Project Title: All About Arsenic Case Study 22/23
School: Conners Emerson School
Grade Level: 8th Grade
Your Name: Lynn Hanna
Project Partners: Sarah Hall COA, Jane Disney MDI Biolab

Teacher/Scientist Partner Profile: I am a 7th and 8th grade science teacher who teaches in Bar Harbor. I have been teaching here for 17 years, ed tech for 7 and teacher for 10. I started teaching in 1993 in a private school in Washington D.C. where I taught 1-5th grade science. I have been teaching a total of around 29 years, taking a couple years off to raise my children. I have recently found a passion for fly fishing, backcountry hiking, and winter camping. I teach both life and physical science and am interested in the All About Arsenic project because I enjoy making what I'm teaching real. Students understand how what they are learning in the classroom has an impact in the world around them.

Summary: All About Arsenic is used in my chemistry unit for the 8th graders. While we waited for the samples to be analyzed students studied the elements that Dartmouth is analyzing for: arsenic, antimony, barium, beryllium, cadmium, chromium, copper, iron, lead, manganese, nickel, selenium, thallium, and uranium. Students chose an element and researched that element. Students then put together an element baby book which they share with the rest of their class. The research included the atomic symbol, mass, and number. Students also researched who discovered the element, the type of element, and state of matter. They also research what health impacts the element has. This year, for a second year in a row, the Town of Bar Harbor offered free well water testing to all residents in Bar Harbor on wells. Jane Disney, Sarah Hall, and I worked with Michael Gurtler, the Town Health Officer. Using the story maps on the All About Arsenic site students researched information about arsenic including what is arsenic, health risks of arsenic, where is arsenic found, recommendations for arsenic limits, and data on arsenic that has been collected in the past. Students met with Sarah Hall, from COA, in a small group setting to go over the information and talk more about what they had discovered. Students then created some way to share this information with the townspeople either through a trifold poster, a flier, or a letter to the editor. This year students went down to the Town Municipal Building and handed out the free kits along with talking with the public about how important it was for townspeople to be testing their well water. Jane Disney also came to school and showed the students how to do a bioseed assay with lettuce seeds and different contaminants. After conducting the experiment students needed to write up a claim, evidence, reasoning as to why students got the results they did.

Project Details:

- 31 Students were involved with this project.
- Element Baby Book Form for students: https://docs.google.com/document/d/1ZwYqp5nqdA8TIGNP4QVx2CDxfoiZRpqTklH66DKQ_tM/copy

- Sarah Hall met with small groups of students to help guide them through the All About Arsenic story map information for students to use in their trifold/flyers/letters to the editor.
- Students were introduced to Tuva by using an intro lesson to get them more familiar with using this tool. Then we analyzed data from the years past about arsenic and the other elements that were being tested. And finally, students used Tuva to create graphs and gather information for their trifold/flyers/letters to the editor.
    - Messing Around with TUVA Data
- Students created trifolds and flyers about arsenic and its' health impacts of arsenic. Other students created letters to the editor to share with the community that the Town of Bar Harbor would be offering free well water testing and sharing how important it is for townspeople to test their water.
- Students met with Jane Disney to do a bioassay on lettuce seeds and contaminants.
    - Lab Write Up for BioAssay
    - In these bioassays students tested lettuce seeds and copper sulfate, iron sulfate, 25 ppb arsenic and 50 ppb arsenic, filter and non filtered water. Some questions students asked were: How will lettuce seed grow in a copper sulfate solution? How will the lettuce seed grow in copper vs. arsenic? How will copper, iron, and arsenic affect the growth of lettuce seeds? And Does a level of 50ppb arsenic negatively affect the germination of lettuce seeds when compared to arsenic-free water?
    - Here is an example of a student's work.
    - The people I had enter my room this year were Jane Disney to share and set up their bioassays and Sarah Hall to talk with students about arsenic, where it's found, and help students gather information about arsenic to share with townspeople.
    - This year students went to the Municipal Building to share out the information they researched along with handed out well water kits to the townspeople.
- I used Tuva this year both for students to analyze some of the data that is used by the All About Arsenic Project, but I also use Tuva for students to gather data and then upload to make their own graphs and talk about a claim evidence reasoning. Students did this with garbage collection, we walked around town and gathered garbage. Students then organized the garbage and put the garbage into categories. Students then created a spreadsheet and uploaded the data to Tuva. From there they came up with a CER.
- This year students created posters, trifolds, and letters to the editor. In November on voting day students went down to the Town Municipal Building and set up their posters and trifolds. Students then talked with community members about arsenic, their well water, and safety issues.

Discussion:
The students really enjoyed going to the municipal building to talk with people. It seemed a better fit from the past where we have made these trifolds and we don't get to see the impact they make. Students were able to see that this year and talk with

townspeople. That was one of the best experiences for me was to see our students talking about science, and tests we have done with townspeople. Students also enjoyed the bioassays. They came up with questions, tested, and were excited to check their seeds every day.

Conclusion: In conclusion this year was better in some ways, but still needs work. I was really excited to do the bioassays with the students, that was an eye opener in the students got to see the impact of these contaminants that they have been studying. I still was not able to get the data back before the students moved on to social studies so I need to think about the timing again. The other thing I would still like to bring back is testing the water bottles for arsenic. I have done that in the past one year and have not been able to get to it again. I love teaching about arsenic, but it's hard when you feel the pressures of having to teach other things that you can't spend time and dive deeper into one area, but I am happy that I am adding something new each year to this unit and that students talk about it to this day.

References:

Acknowledgement: The work reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number R25GM129796. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.