Water Quality Effect of Wildfires & its Potential Impact on Water Treatment Facilities

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- Division of Drinking Water
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Topics

Water Quality
Post-Fire Impact

Assessment of Water Treatment Facilities

Jar Testing
Potential Increase in:

- pH & Alkalinity
- Chloride & Sulfate
- Color
- Taste & Odors
- Suspended Solids/Turbidity
- DOC/TOC/UVA
- Disinfection by Products

Water Quality – Fire Aftermath
Clear Creek, 10/4/18
First Flush (Carr Fire)
Clear Creek

Pre-Fire Water Quality

- Turbidity: 0.4 – 3.6 NTU
- pH: 7.3 – 7.5
- Alk: 34 – 38 mg/L as CaCO₃
- Nitrate: 0 mg/L as N

2018 Post Fire Water Quality (first flush, 10/5/18)

- Turbidity: 180 – 280 NTU
- pH: 8.0 – 8.1
- Alk: 65 mg/L as CaCO₃
- Nitrate: 0.4 mg/L as N
- UVT: 76.5 % (filtrate, 0.2 um)
- UVA: 0.116/cm (filtrate, 0.2 um)
- Black ash
- Settling of solids

UV absorption (UVA): Represents the amount of light absorbed by constituents within a sample stream.
UV transmittance (UVT): Represents the amount of light transmitted through a sample stream.
Whiskey Town Lake

- Clear Creek CSD – Anderson
- Inline Filtration
- Population > 8,700
- Turbidity: 0.3 – 0.5 NTU
- pH: 7.1 – 7.3
- TOC: 1.2 – 1.7 mg/L as C
- Alkalinity: 40 mg/L as CaCO₃
Facilities susceptible to high solids loading - Ranking

1. Slow-sand filtration
2. Stand-alone membrane/cartridge filtration
3. In-line filtration (coagulation/filtration)
4. Direct filtration (coagulation/flocculation/filtration)
5. Package Plants (Roberts/Tridents/Similar Technologies)
6. Conventional filtration
7. Actifloc
8. Expanded conventional filtration (pre-oxidation/GAC)
Assume Forecast of High Solids Loading/Turbidity

1. Shut-down (do you have storage to wait out storm?)
2. Intertie connection and/or well source availability
3. Slow-sand/membrane/cartridge filtration treatment plants - Consider installation of pre-treatment (i.e., inline filtration)
4. Expect frequent backwash and/or flush (inline/Direct, Package Plant)
5. Jar testing (determine coagulant dosage, settleability and filterability)
6. Call an expert for assistant on treatment
Evaluate each of your processes:

- Pre-Oxidation ($\text{KMnO}_4$, $\text{O}_3$, $\text{Cl}_2$, $\text{ClO}_2$)
- pH Adjustment (acid/base)
  - $\text{H}_2\text{SO}_4$, $\text{HCl}$, $\text{CO}_2$; $\text{NaOH}$, $\text{Na}_2\text{CO}_3$
  - Acid Alum ($\text{H}_2\text{SO}_4 + \text{Alum}$)
- Coagulation (multiple injection)
- Flocculation
- Sedimentation
- Filtration (media condition)
- GAC (age)
- Disinfection
Visual Inspection of Filter Media
Media Mounding
BWR < 10 gpm/ft²
Jar Testing to determine optimum coagulant dosage

- Floc size
- Settleability
- Filterability
- TOC reduction
- UVA/%UVT
- Keep it simple
Jar Testing

- UVT/UVA Analyzer
- Turbidity
- Laboratory Charge Analyzer
- pH probe
- Coagulant Stock Solution
- Pipette
- Jar Tester
- Syringe/Filters
ACH (Aluminum Chlorohydrate, dosed as product)
Rapid mix (200 RPM) for 1 minute followed by slow mix (28 RPM) for 5 minutes

LCA: ACH = 38.4 mg/L

32 mg/L ACH
Settled 0.6 NTU
Filtrate 0.11 NTU
UVT: 87.1%
UVA: 0.060/cm

38 mg/L ACH
Settled 1 NTU
Filtrate 0.08 NTU
UVT: 87.7%
UVA: 0.057/cm

44 mg/L ACH
Settled 0.6 NTU
Filtrate 0.08 NTU
UVT: 87.7%
UVA: 0.057/cm

50 mg/L ACH
Settled 0.6 NTU
Filtrate 0.09 NTU
UVT: 89.2%
UVA: 0.050/cm
Settled for 5 minutes and then pull-off 30 mL from each jar for filtration

French Gulch (Clear Creek source)
Jar Test by Hand

End of 5 minute slow stirring
Filterability: 0.10 NTU

End of 5 minutes settling
Filterability: 0.08 NTU

44 mg/L ACH (product)
French Gulch (Clear Creek)
Jar Test
Filterability Test
Equipment

- Turbidity Instrument
- Syringe PP/PE, luer lock tip, capacity 50 mL (part#: Z683698)
- Swinnex Filter Holder, 25 mm (part#: SX0002500)
- Isopore Membrane Filter, 1.2 um, 25 mm (part #: RTTP02500)
- http://www.sigmaaldrich.com/
Jar Test - Filterability Test

- Syringe ~ 30 mL from jar (after 5 minutes of settling)
- Filter-to-waste 2-3 mL
- Filter directly into clean cuvette
- Measure turbidity
- Note: Take several readings before recording final NTU results
Jar test procedures for systems with settling or solids removal

1. Add chemicals and flash mix for 1 minute at 200 RPM
2. Slow mix for 5 minutes at 25 – 30 RPM
3. Settle for 5 minutes
4. Syringe 30 mL from jar taken ½-inch below surface
5. Measure turbidity and %UVT
6. Continue settling for up to 25 to 30 minutes
7. Measure settled water turbidity (pull sample just below surface)
8. Filtered through 1.2 um isopore membrane into cuvette (drop rate)
Jar test procedures for inline and direct filtration plant

1. Add chemicals and flash mix for 1 minute at 200 RPM
2. Slow mix for 5 minutes at 25 – 30 RPM
3. Syringe 30 mL from jar taken ½-inch below surface
4. Filtered through 1.2 um isopore membrane into cuvette (drop rate)
5. Measure turbidity and %UVT
Take Away

- Start Preparing
- Plant Evaluation
- Jar Testing
- Collaboration
- Make it Happen
Contact

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For Stock Solution/Dosage calculations go to:
• https://www.waterboards.ca.gov/drinking_water/programs/districts/mendocino_district.html
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