HAP CREMEAN WATER PLANT CONVERTING TO BIOLOGICALLY ACTIVE FILTRATION

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Presentation Overview

- Hap Cremean Process Flow
- Background to Filter Upgrade
- Existing Filters
- Upgraded Biologically Active Filters
- Monitoring
- Start-up Issues
- Operational Considerations
- Status of Construction
Hap Cremeann – Process Flow
Process Flow, Revised

- PAC
- Alum
  - Rapid Mix
  - Flocculation
  - Sedimentation
- Lime, Soda Ash
  - Flocculation (Softening)
  - Sedimentation (Softening)

- Carbonic Acid
- O₃
- Calcium Thiosulfate
- Chlorine, ZOP
  - Recarbonation
  - Ozonation
  - Ozonation (Fluoride)
  - Filtration (BAF)
  - Chlorine
  - NaOH
  - Clearwell Storage
  - Chlorine

- Sodium Hypochlorite (Chlorine)

Diagram includes various treatment processes and chemicals used in water treatment.
Background, Pilot-scale Demonstration Study

Ozone/BAF TOC

TOC (mg/L)

Source Water
Recarb Water
Filter 1 Effluent
Filter 2 Effluent
Filter 3 Effluent
Filter 4 Effluent

0/1/2008
5/1/2008
6/1/2008
7/1/2008
8/1/2008
8/31/2008
9/1/2008
10/1/2008
10/31/2008
11/1/2008
12/1/2008
12/31/2008
Existing Filters

- Dual cell
- Center gullet
- Leopold style clay underdrains
Upgraded Filters

- 16" Air Pipe @ EL 838.75
- 16" Motorized Butterfly Valve @ EL 833.00 (Typ)
- 16" x 6" Tee (Typ)
- 8" Vent (Typ)
- Clearwell
- 12" Sq Air Vent (Typ)
- FRP Wash Water Trough
- Dismantling Joint (Typ)
- GAC Sand
- Gravel Underdrain

Dimensions:
- EL 797.50
- EL 828.00
- EL 826.25
- EL 838.50

Brands:
- B&N
- One Water
Upgraded Filters

- New underdrain
- Air scour
- Upgraded filter consoles
- Elimination of surface wash
- Raised backwash troughs
- New dual media
Upgraded Filters

Additional Equipment
- Air Scour Blowers
- Backwash Turbidity Monitors
- Level Sensors
- Media Bed Expansion Monitors
Biologically Active Filtration

- **Particulate contaminants**
- **Assimilated organic carbon**
- **Remaining TOC**
- **TOC (AOC & DOC)**
- **Retained Particles**
- **Biofilm**
Biologically Active Filters

- Contaminant removal:
  - NOM
  - Iron
  - Color
  - Manganese
  - Chloroform
  - Selenate
  - Perchlorate
  - Chromate
  - Bromate
  - Arsenate
  - …etc.
Upgraded Filters

Factors Influencing Biological Filtration

- Media type
- Chlorination
- Filtration rate (EBCT)
- Backwashing method
- BOM loading
- Temperature
- Time since start-up
Monitoring Biologically Active Filters
Monitoring

Real-time:

- In-line turbidimeters
- Head loss
- pH
- Differential backwash pressure
- Particle counts (not being used)
Monitoring

Non Real-time:

- Heterotrophic plate count
- ATP analysis
- TOC
- DOC
- AOC
- BDOC
- Molecular Microbial Community Analysis
- SDS DBP
- SDS DBPFP
- Geosmin/MIB
- DO
Construction and Start-up Issues
Construction and Start-up

Staging
Construction and Start-up

Demolition
Construction and Start-up

Demolition
Construction and Start-up

Demolition
Construction and Start-up

Installation of new baffles
Construction and Start-up

Performance testing:
Hydraulic maldistribution
Construction and Start-up

Performance testing:
Air distribution
Construction and Start-up

Corrective Action

Diagram details:
- 16" AIR PIPE @ EL 836.75
- 16" MOTORIZED BUTTERFLY VALVE @ EL 833.00 (TYP)
- 12" SQ AIR VENT (TYP)
- 8" VENT
- CLEARWELL
- EL 797.50

Image details:
- A green machinery with a label that says "DANGER".
- The machinery appears to be part of the construction setup.
Construction and Start-up

Performance testing:
Air and water distribution after correction
Construction and Start-up

New filter control consoles
Construction and Start-up

Becoming Biologically Active

- Impacts of change in point of chlorination on pH and water stability

Diagram:
- Recarbonation
- Ozonation (Future)
- Filtration (BAF)
- Chlorine, ZOP
- NaOH (Future)
- Clearwell Storage
- Chlorine
Operational Considerations
Operational Considerations

- Appearance of biologically active filters
- Control strategies similar to conventional filtration
- Optimization
  - Headloss
  - Ripening time
Operational Considerations

- Backwashing: profiling
- Backwashing with chlorinated water
- Potential for decreased filter run times (DOC > 6 mg/L)
- Duration of filter being off-line
Operational Considerations

- Nutrient Enhancement
- EPS and Fouling
- Empty Bed Contact Time
- Water Temperature
  - biological activity
  - varying backwash rates
Status of Construction