Exeter NH Region

Project Title: What's in your water?

School: Exeter High School

Grade Level: 9

Teacher: Debra Kimball

Project Partners: Kathrin Lawler-Dartmouth College(2016-2018), MDI Biological Laboratory, TUVA Labs, University of New Hampshire(Scott Greenwood and Kevin Gardener (2018-2019))

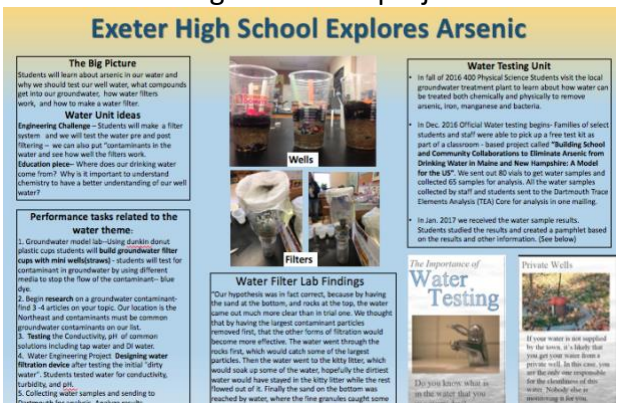
Teacher Profile: I have been a science teacher for over 25 years. I now primarily teach physical science to 9th graders. I have a strong commitment to citizen science being active on my towns conservation commission and part of a team of volunteers for the NH DES VRAP program leading water testing on the rivers in my town. For the past 20 years I have involved students in citizen science projects.

Summary: Data to Action is a citizen science project involving students in the monitoring of arsenic in well water in their communities and sharing that well water data with others by informing the public on the importance of well water testing. I collaborated in 2016-2017 with 4 other teachers on the water filters and story of arsenic in well water but the 65 well water samples taken were from my classes as well as staff members of EHS. In 2018-2019 school year I was able to involve about 80 students in the water filtration and water testing project. Approximately 50 water samples were again tested. Students were able to analyze and report out of the results. A community forum was held in March of 2019, although attendance was low.

Project Details:

In 2016-2017 all 440 freshman attended a field trip to the groundwater treatment plant in Exeter- we used grant funding to make that happen. All students got a full tour of the plant, wells, and testing lab.

- In 2016- About 300 students designed water filters to test samples of dirty water for a lab that was designed for the project. Students also explored ground water models.



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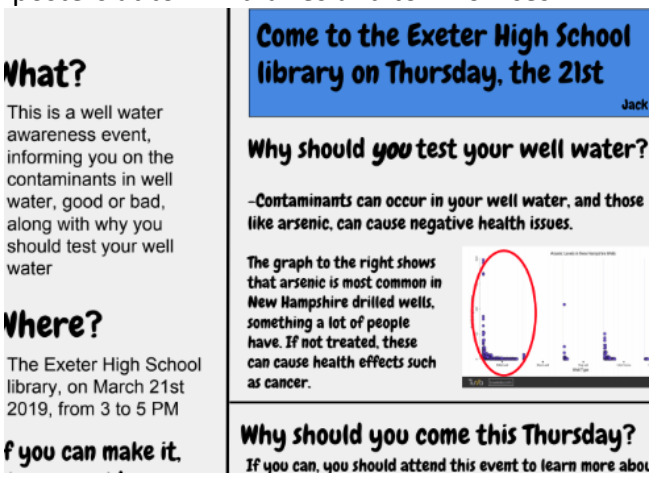
  - In 2018- Fifty more water samples were collected from students and staff at EHS which included the following towns: Exeter, East Kingston, Stratham, Brentwood, Newfields, and Kensington, as well as several other communities in Rockingham and Stratford counties. A new water performance task and community outreach project were developed involving 75 students.

- March 2019--A community outreach presentation was planned for March 21st at the EHS library from 3-6 pm. Approximately 12 students attended the event as well as 40 more submitted projects for display.

  Only a handful of people attended even though students advertised the event on facebook and posters at town libraries and town offices.

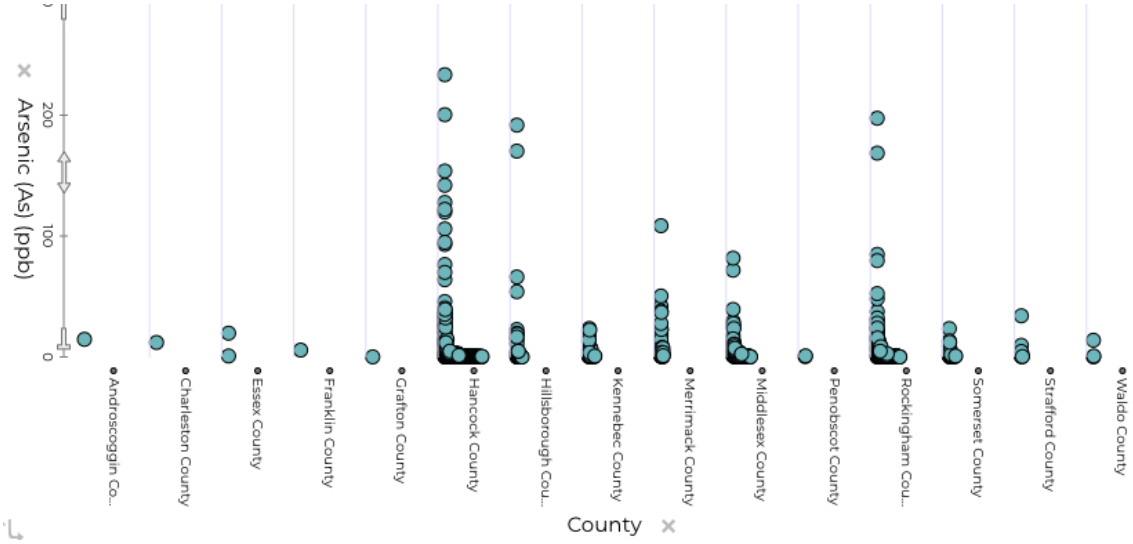


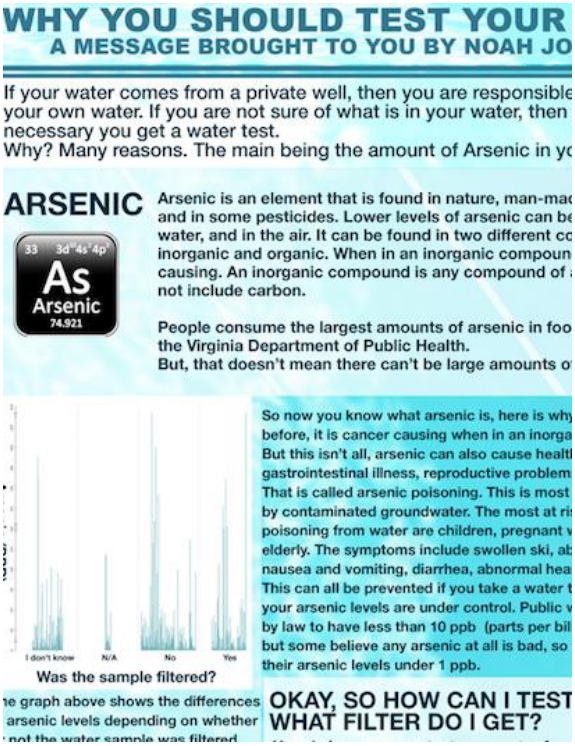
2018-2019--Water performance task:

- **What can students explore? Choose one of the 3 options for project**
- 1.Students explore the production, purpose, and mechanical issues of a water filtration system, investigating the bests ones for common NH contaminants such as arsenic and or designing their own water filters.
- 2.Students explore which contaminants typically occur in NH well water, why they are a concern, how they might be removed via filtration, and how to share this knowledge with the public.
- 3.Students analyze local well water data available via TUVA database and try to find out if levels of certain contaminants/elements are affect by another factor.
- **Choose three I Can statements for your project**
- I can design and conduct a short research project to investigate the types of water filters that best address the contaminants in Southeast NH.
- I can create a water filter prototype that is based on real world research from a range of reliable resources.
- I can evaluate well water data and reach sound conclusions based on the data provided
- I can analyze and make predictions from raw data sets by creating valid graphs
- I can make a convincing case for the community to do water tests
- I can interpret and evaluate information from many sources to develop a complete picture of the Southeast portion of NH well water data.
- I can test my water filter and identify specific design weaknesses
- I can interpret and evaluate information from multiple sources to better analyze groundwater contaminants

About 80 students conducted water tests to see if their filter designed would purify the dirty water samples (iron or copper filings, coffee grounds, silt, and or NaCl or acetic acid, food coloring). There were 4 different types of dirty water- some proved too difficult to clean up with our materials. Twenty five students went on to explore the water filter design option in more depth and engineered many designs. .At least 50 percent of all students analyzed the water data using the TUVA labs site for arsenic data. We received technical help from Scott Greenwood and Kevin Gardener of UNH. Kevin Gardener was also able to interview a few students on their final projects at our community event in March. We had planned for an April Tuva data analysis presentation and tutorial for students but our schedules were too full.

- Students created basic graphs and infographics on the importance of understanding arsenic levels in well water.





  - We had planned on graduate students from UNH helping EHS students with the TUVA data. They did make an instructional video for us but we simply ran out of time to coordinate and follow through on our ideas.

Supplies purchased: Charcoal for filtration, filters, pH, and conductivity probes, water pitcher filter, as well as water test kits and other water testing supplies.

What did students learn?

Students learned about the importance of water testing and understanding how various elements in our water affected our health. Students were surprised to learn about how little of arsenic could have serious health effects. Many encouraged their parents to install better filters and some had their grandparents getting water tests. Students also learned the value of face to face communication with the public. Students had to present their findings to other students and then a few presented to the public at our event. Student learn about how water filters work and how important a water filter is. They also realized that filtered water is what many bottled water companies sell—they wanted to test the various bottled water samples but I did not think we were allowed to do that. I thought it was a good idea.

What did you learn?

- I would rethink how to do a community event- folks just don't turn out for a water event on a Thursday afternoon or evening- it needs to be part of a bigger event. If I did this again I would get volunteers to man a table at one or two of our winter farmers markets.
- I would begin the project earlier and have distinct stage of the water analysis project. I would allow more time to learn TUVA and have perhaps UNH grad students work with our students on this piece. I also realized it might be best to scale back this project so that the most important pieces get done- we focused so much time on investigating and building filters, as well as how they worked that we really did not spend enough time on the data analysis as I would have liked.
- However, I did use this project as a model for Student Centered Learning (there is even an exemplar on the NGSX science project ideas site of how to design a water filtration and community project). I learned that when I let students choose which way they wanted to explore this topic they really got invested in this project since it was their own. Student created amazing filter designs, did good research and created google sites that informed the public. In the end more folks in the community really do know about arsenic in their water and what that means for health. We created awareness around the Arsenic and You website.
- What would you do differently? I would weave the essentials of this project into our curriculum on chemistry and data analysis so that will was not a separate project at the end of chemistry but an evolving thread that wove all of what we learned on chemistry together. I would focus on what ppb really meant as well as explore TUV A data sets sooner. I would also begin this project sooner in the year- say in October. I would also work more closely with my teaching partners, and the UNH mentors that involved data analysis for all students.
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Conclusion: I have a strong commitment to citizen science for both myself (long time member of my town's Conservation Commission) and my students (UNH Albedo study and Harvard Forests Hemlock Wooley adelgid project). The All About Arsenic project fits into this citizen science piece by involving students in the monitoring of water quality in their own homes and getting out the message of how important it is to test and understand how arsenic affects human health. New Hampshire is looking at lowering the MDL of arsenic to 5 ppb from 10 ppb- this will create a new talking point for the importance of water testing in for every NH well.

References:

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