



Who Protects Source Water?

Lesson: 9

**National Science
Education
Standards for
Grades 9-12**

Content Standard A: Abilities Necessary to Do Scientific Inquiry

- *Communicate and defend a scientific argument.*

Content Standard F: Science in Personal and Social Perspectives: Natural and Human-Induced Hazards

- *Human activities can enhance potential for hazards. Acquisition of resources, urban growth and waste disposal can accelerate rates of natural change.*

Content Standard F: Science in Personal and Social Perspectives: Science and Technology in Local, National and Global Challenges

- *Understanding basic concepts and principles of science and technology should precede active debate about the economics, policies, politics and ethics of various science- and technology-related challenges. However, understanding science alone will not resolve local, national or global challenges.*

**Student Learning
Objectives**

- 9.1 Describe who is responsible for protecting public and private drinking water sources in a community. (Broadly)
- 9.2 Describe the roles of landowners, farmers, local community leaders and others protecting and in conserving drinking water resources.

**Teacher Info
Table Time**

Instruction time for this lesson: 60 minutes

**Resources,
Tools, Equipment
and Supplies**

9.1. Describe who is responsible for protecting public and private drinking water sources in their community.

Resources

- Slide SW.9.1.TM.A – *Ensuring Safe Drinking Water*
- *Drinking Water Protection*, EPA, <http://water.epa.gov/drink/drinkingwaterprotection.cfm>
- *Pollution Prevention and Control*, EPA, <http://water.epa.gov/polwaste/>
- *Safe Drinking Water Act*, EPA, <http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm>
- *Safe Drinking Water Act* poster, EPA, http://www.epa.gov/ogwdw/publicoutreach/pdfs/poster_landscape_11x17version.pdf
- *Standards and Risk Management*, EPA, <http://water.epa.gov/drink/standardsriskmanagement.cfm>
- *Source Water Collaborative*, www.sourcewatercollaborative.org

Equipment

Computer
LCD projector
Screen

9.2. Describe the roles of landowners, farmers, local community leaders and others in conserving drinking water resources.

Resources

- Activity Worksheet SW.9.2.AS: *Decision Making – A Mock Town Meeting on a Proposed Tank Farm*
- US EPA Office of Underground Storage Tanks, <http://www.epa.gov/oust/>

Equipment

Computer
LCD projector
Screen

Key Terms

Conservation
Decision maker
Protection
Safe Drinking Water Act
Stakeholder
Underground storage tank
Watershed

SUMMARY OF CONTENT AND TEACHING STRATEGIES:**Ensuring safe drinking water**

A safe drinking water supply requires attention from all stakeholders. There are many types of contaminants and each regulated contaminant has a different maximum allowable threshold. A threshold can be described as the point that must be exceeded to begin producing a given effect or result to elicit a response (e.g., an impact on human health).

- A. Congress passed the Safe Drinking Water Act (SDWA) in 1974 to protect public health by regulating public drinking water. Amendments to the act made in 1996 protect sources of drinking water by requiring state assessments of these sources.
- B. SDWA is administered by the U.S. Environmental Protection Agency (EPA). A few highlights of the SDWA include the following:
 - 1. Authorizes EPA to set enforceable health standards for contaminants in drinking water.
 - 2. Requires public water systems to notify customers of violations.
 - 3. Establishes a federal-state partnership for regulation enforcement.
 - 4. The 1996 amendments require an assessment of the vulnerability of all public drinking water sources to contamination.
- C. The EPA has established pollutant-specific minimum testing schedules for public water systems. If a problem is detected, immediate re-testing requirements go into effect along with strict instructions about how the system informs the public.
- D. A network of government agencies monitor tap water suppliers and enforce public drinking water standards to ensure the safety of drinking water. These agencies include the EPA, state departments of health and environment, and local public health departments.

INTEREST APPROACH:

The experiential role-play activity invites students to view the concepts they are learning from multiple perspectives of community members, broadening their understanding of the complexity of source water issues.

A suggestion for getting started:

A simple “freeze” role-play will warm students up for the mock town meeting that follows in this lesson.

Have I got two volunteers to start a quick game of freeze action? (Select two students.)

Here’s the scene: You are two friends planning to take a backpacking trip. You (point to one student) are nonchalant and feel there isn’t much to worry about. You (point to other student) like to be prepared for anything and want to take lots of supplies along. Go ahead and act out the conversation and packing for this trip until I call out “Freeze.”

Allow about one minute for the conversation to develop.

FREEZE! Now I’m going to switch one of our actors and change the scene a bit.

Select one student to return to seat and pick replacement.

You (new actor) are this person’s friend and he (she) just got back from the backpacking trip and is telling you how it went. Be sympathetic...you’re his (her) friend!

Allow a minute or less for role-play.

FREEZE! (Select a stand in for the actor who has been up longest.) You (point to new actor) are asking advice from your friend here about how to prepare for a backpacking trip.

Continue replacing actors after short intervals, giving as many students as possible, a chance to participate in role-play. If desired, the students may define their own character role as they come to participate, but be prepared to offer a role for anyone who is stumped.

In today’s lesson, everyone will have a role to play and we’ll be making decisions in a mock town meeting about a proposed development.

OBJECTIVE BY OBJECTIVE:**Activity Outline and Teacher Support Information:**

Lesson 9, *Who Protects Source Water?*, introduces standards for drinking water and involves students in exploring who is responsible for upholding and enforcing the standards and what agricultural techniques protect drinking water sources, consistent with drinking water standards. A role-playing activity involves all students in a mock town meeting to help them recognize potential hazards to a community's water supply and to weigh the risks and benefits of community development. It serves to illustrate that decisions governing the use and protection of source water are complex and involve many interest groups (stakeholders). These are topics that will be explored in more depth in Lessons 10 and 11. Assign preparation activity SW.9.AS: *Federal Regulations and Source Water Protection*, which should be read before Lesson 10 begins.

- 9.1. Describe who is responsible for protecting public and private drinking water sources in their community.

Present the overview of the Safe Drinking Water Act (SDWA) of 1974 from the Ensuring Safe Drinking Water slide SW.9.1.TM.A. Lead a class discussion about the SDWA. Who, according to the slide, is responsible for protecting public drinking water supplies? (Congress, EPA, state departments of health and environment and local public health departments) Ask students to name at least 5 other parties that play a role in protecting the purity of our drinking water, such as state agencies, landowners, waste water managers or water utilities. Add their ideas to the slide (SW.9.1.TM.A) or create a list on a blackboard or flip chart.

- 9.2. Describe the roles of decision makers, landowners, local community leaders, and others in protecting drinking water resources.

Activity: Decision Making – A Mock Town Meeting on a Proposed Tank Farm

In this activity, students will...

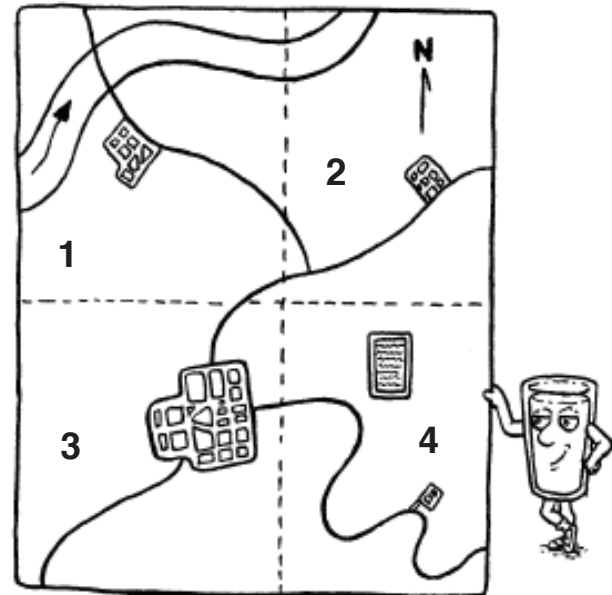
- Gain experience in recognizing potential hazards to a community's water supply and weighing the risks and benefits of community development.
- Consider the viewpoints and roles of a variety of agencies, groups and citizens in positions to influence decisions that affect source water.
- Practice decision-making skills in a mock town meeting.

Make a copy of worksheet SW.9.2.AS for each of the students. Divide the class into five groups representing a town council, a business proposing the installation of underground storage tanks, local home owners, an environmental action group and employees of a county health department. Each group will comment in a mock town hall meeting, leading up to a vote on whether to approve the proposal by the town council members.

INTRODUCTION:

Your class will represent all of the citizens who live and work in a small town called Priceford. A major business development company called Zanec Corporation has asked Priceford for permission to install five 10,000 gallon Underground Storage Tanks (USTs) on their property outside of Priceford, in an area where the predominant land use is dairy and crop farming.

This proposed tank farm will supply fuel and manufacturing chemicals to an existing ball bearing factory. Your class will divide into several groups each having very different interests, and will hold a town meeting to discuss and vote on Zanec's proposal.



GENERAL PROCEDURES:

1. After reading over the activity's introduction and objectives as a class, begin preparing for the town meeting by randomly dividing your class into five groups.
2. Once the groups are formed, they should take (at home or in class) the time they need to:
 - a. Study the facts of Priceford's water resources
 - b. Elaborate on their own special group's interests
 - c. Discuss how each item of Zanec's proposal affects their interests

The background information each group will need for these three tasks is given later in the lesson. Each group should also select its own spokesperson to represent the group's interests at the meeting.

3. When each group is ready, the town council should call the town meeting to order, read the Agenda and introduce the Zanec and Business group to present their proposal. Each other group should then be allowed to comment on the proposal.
4. The council will summarize the issues it believes to be important, BRIEFLY support or refute each issue, and then vote on the proposal.

REVIEW / SUMMARY:

Respond to the following in your journal:

- For the role you played, what was the main point you felt needed to be made to the assembled group at the meeting?
- Pick another character from the meeting and write a short statement from their perspective about the important facts to consider in the decision.
- Did you agree with the decision made by the town council?
- Did your idea about the right choice change at all during the course of the meeting based on the information others presented?
- Were there other stakeholders that you think should have had input on this decision that weren't represented at the meeting? If so, name the stakeholder group(s) and explain your answer.

APPLICATION:**SW.9.AS*****FEDERAL REGULATIONS AND SOURCE WATER PROTECTION*****The Clean Water Act and Safe Drinking Water Act****A. Clean Water Act of 1972**

1. This Act authorized the Environmental Protection Agency (EPA) along with the states and some Indian Tribes to administer the Clean Water Act. The objective of the Act is to:
 - a. Restore and maintain the chemical, physical and biological integrity of the nation's waters
 - b. Employ a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities and manage polluted runoff
2. State adopted water quality standards must be reviewed and approved by the EPA. The following items are necessary for EPA approval:
 - a. Identify all surface waters within state boundaries
 - b. Designate uses for all bodies of water
 - i. Uses may include: public drinking sources, agriculture, aquatic life, recreation, industry and navigation
 - c. Adopt water quality criteria/standards for each designated use for each identified water body
 - d. Develop an anti-degradation policy
 - i. A state or tribal anti-degradation policy describes how the state or tribe will protect existing water quality
 - e. Periodically hold public hearings to review and revise water quality standards

B. Safe Drinking Water Act of 1974

1. This Act provides authority to EPA to establish primary drinking water regulations that specify the maximum allowable levels of specific contaminants (the MCL) that apply to all public water systems in order to protect public health.
2. The Act also states that the MCLG for microbial and some carcinogens (cancer causing contaminants) must be set at zero.
3. EPA has set standards for approximately 90 contaminants and indicators in drinking water.

SW.9.AS (continued)

4. EPA also issues Health Advisories (HAs) provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. Health Advisories are guidance values based on non-cancer health effect for different durations of exposure (e.g., one-day ten-day and lifetime).

C. Water quality terms

1. *Contaminant*: a potentially harmful physical, biological, chemical or radiological substance.
2. *Maximum Contaminant Level (MCL)*: the highest level of a contaminant allowed in drinking water.
 - a. MCLs are set as close to the Maximum Contaminant Level Goal as feasible using the best available treatment technology
3. *Maximum Level Contaminant Goal (MCLG)*: The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety, and are non-enforceable public health goals.
4. *Action Level*: Concentration of a contaminant that, if exceeded, triggers treatment or other requirements that a water system must follow.

EVALUATION AND ANSWERS:**SW.9.RUBRIC**

Use students' journal entries from the Review/Summary section and the assessment tool below to assess their understanding of Lesson 9 content. The assessment is worth 10 points.

	STRONG (2 points)		WEAK (0 points)
The journal entries are reflective in nature and address the questions provided in the assignment.			
The journal also shows an understanding of the concepts presented in class.			
The journal entry explicitly states the application of the content.			
The entry shows the personal meaning or value of the topic for the individual.			
The organization of the journal entry is clear and easy to follow. It is well written; spelling, punctuation and grammar are accurate.			

ACTIVITY WORKSHEET(S) – AS NEEDED:**SW.9.2.AS****Decision Making: A Mock Town Meeting on a Proposed Tank Farm¹****INTRODUCTION:**

Your class will represent all of the citizens who live and work in a small town called Priceford. A major business development company called Zanec Corporation has asked Priceford for permission to install five 10,000 gallon Underground Storage Tanks (USTs) on their property outside of Priceford, in an area where the predominant land use is dairy and crop farming.

This proposed tank farm will supply fuel and manufacturing chemicals to an existing Ball Bearing Factory. Your class will divide into several groups each having very different interests, and will hold a town meeting to discuss and vote on Zanec's proposal.

GENERAL PROCEDURES:

1. Your teacher has assigned you to be in one of the following groups: The town council, Zanec/Business Group, local homeowners/farmers, save the environment, or the county health department. Circle the name of your assigned group.

After reading over the activity's introduction and objectives as a class, begin preparing for the town meeting with your assigned group.

2. As a group:
 - a. Study the facts of Priceford's water resources.
 - b. Elaborate on their own special group's interests.
 - c. Discuss how each item of Zanec's proposal affects their interests.

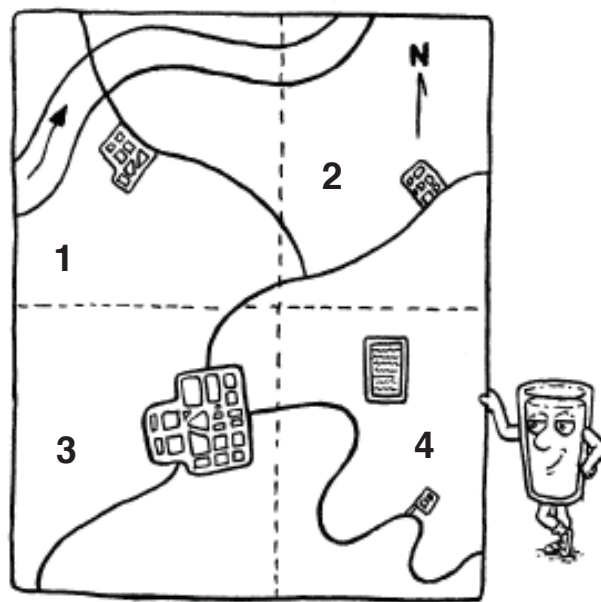
The background information each group will need for these three tasks is given below. Each group should also select its own spokesperson to represent the group's interests at the meeting.

3. When each group is ready, the town council should call the town meeting to order, read the agenda and introduce the Zanec and Business group to present their proposal. Each other group should then be allowed to comment on the proposal.
4. The council will summarize the issues it believes to be important, BRIEFLY support or refute each issue, and then vote on the proposal.

¹ From Office of Water, EPA: http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_9-12_proposedtankfarm.pdf

SW.9.2.AS *(continued)***Priceford's Water Resources:**

Priceford gets more than half its water from groundwater municipal and private wells. The municipal wells draw water from the river (quadrants 1 and 2) and groundwater sources. Private wells all draw water from groundwater sources. The vulnerability of the underlying aquifer in each quadrant of the map below was assessed in the Resource Management Activity in Lesson 5 (use the vulnerability “scores” calculated for the four quadrants in this activity).



- Quadrant 1 is largely farmland in the Priceford area. A small community, Riverville, is about 25 miles down the river. This quadrant is least acceptable to Zanec due to its distance from its property in Quadrant 4.
- Quadrant 2 is largely farmland but also contains a small community which relies on well water.
- Quadrant 3 includes Priceford town center and all the residential areas for the town's citizens.
- Quadrant 4 contains a factory just north of Bucky's Corner. Zanec proposes installing the USTs here.

SW.9.2.AS *(continued)***Special Group Interests**

1. THE TOWN COUNCIL - you must conduct the meeting, listen to all the arguments and decide what is best for all citizens. Based on the facts you gather, the most logical arguments made by any of the groups and your best judgment, you will vote on whether to:
 - a. Allow Zanec to install the tank farm as proposed
 - b. Allow installation only with certain changes in the proposal
 - c. Reject the proposal completely
2. ZANEC and the local BUSINESS GROUP – You must stress the need to allow the ball bearing plant to expand and to attract new businesses for Priceford's economic well-being.
3. LOCAL HOME OWNERS/FARMERS - You are divided. Some desire the new jobs and prosperity made possible by developments like this; others worry about the potential for water, air and noise pollution; still others are concerned about property values; and others are concerned about taxes needed to meet the increased solid waste disposal and sewage demands which are related to development.
4. SAVE THE ENVIRONMENT - Your local chapter of this national group opposes the installation of any USTs until extensive testing has been done and sufficient safeguards are in place. You favor the least vulnerable (but least accessible) site.
5. THE COUNTY HEALTH DEPARTMENT - You are essentially neutral as long as the proposed installation complies with all county health laws and procedures. You must find out whether the proposal meets these standards.

Zanec's Proposal:

Zanec is a major development company which has already invested heavily in the Priceford area. The proposed tank farm is only one improvement in its existing developments. Zanec believes its proposal is in the interest of Priceford for the following reasons:

- The tank farm will allow the ball bearing plant to expand, bringing about 250 new jobs to an area that has an unemployment rate which is above the state average.
- The company will bring revenues to Priceford, not only through wages, but also through property taxes, income taxes and more consumer spending by its workers and their families.

SW.9.2.AS *(continued)*

- The ball bearing plant expansion will be attractively designed, well-maintained and an asset to the community.
- The UST installation will comply with all current regulations and is critical to whether Zanec can continue to build in Priceford.
- The new jobs will result in new home building and increased property values.
- Taxes paid by the plant will help finance school and road improvements while helping to keep home owner's taxes low.
- Zanec requests permission to site its tank farm on its property in Quadrant 4 (see map).

Town Meeting Agenda

The notice to the right was published in the Priceford newspaper.

The town meeting agenda should serve as a guide for the town council to conduct the meeting. As stated in the notice, the council should allow each group only four minutes to offer their views on each of the questions on the agenda.

When all groups have been heard, each town council member may ask one question of one group. Finally, the council will vote on the proposal. The council's vote should be based to a large degree on the most logical and persuasive arguments raised by the groups.

TO ALL CONCERNED PARTIES

An open meeting will be held for community review and input on Zanec Corporation's proposed installation of five 10,000 gallon underground storage tanks on property to the ball bearing factory. All interested groups are to have selected spokespersons who will each be given 4 minutes to present their views. The public is invited to comment on the following issues:

1. Should Zanec be allowed to install the USTs at the proposed site?
2. If not, what alternative location is acceptable to all parties?
3. What are the risks related to the proposal?
4. How can the risks be minimized to protect groundwater?

The remainder of the meeting will consist of a question and answer period after which the Council will vote on the proposal.

Location: Priceford Town Hall

Time: Friday Afternoon

POWERPOINT SLIDES – AS NEEDED:

SW.9.1.TM.A

Ensuring Safe Drinking Water

- Congress passed the Safe Drinking Water Act (SDWA) in 1974 to protect public health by regulating public drinking water and protecting sources of water.
- SDWA is administered by the U.S. Environmental Protection Agency (EPA). A few highlights of the SDWA include the following:
 - Authorizes EPA to set enforceable health standards for contaminants in drinking water
 - Requires public notification of water systems violations
 - Establishes a federal-state partnership for regulation enforcement
 - Requires an assessment of vulnerability to contamination for all public drinking water sources