Wet ESP Water Treatment

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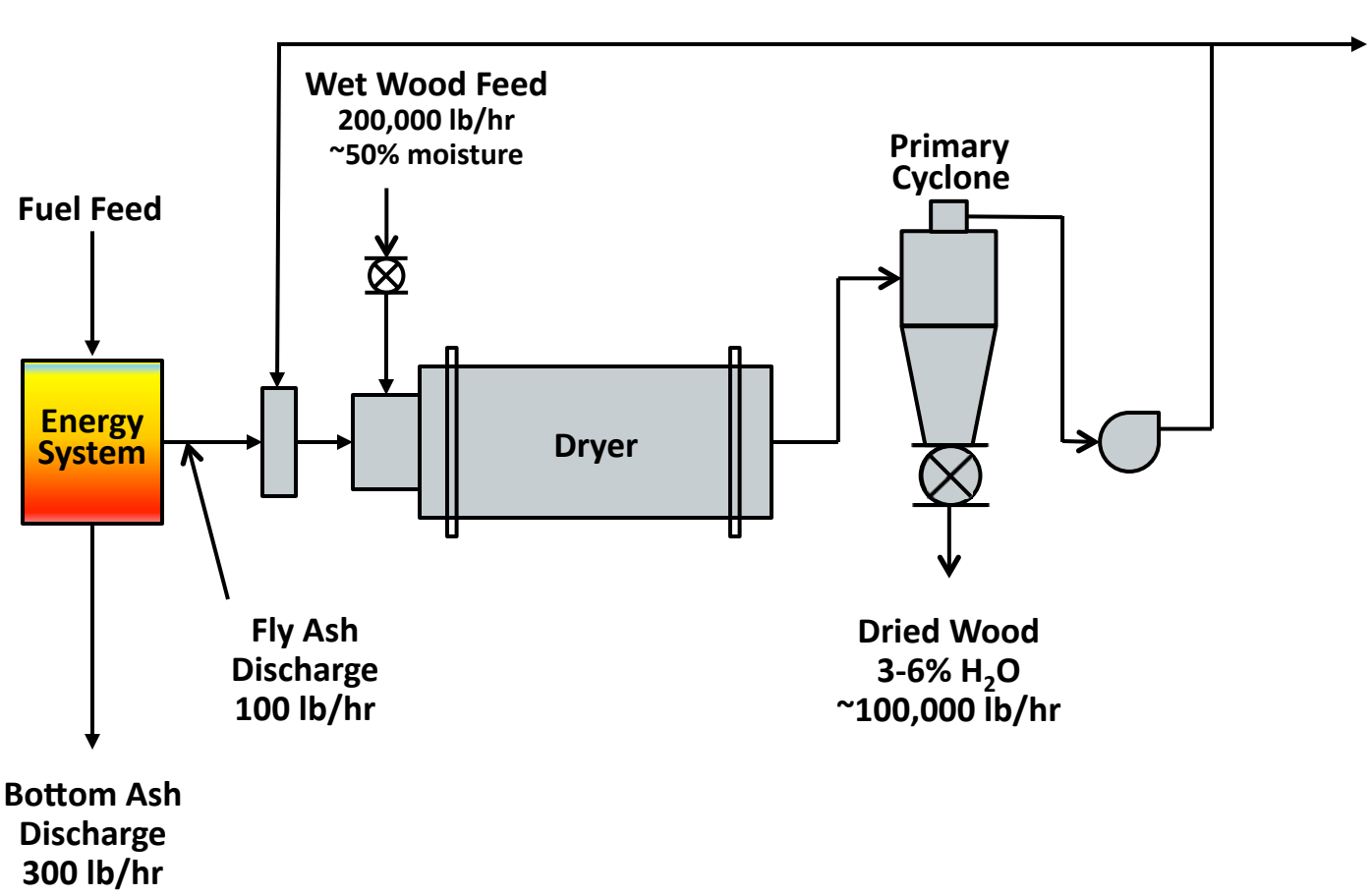
Effects of good water treatment

Trump

Wood Dryer

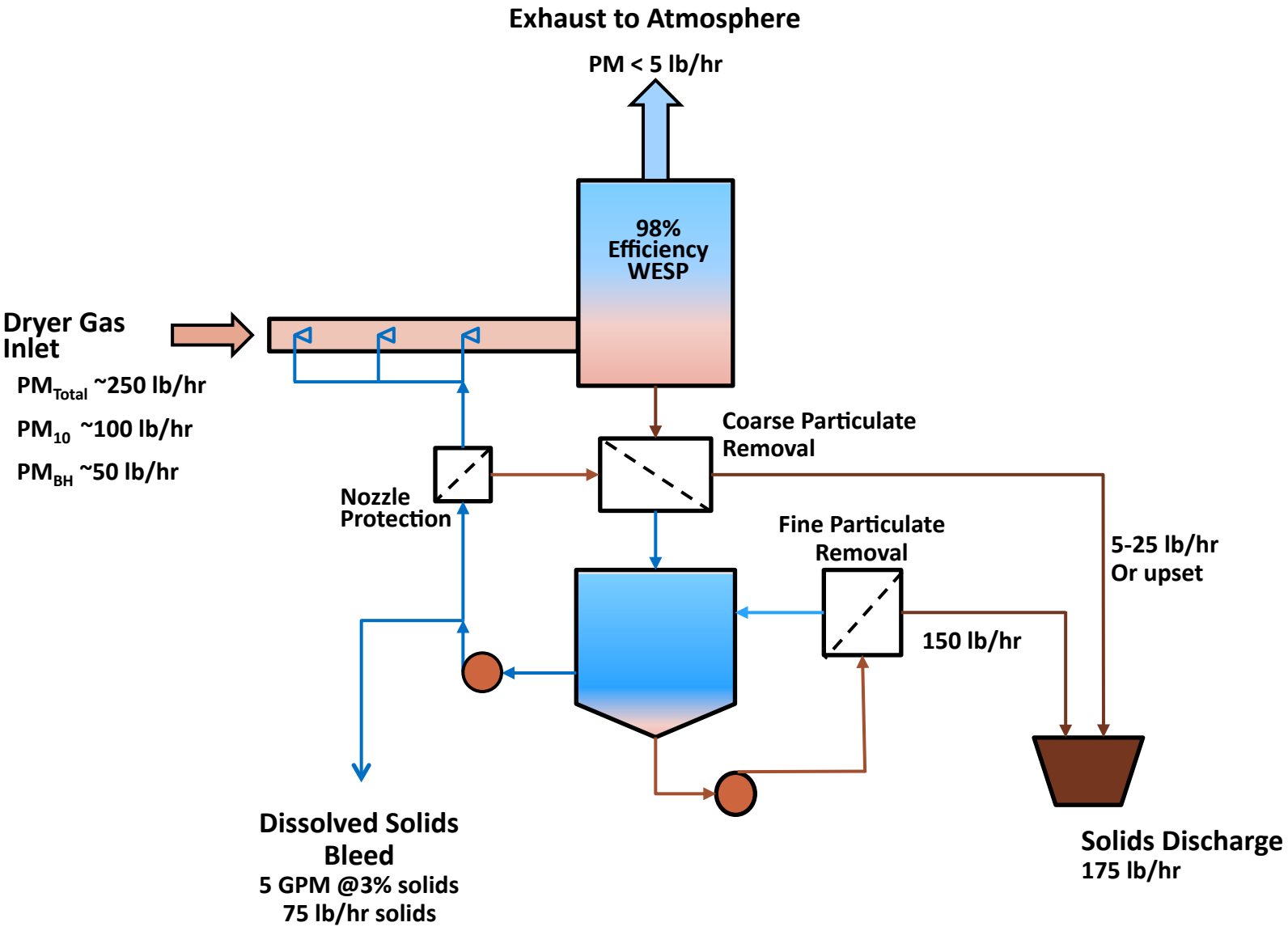


To Emissions Control System

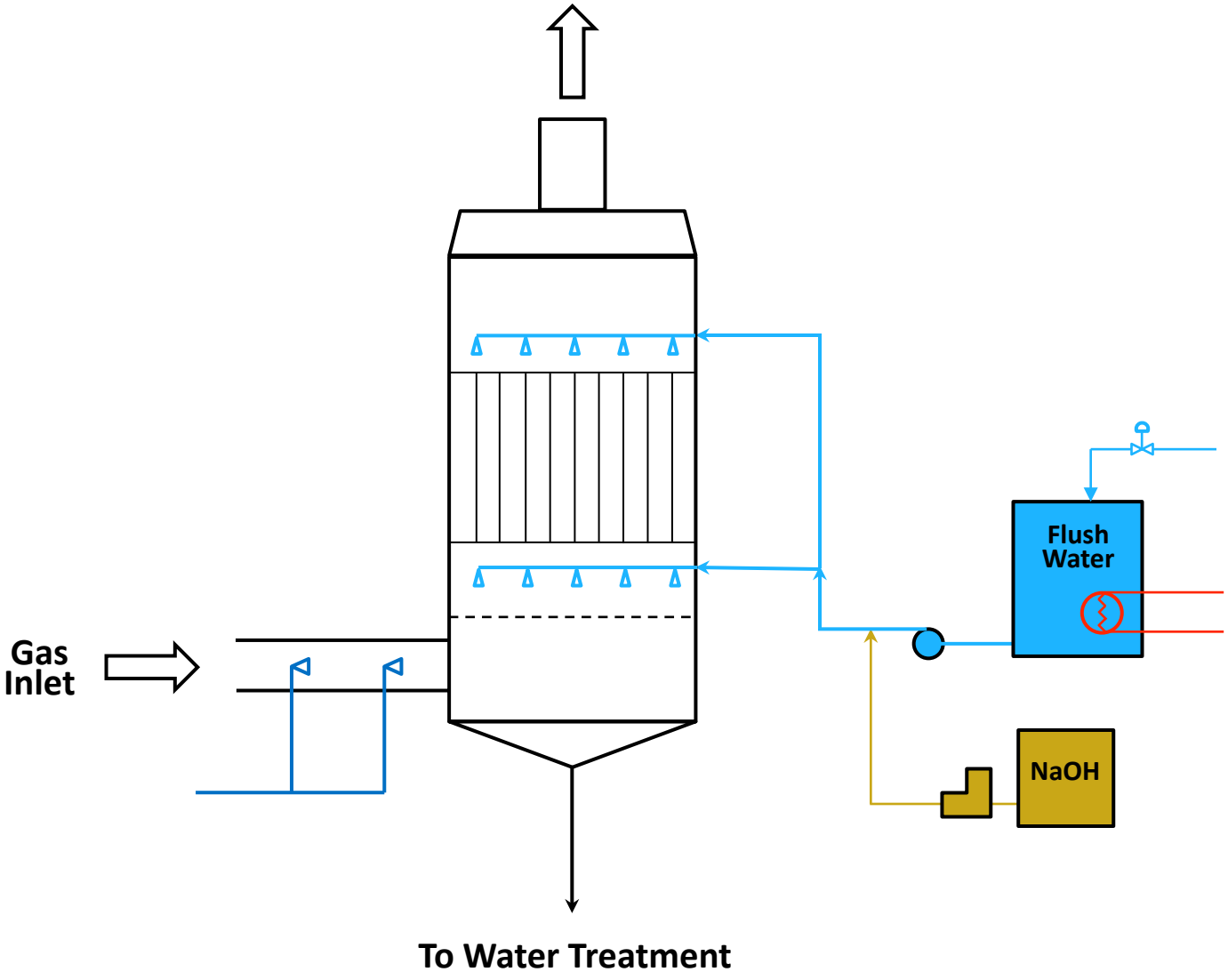
~ 250 lb/hr PM_{Total}
~ 100 lb/hr PM_{10}
~ 50 lb/hr PM_{BH}

Consisting of
- **Wood ash**
- **Dryer fines**
- **Condensables**
- **Tars & Resins**
- **VOC**

Wet ESP Water Treatment



Wet ESP Flushing



Effects of No Suspended Solids Removal Device (Centrifuge Off and Blowdown On)

Time (Hours)	TSS (% by wt)	Notes
0	2.0	• Normal operating TSS with working centrifuge • Solids removal device goes down
2	2.5	• Slightly elevated solids due to solids removal device offline
6	3.5	• Increased dropout of solids in low velocity areas of piping, vessels and ducts
12	4.7	• Plugging of instruments increasingly likely
16	5.3	• Blowdown nozzle(s) with fine orifices may start to plug, compounding solids buildup in system
24	6.4	• Larger agglomerated pieces may be present due to dislodged sediment plugging basket strainers and nozzles
60	8.7	• Less quench water as lines, nozzles and strainers plug leading to unsaturated exhaust feed to wet ESP • Further dries particulate on surfaces making it harder to wash off during flushing
168	9.8	• Extended running at high solids will erode pumps, cause mechanical seals leaks and further degrade efficiency of the wet ESP • Manual cleanouts become much more time consuming (days rather than hours). • Failures, alarms and system shutdown probable. • Suspended solids reaching equilibrium.

MEGTEC

Effects of No Blowdown on TDS (Centrifuge On and Blowdown Off)

Time (Hours)	TDS (% by wt)	Notes
0	2.0	Already elevated Total Solids (TS) at 3.5 – 4% by wt when target TS is 3% by wt
16	3.1	• Increasing tendency to foam
48	5.3	• Pump mechanical seals may start to leak due to salt deposits
120	9.9	• pH continues to rise as caustic builds up in the system. • More caustic allows more tars, pitches, and oils to become dissolved compounding the problems.
144	11.3	• Less soluble salts may precipitate out of solution and create deposits, cause erosion of rotating equipment, etc.
168	12.7	• No equilibrium attained • Dissolved solids continue to accumulate in the system. • At some point, certain salts will accumulate to concentrations which may begin to corrode or pit stainless steel.

Effects of Using Blowdown for Solids Removal (No Suspended Solids Removal, Just Blowdown)

Blowdown Flow (GPM)	TS (% by wt) at equilibrium	Notes
2	22.8	• Handling solids concentrations at or above this level involves considerable capital and operating costs • Economics are questionable
4	12.8	• Within normal blowdown rate range to manage TDS if centrifuge operating
6	8.9	• Within normal blowdown rate range to manage TDS if centrifuge operating
8	6.9	• Within normal blowdown rate range to manage TDS if centrifuge operating
18	3.2	• Minimum recommended blowdown for healthy wastewater system
20	2.9	• Double the normal system makeup water usage • (~20 gpm blowdown plus ~20 gpm evaporative losses)
25	2.3	• Further lowering of TS percentage may allow a more trouble-free operation at the cost of additional makeup water. • Consider condensing more water out of the saturated gas stream on wet ESP outlet to offset makeup water demand.

MEGTEC

Critical Parameters to Monitor for Maintaining a Healthy System

- **pH** – monitor via continuous in situ pH probe or manual daily pH sampling
- **Temperature** – monitor via thermocouple or similar
- **Quench Flow** – monitor liquid flow to nozzles
  – compare with saturation temperature on wet ESP inlet
- **Flush Water Temperature** – monitor and maximize for best cleaning

Critical Parameters to Monitor – Manually Drawn Samples

Monitor Via Daily Waste Water Sampling

- **Total solids (TS) concentration**
- **Suspended solids (TSS) concentration**
- **Dissolved solids (TDS) concentration**

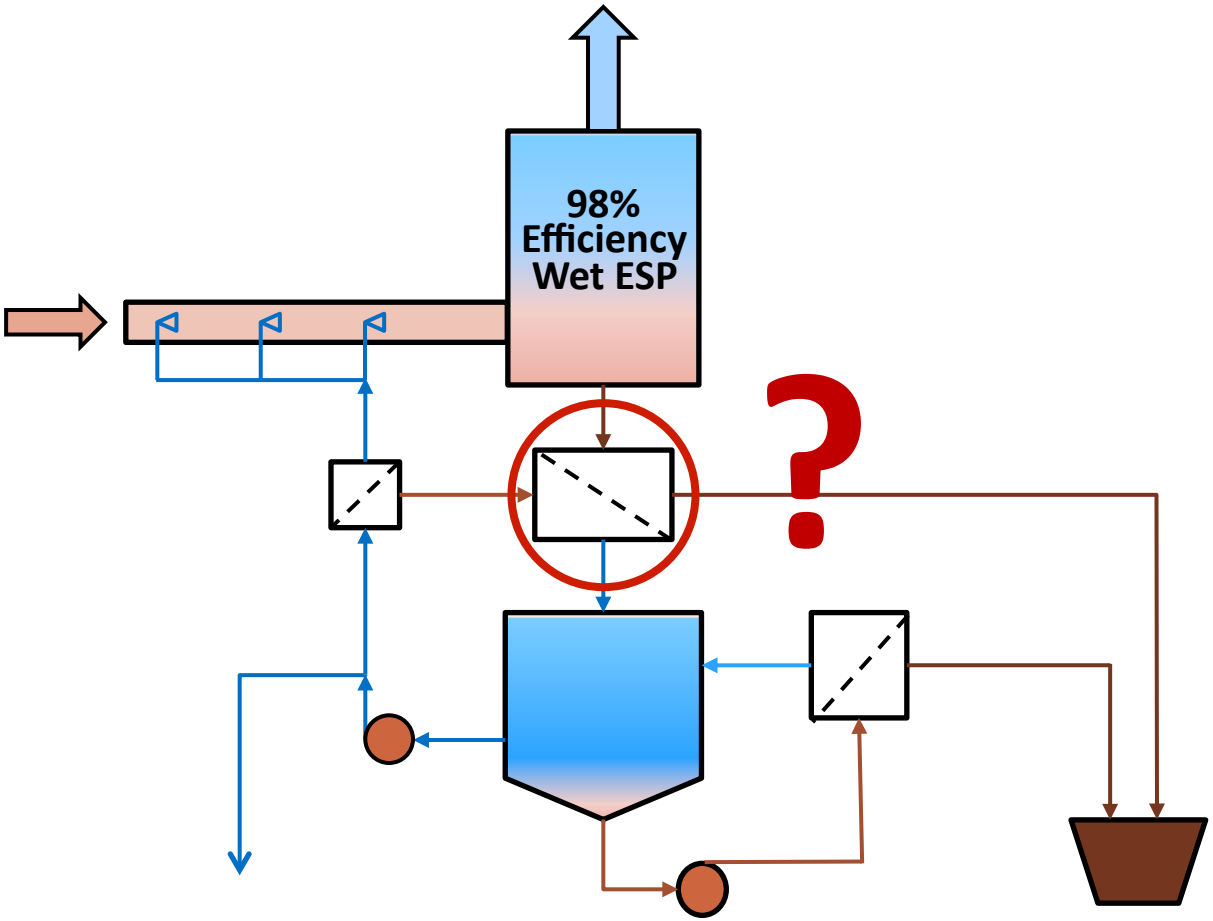
Chemical Addition

- Typical
  - Caustic
  - Defoamer
- Other
  - Flocculants and Coagulants
  - Acid

Operation with Water Treatment System Under Control

Operation with Water Treatment System Out of Control

Coarse Particulate Removal

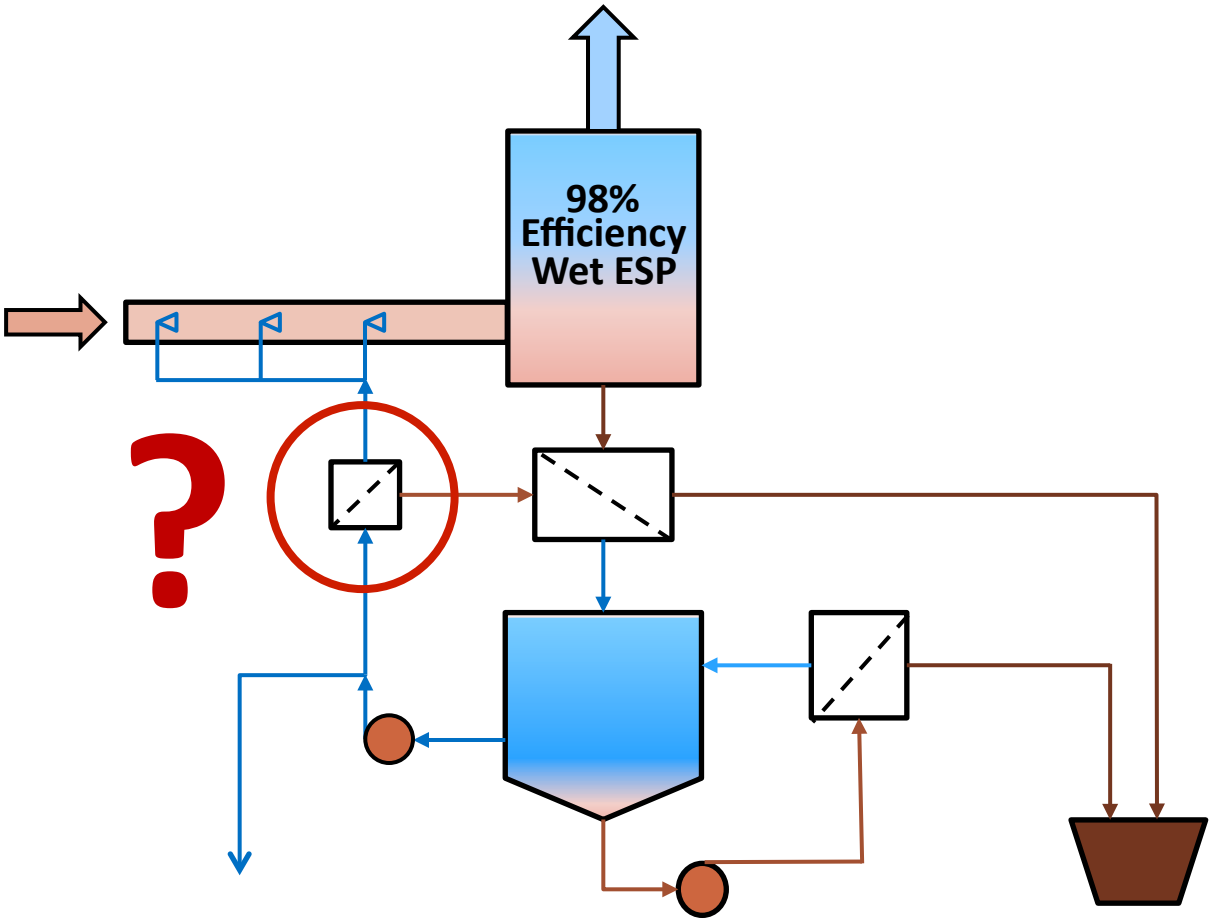


Static Inclined Screens

Internally Fed Rotary Screen

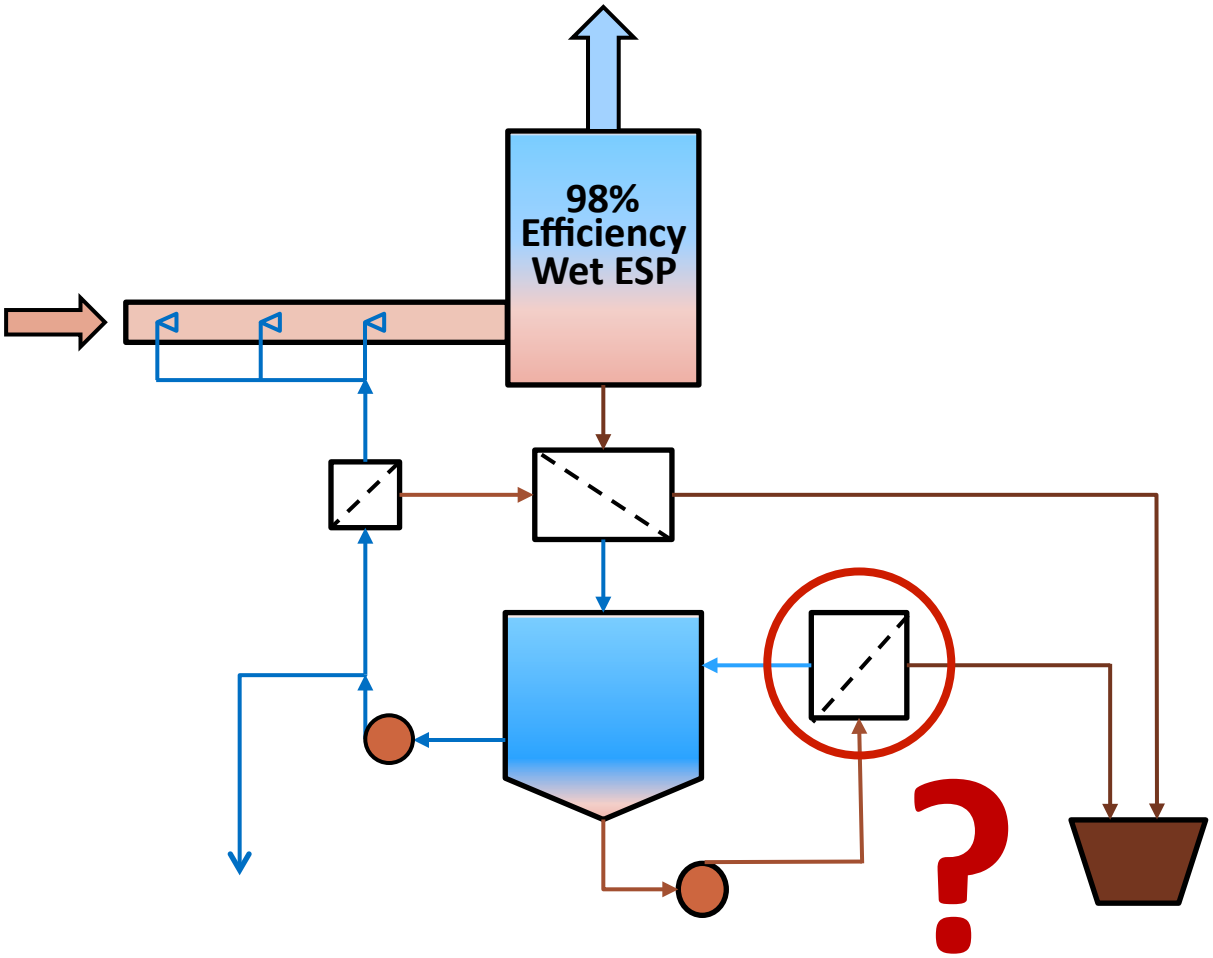
Parkson Rotoshear®

Nozzle Protection

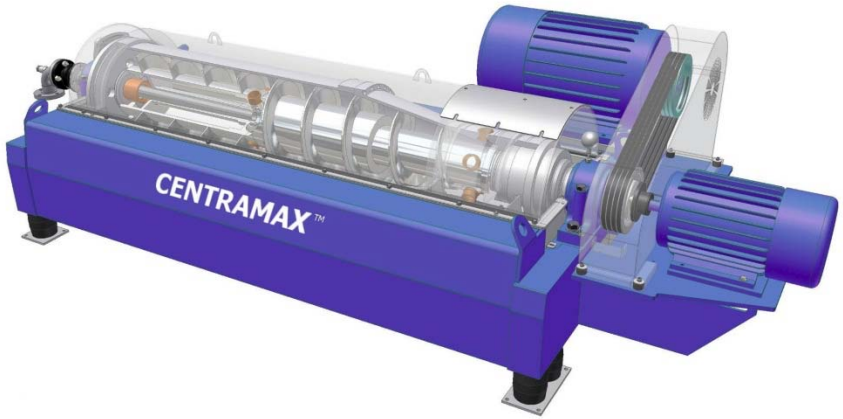


Multiple Basket Strainers

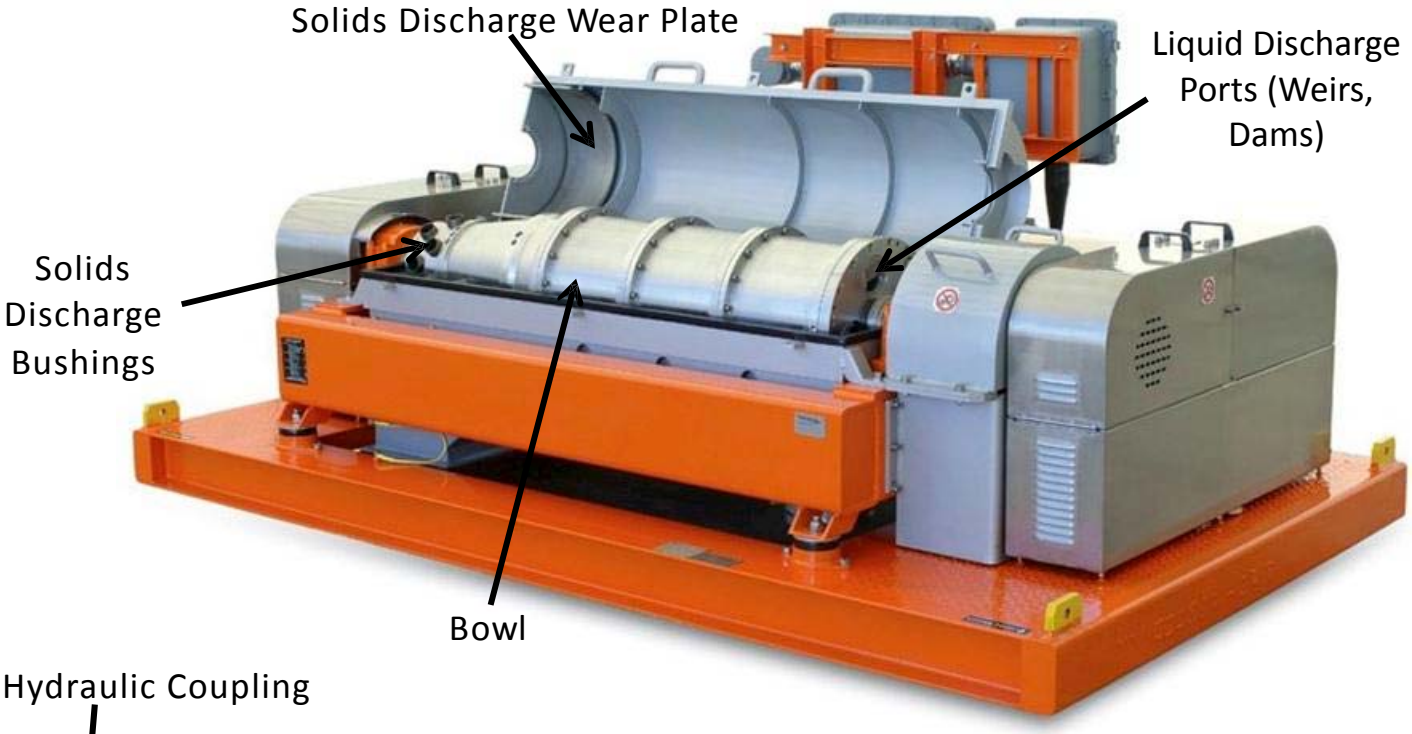
Fine Particulate Removal



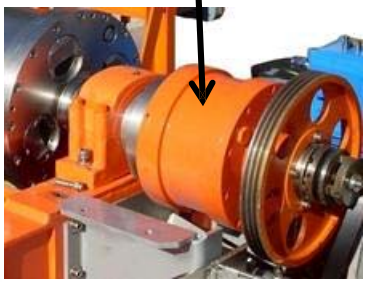
Centrifuge



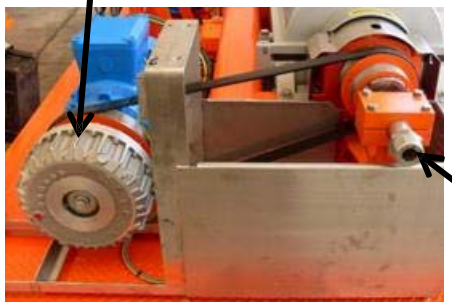
Sweco Centrifuge Overview



Gearbox



Hydraulic Coupling

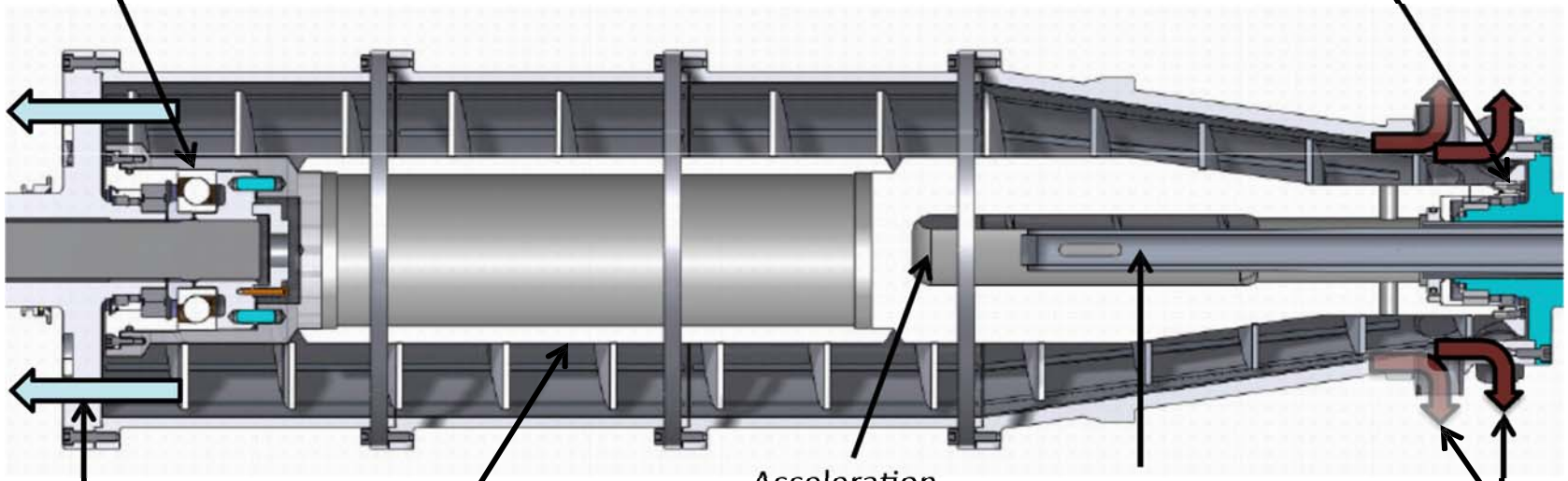


Feed Tube

Back Drive Sheave w/ GS Coupling & Limit Switch

B&W MEGTEC

Internal Bowl with Radial Screw Conveyor

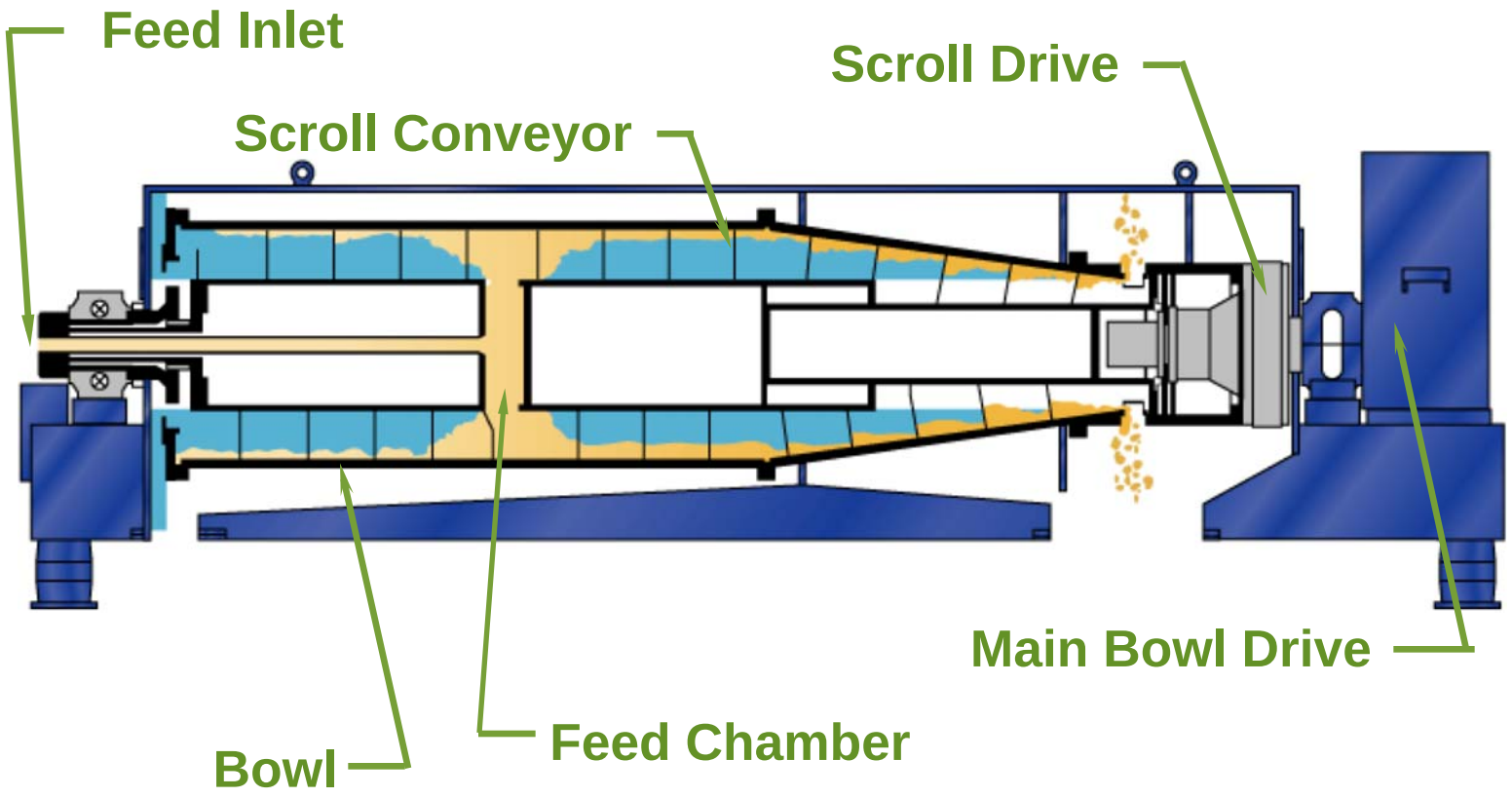


Centrifuge Internals

Conveyor

Bowl

DecaPress General Arrangement



Centrifuge Operation

- Typical wet cake solids from well maintained and controlled centrifuge in wood products WESP wastewater application

- Extreme case - excessively wet solids (thickened process wastewater) from centrifuge in wood products WESP wastewater application

Centrifuge Control

Setting	Increase	Decrease
Bowl speed	• G-force increases • Solids removal efficiency improves • Cut point improves • Drier solids	• G-force decreases • Solids removal efficiency degrades • Cut point degrades • Wetter solids
Feed rate	• Less fluid retention time • Solids removal efficiency degrades • Cut point degrades • Wetter solids	• More fluid retention time • Solids removal efficiency improves • Cut point improves • Drier solids

Centrifuge Control

Setting	Increase	Decrease
Differential speed	• Less solids retention time • Wetter solids • Less torque on gearbox	• More solids retention time • Drier solids • More torque on gearbox
Feed tube position in bowl	• Feed tube in • Drier solids • More torque on gearbox	• Feed tube out (8 in. or 200 mm max) • Wetter solids • Less torque on gearbox
Pool depth	• More fluid retention time • Cut point improves • Wetter solids • Motor load increases	• Less fluid retention time • Cut point degrades • Drier solids • Motor load decreases

Centrifuge Maintenance – Daily/Weekly

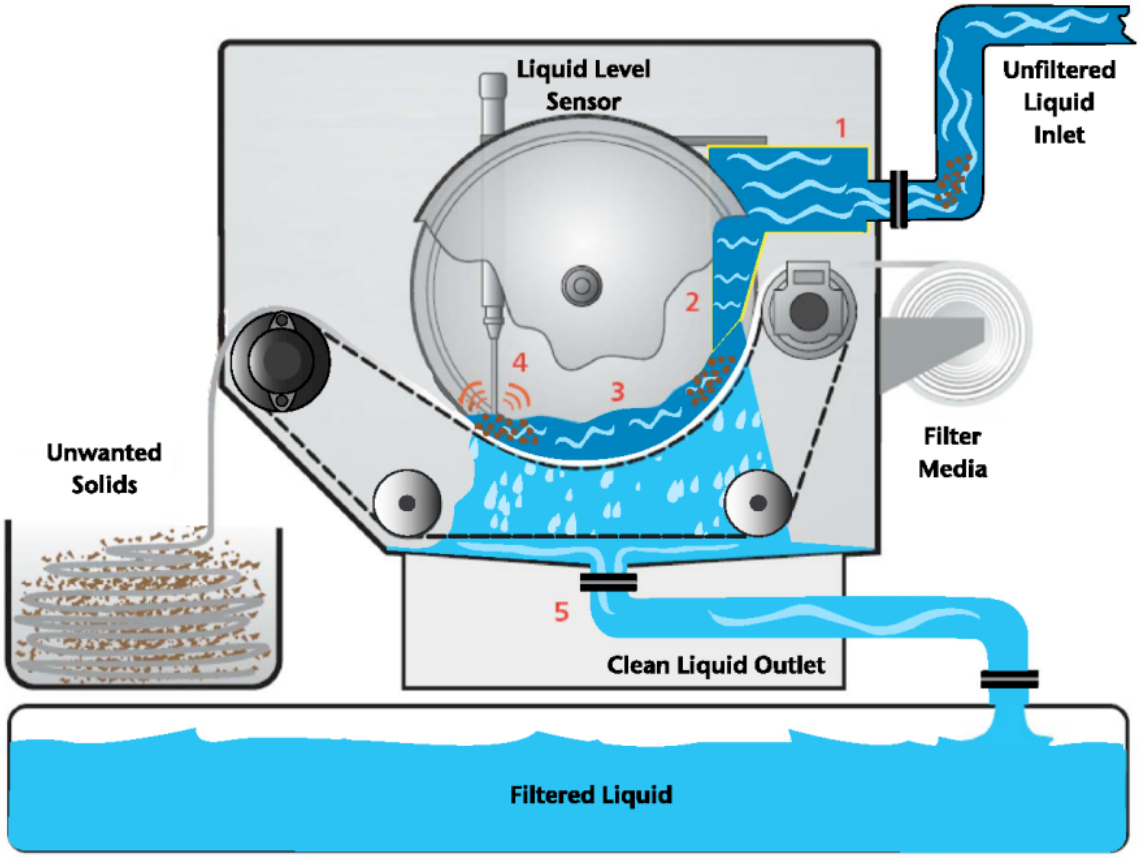
Frequency	Task	Time Required (Estimated)
Daily	• Grease pillow block bearings • Grease nave bearings	10 minutes
Weekly	• Grease pillow block and internal conveyor bearings (100 hrs.) • Check oil level in gearbox • Thorough cleaning of unit and check solids discharge bushings for wear, check wear shield in cover, and check magnetic plugs in gearbox for metal particulate • Check belt tension	1 hour

Centrifuge Maintenance – Longer Term/Periodic

Frequency	Task	Time Required (Estimated)
Monthly	• Check oil level hydraulic coupling • Change gearbox oil • Measure scroll wear and record. Trend data to predict when rebuild will be necessary.	1 hour
4 months	• Change gearbox oil • Change hydraulic coupling oil	30 minutes
18 months	• Rebuild conveyor? • Change bearings?	Varies – from hours to change bearings to a week or more if unit must be sent to manufacturer for rebuilding

Paper Filter

Paper Filter



Paper Filter on Dryer System

Not WESP water treatment

Wet ESP Water Treatment

Thank You