RESEARCH PLAN / PROJECT SUMMARY

Name: Anna Rentz

TITLE: Assessing the Contaminants in Drinking Water

Category: Earth and Environmental Sciences

A. RATIONALE

- **Background -** Especially on Long Island where the only source of clean drinking water is groundwater aquifers, water supply is so limited that it is essential to understand how to utilize it in the most efficient way possible. This can be achieved through awareness of wastewater treatment, along with taking fertilizer precautions. By the time tap water ultimately reaches a person's home, it has already been contaminated with various chemicals and metals. Similarly, this impurity is true with bottled water. Before it is packaged and sent away for the public to drink, bottled water is often treated with chemicals in efforts to clean the water. These chemicals have been shown to have adverse health effects in many cases across the United States.
- **Scientific Importance / Societal Impact -** The water quality phenomenon is an extremely vital issue needing answers in today's society. The EPA has not regulated their water standards in over 20 years, which poses some major questions regarding whether the water people are drinking today is in fact safe.

B. RESEARCH QUESTION / HYPOTHESIS

- **Research Question -** What contaminants are present in bottled vs. tap water?
- **Hypothesis -** Tap water will have more contaminants than bottled water.

C. RESEARCH METHODS

- **Procedures**:

  Gather Water Samples

  Gather water samples from: Eastern Suffolk tap, Western Suffolk tap, Nassau tap, unfiltered school sink, school filtered water, Brita filtered water, Bottled water from: Poland Spring, Aquafina, Dasani, Fiji, Nestle, and SmartWater.

  Test Strip Water Testing

  Use a Baldwin Meadows 14-in-1 drinking water test kit. Put the dipstick into the water sample then immediately remove and compare the resulting color to the color chart to determine chemical levels present in the water.

  Chemical Water Testing

  Use a LaMotte Colorimeter to assess the levels of sulfate, fluoride, copper, zinc, manganese, nitrate, chlorine, iron, lead, and chromium in drinking water. Follow LaMotte colorimeter and test kit protocols for each test.

Fecal Coliform Testing

To use a LaMotte BioPaddle to test for the presence of coliform bacteria in drinking water, expose the BioPaddle to a water sample for 15 seconds. Remove the paddle, empty the vial of water, then replace the paddle into the empty vial to seal the container. Let the BioPaddle in the vial incubate at 35 degrees Celsius for 48 hours. Count the number of bacterial colonies that form on the BioPaddle after 2 days.

- **Identify the Variables**
  - **Independent**: bottled vs. tap water
  - **Dependent:** Test strips and Colorimeter tests for: sulfate, fluoride, copper, zinc, manganese, nitrate, chlorine, iron, lead and chromium as well as fecal coliform testing via BioPaddles
  - **Constants**:
    - Amount of water - 10 ml for each test
    - Lab setup for each test - including the LaMotte Colorimeter
    - Containers the water is kept in

- **Identify the control of the experiment**
  - Purified water, via a Brita Filter

Risk and Safety: Subject Specific Guidelines

1. Human participants research: Not Applicable
2. Vertebrate animal research: Not Applicable
3. Potentially hazardous biological agents research: Not Applicable

4. Hazardous chemicals, activities & devices:

- **Describe Risk Assessment process**

LaMotte water test kits for sulfate, fluoride, copper, zinc, manganese, nitrate, chlorine, iron, and chromium contain some hazardous chemicals including: sulfate reagent, sodium arsenite solution, acid-zirconyl reagent, copper 1 solution, zinc indicator solution, methyl alcohol, zinc buffer powder, sodium cyanide, formaldehyde solution, free chlorine reagent, nitrate tablets, manganese reagent, iron reducing reagent, and chromium tablets. Risks include skin and eye irritation, oral, dermal, and inhalation toxicity, target organ toxicity, skin sensitization, and reproductive toxicity or germ cell mutagenicity. Any chemical with risks greater than irritation will be handled by the designated supervisor only.

- **Detail supervision**

Designated supervisor will handle dangerous chemicals included in the zinc and manganese test kits.

- **Describe safety precautions and procedures to minimize risk**

Researcher will wear lab coat, splash-proof goggles, and nitrile gloves throughout experimentation. Wash hands thoroughly after experimenting. Use chemicals in lab with mechanical ventilation. Keep flammable chemicals away from heat, open flames, or other ignition sources.

- **Discuss methods of disposal**

Dispose of contents/container to an approved waste disposal company. Water coliform test kit (BioPaddle) to be bleached for 24 hours before disposal.

Data Analysis

Water chemical test levels will be compared to EPA safe standards for each chemical tested. EPA safe standards are as follows: sulfate (250pm), fluoride (4ppm), copper (1.3ppm), zinc (5ppm), manganese (0.04ppm), nitrate (10ppm), chlorine (4ppm), iron (3ppm), lead (15ppb) and chromium (0.1ppm). Formation of colonies on the BioPaddle agar will indicate the presence of coliform bacteria in water samples.

D. BIBLIOGRAPHY

Ahmad, S. (2018, October 10). World Water Day 2018 – How Pure is Our Water? Retrieved from https://www.waterlogic.com/

Hoffmann, M. (1996). Application of ultrasonic irradiation for the degradation of chemical contaminants in water. *Ultrasonics Sonochemistry, 3*(3). doi:10.1016/s1350-4177(96)00022-3

Langin, K., Reilly, S., Waldman, S., Stokstad, E., Normile, D., . . . E&E NewsOct. (2018, February 12). Millions of Americans drink potentially unsafe tap water. How does your county stack up? Retrieved from http://www.sciencemag.org/news/2018/02/millions-americans-drink-potentially-unsafe-tap-water-how-does-your-county-stack

The Nature Conservancy. (n.d.). Long Island's Only Source of Clean Drinking Water is Groundwater Aquifers. Retrieved on September 8th, 2018 from www.nature.org.

World Health Organization (WHO). (2011). Guidelines for drinking-water quality. *WHO chronicle*, *38*(4), 104-8.

NO ADDENDUMS EXIST