YOUR BUGS ARE DOING BETTER THAN YOU THINK

Nathan Cassity, Donohue

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DONOHUE

Acknowledgements

- Rick Wenzel, Brookfield
- Sharon Thieszen, Sheboygan
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- Michael Bodoh, Tyson Foods
- Trevor Ghylin, Xylem
- Bob Dabkowski, Hach
- William Marten, Donohue

Presentation Outline

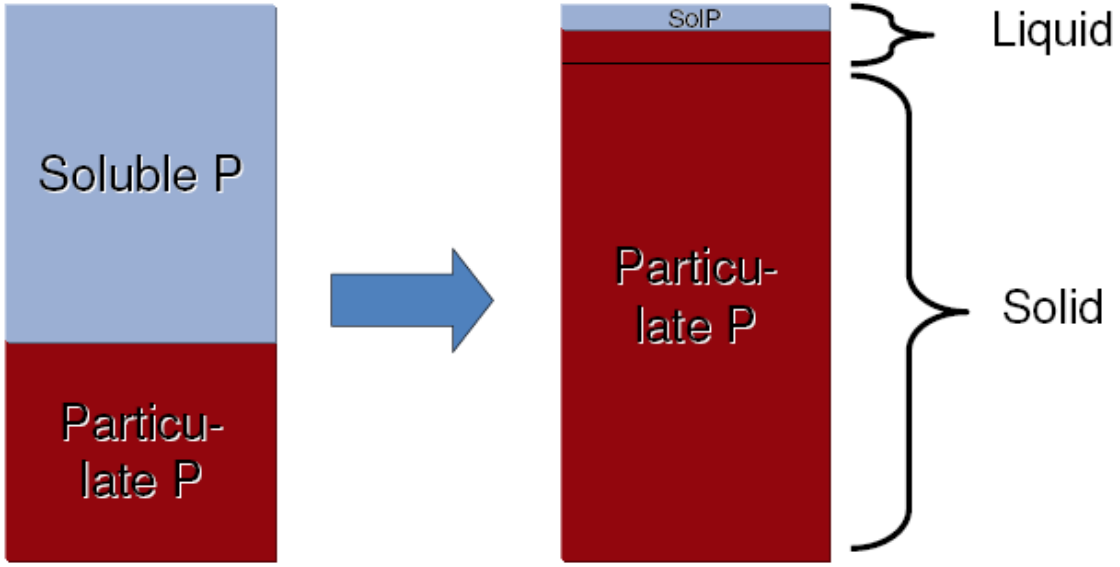
- Background
  - Chemical P Removal
  - Biological + Chemical P Removal
- Ortho-P Analyzers
- Case Studies
- Wrap Up

Background

Phosphorus Removal

Key to Basic P Removal

1. Convert soluble P to particulate P
2. Remove particles

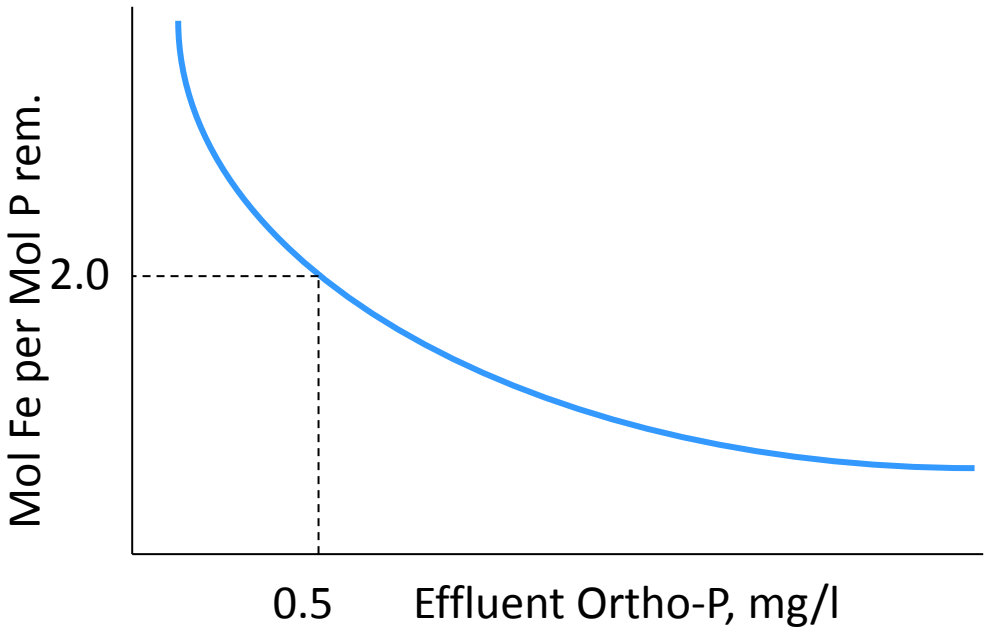


When considering P removal…

- Conversion of soluble P to particulate P
  - Optimize biological processes
  - Increase chemical addition efficiency
  - Holistic plant approach
- Removal of particulate P
  - Improved clarification
  - Filtration

Chemical Phosphorus Removal

- Ortho-P (dissolved) is “reactive”
- Removing Ortho-P with chemical has diminishing returns

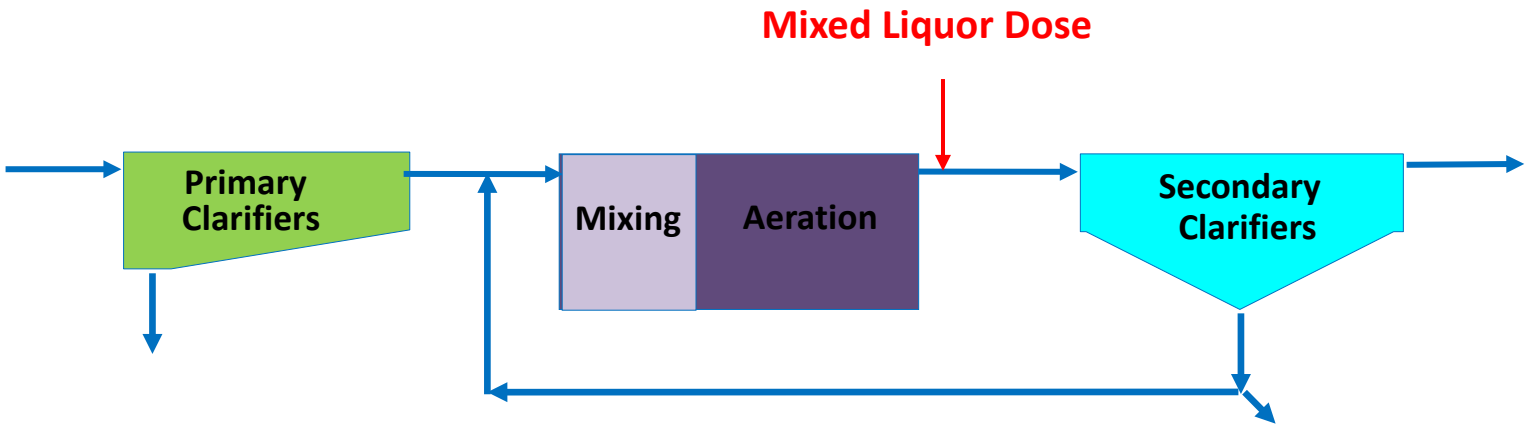


Chemical Phosphorus Removal in Secondary (single point dose)

- Can reliability treat under variable P loading
- Higher phosphorus content of secondary sludge (and effluent TSS)
  - Effluent TSS of 4% to 5% P
  - 10 mg/l effluent TSS → 0.4 mg/l P
- Requires low effluent solids concentration to achieve low effluent total P

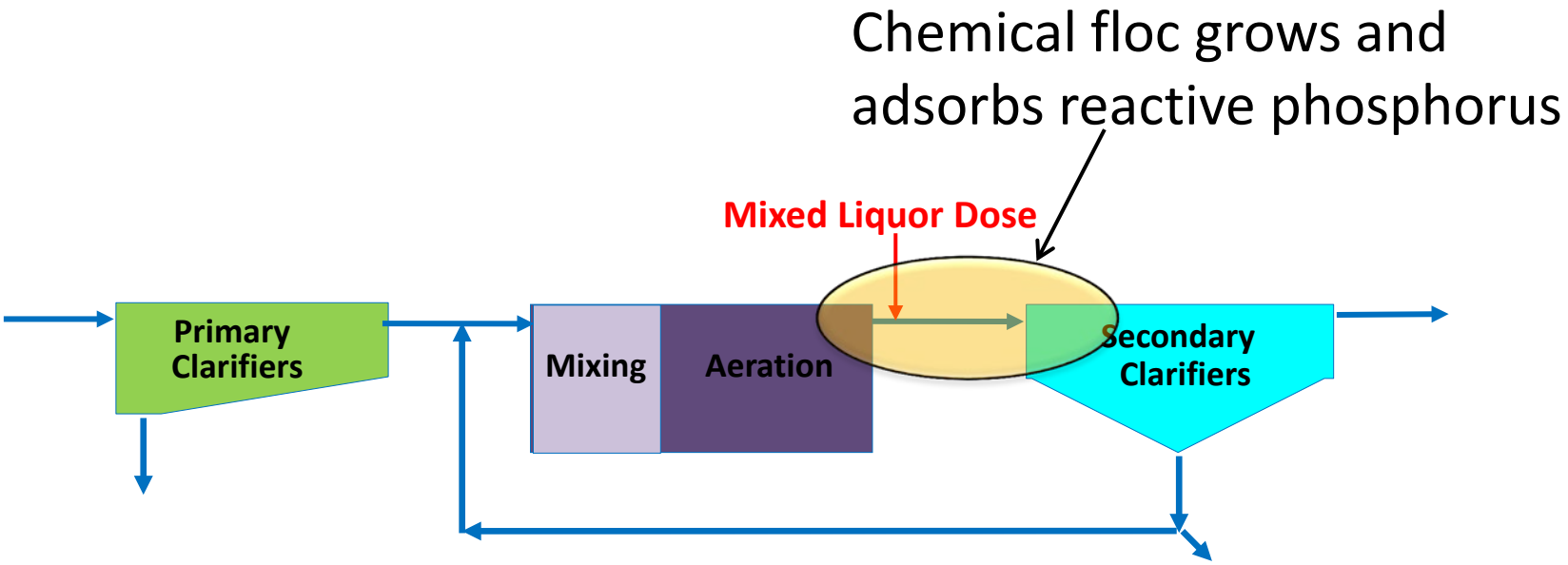
Biological + Chemical

- Chemical addition for polishing
  - BPR + chemical working together
    - Focus on two areas of chemical interaction



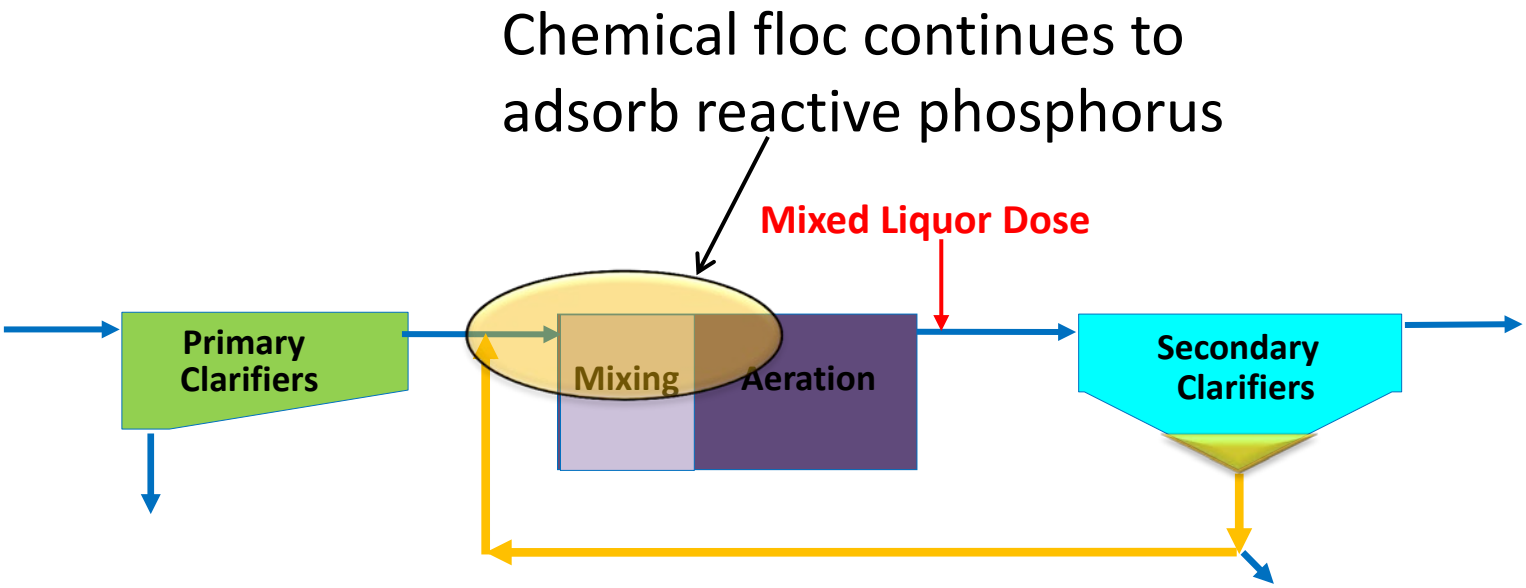
Biological + Chemical

- Dose point interaction



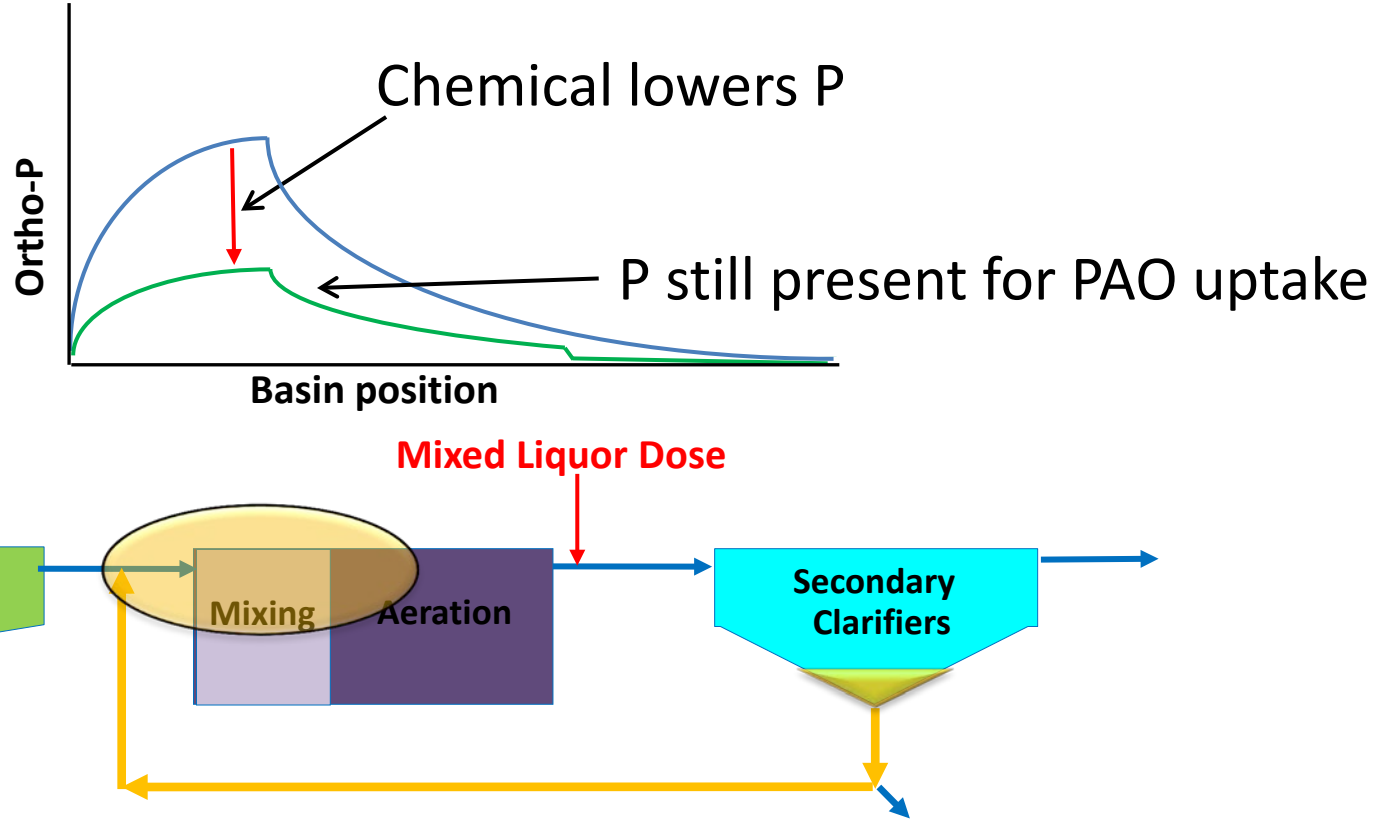
Biological + Chemical

- In-basin interaction



Biological + Chemical

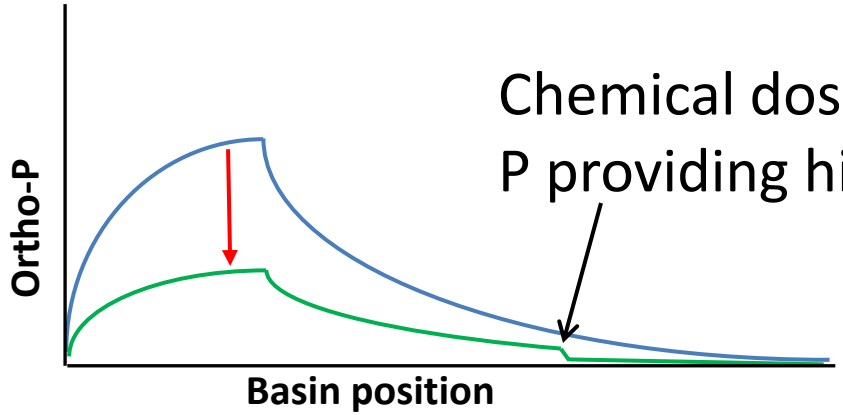
- BPR interaction



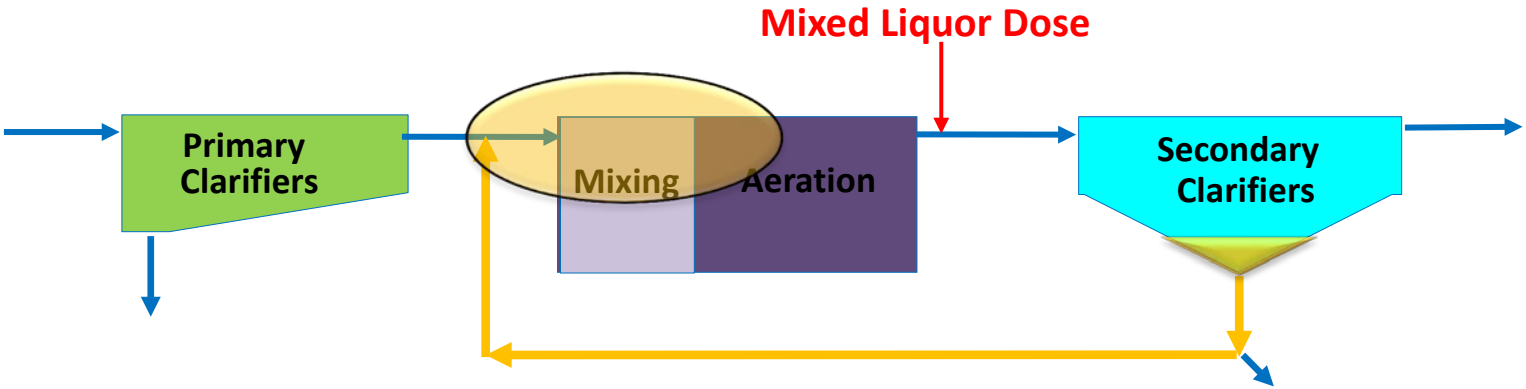
PAOs continue to have an advantage – BPR stays healthy

Biological + Chemical

- Chemical interaction



Chemical dosing occurs at low P providing high dosing ratio



Chemical dose point provides best opportunity for optimization

Ortho-P Analyzers

Ortho-P Analyzers

- Effluent phosphorus concentration can vary widely over 24 hours
  - Composite sample doesn't always tell the story
- Optimization requires more information
  - Real-time feedback = online analysis
- Monitoring probes have improved dramatically, but a phosphorus probe isn't being sold yet

Ortho-P Analyzers

- Ortho-P analyzers utilizing wet chemistry have become numerous in Wisconsin WWTF's
  - Can be used in multiple flowstreams, but most common is effluent
- WI Installations

•Sheboygan	•Fond du Lac	•Jackson
•Kiel	•East Troy	•Brookfield
•New London	•Green Bay	•Black River Falls
•Manitowoc	•De Pere	•Kenosha
•Mayville	•La Crosse	•Sun Prairie
•Rib Mountain	•Beaver Dam	•Superior
•Racine	•Watertown	•Medford

Ortho-P Analyzers

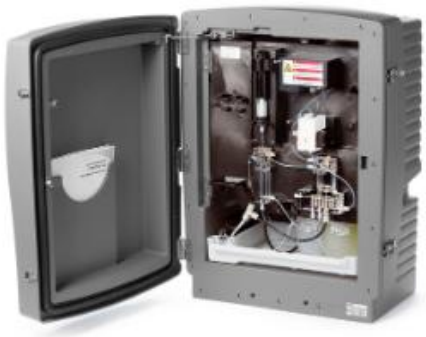
- Manufacturers

asa ANALYTICS
ChemScan

HACH

YSI
a xylem brand

Endress+Hauser



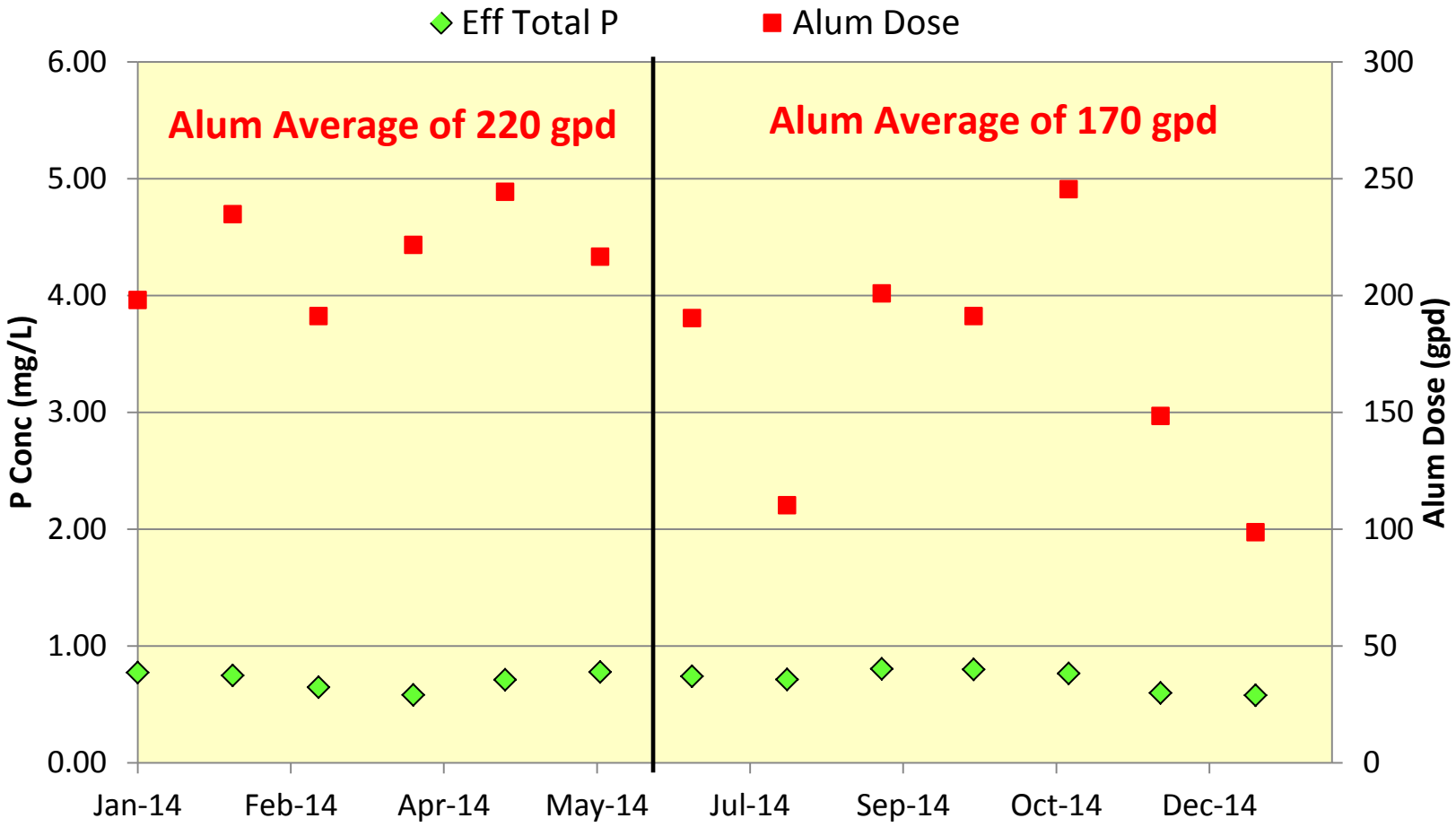
Case Studies

Brookfield Background

- Fox River Water Pollution Control Center
  - Treating 9, permitted for 12.5 MGD
  - BPR with chemical polishing (Alum)
  - 0.075 mg/L WQBEL by September 2021
  - Currently working on OER action items for phosphorus optimization
    - Installed an Ortho-P analyzer in 2014 to control chemical polishing

Brookfield FRWPCC

- Control using Ortho-P analyzer started June 2014



Brookfield FRWPCC

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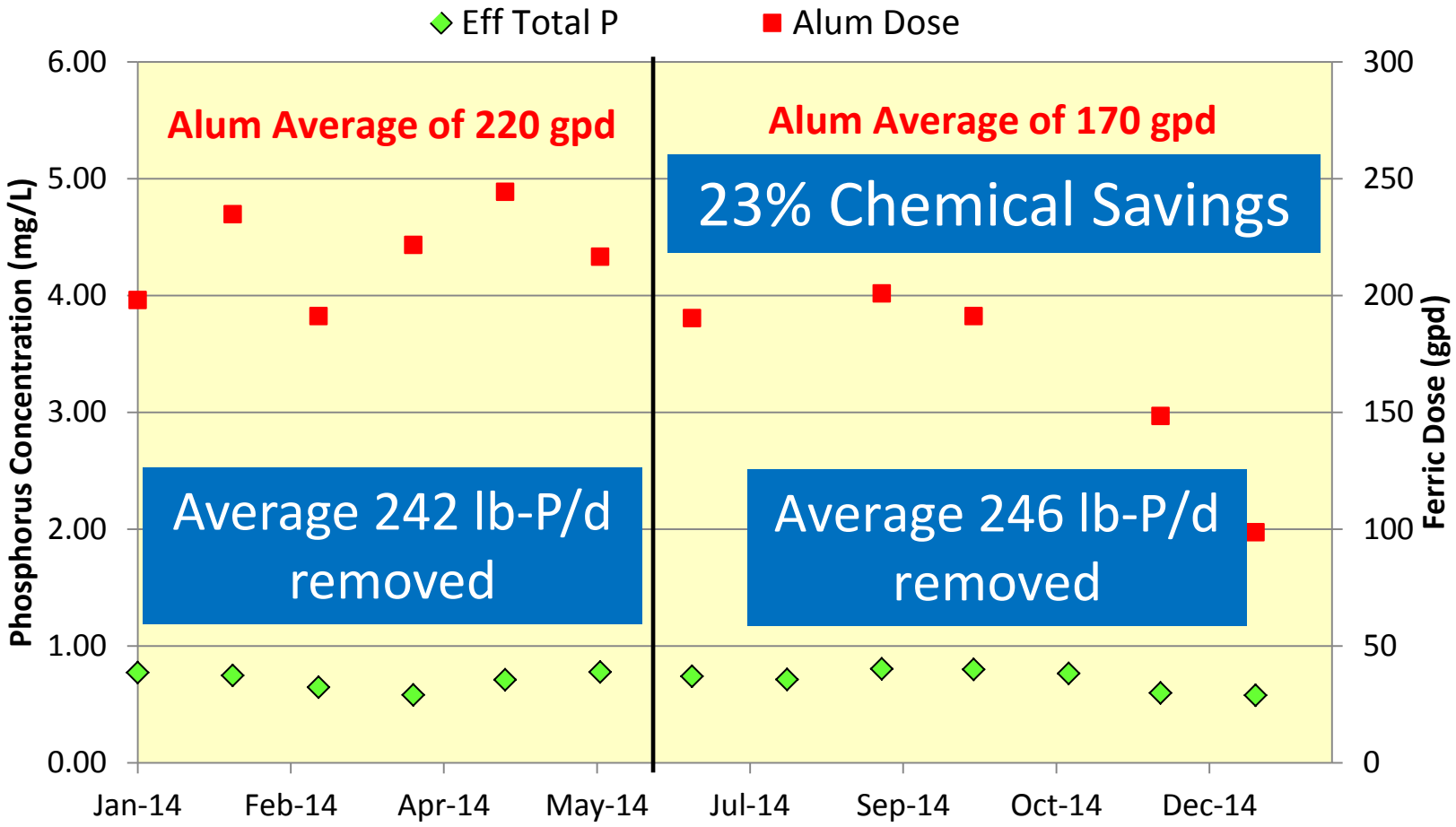
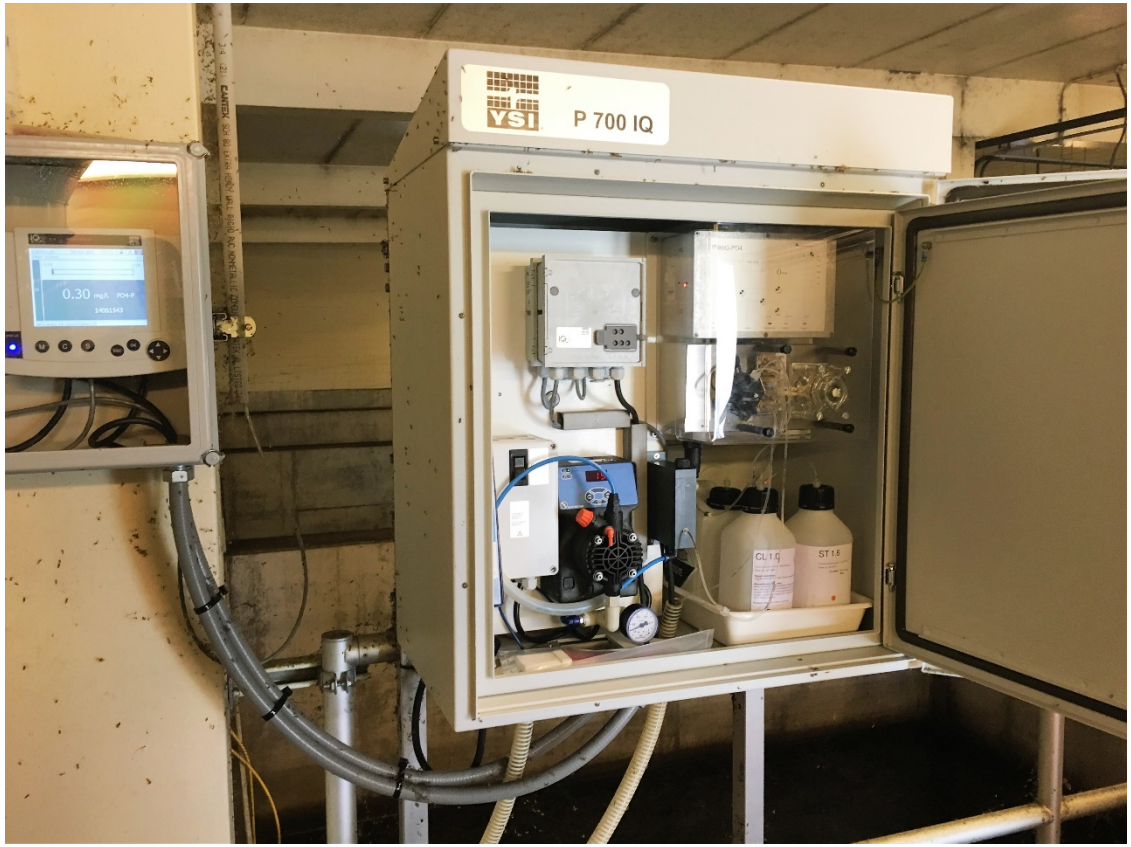


Brookfield FRWPCC

- Alum dosing automated based on real-time effluent Ortho-P



Brookfield FRWPCC

- Alum dosing automated based on real-time effluent Ortho-P

Item	Prior to Analyzer Jan – Jun 2014	With Analyzer Jul – Dec 2014
Alum Use	220 gpd	170 gpd
Alum Cost (6 months)	$45,770	$35,520
Effluent Total P	0.71 mg/L	0.71 mg/L

23% Chemical Savings
$10,250 saved in 6 months

Sheboygan Background

- Sheboygan Regional WWTP
  - Treating 11 mgd, Design 18 MGD
  - BPR with chemical polishing (Ferric)
  - Facing 0.6 mg/L Lake Michigan interim limit
  - Installed Ortho-P analyzer in 2010 to control chemical polishing

Sheboygan Regional WWTP

- Ferric dosing automated based on real-time effluent Ortho-P
  - Between $30k and $45k annual chemical savings

25% Chemical Savings
$38,000 saved per year

Year	Annual Ferric Chloride Cost
2009	$156,340
2010	$149,260
2011	$104,150
2012	$106,770
2013	$121,200
2014	$108,702

Manitowoc Background

- Manitowoc WWTF
  - Treating 6, permitted for 15.5 MGD
  - Fixed film (trickling filters) facility with chemical P removal (ferric chloride)
  - 0.6 mg/L Lake Michigan interim limit caused an increase in ferric chloride dosing/costs
  - Purchased Ortho-P analyzer in 2012 and automated the ferric dosing to keep Ortho-P below 0.4 mg/L

Manitowoc WWTP

- Chemical savings paid for analyzer in 4 months

Year	Annual Ferric Chloride (gal)
2010	142,960
2011	140,750
2012	106,190

25% Chemical Savings
$30,000 saved in 2012

Tyson Foods Background

- Formerly Hillshire Farms in New London
  - Treating 1 MGD
  - Highly loaded facility
  - 0.075 mg/L WQBEL by January 2019
  - Working on OER action items for phosphorus optimization
    - Installed temporary BPR in 2014 - baffle curtain and mixer for A/O process
    - Installed an Ortho-P analyzer in 2014

Tyson Foods

Tyson Foods


0.00 PPM PO4-P lo
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6
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2
3
MAIN MENU
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CLEAR
ChemScan®
mini™
asa
ANALYTICS
www.asaAnalytics.com

Tyson Foods

Item	Prior to BPR Jan – Jun 2014	With BPR Jan – Jun 2015
Ferric Chloride Use	337,000 gal	108,000 gal
Ferric Cost	$66,220	$21,310
Effluent Total P	0.41 mg/L	0.42 mg/L

68% Chemical Savings
$45,000 saved in 6 months

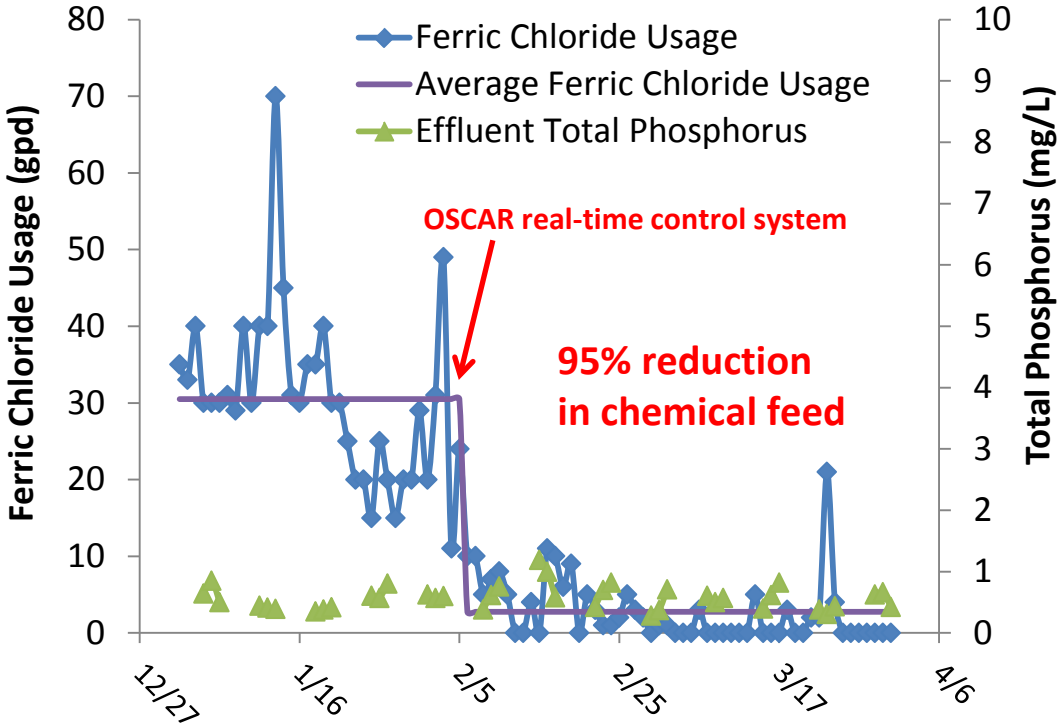
Other stories

- Beaver Dam, WI – published info from Hach
  - Automated dosing system showed 56% savings on ferric chloride feed

Ferric Chloride Savings (160 Day Period)			
Before		**After**	
Dose	12.5	PRTC Dose (average)	5.55
Gallons Consumed	48,000	Gallons Consumed	21,312
		Gallons Saved	**26,668**
		% Saved	**56%**

Other stories

- Black River Falls, WI – provided by Xylem
  - Automated dosing system showed 95% savings on ferric chloride feed



Wrap-Up

- Composite samples don't always tell the story
- Optimization requires more information
  - Real-time feedback = online analysis
- Ortho-P analyzers can provide that real-time feedback
- These success stories illustrate the benefit

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