The Water We Drink

Written for youth in grades 6-12, this tool introduces public and private water systems and includes an activity on how to read a water quality test report.

Why is drinking water important to you?

You have probably heard someone say that you should drink at least 8 glasses of water each day, right? Water is pretty important to your body. It makes up over 60% of your total body weight, including over 75% of your brain. Every day, water does amazing things inside your body. Water helps to keep your body at a constant 98.6° F. Water carries nutrients and oxygen to your cells. Water cushions your joints as you move. Water flushes toxins out of organs and helps you eliminate wastes. Your daily body functions use water that leaves the body through sweat, exhaling, and using the bathroom, so you need to drink new water and fluids into your body every day.

Glass of water

How much drinking water do we have?

When you look at a globe or a map of the Earth, it would seem that we have a lot of water. In fact, 72% of the Earth is covered in water. Unfortunately, we can't use most of that as drinking water. Over 97% of the Earth's water is salt water in oceans and seas. Another 2% is frozen in icecaps and glaciers. That leaves less than 1% of the Earth's water for everyone to drink. As the Earth's population grows, and many countries are further developed, fresh water is becoming more and more limited.

> Did you know…? You can live for up to a month without eating any food, but you can only live for up to a week without drinking any water!

Where We Find the Earth's Water

- Ocean Water: 97.2%
- Icecaps and Glaciers: 2%
- Water in the Atmosphere: 0.001%
- Water in Salt Lakes & Inland Seas: 0.008%
- Groundwater: 0.62%
- Fresh Water Lakes: 0.09%
- Rivers: 0.0001%

Where does your drinking water come from?

Your drinking water comes from natural sources that are either groundwater or surface water.

Groundwater comes from rain and snow that seeps into the ground. The water gets stored in open spaces and pores or in layers of sand and gravel known as aquifers. We use water wells or springs to harvest this groundwater.

Surface Water also comes from rain and snow. It is the water that fills the rivers, lakes, and streams.

Water is pumped, both from groundwater or surface water sources, into pipes or tanks. The pipes eventually lead to our homes, schools, businesses, and any place where you can turn on the tap and drink water.

Most people in the U.S. who live in large cities and towns get their water from a public water supply. If you have a public water supply, a local government agency or private industry delivers water to your home. It comes through a network of underground pipes from a large source of water that you share with your neighbors and community. Your household will receive a bill from your public water supplier based on how much water you use.

How much money is clean drinking water worth to you? Did you know that most people in the U.S. pay more each month for their cable TV or cell phone than they do for their water? If water suddenly became more expensive, what might you give up to continue having clean drinking water in your home?

In rural parts of the U.S., and where there is no public water supply, people rely on private water supplies instead. Roughly 15% of Americans have private water wells for their homes. If you have a private well, water enters your home through pipes that come from a nearby underground water source on your property. You don't receive a bill from a water company when you have a private well, but there are some costs to maintain a well and to power the equipment.

In Pennsylvania, there are over 1 million private water wells.

How do you know your drinking water is safe?

Because your drinking water comes from natural sources, it is exposed to pollutants. Anything on the ground or in the air can end up in the water. Some of these things can cause health problems when you drink the water including pollutants like bacteria, lead, and nitrates. There are other pollutants that aren't dangerous, but cause bad odors and tastes or stain your sinks, such as iron, manganese, and chloride. The United States

Environmental Protection Agency (US EPA) has established Safe Drinking Water Standards, based on research and water testing. The Safe Drinking Water Standards state what amount of each of these pollutants is acceptable in your drinking water.

Has your family ever received a Boil Water Advisory?

When a public water supply fails to meet the Safe Drinking Water Standards for bacteria or a similar pollutant, they are required to notify you and advise you to boil your water before drinking it.

Public drinking water suppliers are required by law to conduct regular tests of their drinking water. The water must meet the US EPA's Drinking Water Standards. In order to remove pollutants from public drinking water, it goes through a treatment process. Dirt and solid particles are removed through a process known as coagulation (the particles are treated to all clump together) and sedimentation (the heavy clumps settle to the bottom of the water). Then the smaller particles are removed by passing the water through filters. Finally, bacteria and other microscopic living things are killed with a disinfectant, like chlorine, before the finished water is distributed.

In Pennsylvania, private water supplies are not regulated by the EPA or required to meet the Safe Drinking Water Standards. Private well owners are responsible for their own water testing and treatment. There are a number of options available for homeowners to have their well water tested. Choosing what tests to perform on well water is dependent on the potential pollution activities taking place on the land around the well (agriculture, industry, mining, housing, etc.) It is recommended that all wells be tested for bacteria once a year. In addition, tests for pH and Total Dissolved Solids, which are indicators of additional problems, should be completed once every three years. If bacteria or other pollutants are discovered in a private water well, homeowners can install treatment systems in their home to improve their water quality.

Does your household have a private well? Penn State Extension, or the Extension Program in your state, can help you identify a certified water testing facility in your area. When was the last time your water was tested?

Activity: Reading a report from a water test

Below are links to two samples of drinking water test reports, one from a private supply and one from a public supply. See if you can answer the following questions:

1. What kind of bacteria did both tests look for? Was it detected in either sample? Which water supply had bacteria levels that were higher than the maximum safe level?

2. What was the pH of the private water supply? The recommended limits for pH are 6.5-8.5, does this private water supply meet those recommendations?

3. What other contaminant did both samples get tested for? Which water supply showed a higher level of this contaminant? What is a possible source of that contaminant? (ppm and mg/L measurements are equivalent when working with liquids.)

4. What was the average amount of mercury in the public water supply? What is the maximum contaminant level of mercury allowed in public drinking water? Does this public drinking water supply violate the standards for mercury?

5. Now analyze your personal water test report. You can find your annual public drinking water supply report, called a Consumer Confidence Report, by contacting your water company. You can also find reports or contact info for all public water suppliers by visiting the EPA's website. For private water supplies, ask your family for a copy of your most recent water test results. If you've never had your water tested, now is a great time to encourage your family to get it done.

SAMPLE REPORT FROM A PRIVATE WELL WATER TEST

*** ANALYTICAL LABORATORY REPORT ***

Client: Client's name — Collected by: KM

Project: Analytical Laboratory Services — Project Number: CL000001

Date Collected: 08/28/90 — Time Collected: 7:35 am

Sample Identification: Kitchen Tap — Lab Number: 01000

Analysis	Results	Units
Total Coliform Bacteria	50	# /100ml
Nitrate-Nitrogen	4.55	mg/l
pH	7.50	units
Iron	0.55	mg/l
Hardness as CaCo3	280	mg/l
Sulfate Sulfur	32.0	mg/l
Chloride	25.4	mg/l
Specific Conductance	344	umhos/cc

On the basis of the above test result(s), this water sample DOES NOT MEET PADEP drinking water standards.

The following notes apply to this sample:

The Total Coliform Bacteria exceeded the max. lev. of 1 colony/100ml.
The Iron level exceeded the limit of 0.3 mg/l.

Submitted by:_____
Laboratory Manager

Sample Private Well Test Report

SAMPLE ANNUAL REPORT FROM A PUBLIC WATER SUPPLIER

YOUR TOWN, PA PUBLIC WATER SUPPLY - SAMPLE CONSUMER CONFIDENCE REPORT

The table below lists the contaminants detected during 2012. It shows the average level of detection and the range of detection from all samples throughout the year. Contaminants that were not detected, are not listed.

CONTAMINANT	AVERAGE DETECTION	RANGE OF DETECTION	MCL	MCLG	VIOLATION	POSSIBLE SOURCES
Barium, ppm	0.0551	ND-0.11	2	2	NO	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium, ppb	4.7	3.0-6.2	100	100	NO	Discharge from steel and pulp mills; erosion of natural deposits
Fluoride, ppm	0.3	ND-0.9	2	2	NO	Erosion of natural deposits; water additive which promotes strong teeth; discharge from fertilizer and aluminum factories.
Mercury, ppb	0.168	0.154-0.189	2	2	NO	Erosion of natural deposits; discharge from factories and refineries; runoff from landfills; runoff from cropland
Nitrate-Nitrogen, ppm	2.6	1.0-4.2	10	10	NO	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
LEAD AND COPPER	**90th PERCENTILE**	**# OF SAMPLES ABOVE AL**	**AL**	**MCLG**	**VIOLATION**	**POSSIBLE SOURCES**
Lead, ppb	3.8	1 of 30	15	0	NO	Corrosion of household plumbing systems; erosion of natural deposits
Copper, ppm	0.27	0 of 30	1.3	1.3	NO	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
MICROBIOLOGICAL CONTAMINANTS	**HIGHEST % POSITIVE SAMPLES**	**RANGE OF % POSITIVE SAMPLES**	**MCL**	**MCLG**	**VIOLATION**	**POSSIBLE SOURCE**
Total Coliform Bacteria	1%	0%-1%	5%	0	NO	Naturally present in the environment

DEFINITIONS:

AL - Action Level, Concentration of contaminant that triggers treatment or other requirements is exceeded

MCL - Maximum Contaminant Level, The highest level of a contaminant allowed in drinking water

MCLG - Maximum Contaminant Level Goal, The level of a contaminant in drinking water below which there is no known or expected health risk.

ppb - Parts per billion, one ppb is equivalent to one penny in $10,000,000

ppm - Parts per million, one ppm is equivalent to one penny in $10,000

Sample Public Water Supply Annual Report

Are There Hormones and Drugs in my Water?

A United States Geologic Survey study of streams in 30 states found that 80% of the streams sampled contained at least one antibiotic, prescription drug, steroid, or hormone contaminant. Although these contaminants are present in very small amounts, aquatic organisms including fish and amphibians are highly sensitive to even low levels of exposure. The effect on humans is unknown and needs to be further researched. Many hospitals and individuals dispose of unused pharmaceuticals by dumping them into toilets or drains leading to wastewater treatment plants. Older wastewater treatment plants are not designed to remove these contaminants from the water. Unwanted medication collection events and education on correct methods for disposing of unwanted drugs are a start toward addressing this problem. Animal manure is another source of antibiotics and pharmaceutical contaminants entering waterways through run-off and leaching. The creation of better farm management plans and practices can help prevent this pollution.

Could you have a career in the field of drinking water?

Are you thinking about a career in science or the environment? There are a variety of job opportunities available in the field of water science. Hydrologists, or scientists that solve water-related problems in society, work on issues such as finding water supplies for cities or farms, or controlling river flooding or soil erosion. Other types of water science professionals may work in environmental protection: preventing or cleaning up pollution or locating sites for safe disposal of hazardous wastes. They may also be educators, teaching others about how to test their private wells or how to manage stormwater on their properties. There are many different job titles that include the science of water including Environmental Engineers, GIS Specialists, Chemists and Lab Technicians, Water Conservation Specialists, Water Treatment Plant Operators, and Environmental Educators.

References

- Robillard, P.D., W.E. Sharpe, B.R. Swistock. How to Interpret a Water Analysis Report. Penn State College of Agricultural Sciences, University Park, PA.
- Drohan, J and C. Abdalla. 2000. Valuing Pennsylvania's Water Resources. Penn State College of Agricultural Sciences, University Park, PA.
- US Geological Survey. The USGS Water Science School.
- US Environmental Protection Agency. Drinking Water & Ground Water Kids' Stuff.

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