

# Evaluation of an “Off the Shelf” Chemical Phosphorus Removal System

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# Agenda

- Phosphorus Control System Description
- Evaluation Plant Profile
- Evaluation Results
- Conclusions

# Phosphorus Controller

- Designed to Control chemical dose in real time based on user defined orthophosphate setpoint
  - Control with feed forward or feed back loops
    - Feed forward: Automatic  $\beta$  Calculation
    - Feed back: PID control
  - Measure orthophosphate directly
  - Collect a plant flow input
  - Contains enhanced algorithms and backup processes

Developed in Germany

- Over 100 installations in EU
- First evaluation in the US at Beaver Dam, Wisconsin

# Phosphorus Controller

## HACH Supplied Components



### PHOSPHAX sc

- Orthophosphate measurement



### sc1000

- Controls RTC parameters
- Signal validation
- All communication capabilities



### RTC

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



### Plant Flow

- Determine loading



### Dosing Pump

- Feed precipitant

# Plant Profile

- **Beaver Dam, Wisconsin**
  - 4.7 MGD Average Daily Flow
  - Extended Aeration Activated Sludge
  - Feed Ferric Chloride into mixed liquor channel before distribution to clarifiers
  - 1.0 mg/L TP monthly average limit
  - Onsite pretreatment from cheese industry
    - UASB and DAFT
  - Influent dissolved orthophosphate ~ 25 mg/L P

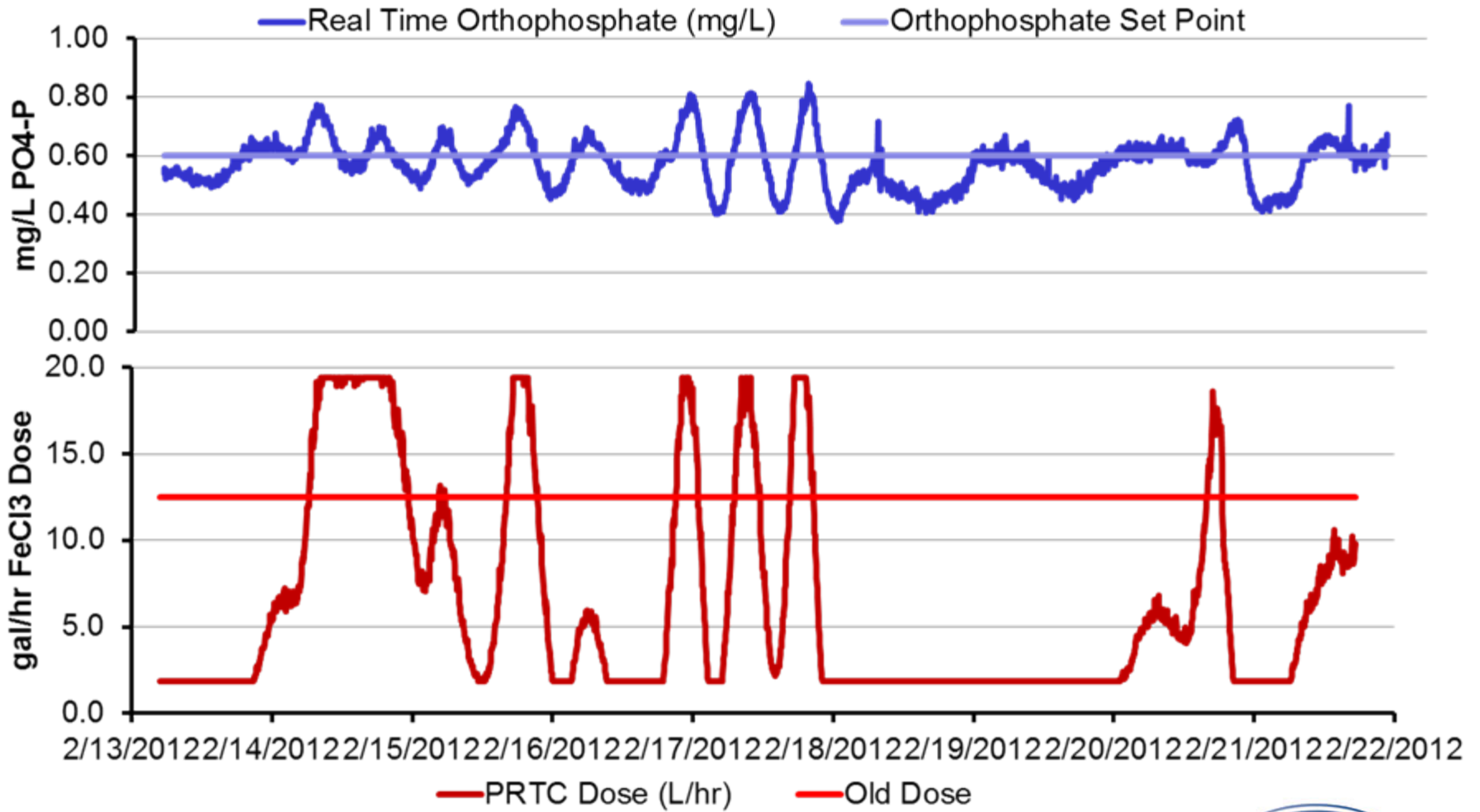


# Installation

- RTC in PLC cabinet
  - Integrated into PLC/SCADA for additional redundancy
  - No maintenance
- Phosphate analyzer
  - Final Effluent sample
  - Installed where it will be maintained
  - Maintenance:
    - Change reagents quarterly
    - Periodically clean filter

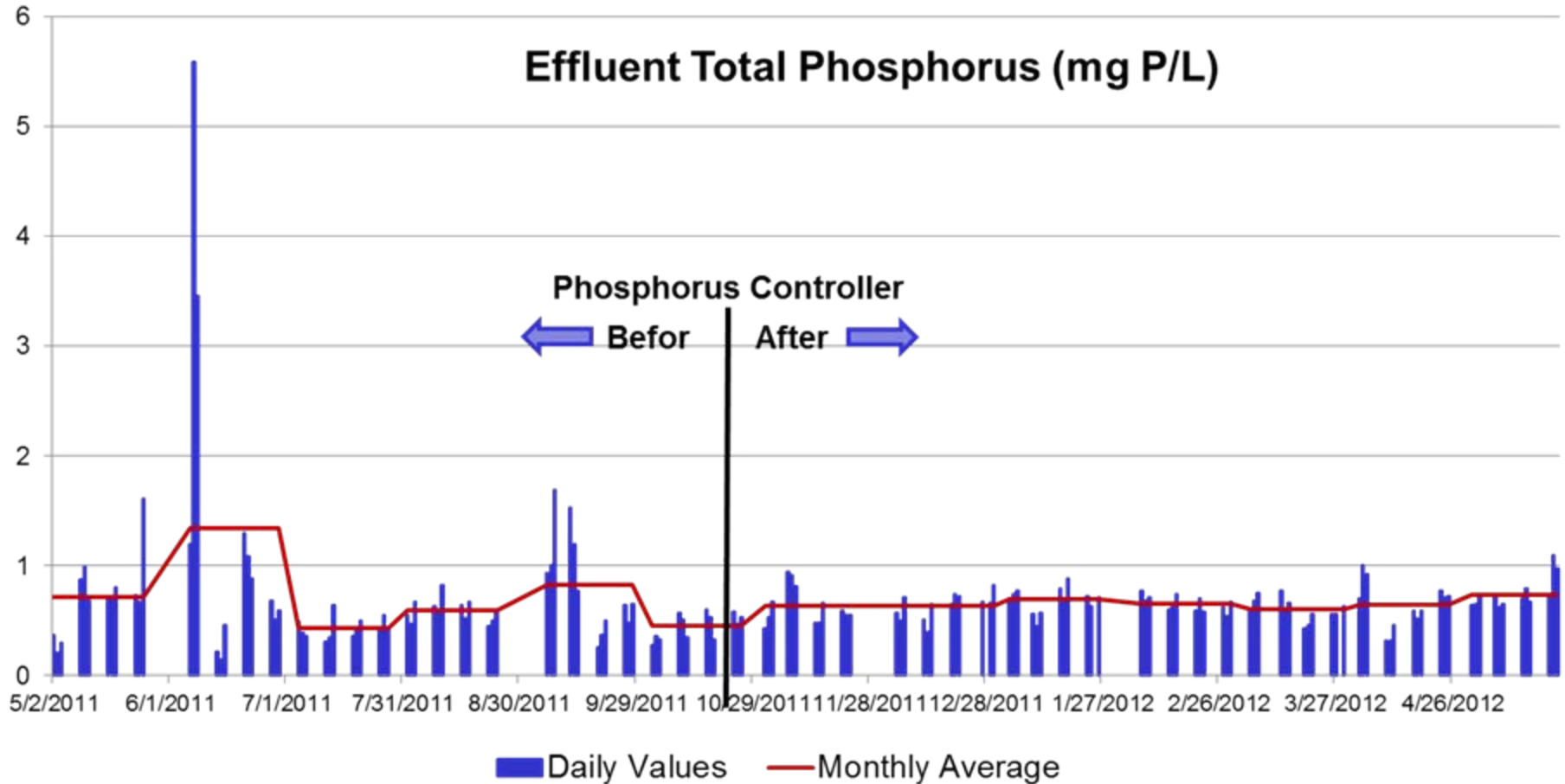


# Results





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# Results

Ferric Chloride Savings (160 Day Period)			
Before		After	
Dose	12.5	Dose (average)	5.55
Gallons Consumed	48,000	Gallons Consumed	21,312
<b>Gallons Saved</b>			<b>26,688</b>
<b>% Saved</b>			<b>56%</b>

- ROI: 6.8 months
- Sludge production not studied
  - Estimated 306,912 fewer pounds produced
  - (Based on 1kg Ferric producing 1kg of Sludge)

# Conclusions

- The Phosphorus Controller performs as expected
- ROI faster than most due to higher static dose (12.5 gph)
- Future research should focus on longer term data (2-5 years) and sludge production data