

TRENTON ELEMENTARY SCHOOL

Arsenic in Well Water

School: Trenton Elementary School

Grade Level: 8th

Teacher: Cynthia Lambert

Project Partners: MDI Biological Laboratory, Healthy Acadia, Washington Hancock Community Agency, Dartmouth College

Teacher Profile:

Cynthia Lambert is a middle school science and math teacher at Trenton Elementary School, where she has taught for 26 years. She is a National Board certified teacher in science and has a Master's in science education. She believes the purpose of science education is to raise science literate citizens. All students will go on to vote on science related issues, and need to be informed voters no matter where they live. Making science relevant and important is the purpose of doing these types of activities.

Summary:

The class began with a water unit, and as part of the water cycle and understanding the importance of ground water, I introduced the project for arsenic in well water.

Year 1-The project started with asking questions about arsenic and making posters to record information for the classroom. Once we had a basic understanding of arsenic, students then collected water samples from their own homes and others in the school. Once the data was in, we analyzed it to determine what areas of town have higher levels of arsenic than others. This led to a look at the geology of the area.

Year 2-The students researched the same questions to acquire their basic understanding of arsenic. We then started planning the community meeting. During the planning session, students were asked how they wanted to share the information they had learned. They decided on writing a skit, handouts for community members to take home and posters for display. The students learned a lot about where their water comes from and how to protect it. The skit turned out very well and was recorded so it can be shared with others. (Link is on trentones.org.) Students are very responsive to doing citizen science work. It has great meaning and lasting impact.

Introduction:

The residents of Trenton all receive their water from private wells including the school. There are an estimated 500 homes in town. Students were able to get water samples from

approximately 30 of them. A total of 35 samples were taken and sent in for testing. There have been reports that Trenton wells contain high levels of arsenic. This project was a valuable way for residents to check their well water to see if this is the case for their well. The project was part of the water unit done by the 8th graders. The study of the water cycle includes ground water. This is a perfect connection to arsenic in well water.

Project Details:

The Trenton Elementary School 8th grade water unit started off by looking at watersheds through modeling and map work. They discussed the sources and impact of pollution on watersheds and living things. We then moved into how water is a solvent and what will dissolve in it. The info about arsenic came into the discussion here. We also started asking for our well water samples at this time so they could be sent out by the beginning of April. Students took water samples of two local streams and wet areas near the school to test for water quality. Next they did a more detailed look at the water cycle and focused on ground water using a groundwater model to understand the movement of pollution from human sources and natural sources. Activities looking at how pollution is measured in ppm helped us understand the results of the arsenic water test. Students also looked more closely at pH of water and its effects on living things. The unit ended with work on municipal water treatment and a potential visit to one of the local treatment plants. The planning of the Community Meeting was the last project for the unit. Students wrote a skit based on the info they had collected. They also designed brochures and posters for the community members to read and take with them.

This is the worksheet used to introduce arsenic.

Name:

Date:

Arsenic Education

Guiding question:

How do we educate the community about arsenic's effects on health?

Information we need to know:

- What is arsenic?
- What does it do to living things? How does it do this?
- Where does it come from? How does it get in the water?
- Do living things ingest arsenic from other sources other than water?
- What is the safe limit?
- How is it tested for? How often should water be tested?
- What affects the amount of arsenic in well water?
- How can arsenic be removed from the water? What does this cost?
- Where is arsenic found naturally?
- What is arsenic important for?

Resources

<http://www.lenntech.com/periodic/elements/as.htm>

<http://www.lenntech.com/p>

<http://www.ducksters.com/science/chemistry/arsenic.phperiodic/water/arsenic/arsenic-and-water.htm>

<http://www.chemistryexplained.com/elements/A-C/Arsenic.html>

<http://www.lenntech.com/hazardous-substances/arsenic.htm>

<http://www.lenntech.com/periodic/water/arsenic/arsenic-and-water.htm>

<http://www.lenntech.com/library/diseases/arsenicosis/arsenicosis.htm>

Discussion:

I think the students learned that water is not something to take for granted. It is a valuable resource that needs to be taken care of. They also learned as a home owner with a well, it is his/her responsibility to make sure that the well water is safe by testing the water. Even though it looks and smells OK does not mean that it is. I learned that there are many families that do not know that arsenic is an issue. That many do not know that they are responsible for their own well water testing and that water that looks OK may not be. I have done citizen science projects before and was reminded that they are the best way to get students engaged and enjoying science.

My community partner, Healthy Acadia, visited my classroom once and was very supportive of the students' work. They also participated in the Community Meeting. MDIBL representatives came to my classroom twice and were very helpful in learning how to use the data from the website All About Arsenic. They were also helpful in helping the students edit their script for the skit they wrote for the Community Meeting.

The way I did the project, split between two years, was very helpful so that one class was not overwhelmed with the testing and doing the community meeting. I would try to have more field trips or guest speakers about wells and water treatment to help my students understand how they work.

References:

Mrs. Lambert provided some links to websites to get students started, then let students find resources and add them to the list. (See above under Project Details)

Arsenic Resources

Chemical properties of arsenic - Health effects of arsenic - Environmental effects of arsenic
<http://www.lenntech.com/periodic/elements/as.htm>

Elements for Kids
<http://www.ducksters.com/science/chemistry/arsenic.php>

Arsenic Explained
<http://www.chemistryexplained.com/elements/A-C/Arsenic.html>

Arsenic in Water
<http://www.lenntech.com/hazardous-substances/arsenic.htm>

Arsenic and water: reaction mechanisms, environmental impact and health effects
<http://www.lenntech.com/periodic/water/arsenic/arsenic-and-water.htm>

<http://www.lenntech.com/library/diseases/ar>

Is your well water safe to drink? Check your town's arsenic rates

<http://vitalsigns.bangordailynews.com/2015/09/26/home/is-your-wesenicosis/arsenicosis.html-water-safe-to-drink-check-your-towns-arsenic-rates/>

Water test directions

<https://www.youtube.com/watch?v=aUE7PcGRKxc>

In Small Doses: Arsenic

<https://www.youtube.com/watch?v=hi5DfRy01vE>

Arsenic information

<http://www.mass.gov/eea/agencies/massdep/water/drinking/arsenic-in-private-well-water-faqs.html>

The website below this sentence teaches you the definition of arsenic.

<http://www.dictionary.com/browse/arsenic>

Arsenic in private wells

<http://www.wellowner.org/water-quality/arsenic>

On the website below this sentence you will find information on where arsenic is found, what is arsenic, and how to remove arsenic from your drinking water.

<http://www.cdc.gov/healthywater/drinking/private/wells/disease/arsenic.html>

Where arsenic is naturally found:

http://www.cdc.gov/biomonitoring/pdf/arsenic_factsheet.pdf

Getting to know arsenic:

http://water.usgs.gov/nawqa/trace/pubs/gw_v38n4/

Why is arsenic bad for you?

In this link you will find, how people are exposed to arsenic, how it affects people's health and levels in the U.S population.

<http://www.who.int/mediacentre/factsheets/fs372/en/>

<http://www.livescience.com/38137-arsenic-fda-apple-juice-toxicity.html>

<https://www.publicintegrity.org/2014/06/28/15004/what-do-if-your-drinking-water-contains-arsenic>

What is arsenic, how arsenic enters drinking water, how to remove arsenic.

<http://ecowaterspokane.com/special-water-problems/types-of-problems/arsenic-in-well-water/>

5 things to know about arsenic

<http://www.livescience.com/23304-arsenic-rice-fda-health-effects.html>

How can arsenic be removed from the water? What does this cost? if you put ferns in the soil the ferns will bioaccumulate the arsenic. You can take arsenic out of water in many different ways. Options include ion exchange, membrane filtration, iron, and aluminum coagulation.

<http://www.ducksters.com/science/chemistry/arsenic.phperiodic/water/arsenic/arsenic-and-water.htm>

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