

SCHOOL NAME Pelham High School

Project Title: Pelham Toxic Metal Study of Well Water

Grade Level: 10 and 11

Teacher: Dr. Janet C. Holden

Project Partners: Ammara N. Khan mentor scientist

Teacher Profile: I have been teaching science for twenty-five years everything from Kindergarten through college. I completed my undergraduate work at the University of New Hampshire with a degree in Food Chemistry. As a military spouse I lived in Japan, the Philippines and Hong Kong before returning to the United States. While stationed in Wisconsin I interviewed for a chemistry position with the state monitoring arsenic in well water in the 1990s. I didn't take the job but that was the first time I had heard of drinking water in the United States having toxic metals in it. I've been interested in toxic metals in drinking water since then.

Summary: At Pelham we begin the discussion of water quality the first week of school. Students in two College Prep Biology classes over several days read articles on water quality for homework and previous well water testing results were discussed. Student volunteers were requested to pass out literature on arsenic in well water at Pelham Old Home Day in September. Students at this community event targeted other student families requesting them to get their water tested if they had not already had it tested through a previous grant. The specifics of how to take samples and register them were discussed after the Data to Action workshop in September and TUVAs were introduced. The Power Point shared with attendees at the MDI workshop was shown during classes and students asked if they could also test water through a Zero Water Filter. The filter was purchased with funds from the grant and a faculty member who had his water tested through a grant in 2016 requested a second sample from his home be tested but through the Zero Water Filter. His original sample had extremely high levels of arsenic, the results after taking his well water sample and placing it through the Zero Water Filter came back with only trace amounts of arsenic and uranium. There were four additional samples sent to Dartmouth that originally had elevated levels of uranium or arsenic and went through the Zero Water Filter. Two additional classes went through the same process as the first two classes in January bringing the number of students involved to 96. Once the first results were released students used TUVAs to create pie charts of the results. Planning of the second community event began with students wanting to present to the Board of Selectman in a televised meeting. The meeting airs numerous times over several weeks, students hoped this would help spread the word of the well water testing. Their presentation included graphs of uranium, arsenic, and manganese and the health risks involved with toxic metals. The students suggested placing well water results on the town's Facebook page and that there will be future testing available in the autumn. In 2018-2019 thirty-eight wells were tested bringing the total homes tested through an EPA and SEPA grant to one hundred sixty-three.

Project Details:

Objectives

- Increase Student Awareness of toxic metals through Citizen Scientists
- Awareness that not all drinking water in the U.S. is safe
- Student understanding of what EPA limits mean for health
- Increase community awareness
- Science- should we trust what we are told both through media, and scientific studies

September 4 and 5

Overview of Toxic Metal grants through Dartmouth and MDI

Past results of well water testing- two rounds of testing

What classes would participate-

Play "PUR" water commercial on PUR Water Bar

<https://vimeo.com/188722887>

Homework- articles-

What is in Your Well Water

https://www.des.nh.gov/organization/divisions/water/dwgb/well_testing/documents/well-testing.pdf

Students go to the resources on "All About Arsenic" must have an abstract written on at least one article from the site

September 6 and 7-

Discuss Community Events one in the past at "Pelham Old Home Day" request volunteers to hand out brochures from Dartmouth College.

September 15-

Old Home Day in Pelham- students handed out discussion point cards and brochures from Dartmouth.

September 21-23 MDI workshop

October 9-12

Students participating in well water receive paperwork, and review how to register samples

Samples should be returned by October 19

Keep track of each student vial number and check off as they come in

October 11-12

Students choose a research question and topic for the Toxic Metal Project

October 15-16

Students divide themselves into groups based off research question

Groups based on their research questions-

Manganese- research and responsible for writing that portion of the final report and presentation at Community Events

Arsenic – research and responsible for writing that portion of the final report and presentation at Community Events

Uranium - research and responsible for writing that portion of the final report and presentation at Community Events

Arsenic and Manganese difficulty when combined- research and responsible for writing that portion of the final report and presentation at Community Events

Zero Water challenge- a group of students wanted to test whether Zero Water Filter really works

Brain Research Group- wanted to research the IQ changes in children exposed to arsenic levels above EPA recommended levels

January 2 – and 3- Results for Pelham in-

Classroom discussion on EPA limits – Student research teams have class time and homework for their research. Teams responsible for division of the work

January 9-10 research is due

March 4- scientist mentor emailed-

March 5 and 6 discuss Tuva

March 7 and 8 register on Tuva as a classroom- code c84tg

March 7, 2019- Tuva User Guide put on Google Classroom

Homework- review EPA lowering arsenic - students will need to look at houses that well water was at 5-10 ppb-

<https://www.des.nh.gov/organization/commissioner/pip/newsletters/en/documents/2019-mar-apr.pdf>

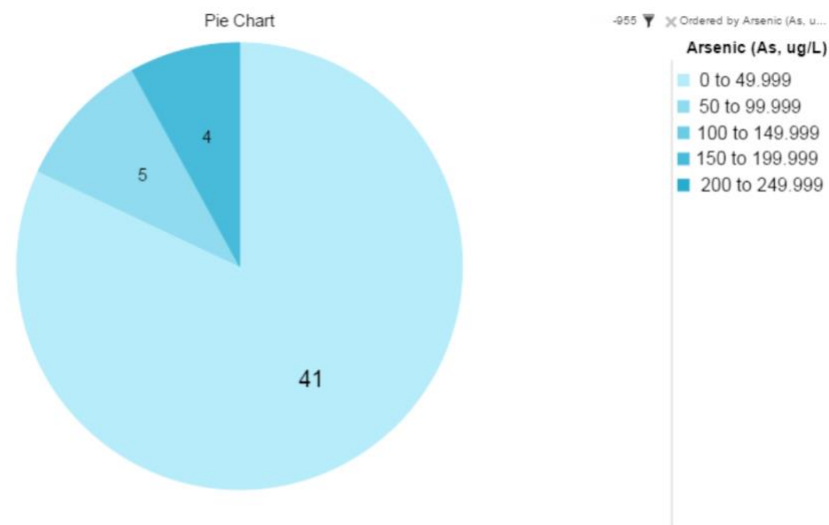
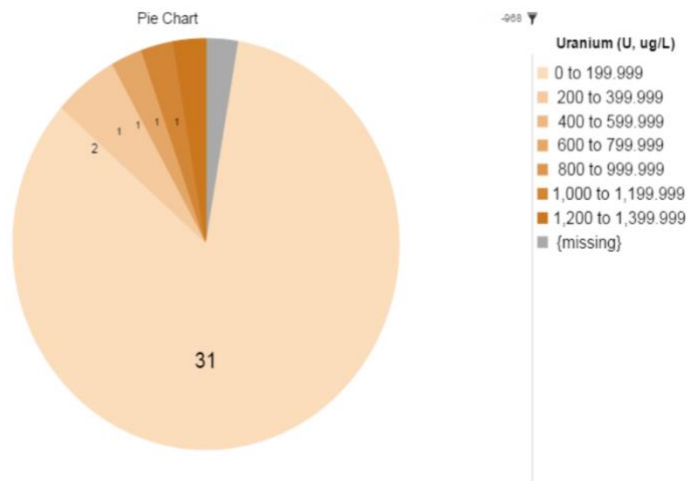
March 4- students practice manipulating data in Tuva

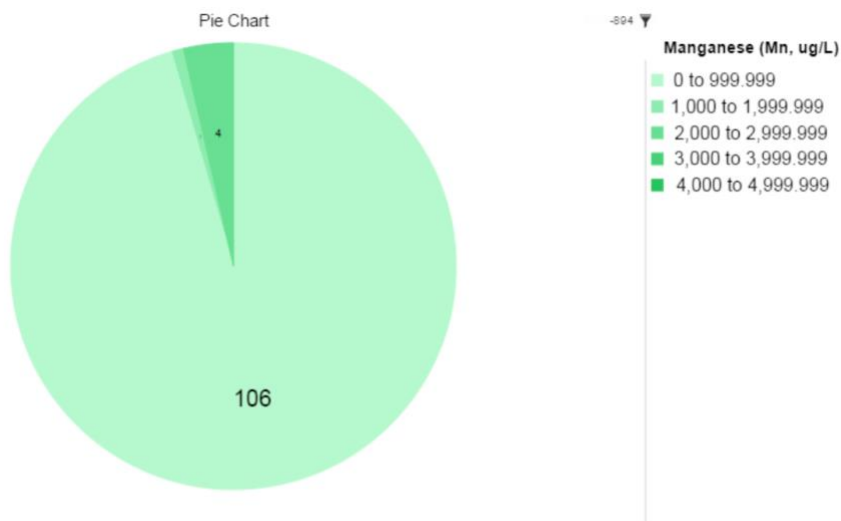
March 11- began handing out vials for homes that have requested retesting after Zero Water Filter is used.

Houses must have had above EPA limits for toxic metals

March 18- final pie charts complete for manganese, arsenic, and uranium at unsafe levels by EPA standards.

Students wished to place all 163 homes tested over the last three years.





March 18- contacted mentor Ammara Khan-over manganese and arsenic combined issues- why is it so difficult to remove arsenic if manganese is also present.

April 2-3

Complete the Board of Selectman report- request volunteers for getting on the docket for the Board meeting

April 11- Community Event date from Pelham Board of Selectman set for May 19- later changed to May 21 at 6:45

April 18 – Requested how to send samples to Dartmouth that have been sent through a Zero Water Filter.

April 29- Assigned Board of Selectman Report 1st Draft

May 6- Draft of report proofed-

Second round of well water vials sent to Dartmouth- Four samples were repeat samples with originally high levels of toxic metals put through Zero Water Filter

May 15 and 17- students practice presentation

May 21- Board of Selectman meeting- second community event televised



Students at Board of Selectman meeting

Discussion:

Objectives that were met

- Increase Student Awareness of toxic metals through Citizen Scientists
- Awareness that not all drinking water in the U.S. is safe
- Student understanding of what EPA limits mean for health
- Increase community awareness
 1. Brochures handed out at Pelham Old Home Day
Students felt only a few people stopped to listen or read literature
 2. Board of Selectman Meeting- results
Selectman will run a commercial on the dangers of arsenic produced through Dartmouth again on Public Television
The presentation on well water results was televised – but how many people watch Public Broadcast Television
 3. Selectman agreed to put the well water results on Pelham Facebook page and they suggested contacting a N.H. Mom’s Facebook page also
- Science- should we trust what we are told both through media, and scientific studies
 1. Flint Michigan – could it happen again-
 2. Research –student scientists need to do their own
 3. Experiment yourself-student scientists should not be afraid to suggest experiments- testing with the Zero Water Filter was a great idea

Conclusion:

Students suggested going to the elementary school Open House in the fall and taking brochures on toxic metals in well water and trying to register vials through the elementary parents. The students were frustrated at the Board of Selectman meeting when a man was interviewed for a new position the town is hiring for head of the Water Department. The man explained his extensive background in water quality and his degrees in chemistry. He then went on to discuss his concerns about water quality in Pelham and talked about the road he lives on in Pelham having a long history of water issues specifically low water levels in wells. The head of the Board of Selectman suggested the man being interviewed remain at the meeting and hear from the high school students that there are more serious issues than water quantity. This is a problem in Pelham where one neighborhood has had water pressure issues and many wells have no water. This has been brought up at numerous meetings overshadowing the serious toxic metal issue. During the first water testing in 2016 we made an effort to demonstrate that toxic metals may be in one person’s well and not the next door neighbor. Students used the voting grid map of the town to test at least one well in each grid point. The reason was to demonstrate that not just one street in Pelham has water issues. The results of the 2016 water tests and the gridded map were displayed in the Town Hall for the next year. Yet here a man living in the town, and an expert in water chemistry did not know about the toxic metals potentially in his own well. As an educator I was frustrated that I’m not making the impact necessary “getting the word out” I’m hoping using social media will help with this.

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