

Survey of water options at Brookhaven National Laboratory

Student Intern:

Kevin Gersbeck, Environmental Science, Lehigh University, Bethlehem, Pennsylvania, 18015

Mentor:

Jennifer Higbie, Environmental Protection Division, Brookhaven National Laboratory, Upton NY, 11973

ABSTRACT

At Brookhaven National Laboratory, employees can obtain water onsite through sinks, water fountains, or bottled water coolers. All of these water options should be tracked and monitored to assure healthy drinking water. Complications can arise if some of these water options are not maintained regularly or do not meet Environmental Protection Agency (EPA) requirements. The objective is to create an inventory survey to provide data to analyze whether these water options are being tracked and monitored regularly. Survey questions will surround sinks, water fountains and water coolers. These questions will include the last date the water station was cleaned, whether it has a filter attached (if the filter has been changed), and pictures of these water options. This survey will provide insight into how many of these water options are tracked, cleaned and monitored regularly. Additionally, research is needed to find alternative options for drinking water at BNL. This can be the water bottle filling stations or other types of filters that help remove harmful contaminants and are more economical and environmentally friendly alternatives.

INTRODUCTION

Onsite at Brookhaven National Laboratory (BNL), 5 water wells are used to provide water for over 3,000 employees yearly. Sinks and water fountains are an effective way to gain drinking water throughout the working day however, there are bottled water coolers in some buildings. Both options are reliable sources of water but are governed by different regulations. For example, drinking water is monitored by the Environmental Protection Agency (EPA) whereas bottled water is monitored by the Food and Drug Administration (FDA). BNL's drinking water is taken from the Long Island Aquifer which is made up of 3 different formations. This Aquifer is considered one of the 78 "sole source" aquifers in the US that are monitored by the U.S. Safe

Water Drinking Act (SDWA)¹. This is a law that was passed by congress to protect the public health by regulating the public drinking water. Another crucial law that is used to protect the public health is the “lead and copper rule”. This is used to limit the concentration of lead and copper in drinking water. At BNL, there is a requirement to sample for copper and lead at 20 consumer taps every three years and to notify the employees of that building with the results of this tests. BNL publishes the results of all water testing and the latest results were published in the “2019 Consumer Confidence Report”². On the other hand, bottled water is managed by the FDA Although they are different, both standards are used to ensure the safety of water for the public.

Bottled water is regulated in New York state under the New York State Department of Health Sanitary Chapter 1: Bottled and Bulk Water Standards as well as monitored by the FDA³. The FDA regulates the bottled water industry as a packaged food product in which they can collect samples for testing from the water facility at any time. The FDA has also established Current Good Manufacturing Practice (GCMP)⁴. Some practices that are addressed by the GCMP are protection of the water source from contamination, sanitation at the bottling facility, quality control to avoid bacterial and chemical growth and sampling, and testing of the source water⁴. It states in the Occupational Safety and Health Administration (OSHA) 1915.88 that the employer shall provide potable drinking water in amounts that are adequate to meet the health and personal needs of each employee⁵. This indicates there must be an adequate amount of healthy and filtered water for all employees. One of the ways to address safe drinking water in the workplace is to create a survey to analyze the current water situation at BNL. To begin, this survey will sample all water options found at BNL.

According to Dr. Emma Derbyshire, an adviser to the natural hydration counsel, states “evidence that being hydrated is associated with better cognition and mental performance which can help organizational productivity.”⁶ This indicates that water in the workplace is an important key to employee performance. One of the actions that have been completed was the creation of a survey to test these water sources. Another objective of this project was to explore alternative water options at BNL. These alternative options are examined to provide quality drinking water that is environmentally friendly and cost-effective.

METHODS

This survey will be completed by employees of the building. This survey will test either a water cooler, sink or water fountain and where this water option is located. This survey will ask whether there is a filter present, the date it was last cleaned, if stated, or is it out of order and if there is a routine cleaning/ filter change that is entered into Maximo if available. Maximo is a spreadsheet that shows all of the water cooler orders and when they are supposed to be regularly cleaned. Another question on this survey that serves a very high purpose is where the spare water coolers are stored. Problems can arise in this storage room if this room has lengthened exposure to UV light or heat, which can cause the plastics to leach chemicals into the water and/or promote bacterial growth. One other factor that plays into the role of this survey is the way these water coolers, sinks, or water fountains look. The employee that is completing this survey must take a picture of the water option if they think it is unsanitary and it must be cleaned. These pictures are used to show visuals of what the employer sees when they do try to obtain water during the workday. When this survey is completed by the employee of the building, there will

be a comparison to the Water Filter PM Work Orders spreadsheet. This is a spreadsheet that contains all of the PM work orders of these bottled water coolers, sinks, or water fountains. This spreadsheet also shows the tracking of when these water options need to be changed or cleaned and also the last time they were changed or cleaned. This comparison of the survey to the spreadsheet will give great insight into how many water options are monitored regularly. Alternative options for water onsite at BNL is a great way to increase the water safety for employees. When analyzing these alternative water filters there were some aspects that were looked at. Some of these aspects include, how economically friendly a filter was, how cost effective it was and most importantly how effective the filter is at removing contaminants. During this process, there were two different filters that were very efficient in these standards. The first filter that is considered is the Elkay Bottle Filling Station and the second filter is a Reverse Osmosis Filter. Both of these types of filters are effective in removing contaminants and are cost friendly as well.

RESULTS

Due to the current situation of a pandemic, the results of this survey have not been completed. A trial run of the survey, seen in Figure 1 is in process and the full survey will be deployed throughout the site next year. The compiled information will be compared to the water filter PM spreadsheet. Some results were obtained regarding the tracking of some of these water coolers. Discrepancies were noted when analyzing the water filter PM work orders spreadsheet as compared to the Brookhaven Laboratory water delivery locations. The comparison between the two fields showed more water coolers exist, that are not logged into the delivery spreadsheet.

Survey of BNL drinking water

Name:

Date:

Building Number: _____

| Sink, water fountain, or water cooler | Room number or nearest room number | Filter? Yes/No | Date last cleaned or Out of Order | Routine cleaning/ filter change entered in maximo | Comments |
|---------------------------------------|------------------------------------|----------------|-----------------------------------|---|----------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Location where spare bottles are stored?:

Pictures of sinks, water fountains or, water bottle stations:

Figure 1. This figure shows the inventory survey that will be completed in the following year.

There are other alternative options that can be explored at BNL. One option to explore is the Elkay Bottle Filling Station. This is a hands-free filling station that provides your water bottle

to fill itself without touching anything. This feature makes this process very sanitary which is an added bonus during the global pandemic. Additionally, it has filters installed which can be replaced which makes this an environmentally friendly option as well as cost effective. These bottle filling stations filter lead and other harmful contaminants. Lead is a particularly dangerous contaminant and the EPA estimates that drinking water can make up 20% or more of a person's exposure to lead⁷. These filling stations have an activated carbon filter to improve taste and odor, also reducing lead 99.3 percent⁸. This filter is certified to the Public Health and Safety Organization (NSF) 42 and 53 for Class 1 particulate, chlorine, lead, and taste and odor reduction⁸. The Elkay Filling station costs around \$1,000-1500 with an already existing fountain. every 3,000 gallons a new filter is replaced which costs \$113 per filter. This type of water option can be very effective with a global pandemic and encourage employees to bring their own water bottle. This will limit the amount of plastic water bottles being used which is better for the environment. Another useful option for water filtration is the reverse osmosis system (ROS). This water filter removes contaminants from water by using pressure to

force water molecules through a semipermeable membrane seen in Figure 2. In this process water flows from the more concentrated (more contaminants) side of the membrane to the less concentrated side (less concentrated side) and has 3 stages of filtration. A sediment filter which reduces larger particles like dirt and dust, a carbon filter which reduces Volatile Organic

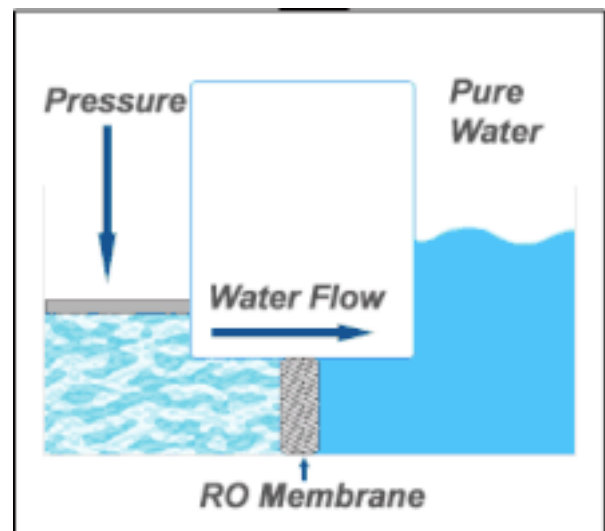


Figure 2. This figure shows the process of the reverse osmosis system. This is the stage of the semipermeable membrane removing the total dissolved solids.

Compounds (VOC), chlorine and other harmful contaminants that make a bad taste or odor, and the semipermeable membrane which removes 98 percent of the total dissolved solids (TDS)⁹. During this process, the contaminants are filtered out and flushed away. This system can be placed under individual sinks/faucets or throughout an entire building. A faucet based ROS can cost around \$500-700 where a whole home/building can range from \$12,000-18,000⁹ This system requires the reverse osmosis membrane to be replaced every 3 to 5 years⁹.

CONCLUSION

At BNL there are many different aspects of life that people work on to maintain a quality work environment. One important aspect throughout the day is having a clean and regulated water supply. With so many water stations at BNL, every water station should be out into Maximo to assure adequate and routine cleaning. This may be where the problem lies. There must be a sense of urgency to all of the cleaning times and regulations into the system so every water station is tracked throughout the year. This survey was created to give a visual into how the BNL water is tracked annually and how it is regulated.

Further research needs to be completed to find an economical and environmentally friendly way to provide healthy drinking water for BNL employees. With advancements in technology, other options such as Elkay bottle filling stations or other types of advanced filtration systems should be considered.

ACKNOWLEDGMENTS

I would like to thank my mentor Jennifer Higbie for sharing her knowledge and making this virtual experience enjoyable and a great learning experience. Further, I would like to thanks

the Department of Energy for making this experience at Brookhaven possible with the situation of the pandemic. I would also like to thank my colleagues throughout this process.

REFERENCES

- 1.) Environmental Protection Agency. "*The Safe Drinking Water Act.*" *Office of Water.*
2004
- 2.) Environmental Protection Division and the Energy & Utilities Division. "*2019 Consumer Commerce Report*" Brookhaven National Lab. 2019
- 3.) Department of Health Sanitary. "*Bottled and Bulk Water Standards.*" State Sanitary Code.
Chapter 1, May 1991
- 4.) Food and Drug Administration. "*Current Good Manufacturing Practice.*" March 2018
- 5.) Occupational Safety and Health Administration. "Sanitation" United States Department of Labor. May 2nd, 2011
- 6.) Occupational Health and Wellbeing "*Why hydration is a workplace issue*" S. Silcox.
November 27th, 2015
- 7.) Elkay Manufacturing Company "*Cleaner, Healthier water for schools*" Fountains for Youth. 2019
- 8.) Because Water "*How to Maintain Filling Bottle Stations*" Elkay. 2018
- 9.) Fresh Water Systems "*What is a reverse osmosis system and how does it work?*" J. Woodard. March 24th 2020.

