Optimization of WWTPs

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Purpose of Optimization

• Improve effluent quality
• Minimize costs of operations
• Alternatives to capital upgrades
Involves all aspects of a WWTPs life

- Operations & Maintenance
  - Improve performance of unit processes
  - Fine tune a process control strategy
- Energy Use
  - Aeration & Digestion
  - Pumping
- Increase level of treatment
  - To achieve permit compliance
  - Add nutrient removal

Range of potential improvements

- Process Control
  - Get the plant back into compliance
  - Improve sludge wasting - #1 issue
- Improve Performance – limited nutrient removal
  - Aeration control
  - MCRT / F:M / Sludge Age
  - Re- location of chemical addition
Range of potential improvements, con’t

• Going beyond initial design (limited applications)
  • Improving nitrification (E.g., alkalinity limited, aeration control)
  • Generally adding denitrification (E.g., on/off aeration, anoxic zone)
  • Energy improvements (E.g., too much air)
• Available tankage – loss of future capacity
  • Aeration tank ORP studies
  • Clarifier dye studies
  • Detention time calculations

Enhanced Nutrient Removal

• Generally, this is outside the scope of optimization.
Operator Training Required

- Most optimization projects fail due to a lack of training operators to maintain new processes.
- Requires basic training on new processes.
- Needs to develop a new process control strategy based on the facility.
- Several weeks of follow-up to insure correct decisions are made.

Best Candidates for Optimization

- Extended aeration activated sludge to BNR levels.
- When actual flows are significantly less than design.
- Potential exists to add new zones to aeration tanks.
- Aeration systems are generally over designed.
- Sufficient nutrients in the influent.
Nitrogen Removal – good potential

- Requirements to remove ammonia is generally well known.
- Going next step to remove total nitrogen is not well understood by the operators.

Phosphorus

- Chemical addition has been around for a long time and the principles are understood by the operators
- Fine tuning chemical addition is an art.
- Biological removal is not well understood by the operators.
  - I.e., VFA’s role, required ORP/O₂ levels,
- Side-stream impacts makes things complicated.
  - Aerobic digestions – shut off to decant, release P
  - Anaerobic digestions – release P
My Approach to Optimization – 4C’s

Based on the principles of first-aid!

• Check the scene
  • Plant tour
  • Discussion with operator
    • Process Control Strategy & testing
    • How they calculate their WAS
    • Aeration
    • RAS control
    • Chemical Addition
  • Review Actual vs. Design conditions
My Approach to Optimization – 4C’s

• Check the scene
• Check the victim
  • Do you have the operator’s buy-in?
  • This is critical to the success of optimization
    • West Goshen – great potential / rejected assistance
    • Morrisville – Delayed acceptance / limited results
    • Montrose – Cautious acceptance / well within new CB permit
    • Bryn Athyn – Enthusiastic acceptance / DIY upgrade for nutrient removal

My Approach to Optimization – 4C’s

• Check the scene
• Check the victim
• Call 911
  • Bring in experts as needed.
My Approach to Optimization – 4C’s

• Check the scene
• Check the victim
• Call 911
• Care for the conditions you find
  • Identify performance limiting factors
  • Prepare a report
  • Include a training plan

West Goshen
Primary Tanks

Trickling Filters – one abandoned
Aeration tanks + chemical feed

Anaerobic Digesters
Concept was to re-purpose existing tanks

- Reuse tankage
  - Primary becomes anaerobic zone
  - Trickling Filters – (1) anoxic, (2) oxic
  - Old digesters for side stream treatment
- Add another chemical addition location

Morrisville

- Process Control implementation.
- Wasting based on MCRT.
- Identified needed metering.
- PaDEP involvement.
Pottstown

- On/Off Aeration
- Establishes an anoxic zone
- Total N removal
- Saves energy
- Saves chemicals

Bryn Athyn

- Needed to meet a new Total Nitrogen limit of 10 mg/L.
- Plant is a small extended aeration facility.
- Actual flows is about half of the design with very low influent BOD.
- Past technical assistance shut off one of the two aeration tanks.
- New superintendent asked for help!
Re-claim “un-used” part of aeration tank

Central Delaware County Authority

- Three new municipalities joined the Authority
- 70 year old force main (24”) needs to be replaced with a 30” diameter pipe.
- Pump Station upgrade from 4 – 100 HP motors to 4 – 200 HP motors.
- Energy Team analyzed the their current and potential energy costs.
Central Delaware County Authority

- Proposed going with a 36” force main and reducing motors to 150 HP.
- Authority Engineer determined this would meet design requirements.
- Force Main costs an extra $200,000 more to build.
- Return on Investment in 12 years.

Questions?

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