



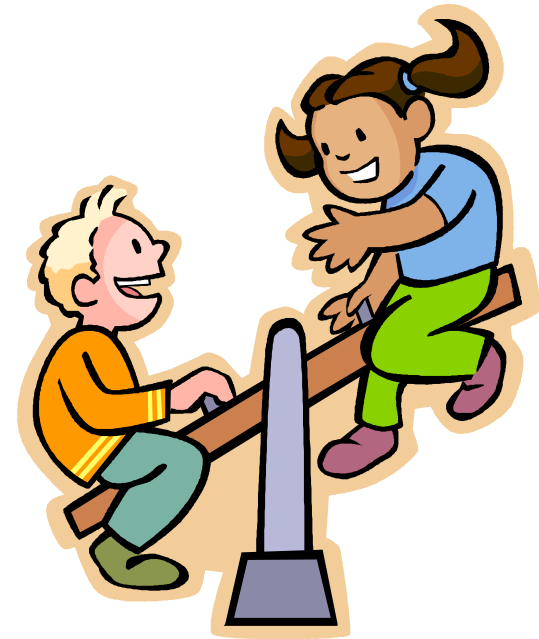
Be Right™

SLUDGE TREATMENT

Do we have a problem?

TEETER-TOTTER EFFECT

- Who loves teeter-totters?
- Who was the 'skinny kid' that could never get them to work?
 - What happens when you apply a different heavy load on one side?



Sludge

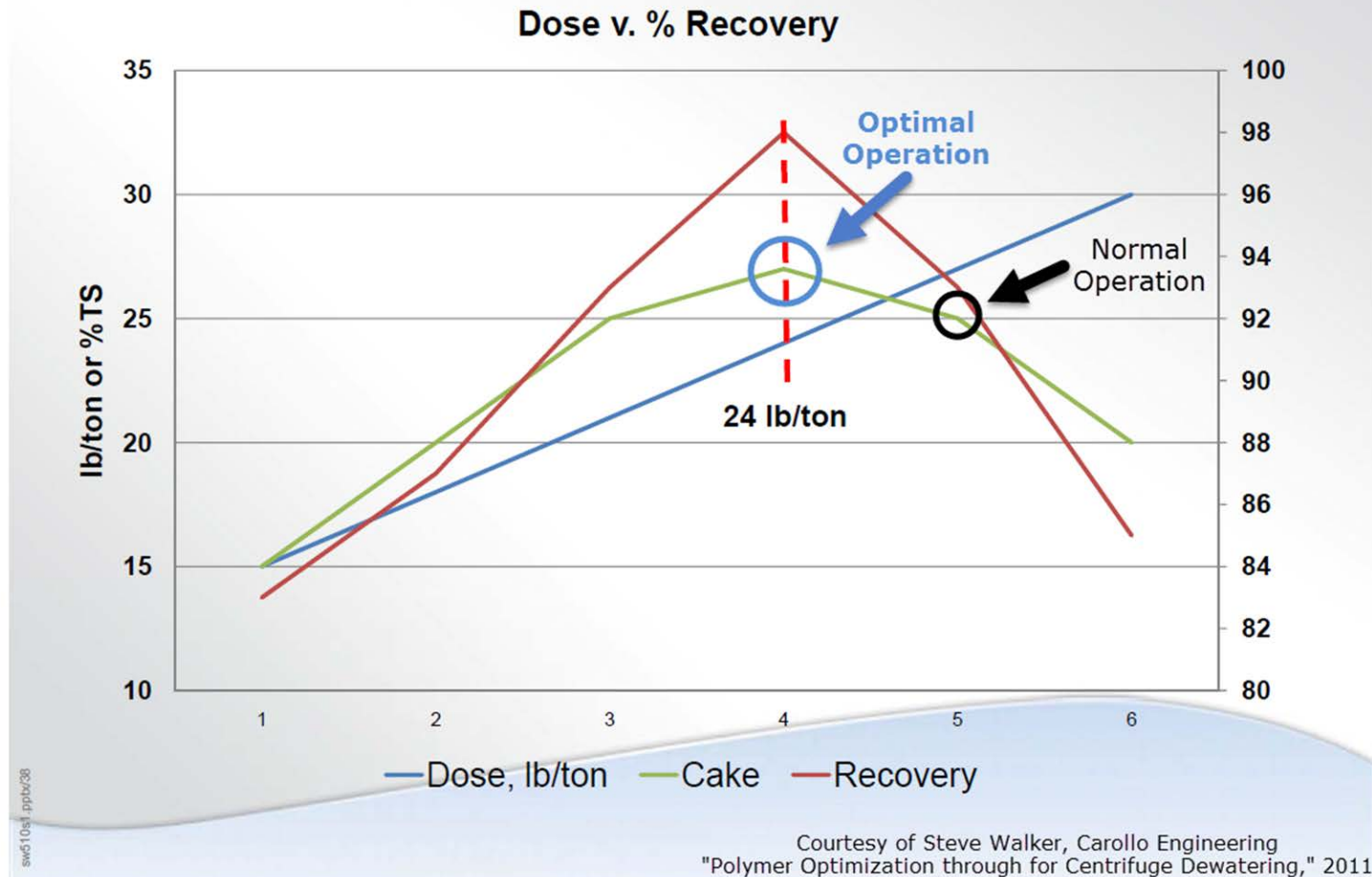
- How do we apply polymer in sludge thickening or dewatering applications?
 - Same 'heavy load' regardless of input
 - Wastes polymer
 - Shears the floc
 - More water in sludge

Sludge Control = Balance

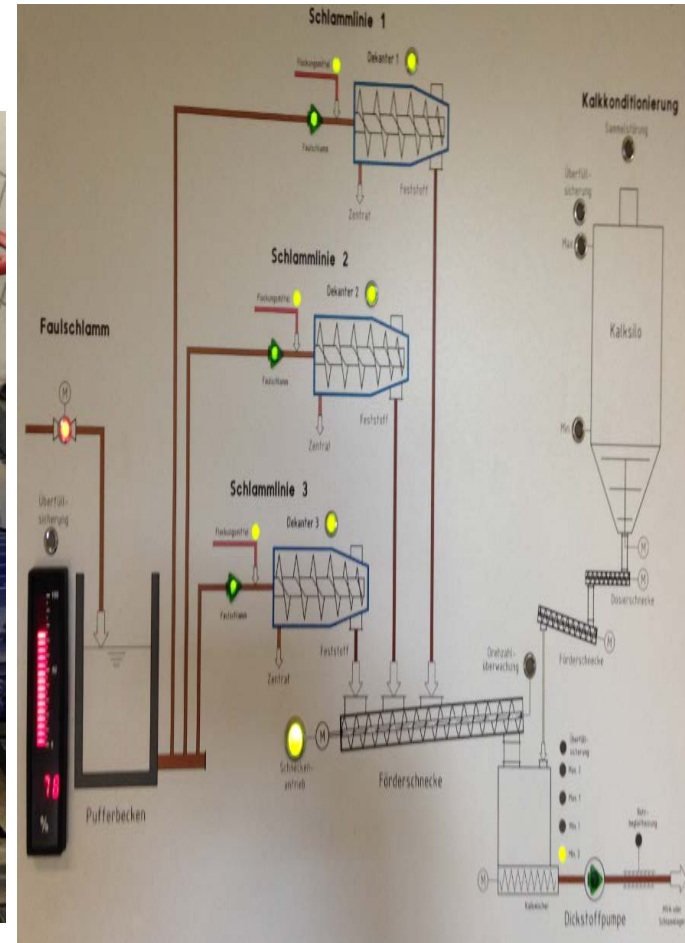


POLYMER PERFORMANCE

Performance Curve



MUNICIPAL WWTP CENTRIFUGE



CENTRIFUGE OPERATOR PANEL FED FROM MCC-3A

Allen-Bradley

PanelView P

Main Drive RUNNING
Back Drive RUNNING

IN PRODUCTION [START] [STOP]

FEED SYSTEM
[PRODUCTION] [STANDBY]

BACK DRIVE CONTROL
[TORQUE] [DIFFERENTIAL]

CLEAN IN PLACE
[START] [STOP]

POLYMER 19.0 GPM
Polymer Pump SP 69.0 % Remote

SLUDGE 300.0 GPM
Sludge PUMP SP 64.0 % Remote

CFV-AUTO [OFF]
CIP-AUTO [OFF]
DFV-AUTO [OFF]

SERVICE WATER

Differential Speed 1.4 RPM
Setpoint 0.5 RPM

Back Drive Torque 41.2 %
Setpoint 41.5 %

SPEED MAIN 2301 RPM
VIBRATION 13.5 MM/S
TEMP 126.5 F

PINION SPEED 203.0 RPM
VIBRATION 5.7 MM/S
TEMP 132.7 F

REAR FRONT

MAIN MOTOR RUNNING
BACK MOTOR RUNNING

CG OPEN
SOLIDS

CENTRATE DRAIN

[TUNING SCREEN] [CENTRIFUGE SETUP] [ALARM SCREEN]

CAN OPERATING THIS CREATE SOME ISSUES?

- 1.
- 2.
- .
- .
- .

What does “good centrate” look like?



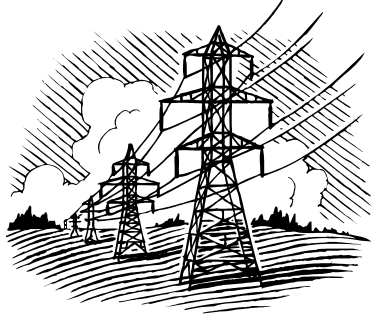
WOULD EXCESS POLYMER REALLY IMPACT US?

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____

- 1.
- 2.
- .
- .
- .

WHAT ARE THE PRIMARY TREATMENT COSTS?

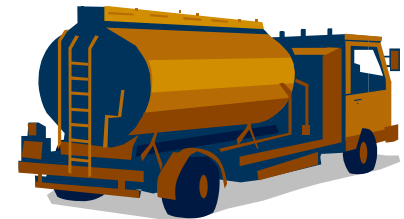
1. Electricity



2. Manpower



3. Chemicals



4. Maintenance



Mark Warberg fans: Come on, feel the vibration?



WHAT ARE MY ALTERNATIVES?



- Do Nothing – Accept the reality
- DIY – have operators program something
- Expect it from Centrifuge OEM
- Have E&C create the software, service and support
- Get a sensor, but not software
- Buy it later
- Ask Hach to help with automatic dosing
- Polymer supplier does it
- Get a competitor to Hach
- Other ideas?

TOTAL SUSPENDED SOLIDS



- Solitax

- Detects light scatter
- Low Range; 0 - 5% solids
- High Range; 0 - 15% solids
- Automatic cleaning wiper
- Immersion or insertion
- Quartz lens

- TSSsc

- Industrial use TSS
- Class 1 Div 2, High Temp, Corrosive Environments
- TriClamp, Varivent fittings
- Sapphire lenses

WHAT'S POSSIBLE?

- 5% reduction in Polymer?
- 10% reduction?
- 25%?
- 50%?
- Consistent cake?
- Reduced labor?
- No re-treating solids?
- No polymer recirc?
- Clear centrate?
- Happy Operators?
- More Compliant?
- Minimum maintenance?
- Chemical savings?



YOUR PROCESS. UNDER CONTROL.

Control on/off aeration through ammonia & nitrate.

N-module Nitrification

N/DN-module Intermittent denitrification

P-module Phosphate elimination

Feed just enough DO to meet the ammonia setpoint.

Feed just enough chemical to meet setpoint.

SD-module Sludge dewatering

ST-module Sludge thickening

SRT-module Sludge age

Calculate & maintain the best SRT for your system.

Feed exact polymer to meet sludge density setpoint.

REAL TIME CONTROLLERS

- Chemical Phosphorus Removal
 - Reduce precipitant use, sludge production
- Nitrification Control
 - Reduce aeration energy, better control of “spikes”
- Nitrification/Denitrification Control
 - Reduce aeration energy, total nitrogen
- Sludge Thickening Control
 - Produce consistent sludge, reduce polymer costs, increase gas production
- Sludge Dewatering Control
 - Produce consistent sludge, reduce polymer, maintenance and transportation costs

RTC112 SD-Module

Sludge Dewatering Control System

- Reduces your polymer costs
- Reduces your sludge disposal costs
- Increases your solids capture
- Decreases equipment maintenance and blinding from overfeeding polymer

RTC113 ST-Module

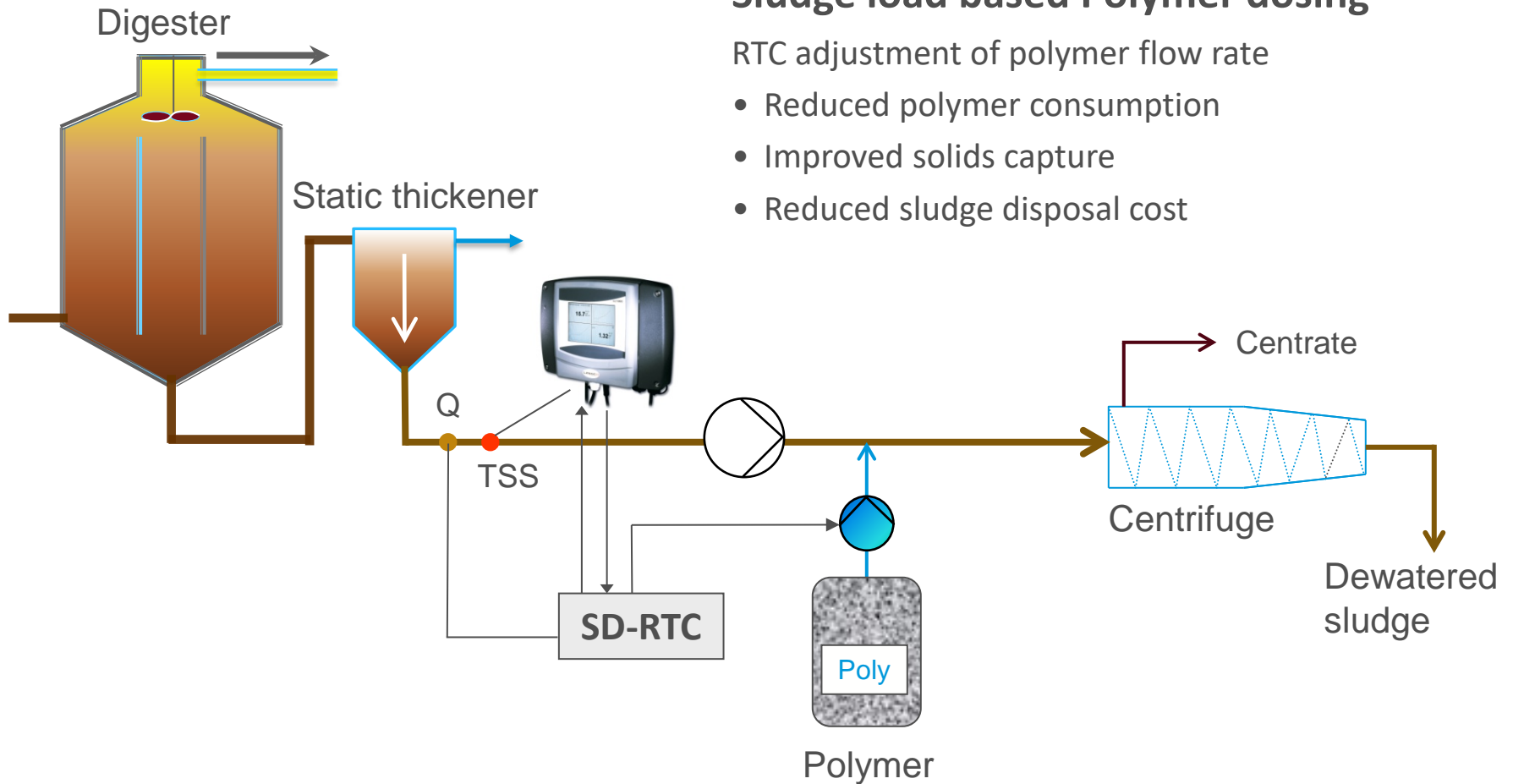
Sludge Thickening Control System

- Increases gas production
- Increases solids capture
- Reduces polymer costs 20-40%
- Reduces sludge handling equipment maintenance
- Reduces sludge disposal costs

SLUDGE DEWATERING CONTROLLER

- Designed to control chemical dose in real time based on loading changes into the dewatering process
 - Control with feed forward
 - Measure Feed Sludge Suspended Solids directly & continuously
 - Collect a sludge flow input
 - Contains enhanced algorithms and backup processes
- Developed in Germany
 - Currently 15 systems in the US

SLUDGE DEWATERING WITH SD-RTC.



RTC Case Study: Sludge Thickening

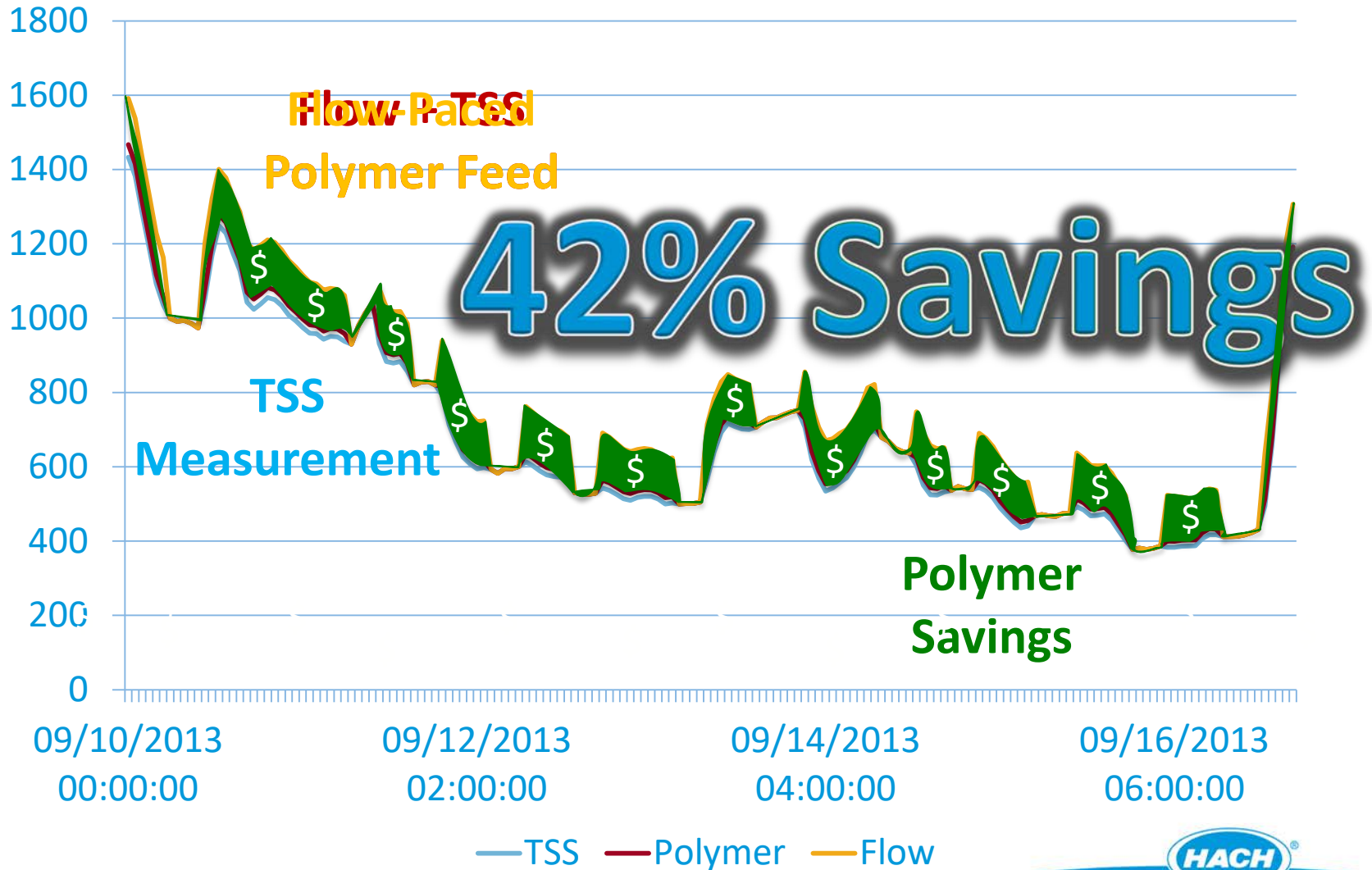
The following industrial pre-treatment plant had difficulty maintaining their waste process thickness.

Large load fluctuations impacted their ability to flocculate and they ran artificially high polymer levels.

Original polymer dose based solely on flow rate.

Installed TSS probe in flocculation tank which tied the Real-Time control directly to their plant PLC.

UTAH FOOD PROCESSING PLANT





Be Right™

BOWLING GREEN MUNICIPAL UTILITIES SLUDGE DEWATERING PROCESS CONTROL IMPROVEMENTS

Melody White¹, Scott Neighbors²

¹ Hach Company, Loveland, CO

² Bowling Green Municipal Utility, KY



Existing Plant:

- 12 MGD Sequencing Batch Reactor (SBR) consisting of two, two basin SBR trains
- Each train wastes on average approximately 130,000 gallons per day of 0.75% solids to three sludge holding tanks.
- The sludge holding tanks are decanted to thicken the solids to 1.5-3.0%.
- Sludge then runs through a grinder and is pumped to two centrifuges for dewatering.

ISSUES AND IMPACTS

- Highly automated WWTP
 - dewatering process very manual
 - Little Automation
- Polymer budget was ~\$250,000/year
 - Looking for ways to save money
- Dewatering occurs 3-4 days/week for 24hr/day
 - Three operator shifts over 24-hr coverage
 - Two Centrifuges running concurrently – unless one is down
 - Independently controlled
- Highly Variable sludge (No digestion)
 - Started looking into inline TSS meters
- Polymer flow meters added to system for accurate polymer usage

WHAT DOES IT DO?

Components



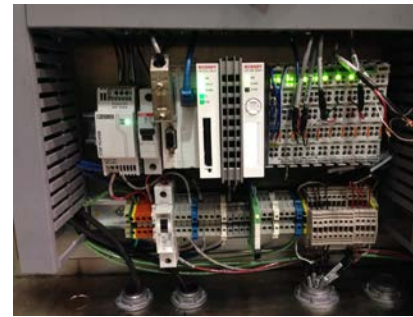
Solitax TSS

- Feed forward control



sc1000

- Controls RTC parameters
- Prognosis
- Signal validation
- **All communication capabilities**



RTC

- Calculates set-points in real time
- Interface for dosing pump
- Install in PLC cabinet



Dosing Pump

- Control pump feed of polymer



Sludge Flow

- Needed to determine loading

Services

- Installation and setup
- Instrumentation service contracts
- On-going service for adjustments and trouble shooting via remote connection supporting installation, optimization and after sales support

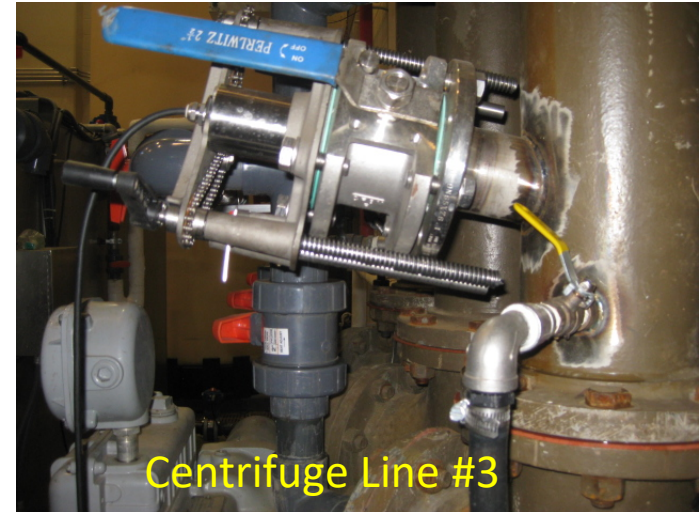
INSTALLATION

- SC1000 & RTC were installed next to the PLC cabinet
 - Integrated into PLC/SCADA for additional redundancy
 - No maintenance



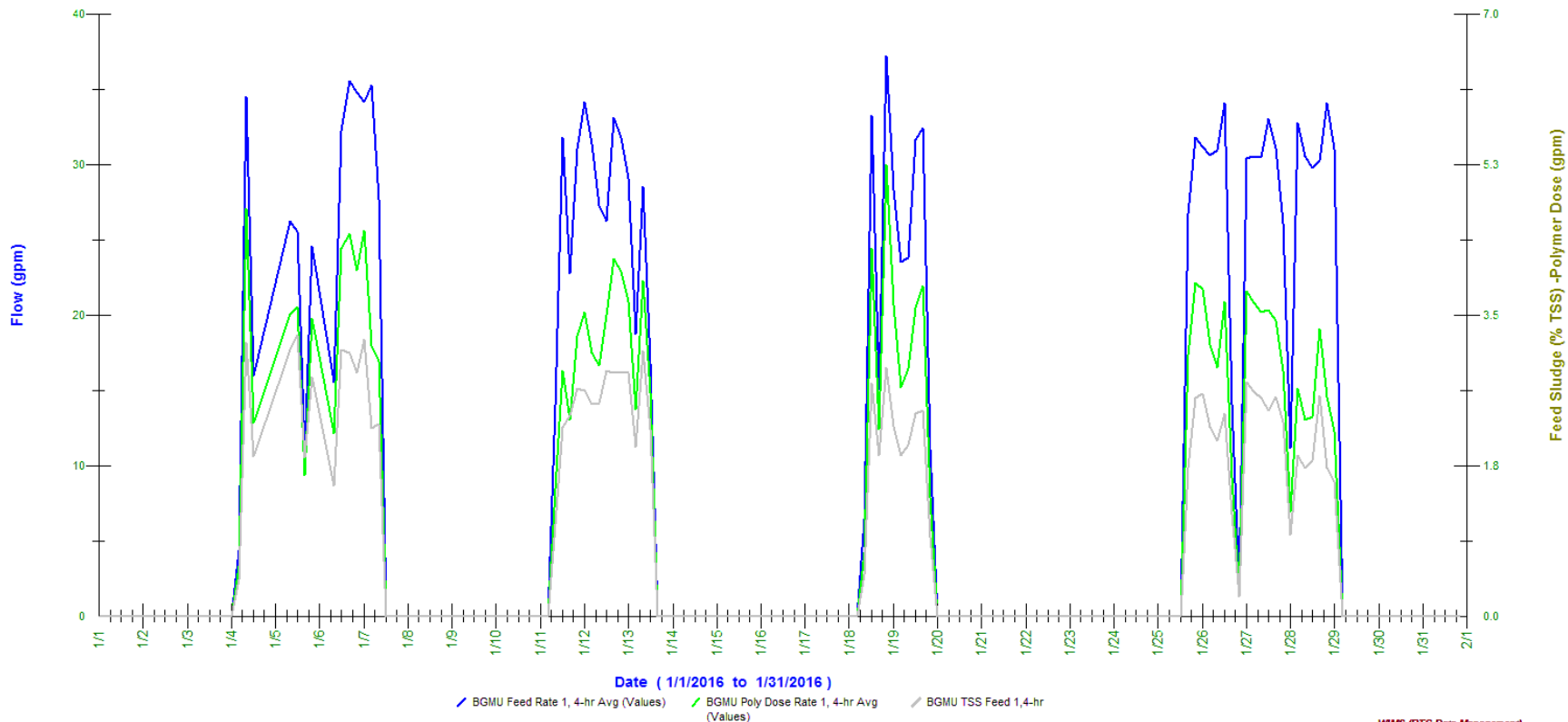
INSTALLATION

- Suspended Solids Probes
 - Feed Sludge before polymer addition
 - Installed where it will be maintained
 - Grab Sample taps for verification & calibrations
- Maintenance:
 - Pull probe and examine/clean
 - Periodically calibrate against a grab sample



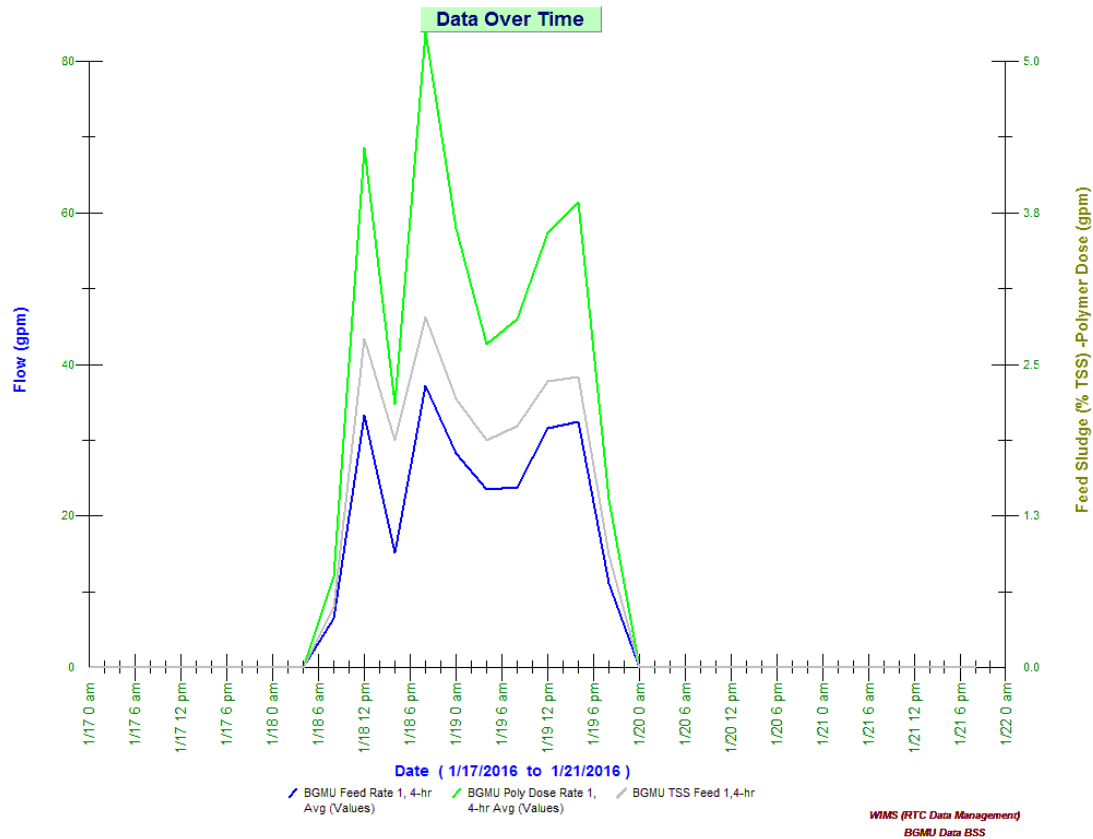
RESULTS: CENTRIFUGE #1

Data Over Time

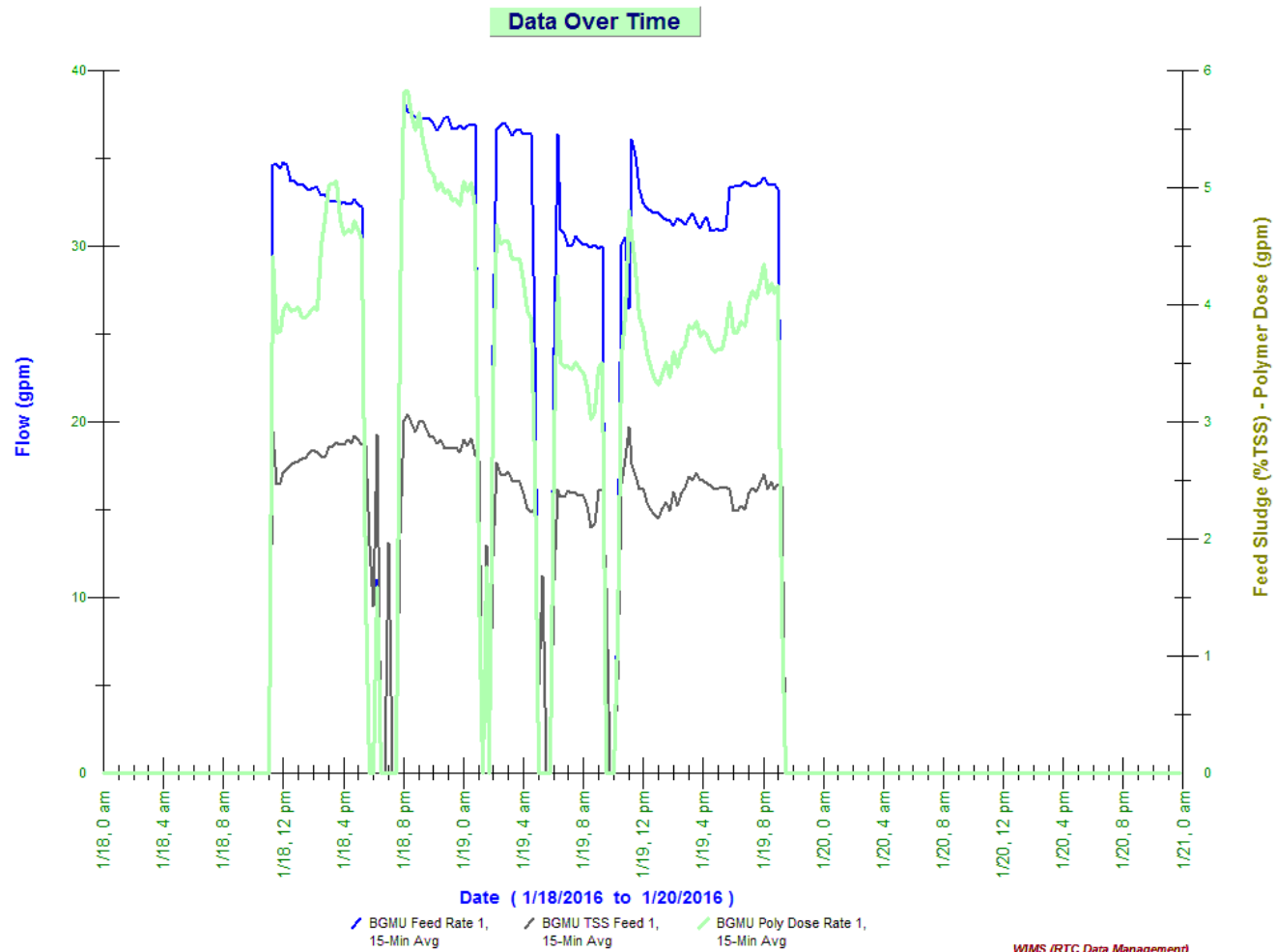


WIMS (RTC Data Management)
BGMU Data BSS

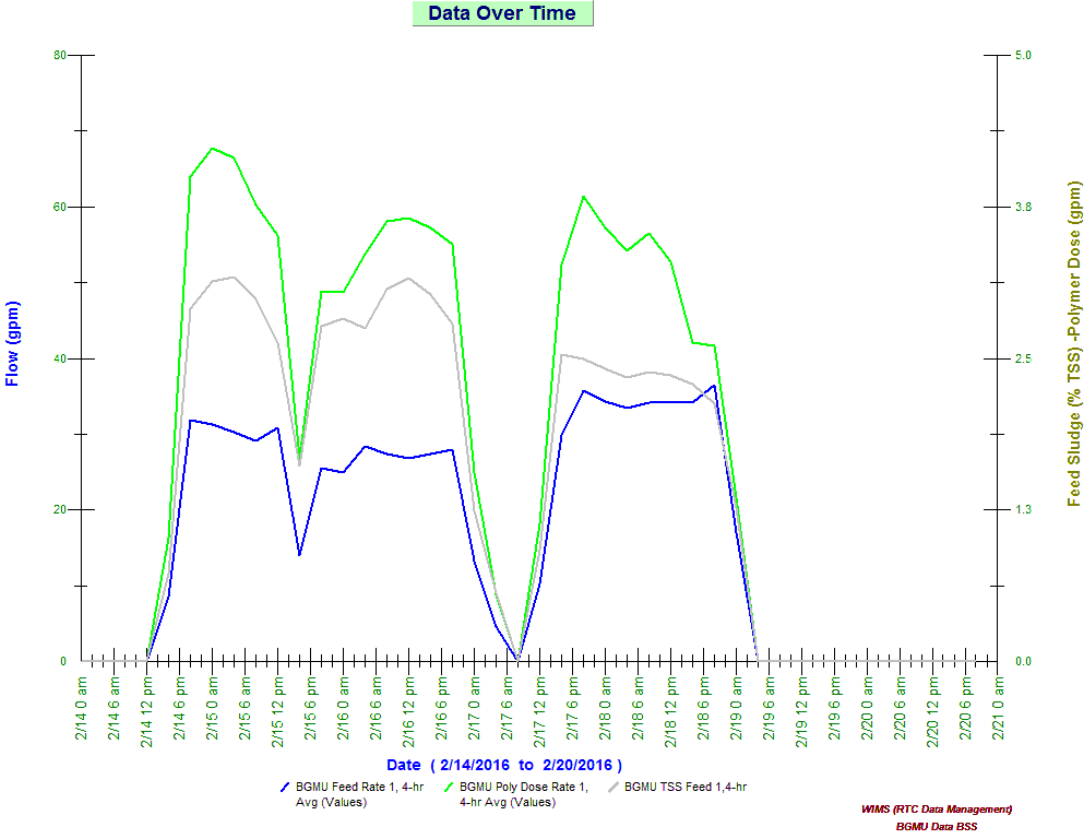
RESULTS: CENTRIFUGE 1 (4HR AVG)



RESULTS: CENTRIFUGE #1 (15-MIN DATA)

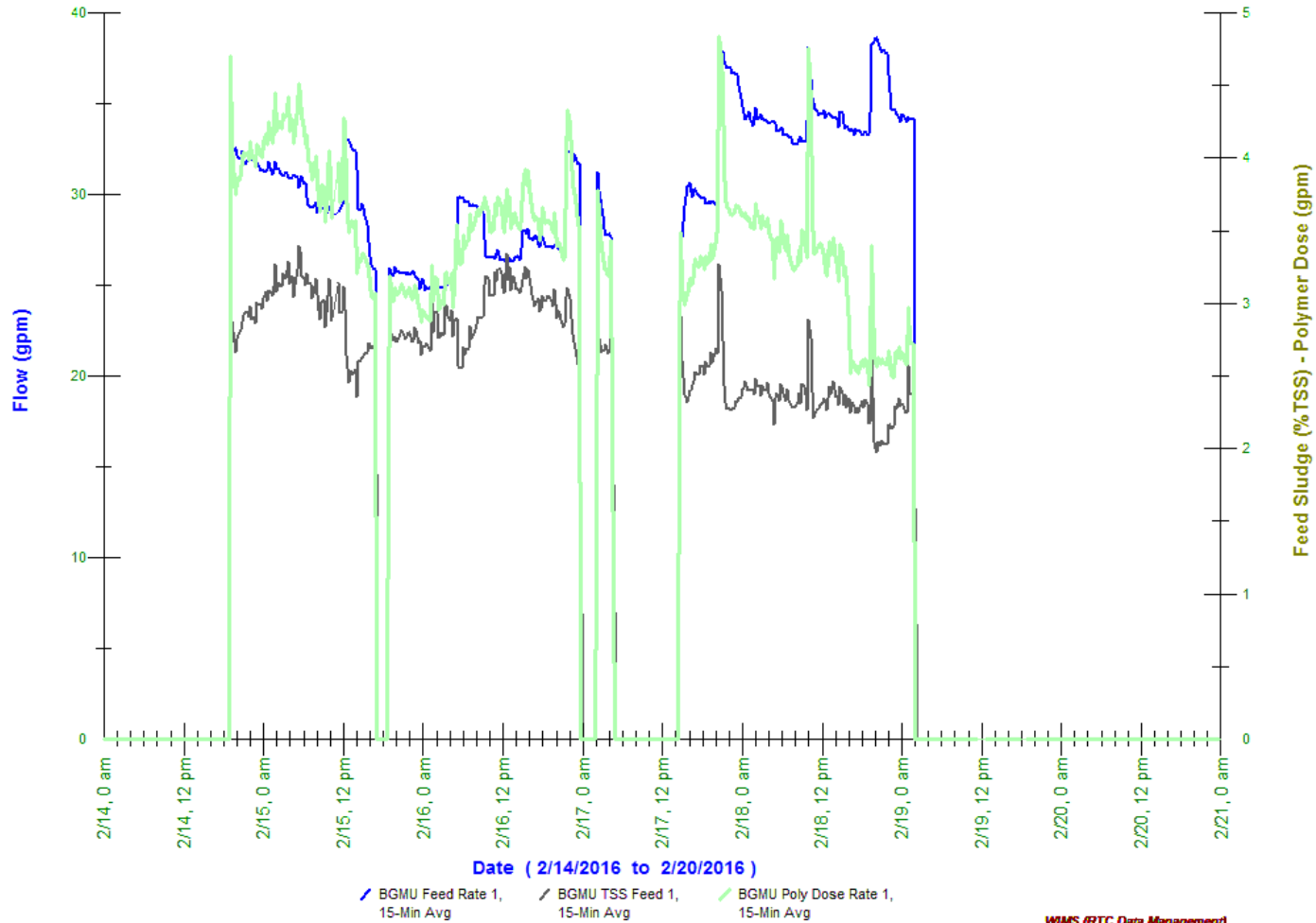


RESULTS: CENTRIFUGE #1

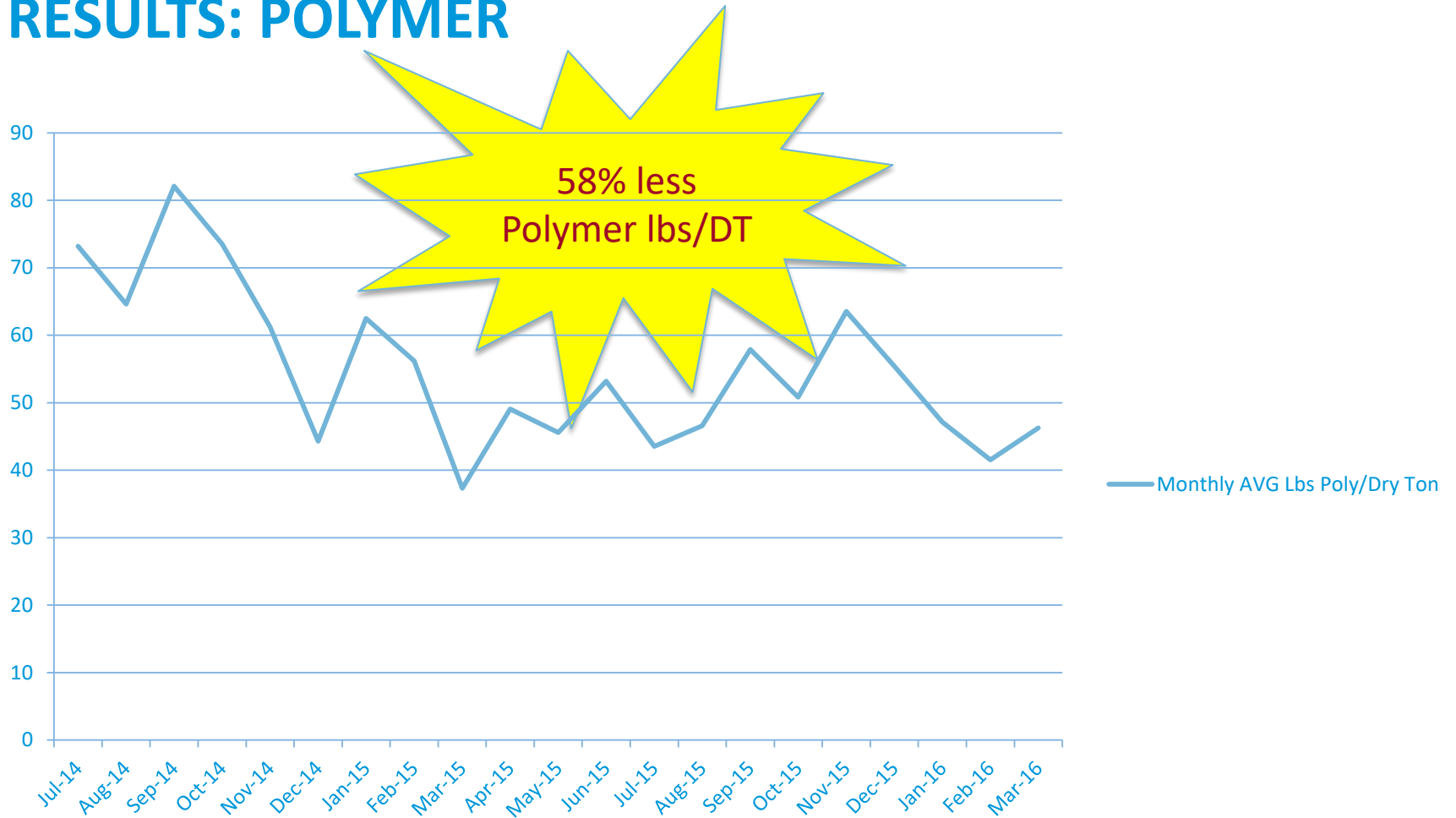


RESULTS: CENTRIFUGE #1 (15-MIN DATA)

Data Over Time



RESULTS: POLYMER



Average Lbs/DT with the Hach unit Running (Jan-March 2016): 40.52

**The Hach System is not always running, due to issues with needing more polymer at startup of centrifuges.

RESULTS

- Maintenance:
 - Probes are pulled, examined, and cleaned once/month
 - Recalibrated a total of 6 times since install in November 2014 (avg every 3 months)
 - Calibration is via lab with a moisture analyzer
 - Grab samples still pulled twice/shift

RESULTS

- Upgrades allowed for accurate tracking of sludge and polymer
 - Online TSS probes in the sludge lines
 - Flow meters installed on the polymer lines
- Hach RTC-SD polymer system performed as expected
- Operating Labor reduction
 - Eliminated approximately 70% of the manual adjustments
- Production of a more consistent cake
- Polymer Savings
 - 58% less polymer lb/DT under RTC control vs manual