Optimization of WWTPs

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Purpose of Optimization

- Improve effluent quality
- Minimize costs of operations
- Alternatives to capital upgrades

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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

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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

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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

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Enhanced Nutrient Removal

- Generally, this is outside the scope of optimization.

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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.

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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.

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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.

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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/O_2 levels,
- Side-stream impacts makes things complicated.
  - Aerobic digestions – shut off to decant, release P
  - Anaerobic digestions – release P

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My Approach to Optimization – 4C's

Based on the principles of first-aid!

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My Approach to Optimization – 4C's

- 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

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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

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My Approach to Optimization – 4C's

- Check the scene
- Check the victim
- Call 911
  - Bring in experts as needed.

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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

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West Goshen

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Primary Tanks

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Trickling Filters – one abandoned

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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

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Morrisville

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

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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!

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Re-claim “un-used” part of aeration tank

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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.

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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.

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Questions?

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