



Drinking Water Treatment

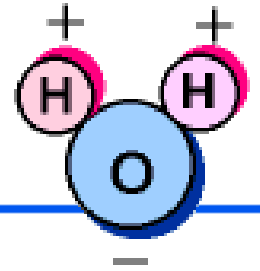
Ref:

Joel Ducoste, Department of Civil, Construction, and Environmental Engineering, North Carolina State Univ.





Importance of Water



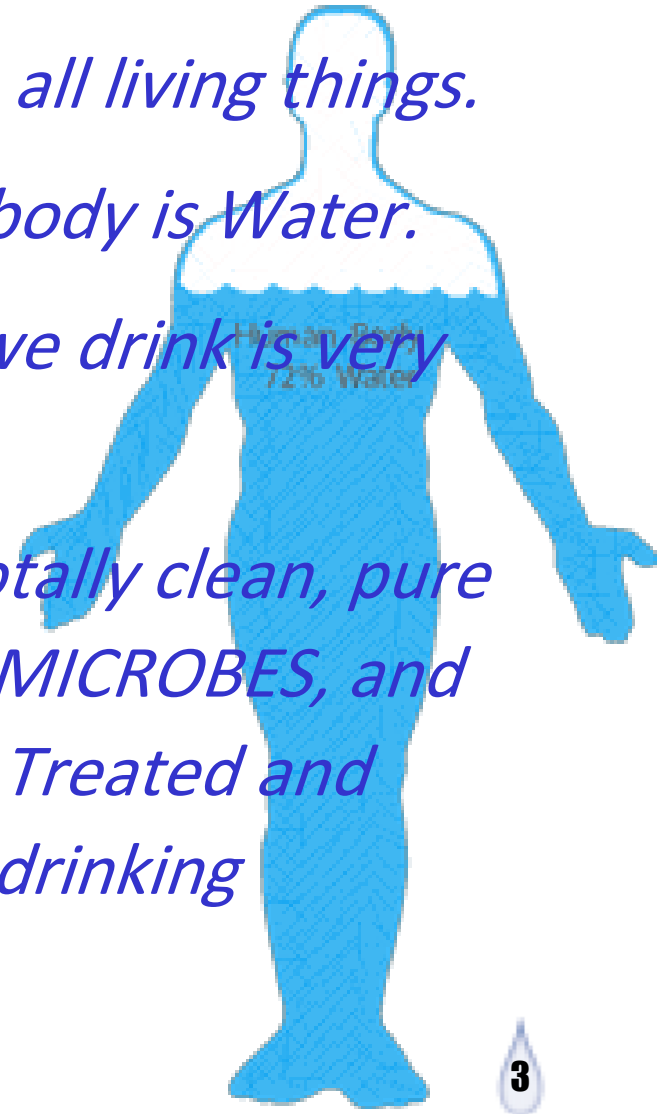
- *Looking at water, you might think that it's the most simple thing around.*
- *Pure water is colorless, odorless, and tasteless.*
- *But it's not at all simple and plain and it is vital for all life on Earth.*
- *Where there is water there is life, and where water is scarce, life has to struggle or just "throw in the towel."*

“Water is life”



So What Is It About Water That Makes It So Important To Us?

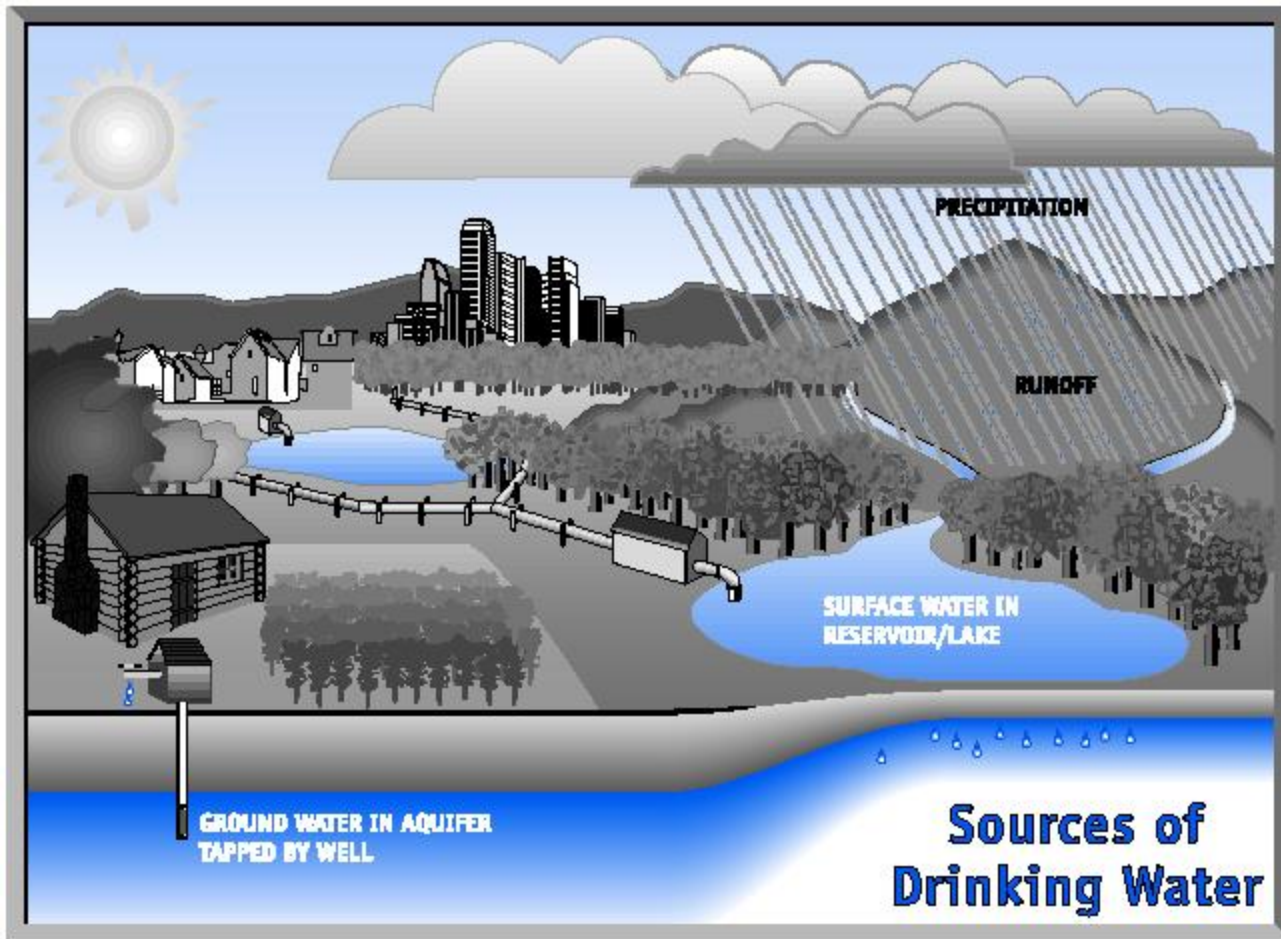
- *Water is of major importance to all living things.*
- *Up to 60 percent of the human body is Water.*
- *Therefore the quality of Water we drink is very important.*
- *The Drinking Water should be totally clean, pure and free of any disease-causing MICROBES, and that's why it should be properly Treated and DISINFECTED before using it for drinking purpose.*





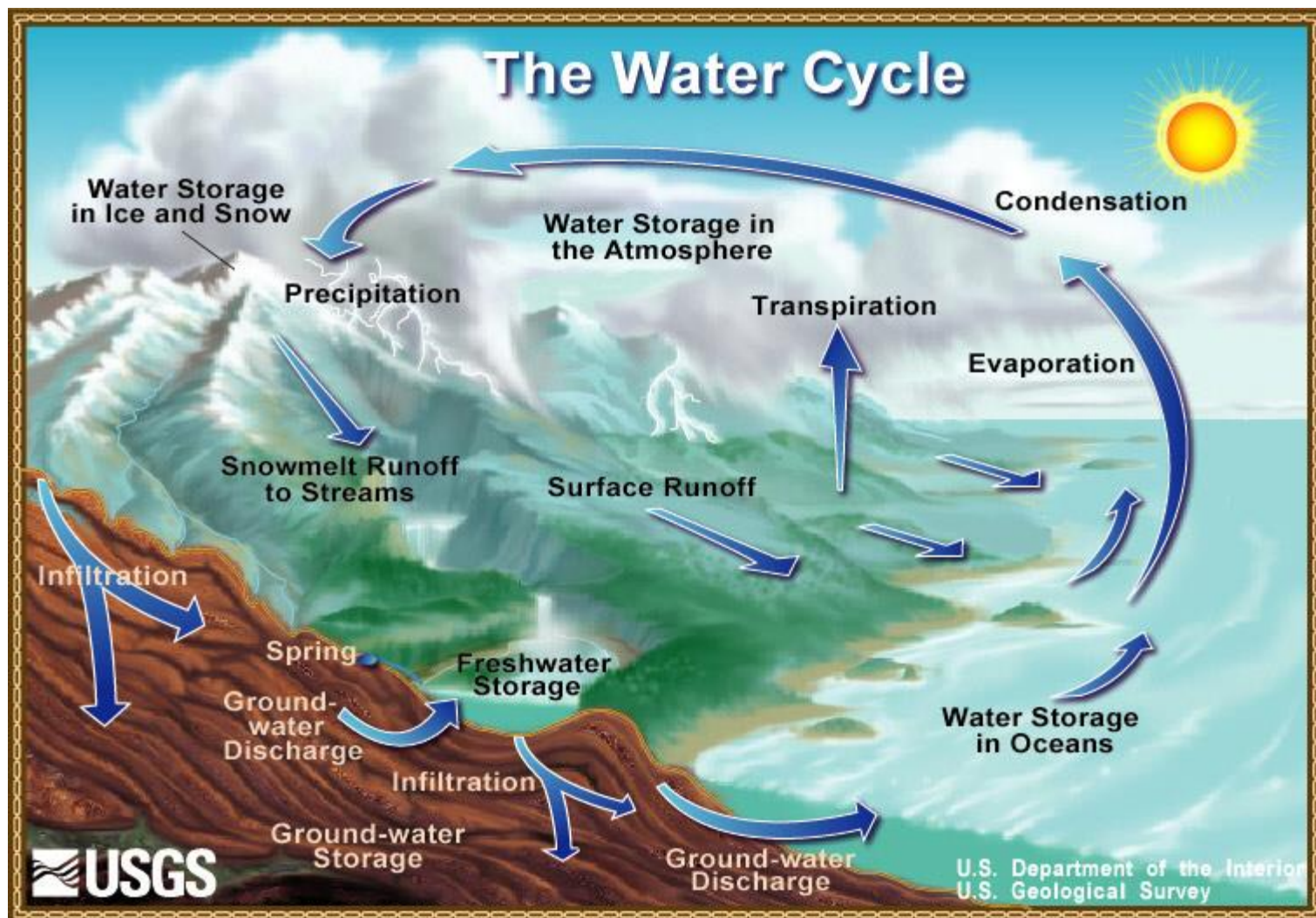
Where does the Water come from?

- *surface waters (lakes, rivers, and reservoirs)*
- *groundwater (wells).*



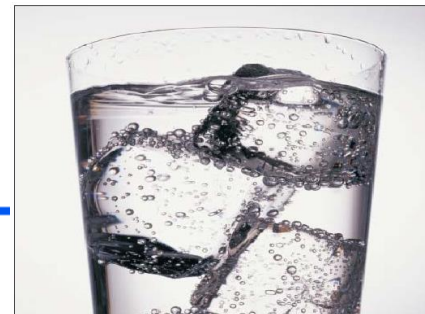


The Water Cycle





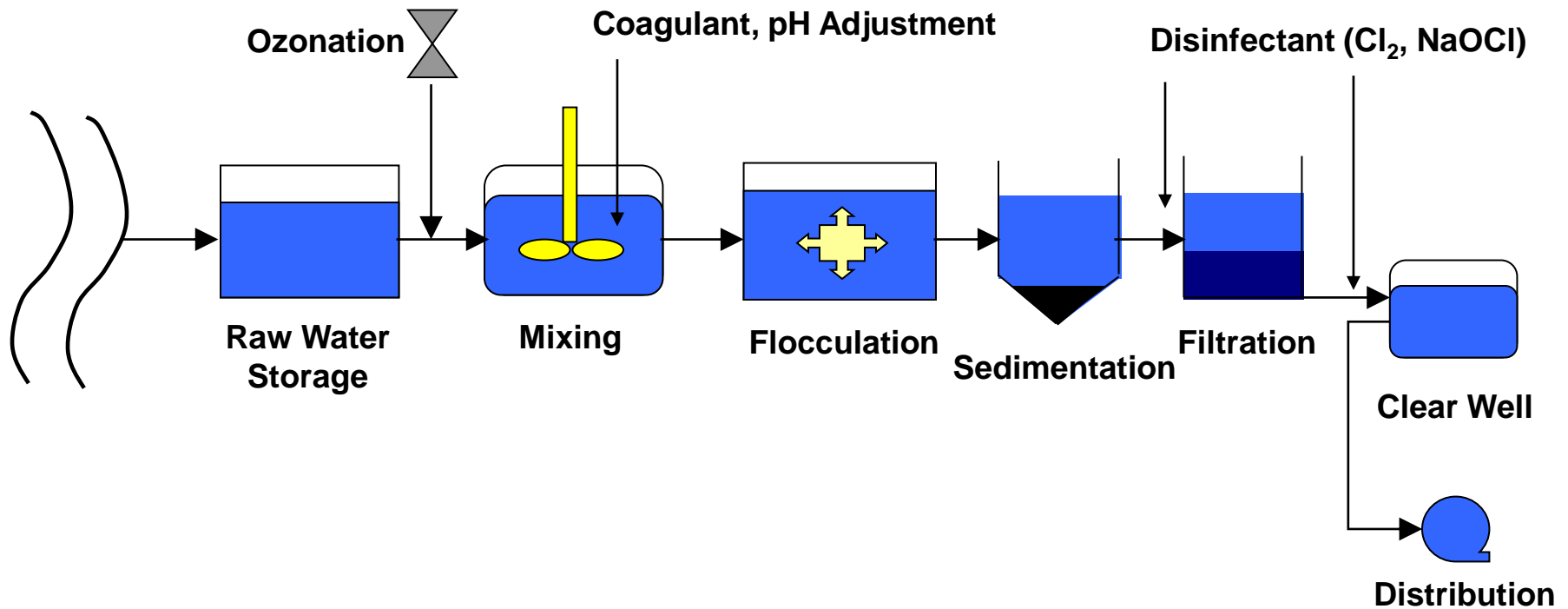
Drinking Water



- *Jordan has scarce water supplies in the world.*
- *In recent years, microbial contamination of the water supply has led to highly publicized outbreaks of disease, causing illness and even death.*
- ***How safe is our water?***
- ***Where do these infectious microbes come from?***
- ***How is water treated now and what's being done to make it even safer?***

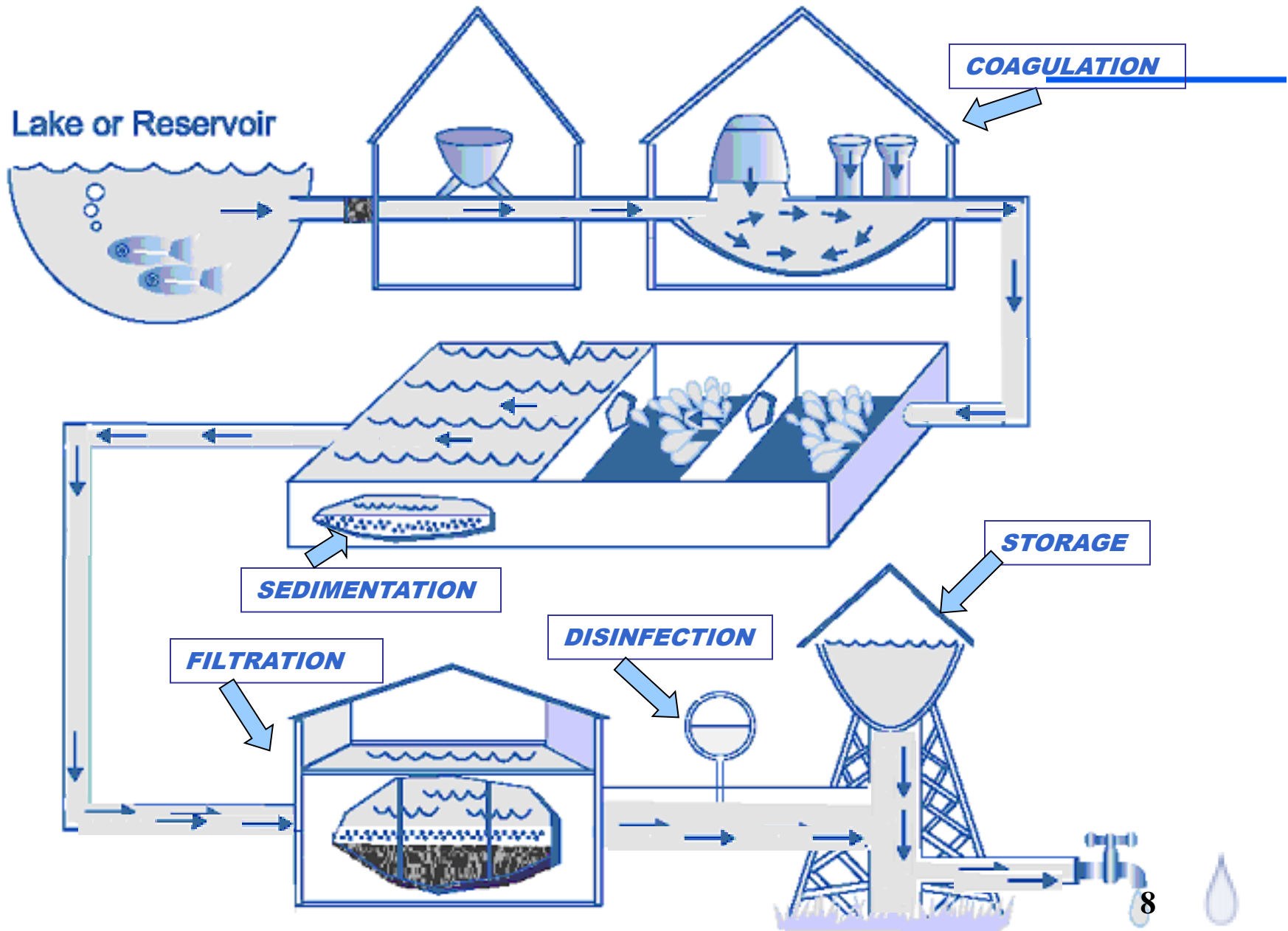


Surface Water Treatment Plant





COMPLETE CYCLE OF WATER TREATMENT

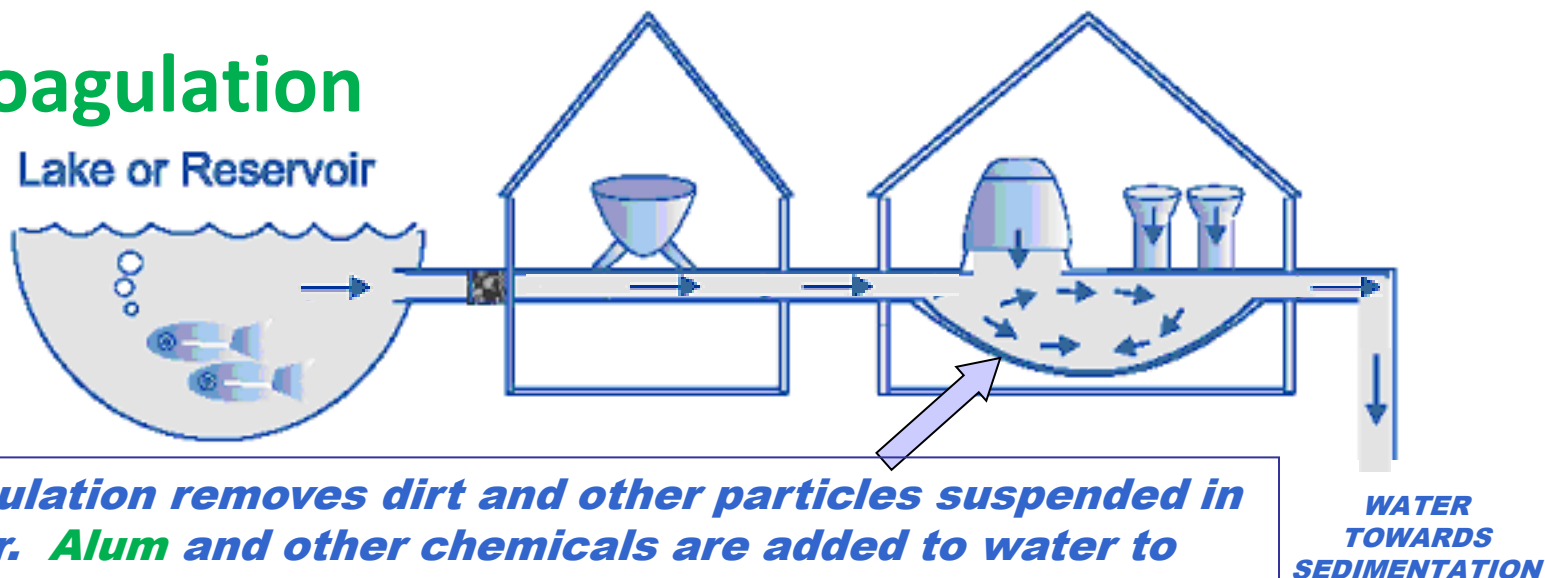




Water Treatment

- *Water treatment transforms raw surface and groundwater into safe drinking water.*
- *Water treatment involves two major processes: **physical removal of solids** and **chemical disinfection**.*

Coagulation

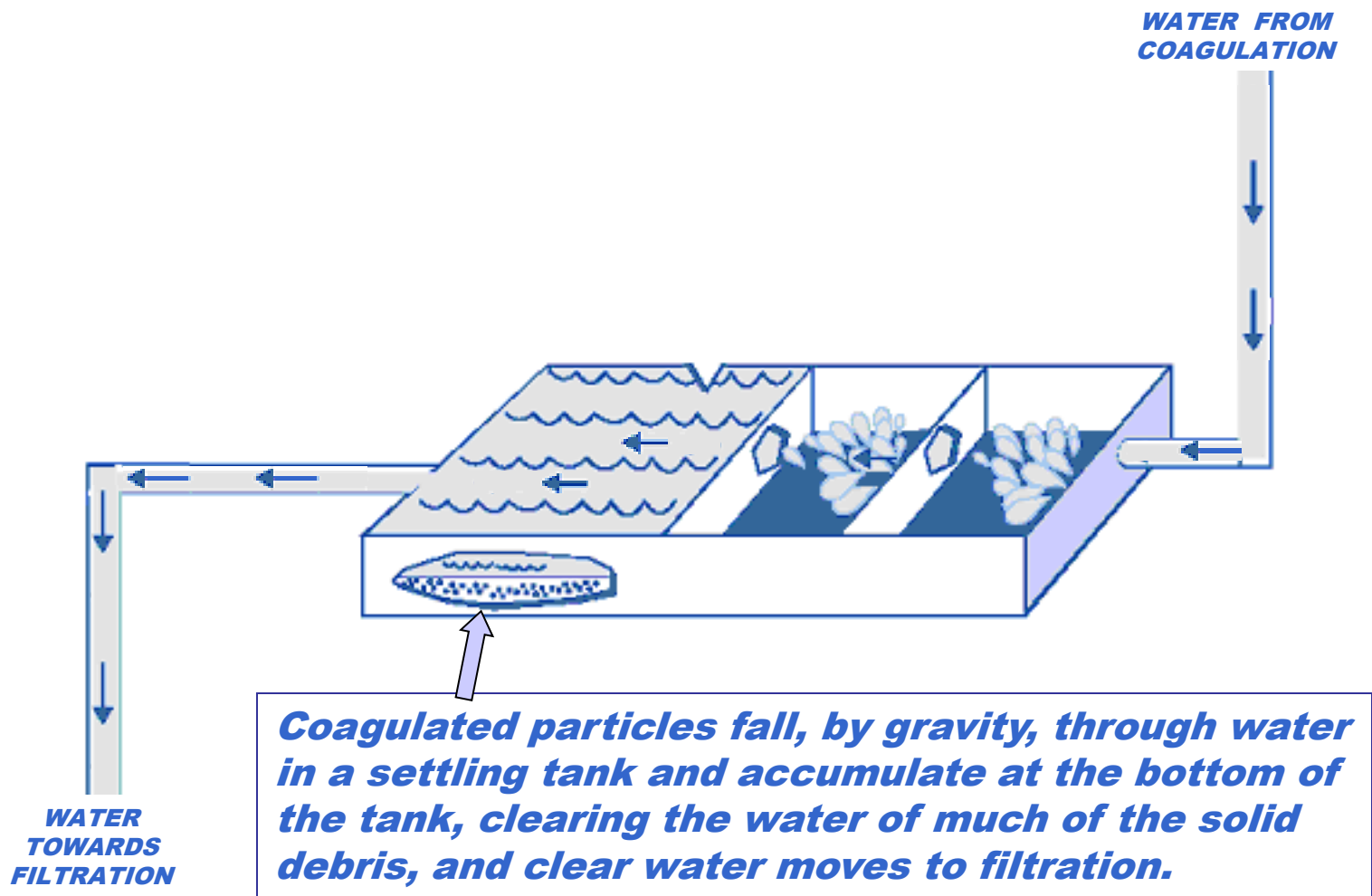


*Coagulation removes dirt and other particles suspended in water. **Alum** and other chemicals are added to water to form tiny sticky particles called “**floc**” which attract the dirt particles. The combined weight of the dirt and the **alums (floc)** becomes heavy enough to sink to the bottom during sedimentation.*



Water Treatment

Sedimentation





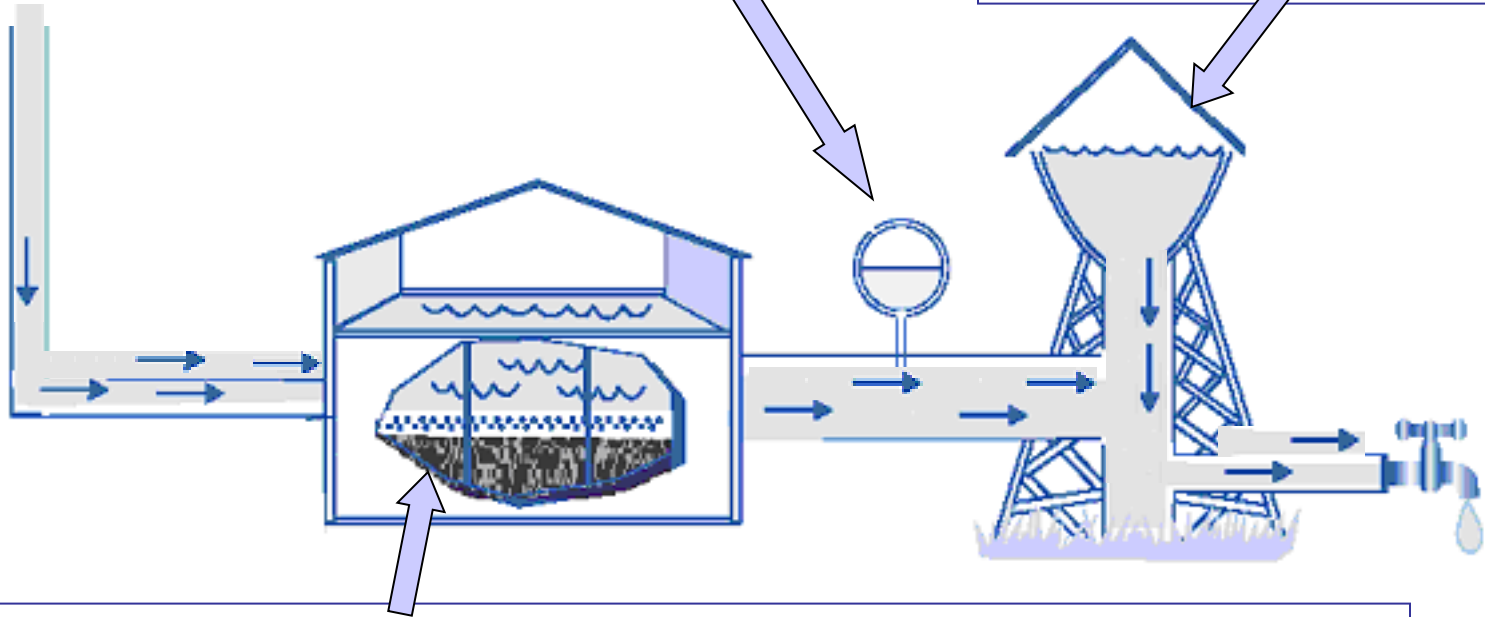
Water Treatment

Filtration, Disinfection & Storage

WATER
FROM
SEDIMENTATION

DISINFECTION: A small amount of chlorine is added or some other disinfection method is used to kill microorganisms that may be in the water.

STORAGE: Water is placed in a closed tank or reservoir for disinfection to take place. The water then flows through pipes to home and business in the community



FILTRATION: The water passes through filters, some made of layers of sand, gravel, and charcoal that help remove smaller dissolved particles such as dust, bacteria, viruses, and chemicals.



Water Disinfection

◆ Purpose of Disinfection

- To make Drinking Water free of any disease causing bacteria and microbes.

◆ Methods of Disinfection

- 3 mainly used disinfection methods at large scale:
 - *CHLORINATION*
 - *OZONATION*
 - *ULTRAVIOLET RADIATION*



Water Disinfection

Chlorination

- Chlorine is the most common cost-effective means of disinfecting water.
- The addition of a small amount of chlorine is highly effective against most bacteria, viruses, and protozoa.
- But cysts (durable seed-like stages) formed by parasitic protozoa such as **Cryptosporidium** and **Giardia** can survive chlorine.
- Chlorine is applied to water in one of three forms: **elemental chlorine** (chlorine gas), **hypochlorite solution** (bleach), or **dry calcium hypochlorite**. All three forms produce free chlorine in water





Water Disinfection

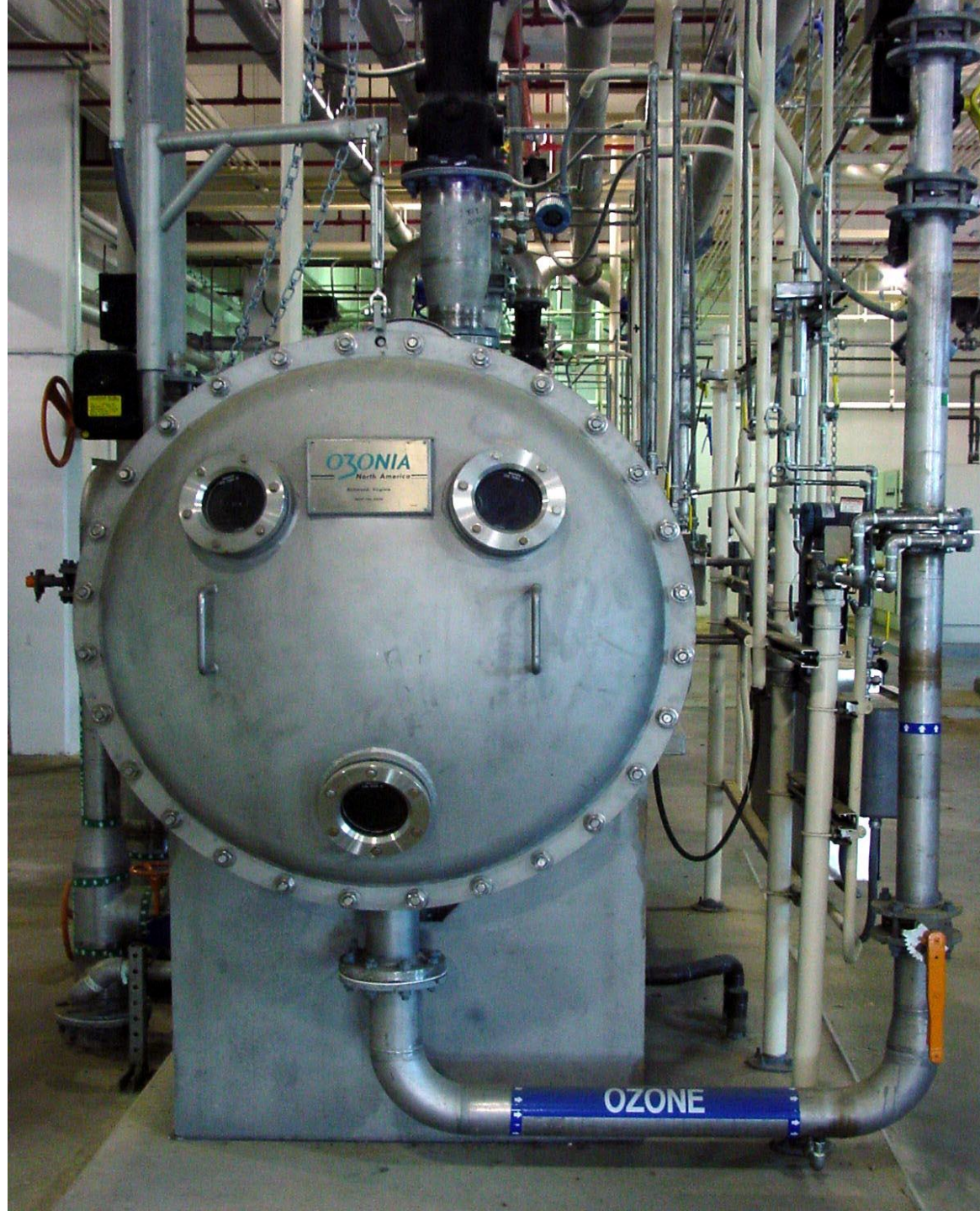
Ozonation

- OZONE is the strongest oxidant/disinfectant available.
- More effective against microbes than chlorination.
- But, costly and difficult to monitor and control under different condition.

◆ Ozonation Process

- Ozone (O_3) is generated on-site at water treatment facilities by passing dry oxygen or air through a system of high voltage electrodes.



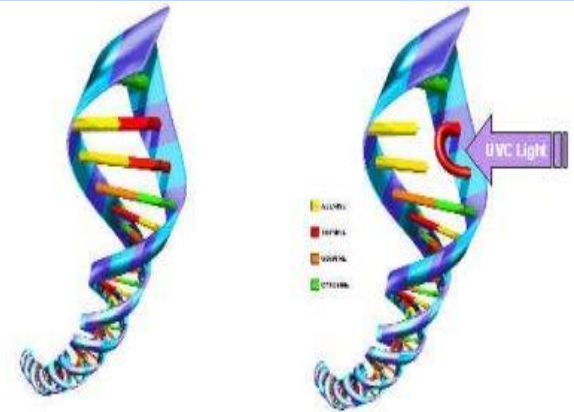




Water Disinfection

Ultraviolet Radiation

- When UV radiation penetrates the cell wall of an organism, it damages genetic material, and prevents the cell from reproducing.
- Now a days emerging technology made UV radiation to find a place in both household and large scale drinking water disinfection.

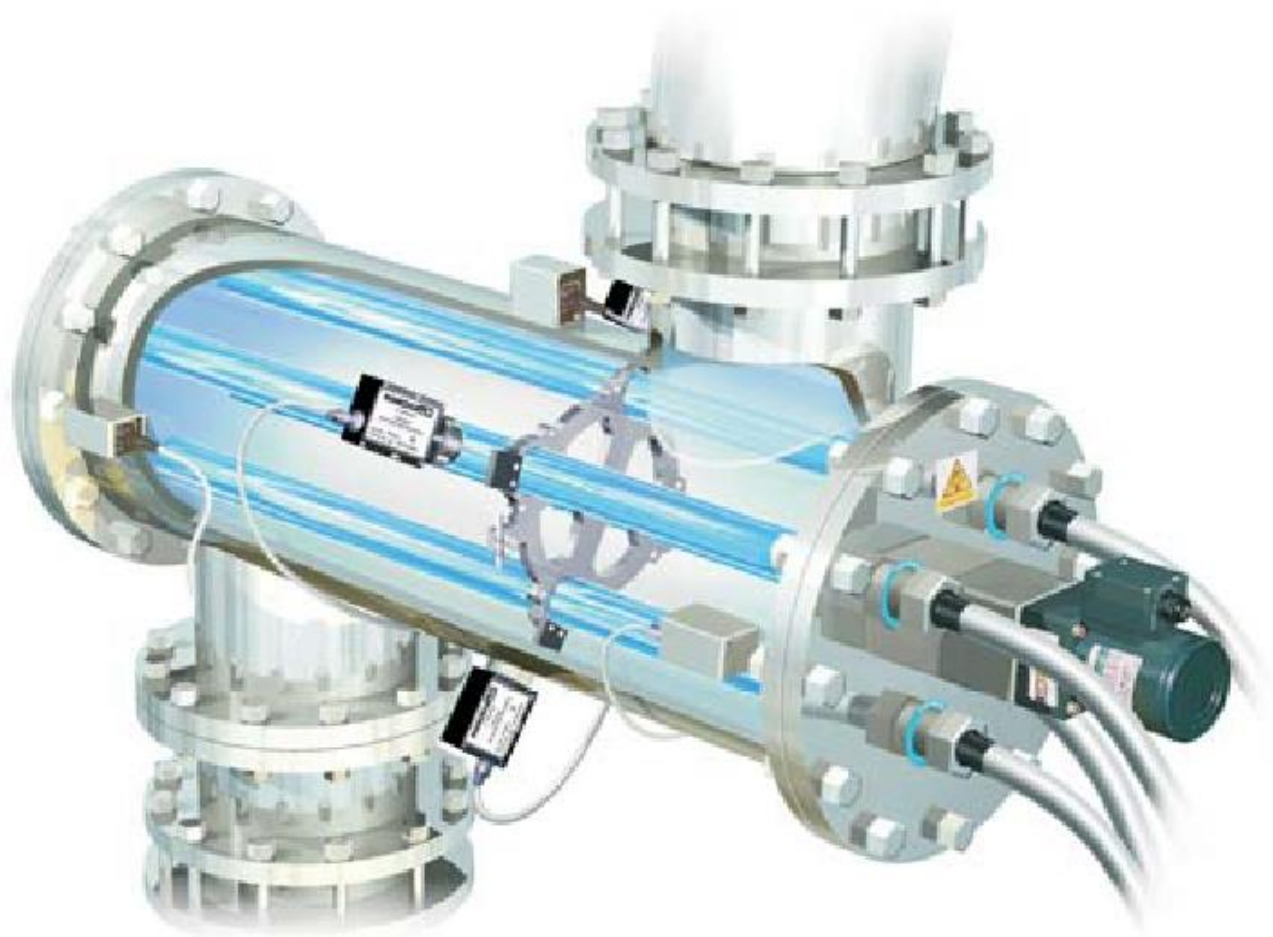


◆ How is UV light generated?

- Ultraviolet light is most typically generated from a low pressure or a medium pressure lamp generating UV light.



ULTRAVIOLET RADIATION





COMPLETE CYCLE OF WATER TREATMENT

