Improvements for Nutrient Removal at a Package Plant

Package Plant Nutrient Management
The Teams

- Regional Sewer District
  - Collections
  - Engineers
  - Maintenance/Electronic Maintenance
  - Operations
- Consulting Engineers
What

- TIN and TN limits
- Current Improvements
- Nutrient Profiling
- Future Improvements
  - Package Plant Upgrades
  - Studies
- CIP vs In-House
  - Fine-bubble diffusers
  - Mixers
Where

- Package Plants
- Tartan Fields
- Scioto Reserve
- Lower Scioto
When and Why

> Implementation of the LAMP permits
> Regulatory-driven
Where We Left Off

- Hydraulic Improvements to Tartan
Hydraulics First, Biology Next
TF Drawbacks

- No EQ
- Sludge Holding Tank
  - Storage Space
  - Decanting
- RAS control
- New Neighbors/odor control
How SR differs

- Aeration in hand
- Parallel tanks/two plants
- Less corrosion
Modeling

- OECC
- Lower Scioto
- Tartan Fields
- Northstar
Nutrient Reduction is for Everyone!

- Nitrification/Denitrification
- Make an anoxic zone in your aeration tank
  - Blower Timers
  - Sampling
  - Settlometer
Settlometer vs Centrifuge
Nitrification

- Oxygen
- Time
- Temperature
- MLSS
- Alkalinity
Denitrification

- Nitrate
- Time
- Temperature
- MLSS
- Alkalinity
Nitrate Recycle
Not RAS
To feed or not to feed (Carbon)
IMLR at Tartan
Mixing

- Course Bubble
- Floating Surface
Mini Mixing Study

- Course bubble mixing
- Lower Scioto vs Northstar
- DO profiling
Nitrite Shunt

- Nitrification/Denitrification Shortcut
- Simultaneous nitrification/denitrification
- Ammonium to Nitrite to Nitrogen Gas
- Nitrite oxidizing bacteria repressed
  - Low DO?
Nitrite Lock

- Typical Effluent Nitrite is less than 1 mg/L
- Nitrite interferes with Cl₂ residual
  - 1 mg/L of Nitrite consumes 2 mg/L of Cl₂ residual
- Short aeration detention time
- Ammonia oxidizing bacteria
  - Nitrite oxidizing bacteria?
Current Process Control

- Ammonia results in 18 minutes
- Nitrate results in 5 minutes
- Anoxic Zones
- Aeration Zones
- Nutrient Probes for Real-time results
Monthly Nutrient Profiling

- Ammonia
- Nitrate
- Orthophosphate
Nutrient Profiling

- Influent
- Digester Decent
- Anoxic Tank
- RAS
- Aeration Tank
- Clarifier
- Effluent
Influent

- CBOD
- Ammonia
- Nitrate
- Total Phosphorus
## Decent Numbers

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<th>Ammonia</th>
<th>Nitrate</th>
<th>Ortho-Phosphate</th>
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<td>Effluent</td>
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<td>Northstar</td>
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Lower Scioto Treatability
Package Plant Upgrades

- Tartan Fields
- Scioto Reserve
- Lower Scioto
Other Package Plants

- Future NPDES discharge for Northstar
- Ammonia Limits for three smaller package plants
You Nutrient Team
Lower Scioto Nitrate Spike

![Graph showing influent and effluent nitrate levels from September 2017 to February 2019. The graph indicates a nitrate spike in October 2018.](image-url)
Ortho-Phosphate at TF

Dec-17 Apr-18 Jul-18 Oct-18 Feb-19 May-19 Aug-19

Influent  Effluent
Future Projects

- High Ammonia at Scioto Reserve
- Low Ammonia at Lower Scioto
- IMLR pump at Tartan Fields
- Nutrient Modeling At Northstar
- Blowers at Lower Scioto
  - Constant air vs cyclic aeration
"You really have to do the lab work, and you have to do the documentation, so you know that when a change is made, this is what you got. And then look at trends to know what happened over a period of time."

-Tim Pfeifer, Slinger (WI) WRF
Thank You!

To all the operators and engineers contributing to these projects!
Questions

FEATURED NEWS

Maintain Your Drain
Posted Monday, June 4, 2018

Cease the Grease
Posted Monday, June 4, 2018

Keep Wipes out of Pipes
Posted Monday, June 4, 2018
Bug’s Menu

- Dissolved Oxygen
- Nitrate
- Sulfate