Advance Control Solution for Bleach Plant - Challenges & Benefits

Bleaching Committee Meeting
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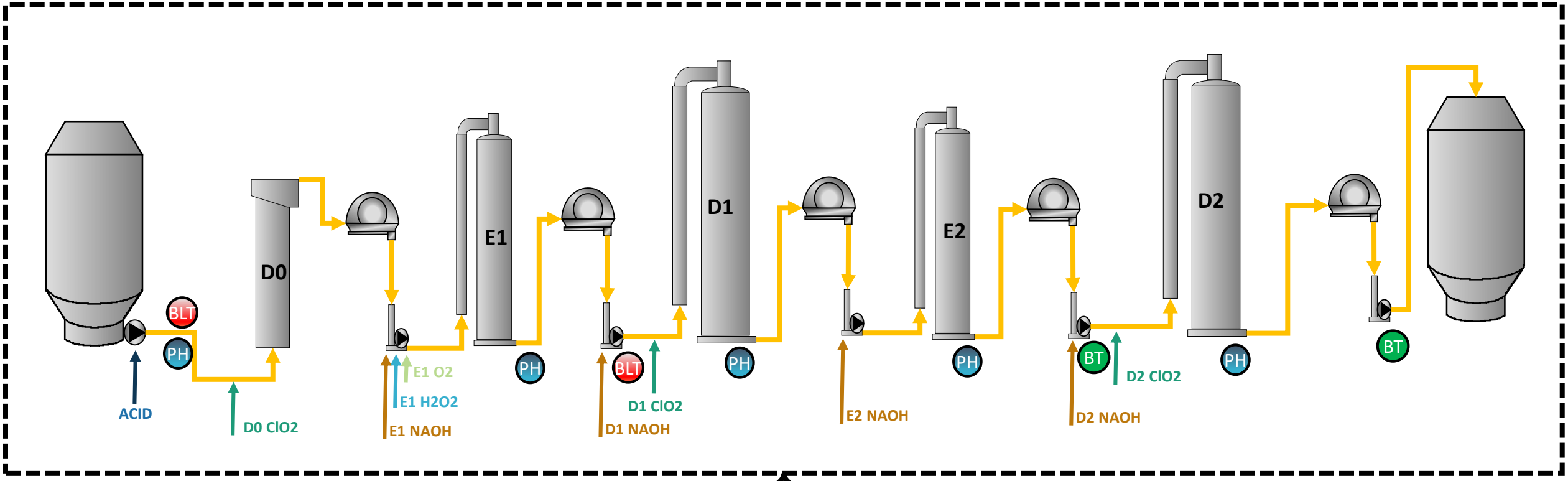
Outline

- Sensors
- Advance Control Solution
  - Implementation
  - Control Loops Overview
  - MPC Based controls
  - Example: E2 pH loop
- Challenges
- Benefits - Chemical Savings

Sensors & Controls



BLT 5500 BLT

pH Sensor PH

Brightness Transmitte BT

Advance Controls

Control Rationale

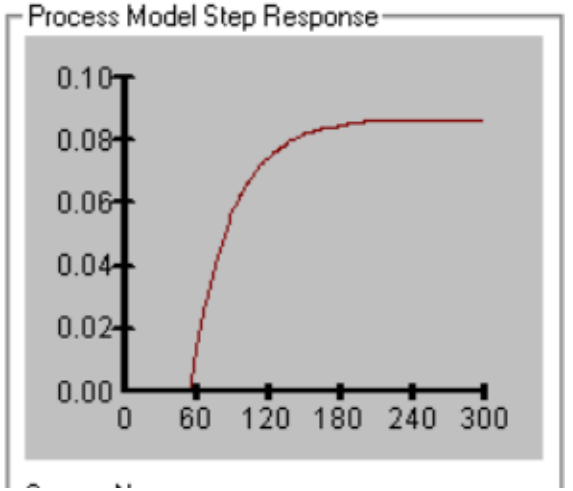
- What to control?
  - Eop Kappa/Brightness;
  - Final Brightnesses;
  - Outlet pHs;

- How to Control?
  - Using Process Bumps;
  - Process Models;
  - Model Predictive Control;

Models and Process Bumps

Process Bump

1st order Model



MPC Controls

Variable Types

Controlled Variables (CVs). These variables have setpoints or a high-low range that the controller will try to respect (Constraint Variables – CTs).

Examples: Final pHs, Final Brightness, etc;

Manipulated Variables (MVs). These variables have new setpoints written to them by the controller in order to achieve the setpoints or honour the limits of the CVs.

Examples: ClO2 dosages;

Feed Forward Variables (FFs). Disturbances. Does not have direct control.

Example: D0 BLT;

Optimization – When there are more than one MV competing to the same target;

EXAMPLE: H2O2 versus ClO2

Control Loops

Control Strategy Overview

		MVs									FFs						
		D0 CLO2	E1 NAOH	E1 H2O2	E1 O2	D1 NAOH	D1 CLO2	E2 NAOH	D2 NAOH	D2 CLO2	FF D0 BLT	FF D0 CLO2	FF E1 BLT K	FF E1 BLT BR	FF D1 CLO2	FF D2 BR IN	FF D2 ClO2
CVs	E1 BLT K#	-		-	-						+						
	E1 BLT BR	+		+	+						-						
	E1 PH		+									-					
	D1 PH					+									-		
	E2 PH							+							-		
	D2 BR IN						+						-	+			
	D2 PH								+								-
	D2 BR OUT									+						+	

Control Loop – E2 pH

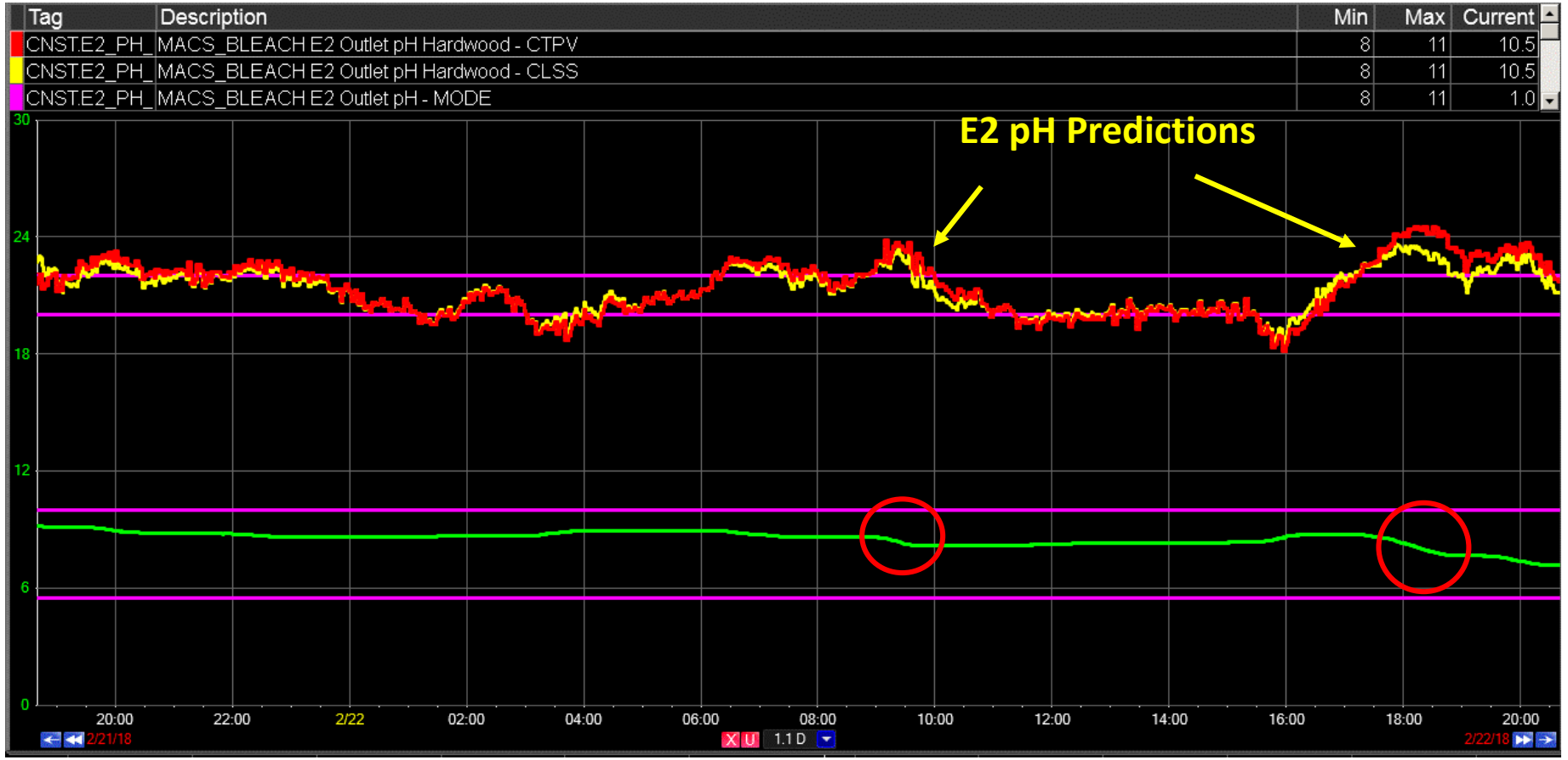
		MVs									FFs						
		D0 CLO2	E1 NAOH	E1 H2O2	E1 O2	D1 NAOH	D1 CLO2	E2 NAOH	D2 NAOH	D2 CLO2	FF D0 BLT	FF D0 CLO2	FF E1 BLT K	FF E1 BLT BR	FF D1 CLO2	FF D2 BR IN	FF D2 ClO2
CVs	E1 BLT K#	-		-	-						+						
	E1 BLT BR	+		+	+						-						
	E1 PH		+									-					
	D1 PH					+									-		
	E2 PH							+							-		
	D2 BR IN						+						-	+			
	D2 PH								+								-
	D2 BR OUT									+						+	

E2 pH Controls

MVs & CVs Limits

E2 pH Control

Predictions



What drives the E2 NaOH?

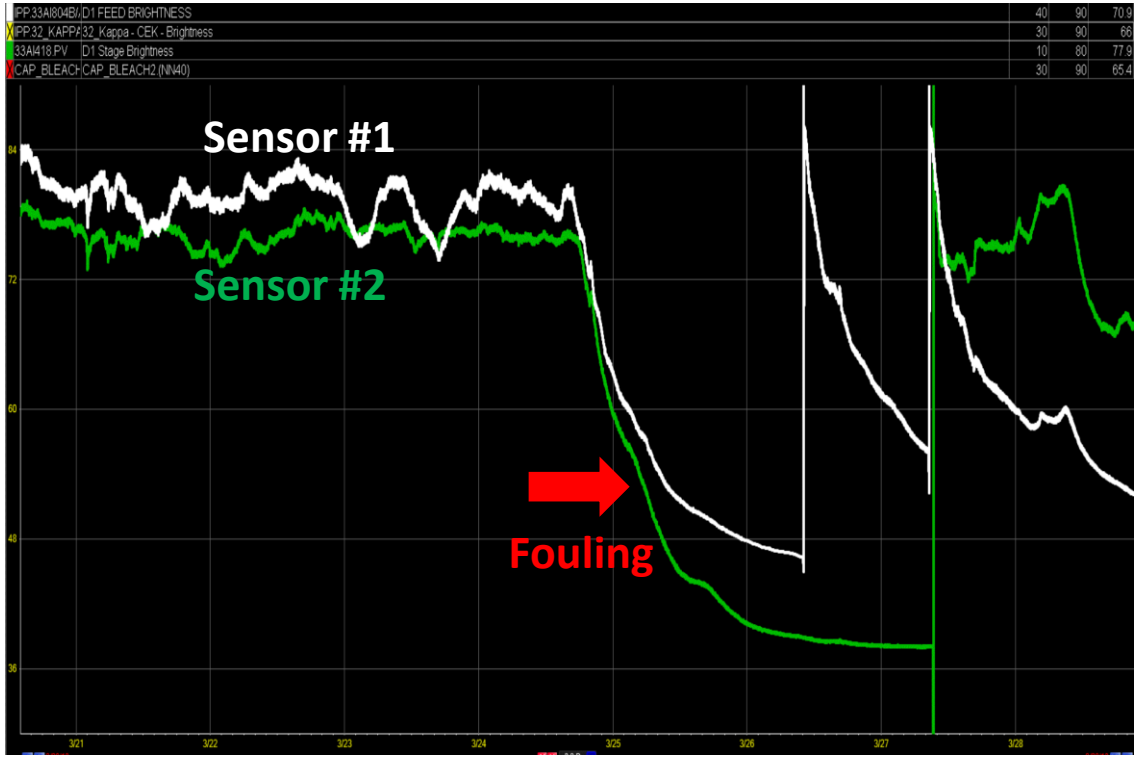
Process Models!!!

Challenges

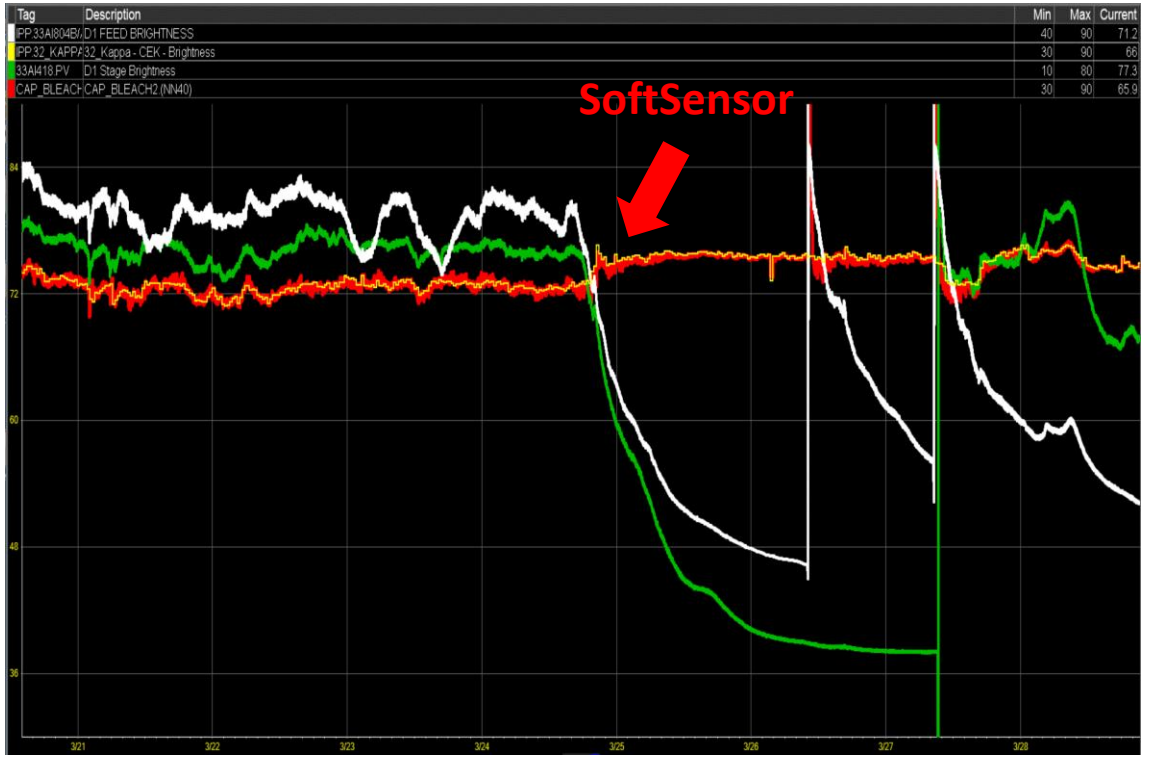
- Production Rate Changes;
- Sensor Fouling;
  - Probably due to higher Calcium Load to the Bleach Plant;
- Training;
  - New control concept, which requires operators engagement and training;

Soft Sensor For fouling

Inline Sensors Fouling

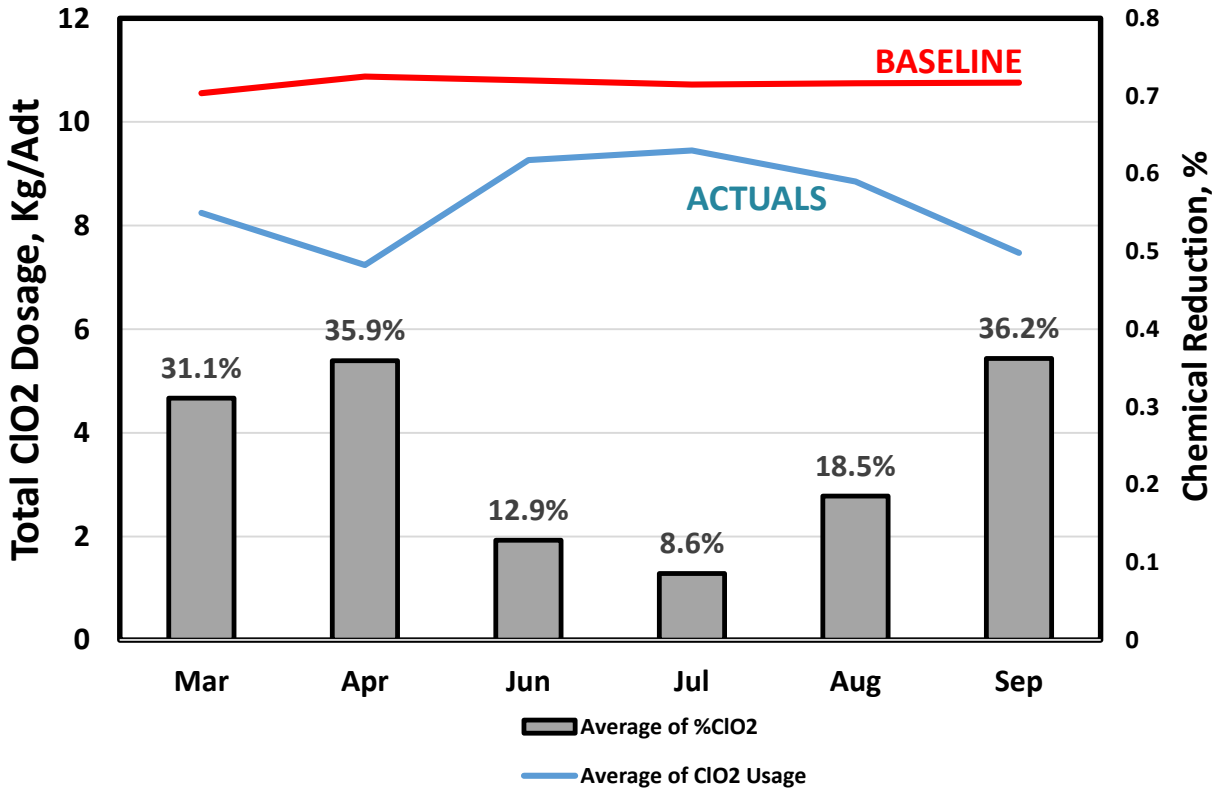


Soft Sensor

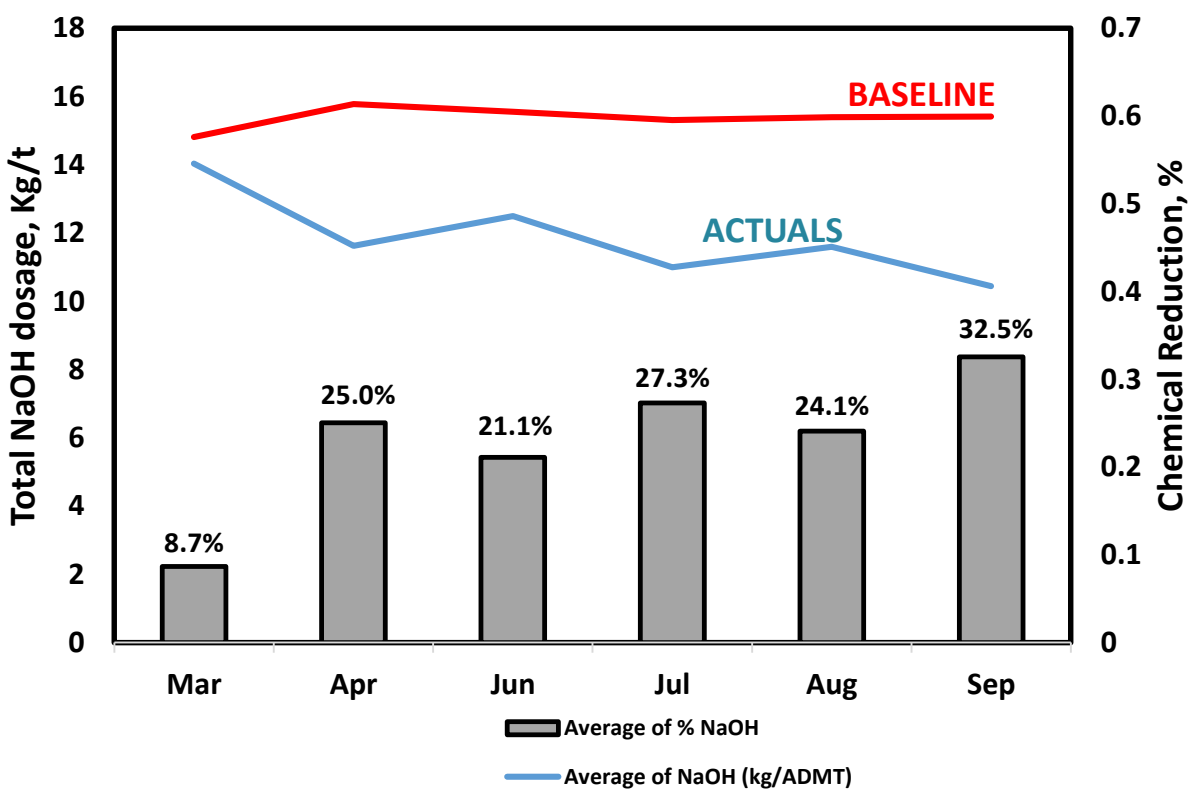


Maple - Chemical Savings

ClO2

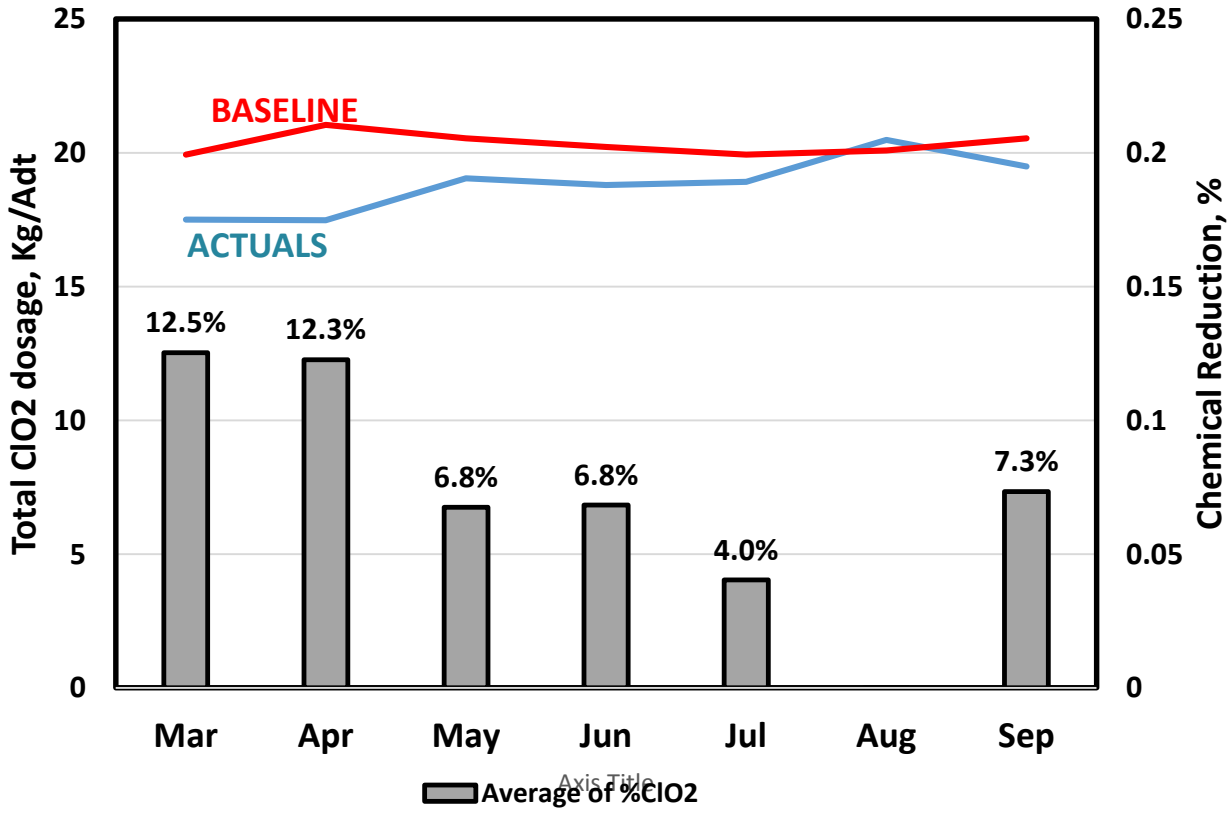


NaOH

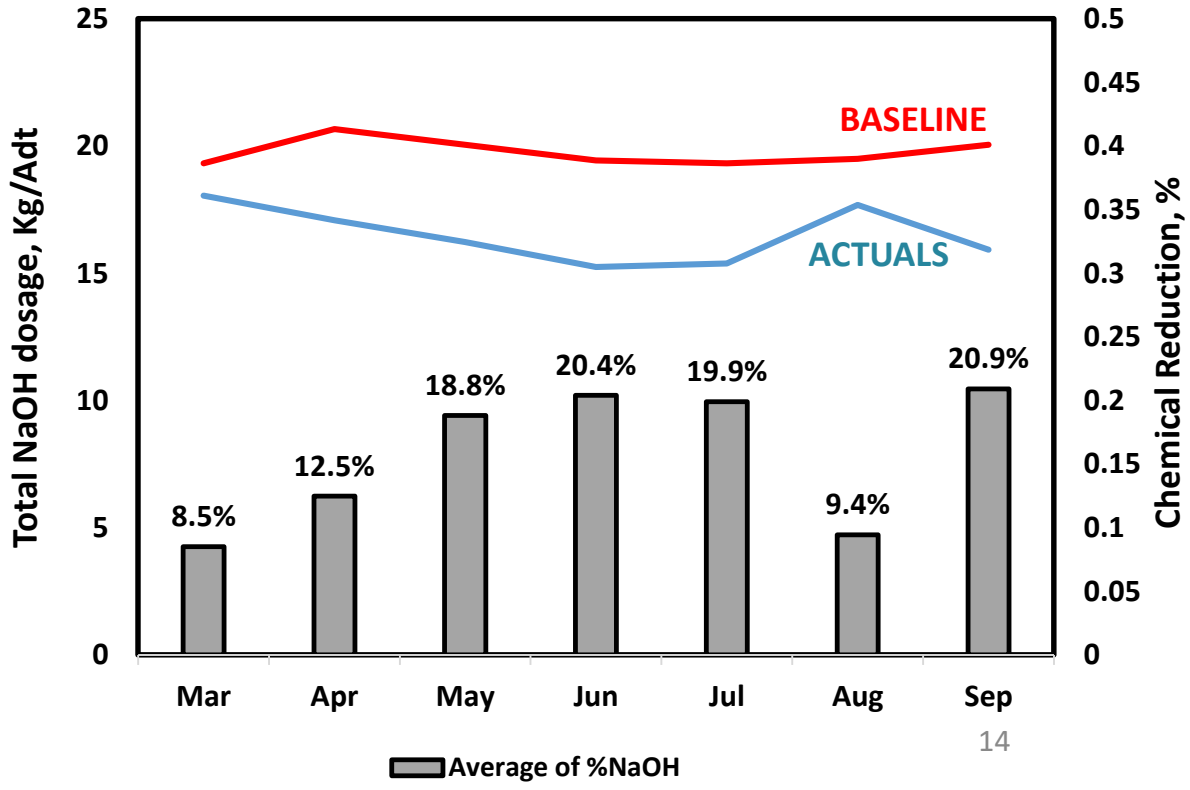


Softwood - Chemical Savings

ClO2



NaOH



Questions?