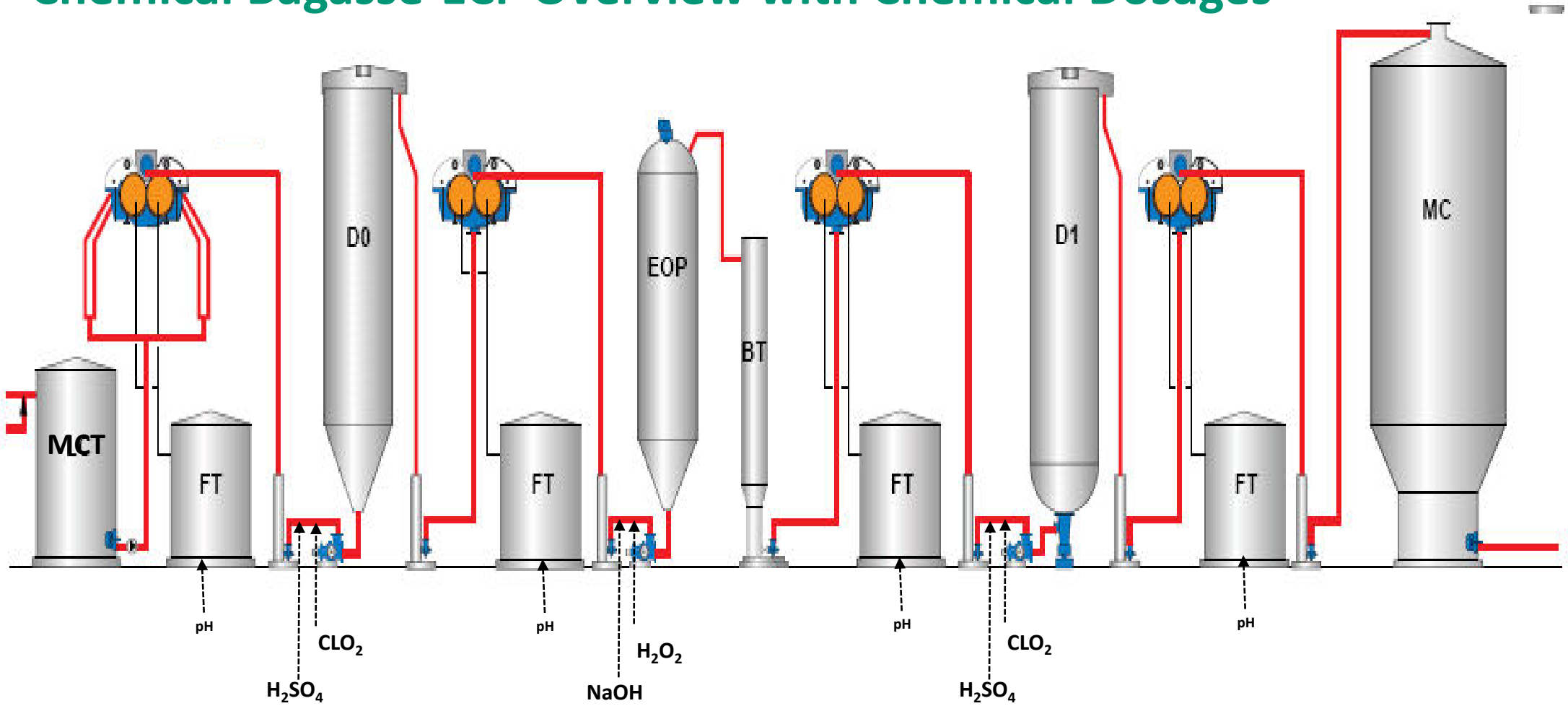
Bleaching Process Chemical Optimization and Control in Chemical Bagasse Pulpmill in TNPL

CBP Plant Overview….

- CBP#3 Plant was commissioned in 2011 during Mill Expansion Plan (MEP).
- Chemical Bagasse(CB)-Elemental Chlorine-Free (ECF) plant was commissioned in 2008 during Mill Development Plan (MDP)
- Both plants were supplied by M/s. Valmet
- Bagasse, a fibrous by-product of sugarcane is used as raw material
- Bagasse is cooked and chemically treated during the process to produce pulp
- Pulp making process involves several critical stages that transform bagasse into pulp

Chemical Bagasse-ECF Overview with Chemical Dosages



Manipulated Variables:

- Chlorine di-oxide (ClO_2)
- Sulphuric Acid (H_2SO_4)
- Sodium Hydroxide (NaOH)
- Hydrogen Peroxide (H_2O_2)

Controlled Variables:

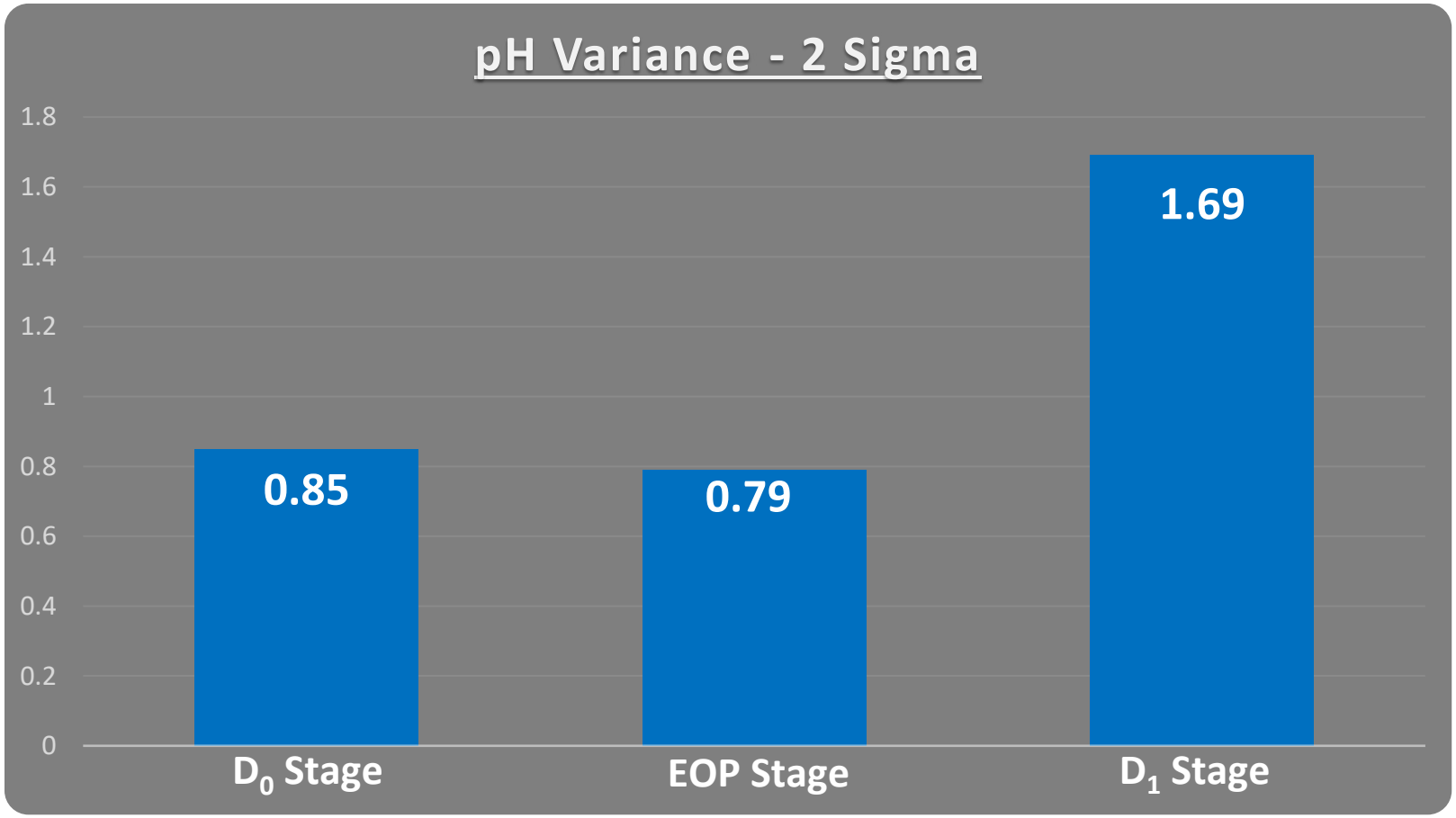
- pH, Brightness

Setbacks in earlier Chemical Controls….

- Manual Control
- Inconsistent Chemical dosage (Over / Under)
- High Specific Chemical Consumptions
- Inconsistent pH quality
- More Norms Deviation

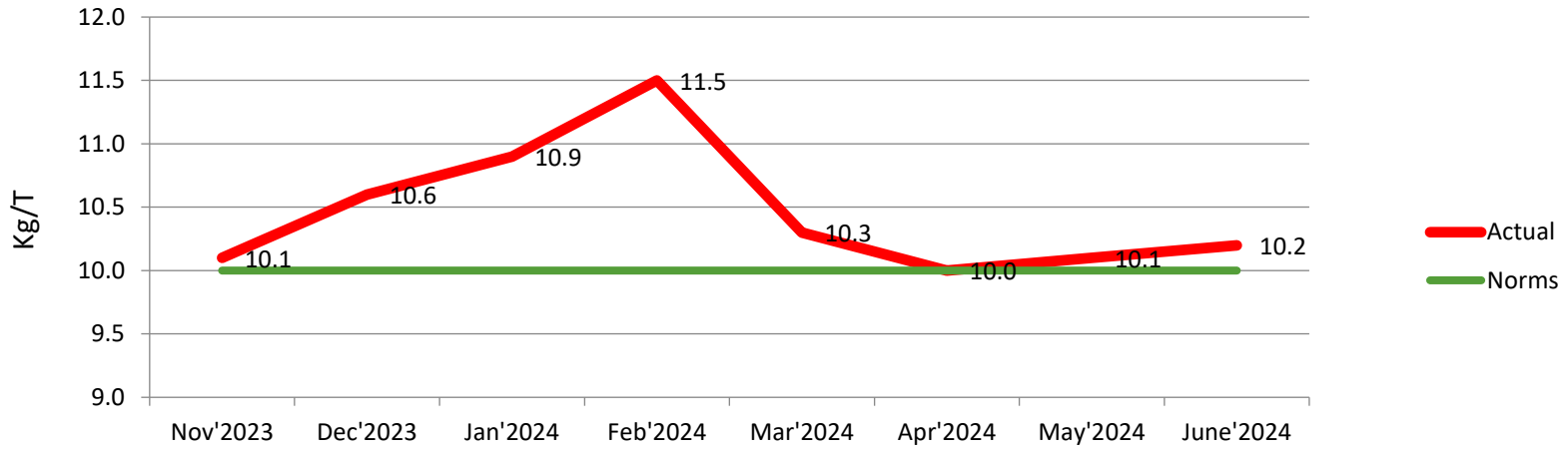
Setbacks in earlier Chemical Controls….

I. pH Variance (Before APC):

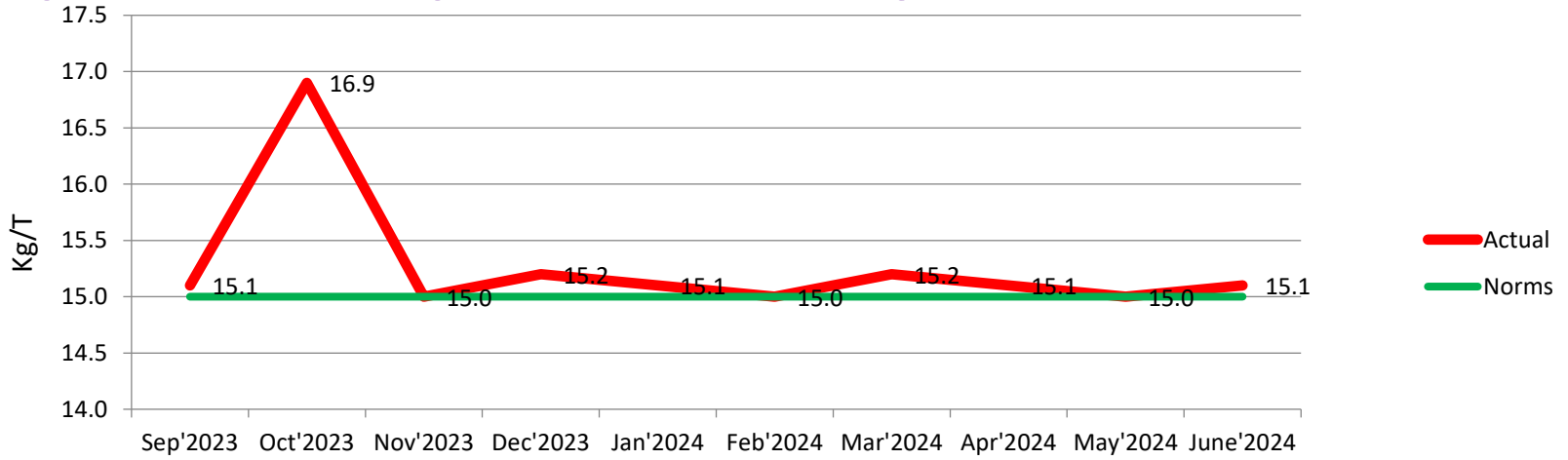


Setbacks in earlier Chemical Controls….

II. Specific Consumption of Sulphuric Acid (H_2SO_4) – Before APC



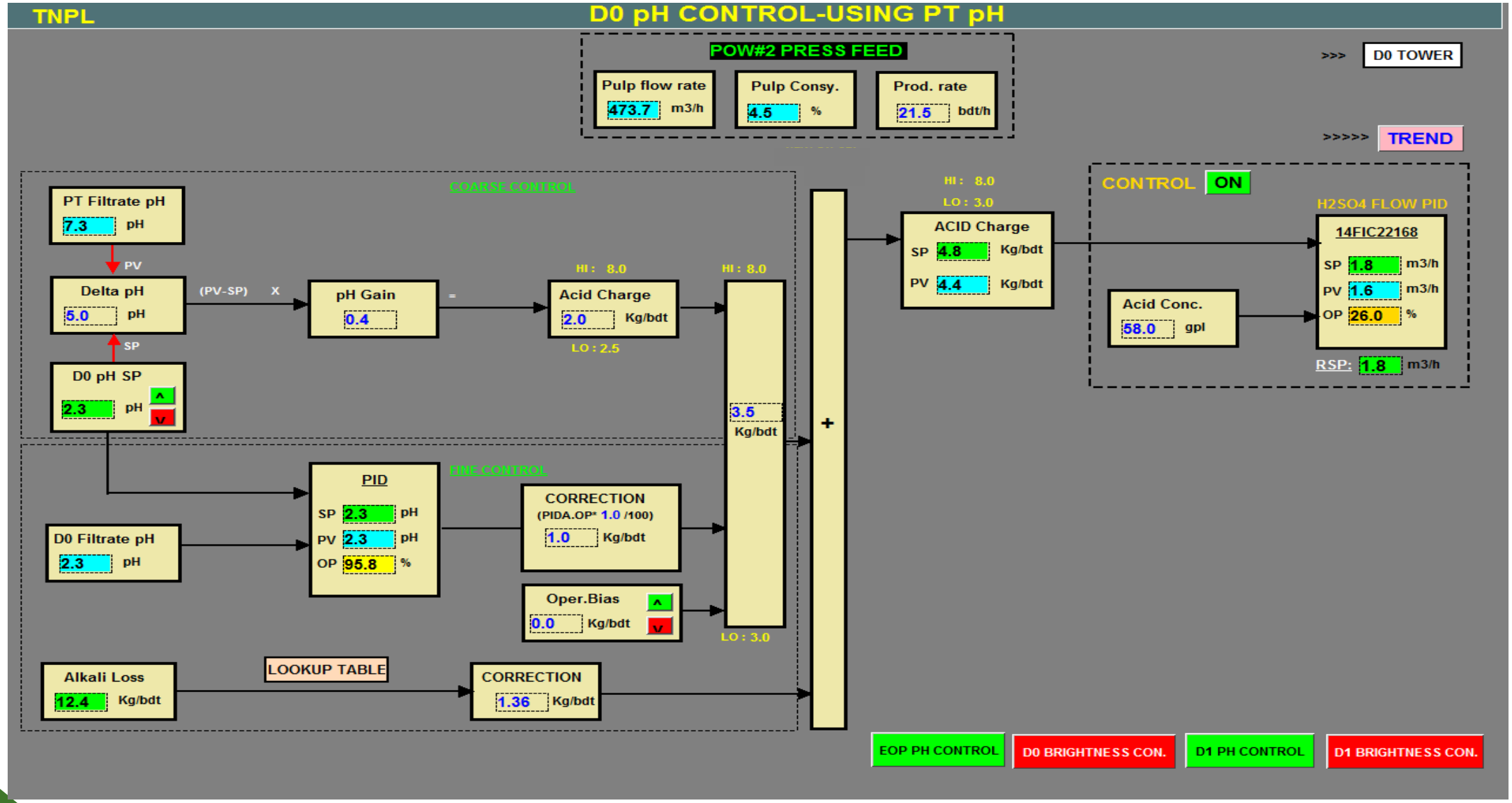
III. Specific Consumption of Sodium hydroxide (NaOH)- Before APC



Advance Process Controls (APC)..

- D_0 stage pH control
- EOP Stage pH control
- D_1 Stage pH control

I. D_0 Stage pH Control..



I. D_0 Stage pH Control..

- **Inputs:**
  - POW#2 filtrate pH
  - D_0 filtrate pH
  - H_2SO_4 flow measurement
- **Outputs:**
  - ✓ H_2SO_4 Flow control valve

I. D_0 Stage pH Control..

Loop Function:

- Primary and Secondary

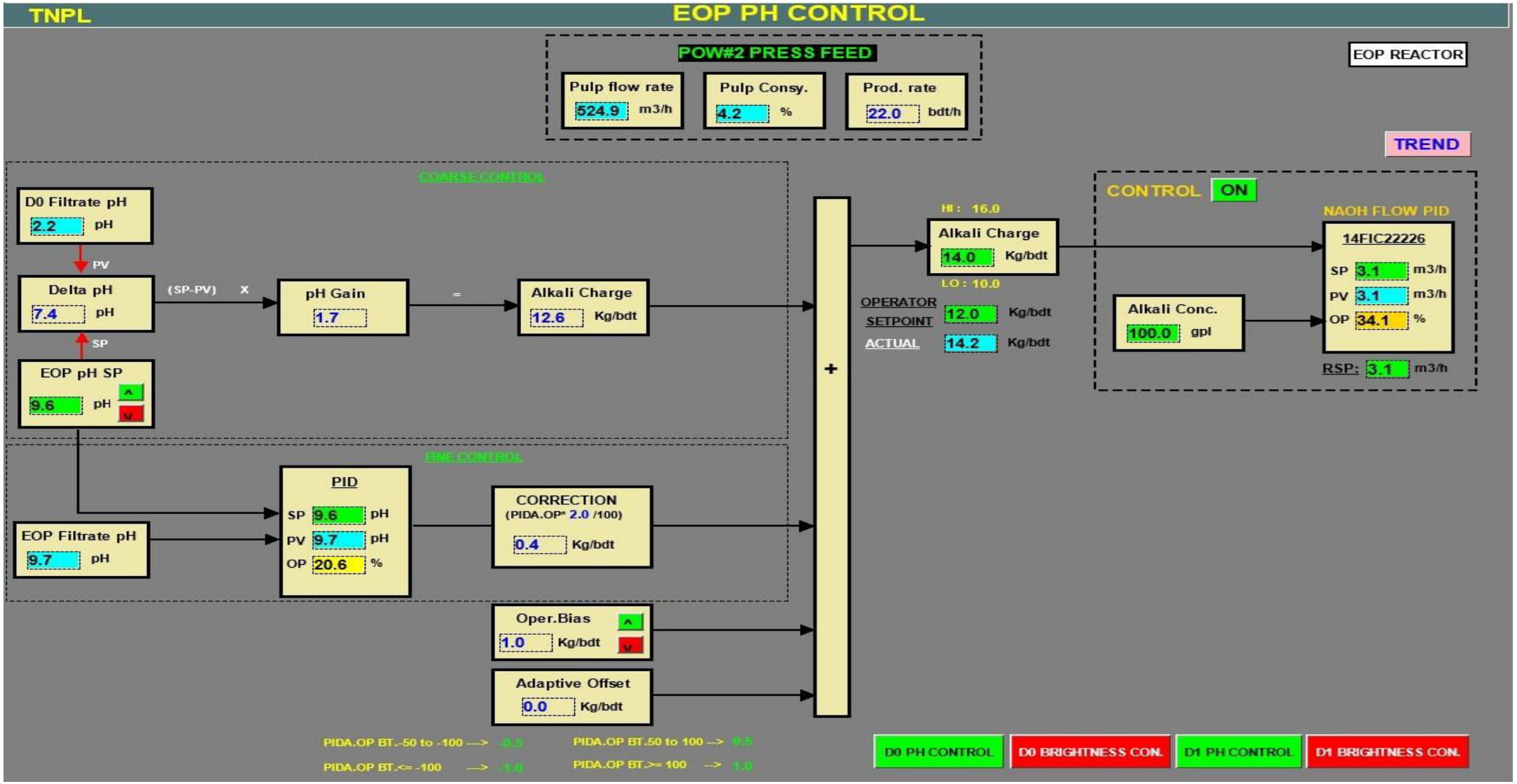
Primary Controls:

- ✓ Coarse (60%) and Fine (40%) control action
- ✓ Operator Bias and Laboratory Inputs – Fine

Secondary Controls:

- ✓ Remote Setpoint Calculation

II. EOP Stage pH Control..



II. EOP Stage pH Control..

Inputs:

- D_0 filtrate pH
- EOP filtrate pH
- NaOH flow measurement

Outputs:

- ✓ NaOH Flow control valve

II. EOP Stage pH Control..

Loop Function:

- Primary and Secondary

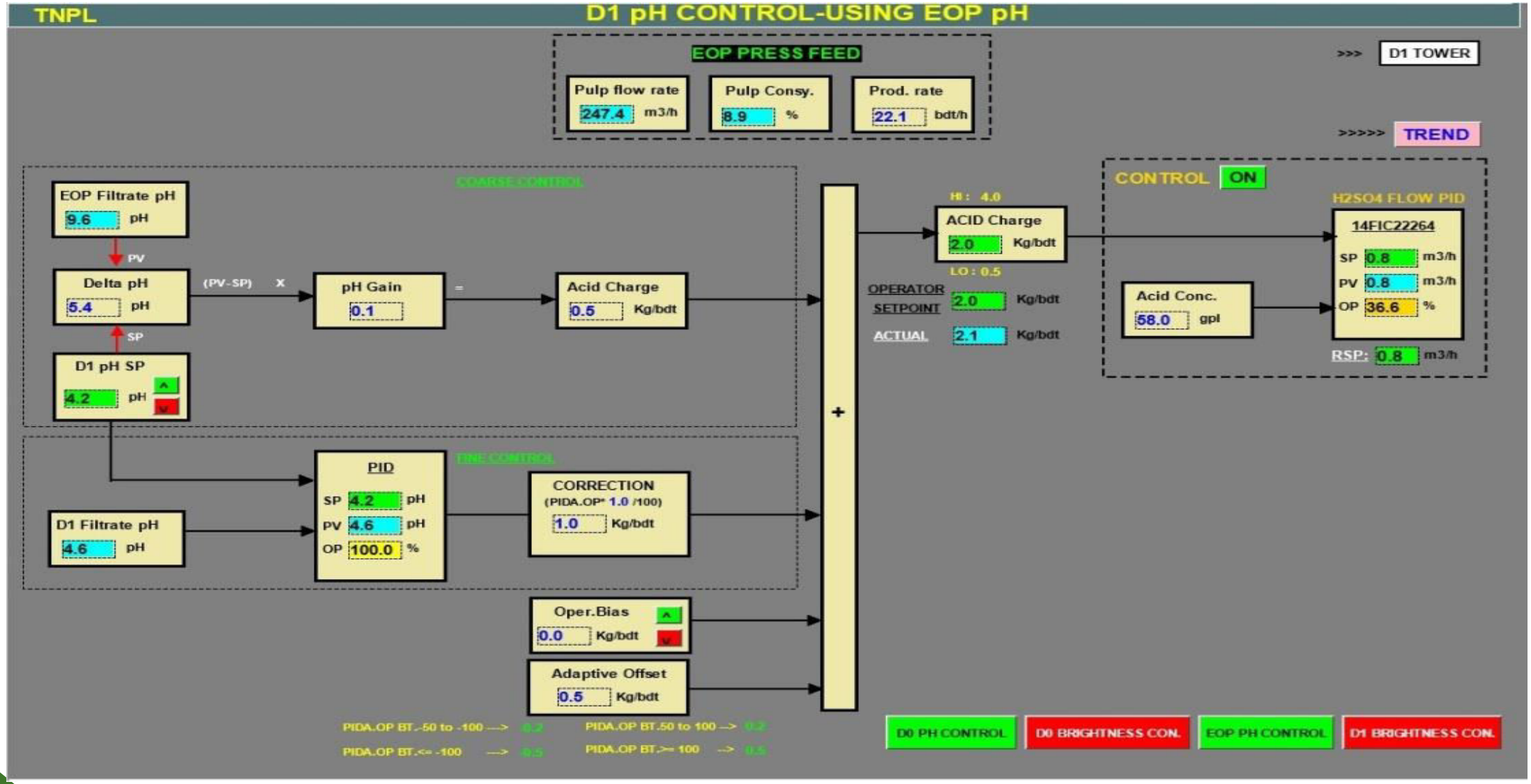
Primary Controls:

- ✓ Coarse (60%) and Fine (40%) control action
- ✓ Operator Bias and Adaptive Offset – Fine

Secondary Controls:

- ✓ Remote Setpoint Calculation

III. D_1 Stage pH Control..



III. D_1 Stage pH Control..

Inputs:

- EOP filtrate pH
- D_1 filtrate pH
- H_2SO_4 flow measurement

Outputs:

- ✓ H_2SO_4 Flow control valve

III. D_1 Stage pH Control..

Loop Function:

- Primary and Secondary

Primary Controls:

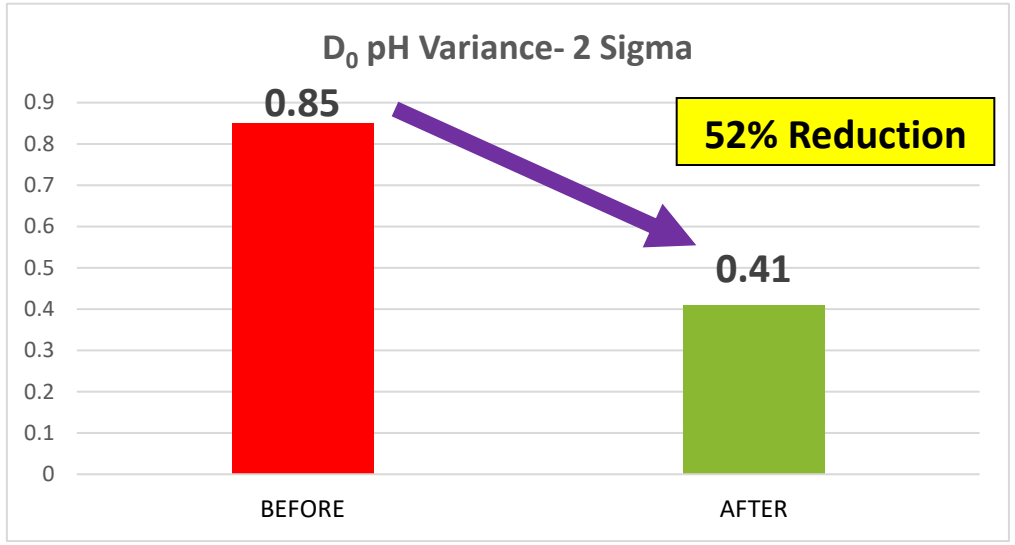
- ✓ Coarse (60%) and Fine (40%) control action
- ✓ Operator Bias and Adaptive Offset – Fine

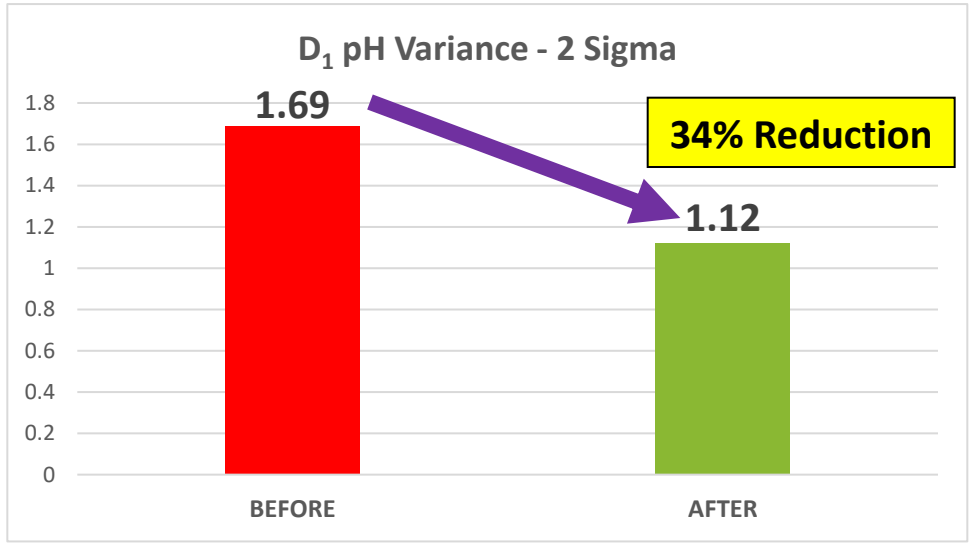
Secondary Controls:

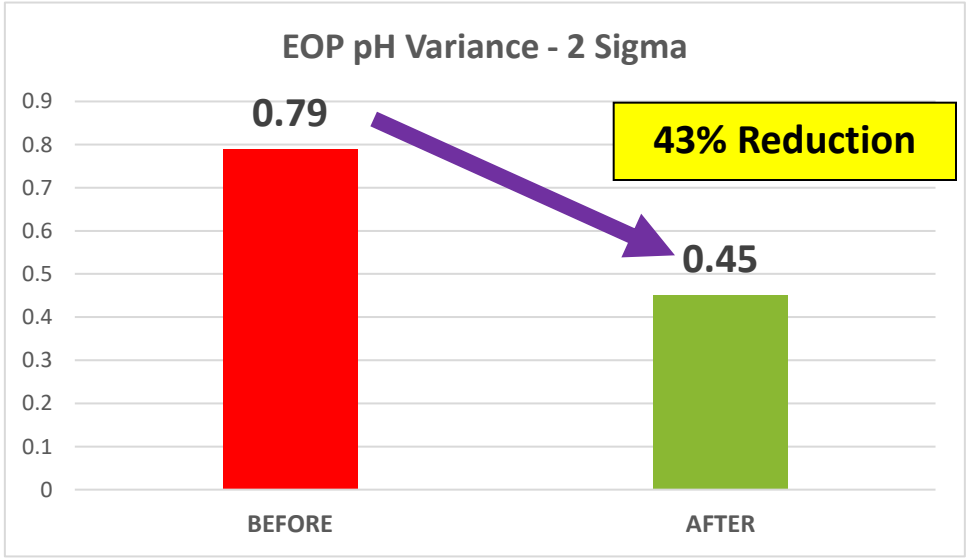
- ✓ Remote Setpoint Calculation

Post APC Results…..

I. pH Variance:(Aug’2024)

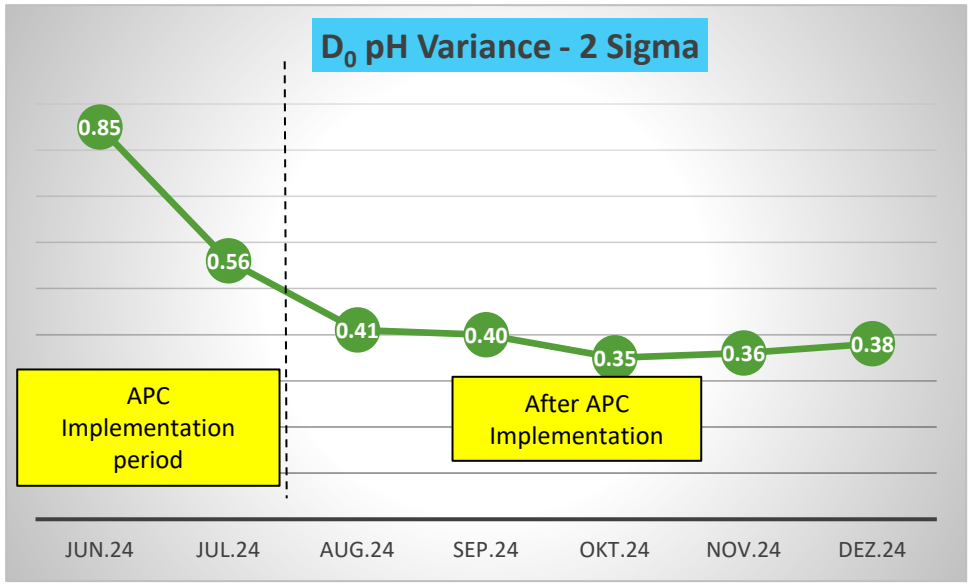


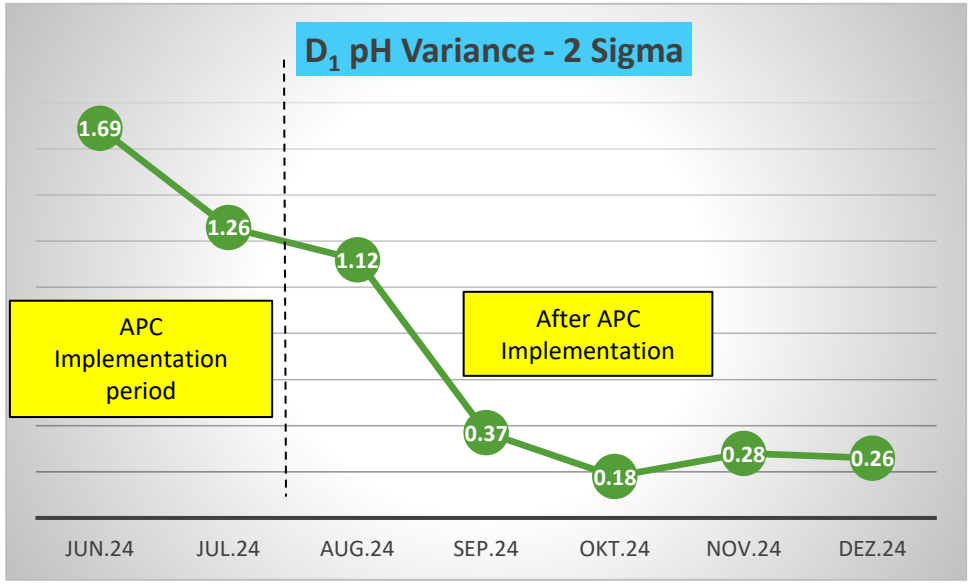


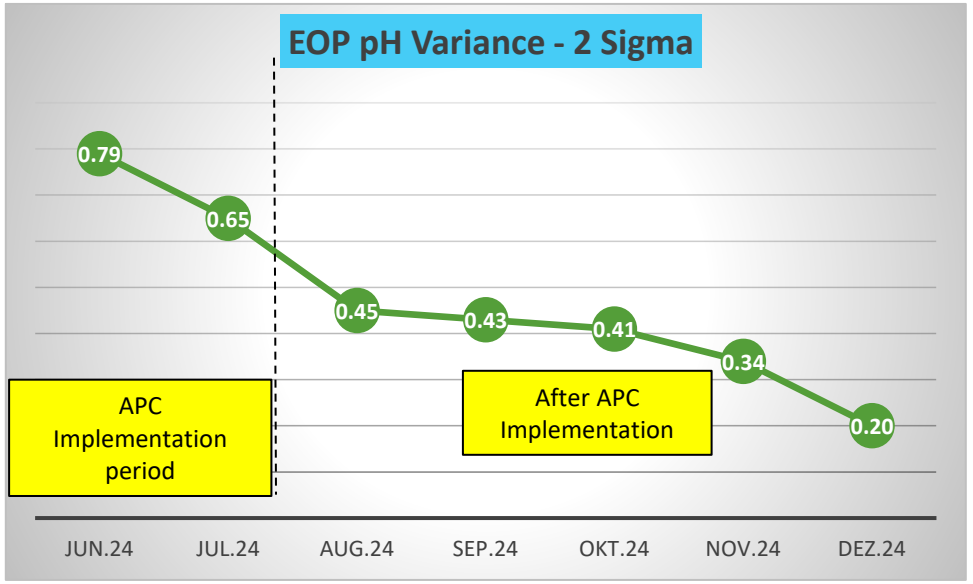


Post APC Results.....

I. pH Variance:

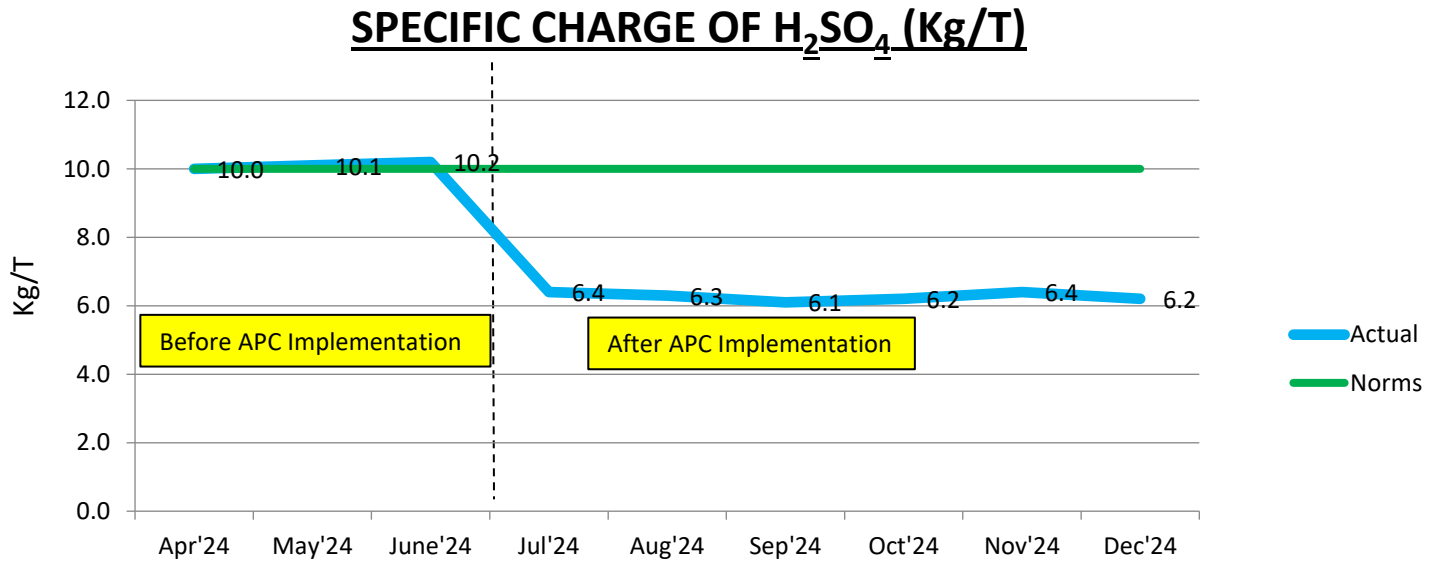


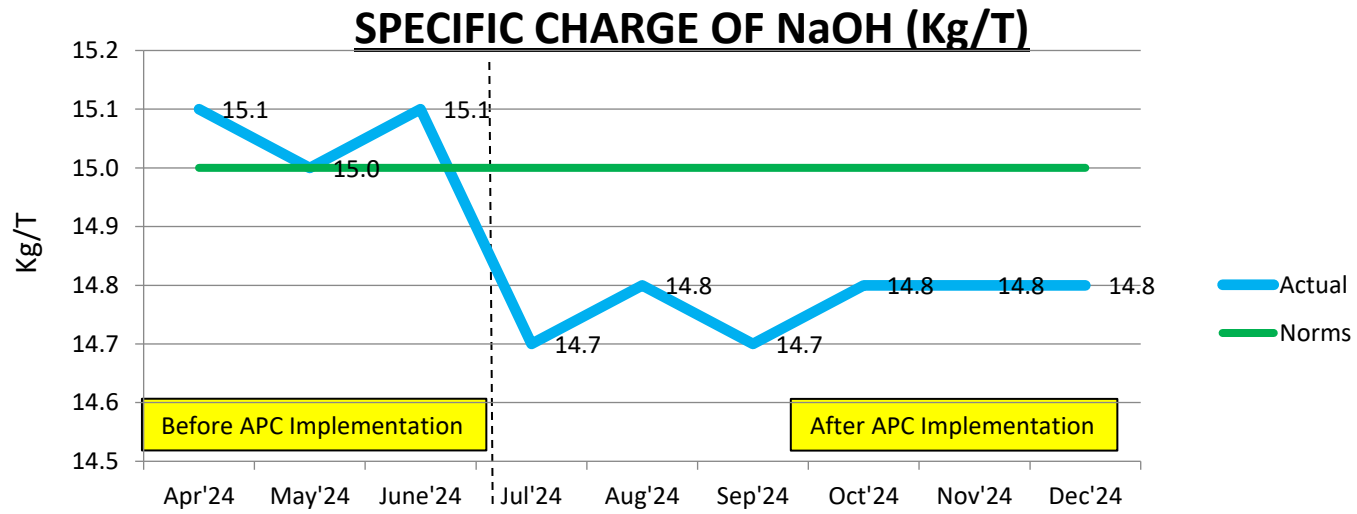




Post APC Results…..

II. Specific Consumptions:





Post APC Results.....

III. pH Variance, Chemical Reduction & Cost benefits:

S.No	Month	Pulp Production (MT)	Chemical : Sodium Hydroxide (N_aOH)		Chemical : Sulphuric Acid (H_2SO_4)			Cost Savings		
			Stage: EOP		Stage: D_0 & D_1					
			pH Variability Reduction	Chemical Reduction %	D_0 - pH Variability Reduction	D_1 - pH Variability Reduction	Chemical Reduction %	N_aOH (Rs)	H_2SO_4 (Rs)	Total (Rs)
1	Aug-24	12636	43%	1.7%	52%	34%	38%	39,576	2,72,243	3,11,819
2	Sep-24	12724	46%	2.4%	53%	78%	40%	81,383	2,91,825	3,73,208
3	Oct-24	12179	48%	1.7%	59%	89%	39%	39,655	2,77,097	3,16,751
4	Nov-24	12007	57%	1.7%	58%	83%	37%	39,611	2,59,351	2,98,962
5	Dec-24	13399	75%	1.7%	55%	85%	39%	44,485	3,10,428	3,54,913

Conclusion…..

- ✓ **pH Variability Reductions in sustainability period**:
  - D_0 stage: **55%**
  - EOP stage: **54%**
  - D_1 stage: **74%**
- ✓ **Specific Chemical Consumptions in sustainability period**:
  - Sulphuric Acid (H_2SO_4) reduced by **38%**
  - Sodium Hydroxide (NaOH) reduced by **1.9%**
- ✓ Average Cost Savings from Aug'24-Dec'24 – **Rs. 3.31 lakhs**
- ✓ Approximate Cost Savings /Annum – **Rs. 39.72 lakhs**
- ✓ **Financial Implications : NIL**

Benefits…..

- ✓ Improved Product Quality
- ✓ Enhanced Process Efficiency
- ✓ Reduced Operator Intervention
- ✓ Reduced Operational Costs
- ✓ Enhanced Data Utilization
- ✓ Reduction in Environment load

Internal Training on APC…..

Path Forward…

- ✓ D_0 Stage Brightness Control
- ✓ EOP Stage Brightness Control
- ✓ D_1 Stage Brightness Control