Oxygen Delignification
How to get pH Right

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Oxygen

CHARACTERISTICS

- Clear colorless gas, pale blue liquid
- Powerful oxidant

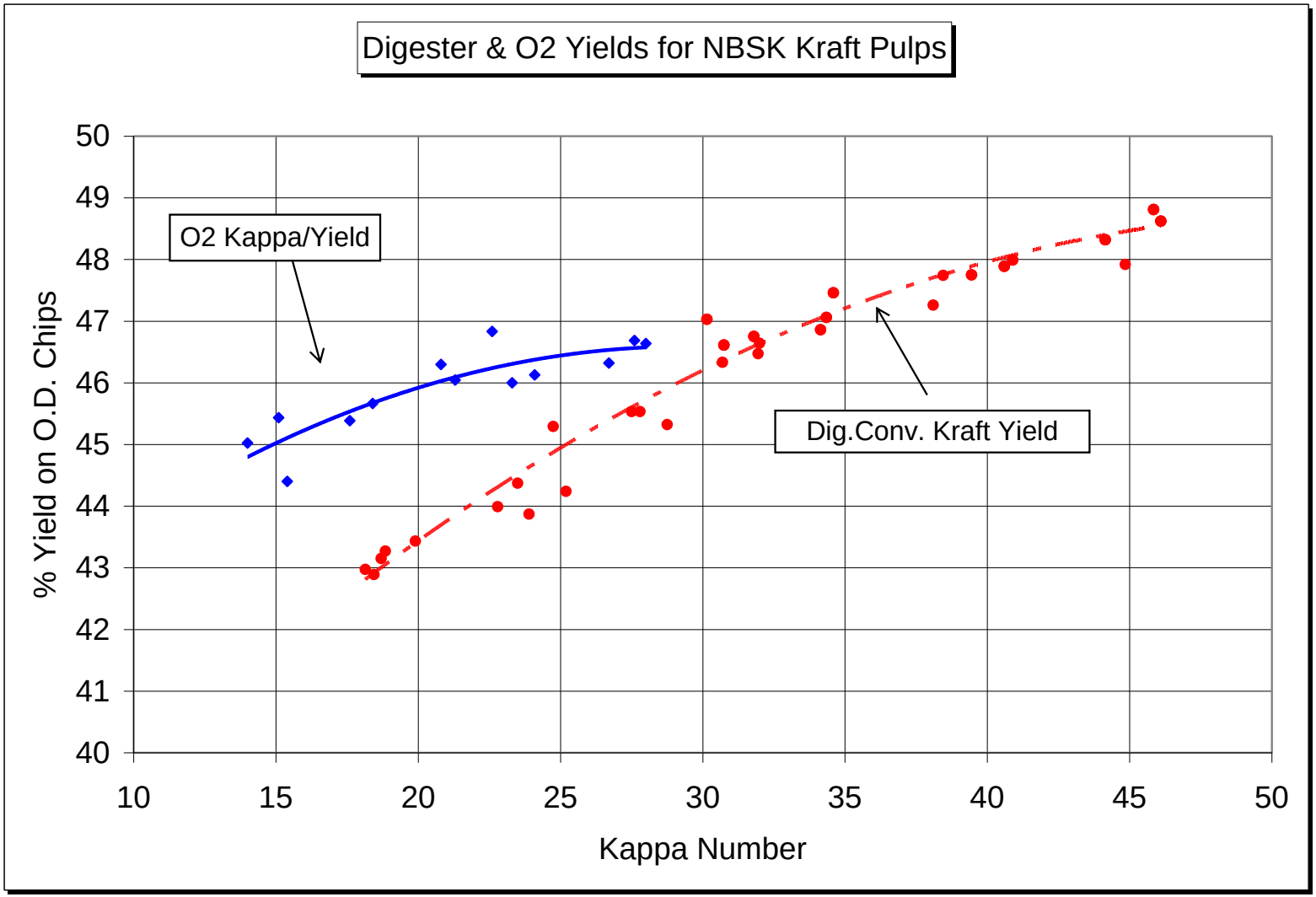
EFFECTS

- Contact with liquid will result in frostbite/burns
- Can be highly flammable in concentrated vapor form

Oxygen Reactions

In the presence of alkali and
temperatures around 200 F,
Oxygen reacts with both lignin
and cellulose

Yield Benefits



Two-Stage Oxygen Chemical Addition

- The alkali and oxygen are added based on the incoming and target kappa (delta kappa), and applied using a fixed caustic and O2 factor. These factors do not have equal values and are tied together or ratioed together.
- The caustic is added for delignification and to hit a target end pH of 10.5 and the O2 is added strictly to hit a delignification target.

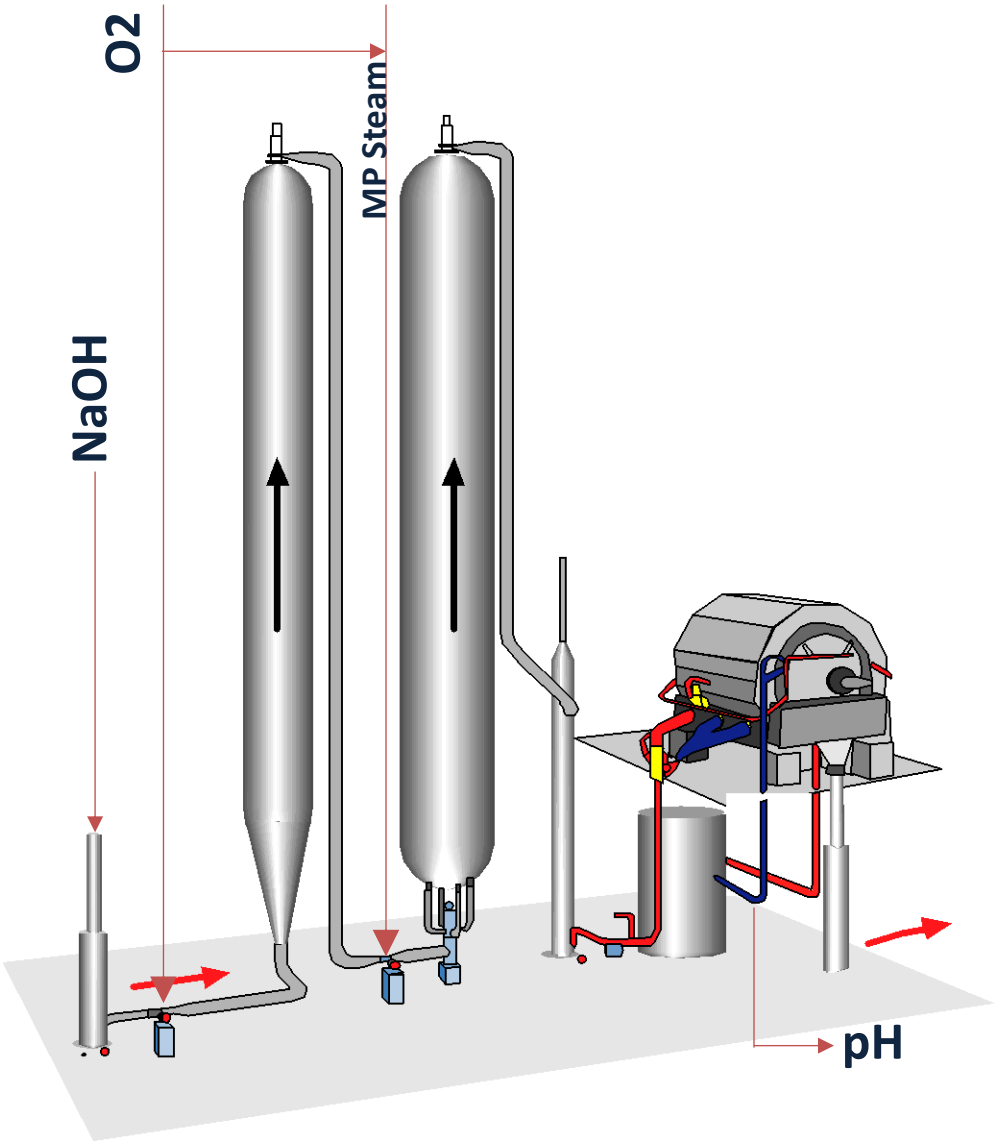
Two-Stage Oxygen Chemical Addition

- The internal recycle streams in the BS washing system can build up excess alkali in the system fairly quickly if fast changes are made to the chemical application rates.
- Before making changes evaluate the trend of:
  - the digester , O2 feed and exit kappa
  - The O2 exit pH
- Over control will lead to greater O2 kappa variability

Two-Stage Oxygen Delignification: Operator Decision Matrix

	Increase NaOH Factor	Increase O2 Factor	Decrease NaOH Factor	Decrease O2 Factor	Increase Temp	Decrease Temp
Kappa is on target pH is on target						
Kappa is on target pH is high			X			
Kappa is on target pH is low	X					
Kappa is high pH is on target	X	X			watch	
Kappa is high pH is high		X			X	
Kappa is high pH is low	X	X			watch	
Kappa is low & pH on Target			watch			X
Kappa is low & pH is high			X			X
Kappa is low & pH is low				X		X

Typical Two Stage MC Oxygen System



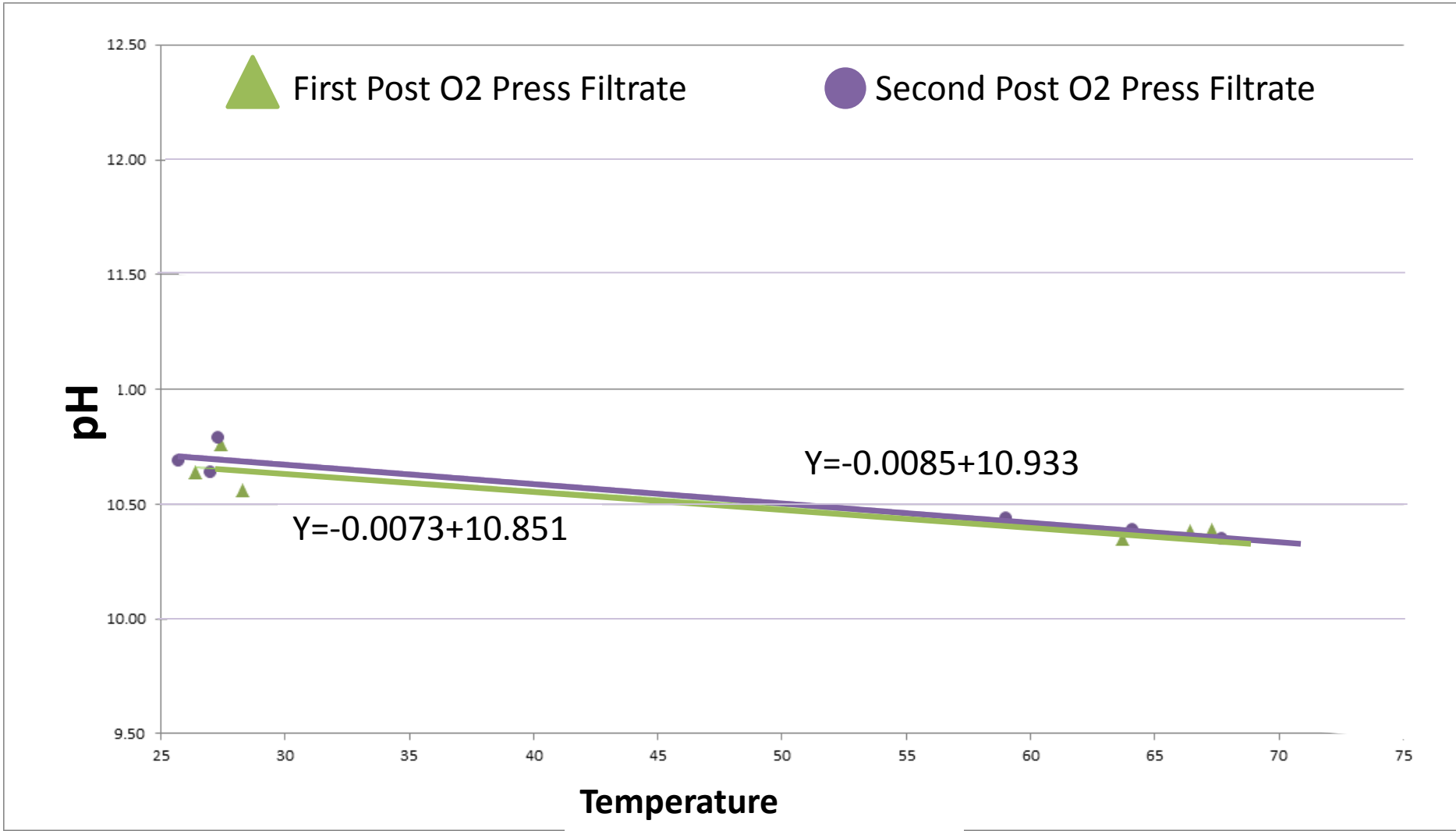
Is Measuring the pH of the post O2 press pressate a true terminal pH?

Difficult to say, as hardly anybody measures the post O2 pH before any dilution done

Next slide shows some filtrate pH testing. The second post O2 pH pressate was essentially the same as the first post O2 stage pressate

- Carbonates creating a buffer?

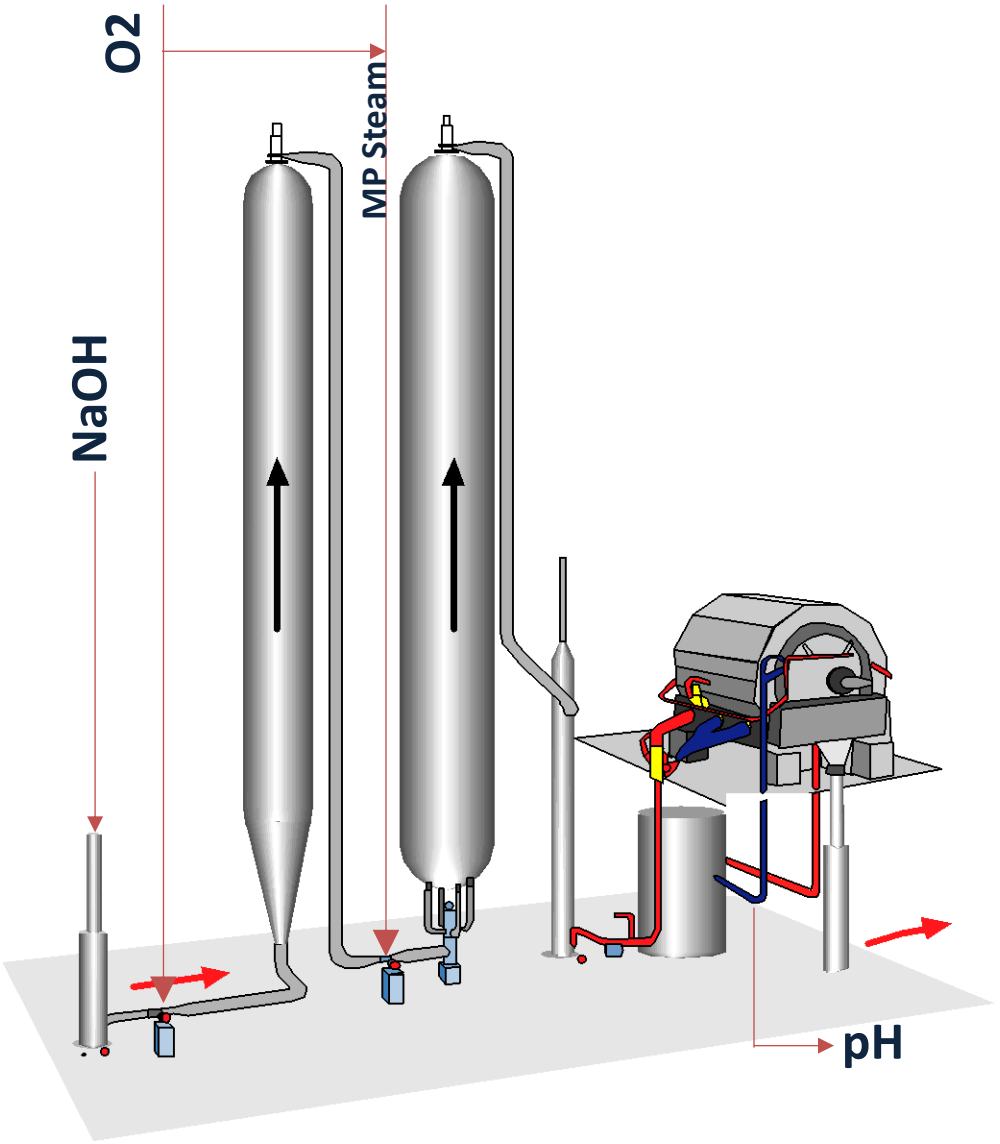
Is Measuring the pH of the post O2 press pressate a true terminal pH?



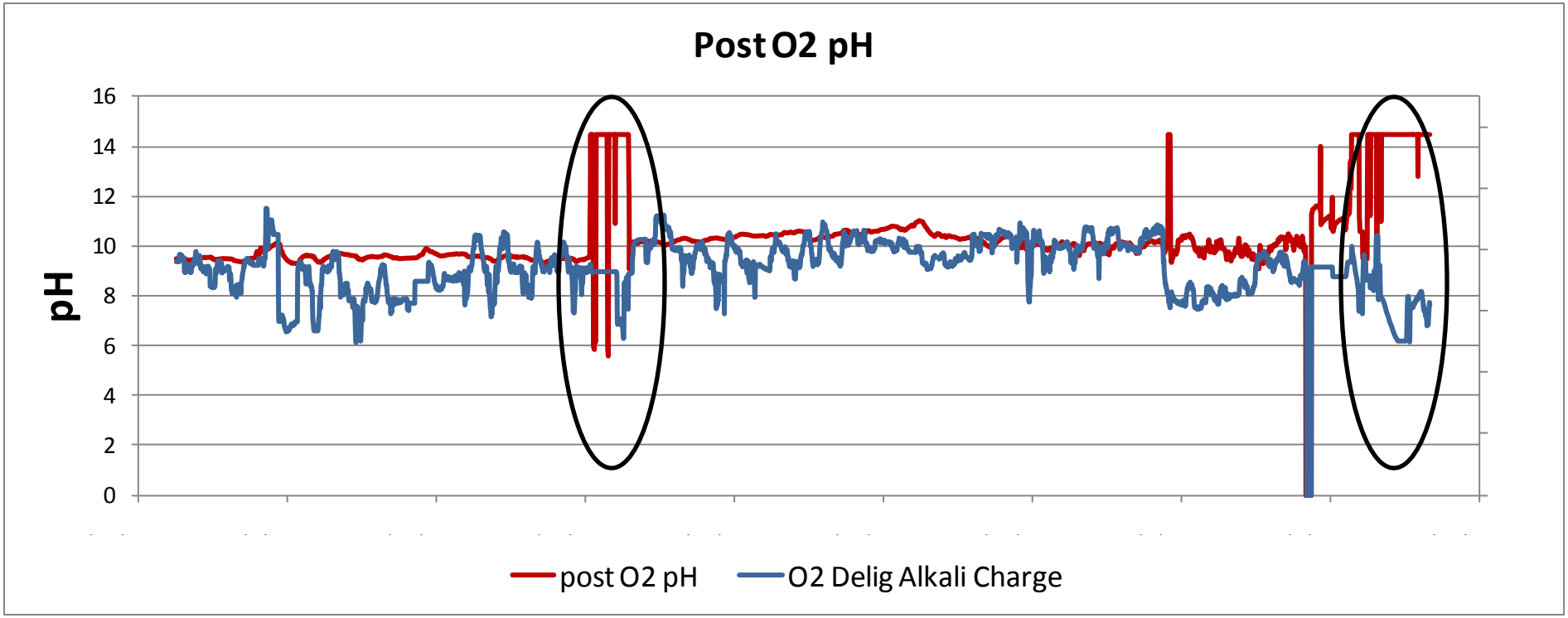
Is Measuring the pH of the post O2 press pressate a true terminal pH?

We believe the first press pressate is a good indication of post O2 terminal pH

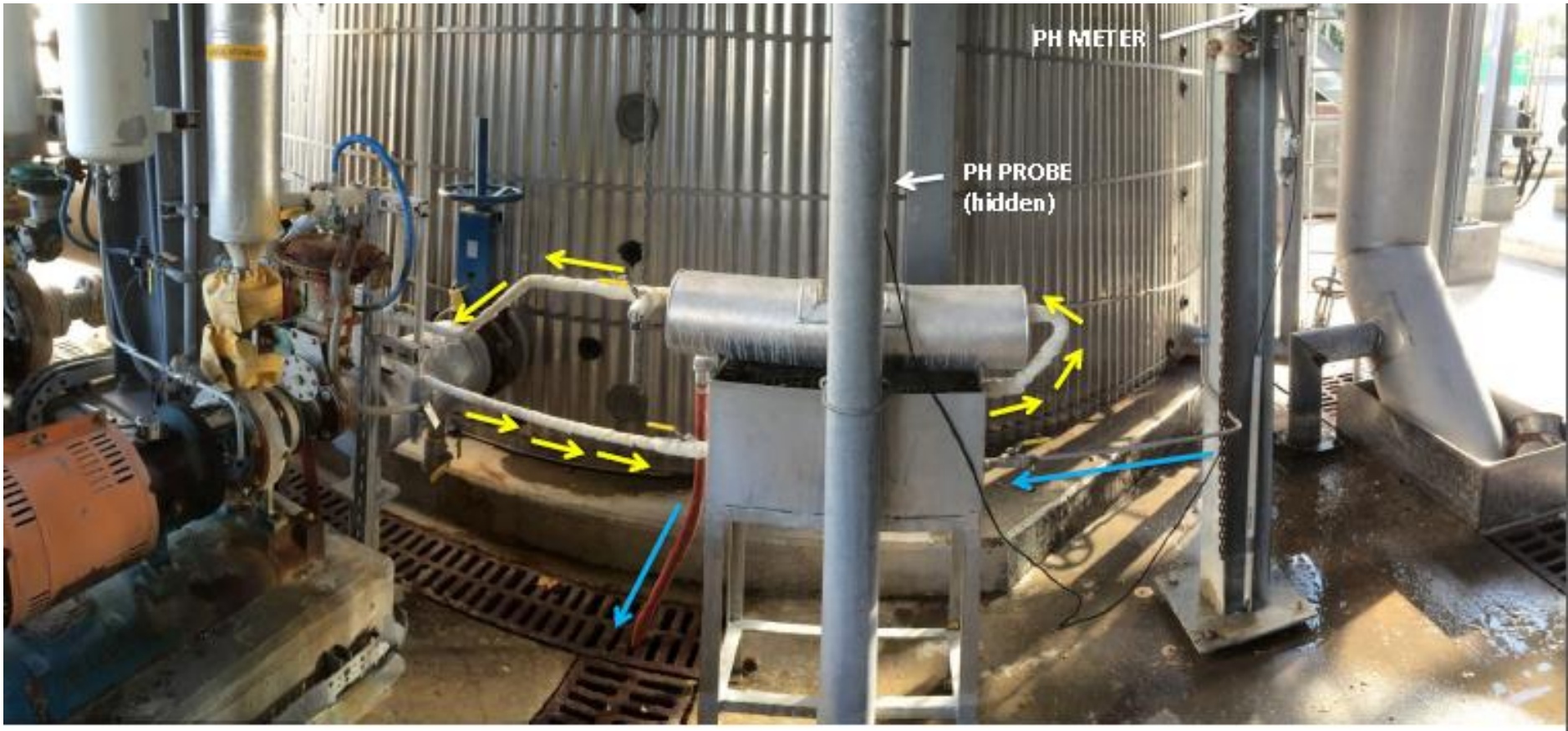
Typical Two Stage MC Oxygen System



Typical trend of post O2 pH - BEFORE

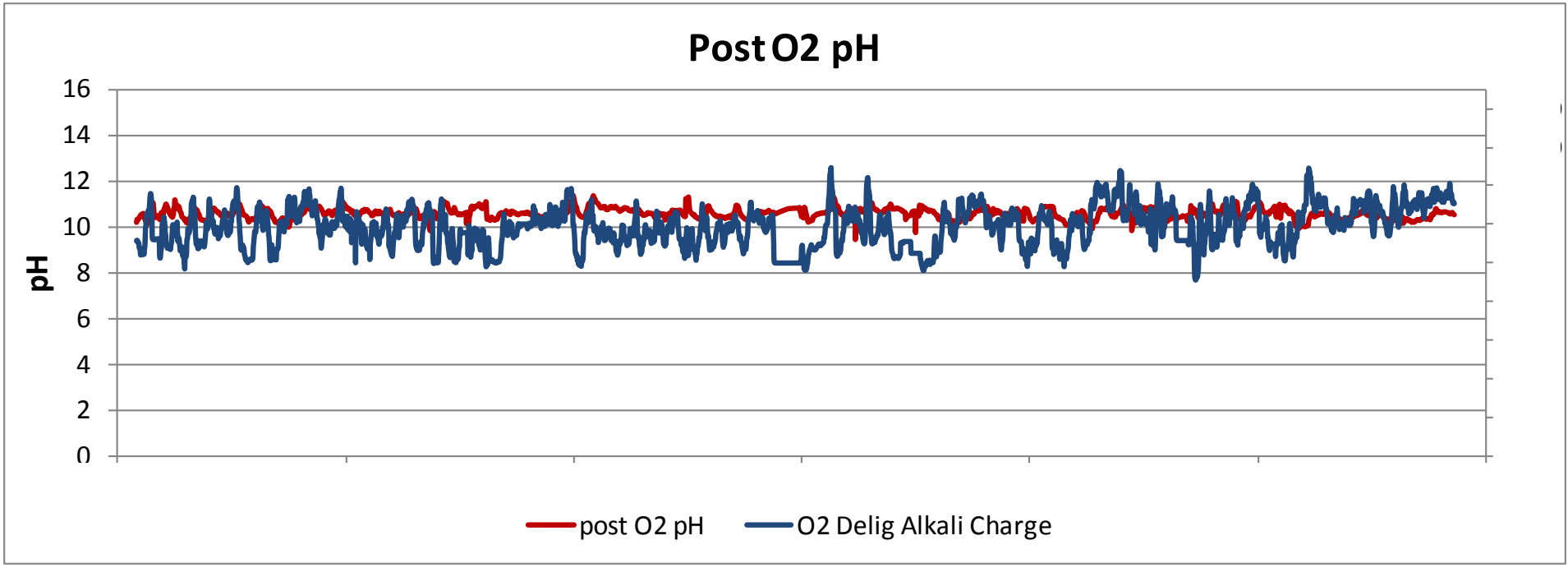


Filtrate Cooling



Bath and Coil, Front and Rear View

Typical trend of post O2 pH - AFTER



Conclusions

- Cooling the sample gives a much more reliable pH – the probe signal does not decay, become unresponsive, or jump to a falsely high value and its life expectancy is much, much longer.
- High pressure or putting the probe in medium consistency environments was thought to be the reason for poor probe performances, but perhaps it is the hot temperature that is more to blame.