



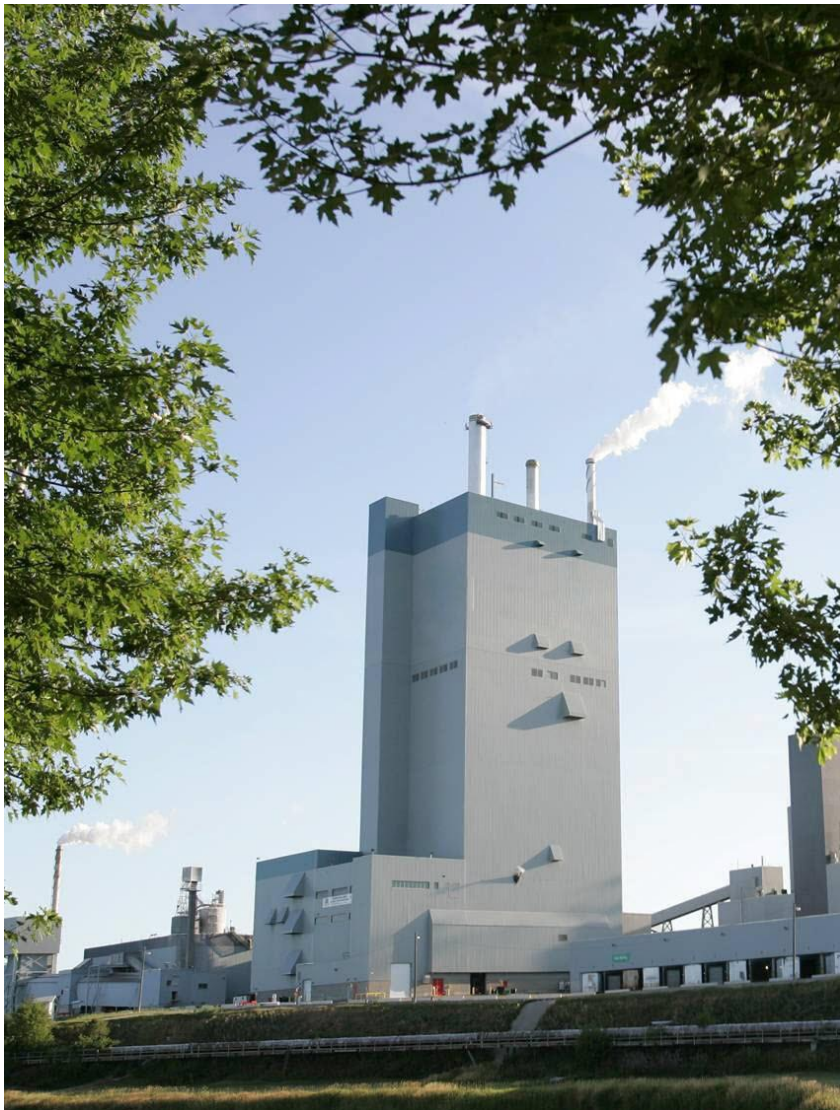
Domtar

Bleach Plant pH Targets and Control

March 2020-Spring Bleaching Committee Meeting

Process Engineer- Olivia Carter

AGENDA



- Overview of Domtar Dryden Bleaching Stages
- Alkaline Stage pH Targets/Control
 - Temperature corrected pHs
- Natural pH in D1 Stage

DOMTAR DRYDEN- BLEACH PLANT

■ 6-Stage Bleaching Process:

D0

→W

→Eop

→D1

→E2p

→D2

BS Kappa: 29

Eop Kappa: 4.75
pH: 10.6

Brightness: 77

pH: 10.6

Brightness: 89.5



ALKALINE PH TARGETS/CONTROL

Background- Temperature Corrected pH's

- Alkaline pH readings change with sample temperature ($T \downarrow$, $pH \uparrow$)
 - As a sample temperature increases, H_2O dissociates and increases $[H^+]$ ions causing an apparent increase in acidity.
- 2 Options-
 - 1) Acknowledge and adjust pH targets accordingly
 - 2) Develop a relationship that will correct measured pH for temperature (25C)
- 3 Phase Implementation
 - 1- Data Collection and Analysis
 - 2- Temperature corrected pH equation and operator Manual Data Entries (MDE)
 - 3- Controlling with new temperature corrected pH's

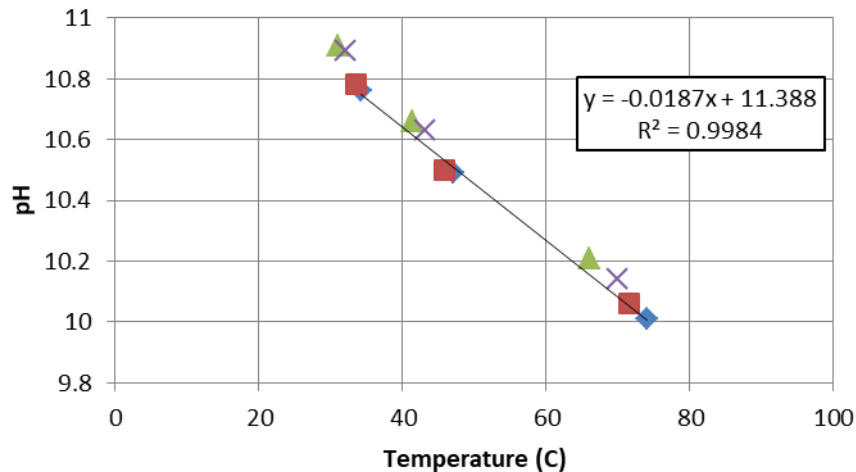


ALKALINE PH TARGETS/CONTROL

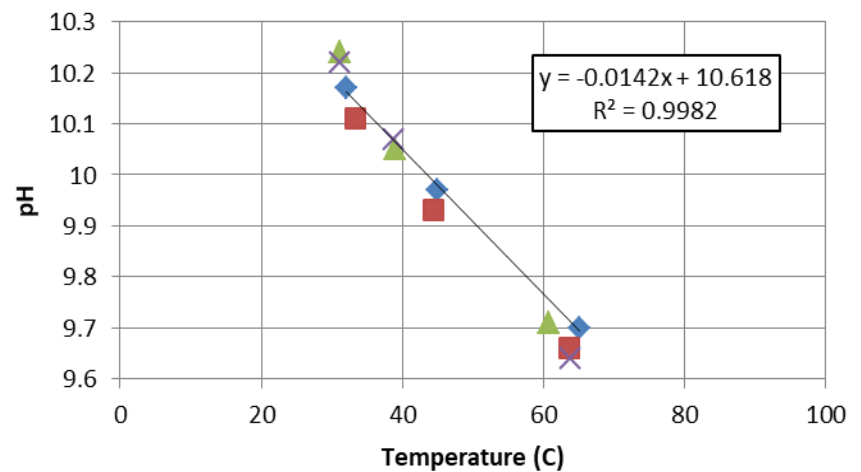
Phase 1- Data Collection and Analysis

- Samples from Eop and E2p vat were collected and pH and temperature were recorded over time.
- Confirmed phenomenon

Eop Vat



E2p Vat



ALKALINE PH TARGETS/CONTROL

Phase 2- Temperature Corrected Equation and Operator MDE's

- Equation developed from linear interpolation using equations of a line for both Eop and E2p data

$$y = y_1 + (x - x_1) \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

$$pH \text{ at } 25C = 10.29 + \frac{(pH_{measured} - (-0.0161T_{meas} + 10.689)) (10.96 - 10.29)}{((-0.019T_{meas} + 11.43) - (-0.019T_{meas} + 11.43))}$$

y : Measured pH at reference Temp (25C)
 y_1 : Reference pH at reference Temp (25C)- low
 y_2 : Reference pH at reference Temp (25C)- high
 x : Measured pH at measured Temp
 x_2 : Reference pH at measured Temp- low
 x_1 : Reference pH at measured Temp- high

$y_1 = -0.0161 * 25 + 10.689 = 10.29$
 $y_2 = -0.019 * 25 + 11.43 = 10.96$
 $x_1 = -0.0161T_{meas} + 10.689$
 $x_2 = -0.019T_{meas} + 11.43$

ALKALINE PH TARGETS/CONTROL

Phase 2- Temperature Corrected Equation and Operator MDE's

- MDE's created for operators to get used to collecting temperature alongside pH and to test validity of equation

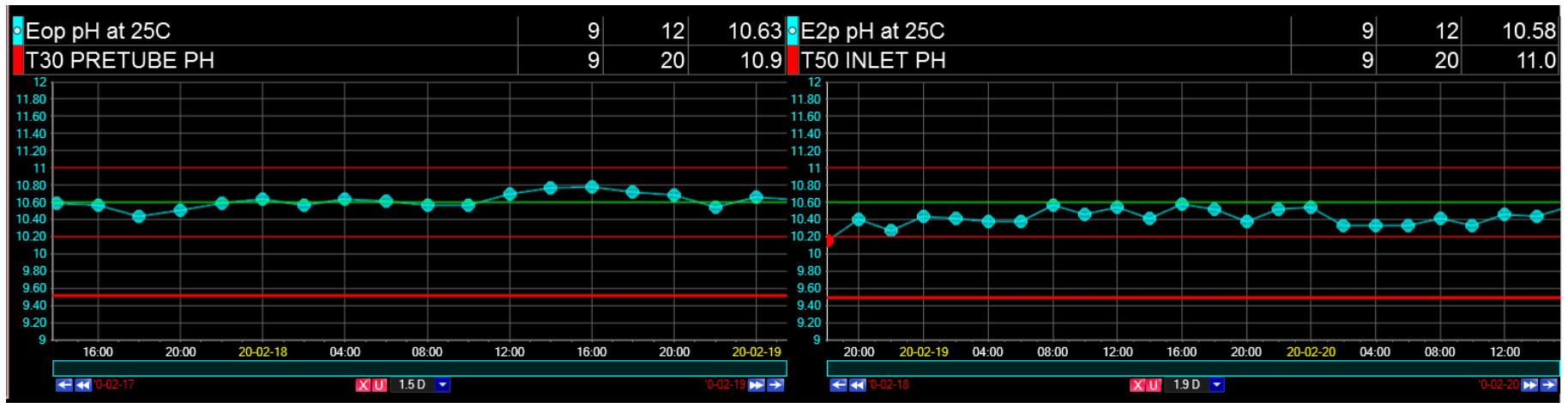
		11.00
		10.60
		10.20
EOP pH (pH)	Eop Measured Temp (C)	Eop pH at 25C
10.10	69.00	10.93
10.00	73.00	10.90
10.10	68.00	10.91
10.00	74.00	10.92
10.00	75.00	10.95
10.00	73.00	10.90

		11.00
		10.60
		10.20
E2P Tower pH (pH)	E2p Measured Temperature (C)	E2p pH at 25C
9.70	67.00	10.40
9.90	64.00	10.58
9.90	66.00	10.62
9.90	65.00	10.60
10.00	66.00	10.74

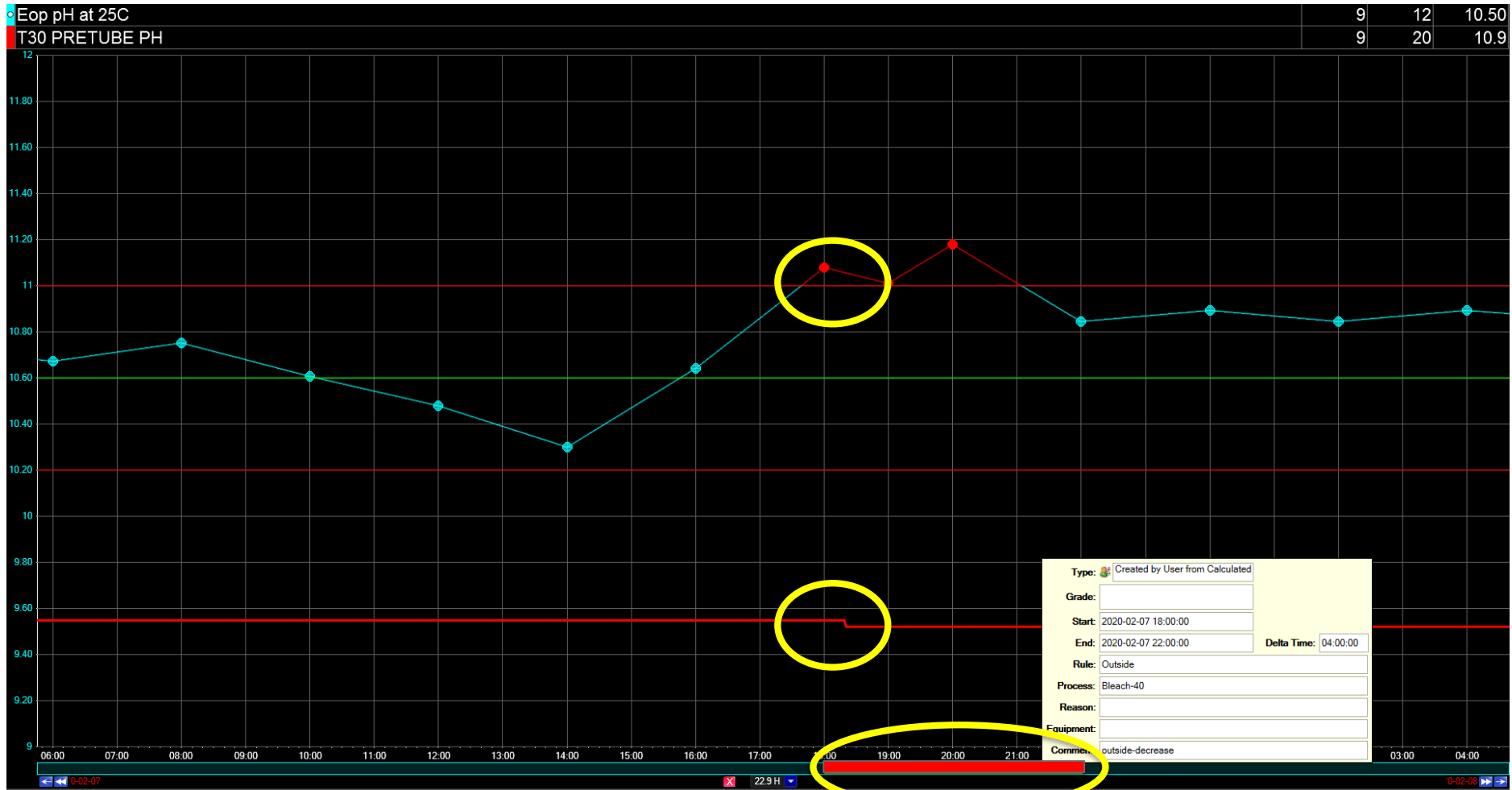
ALKALINE PH TARGETS/CONTROL

Phase 3- Controlling with temperature corrected pH's

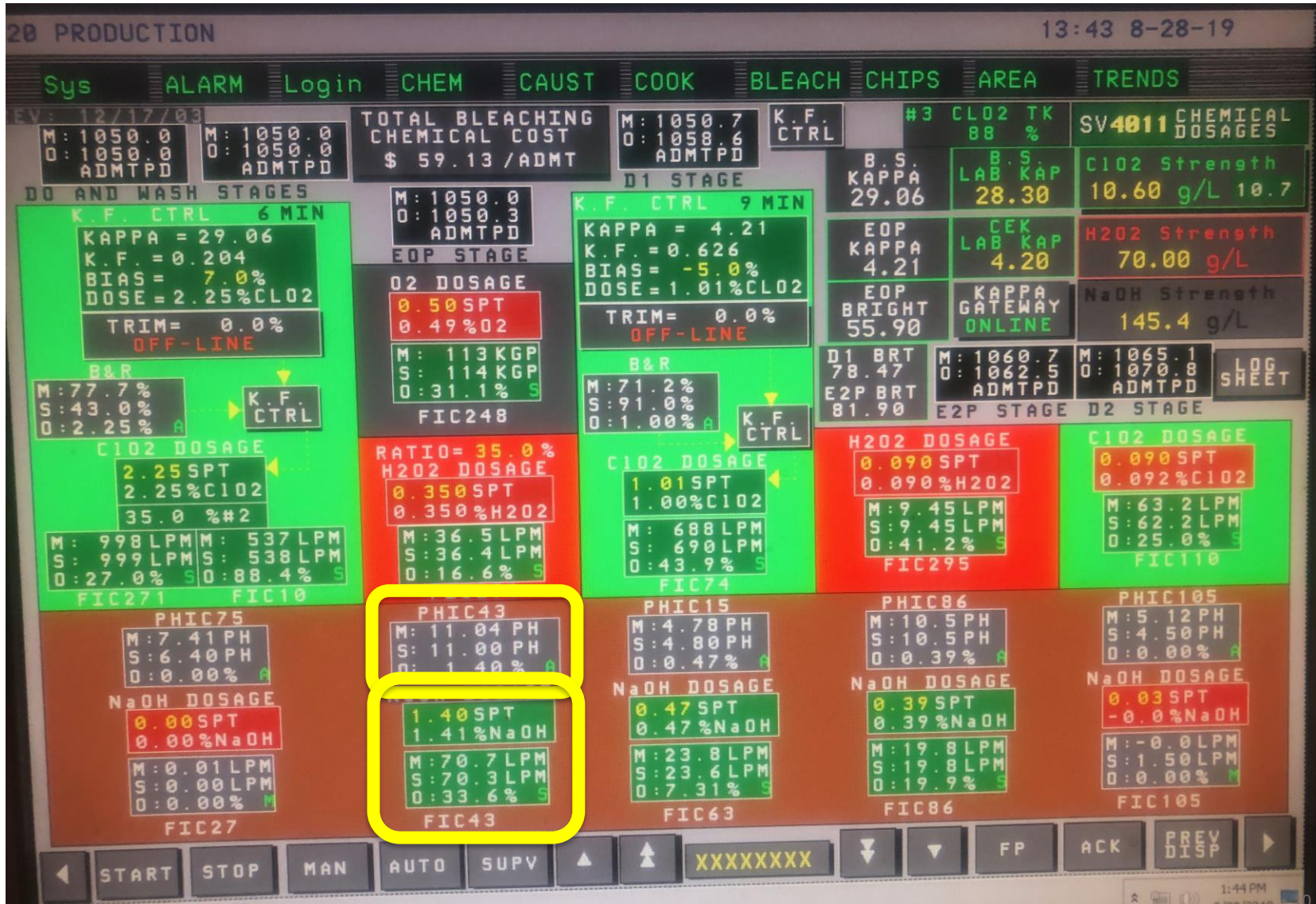
- Develop control charts for operators to monitor
 - Control Chart alarms:
 - 1) One point out of limits
 - 2) 9 points on one side



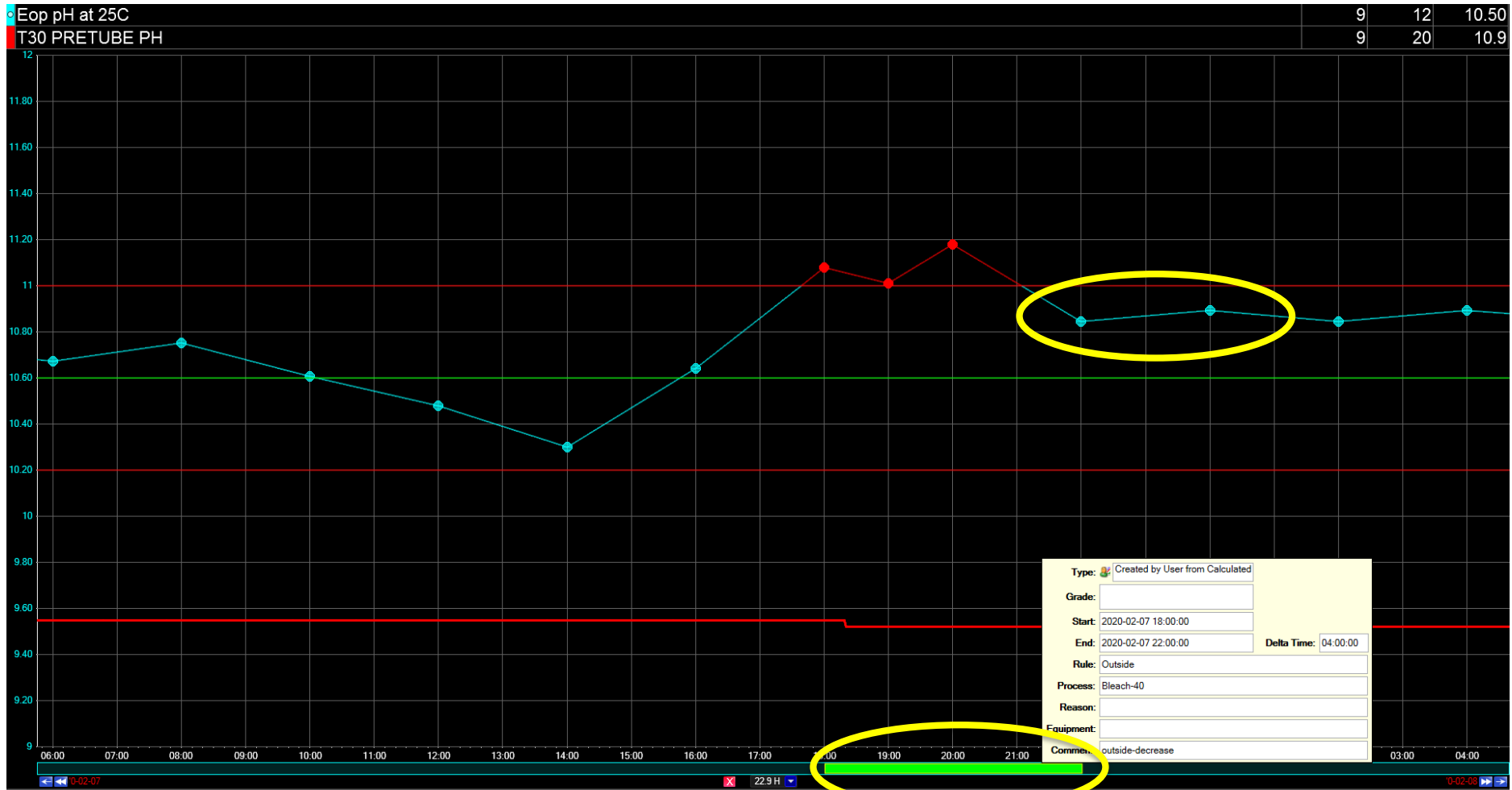
ALKALINE PH TARGETS/CONTROL



ALKALINE PH TARGETS/CONTROL



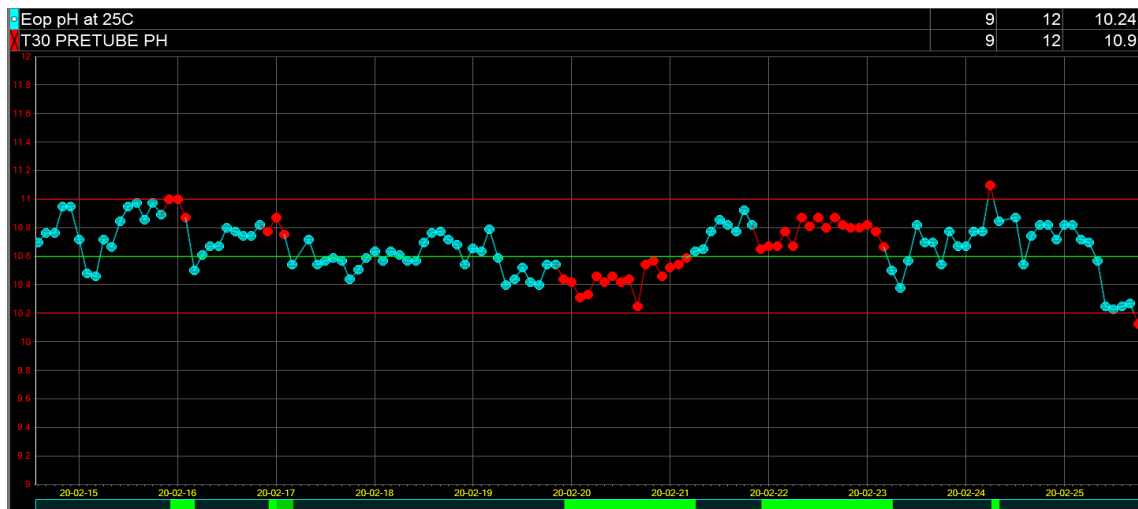
ALKALINE PH TARGETS/CONTROL



ALKALINE PH TARGETS/CONTROL

Trial Takeaways

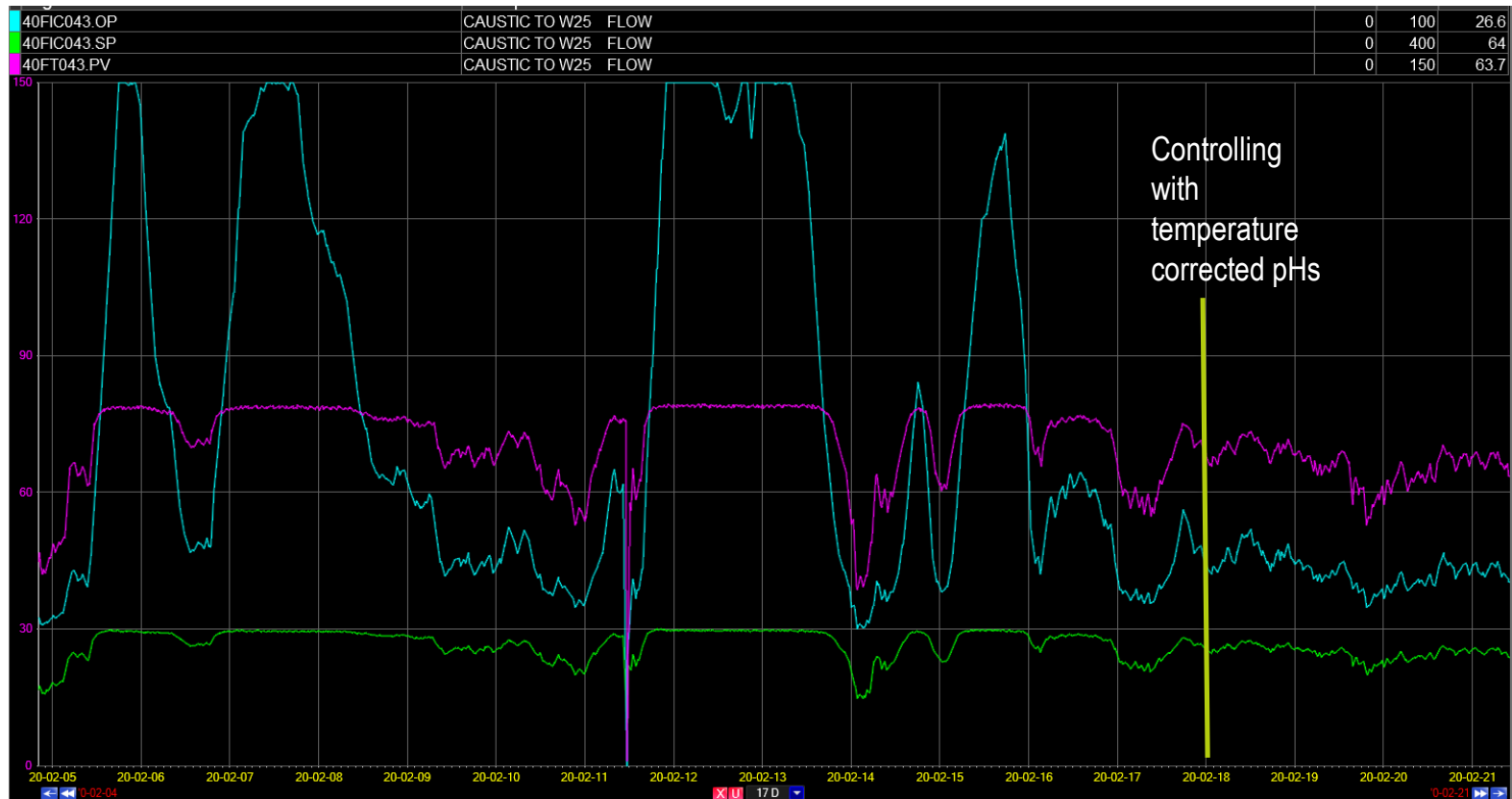
- Less pH Variability



ALKALINE PH TARGETS/CONTROL

Trial Takeaways

- Brought caustic valve back into control



ALKALINE PH TARGETS/CONTROL

Trial Takeaways

- Cut to caustic

	Dates	Sept 1, 2019-Jan 18, 2020	Jan 18, 2020-Feb 18, 2020
Bleach Plant Production Actual	TPD	1021.68 ± 34.51	1039.64 ± 33.40
CAUSTIC TO W25 FLOW (EOP)	%	87.88 ± 22.75	58.10 ± 27.37
CAUSTIC TO W25 FLOW (EOP)	LPM	76.28 ± 3.20	74.49 ± 5.86
Eop pH at 25C		10.75 ± 0.29	10.59 ± 0.47
CAUSTIC TO W45 FLOW	%	34.40 ± 7.30	30.63 ± 8.25
CAUSTIC TO W45 FLOW	LPM	31.22 ± 5.72	28.27 ± 5.83
E2p pH at 25C		10.68 ± 0.33	10.51 ± 0.68

*Still analyzing whether this is the proper pH for optimal extraction, moving forward will trial lower pH

TRIAL: “NATURAL” PH IN D1 STAGE

Background

- Natural pH- Add no caustic for pH control
- Theoretically adding caustic to buffer D1 pH is correct, but is it saving ClO₂?
- Low pH (<3.5) is better for shive bleaching
- Goal: Decrease caustic charge to 0 kg/ADMT (savings of ~5 kg/ADMT) with no impact on other chemical charges



TRIAL: NATURAL PH IN D1 STAGE

Background

■ Trial Plan

- 1) Decrease Eop NaOH Dosage by almost half (~0.45%-0.25%)
- 2) Return to baseline
- 3) Bump test to 0% (1 day) and back to 0.25%
- 4) Decrease NaOH dosage to 0% and monitor



TRIAL: NATURAL PH IN D1 STAGE

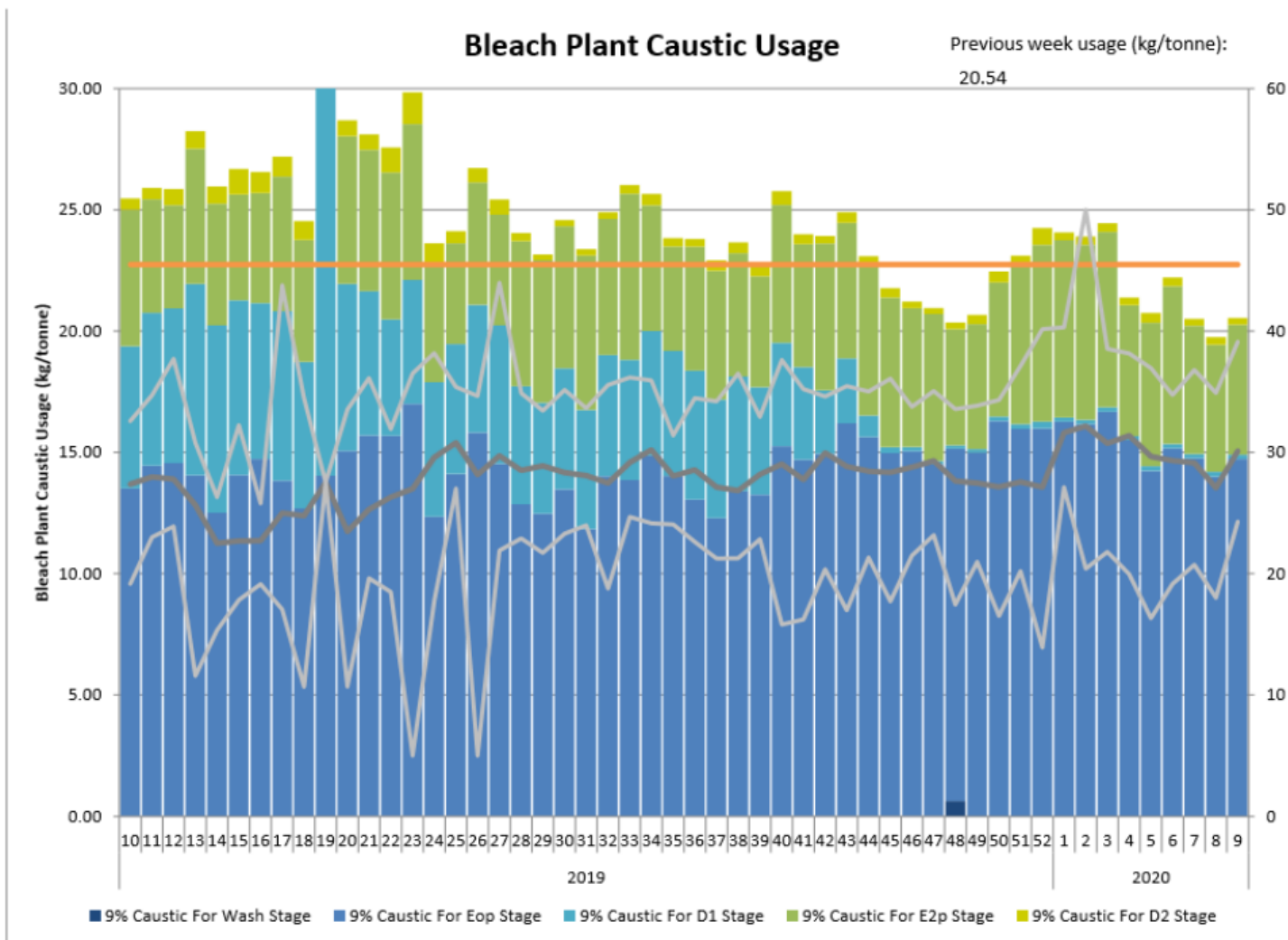
Trial Results

- D1 Vat pH- 2.2-2.5
- Total bleach plant caustic cost savings- 5 kg/ADMT
 - Cut ~20 lpm of caustic- D1
- Small 5% sulfuric acid savings (front-end)
- Operator Buy-In- ✓
- No increase in ClO₂ usage or Eop caustic usage



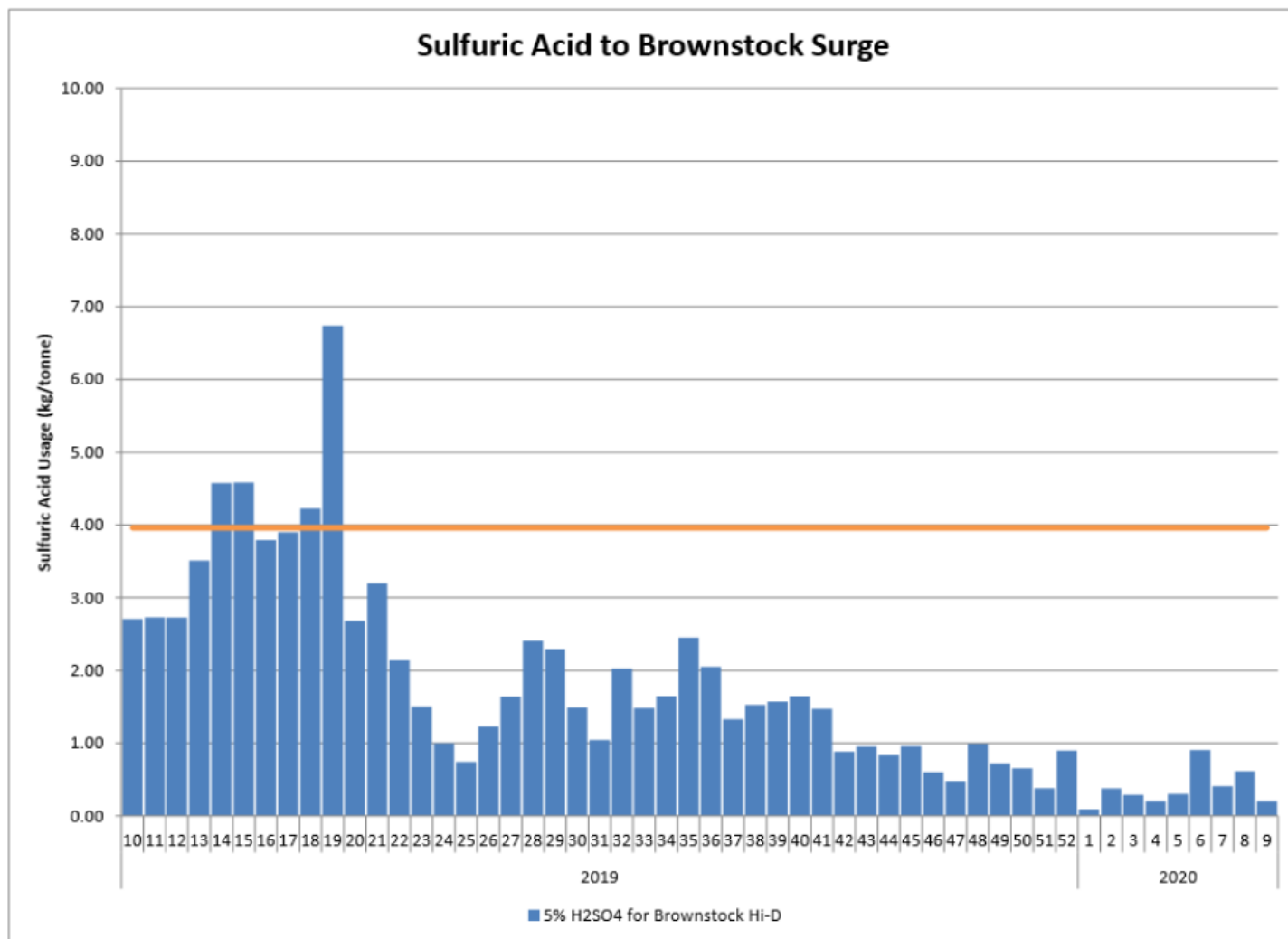
TRIAL: NATURAL PH IN D1 STAGE

Trial Results



TRIAL: NATURAL PH IN D1 STAGE

Trial Results



SUMMARY

- Chemical Savings!
 - Alkaline temperature corrected pHs control
 - So far small savings, moving forward hope to increase this.
 - Natural pH- D1 Stage
 - 5 kg/ADMT NaOH
- Operator Buy-In
- Key to Trial Success: Making one change at a time and documenting everything (Millcat/emails/documents)

THE FIBER *of* Domtar

AGILE | CARING | INNOVATIVE

