Implementation of the Tertiary MBR to Meet Today’s Industrial Water Demands and Solve Tomorrow’s Reuse Challenges

2016 Arizona Water Reuse Symposium

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Overview

MBR Experience

MBR Evolution

Definitions

MBR Process

WBMWD Drivers

Project Progression

Designing for the Future with Operations in Mind
MBR Experience

• Hazen and Sawyer: 10+ Recent MBR Projects

• Personal MBR Experience:
  • Carson Tertiary MBR (TMBR)
    • MBR Operator and Field Engineer
    • Proof of Concept Pilot
    • Process Engineer on 2.0 MGD TMBR Design
  • Process Troubleshooting (Multiple Clients)
    • Biological process modeling/optimization
    • Foam control and mitigation
MBR Evolution

Yamamoto et al. 1989

Definitions

• Recovery – Permeate/Feed
• Flux – Throughput per membrane area.
  • Gallons per square foot per day (gfd)
• Air Scour – Aeration used to remove solids from membranes
• CIP – Clean In Place. Chemical cleaning of membranes in tank
• Backwash – Intermittent reverse flow to remove solids from membranes
• Enhanced Backwash – Reverse flow with brief chemical dosing used to increase CIP interval (Chemical Enhanced Backwash, Enhanced Flux Maintenance)
MBR and CAS Process

**MBR**
- MLSS Conc.: 6 to 10 g/L
- RAS Flow: 2-5 Q

**CAS**
- MLSS Conc.: 2 to 5 g/L
- RAS Flow: 0.5 to 1 Q
MBR Process

- Mixed Liquor from Aeration Tank
- Membranes
- Mixed Liquor Return
- Scour Air
- Backwash
- Gross Filtrate (Inst. Flux)
- Cleaning Chemical
- Net Filtrate (Ave. Flux)
West Basin Municipal Water District

Innovative District – Water and Recycled Water to 185 sq. mile service area (~1 M people)

Designer Water: Irrigation, Cooling Tower, Seawater Barrier and Groundwater Replenishment, Low and High Pressure Boiler Feed
Project Drivers

Legend
- Source Location
- Major Customer
- Seawater Barrier
- US Highway
- State Highway
- Streets

Tesoro Refinery
CRWRF
EMWRF
HSEPS
CNF
ELWRF
West Coast Barrier Blend Station
Inglewood Temporary Disinfection Station
American Honda Lateral Disinfection Station
Dominguez Gap Barrier Blend Station
Hyperion WWTP
Pacific Ocean
Project Drivers

• Compact Footprint
• Adaptable and Robust treatment for Variable Influent Quality
• Submerged Membrane Filtration
• Excellent and Consistent Effluent Quality
• Easily Expandable Design
• High On-line Factor
Innovative Process – The Overall Flow Scheme

Los Angeles → HWRP → ECLWRF → CRWRF Nit. Product → Tesoro Refinery

HWRP Secondary Effluent
- NH3-N: 48
- TSS: 25
- NTU: 10

ECLWRF T22
- NH3-N: 48
- TSS: 5
- NTU: 3

CRWRF Nit. Product
- NH3-N: 0.1
- TSS: <0.2
- NTU: <0.5
Project Progression

Technology Evaluation

Validation Pilot Testing

30% Design

60%, 90%, 100% Design

Construction – Startup – Implementation
Technology Evaluation

- BAFs
- MBBR
- SBR
- TMBR
Project Progression - Piloting

- Proof of concept pilot
- Excellent robust performance
- Minor Pilot Challenges
Project Progression - Piloting
Piloting Progression – 30% Design

- Reviewed Multiple Capacity Options
  - Partial or Complete MF Replacement
  - 2 – 3 mgd TMBR
  - Potential Biofor build out
- Developed 30% PDR and Cost Estimate
- Laid foundation for current project
Project Progression – 60% Design

- Builds upon 30% design
- Independent review and improvement of design
- 2nd Piloting Round – Operator Training
Project Progression – 60% Design
Designing for Today and the Future
Designing for Today and the Future

- Open membrane system approach
- Provides district flexibility for future installations
- Tankage and support equipment designed to suit multiple vendors
Designing for Today and the Future

- In place Clean Water Flux  Flexible System (blowers and chem addition)
Project Progression – 90% and 100% Design

- Finalize Design
- Membrane Pre-Selection
- Potentially Pilot Selected Membrane
Project Progression – Construction and Startup

• MOPO incorporated into design

• Key to maintain plant production during startup and testing
Key Advantages Recap

- Superior Water Quality
  - Cooling Tower Feed – no ammonia or particulates
  - Boiler Feed – suitable for feed to RO
- Robust Treatment of Variable Influent
- Designed with Operations in Mind
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