

Class	Groundwater	Surface water
Dissolved materials	Fe, Mn, hardness ions, inorganic salts, trace organic compounds	Organic compounds, tannic acids, hardness ions, inorganic salts
Dissolved gases	Carbon dioxide, hydrogen sulfide	
Immiscible liquids		Oils and greases

WATER TREATMENT CHART

DRINKING WATER SOURCE (RAW WATER)



COAGULATION, THEN FLOCCULATION

Chemical treatment to form floc,
which is allowed to settle from water



SEDIMENTATION



FILTRATION

To remove remaining solids



DISINFECTION

Chlorine to kill microorganisms



DISTRIBUTION SYSTEM



DISINFECTION OF WATER

- Must destroy bacteria, viruses, and amebic cysts in water within a reasonable time despite all variations in water temperature, composition, and concentration of contaminants
- Must not be toxic for humans and domestic animals, unpalatable, or otherwise objectionable

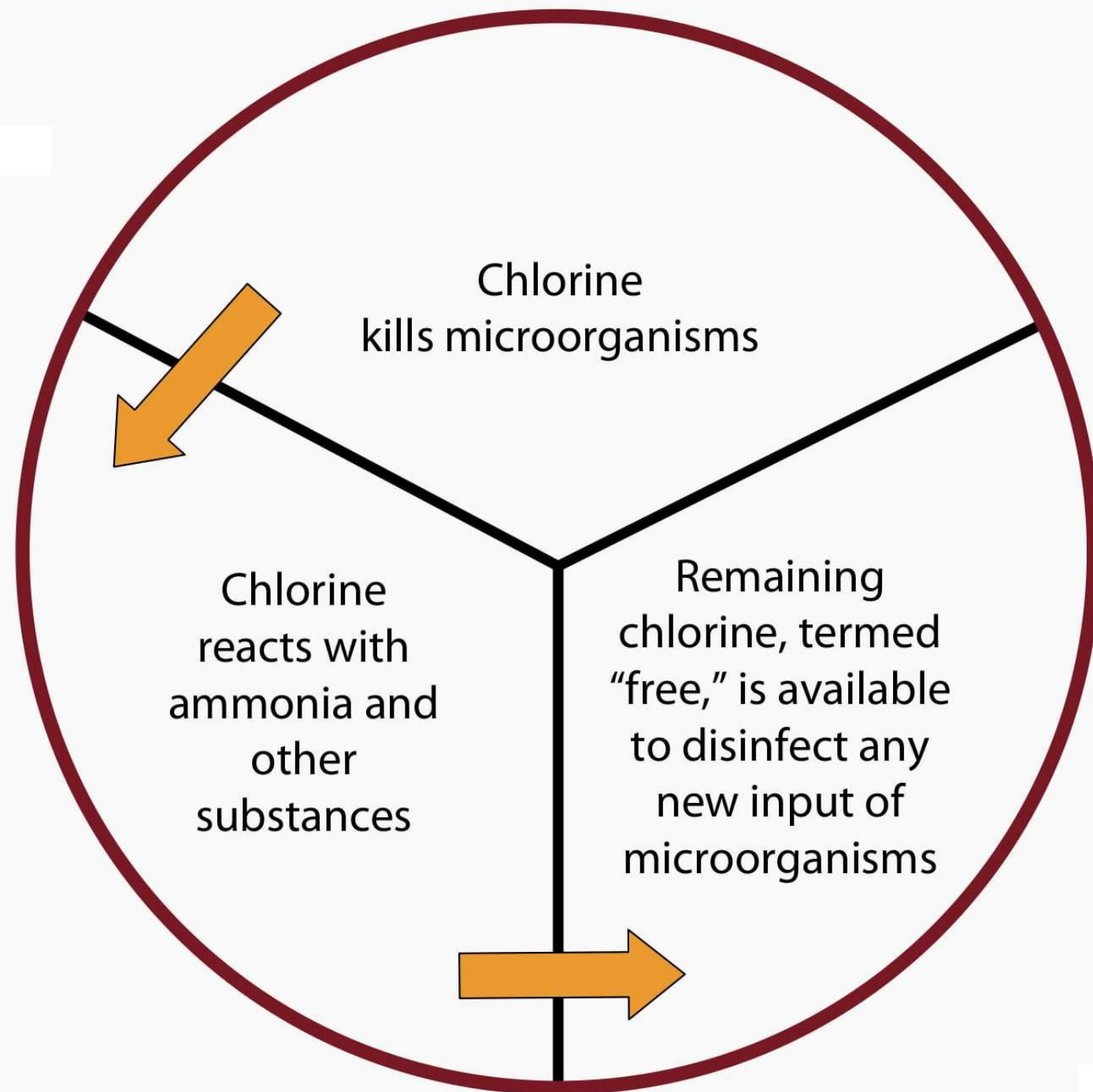
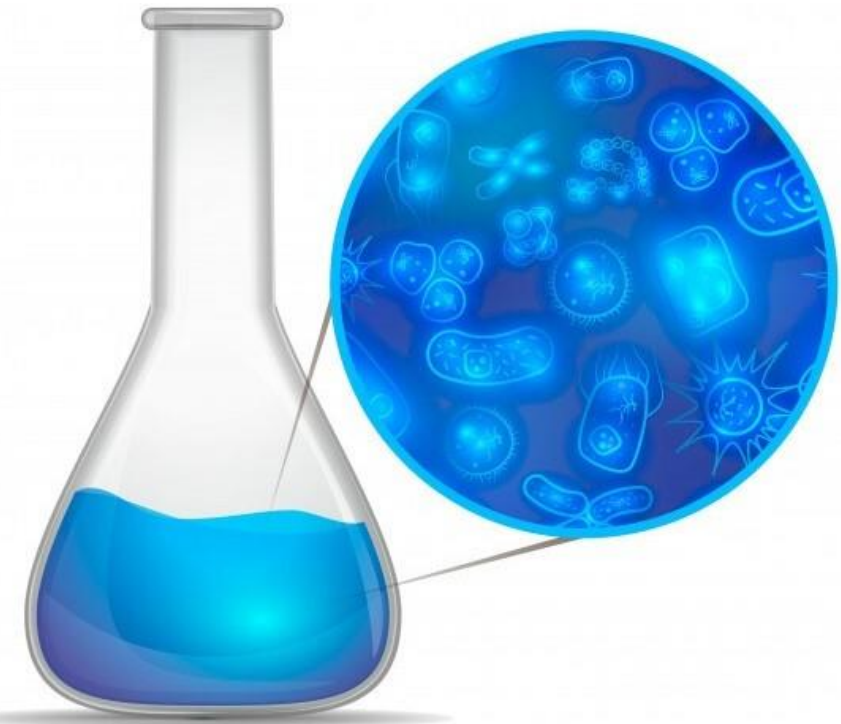


- Must be reasonable in cost and safe and easy to store, transport, handle, and apply
- Residual concentration in the treated water must be easily and, preferably, automatically determinable
- Must be sufficiently persistent so that the disappearance of the residual would be a warning of contamination



CHLORINE

Chlorine is the favored disinfectant used for drinking water

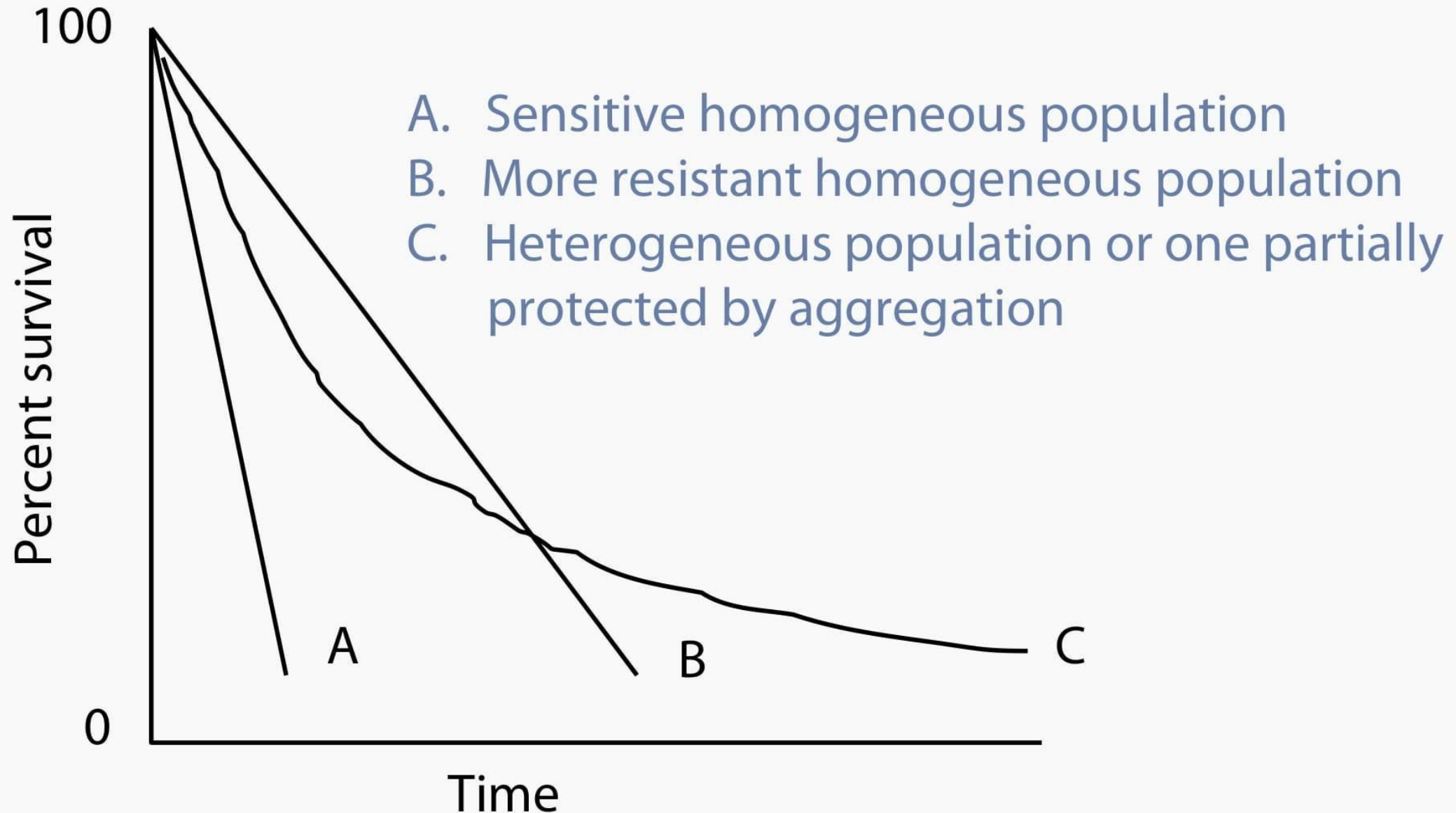


Chlorine kills microorganisms

Chlorine reacts with ammonia and other substances

Remaining chlorine, termed "free," is available to disinfect any new input of microorganisms

■ Inactivation curves of microorganisms following disinfection

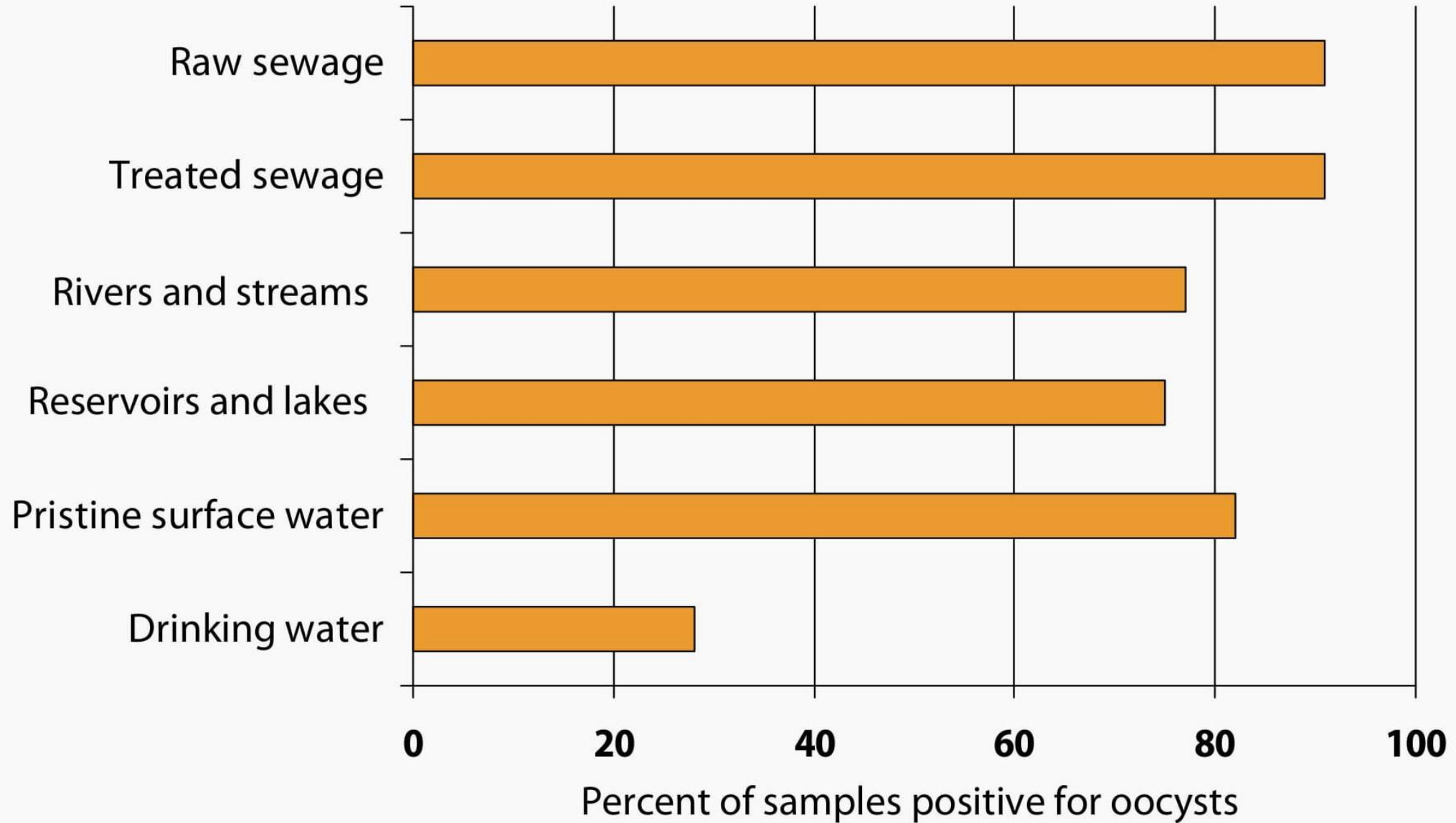


- Microbial inactivation by chlorine (99.9% of organisms killed)

Chlorine concentration (mg/L)	Inactivation time (minutes)	Ct (concentration x time)
0.5	1.0	0.5
1.0	0.5	0.5
2.0	0.25	0.5

The organism, temperature and pH are the same

- Chlorine does not kill protozoan cysts and some resistant viruses



CHLORINE REACTION PRODUCTS

- Chlorination has the potential of reacting with some organic compounds present in the water supply to create *trihalomethanes* (THM; chloroform)
- Surface water supplies, high in dissolved natural organic material (humics), are especially vulnerable to THM formation
- When free chlorine is the disinfectant, THM levels are generally higher in communities using rivers and streams as their source of drinking water than in communities using wells
- THMs are potentially carcinogenic

- Activities permitted for various levels of coliform bacteria in water

Coliform level per 100 ml of water	Activity permitted
1 coliform or fewer	Water safe for drinking
4 coliforms or more	State must be notified and corrective measures taken
2,300 coliforms or fewer	Swimming is allowed
10,000 coliforms or fewer	Boating is allowed



AVOID DISEASES THAT SPREAD THROUGH WATER



Disease Caused by Drinking Polluted Water



Cholera



Typhoid



Giardia



Diarrhoea



Hepatitis A

The End

