Project Title: Well, well, what's in your well?

School: Pinkerton Academy, Derry, NH

Grade Level: 11-12

Teacher: Michelle Mize

Project Partners: SEPA Team, Anecdata, Tuva, PIDL, MDI Biological Laboratory, Dartmouth College Geisel School of Medicine, Derry and Manchester, NH Municipalities.

Teacher Profile: Michelle Mize, a NH native is a Career and Technical Education teacher for the past 22 years in plant science, natural resources, forestry and previously worked in the field. She has a M.A.L.S. degree from UNH with a focus in Environmental Education and Natural Resource Inventory (N.R.I.) applications and case studies. In addition she has a great interest in water quality and is excited about her students being involved in an EPA study about arsenic in drinking water. She is also involved in lake monitoring in Southern NH and has long volunteered to serve the NH Dept. of Environmental Services "Weed Watch Program" as well as the Sunset Lake Association. As a product of CTE herself (KHS- '85) she realizes the value of hands-on application in real life scenarios to interest and motivate high school students to develop cross curricular critical thinking skills.

Summary:
The 2021-22 school year students planned the execution, budget and ordering of supplies to take 30 samples of class students well water and a set of CTE faculty samples as well as pH and Nitrites strips. Students had identified areas in need for testing and realized that Pinkerton students and staff cover a variety of towns that are in need of education. We planned to tour Derry and Manchester municipal water and wastewater plants and learned where much of our Town water in Derry comes from and where it goes as well as ways of remediation. The students are from many NH towns in the surrounding area; Derry, Hampstead, Chester, Auburn, Hooksett and sending students from Timberlane and Windham for CTE courses. We focused on the issues of our soil types having high occurrence of potential arsenic, high past/present farm/apple orchards/pesticide and subsequent potential health issues. We broke town parts of a water test, EPA parameters and aesthetic issues with drinking water. We looked at previous tests and students brought in test outcomes from home.

2021-2022 Fred McNeil of Manchester NH Water Works gave a virtual discussion regarding the field of water quality management as a career. The involved student group was much smaller than previous years and 2022-23 enrollment will be much larger and also involve AP Environmental Science course in which this will add another set of students in the study.

Project Details:
Several lectures and student research were completed as well as writing our proposal and obtaining materials.

● **2021-Dec.** Students developed an outline for the project with guidance and the questions were posed “what do you know, don’t you know and curious to know " about drinking water quality regarding arsenic and other factors and parameters. Much of the semester 1 learning targets were difficult to move along and complete due to the hybrid learning model.

● **2022- Jan.- May**- Students and faculty received test kits in the mail and were provided return postage as we were in a fully remote learning model. Online guidance was provided for students to collect samples of their well water sample. We discuss parameters and recent EPA standards as well as New Hampshire drinking water standards and changes. We went over types of remediation for arsenic, uranium and aesthetics and how pH and correlative parameters such as soil and ionic exchange. Students became familiar with using Anecdata, TUVA and began using the tools. Students developed independent research projects comparing 3 schools and arsenic and other chosen parameters to start their investigations based on last year’s results as we were behind in getting samples to the lab.

● Once our sample data was available students compared data to prior tests and developed a comprehensive project with community PSA and outreach material which was shared. We did participate in science week this year and students found alternative ways to educate the community by sharing with their science classes and advisory board members.

Discussion:
Students learned that it was important to be aware of one’s own well and that municipalities have a responsibility under EPA requirements to provide clean drinking water. This happens to coincide with the EPA drinking water standards and what that means for New England residents and this studies importance as these standards have now been rolled out. Several students explained the systems they had at their homes remediating arsenic.

What do you think that students learned?
That they have a responsibility to know what is in their drinking water. Which elements are common in water, Types of water sources, processing and pH levels. What arsenic is.
• Arsenic is a carcinogen.
• Arsenic is very common in certain soils.
How arsenic affects the body. E.PA. standards for levels acceptable in drinking water and how they have changed over time. That arsenic is a health problem that can be remediated if one is aware of the presence of the contaminant(s) and well water testing is important.
• They learned that several of the areas surrounding Derry were in apple production for many years and several of those property wells have an abundance of arsenic in soil and well water. Students learned data analysis through Anecdata and TUVA and some plan to use these tools post-secondary.

In the fall of 2021, a graduate of 2020, and current UNH student reached out to obtain maple syrup production data from Pinkerton Academy as well as other producers. A research project using the data analysis tools that was acquired at Pinkerton Academy through the All About Arsenic study was implemented.. The project compared maple syrup production volume,

location and weather patterns. It was exciting to hear that what was learned in high school is being used several years later!

References: ***See 2019/20 A 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.