2019 BROOKHAVEN NATIONAL LABORATORY Water Quality CONSUMER CONFIDENCE REPORT

BNL publishes an annual water quality report to provide on-site drinking-water consumers with an overview of the Lab's water quality during the previous calendar year. The purpose of this report is to inform you about where your water comes from; what analytical tests are conducted; what they reveal; how the results compare to New York State standards; and to educate you about the importance of preventative measures. Educated consumers are more likely to help protect their drinking water sources.

For questions about this report, or to speak with someone regarding your drinking water, please contact:

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With the exception of an iron exceedance at the Water Treatment Plant in June, BNL's drinking water and the supply and distribution system were in compliance with all applicable county, state, and federal regulations regarding drinking-water quality, monitoring, operations, and reporting in 2018.

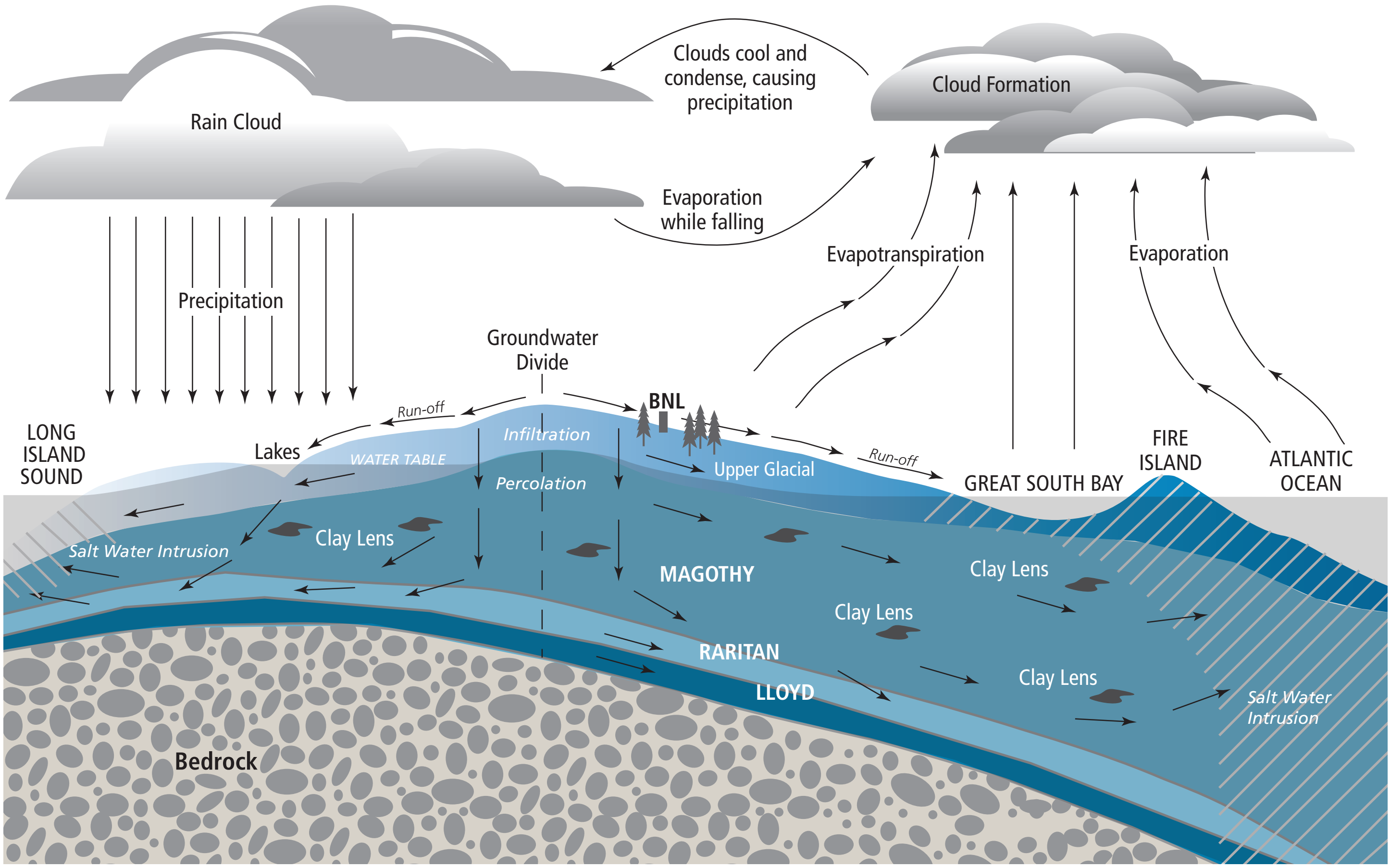
Overseeing the Lab's water supply system, which includes five wells dedicated to pumping drinking water and the on-site Water Treatment Plant, BNL's Energy & Utilities (EU) Division is committed to providing over 3,000 employees, facility users, contractors, and guests annually with safe drinking water.

BNL's drinking water is regularly tested using an independent laboratory approved by the New York State Department of Health (NYSDOH). Analytical data are reviewed by the Lab's Environmental Protection Division (EPD) to ensure that testing results comply with all applicable regulatory standards. In addition, EU and EPD work with BNL's Groundwater Protection Group to make sure our potable-water supply is not adversely impacted by possible groundwater contamination or remediation operations.

Where Does Our Water Come From?

The Long-Island aquifer system is made up of three primary formations. From the surface to approximately 150 feet below is the Upper Glacial aquifer, from 150 to 1,000 feet below is the Magothy aquifer, and from 1,000 to about 1,600 feet below is the Lloyd aquifer. As designated by the U.S. Environmental Protection Agency (EPA), Long Island's aquifer system is one of 78 "sole source" aquifers in the nation recognized under the aquifer-protection program authorized by the U.S. Safe Drinking Water Act (SDWA).

The Lab's five in-service drinking-water wells draw up to 1,000 gallons per minute, or about 1.34 million gallons of water per day from the Upper Glacial aquifer to supply drinking water, process cooling water, and fire protection. The water from three wells (4, 6, and 7) is processed at BNL's on-site Water Treatment Plant. Water from two other wells (10 and 11) is pumped directly to the distribution system after disinfection and pH adjustments. Last year, BNL pumped approximately 413 million gallons of water.



Long Island Aquifer System

What's in Our Drinking Water?

Although rivers, lakes, streams, ponds, and reservoirs are all sources of tap and bottled drinking water, most Long Island residents get their water from groundwater wells that are drilled into the underlying aquifer system. As water travels over land surfaces or through the ground, it dissolves naturally occurring minerals and radioactive material. Water can also pick up substances resulting from the presence of animals or from human activities. Contaminants that may be present in source water include: microbiological contaminants; inorganic contaminants; pesticides and herbicides; organic chemical contaminants; and radioactive contaminants.

In order to ensure that tap water is safe to drink, New York State and the EPA prescribe regulations which limit the amount of certain contaminants in water provided by public water systems. In addition, regulations from NYSDOH and the Food and Drug Administration establish limits for contaminants in bottled water, which must provide the same protection for public health.

Source water is treated to remove substances or reduce their concentration before the water is fit for human consumption. Regardless, drinking water, including bottled water, may reasonably be expected to contain at least small amounts of contaminants; however, that does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling EPA's Safe Drinking Water Hotline at (1-800-426-4791).

Some people may be more vulnerable to disease-causing microorganisms or pathogens in drinking water than others. Immuno-compromised persons such as those with cancer undergoing chemotherapy, who have undergone organ transplants, with HIV/AIDS or other immune system disorders, some elderly, and infants can be particularly at risk from infections. These people should seek advice from their health care provider about their drinking water.

Guidelines from EPA and the Centers for Disease Control on appropriate means to reduce the risk of illness from Cryptosporidium, Giardia, and other microbial pathogens are also available at EPA's Safe Drinking Water Hotline.

BNL's Source Water Assessment

As required under the 1996 Safe Drinking Water Act, NYSDOH performed an assessment of the source water used by the Lab's public water system to evaluate known and possible contamination sources. The assessment includes a susceptibility rating for each well based on the risk posed by the presence of potential sources of contamination within the well's contributing area and the likelihood that the contaminants will travel through the environment to reach the well. Although the susceptibility rating is an estimate of the potential for source-water contamination, it does not mean that the water delivered to consumers is or will become contaminated. If a contaminant is present, it does not necessarily mean that there is a health risk.

Results from the assessment concluded that two on-site wells are rated as having a very high susceptibility to industrial solvents, primarily due to point sources of contamination along transportation routes and from previous spills within the source area. If industrial solvents were to impact water quality at a well, the contamination would be removed by treatment facilities (air-stripping or carbon filtration) before the water is delivered to the consumer. BNL recently determined that four of its supply wells are susceptible to Per- and Polyfluoroalkyl Substances (PFAS) contamination. Although drinking water standards have not been established for PFAS, in 2016 the USEPA established a Lifetime Health Advisory Level (HAL) of 70 ng/L. This non-enforceable advisory level applies to the combined concentrations of two PFAS compounds, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS). Although combined PFOA/PFOS levels in water entering the distribution system have not exceeded the HAL, BNL has proactively removed one well from service and has restricted the operation of a second well. BNL is also preparing to return to service granular activated carbon filtration systems at two other supply wells to remove PFAS before the water is released into the distribution system. The potable supply wells and water leaving the Water Treatment Plant are now tested for PFAS on a quarterly basis. If a supply well cannot provide water that meets the HAL, it would be immediately removed from service.

A copy of the complete assessment may be reviewed by contacting Doug Paquette (631) 344-7046 or Jason Remien (631) 344-3477.

Water Conservation Measures

BNL's water conservation program has achieved dramatic reductions in water use since the mid-1990's. The Lab continually evaluates water conservation as part of facility upgrades, such as replacing existing conventional plumbing fixtures with low-flow devices, or new construction. BNL's Water Management Plan describes how the Lab designs and operates buildings and facilities to be sustainable and water efficient. It also outlines our efforts to meet legislative requirements by implementing best-management practices and details the steps being implemented to reduce BNL's water consumption. For more information on BNL's water use efficiency and management, please see BNL's Site Sustainability Plan for fiscal year 2019 at *https://www.bnl.gov/about/sustainability/reports.php.*

To help the Lab conserve water, start by being conscious of your personal use, e.g., reduce faucet flow, decrease running water while not in use, and report any drips, leaks, or other plumbing problems promptly to your Facility Project Manager. Regarding process and research use, make sure temperature controls operate properly to minimize flow and specify re-circulating water or air-cooled systems for new devices.

While it is important to conserve water, the EPA encourages that you run your tap water for 30 seconds to 2 minutes and only use cold water for drinking or cooking. Due to the aging infrastructure at BNL, iron and lead may leach into the water from the pipes. Flushing the water will help to remove any contaminants that may have built up while the water was sitting in the pipes.

Water Treatment Process

BNL's Water Treatment Plant typically treats up to 2 million gallons of "raw" water per day to remove naturally occurring iron and manganese from the groundwater.

Of the five in-service drinking-water wells, Wells 4, 6, and 7 provide high-iron source water which must be passed through a sand filter before being distributed around the site. This water is chlorinated and the pH is adjusted before it enters the distribution system. Chlorine is a disinfection agent and prevents the spread of water borne diseases.

Water from Wells 4, 6, and 7 is aerated to reduce carbon dioxide gas and aid in iron oxidation. Lime is added to raise the pH to provide for proper corrosion control. A polymer is added to aid in flocculation in the filtration process. Flocculation, or the formation of particle aggregates which settle out of the water as sediment, begins in the retention tank. To help form "floc," water is sent from the retention tank to a slow-mix tank.

Filtration is performed using a rapid sand filter made up of sand and anthracite coal to remove all particles. Filtered water is stored in the "wet well" before it is pumped into air-stripping towers, which remove volatile organic compounds, if present, from the water being treated.

Up to 250,000 gallons of treated water is stored at the clear well before its final chlorination and distribution. Pumps send finished water from the Water Treatment Plant to the two water towers on site. Wells 10 and 11 pump water that is low in iron, and does not require treatment for iron. However, they do receive chlorine for disinfection and sodium hydroxide for pH correction prior to being sent to the two water towers. The water from the two storage towers is delivered on site at 55 to 70 pounds of pressure per square inch via 45 miles of distribution pipe.

For more information on the Lab's water treatment process, visit the Water Quality website at *http://www.bnl.gov/water/index.php.*

Plant Upgrades

In August 2018, the Lab completed Phase I of the Water Treatment Plant Lime Room Upgrade Project. This project involved the removal of the existing lime and polymer injection systems and replaced them with a new lime and polymer mixing tank, new pumps, electrical controls, lighting, mechanical, and piping systems. This new system will allow for better control of the system pH and corrosion control for the water being treated at this facility.

BNL's Water-Main Flush Program

In accordance with American Water Works Association recommendations, unidirectional flushing of water mains using fire hydrants within a water distribution system is the most effective and economical way to cleanse and improve water quality.

Much of Long Island's groundwater is high in iron as a result of naturally occurring iron-containing minerals within the aquifer. The Lab's water-mains are flushed twice per year to improve the quality of the water delivered to facilities by the Lab's on-site taps, and to help eliminate rusty water.

Visit the Water Quality website at *http://www.bnl.gov/water/* for some tap-water recommendations to be sure your on-site drinking water is the best possible quality.

BNL's 2018 Drinking Water Sampling Results

Our water system had one violation. Through water sampling and testing, results show that the compounds listed below were not detected or below the minimum detection limit (MDL). Thirty-six out of the total 256 contaminants tested were detected and are summarized in the table starting on Page 6.

1,1-dichloroethane
1,1-dichloroethene
1,1-dichloropropene
1,1,1-trichloroethane
1,1,1,2-tetrachloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
1,2-dichlorobenzene
1,2-dichloroethane
1,2-dichloropropane
1,2,3-trichlorobenzene
1,2,3-trichloropropane
1,2,4-trichlorobenzene
1,2,4-trimethylbenzene
1,2,4,5 tetramethylbenzene
1,3-dichlorobenzene
1,3-dichloropropane
1,3,5-trimethylbenzene
1,4-dichlorobenzene
1,4-dichlorobutane
1-butanol*
1-bromo-2-chloropropane
1-naphthol
2,2-dichloropropane
2,3 dichloropropene
2,4,-D
2,4,5,-TP (silvex)
2,6-dichlorobenzamide
2-bromo-1-chloropropane
2-butanone
2-chlorotoluene
2-hydroxyAtrazine
2-methoxyethanol*
2-propen-1-ol*
3-hydroxycardofuran
4,4 DDD
4,4 DDE
4,4 DDT
4-androstene-3,17-dione
4-chlorotoluene
4-hydroxyphenytoin
4-isopropyltoluene
17 alpha ethynylestradiol
acetaminophen
acrylonitrile
alachlor
alachlor ESA
alachlor OA
aldicarb
aldicarb sulfone
aldicarb sulfoxide
aldrin
allyl chloride
alpha-BHC
alpha-hexachlorocyclohexane*
aluminum
ammonia
antimony
arsenic
asbestos
atrazine
benzene
benzo (A) pyrene
beryllium
beta-BHC
bisphenol A
bisphenol B
bromobenzene
bromomethane
butachlor
butylated hydroxyanisole*
cadmium
caffeine
carbaryl
carbofuran
carbon disulfide
carbon tetrachloride
cesium-137
chlordane
chlorobenzene
chlorodifluoromethane
chloroethane
chloromethane
chlorpyrifos*
chromium
cis-1,2-dichloroethene
cis-1,3-dichloropropene
cobalt
color
cyanide (as free cyanide)
dacthal
dalapon
deisopropylatrazine
delta-BHC
desethylatrazine
di(2-ethylhexyl) adipate
di(2-ethylhexyl) phthalate
dibromomethane
dicamba
dichlorodifluoromethane
dichlorvos
didealkylatrazine
dieldrin
diethyl ether
diethylstilbestrol
diethyltoluamide (DEET)
dimethipin*
dimethyldisulfide
dinoseb
diquat
diuron
d-Limonene
e. coli
endosulfan I
endosulfan II
endosulfan sulfate
endothall
endrin
equilin
estriol
estrone
ethoprop*
ethyl methacrylate
ethylbenzene
fluoride
freon-113
gemfibrozil
geranium
glyphosate
heptachlor
heptachlor epoxide
hexachlorobenzene
hexachlorobutadiene
hexachlorocyclopentadiene
ibuprofen
imidacloprid
imidacloprid urea
isobutane
isopropylbenzene
lindane
lithium
m,p-xylene
malaoxon
mercury
metalaxyl
methacrylonitrile
methiocarb
methiocarb sulfone
methomyl
methoxychlor
methyl isothiocyanate
methyl methacrylate
methyl sulfide
methyl tert-butyl ether
methylene blue active substances (MBAS)
methylene chloride
metolachlor
metolachlor ESA
metolachlor metabolite
metolachlor OA
metribuzin
molybdenum
monomethyltetrachloroterephthalate
n-butane
n-butylbenzene
n-propylbenzene
naphthalene
nitrite
odor
orthophosphate
oxamyl
o-toluidine*
oxyfluorfen*
o-xylene
p-diethylbenzene
pentachlorophenol
phenytoin (dilantin)
picaridin
picloram
profenofos*
propachlor
propamocarb hydrochloride
propanal
propoxur
quinoline*
radium-228**
sec-butylbenzene
selenium
siduron
silver
simazine
strontium-90
styrene
tebuconazole*
tebuthiuron
tellurium
tert-butylbenzene
testosterone
tetrachloroethene
tetrachloroterephthalic acid
tetrahydrofuran
thalium
thorium
tin
titanium
toluene
total coliform bacteria
total permethrin*
total polychlorinated biphenals (PCBs)
toxaphene
trans-1,2-dichloroethene
trans-1,3-dichloropropene
trichlorfon
trichloroethene
trichlorofluoromethane
tribufos*
tritium
uranium
vinyl cloride
zinc

Notes: * Part of UCMR4. See page 8. **Radium-228 was tested in 2011 and will be retested in 2020.
Contaminants on this list include results from BNL compliance samples, surveillance samples, and Suffolk County Department of Health Services samples.

Types of Contaminants

- **disinfectant and disinfection by-products:** formed when disinfectants used in water treatment plants react with bromide and/or natural organic matter (i.e., decaying vegetation) present in the source water. Different disinfectants produce different types or amounts of disinfection by-products. Disinfection by-products for which regulations have been established have been identified in drinking water, including trihalomethanes, haloacetic acids, bromate, and chlorite.
- **inorganics:** dissolved salts and metals, which can occur naturally or result from stormwater runoff, industrial or domestic wastewater discharges, oil and gas production, mining, farming, etc.
- **microbiological:** bacteria and viruses, which may come from sewage, livestock operations, wildlife, etc.
- **organic:** natural and synthetic compounds, including volatile organic compounds (VOCs). These chemicals are by-products of industrial processes, residential uses and petroleum production, and they can also come from gas stations, stormwater runoff, septic systems, etc.
- **perfluorinated:** man-made compounds used in firefighting foams and stain proof coatings.
- **pesticides & herbicides:** substances for, respectively, eliminating problem insects and plants, which may come from a variety of sources, such as agricultural operations, stormwater runoff, residential uses, etc.
- **radioactive:** naturally occurring, or from oil and gas production, mining activities, nuclear facilities, etc.
- **synthetic organic:** man-made compounds used for a variety of industrial and agricultural purposes.
- **volatile organic:** emitted by products including contaminants: paints and lacquer; paint strippers; cleaning supplies; pesticides, building materials and furnishings; office equipment such as copiers and printers; correction fluids and carbonless copy paper; graphics and craft materials including glues and adhesives; permanent markers; and photographic solutions.

CONTAMINANT	UNIT OF MEAS.	DATE OF DETECTION	VIOLATION (YES/NO)	LEVEL DETECTED	RANGE OF RESULTS	MCLG	REGULATORY LIMIT (MCL)	LIKELY SOURCE OF CONTAMINATION
Chlorine Residual, Free	mg/L	5/18/18	No	0.6	0.3 – 1.3	NS	4	Water additive to control microbes.
DISINFECTION BY-PRODUCTS								
Haloacetic Acids	µg/L	8/6/18	No	7	5–7	NS	60	By-product of drinking water disinfection needed to kill harmful organisms.
Total Trihalomethanes	µg/L	8/6/18	No	36.4	35.2 – 36.4	NS	80	By-product of drinking water chlorination needed to kill harmful organisms; formed when source water contains large amounts of organic matter.
INORGANIC CONTAMINANTS								
Barium	mg/L	6/4/18	No	0.06	<0.021 – 0.06	2	2	Erosion of natural deposits.
Chloride	mg/L	6/4/18	No	74.2	38.2 – 74.2	NS	250	Naturally occurring; indicative of road-salt contamination.
Hexavalent Chromium	µg/L	3/19/18	No	0.73	<0.03 – 0.73	NS	NS	Erosion of natural deposits.
Iron*	µg/L	6/11/18	Yes	640	<50 – 640	NS	300	Naturally occurring; Corrosion of plumbing.
Manganese	µg/L	6/11/18	No	15	<10 – 15	NS	300	Naturally occurring.
Magnesium	mg/L	3/19/18	No	5.4	2.9 - 5.4	NS	NS	Naturally occurring.
Nickel	µg/L	6/4/18	No	2.4	0.6 – 2.4	NS	100	Nickel enters groundwater and surface water by dissolution of rocks and soils, from atmospheric fallout, or from biological decays.
Nitrates	mg/L	6/4/18	No	0.59	<0.5 – 0.59	10	10	Erosion of natural deposits; runoff from fertilizer use; leaching from septic tanks and sewage.
Potassium	mg/L	3/19/18	No	1.8	1.1 - 1.8	NS	NS	Naturally occurring.
Sodium	mg/L	6/4/18	No	40.7	21.6 – 40.7	NS	NS	Naturally occurring; road salt; water softeners.
Strontium	µg/L	3/19/18	No	64.6	43.1 - 64.6	NS	NS	Naturally occurring.
Sulfates	mg/L	6/4/18	No	14.5	8.8 – 14.5	NS	250	Naturally occurring.
Zinc	mg/L	7/9/18	No	0.022	<0.02 - 0.022	NS	5	Naturally occurring.

CONTAMINANT	UNIT OF MEAS.	DATE OF DETECTION	VIOLATION (YES/NO)	LEVEL DETECTED	RANGE OF RESULTS	MCLG	REGULATORY LIMIT (MCL)	LIKELY SOURCE OF CONTAMINATION
PERFLUORINATED CONTAMINANTS								
PFBS (Perfluorobutanesulfonic Acid)	µg/L	11/29/18	No	0.002	<0.002 - 0.002	NS	50	PFAS can get into drinking water through releases from fluoropolymer manufacturing or processing facilities, wastewater treatment plants, and landfills.
PFHpA (Perfluoroheptanoic Acid)	µg/L	11/29/18	No	0.003	<0.002 - 0.003	NS	50	
PFHxS (Perfluorohexanesulfonic Acid)	µg/L	8/10/18	No	0.013	<0.002 - 0.013	NS	50	
PFOA (Perfluorooctanoic Acid)	ng/L	11/29/18	No	7.3	<2 – 7.3	NS	70**	
PFOS (Perfluorooctanesulfonic Acid)	ng/L	11/29/18	No	26.1	<1.78 - 26.1	NS	70**	
PFNA (Perfluorononanoic Acid)	µg/L	8/10/18	No	0.003	<0.002 - 0.003	NS	50	
RADIOACTIVE CONTAMINANTS								
Gross Alpha Activity	pCi/L	4/4/18	No	2.5	<1.4 - 2.5	NS	15	Erosion of natural deposits.
Gross Beta Activity (a)	pCi/L	7/18/18	No	3.42	<1.05 - 3.42	NS	50	Decay of natural deposits and atmospheric fallout.
SYNTHETIC ORGANIC CONTAMINANTS								
1,4 Dioxane	µg/L	3/19/18	No	0.12	<0.1-0.12	NS	50	Runoff from insecticide use on row crops.
UNREGULATED CONTAMINANTS MONITORING RULE (UCMR) LIST 4 (b)								
Bromide	µg/L	4/17/18	No	413.3	33.4 - 413.3	NS	NS	Naturally occurring.
HAA5	µg/L	10/9/18	No	10.33	6.1 - 10.33	NS	NS	By-product of drinking water chlorination needed to kill harmful organisms.
HAA6Br	µg/L	10/9/18	No	10.9	6.8 - 10.9	NS	NS	By-product of drinking water chlorination needed to kill harmful organisms.
HAA9	µg/L	10/9/18	No	17.4	11.5 - 17.4	NS	NS	By-product of drinking water chlorination needed to kill harmful organisms.
Total Organic Carbon	µg/L	4/17/18	No	1135	< 1000 - 1135	NS	NS	Naturally occurring.
VOLATILE ORGANIC CONTAMINANTS								
Bromochloromethane	µg/L	4/9/18	No	3.7	<0.5 – 3.7	NS	80***	By-product of drinking water chlorination needed to kill harmful organisms.
Bromoform	µg/L	7/9/18	No	4.2	<0.5 - 4.2	NS	80***	By-product of drinking water chlorination needed to kill harmful organisms.
Chloroform	µg/L	7/9/18	No	2.1	<0.5 – 2.1	NS	80***	By-product of drinking water chlorination needed to kill harmful organisms.
Dibromochloromethane	µg/L	4/9/18	No	4.6	<0.5 – 4.6	NS	80***	By-product of drinking water chlorination needed to kill harmful organisms.

SAMPLING AT THE CONSUMER'S TAP (Tap water samples were collected throughout the Laboratory site) (c)

CONTAMINANT	UNIT OF MEAS.	DATE OF SAMPLING (MO./YR.)	AL EXCEEDANCE (YES/NO)	90th PERCENTILE RESULT	RANGE OF RESULTS	MCLG	REGULATORY LIMIT (AL)	LIKELY SOURCE OF CONTAMINATION
Copper	mg/L	8/10/17	No	0.041	<0.02 – 0.105	1.3	1.3	Corrosion of plumbing.
Lead	µg/L	8/10/17	No	5.3	<1.0 – 22.6	0	15	Corrosion of plumbing.

Table Notes:
Table includes results from BNL compliance samples, surveillance samples, and Suffolk County Department of Health Services samples.
* Please see article on Page 8 for health advisory information
**The EPA Health Advisory Level is 70 ng/L for PFOA and PFOS combined. Please see article on Page 8 for more information.
*** MCL is the sum of the four compounds (Bromocloromethane, Bromoform, Chloroform, and Dibromochloromethane).
NS = drinking-water standard not specified
(a) The State considers 50 pCi/L to be the level of concern for beta particles.
(b) Please see the article on Page 8 for more information on UCMR4
(c) Sampling at the consumer's tap for lead and copper is performed every 3 years; next sampling is scheduled for 2020. Please see article on Page 9 for health advisory information.

Iron Exceedance

The iron exceedance on June 11, 2018, was caused by the failure of a temporary chemical feed system that aids in the iron removal process at the Laboratory's Water Treatment Plant. This system was set up to accommodate construction of the Lime Room Phase I renovation project *(See Plant Upgrades section on page 4 for more details).* This temporary system took the place of the permanent chemical feed system normally used at the Water Treatment Plant, as it was being removed from service. The temporary system failure combined with increased demand on the facility during the month of June resulted in a short-term reduction of iron removal capabilities at the facility. Process control testing during this time indicated that the iron exceedance only occurred for a few hours. Once discovered, the facility was removed from service so the temporary chemical system could be repaired. Once repaired, the facility was returned to service following additional follow-up sampling for iron levels.

Iron is a common metal and a dietary mineral that is essential for maintaining human health. It is used in construction materials, in drinking water pipes, in paint pigments and plastics, and as a treatment for iron deficiency in humans. Iron can be elevated in drinking water in areas where there are high concentrations of iron in soil and rocks, and where iron salts are used in the water treatment process. Iron can also get into drinking water from corrosion of cast iron, steel, and galvanized iron pipes used for water distribution. Elevated levels of iron in water can result in a rusty color and sediment, a metallic taste, and reddish or orange staining.

Although iron is essential for good health, too much iron can cause adverse health effects. For example, oral exposure to very large amounts of iron can cause effects on the stomach and intestines (nausea, vomiting, diarrhea, constipation and stomach pain). These effects occur at iron exposure levels higher than those typically found in drinking water, and usually diminish once the elevated iron exposure is stopped. A small percentage of people have a condition called hemochromatosis, in which the body absorbs and stores too much iron. People with hemochromatosis may be at greater risk for health effects resulting from too much iron in the body (sometimes called "iron overload") and should be aware of their overall iron intake. The New York State standard for iron in drinking water is 0.3 milligrams per liter and is based on the effects of iron on the taste, odor and appearance of the water.

2018 UCMR 4 Testing

In 2017, the Laboratory was randomly chosen to participate in EPA's Unregulated Contaminants Monitoring Rule – List 4 (UCMR4) Testing. This is an EPA program, required by the SDWA that looks at unregulated contaminants in drinking water every 5 years. This was the first time the Laboratory participated in the program. The testing consisted of 20 additional contaminants, five of which were found in the BNL samples. Results can be found on page 7. There are no regulatory limits on these compounds at this time. The information is used by the EPA to determine if the contaminants should be added to the list of regularly sampled contaminates and to gain information toward setting regulatory limits. More information about the UCMR4 program can be found on the EPA website: *https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule.*

Testing for Per- and Polyfluoroalkyl Substances (PFAS)

In 2013, the EPA required large water providers to start testing for six common PFAS chemicals under the third Unregulated Contaminant Monitoring Rule (UCMR 3). As a medium size system, BNL was not required to participate in this testing program. In 2017, Suffolk County Department of Health Services began routine testing of all water supply systems, including BNL's, for PFAS. PFAS chemicals were detected in three of BNL's water supply wells. In these initial tests, Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) were detected at concentrations below the current EPA Health Advisory Level of 70 ng/L (ppt) that was established specifically for these two chemicals. Following repeated confirmed detections of PFAS in the supply wells, the Lab started routine quarterly testing for PFAS. The results of the testing are provided on Page 7 of this report.

EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination. New York State is currently evaluating whether to establish enforceable drinking water standards for PFOS and PFOA at concentrations that may be lower than the current EPA advisory level. The other four PFAS chemicals would continue to be regulated under the current New York State limit of 50 ug/L (ppb) for unregulated contaminants. EU is monitoring the sample results and can utilize Granular Activated Carbon filters to remove PFAS, if necessary. All future results of PFAS sampling or changes to the water system will be reported in the Annual Water Report. For further information, please contact Jason Remien (ext.3477) or Chris Bruno (ext. 8262).

Lead and Copper Testing

Lead and copper enters drinking water primarily through plumbing materials. In 1991, the EPA established a "lead and copper rule" to limit the concentration of lead and copper in public water. BNL is required to sample for lead and copper at 20 consumer taps every 3 years and to notify those occupants of the buildings tested with the results. Results from testing performed in 2017 are shown in the table to the right. While lead was detected in some samples, the action limit was not exceeded. Testing will be performed again in 2020.

If present, elevated levels of lead can cause serious health problems, especially for pregnant women, infants, and young children. It is possible that lead levels in your building may be higher than at other buildings at the Laboratory as a result of materials used in your building's plumbing. Brookhaven Lab is responsible for providing high quality drinking water. When your water has been sitting in the pipes for several hours, you can minimize the potential for lead exposure by flushing your tap for 30 seconds to 2 minutes before using for drinking or cooking. If you are concerned about lead in your water, you may wish to have your water tested. Information on lead in drinking water, testing methods, and steps you can take to minimize exposure is available from the Safe Drinking Water Hotline (1-800-426-4791) or at *http://www.epa.gov/safewater/lead.*

2017 Lead and Copper Sampling Results

Location	Faucet	Lead (µg/L)	Copper (mg/L)
Apt. 13D	kitchen	< MDL	0.01
Apt. 1A	kitchen	1.6	0.11
Apt. 24A	kitchen	6.8	0.007
Apt. 26B	kitchen	1.2	0.01
Apt. 28A	kitchen	1.2	0.006
Apt. 34E	kitchen	< MDL	0.014
Apt. 36B	kitchen	1.6	0.005
Apt. 40M	kitchen	< MDL	0.005
Apt. 42A	kitchen	< MDL	0.023
Apt. 4B	kitchen	4.1	0.009
Apt. 5B	kitchen	5.3	0.041
Apt. 6A	kitchen	1.3	0.01
Apt. 8C	kitchen	< MDL	0.016
Bldg. 153	bathroom	< MDL	0.036
Bldg. 170	bathroom	< MDL	0.008
Bldg. 371	bathroom	22.6	0.084
Bldg. 460	kitchen	3.6	0.105
Bldg. 535	bathroom	< MDL	0.041
Bldg. 703	bathroom	< MDL	0.025
Bldg. 911	bathroom	< MDL	0.011

Notes:
Action Level for Lead is 15 µg/L.
Action Level for Copper is 1.3 mg/L.

Chlorine Disinfectant and Its By-Products

Each day, more than 200 million people in the U.S. consume water that has been disinfected to kill unwanted microorganisms found in source water. Worldwide, one of the most commonly used and effective disinfectants is chlorine. A form of chlorine known as sodium hypochlorite is used by BNL for disinfection of its potable water.

Although disinfectants are effective in killing unwanted microorganisms in source water, they can react with naturally occurring organic matter and inorganics to form disinfectant by-products which may pose health risks. Under the SDWA, disinfectants and their by-products are regulated. The Lab had no violations in 2018; annual averages for chlorine residual and by-products are based on results from finished tap water.

Disinfection Residual	2018 Annual Running Average	MRDLG
chlorine*	0.6 mg/L	4 mg/L
Disinfection By-product	**2018 Annual Average**	**MCL**
total trihalomethanes[1]	36.4 µg/L	80 µg/L
haloacetic acids (five)[2]	7.0 µg/L	60 µg/L

Notes:
* BNL range of results for chlorine is 0.3 - 1.3 mg/L; maximum found in Bldg. 930.
[1] Total trihalomethanes is the sum of the concentration of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.
[2] Haloacetic acids (five) is the sum of the concentration of mono-, di-, and trichloroacetic acids, and mono- and dibromoacetic acids.

Other Water Quality Indicators

The following maximum values were measured in samples of well water or finished water at the BNL Water Treatment Plant in 2018. Although the Lab is required to test these indicators, there are no MCLs set for these parameters.

Other indicators tested, but not detected, include cyanide and methylene blue active substances.

Indicator	BNL Sample	MCL
alkalinity†	48.4 mg/L	NS
calcium†	15.2 mg/L	NS
conductivity†	389 µmhos/cm	NS
pH	6 standard units	NS

Notes:
NS = drinking-water standard not specified
† = measure of water hardness or dissolved salts

BNL's 2018 Surveillance/ Investigative Testing for Lead

In addition to the lead and copper sampling conducted under the EPA's Lead and Copper Rule (LCR), the Laboratory collects water samples on request to determine lead levels and manage risk to residents. Any dwelling constructed prior to 1986 could have lead in the plumbing which can cause elevated levels of lead in the drinking water. BNL has a voluntary program to test for lead and, when necessary, has replaced plumbing or closed faucets or water fountains for further investigation.

During surveillance sampling, two samples are collected; one as soon as water is turned on and one after the water is run for 30 seconds. The first sample helps determine how much lead may be in the immediate faucet and piping and determine if a replacement faucet would remove a source of the lead. The second sample may show if lead was used in the piping in the walls, flooring, or pipes running into the building. In 2018, samples were taken from five facilities.

Building 935 (Science Learning Center) was tested in 2017 as a precautionary measure due to the presence of visiting school children. It was noted in 2017 that the results for the Men's restroom faucet exceeded the 15 µg/L for lead and the faucet and valves were changed. In January of 2018, the faucets were resampled, and the men's bathroom faucet was still high for lead. A decision was made to replace the plumbing behind the wall, removing lead solder and connections, due to the frequency of children in the building. One month after the plumbing was replaced, the faucet was sampled, and results were below 15 µg/L.

Building 317 (Recreational Hall) has 2-3 employees present on a regular basis. The water fountain in Building 317 is below the action level for lead. The faucet in the kitchen tested over the action level of 15 µg/L for lead. The service lines and faucet were replaced. Sampling in May showed the faucet still exceeded the action level on the first sample. The kitchen faucet was posted as non-potable water for handwashing and dishwashing only until repairs could be made to the piping. After new piping was installed into the kitchen area, the kitchen faucet was resampled, and the lead result was below 15 µg/L. The non-potable water sign has been taken down. A bottle water cooler is adjacent to the kitchen and also made available to all visitors.

Building 422 (Cabinet Shop) was tested at the request of the building occupants. Initial testing results in July showed the kitchen faucet exceeded the 15 µg/L limit for lead. The kitchen faucet was posted as non-potable water for handwashing and dishwashing only until the faucet and immediately accessible piping was replaced. Follow-up testing shows the faucet is now below the 15 µg/L limit for lead and the non-potable water sign was removed.

Building 452 (F&O Complex Offices and Craft Shops) was sampled at the request of building occupants. Analytical results indicated that the kitchen faucets in rooms 29 and 36A exceeded the 15 µg/L limit for lead. All other potable water locations tested did meet the standard. Due to lead in the two kitchen sinks being above the action level, the sinks were posted non-potable water for handwashing and dishwashing only until the faucet and immediately accessible piping can be changed. The faucets were resampled 30 days after the plumbing work and the results were still above 15 µg/L. Signs will remain posted until further remediation can be completed, and future results are under the standard for lead.

Building 463 (Biology Department) was tested at the request of facility management to determine if the water quality was having any impact on equipment in the cooling system in the building. Four 250-ml samples were taken from the basement piping of the building. Results showed high levels of lead and iron at all locations. Further review of the locations sampled identified them to be dead-ends in the piping and the results not likely representative of the plumbing being utilized by employees for drinking water purposes. The building faucets and fountains were tested to ensure the water quality provided to employees in the building did not contain high lead levels. Review of these samples show the kitchen faucets, ice machines, and some water fountains were below the action level for lead. Three water fountains were above the action level and were permanently removed from service.

As both a water provider and owner of the facilities, the Laboratory continues to improve infrastructure whenever possible and will continue to monitor for lead. Federal regulation requires the Laboratory to notify its residents about the risks of lead and reminds all employees that running the water prior to use at work and at home may lower your risk of exposure.

2018 Surveillence/Investigative Sampling for Lead				
Location/Date	Lead – Sample 1 First draw (µg/L)	Lead – Sample 2 After 30 sec flush (µg/L)	Iron (µg/L)	Action Taken
Bldg. 935 Men's Room Bathroom Faucet 1/10/17	54.4	22.8	NS	Warning Sign Posted, Faucet Changed
Bldg. 935 Men's Room Bathroom Faucet 1/23/18	41.8	2.8	NS	Pipes Replaced
Bldg. 935 Men's Room Bathroom Faucet 5/9/18	13.7	0.6	NS	Warning Sign Removed
Bldg. 935 Women's Room Bathroom Faucet 1/23/18	1.3	0.6	NS	None taken – Result below action level
Bldg. 317 Kitchen Faucet 5/9/18	51.3	4.2	NS	Warning Posted, Faucet Changed
Bldg. 317 Kitchen Faucet 10/23/18	12.5	2.6	NS	Warning Sign Removed
Bldg. 317 Water Fountain 5/9/18	3.9	8.4	NS	None taken – Result below action level
Bldg. 422 Kitchen Sink 7/14/18	15.6	0.6	NS	Warning Posted, Faucet Changed
Bldg. 422 Kitchen Sink 10/23/18	2.4	<0.5	NS	Warning Sign Removed
Bldg. 422 Water Fountain 7/14/18	1.2	1.2	NS	None taken – Result below action level
Bldg. 463 Main Line in Building 3/28/18	48.2	NS	945	Review of the locations sampled identified them to be dead-ends in the piping and the results not likely representative of the plumbing being utilized by employees. All potable water faucets tested in building.
Bldg. 463 End of Water Line 3/28/18	35.5	NS	431	
Bldg. 463 Growth Chamber 11 3/28/18	15.2	NS	246	
Bldg. 463 Growth Chamber 5 3/28/18	3740	NS	10,100	
Bldg. 463 Rm 155 Water Fountain 6/15/18	38.9	15.4	NS	Removed from service
Bldg. 463 Rm 110 Water Fountain 6/15/18	22.6	25.8	NS	Removed from service
Bldg. 463 Rm 255F Kitchen Sink 6/15/18	< 0.5	< 0.5	NS	None taken – Results below action level

2018 Surveillence/Investigative Sampling for Lead				
Location/Date	Lead – Sample 1 First draw (µg/L)	Lead – Sample 2 After 30 sec flush (µg/L)	Iron (µg/L)	Action Taken
Bldg. 463 Rm 158A Kitchen Sink 6/15/18	4.3	< 0.5	NS	None taken – Results below action level
Bldg. 463 Rm 121 Kitchen Sink 6/15/18	2.5	< 0.5	NS	
Bldg. 463 Rm 124 Ice Machine 6/15/18	< 0.5	NS	NS	
Bldg. 463 Rm 159 Water Fountain 6/15/18	1.2	1.04	NS	
Bldg. 463 Rm JC1 Kitchen Sink 6/15/18	5.1	6.1	NS	
Bldg. 463 Rm 212 Kitchen Sink 6/15/18	6.17	4.6	NS	None taken – Result below action level
Bldg. 463 Rm 222 Ice Machine 6/15/18	< 0.5	NS	NS	None taken – Result below action level
Bldg. 463 Rm 251 Water Fountain 6/15/18	12.5	30.1	NS	Removed from service
Bldg. 452 Water Fountain 8/18/18	2.38	3.94	NS	None taken – Result below action level
Bldg. 452 Room 15 Kitchen Sink 8/18/18	4.49	1.23	NS	None taken – Result below action level
Bldg. 452 Room 4 Kitchen Sink 8/18/18	1.58	0.77	NS	None taken – Result below action level
Bldg. 452 Room 29 Kitchen Sink 8/18/18	13	19.1	NS	Warning Posted, Faucet Changed
Bldg. 452 Room 36A Kitchen Sink 8/18/18	28.9	2.69	NS	Warning Posted, Faucet Changed
Bldg. 452 Room 50 Kitchen Sink 8/18/18	1.39	< 0.5	NS	None taken – Result below action level
Bldg. 452 Room 48 Ice Machine 8/18/18	< 0.5	NS	NS	None taken – Result below action level
Bldg. 452 Room 40 Kitchen Sink 8/18/18	1.99	< 0.5	NS	None taken – Result below action level
Bldg. 452 Room 29 Kitchen Sink 12/8/18	78.2	2.58	NS	Warning Posted until Repair
Bldg. 452 Room 36A Kitchen Sink 12/8/18	33	2.95	NS	Warning Posted until Repair

Notes: Action Level for Lead is 15 µg/L.
NS - Not Sampled

Definitions Used in this Report

- **90th percentile value:** The reported copper and lead values represent the 90th percentile. A percentile is a value on a scale of 100 that indicates the percent of a distribution that is equal to or below it. The 90th percentile is equal to or greater than 90 percent of the lead and copper values detected in the water system.
- **action level (AL):** The concentration of a contaminant which, if exceeded, triggers treatment or other requirements that a drinking-water supplier must follow.
- **maximum contaminant level (MCL):** The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as possible.
- **maximum contaminant level goal (MCLG):** The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
- **maximum residual disinfectant level (MRDL):** The highest level of a disinfectant allowed in drinking water. There is convincing evidence that the addition of disinfectants is necessary for control of microbial contaminants.
- **maximum residual disinfectant level goal (MRDLG):** The concentration of a drinking-water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of using disinfectants to control microbial contamination.
- **micrograms per liter (µg/L):** Equals one part of liquid in one billion parts of liquid or parts per billion (ppb).
- **micromhos per centimeter (µmhos/cm):** A measure of the ability of water to conduct electricity. Conductivity effectively measures the concentration of ions, such as dissolved salts.
- **milligrams per liter (mg/L):** Equals one part of liquid per million parts of liquid, or parts per million (ppm).
- **minimum detection limit (MDL):** The lowest level to which an analytical parameter can be measured with certainty by the analytical lab performing the measurement. While results below the MDL are sometimes measureable, they represent values that have a reduced statistical confidence associated with them (less than 95 percent confidence).
- **picocuries per liter (pCi/L):** Picocuries per liter is a measure of radioactivity in water equal to one trillionth of a curie.
- **nanograms per liter (ng/L):** Equals one part of liquid in one trillion parts of liquid or parts per trillion (ppt).
- **treatment technique (TT):** A required process intended to reduce the level of a contaminant in drinking water.
- **volatile organic contaminants (VOCs):** Organic chemicals that have a high vapor pressure at ordinary room temperature. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air. VOCs include both man-made and naturally occurring chemical compounds.

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