VEOLIA

Contaminated Water Treatment from Site Remediation Work using Ballasted Floculation and Disc Filtration

Myriam De Ladurantaye-Noël, P. Eng.
Process Engineer- Heavy Industry

WATER TECHNOLOGIES

Introduction – Water treatment in remediation

- Remediation projects have to deal with water
  - *Dredging of sediments*
  - *Run-off water from remediation site*
- Water from remediation sites are heavy in solids, and leaching contaminants
  - *Water discharge criteria to environment are stringent*
  - *Metal concentration exceeding discharge criteria is common*

Introduction- Eastern Ontario case-study

- VEOLIA was contacted to address water management on a eastern Ontario remediation site
- Cause of the remediation: copper and zinc ore spilled alongside a railroad
- Expected contaminants in runoff water:
  - *TSS*
  - *Cu*
  - *Zn*
  - *PAH (polycyclic aromatic hydrocarbons)*

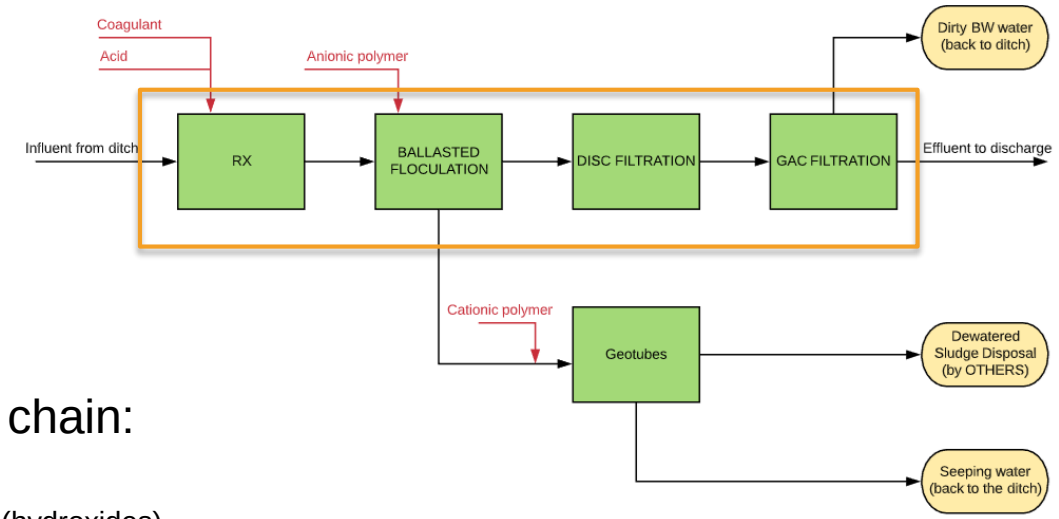
Agenda

- Proposed Water Treatment Plant (WTP)
- Principles Behind Proposed WTP
- Results from 2 years operation of the WTP
- Conclusions

Proposed Water Treatment Plant (WTP)

Eastern Ontario Remediation Site- Proposed WTP

- Technologies:
  - *ACTIFLO for metal removal*
  - *DISCFILTER filtration*
  - *Neutralization*
  - *GAC filtration for PAH removal*
- Capacity: 4 500 m^3/d



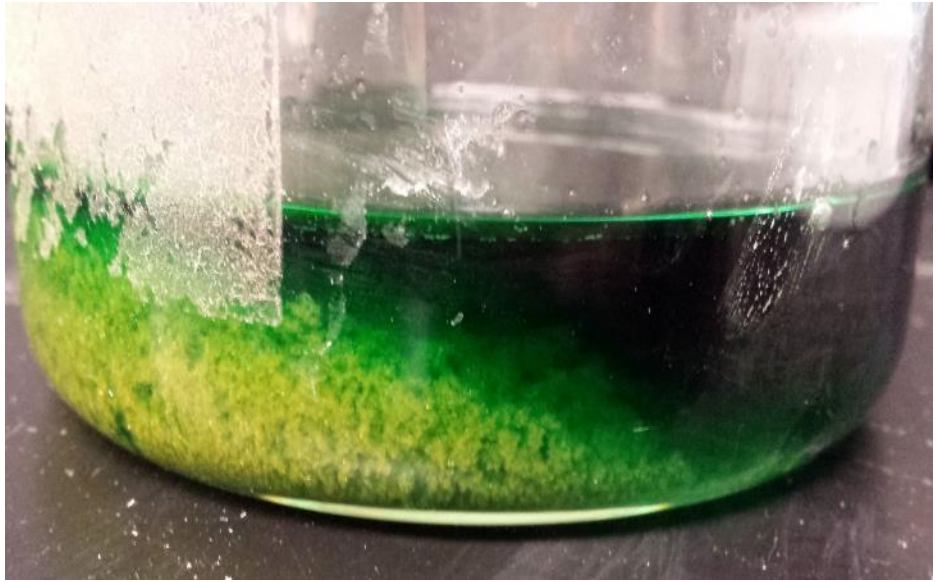
- Mechanisms in water treatment chain:
  - *Ballasted Floculation:*
    - Metals precipitation using precipitation (hydroxides)
    - Metals adsorption by surface complexation (alkaline pH)
  - *Disc Filtration*
    - Further solids separation for polishing (pinflocs)
  - *GAC Filtration:*
    - Adsorption of non-polar organics such as PAH and organic bounded metals

Principles Behind Proposed WTP

Physico-chemical Treatment – A review

- Advantage:
  - *Simple process*
  - *Flexibility according to chemical selection*
  - *Selective metal removal*
  - *No liquid waste (concentrate)*

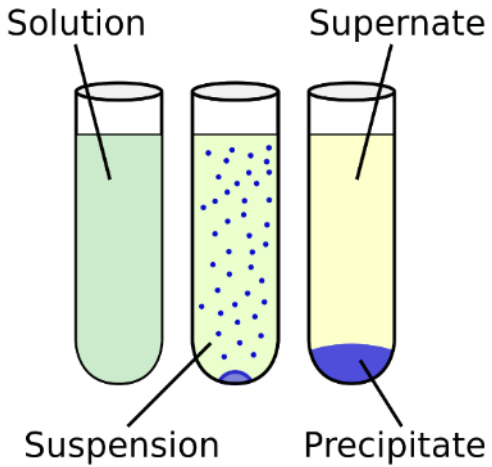
- Disadvantage:
  - *Chemical sludge handling*
  - *Chemical consumption can be high*



Metal Precipitation - Basis

- What is metals precipitation?
  - *Combination of soluble metal ions to another ion to form low solubility molecules*
  - *Solidification of the barely soluble molecule (precipitation)*

- The precipitation can happen through different paths:
  - *Hydroxides*
  - *Sulfides*
  - *Carbonates, sulfates, oxides, etc.*
  - *Surface complexation*

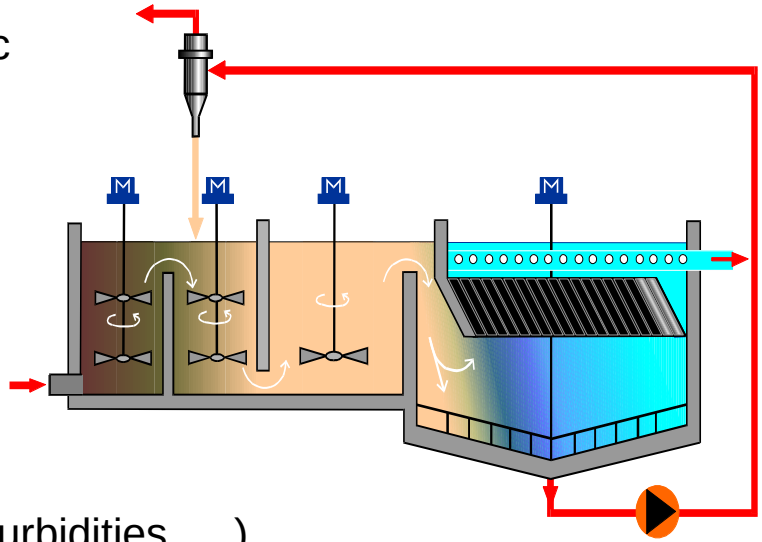


Source: Wikipedia

Solids Removal- Ballasted floculation (ACTIFLO)

ACTIFLO is a clarification process that relies on :

- Enhanced flocculation using ballasted floc
- Lamella tube settling
- Microsand recirculation
- Possibility of sludge recirculation (surface complexation)



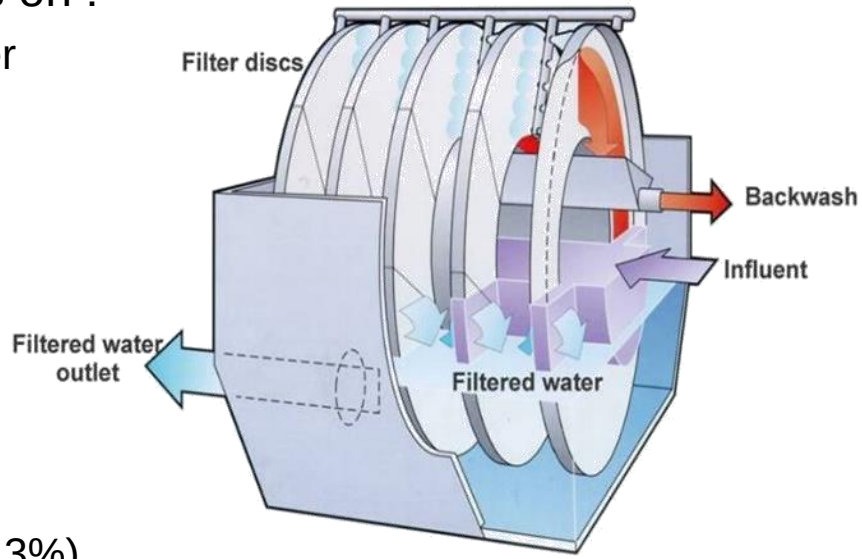
The ACTIFLO main characteristics are:

- Compact system (Short retention time)
- Efficiency in all conditions (temperature, turbidities, …)
- Easy to operate

Solids Removal - Disc Filtration (DISCFILTER)

DISCFILTER is a filtration process that relies on :

- Rotating Disc Filters in woven polyester
- Effluent filtration up to 10 micron
- Gravity Operation



The DISCFILTER main characteristics are:

- Compact system (small footprint)
- Easy operation and process control
- Continuous filtration
- Low backwash water production (1% - 3%)
- Discs media is fouling resistant, easily cleaned and corrosion proof

Eastern Ontario Remediation site

Two years of operation analysis

WATER TECHNOLOGIES

Operation Analysis – Operating conditions

Flow to be treated:

- 20 m^3/h to 155 m^3/h (average 111 m^3/h)

Duration of operation:

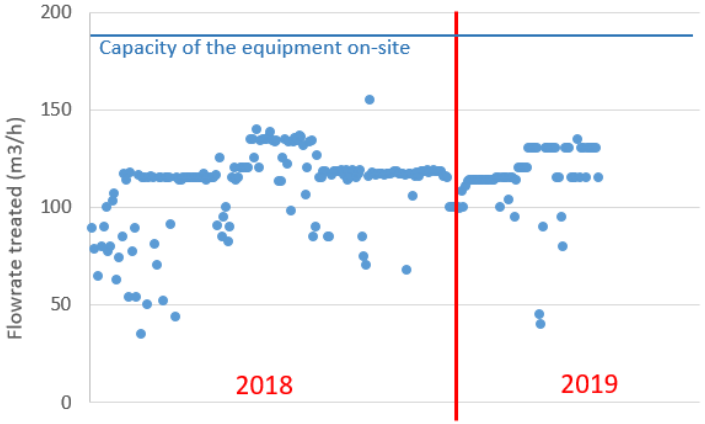
- 4 months in 2018, 3 months in 2019

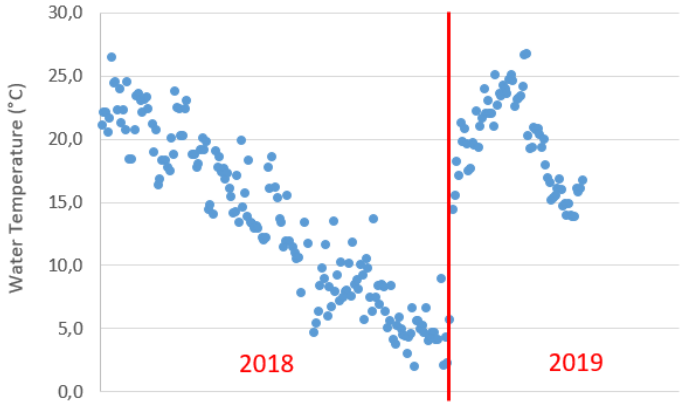
Water temperature:

- 2 °C to 26 °C

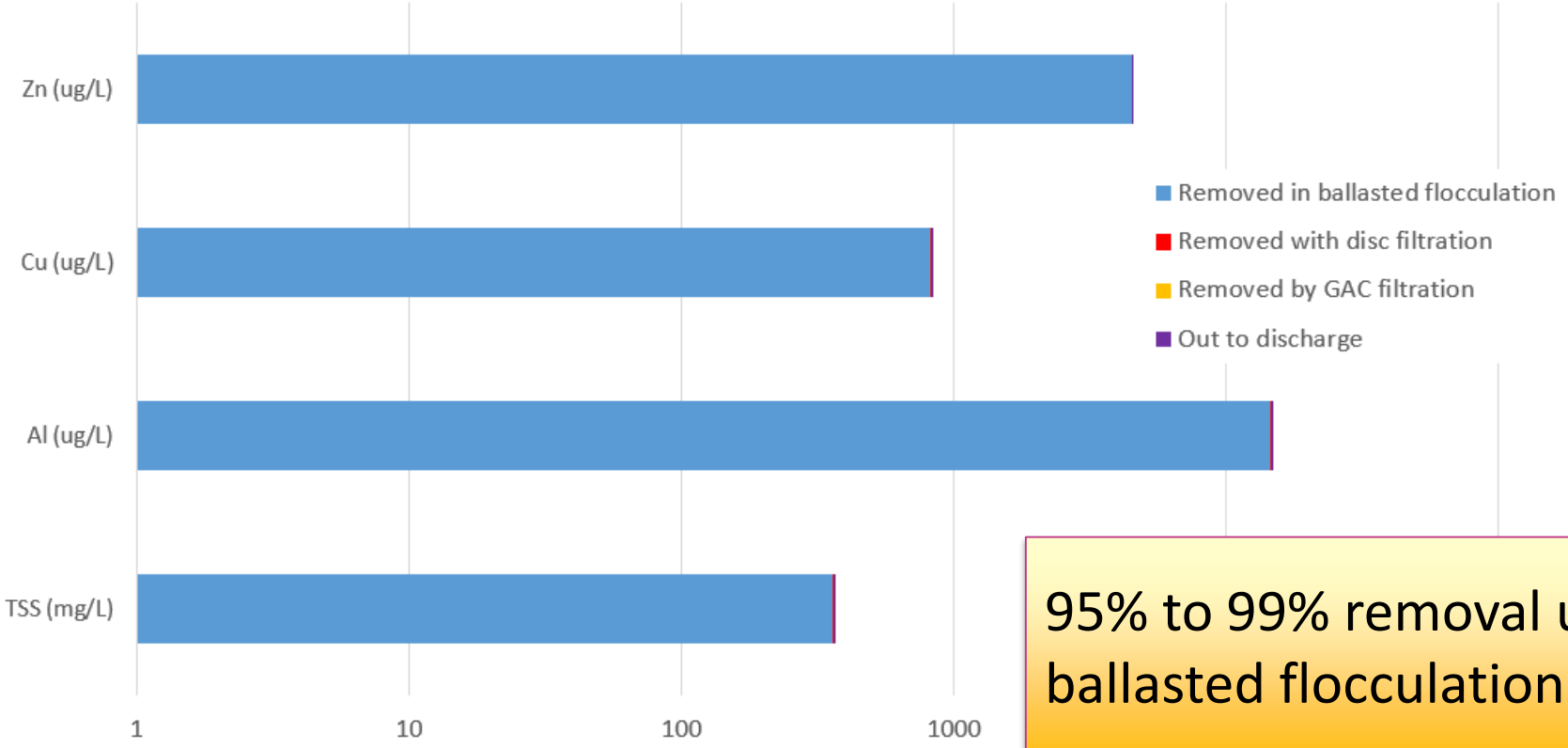
Coagulant type:

- Ferric sulfate





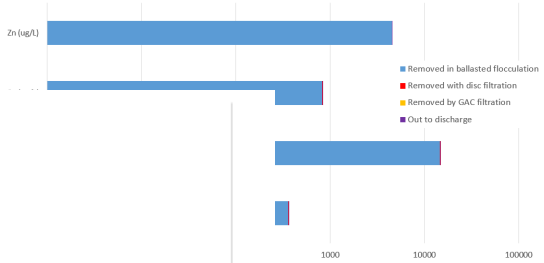
Operation Analysis – Ballasted Floculation Efficiency

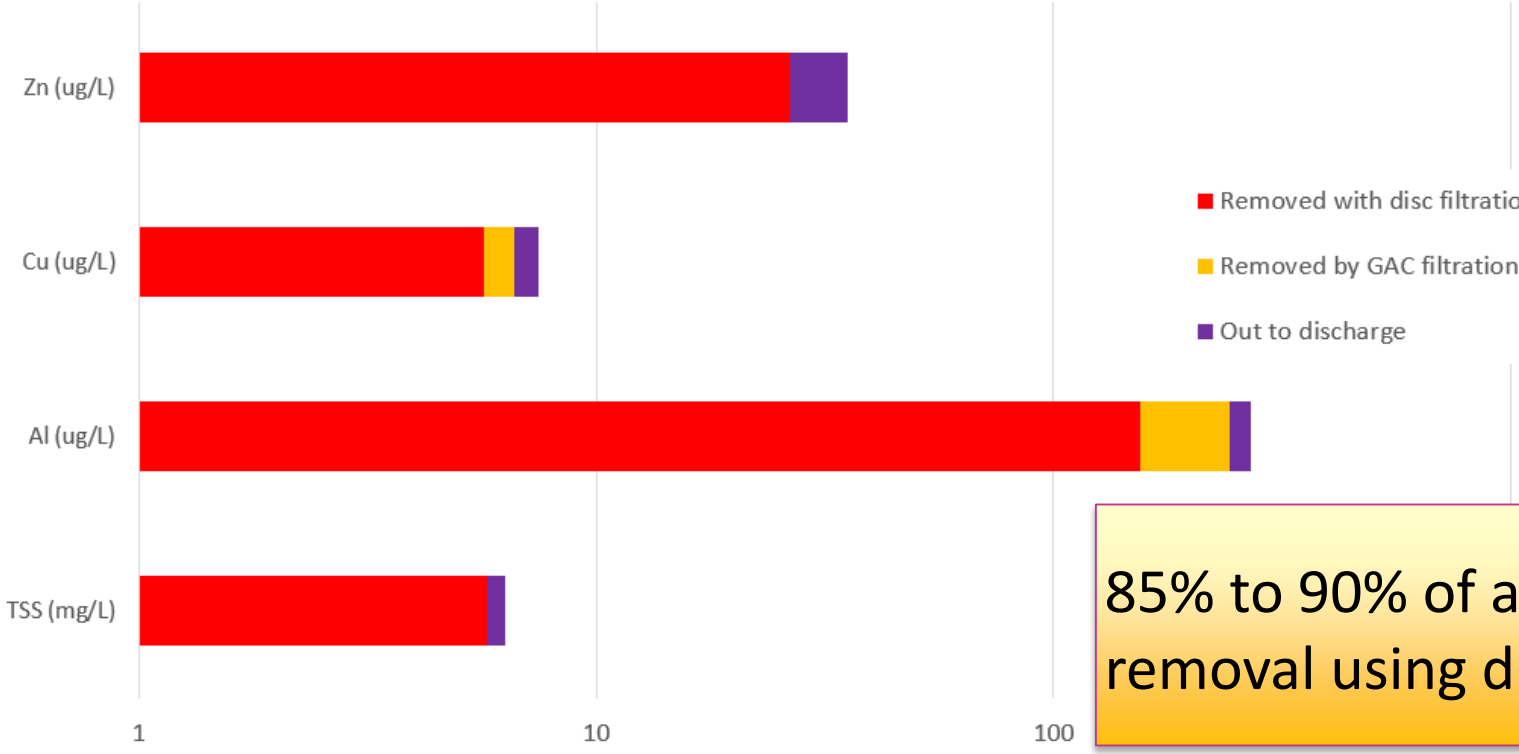


95% to 99% removal using ballasted flocculation

Operation Analysis – Disc Filtration Efficiency

Focus on the removal of the polishing steps (metal removal)

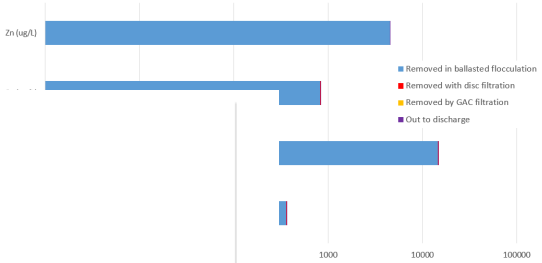


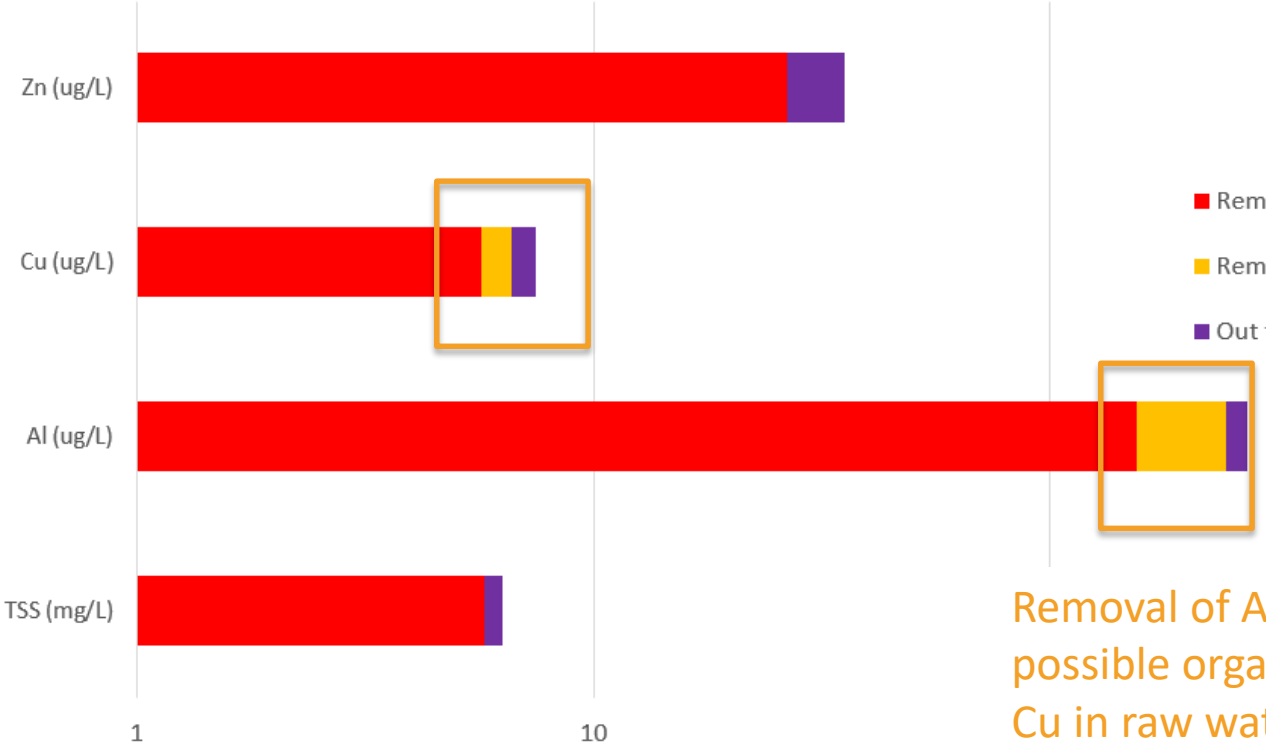


85% to 90% of additional removal using disc filtration

Operation Analysis – GAC filtration Efficiency

Focus on the removal of the polishing steps (metal removal)





Removal of Al and Cu using GAC; possible organically-bounded Al and Cu in raw water

Operation Analysis – Overall metal removal

- Global performances observed during operation of the water treatment chain

		Residual concentration (total)	
		Average	TARGET
TSS [mg/L]	Raw Water	446	
	Ballasted flocculation	0.72	
	Disc filtration	2.2	
	GAC filter	**0.7**	**25**
Al total [µg/L]	Raw Water	14 834	
	Ballasted flocculation	166	
	Disc filtration	116	
	GAC filter	**30.2**	**75**
Cu total [µg/L]	Raw Water	832	
	Ballasted flocculation	7.0	
	Disc filtration	1.7	
	GAC filter	**0.9**	**75**
Zn total [µg/L]	Raw Water	4542	
	Ballasted flocculation	31	
	Disc filtration	4.3	
	GAC filter	**9.1**	**240**

Conclusion

- Good performances are obtained using the ballasted flocculation for metal removal
- Disc filtration allows lower metal concentration to the final effluent and protects from temporary offsets
- The combination of ballasted flocculation (ACTIFLO) and disc filtration (DISCFILTER) provides low metal concentration at the effluent and stable operation of the water treatment chain in fluctuating operating conditions

Thank You

Myriam De Ladurantaye Noël
myriam.deladurantaye@veolia.com