

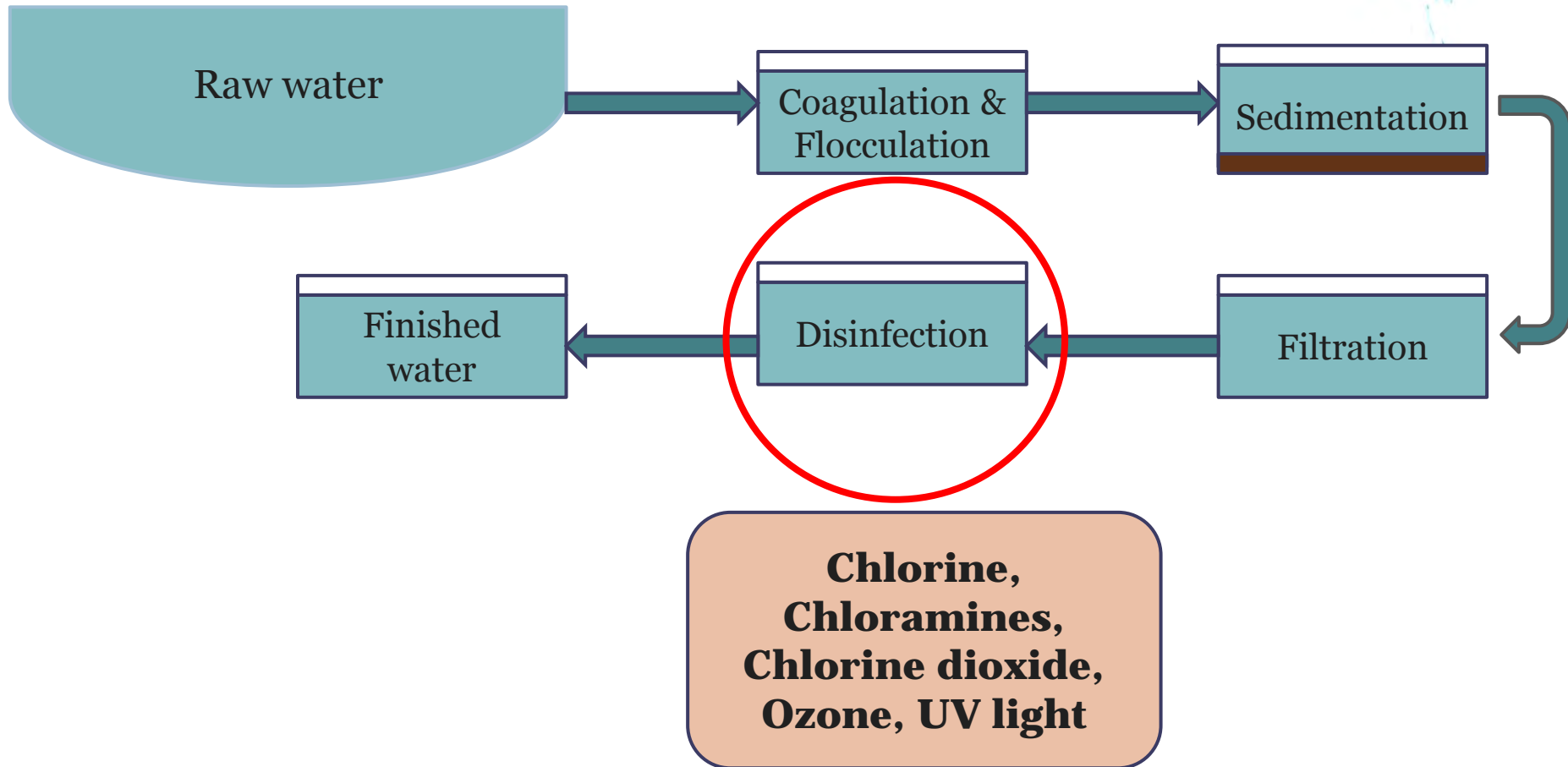
Drinking Water Quality as Affected by Water Treatment, Distribution, and Source Water Quality

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Introduction



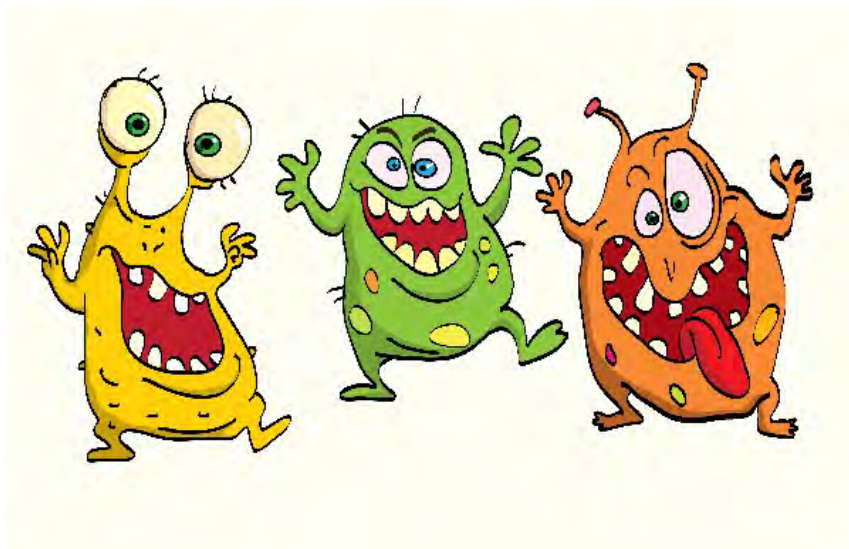
- **Cl decays in water distribution**
 - **Volatilization**
 - **Bulk decay – by reacting with organic/inorganic compounds in water**
 - **Wall decay – by reacting with pipes & tank walls**



- **Chlorine decay –**

- **Decreases disinfection efficiency**

- Can result microbial re-growth**

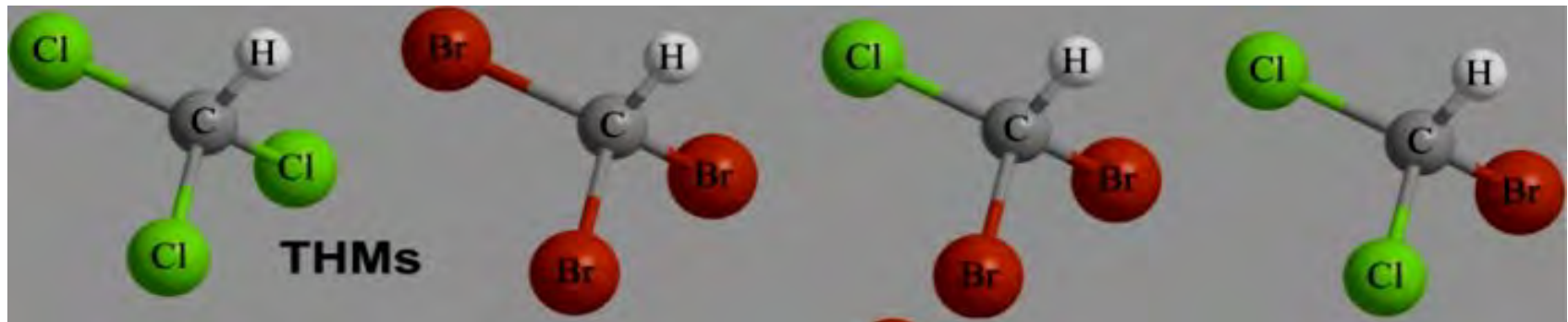


• Chlorine decay –

- Produces disinfection by-products (DBPs)

DBPs = Chlorine + organic matter

e.g., Trihalomethanes (THMs)

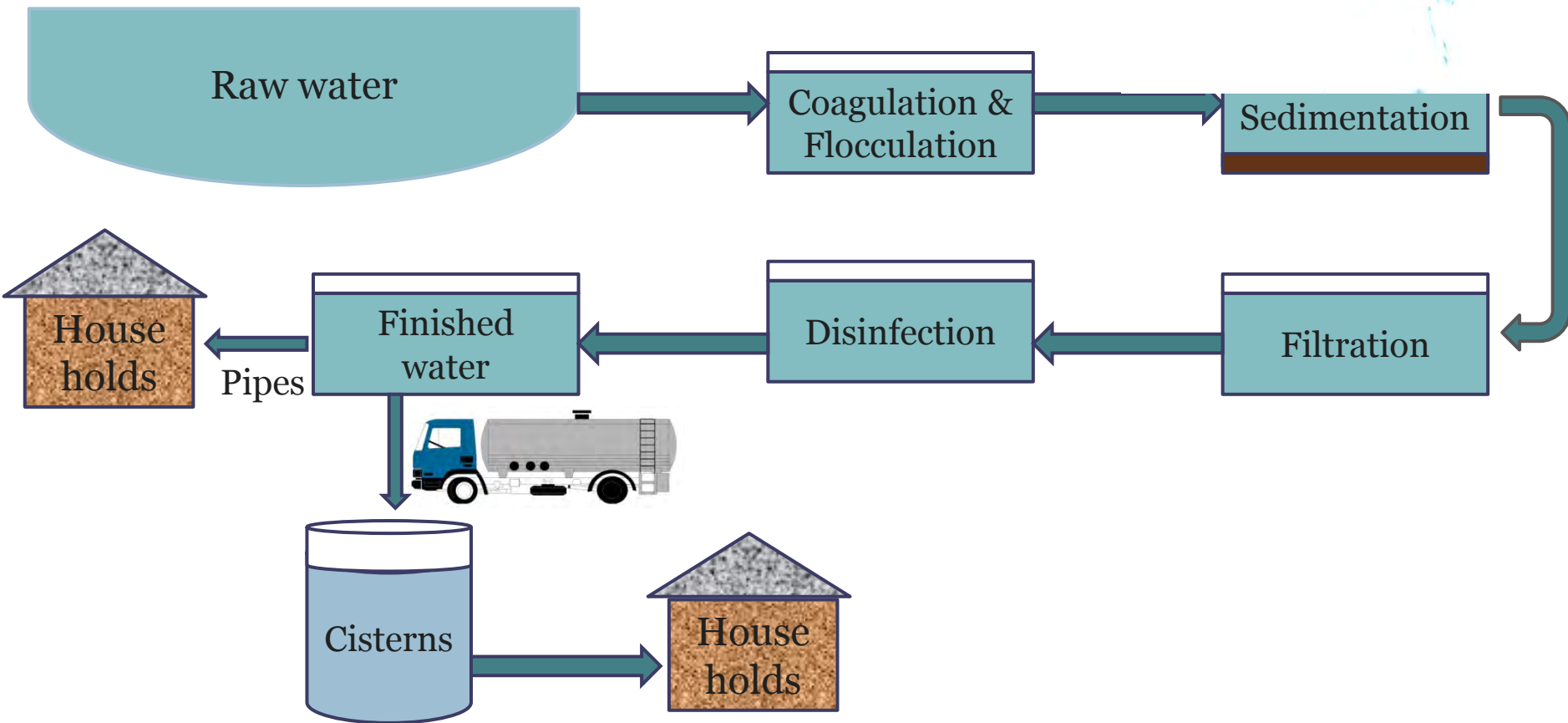


Factors affecting on bulk chlorine decay

- **Type & dose of chlorine**
- **Chemistry of water – composition, pH**
- **Natural & anthropogenic organic matter content**
- **Temperature**
- **Contact time - storage**
- **Sediment properties of water source**
- **Algal growth in source water – amount & species**



Water Distribution Methods



Water Systems in First Nation's communities



	Manitoba (%)	Canada (%)
Piped	51	72
Truck delivery - Cisterns	31	13.5
Individual Wells	13	13
No Water Service	5	1.5

National Assessment of First Nation's Water and Waste Water Systems, Manitoba and National Roll-Up Reports, 2011

Concerns about Cisterns



- **Cl may react with compounds in the water & tank walls**
- **Cl decay may reduce the residual chlorine concentration in the cisterns**
- **These reactions may reduce the disinfection efficiency**
- **Risks in transportation of water**

Baird et al., 2013 & Personal communications

Objectives

- **To compare the water quality of direct pipe water & the cisterns in the communities**
- **To study seasonal variation of water quality (chlorine decay and DBP formation) in the cisterns**
- **To identify the factors (treatment/source water quality) affecting on water quality issues**



Experimental Approach - Field

- 1. On-site study – Water samples from direct piped water & cisterns will be collected four times a year during spring, summer, fall, and winter to study bacterial re-growth & DBP formation.**



Experimental Approach - Lab



- 2. Laboratory study I – Source water samples from the source water will be incubated under a range of chlorine concentrations & temperatures to study the chlorine decay kinetics & DBP formation.**
- 3. Laboratory study II – Source water will be incubated under different light conditions to study the growth of algae in source water on DBP formation**
- 4. Laboratory study III – Sediments from the source water will be incubated to study the DBP formation potential**

Significance of the Research



- **Research will evaluate effects of using cisterns as a drinking water storage and distribution method in First Nation's communities**
- **Results will identify the potential sources of DBP precursors in drinking water**
- **Results can be used to develop effective and novel techniques to remove those precursors during the water treatment process.**



Thank you