Traverse City Regional Wastewater Treatment Plant Membrane Technology



City Commission and Grand Traverse County Board of Public Works Joint Study Session

December 9, 2013

Agenda

- Background
- Current situation
- Recommendations
- Discussion

Background

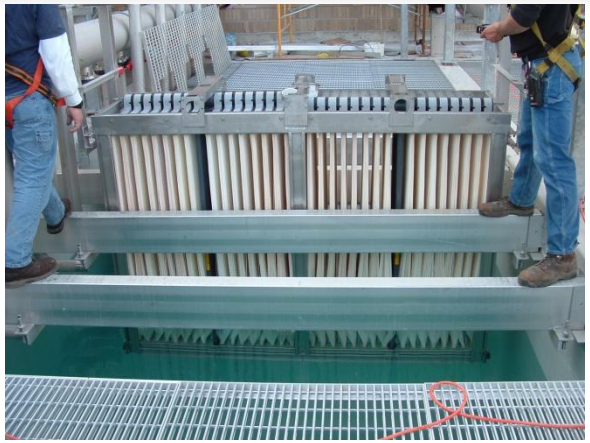
- CH2M Hill has operated the Traverse City RWWTP since 1990
- Plant was converted to membrane bioreactor (MBR) process:
  - To increase capacity (based on flow projections)
  - To improve effluent quality (new discharge limits)
  - To fit within existing fence line (maintain adjacent park and defer construction on separate site)
- Began producing high-quality, membrane-filtered effluent July 2004
- Largest MBR facility in North America at the time (now #15)
- Excellent record of discharge permit compliance

Current Situation

- Typical membrane life
  - 8-10 years
  - End of life is not reached suddenly – potting failure and/or gradual increase in pressure and chemical cleaning requirement
- TCRWWTP membranes
  - Approaching 10 years of service
  - Plant is operating at 60% of design capacity
  - Historical low operating flux and gentle cleaning could extend membrane life
  - However, stainless steel cassettes are showing wear and have been repaired
- Episodes of impaired membrane productivity
  - Not reported elsewhere - apparently unique to TCRWWTP
  - Cause and prevention uncertain - actively being studied
  - Unpredictable - risk of not being able to process flow as quickly as it arrives

Michael Richard, PhD wrote, "*The Gram positive commas were not in the flocs, but dispersed and in clump… These cause membrane plugging because of their small size, dispersed nature and positive charge…*"

Traverse City RWWTP Membrane Photos



2004 (new)

2006

Recommendations

- Mitigate risk of impaired membrane productivity:
  - As soon as practical, install new membranes (modules and cassettes) in one membrane train
  - Redistribute membranes cassettes from that train to available spaces in the other trains (no waste of residual membrane life)
  - Increased membrane area (reduced flux) will allow more flow to be processed during impaired productivity events
  - Assess whether membrane age is a factor
- Monitor membrane performance and replace membranes in other trains on an as-needed basis
- Budget for replacement of membranes in other trains (half in 2015 and half in 2016)

Membrane Replacement

- ZENON 500C membranes currently installed (500C32M)
- General Electric (GE) purchased ZENON in 2006
- GE uses 500D membranes for its latest designs
  - Will not manufacturer 500C membranes indefinitely; expectation is 2 to 4 more years
  - Standard 500D48M cassette will not fit at TCRWWTP
  - However, short 500D modules in smaller cassettes will fit

1-1/2 of these (500D16M + 500D8M) fill the space of one existing 500C32M cassette

500C32M
(non-standard)

500C22M
(standard)

500D48M
(standard)

500D16M
(standard)

Membrane Replacement Options

- Install new 500D membranes and cassettes in one train
  - $825,000 per train
  - Recommended because this achieves goal of adding membrane area
  - Once 500D cassettes are installed, subsequent module replacement without cassette frames would cost ~$740,000 per train (preliminary estimate)
- Install new 500C membranes in existing cassette frames
  - $650,000 per train
  - Not recommended because this would not increase installed membrane area, and existing cassettes are showing wear
- Install new 500C membranes and cassettes
  - ~$725,000 per train (preliminary estimate)
  - Not recommended because subsequent membrane module replacement likely would require new frames (would be investing in soon-to-be obsolete cassette hardware)

Membrane Cost Increase Since Original Installation (New 500C Modules in Existing Cassette Frames)

Item	2002	2013
Canadian Consumer Price Index	100.0	123.1
Membrane modules	$377,700	$465,000
Warranty (2 years)		$9,600
Hoses & miscellaneous parts		$30,600
GE services		$90,000
SUBTOTAL		$595,200
Local sales tax @ 6%		$36,000
CH2M Hill services		$10,000
Used module disposal		$5,000
TOTAL (rounded)		$650,000