Solutions to Mitigate Effects of *Microthrix parvicella* at the Meridian WWTP
Outline

• Background
  • Meridian WWTP
  • What is Microthrix?
  • Meridian’s Experiences with Microthrix

• Investigating solutions

• Concluding remarks
Background
Meridian WWTP

- 6 mgd ADF
- Screenings, grit removal, primary clarifiers
- Secondary treatment pump station
- BNR activated sludge secondary treatment
- UV disinfection, filtration for reclaimed water
- Mesophilic anaerobic digestion
What is *Microthrix Parvicella* (MP)?
- Bête noir of filaments

- Gram positive, un-branched filament
- Surveys in many countries show MP dominates bulking sludges and foams
- Favored by:
  - Long SRTs (BNR Plants)
  - Alternating aerated/ non-aerated zones (BNR plants)
  - Foam trapping environments
  - Low T (Winter/Spring)
  - Long Chain Fatty Acids (LCFA) food source (FOG)
Why is Microthrix a Problem?

• Foaming
  • Aesthetics
  • Carryover to effluent
  • Breeding ground for filaments
  • Digester foaming

• Poor Settling
  • Formation of high sludge blankets
  • High effluent TSS
  • Loss of Clarifier capacity

• Requires low SRT to wash out or chemicals to kill
  • Nitrification can be a problem with both solutions
Meridian *Microthrix* Issues

Seasonal MP blooms (winter and spring) lead to:

- *Microthrix* bulking = reduced capacity of clarifiers
- *Microthrix* foam leads to high TSS = increased filter backwashing

![Biological foam on AS basin](image-url)
Meridian *Microthrix* Control Methods

- Reduce SRT and/or add chlorine for bulking control
  - Inhibited nitrification
  - Increased effluent TSS
- High effluent TSS = reduced tertiary filter capacity
- No nitrification = no reclaimed water production
  - 15.5 mg/L TN limit
City Needed Help Controlling MP

- BC retained to review entire process
Investigating Solutions

How can *Microthrix* be controlled?
Control of *Microthrix*

Various control measures exist for controlling *Microthrix parvicella*

- Eliminate FOG/food sources
  - Addresses cause of filament growth
  - Difficult to accomplish

- Lower SRT, wash out filaments
  - Simple, addresses cause
  - Washes out filaments
  - Loss of nitrification, more WAS

- Surface spraying of foam (polymer, hypo)
  - Difficult to do if covered tanks, maintenance
  - Treats symptom, not cause
Control of *Microthrix*

Various control measures exist for *Microthrix parvicella*

- RAS injection of chemical (Cl₂)
  - Loss of nitrification, increased eff TSS
- Digester modifications (water sprays, submerged fixed cover)
  - Treats symptom, not cause
  - Expensive
- PAX addition
  - Specific to Microthrix, treats cause
- Surface wasting of ML (Classifying Selector) and/or foam
  - Eliminates *Microthrix* at source
Investigating Solutions

Can we eliminate the food source?
BC led investigations – eliminate source of food

- Operator visual inspection for grease conducted
  - No significant grease noted at plant

- Wastewater characterization conducted looking for food sources
  - No significant VFAs inside plant
  - Some external VFAs, but not traced to point source

- Eliminate grease/food not an option
Investigating Solutions

Can we change the SRT?
BC led investigations – SRT Control

Nitrification Occurs

Nitrification Does Not Occur

Need >6 day SRT in spring for complete nitrification – SRT CONTROL WON’T WORK
Investigating Solutions

Chemical addition without detrimental effects?
BC led investigations – add Polyaluminum Chloride (PAX)

- *MP* sensitivity to PAX-14 (no other PAX forms found effective)
  - pre-polymerized aluminum hydroxide
  - Used extensively in Europe for control of MP
- PAX diminishes *MP* ability to use lipids
  - Effectively “starves” *MP*
BC led investigations – effects of adding PAX
BC led investigations – effects of adding PAX

SVI (mL/g)

Nov-10 Feb-11 Jun-11 Sep-11 Dec-11 Apr-12 Jul-12 Oct-12 Jan-13
Investigating Solutions

Can we eliminate the *Microthrix* through alternate means?
BC led investigations – eliminate Microthrix
BC led investigations – eliminate foam trapping structures

Secondary Pump Station is significant grease and foam trapping structure

- RAS and Primary Effluent mixed in wet well
  - Provides food for filament growth
- Low level of aeration, bubble formation due to pump intake turbulence
  - Promotes filament growth, foam formation
- Submerged withdraw from wet well keeps foam trapped
  - Seeds MP from foam in SPS to ABs even with foam control in ABs
BC led investigations – eliminate breeding ground of *M. Parvicella*

- MP laced foam trapped in Secondary Pump Station
- Seeds MP into the aeration tank
- Leads to foaming in aeration basin
- Gets into mixed liquor and leads to poor settling sludge in the clarifier
BC led investigations – Foam Wasting

• When foam concentrates at surface, MP retained longer than average biomass
• Foam trapping aggravates problem and must be minimized for effective control
• Surface foam removal removes foaming filaments first rather than last, eliminating nuisance foams
Classifying Selector Arrangement

Implemented at Dublin San Ramon, CA; El Paso, TX; Minn-St. Paul, MN; Atlanta, GA; Appleton, WI
Eliminating MP in Meridian

• Install a classifying selector to remove foam continuously and prevent buildup
• Makes operation feasible at high SRT, allows for year round nitrification
• Eliminate MP Breeding ground
• Continuous wasting eliminates foam plantwide
• Preferred solids wasting means
Eliminating MP in Meridian
Eliminate foam trapping - Repipe RAS

• Re-use existing pipeline
• Pipe directly into AB (remove foam trapping in SPS)
• Separate RAS and PE

Reroute RAS directly to Aeration Basin
NOTE: PIPING FOR AERATION BASINS 3 AND 4 SIMILAR.
Eliminate Foam Trapping - New RAS Pump Station

- No longer use SPS to pump RAS
- Gravity RAS return to wet well
- Lift RAS into each aeration tank
Meridian Classifying selectors

- Baffles at AB exit
- ML Pump stations
- 3,000 gal wet well
- 6 in dia suction pipe-short length
- 400-500 gpm pumps
Classifying selectors have downsides

- Continuous surface wasting = thin WAS
- Thickening prior to digestion is very important
  - Meridian has DAFTs for WAS thickening – ideal for thin WAS because not hydraulically limited
- Results of non-continuous wasting
  - Remove foam when it becomes a problem
  - Can still lead to bulking and may require secondary bulking control method like PAX addition
  - Could lead to Digester foaming
Investigating Solutions

What’s the most cost effective solution?
PAX vs. Classifying Selector - Which is better solution?

- PAX is good emergency fix

- Long term solution:
  - PAX has relatively low capital but high chemical costs
  - Classifying selector has relatively high capital cost and low operating cost

- Present worth analysis performed
Present worth analysis

- PAX vs Classifying Selector
- PAX slightly more expensive

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Note: “Status quo” refers to Alternative 1
Make entries in yellow cells only
Concluding Remarks
Meridian has been able to successfully control *Microthrix*

- PAX 14 addition proved to be an effective short-term solution for eliminating *Microthrix*
- A classifying selector proves to be the most cost effective long-term solution at controlling *Microthrix*
  - Requires continuous surface wasting – no more RAS wasting
  - DAFTs will prove invaluable at thickening the mixed liquor prior to digestion
Questions
Meridian Microthrix Issues-Add PAX

- Pax
- 150-190 gpd initially
- 25-30 gpd maintenance
- $3.50/gallon
  - Poly aluminum chloride (PAX) addition is effective
    - Expensive
    - “Chemically Dependent”