Activity 34: Water Testing and Analysis by the USGS

Maine Geological Survey

Objectives:

This activity allows the students to meet and interact with practicing scientists, and to see scientific equipment being used by professionals. It provides an excellent opportunity for student participation in a local data gathering and analysis exercise. It also should provide the student with some information on what is and is not in clean or potable water.

Time:

This activity will take 45 minutes to 2 hours depending on the types of tests run and class size.

Background:

Every human being needs to drink two pints of water, or water based liquids, each day to survive. The entire question of water quality, allocation, use, and conservation is one of the most significant issues today's children will face in their lifetime. To compound the problem, water that appears clean and pure often isn't, and water that appears cloudy and dirty can be fit for human consumption.

Water that is fit to drink is called potable. Potable water has three major attributes: it has a very low E. coli bacteria count, a low concentration of heavy metals, and a high degree of dissolved oxygen. E. coli bacteria are found in the digestive tracts of all larger mammals including humans; the presence of these bacteria in water to any significant

degree indicates contamination by some source of waste products which could also contain other more deadly bacterium such as hepatitis, diphtheria, and plague. Clean water is also free from significant amounts of heavy metal contaminants such as lead, mercury, and cadmium. Once thought to be insoluble, such organic chelates as methylmercury can be dissolved in water and are fat soluble in the higher animals such as birds, fish, and man. Heavy metals damage the liver, kidneys, and reproductive organs as well as being carcinogenic. Clean water also has an appreciable amount of dissolved oxygen which helps the water keep itself clean and improves the taste.

While the number of specific water tests one can do is very large, a dissolved oxygen (DO) test, a conductivity test (general metallic ions) and an E. Coli test are recommended to assess the three major aspects of water quality mentioned above. Bacterial culture tests take several days and may not be practical if great distances are involved between the school and the local USGS office.

Materials:

A sterilized screw top bottle for each student and a copy of the USGS Data Source book for comparative purposes.

Procedure:

Arrange, well in advance, with the USGS hydrologic branch for one their scientists to visit your school and test water samples.

Prior to this visit, discuss with the class the issues associated with water quality and the three major aspects of water quality described above.

The day before the visit pass out the sterilized bottles and explain how to collect water samples. Lake and stream samples must be collected with the bottle fully submerged under the water. The top is screwed onto the bottle under water. This prevents contamination by atmospheric oxygen. Well samples can be collected from the kitchen sink; let the water run for 5 minutes before collecting the sample. Fill to overflowing and screw on cap. All samples should be labeled as to location.

After a brief explanation of the equipment used, the hydrologist can test the samples and you can tabulate the results. After testing is complete, compare test values for the different sources of water: surface water, dug wells, and drilled wells. Develop a hypothesis for the observed variations noted. This discussion, ideally, will involve the USGS scientist if time allows.

Follow-Up:

If a local stream, river or lake is easily accessible to the school, you may wish to purchase some test equipment and monitor the water body through the school year (or year round). The profile you develop may have value to others doing research in your area. See the LaMotte catalog for testing materials. This activity is invaluable in any area where there is some question about water quality or the quality is undergoing degradation. Often local interest groups such as the fish and game club or Sportsman's Alliance of Maine (SAM) will fund the equipment costs if students will do the sampling and analysis work.

Correlate the type of fish and other wildlife that lives in a water body with the DO and pH of the water. What are the implications for fish management programs here in the northeastern U.S.?

Plan trips to local water supplies and/or local waste treatment plants.

References:

Activity developed by Curtis Talbot during the 1991 CREST intern program.

Name_____

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Student Sheet

Purpose:

To analyze local water sources for indicators of potability.

Materials:

You will be provided with a sterilized, plastic screw top bottle for each sample that you wish to have tested. You MUST NOT open the bottle until just prior to collecting the sample; this ensures that the tests performed on your sample show ONLY what is in the sample. Markers, pens, and notebook.

PROCEDURE:

1. Select a source of water near or in your home that you wish to have tested.
2. For a lake, stream, pond, or river, use the following procedure. Submerge the bottle in the water, open the bottle, and allow the bottle to fill completely, replace the cover tightly while the bottle is still under water. Record the place, time, and date that the sample was collected. Be very specific about the location; for example, the Big Trout river is over 40 miles long, but there is only one spot where it crosses U.S. Route 1.
3. If you are collecting your sample from a well, run the water from a faucet for at least five minutes, uncap your bottle and fill the bottle swiftly, but not so fast that the water bubbles or splashes around in the bottle. Fill to overflowing, cap and label.

4. When you have collected all the samples you want tested, bring them to school and the scientist from the United States Geological Survey (USGS) will test your samples. Be sure to record the information you get on the data sheet (your parents may want to see this). As appropriate, ask the scientist any questions you have about your water and the testing processes.

DATA TABLE	
Sample Collector:	Sample#:
Sample Location:	
Test Results	
pH:	Conductivity:
DO:	E. coli:
Other:	

Questions:

1. Based on the above data, and previous class discussion, would you say that your sample was fit for human consumption? Explain your answer.

2. Are your values the same as other samples tested in your class? If not, find the range of values that the samples cover, record the high points and low points for each value, and find the average of the class.

Test	High Value	Low Value	Class Average
pH			
Conductance			
Oxygen			
E. Coli			

3. List and discuss factors which could cause a range of values for:

   E. coli –

   Conductance –

   Dissolved oxygen –