

The Ministry of Health Care and Social Development
The Volgograd State Medical University
The Chair of hygiene and ecology

LECTURE:

**Sources of water supply.
Sanitary & hygienic characteristics.¹**

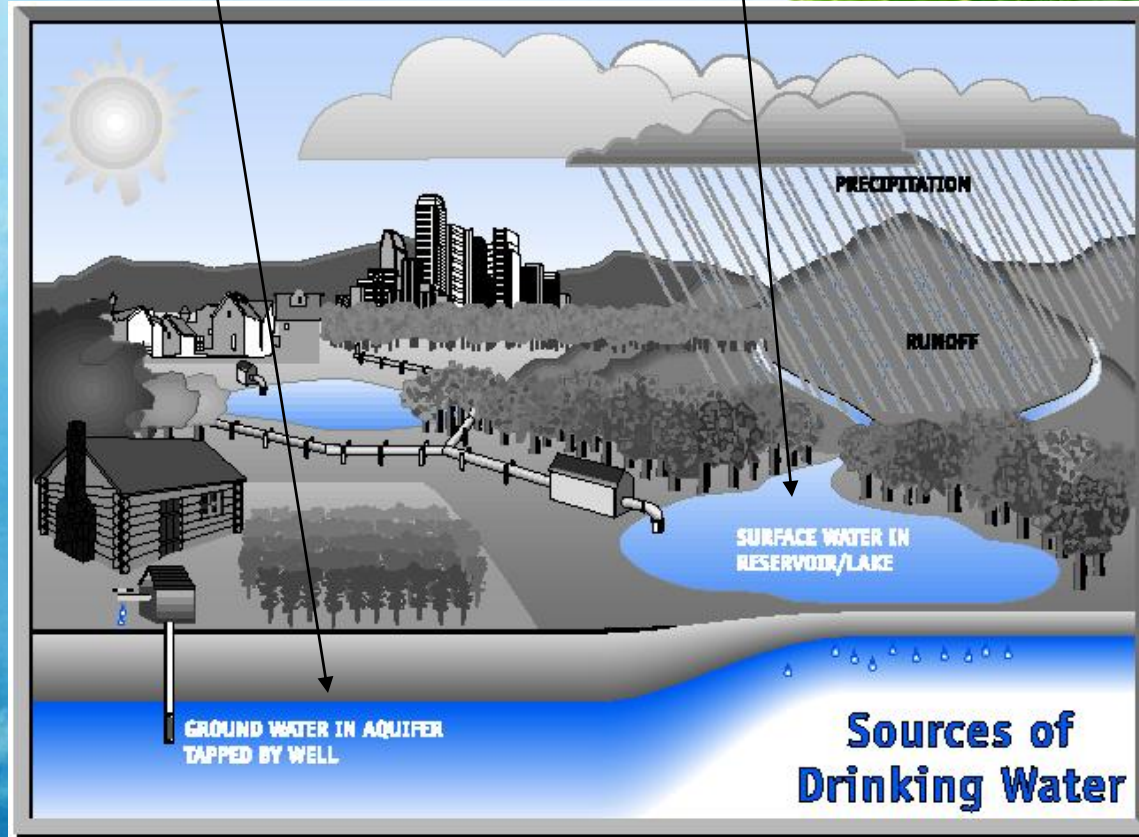


Sources of water supply

Surface waters (lakes, rivers, and reservoirs)

Groundwater (wells)

Rain water



Surface Water

- This includes water from also streams, lakes, and rivers.



Sources of pollution and structure of pollutants of surface water supplies

- **1. Industrial and household waste : detergents, heavy metals, organic and inorganic chemical substances.**
- **2. Atmospheric aerosols: different chemical substances, radioactive substances.**
- **3. Washing away pollutants from soil with precipitation (rain, snow): chemical substances of fertilizer and pesticides, heavy metals, microbes.**
- **4. Accidents on sea and land: oil and oil products**

River Water

- This water is most capable of natural purification. At the same time it is badly contaminated with antropogenic contaminants, as rivers often serve as landfills for industrial waste and wastes from man or animal.
- It receives **various impurities**, including animal excreta and human sewage, and soon becomes dangerously polluted.
- As a rule, more organic impurity will be found in river water than in the other sources. Rivers possess a self-purifying action, by means of which they are enabled to get rid of many of their impurities.
- The sources of surface water, such as rivers, channels, lakes, cannot be used as the sources of drinking water. This water has to undergo a special decontaminating processing.

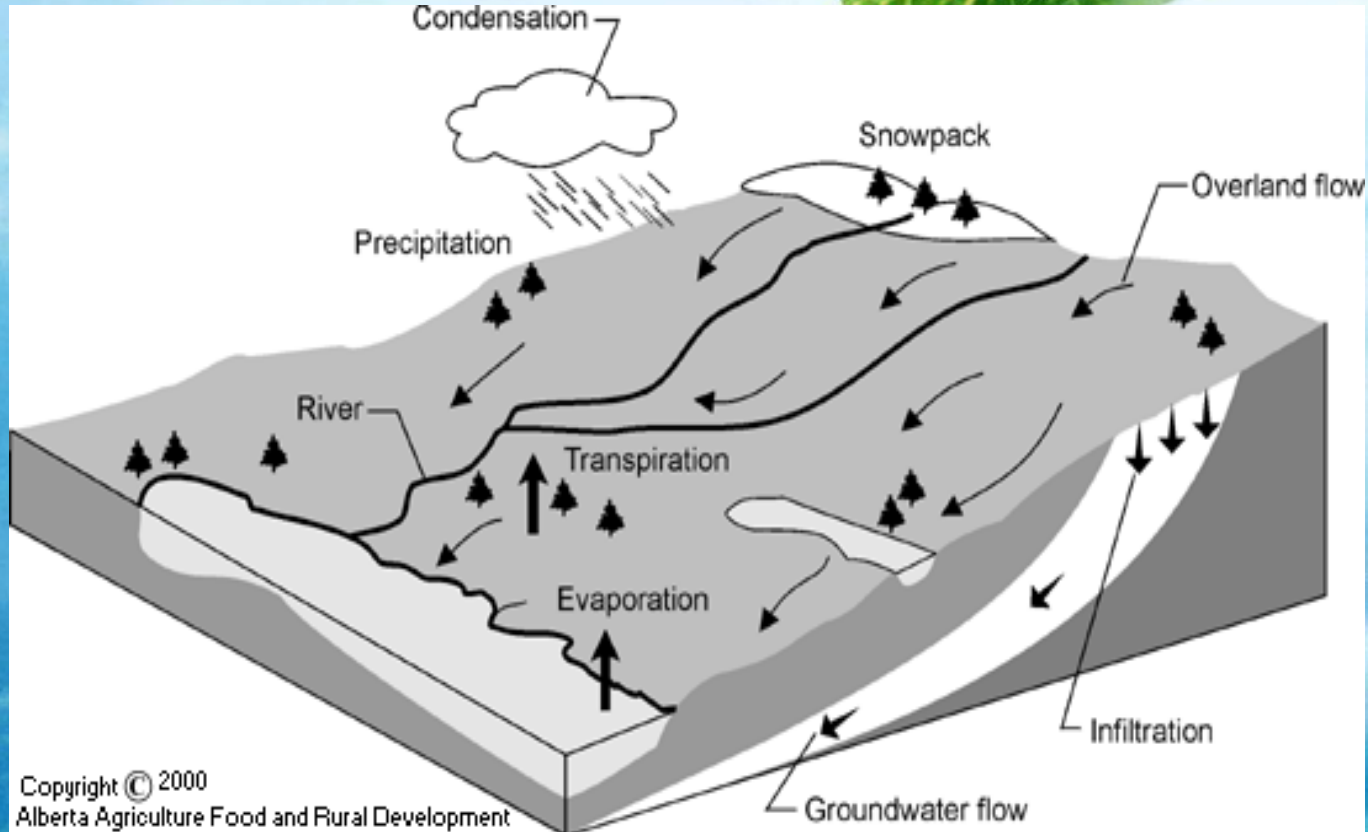


The process of purification:

- This process of purification is due to:
- Oxidation of the impurities by the oxygen absorbed from the air and dissolved in the water.
- Removal of the organic impurities by various forms of vegetable and animal life, including fish.
- The settling of the solid matter to the bottom, carrying with it many micro-organisms.
- Dilution by the water of the tributaries flowing into it.

Ground water

- is formed as a result of filtration of water released as precipitation and surface water through soil.
- According to its depth, all ground water is divided into upper, middle and lower ground water reservoirs.



Upper ground water

The water of the **upper ground water** reservoir which is at a depth of **100 to 2000 meters** is usually used for water supply.

The less the depth of ground water reservoir is, the greater the possibility of its contamination with microorganisms, organic substances and toxic contaminants.

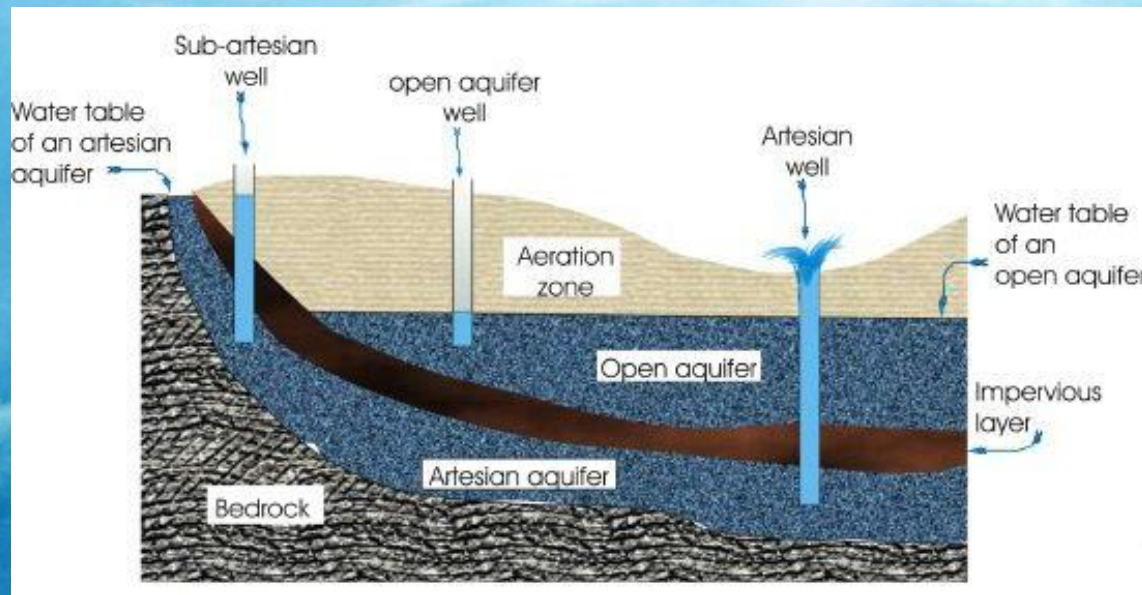
When ground water penetrates through the layers of soil, it is purified and all microorganisms and organic substances are adsorbed.

The efficiency of natural water purification in soil depends upon type, structure, thickness of soil, the rate of its insolation, aeration and temperature.



Middle water

- which is located between the waterproof layers of soil is the best choice in relation to sanitary and epidemiological control.
- Middle water is characterized by stable composition, variety of mineral salts and it has valuable organoleptic properties. **Artesian water** is the best middle water as it is characterized by favorable bacterial properties and is always under pressure.
- The middle layer of ground water is at a depth of some **hundreds** of even **thousands meters**. This water is highly mineralized, it is rich in sulphates, chlorides and other minerals.
- This water is usually used for balneological purposes.



The lower ground water

- reservoirs are at a depth of **some kilometers**. This water is highly mineralized. It contains great amounts of chloride, sodium, iodine, bromide, hydrogen sulphide and some rare elements. This water is used for extraction of minerals which are found in water.

WATER QUALITY PARAMETERS

A green leaf with a water droplet is positioned in the upper right corner, with the droplet falling into a pool of water below, creating concentric ripples. The background is a bright blue sky with soft white clouds.

- Organoleptic
- Physical
- Chemical
- Bacteriological
- Radiation safety

Water Purification Defined

Water purification, or drinking water treatment, is the process of removing contaminants from surface water or groundwater to make it safe and palatable for human consumption.



Purification of water supplies



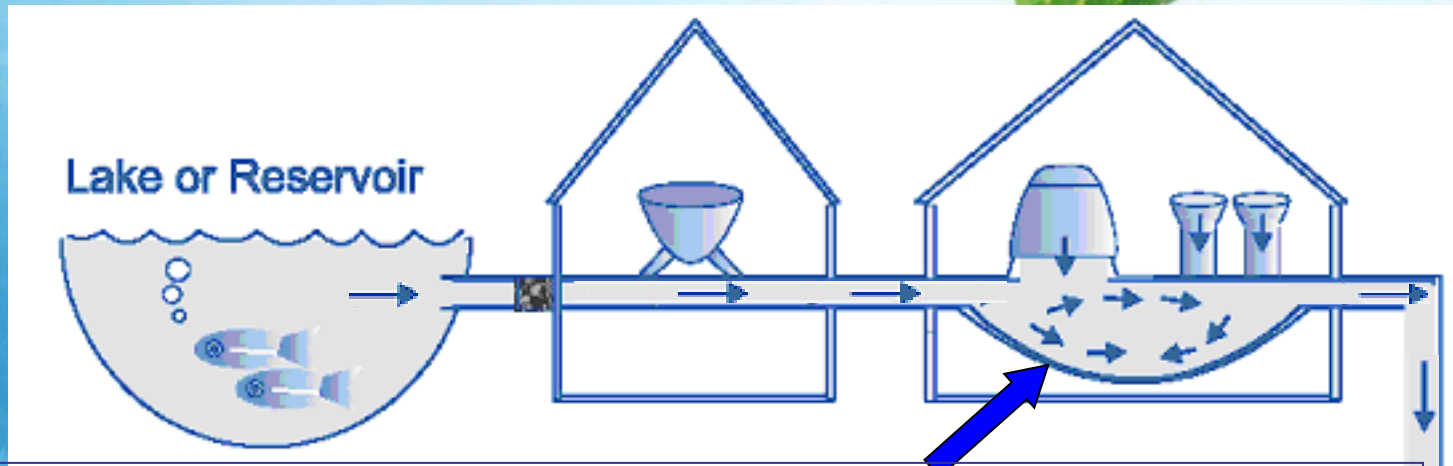
- Methods of purification of water can be classified in two main groups:
- **General**
- 1. Water clearing and decolorization.
- -sedimentation
- -filtration
- -coagulation

COAGULATION:

of drinking water:



COAGULATION is aided by chemicals which cause particulates to aggregate, precipitate, and form sediment (sludge).

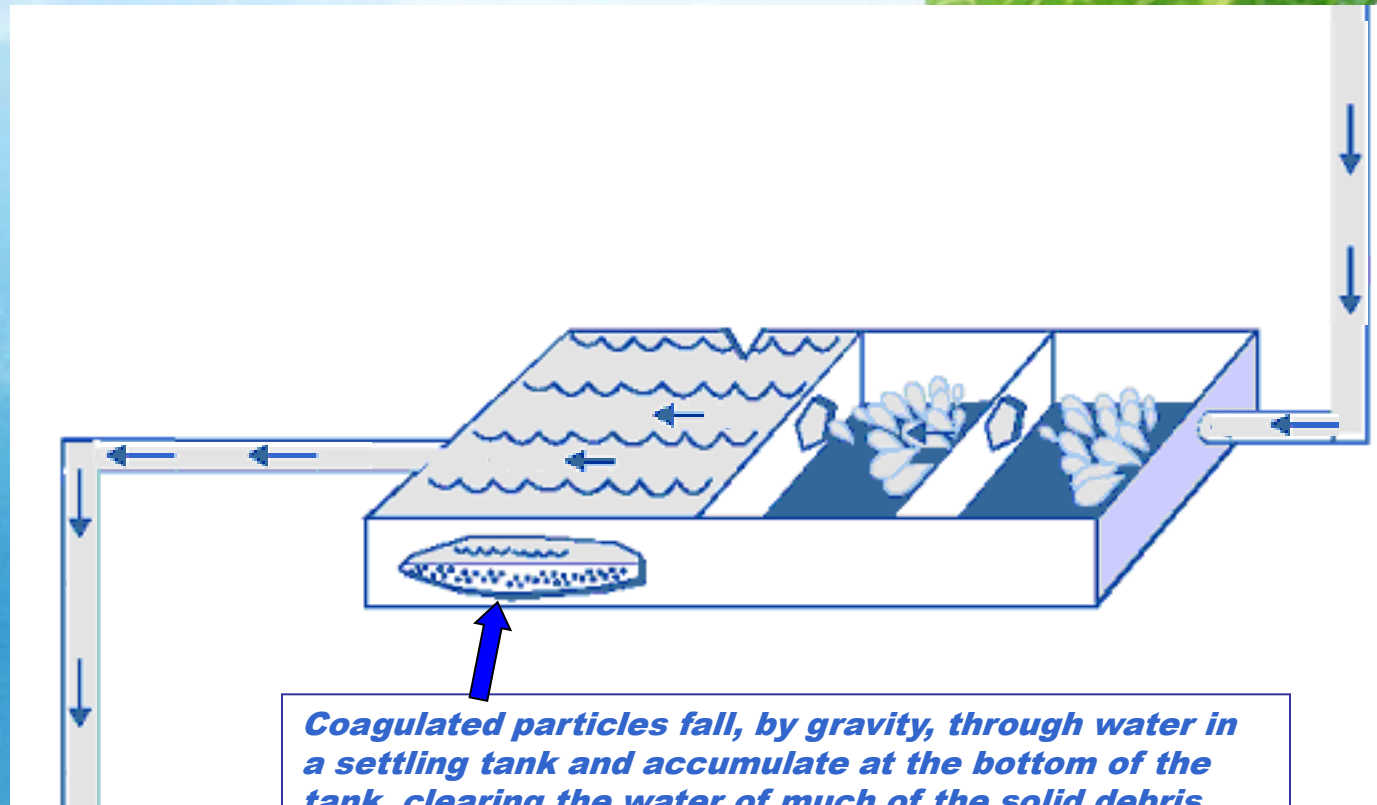


Coagulation removes dirt and other particles suspended in water. alum and other chemicals are added to water to form tiny sticky particles called “floc” which attract the dirt particles. The combined weight of the dirt and the alums (floc) becomes heavy enough to sink to the bottom during sedimentation.

WATER
TOWARDS
SEDIMENTATION

◆ SEDIMENTATION:

WATER
FROM
COAGULATION



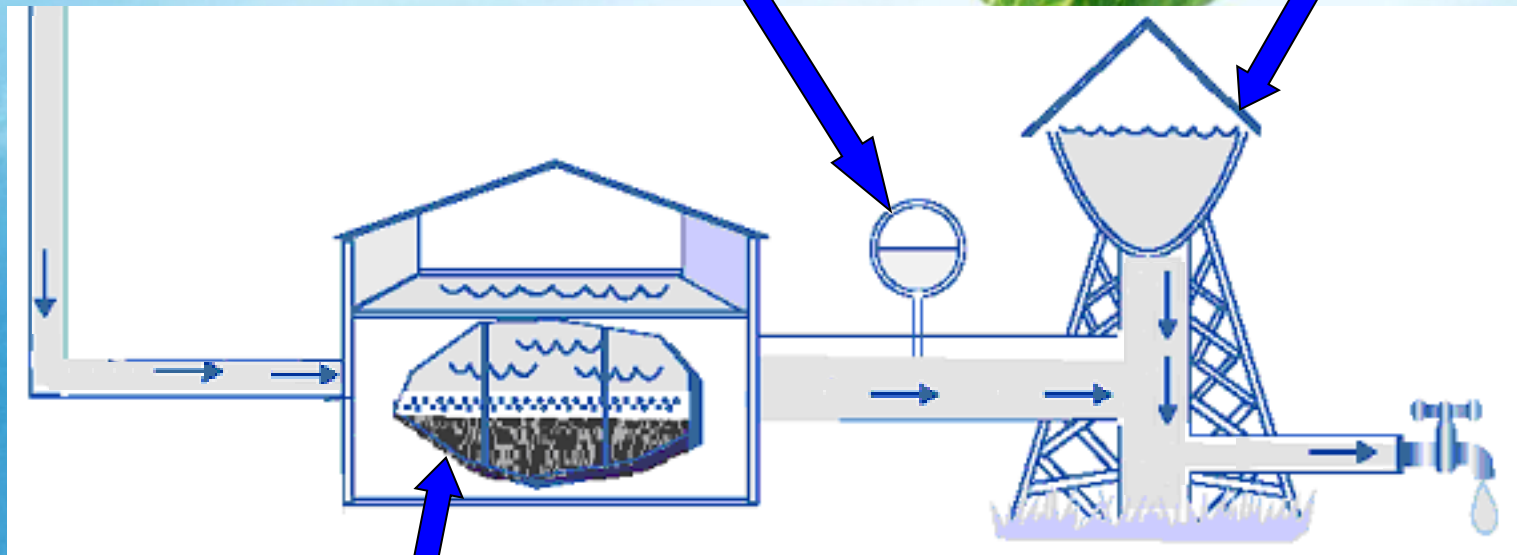
Coagulated particles fall, by gravity, through water in a settling tank and accumulate at the bottom of the tank, clearing the water of much of the solid debris and clear water moves to filtration.

WATER
TOWARDS
FILTRATION

FILTRATION:

FILTRATION: The water passes through filters, some made of layers of sand, and charcoal that help remove smaller particles.

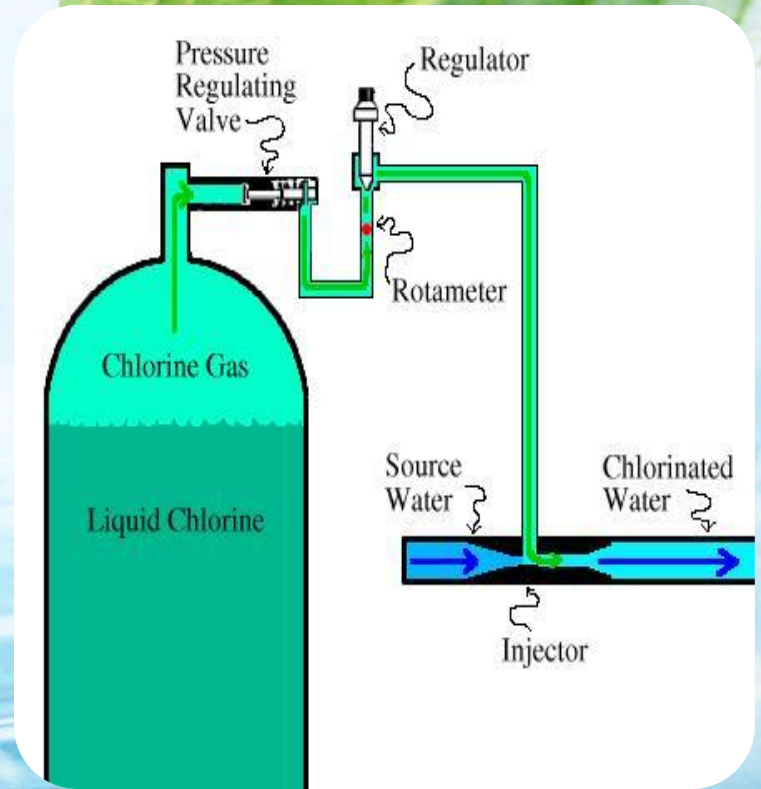
WATER
FROM
SEDIMENTATION



Types of disinfection:

- **Physical disinfection** techniques include boiling and irradiation with ultraviolet light.
- **Chemical disinfection** techniques include adding chlorine, bromine, and ozone to water.

- 2. Chemical processes used for the removal of undesirable constituents include:
 - -chlorination
 - -ozonization
 - Chlorinating. Small doses of chlorine when added to water have a lethal effect on micro-organisms.
 - For this purpose may be used chlorine gas or chloramine. Chloramine is a powerful germicide with a more persistent action than that of chlorine alone.



Chlorine disinfection:

- Chlorination is a cheap, effective, relatively harmless (and therefore most popular) disinfection method. Small doses of chlorine when added to water have a lethal effect on micro-organisms.
- For this purpose may be used chlorine gas or chloramine. **Chloramine** is a powerful germicide with a more persistent action than that of chlorine alone.
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OZONATION

- OZONE is 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.



Special methods

A green leaf with a water droplet is positioned in the upper right corner. The droplet is falling towards a pool of water at the bottom, creating concentric ripples. The background is a bright blue sky with soft white clouds.

- Deironing
- -softening
- desalination
- fluoridation
- -deodorization