

CLEARLOGX Process™

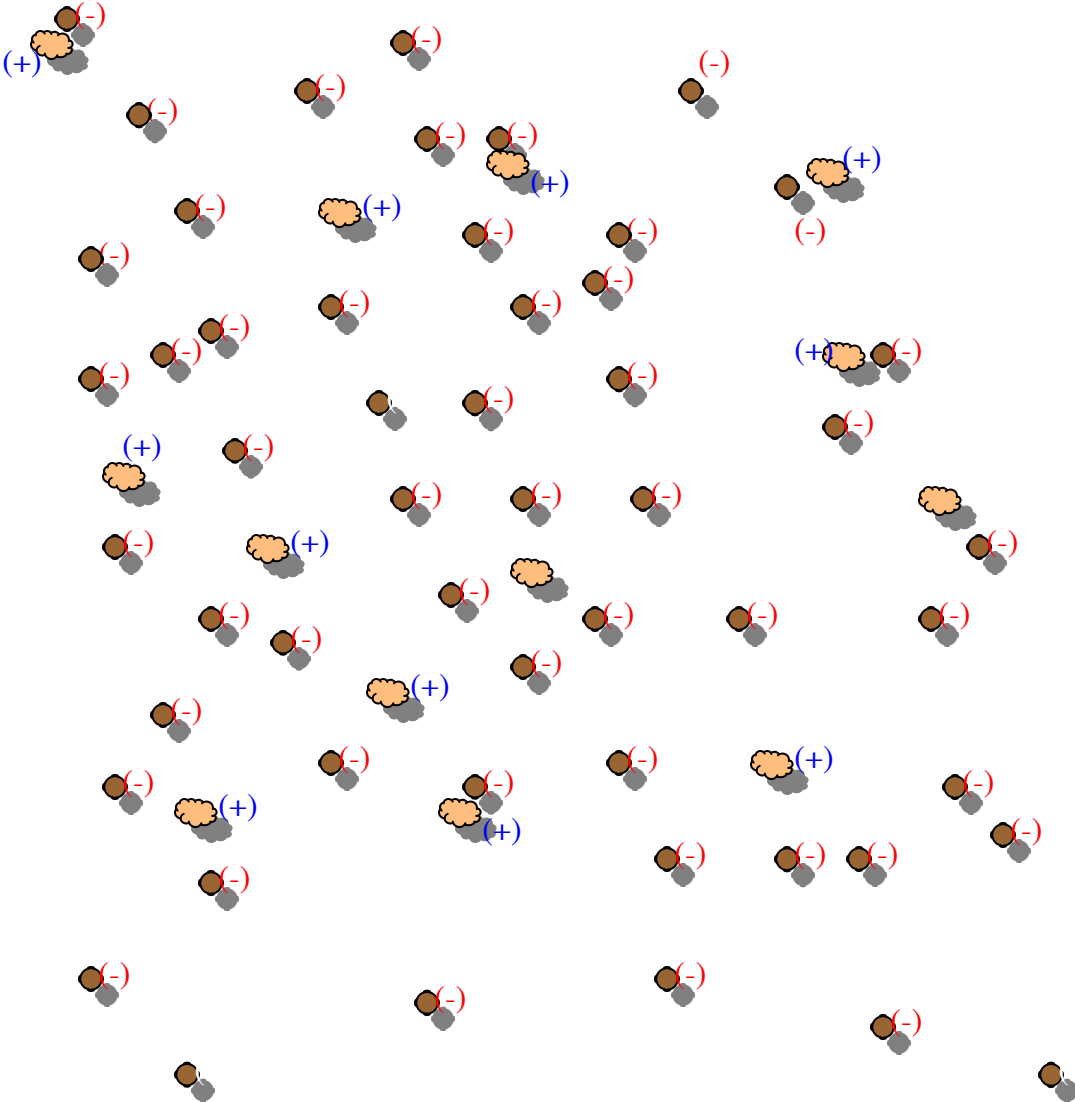
Optimizing Total Organic Carbon Removal
While Enhancing Membrane Filter
Performance

The Science of Water Made Simple

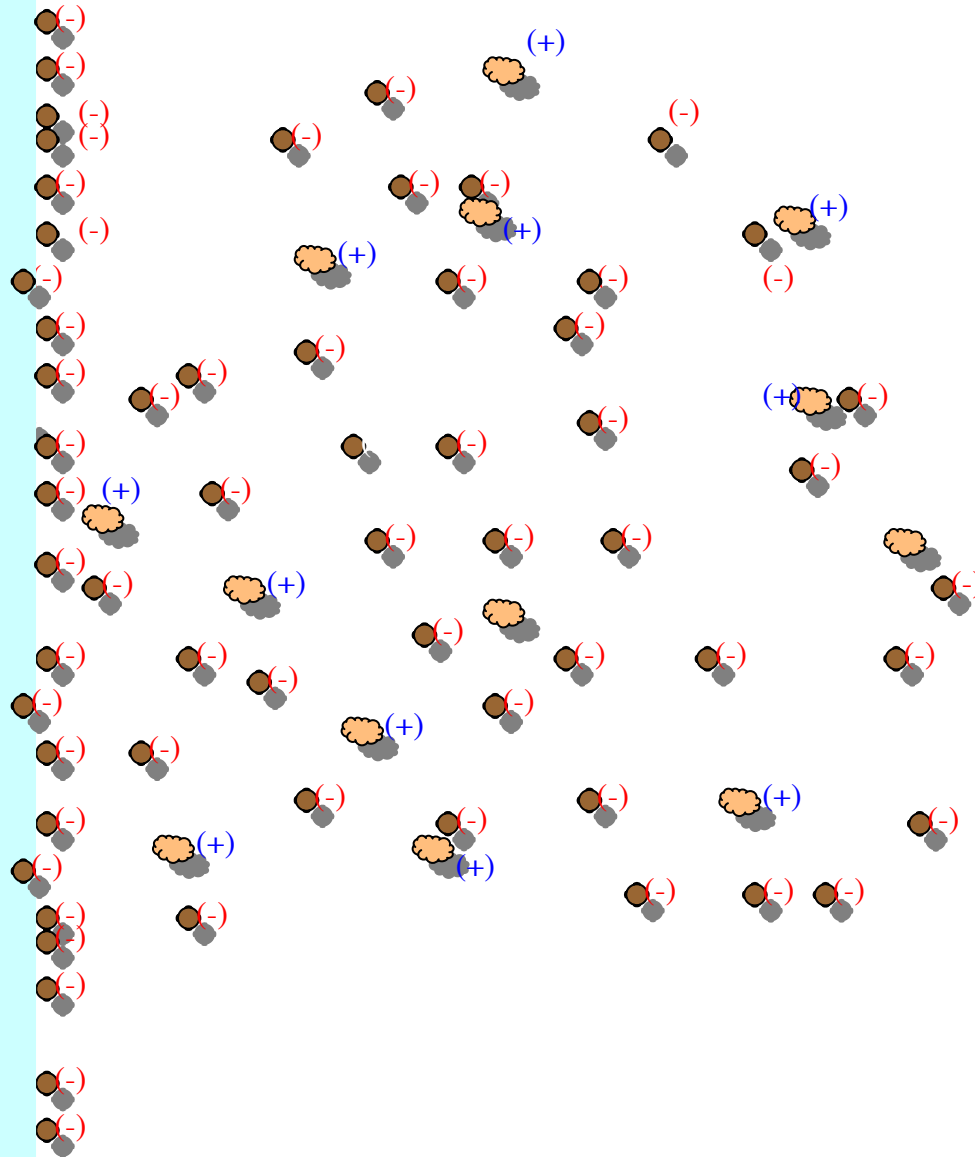
Enhanced coagulation utilizing charge neutralization

- Natural organic particles are almost always negatively charged.
- Coagulant addition alters the particle surface charge and lessens the repulsive energy.
- Additional coagulant can be added to completely eliminate or exceed the energy barrier (destabilization).
- Adsorption of a positively charged coagulant on the surface of the colloid can provide for: agglomeration of colloids, micro flocs, floc masses
- Charge neutralization for conventional plants, alters the particle charges to optimize agglomeration, settling and filter runs.
- Enhanced coagulation (higher coagulant dose, pH suppression) interferes in the process of optimizing particle charge

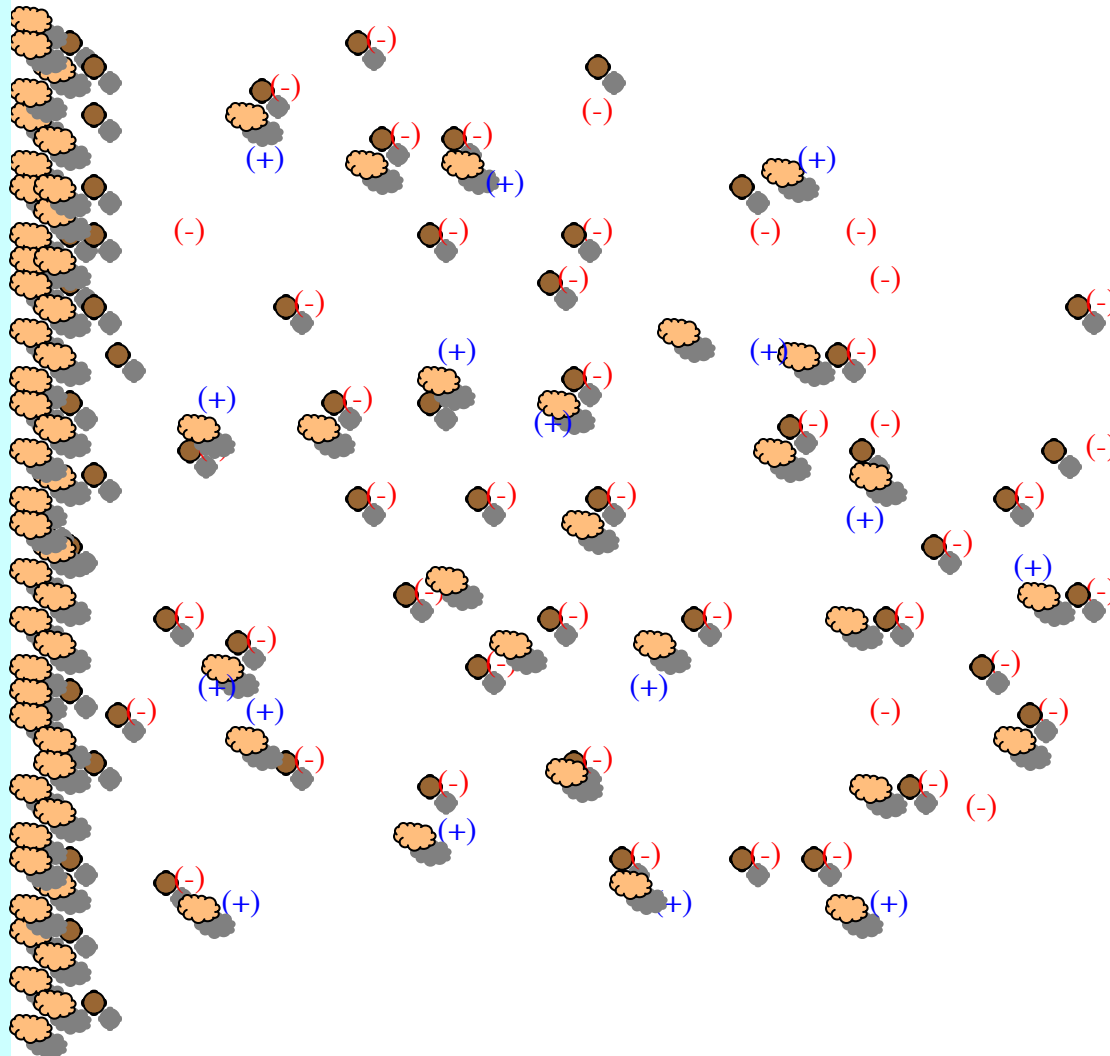
Charge Neutralization



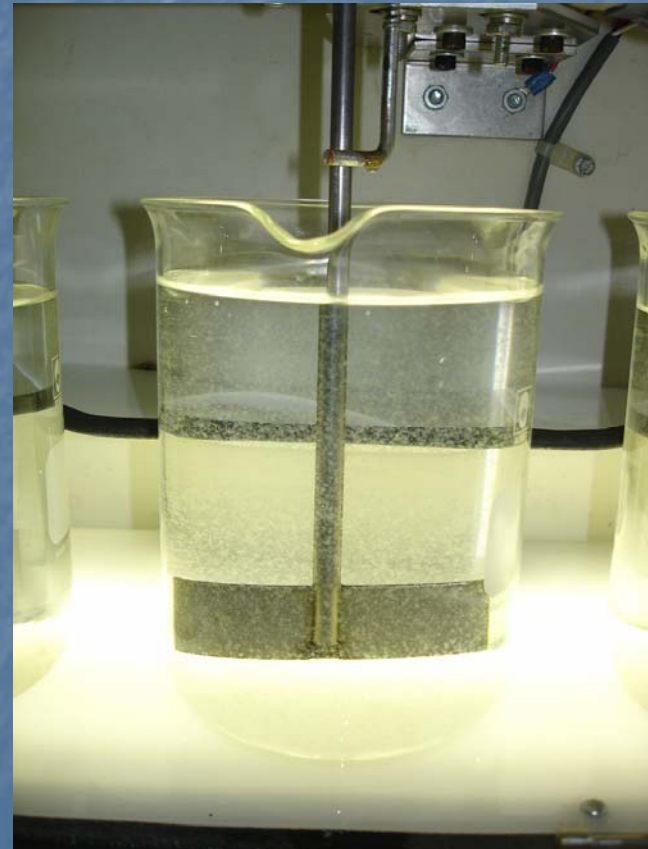
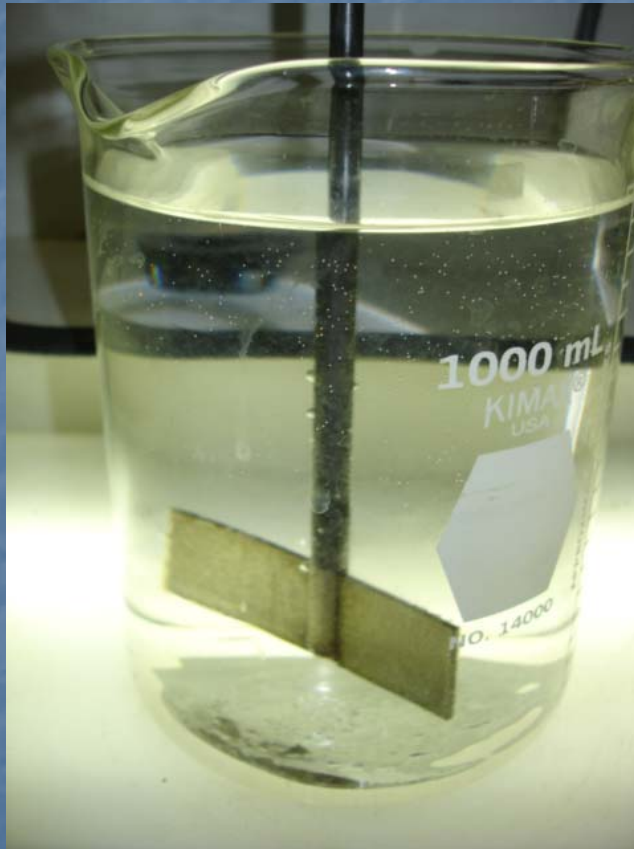
Approaching Net Zero Charge Neutralization



Membrane Charge Neutralization



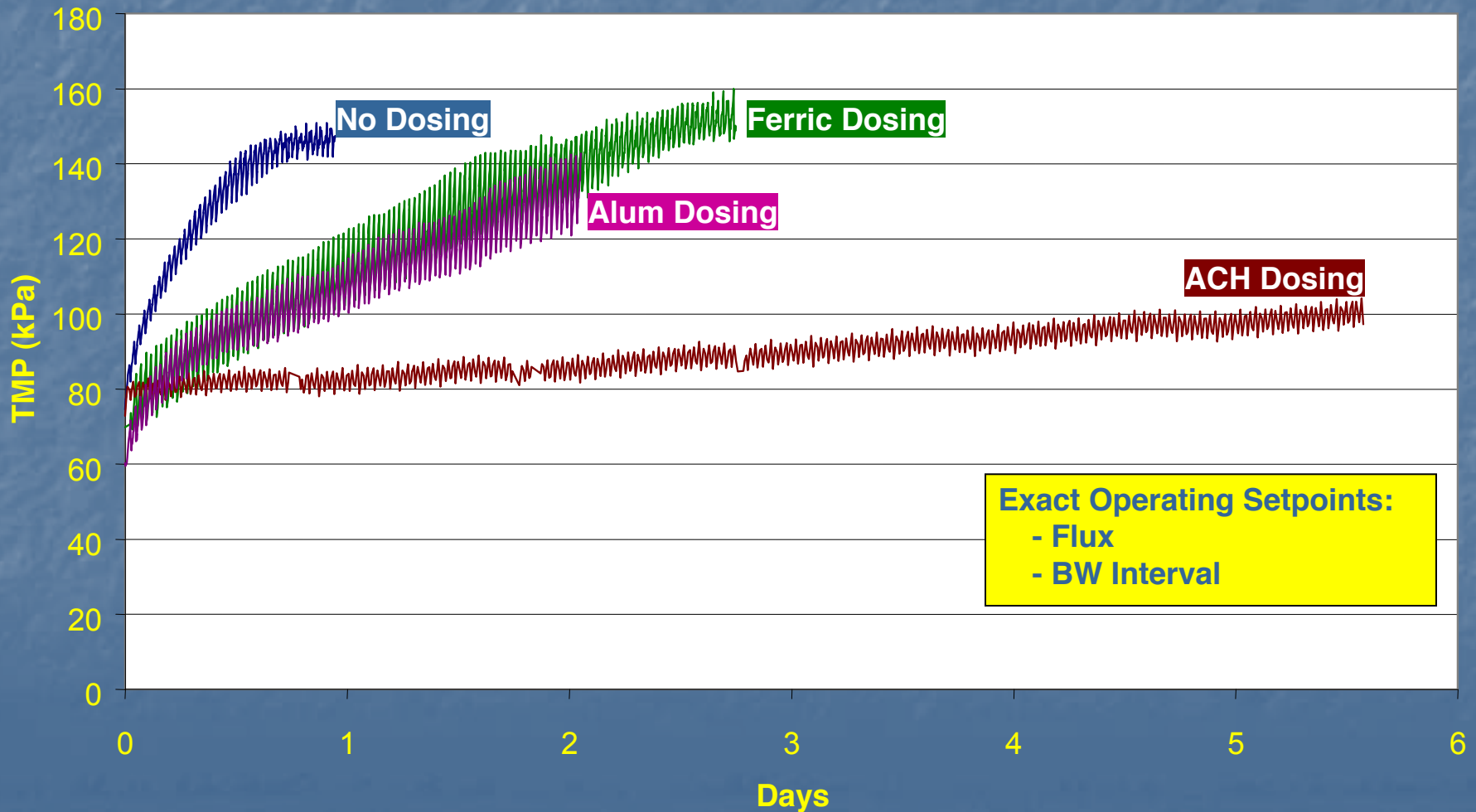
Manipulating pH/alkalinity can alter precipitation



Particle charge

- pH can affect particle charge. Coagulants are weak acids
- Temperature can affect particle charge.
- Turbidity levels and particle size/shearing effects can alter charge.

Membrane supplier coagulant fouling curve



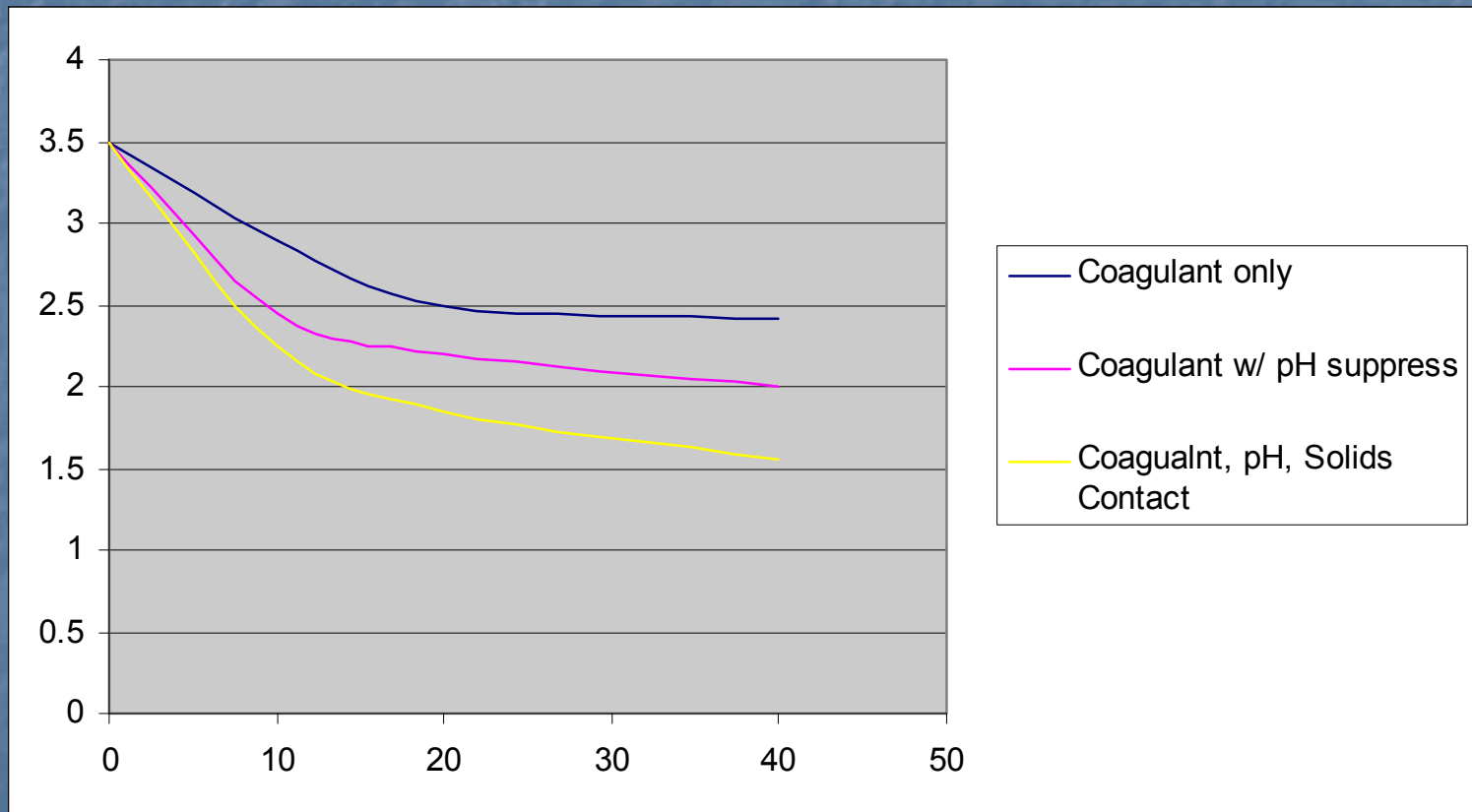
Enhanced coagulation definition

- Higher dose of coagulant to remove more organics
- Suppress pH on top of coagulant addition

Outcome

- Will not be able to dose coagulant with streaming current monitor
- Filter performance will suffer

TOC Removal



Short Clip.wmv

Ft. Lupton Demonstration

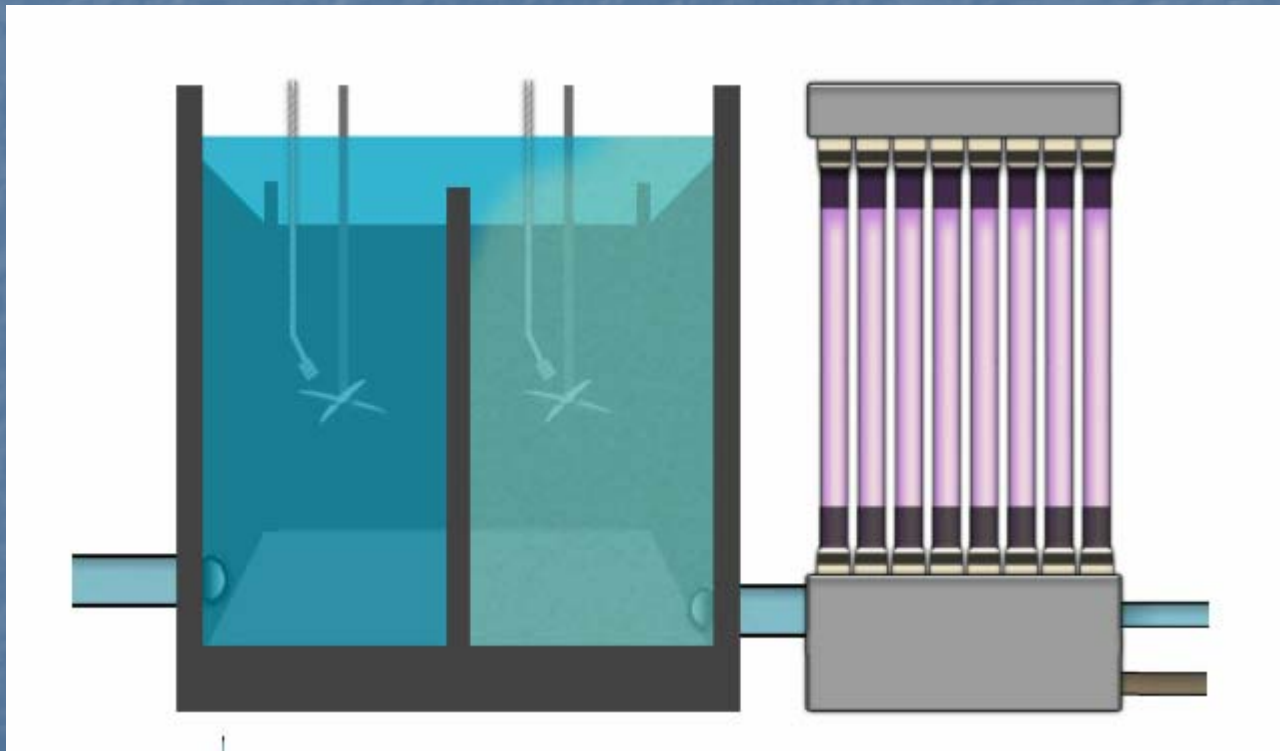




Ft. Lupton, Colorado WTP

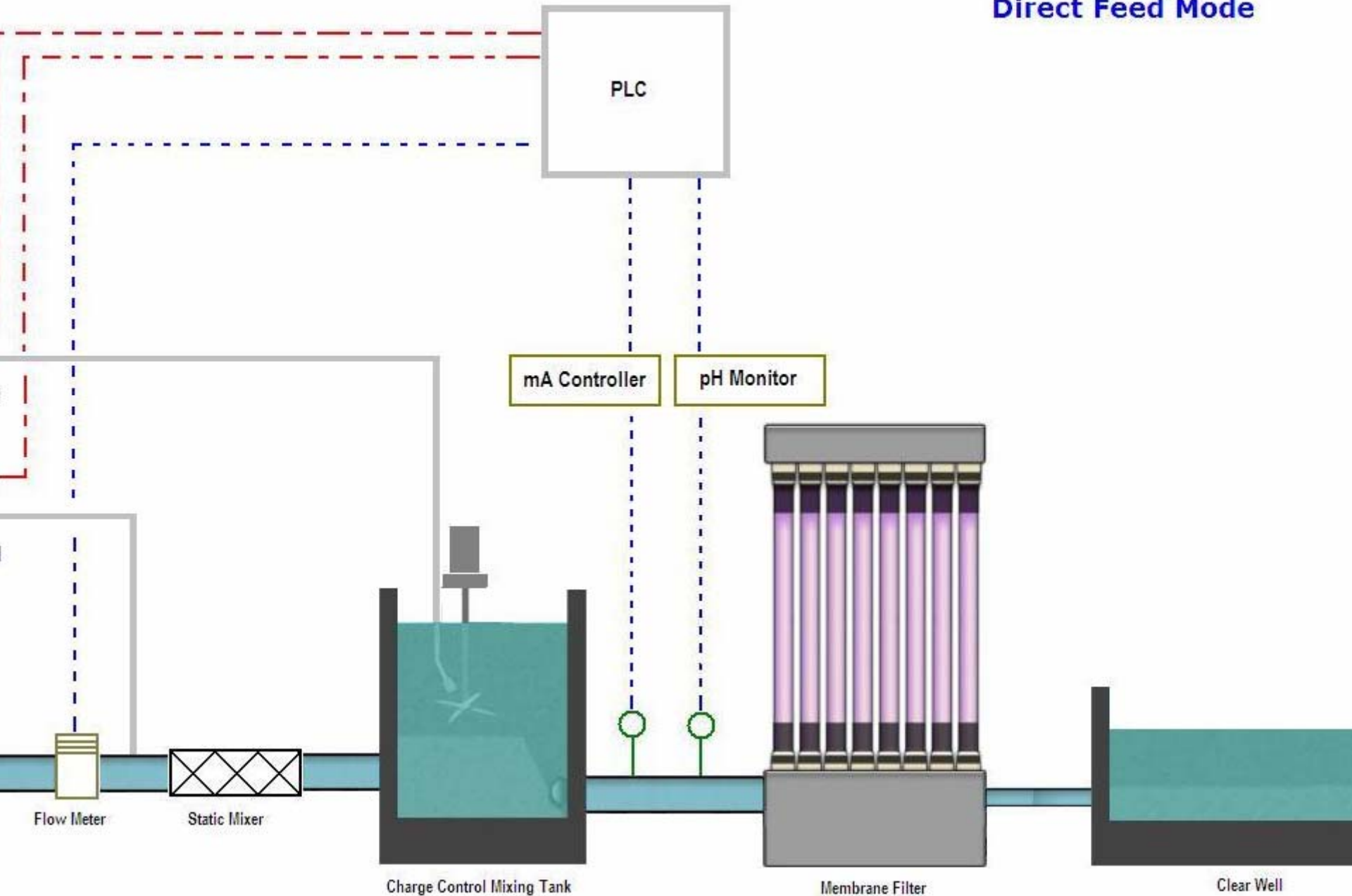
- Failing DBP. Under Compliance Order
- Needs: Expand Existing Memcor System, Increase Recovery and Comply with Stage 1, 2 DBP
- Engineer 1 Recommended Uncontrolled Ferric + GAC System. Cost: \$5,000,000
- Engineer 2 Recommended Uncontrolled Ferric + Clarification (LPS or Solids Contact Clarifier). Cost: \$5,500,000

Direct feed mode

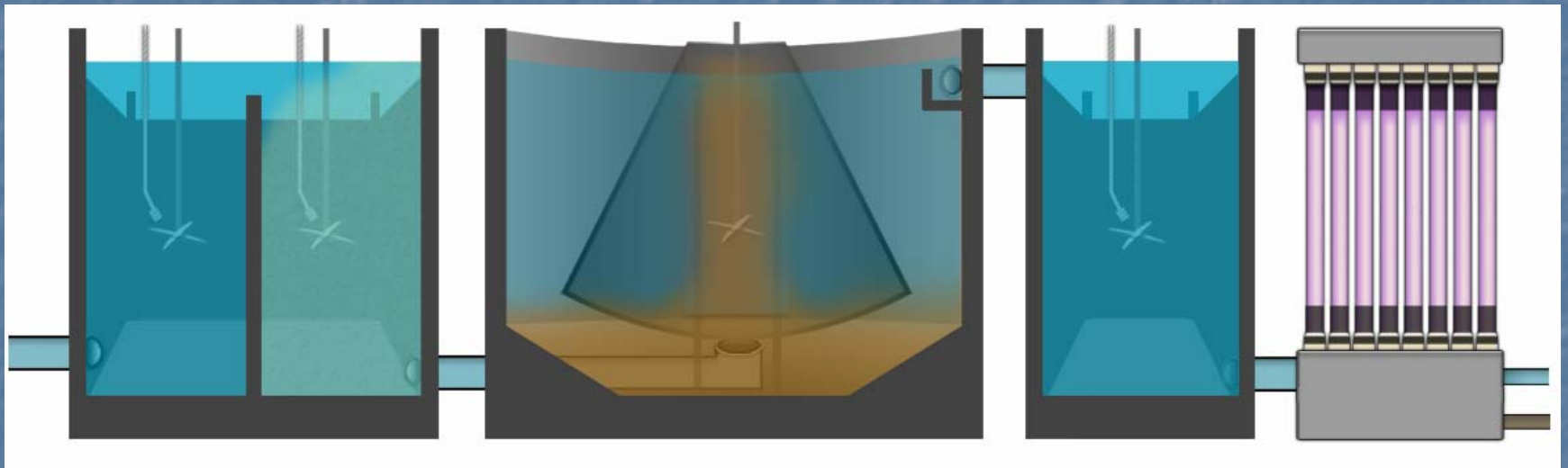


CLEARLOGX PROC

Direct Feed Mode

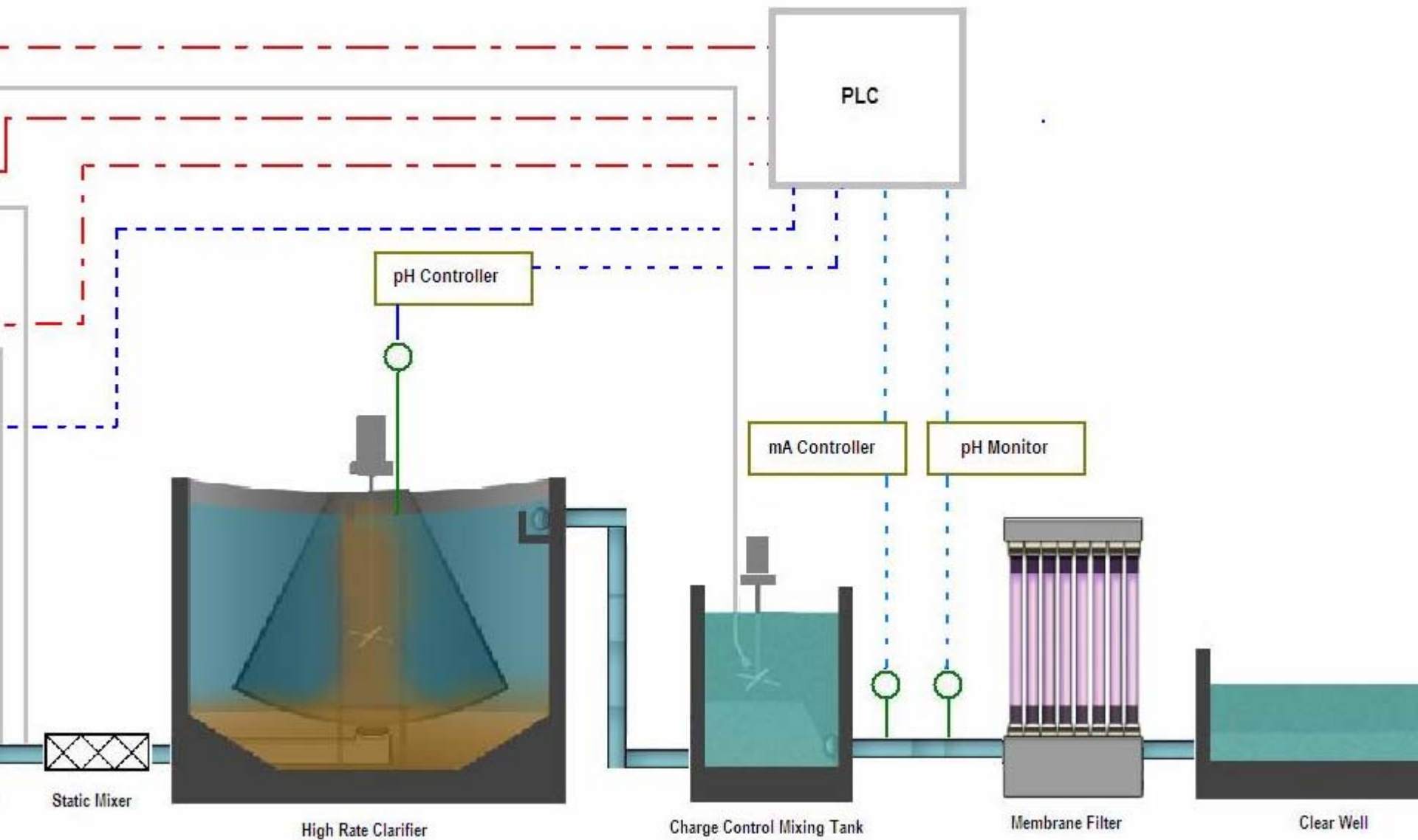


Clarifier feed mode



CLEARLOGX PROCESS

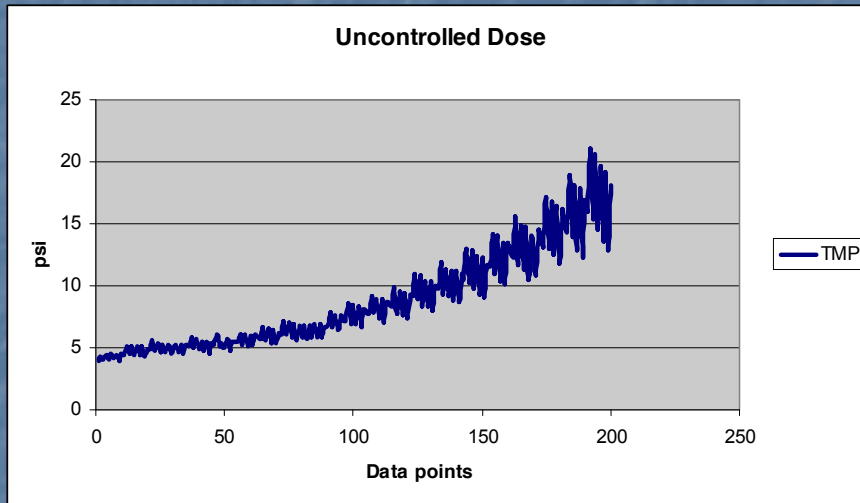
Clarifier Feed Mode



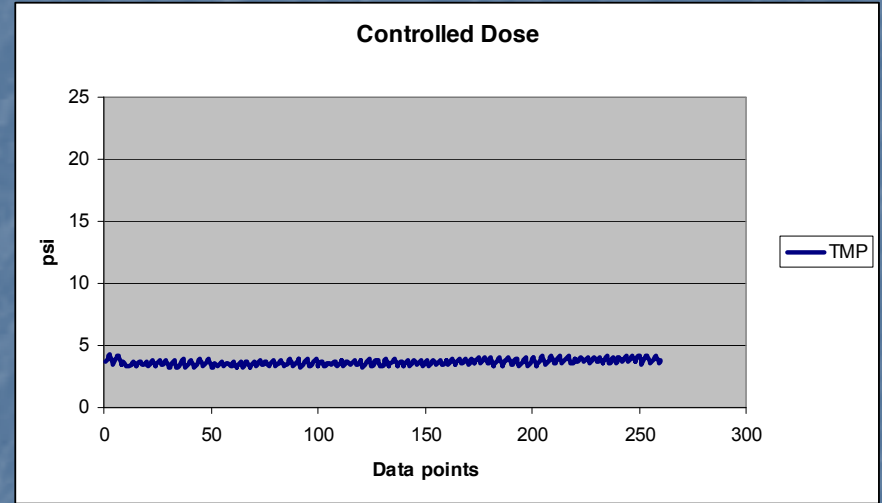
Clearlogx Process Demonstration Results

- TOC Removal: Direct Feed: 50%
Clarifier Feed: 79%
- Flux: 50 – 70 gfd (minimal fouling)
- Recommended Direct Feed (no clarification)
- Low Mn FeCl₃ coagulant
- Clearlogx Process Selected

Direct feed mode

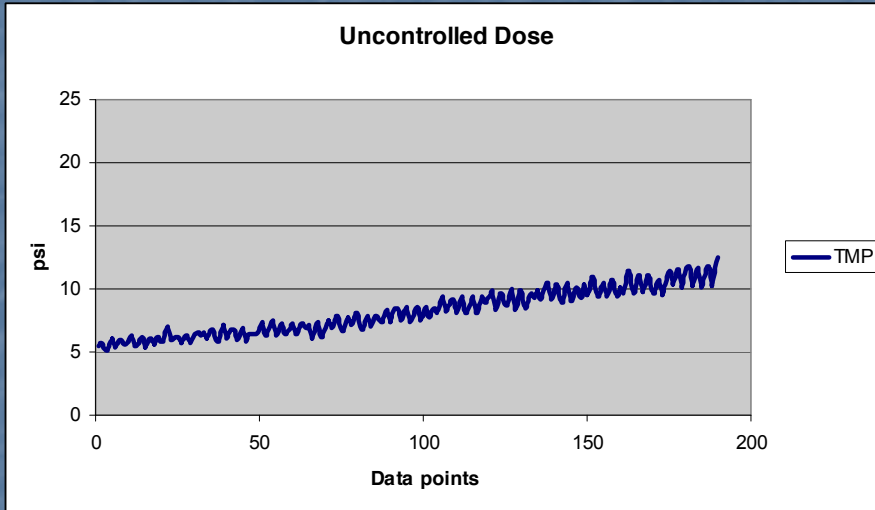


30 ppm Low Mn FeCl₃, Uncontrolled

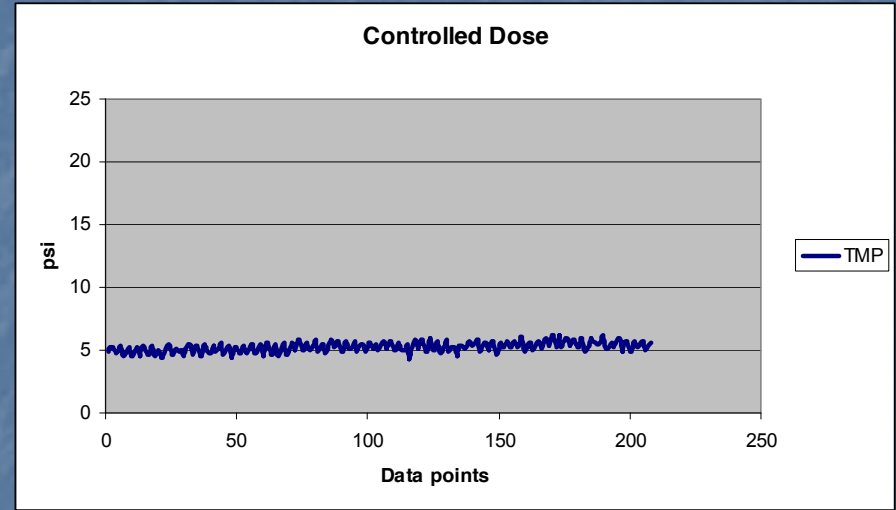


30 ppm Low Mn FeCl₃, Controlled

Clarifier feed mode



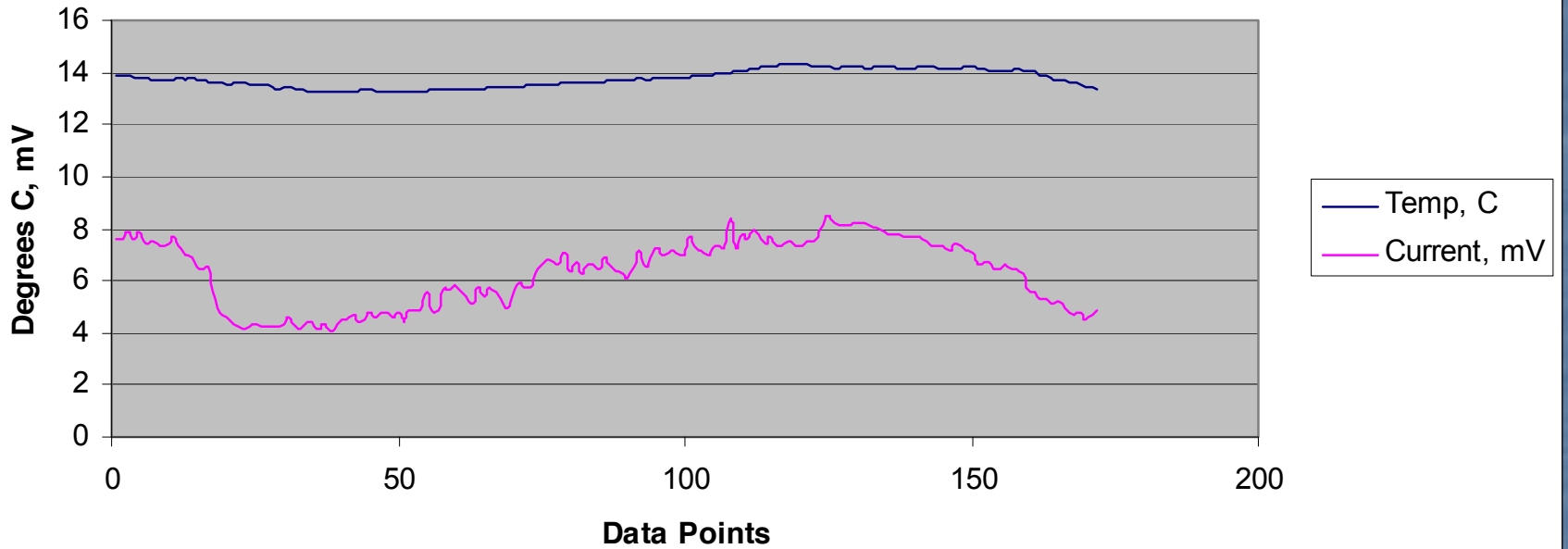
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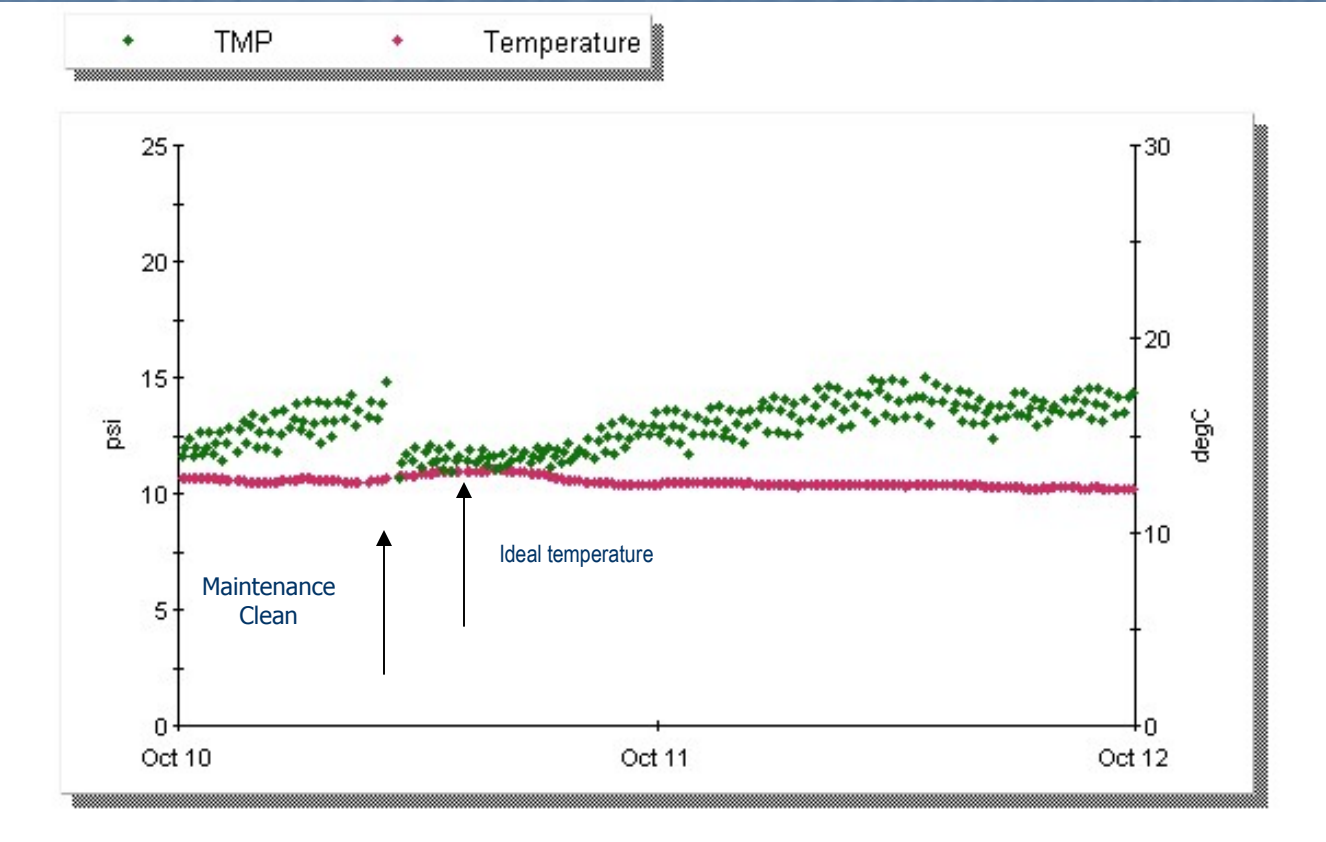
30 ppm Low Mn FeCl₃, Controlled

Temperature effects on charge

Temperature vs Current

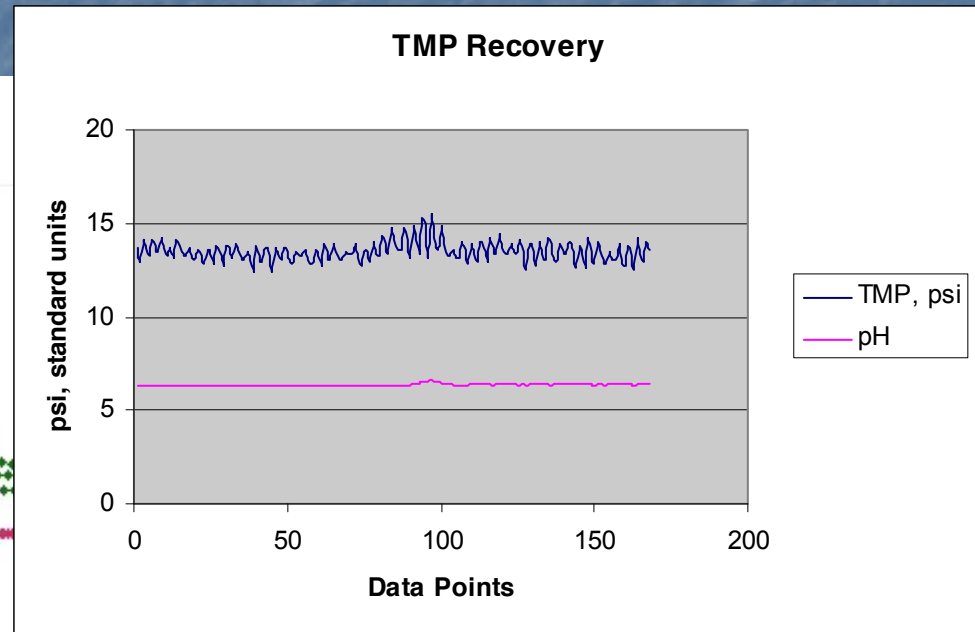
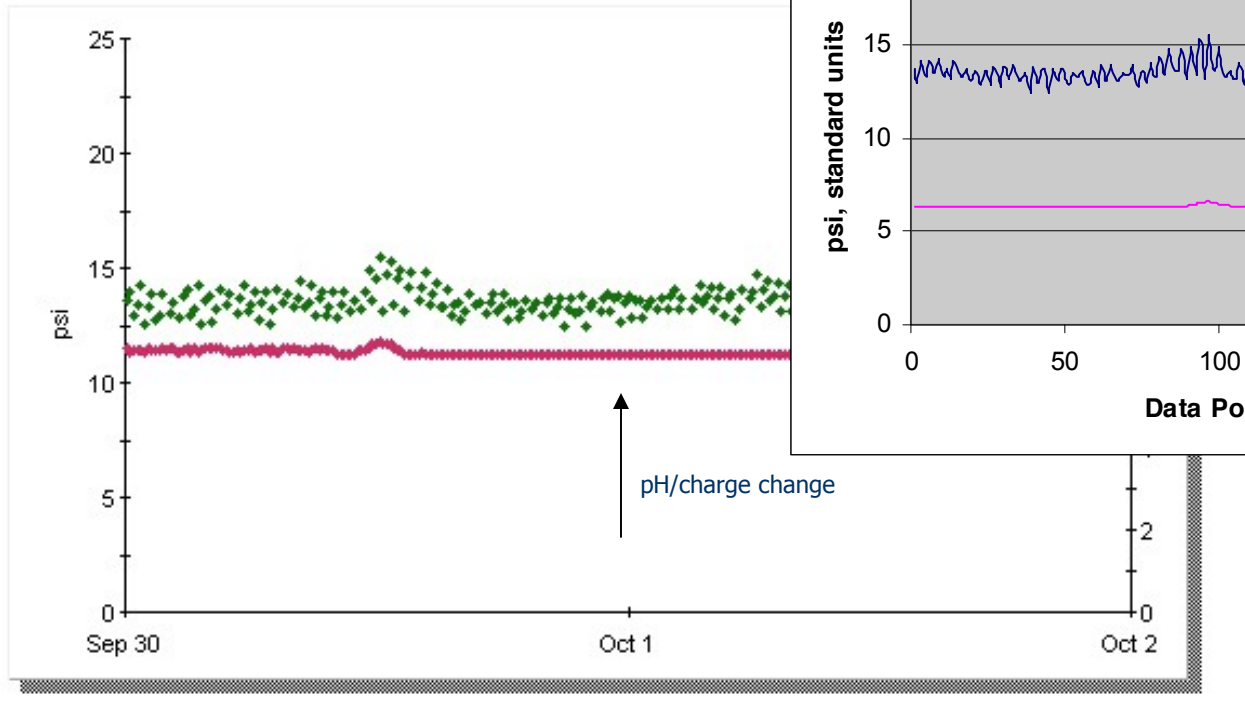


Temperature affects charge and membrane performance

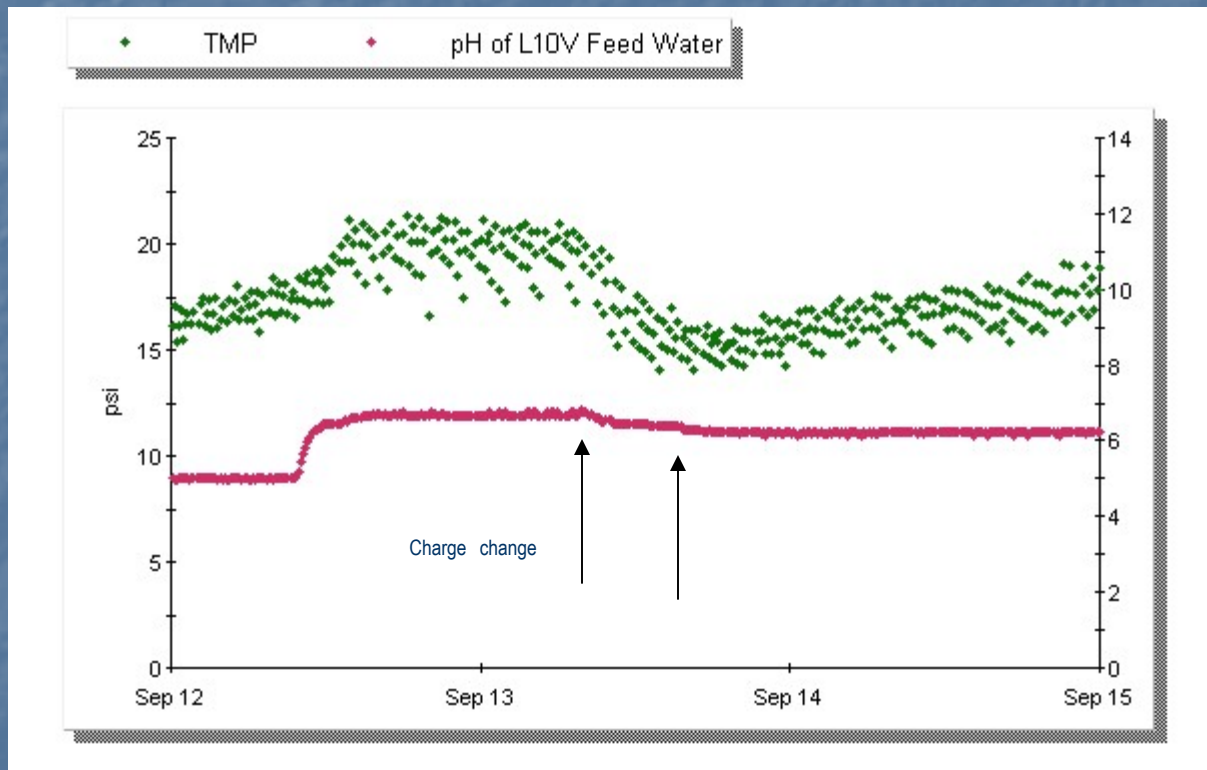


Recover from fouling event

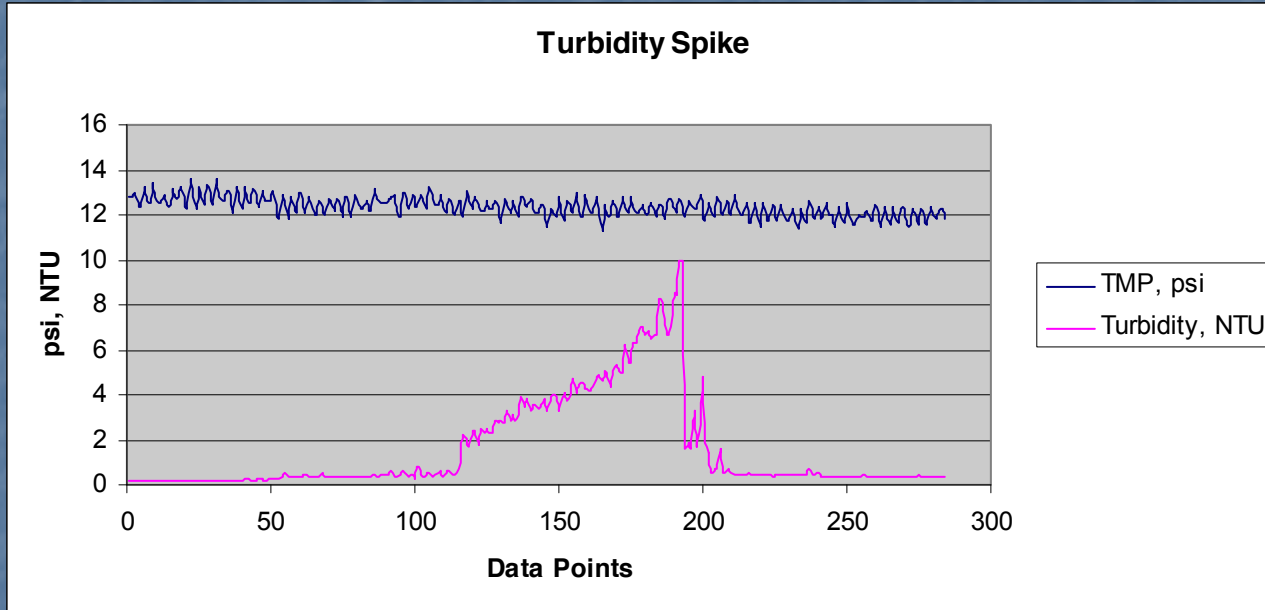
◆ TMP ◆ pH of L10V Feed Water



Recover from fouling event



Turbidity does not cause membrane fouling
Wrongly charged particles cause membrane fouling



Coagulant Selection

Membrane Pretreatment Coagulant

- Straight Metal/Salt. No Polymer.
- Alum?
- ACH, PACL, Ferric Chloride, Low Mn Ferric

Ferric vs Aluminum Based

Advantages

- Higher TOC Removal
- Lower Cost
- More Acidic
- Pretreatment to RO/Nano

Disadvantages

- Manganese, Ferrous Precipitation
- Handling, Stains

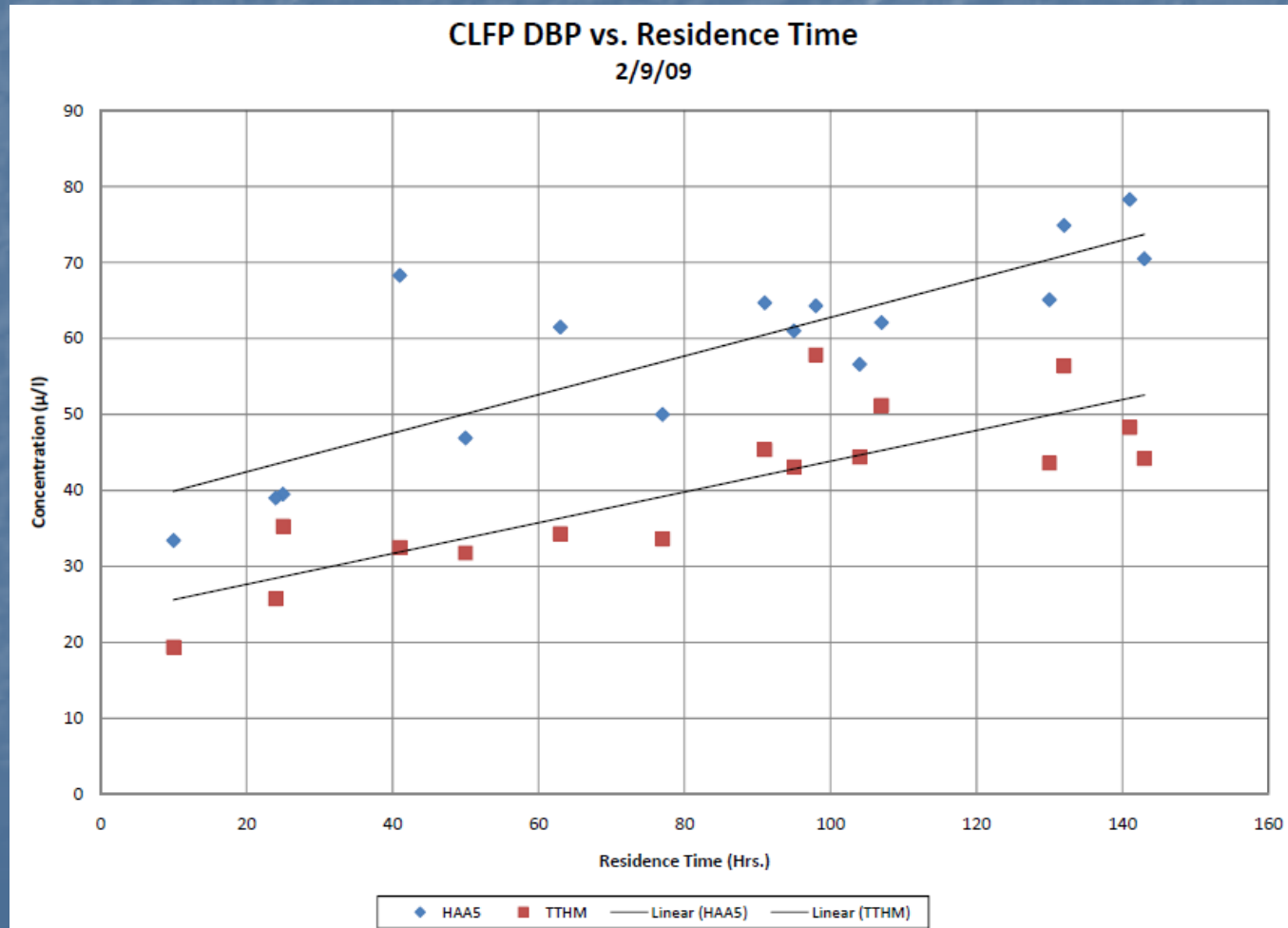
Low Mn Ferric vs Conventional Ferric

Advantages

- No Manganese, Ferrous Precipitation Issues
- No Dose Restrictions
- Lower Contaminant Issues
- Excellent Membrane Performance

Total DBP Control System

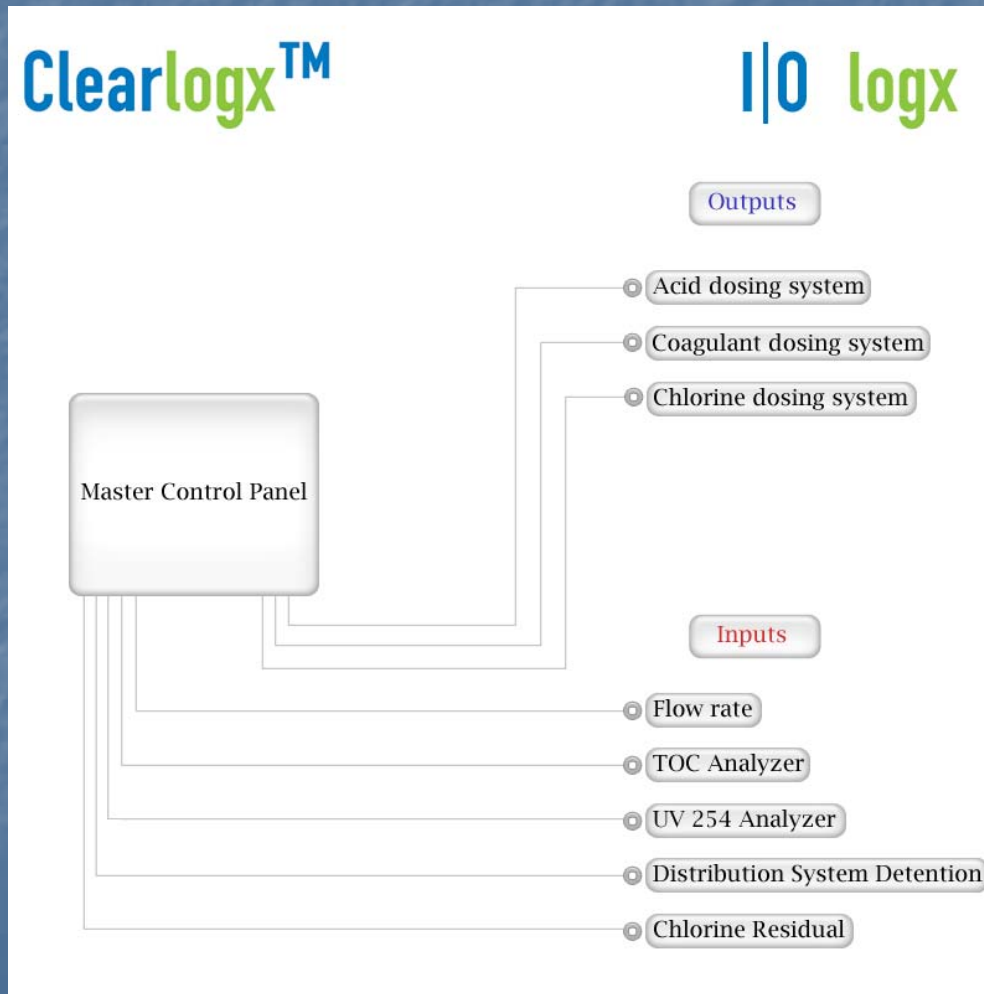
DBP Formation over time



DBP Control Variables

- Dose Coagulant Based On “Demand”
Coagulant Dose Required To Remove TOC
- Estimate Distribution System Detention Time
- Control Chlorine Feed

Total Process Control for DBP Compliance



Questions?