

**PAPTAC BLEACHING COMMITTEE**  
**FALL 2016 MEETING MINUTES – HINTON, AB**  
**October 24-26, 2016**

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*PAPTAC Bleaching Committee, Fall 2016 Meeting  
Hosted by West Fraser Hinton, AB (October 24-26, 2016)*





PAPTAC Bleaching Committee, Fall 2016 Meeting  
Hosted by Hinton Pulp, Hinton AB (Oct 24-26 )



# PAPTAC Bleaching Committee

## Section 2 - ATTENDANCE LIST

Hinton, AB – October 24-26, 2016

	Name	Mill / Company	Job Title
	Brian La Brash	Quinnsec-Verso Corp	Process Engineer
	Chris Brennan	Allnorth	Process Engineer
	Rick Wasson	Irving Pulp & Paper	Bleach Plant Superintendent
	Heather Fritzen	West Fraser HLP	Process Eng.
5	Laurier Monissetto	TEXACO CONTROLS	Process Control Eng.
	RAYMOND PAQUET	KEMIRA	APPLICATION SPECIALIST
	Ces Adams	Irving Pulp & Paper	Process Engineer
	Manny Sidhu	Spartan Controls	Advanced Solutions
	KARL RAE	EARTH FIRE ENERGY	PROCESS ENGINEER
10	Sandy Beder-Miller	BTG Americas	SR. Applications Specialist
	Marty Hoskins	BTG Americas	Business Development Manager - Fiberline
	Coby Stone	BTG America	Western N.A. Manager
	David Flater	Pöyry (Montreal)	SR. PROCESS SPECIALIST
	Sabrina Burkhardt	Econotech	Mgr. Pulping + Bleaching
15	Honey Nampak	Harmac Pacific	Production area engineer
	GOPAL GOYAL	International Paper	Chief Scientist
	ALISON ROWAT	WEYERHAEUSER	MANUFACTURING SERVICES MGR.
	Paul Earl	Paul Earl Consulting	consultant
	Ant Meusel	CHEMSTONE	SALES
20	Chad Start	Hinton Pulp	Operator
	CHRIS LOCK	BORDER CHEMICAL	ENGINEER-IN-TRAINING
	DAVE GUSTAFSON	HINTON PULP	SHIFT SUPERVISOR
	Mark Wright	Hinton Pulp	shift supervisor
	Darryl Dyer	Hinton Pulp	Control Operator
25	Stephen Desrosiers	HSPP	Bleach/Chem Supt



## PAPTAC Bleaching Committee

## Section 2 - ATTENDANCE LIST

Hinton, AB – June 24-26, 2016

	Name	Mill / Company	Job Title
26	James Hogg	Hinton Pulp	E/I Planner
	ADAR VASHISHT	Evonik	Sales Manager
	DENNIS FROATS	ERCO	TECHNICAL SERVICE
	DAN KARNENICIUS	CANFOR - NORTHWOOD	PROCESS ENGINEER
30	Guy Young	CANFOR - INTERCOR	BLEACHING MACHINE ROOM TEAM LEADER
	JAMES GOLDMAN	VALMET AUTOMATION	SOLUTIONS MANAGER
	Waqas Saifraz	Canfor - PGR Pulp	Process Engineer
	MICHAEL KJERULF	NALCO	INDUSTRIAL TECHNICAL CONSULTANT
	Alia Obermayer	Canfor Pulp Innovation	Chemist
35	AARON SHIELDS	CANFOR - NORTHWOOD	PROCESS CONTROL SPECIALIST
	Steven Kuckowski	Verso - Wisconsin Rapids	Shift Supervisor
	Brittany Spencer	Verso - Wisconsin Rapids	Pulp Mill Manager
	RAHUL FURADYIL	CARIBOO PULP & PAPER	Process Engineer - Digestion & Bleaching
	Rashiv Lubana	Cariboo Pulp & Paper	Bleach Plant - POC Eng
40	Roger Tembreull	Verso - Escanaba	Tech Serv Eng
	Aamirah Allykhan	Howe Sound Pulp & Paper	Process Engineer
	Allen Turner	Andritz Inc	Capital Sales Mgr
	John Shao	Skookumchuck Pulp Inc.	Process Engineer
	Val DeLeo	Valmet	Performance Engineer
45	Doug Reid	Akzo Nobel	Sr. Process Engineer
	JACKIE LORETTE	SOLENIS	PULP APPLICATIONS
	JIM COLLINS	MARATHON ON	RETIRED
	Kent Rabarge	Weyerhaeuser	Manufacturing Serv Director
	Rob White	Buckman	Market Development Mgr - Pulp
50	Shree Prakash Mishra	FPI Innovations	Scientist



# PAPTAC Bleaching Committee

## Section 2 - ATTENDANCE LIST

Hinton, AB – June 24-26, 2016

	Name	Mill / Company	Job Title
51	Stephane Messier	CANEXUS	Technical Service Manager
	ALMER TETAHOVIC	DMI PEACE RIVER	Process Specialist
	Craig Simon	DMI Peace River, AB.	Fiberline Day Lead
	Dominic Côté	WESTROK LATOQUE (Q)	ASS. SUPERINTENDENT Pulp Mill.
55	Dan Davies	Eronik	Applications Manager
	Mona Henderson	Valmet	Business Manager
	JENNIFER BOESE	WEST FRASER	QUALITY SUPT.
	Kimberly Chin	Weyerhaeuser	Fiberline Process Eng.
	STEWART BRAIN	KEMIRA	Sales
60	Dominic Michaud	Weyerhaeuser	Whiteside Op. Leader.
	LANCE LARRY	Howe Sound Pulp	BLEACH OPERATOR.
	Tony Greer	VALMET	Regional Manager
	Rolan Bandolan	Noram	Process Engineer
65			
70			
75			



**PAPTAC Bleaching Committee**  
**Section 3 – BUSINESS MEETING MINUTES**  
*Hinton, AB; October 24-26, 2016*

**Steering Committee**

- Retiree email list
  - How to coordinate with PAPTAC?
  - PAPTAC “owns” the group email list and requires that everyone on it be a PAPTAC member
- Daniel Brouillette accepted vice-chair position
  - Will also be made a full supplier member of the committee
- Mill/supplier ratio is OK
- Discussion regarding how suppliers graduate from probationary to full status
  - They are eligible to apply to the chairman for full supplier membership after two years as a probationary member
  - Approval is based on the probationary member’s participation and attendance. See excerpt from membership guidelines at the end of this document.
- Sabrina Burkhardt is changing companies but will remain on the committee
- Conflicting meeting dates between the Bleaching Committee and the newly reformed Alkaline Pulping Committee will be addressed

*From the Membership Guidelines as described in the 2006 PAPTAC Bleach Committee Annual Report:*

- A member must first be a member of PAPTAC.
- A Mill member can be designated by the mill and is a full member right away. A mill can have up to two alternate members but each alternate is expected to effectively carry forward work on Subcommittee projects.
- A Supplier Probationary member must be proposed and accepted by the Chair and Steering Committee and then must fulfill at least 2 years of committee duty before becoming eligible for full Member status. After two years a Probationary member can write an email or letter to the Chair asking to become a full Member and the Chair will take the request to the Steering Committee for review and potential approval.
- Any member's contribution and attendance can be reviewed and if the Steering Committee feels the member has a consistent pattern of sporadic attendance and/or lack of contribution to Committee and Subcommittee work then the Chair will first send a letter/email to the member recommending increased participation. If another year passes or the pattern repeats then the Chair will discuss with the Steering Committee the removal of membership status and write a letter to the member and in the case of a mill member to his or her Mill Manager recommending alternative participation from the mill.



## Fall 2016 Bleaching Committee – Business Meeting

- If a member cannot attend a meeting then he or she should either send an alternate who can participate or further the member's work in ongoing projects or be excused by the Chair.
- The proportion of Mill to Supplier members will be 75/25. Research and University members are considered to be Mill members.

### **Treasurer's Report**

- Current Supplier Fund Balance = \$4042
- Expenses since last report:
  - \$2260 for Spring 2016 committee dinner
- Contributions in 2016:
  - \$4945 from the following suppliers: AkzoNobel, Arkema, Chemstone, Econotech, Evonik, ERCO, GL&V, Kemira, Paul Earl, Peroxychem, Spartan, TACWest, Taylor, TEXO, Valmet Equipment, and Valmet Instrumentation.
- We will approach the suppliers for another round of contributions in the spring of 2017

Mill Host Heather Friesen  
(Hinton Pulp) presents the  
Rae Cunningham Award for  
Bleaching Committee  
participation to  
Mona Henderson (Valmet)

Hinton, AB  
(Oct 25, 2016)





**PAPTAC Bleaching Committee**  
**Section 4 – SUBCOMMITTEE MEETINGS**  
*Hinton, AB; October 24-26, 2016*

See following presentations.

# Technical Sub-Committee

- ❑ Organize Monday morning Technical Sessions
  - ❑ Meeting attendees suggest new topics
  - ❑ Vote for next year's session (so Fall 2016 meeting chooses Fall 2017 technical theme)
- ❑ Remember that a “technical theme” must be broad enough to support 5-6 presentations
  - ❑ Smaller topics may make good Project presentations
- ❑ Advance volunteer speakers are always welcome!
  
- ❑ ***Fall 2016* = Brownstock & Bleach Plant Measurements and Testing Fundamentals**



❑ New Topics suggested Spring 2016 meeting:	
❑ Dealing with an Aging Pulp Mill	1
❑ Pulp Strength / Pulp Quality Control	12
❑ Bleach Plant Simulators / Data Analysis/ Process Modelling	7
❑ Advanced Process Control	3
❑ Bleach Plant Scale	3
❑ Bleach Plant Effluent Impacts Downstream/Filtrate Recycle	6
❑ Real Time Equipment Health/Predictive Maintenance	5
❑ Energy, Steam, & Water Use	9
❑ Safety / Best Practices for New Operators	5
❑ Wood Yield	5
❑ Sustainability of Process Improvements	3
❑ Design Components of Bleach Plant	0
❑ Pulpmill Alarm Systems	0
❑ Contaminants in Dilution/Filtrates/Water/Wood	0
❑ Recent Bleach Plant Trial Work	8
❑ Explosion Factors/Safety Hazards	2

❑ ***Spring 2017 = Pulp Strength / Pulp Quality Control***

❑	Topics from Spring 2016 meeting, feel free to add:	
❑	Dealing with an Aging Pulp Mill	10
❑	Bleach Plant Simulators / Data Analysis/ Process Modelling	19
❑	Advanced Process Control	5
❑	Bleach Plant Scale	12
❑	Bleach Plant Effluent Impacts Downstream/Filtrate Recycle	6
❑	Real Time Equipment Health/Predictive Maintenance	2
❑	Energy, Steam, & Water Use	15
❑	Yield	5
❑	Sustainability of Process Improvements	12
❑	Contaminants in Dilution/Filtrates/Water/Wood	9
❑	Bleaching Chemistry	5
❑	<b>Fall 2017 = ??????</b>	



- ❑ Topics for Fall 2017 meeting:
  - ❑ Bleach Plant Simulators / Data Analysis/ Process Modelling 27
  - ❑ Energy, Steam, & Water Use 23
- ❑ **Fall 2017 =** Bleach Plant Simulators / Data Analysis/ Process Modelling

**PAPTAC Bleaching Committee**  
**Section 5 – TECHNICAL SESSION PRESENTATIONS**  
*Hinton, AB; October 24-26, 2016*

See following presentations.



# Consistency Measurement and Control

PAPTAC Bleaching Committee Fall 2016 Meeting

- *Defining and measuring consistency*
- *Factors affecting consistency measurements*
- *Consistency measurement sensor types*
- *Things to think about*
- *Some ideas on control strategies*

Tony Guerra

[Tony.guerra@valmet.com](mailto:Tony.guerra@valmet.com)

# Consistency Basics

## Definition and available measurement technology

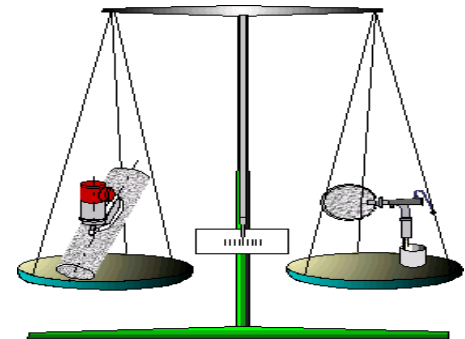
### Measuring Consistency

- Consistency, total (%)
  - $\text{= (dry weight of fiber / total weight of sample) X 100}$
- Consistency, fiber only (%)
  - $\text{= (dry weight of sample (solids – additives)) / total weight of sample X 100}$
- Production (t/h)
  - $\text{= pulp flow (m}^3\text{/h) X consistency (kg/m}^3\text{) / 1000}$

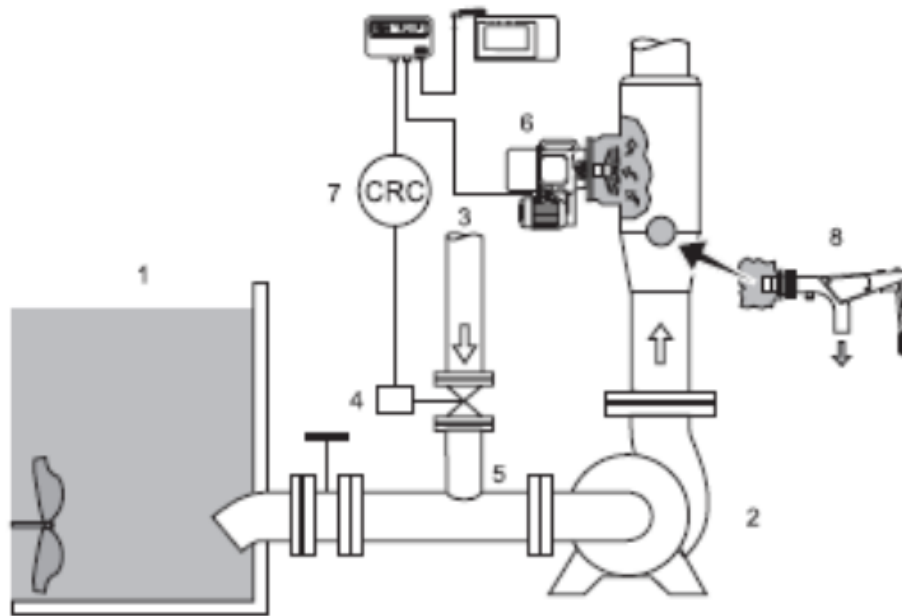
### Available Measurement Technology

- Shear force (blade and rotary)
  - Fiber force to consistency
- Optical
  - Attenuation/reflection/dispersion/de-polarization of light
- Microwave
  - Time of flight

*All consistency sensor are inferred measurements!*



# Basic consistency control loop



1. Stock chest with agitator
2. Stock pump
3. Dilution water supply
4. Dilution control valve
5. Dilution nozzle
6. Consistency transmitter
7. Controller
8. Sample valve
9. Lab work

**The weakest link will decide the result!**

# Consistency Control

Some factors actors affecting accuracy and repeatability

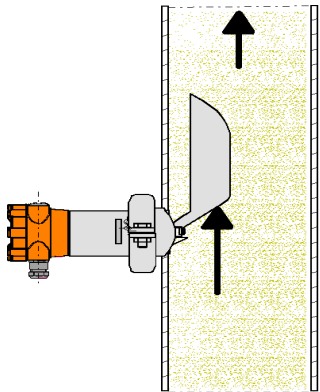
- Poor mixing in chest/tower including dilution zone
- Poor sensor installation
- Poor dilution control valve dynamics limiting resolution
- Variable dilution header pressure – multiple demand
- Poor control strategy / controller tuning
- Process dynamics like large flow turndown or freeness swings
- Poor level control tuning of pulp storage chests
- Limited instrument calibration range - production range?
- Sampling point lag to instrument





# Shear force measurement

- Static and rotary, around 50+ years.
- Most common technology - well accepted
- Works in most mill processes
- Recipes based on fiber force acting on sensor, laboratory correlation into Cs.



***Different fibers  
generate different  
forces***

Species	Fiber length mm	Fiber diameter microns	Wood density lb/cu ft
<b>Southern Region</b>			
Longleaf Pine	4.9	35-45	41
Shortleaf Pine	4.6	35-45	36
Loblolly Pine	3.6	35-45	36
Slash Pine	4.6	35-45	43
<b>Northeast Region</b>			
Black Spruce	3.5	25-30	30
White Spruce	3.3	25-30	26
Jack Pine	3.5	28-40	30
Balsam Fir	3.5	30-40	25
<b>Northwest Region</b>			
Douglas Fir	3.9	35-45	34
Western Hemlock	4.2	30-40	29
Redwood	6.1	50-65	25
Red Cedar	3.5	30-40	23
<b>Hardwoods</b>			
Aspen	1.04	10-27	27
Birch	1.85	20-36	38
Beech	1.20	16-22	45
Oaks	1.40	14-22	46
Red Gum	1.70	20-40	34

# Blade Type



- **Pros**

- Most economical solution
- Sensitive and repeatable
- Wide range - sensor designs
- Built in pulp stock recipes
- Robust solution
- Wide applicability in fiber line and bleaching
- Insensitive to air and conductivity swings
- Customer acceptance
- Sensor materials for bleaching

- **Cons**

- Intrusive to process
- Fiber only measurement
- Can be sensitive to large velocity swings
- Needs good pipe run although turbulence generators are efficient and cheap to install

# Rotary Type



- **Pros**

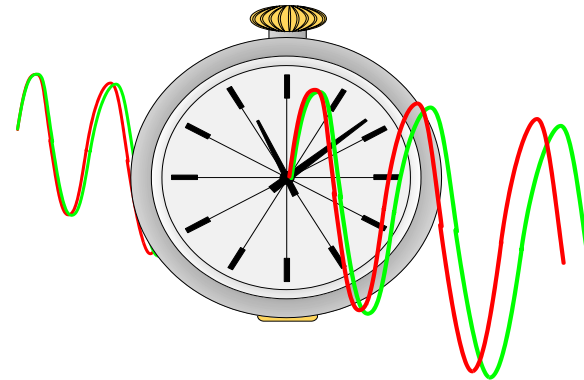
- Sensitive and repeatable
- Wide range - sensor designs
- Built in pulp stock recipes
- Robust solution
- Wide applicability in fiber line and bleaching
- Insensitive to air and conductivity swings
- Customer acceptance
- Sensor material for bleaching

- **Cons**

- Intrusive to process
- Fiber only measurement
- High installation cost
- High maintenance cost
- Can be slow to adjust after disturbances – mechanical

# Microwave measurement

- Around for 20+ years
- Most sensitive measurement
- Time of flight to consistency is linear relationship
- First choice for machine approach and stock prep applications
- Mostly used after bleaching process, with some exceptions



# Microwave Type



- **Pros**

- Most sensitive measurement
- Total solids
- First choice of paper makers
- Insensitive to fiber mix, type, production swings or fillers
- Wide range, linear to solids
- Non intrusive, no moving parts
- Mostly used after bleaching
- Ideal in stock prep, broke, BW control and OCC applications
- Simple calibration

- **Cons**

- Conductivity limits
- Sensitive to entrained air

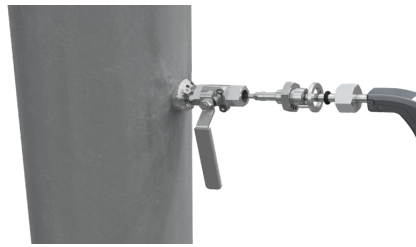


# Optical measurement

- Uses light reflection, dispersion, scattering or polarization or combination of above
- Around for 25 plus years
- Intended mainly for low consistency clean applications although manufacturers are pushing range limits



# Optical Type



- **Pros**

- Simplest installation
- Best solution in low solids like white water circulation
- No moving parts
- Process removable
- Can somewhat see fillers with recent technologies

- **Cons**

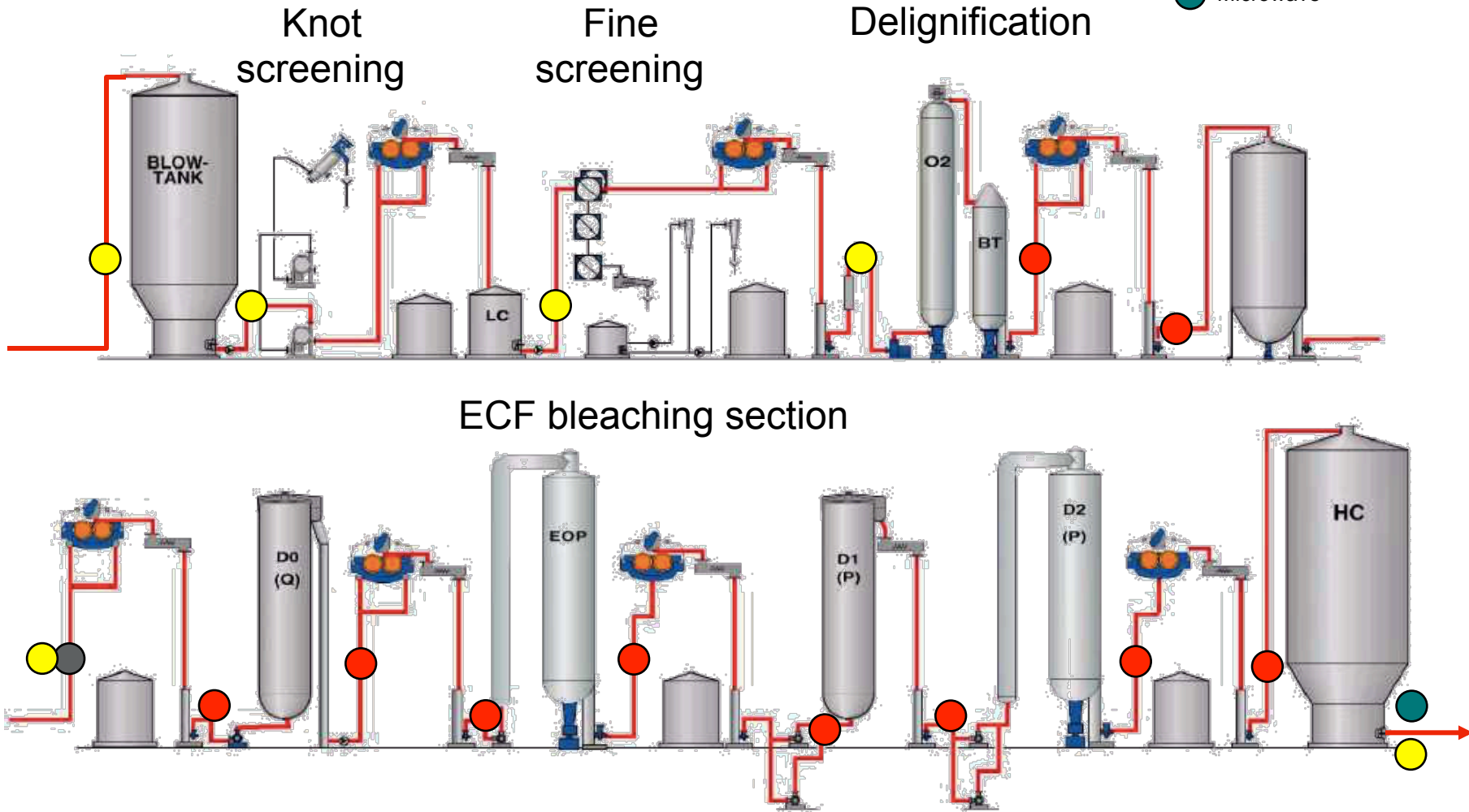
- Range limits
- Intrusive to process
- Sensitive to color
- Sensitive to freeness
- Lens can become high maintenance issues in some mill processes – cleaning
- Needs turbulent flow
- Can be complicated to calibrate when fillers content vary

## Sensor Comparison 1=weak 5=best

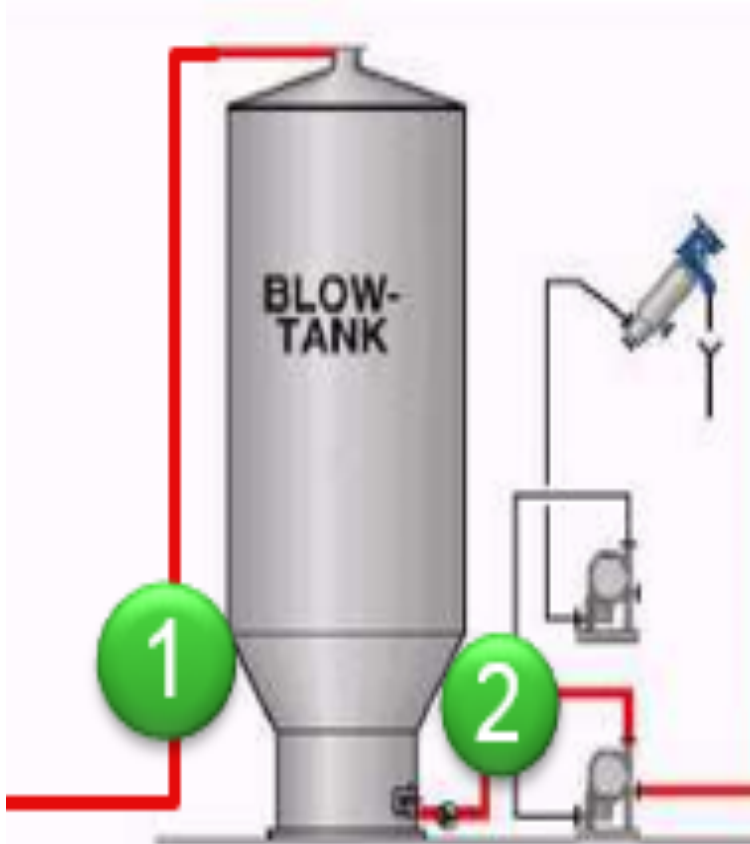
	Blade	Rotary	Microwave	Optical
Cs Range	4	4	5	3
Representative measurement	4	4	5	2
Sensitivity	4	4	5	4
Location piping	3	4	4	3
Flow profile	3	4	5	3
TSS (w/fillers)	2	2	5	3
Air content (P)	5	5	2	4
Brightness	5	5	5	3
Conductivity	5	5	3	5
Freeness	3	4	5	2
Ease of Calibration	4	4	5	3
Cost	5	2	2	3
Versatility	4	4	3	2

# Shear Force Predominant in Fiberline applications

- Rotary
- Blade
- Microwave



## Digester blow and blow tank – rotary best

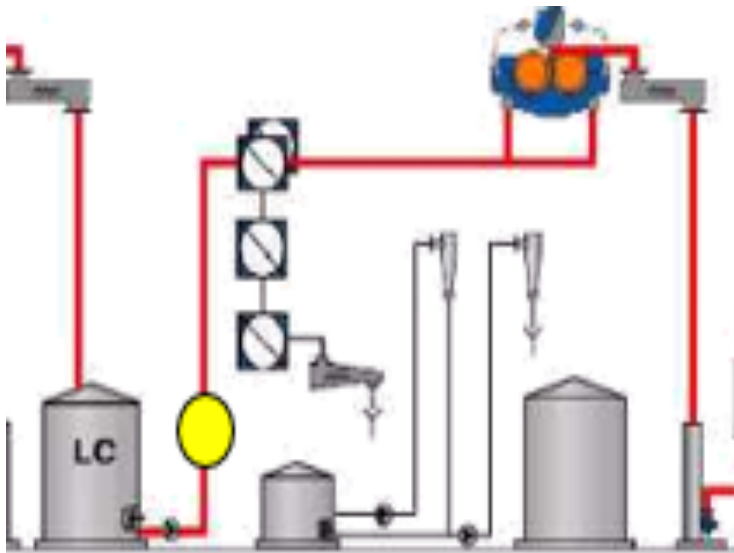


- First consistency measurement after cooking
- Reliable measurement helps control all downstream processes as well as help other measurements.
- Difficult location, sensor must be well protected.



# Critical Measurement

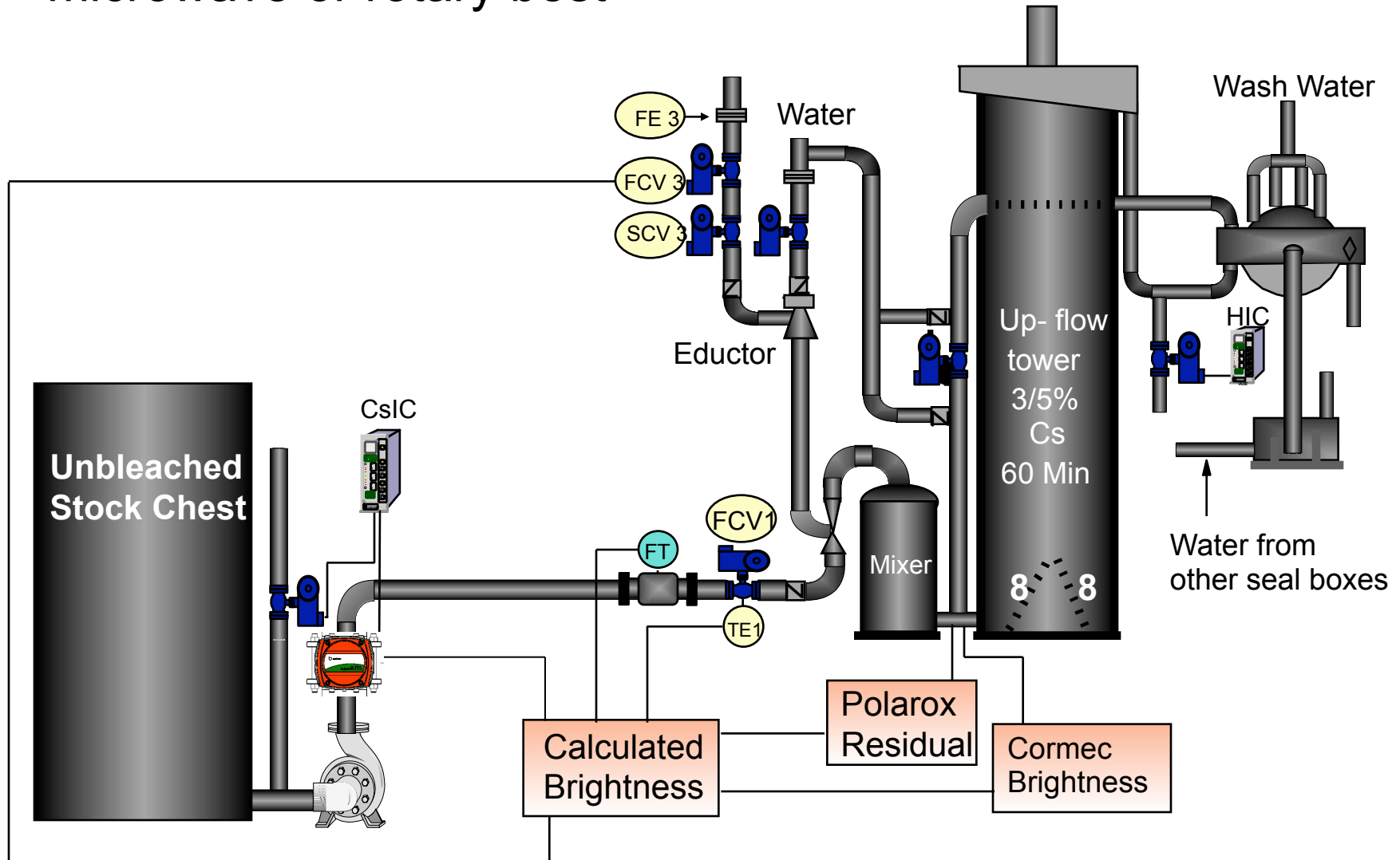
Feed to screening – rotary or blade best



- Good measurement helps control the screening process.
- Impregnated chemicals mean shear force is best solution
- For late screening stages, such as in clean TMP process, lower consistency range may suit optical device.

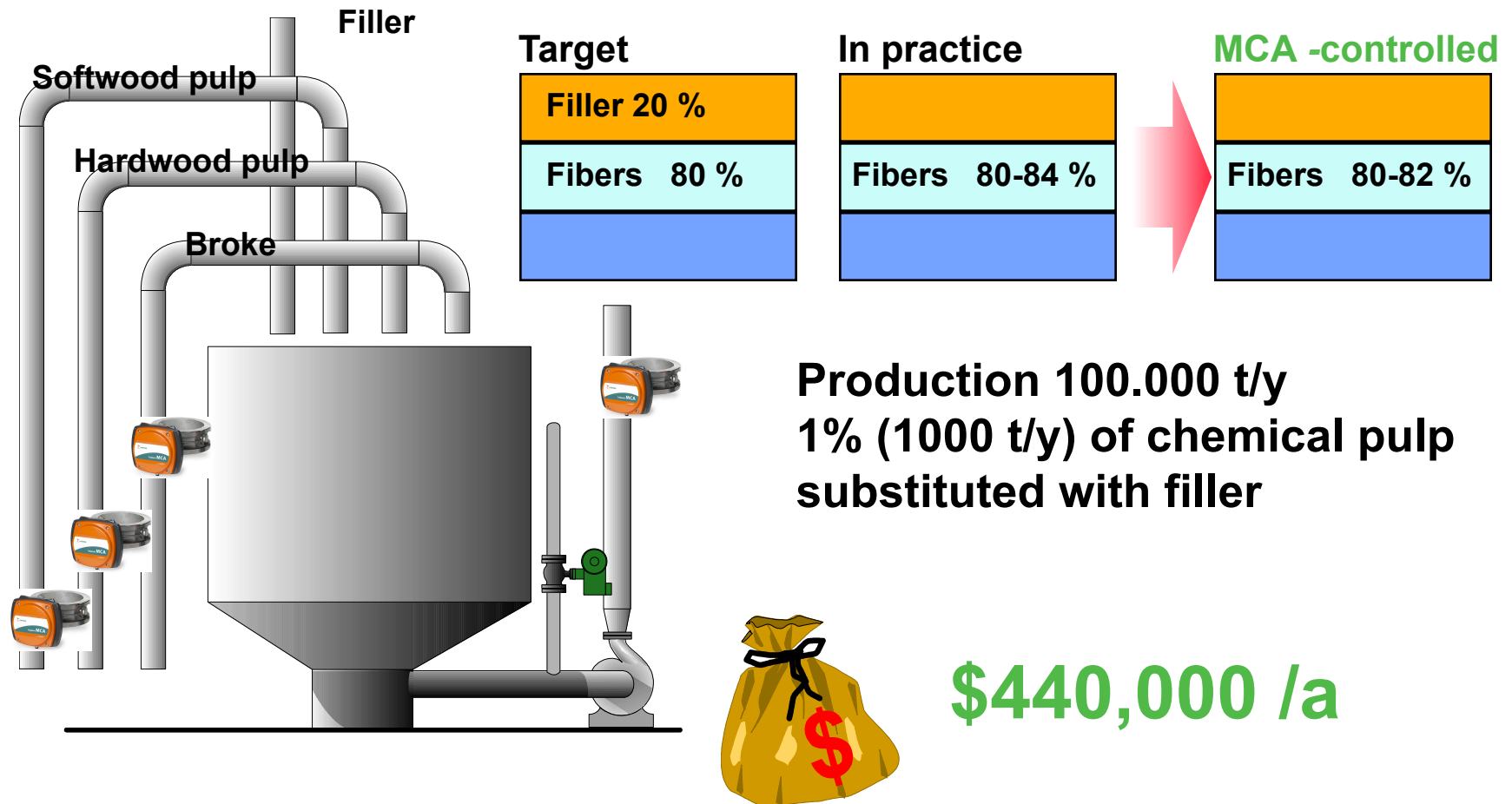
# Critical Measurement

Stock feed to bleaching (chemical dosing)  
microwave or rotary best



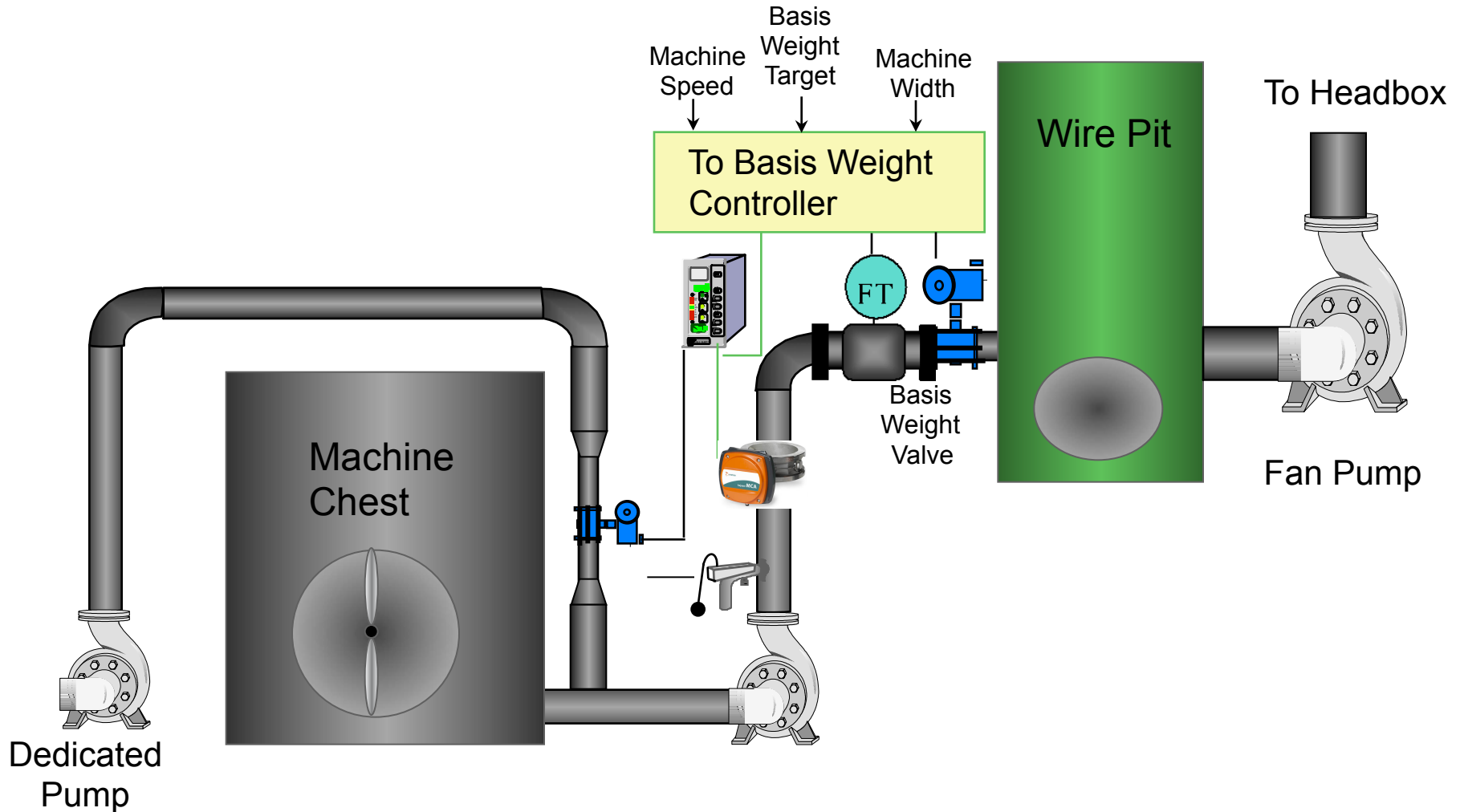
# Critical Measurement

Stock blending / stock prep – microwave best



# Critical Measurement

FF BWC – improve CD/MD profile – microwave best



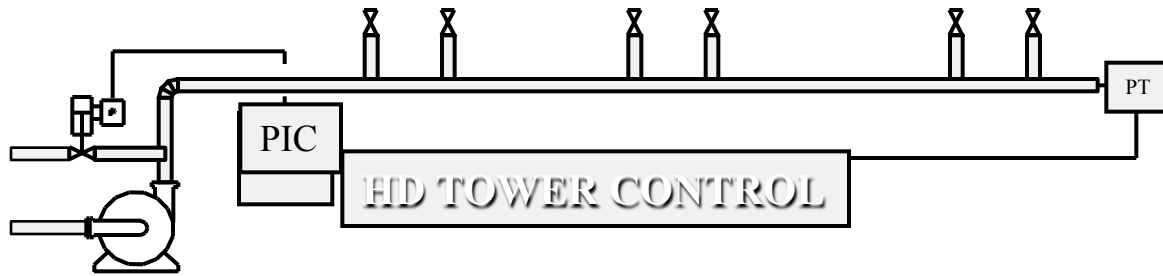
Consistency measurements  
*Things to think about*



## Influence of Consistency variation on ClO<sub>2</sub> consumption

<b>TX 1</b>	<b>Consistency %</b>	<b>Stock Flow lpm</b>	<b>Tonnage admtpd</b>	<b>Variation %</b>	<b>CIO2 %</b>	<b>[CIO2] g/l</b>	<b>CIO2 lpm</b>	<b>CIO2 kg/yr</b>
	3.10	14000	694.4	-4.62	1.2	12.0	434	2624832
	3.25	14000	728.0	0.00	1.2	12.0	455	2751840
	3.40	14000	761.6	4.62	1.2	12.0	476	2878848
<b>Std.dev (1 sigma)</b>	0.15		33.6				21	127008
<b>TX 2</b>	<b>Consistency %</b>	<b>Stock Flow lpm</b>	<b>Tonnage admtpd</b>	<b>Variation %</b>	<b>CIO2 %</b>	<b>[CIO2] g/l</b>	<b>CIO2 lpm</b>	<b>CIO2 kg/yr</b>
	3.25	14000	728.0	-2.99	1.2	12.0	455	2751840
	3.35	14000	750.4	0.00	1.2	12.0	469	2836512
	3.45	14000	772.8	2.99	1.2	12.0	483	2921184
<b>Std.dev (1 sigma)</b>	0.10		22.4				14	84672
	<b>Operating day:</b>			350	days/yr			
<b>If only chemical saving is seeked:</b>								
		<b>Reduction of std. dev. :</b>		0.05				
		<b>Saving in chemical:</b>		42336	kg/yr			
		<b>Price of CIO2:</b>		\$3.50	/kg			
		<b>Chemical Saving cost:</b>		\$148,176	/yr			

# Consistency Control Loop - Dilution

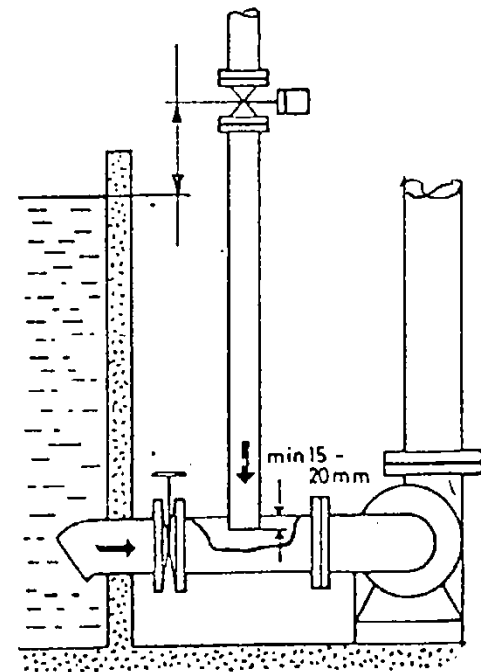


Consider for Header Pressure Control:

1. The pressure drop across the dilution control valve should be constant.
2. HD Towers and large intermittent users should have a dedicated pump.
3. If more than one consistency loop is supplied from the same header, the header pressure should be controlled to minimize interaction (VFD pump, or pressure control valve strategy ).

# Dilution Valve & Piping Installation

- Install valve as close as possible to the dilution point perpendicular to the stock flow.
- Dilution water pipe must enter main line close to the pump.
- Size the entry section to control flow velocity  $<4$  ft/sec.
- Use a V-ported style ball valve.
- Valve to have a equal percentage inherit characteristic which leads to linearity under process pressure.
- Dilution water pipe to penetrate main line by  $\frac{1}{2}$  -  $\frac{3}{4}$  inch minimum.



# Process Dynamics for Consistency Loops

## Targets

- Process Gain: 0.5-1
- Time Constant: 1 to 3 seconds
- Dead Time: 3 to 7 seconds

The process dynamics should be as linear as possible. A reasonable goal is that the process gain never changes by more than a factor of 2 over the entire operating range.

In double dilution strategy, pay attention to controller aggressiveness.

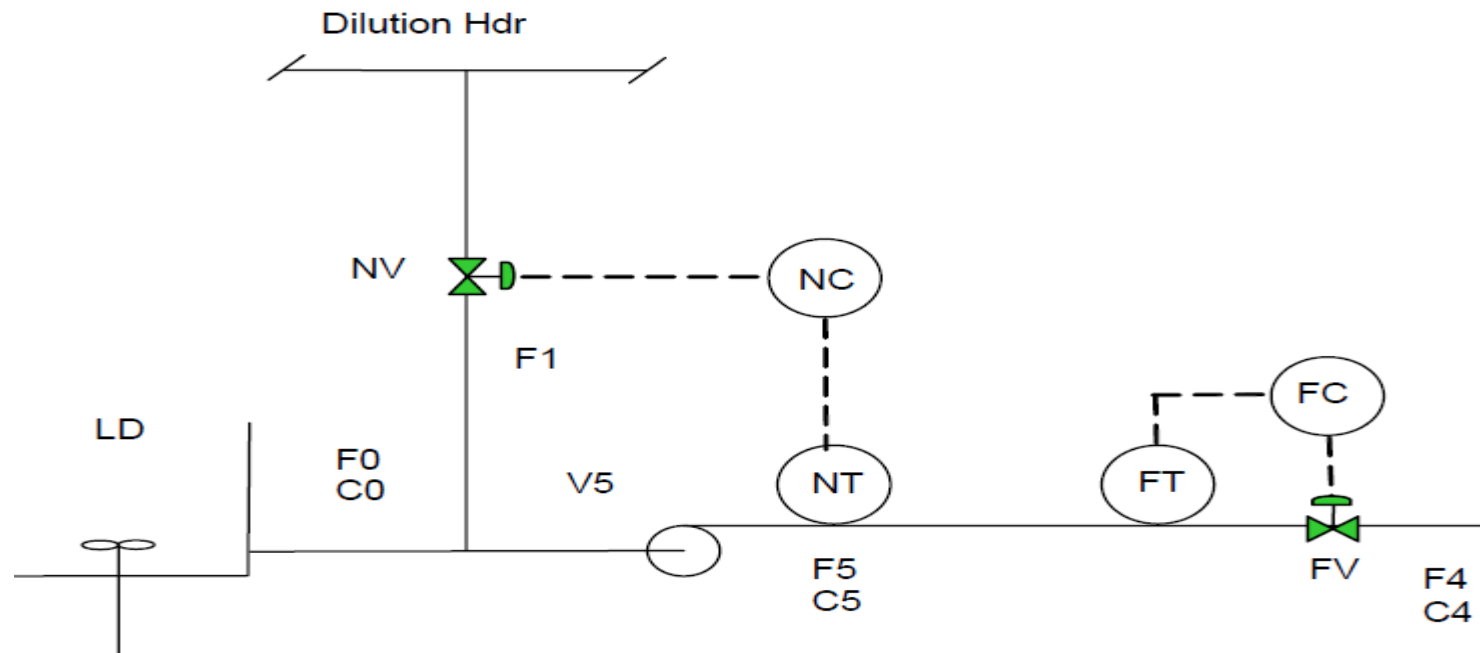
# 1. Small step, constant demand

## Most common design

Fiber balance  $F4 \cdot C4 = F0 \cdot C0$

Consistency output controls dilution valve position.

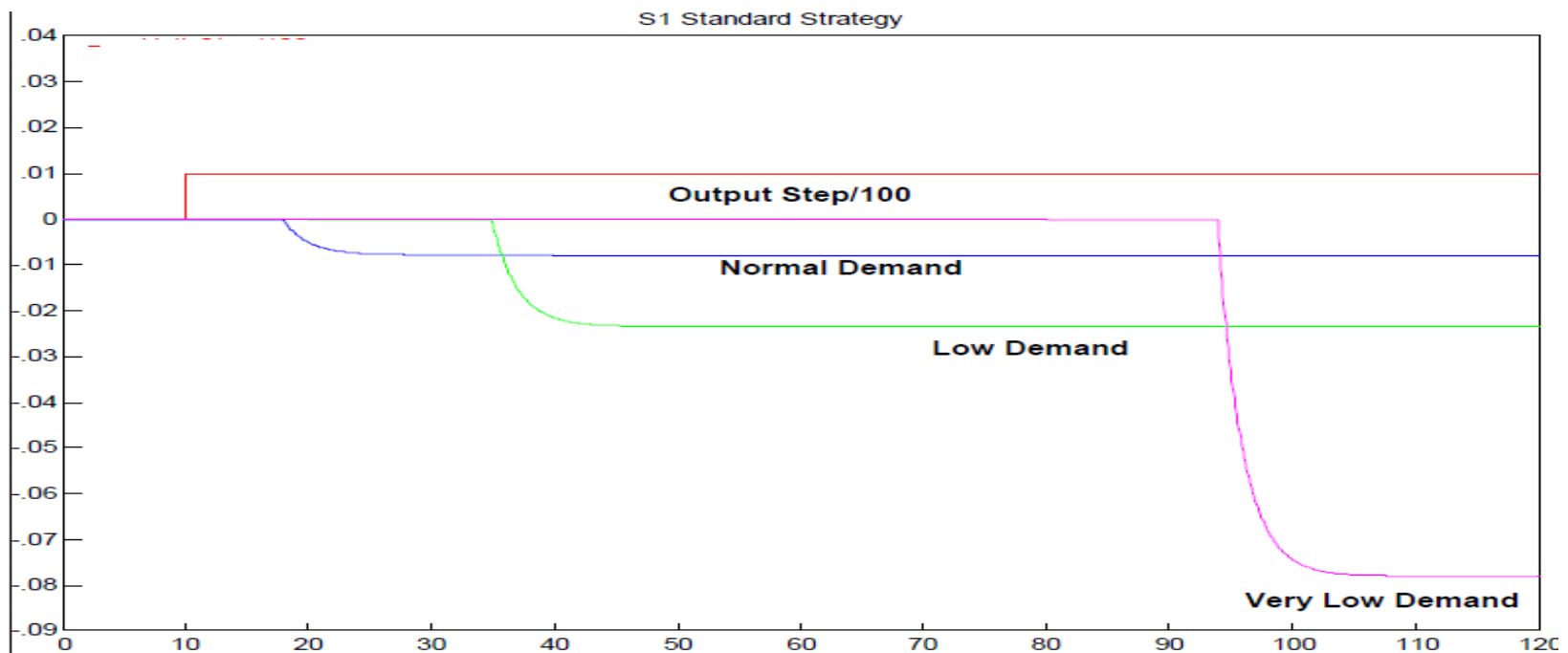
Must have a linear gain installed control valve and stable header pressure!



# 1. Small step, constant demand

## Response from open loop bump test

Simple strategy works well for normal demand





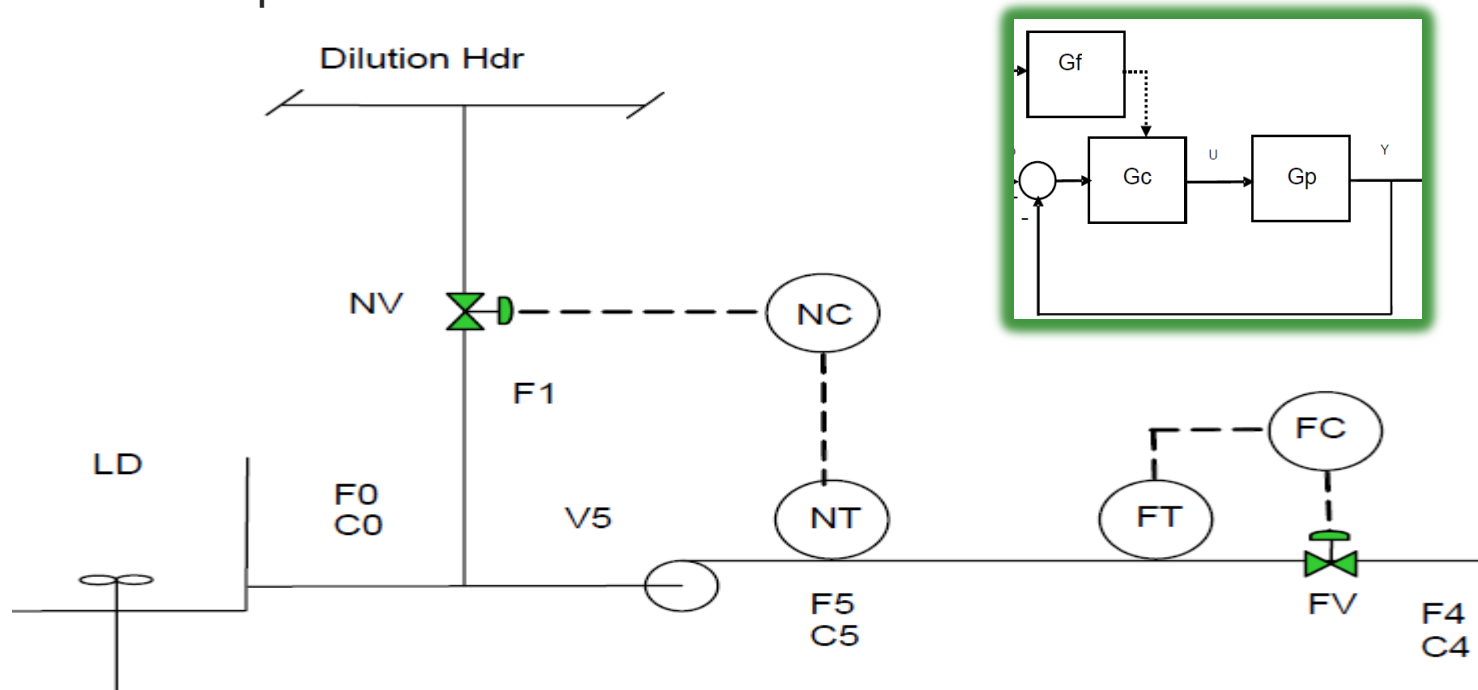
## 2. Small step, high demand flow (turndown)

## Common in LD chests

## Same strategy as first one, simple design

Same assumptions (header pressure, valve linear)

Add simple adaptive gain  $G_f$  determining controller gain and reset time based on demand flow set point

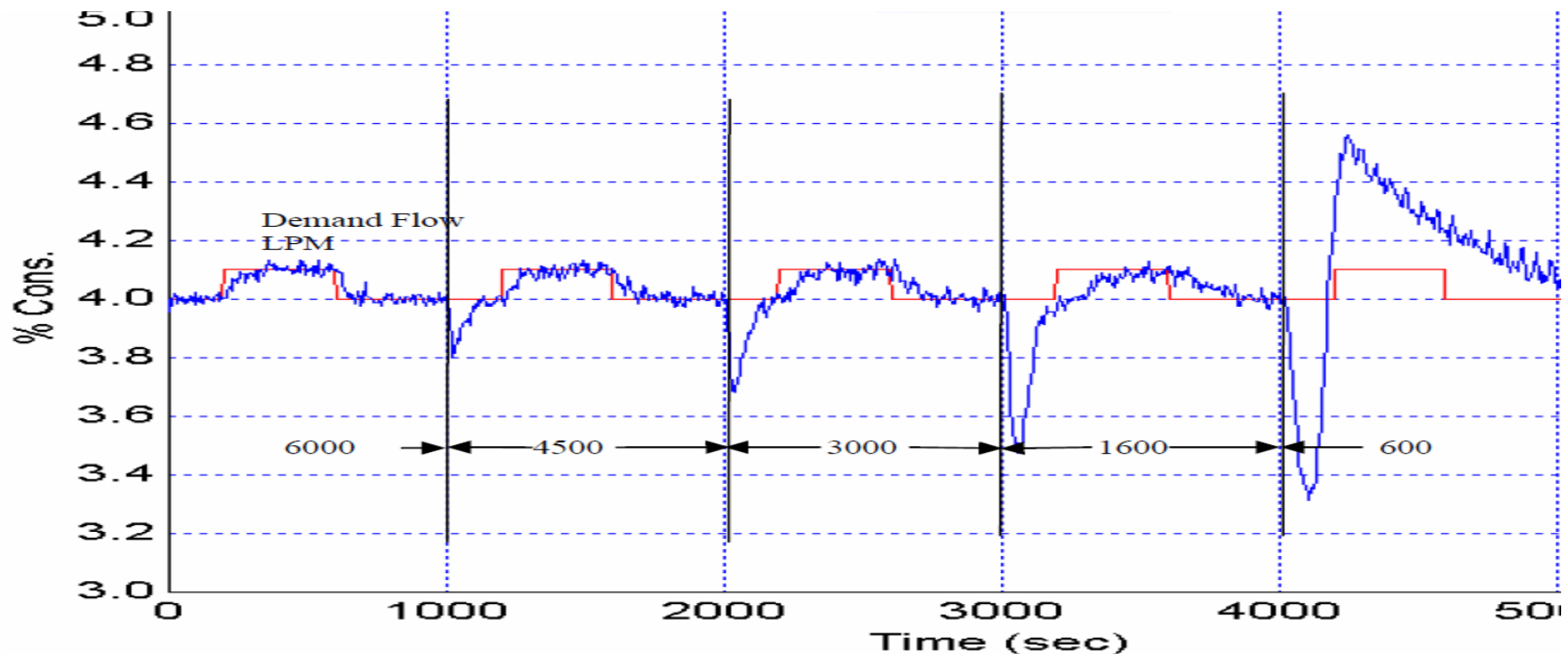


## 2. Small step, high demand flow turndown

### Adaptive gain added – bump tests

Simple strategy works better for flow variations

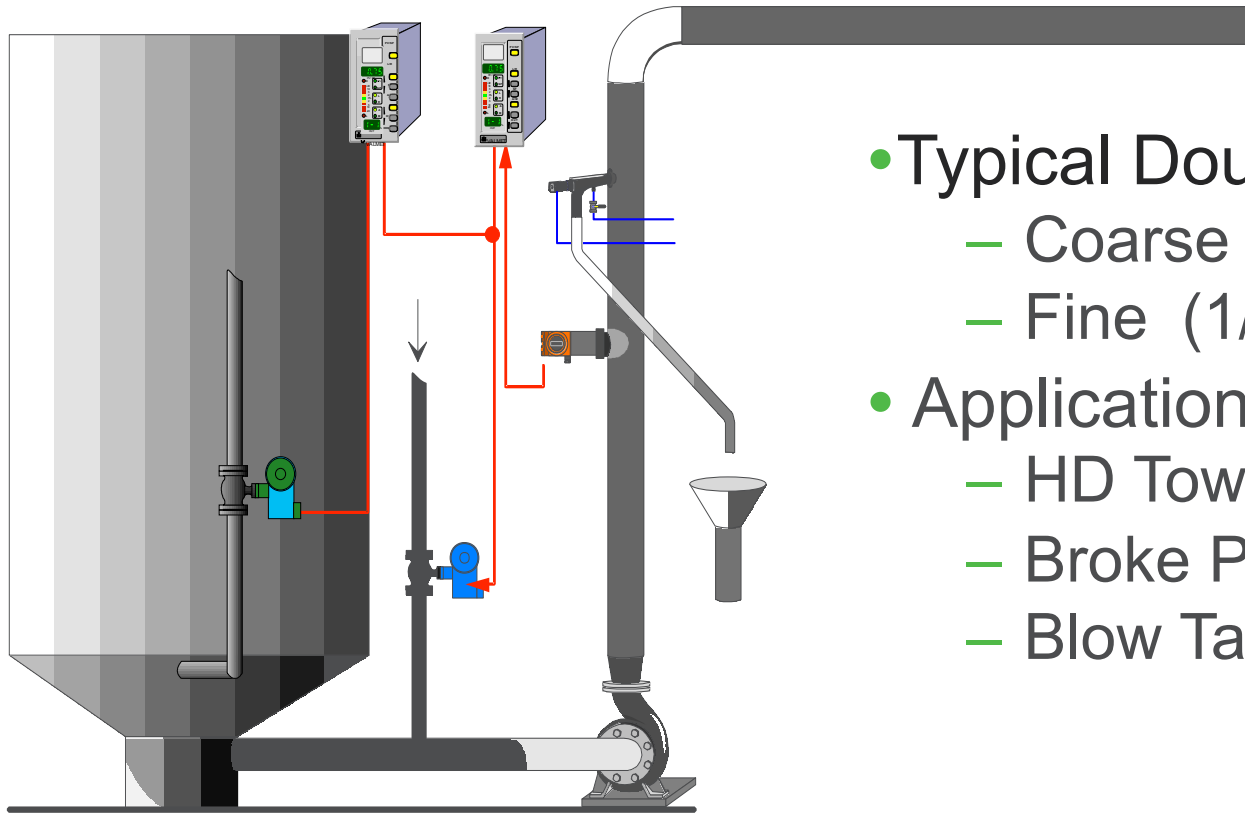
Note at low flows the process variable (PV) tracking the set point becomes sluggish, showing this works best for turndowns of less than 4 (6000/1600 LPM)



### 3. Large step, constant demand

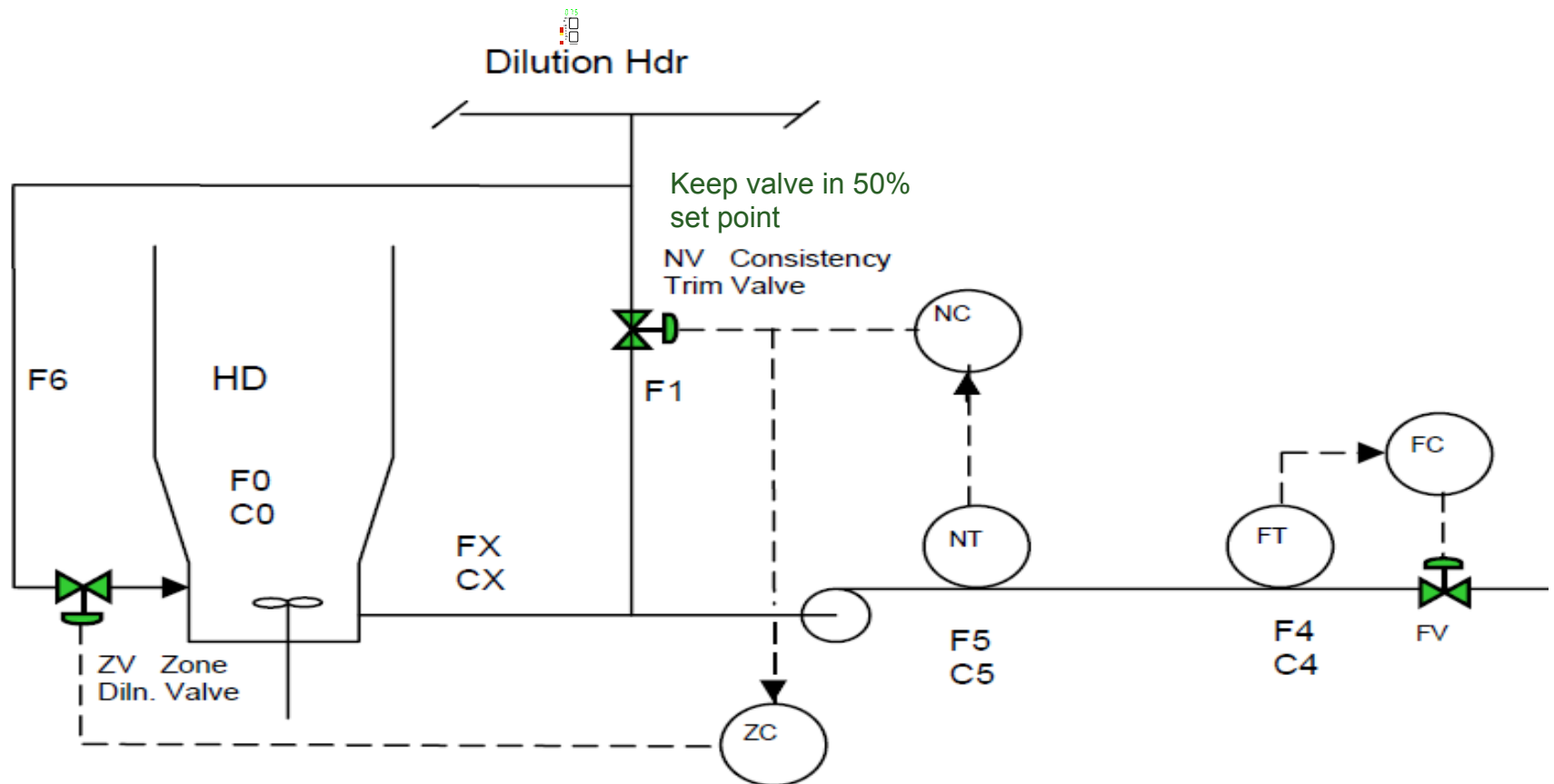
#### Dual dilution system

A trim dilution valve is controlled from the consistency transmitter in the demand flow, at the same time that much larger water flow is controlled in dilution zone of tower.



- Typical Double Dilution
  - Coarse ( $3/4$ )
  - Fine ( $1/4$ )
- Applications
  - HD Towers
  - Broke Pulpers
  - Blow Tanks

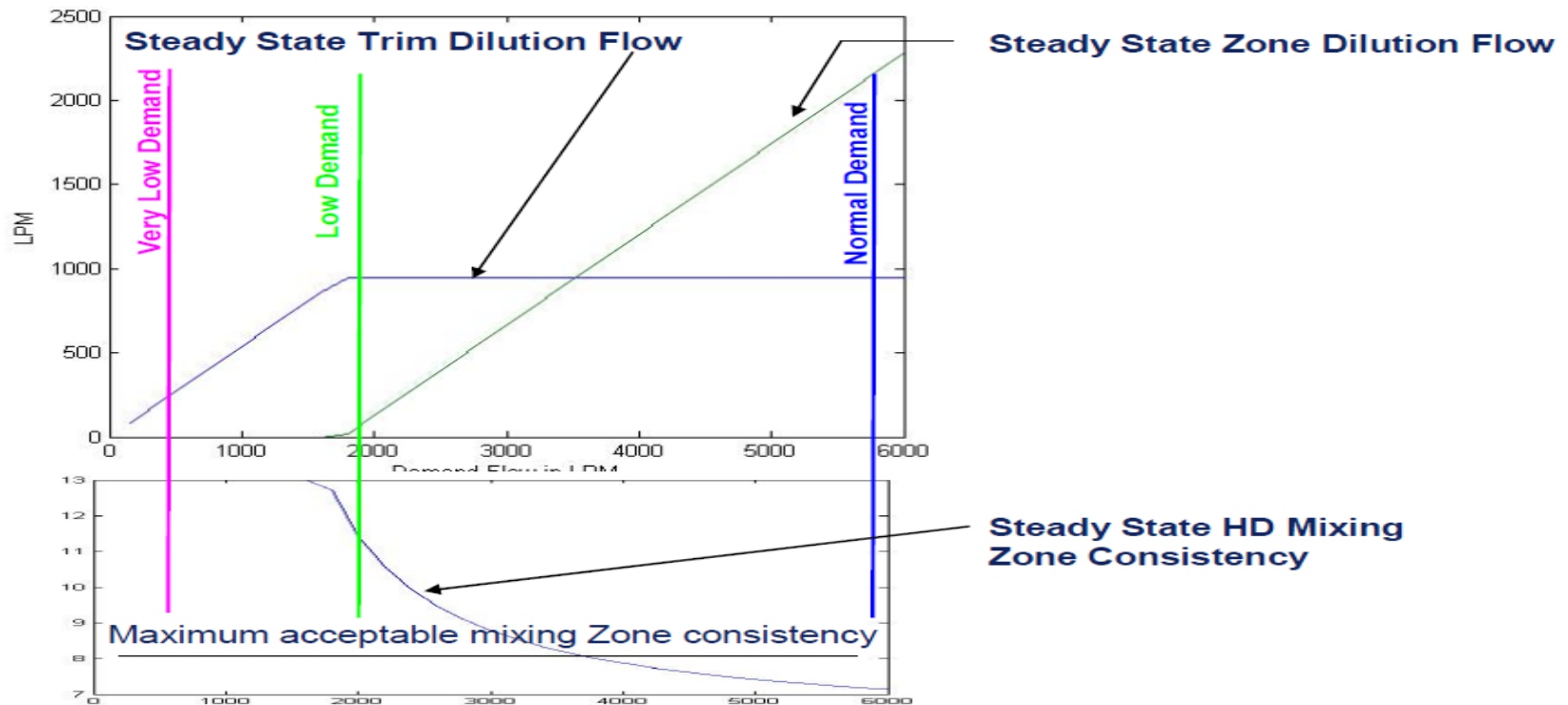
## Dual dilution system with mid range controller added (ZC)



### 3. Large step, constant demand

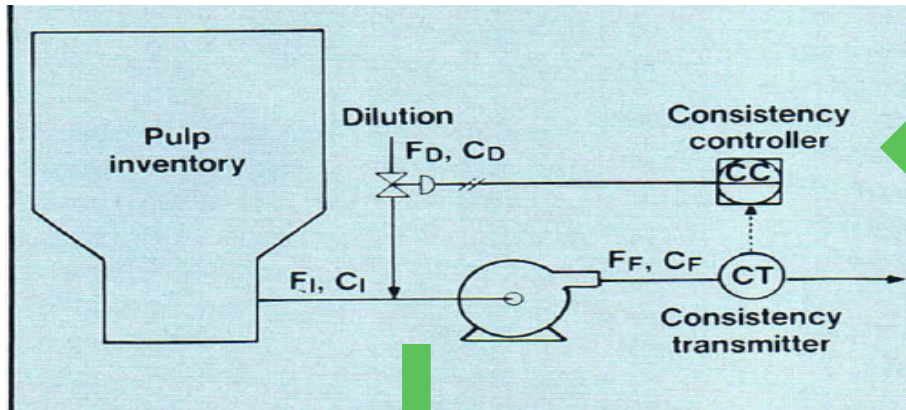
#### Dual dilution system with mid range controller added (ZC) HD Towers example

Tower dilution flow midranges the trim dilution valve until the demand is so low that the tower dilution valve is closed. With tower dilution closed, if demand flow drops significantly, the strategy will not work.





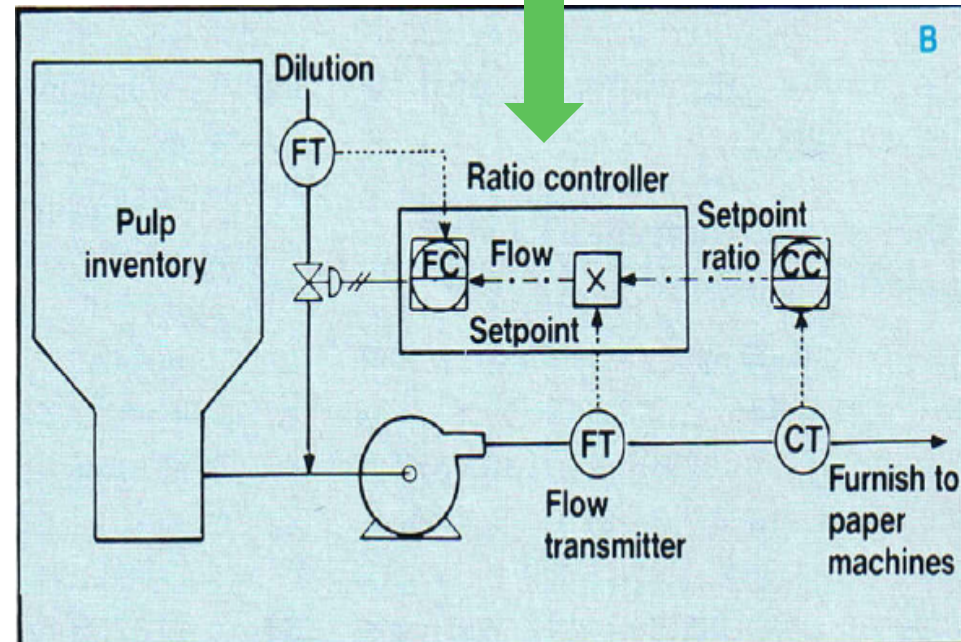
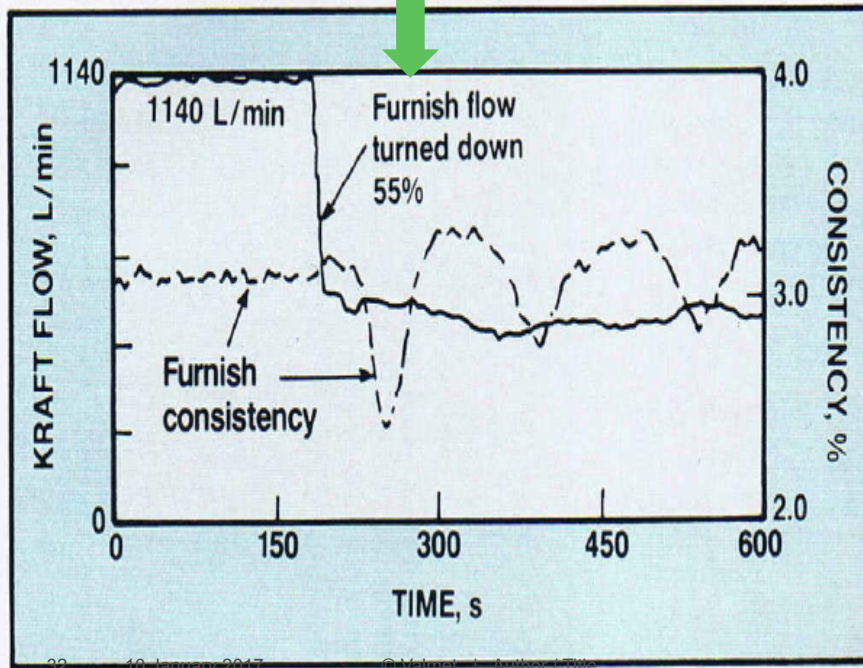
# Ratio control can help eliminate cycling loops



Typical loop set up based on  $C_s$  set point

Perfect place to redesign with ratio flow control

3. Loss of stability with conventional consistency control when furnish flow is turned down (1140 L/min = 300 gal/min)





# Consistency Control

## Think it through

- Poor mixing in chest/tower including dilution zone
  - Test agitation and mixing, review retention time
- Poor sensor and sampler installation
  - Review and adjust, small change can have drastic result
- Variable dilution header pressure – multiple demand
  - Use pressure control or similar strategy on dilution
- Poor control strategy / controller tuning
  - Review and adjust, many strategies available and proven in use
- Process dynamics like large demand flow turndown velocity
  - Be aware of loop behavior to various disturbances, as well as recipe needs
- Poor level control tuning of pulp storage chests
  - Target steady (70% full) level in towers to minimize work of the Cs loop
- Limited instrument calibration range
  - Production range variations can mean calibrating across demand flows





# **PACWEST 2016**

## **"EMBRACING TECHNOLOGY"**

### **Auditing Your Lab to Insure Sensor Reliability**

**Sandy Beder-Miller - Senior Applications Specialist**

**BTG Americas INC**

**Rick Van Fleet - Cave Creek, Arizona**

**June, 2016**



# TOPICS

- Why is the lab so important to sensor performance?
- What is Repeatability and how do we quantify it?
- The importance of a good sample valve
- Variability Makers in the lab
- How to conduct a lab audit?
- Real life challenges and solutions



# Why Should We be Concerned?

- We rely on well calibrated on-line sensors and analyzers
  - Rapid update to advanced control
  - The “eyes” for the operator
  - Reduce manual testing
- Sensors are calibrated to a lab test
- Every analyzer and sensor has “error” associated with it
- Each test has the following
  - $\text{Variance}_{(\text{total})} = \text{Variance}_{(\text{process})} + \text{Variance}_{(\text{measurement})}$

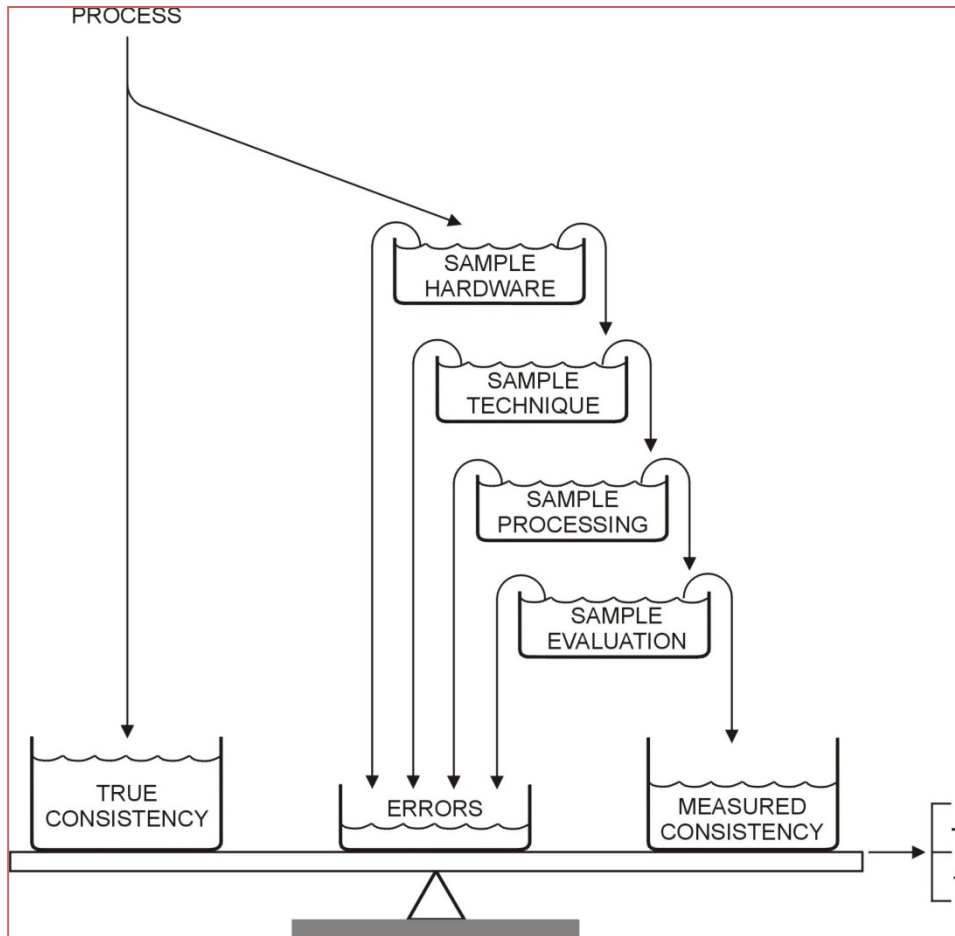


# Measurement error

- **Repeatability** is a term used to describe a precision study for an individual operator's variation when the same sample is tested under the same conditions.
- **Reproducibility** is a component of precision associated with operator-to-operator differences when several operators run the same sample under identical conditions.



# Accuracy of sample



- Sampling method
- Repeatable equipment
- Lab routine

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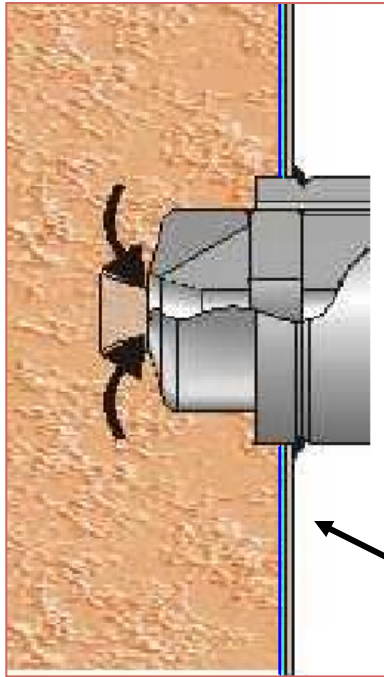


# The ball valve – a reliable sampling valve?

- Sample is taken at pipe wall > **Bad sample**
- Dewaterers pulp unless fully opened > **Bad sample**
- Different opening degrees at different occasions and for different operators > **Bad sample**
- Gives large volume and splashes at high line pressure. **Safety Concern**
- Often plugged at start > **Safety Concern**
- Low price – **Is the bad result worth it?**



# A Reliable Sampling Valve



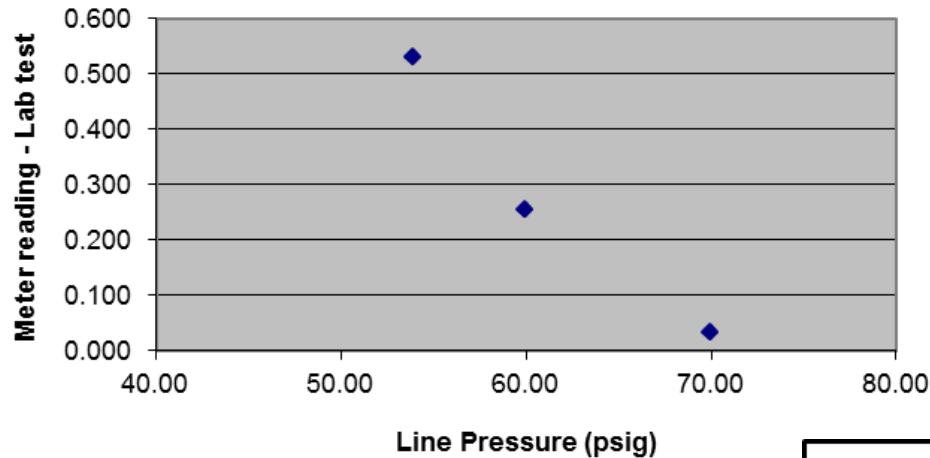
- Takes the sample well inside the pipe wall – inside the water film!
- Always fully open
- Not depending on operator
- Safe to operate under all conditions

Water film

**The location of the sampling valve is important, it should extract the same sample as the consistency transmitter is measuring**

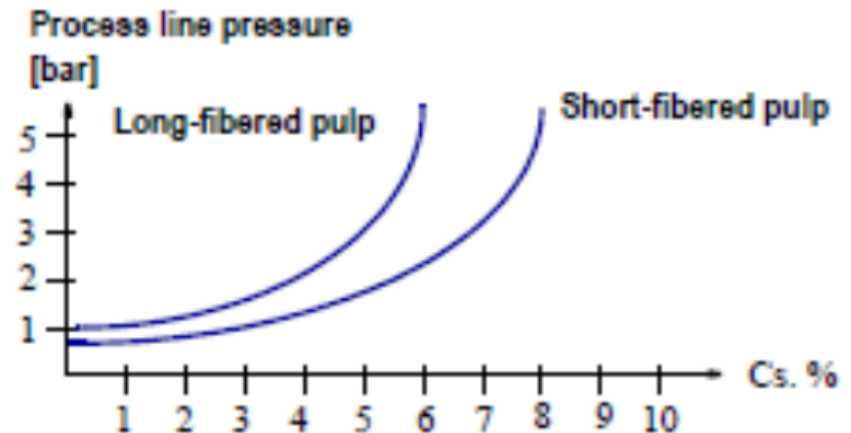


# The Importance of Knowing Your Application



Varying line pressure will effect the consistency test

Always select the appropriate sampling Valve for the species and process conditions



"EMBRACING TECHNOLOGY"

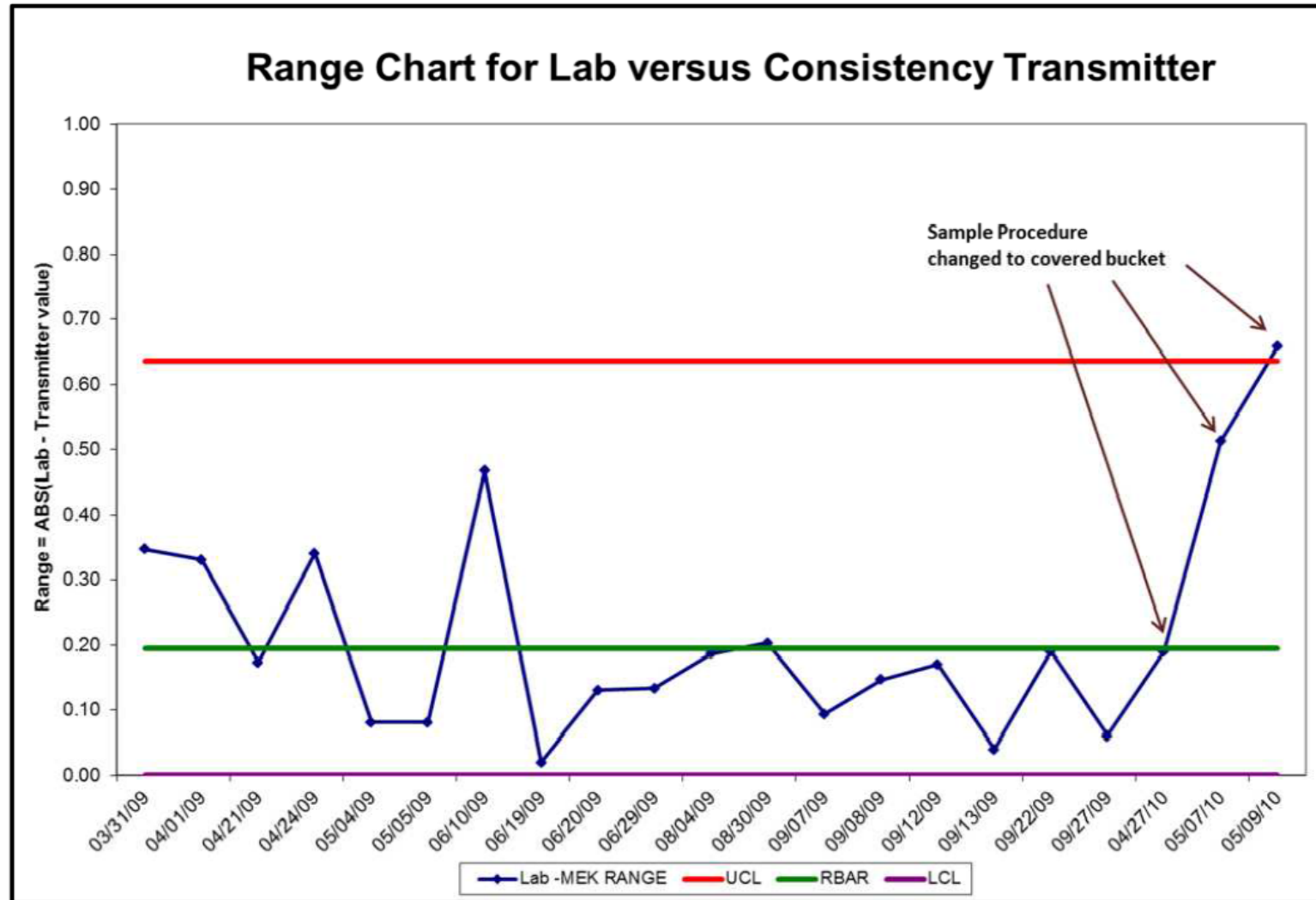


# Variability Makers In The Lab

- Bucket versus separate containers
  - Covered or not?
- Weighing the sample
- Not using enough sample in the test
- Washing the sample
- Drying the sample (too hot?, scorched?)
- Lab cleanliness
- Testing chemicals
- Temperature compensation
- Testers

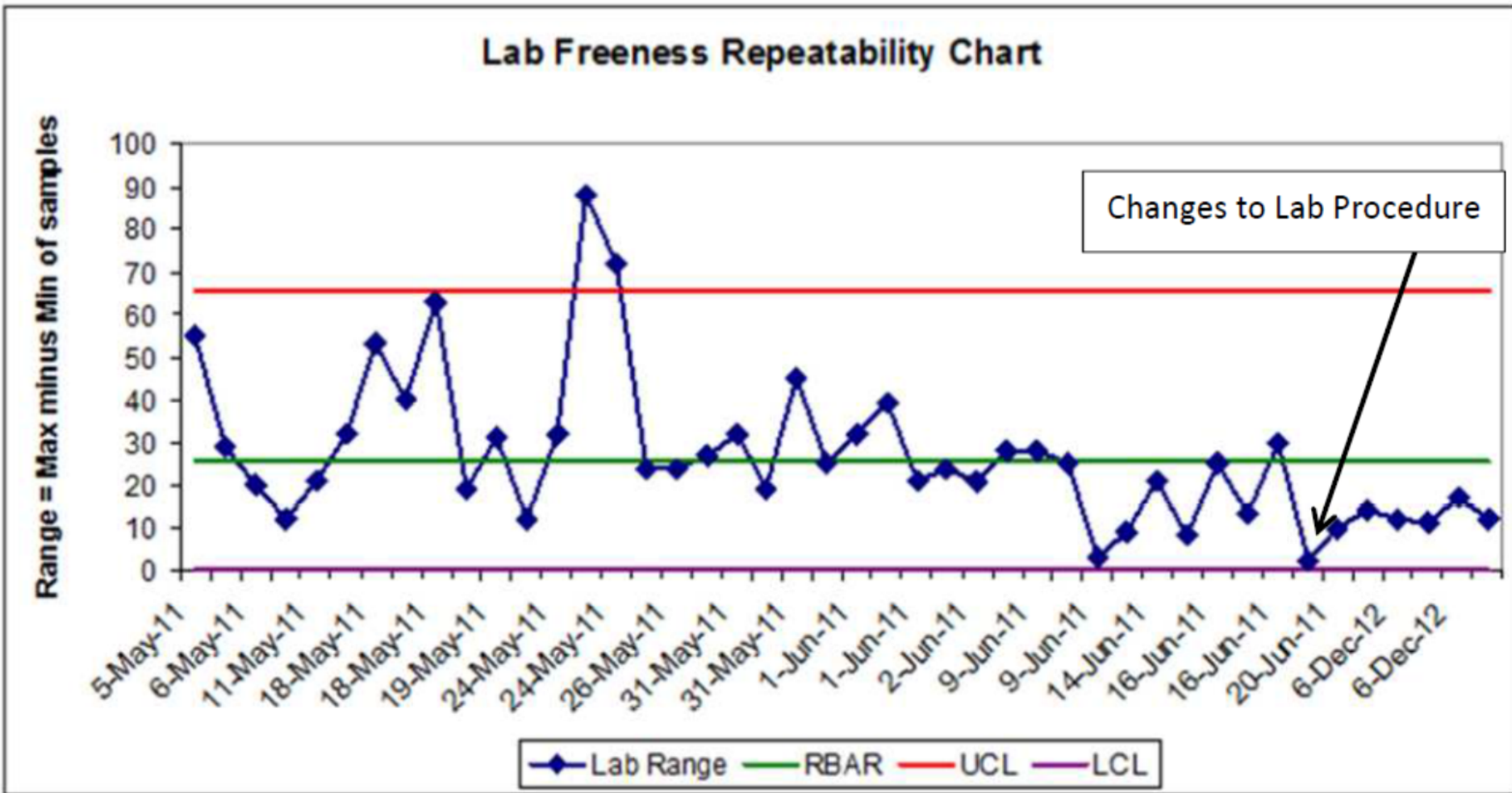


# A Small Change Can Make A Big Difference



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# Identifying the Cause of the Variability



# The Laboratory Audit

- Quantify laboratory variability BEFORE calibration starts
- Need 30 sets of repeated samples
- We are measuring:

$$\text{Total Variance}_{(Total)} = \text{Process Variance} + \text{Measurement Variance}$$

$$\% \text{ Measurement Variance} = \frac{\text{Measurement Variance}}{\text{Total Variance}} \times 100$$



# Lab Audit Procedure

- Review current test procedure
- Involve all testers who will be involved in calibration
- Observe testers from sample collection through processing the sample without comment
- Report the results using a control chart and calculate statistics



# How Bad is Bad?

- Normal field testing is usually over 20% measurement error!
- “Central” labs are better @ below 10%
- A Kappa Example:

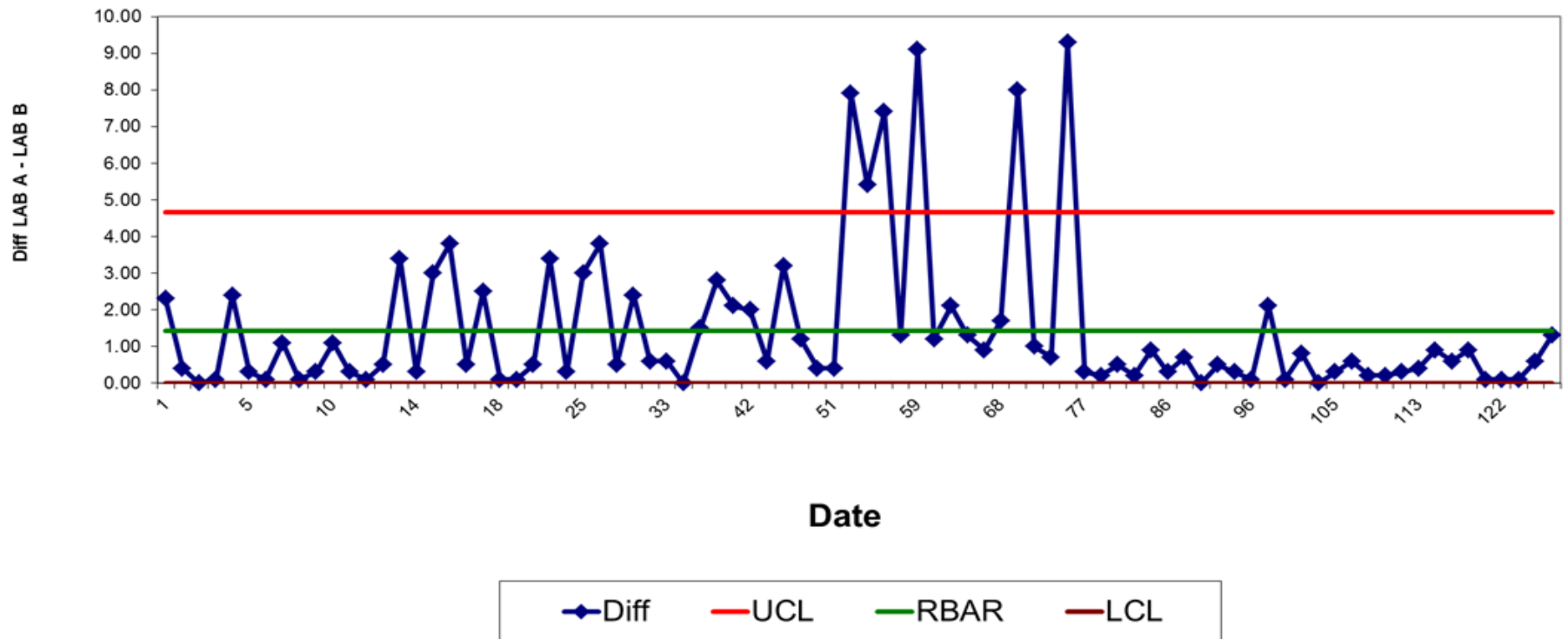
Source	Standard Deviation	Variance	Percent of total
Measurement	1.26	1.60	22.25
Total	2.68	7.18	

- This error is added to the measuring error associated with the analyzer or sensor



# How can we reduce the measurement error: A Kappa Example

Lab Variability for Testers  
Difference Between Two Lab Tests On Split Sample



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# Uncovering the Variability Makers Leads to Improvement

Source	Standard Deviation	Variance	Percent of total
Measurement	0.90	0.82	11.37
Total	2.68	7.18	



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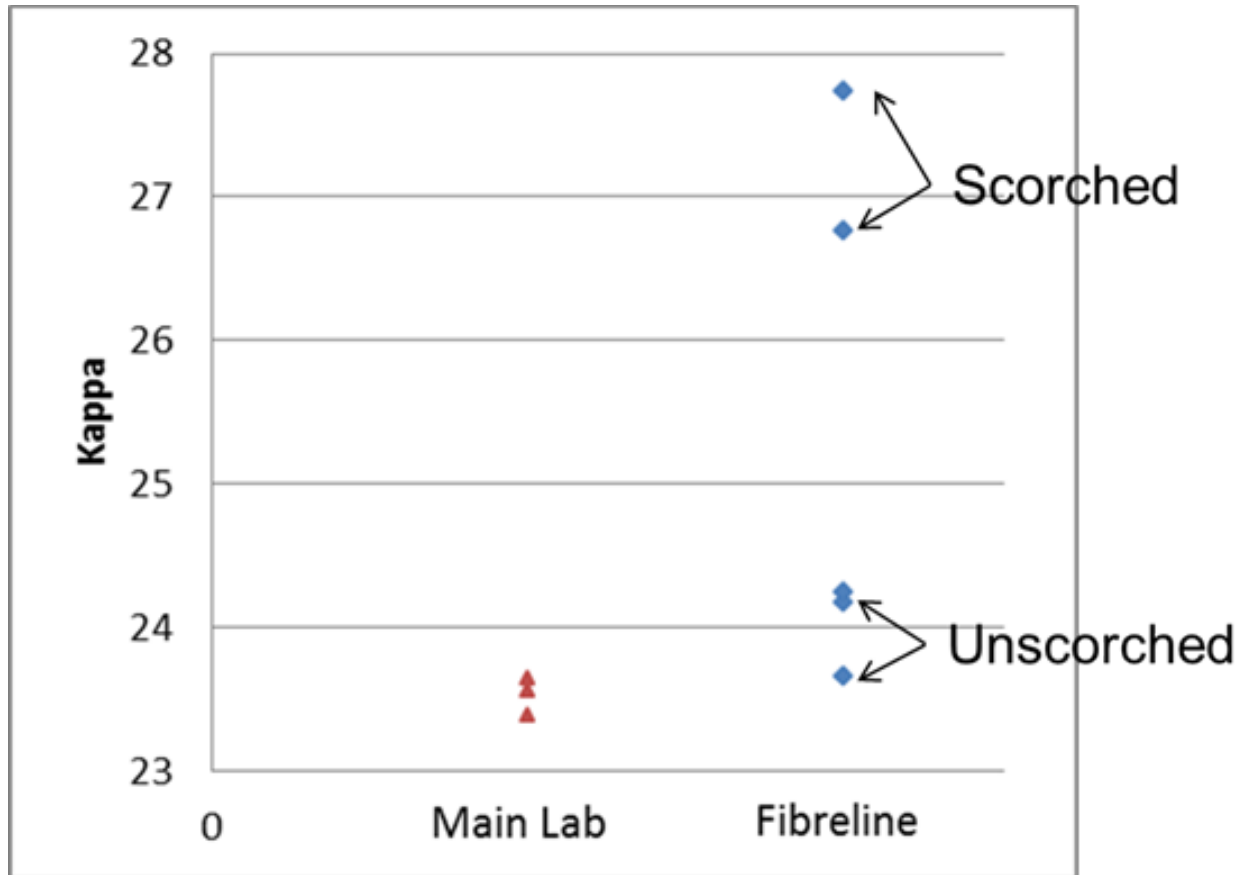


# Another Example: Improving Lab Kappa

- Zellstoff CELGAR
- Kappa tests processed at two locations
  - Main lab (used for calibration)
  - Field lab (used as a quick check)
- Methods varied
- Equipment differences
  - Main Lab: oven
  - Field lab: speed dryer
- Review of methods initiated when mill started to measure Bleach Load

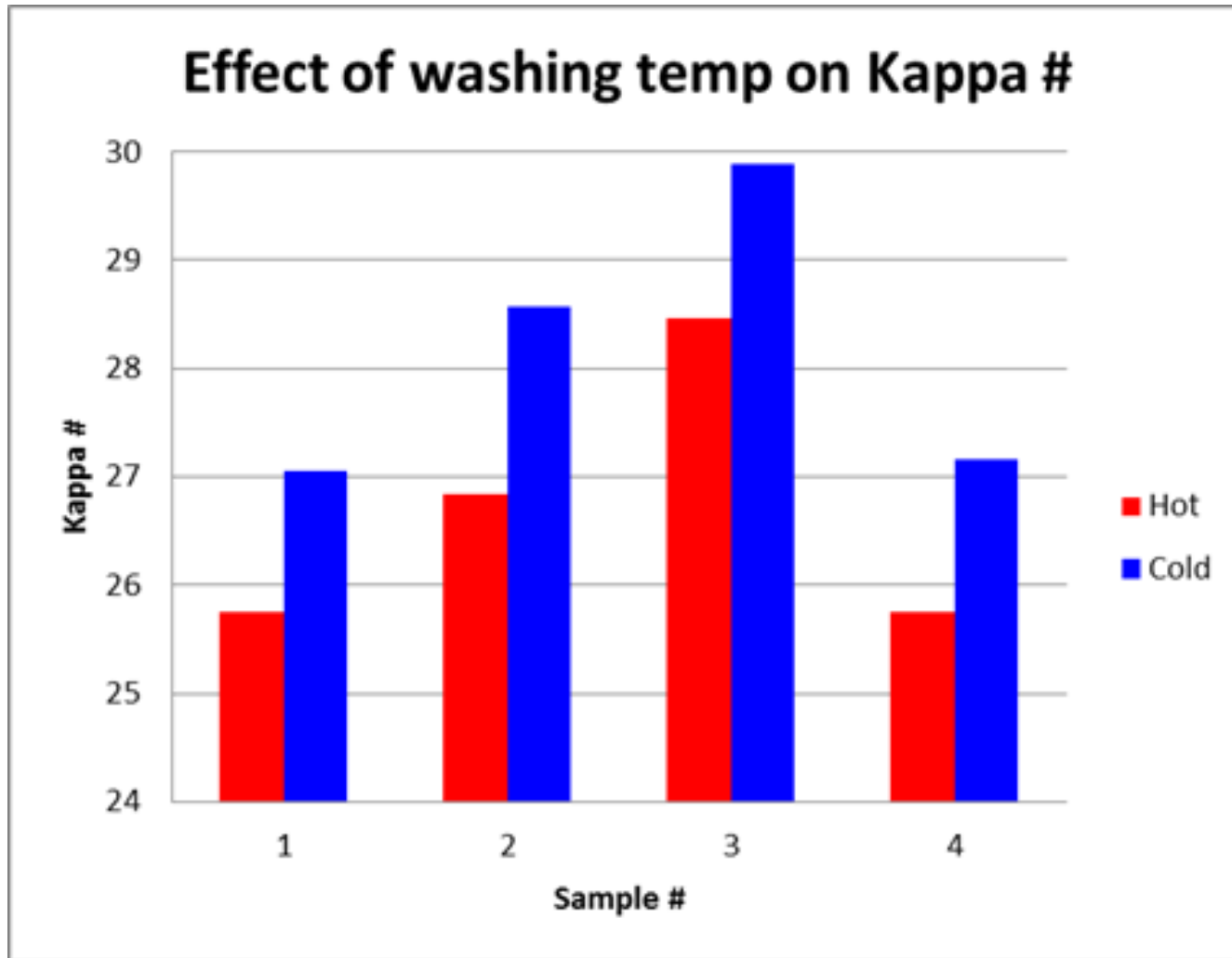


# Pad Drying Temperature Effects Kappa



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# Washing Temperature Effects Kappa



# Other CELGAR Lab Improvements

- New titrators to add chemicals
- New chemical dispensers
- Color coding the dispensers, carboys so there were no mix ups.
- Ensuring the carboys got cleaned of crusty solids (read 100% chemical!!)



# Summary

- Spend the time to audit your lab BEFORE undertaking a major calibration effort
- How you sample is critical
- Need for well written procedures and training
- Constantly work to reduce measurement error
- Measurement error will influence the overall error of your analyzer or sensor



Thank You For Listening!!

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406-295-7095 (office)



RAISING YOUR PRODUCTIVITY

# Collaborative Innovation:

## *Driving Value in Instrument Development and Implementation*

Marty Hoskins

Business Development Manager – Pulping

PAPTAC Bleaching Committee Meeting  
Fall of 2016  
Hinton, Alberta



“For good ideas and true innovation,  
you need human interaction,  
conflict, argument, debate.”

Margaret Heffernan



The process of translating an idea or invention into a good or service that creates value or for which customers will pay.

To be called an innovation, an idea must be replicable at an economical cost and must satisfy a specific need. Innovation involves deliberate application of information, imagination and initiative in deriving greater or different values from resources, and includes all processes by which new ideas are generated and converted into useful products. In business, innovation often results when ideas are applied by the company in order to further satisfy the needs and expectations of the customers.



# Invention vs. Innovation

- Invention is the creation of something.
- Innovation is the creation of something that has value.
  - May be the implementation of an invention in a unique way that gives it value.

Innovation always involves the creation of



“Necessity is the mother of invention.” – Author Unknown

Maybe, but.....

**Necessity IS the mother of innovation!**

*Sometimes we do not know what we need.*

Most people did not know that they “needed” a smart phone until the iPhone came to market.



Evolutionary innovations (continuous or dynamic evolutionary innovation) that are brought about by many incremental advances in technology or processes.

- iPhone
- iPod

Revolutionary innovations (also called discontinuous innovations) which are often disruptive and new.

- Skype
- Facebook

<http://www.businessdictionary.com/definition/innovation.html>

# Why is Innovation Important?

“One of the symptoms of an absence of innovation is the fact that you lose your jobs. Everyone else catches up with you. They can do what you do better than you or cheaper than you. And in a multinational corporate-free market enterprise, it is the company's obligation to take the factory to a place where they can make it more cheaply.”

Neil deGrasse Tyson



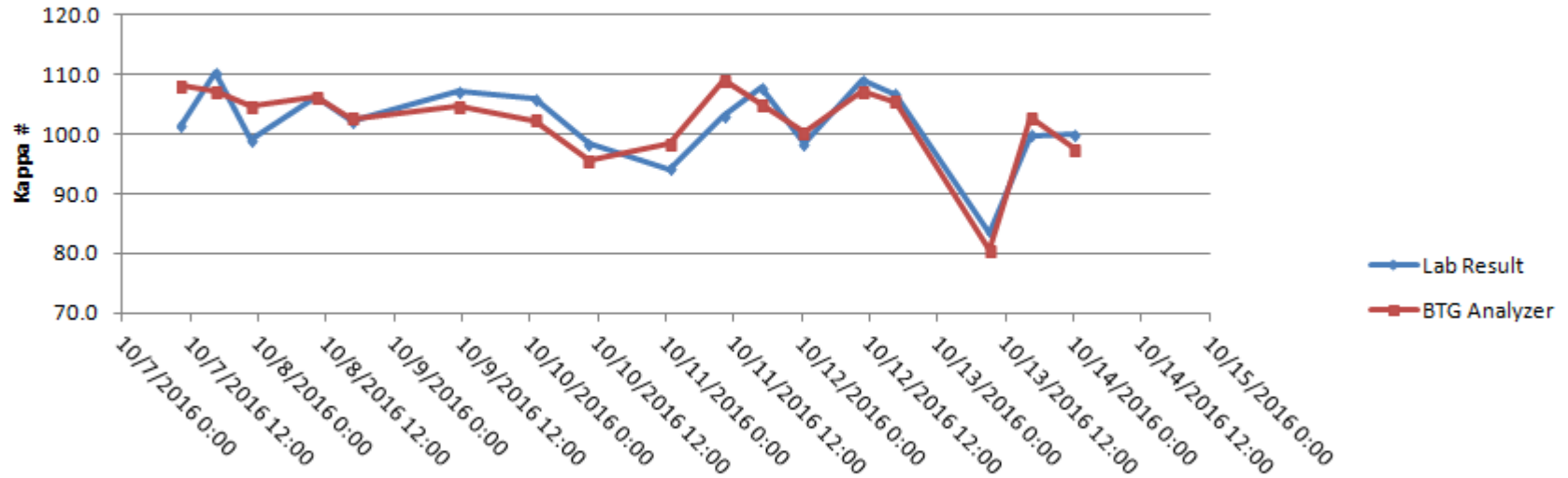
Examples of Collaborative Innovation

# Single Point Kappa Analyzer



- Concept instrument for smaller bleached mills
- Designed with low kappa (<50) in mind
- Potential for High Kappa digester control

# Single Point Kappa Analyzer



- Customer took significant informed risk
- Instrument modifications required to process longer, stiffer fibers



# Innovation Means Value

	Before	After
Target Kappa	90	104
Kappa COV	9%	<4%

	% Change
EA to Wood Ratio Changes	-45%



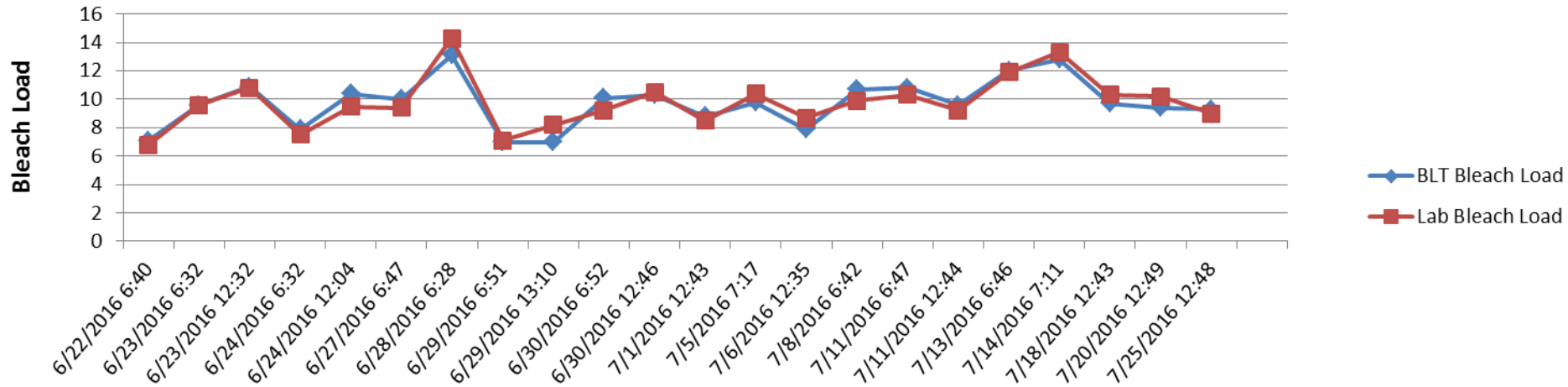
# Bleach Load Transmitter

- Designed to measure total lignin entering bleach plant
- Potential to use as a brightness meter for feed forward control

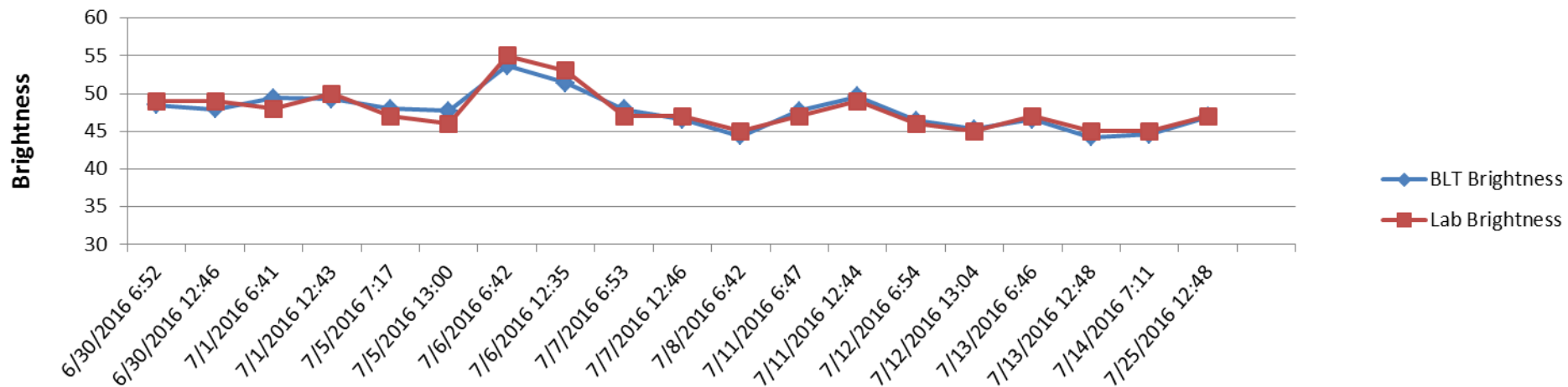


# Bleached Load Transmitter

## Bleached BLT Time Series Trend



## Bleached BLT Brightness Time Series Trend

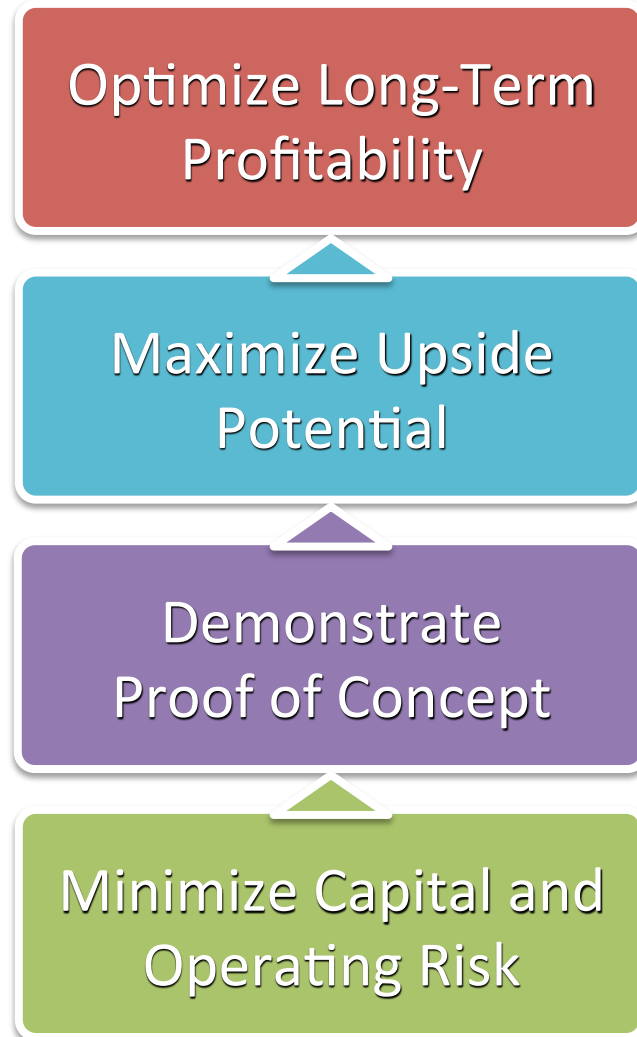


# Innovation Means Value

- One instrument – two process parameters
- Bleach Load as a feed back for first stage  $\text{ClO}_2$  control
- Brightness as a feed forward for further  $\text{ClO}_2$  control for brightening



# Unique Commercial Approach



# Unique Commercial Approach

1. Identify a value based project
2. Develop a project scope and price
3. Develop a pilot price and pilot time period
  1. Pilot price paid to supplier from generated savings
  2. No savings – No payment!
4. When pilot price is paid – decision time!

# Innovation Means Value

- Potential to develop proof of concept without capital
- Realize project savings much earlier by quicker approval and implementation



# Elements of Innovation

- ✓ Culture
- ✓ Communication
- ✓ Conflict
- ✓ Courage

“For good ideas and true innovation, you need human interaction, conflict, argument, debate.” - Margaret Heffernan

“I have not failed. I’ve just found 10,000 ways that won’t work.” - Thomas A. Edison

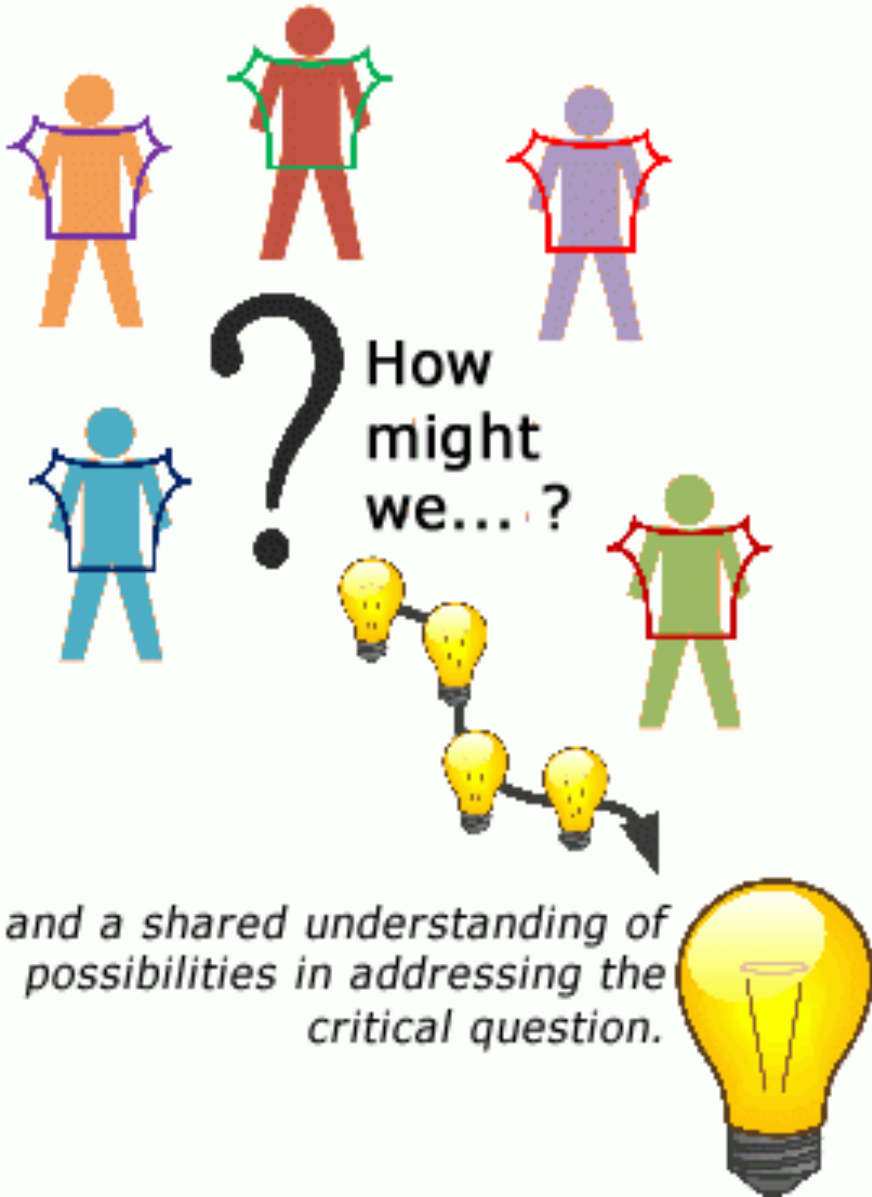
“Success is not final, failure is not fatal: it is the courage to continue that counts.” - Winston Churchill





# Collaborative innovation

*People with a diversity of views...*



For true innovation, which drives value, we must be willing to fail!

Supplier and User must be willing to work together with the same goal – increased value.

Supplier must help user understand the risks.

Customer must have the courage to continue in the face of failure.

# Closing Comments

- We could debate various definitions or key elements for innovation
- We cannot debate that collaborative innovation is critical to our future success


*“Without tradition, art is a flock of sheep without a shepherd. Without innovation, it is a corpse.”*

*- Winston Churchill*

“One who fears failure limits his activities. Failure is only the opportunity to more intelligently begin again.” – Henry Ford



**THANK YOU!**



# Online Kappa & Brightness Measurements, Fiber Length & Shive Analyzer, Inline Brightness and Chemical Residual Measurement Technology

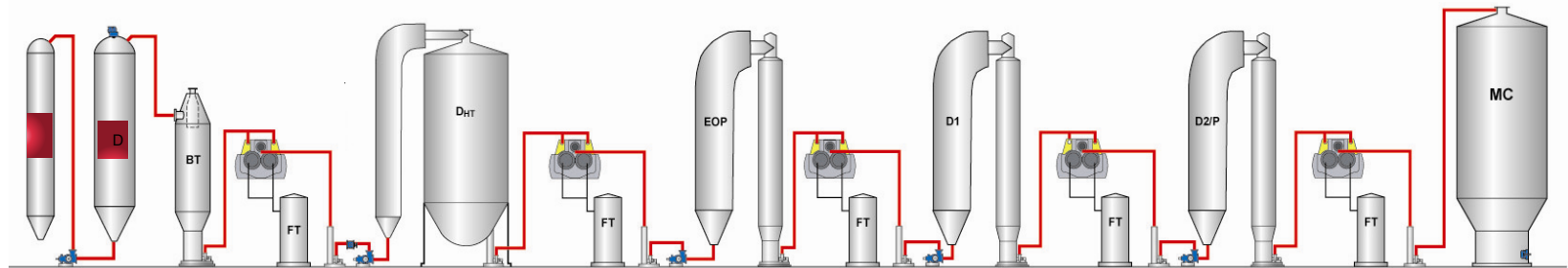
Presented by

James Goldman

Valmet Solutions Manager

# Stock Samples from Critical Process Locations

## First Step in Optimizing your Process



Blowline    Bleach Feed

Post Eop

Post D1

Final Pulp

K

K

K

B

B

B

S

S

S

S

S

F

F

F

F

F

**K** Kappa (fiber lignin)

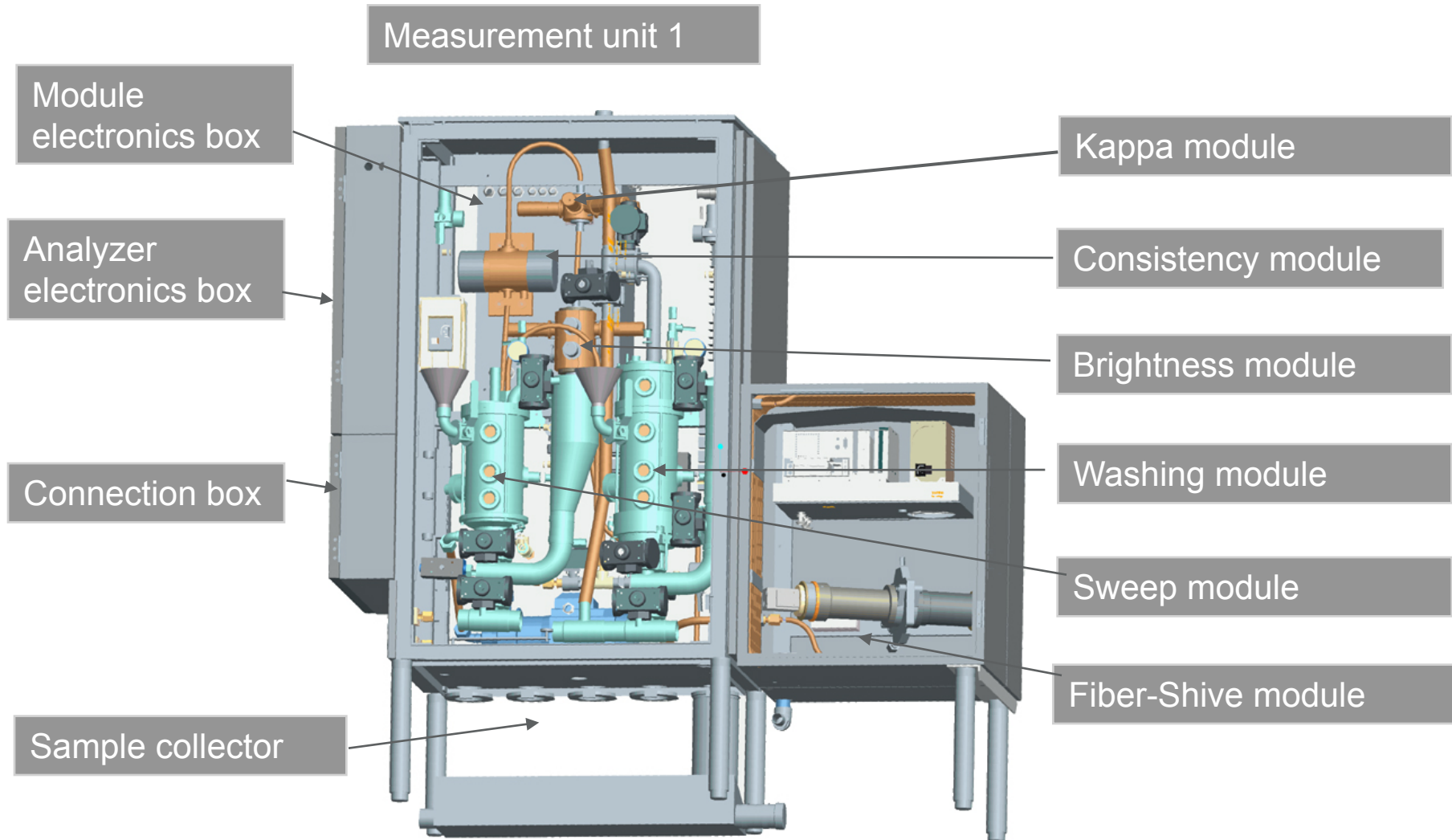
**B** Brightness

**S** Shive Count

**F** Fiber Length

# Kappa Analyzer Overview

## Main Components Of The Cabinet



# Automatic Process Sampling Devices

## Reliable Sampling

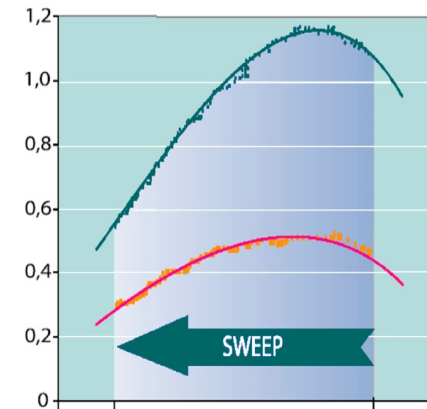
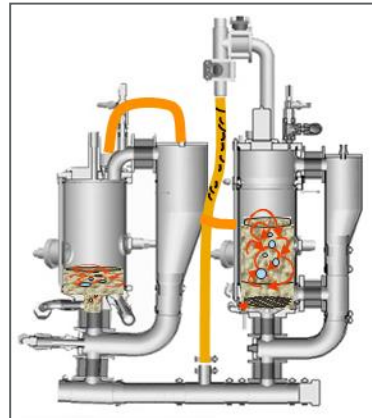
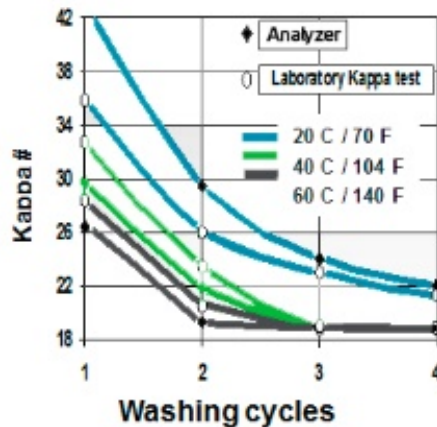
- Piston/Cylinder **metal to metal** construction, no gaskets, robust design and continuous operation for years. Minimum **service** period **one year**.
- Prescreening of knots and big particles already in the process; blow and midpoint with SD-502. Titanium based SD-505 for  $\text{Cl}_2/\text{ClO}_2$  applications.
- Different sample volumes corrected by analyzer's **consistency adjustment**.



**SD-502/505  
piston closed**

# Performance

## Unique sample treatment and measurement



### Hot water sample transportation

- Important especially with brown pulp samples to avoid lignin precipitation on fiber

### Hot water washing

- Removes all black liquor quickly

### Mixing & Washing

- Air and water together give powerful mixing
- Pressurized washing
- Pulp meets measurement and laboratory test cleanliness
- No fiber losses

### Sweep measurement

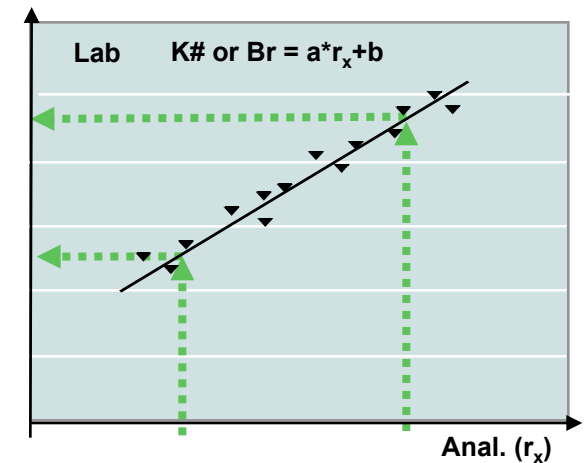
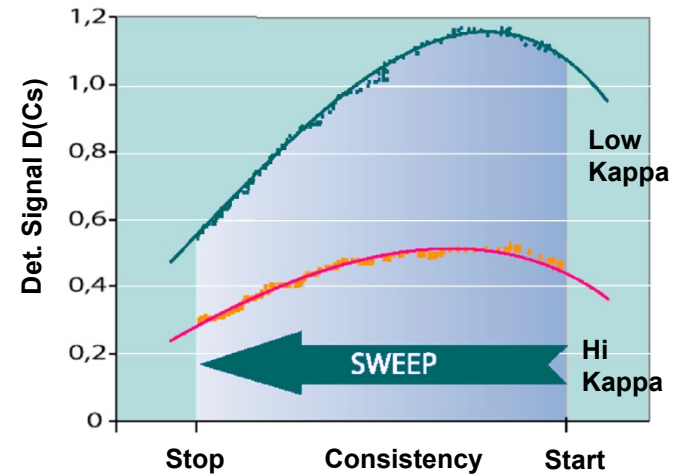
- Hundreds of Kappa measurements in a minute
- Brightness measurement with high accuracy up to 95 ISO
- Measurement response is linear to lignin content and brightness



# Kappa Analyzer Measurement Principle

## Sweep measurement:

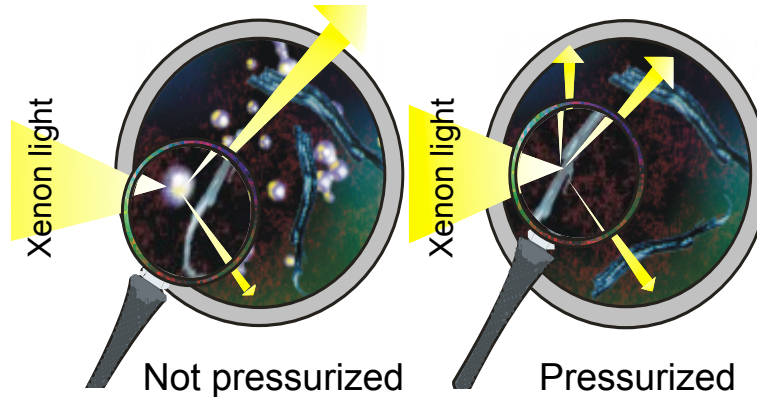
- The sweep measurement is based on this continuous optical response curve over a pre-set consistency range
- Kappa measurement with high accuracy from high yield kappa pulp down to micro levels
- The measurement loop is pressurized during the sweep to reduce air bubbles that can affect the measurement



# Kappa Analyzer Measurement Principles

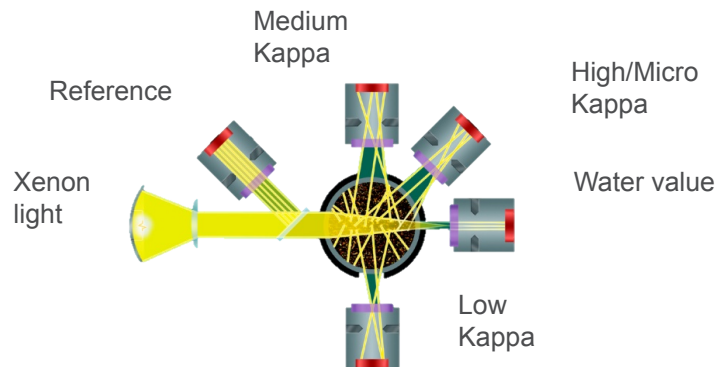
Control must tackle all chemicals consuming substances

Air bubbles scatter the light, the measurement is not accurate.

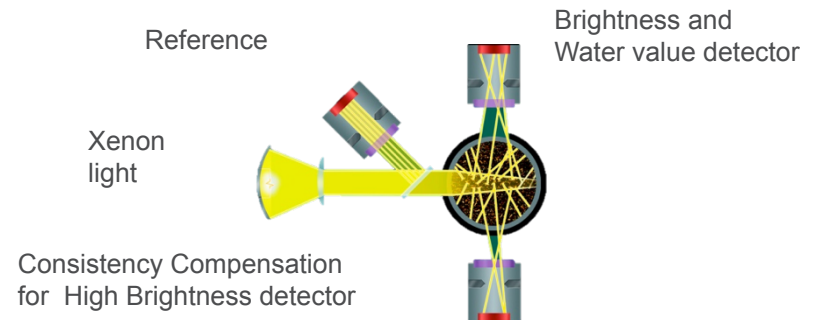


The pressurized measurement principle totally eliminates the air bubble effect

## Kappa & Hex-A (from 0 to 120)

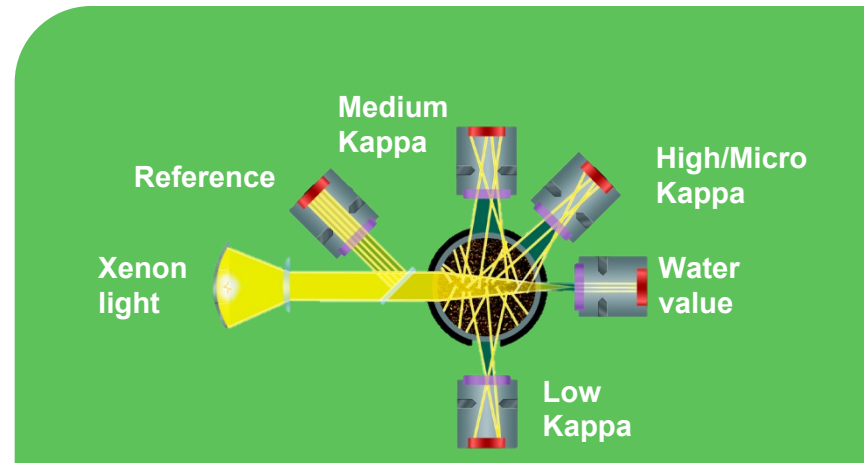


## Brightness (up to 95 ISO)



# Kappa Analyzer Measurement Principle

- The analyzer uses an optical measurement principle.
- The sample is led through the measurement cell and illuminated with a xenon light.
- The analyzer measures the light scattering/absorption of the sample at different wavelengths.
- The measurement is made in a preset consistency range dependent on the kappa level of the pulp being measured.



# Kappa Analyzer Lab Sample Collection

## Lab Sample Collector

### **Adapting automatic sampling to the mill's procedures and standards**

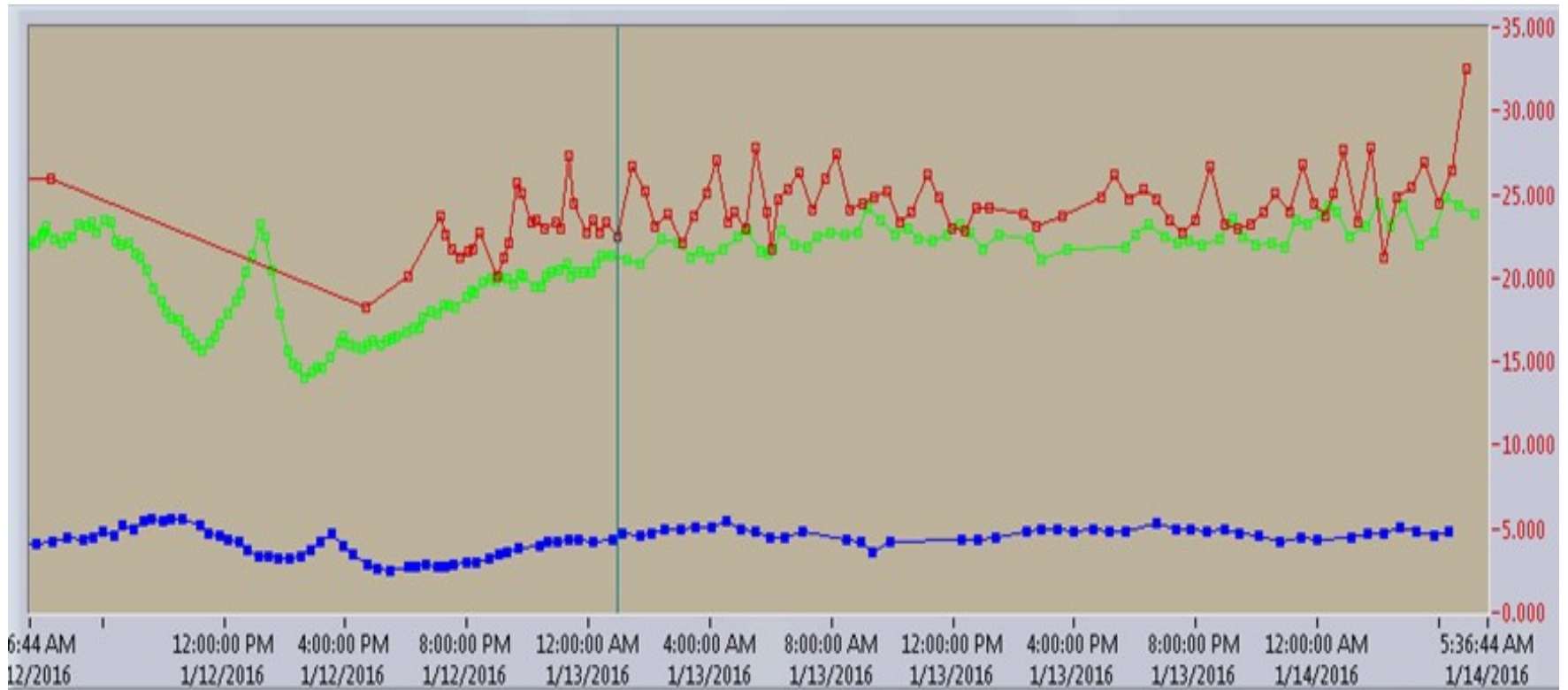
- Weekly analyzer accuracy verification
- No shift laboratory tests needed – a member of the quality team
- Analyzer lab sample test results follow-up through a communicator or Kajaani interface via Ethernet

### **Three operating modes:**

- Manually initiated
- Collection timer 24/7
- Lo/Hi limit trigger



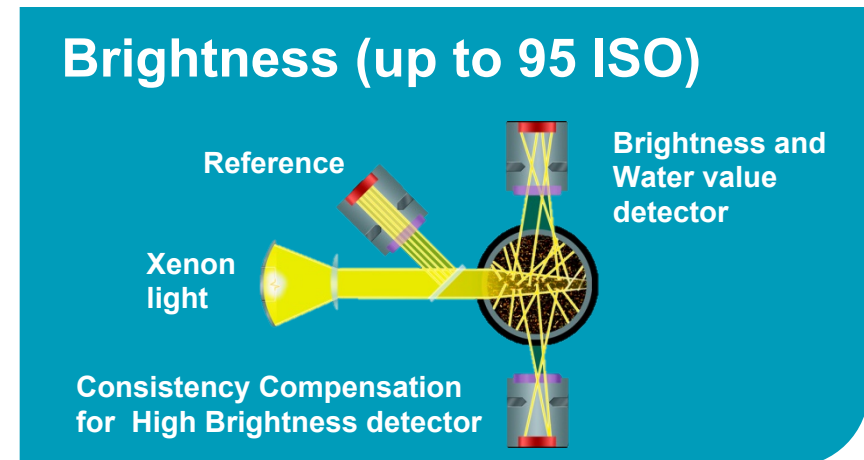
# Fiberline Kappa Profile



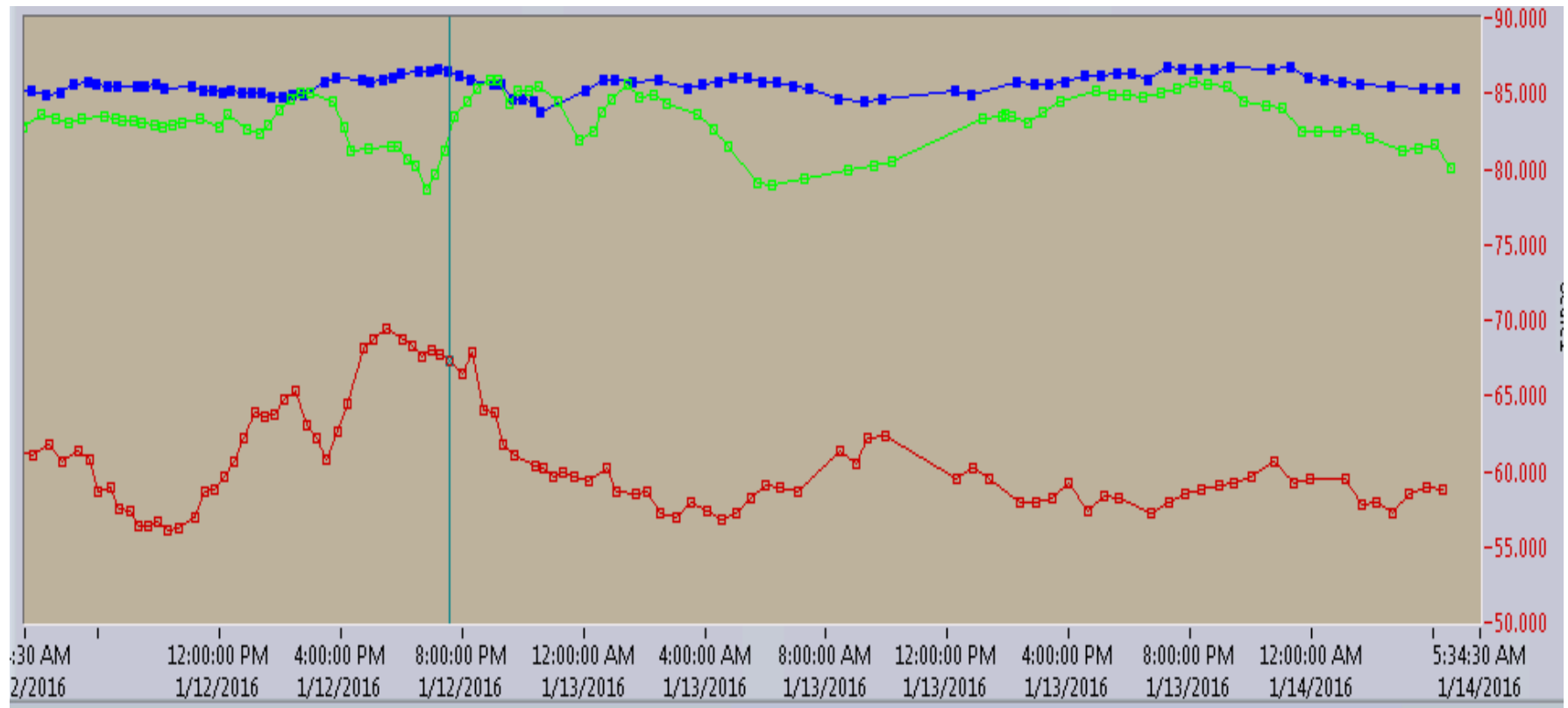
- Blowline Kappa
- D0 Pre-Stage Kappa
- Eop Post-Stage Kappa

# Analyzer Brightness Measurement Principle

- Incoming sample is washed and neutralized, and the brightness of the pulp fiber is measured
- For this measurement, the entire sample is pumped through the measurement loop and the optical properties are measured from detectors measuring the reflectance of a xenon light at a certain consistency
- Variations in lamp intensity are detected and compensated for using the reference detector
- Cell contamination and variations in water color is measured by light transmitted through clean water in the measuring cell.



# Bleach Plant Brightness Profile

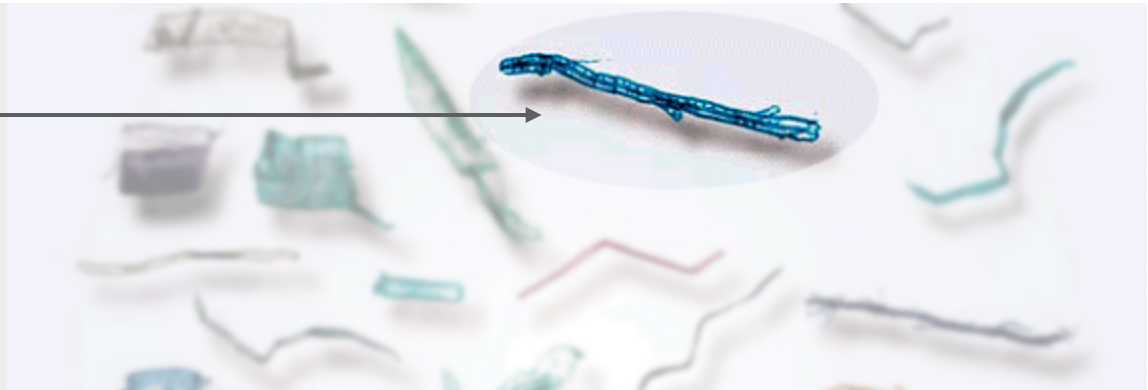


- Eop Post-Stage Brightness
- Post D1 Stage Brightness
- Post D2 Stage Brightness

# Fiber-Shive Module Overview

## Relationship Between Fiber and Paper Properties

**Target is to keep the fiber quality consistent through the pulping process**



Fiber property	Interdependency
<b>Length</b>	Tear strength, folding endurance, formation, light scattering, bonding
<b>Width</b>	Flexibility, bonding (area), bulk
<b>Coarseness</b>	Bulk
<b>Curl</b>	Strength of fiber network, formation, bulk
<b>Fines</b>	Freeness, bonding, light scattering, tensile strength, bulk, smoothness
<b>Kink</b>	Tearing strength
<b>Vessels</b>	Print picking, dust, coating problems



# Fiber-Shive Module Overview

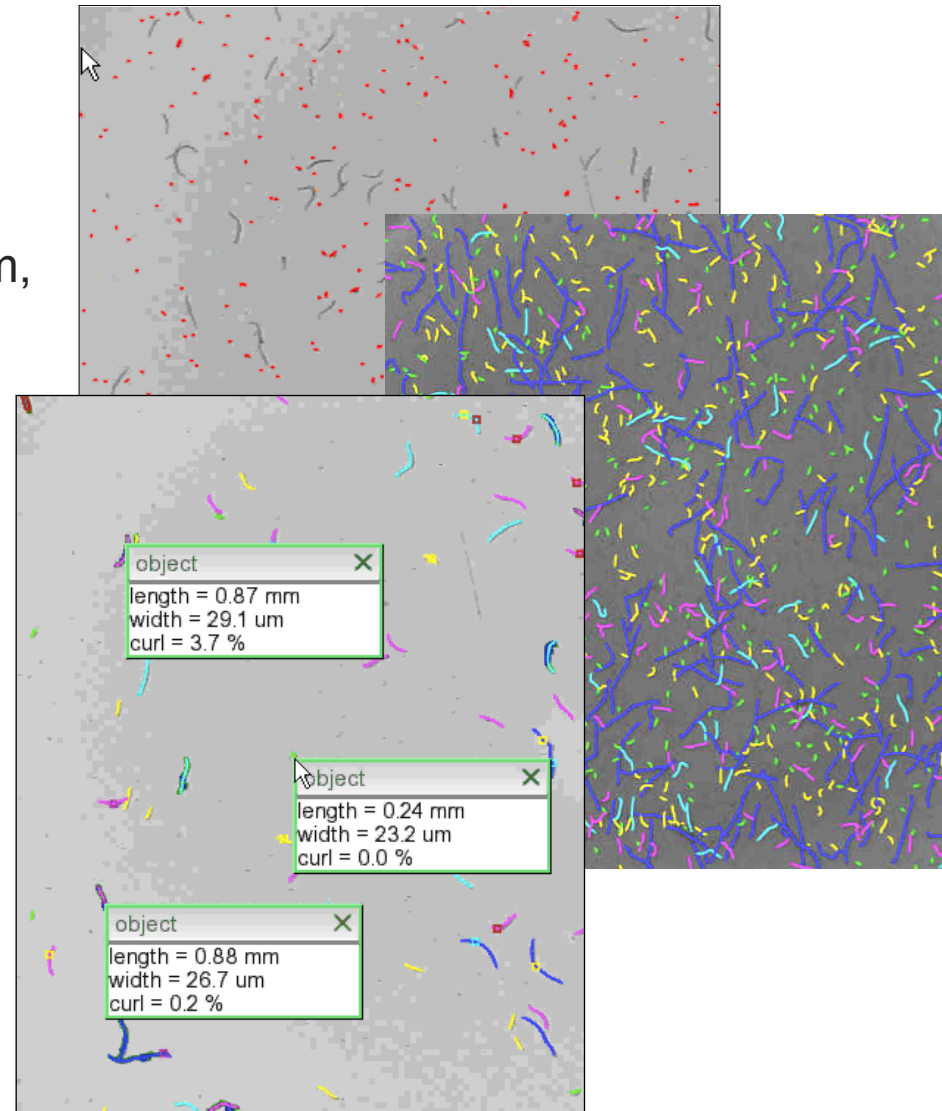
## Measurements

### Shive measurement

- [% (of weight), n/mg, n/g, n]
- Measuring range, width 75–2000  $\mu\text{m}$ , length 0.3–20 mm

### Fiber measurement

- Measuring range, width 2–500  $\mu\text{m}$ , length 0.01–7.6 mm
- Averages, distributions and matrix presentations available
  - Length (Lc)
  - Curl
  - HW/SW ratio
  - Fines content
  - Width
  - Kink
  - Vessels



# Fiber-Shive Module Overview

## Measurement Principal

- A high resolution camera is used to take digital photos of a very dilute sample, at two different dilution levels for fiber and shive analysis.
- The digital images are then analyzed to determine various properties of the sample.
- The Fiber analysis is done at the lowest consistency to better capture individual fiber properties. It is looking at fiber length, width, curl, coarseness, kink, fines content, vessels, etc.
- The Shive analysis is run at a slightly higher consistency to allow it to look at more sample overall. It is looking at fiber bundles and various sized shives based on a classification matrix that sets the size requirements for each class of shive.

# Fiber-Shive Module Components

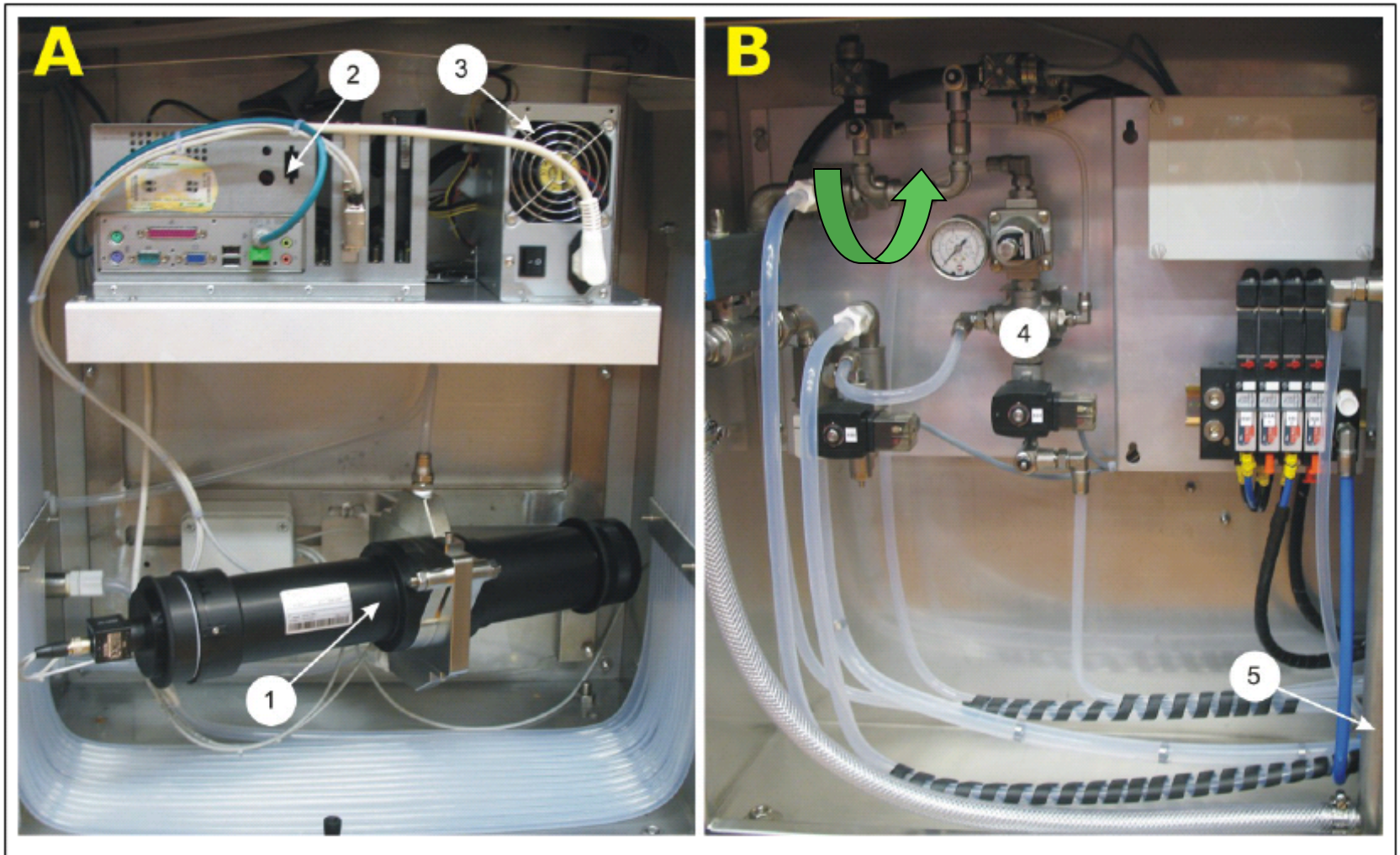


Fig. 2. Fiber-Shive module: A. 1 - measurement loop, 2 - computer unit, 3 - power; B. 4 - valve assemblies, 5 - discharge.



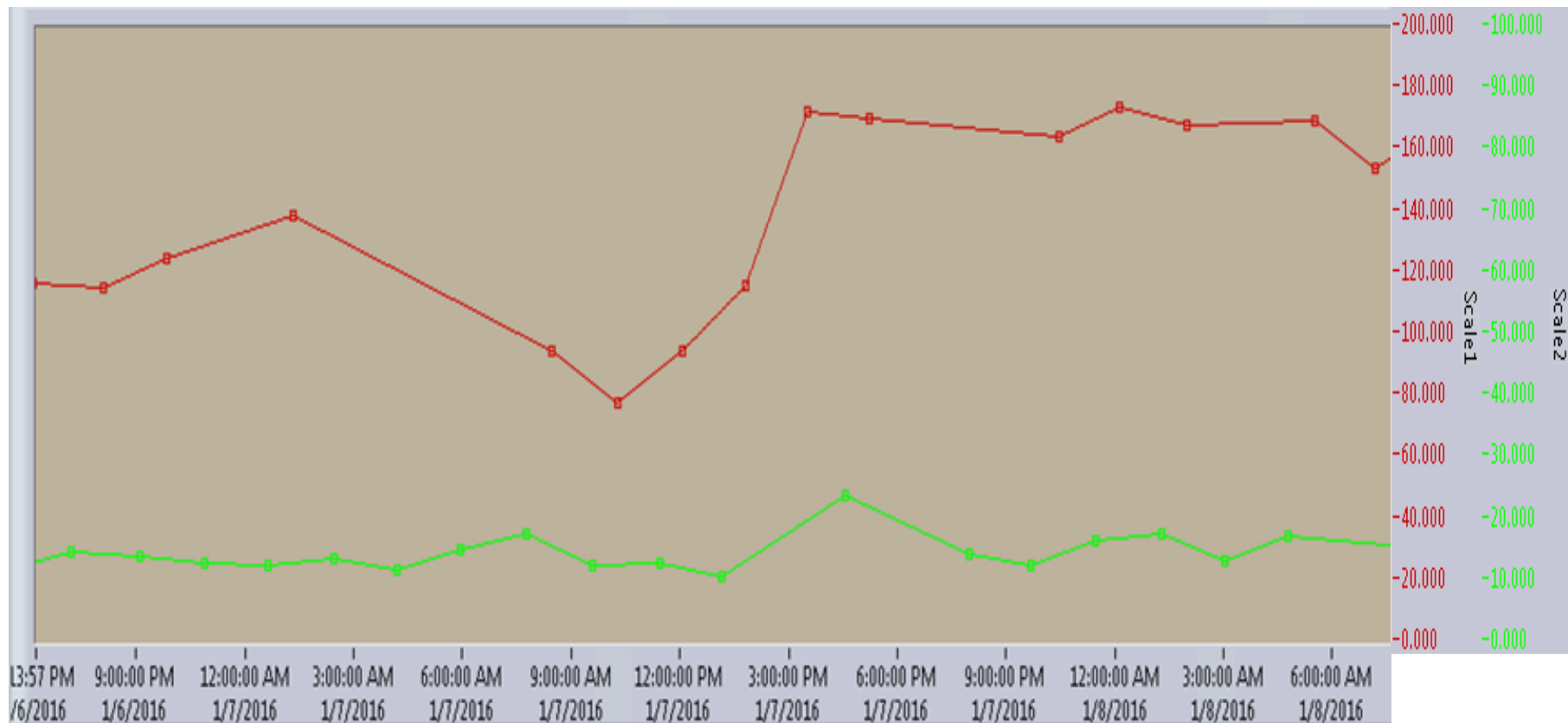
# Shive Module Measurements



## Shive measurement

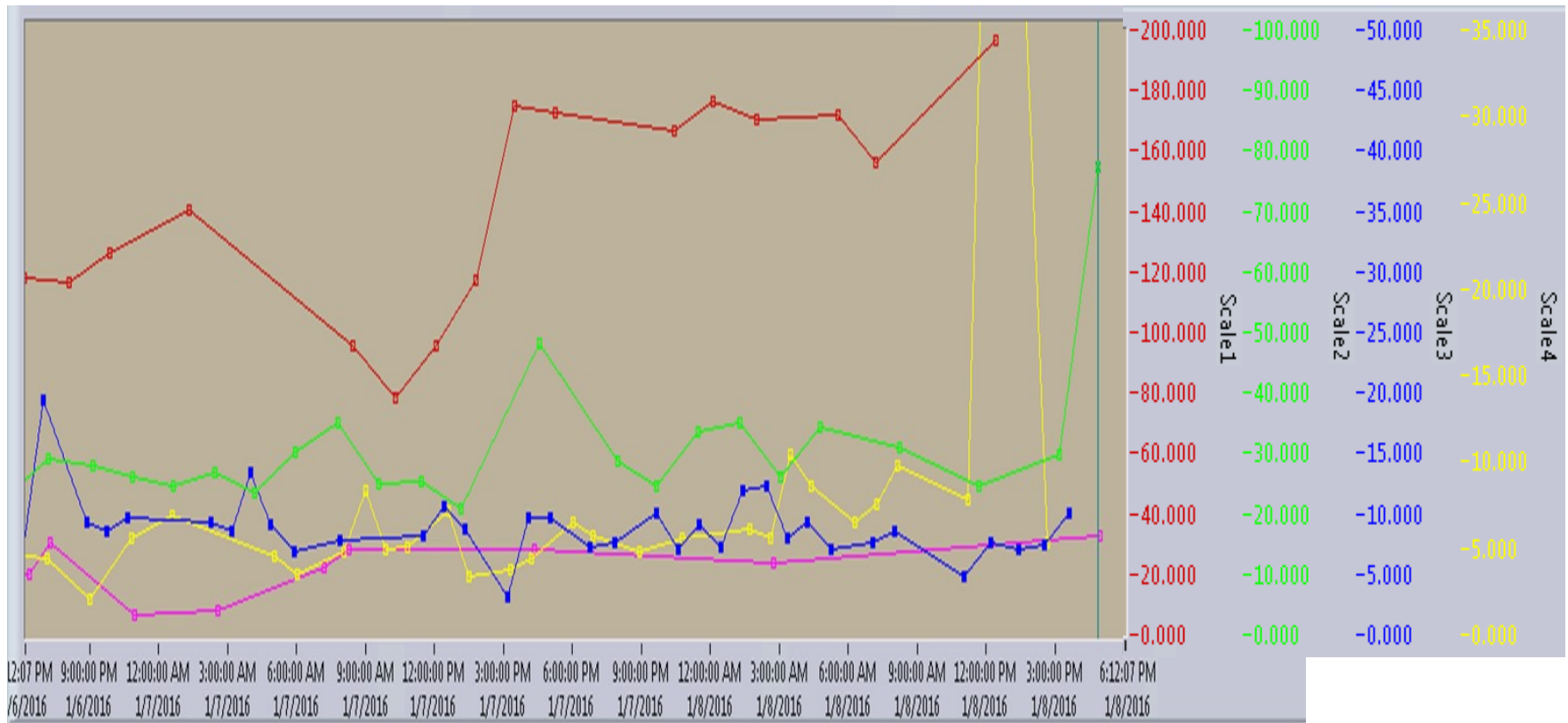
- Camera view of measurement
- Measuring range, width 75–2000  $\mu\text{m}$ , length 0.3–20 mm
- Preset shive classes – mini, wide, long, and course
- Preset units available - %, shives/gram, number of shives

# Shive Module Measurements



- Blowline Shive Count
- D0 Stage Shive Count

# Fiberline Shive Profile



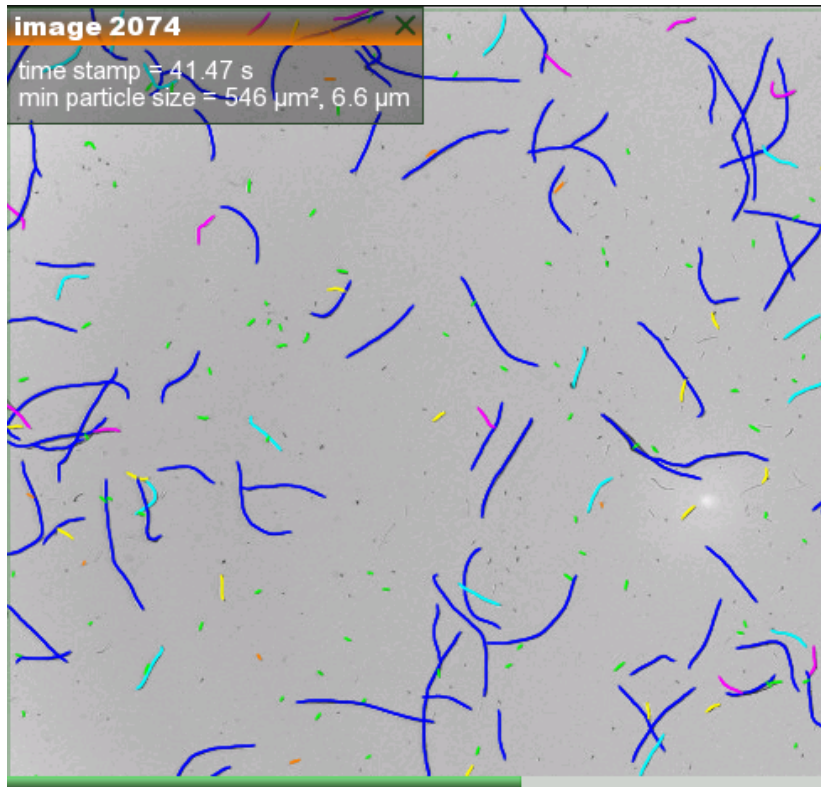
- Blowline Shive Count
- D0 Stage Shive Count
- Post-Eop Shive Count
- Post-D1 Shive Count
- Post-D2 Shive Count

# Shive Profile Measurements

- The shive content from different sample locations can be very helpful in troubleshooting your process
  - Digester shive issue – correct liquor impregnation issues
  - Bleach feed shive issue – correct stock screens
  - Eop shive issue – modify D1 bleaching stage conditions to bleach shives better

# Kappa Analyzer Fiber Property Measurements

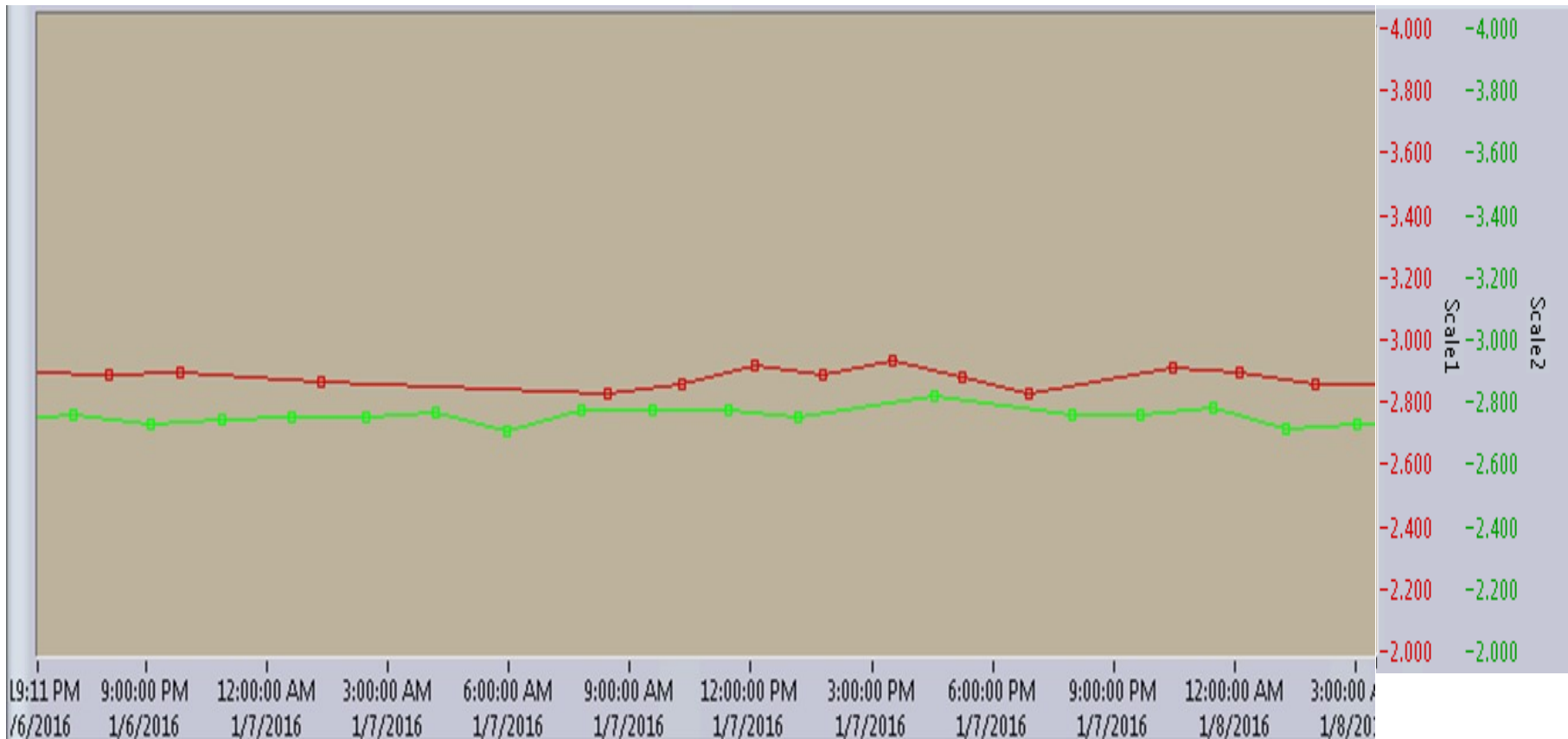
- After the shive measurement the sample is diluted even further for fiber length measurements
- This give definitive species recognition if you have a swing line
- Several other paper properties can be determined from these measurements as shown below



- Length (Lc)
- Curl
- HW/SW ratio
- Fines content
- Width
- Kink
- Vessels



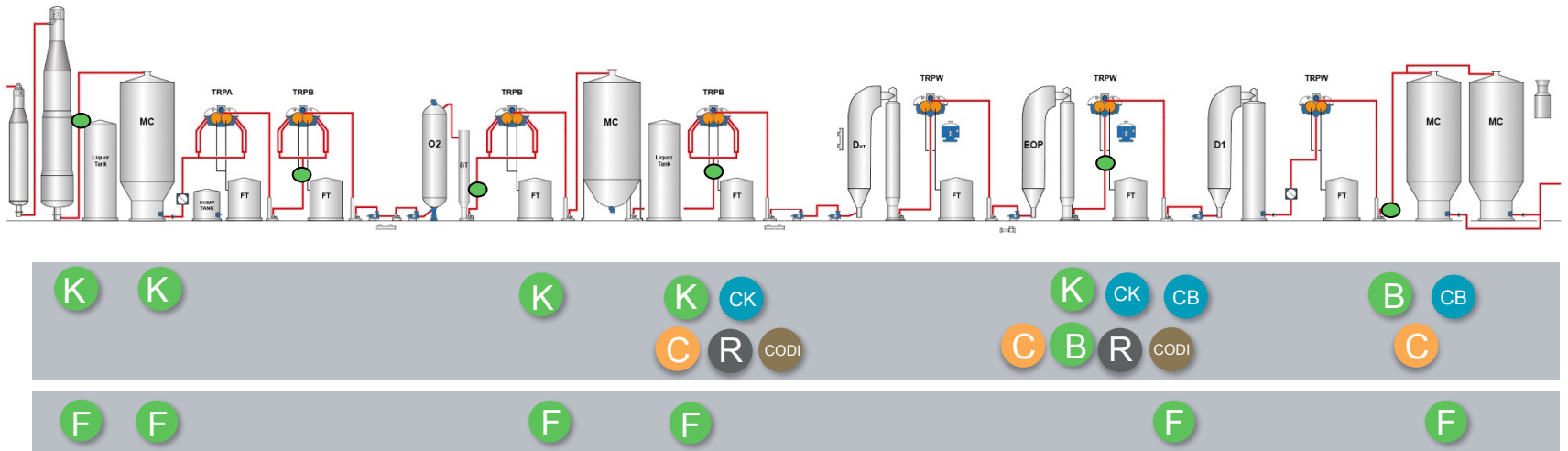
# Fiber Module Measurements



- Blowline Fiber Length
- D0 Stage Fiber Length

# Combining Measurements Provides Beneficial Results

Combining inline brightness and residual measurements to online absolute kappa and brightness measurements provides continuous process response into pulp quality & enhances process control



**K** Kappa (fiber lignin)

**B** Brightness

**F** Fiber Properties and Shives

**C** Inline Brightness

**R** Chemical Residual

**CK** Continuous Kappa

**CB** Continuous Brightness

**CODI** Continuous COD Index (Chemical oxygen demand index)

# Cormec5 Brightness Sensor

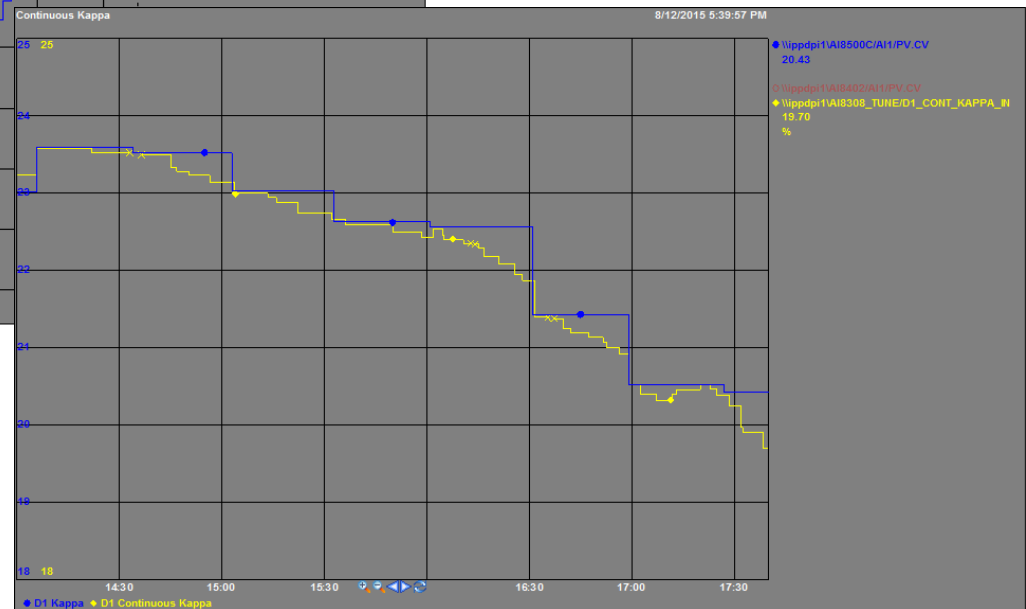
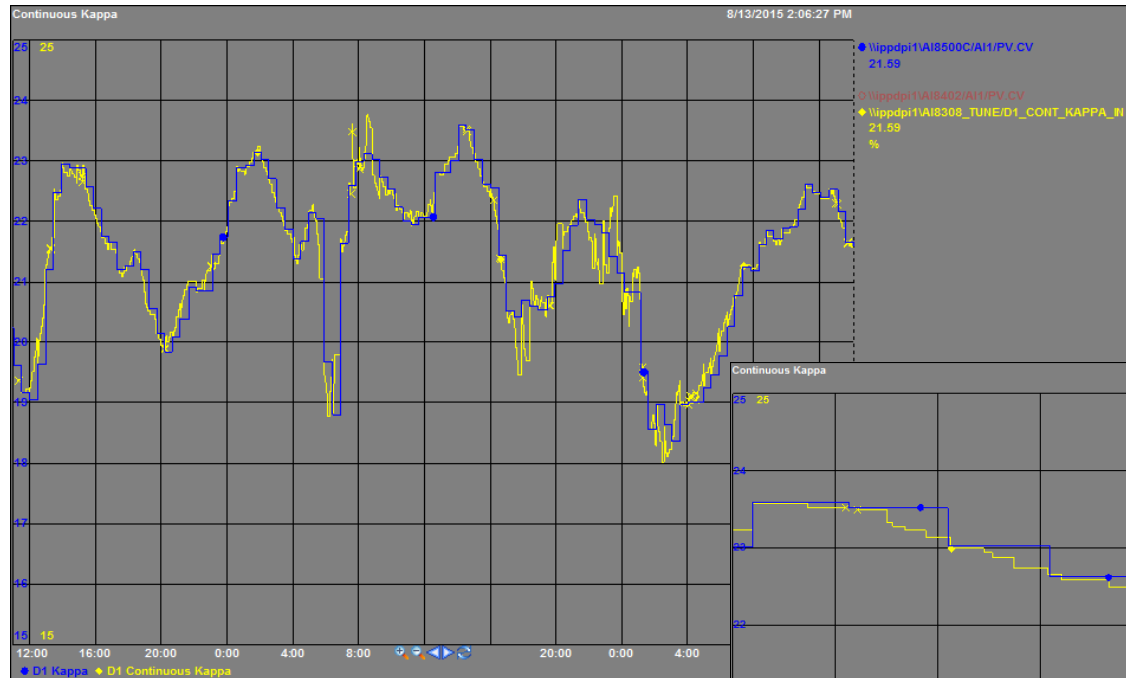
- Provides a broad online window to the process by continuous relative brightness measurement
- Sampling points:
  - D0 inlet
  - D1 inlet
  - D2/P inlet
- Benefits:
  - Continuous measurement
  - D2C-application composes continuous absolute brightness or continuous absolute kappa information from this measurement and from the kappa analyzer for control purposes



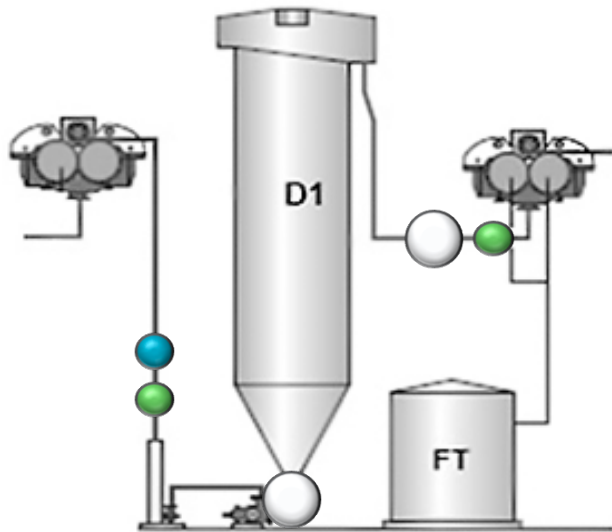
- Along with the Polarox residual sensor it compensates for changes in the process that a washed kappa sample would not see
  - Carryover
  - Consistency
  - pH
  - bleachability




# Continuous Kappa measurement

Combines Kappa Analyzer and Cormec5 brightness measurement

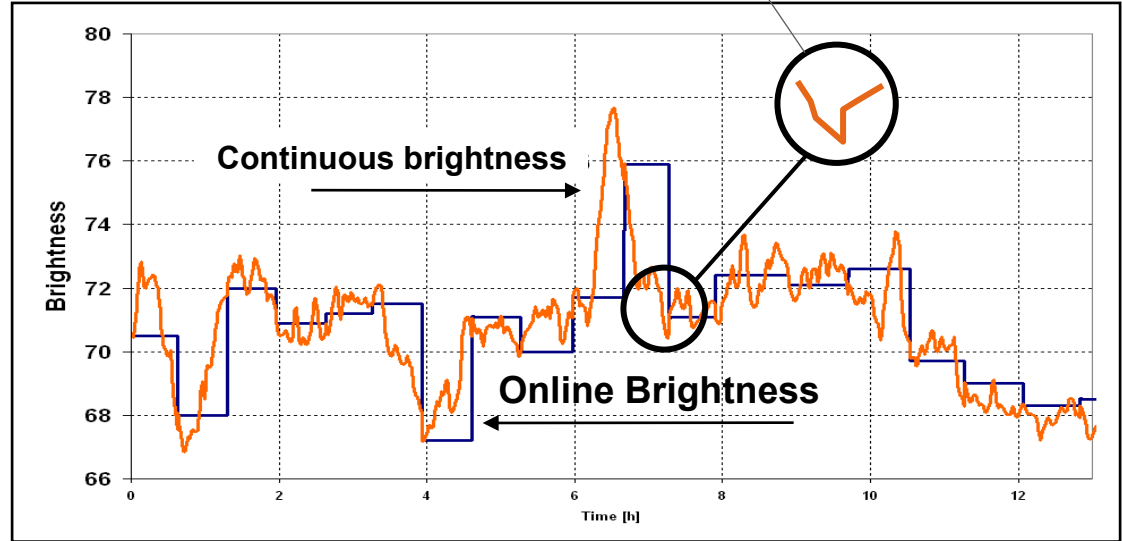


# Continuous brightness signal for D-stages



-  Cormec Brightness Sensor
-  Kappa Analyzer Kappa Sample
-  Kappa Analyzer Brightness Sample

Continuous brightness signal auto tunes  
after each new measurement from  
online analyzer



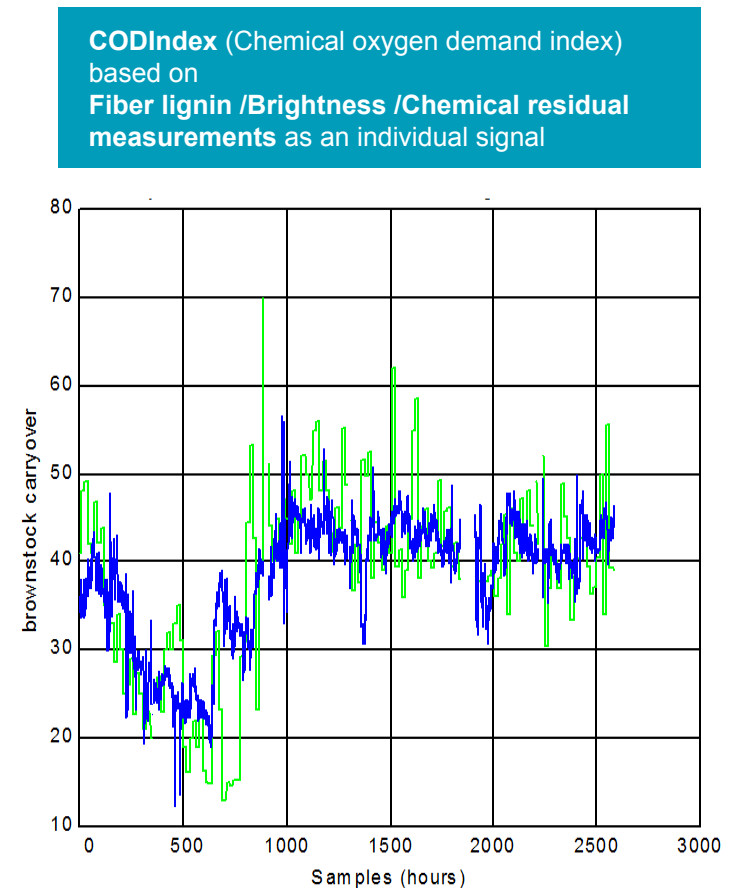
# Polarox5 Residual Measurement



- Provides a broad online window to the process by continuous relative residual measurement
- Sampling points:
  - D0 inlet
  - D1 inlet
  - D2 inlet
- Benefits:
  - Provides continuous, timely information of washer losses and optimal chemical charge for Bleaching Chemical Controls
  - After tower residual measurement for antichlor control to safe guard process equipment and minimize pulp brightness reversion
- Chemical pulping:
  - $\text{ClO}_2$
  - Peroxide
  - $\text{Cl}_2$
  - $\text{SO}_2$
  - Sodium Bisulphite
- Mechanical pulping:
  - Peroxide
  - Sodium Hydrosulphite
- RCF/DIP:
  - Peroxide
  - Sodium Hydrosulphite

# CODIndex – Measures overall chemical demand relative to the absolute kappa and brightness level

- Continuous Kappa signal combines fast pulp lignin variation measured by the inline brightness sensor and discrete fiber bound lignin variation measured by Kappa analyzer
  - Continuous inline brightness also responds to pulp bleachability variations
  - Chemical residual signal responds to washing efficiency and bleaching chemical strength variations as well as chemical reaction speed with lignin



# Conclusions

- The fiberline process is very dynamic and challenging to monitor and control
- Good measurements are the first key to understanding the process. Once the measurements are in place and proven to be reliable and accurate, you can begin to optimize your fiberline
- Optimizing your fiberline is a step by step process that must be done correctly with a systematic and sustainable approach
- Frequent, reliable, and accurate process measurements are the first and most important step in the process. Without this step any hope of optimizing a fiberline to operate at its most efficient stage and sustain the results is futile.
- If a proper control strategy is developed based on accurate and reliable lab quality or better measurements, then the savings in wood and chemical cost should be substantial enough to more than cover the cost and effort required to add and maintain these measurements
- This approach should also lead to reduced variation in the process that results in improved final product quality





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# CPP Analyzer Update

KappaQ and AlkaliC Analyzer

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Presented by:  
Rahul Pukadyil  
Rashiv Lubana



Cariboo Pulp & Paper Company

# Agenda

- Mill information
- AlkaliC
  - ❑ Start-up
  - ❑ Current Challenges
  - ❑ Path Forward
- KappaQ
  - ❑ Installation
  - ❑ Issues
  - ❑ Advantages/Savings
- Questions



# Mill Information

- Softwood (SPF)
- Lo-Solids Digester
- 7-Stage Brownstock Washing
  - ▣ Oxygen Delignification stage
- 5-Stage Bleach Plant (DEDE<sub>p</sub>D)



# Valmet Alkali-C



- Project approved in 2015 and commissioned in July 2016
- 5 sample points:
  - ❑ *White liquor*: Feed to Digester
  - ❑ *Black liquor*: Upper Extraction, Lower Circulation, Main Extraction and Wash Extraction
- Measured liquor properties:
  - ❑ *White liquor*: EA, AA, TTA, % sulphidity, % CE, carbonate
  - ❑ *Black liquor*: Residual EA



# Analyzer Start-Up

- Smooth start-up with minor issues:
  - ❑ Analyzer user interface PC failed
    - ❖ Valmet ordered a replacement under the warranty
    - ❖ Vortex cooler added to electronics cabinet
  - ❑ Minor piping modifications required
- Sodium carbonate not being used in the black liquor analysis



# Current Challenges

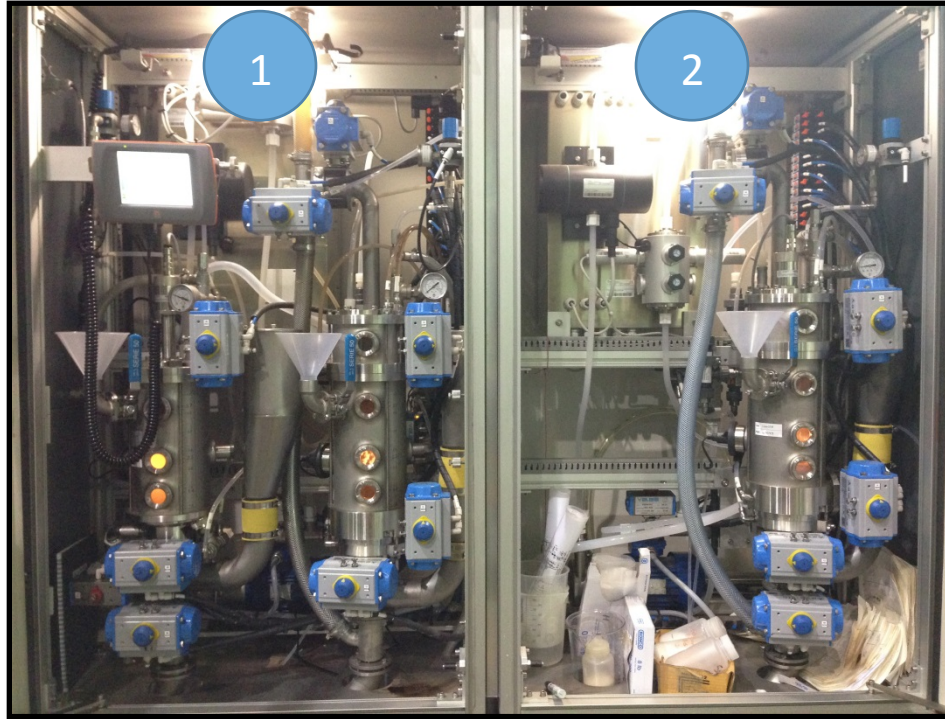
- Validating results of the analyzer
  - ❑ Benchtop autotitrator required for validation
  - ❑ Analyzer reading higher values than lab tester
- SCAN vs TAPPI
  - ❑ Analyzer currently runs SCAN method on both WL and BL samples
  - ❑ CPP's lab uses TAPPI method for WL analysis and a modified version of SCAN (titrating with HCL and  $\text{Na}_2\text{CO}_3$  to end-point pH) for BL samples
  - ❑ Currently working with Valmet to understand the differences in results

# Path Forward

- Make an informed decision on the titration method used in the Analyzer (inflection point vs. end-point pH titration)
  - Test more black liquor with the different methods and compare the results with the analyzer
- Develop and implement controls on the Digester using the results from the liquor analyzer



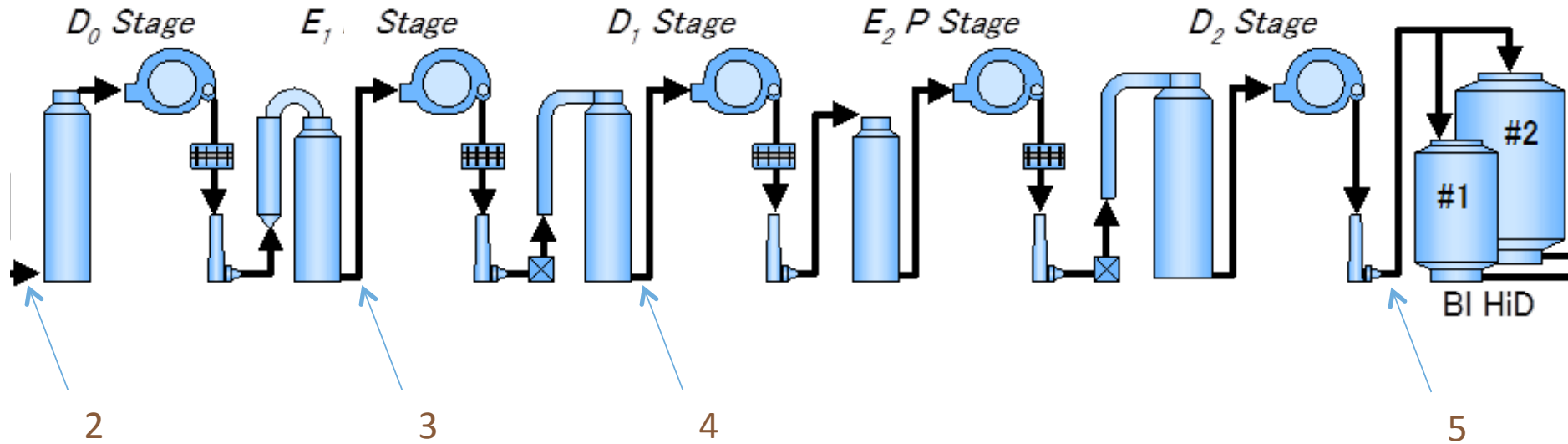
# Valmet KappaQ



- Project approved in 2014 and commissioned in September 2015
- Two cabinet analyzer
  - ▣ Dual chamber: Kappa#
  - ▣ Single chamber: Brightness
- 30-35 measurements/hour

# Sample Points

## *Bleach Plant*



5 sample points:

1. Digester Blow line (Kappa#)
2. 2 X Feed to bleach (Kappa#)
3. After E-1 tower (CEKappa#)
4. After D1 tower (Brightness)
5. After D2 washer (Brightness)

# KappaQ Issues

- Start-up issues:
  - ❑ Transfer hose connections: changed clamp type
  - ❑ Hot water pressure: installed booster pump
  - ❑ Sampler leak: moved sampler location
  - ❑ Reducer leak: switched from fiberglass to Alloy 254 SMO
- Development of calibration curves for each sample point
  - ❑ Spanned over six months
  - ❑ Duplicate points
- Hot vs. cold water wash of blowline sample



*Reducer leak*

# Savings

- Developed in-house compensated kappa factor controls
  - ▣ Implemented in April 2016

Chemicals	Current Savings (Kg/Machine ADt)
ClO <sub>2</sub>	1.92
NaOH	2.53
H <sub>2</sub> O <sub>2</sub>	-0.01

# Questions?



# Digester and Recaust Automatic Liquor Titrator Measurement Technology

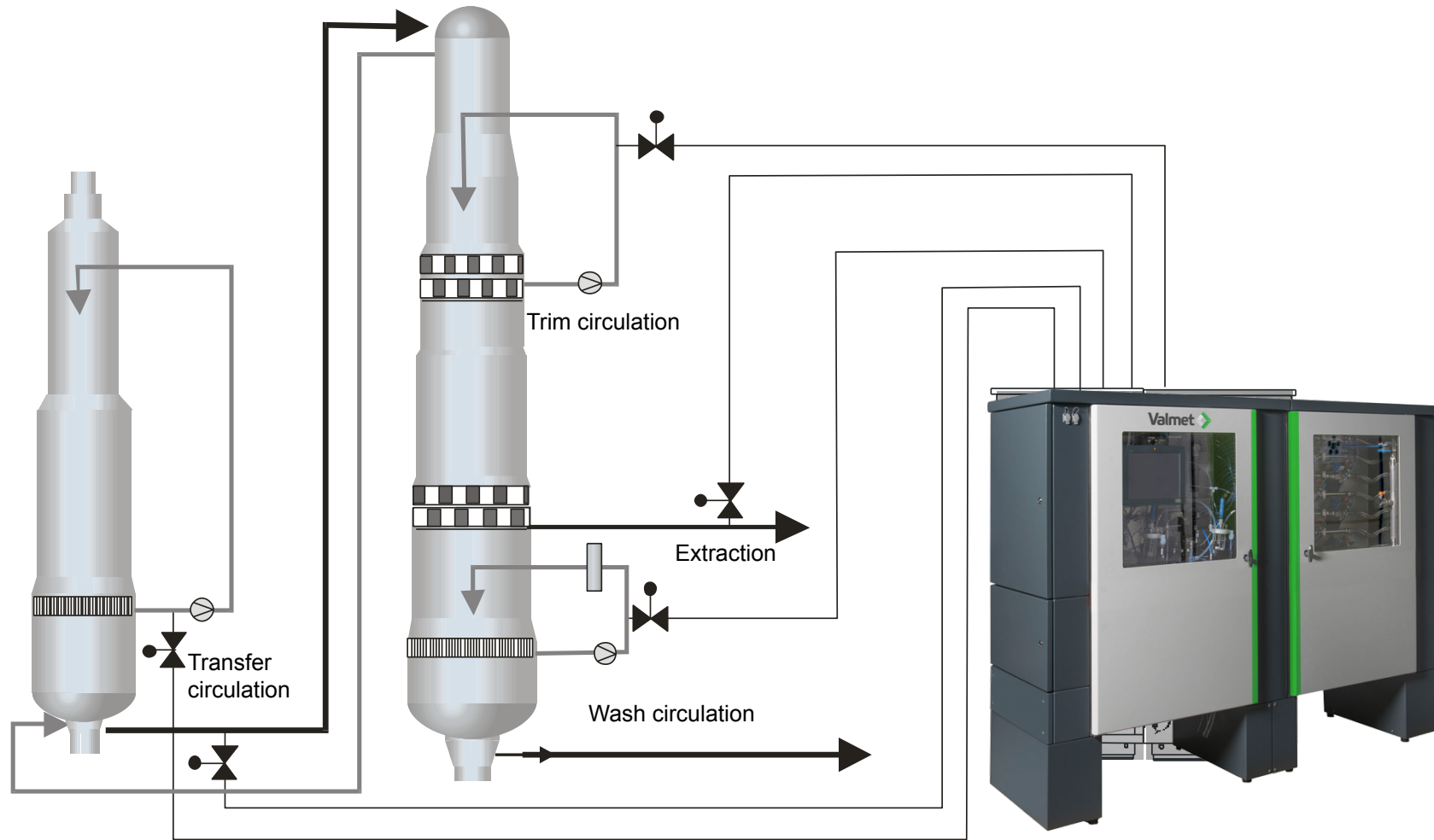
Presented by  
James Goldman  
Valmet Solutions Manager

# Cooking Liquor Titrator

- Standard analysis method for black liquor residual alkali
  - EA
- Complete white liquor analysis as an optional feature
  - NaOH, Na<sub>2</sub>CO<sub>3</sub>, Na<sub>2</sub>S
  - Effective alkali (EA), Active alkali (AA), Total Titratable Alkali (TTA), Causticizing Efficiency (CE %), Sulphidity (S%)
- Analysis based on an inflection point titration that eliminates the effect of any pH electrode drift
- Sample Handling unit and Analysis unit can be separated to facilitate installation if needed.
  - There are some distance requirements that need to be considered if this option is used.



# Typical sampling points for a continuous digester





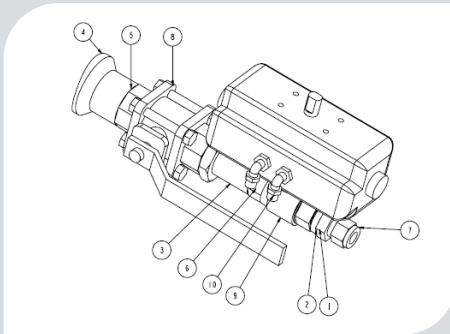
# Process Samplers

## Sample line:

- Maximum: 16 lines
- AISI 316L

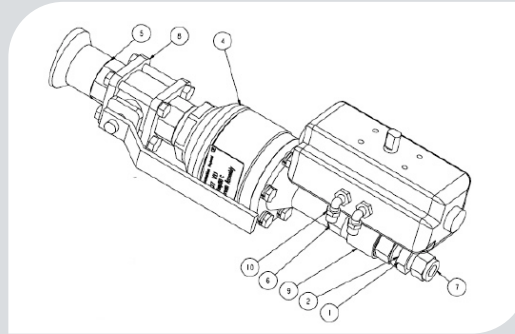
## Samplers:

- Installation with a coupling welded to the process pipeline



Sampler SD 711

- White liquor or shive-free black liquor
- Sample line max. 100 m



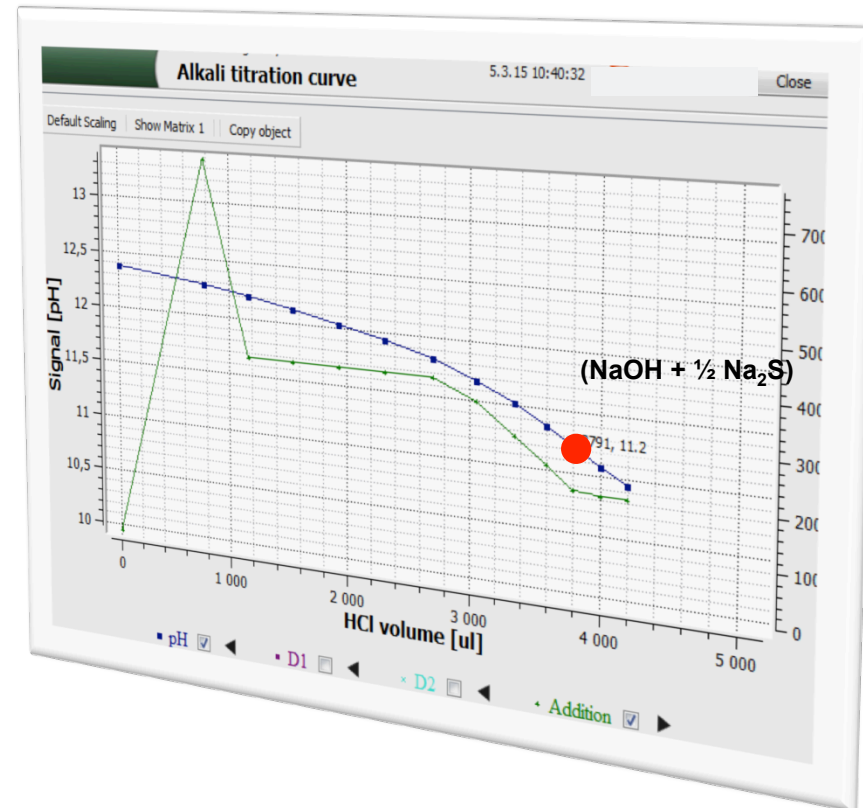
Sampler SD 712

- Shive-containing liquors
- Sample line max. 30 m

# Analysis method

## Black liquor

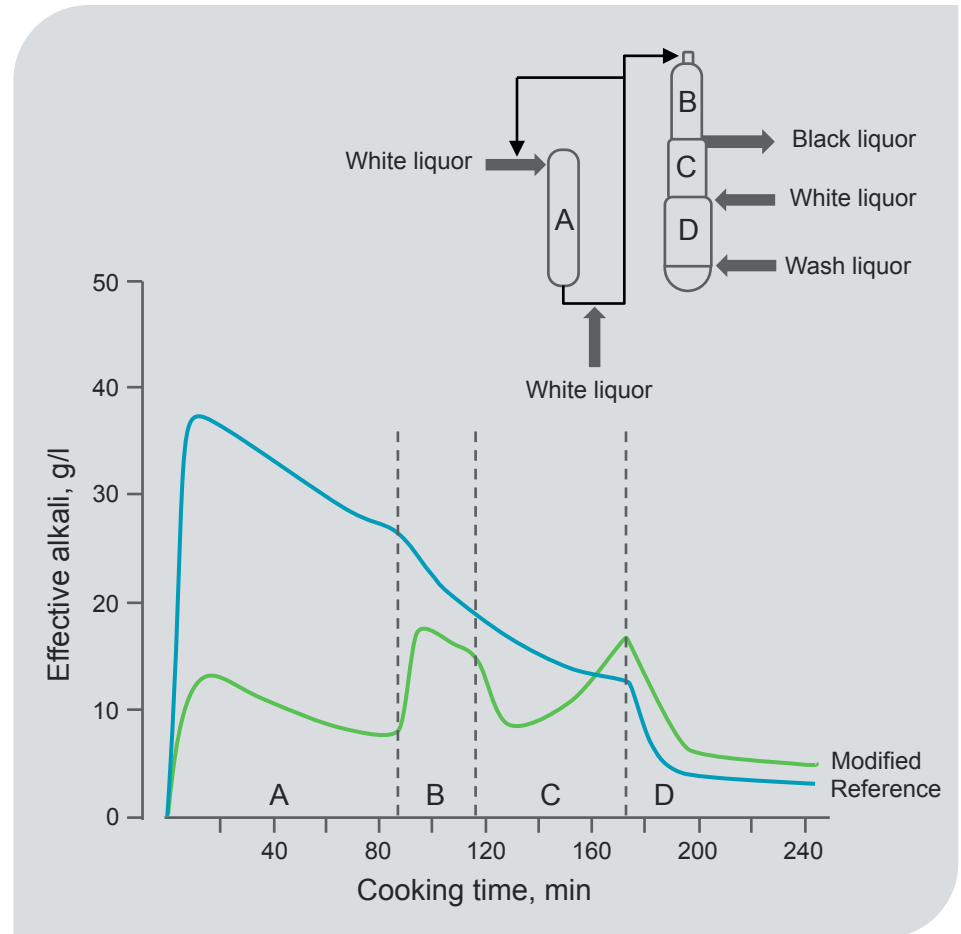
- SCAN N 33:94
- Potentiometric titration with hydrochloric acid (HCl)
- Sodium carbonate is added to give a better inflection and buffer the titration solution
- Autocalibration feature for adaptation to changing process conditions
- Possible to use pH end point titration if desired.
  - Requires regular pH probe calibration



# Managing the alkali profile

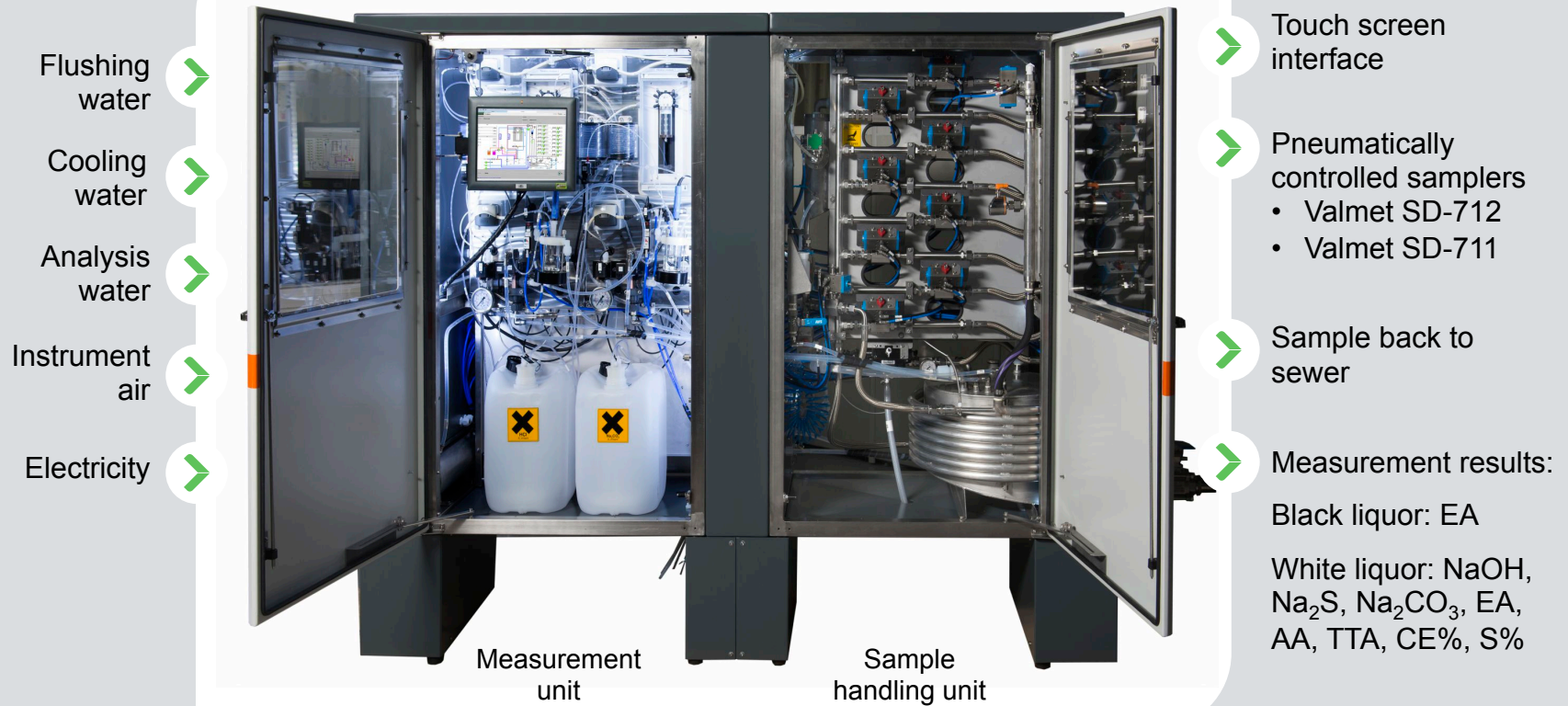
Reliable and dependable measurement information

- Automatic sampling and analysis for real liquor chemistry results
- Absolute measurements
- Managing the alkali charge and profile
- System point of view for operators
- Seamless integration into process and mill
- High frequency measurements



# Centralized system

## Liquor Titrator Structure



# Cooking Liquore Titrator Analysis Unit

## Sample Analysis Waste & H<sub>2</sub>S Vapor Removal

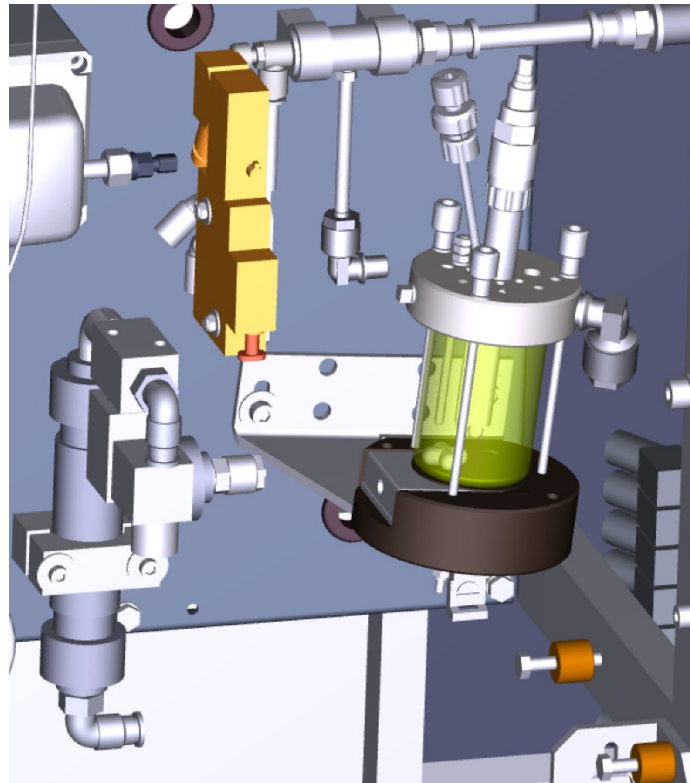
Empties Analysis  
Cup after tests



Evacuates Vapors from  
Analysis cup during  
white liquor titration



Vented externally via  
connection @ analyzer  
bulk head



**Ejector  
unit**

**Sample Analysis  
unit**



Sealed Analysis  
Unit



Liquid and vapors  
removed by ejector

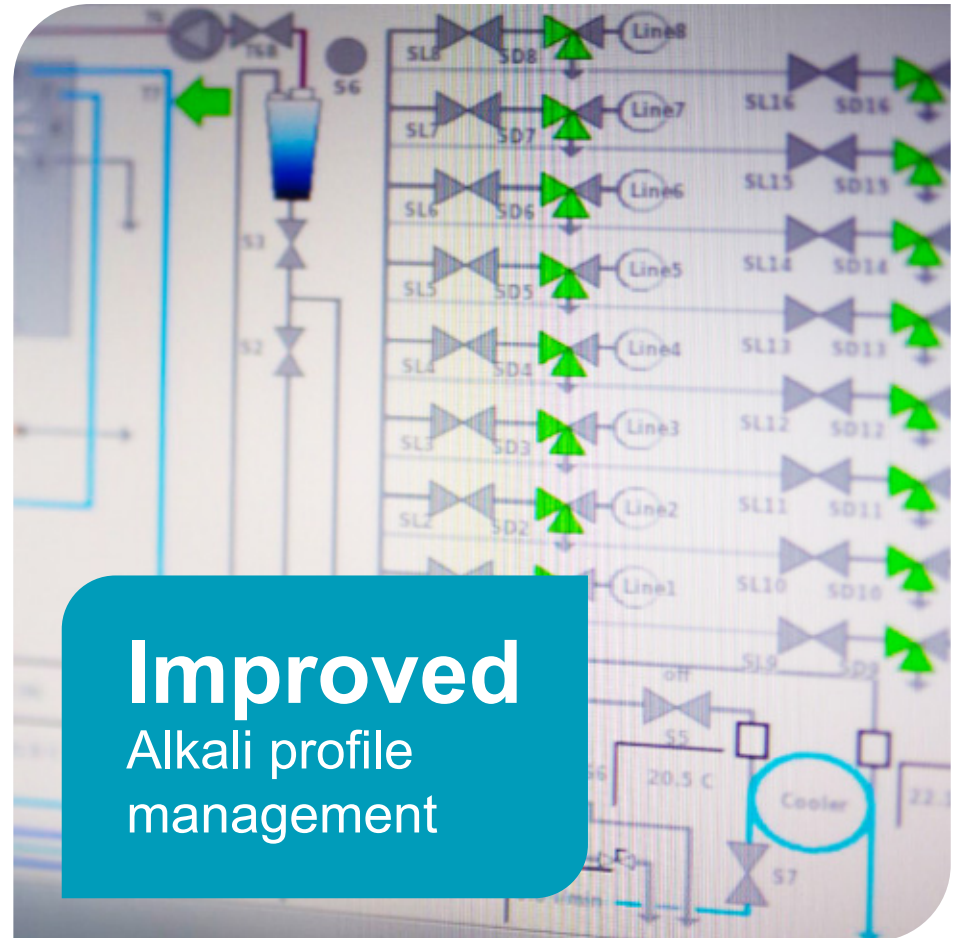


H<sub>2</sub>S cannot escape  
into Analyzer

# Accurate results from day one

Based on reliable measurement

- An effective cooking management tool
- Better pulp quality and production control
- Easy installation without need for calibration
  - Only calibrate new pH probe
- Large reference base
- Field-proven results

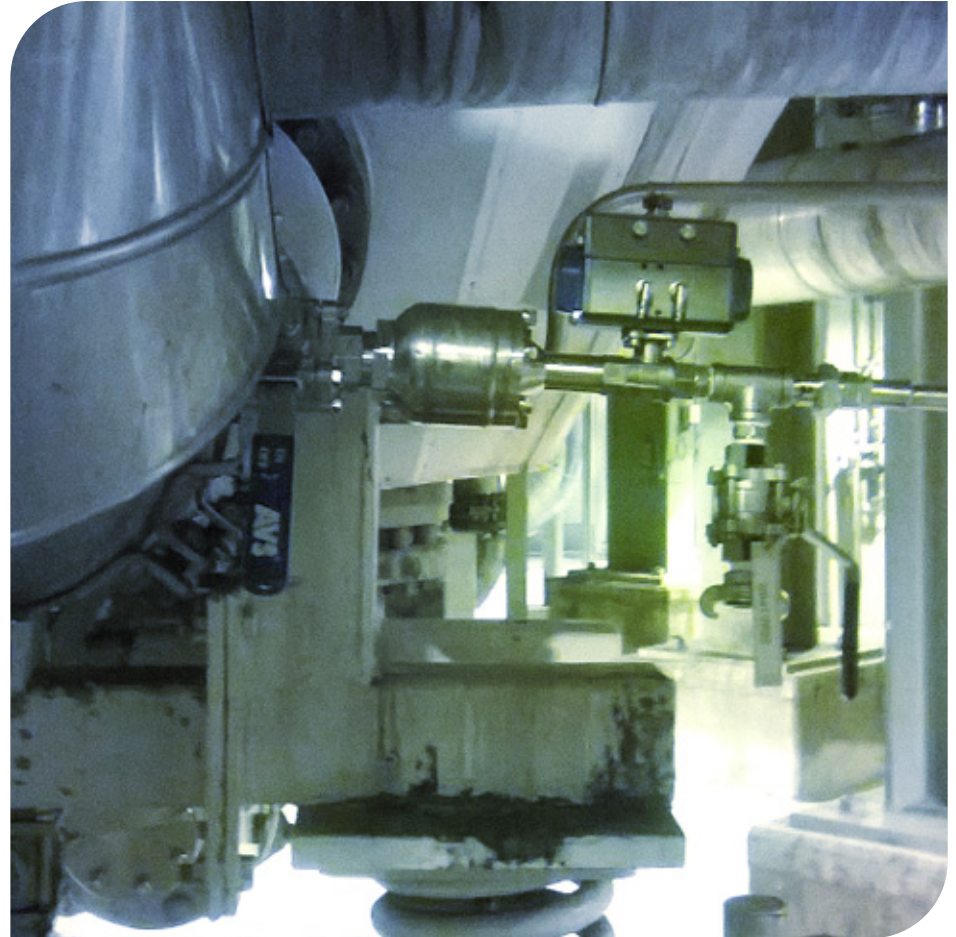




# Safe and convenient

## The multipoint analyzer concept

- Simple installation, cost-effective maintenance
- Centralized location of most critical sample handling and components
- Minimized exposure to equipment in harsh environments
- Automatic self-cleaning system
- Industry-standard communication alternatives and protocols



# Automatic Sampling Liquor Titrator

- Alkali Titrator runs the Scandinavian test method in order to perform the ABC titration for white liquor samples
- Black liquor circulations can be sampled automatically also. The titrator can be configured to run a titration to measure the A point, or it can be setup to run to an endpoint pH in order to match the lab unit in obtaining the EA result.
- No calibration is required since it is running the same or very similar test as the lab. This allows the operator or control scheme to utilize the data within a week of start-up.
- The liquor profile across the digester can be stabilized
- Corrections for inaccuracies in the chip feed rate, moisture content, or even poor chip quality can be corrected by measuring the residual alkali as early in the digester as possible.
- The final alkali content can be measured in the wash zone in order to ensure proper residual levels that will protect against lignin re-precipitation and also corrosion issues.



# Caustic Plant Liquor Titrator

## Online measurements available from day one

- Provides actual liquor chemistry titration results
- No calibration needed – online measurements available from day one
- Measurement Capabilities:
  - Dissolving Tank green liquor
  - Weak Wash
  - Green liquor to slaker
  - Slaker/1<sup>st</sup> causticizer lime mud slurry
  - Final causticizer lime mud slurry
  - Final white liquor to the digester
  - NEW Recovery Boiler Reduction
- Automatic flushing and acid washing sequences
- Can be used to measure manual liquor samples
- Rugged design ensures high uptime (98%) and low maintenance (clear maintenance program)

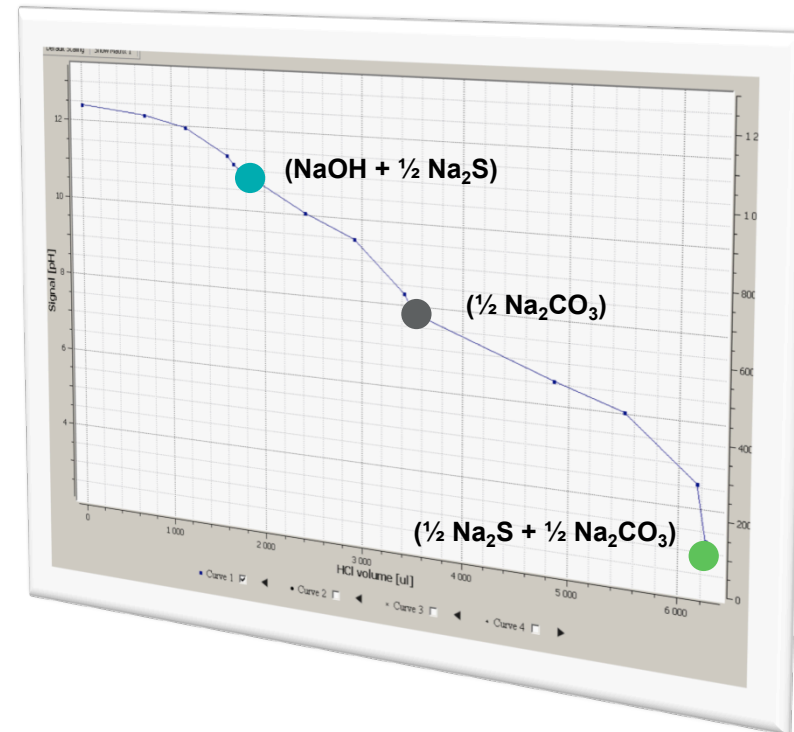


# Analysis method

## White liquor

- SCAN 30:85
- 2 ml sample is titrated with 1.0 N HCl – an electrode registers pH
- Reactions for the three equivalence points

- **EP1:**  $\text{NaOH} + \text{Na}_2\text{S} + \text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow \text{NaHS} + \text{Na}_2\text{CO}_3 + 2\text{NaCl} + \text{H}_2\text{O}$  pH 10.6
- **EP2:**  $\text{NaHS} + \text{Na}_2\text{CO}_3 + \text{HCl} \rightarrow \text{NaHS} + \text{NaHCO}_3 + \text{NaCl}$  pH 8.4
- **EP3:**  $\text{NaHS} + \text{NaHCO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{S} + \text{H}_2\text{O} + \text{CO}_2$  pH 3.8



# Calculations of Results

Effective Alkali	EA	EA = NaOH + 1/2 Na <sub>2</sub> S EA = A * NM / V
Active Alkali	AA	AA = NaOH + Na <sub>2</sub> S AA = (2A - 2B + C) NM / V
Total Titratable Alkali	TTA	TTA = NaOH + Na <sub>2</sub> S + Na <sub>2</sub> CO <sub>3</sub> TTA = C * NM / V
Causticizing Degree	CE%	CE% = NaOH * 100 / (NaOH + Na <sub>2</sub> CO <sub>3</sub> ) CE% = (2 B - C) * 100 / (4B - C - 2A)
Sulfidity	S%	S% = Na <sub>2</sub> S * 100 / (NaOH + Na <sub>2</sub> S) S% = (2B - C) * 100 / (2A - 2B + C)
Sodium Carbonate	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> CO <sub>3</sub> = (2B - 2A) * NM / V
Sodium Hydroxide	NaOH	NaOH = (2B - C) * NM / V
Sodium Sulfide	Na <sub>2</sub> S	Na <sub>2</sub> S = (2A - 4B + 2C) * NM / V

A = Titration volume at equivalence point 1 (EP1)

B = Total titration volume at eq. point 2 (EP2)

C = Total titration volume at eq. point 3 (EP3)

N = HCl normality

V = Sample volume

M = Molecular weight

- if result is computed as Na<sub>2</sub>O, M = 31

- if result is computed as NaOH, M = 40

# Caustic Plant Liquor Titrator

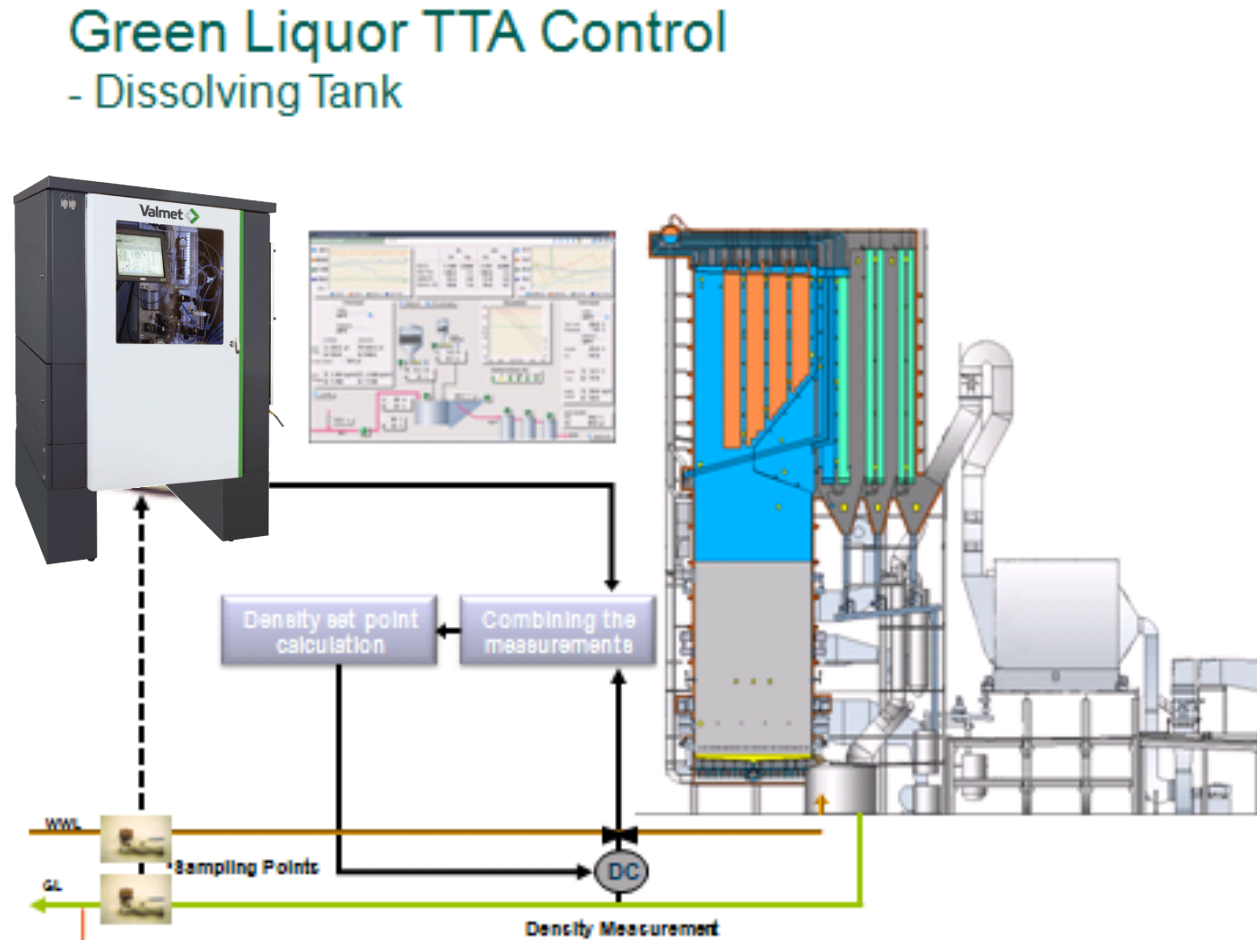
## For Employee Safety!

- With automated liquor sample collection preparation and testing, operators and laboratory personnel are exposed less to the safety hazards of manual sample collection
- Eliminate need for operators or laboratory personnel to collect dissolving tank/caustic plant samples for TTA/Density or smelt spout sampling for reduction.
- Automated liquor sampling, sample preparation and testing allows time for operators and laboratory personnel to:
  - Work Safer!
  - Focus on managing the process
  - Improve housekeeping in process areas
  - Assume additional operational tasks
  - Perform more value added tests



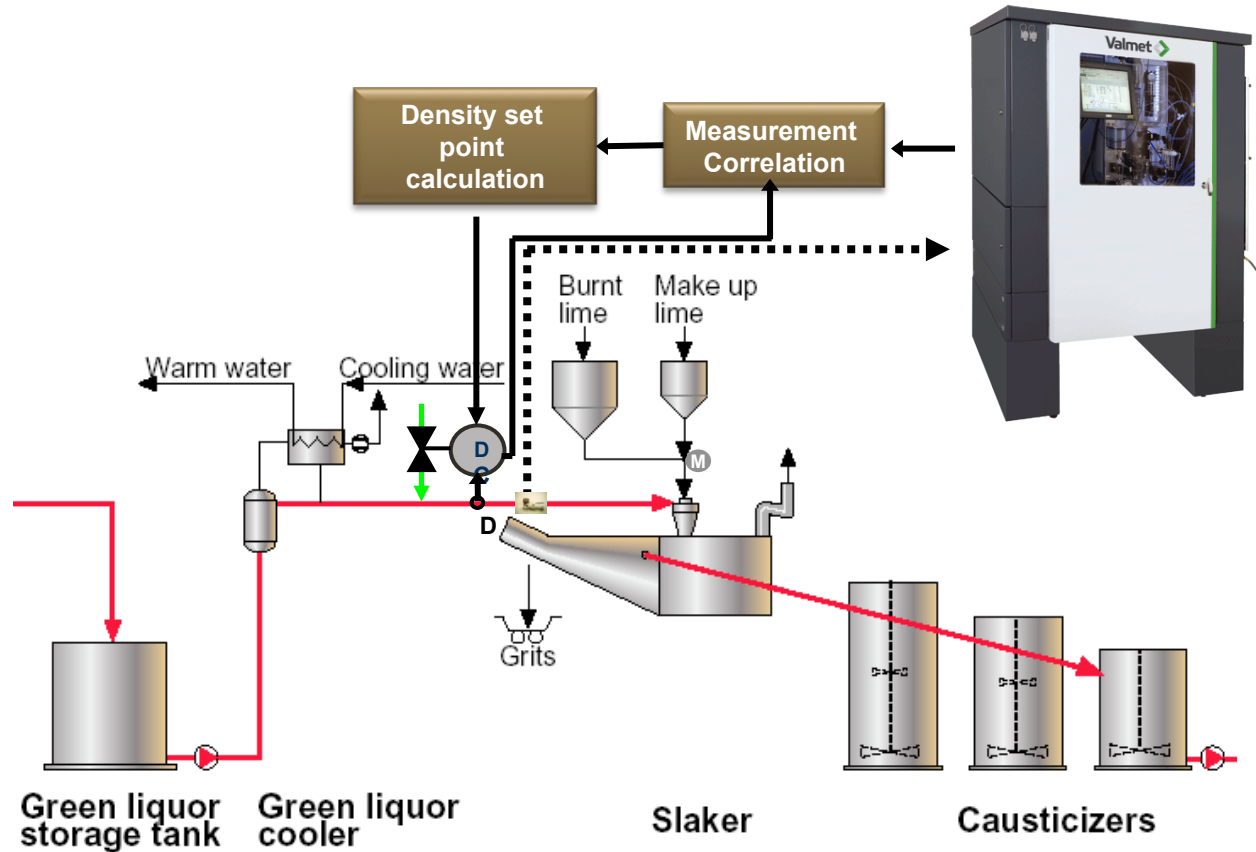
# Green Liquor TTA Control – Dissolving Tank

- Best Results are achieved with density control at the Recovery Boiler Dissolving Tank AND at the Slaker
- Alkali analyzer measures TTA and correlates result to density. Density setpoint is sent to existing density controls
- Manipulated Variables
  - Weak Wash Flow
- Control Variables
  - Green Liquor Density
  - Green Liquor TTA

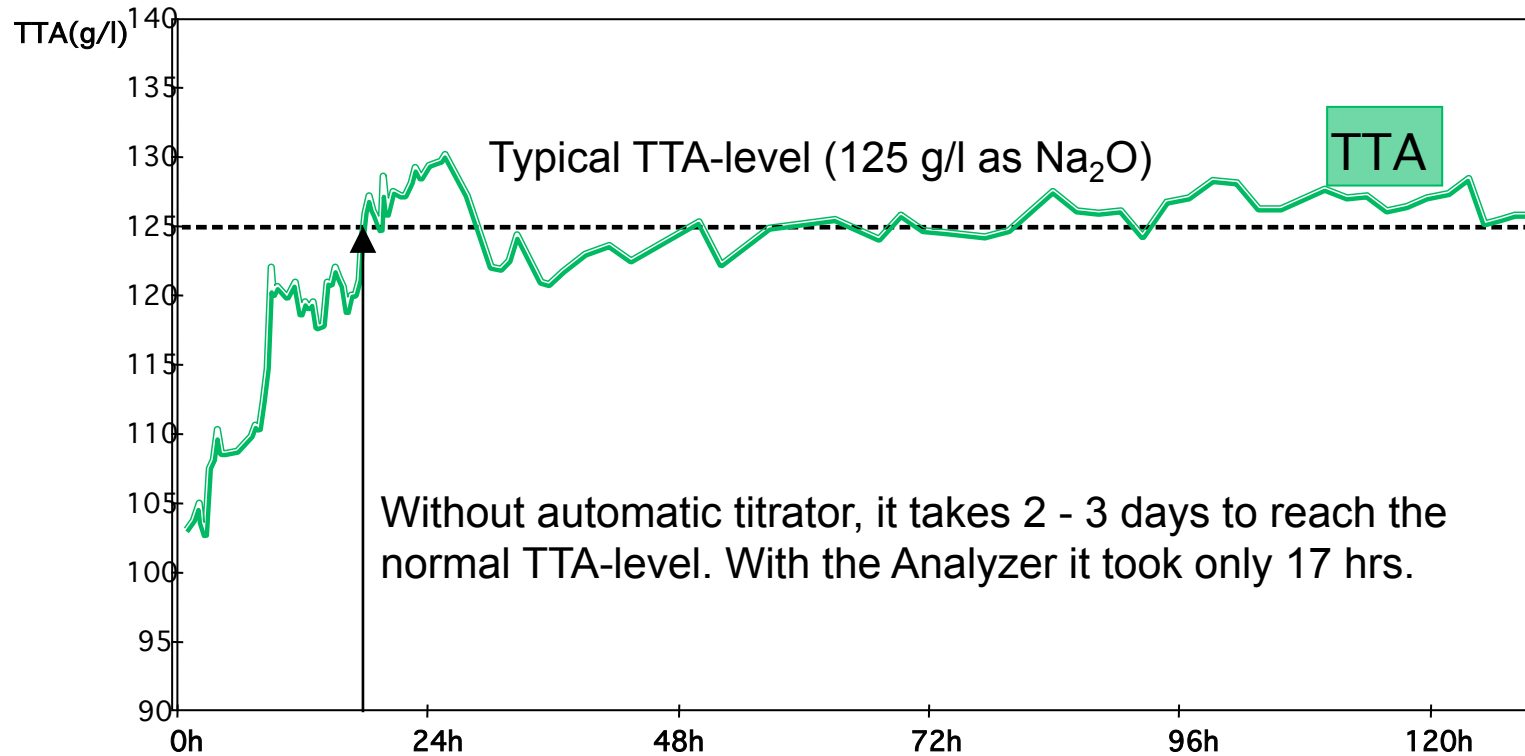


# Green Liquor TTA Control - Slaker

- Requires Green Liquor Density Control at the slaker
- Goal is a stable and consistent green liquor TTA to the slaker to minimize variability and maximize lime addition
- Manipulated Variables
  - Weak Wash Flow
- Control Variables
  - Green Liquor Density
  - Green Liquor TTA



# Causticizing Process Start-up



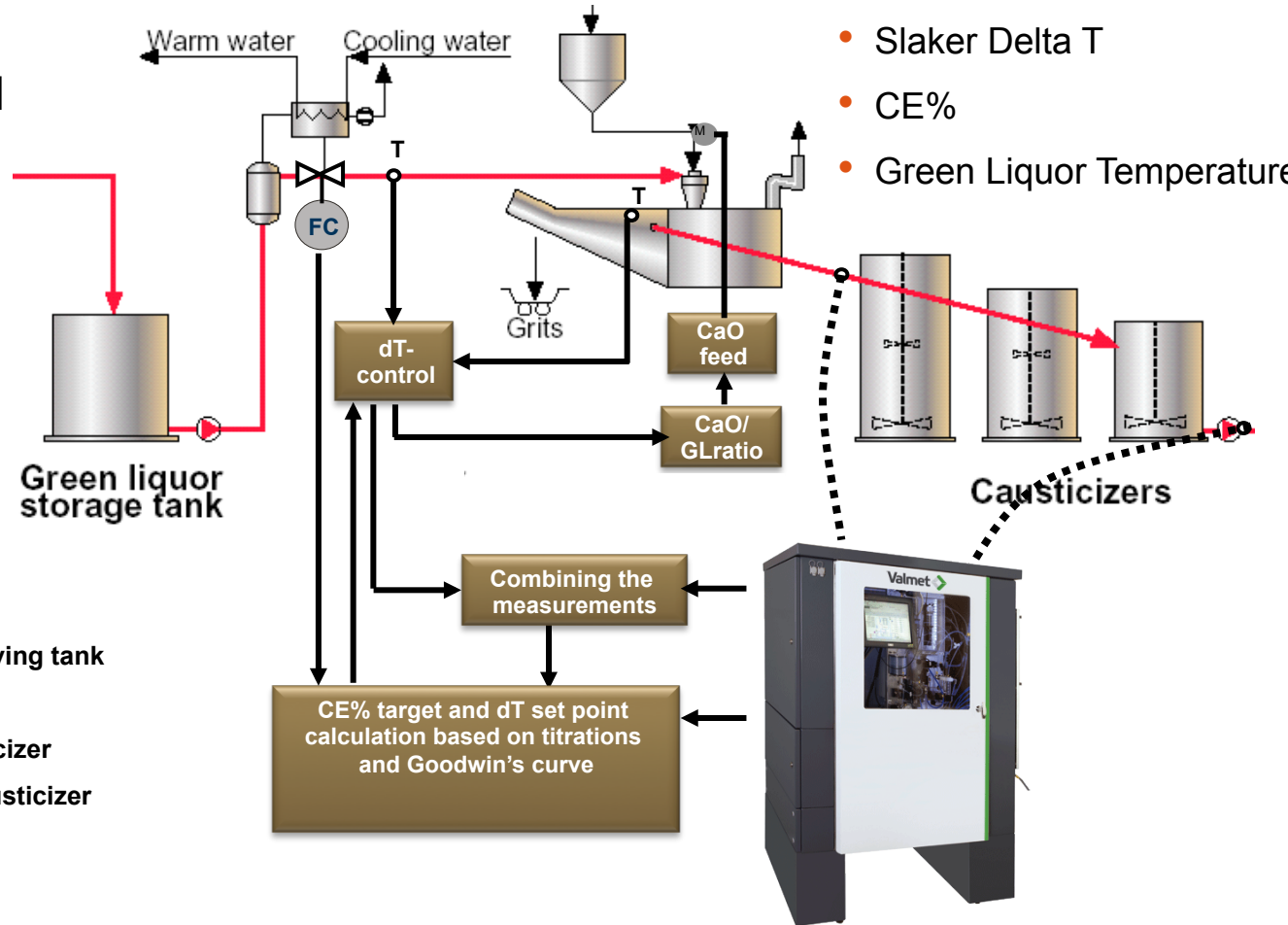
# Causticizing Optimization %CE Control

- Incoming TTA Sets the Correct %CE Target Based on Goodwin's Curve
- Slaker Delta T Is Used for Quick Feedback to Lime Reactivity and is Modeled to the %CE
- Green Liquor Temperature can Also Be Controlled to Maximize the Slaker Temp Short of Boiling

Sampling points:

- 1 Green Liquor at dissolving tank
- 2 Green liquor to slaker
- 3 Lime milk at 1st causticizer
- 4 Lime milk after last causticizer
- 5 White liquor CE%

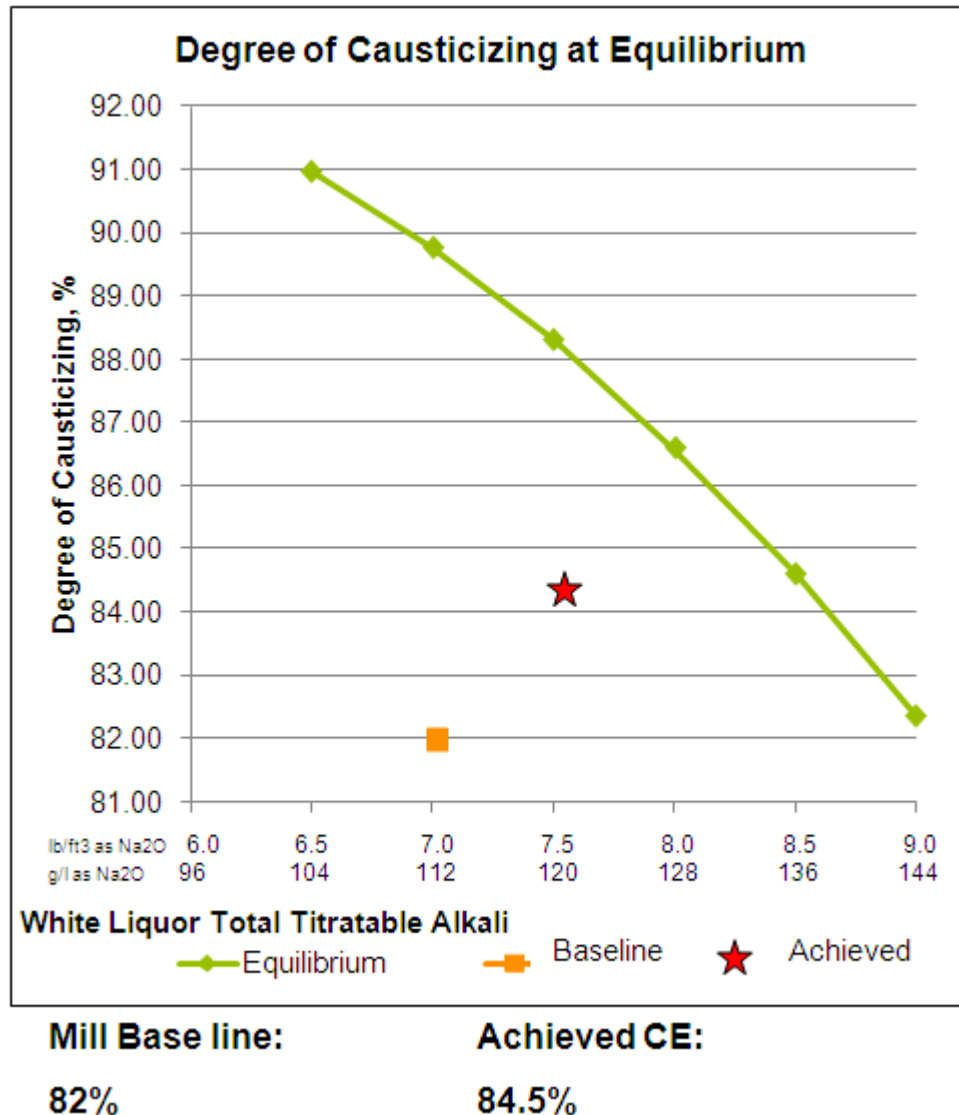
## CE% Controls



- Manipulated Variables
  - Lime/Green Liquor Ratio
- Controlled Variable
  - Slaker Delta T
  - CE%
  - Green Liquor Temperature



# Causticizing Optimization Results





**PAPTAC Bleaching Committee**  
**Section 6 – PROJECTS SESSION PRESENTATIONS**  
*Hinton, AB; October 24-26, 2016*

See following presentations.



# Safe Handling of Sodium Chlorate



**PAPTAC**

**Bleaching Committee— Fall 2016**

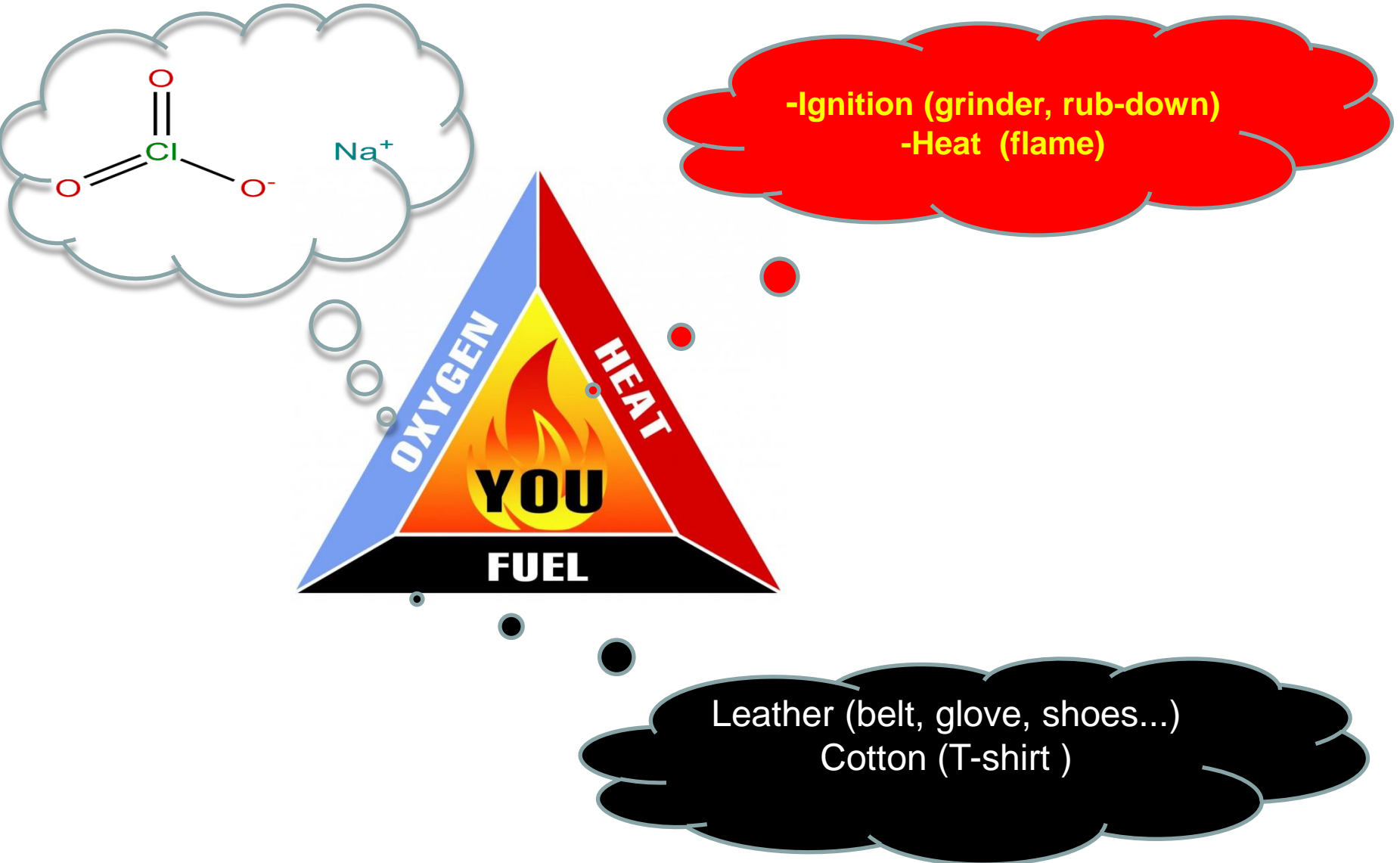


**Presented by**  
**Stéphane Messier, ing. MBA**

**Responsible Care®**  
Our commitment to sustainability.



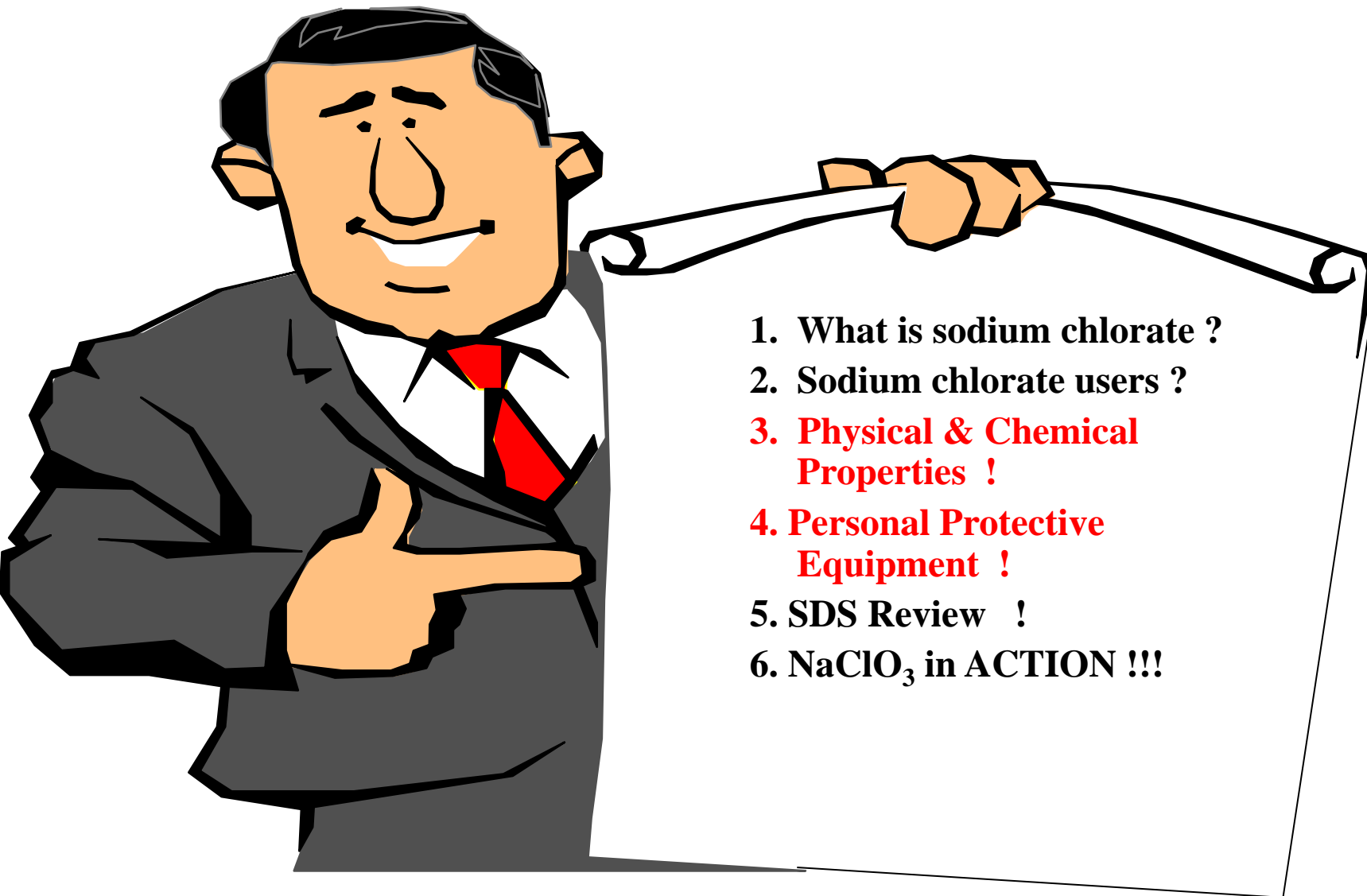
# Why a sodium chlorate safety seminar?



# PRODUCT SAFETY SEMINAR

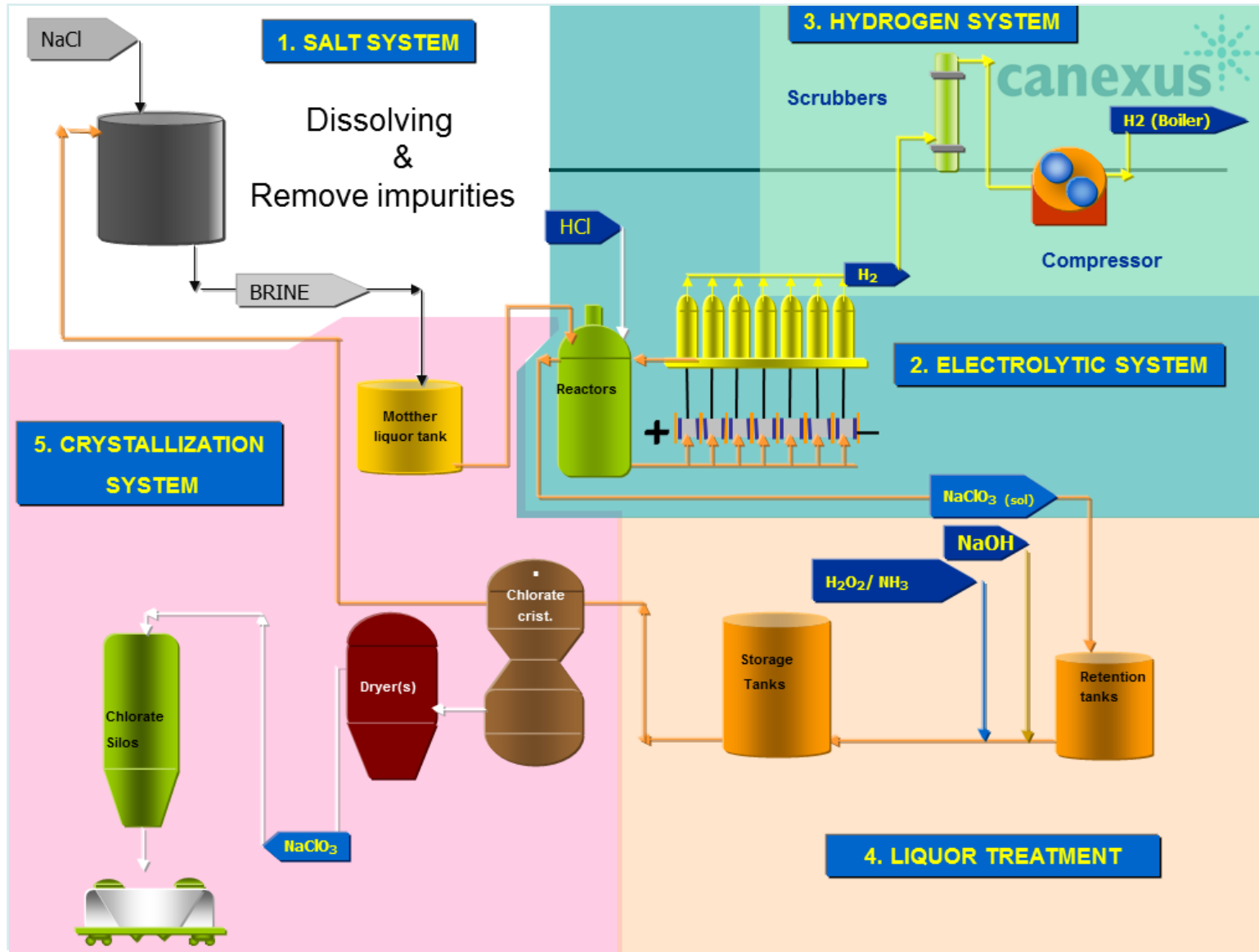
## SODIUM CHLORATE

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1. What is sodium chlorate ?
2. Sodium chlorate users ?
3. **Physical & Chemical Properties !**
4. **Personal Protective Equipment !**
5. SDS Review !
6.  $\text{NaClO}_3$  in ACTION !!!

# What is Sodium chlorate?

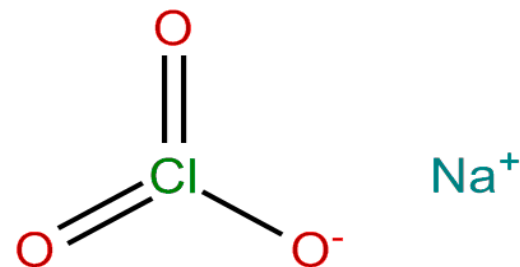


# PRODUCT SAFETY SEMINAR

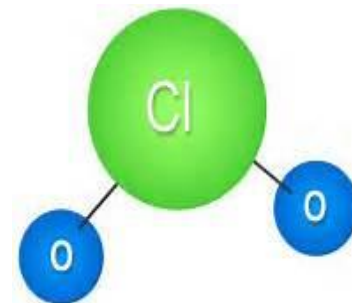
## SODIUM CHLORATE

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- **Sodium chlorate users**



- Majority (>95%) of the production is used in pulp and paper industry for chlorine dioxide generation
- Other application include
  - Agriculture (herbicides and defoliants)
  - Mining (vanadium and uranium)
  - Chemical synthesis (rocket propellants and dyes)
  - Shale gas





# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

### Physical & Chemical Properties

- **General**

- **Chemical formula:**  $\text{NaClO}_3$
- **Appearance:** White crystalline solid
- **Odor:** Odorless
- **Density:** Solid is 2.5 times as heavy as water



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE



## Physical & Chemical Properties

### • General

- **pH:** Neutral (solution in water)

- **Solubility:** Soluble in water

-79 g/100 ml or 2.8 oz/ 0.21 pt (0 °C=32 F)

-101 g/100 ml or 3.6 oz/ 0.21 pt (20 °C = 68F)

- 230 g/100 ml or 8.1oz/0.21 pt (100°C= 212 F)

Heated water  
is  
The POWER !

- **QUIZ:**  $\text{H}_2\text{O} + \text{NaClO}_3$  then

a) temp.  b) temp.  c) temp. 

**Answer:** Endothermic reaction;  
Temperature decreased

# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

### Physical & Chemical Properties

- **Reactivity**

- Stable under normal temperature condition
- Decomposes at 265 C (509F) into Oxygen and salt.
- Reacts with acids to produce chlorine, chlorine dioxide



- Reacts violently with **sulfuric acid**.
- Mixture of dry sodium chlorate with organic materials such as **cloth, leather, oil, greases**, may be readily ignited by heat or **friction**.



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

-True story -



This worker suffered burns as shown when a **flash fire** occurred as he **began welding**. His leather gloves had become contaminated with sodium chlorate solution and became **extremely combustible when the gloves dried**.



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

---

### In case of fire???

Only water can put out chlorate fires

Never smother with blanket or chemical extinguisher

Drench with water immediately (fire propagation is rapid)

A)



B)



WHY ??



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

### Personal Protective Equipment (PPE)

- High Exposure (e.g. Chemical Unloading)



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

---

### Personal Protective Equipment (PPE)

- **General Practice**

- Remove contaminated clothing and immediately rinse
- Shower with soap & water after each shift
- Keep work and street clothes separate
- Be cautious of leather clothing (e.g. belts, watch bands, gloves)



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

---

### SDS Review

- **Skin Irritant.**
  - **Mild Irritant** (may irritate eyes and skin)
  - Safety showers and eyewash fountains should be provided in strategic locations to permit easy access.



### First Aid



- Flush eyes and skin with water for at least 15 minutes.
- Remove contaminated clothing and rinse immediately.
- Get medical attention (**do not apply oils, greases** or skin creams – can cause flammable mixture).



# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

---



### SDS Review



- **Inhalation.**

- **Irritant** (dust may irritate respiratory tract and mucous membranes).
- Proper ventilation will minimize exposure.
- Workers should wear particulate respirators in areas where high concentration of dust may exist.

### First Aid



- Remove victim to fresh air. Give artificial respiration or oxygen if breathing becomes difficult.
- Seek medical attention.

# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

---



## SDS Review

- **Ingestion.**
  - **Swallowing** sodium chlorate is dangerous and may be fatal.
  - Workers should not eat or drink in the sodium chlorate area. After handling chlorate wash thoroughly before eating.

## First Aid



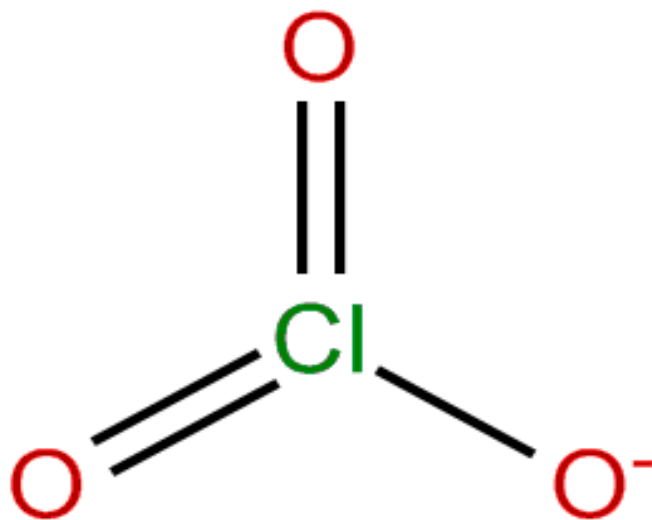
- Seek medical attention immediately.

# PRODUCT SAFETY SEMINAR

## SODIUM CHLORATE

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### NaClO<sub>3</sub> Movie TIME





**IMPORTANT:** The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. No warranty or guarantee, expressed or implied, is made regarding performance, stability or otherwise. This information is not intended to be all-inclusive as the manner and conditions of use, handling, storage and other factors may involve other or additional safety or performance considerations. While our technical personnel will be happy to respond to questions regarding safe handling and use procedures, safe handling and use remains the responsibility of the customer. No suggestions for use are intended as, and nothing shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, Provincial and local laws.



# Training Time Survey

Bleaching Committee Fall 2016

Hinton, AB

Compiled by Rick Wasson

Irving Pulp & Paper

# Training Program Review

- Training Programs Overview
- Simulators
- Trainers
- Training Times
- Qualification and Controls

# Overview Mill A

- Classroom safety and orientation
- Training coordinator
- Coordinator
  - Schedule
  - Update meetings and stage checks
- 60 day decision point
  - Can postpone to 90 days in special case
- Video, CBT, Classes, OJT, Written material, interactive testing

# Overview Mill B

- Online Tracking system
- Team member –Tell, Show, Do
- Coordinator
  - Sign off – Tell, Show, Do
- 60 day decision point
  - Can postpone to 90 days in special case
- CBT, Classes, OJT (internal trainers), Written Materials



# Overview Mill C

- Qualification checklist
  - Sketch and trace, write procedure, review lockouts...
- Manuals, OJT, Yearly Training, Classroom
- OTJ Trainer (Not designated)
  - New operators training newer operators
- Once through checklist meet:
  - Shift Supervisor, Pulp Mill Manager, Operations Manager
  - Questions
  - Sign Off

# Overview Mill D

- Competency based training
- Coordinator
  - Manuals, learner guides, regulatory training
  - Schedule
  - Update meetings and stage checks
  - Written and verbal testing
- On the job training – Supervisor/Supt guidance
- 60 day decision point
- Video, CBT, Classes, OJT, Written material, interactive testing
- Panel Qualification
- Seasoning

# Methods

- Videos
- Computer Based Training
- Classroom (Specialized, Vendor...)
- On the Job Training
- Written material
- Interactive Testing
- Shift swaps, called in for events
- Simulator

# Training Times

- 6 months
- 1.5 years (new to industry), 9 months afterward
  - Seasoning time varies
- 6 weeks to 6 months depending on position
- 1 to 6 months depending on position
  - Can extend

# Pre Qualifications

- 60 day evaluations
- Requirements to join company
  - Testing
  - Do they meet technical training requirements?
  - HR & Area work together

# ClO<sub>2</sub> Generator Safety Systems

Bleaching Committee Fall 2016

Hinton, AB

Compiled by Rick Wasson

Irving Pulp & Paper

# ClO<sub>2</sub> Plant Safety Systems Survey

## Survey Questions

- ClO<sub>2</sub> Generator
- ClO<sub>2</sub> Solution Storage
- ClO<sub>2</sub> Heating
- Control Systems
- Redundancy
- Community
- Audits and Training

# ClO<sub>2</sub> Generator Safety Best Practices

- Separate Building
- Access Controls
  - Lights/horns – Red/Amber (Auto and Manual triggers)
  - Operator interaction (Permit, Radio, sign in)
- Hot Work Process
  - System down and empty/Mill hot work process
  - Fire Watch/levels
- Functional Checks
  - Annually (Interlocks)
- Strength Monitoring
  - Online (redundant) with lab checks



# ClO<sub>2</sub> Generator Safety Best Practices

- Absorber with gravity drains (rare)
  - Alternately Redundant pumps and backup power
- Relief Cap Vents
  - Outside (through a scrubber)
- Steam Ejectors
  - Interlocks/physical locks
- Organics policy
  - No organic material allowed
- Management of Change
  - Robust, including process, controls, parts and equipment

# ClO<sub>2</sub> Storage Safety Best Practices

- Containment dyke
  - Full volume +
- Off Gas Protection
  - Passive and active systems
    - Mineral oil, bisulfate, foam
- Pressure Relief
  - Vent outside/Scrubber
- Pressure relief protection???
- Traffic Calming

# ClO<sub>2</sub> Heating Safety Best Practices

- Physical protection
  - Vent ClO<sub>2</sub> when too hot, Under/over pressure
    - Flush
  - Control heating medium temperature
  - Interlocks

# ClO<sub>2</sub> Control System Safety Best Practices

- Operator Attention
  - Dedicated/focused
- Interlocks: Manufacturer Recommended
- Supervisory controls?
- Backup systems
  - Looped controls/Multiple feeds
- Controls Access
  - Tight on operator changes
  - Limited access to systems changes
    - MoC system

# ClO<sub>2</sub> Redundancy Safety Best Practices

- ClO<sub>2</sub> pumps to storage
- ClO<sub>2</sub> scrubber exhaust fans
- ClO<sub>2</sub> area sumps (if not gravity drained)
- Backup generator and air for above
- ClO<sub>2</sub> solution strength online
- ClO<sub>2</sub> solution pumps to storage
- Control systems

# ClO<sub>2</sub> Incident Response Safety Best Practices

- Community coordination
- Community response team site tours
- Mock events

# ClO<sub>2</sub> Incident Response Safety Best Practices

- Community coordination
- Community response team site tours
- Mock events
- E2

# ClO<sub>2</sub> Audit and Training Safety Best Practices

- Annual Audits
- Annual Training
  - Chemical Training
  - Procedure Review
    - Emergency Response
- HAZOP for Changes



# Acknowledgements

Thank you to the mills that participated in the survey and to those who made additions today

Please respond to the survey if you haven't already.



# **CHEMICAL UNLOADING & HANDLING OVER THE YEARS**

**Summary of Past Presentations**  
**Report to Bleaching Committee**  
**Fall 2016 Updates**

Jim Collins – October 25, 2016

# Chemical Unloading & Handling

## Summary of Past Presentations

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### ✓ Chemical Handling Safety

- Proposed 1989
- Project still on-going
- Presentation on different bleaching chemicals at each meeting

# Chemical Unloading & Handling

## Summary of Past Presentations

---

### ✓ Chemical Handling Safety Presentations

- Fall 1996 – Sodium Hydroxide
- Spring 1997 – Sulphuric Acid
- Spring 1997 – Oxygen & Ozone
- Fall 1997 - No presentations
- Spring 1998 - Sulphur Dioxide
- Fall 1998 - Chlorine Dioxide
- Spring 1999 - Sodium Chlorate
- Fall 1999 - Oxygen
- Spring 2000 - No Presentation – 2000 IPBC

# Chemical Unloading & Handling

## Summary of Past Presentations

---

### ✓ Chemical Handling Safety Presentations

- Fall 2000 - Hydrogen Peroxide
- Spring 2001 - Methanol
- Fall 2001 - Sodium Chlorate
- Spring 2002 - Sulphur Dioxide
- Fall 2002 - Chlorine Dioxide
- Spring 2003 - Best Practices for Chemical Unloading
- Fall 2003 - Oxygen / Ozone
- Spring 2004 - White Liquor (Hydrosulphite)
- Fall 2004 - Non-Bleaching Chemical (Defoamers)

# Chemical Unloading & Handling

## Summary of Past Presentations

---

### ✓ Chemical Handling Safety Presentations

- Spring 2005 - Sodium Hydroxide
- Fall 2005 – Chlorine Dioxide
- Spring 2006 – Sulphur Dioxide
- Fall 2006 – Sulphuric Acid
- Spring 2007 – Hydrogen Peroxide
- Fall 2007 – Occupational Hygiene
- Spring 2008 – No Presentation – 2008 IPBC
- Fall 2008 – Sodium Hydroxide
- Spring 2009 – Carbon Monoxide

# Chemical Unloading & Handling

## Summary of Past Presentations

---

### ✓ Chemical Handling Safety Presentations

- Fall 2009 – Oxygen Handling
- Spring 2010 - Methanol
- Fall 2010 – Chlorine Dioxide Storage
- Spring 2011 – Sodium Chlorate Railcars
- Fall 2011 – Chlorine Dioxide
- Spring 2012 – Sulphuric Acid
- Fall 2012 – Hydrogen Peroxide
- Spring 2013 – Sodium Chlorate
- Fall 2013 – Sodium Hydroxide

# Chemical Unloading & Handling

## Summary of Past Presentations

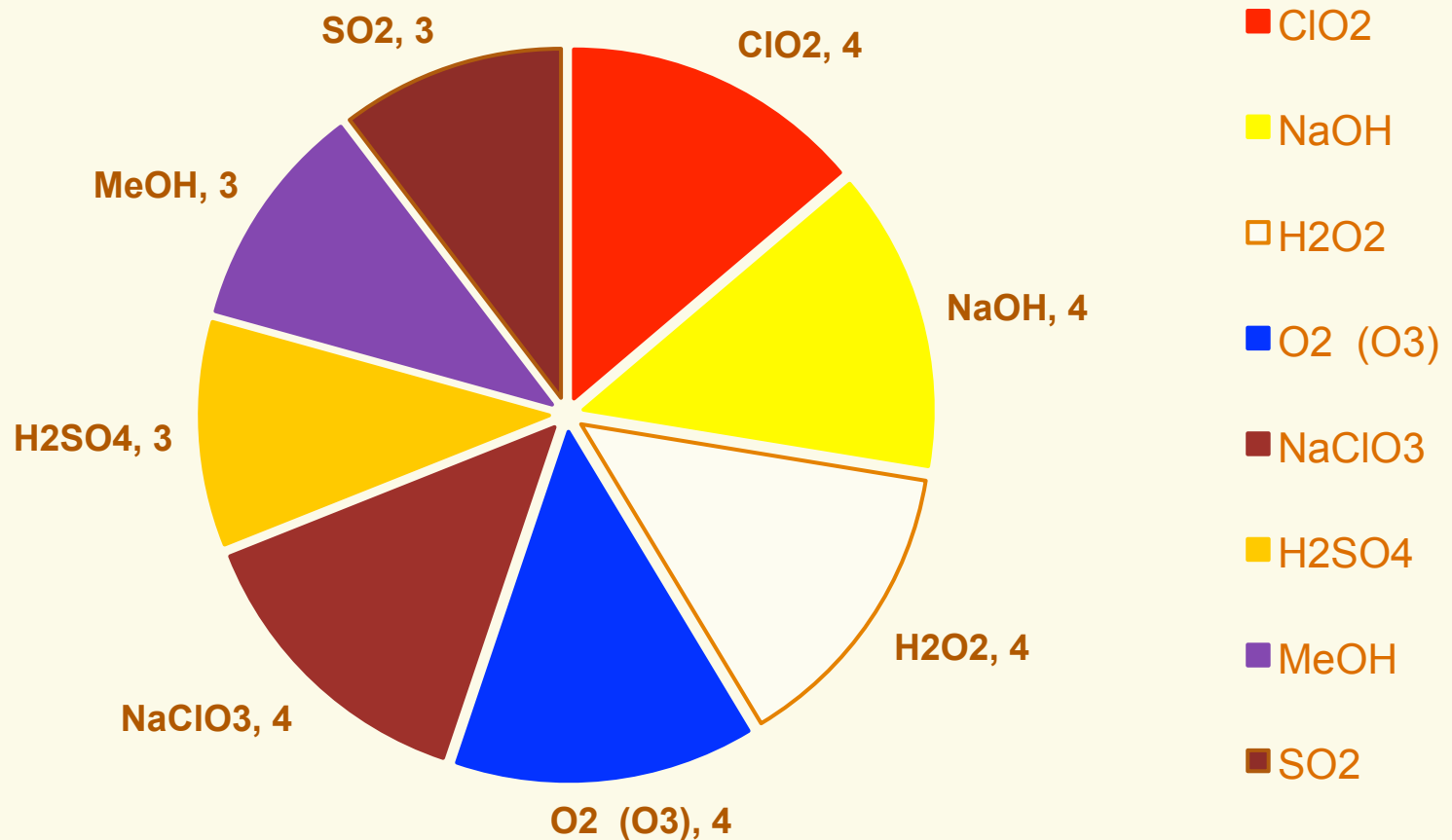
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### ✓ Chemical Handling Safety Presentations

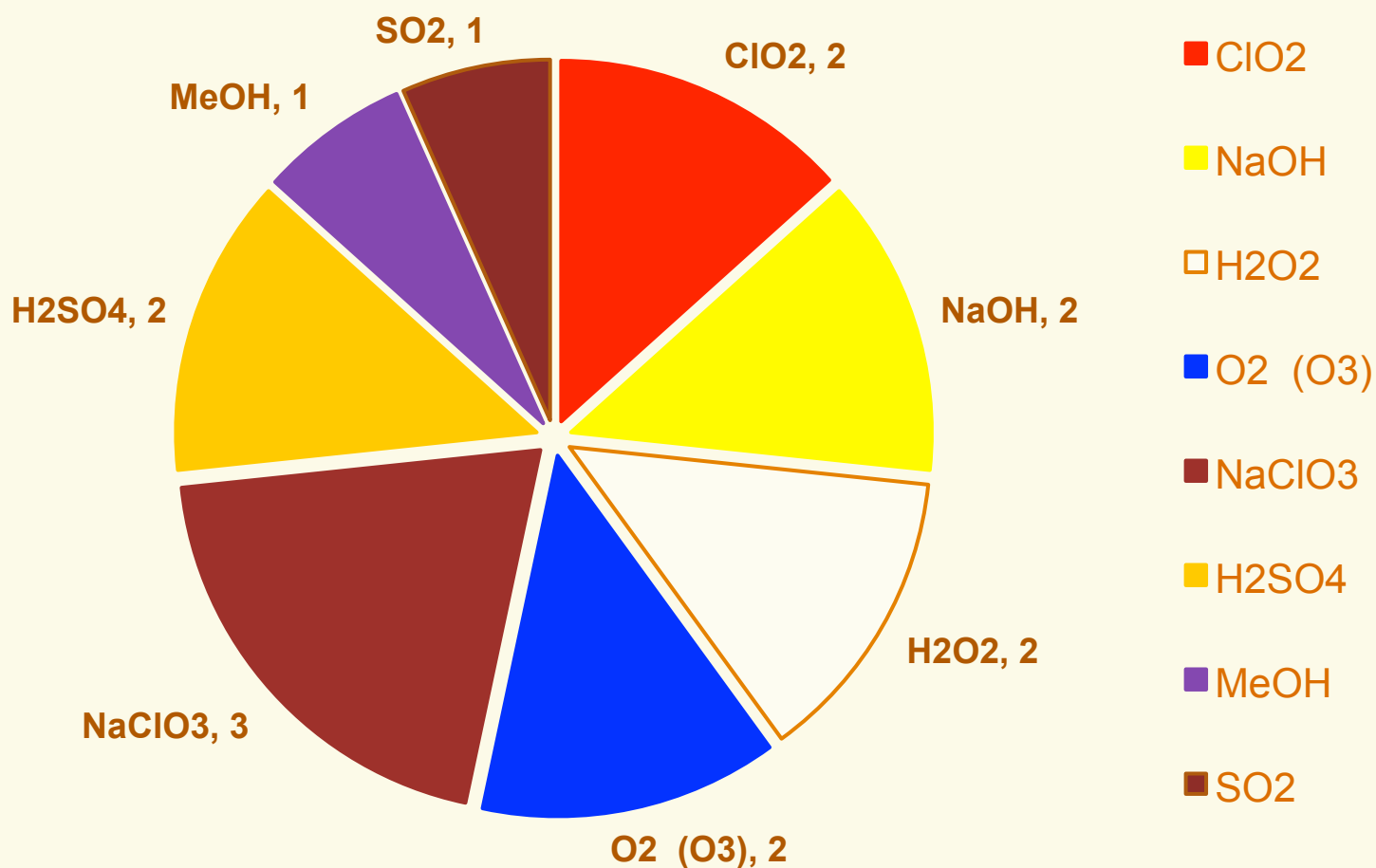
- Spring 2014 – Oxygen
- Fall 2014 – Defoamers & Pitch Dispersants
- Spring 2015 – Respirators
- Fall 2015 – Methanol
- Spring 2016 – Hydrogen Peroxide
- Fall 2016 – Sodium Chlorate
- Spring 2017 – ??
- Fall 2017 – ??



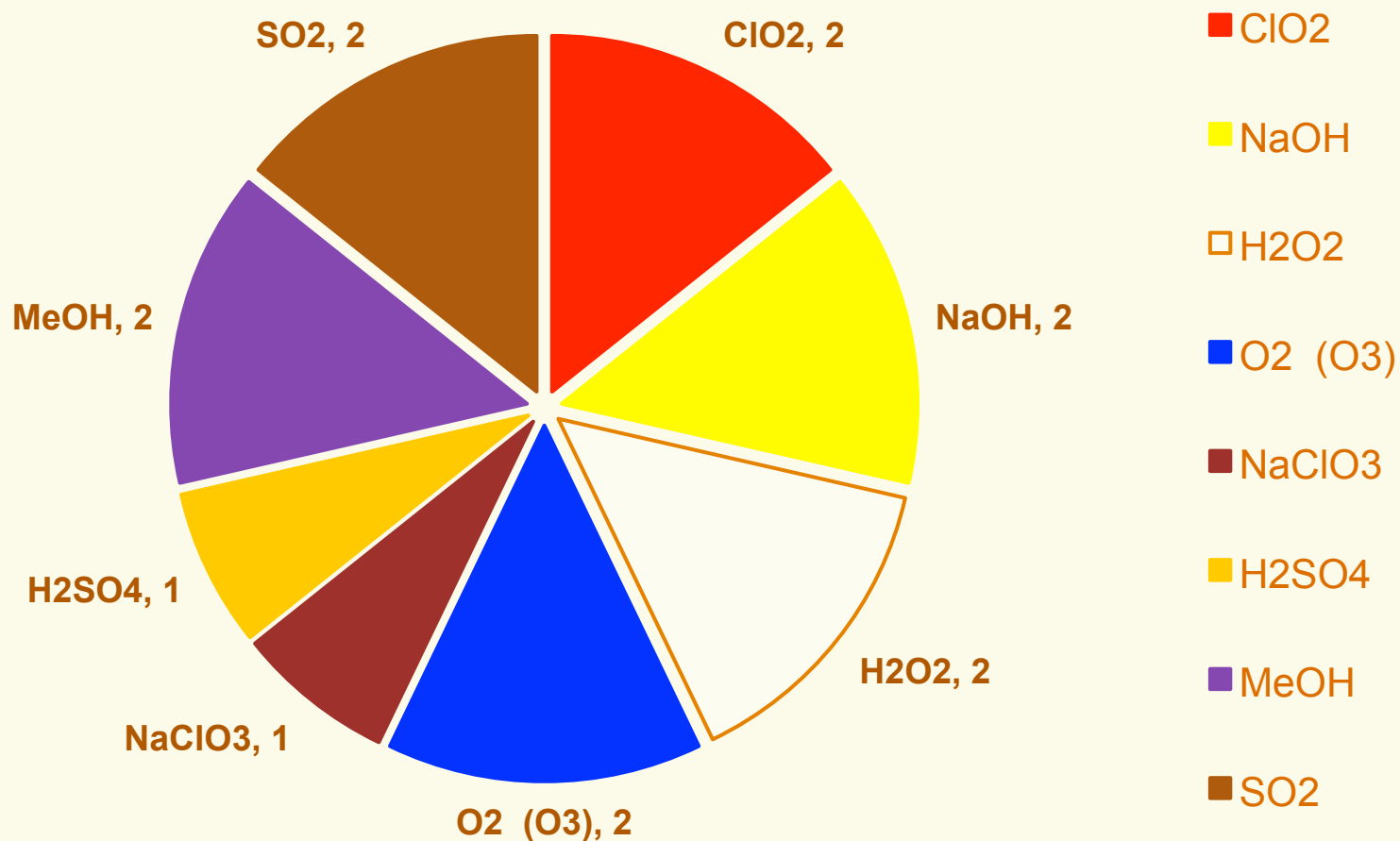
# Major Bleach Process Chemicals Presentations



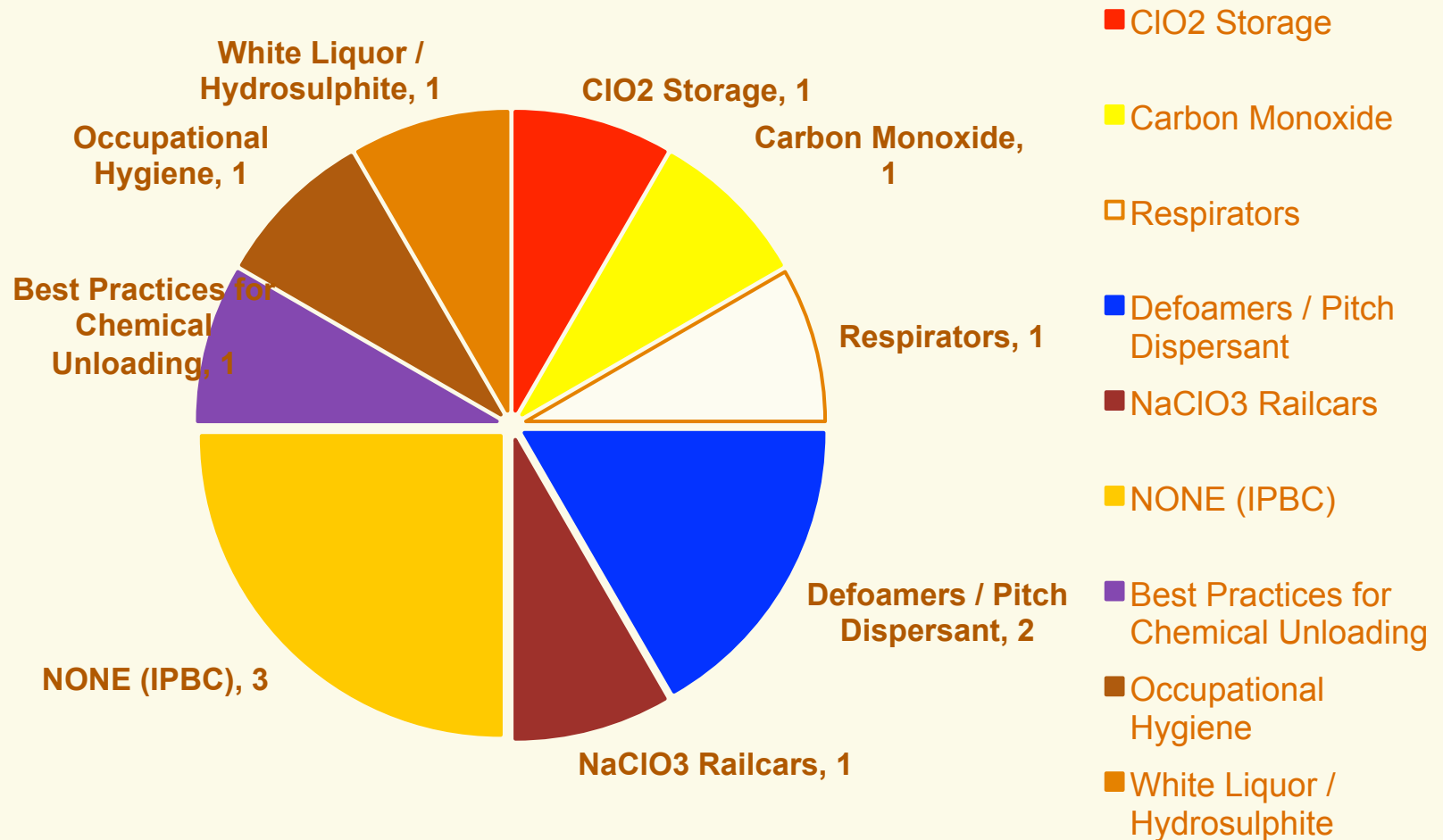
# Major Bleach Process Chemicals – WEST



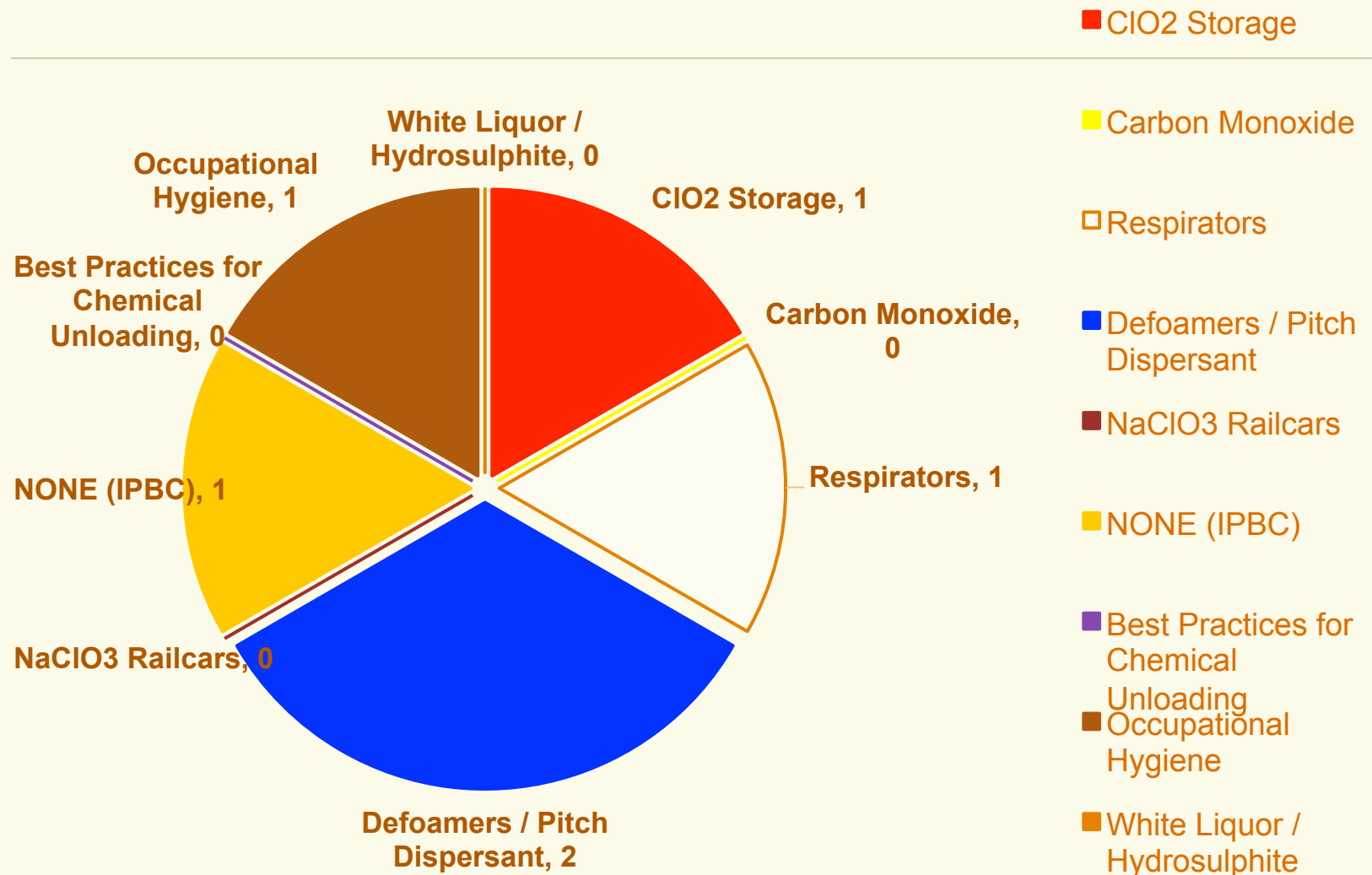
## Major Bleach Process Chemicals – EAST



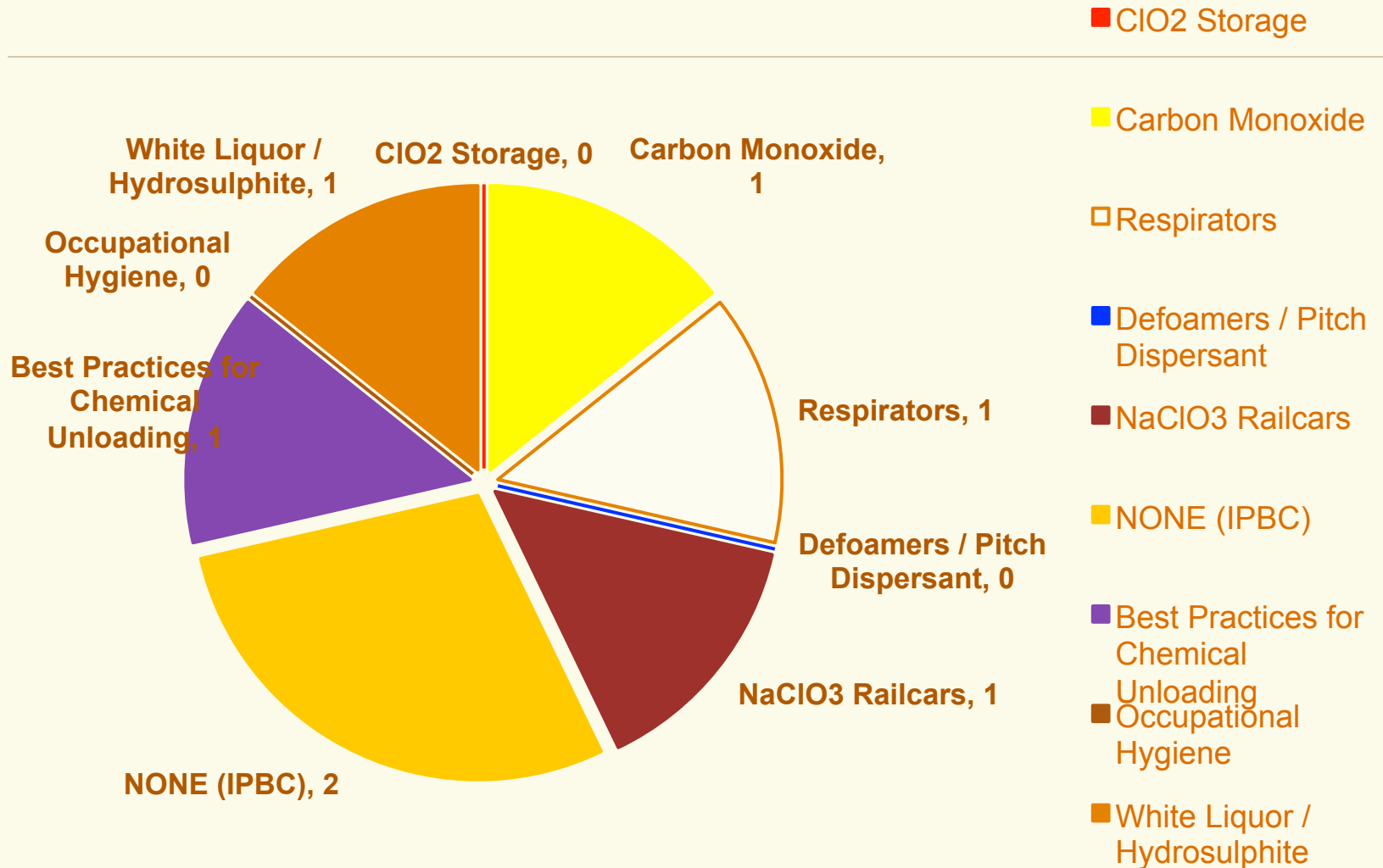
## Other Presentations – SAFETY



## Other – Safety – WEST



## Other – Safety – WEST



## *Major Bleach Process Chemicals Presentations*

<i>Process Chemicals</i>	Meeting in East	Meeting in West	Times in East	Times in West	Total Times Presented	Last presented in East	Last presented in West
ClO <sub>2</sub>	F98	F02, F05, F11	2	2	4	F98	F11
NaOH	F96, S05	F08, F13	2	2	4	S05	F13
H <sub>2</sub> O <sub>2</sub>	S07, S16	F00, F12	2	2	4	S16	F12
O <sub>2</sub> (O <sub>3</sub> )	F99, S14	F03, F09	2	2	4	S14	F09
NaClO <sub>3</sub>	S13	S99, F01, F16	1	3	4	S13	F16
H <sub>2</sub> SO <sub>4</sub>	S12	S97, F06	1	2	3	S12	F06
MeOH	S01, S10	F15	2	1	3	S10	F15
SO <sub>2</sub>	S02, S06	S98	2	1	3	S06	S98

## Other Presentations – SAFETY

Chemical <i>OTHER:</i>	Meeting in East	Meeting in West	Times in East	Times in West	Total Times Presented	Last presented in East	Last presented in West
ClO <sub>2</sub> Storage		F10	0	1	1		
Carbon Monoxide	S09		1	0	1		
Respirators	S15		1	0	1		
Defoamers / Pitch Disp.		F14, F04 (Def)	0	2	2		F14
NaClO <sub>3</sub> Railcars	S11		1	0	1		
NONE - IPBC / Other	S08, S00 (IPBC)	F97 (Mtg)	2	1	3		
Best Practices Chem. Unloading	S03		1	0	1		
Occupational Hygiene		F07	0	1	1		
White Liq / Hydrosulphite	S04		1	0	1		



# Chemical Unloading & Handling

## Summary of Past Presentations

---

### ✓ Chemical Handling Safety Presentations - Future?

- East – Spring 2017 ?
  - $\text{ClO}_2$
  - $\text{NaOH}$
- West – Fall 2017 ?
  - $\text{H}_2\text{SO}_4$
  - $\text{O}_2 / \text{O}_3$

# Other Suggestions

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# Advanced Bleach Plant Controls

## Can Uptime be High with No Operator Intervention?

Alison Rowat

PAPTAC Fall Conference 2016



# Yes!

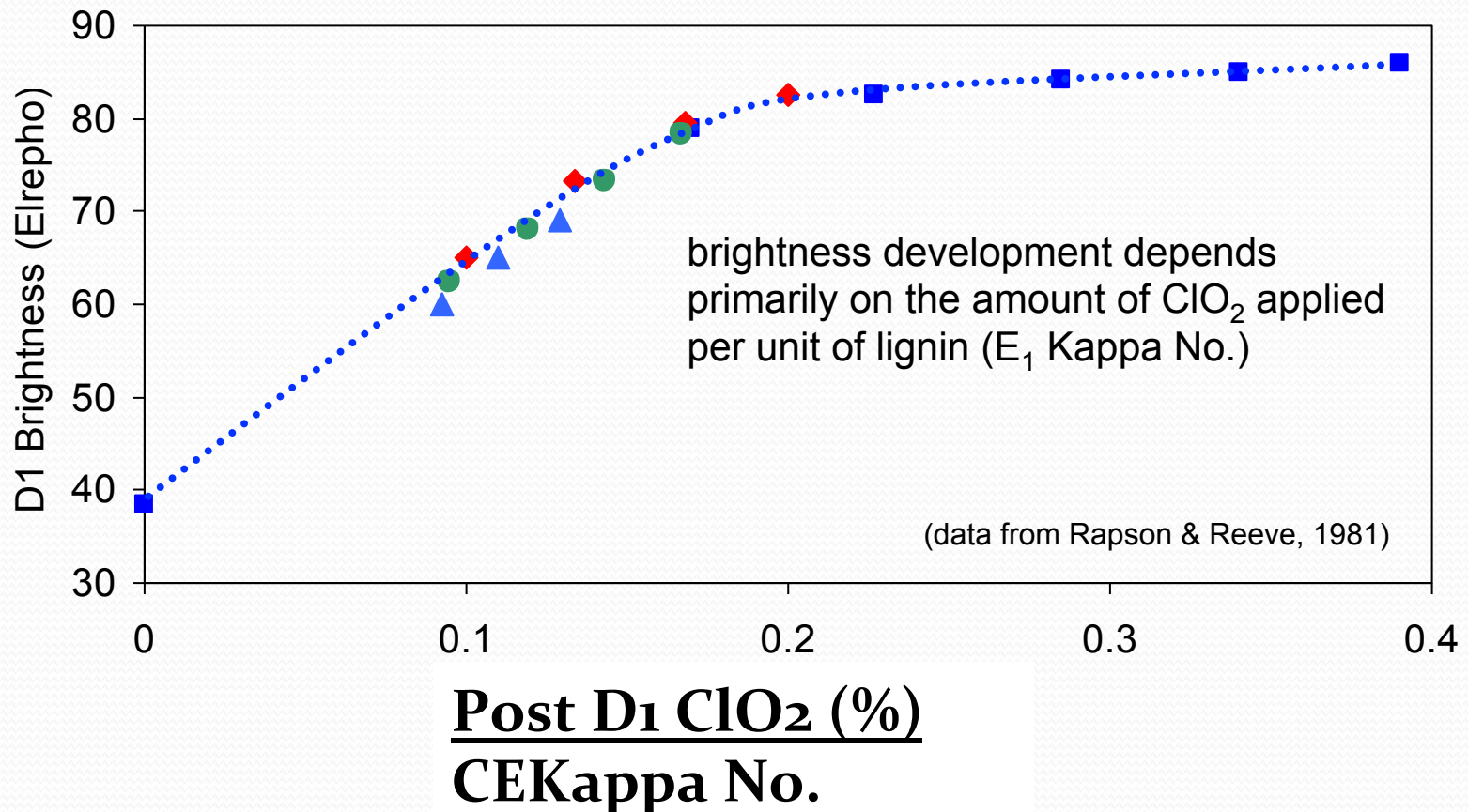
Bleach Plant Control Uptime can be high with no operator intervention if:

1) controls are set up to add too much chemical

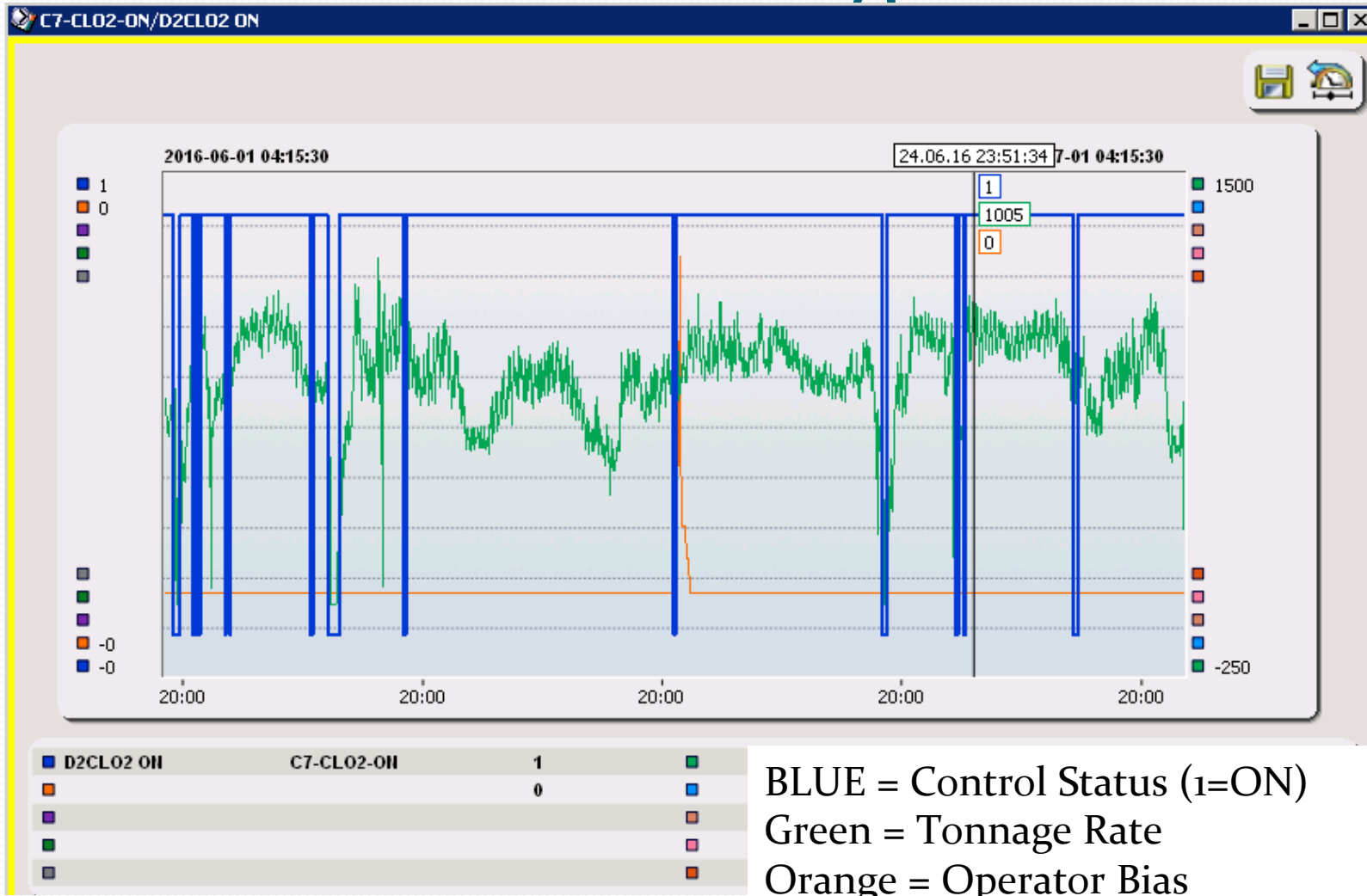
OR

2) controls work well and are routinely monitored

When Controls are set up to add too much chemical, operate at asymptote. Brightness is stable but chemical usage is higher than it needs to be



# Here is a 1 month snapshot of one of our mill's D0 Stage



# D0 Control Uptime 95% for entire month

- Bias used once
- This is typical for our mills
- Keys to Success:
  - Accurate, repeatable and frequent measurements
  - Good control strategy (Use of online kappa and brightness measurements AND bleaching sensors (inline brightness/inline residual), tonnage rate, and long term feedback)
- Monitoring – seasonal changes, moisture of wood, age of wood and cooking conditions can all impact bleachability – must decide if/when to make any tuning changes but shouldn't require more than 2-3 times per year, or if sensors are replaced/cleaned and tuning on them should be checked

D2CL02 0N	C7-CL02-0N	1	0
0	0	0	0
0	0	0	0
0	0	0	0

BLUE = Control Status (1=ON)  
 Green = Tonnage Rate  
 Purple = Operator Bias

BLUE = Control Status (i=ON)  
Green = Tonnage Rate  
Purple = Operator Bias



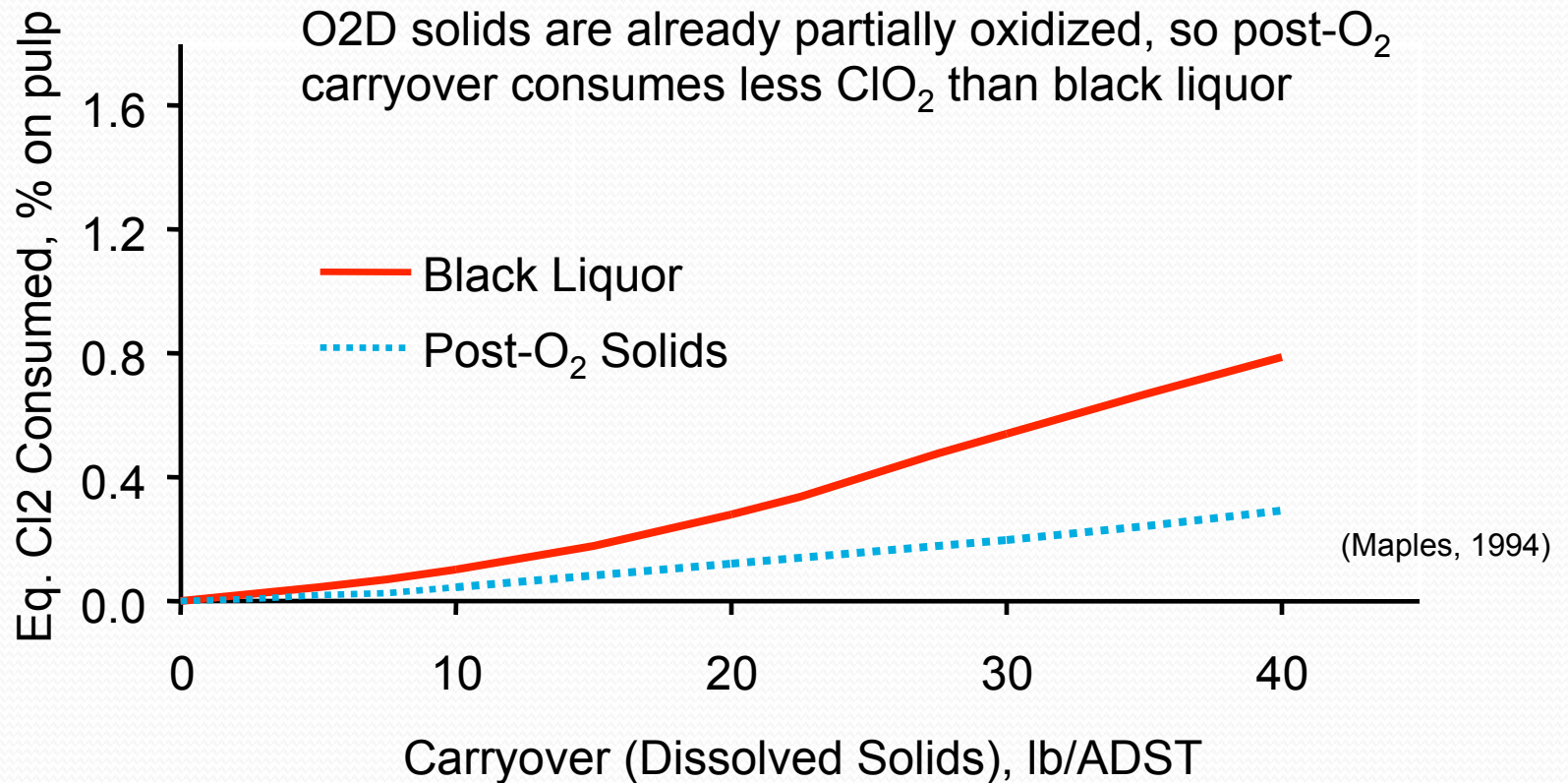
# Second D Stage Control Uptime 96% for entire month

- Bias used once (same operator, same time it was used in Do)
- Controls being off is exactly the same as for the first D stage, which is when the bleach plant was down.

Controls off for both D stages is identical – when bleach plant down

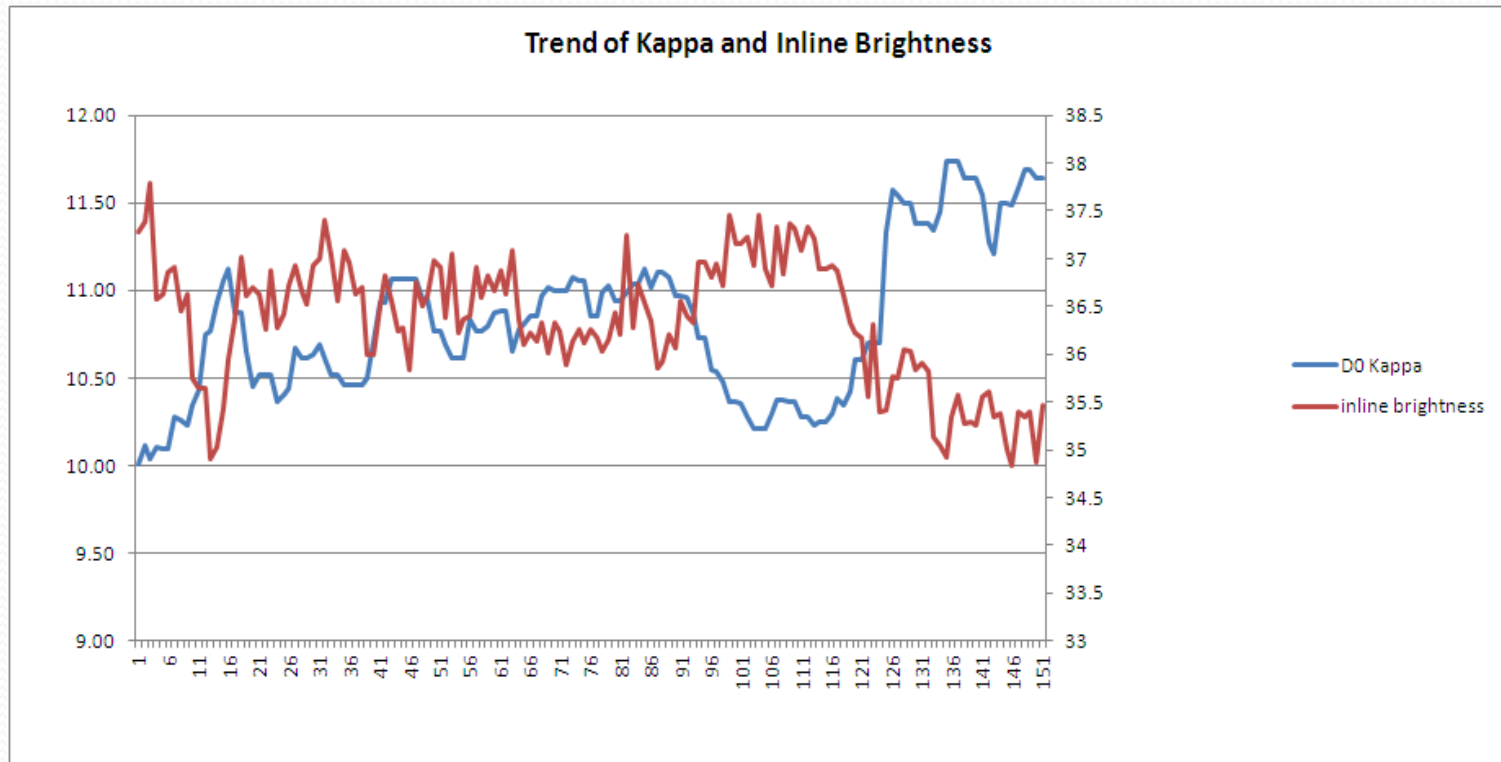


# Carryover from O<sub>2</sub> Delignification



# Inline Brightness and Kappa

- In the Do bleaching inline brightness signal responds to the *lignin content* (kappa) – it is an inverse relationship.

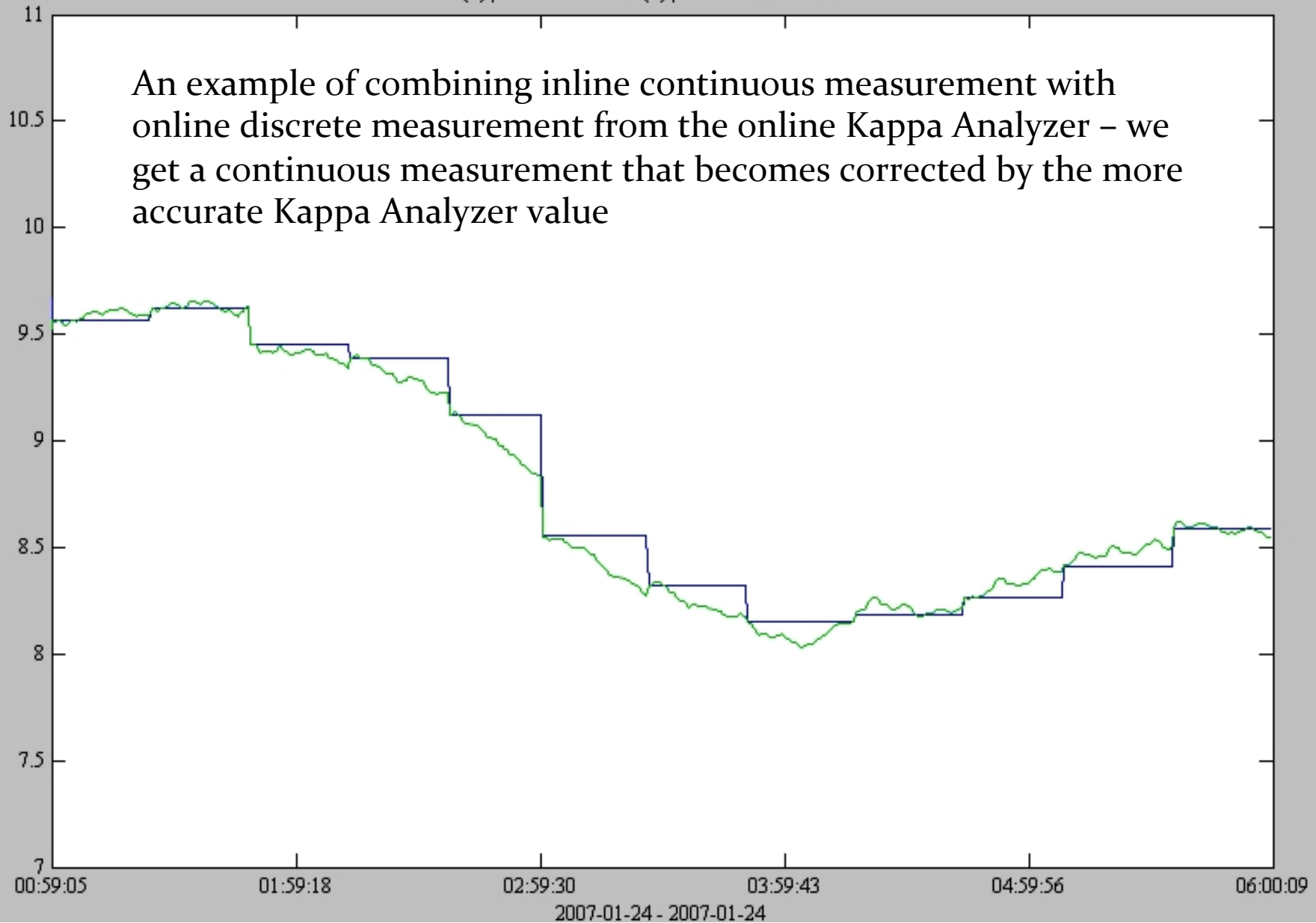


**So we can combine the Kappa from an online Analyzer and inline Brightness to make a continuous Kappa (D to C)**

# Inline Brightness + Kappa = Continuous Kappa

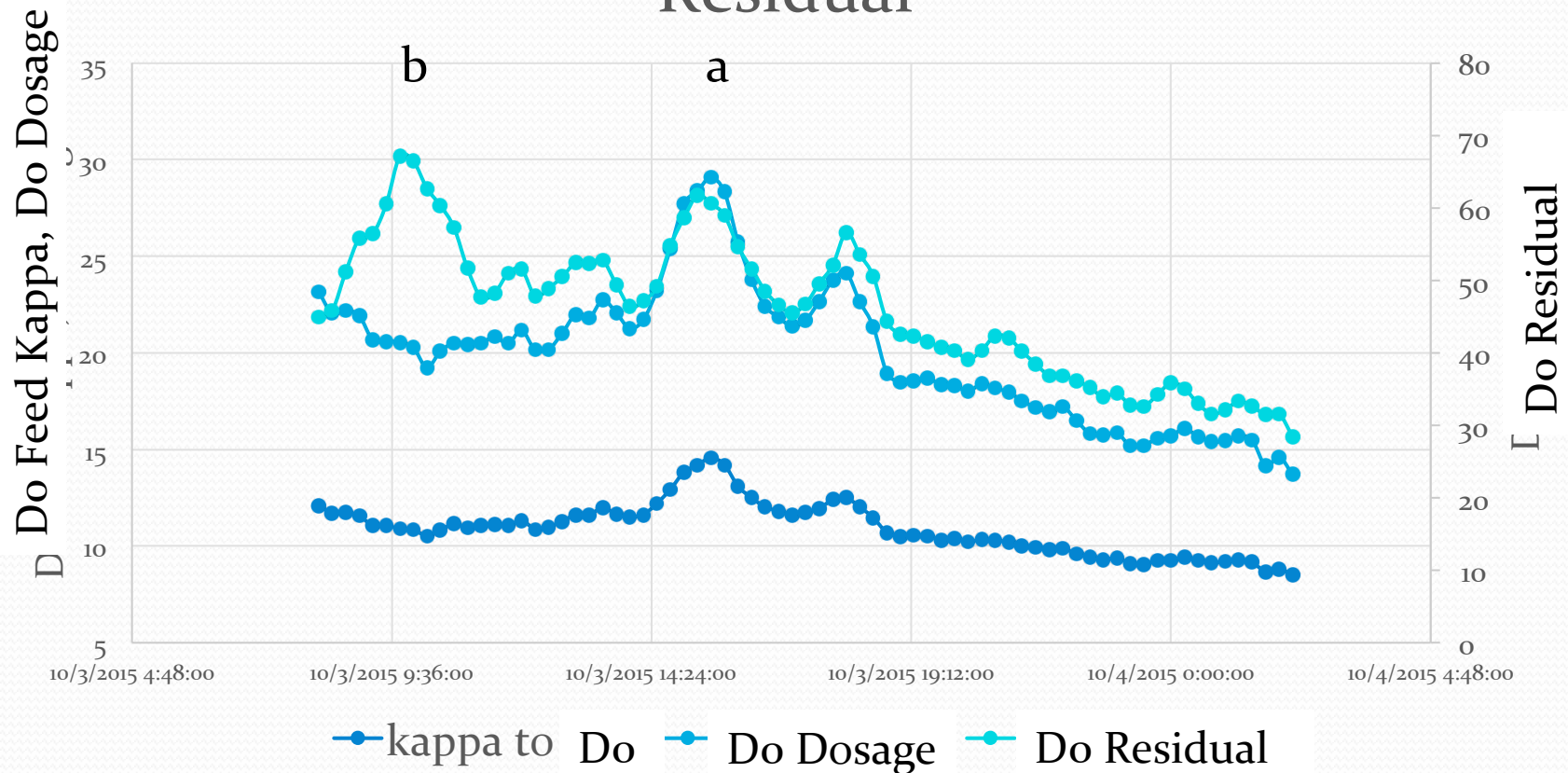
(7) pr:16-KAPPA-l:av (8) pr:16-KAPPA-CON:av

An example of combining inline continuous measurement with online discrete measurement from the online Kappa Analyzer – we get a continuous measurement that becomes corrected by the more accurate Kappa Analyzer value



# Effectively Use the Residual Sensor

Do Feed Kappa, Do Dosage and Do Residual



# Summary

- High Control Uptime and no operator bias is possible at low bleaching costs
- Operators are quick to turn advanced controls on and leave them there
- Our mills have low chemical usage from 3<sup>rd</sup> party benchmarking studies
- Good control strategy and routine monitoring and understanding of the strategy are key





## Focus on pH





# Spartan Controls – Emerson's Local Business Partner



- 51 years of employee owned sales, service and support
- 12 million hours without a lost time injury
- > 400,000 ft<sup>2</sup> locally owned infrastructure
- \$50M in inventory
- 13 years running as one of Canada's 50 Best Managed Companies

***We sell, apply and service instruments, control and automation solutions in the process industries***



# Presentation Overview



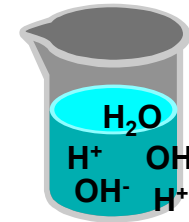
- Basic pH Theory
- Tips on the installation and use of pH sensors.
- Diagnostics can minimize maintenance
- pH issues and troubleshooting

# What is pH?



pH is the unit of measurement for determining the acidity or alkalinity of a solution

The symbol (pH) represents the Hydrogen Ion ( $H^+$ ) Activity in an Aqueous Solution



## *pH Scale vs Moles/Liter Ion Concentration*

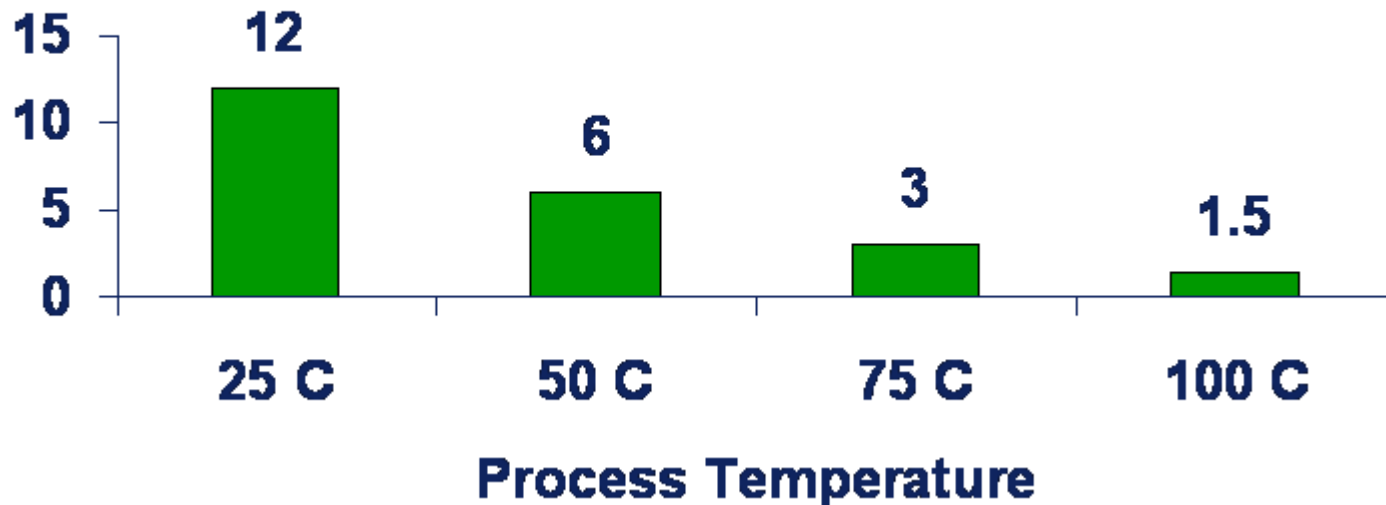
pH	Hydrogen Ion [ $H^+$ ]	Hydroxyl Ion [ $OH^-$ ]
0 Acidic	1.0	0.0000000000000001
1	0.1	0.000000000000001
2	0.01	0.0000000000000001
3	0.001	0.00000000000000001
4	0.0001	0.000000000000000001
5	0.00001	0.0000000000000000001
6	0.000001	0.00000000000000000001
7 Neutral	0.0000001	0.0000001
8	0.00000001	0.00000001
9	0.000000001	0.000000001
10	0.0000000001	0.0000000001
11	0.00000000001	0.00000000001
12	0.000000000001	0.000000000001
13	0.00000000000001	0.00000000000001
14 Basic	0.0000000000000001	1.0

# pH Probe a Consumable



- Room Temperature and Benign Process = 1 Year Life
- Life Halved for each 25 Deg C

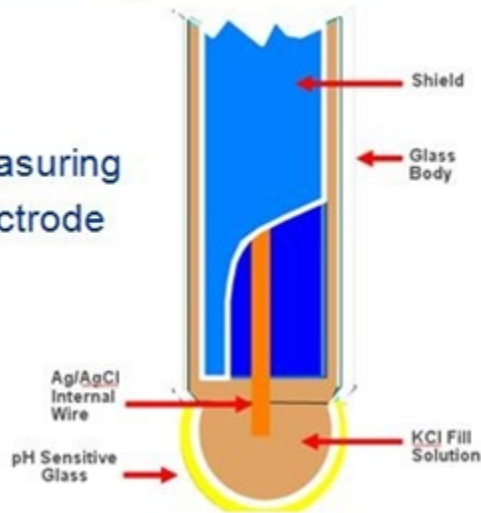
Months



# What's Inside a pH Sensor



Measuring  
Electrode



Reference  
Electrode

Ag/AgCl  
Internal  
Wire

Glass  
Body

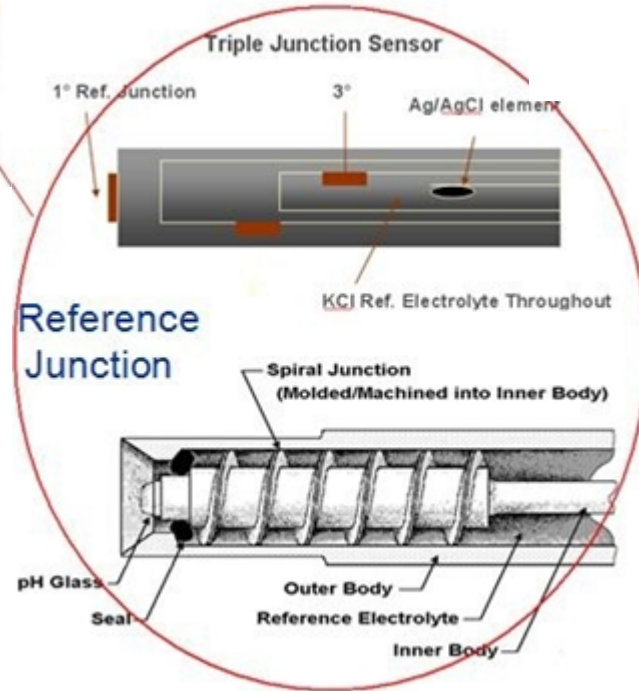
KCl  
Fill  
Solution

Temperature  
Compensator



Signal  
Pre-Amplifier

- At 25°C the pH electrode produces 59.16 mV per pH unit
  - The impedance of a general purpose pH electrode is approximately 100 Meg ohms
  - Ohms Law
    - Voltage (E) / Resistance (R) = Current (I)
    - $E/R = I$
- .....therefore 0.05916 v / 100,000,000 ohms = 0.000000001 Amps



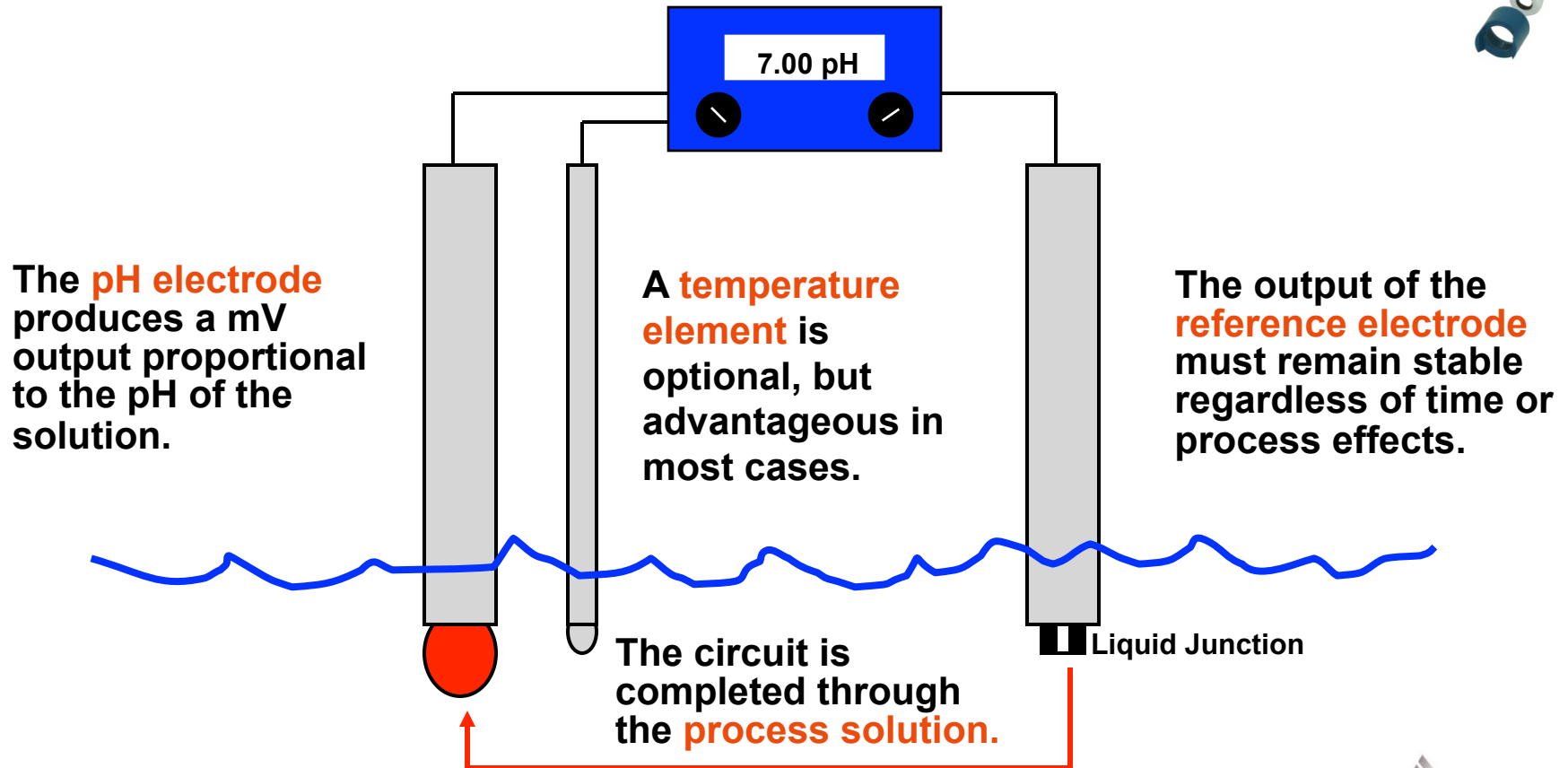
b



# How is pH measured?...

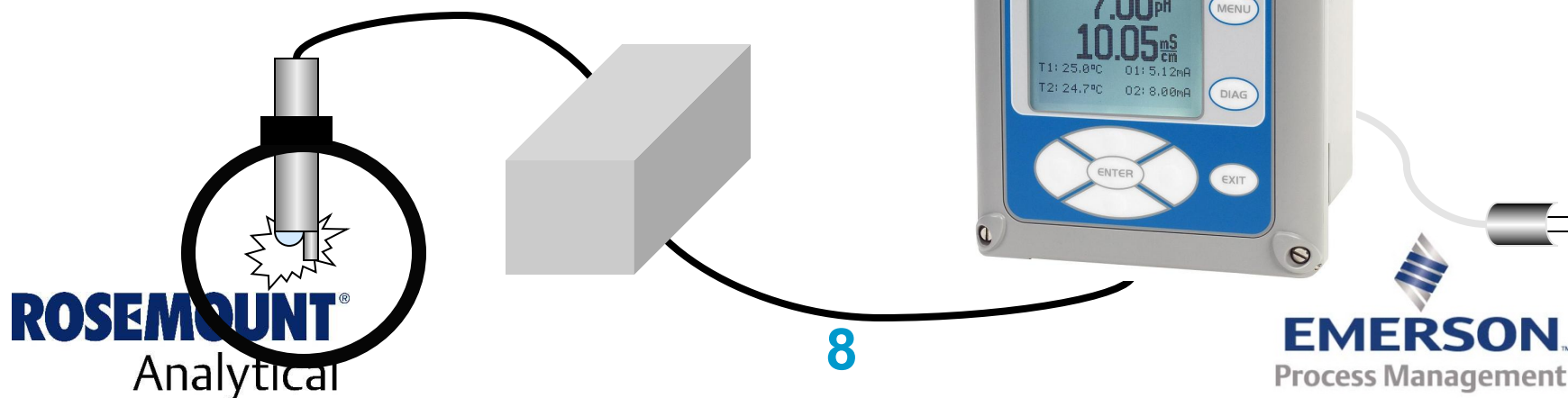


The **pH meter** is a high impedance volt meter



# *pH measurement*

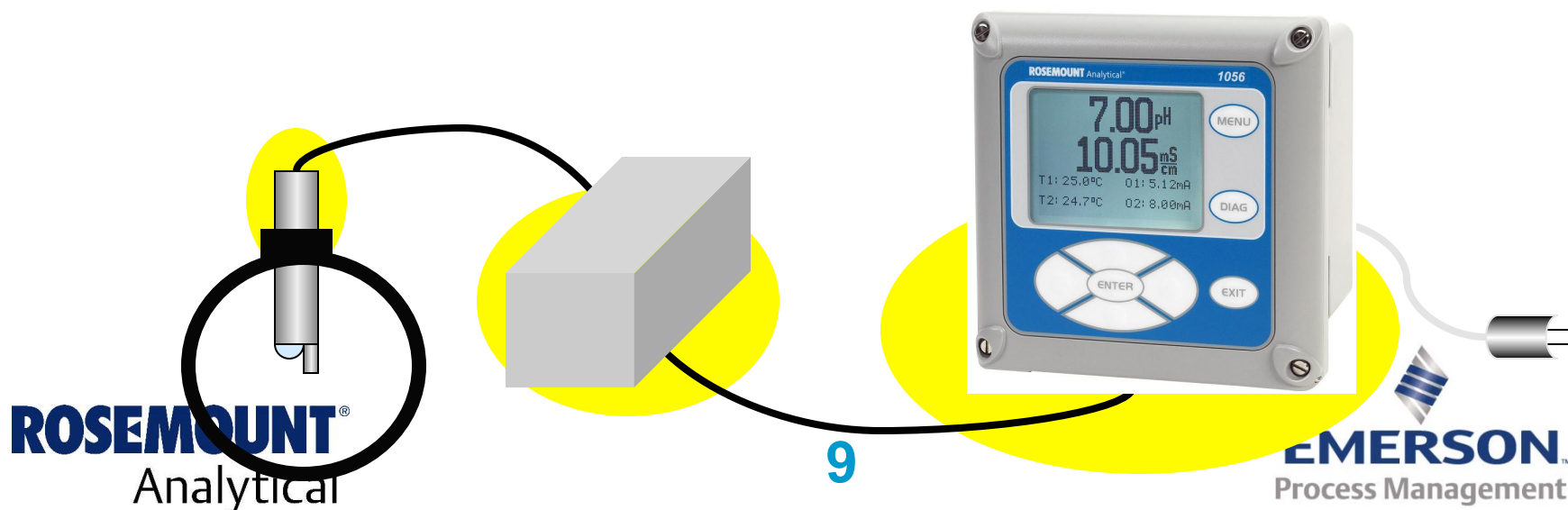
pH measurement starts with the sensor making an electro-chemical reaction with a solution. Please, keep your pH sensors wet!!



# pH measurement

pH measurement starts with the sensor making an electro-chemical reaction with a solution.

The signal is then processed through a preamplifier. The preamplifier can be physically located in the sensor body, the j-box, or in the analyzer's electronics. Do not use integral preamp if the process > 80 degrees C.



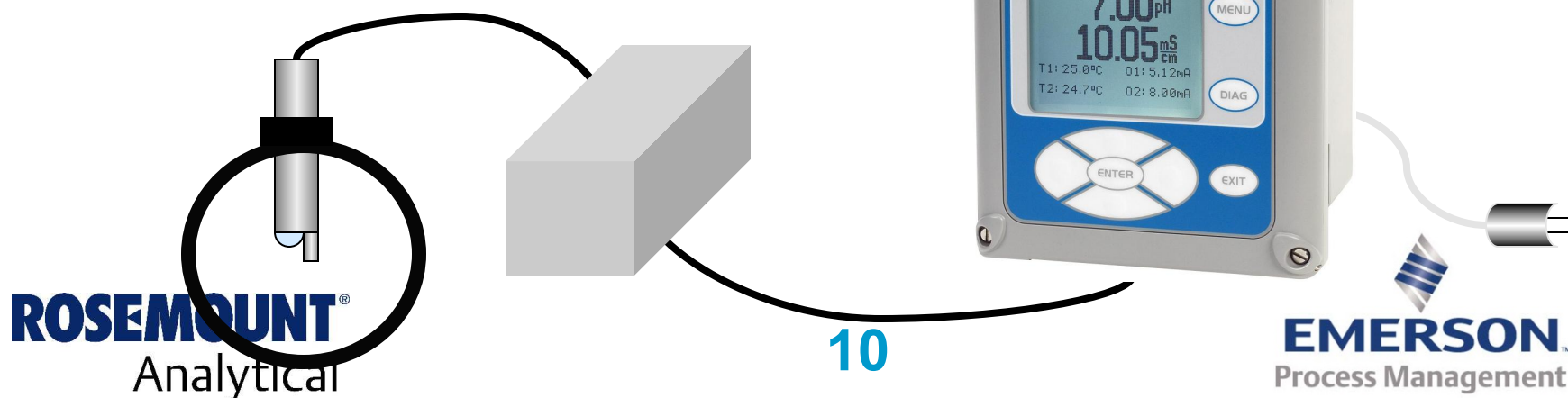


# pH measurement

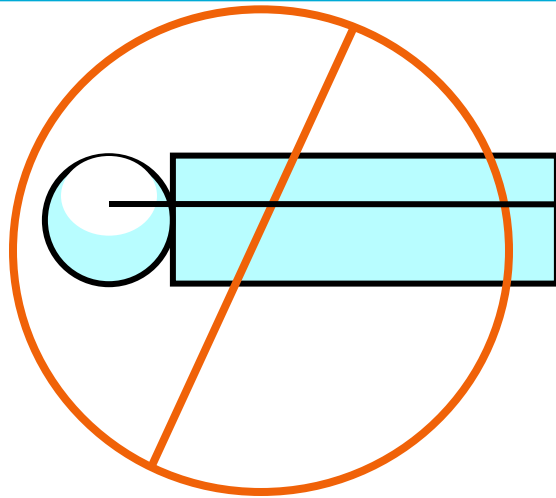
pH measurement starts with the sensor making an electro-chemical reaction with a solution.

The signal is then processed through a preamplifier. The preamplifier can be physically located in the sensor body, the j-box, or in the analyzer's electronics.

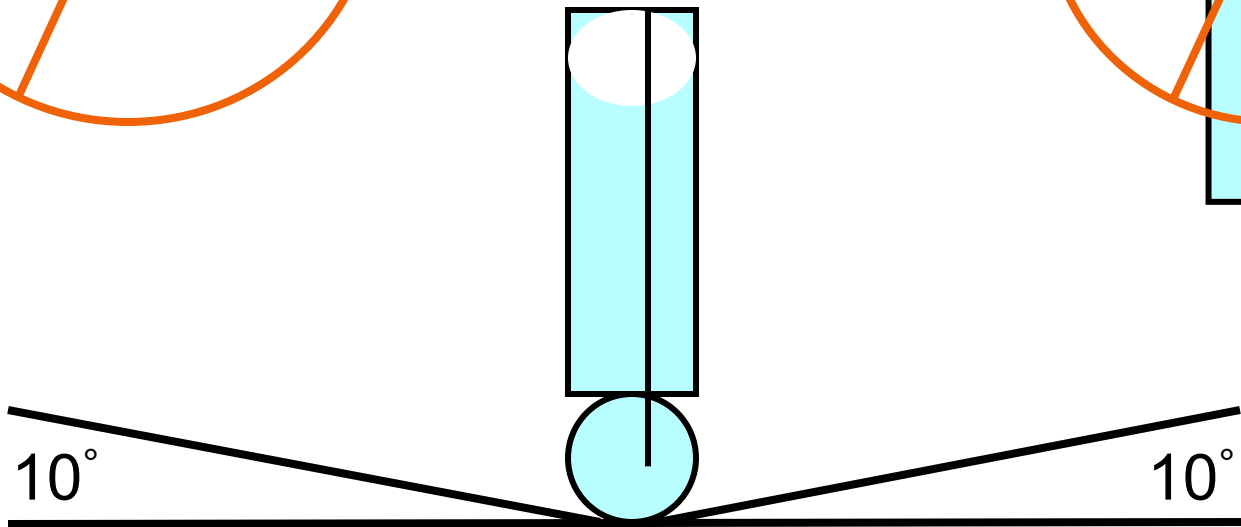
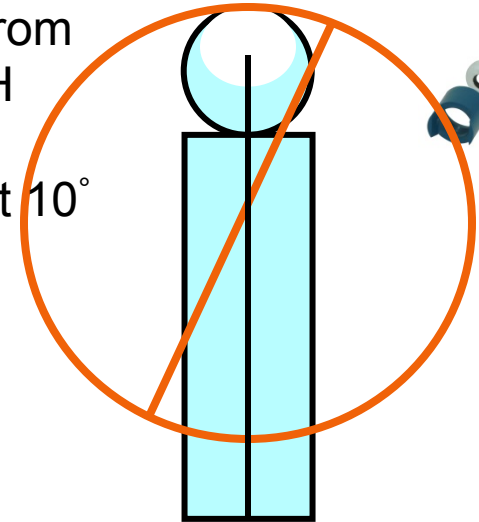
Finally, the millivolt input signal and the temperature signal are processed through the microprocessor, and a pH value is displayed.



# *pH sensor mounting*



To prevent the air bubble from blocking signal from the pH sensitive glass, the sensor should be mounted at least 10° above horizontal.



pH sensors generally have an air bubble sealed inside to allow for expansion and contraction of the fill solution.

# Mixing and Reagent Addition



- If the sensor does not see a representative sample of the process, it won't measure correctly.
- Don't try to do all the neutralizing in a pipe!
- pH reagents can be more viscous than water and require time to mix and react.
- If the pH reading appears noisy it may be installed in an area that is not well mixed....move the probe farther downstream of the reagent additive point.

# Theoretical Response of a pH Sensor



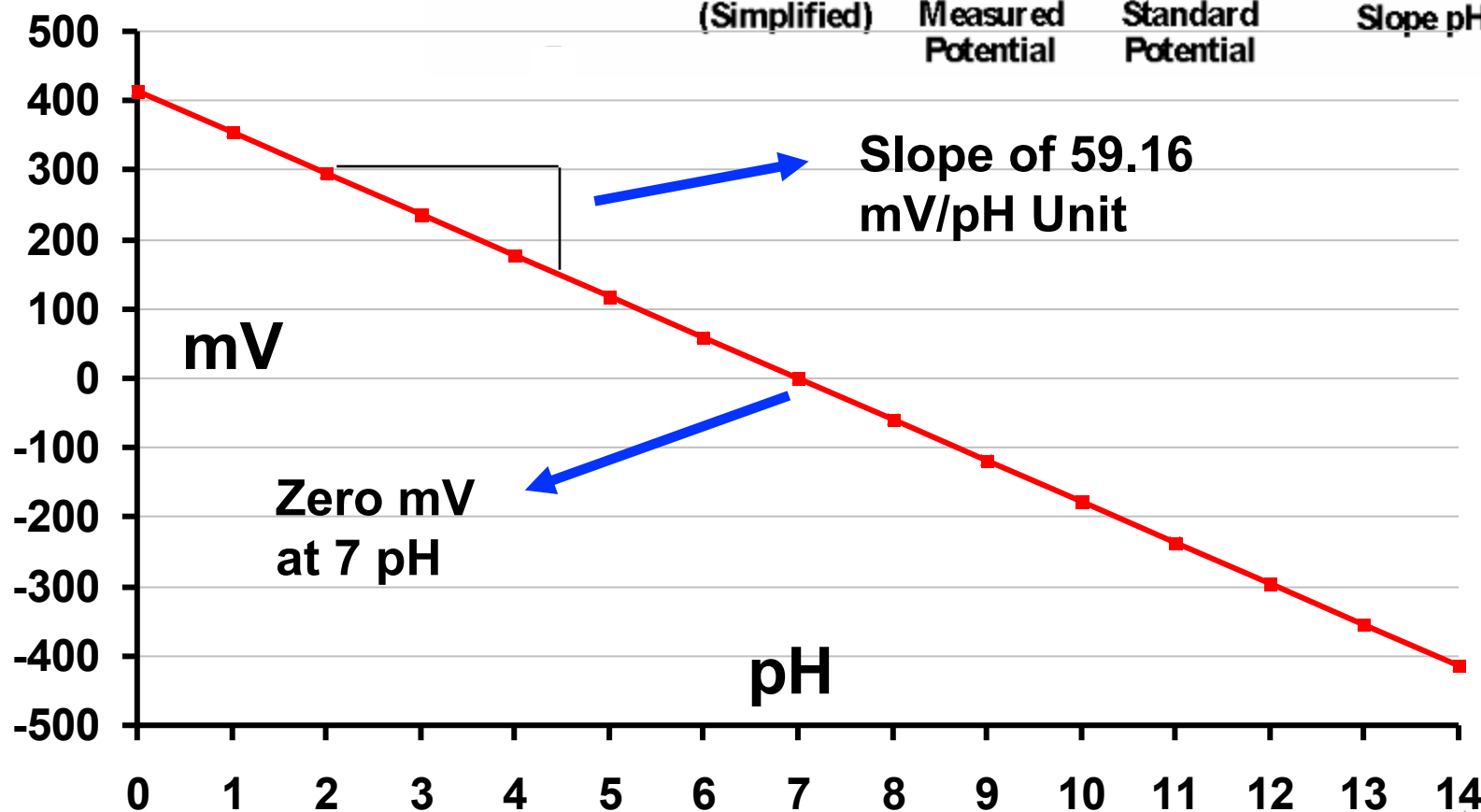
$$\text{Nernst Equation: } E = E^{\circ} - s \times \text{pH}$$

(Simplified)

Measured  
Potential

Standard  
Potential

Slope pH



# Temperature compensation



- Sensor slope is affected by temperature... so we measure temperature to compensate for it.
- Auto temp comp...calculation done at the analyzer... is Standard.
- Some processes change their pH with temperature (example...high pH buffers)
- Can lead to errors between process pH and grab sample measurements at different temperatures

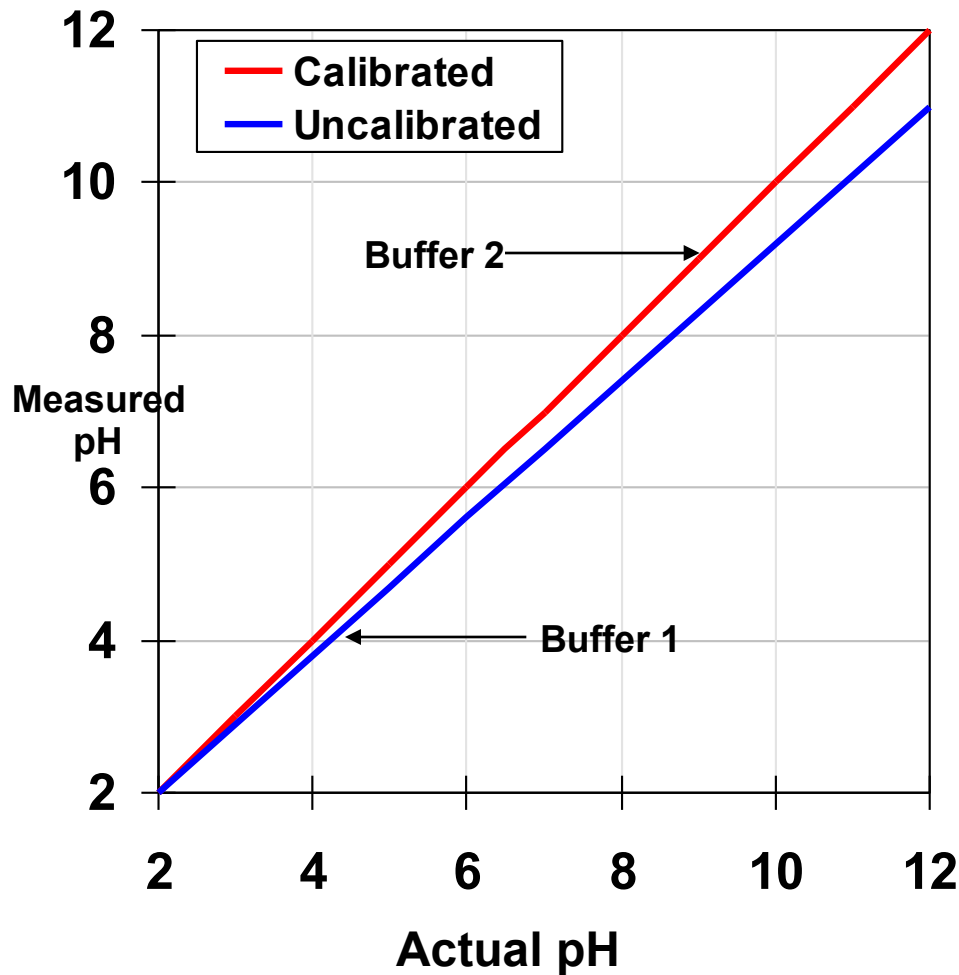
# Calibration with Buffer Solutions



- Solutions of known pH that can withstand moderate contamination or dilution without significant pH variation.  
**Automatic buffer recognition in some analyzers adjusts buffer values for different temperatures**
- Buffers 4 and 7 are most recommended, however can use 10 as well depending on the pH value of interest.
- Rules of buffering
  - ☐ Use fresh buffer
  - ☐ Rinse between buffers
  - ☐ Allow reading to settle



# pH Buffer Calibration



## Two Point Calibration

- ☐ Verifies Sensor Response to pH Change
- ☐ *Determines Slope*
- ☐ *Determines Zero Offset*

# Single Point pH Calibration (Standardize)



- Performed on-line by grab sample evaluation
  - ❑ *Only Determines Zero Offset*
  - ❑ *Use calibrated portable analyzer*
  - ❑ *Take sample at or near pH sensor installation point*
  - ❑ *Analyze grab sample ASAP if not immediately*
- Calibrates pH sensor in process environment
  - ❑ *Does not verify that sensor is operational*
  - ❑ *Compensates for small offsets in the liquid junction potential due to flow, pressure, temperature, conductance, etc...*



# *pH Maintenance*

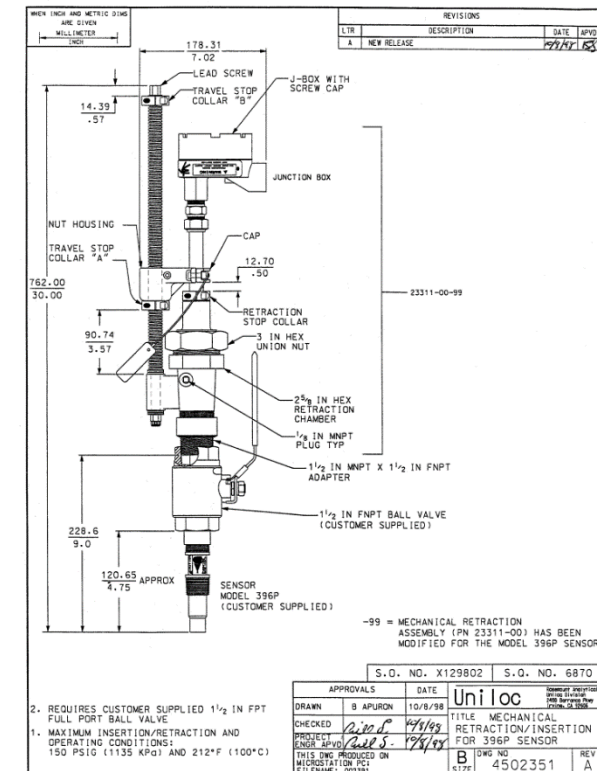
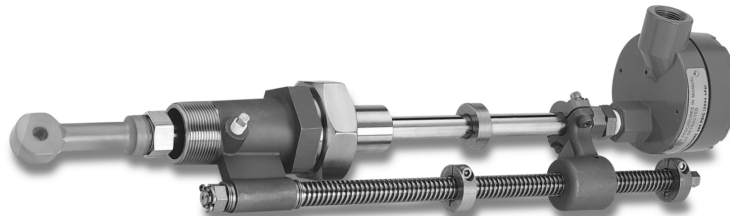
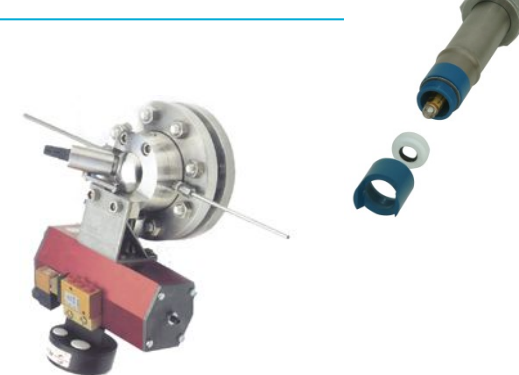


- How often should you buffer calibrate a pH sensor?
- Depends on the process, however every 2 weeks is a good start
- Whenever your process reading is off by more than 0.2 to 0.5 pH units from a grab sample (adjusting for temperature effects).
- In practice it depends on how precise the reading needs to be and how old the sensor is...as the sensor gets older it will need calibration more.

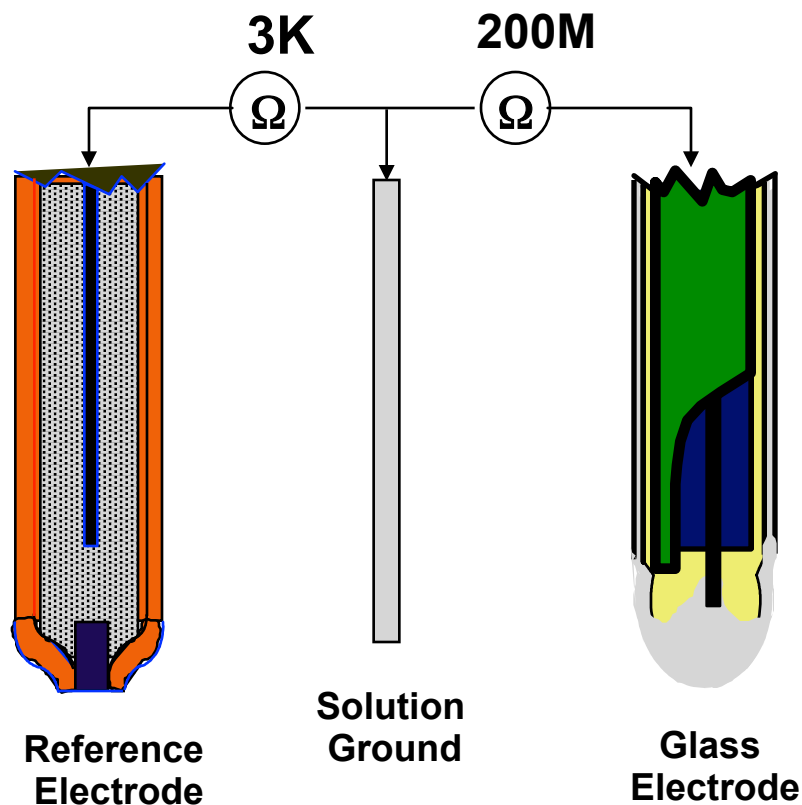
# Retraction assemblies



- Retractable sensors have retraction pressure spec of 64 psig –limited by strength of average human being
- Options:
  - Reduce pressure when installing sensor
  - PASVE rotary valve
  - Special 228 retraction mechanism



# Typical pH Sensor Impedances



# ***What is Glass Impedance?***



- The glass impedance is a resistance measurement of the glass electrode
- Expressed in Meg ohms (MΩ)
- Glass impedance increases with age and cold process temperatures
- Glass impedance decreases with breakage, and high process temperatures
- Temperature compensation for glass impedance is approximate

# What is Reference impedance?



- The reference impedance is a conductance measurement of reference electrode and the liquid junction
- Reference impedance is expressed in kilohms ( $k\Omega$ )
- Reference impedance increase with coating, plugging

# When does the sensor need to be cleaned?



- The reference impedance increases as the open surface area of the liquid junction decreases.
- A large (typically double or triple) change in reference impedance indicates that the sensor should be removed and cleaned.
- In early stages, periodic standardization may be sufficient to keep the sensor reading correctly
  - Note: the **Offset** updates after a two-point calibration or a standardization is performed

# ***pH Glass Electrode Cleaning***



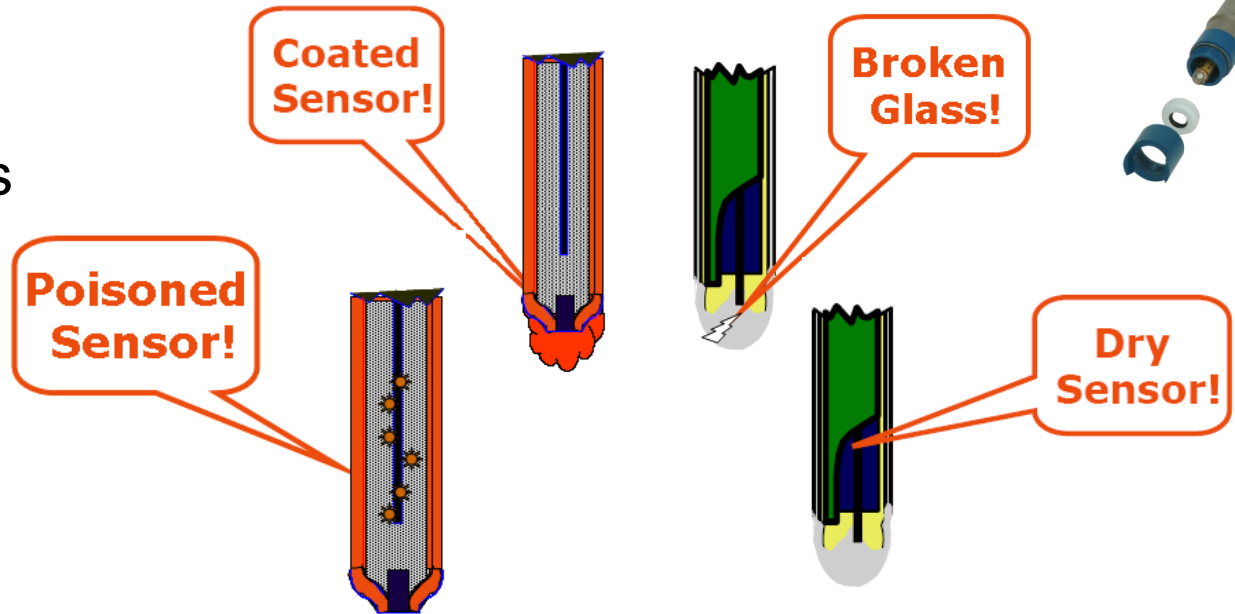
- **Alkaline or scale coating**
  - 5% HCl solution or vinegar
- **Acidic coatings**
  - Weak caustic <4%NaOH
- **Oil, grease or organic compounds**
  - Detergent
  - Organic solvent compatible with sensor materials
- **Don't use a small brush (toothbrush) with abrasive powder (baking soda) to clean the sensor unless no other method is working.**



# Diagnostics



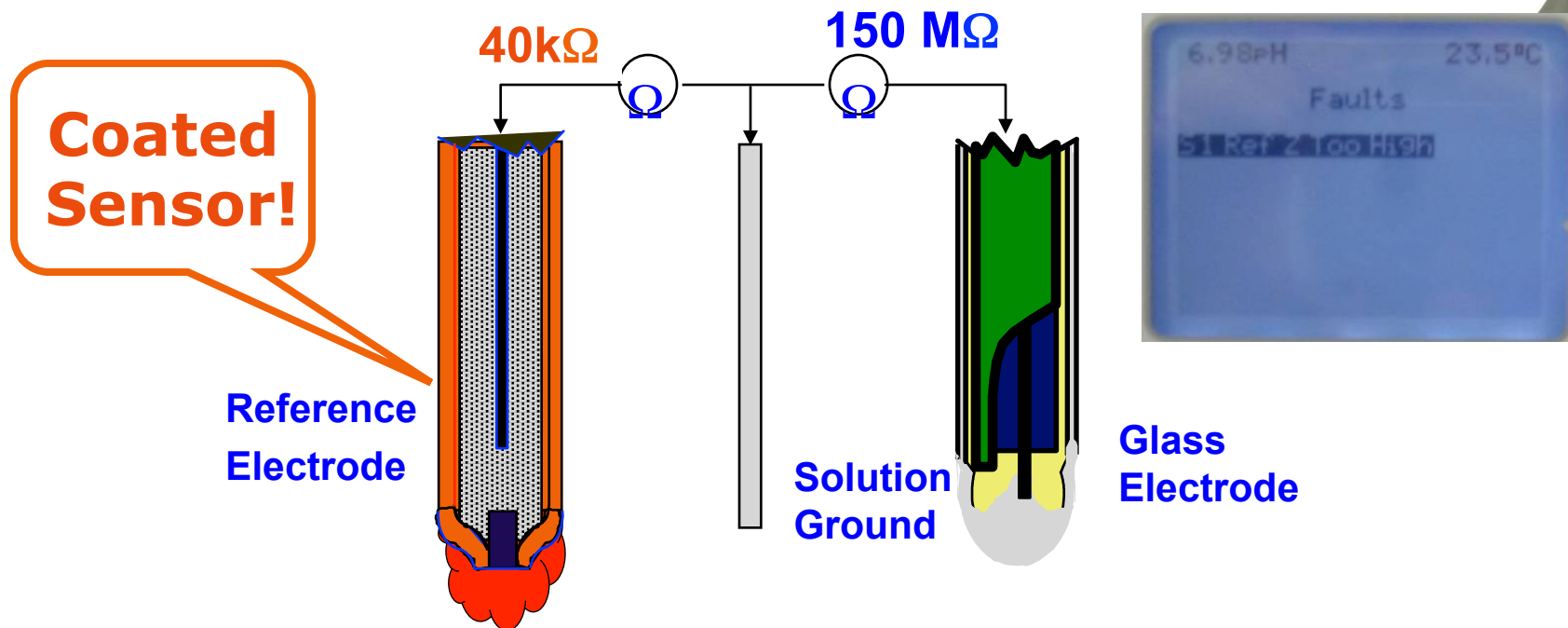
- Cracked Glass
- Aged Glass
- Coating
- Poisoning



- History of impedance behavior of electrodes will allow yourself to avoid unnecessary cleaning or buffer calibration



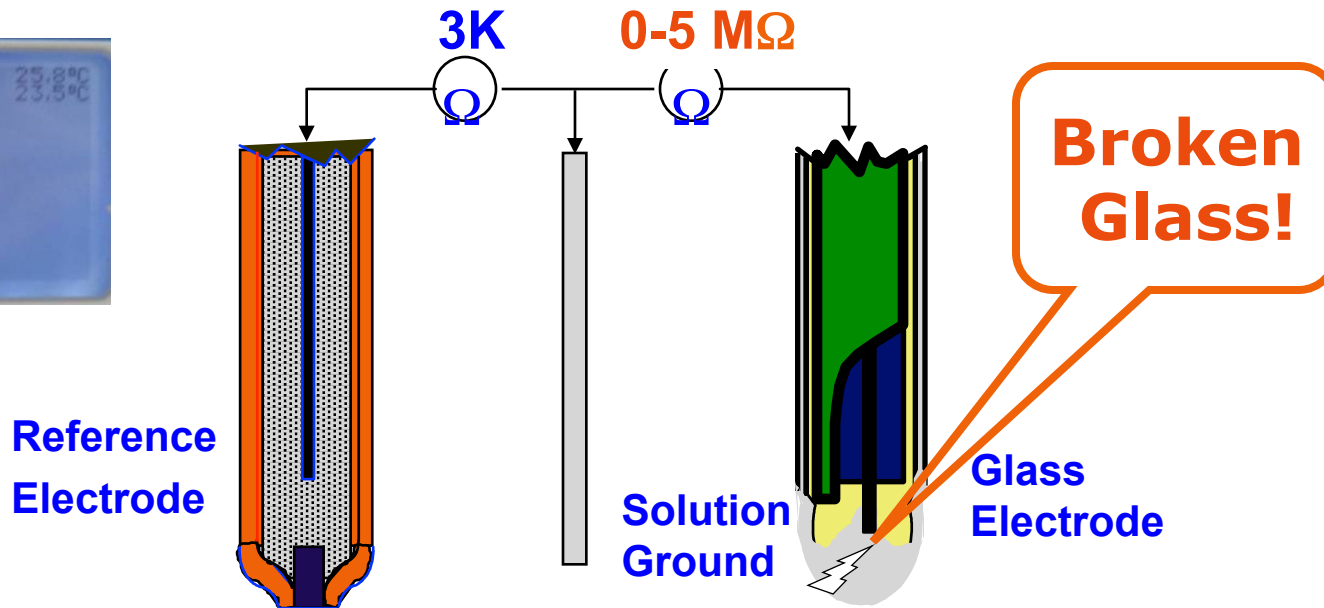
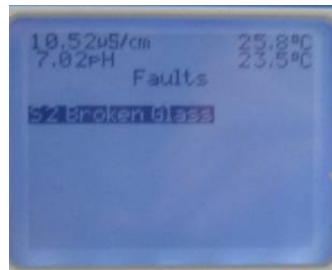
# Diagnostics - Coated Sensor



## ■ Coated Sensor Fault (Ref Z Too High)

- pH Reference electrode normally has low impedance of 1-10 KilOhm
- Reference coating slowly builds up around the junction
- Recommended setting of 20 KilOhm should not generally cause false alarms, but sensors can vary

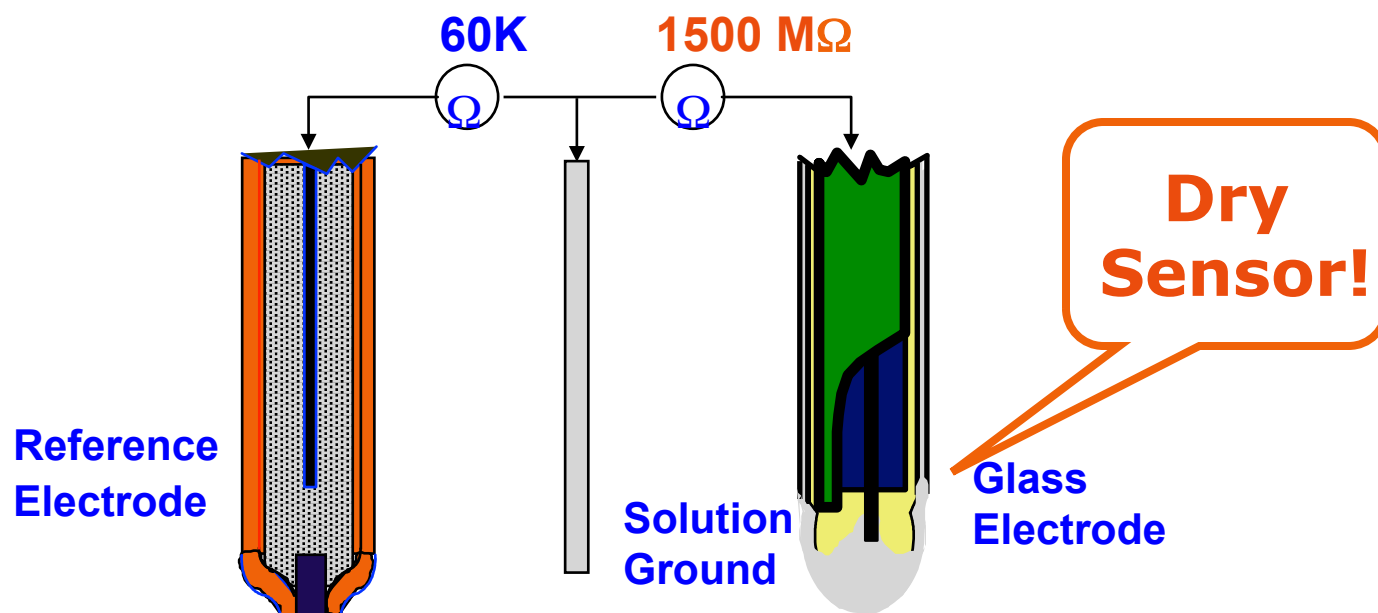
# Diagnostics - Broken Glass



## ■ Broken Glass Fault (Glass Fault Low)

- pH Glass electrode normally has high impedance of 50-500 Megohm
- Recommended setting of 10 Megohm will detect even hairline cracks
- Glass can be cracked at the tip or further back inside the sensor (and not easily visible)

# Diagnostics - Non-Immersed Sensor



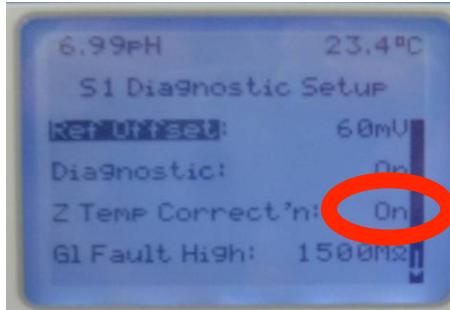
## ■ Dry Sensor Fault (Glass Z Too High)

- pH Glass electrode normally has impedance of 50-500 Megohm
- When sensor is dry there is no continuity between the electrode(s) and the solution ground so impedance reading is very high
- Recommended setting of 1000 Megohm will not cause false alarms
- May also detect problem with horizontal orientation

# Glass Temperature Effects

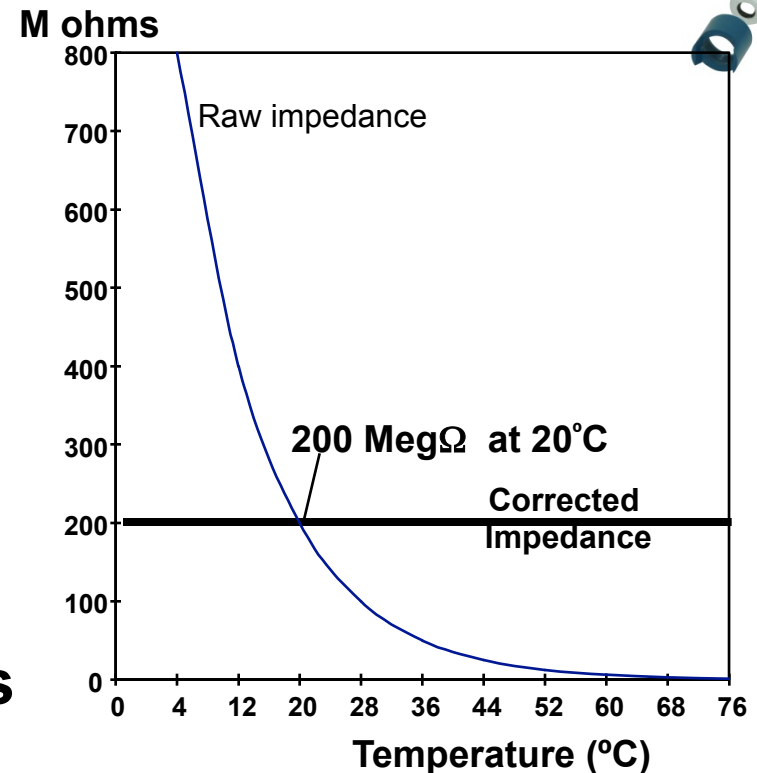


- Always use temperature correction



- When online temperature is not available, enter the operating temperature manually
- If rapid temperature changes occur, false alarms may be generated.

## Glass Impedance vs. Temperature



# Reference Electrode Plugging



Over 80% of sensor failures are reference related:

- Reference Junction Blocked
- 
- The Liquid Junction can become plugged by precipitation or coating, creating an open measuring circuit.
    - Precipitation occurs by the reaction of a contaminant with a constituent of the reference fill solution.
  - Plugging of the liquid junction by precipitation of:
    - Sulfide ion in the process and silver ion in the reference fill
    - Heavy metals, lead, mercury, and silver, in the process, with chloride ion present in the fill solution
  - Plugging causes the reference impedance to increase

# Reference Electrode poisoning



## Over 80% of sensor failures are reference related:

- Fill Solution Depleted or Poisoned
- The potential of the reference can be changed (poisoned) by contamination from the process.
  - Reaction with the silver ion concentration in the reference, causes a potential change within the reference.
  - The amount of poisoning can be viewed on the offset diagnostic feature. The reference offset updates every time a standardization or a two point calibration is performed.

# Addressing the Problems



- Provide a high Porosity Liquid Junction for minimal to No Junction Potential
- Protect the Ag/AgCl wire from Poisoning
- Stop Depletion of the KCl, especially in High-Temperature applications.
- Attack the Poisoning, Coating and Fouling Problems that cause drift and offsets



# Challenging Process Conditions



- **Temperature**... sustained elevated temperatures and temperature cycling are tough on glass and reference
- **Poisoning**... sulfide, cyanide, and other reducing agents attack the reference element and can damage the reference from the inside
- **Scaling**... the reference junction gets clogged with calcium scale and mineral deposits
- **Coating**... oils and greases blind the sensor
- **Heavy Metals**... react with the Cl- in the reference electrolyte, precipitate and clog the junction
- **Water**... bio-films and algae can blind a sensor similar to oils and greases... requires a different solution yet
- **High Purity / Low Conductivity Water**... junction potentials frustrate accurate, stable measurements

>80% of pH Problems are  
Reference Electrode Problems



# Semi Rebuildable Sensor



# Re-buildable / Extended Life



Fill kits available to match the application:

- Poisoning
- Coating
- High Temperature
- Scaling
- Heavy Metals
- Bio-films & Algae



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# Advanced Technology: SMART pH



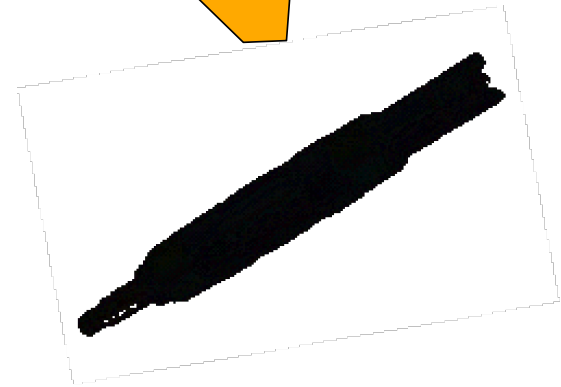
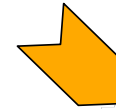
## ■ Plug and Play

- Factory pre-calibrated
- Calibrate **in lab** instead of in field
- Can restore to factory values

*Smart Preamp in sensor*

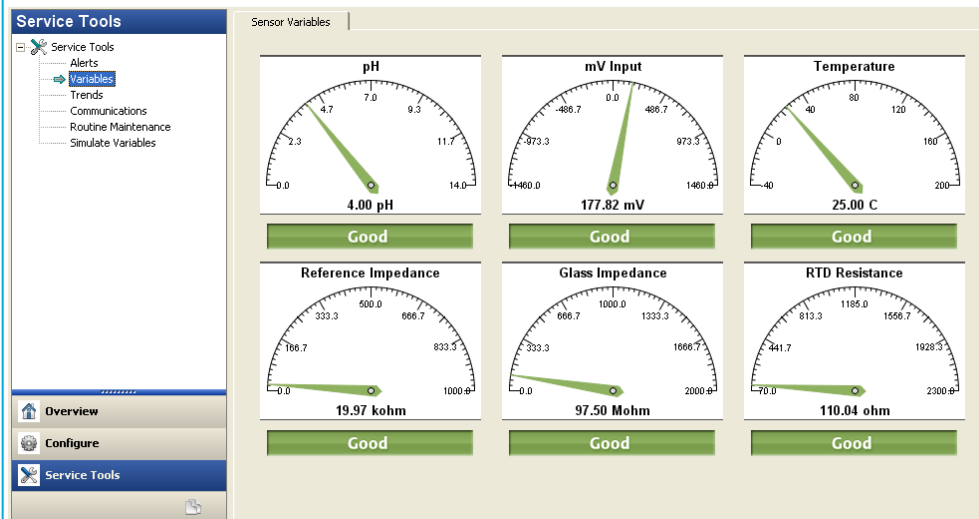
## ■ SMART technology

- Automatically trend diagnostics
- Capture intermittent sensor problems
- SMART signal superimposed on mV signal





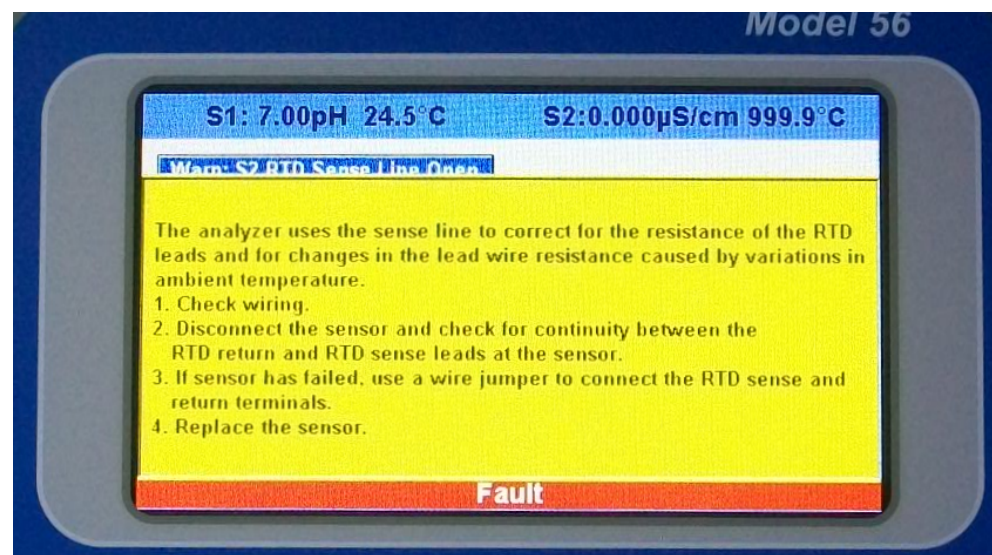
# Diagnostic Software provides a window on the process: Key Indicators of Sensor Performance



**Software Can Display Live Readings of All Transmitter Variables Available at a glance.**

**Some Instruments provide Graphical Information Right on the Instrument Display Itself.**

**ROSEMOUNT<sup>®</sup>**  
Analytical



# Example: Coated pH Sensor Troubleshoot in shop



**Press Troubleshoot Button**

**Alert Tracker Finds Issue. Next step open device.**

**Failed - Fix Now**

**Reference Impedance Too High**

The reference impedance is above the high fault setpoint. The reference electrode may be coated or plugged.

**Recommended Actions:**

1. Clean or replace sensor.
2. Check sensor wiring.
3. Increase the reference impedance.
4. Set the reference impedance level to high.

**Reference Impedance**

58 kohm

High Fault Setpoint 40 kohm

**Advisory**

**Output 1 Fixed**

Analog output 1 is either being tested, calibrated, or accidentally left on hold. A fault condition could also set the analog output to a fixed value.

**PV Loop current**

22.000 mA

**Recommended Action:**

If there is no active fault, wait for test or calibration to be done or take output 1 out of hold mode.

Send Close Print

Device last synchronized: 10/6/2015 10:53:32

Alert Count = 4 | Unacknowledged Alert Count = 1

# pH Sensor Application Guide



Designed for general use in most industries.

For processes that require a high performance or special application sensor, there's a more specific Rosemount Analytical solution.



2

## Non-Coating with Possible Poisoning

Processes containing sugar, ammonia, chloride or sulfides  
Chemical  
Wastewater  
Pulp and Paper  
Refining  
Metals



3

## Sanitary

For ultra-clean SIP and CIP Processes  
Food and Beverage  
Pharmaceutical  
Life Sciences



4

## Heavy-Duty Industry

For dirty applications and processes with viscous coating  
Metals and Mining  
Chemical Refining  
Oil Refining  
Pulp and Paper



5

## Low-Conductivity

Power Generation  
Boiler water  
Boiler feedwater



6

## High-Temperature and Pressure

Processes requiring high performance  
Oil Refining  
Chemical  
Pulp and paper  
Water and Wastewater  
Metals and Mining



7

## Special Use

Hydrofluoric Acid Processes  
Non-glass applications

# Troubleshooting



## ■ How to troubleshoot pH issues

# Troubleshooting a pH loop



- All pH loops have the same basic components
- There are several steps that can be taken to troubleshoot a pH loop
  - Verification of compatible components
  - Verification of proper wiring
  - Isolation to finding the problem component.



# Basic Troubleshooting



## Determine the extent of the problem

- What is the primary value indication (realistic, steady or erratic)
- What is the temperature (realistic, steady or erratic)
- Where is the sensor (in the process, in a beaker filled with a grab sample, or in a beaker filled with standard / buffer)
- Are the sensor and analyzer / transmitter compatible

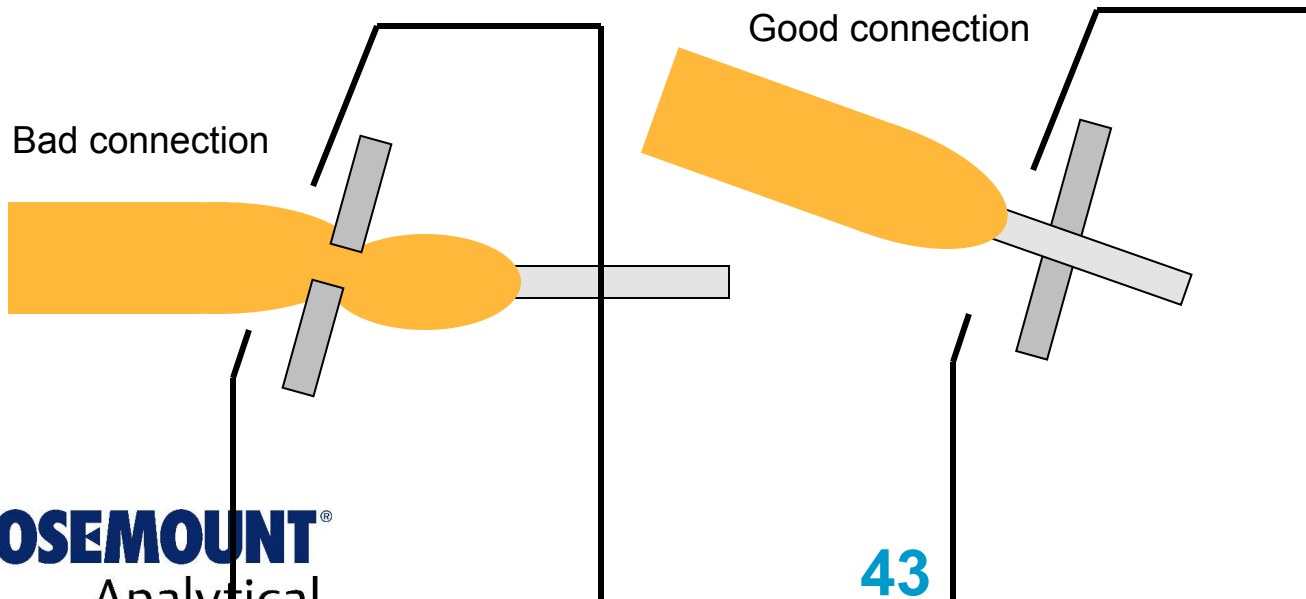
# Checking the wires



Verify that the wire is in the correct terminal spot, and the bare wire makes proper contact with the terminal.

Check that the terminal is NOT clamped down on the insulation of the wire; otherwise, poor or no contact will result.

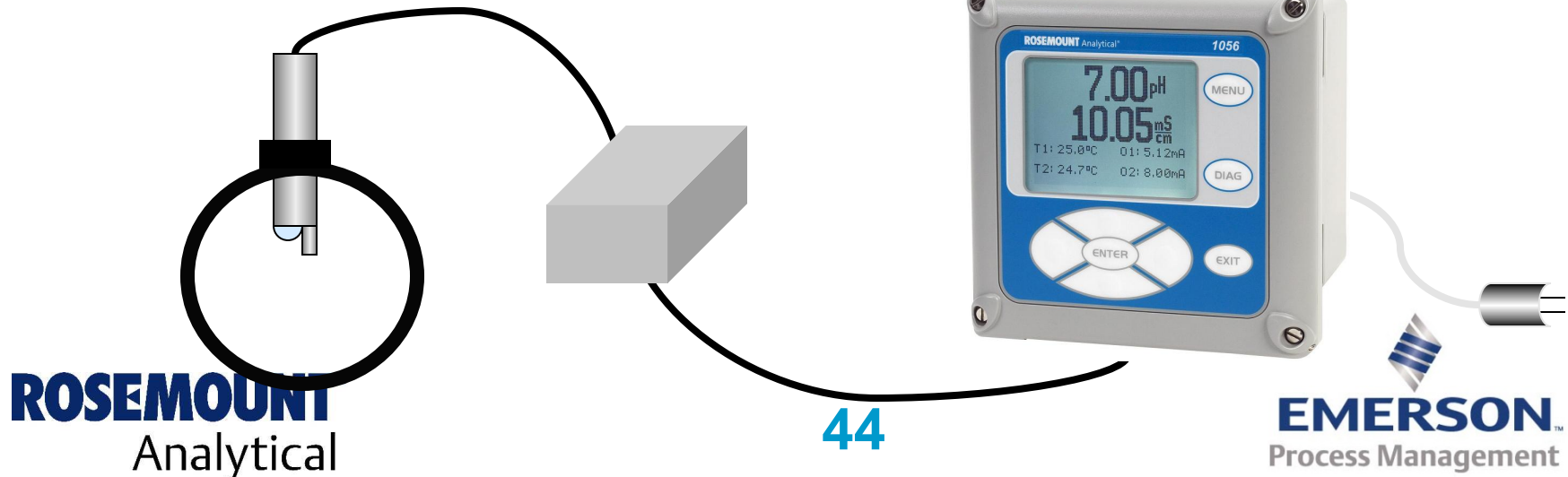
Verify that some of the bare wire is visible, guarantying proper connections



# Isolation Steps

A pH measurement loop is comprised of 6 distinct components.

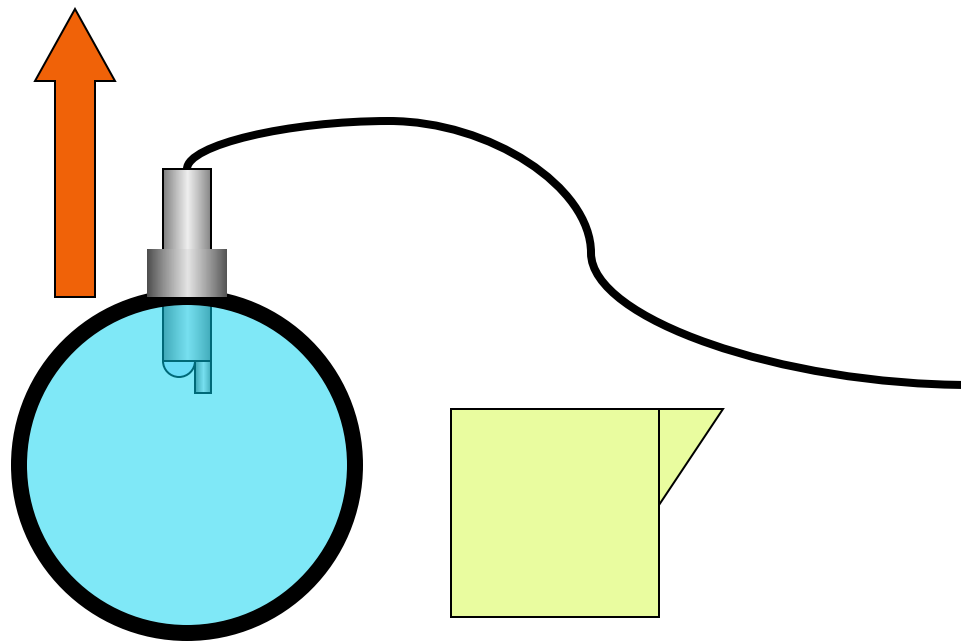
- 1) Process solution
- 2) The Sensor
- 3) The connecting cable
- 4) A preamp
- 5) The Analyzer
- 6) A power source



# Step 1 Remove sensor from the process



The first step is to isolating the sensor from the process. Remove the sensor from the process to see if the erratic readings go away.



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pH 7 buffer

45



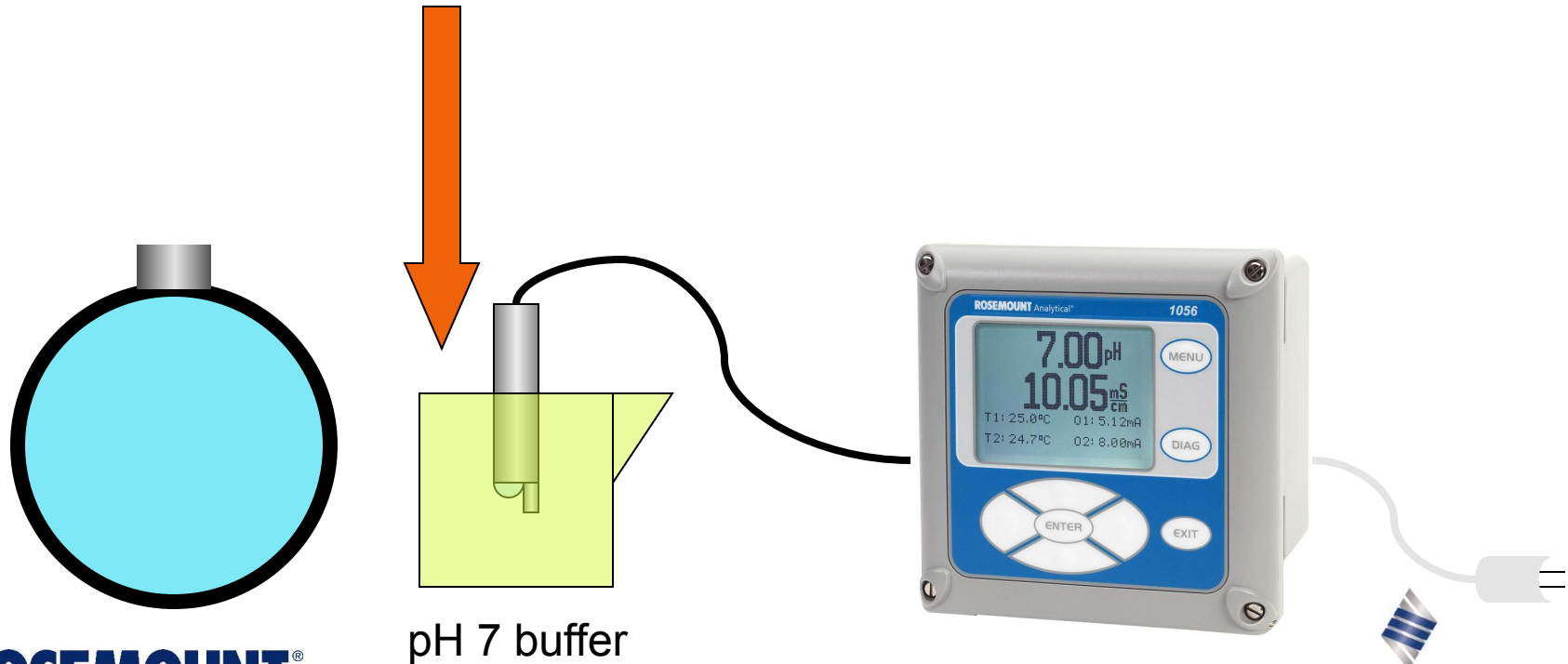
**EMERSON**  
Process Management

# Step 2 place sensor in known solution



The first step in isolating the problem component is to remove the sensor from the process. If the problem is process-related, then this procedure will prove it.

Next, place the sensor into a solution of known value (buffer or standard). Confirm the reading is steady and reflects the proper value of the buffer or standard.



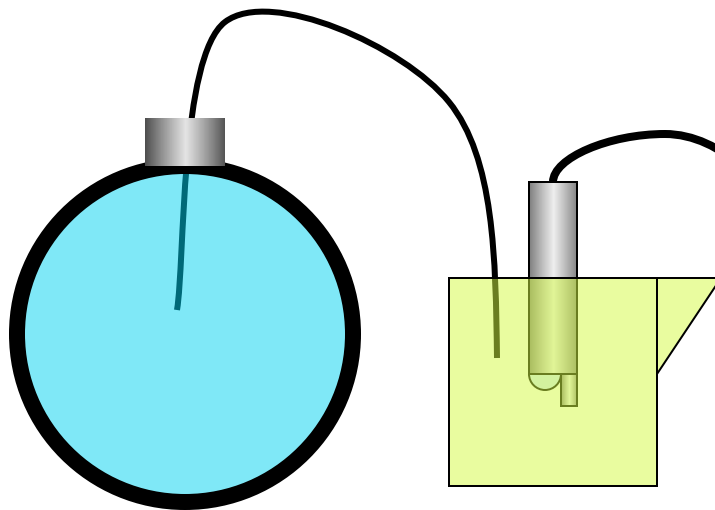
# Step 3 Check for process interference



The first step in isolating the problem component is to remove the sensor from the process. If the problem is process-related, then this procedure will prove it.

Next, place the sensor into a solution of known value (buffer or standard) to confirm the reading is steady and the reading reflects the value of the buffer / standard.

Confirm the interference is process related, by making an electrical connection from the process to the beaker. If it is a process related problem the interference will start up again.



pH 7 buffer



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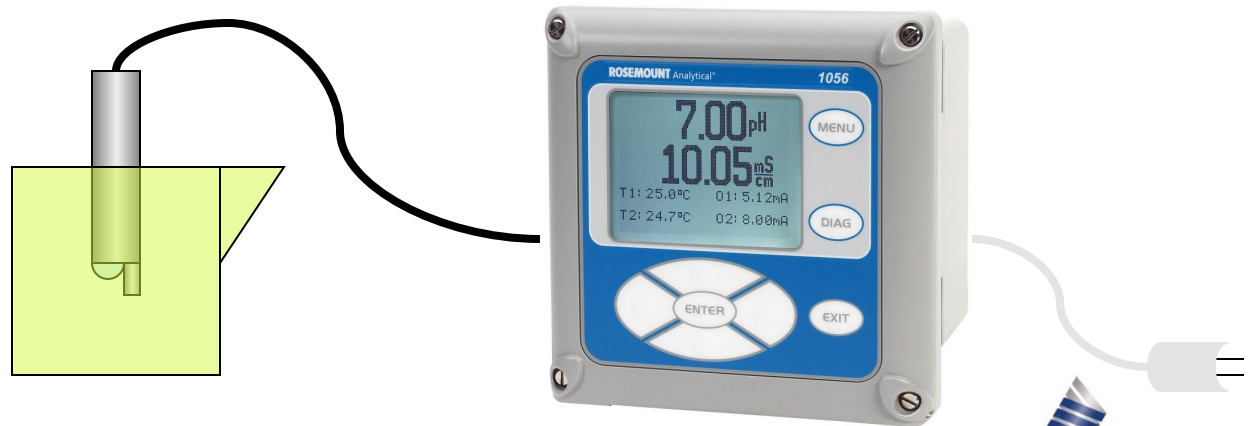
47

**EMERSON**  
Process Management

# Step 4 Remove sensor



If the source of problem has not been determined by step one, simulate an input to the analyzer.





# Step 5 Simulate an input



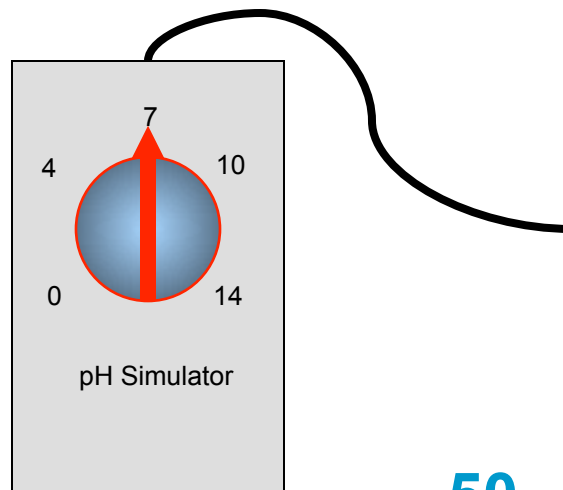
Simulating an input signal will confirm the analyzer's status.





## Step 6 Use a different power source.

Remove the loop from the factory floor and place on a bench top. Use a separate power source to determine if the analyzer is still working correctly. If the unit is still bad return it to the factory for repair or replacement.





## ***Troubleshooting Conclusion***

If a problem with the pH loop is detected use these steps to determine the source of the problem.

- Remove sensor from the process
- Place the sensor in a known solution
- Simulate an input directly into the analyzer
- Remove the analyzer from its power source.

# Overall Summary



- pH sensors include a glass electrode and a reference electrode
- Buffer calibration is the primary method of checking the sensor
- Most measurement problems are due to the reference electrode
- Sensor installation is key to success

# **BLEACH SCRUBBER SURVEY**

**Review of Past Surveys  
/ Format of New Survey**

**Report to Bleaching Committee  
Fall 2016**

**Jim Collins – October 25, 2016**

# Bleach Scrubber Survey Review

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## ✓ Review of Past Scrubber Surveys

- Spring 1989 Scrubber Survey – by Trevor Tenn
- Survey was to include:
  - Federal, provincial and other regulations for  $\text{Cl}_2$ ,  $\text{ClO}_2$  emissions from the bleach plant
  - Processes used for absorption
  - Removal efficiencies achieved, versus targets
  - Materials of construction
  - New process solutions developed by mills
  - Problems encountered that still need solutions

# Bleach Scrubber Survey

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## ✓ Spring 1989 Scrubber Survey Sections

- Part I – General
  - Mill / Chemical Charges
- Part II – Federal / Provincial / Others Regulations
- Part III –  $\text{Cl}_2$ ,  $\text{ClO}_2$  Absorption Processes in Mill
  - Gases to Scrubber (Properties)
  - Liquids to Scrubber / Liquid from Scrubber (Properties)
  - Scrubbing Efficiency
- Part IV – Mechanical Details – Tower, Packing, Materials, Fans, Pumps, Problems, Solutions, etc.

# Bleach Scrubber Survey

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## ✓ Spring 1989 Survey

- At the time of this survey, any surveys were sent out by CPPA Technical Section to the member companies (pre-internet / e-mail)
- Surveys conducted by the Bleaching Committee during 1991/92

## ✓ Fall 1993 Survey Paper

- Work continued on this survey by committee members through 1993 when a paper was developed by Dennis Owen and presented at the CPPA Annual Meeting? Published?
  - Paper: Bleach Plant Scrubber Survey by Dennis Owen, Mark Owen and Larry Merriman – Date 1993?

# Bleach Scrubber Survey

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## ✓ Fall 1993 Bleach Plant Scrubber Survey Paper

### — Highlights:

- 42 mills surveyed
- 29 mills participated in the survey from coast to coast
- Scrubbers reported were 18 packed tower and 7 cross flow (Waterloo Turbotac)
- Paper included the chemistry, stoichiometry and costs of the various scrubbing media
- Major Problems — Tower Corrosion, Tower Wear, Packing, Coating, Precipitation, Clogging, Channelling, FRP Delamination.
- Solutions — Packing: Replace with New, Packing: Wash and Re-use, Tower: Replace or Reline, Internals: Internals: Replace with new materials, Install Strainers in the Scrubbing Liquor



# Bleach Scrubber Survey

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## ✓ Fall 1993 Bleach Plant Scrubber Survey Paper

### – Conclusions:

- Significant benefit in understanding the source, volume & concentrations of the gaseous emissions
- Need to understand cause of variation in reductant and caustic residual in the scrubbing media for surge flows
- Strong justification for installing filters in scrubbing medium feeds and/or understanding why the precipitates are formed
- Obvious room for locating reliable ORP and pH systems
- Need means to have rapid response to excessive emissions to scrubber (alarms, alkali/reducing agent flow response)

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey:

- Update of the 1993 survey was sent out to the committee members at the start of 1998? This was headed by Dennis Owen – 38 mills surveyed
- Survey was completed during summer 1999 and results presented at Fall 1999 Meeting by Dennis Owen

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (1):

- 38 mills surveyed
- Performance of 37 scrubbers reported:
  - 26 packed scrubbing tower
  - 11 cross flow scrubbers (Waterloo Turbotac?)
- **Emissions:**
  - With tower residuals having reduced since previous report, bleaching efficiency has improved leading to reduced  $\text{Cl}_2$  and  $\text{ClO}_2$  to the scrubber

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (2):

- **Packing:**

- Type of packing used has shifted to a structured type of packing (Tray, Tellerettes, Heilex, Interlox, Tri-pack, Snowflake)

- **Packing Material of Construction:**

- Materials of construction have shifted to more corrosion resistant packing (CPVC, Kynar, Polypropylene, Ceramic)

- **Scrubbing Efficiency:**

- Efficiency of scrubbing is still rather poor.
  - » Chlorine: 45% to 100%, majority <80%
  - » Chlorine Dioxide: 46% to 100%

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (3):

- Although the use of Eop Filtrate is the predominate scrubbing liquor, there was a shift to use of more effective scrubbing liquors – White Liquor / Weak Wash /  $\text{SO}_2$
- Some less effective scrubbing liquors have been reinforced with alkali or reducing agent
- **Scrubbing Liquor Used in order of preference:**
  - Eop Filtrate / White Liquor / Weak Wash / Caustic Soda /  $\text{SO}_2$  / Eop plus White Liquor / Eop plus  $\text{NaOH}$  / Water plus  $\text{SO}_2$  / Water plus Peroxide

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (4):

- **Control of Bleach Plant Scrubbers:**

- More mills are trying to control the effectiveness of their scrubber by the use of
  - » ORP and pH Control
  - » Chlorine Dioxide analyser (3 mills) – more exploring that option
  - » Installing Filter / Screens in recirculating liquor to reduce the tendency of plugged packing (e.g. high fibre in Eop Filtrate and high suspended solids in white liquor)

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (5):

- **Problems:**

- Coating and precipitation of fibre or solids on the packing is still a significant problem. It calls for periodic acid washing and / or removal and cleaning of the packing.

- **Scrubbing Problems order of seriousness:**

- Clogged Packing / Packing Coating / Packing Precipitation (Fibre / Solids) / Packing Corrosion / Fan / FRP delamination / Metal corrosion / Tower Corrosion / Tower Wear / Nozzle Plugging / Demister / Entrainment

# Bleach Scrubber Survey

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## ✓ Fall 1999 Bleach Scrubber Survey

### – Highlights (6):

- **Solutions to Scrubber Problems:**

- New Packing / Wash & Reuse Packing / Replace Material /  
Replace Tower / Acid Wash / Replace Internals /  
Other Solutions / Install Second Demister



# New 2016 Bleach Scrubber Survey

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## ✓ SURVEY PURPOSE:

- To determine the state of the art of Bleach Plant Air Emission Scrubbers presently installed in member company mills and non-member mills in Canada (excluding  $\text{ClO}_2$  generator plant tail gas scrubber)
- To update information from the previous surveys, conducted in 1998-9 and 1989, and paper published in 1993

# New 2016 Bleach Scrubber Survey

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## ✓ The survey will include:

- Federal, provincial, state and other regulations for  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$  emissions from the bleach plant
- Processes used for absorption
- Removal efficiencies achieved, versus targets
- Materials of Construction
- New process solutions developed by mills
- Problems encountered that still need solutions

# New 2016 Bleach Scrubber Survey

---

## ✓ Part I – GENERAL:

- Mill Name, Mill Contact, Location, Telephone No., E-mail address
- Mill Company and Location will be coded
- Number of Bleach Plants at Mill:
- Bleaching Sequence (s):
- O<sub>2</sub> Delignification: Yes / No
- Tonnage / Bleach Plant:
- Target Brightness:
- Wood Species: (Hardwood, Softwood)

# New 2016 Bleach Scrubber Survey

## ✓ Part I – GENERAL (2):

- **CHEMICAL CHARGES (kg/ADMT)** (by Bleach Plant)
  - Kappa Number into Bleach Plant /O<sub>2</sub> Delignification (in & out)
  - O<sub>2</sub> Delignification Stage (Yes / No)
  - D<sub>0</sub> Stage – ClO<sub>2</sub>, tower/vat residual, pH, temperature
  - Pc Stage – NaOH, pH, temperature
  - E<sub>1</sub> Stage – NaOH, O<sub>2</sub>, H<sub>2</sub>O<sub>2</sub>, etc., pH, temperature, Kappa #, Brite
  - D<sub>1</sub> Stage – ClO<sub>2</sub>, NaOH, tower/vat residual, pH, temperature, Brightness
  - E<sub>2</sub> Stage – NaOH, H<sub>2</sub>O<sub>2</sub>, Other, pH, temperature
  - D<sub>2</sub> Stage – ClO<sub>2</sub>, NaOH, tower/vat residual, pH, temperature, Brightness
  - H Stage – Cl<sub>2</sub>, tower/vat residual

# New 2016 Bleach Scrubber Survey

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## ✓ Part II – Government Regulations regarding Bleach Plant Emissions:

- Federal Regulations (Canada) –  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$ , Other
- Federal Regulations (USA) –  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$ , Other
- Provincial Regulations (Canada) –  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$ , Other
- State Regulations (USA) –  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$ , Other
- Other Regulations –  $\text{Cl}_2$ ,  $\text{ClO}_2$ ,  $\text{CHCl}_3$ , Other

# New 2016 Bleach Scrubber Survey

## ✓ Part III – Mill $\text{Cl}_2$ , $\text{ClO}_2$ Absorption Processes:

- Identify if packed tower or cross flow scrubber (Waterloo / Teller)
- Use a water “pre-absorber” to treat gases from Seal Tanks, Towers prior to Bleach Scrubber?
- **A. Gases to Scrubber** (Temperature, ACFM, kg/d:  $\text{Cl}_2$  /  $\text{ClO}_2$  /  $\text{CHCl}_3$  )
  - Flow rates (Tower, Washer, Seal Pit) – all stages
  - Flow rates (Total) – give total if breakdown unknown
  - Temperature
  - Content:
    - Total  $\text{Cl}_2$  kg/d
    - Total  $\text{ClO}_2$  kg/d
    - Total  $\text{CHCl}_3$  kg/d

# New 2016 Bleach Scrubber Survey

## ✓ Part III – Mill $\text{Cl}_2$ , $\text{ClO}_2$ Absorption Processes:

### – B. Gases from Scrubber Stack (Temperature, ACFM, kg/d: $\text{Cl}_2$ / $\text{ClO}_2$ / $\text{CHCl}_3$ )

- Flow rates (Stack)
- Temperature
- Content:
  - Total  $\text{Cl}_2$  kg/d
  - Total  $\text{ClO}_2$  kg/d
  - Total  $\text{CHCl}_3$  kg/d

### – C. Scrubbing Efficiency:

- $\text{Cl}_2$     Target:                      Actual:
- $\text{ClO}_2$    Target:                      Actual:
- $\text{CHCl}_3$  Target:                      Actual:

# New 2016 Bleach Scrubber Survey

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## ✓ Part III – Mill $\text{Cl}_2$ , $\text{ClO}_2$ Absorption Processes:

### – D. Liquid to Scrubber:

- **Source** ( $\text{E}_1$  filtrate,  $\text{E}_2$  filtrate, White Liquor, Weak Wash, Dilute Caustic, Green Liquor, Mixtures (identify), secret snake oil, other)
- Make-up Flow
- pH
- Temperature
- Recirculation or once-through
- Solids/Fibre in Suspension (ppm)
- Pre-Treatment: e.g. filter, caustic addition to set pH, other



# New 2016 Bleach Scrubber Survey

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## ✓ Part III – Mill $\text{Cl}_2$ , $\text{ClO}_2$ Absorption Processes:

### – E. Liquid from Scrubber:

- Flow
- pH
- Temperature
- Disposal to ???
- Recirculate?

# New 2016 Bleach Scrubber Survey

---

## ✓ Part III – Mill $\text{Cl}_2$ , $\text{ClO}_2$ Absorption Processes:

### – F. Control of Bleach Scrubbers:

- ORP Control
- pH Control
- Control of Reducing Agent and Caustic Addition
- $\text{ClO}_2$  Analyser
- Recirculation of Scrubbing Liquor

### – G. Process Problems:

- Control:
- Efficiency:

# New 2016 Bleach Scrubber Survey

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## ✓ **Part IV – Mechanical Details:**

– Complete For Each Bleach Plant Scrubber

– **A. Tower:**

- Diameter
- Material

– **B. Packing:**

- **Type:** (Tri-Pack, Tray, Tellerettes, Heilex, Interlox, Snowflake, other)
- **Material:** (Ceramic, PVC, CPVC, Polypropylene, Kynar, other)
- **Size:** (2 inch, 3 inch, other)
- Height
- Pressure Drop
- Scrubbing Liquor Flow of Packing

# New 2016 Bleach Scrubber Survey

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## ✓ Part IV – Mechanical Details:

- **C. Support Plate:**
  - Type
  - Material
- **D. Hold-down Plate Type:**
  - Type
  - Material
- **E. Spray Nozzles:**
  - Type
  - Material
- **F. Spray Nozzles / Demister:**
  - Type
  - Material

# New 2016 Bleach Scrubber Survey

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## ✓ Part IV – Mechanical Details:

### – G. Describe Problems:

- |                     |                          |               |             |
|---------------------|--------------------------|---------------|-------------|
| • <b>Tower:</b>     | – Corrosion              | Wear          | Channelling |
| • <b>Packing:</b>   | – Coating                | Precipitation | Clogging    |
| • <b>FRP/Resin:</b> | – Separation             | Leaching      | Other       |
| • <b>Materials:</b> | – FRP Resin Delamination |               |             |
| • <b>Metals:</b>    | – Corrosion              | Other         |             |

### – H. Solutions:

- |                     |   |                          |           |
|---------------------|---|--------------------------|-----------|
| • <b>Tower:</b>     | – Replace Tower                             | Replace Material         | Reline    |
| • <b>Packing:</b>   | – Replace with New,                         | Wash and Re-Use,         | Acid Wash |
| • <b>Internals:</b> | – Replace with Better Materials,            | 2 <sup>nd</sup> Demister |           |
| • <b>Strainers:</b> | – Install Strainers in the Scrubbing Liquor |                          |           |

# New 2016 Bleach Scrubber Survey

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## ✓ Part IV – Mechanical Details:

### – I. Fan (s):

- **Make:**                      – Type (FD / ID)      Model No.      Year Installed
- Rated Capacity
- Differential Pressure
- Speed
- **Material:**              – Housing                      Impeller                      Shaft
- **Motor:**                      – Hp
- **Problems:**                      – Chemical Corrosion

# New 2016 Bleach Scrubber Survey

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## ✓ Part IV – Mechanical Details:

### – J. Pump (s):

- **Make:** – Model No. Year Installed
- Rated Capacity (gpm)
- **Material:** – Housing Impeller Shaft
- **Motor:** – Hp
- **Problems:** – Chemical Corrosion Packing Mechanical Seal

### – K. Other?

# Other Suggestions

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# ***Improving Mill Lab Performance***

Val DeLeo

Performance Management Engineer

Automation Business Line

- Topics for Discussion

Scheduling

Filtrate Testing

Residual

pH

Bleach Pulp Testing

Brightness

K Number/ Kappa

Lab Conditions

Data Handling

# Lab Scheduling



- Mill Lab testers typically have busy schedules, and careful thought needs to be paid to sample scheduling.
- 1<sup>st</sup> hour samples are often not scheduled to allow for shift meetings and ISO calibrations.
- Residual samples need to be collected and tested quickly.
- Brightness/Kappa
  - Typically pulp samples collected from washer mat.
  - Collect Extraction pulp from vat.
- Avoid samples less than 1/shift.
- More frequent with results entered as soon as completed is better.

# Filtrate Testing

## Sampling

- Filtrate samples may be from extraction devices or washer vats.
- Special care should be taken to assure extraction filtrate measurements are continuous.
  - Small piping with large vent bypass for blowback is recommended
  - Lab sample valve should be tight to the sample line.
  - Testers should observe the sample discharge flow and report low flow to operator.



# Filtrate Testing

## Sampling

- Vat samples are convenient.
- Pulp can easily be removed using a screen or press device
- Testers can learn what type of vat consistency is normal and report any issues to the operator.



## Residual Testing

- Since residual is depleted as a sample ages, it is important to specify a time interval where residual tests should be completed.
- This time interval should be consistent, each round.
- Residual samples should be tested first.
- Residual samples require 100 mls of filtrate.
- Residual testing varies widely from location to location. Check units if you are not familiar (gpl or lb/ton)
- To titrate total ClO<sub>2</sub> residual, the sample must be acidified.
- Vat residuals typically run 0 or require a few drops of titrant. A procedure must be developed if wanting to measure low residual amounts.

# Residual Testing



- A typical thiosulfate pipette does not indicate until more than 1 ml is titrated.
- Digital pipettes are more accurate at low levels, are relatively cheap and work well with thiosulfate.



# pH Testing

- A Low and a high pH meter is typically used to help calibration.
- More than 100 mls of filtrate is required, so pH testing is typically done at the same time as residual testing.





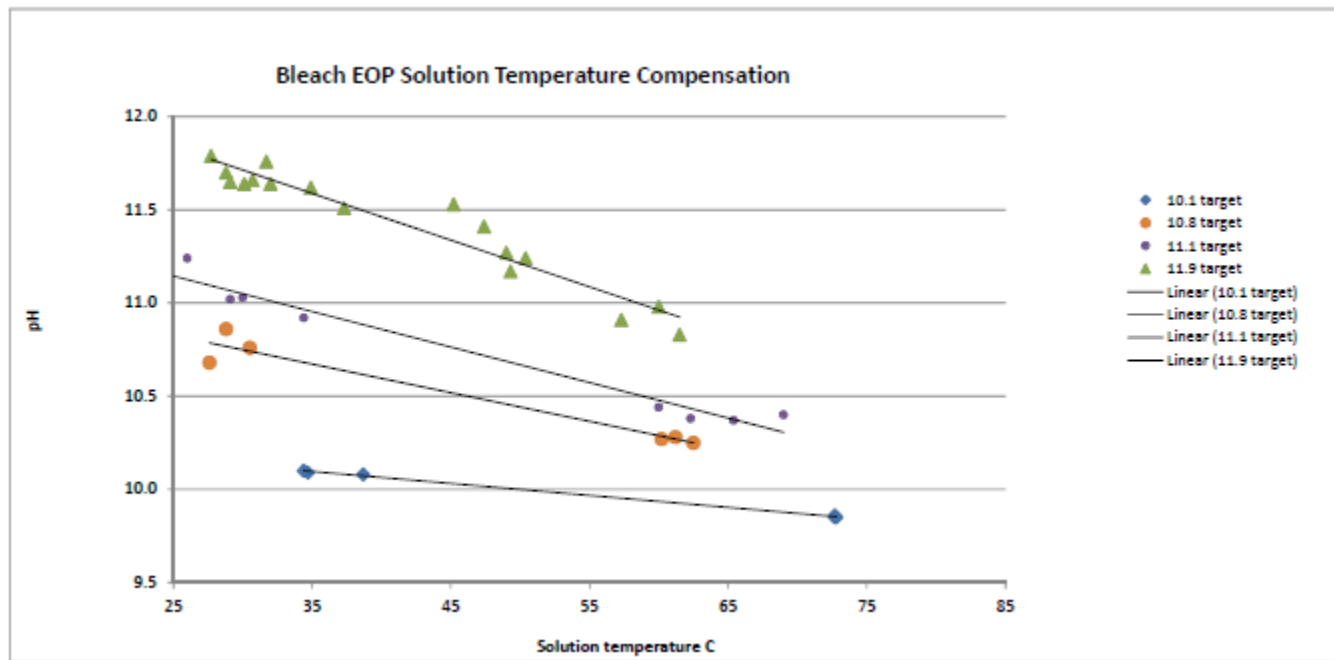
# pH Testing



- Probe temperature calibration is on when ATC is indicated on the display.
- ATC does NOT adequately correct for temperature variation in extraction stage samples (E1 and E2)

# pH Testing

E stage temperature correction maybe up to 1.5 pH units, and varies with caustic content. A correction factor is recommended for lab measurements and also online extraction pH probes that are exposed to the weather.



\* A good discussion of this can be found in an article by Doug Reid, Eka Chemicals.

# Brightness



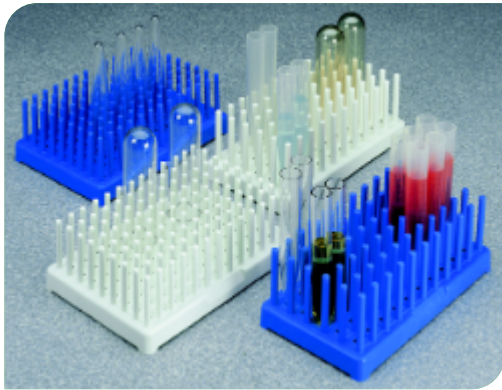
- Typical pulp pad former used in labs if sheet mold is not available.
- Pulp samples are washed prior to forming by diluting with a large amount of clean water.
- After the pads are formed, it is recommended to press the sheet using blotter paper and a sheet roller.

# Brightness

- Microwave oven speeds up drying of the pads, and can reduce the standard deviation of brightness measured on a pad.
- Timer helps to control the pad dryness.
- Testers learn the feel of a properly dried sheet.
- Not recommended for drying pads to bone dry – consistency and kappa testing.



# Brightness



- Peg rack is a useful rack that can be used for brightness testing.



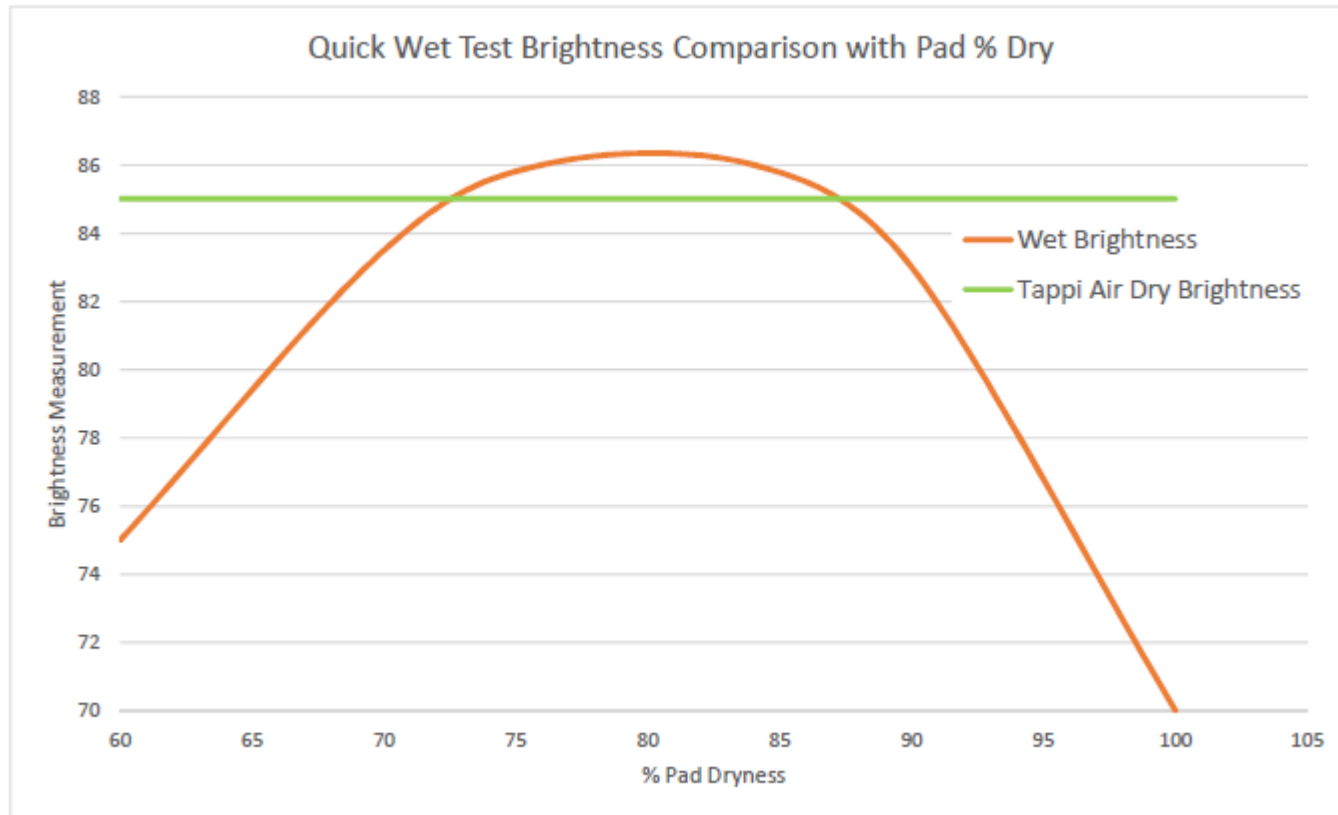
# Brightness

- Quick lab brightness measurements are affected by the drying of the pulp pad.
- Pad weight should be enough so that the pad is thick enough that the filter paper used is not visible in the test.
- Pads are often folded so that a thick layer is provided for testing.
- Brightness should be measured in 4 places and most typical measurement reported.
- A single low or high test should be ignored or verified.



# Brightness

A pad that has about 80% moisture or tested at the flat region of the brightness curve provides the most repeatable results, but may be 1 point higher than an air dry brightness run on the same pulp.



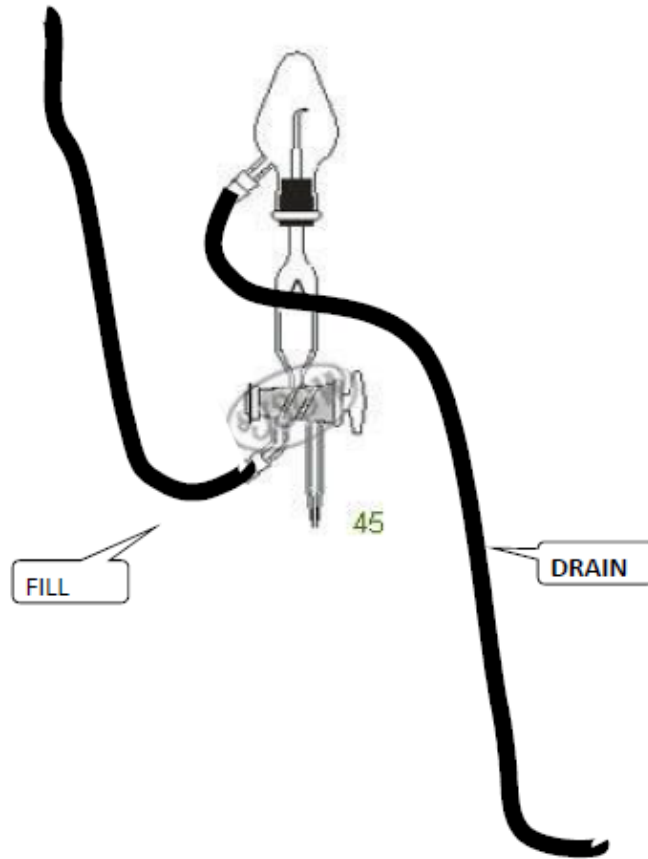
# K Num/Kappa

- There is not a good, quick method for drying a hand sheet.
- A drying oven is recommended.
- Due to time required, kappa testing by a single technician is recommended, especially for calibration purposes.



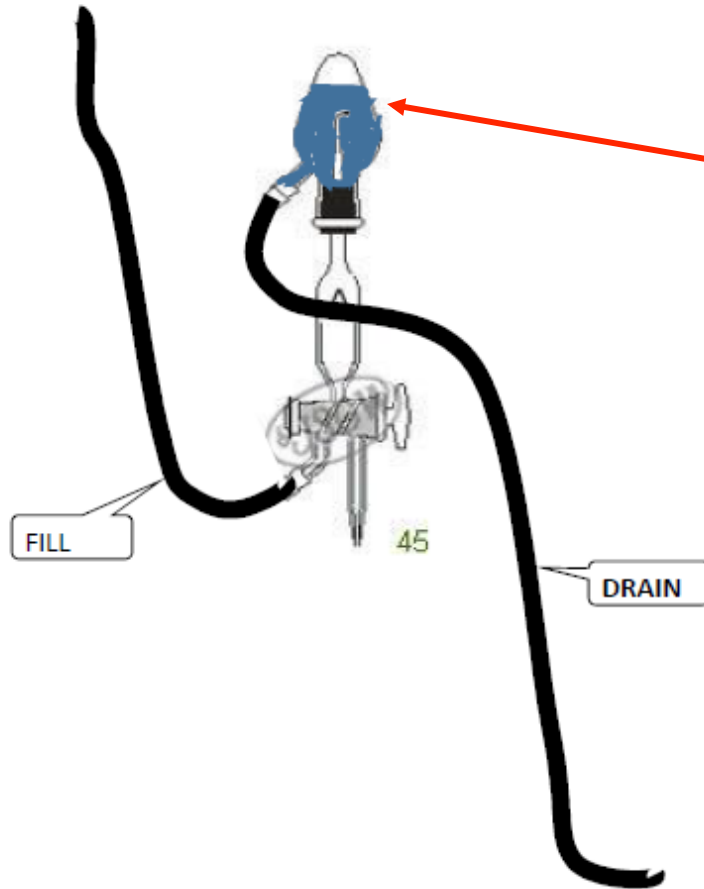


# K Num/Kappa



- Permanganate is typically measured using a autofill pipette.
- Permanganate will degrade with light and on storage – shorter fill lines help to reduce permanganate in fill lines that has aged.

# K Num/Kappa

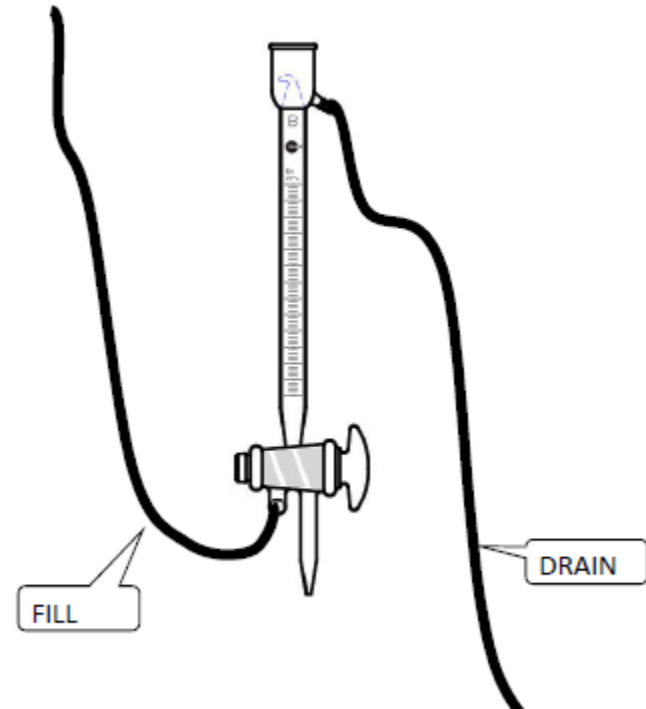


- Need to assure that permanganate does not overfill the pipette leveling device.
- Drain tube and top vent must remain clear.
- Since permanganate stains glassware until it is very dark, this error often is unobserved.
- Causes K or Kappa number to measure low.
- Larger test volume reduces error.

# K Num/Kappa

Auto burette.

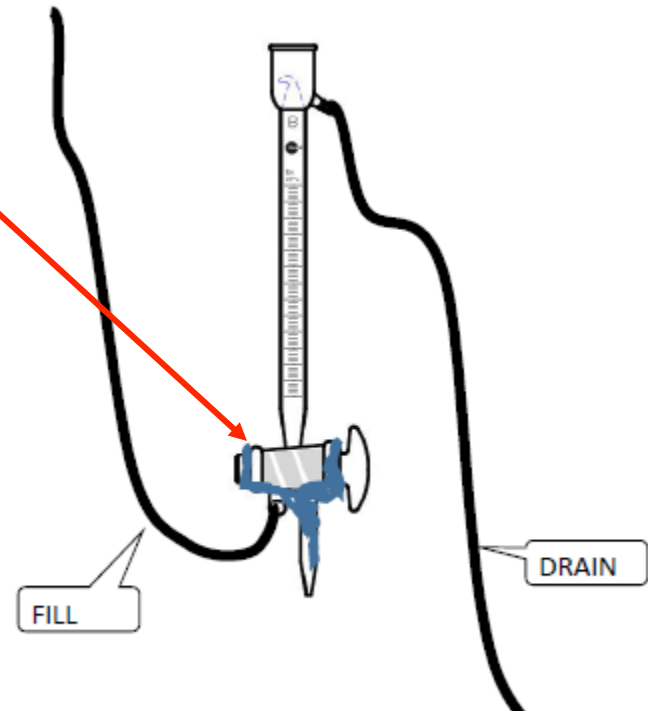
- An auto fill burette is typically used to titrate, using sodium thiosulfate.



# K Num/Kappa

Auto burette.

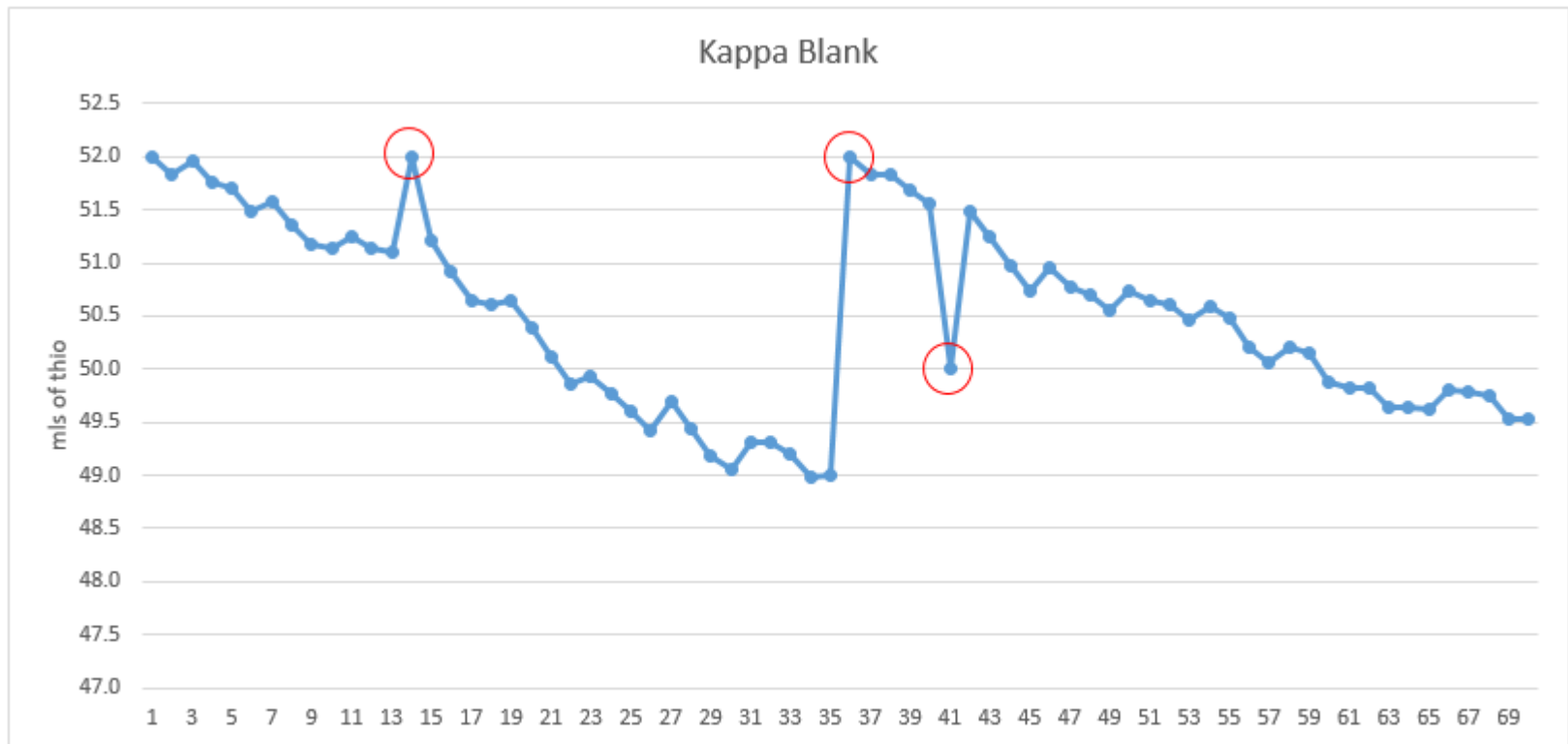
- Thiosulfate crystals need to be kept clean from the burette tip.
- Crystals can randomly drop into test solutions.
- Keep stop cocks greased.
- Rinse with water periodically.
- Will result in a periodic high K Number or Kappa.



# K Num/Kappa

Permanganate blank value should be recorded, and if there is an unexplained change more than  $\pm 0.2$  mls, the blank should be rettested.

- The blank will increase after chemicals are refreshed.
- It is good practice to flush the permanganate pipette testing is intermittent.



# K Num/Kappa



- Digital burettes and pipettes are more easily obtained and provide accurate results.
- These are NOT recommended for use with permanganate due to the oxidizing reactions with seals, etc.
- Over time, performance may deteriorate.
- Verify repeatability by weighing the permanganate solution.

# Other



- Improved air ventilation system.
- Comfortable work conditions are much appreciated.











**PAPTAC Bleaching Committee**  
**Section 7 - MILL UPDATES AND PROBLEMS SESSION**  
*Hinton, AB; October 24-26, 2016*

See following sheets.

Don Davies - Evanik

Q: Has anyone encountered DCS coding errors?

A: Everyone has. Always ensure coding changes are well documented in comments, both explanations and why changes are made. Make sure simulations are well marked & removed as possible. Can keep a database record of all changes made to DCS coding.

## Mill / Company Update & Opportunities Roundtable

Affiliation: TEXO Name: LAURIER MORISSETTE

### Mill / Company Update:

1. new upgraded wood chip analyzer CMS-AWA on sawdust up and running
2. development of digester control for better hydraulic digester level control
3. sand measurement development
4. successful commissioning of advanced recaust control at Clearwater Lewiston ID

### Problems:

1. Q: .....

A: .....

.....

.....

2. Q: .....

A: .....

.....

.....

3. Q: .....

A: .....

.....

.....

4. Q: .....

A: .....

.....

.....

## Mill / Company Update & Opportunities Roundtable

Affiliation: Howe Sound Pulp Name: Aamirah Allykhan

### Mill / Company Update:

1. Rebalanced  $\text{ClO}_2$  application to use bleach towers retention to full capacity. Approx 2-3 kg / ADT of chlorate savings
2. Lowered Eop exit pH to 9.5. No negative effects
3. New evaporators will be commissioned by the end of 2016.
4. New  $\text{O}_2$  Delig tower project delayed; will be online in 2017.
5. New MC Do tower project postponed by ~~2~~ 1 year.

### Problems:

1. Q: Evaporator fouling; boilouts every 12-20h.

A: <sup>1</sup> lower residual FA <sup>4</sup> Ash seeding (RB ash)  
<sup>2</sup> fatty acid ratio in soap (paper) <sup>5</sup> More  $\text{SO}_4$ , less  $\text{CO}_2$   
<sup>3</sup> residual sodium carbonate in w/L to digester

2. Q:

A:

3. Q:

A:

4. Q:

A:

## Mill / Company Update & Opportunities Roundtable

Affiliation: Irving Pulp & Paper Name: Rick Wasson

### Mill / Company Update:

1. New kappa Q
2. GZ
3. Bleach Plant Adv. Controls.

### Problems:

1. Q:.....

A:.....

2. Q:.....

A:.....

3. Q:.....

A:.....

4. Q:.....

A:.....

## Mill / Company Update & Opportunities Roundtable

Affiliation: Verso - Wisconsin Rapids Name: Brittany Spencer

### Mill / Company Update:

1. Verso emerged from bankruptcy in July
2. Finished a large capital upgrade to replace the boiler bottom of 1 of our 3 recovery boilers
3. Have seen huge success with pre-bleach enzyme with good reduction in  $\text{ClO}_2$  consumption

### Problems:

- We struggle w/ scale on our DI stage optical instrumentation.
1. Q: The scale needs to be wiped off weekly, occurs after operational upsets.

A: ...likely pitch deframer deposits, moving it post  $\text{ClO}_2$  addition may be helpful, IP runs last stage neutral, see

2. Q: if it correlates to upsets w/ liquor in recaust,

A: caustic/ $\text{ClO}_2$  ratio control may help pH control

3. Q:

A:

4. Q:

A:

## Mill / Company Update & Opportunities Roundtable

Affiliation: NORTHWOOD - CANFOR

Name: DAN KAKNEVICIUS

### Mill / Company Update:

1. Installed new centrifugal chiller for  $\text{ClO}_2$  plant.
2. Capital - Obsolescence mostly. Front end instrumentation, kappa analyzer, lenses, droplegs, shower bars, washer heads.
3. Long term - maybe chloride removal, condensing turbine, lots of steam savings projects.

### Problems:

1. Q: Anyone have concrete benefits of using gas-free valves on washers?

A:

Yes - some data from down south that they work really, really well.

2. Q: Anyone using  $\text{MgOH}$  (Magnesium Hydroxide)?

A: - We really to unplug lines - not soluble.

→ pump in pH, and then second bump after it dissolves

→ very abrasive. Couple mills in south 20-30% replacement

→ will never unsettle.

3. Q:

A: → Mechanical pulp mills use it.

→ No benefit for  $\text{O}_2$  delign - paper by FP innovations. Data inconclusive for strength.

4. Q:

A:



## Mill / Company Update & Opportunities Roundtable

Affiliation: <sup>WEST ROCK</sup> LA TUQUE-MILL Name: Dominic Côté

### Mill / Company Update:

1. Will start new batch digester next month.  
Should also change 3 others digester in 2017.
2. Working with ~~LA TUQUE-MILL~~ to have an  
auto control for white liquor usage vs wood density.
3. ....

### Problems:

1. Q: Do you see bleaching cost change with season change?  
A: Yes, it seems to be winter time, the  
more expensive because bark.

2. Q: .....

A: .....

3. Q: .....

A: .....

4. Q: .....

A: .....

## Mill / Company Update & Opportunities Roundtable

Affiliation: CHEM STONE Name: Ant Meuse

### Mill / Company Update:

1. RECENT SUCCESSSES (MULTIPLE) FOR GL/WL/W WASH FOR VERY LOW DOSE MAINTENANCE OF SCALE CONTROL
2. CLEAN ON THE FLY, INTERMITTENT USE OF HIGHER DOSE TO SAFELY REMOVE EXISTING  $\text{CaCO}_3$  DEPOSITION
3. ~~WATER RECYCLING~~ W/O DT

### Problems:

1. Q: .....

A: .....

2. Q: .....

A: .....

3. Q: .....

A: .....

4. Q: .....

A: .....

## Mill / Company Update & Opportunities Roundtable

Affiliation: WEYERHAEUSER Name: ALISON ROWAT

### Mill / Company Update:

1. Weyerhaeuser Longview went to Nippon  
~~Dynalene~~ Dynalene Packaging Aug 2016
2. Port Wentworth & New Bern took downtime  
ahead of hurricane Matthew. Both running well  
after mild submersion
3. PW has major recovery upgrade Q1 2017

### Problems:

1. Q: .....

A: .....

2. Q: .....

A: .....

3. Q: .....

A: .....

4. Q: .....

A: .....

## Mill / Company Update & Opportunities Roundtable

Affiliation: Collins & Family Name: Jim Collins

### Mill / Company Update:

1. Working on new Bleach & Scrubber Survey  
preliminary presentation tomorrow Oct 25

2. ....  
3. ....

### Problems:

1. Q: FRP Monitoring Program Core Sampling

- 4 A: 1. Core sampling / plan for following shut <sup>or immediate</sup> repair on shutdown  
2. Monitor "weak spots" & replace on short shuts or annual  
1 3. Run to Failure

2. Q: Programs other than Core Sampling

A: Inspection: inspect using cameras  
- look at different sections each shut

3. Q: Howe / Northwood - A good experience with Ultrasound  
- stamp & replacement dates and material on piping, replaced  
(or good records in maint. files) when

A: Cariboo: company for predictive data predetermined  
company Horizontal? suspects spot  
bad

4. Q: ....  
A: ....

## Mill / Company Update & Opportunities Roundtable

Affiliation: DMI Peace River Name: Almer Fetahovic

### Mill / Company Update:

1. New Brownstock Keppa & EA Analyzer installed and Commissioned
2. Flash Tank Upgrade
3. Overfire Air System / Power Boiler Upgrade - Improved Combustion Air Control
4. Digestor <sup>Wet</sup> Overlay Project

### Problems:

1. Q: .....

A: .....

2. Q: .....

A: .....

3. Q: .....

A: .....

4. Q: .....

A: .....

## Mill / Company Update & Opportunities Roundtable

Affiliation: Skookumchuck Pulp Name: John Shao

### Mill / Company Update:

1. 2 BLTs will be installed and commissioned by the end of the year
2. Tried a new washer drum ~~from China~~ at Washer 11 ~~from~~, It did not work.
3. Enzyme trial in machine stage for pulp drainage shows 3-4% improvement of machine. Extended trial will be run by the end of the year.

### Problems:

1. Q: Any steam mixer tripping before E2?

A:

- steam nozzles plugged. They should be unplugged
- scale from the pump and chute by changing pH.

2. Q: it can be improved.

A:

3. Q:

A:

4. Q:

A:

**Mill / Company Update & Opportunities Roundtable**

Affiliation: Verso Quinnesec Name: Brian LaBrash

**Mill / Company Update:**

1. Emerged from Bankruptcy and have a new Board
2. ~~Atex~~ Installed a new D2 Washer in May
3. Will replace Surface Condenser in Rio in Nov

**Problems:**

1. Q: Anyone with a concrete chip pad have issues w/ sand <sup>when rotating pile</sup>  
A: Hinton does, Irving too. Check sand for magnetic particles - Dave Flater. Are suppliers sending more sand?

2. Q: Is anyone seeing increased frequency of expansion joint failures <sup>in the BP</sup>  
A: No responses

3. Q: How many mills use a work permit - <sup>operations issues</sup> permit for work in the area  
A:

4. Q: How many mills are controlling consistency to Bleach Absorbers?  
A:

## Mill / Company Update & Opportunities Roundtable

Affiliation: TEXO Name: LAURIER MORISSETTE

### Mill / Company Update:

1. .... new upgraded wood chip analyzer on sawdust up and running.
2. .... hydraulic digester control <sup>or better</sup> from level control ~~digester~~
3. .... sand measurement development
4. .... successful commissioning of advanced recaust control at Clearwater Lewiston.

### Problems:

1. Q: .....

A: .....

2. Q: .....

A: .....

3. Q: .....

A: .....

4. Q: .....

A: .....



## Mill / Company Update & Opportunities Roundtable

Affiliation: West Fraser Name: Heather Friesen

### Mill / Company Update:

1. Optimizing machine, able to produce above 1300 ADTPD.  
Have a dedicated task force dedicated to pulp machine.
2. Went to area teams (OMC, process eng., mechanical eng., maintenance supv., maint. planner)  
Also got rid of Pi Process book + using Copstone's Parview.
3. Installing KappaQ by end of this year.
4. Worked w bleach washers + shower bars + saw significant NaOH reduction.

### Problems:

1. Q: O<sub>2</sub> reactor vessel crack and have decreased press. at top of vessel to 2psig, didn't see much of a change in Delta Kappa any reasons why?

A: - Retention time playing - poor mixing of O<sub>2</sub>

- Consistency + temp → look at channeling - check chemical flows

- ordered a new head at weyerhaeuser mill, same vintage as our O<sub>2</sub> reactor,

2. Q: What do mills use for O<sub>2</sub> chemicals caustic or OWL? Which do you see works better/problems?

A: - depends on balance : OWL for base load

- oxidizes → exotherms → control oxidation

- majority using OWL or both, few using just caustic

3. Q: Roll cleaning showers on press washers, what do most people use for wash water + if using hot water where do you return it?

A: - Mena Henderson talk to her about filtrate loop

4. Q: RS: MeOH<sup>trans</sup> addition to ensure higher efficiency at higher production

A:

## Mill / Company Update & Opportunities Roundtable

Affiliation: Canfor Pulp Name: Waqas Sayyaz

### Mill / Company Update:

- (Brittany)
1. Enzyme trial (Xylene based Enzyme)  
Looking for bleaching chemical saving
  2. 2-hour retention ↑ Application point unbleached h.i.D
  3. 0-2 delig 2nd Reactor - Nov 2016 installation  
~~increasing to 3~~ Looking for biodiesel production by hydrocracking from black Liquor.

### Problems:

1. Q:

A:

2. Q:

A:

3. Q:

A:

4. Q:

A:

## Mill / Company Update & Opportunities Roundtable

Affiliation: Cariboo Pulp Name: Rahiv Lubana  
Rohul Pukodyil

### Mill / Company Update:

1. We recently got Koppa G and Alkali C Analyzers. Koppa G is in control, Alkali C is still work in progress.
2. Implemented a dust collection system at the Chip dumps.
3. New Process and mechanical engineers.

### Problems:

1. Q: How many mill have an R10, do you neutralize? your  
sulfate? Where do you recover Sodium Sulfate? Neutralize?  
A: mill Brian to brush <sup>NaOH</sup> -> don't neutralize, 20% Sulfuric Acid.  
1 mill Thunder boy

2. Q: \_\_\_\_\_

A: \_\_\_\_\_

3. Q: ~~Has anyone looked at the <sup>throughout</sup> Koppa Yield model for the~~  
A: ~~mill? For working on making the model for the mill~~  
~~and wanted to know if anyone has done much in that~~  
~~field.~~

4. Q: Has mill implemented controls on the Digester using results  
Things to watch out for! from an online

A: \_\_\_\_\_ analyzer?  
- Weyerhaeuser mills use liquor analyzer in most of their Any feedb.  
mill.  
- Aaron ~~Weyerhaeuser~~ recommends having a protection signal  
to avoid any issue with false reading