



Packaged Treatment Systems to
meet Regulatory Objectives:
Benefits for Small Communities

Michael Blair, CH2M HILL Canada Limited

Michael.Blair@CH2M.com

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Summary of Presentation

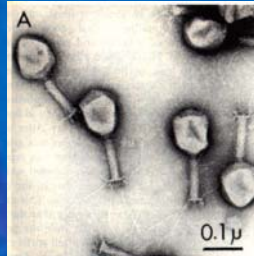
- ◆ What are we worried about??
- ◆ Source Water Risks
- ◆ Treatment Design Objectives
- ◆ Packaged Treatment Systems (Options)
- ◆ Benefits of Packaged Treatment Systems

WHAT ARE WE WORRIED ABOUT ?....

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Viruses

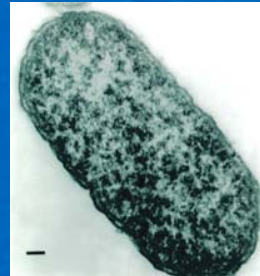
T4 Phage



size = 0.02 - 0.07 μm

Bacteria

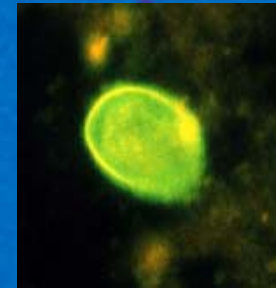
E.coli



size = 0.5 - 2 μm

Cysts

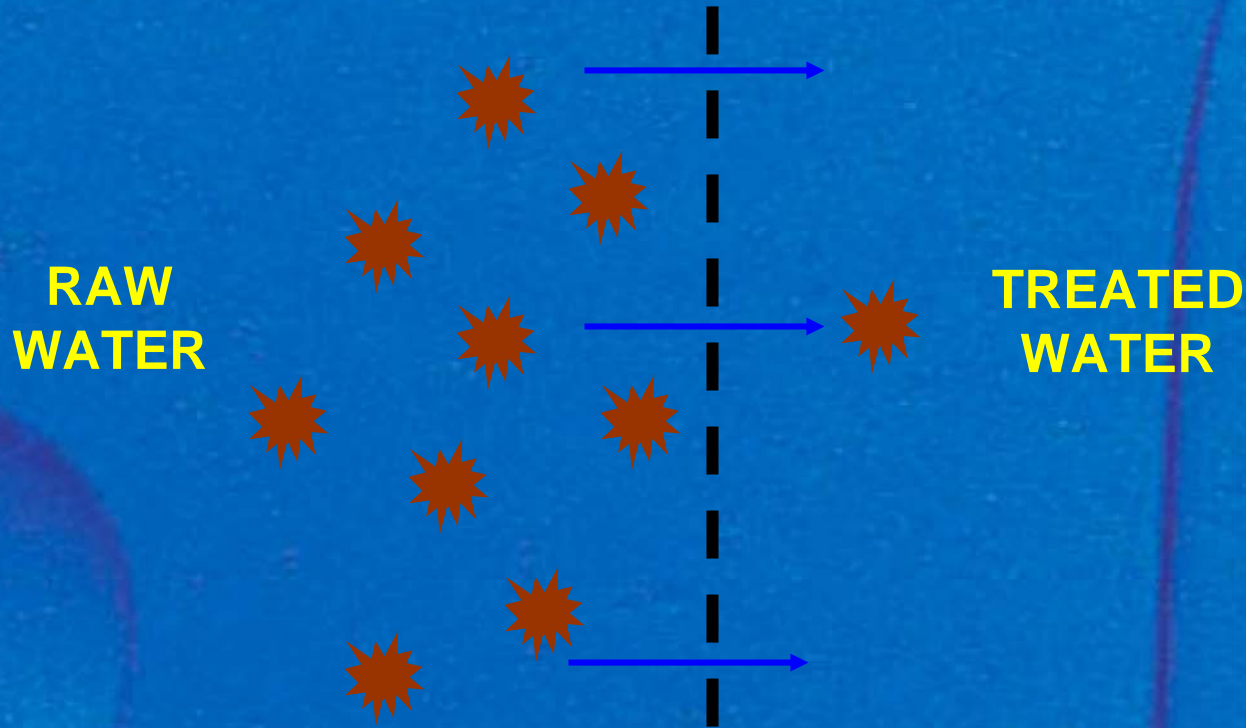
Giardia



size = 3 - 15 μm

Note: A human hair thickness is 17 – 200 microns

Treatment Effectiveness



◇ Same concept for disinfection processes

Measuring Disinfection Effectiveness (Log-Inactivation)

Log Inactivation	% Inactivated	Removal
0.5-Log	33%	2 out of 3
1.0-Log	90%	9 out of 10
2.0-Log	99%	99 out of 100
3.0-Log	99.9%	999 out of 1000
4.0-Log	99.99%	9999 out of 10,000

ANYTHING ELSE ?....

- ◆ TASTE AND ODOUR
- ◆ COLOUR IN WATER
- ◆ RUNOFF CONTAMINANTS??

TREATMENT FOR THESE?....

- ◆ Much harder to treat for because.....
 - ◆ they can be dissolved or colloidal (both very tiny particles) that can not be easily removed
- ◆ resultant colour or taste in water
- ◆ disinfection by-products can be formed...MAYBE
- ◆ TYPICALLY COAGULATION PROCESS IS REQUIRED ELIMINATE PRECURSORS

COAGUL...WHAT?....

- ❖ REMEMBER...tiny particles do not like to settle down.
- ❖ We have to pull a bunch of these smaller particles together to make a larger particle.....that will actually settle.
- ❖ UNFORTUNATELY, we need chemicals to do this through coagulation process.

Source Water Risks

- ❖ Three basic water source categories
 - ❖ Pond or lake water – HIGH RISK
 - ❖ Well Water (UNDER THE INFLUENCE) – MODERATE RISK
 - ❖ Well Water (NOT UNDER THE INFLUENCE) – LOW RISK

There's more than one way to skin a cat....

❖ MULTI-BARRIER TREATMENT APPROACHES

- ❖ Source Water Protection
- ❖ Operator Training
- ❖ Treatment - typically physical removal combined with chlorination or ozone or UV or.....

Examples - Guidelines for Canadian Drinking Water Quality (CDWQ)

◆ Microbiological Parameters

◆ Protozoa (Giardia (beaver fever), Cryptosporidium)

- ◆ 3 log removal/inactivation
- ◆ 0.5 log minimum from primary disinfection

◆ Viruses

- ◆ 4 log removal/inactivation
- ◆ 2 log minimum from primary disinfection

Example - Canadian Drinking Water Quality (CDWQ)

◆ Physical Parameters

◆ Turbidity

- ◆ Less than or equal to 0.3 NTU 95% of the time
- ◆ Not to exceed 1.0 NTU 100% of the time

◆ Chemical Parameters

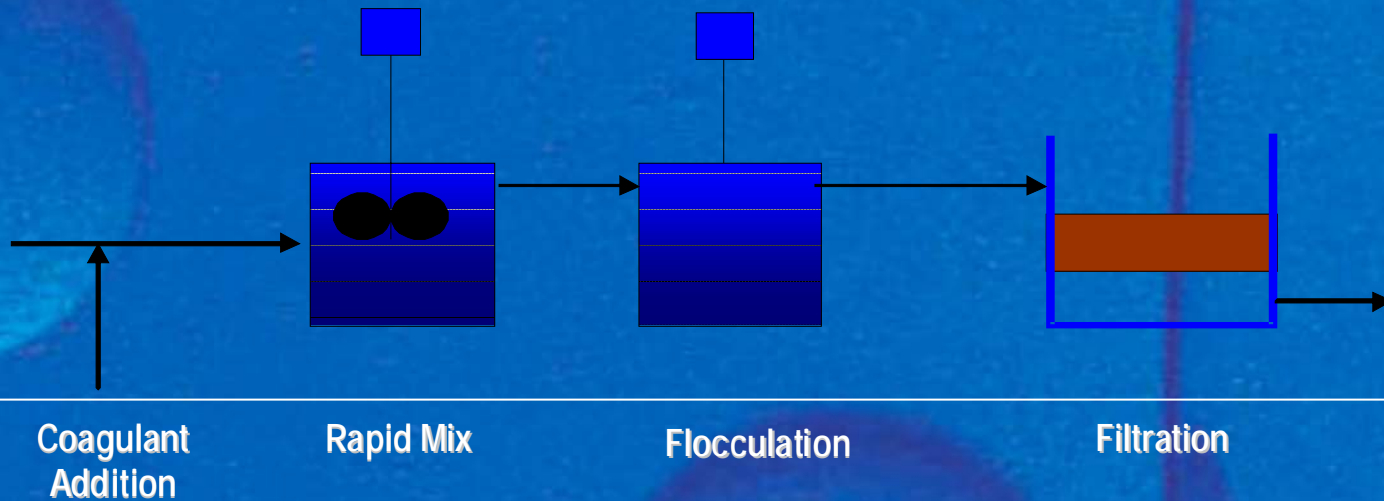
- ◆ Disinfection Bi-Products (Trihalomethanes, Bromates, Haloacetic Acids)
 - ▲ varied treatment levels

Available Packaged Treatment Systems

- ◆ Direct Filtration System
- ◆ Conventional Filtration System
- ◆ Slow Sand Filtration System
- ◆ Cartridge Filtration System
- ◆ Membrane Filtration System

Direct Filtration

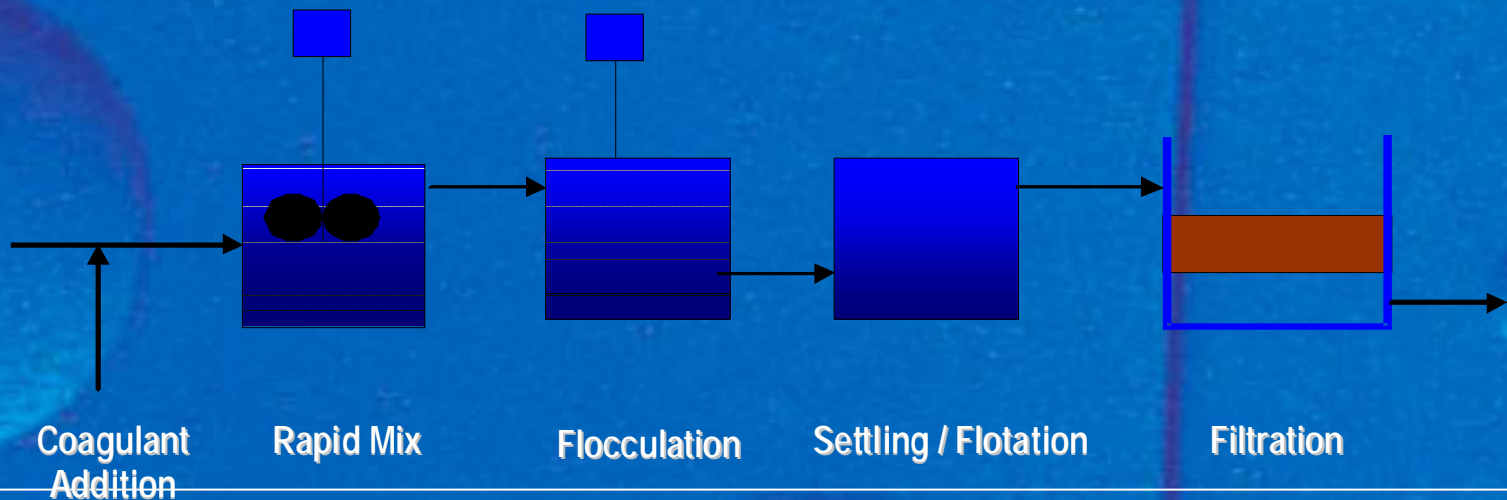
- ❖ Coagulated particles removed DIRECTLY by filter
- ❖ 2.5 log removal
- ❖ Additional disinfection required



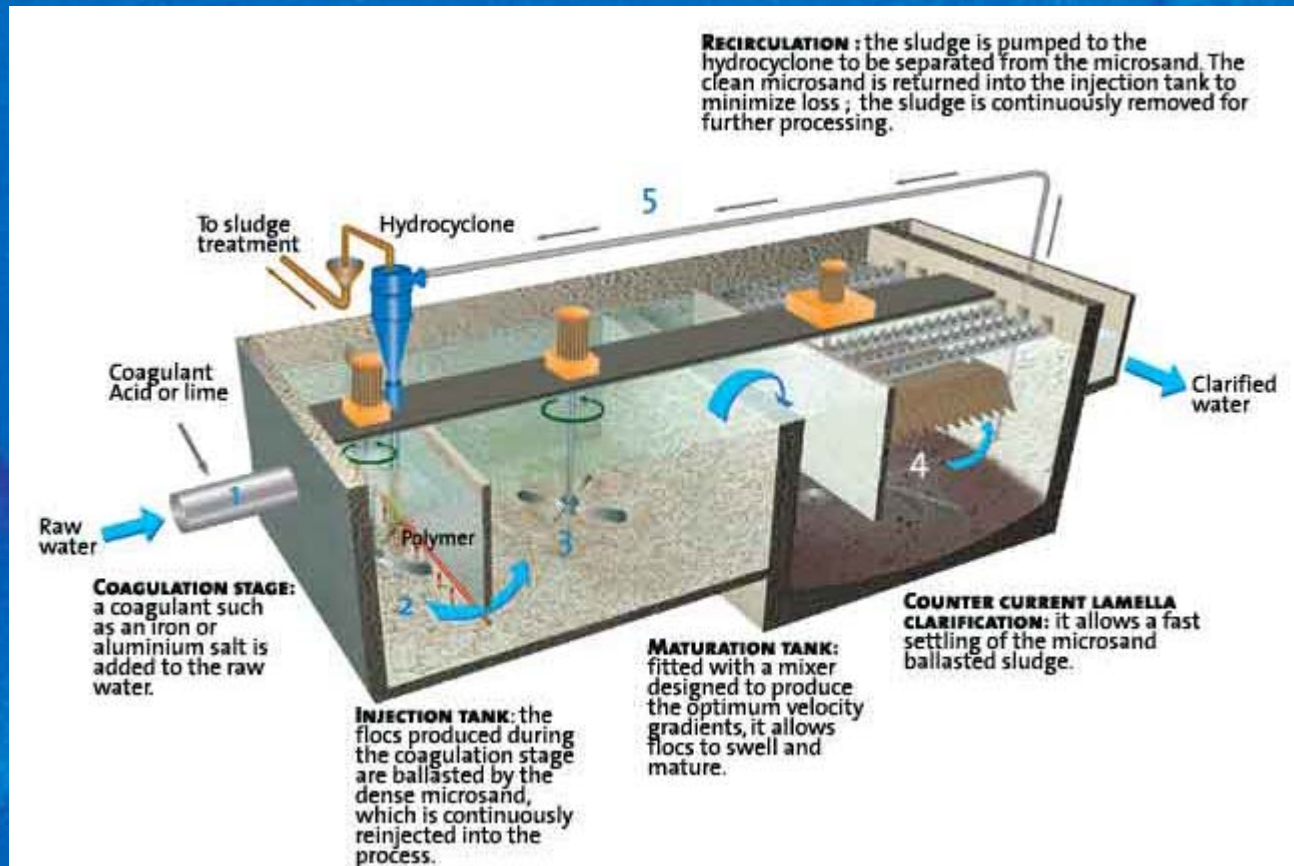
Conventional Filtration System

❖ Conventional Filtration

- ❖ Coagulated particle removed prior to filters
- ❖ Greater than 3.0 log removal
- ❖ Additional disinfection required



Conventional Clarification System



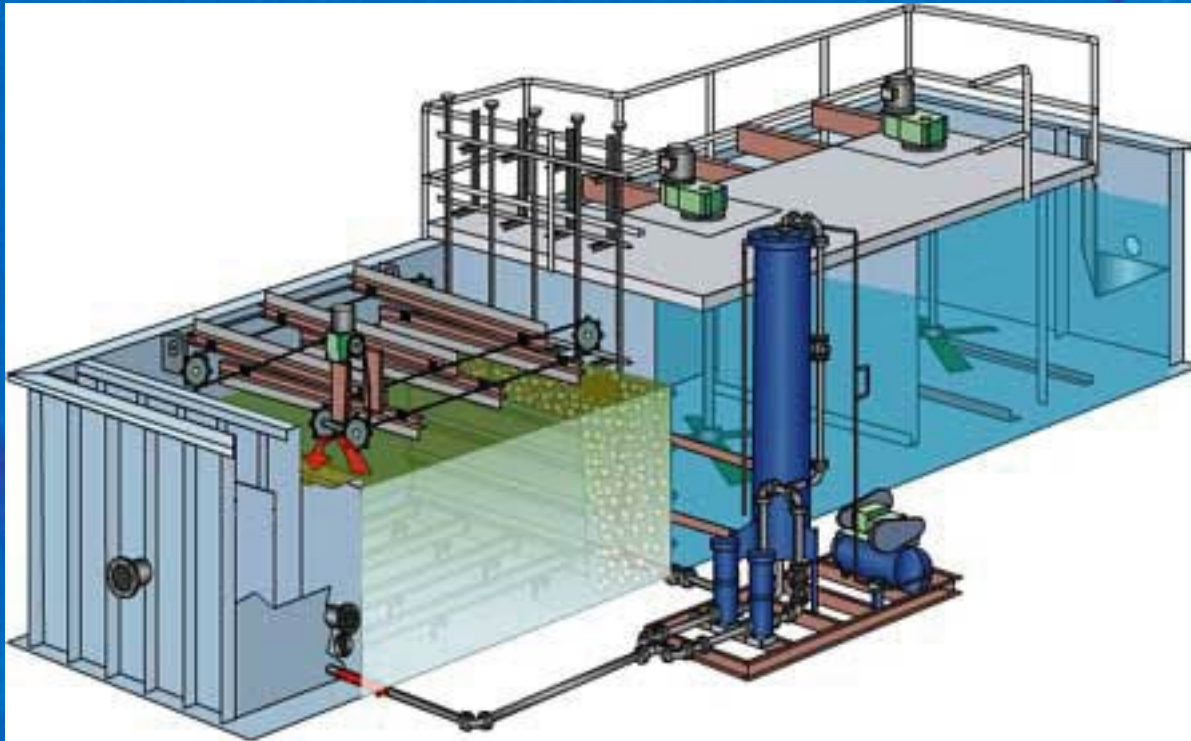
¹ Courtesy of Veolia Water

Actiflo™ Clarification Process¹



¹ Courtesy of Veolia Water

Dissolved Air Flotation (DAF) System¹



¹ Courtesy of Leopold Water

Slow Sand Filtration

◆ Slow Sand Filtration

- ◆ 3.0 log removal
- ◆ Biological top layer (scmutzdecke) eliminates the need for chemical addition
- ◆ Additional disinfection required
- ◆ Smaller populations from 20 to 2000

Slow Sand Filtration System¹



¹ Courtesy of MS Filter

Pall Septra™ Cartridge Filter System¹

◆ Cartridge Filtration

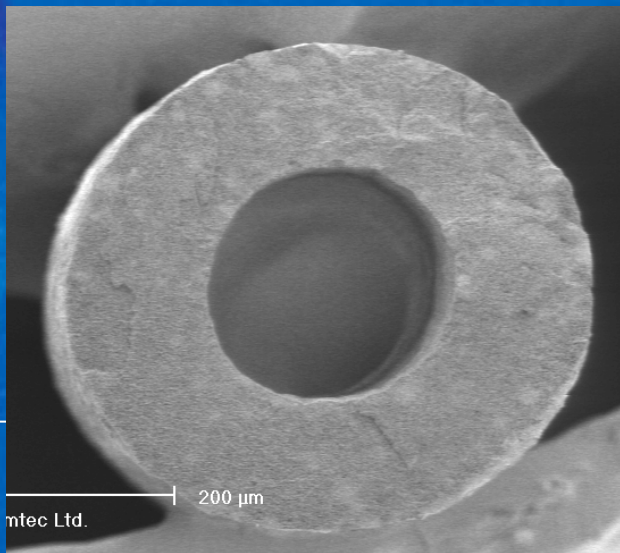
- ◆ Typically coagulation not required
- ◆ 2.0 + log removal (depending on independent test results)
- ◆ Additional disinfection required
- ◆ up to 2000 people



¹ Courtesy of Pall Corporation

Membrane Filtration System

- ◆ Membrane Filtration (hollow fibre technology)
 - ◆ 3.0 + log removal (depending on independent test results)
 - ◆ Additional disinfection required



Memcor[®] XS Packaged Membrane System¹



¹ Courtesy of Siemens Water Technologies

Packaged System Benefits (for Towns)

- ❖ Can be easily integrated into a Multi-barrier treatment approach
- ❖ Compact Foot prints
 - ❖ Smaller building requirements
 - ❖ Simpler building Designs
- ❖ Possible to have plug and play operation
 - ❖ Factory Testing can be performed prior to arriving at site

Packaged System Benefits (cont'd)

- ◆ Modular Design allows for standardized design and lower resultant costs
- ◆ Typically have most (if not all) of the same bells and whistles as the full scale systems
- ◆ In many cases, more conservative designs can be employed

Questions and Answers

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