

Lesson A3–3

Identifying Water Sources and Quality Standards

Unit A. Natural Resources

Problem Area 3. Water

Lesson 3. Identifying Water Sources and Quality Standards

New Mexico Content Standard:

Pathway Strand: Natural Resources and Environmental Systems

Standard: VII: Apply scientific principles to environmental services.

Benchmark: VII-C: Explain well design and groundwater supplies to demonstrate knowledge of hydrology.

Performance Standard: 1. Explain hydrology. 2. Explain geological and meteorological principles affecting groundwater supply. 3. Conduct channel flow analysis.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Identify sources of water.
2. Describe factors used to determine water quality.
3. Describe when and what to test for.

List of Resources. The following resources may be useful in teaching this lesson:

Porter, Lynn, et al. *Environmental Science and Technology*. 2nd Edition. Upper Saddle River, New Jersey: Prentice Hall Interstate, 2003. (Textbook and Activity Manual, Chapters 14 and 15)

Lee, Jasper. *Natural Resources and Environmental Technology*. Danville, Illinois: Interstate Publishers, Inc., 2000. (Textbook, Chapter 7)

Dorman, Dale. *Testing for Water Quality*. University of Georgia College of Family and Consumer Sciences and College of Agricultural and Environmental Sciences and Cooperative Extension Service, 1992.

Other Resources. The following resources will be useful to students and teachers:

Turk, Jonathan and Amos Turk. *Environmental Science*. 3rd Edition. New York: CBS College Publishing, 1984.

Arms, Karen. *Environmental Science*. New York: Holt, Rinehart and Winston, 1996.

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of student lab sheets
pH test strips
Water samples

Terms. The following terms are presented in this lesson (shown in bold italics):

Ground water
Hardness
Surface water
Turbidity
Water quality

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Have the students think about the last time they went to the doctor. What did they have done? Did the doctor give them a shot? Ask them questions? Give them a prescription? Give them a physical? Have the students give you examples of things a doctor would do during a routine visit. Ask the students to think about how often they visit the doctor or how often anyone should visit a doctor. Once or twice a year for a

regular check-up is about average. Now tell them that just like people need to be regularly checked, so does our water supply. Even though we may feel well, there may still be something wrong internally. The same is true with water, just because it looks safe to drink doesn't mean it is. Continue with the lesson following the discussion.

Summary of Content and Teaching Strategies

Objective 1: Identify sources of water.

Anticipated Problem: What are the sources of water?

- I. The two main sources of water are surface water and ground water.
 - A. **Surface water** is water that can be found on the surface of the earth in lakes, streams, rivers, and oceans. Surface water can be either freshwater or saltwater. The main source of surface water is precipitation. Surface water is good for human consumption and agricultural use. Surface water should be treated before use.
 - B. **Ground water** is water from within the earth. This water may be located a few feet or thousands of feet within the earth. Ground water provides much of the freshwater we use. Ground water can usually be used with little treatment.

Use TM: A3–3A to review the two main sources of water and the definitions of surface water and ground water.

Objective 2: Describe factors used to determine water quality.

Anticipated Problem: What factors are used to determine water quality?

- II. **Water quality** is the condition of water for a particular use. Water quality is affected by how people use and abuse water resources. Eight common factors of water quality include odor and taste, color, pH, hardness, turbidity, heavy metals, chemical residues, and coliform bacteria.
 - A. The odor and taste of water are the result of the water source. Bad odor and taste in water may result from pollution, sulfur, or microorganisms.
 - B. For most people, clean, clear water is their first choice. However, colored water may be safe to drink. Colored water is often the result of mineral presence. Minerals that may change the color of water include iron, magnesium, and calcium. Other factors that may alter water color include sediment, organic matter, and plankton.
 - C. The pH of water is commonly between 5.5 to 8.6. The safest pH level for pipes and pumps is 7.0 to 7.8.
 - D. The presence of calcium and magnesium ions in water is referred to as **hardness**. The greater the presence of these ions, the harder the water. Hard water leaves residue in hot water pipes and water heaters.

- E. **Turbidity** is the solid material suspended in water. These materials may be soil particles or microscopic organisms. Turbid water is not clear; light cannot pass through the water. To remove turbidity, the water has to be filtered and the particles allowed to settle.
- F. Heavy metals, including mercury and lead, may be hazardous to the water supply. Lead was once commonly used to seal joints, now that lead may leak into the water supply within the pipes. These pipes should be replaced.
- G. Chemical residues from various chemicals including pesticides can be dangerous to human health. However, the extent of these dangers is still unknown.
- H. Coliform bacteria in water is an indication of fecal contamination in the water supply. The contamination may result from human or animal waste getting into the water. Water contaminated with coliform bacteria is not fit for consumption. Coliform bacteria can be destroyed by boiling the water.

Use TM: A3–3B to review the eight common factors of water quality. To apply the information from this objective, use pH test strips to test various samples of water. Have students bring samples from home and take samples from around the school to test.

Objective 3: Describe when and what to test for.

Anticipated Problem: When should you test water and what should you test for?

- III. Testing your household water supply is important to the health of everyone within the house. Invisible contaminants in the water may be hazardous. Visible contaminants can be harmful to both people and household items. Other pollutants may not be harmful but may leave the water unfit to drink or cook with. No matter the problem, water testing will help determine how to solve it.
 - A. Household water supplies should be tested regularly and when special situations arise.
 - 1. Regular water tests that should be done on a yearly basis include coliform, nitrate, and pH. Regular water tests that should be done every three years include tests for sulfate, chloride, iron, manganese, and lead.
 - 2. In special situations, water should be tested more frequently and more thoroughly. Examples of such situations include the location of the water source to agricultural use, drilling, and landfills or dumps. Each of these may be responsible for contamination to local water supplies.
 - B. Three specific areas of testing that should be done include bacteriological testing, mineral testing, and chemical testing.
 - 1. Bacteriological testing helps determine the presence of bacteria that may cause disease. The most common bacteria to test for is coliform.
 - 2. Mineral testing helps determine the level of mineral impurities in the water. Large amounts of minerals can be hazardous and may reduce the usefulness of the water. Common minerals to be tested for include calcium, iron, copper, zinc, manganese, and magnesium.

3. Chemical testing is an expensive process, therefore it is usually only done when contamination is suspected. Common chemical pollutants include petroleum products and agricultural and industrial chemicals.

Use TM: A3–3C to review the water tests that should be conducted yearly and every three years. TM: A3–3D can be used to show the special situations in which wells should be tested more regularly and the three areas of water testing.

Review/Summary. To review and summarize the information in this lesson, have the students define the terms and answer the anticipated questions.

Application. To apply the objectives in this lesson, refer to Chapters 14 and 15 of the *Environmental Science and Technology Activity Manual*.

Evaluation. Use the following sample test to evaluate the students' comprehension of the objectives covered in this lesson.

Answers to Sample Test:

Part One: Matching

1 = c, 2 = b, 3 = a

Part Two: Completion

1. surface water, ground water
2. 7.0, 7.8
3. fecal

Part Three: Short Answer

1. Eight common factors of water quality include odor and taste, color, pH, hardness, turbidity, heavy metals, chemical residues, and coliform bacteria.
2. Three specific areas of testing that should be done include bacteriological testing, mineral testing, and chemical testing.

Test

Lesson A3–3: Identifying Water Sources and Quality Standards

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- a. water quality b. hardness c. turbidity

- _____ 1. The solid material suspended in water.
_____ 2. Presence of calcium and magnesium ions in water.
_____ 3. The condition of water for a particular use.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. The two main sources of water are _____ and _____.
2. The safest pH for pipes and pumps is _____ to _____.
3. Coliform bacteria in water is an indication of _____ contamination in the water supply.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. What are the eight common factors of water quality?

2. What are the three specific areas of testing that should be done?

The two main sources of water are surface water and ground water.

- ◆ **Surface water is water that can be found on the surface of the earth in lakes, streams, rivers, and oceans.**
- ◆ **Ground water is water from within the earth.**

EIGHT COMMON FACTORS OF WATER QUALITY

- ◆ **Odor and taste**
- ◆ **Color**
- ◆ **PH**
- ◆ **Hardness**
- ◆ **Turbidity**
- ◆ **Heavy metals**
- ◆ **Chemical residues**
- ◆ **Coliform bacteria**

REGULAR WATER TESTS— YEARLY

- ◆ **Coliform**
- ◆ **Nitrate**
- ◆ **pH**

REGULAR WATER TESTS— EVERY THREE YEARS

- ◆ **Sulfate**
- ◆ **Chloride**
- ◆ **Iron**
- ◆ **Manganese**
- ◆ **Lead**

SPECIAL TESTING SITUATIONS

- ◆ **Extra testing is needed on land near:**
 - **Agricultural use**
 - **Drilling**
 - **Landfills and dumps**

THREE AREAS OF WATER TESTING

- ◆ **Bacteriological**
- ◆ **Mineral**
- ◆ **Chemical**