



Fix a Leak Week Teacher's Guide

Grade Level: 3-5

Key Concepts: Water meter/measurement, leak detection, toilet components, water efficiency, water conservation, water savings calculations

Goal: Students will learn how much water leaks can waste in homes across the country; understand how to measure the water used in their homes; examine possible sources of leaks at home; determine whether their toilet(s) leak; and calculate savings from fixing leaks.

Background Information

What Is Fix a Leak Week?

Leaks account for approximately 1 trillion gallons of water wasted in the United States each year. The U.S. Environmental Protection Agency's (EPA's) WaterSense® program promotes its annual Fix a Leak Week in March as part of its efforts to encourage Americans to use water efficiently. The average home can waste 11,000 gallons of water per year—more than enough to fill a backyard swimming pool. By finding and fixing running toilets, leaky faucets, and dripping showerheads, a family can save as much as 10 percent on its utility bills and save water for future generations.

Why Save Water?

Water is a precious resource. Even though our water sources in some parts of the country can replenish themselves through precipitation, our changing climate, growing population, and ever-increasing thirst for water threaten these supplies. (Note: See the accompanying *Teacher's Guide to Using A Day in the Life of a Drop* for more information about water supplies.) In fact, from 1950 to 2000, our country's population doubled, but our demand for water more than tripled. Water efficiency is a way for families to use less water without sacrificing their quality of life. Taking simple steps such as finding and fixing leaks and looking for the WaterSense label when shopping for plumbing products can make a big difference.

What Is WaterSense?

WaterSense is a partnership program sponsored by EPA that makes it easy for consumers to identify water-efficient products and learn water-saving behaviors. The WaterSense label can be found on plumbing fixtures that use less water but still perform as well or better than conventional models. The WaterSense Web site, www.epa.gov/watersense, has a wealth of information on water-efficient products, facts, and figures about water use in the United States, as well as simple steps consumers can take to save water.

Fix a Leak Week Lesson Plan

While Fix a Leak Week itself (scheduled for March 15 to 21, 2010) is a good time to cover this topic, saving water can be taught at any time of the year. Students can be encouraged to conduct water-saving audits of their homes and experiments on leaky toilets to celebrate Earth Day (April 22), promote Drinking Water Week

(May 2 to 8, 2010), or participate in their local science fair. Your local utility may also be interested in your efforts; WaterSense utility partners often celebrate Fix a Leak Week in March with educational campaigns and distribute free materials to help their customers find and fix leaks. This curriculum covers a range of subjects (reading, science, math, social studies), and lessons were developed to ensure this work can help meet relevant standards in the various curriculum areas. It can be adapted to different grade levels and class abilities.

Lesson 1: Water Meters and Measurement

Goal(s): To introduce Fix a Leak Week
To discuss how water meters can give clues as to whether a house has a leak

Estimated Class Time: 45 minutes

Materials Needed: *Fix a Leak Week Student Worksheet* and *Fix a Leak Week Family Fact Sheet*

Curriculum Focus:

- *English:* Students will improve reading comprehension by learning new vocabulary about water use.
- *Math:* Students will develop greater understanding of multiplication or division by learning to convert water measures.

Homework:

- Students will locate the water meter in their homes, answer questions about water meters, and record meter readings at the start and finish of a period when water isn't being used.
- Students will convert reading from gallons to cubic feet, or vice-versa.

Use this first lesson to get students excited about finding and fixing leaks—and for explaining why saving water matters. Encourage students to read the *Fix a Leak Week Family Fact Sheet* either in class or at their homes. To expand this reading activity, you can create a pre-reading and post-reading questionnaire for students to fill out individually or as a class.

Before students see how much water can be wasted by leaks in their homes, they need to learn how much water their families use. A meter that tracks water consumption in gallons or cubic feet can be found on the outside of most homes or under a metal cover marked “Water” on the sidewalk. Ask your students to find out where the water meter is located at their homes, seeking help from a parent if necessary. If the meter records cubic feet (or ccf, a hundred cubic feet), it will be necessary to convert this measurement to gallons. 1 cubic foot of water = 7.48 gallons. A good source for how to read a water meter can be found at www.h2ouse.org/resources/meter/index.cfm.

A simple way to determine if a home has silent water leaks is to take a water meter reading at a time when no one is using water, maybe when everyone is away from home. Wait at least two hours, during which time no one should use water in the house, even to flush the toilet, then take a meter reading again. If the number changed, there is probably a leak. Note: When water is measured in cubic feet it may take several hours to show a change in water use. Students can instead try taking a meter reading before school and after school, if no water is used at home during the school day.

Another activity involving the water meter is having the students take a reading once per week for a semester. Adding up the weeks and dividing by the number of days in the period will result in an average daily water use rate for the family. For Earth Day or during Fix a Leak Week, students and their parents can be encouraged to take the pledge on the WaterSense Kids' site, www.epa.gov/watersense/docs/drop_pledge508.pdf, and see if their water-saving behaviors have resulted in daily savings.



Lesson 2: Experiment in the Tank

Goal(s): To understand how a toilet works
To learn how to check toilets for leaks

Estimated Class Time: 45 minutes

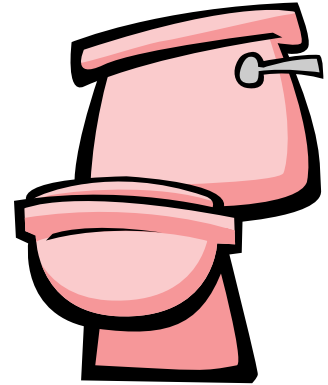
Materials Needed: *Fix a Leak Week Student Worksheet*

Curriculum Focus:

- *Science:* Students will gain greater understanding of science and technology by conducting an at-home experiment.

Homework:

- Students will check a toilet for leaks using food coloring or dye tablets.



Before conducting this fun, at-home experiment, students will need to understand how a toilet works: the bowl is the part that they normally see, where a small amount of water is kept. The tank is the area behind the bowl that holds the water waiting to flush the toilet, and it has a lid over the top of it.

For this experiment, students will need either dissolvable food coloring or a dye tablet (these “potty tabs” are often available at your local utility or on the Internet; www.culverco.com is one site that has dye tabs available for purchase, but there are many other sources as well). They should remove the lid from the toilet tank (parental assistance may be necessary, as lids are often heavy and awkward to move) and drop a dye tablet or a few drops of food coloring into the tank, then wait 15 minutes without flushing the toilet. If color appears in the toilet bowl after 15 minutes without flushing, the toilet has a leak.

Note: Students should flush the toilet after 15 minutes have elapsed, to avoid staining the inside of the tank. It may take several flushes to remove the coloring completely from the tank water. Have an adult help replace the tank lid, and record findings. If this experiment is for a science fair project, the student may want to conduct it again for accuracy and test every toilet in the house for leaks. Teachers can also conduct this experiment at school, if any tank-type toilets are installed in the building; however, most schoolchildren’s restrooms use flushometer valve toilets, not tanks.

Lesson 3: Detecting Other Leaks Around the Home

Goal(s): To learn how little leaks can add up to a lot of water loss
To learn how to find leaks

Estimated Class Time: 30 minutes

Materials Needed: *Fix a Leak Week Student Worksheet*, water dropper, stopwatch or clock

Curriculum Focus:

- *Math:* Students will develop greater understanding of multiplication and division by converting drips to gallons.
- *Science:* Students will search for potential water leaks in their homes and develop greater understanding of scientific inquiry.

Homework:

- Students will do a “drip scavenger hunt” at home.
- Students will solve drip-related math questions.

The easiest way to find leaks is simply to look for them. Students can use the *Fix a Leak Week Student Worksheet* as a checklist to search for dripping faucets, showerheads, pipes, sprinklers, and hoses. If they find a drip, they

should time how often a drop of water comes out of the fixture by timing it for one minute, then multiplying that rate by 60 minutes, 24 hours, and 365 days to get an annual water waste rate. A showerhead leaking at a rate of just 10 drips per minute, for example, wastes more than 500 gallons per year—enough water to wash 60 loads of dishes in your dishwasher. Students may find it helpful if you demonstrate how to measure the speed of a drip in class by using a water dropper to simulate a drip and timing it with a stop watch or clock with a second hand.

WaterSense has prepared a *Fix a Leak Week Student Worksheet* to help walk children through all of the steps described above, as well as calculate potential waste from leaks and savings from fixing them. Please review the worksheet to determine whether the math knowledge required is level-appropriate for your students. You can also reorganize the drip scavenger hunt as a scientific inquiry. Instruct students to formulate what they predict the scavenger hunt's outcome will be (e.g., drips or no drips? or drips in the bathroom sink but not the kitchen sink?), and then walk them through the scientific method to discover whether they guessed correctly (question, background research, hypothesis, procedure, data, and conclusion).

Lesson 4: Students Share What They Learned

Goal: To encourage students to share Fix a Leak Week with their families

Estimated Class Time: 30-45 minutes

Materials Needed: *Pledge to Filter out Bad Water Habits* and *Test Your WaterSense* quiz and interactive game (students can access these tools online or a teacher can provide paper copies from the WaterSense Web site)

Curriculum Focus:

- *Social Studies:* Students will develop greater understanding of their roles as citizens.

Homework:

- Students will sit down with their families to take the *Pledge to Filter out Bad Water Habits*.
- Students will play the *Test Your WaterSense* online quiz and interactive game.

For the final Fix a Leak Week lesson, encourage students to take their learning home and reflect on why saving water matters. Encourage students to think and write about the connections between being a responsible citizen and water use. Here are some questions to consider as a class:

1. What do you think are our rights to drinking water? Do all citizens have the right to have water? Do citizens have the right to waste water? Why or why not?
2. What do you think are our responsibilities regarding drinking water? Are we responsible for protecting our water? Are we responsible for using it wisely? Why or why not?

If families take the *Pledge to Filter out Bad Water Habits* and are interested in fixing leaks that students identify around the home, you can refer them to the WaterSense Fix a Leak Week Web pages at www.epa.gov/watersense/fixaleak for links to resources on do-it-yourself repairs. EPA encourages consumers who need to replace plumbing fixtures to look for WaterSense labeled models, which use at least 20 percent less water and have been independently tested to perform as well or better than standard fixtures. A simple WaterSense labeled aerator, for example, can be screwed onto most bathroom faucets to reduce water from the tap by 30 percent compared to standard models without a noticeable difference in flow.

Kids can also have fun learning about water waste and how to stop it by visiting the *Test Your WaterSense* quiz and interactive game found at www.epa.gov/watersense/kids/games.htm.

For more information and teaching resources on water efficiency, visit www.epa.gov/watersense or www.epa.gov/watersense/teachers.





Name: _____



Fix a Leak Week Student Worksheet

Learn how to find leaks and save water at home during Fix a Leak Week

Lesson 1: Watch the Clock (and the Meter)

What's the big deal with drips? Small leaks can add to big water waste. Try these activities and math problems to see how fast water waste adds up.

Activity: Check Your Water Meter

Water utilities, the companies or organizations that provide running water to our homes, keep track of how much water a family uses each month or season with a water meter. Your home's water meter is a device that measures how much water flows into your house. Water meters are usually located outside, either under a metal cover on the sidewalk or in a box outside the house.

See the example of a water meter to the right. The numbers in the boxes show how much water has been used since the last reading. Meters show water use in either gallons or cubic feet (or ccf, a hundred cubic feet). 1 cubic foot of water = 7.48 gallons.



One way to discover if your home has leaks is to check your water meter before and after a two-hour period when no water is being used. Here's how: Check the meter and write down what it says. Then be careful not to flush the toilet, run the faucet, or use any water for at least two hours. At the end of two hours, check the water meter again. If the meter does not read exactly the same, you probably have a leak. Note: If your water meter is in cubic feet, the leak may not register within two hours unless it's a very large leak.

- Where is the water meter located at your house? _____
- What unit of measure does your water meter use? (Circle one) Gallons or Cubic Feet

Instructions:

1. Find the water meter for your house. Write the number and unit it says here: _____
2. Wait at least two hours. Be careful not to use any water. That means no toilet flushing, dish washing, clothes washing, hand washing, showering, bathing, or running the hose for the next two hours.
3. At the end of two hours, go back to the water meter to see if it has changed. If it has changed at all, you probably have a leak.

Write the number and unit it says here: _____

Bonus: If your water meter reading is in cubic feet, convert it to gallons. Or, if your water meter reading is in gallons, convert it to cubic feet. Use the equation to the right. Use the final water meter reading for this exercise.

Write the conversion here: _____

Conversion Equation

Cubic Feet to Gallons

1 cubic foot = 7.48 gallons

100 cubic feet = 748 gallons

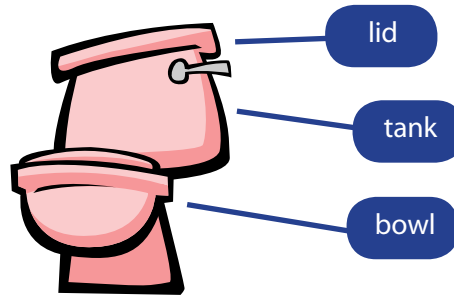
Lesson 2: Be a Leak Detective

Some leaks are harder to find than others. They can be sneaky and silent, and you have to be a sleuth to detect them. Here is an experiment to help you track them down.

Activity: Check for Toilet Leaks

For this activity you will need:

- Food coloring or dye tablets
- A clock or watch
- A helpful grown-up
- A toilet



Instructions:

1. Remove the lid off the toilet tank. (Ask an adult for help—the lid can be heavy and hard to move.)
2. Add a few drops of food coloring or a dye tablet into the tank. Do not flush the toilet.
3. Wait 15 minutes. If color appears in the toilet bowl without flushing, it has a leak.
4. Flush the toilet immediately after the experiment ends to avoid staining inside of the tank.

Do the Math:

A constantly running toilet can waste more than 200 gallons of water every day. How many gallons will the leaking toilet waste in a week (7 days)?

Show your work here:

Write your answer here: _____ gallons

Bonus: How many 8-ounce glasses of water could you fill with the amount of water saved from fixing the leaking toilet?

Conversion Equation

Fluid Ounces to Gallons

128 fluid ounces = 1 gallon

Write above answer here: _____ gallons

Multiply it by x **128 fluid ounces**
= _____ **fluid ounces**

Divide it by ÷ **8 fluid ounces**
= _____ **glasses of water**



Lesson 3: Do a Drip Scavenger Hunt

While toilet leaks are usually the biggest water wasters, even small drips from a faucet can add up.

Activity: Check for Dripping Faucets, Showers, Pipes, and Hoses

For this activity you will need:

- A watch or clock with a second hand

Instructions:

1. Walk through your whole house, looking and listening as you go from room to room. Use the list at right as a guide on where to check for drips.
2. Check the appropriate checkbox if you find a drip or leak.
3. If you find a drip, use your watch to measure how many times it drips in one minute. If you find a pipe that isn't dripping, but is wet, write that down too.

Location of Drip	Drips per Minute
Bathroom(s)	
Faucet <input type="checkbox"/>	
Showers <input type="checkbox"/>	
Bath tub <input type="checkbox"/>	
Kitchen	
Faucet <input type="checkbox"/>	
Pipes under sink <input type="checkbox"/>	
Outside	
Hose <input type="checkbox"/>	
Sprinklers <input type="checkbox"/>	

Do the Math:

If a faucet leaks at the rate of 1 drip per second, how many gallons of water does it waste in 1 year?

Show your work here:

1 drip x 60 seconds x
60 minutes x 24 hours
x 365 days

= _____ drips

Divide it by

÷ 10,000 drips

Write your answer here:

_____ gallons

Conversion Equation

Drips to Gallons

10,000 drips = 1 gallon

If a shower leaks at the rate of 10 drips per minute, how many gallons does it waste in 1 year?

Show your work here:

10 drips x 60 minutes
x 24 hours x 365 days

= _____ drips

Divide it by

÷ 10,000 drips

Write your answer here:

_____ gallons

Conversion Equation

Drips to Gallons

10,000 drips = 1 gallon

Lesson 4: Share What You Learned

Now that you're an expert leak detective, share what you've learned with your family. Fixing leaks is a good start, plus there are many more ways you can save water and have fun doing it.

Activity: Test Your WaterSense Game

For this activity you will need:

- Access to a computer with Internet or a paper handout of the game from your teacher

Instructions:

1. Log on to www.epa.gov/watersense/kids/games.htm to play *Test Your WaterSense*.
2. Move *Flow*, the water-saving character, through water pipes and answer questions while avoiding water-wasting monsters. Use the information you've learned in class and more facts found on the WaterSense Kids' Web site to test your knowledge.
3. Challenge your family to see who can get the best score.



Activity: Take the Pledge to Filter out Bad Water Habits

For this activity you will need:

- Access to a computer with Internet and a printer or a pledge handout from your teacher
- Your family

Instructions:

1. Print out a copy of the pledge from this Web page: www.epa.gov/watersense/docs/drop_pledge508.pdf.
2. Sit down with your family and share what you have learned.
3. As a group, go through the tips for helping you use water more efficiently, and check each one that you are willing to pledge to do.
4. When you are finished, you and each family member who is participating must sign the pledge at the bottom and record the date. Congratulations and good luck!

For More Information

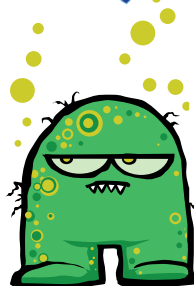
Visit the WaterSense Fix a Leak Week site: www.epa.gov/watersense/fixaleak

Or the WaterSense Kids' site: www.epa.gov/watersense/kids

Drainiac



Swirly



Drip Drip



Sogosaurus





Fix a Leak Week Family Fact Sheet

Fix a Leak Week, sponsored by the U.S. Environmental Protection Agency's WaterSense® program, takes place in March. It's a time when families are encouraged to check for water leaks and drips in bathrooms, kitchens, and yards at home.

What Is WaterSense?

The U.S. Environmental Protection Agency, or EPA for short, is the part of our nation's government that helps to protect the air we breathe, the water we drink, and the land where we live. EPA's WaterSense program encourages Americans to use only the water they need and avoid wasting this precious resource. This concept, known as "water efficiency," is important because the more people there are on the planet, the more strain it puts on limited water supplies. In fact, from 1950 to 2000, the number of people living in the United States doubled, while the demand for water more than tripled. Using only what we need helps keep this growing thirst for water in check.



The Facts on Leaks:

- Did you know that, in a year, water leaks in your home can waste enough water to fill a backyard swimming pool? And if we added up all the water leaking in people's homes right now it could fill a trillion gallons of milk jugs? That's enough water for all the people living in the cities Los Angeles, Chicago, and Miami combined.
- Water-wasting leaks include running toilets, dripping faucets, and other leaking pipes around your home. Most of these leaks can be fixed easily.
- Fixing these leaks can save your family more than 10 percent on water bills. That's like saving \$1 for every \$10 spent on water.

Finding Leaks:

- Ask your parents to help you find the water meter on your house. Usually, it's on the outside of the house in a box or under a metal cover on the sidewalk that says "Water." The numbers in the box represent either gallons or cubic feet of water used in your home. Check your meter, then don't flush the toilet, run the faucet, or use any water for two hours. At the end of the two hours, check the water meter again. If the meter does not read exactly the same, you probably have a leak.
- Walk through your house listening for running toilets and looking for drips. Drips usually mean leaks.
- Find out if your toilet is leaking silently by placing a drop of food coloring in the toilet tank (that's the area behind the toilet seat—ask for mom or dad's help to remove the lid). If color shows up in the toilet bowl after 15 minutes without flushing, you have a leak. Once you finish the experiment, flush a few times so you don't stain the toilet.



Faucets:

- Take a watch or clock with a second hand and time how often your faucet drips. A leaky faucet that drips at the rate of one drip per second can waste more than 3,000 gallons in a year!
- There are parts that hold your faucet together called washers and gaskets—they can wear down and cause drips. If someone in your house is handy, these parts usually can be replaced easily.
- There's also a little screen device called an "aerator" that can be screwed onto the tip of your faucet—it adds air into the water stream so you can use less water to wash your hands or brush your teeth without noticing a difference in water flow. Ask your parents to look for the WaterSense label when buying an aerator or replacing a faucet—that means the product will work well and save water.

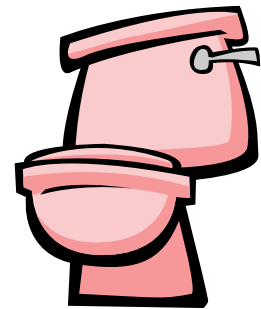


Showers:

- Showerheads—the place where water comes out in streams at the top of your shower—can also get old and leak, even when the water is not on. A showerhead that drops just 10 drips in a minute wastes more than 500 gallons per year. That's enough water, if you saved it all up, to wash 60 loads of dishes in your dishwasher!
- Most leaky showerheads can be fixed by making sure they're screwed in tight. Having someone handy wrap the showerhead in "pipe tape," a special tape available at hardware stores, and using a wrench to tighten it will help.

Toilets:

- It's one of the oldest prank phone calls—"Is your toilet running? Then you'd better catch it!" But a running toilet is no joke. If you can hear the water in your toilet making noise, even when no one flushed recently, you have a running toilet that could be wasting 200 gallons of water or more every day! Sometimes you just need to jiggle the handle to fix it, but sometimes a part needs to be replaced.
- Many toilets leaks are caused because the "flapper" is decayed or broken. The flapper is a rubber piece that opens up to let the water flow from the tank into the bowl when you pull down on the toilet handle. If someone in your house is handy, they can easily replace this inexpensive part of your toilet.
- If the problem is not just an old flapper and your family has to replace a leaky toilet, tell your parents to look for one with the WaterSense label to save both water and money on your family's water and sewer bill.



Outdoors:

- Check your garden hose for leaks where it connects to the side of the house. If it leaks when the hose is turned on, make sure the hose is screwed in tight. If that doesn't work, someone handy may need to replace the nylon or rubber hose washer or wrap the "spigot," which is the metal faucet where the end of the hose attaches to the wall, in pipe tape.
- If your family has a sprinkler system that waters your lawn, remind your parents to check the system each spring before turning it on to make sure the sprinklers were not broken during the winter or have sprung any leaks.

For more information, visit www.epa.gov/watersense/fixaleak.