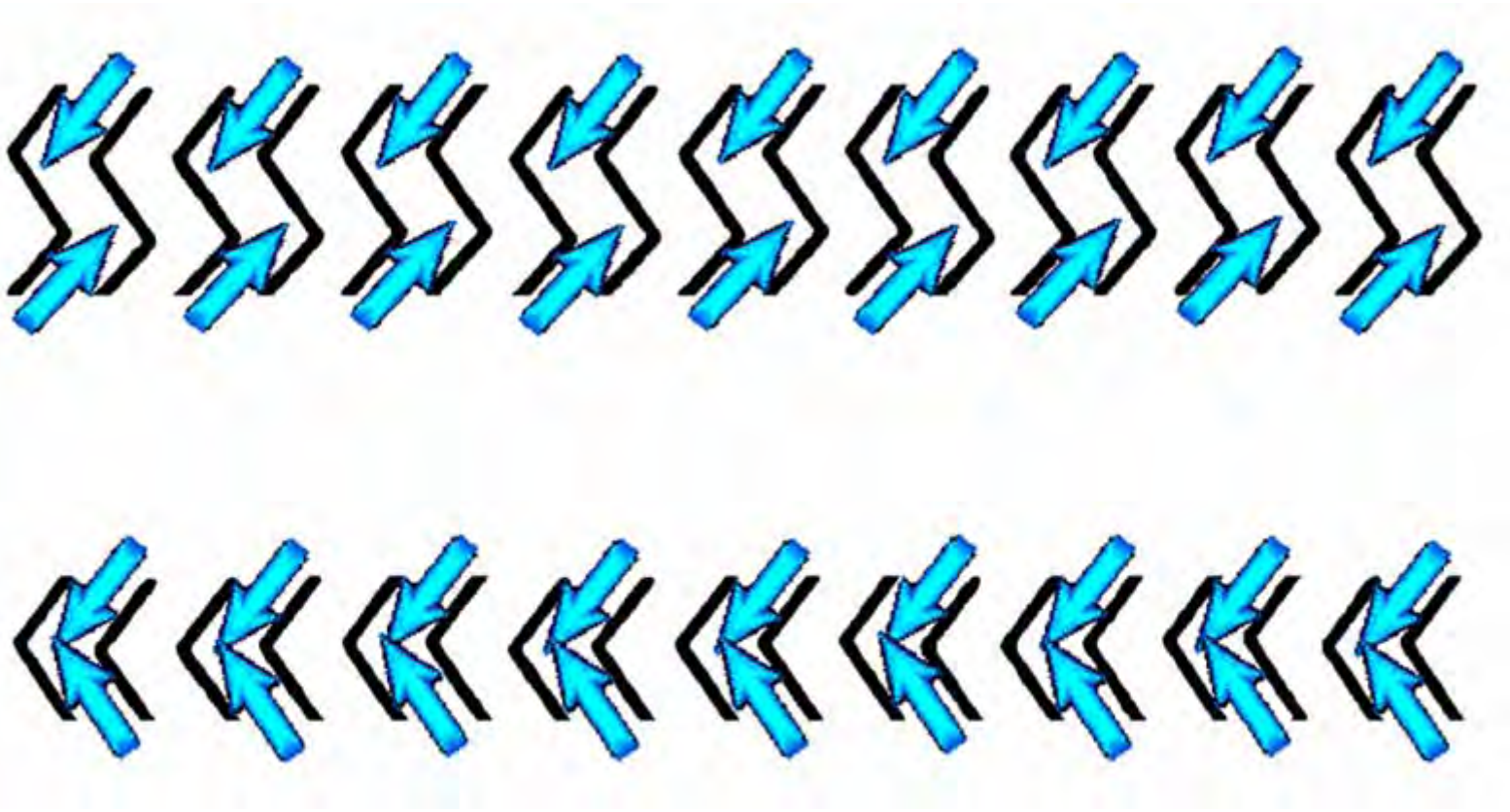
ME Plugged 15 Days After Previous Cleaning



Wash Failure Resulting In Tower Forced Outage



Cleaning Effectiveness



Preventing Damage During High Pressure Washing

- Don’t use any more nozzle pressure than necessary to remove the deposit.
- A fan pattern nozzle does less cutting of the blade than a straight pattern nozzle.
- Keep the nozzle several inches from the blade.
- Keep the nozzle as parallel as possible with the blades.

I hope that something you saw here today will allow you to experience less problems with your mist eliminators.