Worldwide Pollution Control Association

IL Regional Technical Seminar

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Babcock Power Inc.




Lessons Learned

WFGD

www.babcockpower.com

Design Considerations

- Interface Points
  - Minimize Interface Points
  - Clearly Define Interface Points (minimum/maximum operating conditions as well as design conditions)
- Design vs. Reality (bigger is not always better)
  - Margin on top of margin on top of margin effect
  - Smart design

    Size equipment to handle design conditions but do not oversize where operation at normal/present conditions results in un-necessary parasitic load (i.e. oxidation air blowers and O:SO_2 ratio)

    For redundant equipment consider what condition is the equipment sized for 100%. For example, at normal conditions there is a 100% spare but at design conditions both pieces of equipment are in service.

Design Considerations

- To Spare or Not to Spare
  - Spare recycle spray level vs. no spare recycle spray level
  - If DBA is considered to be used as a “spare” recycle pump consider future wastewater requirements
- Capital Cost vs. Operating and Maintenance
  - Savings up front can lead to increased O&M costs and reduced reliability in the future
  - Picture the plant 10-20 years down the road. Gain knowledge from other systems that have been in service
- Equipment Layout and Maintenance Access
  - 3D model review by plant operations and maintenance
  - Involve vendors to understand what accessibility is required
  - Frequent accessibility versus required access every 2-5 years

Design Considerations

- Access to Spray Levels
  - Dance floor to minimize scaffolding requirements to spray levels
- Generic Specifications versus Reality
  - Provide specifications for all potential makeup water sources
  - Provide actual limestone quality and samples of limestone to vendors
- Filters/Screens
  - How clean is the water?
  - Static versus self-cleaning filters
  - Screens in front of recycle pump suctions

Lessons Learned

- Startup Conditions
  - Unit startup on oil/gas? Duration?
  - Is particulate control going to be in service during startup?
- SO_2 Control
  - Control to emissions or percent removal?
    Is absorber inlet CEMs maintained like the stack CEMs (i.e. linearity checks, inspect for CO_2 leakage, etc..)
  - Feed forward control with feedback loops
    Tighter control with feed forward loop but absorber slurry pH feedback loop to keep absorber reaction tank pH between 5 and 6 to prevent corrosion issues at low pH and super saturation of limestone at high pH

Lessons Learned

- Specifying CEMs Equipment for High Removal/Low Emissions
  - What is the reliability/degree of error monitoring at extremely low emissions (i.e. 98+% SO_2 removal and monitoring Hg emissions)
- Closed Loop Operation
  - Must consider particulate fines as well as chlorides
  - Provide a realistic slurry particle size distribution instead of a standard gypsum PSD. Work with primary hydrocyclone vendor to develop
  - Higher chlorides also means higher concentrations of other constituents that may lead to limestone blinding
- Drum Filters vs. Belt Filters
  - Drum filters take up less space and less maintenance
  - Belt filters have more flexibility and better equipped for closed loop operation

Lessons Learned

- Follow-up Training
  - Troubleshooting guides/one-page guidelines for operators and lab
- Monitoring data
  - Data creep – low slope

    System slowly creeps out of design range
  - Removing nuisance alarms
  - High (Low) alarms set at a logical set point to warn operator to respond prior to a trip
  - High-High (Low-Low) trips equipment prior to damage

High removal rates and high availability have been achieved

Operating Guilds

	Frequency		Target	Min.	Max.	Troubleshooting
	Normal	Startup				
Absorber						
pH	daily	daily	5.0-6.0	4.8	6.1	Check pH against a held held meter. If the difference between the online and handheld pH's is <0.2 units, do nothing. If the difference between the online and handheld pH's is >0.2 units enter the portable pH probe reading. If the difference is greater than 0.5 units, calibrate the probe using 4 and 7 buffers. Keep a log of pH readings and adjustments made to online meters. If pH is low and the absorber overscrubbing, consider taking a recycle pump out of service. If pH is high and the absorber underscrubbing, place a recycle pump in service.
Solids, wt%	weekly	3xs/week	15-17	14	18	Make sure bleed valve is in auto. If solids does not match density meter (consistently off for 3 or more samples), recalibrate density meter. Can measure density (using a Marcy scale or hydrometer) or filter and dry sample (at 60°C) to measure solids.
Gypsum Purity, %	2xs/week	daily	>90	85		If gypsum purity is low, look at limestone addition rate and oxidation. Check the dewatering hydrocyclone overflow solids concentration for excessive fines (>5 wt% solids)
$CaSO_3$*[1]/$_2H_2O$, %	2xs/week	daily	<1		2	If high, confirm oxidation air blower is in service and supplying adequate air for oxidation. Confirm all the air lances are valved open. Check actual flow rate on DCS and inlet guide vane position (IGV). Confirm blow off valve is closed
Oxidation, %	calculated		>99	98		
$CaCO_3$, %	2xs/week	daily	<2.7		4	If high, confirm limestone slurry feed is in auto. Check hand held pH metter against buffer and standardize the online pH meters to th ecalibrated hand held pH meter. Confirm the correct number of recycle pumps are in service to maintain SO2 removal.
Reagent Ratio	calculated		<1.05		1.07	
Cl, ppm	weekly	weekly	30,000		50,000	If high or trending up, start/increase chloride purge.

Operating Guilds

	Frequency		Target	Min.	Max.	Troubleshooting
	Normal	Startup				
Filter Cake						
Moisture, %	daily	daily	<10		12	If high, make sure vacuum belt filter cake thickness is in auto. Check for even distrubution of slurry on the belt, check spray pattern of hydrocyclone underflow for a 30 degree cone (no plugagge and/or wear). Check the filter cloth for blinding issues
Gypsum Purity, %	daily	daily	>93	90		Check hydrocyclone overflow solids concentration for excessive fines (>5 wt% solids). Increase purge 50 gpm if overs solids concentration is greater than 3 wt% solids. Confirm oxidation and reagent ratio are in spec.
Cl, ppmd	weekly	daily	<100		150	Analysis required only if cake is being washed. Confirm cake wash is valved in. Confirm there is adequate flow and none of the wash nozzles appear plugged. Make sure cake is evenly distributed across the belt and that cake thickness is set appropriately.
Hydrocyclone Overflow Solids, wt%	2xs/month	weekly	<3		5	Make sure correct number of cyclones valved in. If high, determine if a purge is necessary to remove fines. If high and purge is increased, re-check solids concentration the following week. Increase purge rate in increments of 50 gpm.
Hydrocyclone Underflow Solids, wt%	2xs/month	weekly	50	45	60	Check for 30 degree-cone spray pattern (no roping). Make sure correct number of cyclones valved in. Check for pluggage and wear. Confirm from DCS that supply pressure to the hydrocyclone is at design
Limestone Slurry						
Solids, wt%	weekly	3xs/week	30	27	32	Check ball charge by monitoring motor kw. Check for wear/pluggage on hydrocyclone assembly. Confirm from DCS that the supply pressure the the hydrocyclone is at design.
Grind, passing 325 mesh	weekly	3xs/week	>95	90		Check ball charge by monitoring motor kw. Check for wear/pluggage on hydrocyclone assembly. Confirm from DCS that the supply pressure the the hydrocyclone is at design. Measure solids concentration on the supply to the hydrocyclones and compare to the online density meter. Recalibrate meter if necessary.

Thank You