



Module #8

Calculating Water Quality Index

Adapted and excerpted from *Field Manual for Water Quality Monitoring: An Environmental Education Program for Schools* by Mark M. Mitchell and William B. Stapp

Materials

spotless glassware, rinsed with demineralized water:
test tubes and caps
small water sample bottle and rod sampler if needed
(constructed from a series of metal rods that can be extended and rubber tubing that holds a sample bottle)
Mixed Acid Reagent
0.1 g of Nitrate Reducing Reagent
Nitrate Nitrogen Comparator

Testing materials can be purchased as individual test kits from Hach or LaMotte. Nitrate tests also

are available in Multiple Water Quality Test kits from these manufacturers as well. The materials and instructions that follow are based on a LaMotte test kit. If you use the Hach kit or another testing method, please follow the directions you receive with your test kit.

Background Information

from <http://www.h2ou.com/h2wtrqual.htm> a subsite of hach.com

Nitrite and Nitrate are forms of the element Nitrogen, which makes up about 80 percent of the air we breathe. As an essential component of life, nitrogen is recycled continually by plants and animals, and is found in the cells of all living things. Organic nitrogen (nitrogen combined with carbon) is found in proteins and other compounds. Inorganic nitrogen may exist in the free state as a gas, as ammonia (when combined with hydrogen), or as nitrite or nitrate (when combined with oxygen). Nitrites and nitrates

are produced naturally as part of the nitrogen cycle, when a bacteria 'production line' breaks down toxic ammonia wastes first into nitrite, and then into nitrate. Sources of nitrites and nitrates

Nitrites are relatively short-lived because they're quickly converted to nitrates by bacteria. Nitrites produce a serious illness (brown blood disease) in fish, even though they don't exist for very long in the environment. Nitrites also react directly with hemoglobin in human blood to produce methemoglobin, which destroys the ability of blood cells to transport oxygen. This condition is especially serious in babies under three months of age as it causes a condition known as methemoglobinemia or "blue baby" disease. Water with nitrite levels exceeding 1.0 mg/L should not be given to babies. Nitrite concentrations in drinking water seldom exceed 0.1 mg/L.

Nitrate is a major ingredient of farm fertilizer and is necessary for crop production. When it rains, varying nitrate amounts wash from farmland into nearby waterways. Nitrates also get into waterways from lawn fertilizer run-off, leaking septic tanks and cesspools, manure from farm livestock, animal wastes (including fish and birds), and discharges from car exhausts.

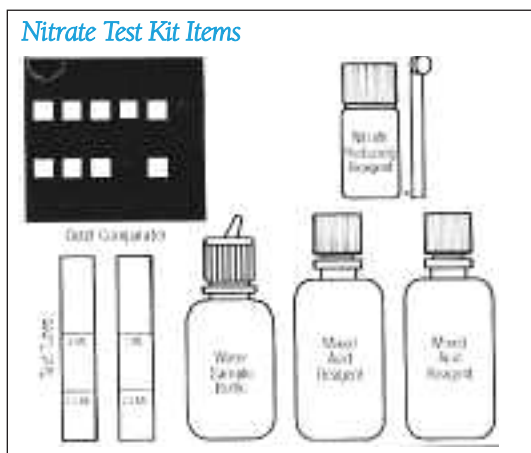
Nitrates stimulate the growth of plankton and water weeds that provide food for fish. This may increase the fish population. However, if algae grow too wildly, oxygen levels will be reduced and fish will die.

Nitrates can be reduced to toxic nitrites in the human intestine, and many babies have been seriously poisoned by well water containing high levels of nitrate-nitrogen. The U.S. Public Health Service has established 10 mg/L of nitrate-nitrogen as the maximum contamination level allowed in public drinking water.

Nitrate-nitrogen levels below 90 mg/L and nitrite levels below 0.5 mg/L seem to have no effect on warm-water fish*, but salmon and other cold-water fish are more sensitive. The recommended nitrite minimum for salmon is 0.06 mg/L.

A. NITRATES Sampling Procedure

Any sampling device might be used for this water quality test to obtain representative samples. It is also important to have spotless glassware, rinsed with demineralized water. Always use de-mineralized water during the nitrate test, distilled water contains ammonia (NH₃) ions that will interfere with the test.





B. NITRATES Testing Procedure

Note: Use the following procedure for suspected nitrate nitrogen in the 0.25- 10.0 mg/L range. A low range test 0-1 mg/L Nitrate test is also available.

1. Fill the sample bottle with sample water. Use gloves if drawing the sample by hand.
2. Rinse and fill one test tube to the 2.5 ml line with water from the sample bottle,
3. Dilute to the 5 ml line with the Mixed Acid Reagent, cap and mix. Wait 2 minutes.
4. Use the 0.1 g spoon to add one level measure (avoid any excess) of Nitrate Reducing Reagent. Cap and invert gently 50-60 times in one minute. Wait 10 minutes.
5. Insert the test tube into the Nitrate Nitrogen Comparator. Match the sample color to a color standard. Record the result as mg/L, (ppm) Nitrate Nitrogen (NO₃-N). To convert to mg/L Nitrate (NO₃), multiply by 4.4.
6. Place the reacted sample in a clearly marked container. Arrangements should be made with toxic material handlers for safe disposal. Please wash your hands after this water test is completed.

For Your Information: Nitrate Test Kits which do not require the use of cadmium are also available.

C. NITRATES Calculating the Results

To compute the Q-value for the nitrate (NO₃) test, follow these steps:

1. Find the weighting curve chart (upper right);
2. Locate your test result on the bottom (horizontal or “x” axis) of the chart;
3. Interpolate the Q-value for your test result using the following steps;
4. From your test result value on the horizontal (“x”) axis of the chart, draw a vertical line up until it intersects the weighting curve line;
5. From this point of intersection, draw a horizontal line to the left hand side (the vertical or “y” axis) of the chart;
6. Where this horizontal line intersects the vertical (“y”) axis of the chart, read off the value. This is the Q-value for this test; it should be recorded in Column B on the WQI chart on the Calculating Water Quality Index (Module 10).

The Q-value for each test should then be multiplied

by the weighting factor listed in the chart on the Water Quality Index page. Record the product of this calculation in Column D of the chart.

