
Disruptor®

Introduction to Disruptor®

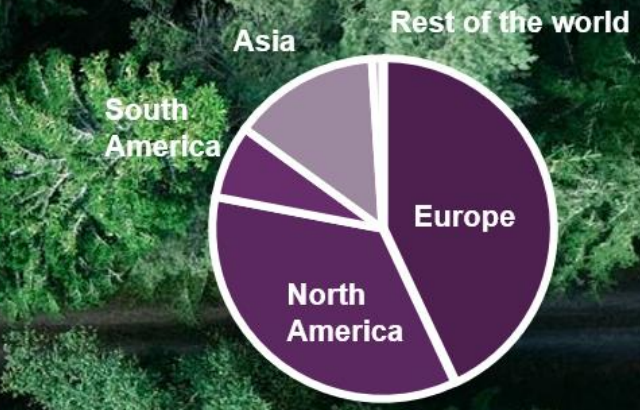
AHLSTROM MUNKSJÖ

Ahlstrom – Munksjö in a nutshell

Global leader in sustainable and innovative fiber-based solutions

What we do

- Fibers are at the core of what we do and the common denominator for our products and solutions
- Natural fibers represent 95% of our total fiber use
- We offer custom made specialized fiber-based materials
- Our value proposition is based on innovation, quality and service
- Our offering contributes to a more sustainable everyday life



Global presence with 45 plants in 14 countries

- Global network of sales offices and 45 plants in 14 countries
- Approximately 7,800 employees
- More than 6,000 customers in over 100 countries
- Net sales of approximately EUR 2.7 billion
- Head office in Helsinki, Finland

Ahlstrom-Munksjö in the value chain

Disruptor® - Electro-Positive Technology

What?

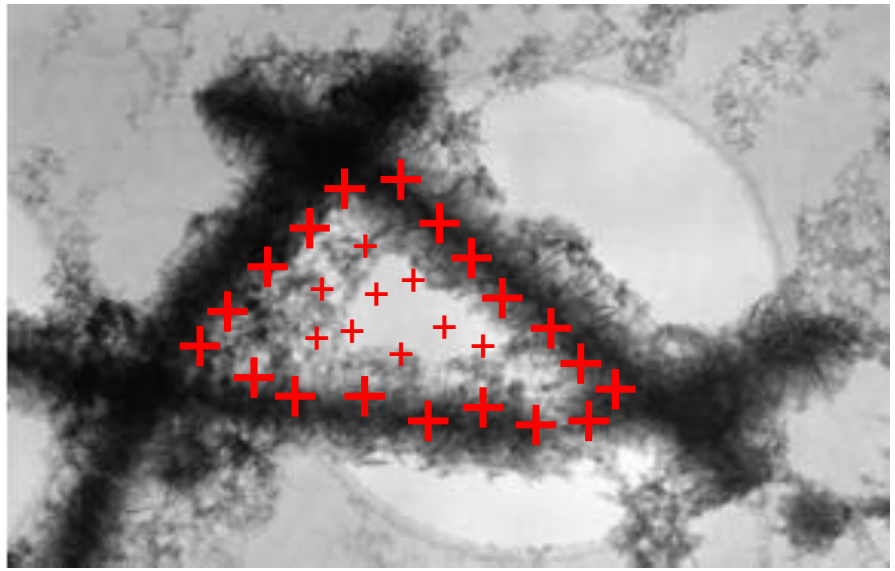
Why?

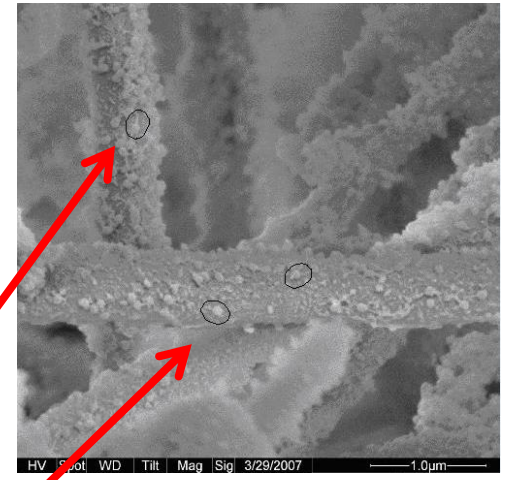
How?

Where?

What is Disruptor®?

- Disruptor® is a breakthrough technology for the **more demanding** water purification needs.
- Not directly comparable to any other water purification media currently in the market, Disruptor® is an **electro-adsorptive technology**: due to its crystal structure, the mineral creates a natural, strong positive charge which attracts the negative charge present on most submicron contaminants.
- When exposed to water having a **pH between 5 – 9,5** a charge potential is generated by the natural crystal structure of the fibers overlapping further into the fiber pore structure.
- Since Disruptor® is an electro-positive wet-laid nonwoven with a pore size around 1.2-1.5 microns it captures very small diameter substances and pathogens, but in addition also removes larger particles **mechanically**.





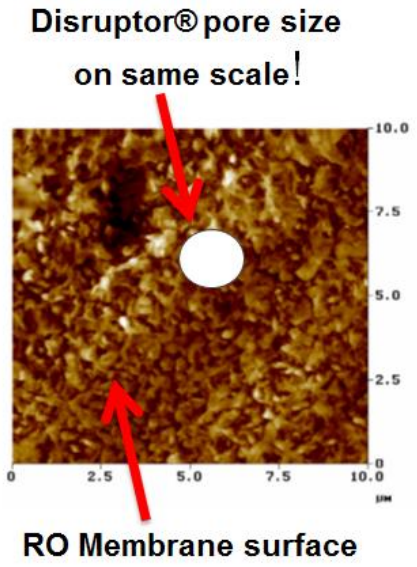
Bacterial cells: typically 1-10 micron in length & 0,2-1 ,0 micron in width

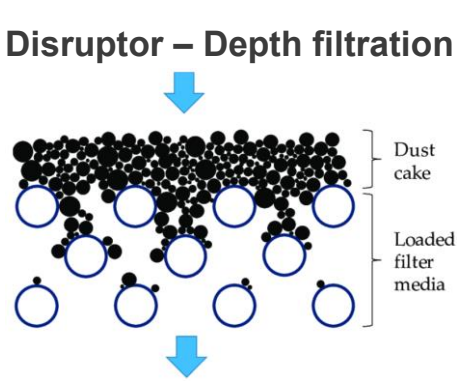
Viruses: typically 0,004 – 0,1 micron in size

Cysts: typically 2 – 50 micron in diameter

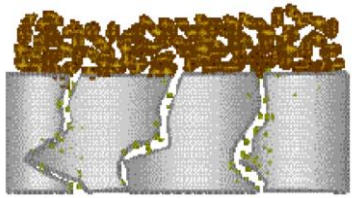
Biological testing vs. pathogen and contamination types

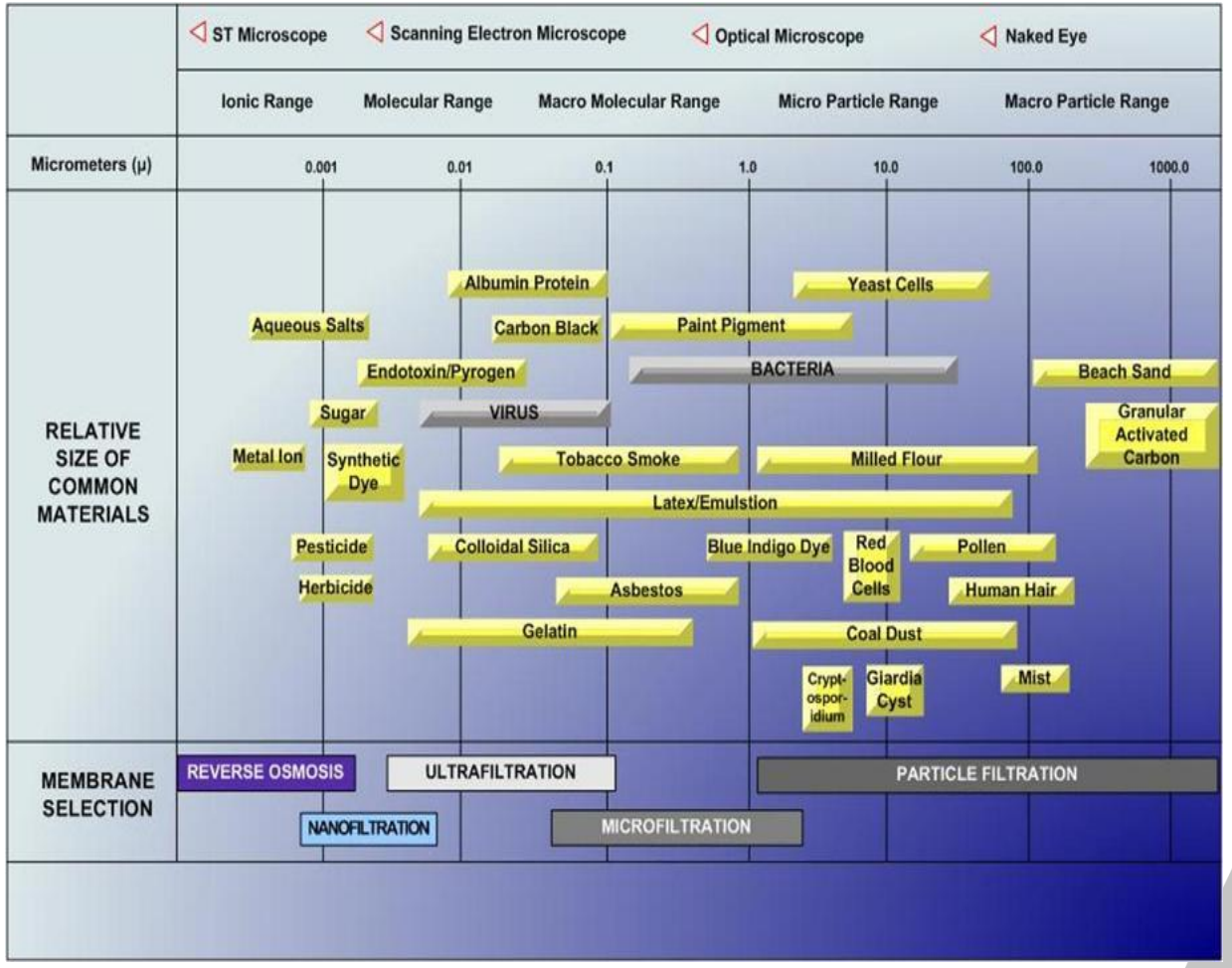
- Reduction of virus typically requires the use of ultrafiltration or reverse osmosis membranes
- Disruptor® technology reduces virus, bacteria and endotoxin with high flow and low pressure drop as compared to polymeric membranes
- Thanks to the wet-laid production technique Disruptor removes contaminants both by the electro-positive charging mechanism but also mechanically due to the porosity gradient and depth filtration mechanism.



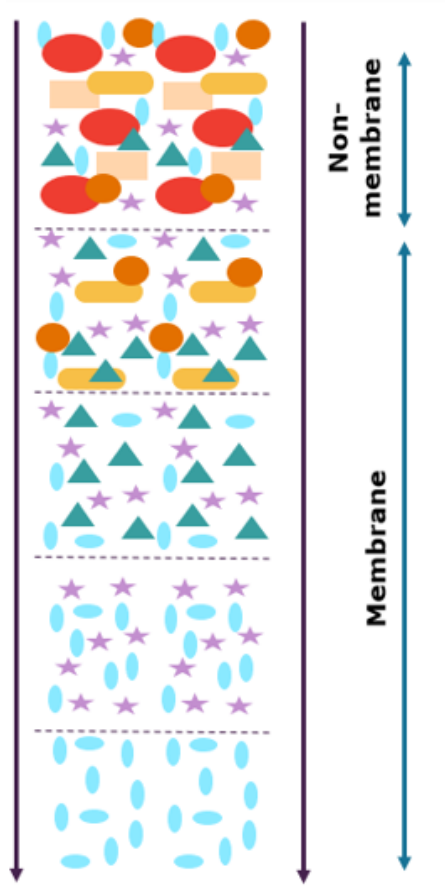


MF/UF/NF membranes – Surface filtration





Disruptor® performance coverage compared to std. membrane product offerings



Non-membrane

Membrane

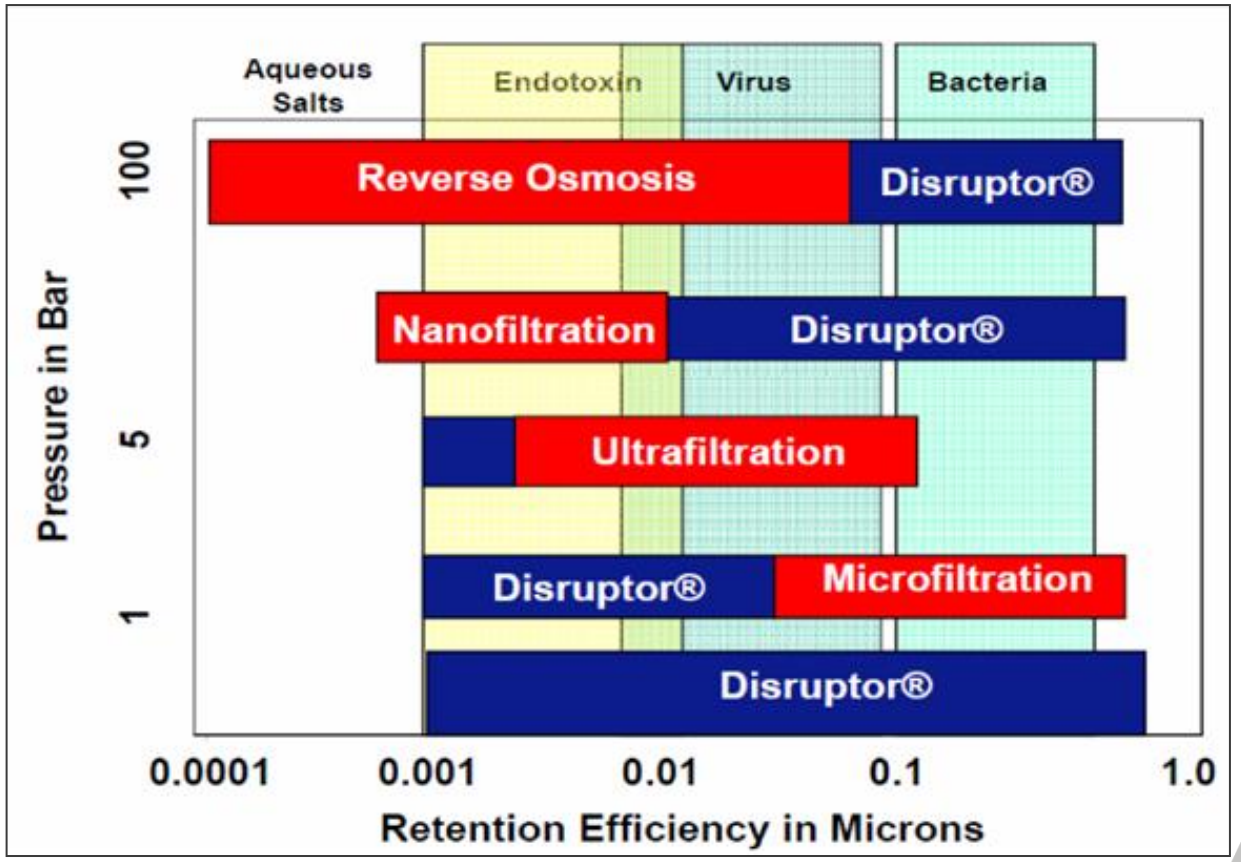
Mechanical filtration classes	Particle size	Typical applications
Particle filtration Removes large particles, e.g. blood cells (5-15 µm) or sand (100 – 1,000 µm)	>1 – 1,000 µm	▪ Surface filtration: collection of larger particles on the medium's surface ▪ Depth filtration: particles penetrate the surface of the medium
Microfiltration (MF) Removes bacteria and suspended solids	>0.1 – 1 µm	▪ Water and wastewater treatment ▪ Chemical processing
Ultrafiltration (UF) Removes viruses	>0.01 – 0.1 µm	▪ Water and wastewater treatment ▪ Chemical processing ▪ Pharma & biotech
Nanofiltration (NF) Removes multivalent ions	0.01 – 0.001 µm	▪ Water treatment
Reverse osmosis (RO) Removes monovalent ions etc.	<0.001 µm	▪ Water desalination

Increasing degree of fineness

Disruptor®

How can Disruptor® be used?

- Due to the open media structure Disruptor® can be used in a very wide range of end uses covering both **pressurized** water purification systems as well as **gravity flow** applications.
- Disruptor® can compete as a **stand alone** alternative to polymeric membranes or used **in combination** with other water purification technologies.
- In addition to outstanding pathogen performance products available also with special functionalities such as **chlorine** removal, **heat-sealing**, and **antimicrobial treatment** for preventing bacteria build-up.
- The removal of selected **trace metals** also possible in given pH ranges.
- Disruptor® media is **easy to convert** and can be made into virtually any size filter cartridge.



Why buy Disruptor®? Key value propositions

Performance

- Disruptor® removes a **wider range** of contaminants than membranes, carbon blocks, particulate cartridges and ultraviolet technologies such as bacteria/legionella, viruses, cyst, endotoxin, polysaccharides, colloids, trace pharmaceuticals, particulates, PFOA/PFOS, chlorine, etc.
- **Hundreds of billions** of bacteria, viruses, Cysts, and other pathogens can be removed per m^2 of Disruptor® filter media at a very high % removal rate**.**
- The contamination removal functionality is based on **electro-positive charge** but also **mechanical filtration** since the media MFP (Mean Flow Pore) is in the 1-2 micron size range. Thanks to the porosity gradient for enhanced depth filtration Disruptor® offers extended filter life opposed to membranes relying only on surface filtration for contaminant removal.

Energy Savings - Sustainability

- Disruptor® offers very **high flux rates** at lower pressure drops compared to competing technologies with similar biological removal performance and media pore sizes.
- Disruptor® can therefore be designed for **both gravity flow** as well as **pressurized** water purification systems.
- Due to the **high surface area** less material is needed compared to competing technologies such as e.g. hollow fibers or flat membranes

Product Safety - Taste

- Disruptor® removes effectively the pathogens and other contaminants, but in parallel **maintaining the minerals** for taste in the water **without issues of handling "brine" waste-water** using RO systems.
- Compared to UF/hollow fibers Disruptor® **does not block easily** and filter remains odorless even if not used for several days.
- All Disruptor® grades are complying under **NSF/ANSI 42** applicable drinking water requirements.

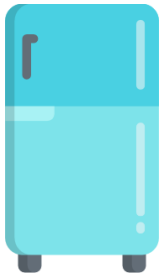
Flexibility & Multi-functionality

- Disruptor® can be used as a **stand-alone** solution or **in combination** with other technologies depending on the level of water purification needs. It can be used in pleated configurations to fit any filter housing size, or in the format of die cut flat samples.
- Since Disruptor® is also a unique **"one of it's kind" technology** in the market-place it offers excellent opportunities for **product differentiation** in both pressurized and gravity flow applications.

Where can Disruptor® be used?

Personal Use

- Water bottle
- Backpack



Residential

- Top
- Countertop
- Under sink
- Pitcher
- Shower
- Dispenser
- Cooler
- Refrigerator
- Roof-top tank
- Whole house

Commercial

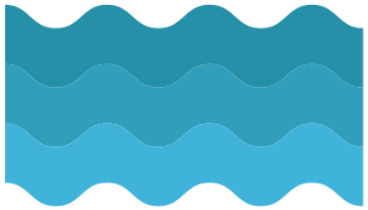
- Soft drink
- Coffee
- Tea
- Water
- Ice machines
- Buildings
- Hospitals

Industrial

- Cooling tower
- Manufacturing
- Water reuse
- Nuclear
- Aquaculture

Municipal

- Drinking water
- Waste water



Desalination

- Sea water
- Brackish water
- River water

Opportunities to tailor-make Disruptor® solutions covering the complete range of water purification applications!

Where can Disruptor® be used? (cont.)

Applicable both for point-of-entry (POE) and point-of-use (POU) applications:

- In a single or multi-layer Disruptor® stand-alone format for biological removal (personal & residential)
- In a single or multi-layer Disruptor® stand-alone format for biological removal and chlorine removal (personal & residential)
- In combination with CTO (Carbon Blocks) for biological removal and chlorine and/or heavy-metal removal (personal & residential)
- Before RO system for reducing RO membrane fouling (residential & commercial)
- After RO system for biological removal and improved water taste (residential & commercial)
- Gravity applications such as countertop dispensers, rain water treatment, roof top filters, etc. (personal & residential)

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Retention Studies – Lead

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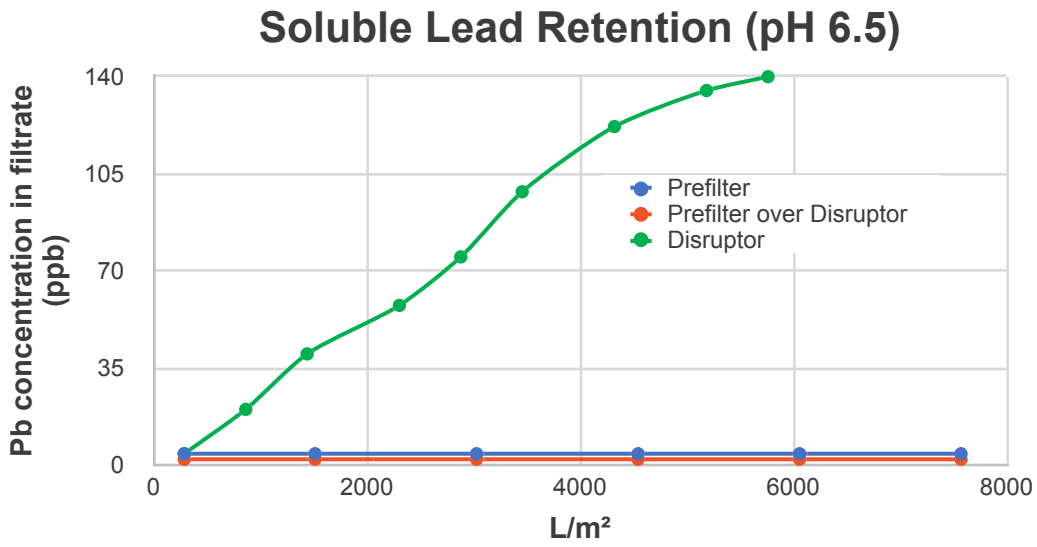
Lead retention results

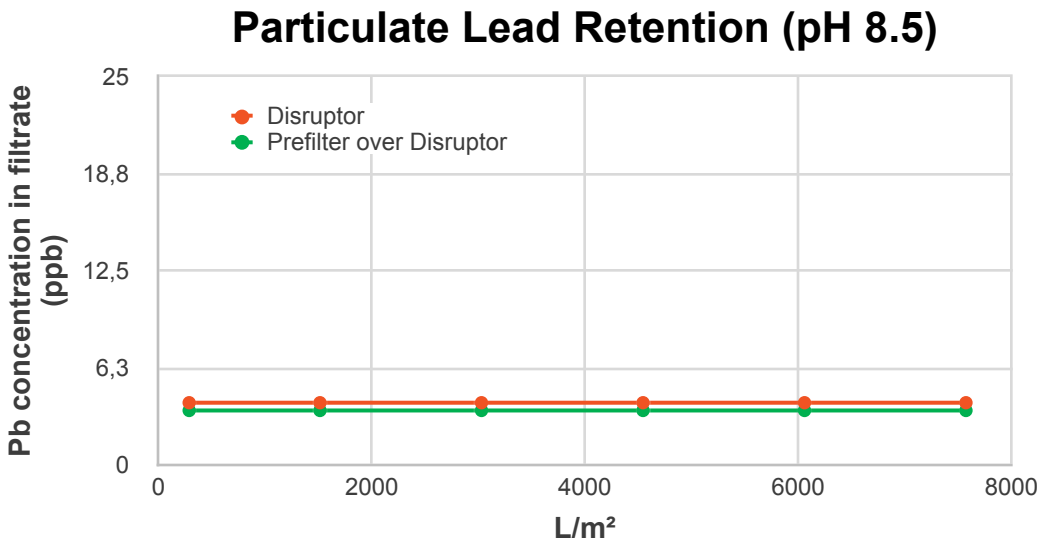
Results:

- Disruptor Lead prefilter improved significantly soluble lead reduction

- Lead concentration is under 5 ppb during the entire test for both soluble and particulate lead (NSF requirement)

- Disruptor alone clogs during particulate lead test reducing the filter life. However, no clogging issues were observed during the entire test when the prefilter is used on top of Disruptor.





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Retention Studies – Iron

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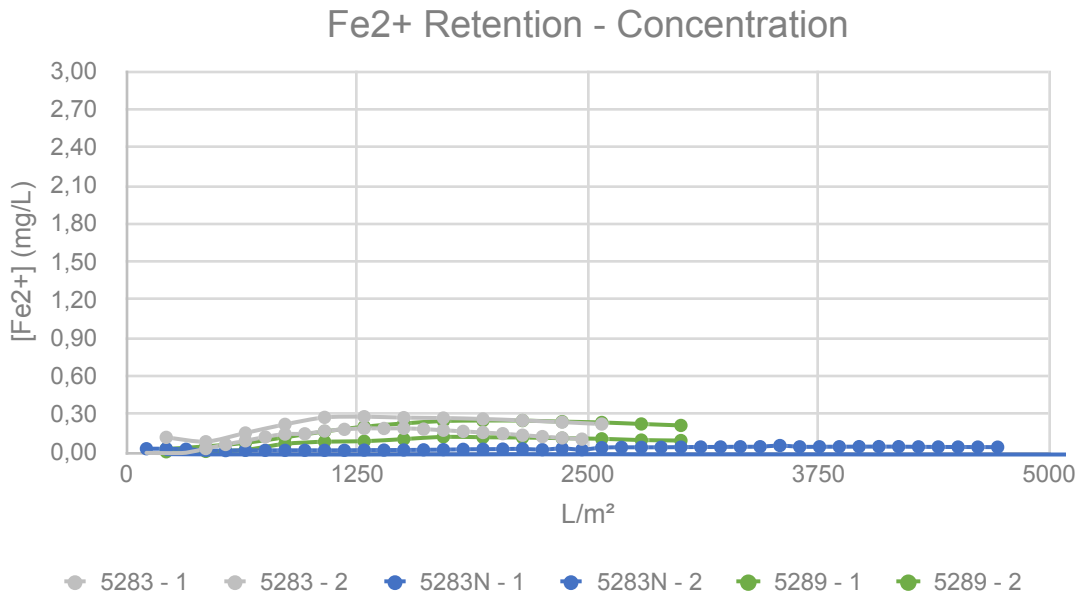
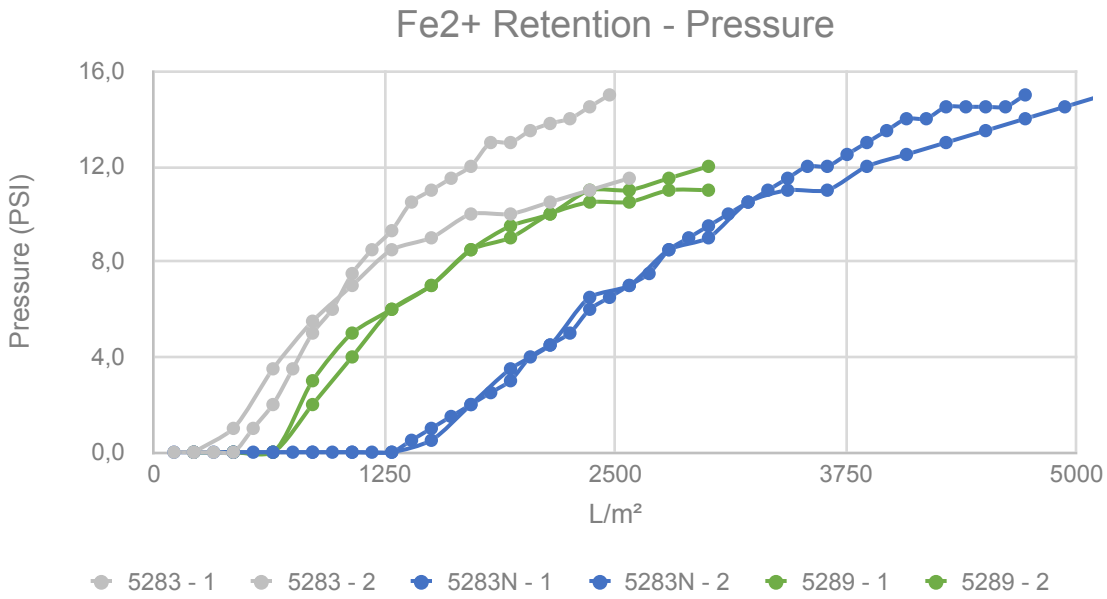
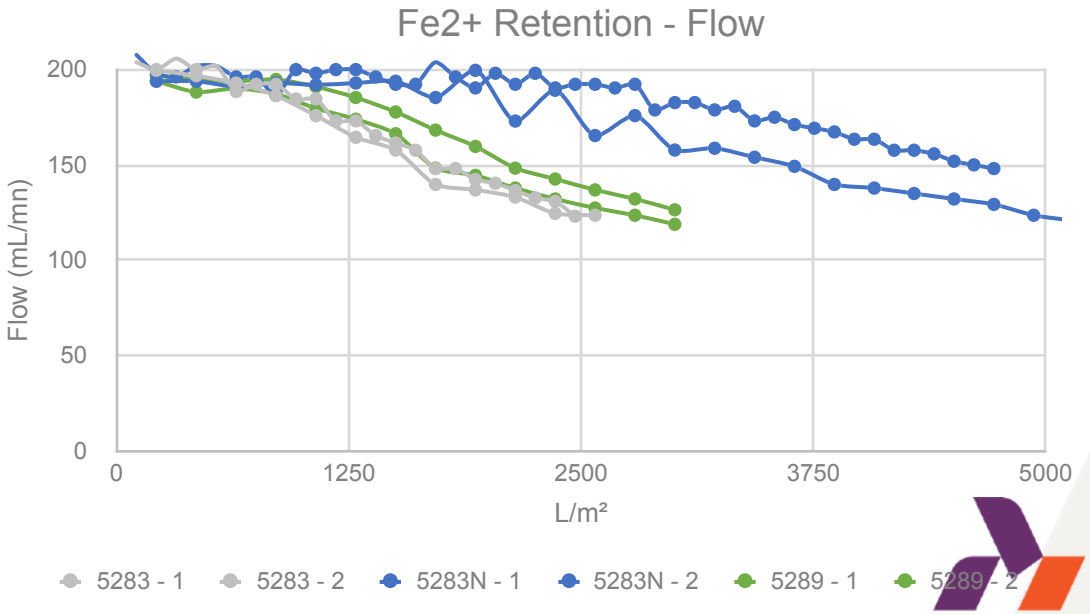
Iron II

Summary





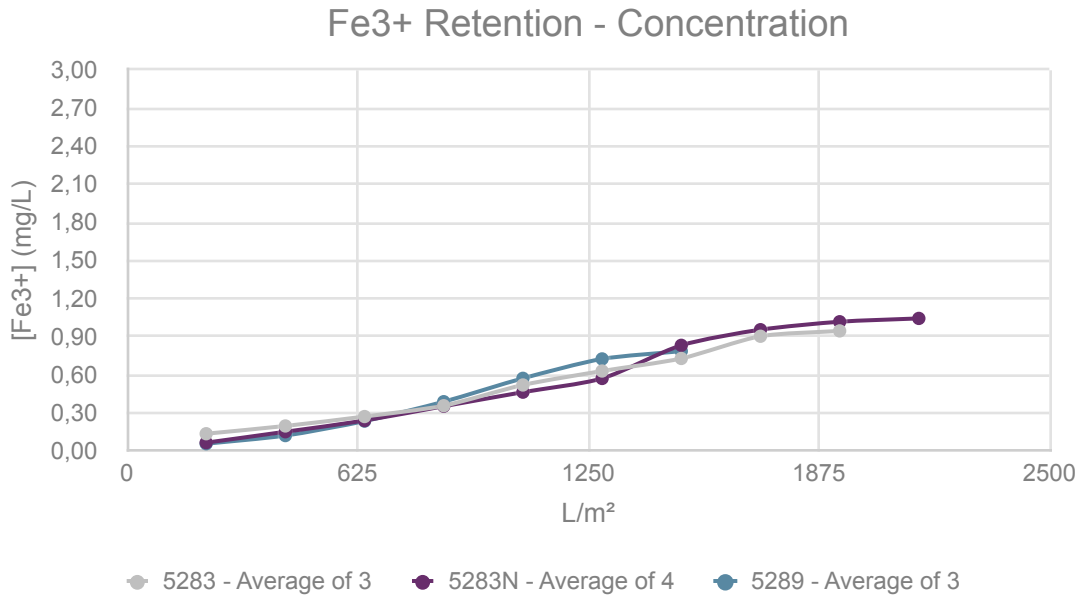


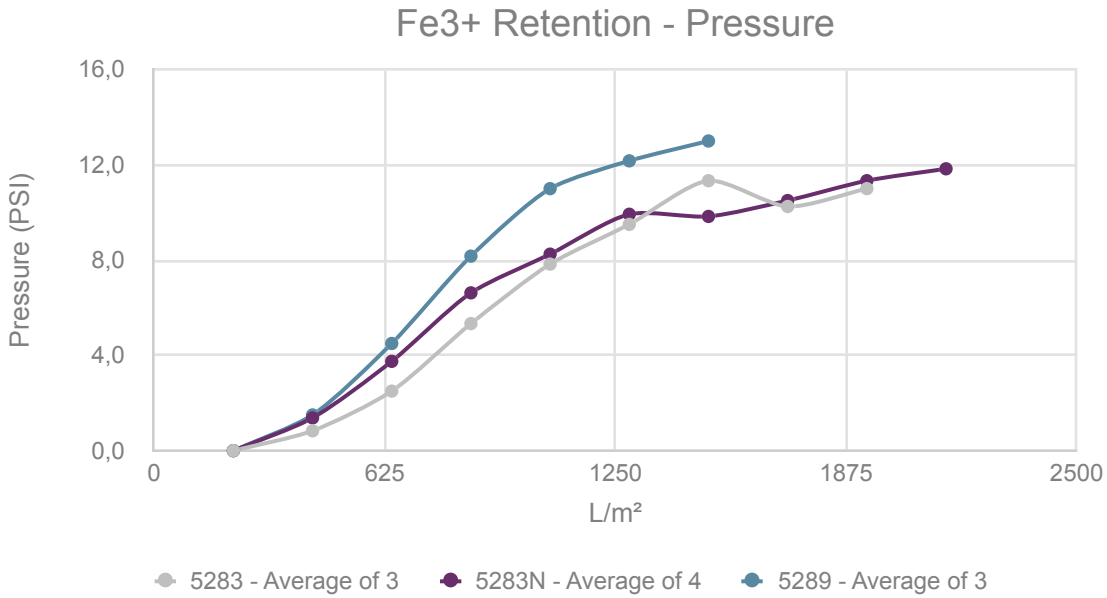
Conditions:

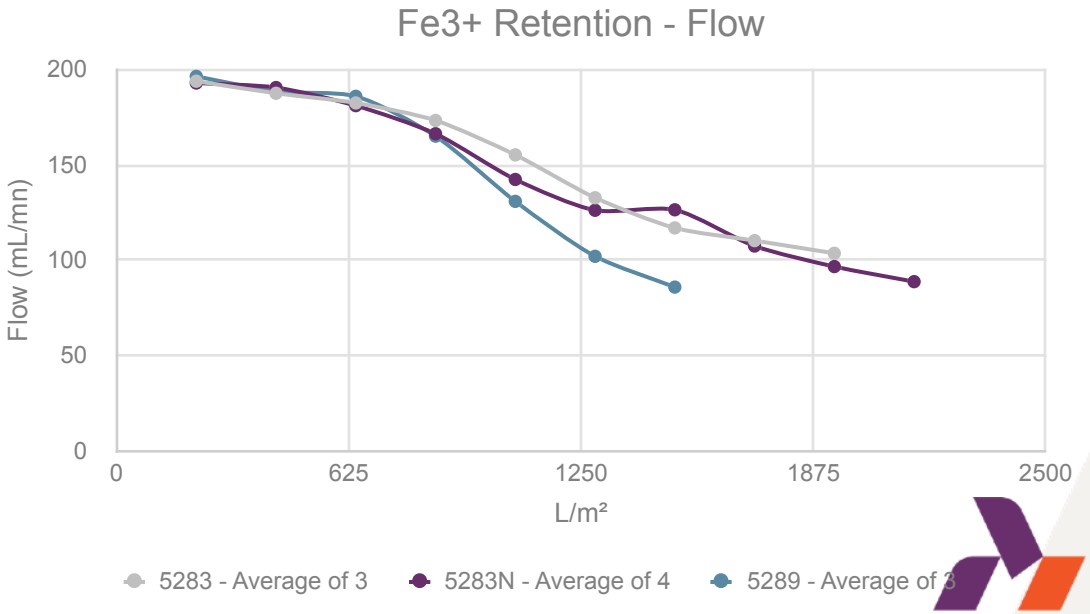
- Tap water from Pont Eveque-PEV
- (*Conductivity 590µS/cm, T° 20°C, TDS 310 mg/L, 6.5 < pH < 8.5*)
- Iron II concentration: 3 ppm
- Flat sheet samples, surface area: 46.6 cm²
- Flow rate: 1 gpm/ft² = 190 mL/mn
- Analysis by ICP-AES

Iron III

Summary







Conditions:

- Tap water from Pont Eveque-PEV
- (*Conductivity 590µS/cm, T° 20°C, TDS 310 mg/L, 6.5 < pH < 8.5*)
- Iron III concentration: 3 ppm
- Flat sheet samples, surface area: 46.6 cm²
- Flow rate: 1 gpm/ft² = 190 mL/mn
- Analysis by ICP-AES

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Retention Studies – Chlorine

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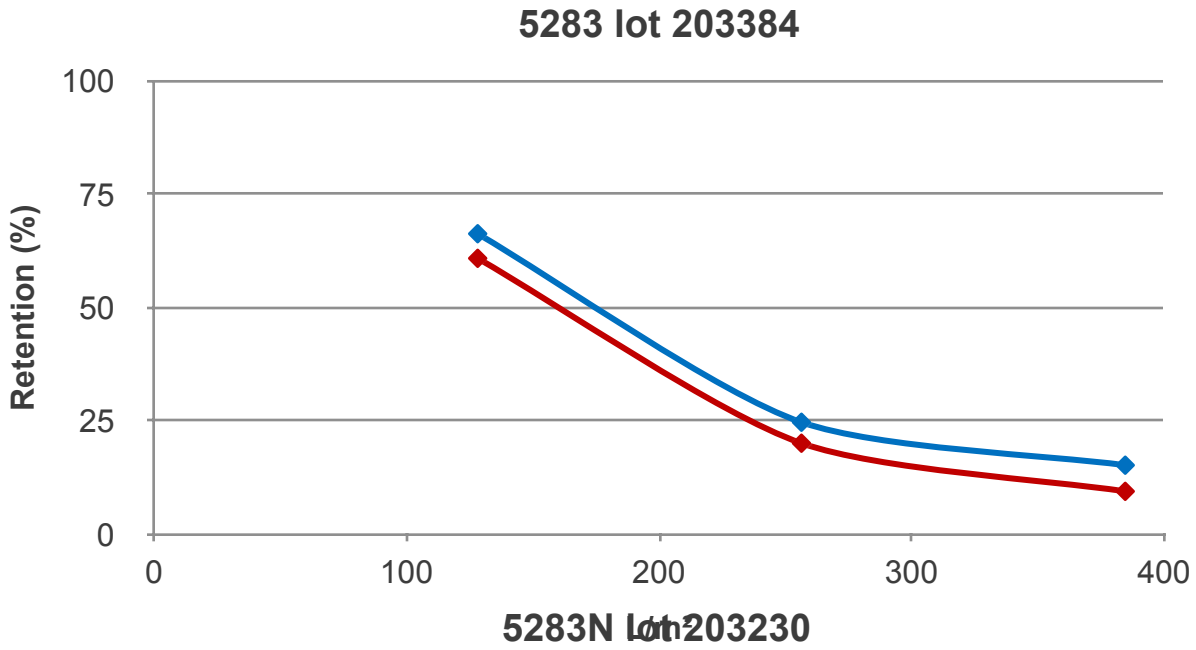
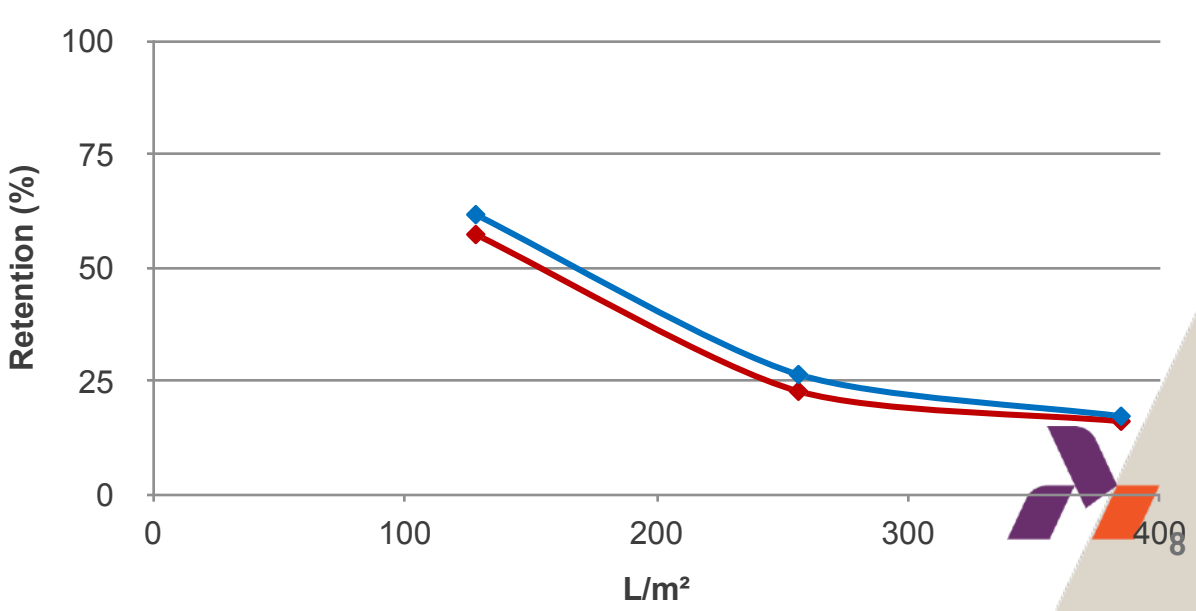
Chlorine Retention

Grade 5283 and 5283N

All grades are below 50% retention after first sampling





Conditions:

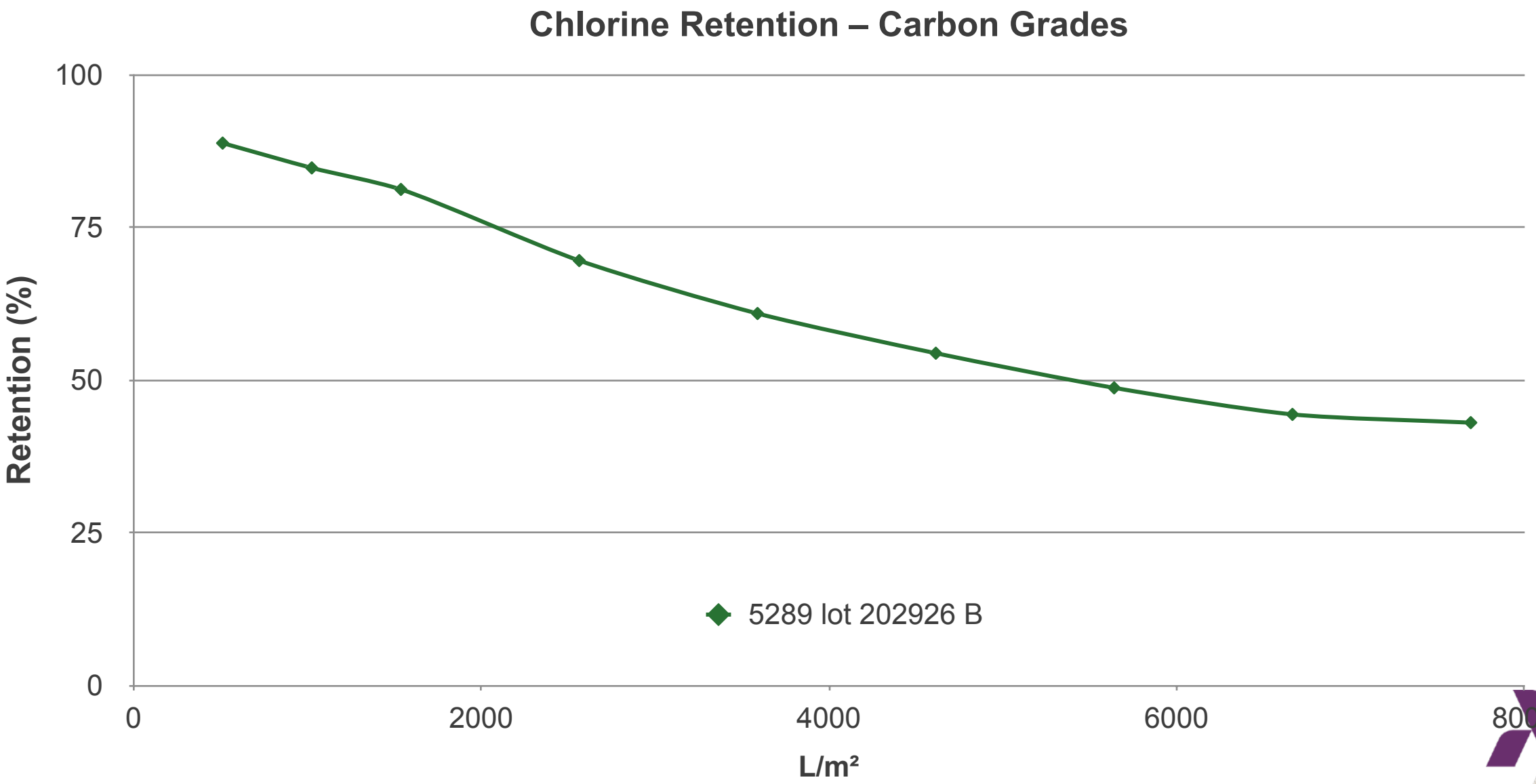
- Tap water from Pont Eveque-PEV

(*Conductivity 590µS/cm, Temperature 20°C, TDS 310 mg/L, pH 7.4*)

- Chlorine initial concentration: 2 ppm
- Flat sheet samples, surface area: 3.9 cm²
- Flow rate: 1 gpm/ft² = 15.9 mL/mn
- Analysis by spectrophotometry using kit test reagents from Hach.
- Concentration range between 0 and 2 ppm.

Chlorine Retention

Carbon Grades Summary



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Retention Studies – Copper

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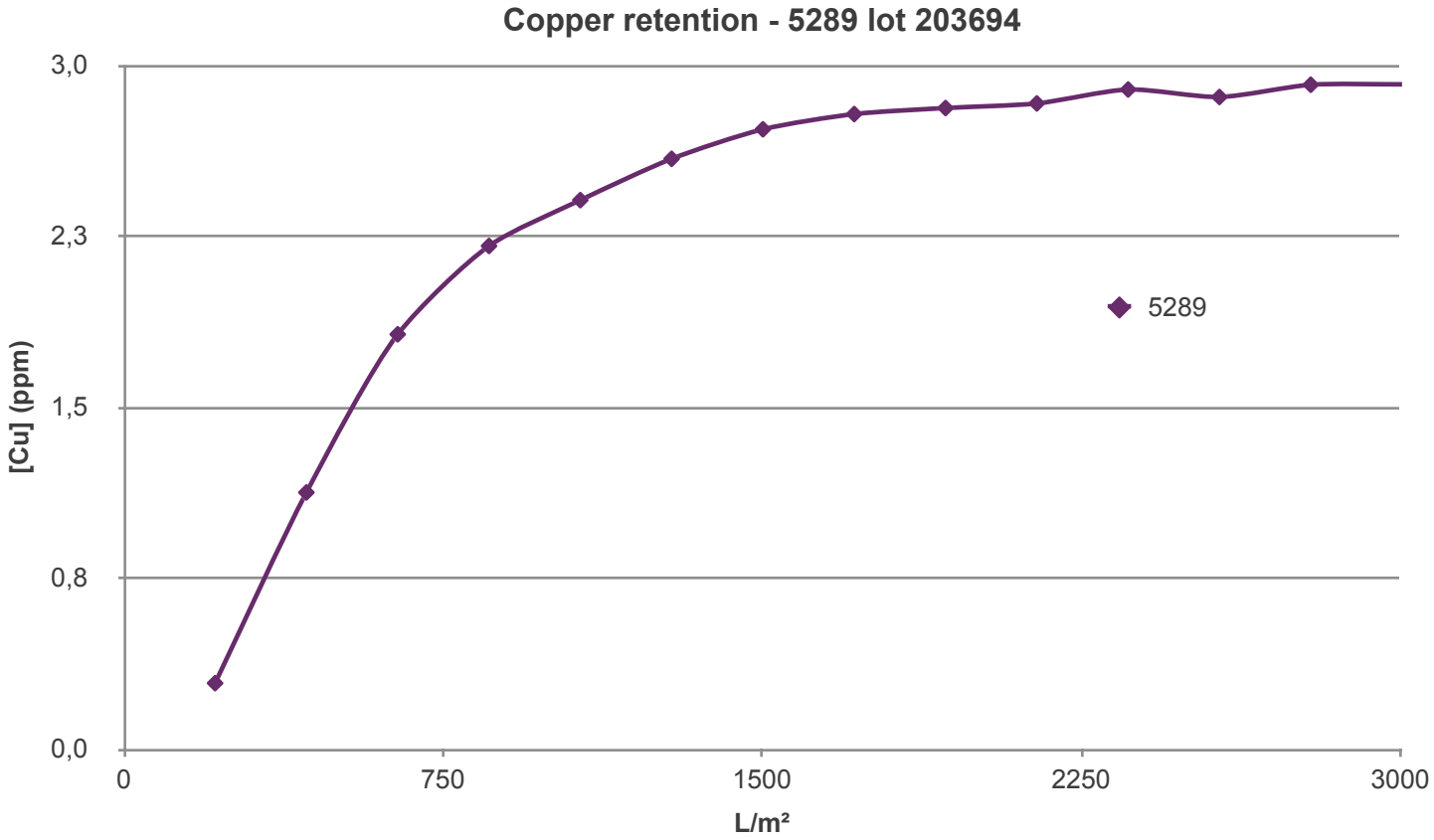
Copper Retention

5289



Conditions:

- Tap water from Pont Eveque-PEV

(*Conductivity 590µS/cm, Temperature 20°C, TDS 310 mg/L, pH 7.4*)

- Copper initial concentration: 3 ppm
- Flat sheet samples, surface area: 3.9 cm²
- Flow rate: 1 gpm/ft² = 15.9 mL/mn
- Analysis by spectrophotometry using kit test reagents from Hach.
- Concentration range between 0 and 2 ppm.

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Retention Studies – Emerging Contaminants

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Emerging Contaminants retention

Grade 5293

Prescription Drugs

- *Meprobamate: a compound found in anti-anxiety drugs.*
- *Phenytoin: an anti-epileptic drug.*
- *Atenolol: a beta blocker drug.*
- *Carbamazepine: an anti-convulsant and mood-stabilizing drug.*
- *Trimethoprim: an antibiotic medication.*
- *Estrone: a prescription birth control drug.*[2]

Chemical Compounds

- *TCEP (Tris(2-chloroethyl)phosphate): a chemical compound used as a flame retardant, plasticizer and viscosity regulator in various types of polymers including polyurethanes, polyester resins and polyacrylates.*
- *TCPP (Tris(1-chloro-2-propyl) phosphate): a chemical compound used as a flame retardant.*
- *BPA (Bisphenol A): a chemical compound used as a plasticizer.*
- *Nonyl phenol: a collection of compounds often used as a precursor to commercial detergents.*[3]

Prescription Drug Testing NSF 401

Analyte	Sample Point				
	50%	100%	150%	180%	200%
Meprobamate	NO	NO	NO	NO	NO
Phenytoin	YES	YES	YES	YES	YES
Atenolol	YES	NO	NO	NO	NO
Carbamazepine	YES	YES	NO	NO	NO
Trimethoprim	YES	YES	YES	YES	NO
Estrone	YES	YES	YES	YES	YES

Chemical Compound Testing NSF 401

Analyte	Sample Point				
	50%	100%	150%	180%	200%
TCEP	YES	YES	NO	NO	NO
TCPP	YES	YES	YES	YES	YES
Bisphenol A	YES	YES	YES	YES	YES
Nonyl phenol	YES	YES	YES	YES	YES

All testing based on a life estimation of 1000 liters/ft2 corresponding to 100% in the tables.

Emerging Contaminants retention

Grade 5293

Over-the-Counter Medications

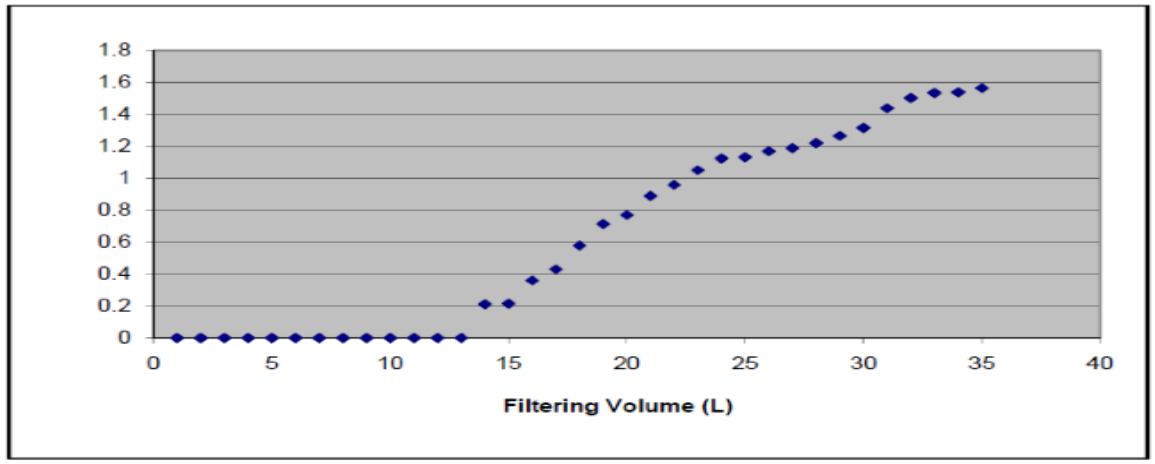
- *Ibuprofen: an over-the-counter pain reliever and anti-inflammatory medication.*
- *Naproxen: an over-the-counter pain reliever and anti-inflammatory medication.*
- *DEET (N,N-Diethyl-meta-toluamide): a pesticide and common active ingredient in insect repellents.*
- *Metolachlor: an organic compound that is widely used as an herbicide.*
- *Linuron: an herbicide often used in the control of grasses and weeds[4].*

OTC Medication Testing NSF 401					
Analyte	Sample Point				
	50%	**100%**	**150%**	**180%**	**200%**
Ibuprofen	YES	YES	NO	NO	NO
Naproxen	YES	YES	YES	YES	YES
DEET	YES	NO	NO	NO	NO
Metolachlor	YES	YES	YES	NO	NO
Linuron	YES	YES	YES	YES	YES

Other trace pharmaceutical / micro contaminant reduction results with Disruptor®

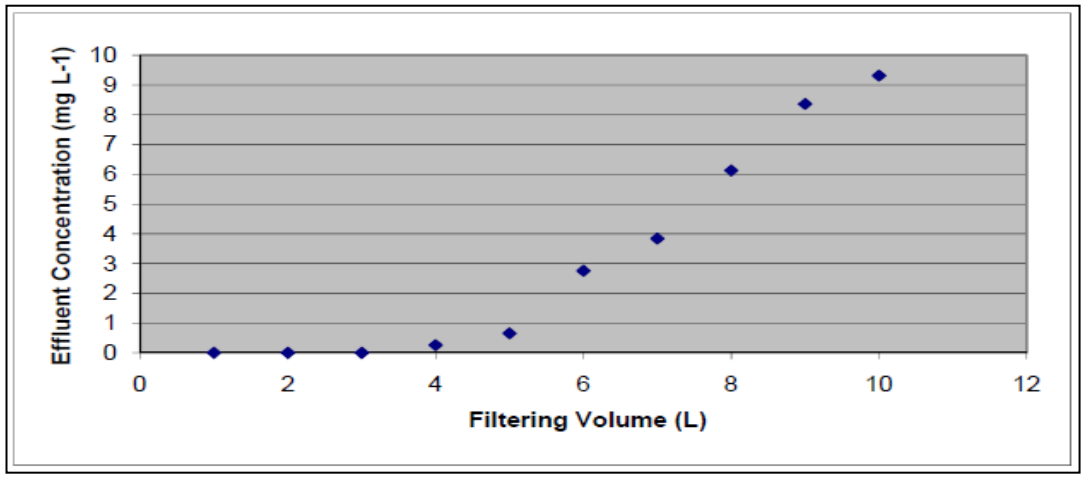
- Micro-contaminants of many types are now being detected in many waste water and in some potable water sources.
- The dangers these contaminants present to humans and the environment are not well understood
- Reduction of removal of these compounds from both waste and potable water is a concern to many health authorities and agencies

Penicillin G Removal



Penicillin G was used as a representative antibiotic. It was first studied using a challenge solution of 2 mg/l. This slide shows that the entire antibiotic was removed from 13 liters of water. At more typical concentration in the range of 2 micrograms per liter, a square foot of Disruptor® PAC could theoretically process more than 900,000 liters of water if it were free of other contaminants.

Flumequine Removal



Flumequine is a chemotherapeutic antibiotic implicated in tendon rupture, DNA damage and anaphylactic shock. It has been taken off the market but is representative of the flumequine drug class. The data shows complete removed from 3 liters of water having a concentration of 10 mg/L. At more typical concentration in the range of 2 micrograms per liter, a square foot of Disruptor® could theoretically process more than 1 million liters of water if it were free of other contaminants.

Other trace pharmaceutical / micro contaminant reduction results with Disruptor® (cont.)

PCB Removal

Congener Group	ng/L influent	5284 ng/L effluent	5283 ng/L effluent
Total monochloro biphenyls	158	2.36	0.377
Total Dichloro Biphenyls	629	0.85	nd
Total Trichloro Biphenyls	1260	nd	nd
Total Tetrachloro Biphenyls	4490	nd	nd
Total Pentachloro Biphenyls	4870	nd	nd
Total Hezachloro Biphenyls	4460	nd	nd
Total Heptachloro Biphenyls	2460	nd	nd
Total Octachloro Biphenyls	1810	nd	nd
Total Nonachloro Biphenyls	473	nd	nd
Decachloro Biphenyls	187	nd	nd
Total PCBs	20797	3.21	0.377

Polychlorinated biphenyls (PCBs) are man made organic chemicals that are known for their toxic and carcinogenic effects. Independent testing has shown Disruptor® and Disruptor® PAC to be effective in removing PCBs from water as indicated by the above chart.

Orthophosphate (fertilizer) reduction

Criteria	Median MBE Effluent Concentration	Disruptor RO-Prefilter Effluent
cBOD (mg/L)	2	
Turbidity (NTU)	0.07	
Ammonia (mg/L-N)	0.03	
Nitrate (mg/L-N)	1.33	
TKN (mg/L)	0.95	
Total Phosphorus (mg/L-P)	0.145	
Ortho-phosphate (mg/L-P) - 3/7/11	**0.118**	**0.002**
Ortho-phosphate (mg/L-P) - 3/10/11		**0.023**
TOC (mg/L)	7.93	8.15

Pilot trial data in tertiary waste water to evaluate orthophosphate reduction using Disruptor®

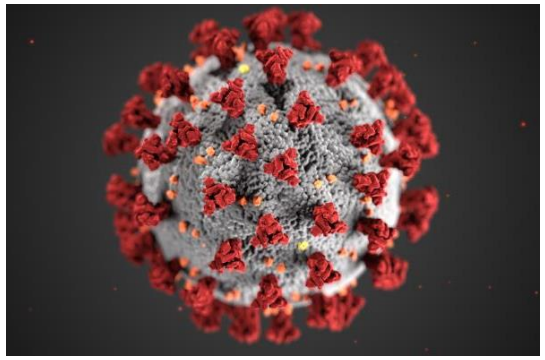
Ahlstrom-Munksjö quality testing of initial bacteria (RT), virus (MS2), and cyst (test method: TM-120)

Bacteria

- *Raoultella terrigena*
- Influent concentration of 10^5 or 10^6 per ml
- Required reduction 99.9999% or **6 log**

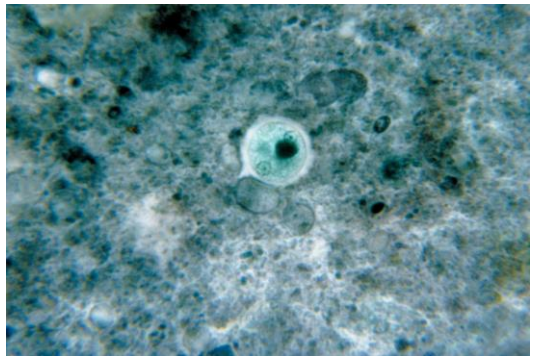
Virus

- MS2 Bacteriophage
- Influent concentration of 10^5 or 10^6 per ml
- Required reduction 99.99% or **4 log**



Cyst

- 3 microns bead surrogate
- Influent concentration of 10^5 or 10^6 ml
- Required reduction 99.95% or **3.5 log**



In comparison: Ganges River in India carries a total coliform concentration in the 1 x 10^6/ml range

Virus (MS2) capacity testing for 5283 at 3rd party BCS labs.

Biological Consulting Services of North Florida, Inc.

Single Layer 90 mm	MS-2 PLAQUE FORMING UNITS COUNTS PER MILLILITER												
	Influent	1 Liter Effluent	5 Liter Effluent	10 Liters Effluent	15 Liters Effluent	20 Liters Effluent	25 Liters Effluent	30 Liters Effluent	35 Liters Effluent	40 Liters Effluent	45 Liters Effluent	50 Liters Effluent	55 Liters Effluent
Filter A	3.0×10^5	<0.45	<0.45	1,4	1,4	0,91	4,5	6,3	12,2	24,1	27,2	28,6	N/A
Filter B		<0.45	<0.45	1,4	1,4	2,7	3,6	6,3	16,8	28,1	31,8	32,7	N/A

Single Layer 90 mm	MS2 PERCENT REDUCTION (%)												
	Influent	1 Liter Effluent	5 Liter Effluent	10 Liters Effluent	15 Liters Effluent	20 Liters Effluent	25 Liters Effluent	30 Liters Effluent	35 Liters Effluent	40 Liters Effluent	45 Liters Effluent	50 Liters Effluent	55 Liters Effluent
Filter A	3.0×10^5	>99.9999%	>99.9999%	99,9995%	99,9995%	99,99997%	99,999%	99,998%	99,996%	99,991%	99,991%	99,99 %	N/A
Filter B		>99.9999%	>99.9999%	99,9995%	99,9995%	99,9991%	99,999%	99,998%	99,994%	99,99 %	99,99 %	99,99 %	N/A

Corresponding to ca. 8000 liters/m^2 capacity or in total $2{,}36 \times 10^{12}$ (2,36 trillion) MS2 virus removed per m2 media at LRV 4.

Bacteria (E-Coli) capacity testing for 5283 at 3rd party BCS labs.

Biological Consulting Services of North Florida, Inc.

Single Layer 90 mm	Day 1 Date:__02/14/2017___ EC 11229 PERCENT REDUCTION (%)													
	Influent	1 Liter Effluent	15 Liter Effluent	30 Liters Effluent	45 Liters Effluent	60 Liters Effluent	75 Liters Effluent	90 Liters Effluent	105 Liters Effluent	120 Liters Effluent	135 Liters Effluent	150 Liters Effluent	165 Liters Effluent	180 Liters Effluent
5283 Filter A__	6.0 x 105	>99.99993%	>99.99993%	>99.99993%	>99.99993%	>99.99993%	99,9991%	99,998%	99,996%	99,998%	99,992%	99,99 %	99,98 %	99,91 %
5283 Filter B__		>99.99993%	>99.99993%	>99.99993%	>99.99993%	99,9998%	99,999%	99,998%	99,996%	99,996%	99,995%	99,99 %	99,96 %	99,9%

Corresponding to ca. 7100 liters/m^2 capacity or in total 4,25 x 10^{12} (4,25 trillion) E-Coli bacteria removed per m2 media at LRV 6.

Where can Disruptor® be used? (cont.)

Filtration Technology Positioning

Water Remediation Technologies - Residential, Commercial, Industrial, Municipal,Desalination								
	Disruptor® PAC Technology	RO	NF	UF	MF	Particulate Catridges	Carbon Block	Ultra Violet
Contaminants								
Dissolved Salts		x						
Endotoxin	X	x	x	x	x	x		
Virus	X	x	x					x
Bacteria	X	x	x	x	x	x	x	x
Cysts	X	x	x	x	x	x	x	x
Polysaccharides (TEP)	X	x	x	x	x			
Colloids	X	x	x	x				
Particulates	X	x	x	x	x	x	x	
Chemical Reduction	X	x					x	x
Trace Pharmaceuticals	X	x					x	x

Membrane definition: Reverse Osmosis=RO; Nanofiltration=NF; Ultrafiltratio=UF; Microfiltration=MF.

Disruptor® - Product Portfolio – Commercial Grades

Properties	5283	5283N	5284	5287	5288	5289	5293	5294
PM Code	4603	4603	4604	4607	4608	4609	4613	4614
Grade Type	White	White	Carbon	Carbon	White	Carbon	Carbon	Carbon
Carbon Type	n/a	n/a	Coconut	Coconut	n/a	Coconut	Wood	Coconut
Heat-seal	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Silver	No	No	No	Yes	Yes	Yes	Yes	Yes
Special Product Features	n/a	Netting Lamination	n/a	No Binder Fiber	n/a	n/a	n/a	No Binder Fiber
Basis weight – gsm	318	307	313	318	313	313	313	313
Thickness – mm	0,99	1,01	0,95	0,95	0,95	0,95	0,95	0,95
MFP – micron	1,2	1,1	1,4	1,5	1,2	1,4	1,6	1,4
Gravity flow – sec. (TM-134)	222	227	353	275	377	276	200	310
MD Tensile strength – N/m	3100	2700	2100	2100	2800	2100	3100	2200
Biological removal Initial LRV: RT, MS2, Cyst (TM-133)	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5	Log 6 / Log 4 / Log 3,5
Biological removal E-Coli Capacity (1-5 rating)	5	5	4	4	5	4	3	4
Chlorine reduction Capacity at 50% (NSF42)	n/a	n/a	9,000 liter/m2	9,000 liter/m2	n/a	12,000 liter/m2	28,000 liter/m2	9,000 liter/m2

Disruptor® - Product Portfolio – Experimental Grades

Properties	2194-460	2194-461	2194-464	2194-468	9954
PM Code	9944	9949	9955	9954	9954
Grade Type	White	White	White	White	White
Carbon Type	n/a	n/a	n/a	n/a	n/a
Heat-seal	Yes	Yes	Yes	Yes	Yes
Silver	No	No	No	No	No
Special Product Features	Heavy Metals Sheet	Synthetic pre-filter	Glass-based pre-filter	Lead sheet (< 5 ppb threshold)	Lead sheet without lamination
Basis weight – gsm	309	313	313	306	228
Thickness – mm	1,02	1,16	1,20	1,00	0,79
MFP – micron	0,9	9,3	4,9	1,8	1,8
Gravity flow – sec. (TM-134)	n/a	34	64	163	93
MD Tensile strength – N/m	2600	4200	2300	4400	2700
Biological removal Initial LRV: RT, MS2, Cyst (TM-133)	n/a	n/a	n/a	n/a	n/a
Biological removal E-Coli Capacity (1-5 rating)	n/a	n/a	n/a	n/a	n/a
Chlorine reduction Capacity at 50% (NSF42)	n/a	n/a	n/a	n/a	n/a

Disruptor ®

Legionella removal

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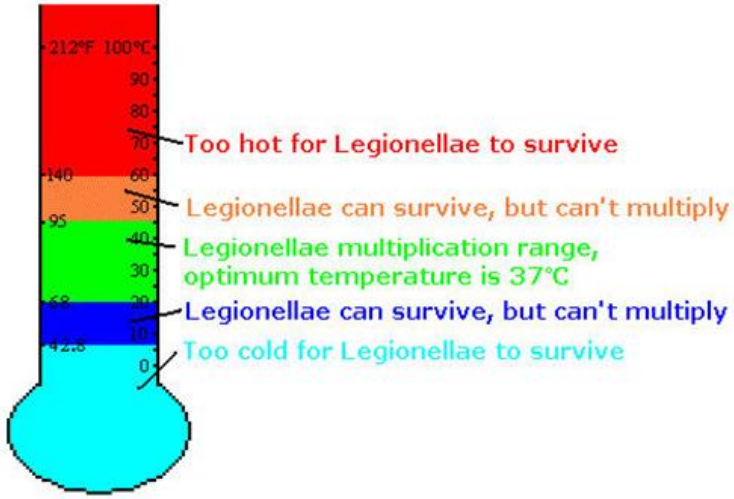
Legionella Removal

Premise Plumbing POE filters

Cooling tower , cold water loops

Faucet Filter POU

Temperature range for legionella



- Disruptor can reduce bio scale buildup that is an environment for bacteria to live
- Iron that is a nutrient for the legionella bacteria causing growth
- Submicron particulate in pipe scale
- Legionella boil-outs typically at 160 F. (71 C) temperatures

Legionella Facts

- Legionella is the only growing waterborne illness in the developing world
- Cost of legionella estimated by the CDC annually is $434M
- In comparisons the cost of Cryptosporidiosis is $46M (CDC estimate)
- Disruptor can be used as a standalone technology or with other treatment technologies

Legionella Removal

Initial Legionella Removal

Disruptor Grades	Single Layer (LRV Removal)	Double Layer (LRV Removal)
5283 - White	4.6	4.7
5284 - Carbon	5.5	5.5
5288 - White	5.5	5.5
5289 - Carbon	5	5.5

- Only a slight benefit can be seen during initial biological testing with two layers of Disruptor, the main benefit of two layers is visible under capacity testing.
- Both white and Carbon Disruptor grades removes Legionella

Legionella Removal

Capacity Legionella Removal

TEST DATA: Microbial reduction @ Flow rate- 65ml / min

Sample Code/ Customer Code	Tested parameter	Input Water Microbial Count	Output Water Microbial Count	% Reduction
5289	Legionella pneumophila ATCC 33152	7x 10^5cfu/ml 5.84 $\log_{10}$	169 cfu /ml 2.23 $\log_{10}$	99.975% 3.61 LRV

Cfu: Colony forming units.

TEST DATA: Microbial reduction @ Flow rate- 65ml / min

Sample Code/ Customer Code	Tested parameter	Input Water Microbial Count	Output Water Microbial Count	% Reduction
5288	Legionella pneumophila ATCC 33152	7x 10^5cfu/ml 5.84 $\log_{10}$	147 cfu /ml 2.16 $\log_{10}$	99.979% 3.68LRV

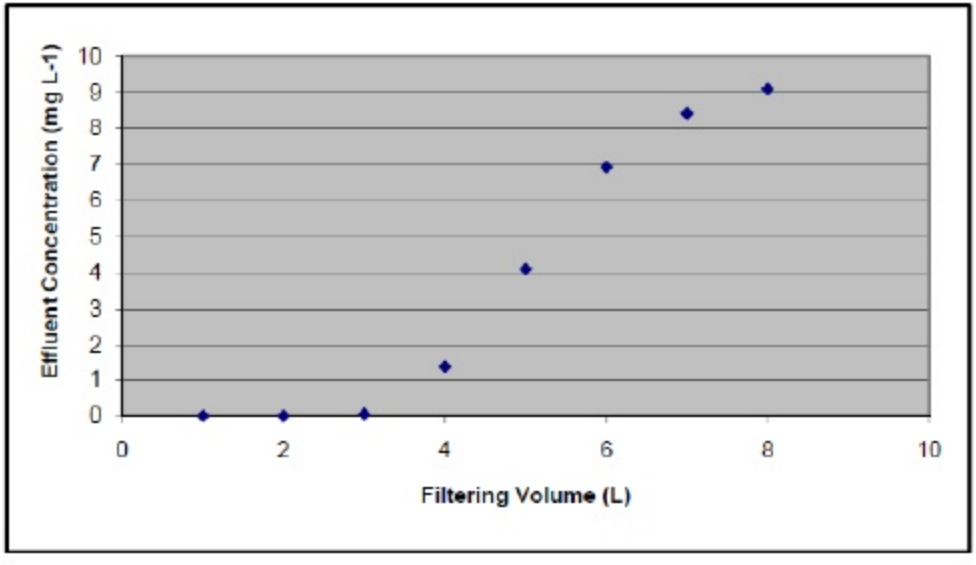
Cfu: Colony forming units. LRV= Log reduction value, Sampling after 10L filtration.

Conditions: pH=7.10 ; TDS=260 mg/L ; TOC=1 mg/L ; Turbidity<1 NTU ; Temperature=23°C
Sampling: 10L, disc=45mm, 6300 L/m²

PFC Species	Initial Concentration (ng/L)	At 123 L/m² (ng/L)	At 530 L/m² (ng/L)	At 938 L/m² (ng/L)	At 1345 L/m² (ng/L)	At 1753 L/m² (ng/L)	At 2568 L/m² (ng/L)	At 3383 L/m² (ng/L)	4605 L/m² (ng/L)
PFOA	50	2.2	8.7	13	20	26	23	39	36
PFOS	237	ND	12	25	53	59	57	100	84
PFBA	20	7.0	19	18	16	21	19	23	18
PFPeA	66	11	37	49	63	70	78	70	79
PFHxA	61	4.8	19	29	42	49	52	54	53
PFHpA	30	1.9	6.4	9.1	15	18	27	23	26
PFNA	3.4	ND	ND	ND	ND	ND	ND	1.5	1.6
PFBS	14	ND	5.3	6.8	7.9	13	10	16	12
PFHxS	74	ND	10	19	29	45	30	55	59
PFDA	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFUnA	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFDoA	ND	ND	ND	ND	ND	ND	ND	ND	ND
PFOSA	ND	ND	ND	ND	ND	ND	ND	ND	ND

Concentration of thirteen PFC species before (i.e., initial concentration) and during filtration experiments

Bisphenol A (BPA) removal



BPA is monomer used in the manufacture of polycarbonate and epoxy resins. It is know to be estrogenic and is controversial and well studied in conjunction with many health related issues including: reproduction, heart disease and diabetes. The data shows complete removed from 3 liters of water having a concentration of 10 mg/L. At more typical concentration in the range of 2 micrograms per liter, a square foot of Disruptor® could theoretically process more than 1 million liters of water if it were free of other contaminants.

Testing Parameter	Sample	Control	Result	Units
Phthalates by Base/Neutral/Acid modifed 625 Method Modified (DHP, Di(n-prop				
Dihexyl phthalate	ND(4)	ND(4)	ND(4)	ug/L
Di(n-propyl heptyl) phthalate	ND(4)	ND(4)	ND(4)	ug/L
Bis(2-ethylhexyl)terephthalate	ND(4)	ND(4)	ND(4)	ug/L
Diisodecyl phthalate (DIDP)	ND(4)	ND(4)	ND(4)	ug/L
Diisononyl phthalate (DINP)	ND(4)	ND(4)	ND(4)	ug/L
Diisooctyl phthalate (DIOP)	ND(4)	ND(4)	ND(4)	ug/L
Bisphenol A - propylene oxide adducts, LC/UV				
Bisphenol A diglycideryl ether	ND(20)	ND(20)	ND(20)	ug/L
Bisphenol A propoxylate	ND(20)	ND(20)	ND(20)	ug/L
Bisphenol A diglycidyl ether	ND(20)	ND(20)	ND(20)	ug/L
Bisphenol A, LC/UV				
Bisphenol A	ND(10)	ND(10)	ND(10)	ug/L

Thank you!

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