



Chesapeake AWWA

American Water Works Association

What's in Safe Drinking Water?

Grade level – 6th – 12th

Time - 30 minutes

Activity Goal- students will begin to understand that drinking water isn't pure H₂O and that federal regulations inform what is and isn't allowed in drinking water that is produced by a water utility.

Materials Needed- a copy of the water sorting cards for each group/student

Engagement

- In your groups brainstorm the following question- What's the difference between the following words- Safe and Clean?
- Take answers and discuss. Is the water produced by a water utility clean or safe, both?
- Ask students- Who decides when water is safe for a community to drink?
 - The EPA and state regulators via the Safe Drinking Water Act set standards for drinking water quality.
 - The National Primary Drinking Water Regulations (NPDWR) are legally enforceable primary standards and treatment techniques that apply to public water systems. Primary standards and treatment techniques protect public health by limiting the levels of contaminants in drinking water.
 - This regulates microorganisms, disinfectants, disinfection byproducts, inorganic and organic chemicals and radioactive materials.

Explore

- You're going to get a chance to be federal regulators. In your group you're going to be given cards with names of substances that could be found in water.
- As a group you will have to decide what is ok to leave in the water and what things should be removed before the water can be deemed safe for communities to drink it.
- You will have 15 minutes to sort the cards and to justify why each substance should or shouldn't be taken out of the water.
- Use the attached worksheet to record your answers.

Explain

- Ask groups to share what they would allow and what they wouldn't allow. For substances where there is not agreement discuss why groups would or wouldn't allow that particular substance.

Elaborate

- Share with students that they can visit the EPA's Safe drinking water site to see what is currently regulated and find out about regulations that are under development and learn about emerging contaminants and how the EPA decides what to allow as new contaminants are identified.

<https://www.epa.gov/sdwa>

<https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>

Group Members:

Substances to keep in water	Justification

Substances to take out of water	Justification

Resources for Teacher

Substance	Description	Facilitator Notes
Calcium	Calcium is a mineral that is necessary for all life and is the fifth most abundant element in Earth's crust. Naturally, it's found in rocks like limestone and is an important soil mineral. Calcium in water can create "hardwater" which can make it difficult for many cleaning agents to work properly.	
Chlorine (as a disinfectant)	Water additive used to control microbes. Can cause eye and nose irritation as well as stomach discomfort.	Regulated so that it is not too low, allowing pathogens to survive. Also regulated so that it is not too high and causes irritation.
Nitrate (from fertilizer, used to give nutrients to agriculture)	Runoff from fertilizer use, erosion, and leaking from septic tanks. Nitrogen as an element is harmless and makes up a good portion of our air. Can cause problems for infants below age of 6 months old.	
Algae	Naturally occurring; can cause taste and odor issues for drinking water (aesthetics). Toxins created by algal blooms can be harmful to humans.	Only recently have guidelines been introduced as understanding of algal toxins grows; We will not expect regulations on algae but do expect regulations on their toxins to be developed soon.
Manganese	Naturally occurring and mostly released from soil. In the water supply it can cause discolored water when above a certain concentration. No health effects at a low concentration. Although manganese is an essential nutrient at low doses, there can be health effects from over-exposure of manganese which can lead to neurological effects.	To enhance consumer acceptance of water resources EPA recommends reducing manganese concentrations to or below 0.050 mg/L. EPA's Secondary Maximum Contaminant Level (SMCL) is based on staining and taste considerations.
Sodium	Sodium is a metal and is the 6 th most abundant element on earth but is never found by itself in nature as it is explosive when mixed with water. Generally, we find it as a compound like salt- sodium chloride. Sodium found in drinking water generally is due to road de-icers, mineral deposits or in water softening agents. Too much sodium can lead to high blood pressure in humans.	EPA drinking water advisory recommends reducing sodium concentrations in drinking water to between 30 and 60 mg/L based on esthetic effects (i.e., taste). EPA guidance level for sodium in drinking water is 20 mg/L for those on restricted sodium intake diets. This is a recommendation so it not federally enforceable but is intended as a guideline for States
Fish Eggs or other particles	There are many naturally occurring substances that do not dissolve in water and are visible upon inspection of the water.	Anything related to turbidity (water cloudiness) tends to be regulated not because the particles

		are necessarily harmful, but because they can harbor/shelter/hide pathogens with them. This applies to fish eggs or any other particles.
Iron	The 4 th most abundant element in Earth's crust and is widely distributed in other minerals. It is an essential element for all forms of life and is non-toxic. Iron is found in our red blood cells where it helps transport oxygen from our lungs to our cells.	Dissolved ferrous iron gives water a disagreeable metallic taste; can leave reddish brown stains on fixtures, tableware and laundry that are very hard to remove. When these deposits break loose from water piping, rusty water will flow through the faucet. Iron is mainly present in water in two forms: either the soluble ferrous iron or the insoluble ferric iron. Water containing ferrous iron is clear and colorless because the iron is completely dissolved. When exposed to air in the pressure tank or atmosphere, the water turns cloudy and a reddish brown substance begins to form. This sediment is the oxidized or ferric form of iron that will not dissolve in water.
Bacteria	Most bacteria are harmless to the human body.	But they are regulated by measuring for fecal coliforms and E. coli (those bacteria associated with fecal waste) which have been shown to be red flags of the presence of other harmful bacteria
Atrazine (an herbicide)	Atrazine controls weeds in agriculture fields, used especially with corn and sugar-cane is also used to reduce weeds in non-crop areas. It works by impeding photosynthesis in vulnerable plants and enters water ways via runoff from agricultural fields. Negative health effects at low concentrations.	