

SCIENCE / EARTH SCIENCE

WHERE OUR WATER COMES FROM

GRADES: 6-8

INTRODUCTION

The USS Intrepid is an Essex Class Aircraft Carrier that was docked in New York City's Hudson River (it is now in Bayonne to be dry docked for repairs). From its early service in the Pacific Ocean during World War II to recovering space capsules for NASA in the Caribbean Sea, the Intrepid has served in many of our neighboring waters. With this in mind, we have a great opportunity to learn about various marine environments and how water affects us and our community. The activities included in this lesson allow students to explore where our drinking water comes from, learn about different types of water, and build their own water filters as they learn about the process of water filtration.

OBJECTIVES

Students will:

- learn about where our drinking water comes from by observing the three types of water environments (fresh, marine, and estuary).
- observe the path that water takes before it gets to our faucets and learn about the water cycle.
- learn the basic steps in the process of water filtration by building their own water filters.

PROCEDURE

Part A- Where Does Our Water Come From

- Start by discussing what type of water we drink. Begin by briefly discussing the three types of water environments (fresh water, marine, and estuary). The Intrepid Sea, Air, and Space Museum actually sit in an area of the Hudson River which is an estuary. An estuary is a transition zone between salt water and fresh water.
- Point out that the Earth's surface is 70% water. The Earth is the only place known where water exists in its liquid form in such high quantity. An interesting fact to point out is that while 70% of Earth's surface is water, 97% is salt water. To illustrate this, you may want to look at a map of the Earth while discussing these points. While looking at a world map students can identify the oceans or seas, as well as rivers, etc. Also, another fascinating fact to point out is that 75% of the fresh water on Earth is frozen in polar ice caps, which leaves us with a limited amount of drinking water.
- There are two types of places where we get our water from; surface water systems, i.e. **reservoirs**, and ground water systems, i.e. **aquifers**. When it rains water runs into lakes, rivers, and oceans, or seeps into underground storage areas called aquifers. Almost no bacteria live in aquifers; many pollutants and bacteria are filtered out as the water passes through the soil.

Trigger Questions:

- How do we get this water?
 - The top layer of an aquifer is the water table. To get water from an aquifer wells are dug to reach the water table. As water is removed from the aquifer, it is replenished by water absorbed into the ground.
 - This is also how we get pollution into our water systems.



All Lesson Plans developed by the Intrepid Museum's Education Department

- Have students research where water in their area comes from. Is it from an aquifer or reservoir? Use NYC as an example. Our drinking water comes from three different reservoir systems in upstate New York – the Croton System, the Catskill System, and the Delaware System. In the three systems combined there is a total storage capacity of 580 billion gallons over the entire water shed. We have over nine million people receiving water from those three systems daily.

Trigger Questions:

- Why do we need so much water?
- How much water do you think we use every day?
- How much water do you use for some regular daily activities? (I.e. taking a shower, doing the laundry, washing dishes, brushing your teeth)

*An interesting fact is that the daily average of water delivered to consumers is 1.5 billion gallons.

Part B: Make Your Own Water Filter

- Build Your Own Filter: (Use a plastic bottle with bottom end removed)
 - Place coffee filter over the neck of bottle, securing with a rubber band.
 - Use pebbles to create a first layer.
 - Then add a layer of coarse sand.
 - Finally add a layer of fine sand. (This can be replaced by cotton balls instead).
 - Pour water through the filter to clear it.

Only pour the top layers of the water through the filter. Leave the sediment (floc) on the bottom that would have normally been removed after sedimentation.

Materials:

- one 2 liter bottle (top cut off)
- one 2 liter bottle (bottom cut off)
- 2 large beakers
- one 2 liter soda bottle
- Fine sand
- Coarse sand
- Pebbles
- Coffee filter
- Rubber band
- Alum

Five Steps of Water Filtration:

1. Aeration

A process that allows gases trapped in the water to escape while adding oxygen.

- a. Begin by filling the soda bottle with water and then shake well for 30 seconds allowing gases to escape.
- b. Continue aeration by passing the water between the 2 large beakers about 5 times. Gases are released, and oxygen is added.

2. Coagulation

Coagulation is the process by which water is slowly stirred with a substance called alum. Impurities in the water cling to this alum, causing them to form larger and heavier particles called floc. Floc is a very fine, fluffy mass formed by these suspended particles binding together. After coagulation, the water flows into *flocculation* basins. Here the water is gently stirred, while suspended matter coagulates into larger floc. Water is then passed into the sedimentation basins.



- a. Add 2 tbsp of alum to the water and slowly stir for 5 minutes. You should see particles clumping together to form floc.

3. Sedimentation

In this step water is left to settle. The floc settles to the bottom of a basin, for example, so that chemicals and impurities can be separated from the water.

- a. Let the water stand so that floc can settle to the bottom (observe periodically while building the water filter as time may vary.)

4. Filtration

The water is then filtered. Layers of sand, gravel and sometimes charcoal are used to remove any other particles from the water. At this point everything has been removed from the water.

5. Disinfection

A small amount of chlorine is needed to be added as a disinfectant, and then the water is ready for drinking, bathing, and other uses. This chemical is added to kill any remaining bacteria or microorganisms that may be in the water. (This process is not covered in our demonstration because these chemicals are not safe to handle in this setting).

