Phosphorus Removal

Enhanced coagulation drives plant efficiency and performance

THE CHALLENGE

A 770,000 GPD municipal wastewater treatment plant discharging to a stream leading to Lake Erie was having difficulty meeting its total aluminum (1.1 mg/L) and total phosphorus (1.0 mg/L) permits. After months of dosing 60 ppm_v of either ferric chloride or PAC prior to the secondary clarifier, the plant was unable to meet its permit limits. Attempts to meet the permit by increasing the dosage rate of either coagulant were unsuccessful. When higher doses of ferric chloride were attempted, buried chemical feed lines corroded, leading to expensive repairs. Higher doses of PAC caused aluminum concentrations in the final effluent to exceed the plant's aluminum permit. Since the plant was running out of options, plant management decided to conduct a full-scale trial with NeoWaterFX$_{100}$.

TRIAL OVERVIEW AND RESULTS

The plant process is shown in Figure 1. NeoWaterFX$_{100}$ was dosed into both the primary and secondary clarifiers beginning October 2014.

Figure 1: Plant Process Diagram

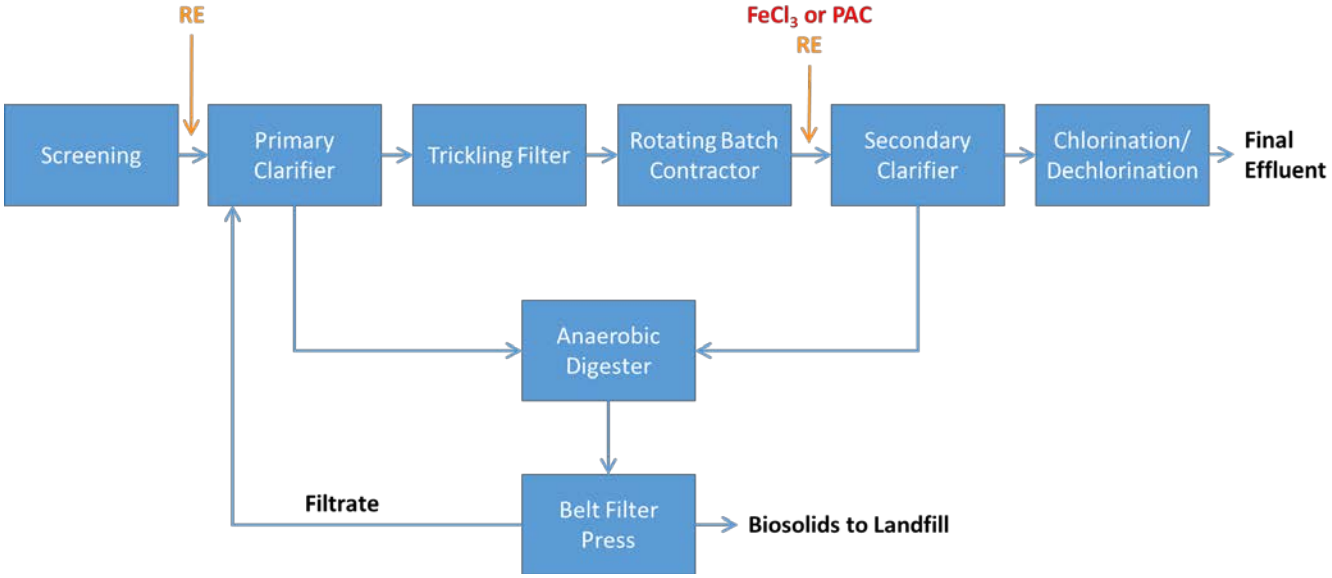
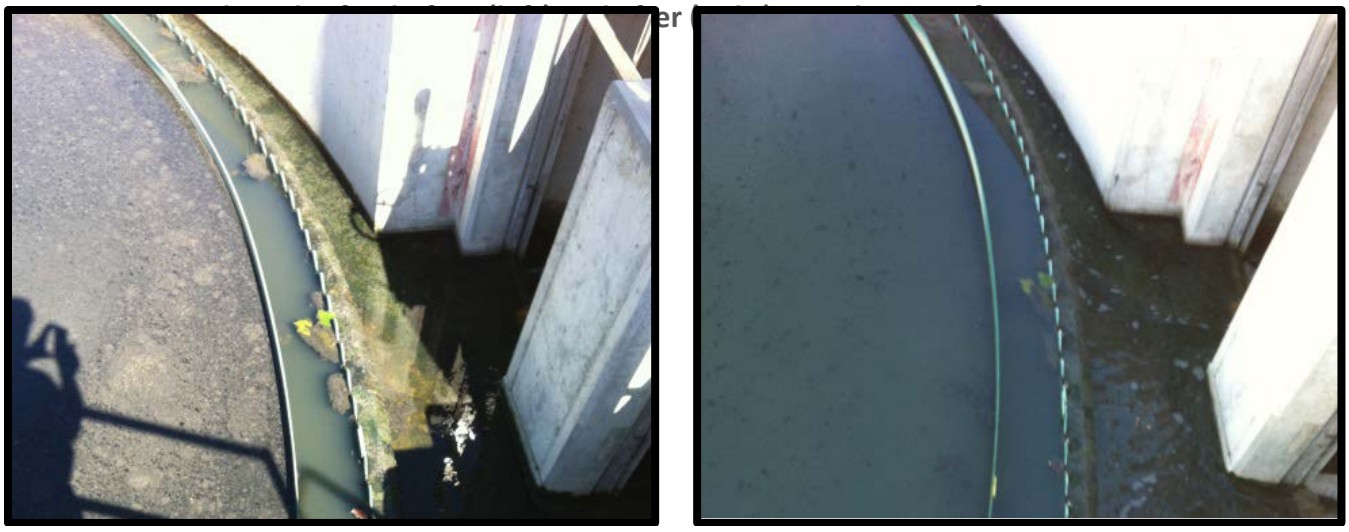


Figure 2. NeoWaterFX$_{100}$ totes awaiting use in the trial on a -25°F day

Prior to the trial, the clarifiers did a poor job of settling solids. To improve solids removal in the primary clarifier, 16 ppmv of NeoWaterFX$_{100}$ was added. In the secondary clarifier, 100 ppmv of NeoWaterFX$_{100}$ was added to improve settling and to bring the phosphorus and aluminum quickly into compliance. Figure 3 below shows how the secondary clarifier's appearance improved after 48 hours of NeoWaterFX$_{100}$ dosing.



As shown in Figures 4(a) and 4(b), on the following page, NeoWaterFX$_{100}$ successfully reduced phosphorus within the first month to meet permit limits. After only four days of NeoWaterFX$_{100}$ dosing, the phosphorus dropped from 1.5 ppm TP to below 0.5 ppm TP.

Better coagulation led to improvements in other plant process parameters, as shown in Table II below. With NeoWaterFX$_{100}$, BOD, ammonia, and fecal coliform removals were higher, and sludge landfill costs on a $-per-dry-solids-basis were 25% lower. The plant also noticed that the rotating batch contactor (RBC) blowers are activated less frequently, which results in lower electricity usage. Lower BOD, in particular, may contribute to less growth on the RBCs, reducing the air flow needed to slough off excess biomass.

Table II. Other benefits observed

Parameter	Ferric Chloride/PAC	NeoWaterFX$_{100}$
Inlet BOD, mg/L	135.3	112.8
Outlet BOD, mg/L	11.4	4.9
BOD Reduction, %	*91.6%*	*95.6%*
Inlet Ammonia, mg/L	13.2	14.3
Outlet Ammonia, mg/L	1.4	1.0
% Ammonia Reduction	*89.4%*	*93.0%*
Fecal coliform, cfu	19.7	6.3
Disposal Cost, $/wet ton sludge	$102.90	$102.90
Disposal Cost, $/dry ton solids	$655	$488

CONCLUSION

NeoWaterFX$_{100}$ dramatically improved solids settling in the plant's clarifiers, which positively impacted plant efficiency and performance. Since October 2014, this plant has been in total compliance with its NPDES discharge permits. The higher solids content in the belt filter press cake and reduced polymer usage has allowed the plant to lower its per-unit costs of dry solids disposal. The plant is continuing to optimize the process and quantify reduced electricity usage to determine additional cost savings.

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