

# NEW YORK CITY WATER SUPPLY

## Activity 4 : TESTING THE WATERS: AN INTRODUCTION TO WATER QUALITY



*This hands-on curriculum-based activity allows students and teachers to explore introductory water quality testing. The lesson focuses on two specific parameters, pH and chlorine residual.*

### **Objectives:**

- To introduce the concept of water quality testing, utilizing kits and/or scientific instruments.
- To investigate specific water quality parameters - pH and chlorine residual.
- To link the importance of good water quality for humans with other living things.
- To support curriculum-based learning and new performance standards.

### **Materials:**

- Plastic collection bottle
- pH testing kit or litmus paper
- Chlorine testing kit

### **Background:**

Ask your students what they think it means to have a good and safe drinking water supply. Why is good water quality so important to us and other living things? Ask the class if they know what agency in New York City is responsible for the operation, maintenance and protection of our water supply.

The New York City Department of Environmental Protection (DEP) has the job of supplying water to all of you every day. DEP provides approximately 1.3 billion gallons of water to over 9 million people each day. DEP has to make sure that there is enough water for all of us to use. They also have to make sure that the water is safe to drink.

There are many types of scientists that work at DEP to test the water. A monitoring program is in place in our upstate watersheds (at the reservoirs and feeder streams) and in the city (within the distribution system) to do this. Scientists that study fresh bodies of water are

called limnologists. They go out to the streams and reservoirs seven days a week to collect water samples and then bring these bottles into the laboratory. There, microbiologists examine the water for bacteria and algae. Chemists, another type of scientist, look for chemicals and compounds such as calcium, lead, copper, nitrates, phosphates and hardness to determine the chemical composition of the water. There are five laboratories that test our water daily. Four of them are located upstate and conduct various analyses on our source water. The one laboratory in Queens examines the water throughout the distribution system within the City of New York.

New York City's water supply is not filtered, but certain chemicals are added to treat the water. Query the class on what chemicals are added. All water entering New York City's distribution system is treated with chlorine, fluoride, orthophosphate, and, in some cases, sodium hydroxide. Chlorine is added to disinfect the water. Fluoride is added to prevent tooth decay and cavities. Orthophosphate is added to create a protective film on pipes which reduces the release of metals, such as lead, from household plumbing. Sodium hydroxide is added to the water to raise the pH and reduce corrosivity.

As the water is entering the distribution system, samples are collected by field personnel at sampling stations, which are located throughout the five boroughs. Sampling stations were installed throughout the five boroughs to ensure an accurate and reliable method of collecting distribution water samples. At these stations, preliminary testing is done for temperature, pH, chlorine residual and phosphates. Then the water sample is brought back to the laboratory for routine and more intensive testing. The water is analyzed for a broad spectrum of microbiological, chemical, and physical measures of quality. In 2001, DEP collected over 47,000 in-City samples and performed approximately 1,031,000 analyses.

## Procedure:

- The first test done will be for pH. There are many ways to test for pH. Ask the class what pH is. [pH is a scale that scientists (chemists) use to tell whether a solution is acidic or basic]. Lets look at some examples. Lemon juice is acidic. Baking soda is basic. The pH scale goes from 0 to 14 (see below)

**0 - 1 - 2 - 3 - 4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 - 12 -  
13 - 14**

Seven is considered neutral (New York City water ranges from pH 6.8-8.0); anything below 7 is acidic, with the lower numbers being a stronger acid. Anything above 7 is basic, with the higher numbers being a stronger base.

## Method

- A very simple way to tell whether a solution is acid or alkaline (basic) is by using litmus paper. Take three strips of blue litmus paper and three strips of red litmus paper out of the vial. Squeeze some lemon juice (an acid) on one strip of blue and one strip of red paper. Which one has a color change? What color does it change to?
- Take a few drops of a strong soap solution (a base) on one strip of each color as you did above. Which turns color? What color does it become? In bases, red litmus paper turns blue. In acids, blue litmus paper turns red.
- Try the same thing with other things such as vinegar, milk of magnesia, the juice of an onion, grape juice, and your water sample. Record your results and explain what they mean.
- Another way to test for pH is to use a pH testing kit. Follow the directions that come attached to your particular kit and evaluate your results. What do your results mean? How are they different from the litmus paper results (if you used both methods)?
- The other test we will do today is the chlorine residual. Ask the class why chlorine is added to the water supply. [A small amount of chlorine is added to disinfect the water and to kill off any disease-causing bacteria that may be present]. By the time the water reaches the distribution system, most of the chlorine is used up or evaporated off. Chlorine residual is tested at the sampling stations to make

sure that there is a residual measured which tells scientists that the chlorine is doing its job. A minimal reading of 0.2 ppm (parts per million) ensures that enough chlorine has been added to kill off the organisms, and that not too much has been added. To help your students understand the concept of parts per million, use one part per million as an example and ask your students to visualize a swimming pool. Then, put one drop of food coloring in it. That would be the equivalent to 1 ppm of a substance.

- Follow the directions of your testing kit and evaluate your results. Do you think you got a good reading or a bad reading? Why?
- Ask the class if their results tell them whether the water quality is good or not. Also ask if the students think they did enough testing to determine how good the water is. Why or why not? What other kinds of tests do the students think they should do?

## Extension:

- For a complete listing of water quality tests performed throughout the New York City water supply system, visit DEP's Web site at: [www.nyc.gov/dep](http://www.nyc.gov/dep)

## Equipment Suppliers:

- Any pet or aquarium store will carry simple water testing kits that you may inexpensively purchase. Just make sure you read the directions carefully and have an adult or teacher present during the procedure.
- Carolina Biological 1-800-334-5551
- Hach 1-800-227-4224
- Chemetrics 1-800-356-3072
- Sargent Welch 1-800-727-4368

## For more information contact:

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Dial 311 for all NYC government information and services

Also visit DEP's Web site at:

[www.nyc.gov/dep](http://www.nyc.gov/dep)