BNL Drinking Water: Step by Step From Source to Finished Product

STEP 1A. Wells 4, 6, and 7 provide high-in-iron source water which must be "finished" at BNL's Water Treatment Facility (WTF). At one of these wells, Phil Pizzo performs preventive maintenance on a pump motor. — CN10-144-00

STEP 1B. Wells 10, 11, and 12 pump low-iron water not requiring treatment. Instead, this water is put through activated carbon filters to remove volatile organic compounds. It is then chlorinated and pH adjusted before entering the water distribution system. Noting the pressure of the carbon filtration system is Richard Lutz. — CN10-147-00

STEP 2. Chlorine is added water from wells 4,6, and 7 to kill microbes and oxidize iron. Inspecting a liquid sodium hypochlorite storage tank is Joe Tullo. — CN10-143-01

STEP 3. Aeration reduces carbon dioxide gas and aids in iron oxidation. At the aeration tank, Phil Pizzo and Greg Stawski sample the water. — D2850306

STEP 4. Lime is added to raise the pH and soften the water. Feeding lime into the hopper is Greg Stawski. — D2800306

STEP 5. Polymer is added to aid in flocculation (see step 6). Richard Lutz (front) adds polymer into a rapid-mix tank, as Phil Pizzo adjust the flow rate. — D2810306

In the control room of BNL's Water Treatment Facility (WTF), Bldg. 624 on Upton Road, is Richard Lutz. — D2820306

While BNL's "raw" water comes from six on-site drinking-water wells drilled into the Upper Glacial aquifer (see page 3), the Lab's "finished" drinking water is produced with pride by the staff of BNL's Water Treatment Facility (WTF) of the Plant Engineering (PE) Division.

Producing BNL's finished water are six water-treatment engineers, each having New York State Department of Health (NYSDOH) grade IIA certification. In alphabetical order, they are: Tom Boucher, Jack Kulesa, Richard Lutz, Phil Pizzo, Greg Stawski, and Joe Tullo. They are supervised by Water System Supervisor Tony Ross, who is NYSDOH grade IA certified. WTF operations are overseen by Plant Engineering's Assistant Division Manager for Operations & Environment Bill Chaloupka, PE.

To make what is called potable water for BNL's daily transient and resident population of approximately 3,000 people , WTF staff employ "federal public water system no. 511891." The centerpiece of this system is the WTF itself, located in and around Bldg. 624 on Upton Road. Able to handle up to 6 million gallons per day, the WTF was built in 1963 to remove iron and manganese from the Lab's source water. Over the years, the facility has undergone a series of upgrades, most recently in 1995-96.

The step-by-step flow of water through the water-treatment process and the on-the-job performance of the WTF's certified staff are shown in the following photos taken by BNL photographer Roger Stoutenburgh. — Marsha Belford

STEP 6. 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. At the retention tank, Jack Kulesa (left) is checking for floc. — CN10-35-00

STEP 7. To remove all particles, filtration is performed using a rapid sand filter made up of sand and anthracite coal. Inspecting the valves in the filtration valve gallery are: (front to back) Richard Lutz, Phil Pizzo and Greg Stawski. — D2750306

STEP 8. The wet well stores filtered water before it is pumped into the air-stripping towers. In the wet-well pump room, Richard Lutz (front) works on a check valve, while Jack Kulesa inspects pump seals. — CN10-38-00

STEP 9. The air-stripping towers remove any volatile organic compounds (VOCs) from water undergoing treatment. Inspecting a tower is Joe Tullo. — D2840306

STEP 10. At the clear well, where up to 250,000 gallons of "finished" water is stored before its final chlorination and distribution, Richard Lutz and Jack Kulesa take samples. — CN10-146-00

STEP 11. The high-service pumps send finished water from the WTF to the two water towers on site. Greasing a pump bearing is Joe Tullo. — D2830306

STEP 12. Water from the Lab's two storage towers is delivered on site at 55 to 70 pounds of pressure per square inch via 45 miles of distribution pipe. Viewed from its base is the larger of the Lab's towers, which holds one million gallons of water. — CN10-44-00

STEP 13. Testing BNL water quality is Tom Boucher. Drinking water is sampled at different intervals in various locations, depending upon the test, and samples are analyzed by an independent, certified lab. Results are reported to the Suffolk County Department of Health Services and to BNL's Environmental & Waste Management Services Division, which ensures that the Lab's water complies with all applicable regulations. — CN10-41-00

Definition of Report Terms

- 90th percentile value: 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 by your water system. The reported copper and lead values represent the 90th percentile.
- action level (AL): The concentration of a contaminant which, if exceeded, then triggers treatment and/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 what is called the maximum contamination level goal (MCLG) as possible.
- maximum contamination 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 concentration of a disinfectant allowed in drinking water. Disinfectants have been proven to be necessary for controlling microbial contamination of water and eliminating water-borne illnesses.
- maximum residual disinfectant level goal (MRDLG): the concentration of a drinking-water disinfectant below which there is no known or expected risk to health.
- treatment technique: A required process intended to reduce the level of a contaminant in drinking water.
- micromhos per centimeter (umhos/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).
- millirem per year (mrem/yr): A measure of radiation absorbed by the body.
- micrograms per liter (µg/l): Equals one part of liquid per billion parts of liquid, or parts per billion (ppb).
- picocuries per liter (pCi/L): A measure of radioactivity in water.
- million fibers per liter (MFL): A measure of asbestos fibers longer than 10 micrometers.

BNL Water Quality Consumer Confidence Report

This annual special edition of the Bulletin is published by the Community, Education, Government & Public Affairs Directorate with the assistance of the Environmental & Waste Management Services (EWMS) Division and the Plant Engineering (PE) Division. It is distributed to the approximately 3,000 on-site drinking-water consumers served daily by federal public water system no. 5111891 at Brookhaven National Laboratory, Upton, New York 11973, which is owned by the U.S. Department of Energy and operated under contract by Brookhaven Science Associates, LLC.

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the Bulletin

BROOKHAVEN NATIONAL LABORATORY

2008 BNL Water Quality Consumer Confidence Report May 30, 2008

BNL's Drinking Water Complies With All Health, Safety Regulations

Last year, as in the past, Brookhaven Lab's drinking water and the supply system that produces it were in full compliance with all applicable county, state and federal regulations regarding drinking-water quality, monitoring, operations, and reporting.

In fact, the Plant Engineering (PE) Division, which is responsible for the Lab's drinking-water supply system, is proud to report that BNL's water has never reached or exceeded what are called primary maximum contaminant levels (MCLs).

To ensure that tap water is safe to drink, the U.S. Environmental Protection Agency (EPA) and the New York State Department of Health (NYSDOH) have prescribed regulations that limit the amounts of certain contaminants in water provided by public water systems such as BNL's. Each drinking-water contaminant has an allowable MCL. Water for drinking that exceeds MCLs for one or more compounds is in violation of the law.

To provide the same protection to those who drink bottled water, the U.S. Food & Drug Administration has established regulations to limit contaminants in bottled water.

Of the 113 drinking-water contaminants for which BNL tests its drinking water at the well, after treatment at the Water Treatment Facility, or at the consumers' tap, only 16 compounds were detected in the Lab's drinking water in 2007 (see tables on page 1, below right, and pages 2 and 3; and the discussion of those compounds on page 3).

Bulletin Special Edition

2008 BNL Water Quality Consumer Confidence Report

This special edition of the Brookhaven Bulletin is Brookhaven National Laboratory's tenth annual Consumer Confidence Report. This report is published yearly for the BNL drinking-water consumer, to present an overview of water quality during the previous calendar year. Because the Lab is the on-site drinking-water supplier, BNL is required by the federal Safe Drinking Water Act (SDWA) of 1976, as amended in 1996, to produce an annual report on the quality of its drinking water.

In addition to reminding consumers of the importance and need to protect drinking-water sources, the report's purpose is to inform drinking-water consumers:

- where our water comes from
- what those tests reveal about the water
- what analytical tests are conducted
- how those results compare to state standards

Among its other responsibilities, BNL's Plant Engineering (PE) Division is committed to providing all employees, facility-users, guests, residents, and other visitors with safe drinking water while they are on site. To do so, PE operates BNL's drinking-water supply system, which is considered by the U.S. Environmental Protection Agency to be a "small community public water system" because it serves between 501 and 3,300 people. BNL's water supply system includes six wells dedicated to pumping drinking water and the Water Treatment Facility in Bldg. 624 (see photo essay on page 4).

To make sure that the Lab's drinking water meets all applicable local, state and federal water-quality standards, PE has BNL's drinking water regularly tested using an independent laboratory approved by the New York State Department of Health.

To ensure that testing results comply with all applicable regulatory standards, analytical data are reviewed by the Lab's Environmental & Waste Management Services (EWMS) Division. In addition, PE and EWMS work with BNL's Environmental Restoration Projects to make sure that the Lab's potable-water supply is not impacted by groundwater contamination or remediation operations.

For more information and/or copies of the complete analyses of BNL's 2007 drinking-water samples discussed in this report, contact those listed below:

- Bill Chaloupka, PE Assistant Division Manager for Operations & Environment, Ext. 7136, chaloupka@bnl.gov
- Bob Lee, EWMS Deputy Division Manager for Environmental Programs, Ext. 3148, blee@bnl.gov
- Suffolk County Department of Health Services, (631) 853-2251

This report is also available at www.bnl.gov/bnlweb/pubaf/bulletin.html and www.bnl.gov/bnlweb/pubaf/water/reports.htm. — Marsha Belford

Reducing 'Rusty' Water Around the Site

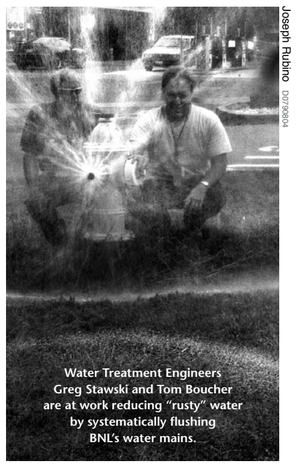
2008 Water-Main Flush Program Started

On May 12, the water treatment engineers of BNL's Water Treatment Facility (WTF) began working their way around the site over a week to flush BNL's water mains. By systematically opening and closing fire hydrants from May 12 to 16, they inaugurated BNL's 2008 water-main flushing program.

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

Performed three times a year, on-site water-main flushing will also take place in July and October. Closer to the weeks selected in those months, the hydrant-flushing schedule will be announced via broadcast e-mail, a Bulletin notice, and a flyer distributed to on-site residents and posted on the Web.

Much of Long Island's groundwater is high in iron as a result of naturally occurring iron-containing minerals within the aquifer. Water that enters BNL's distribution system, however, contains very low iron for one of two reasons: either because it comes from one of the three BNL drinking-water wells that produces water naturally low in iron; or because, if it comes from one of the three high-iron wells, the water is then treated in a multi-step process to remove iron at the Water Treatment Plant (see photo essay on page 4).



Joseph Rubino DSP0804

Water Treatment Engineers Greg Stawski and Tom Boucher are at work reducing "rusty" water by systematically flushing BNL's water mains.

While being delivered around site via 45 miles of underground water mains, however, BNL water can and does pick up insoluble iron.

There are two sources of iron in BNL's water-distribution system: First, between 1941, when Camp Upton was reopened on the site during World War II, and 1963, when the WTF was commissioned, BNL did not treat its drinking water for iron; as a result, some 700 pounds of iron per year—or 7.7 tons over 22 years—was deposited. Second, the site has cast-iron and ductile iron water mains which add insoluble iron into the system as a result of oxidation.

Depending upon where a building is located along the water-distribution system, "rusty" water can be more or less of a problem. Because iron does not pose a health risk to most people at levels usually found in water, the EPA regulates it via secondary, or aesthetic, standards (see pages 2 and 3). — M.B.

Visit the WTF: 6/20

Once you've looked at the pictures and read all about the Water Treatment Facility (WTF), why don't you come to see it for yourself—by going on a lunchtime tour for BNL employees, facility-users and other on-site guests.

Organized by Tour Program coordinator Elaine Lowenstein of the Community Relations Office, the WTF tour will take place on Friday, June 20th, from 12 noon to 1 p.m. Meet in the upper lobby of Berkner Hall by 12 noon sharp!

Federal Lead & Copper Rule Revision Requires Increased Communications With Consumers

In the U.S. today, the use of lead in plumbing pipes, fixture, fittings, and solder has been restricted by law since 1986, when the federal Safe Drinking Water Act was first amended, requiring a rule regulating lead and copper at the drinking-water consumer's tap.

Posing certain health risks to most people if consumed in excess, lead and copper enter drinking water mainly as a result of the corrosion of plumbing materials. As a result, the federal "lead and copper rule" was issued in 1991 by the U.S. Environmental Protection Agency (EPA) to limit the concentration of these two metals in public water.

Last October, this rule was revised in attempt to protect public water-system consumers from excessive exposure to lead and copper even further.

In restricting the amount of lead and copper at the consumer's tap, the rule aims to protect public health by having water suppliers reduce water corrosiveness. To know how well they are doing this, water suppliers are required to sample a representative number of consumers' taps, as per an agreement with their state's department of health. The frequency of sampling depends upon the lead and copper results.

BNL, for instance, is required to sample for lead and copper at 20 consumers' taps every three years (see list, above, right). Sampling was last required and performed in 2006 (see aggregate result, below, right). Sampling will again take place in 2009 and those results will be reported in 2010.

The recent revision to the lead and copper rule calls for improved monitoring, treatment, lead service-line replacement, and communication with drinking-water consumers across the nation. The rule revision that most affects BNL is the new requirement that occupants of buildings part of the lead and copper tap-water sampling program be notified of the test results for their specific faucets.

So these results will be published the annual Consumer Confidence Report (CCR), building managers will be asked to post the results by the tested taps, and on-site residents will receive the CCR in their Housing Office packets.

location	faucet	lead	copper
		2006 sampling results	
Apt. 1A	kitchen	28.7 µg/l	0.10 mg/l
Apt. 4C	kitchen	7.6 µg/l	0.03 mg/l
Apt. 5B	kitchen	7.5 µg/l	0.05 mg/l
Apt. 6A	kitchen	4.0 µg/l	0.02 mg/l
Apt. 13D	kitchen	1.0 µg/l	0.02 mg/l
Apt. 24D	kitchen	1.9 µg/l	<MDL
Apt. 26A	kitchen	2.5 µg/l	0.04 mg/l
Apt. 28B	kitchen	<MDL	<MDL
Apt. 34E	kitchen	1.6 µg/l	0.03 mg/l
Apt. 36A	kitchen	2.8 µg/l	0.05 mg/l
Apt. 40G	kitchen	8.8 µg/l	0.03 mg/l
Apt. 42A	kitchen	18.7 µg/l	0.07 mg/l
Bldg. 51	bathrm.	<MDL	<MDL
Bldg. 153	bathrm.	1.3 µg/l	0.02 mg/l
Bldg. 170	bathrm.	<MDL	<MDL
Bldg. 371	bathrm.	11.4 µg/l	0.11 mg/l
Bldg. 460	bathrm.	5.2 µg/l	0.21 mg/l
Bldg. 535	bathrm.	1.2 µg/l	0.32 mg/l
Bldg. 703	bathrm.	1.0 µg/l	0.46 mg/l
Bldg. 911	bathrm.	1.5 µg/l	0.23 mg/l

LEAD AT CONSUMERS' TAP*
MCLG: 0 µg/l **BNL range:** <1.0 to 28.7 µg/l
AL at the 90th percentile: 15 µg/l
BNL 90th percentile value: 11.4 µg/l
date: 08/04/06, Bldg. 371 bathrm. **violation?** No

COPPER AT CONSUMERS' TAP*
MCLG: 1.3 mg/l **BNL range:** <0.02 to 0.46 mg/l
AL at the 90th percentile: 1.3 mg/l
BNL 90th percentile value: 0.23 mg/l
date: 08/04/06, Bldg. 911 bathrm. **violation?** No

* Discussed in "2007: 16 Parameters Detected in BNL's Drinking Water," on page 3.

What Is in Our Drinking Water?

Although rivers, lakes, streams, ponds, and reservoirs are all sources of tap and bottled drinking water, BNL and the rest of Long Island draw drinking water from groundwater wells that are drilled into the aquifer (see story below).

As water travels over land surfaces or through the ground, it dissolves naturally occurring minerals and radioactive material. In addition, water can pick up substances resulting from human activity or the presence of animals. Contaminants that may be present in water include:

- **microbial contaminants:** bacteria and viruses, which may come from sewage, livestock operations, wildlife, etc.
- **inorganic chemical contaminants:** dissolved salts and metals, which can occur naturally or result from: storm-water runoff, industrial or domestic wastewater discharges, oil and gas production, mining, farming, etc.
- **pesticides & herbicides:** substances for, respectively, eliminating problem insects and plants which may come from a variety of sources, such as agricultural operations, storm-water runoff, residential uses, etc.
- **organic chemical contaminants:** natural and synthetic compounds, including volatile organic compounds (VOCs). These chemicals are by-products of industrial processes and petroleum production, and they can also come from gas stations, storm-water runoff, septic systems, etc.
- **radioactive contaminants:** can be naturally occurring, or from oil and gas production, mining activities, nuclear facilities, etc.

Because of the presence of contaminants, source water is often "finished," or treated, to remove substances or reduce their concentration before that water is fit for human consumption (see photo essay on page 4).

Regardless, drinking water — including bottled water — may reasonably be expected to contain at least small amounts of contaminants. The presence of contaminants, however, does not necessarily indicate that the water poses a health risk (see story on page 3).

Some people may be more vulnerable to illness-causing microorganisms or pathogens in drinking water than others. People whose immune systems are compromised may be particularly at risk of infections. Those people include: cancer patients who are undergoing chemotherapy, people who have undergone organ transplants, persons with HIV/AIDS or other immune system disorders, and some elderly people and infants. These people or their care-givers should seek advice from their health-care providers.

Guidelines from the U.S. Environmental Protection Agency (EPA) and the U.S. Centers for Disease Control on ways to reduce the risk of illness by cryptosporidium, giardia and other microbial pathogens are available from the EPA's Safe Drinking-Water Hotline, (800) 426-4791.

More information about drinking-water contaminants can be obtained from the EPA at www.epa.gov/safewater; or from the NYSDOH at www.health.state.ny.us.

2007 Analytical Data

Inorganic Chemicals, Bacteria, Radioactivity

The following maximum values were measured in samples of well water or finished water at the Water Treatment Plant. The 12 parameters noted in this table as detected in BNL water are discussed on page 3.

WATER-QUALITY INDICATORS

indicator	*BNL sample*	*MCL*
alkalinity†	25.6 mg/l	NS
ammonia	<MDL	NS
calcium†	10.1 mg/l	NS
chlorides*	39.0 mg/l	250 mg/l
color*	50 units	15 units
conductivity†	301 µmhos/cm	NS
cyanide	<MDL	NS
methylene blue active substances	<MDL	NS
nitrates*	0.48 mg/l	10 mg/l
nitrites*	0.12 mg/l	1.0 mg/l
odor	0 units	3 units
pH	5.4 standard units	NS
sulfates*	11.1 mg/l	250 mg/l
total coliform*	1 sample	ND

METALS

metal	*BNL sample*	*MCL*
antimony	<MDL	6.0 µg/l
arsenic	<MDL	50 µg/l
barium	<MDL	2.0 mg/l
beryllium	<MDL	4.0 µg/l
cadmium	<MDL	5.0 µg/l
chromium	<MDL	0.10 mg/l
fluoride	<MDL	2.2 mg/l
iron*	3.33 mg/l	0.3 mg/l
lead	<MDL	15 µg/l
manganese*	0.154 mg/l	0.3 mg/l
mercury	<MDL	2.0 µg/l
nickel	<MDL	0.1 mg/l
selenium	<MDL	50 µg/l
silver	<MDL	100 µg/l
sodium*	21.2 mg/l	NS
thallium	<MDL	2.0 µg/l
zinc*	0.03 mg/l	5.0 mg/l

OTHER

parameter	*BNL sample*	*MCL*
asbestos	<MDL	7 MFL

RADIOACTIVITY

parameter	*BNL well max.*	*MCL*
gross alpha*	2.37 pCi/l	15 pCi/l
gross beta*	2.99 pCi/l	4 mrem/yr
tritium	<MDL	20,000 pCi/l
strontium-90	<MDL	8 pCi/l

<MDL: less than the minimum detection limit.
NS: drinking-water standard not specified.
ND: not detected.
† measure of water hardness or dissolved salts.
* Discussed in "2007: 16 Parameters Detected in BNL's Drinking Water," page 3.

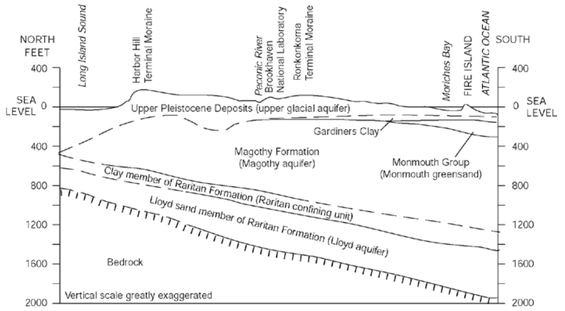
Long Island's 'Sole Source' Aquifer Is Brookhaven Lab's Water Source

All of the water supplied by BNL comes from beneath the ground and, hence, is referred to as groundwater. That water is stored beneath the ground in a sandy, geological formation known as an aquifer. Water in the aquifer originates as precipitation that percolates down through the soil, and this groundwater may be source water for natural springs or man-made wells.

The Long Island aquifer system is made up of three primary formations (see diagram below): From the surface to about 150 feet down is the Upper Glacial aquifer, from 150 to 1,000 feet is the Magothy, and from 1,000 to about 2,000 feet is the Lloyd. Drilled into the Upper Glacial, the Lab's six drinking-water wells draw up to 1,000 gallons per minute, or about 2.2 million gallons of water a day for use as drinking water, process cooling water or fire protection. Last year, BNL pumped some 421,014,000 gallons.

Long Island's aquifer system is one of 72 "sole source" aquifers in the nation recognized under the aquifer-protection program authorized by the U.S. Safe Drinking Water Act. Long Island's regional aquifer was so named on June 21, 1978, following a 1975 petition to the EPA by the Environmental Defense Fund.

— Marsha Belford



BNL's Source Water Assessed

As required by the 1996 amendments to the Safe Drinking Water Act, an assessment of the source water used by BNL's public water system was done by the New York State Department of Health (NYSDOH), as noted below. Based upon available hydrogeological, land use, and water-quality susceptibility information, the assessment of Brookhaven Lab's source water provides the Laboratory with additional information for use in protecting the source of BNL's drinking water.

As part of the assessment, known and possible contamination sources were evaluated. The assessment includes a susceptibility rating for each well, which is 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, then it does not necessarily mean that there is a health risk. For a discussion of contaminants detected in 2007, see "2007: 16 Parameters Detected in BNL's Drinking Water" on page 3.

BNL's drinking water is pumped from six on-site wells (see story above and photo essay on page 4). According to the NYSDOH source-water assessment, two wells are rated as having a very high susceptibility to industrial solvents. This is 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 the well, then this contamination would be removed by existing treatment facilities (carbon filters or air stripping; see photo essay on page 4) before the water is delivered to the consumer.

In addition, BNL has also identified that one well is susceptible to radionuclide contamination, specifically tritium. Although tritium has never been detected in this well, the Lab controls water-pumping operations to reduce the potential for impact. In addition to testing the supply-well water, BNL uses a network of groundwater-monitoring wells to track potential sources and contamination. If a supply well cannot provide water that meets drinking-water standards, then the Lab would immediately remove it from service.

A copy of the complete NYSDOH assessment may be reviewed by contacting either Doug Paquette, Ext. 7046, or Bob Lee, Ext. 3148.

2007 Analytical Data

Organic Compounds, Pesticides, Micro-Extractables

With one exception noted in the table below and discussed on page 3, the following compounds were not detected in source water from the Lab's six drinking-water wells or finished water at the Water Treatment Facility:

compounds	*BNL max.*	*MCL µg/l*
dichlorodifluoromethane	<MDL	5
chloromethane	<MDL	5
vinyl chloride	<MDL	2
bromomethane	<MDL	5
chloroethane	<MDL	5
fluorotrichloromethane	<MDL	5
1,1-dichloroethene	<MDL	5
methylene chloride	<MDL	5
trans-1,2-dichloroethene	<MDL	5
1,1-dichloroethane	<MDL	5
cis-1,2-dichloroethene	<MDL	5
2,2-dichloropropane	<MDL	5
bromochloromethane	<MDL	5
1,1,1-trichloroethane*	<MDL	5
carbon tetrachloride	<MDL	5
1,1-dichloropropene	<MDL	5
1,2-dichloroethane	<MDL	5
trichloroethene	<MDL	5
1,2-dichloropropane	<MDL	5
dibromomethane	<MDL	5
trans-1,3-dichloropropene	<MDL	5
cis-1,3-dichloropropene	<MDL	5
1,1,2-trichloroethane	<MDL	5
total trihalomethanes*	26.4	80
1,1,2,2-tetrachloroethane	<MDL	5
1,3-dichloropropane	<MDL	5
chlorobenzene	<MDL	5
bromobenzene	<MDL	5
1,2,3-trichloropropane	<MDL	5
2-chlorotoluene	<MDL	5
4-chlorotoluene	<MDL	5
1,3-dichlorobenzene	<MDL	5
1,4-dichlorobenzene	<MDL	5
1,2-dichlorobenzene	<MDL	5
1,2,4-trichlorobenzene	<MDL	5
hexachlorobutadiene	<MDL	5
tetrachloroethene	<MDL	5
1,1,2,2-tetrachloroethane	<MDL	5
1,2,3-trichlorobenzene	<MDL	5
benzene	<MDL	5
toluene	<MDL	5
ethylbenzene	<MDL	5
m,p-xylene	<MDL	5
p-xylene	<MDL	5
o-xylene	<MDL	5
styrene	<MDL	5
isopropylbenzene	<MDL	5
n-propylbenzene	<MDL	5
1,3,5-trimethylbenzene	<MDL	5
tert-butylbenzene	<MDL	5
1,2,4-trimethylbenzene	<MDL	5
sec-butylbenzene	<MDL	5
4-isopropyltoluene	<MDL	5
n-butylbenzene	<MDL	5
methyl tertiary butyl ether	<MDL	50
lindane	<MDL	0.2
heptachlor	<MDL	0.4
aldrin	<MDL	5
heptachlor epoxide	<MDL	0.2
dieldrin	<MDL	5
endrin	<MDL	0.2
methoxychlor	<MDL	40
toxaphene	<MDL	3
chlordane	<MDL	2
polychlorinated biphenyls (PCBs)	<MDL	0.5
2,4,5-TP (silvex)	<MDL	10
dinoseb	<MDL	50
dalapon	<MDL	50
pichloram	<MDL	50
dicamba	<MDL	50
pentachlorophenol	<MDL	1
hexachlorocyclopentadiene	<MDL	5
di(2-ethylhexyl)phthalate	<MDL	50
di(2-ethylhexyl)adipate	<MDL	50
hexachlorobenzene	<MDL	5
benzo(A)pyrene	<MDL	50
aldicarb sulfone	<MDL	NS
aldicarb sulfoxide	<MDL	NS
aldicarb	<MDL	NS
oxamyl	<MDL	50
3-hydroxycarbofuran	<MDL	50
carbofuran	<MDL	40
carbaryl	<MDL	50
methomyl	<MDL	50
glyphosate	<MDL	50
diquat	<MDL	50
ethylene dibromide	<MDL	0.05
1,2-dibromo-3-chloropropane	<MDL	0.2
2,4-D	<MDL	50
alachlor	<MDL	2
simazine	<MDL	50
atrazine	<MDL	3
metolachlor	<MDL	50
metribuzin	<MDL	50
butachlor	<MDL	50
propachlor	<MDL	50

<MDL: less than the minimum detection limit.
NS: drinking-water standard not specified.
* discussed in "2007: 16 Parameters Detected in BNL's Drinking Water," page 3.

2007: 16 Parameters Detected in BNL's Drinking Water

As marked with an asterisk in the analytical data on pages 1 and 2, and on page 3 below, the 16 parameters discussed below were detected in BNL's drinking water in 2007.

According to the U.S. Environmental Protection Agency, it is reasonable to expect that drinking water—including bottled water—may contain at least small amounts of some contaminants. The presence of contaminants, however, does not necessarily indicate that the water poses a health risk (see story, page 2).

The 16 parameters detected in 2007 in drinking water were found at concentrations well below what are called the maximum contaminant level (MCL; see term definitions on page 4). Thus there were no violations of the federal Safe Drinking Water Act, as amended, or any other applicable government regulation. For more information on these contaminants, go to EPA's Web site: www.epa.gov/safewater/hfacts.html.

WATER-QUALITY INDICATOR

• COLOR

MCLG: none **BNL max.:** 50 units **detected:** 06/08/07, wells #6
MCL: 15 units **BNL range:** <5-50 units **violation?:** No

- **major sources in drinking water:** Natural presence of metals such as copper, iron and manganese.
- **possible health effects:** Water color has no health effects. When color is present at levels as low as 5 units, some people may find the color aesthetically displeasing and objectionable.

BACTERIA

• TOTAL COLIFORM

MCLG: none **# positive samples:** 1 **detected:** 07/13/07, well #6
MCL: positive sample **violation?:** No

- **major sources in drinking water:** Naturally present in the environment.
- **possible health effects:** Coliforms are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful bacteria may be present. Coliforms were *not* found in more samples than allowed.

RADIOACTIVITY

• GROSS ALPHA

MCLG: 0 pCi/l **BNL max.:** 2.37 pCi/l **detected:** 10/30/07, Well #11
MCL: 15 pCi/l **BNL range:** <0.98-2.37 pCi/l **violation?:** No

- **major sources in drinking water:** Erosion of natural deposits
- **possible health effects:** Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the MCL over many years may have an increased risk of cancer.

• GROSS BETA

MCLG: 0 pCi/l **BNL max.:** 2.99 pCi/l **detected:** 04/12/07, Well #12
MCL: 4 mrem/year **BNL range:** <1.39-2.99 pCi/l **violation?:** No

- **major sources in drinking water:** Decay of natural deposits and man-made emissions.
- **possible health effects:** Certain materials are radioactive and may emit forms of radiation known as beta radiation. Some people who drink water containing beta emitters in excess of the MCL over many years may have an increased risk of cancer.

INORGANIC CONTAMINANTS

• CHLORIDES

MCLG: none **BNL max.:** 39.0 mg/l **detected:** 06/08/07, well #4
MCL: 250 mg/l **BNL range:** 17.2-39.0 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring or indicative of road-salt contamination.
- **possible health effects:** No health effects. The MCL for chloride is the level above which the taste of water may become objectionable. In addition to the adverse taste effects, high chloride concentrations in water contribute to the deterioration of domestic plumbing and water heaters. Elevated chloride concentrations may also be associated with sodium in drinking water.

• COPPER*

COPPER AT THE CONSUMERS' TAP*

MCLG: 1.3 mg/l **AL at 90th percentile:** 1.3 mg/l **BNL range:** <0.02-0.46 mg/l
 # samples exceeding AL: 0 of 20 **BNL value at 90th percentile:** 0.23 mg/l
detected: 08/04/06, Bldg. 703 bathroom **violation?:** No

- **major sources in drinking water:** Corrosion of household plumbing.
- **possible health effects:** Copper is an essential nutrient, required by the body in very small amounts. When people drink water containing copper above the action level over a short time, some could experience gastrointestinal distress, such as nausea and vomiting. Some people who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's disease may be more sensitive than others to the effects of copper, so they are advised to consult their health-care provider.

* ***note:*** *These are the latest results from sampling at the consumers' tap, which last took place in 2006. Sampling will again take place in 2009; those results will be reported in 2010.*

• IRON

MCLG: none **BNL max.:** 3.33 mg/l **detected:** 06/08/07, well #6
MCL: 0.3 mg/l **BNL range:** 0.02-3.33 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring.
- **possible health effects:** Iron usually has no health effects. When iron reaches 1 mg/l, a substantial number of people will notice the bitter, astringent taste of iron. At this concentration, it also imparts a brownish color to laundered clothing and stains plumbing fixtures with a characteristic brown color. Therefore, the MCL of 0.3 mg/l represents a reasonable compromise, as, at this level, adverse aesthetic effects are minimized. Many multivitamins contain 3,000-4,000 mg of iron per capsule. Color in BNL water is due to iron. All treated water, however, meets the MCL at the WTF.

• LEAD*

LEAD AT THE CONSUMERS' TAP*

MCLG: 0 µg/l **AL at 90th percentile:** 15 µg/l **BNL range:** <1.0-28.7 µg/l
 # samples exceeding AL: 2 of 20 **BNL value at 90th percentile:** 11.4 µg/l
detected: 08/04/06, Apt. 1A kitchen **violation?:** No

- **major sources in drinking water:** Corrosion of household plumbing, typically plumbing in older buildings.
- **possible health effects:** Children and pregnant women are most susceptible to the health risks of lead. Infants and children who drink water containing lead in excess of the action level could experience delays in their physical or mental development. Children could show slight defects in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure.

* ***note:*** *These are the latest results from sampling at the consumers' tap which last took place in 2006. Sampling will again take place in 2009; those results will be reported in 2010.*

• MANGANESE

MCLG: none **BNL max.:** 0.154 mg/l **detected:** 06/08/07, Well #4
MCL: 0.3 mg/l **BNL range:** <0.01-0.154 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring; indicative of landfill contamination.
- **possible health effects:** The National Research Council has determined that an estimated safe and adequate daily dietary intake of manganese is 20-50 mg for adults. Many people, however, consume even higher amounts of manganese, especially those who consume large amounts of vegetables. Since drinking water contains iron and manganese, it is better if it is not used to make infant formula. Excess manganese produces a brownish color in laundered goods, and it affects the taste of tea, coffee and other beverages. High concentrations may cause a dark brown or black stain on porcelain plumbing fixtures. As does iron, manganese may form a coating on distribution pipes which may slough off, causing black particles in the water and/or brown blotches on laundry.

• NITRATE

MCLG: 10 mg/l **BNL max.:** 0.48 mg/l **detected:** 06/08/07, well #11
MCL: 10 mg/l **BNL range:** 0.17-0.48 mg/l **violation?:** No

- **major sources in drinking water:** Runoff from fertilizer use; leaching from septic tanks, and/or sewage; erosion of natural deposits.
- **possible health effects:** Excessive levels of nitrate in water have caused serious illness and sometimes death. Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blueness of the skin, which is known as blue-baby syndrome.

• NITRITE

MCLG: 1 mg/l **BNL max.:** 0.12 mg/l **detected:** 06/08/07, well #4
MCL: 1 mg/l **BNL range:** <0.10-0.12 mg/l **violation?:** No

- **major sources in drinking water:** Runoff from fertilizer use; leaching from septic tanks, and/or sewage; erosion of natural deposits.
- **possible health effects:** Excessive levels of nitrate in water have caused serious illness and sometimes death. Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blueness of the skin, which is known as blue-baby syndrome.

• SODIUM

MCLG: none **BNL max.:** 21.2 mg/l **detected:** 06/08/07, well #4
MCL: none **BNL range:** 10.8-21.2 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring, or due to road salt, water softeners, and/or animal waste.
- **possible health effects:** Water containing more than 20 mg/l of sodium should not be used for drinking by people on severely restricted sodium diets. Water containing more than 270 mg/l of sodium should not be used for drinking by people on moderately restricted sodium diets.

• SULFATES

MCLG: none **BNL max.:** 11.1 mg/l **detected:** 07/13/07, Bldg. 185
MCL: 250 mg/l **BNL range:** 6.5-11.1 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring.
- **possible health effects:** High sulfate concentrations in drinking water can have three effects: first, water containing appreciable amounts of sulfates tends to form hard scale in boilers and heat exchangers; second, sulfates affect the taste of water; and, third, sulfates can act as a laxative if intake is excessive. Sulfates' laxative effect is usually observed in transient users of a water supply, as people who are accustomed to high sulfate level do not respond adversely. Diarrhea may result from sulfate levels greater than 500 mg/l, but, typically, from levels closer to 750 mg/l.

• ZINC

MCLG: none **BNL max.:** 0.03 mg/l **detected:** 06/08/07, Bldg. 185
MCL: 5 mg/l **BNL range:** <0.02-0.03 mg/l **violation?:** No

- **major sources in drinking water:** Naturally occurring, or due to mining waste or corrosion of household plumbing.
- **possible health effects:** Zinc has no health effects unless detected in very high concentrations. The presence of zinc may result in an undesirable taste in drinking water.

VOLATILE ORGANIC CONTAMINANT

• TOTAL TRIHALOMETHANES

TOTAL TRIHALOMETHANES AT THE WELL OR IN WTF EFFLUENT

MCLG: none **BNL max.:** 26.4 µg/l **detected:** 07/13/07, well #6
MCL: 80 µg/l **BNL range:** <0.5-26.4 µg/l **violation?:** No

TOTAL TRIHALOMETHANES AT CONSUMERS' TAP

MCLG: none **BNL annual value:** 10 µg/l **detected:** 08/03/07, Bldg. 363
MCL: 80 µg/l **violation?:** No

- **major sources in drinking water:** By-product of water chlorination, which is performed to kill harmful organisms. Trihalomethanes are formed when source water contains large amounts of organic matter. Total trihalomethanes is the sum of chloroform, bromodichloromethane, dibromochloromethane and bromoform.
- **possible health effects:** Some people who drink water containing trihalomethanes in excess of the MCL over many years may experience liver, kidney or central nervous system problems, and they may have an increased risk of getting cancer.

DISINFECTANT

• CHLORINE RESIDUAL

MCLG: none **BNL annual average:** 0.6 mg/l **detected:** 05/04/07, Bldg. 930
MCL: 4 mg/l **BNL range:** 0.3-1.5 mg/l **violation?:** No

- **major sources in drinking water:** By-product of drinking-water chlorination.
- **possible health effects:** Some people who use drinking water containing chlorine in excess of the MCL could experience eye or nose irritation. Some people who drink water containing chlorine in excess of the MCL could experience stomach discomfort.

2007 Analytical Data

Disinfectant and By-Products

Effective in killing unwanted microorganisms in source water, disinfectants can react with naturally occurring organic matter and inorganics to form disinfectant by-products, which may pose health risks. As a result, the Safe Drinking Water Act was amended in 1996 to regulate disinfectants and their by-products.

BNL uses a form of chlorine called sodium hypochlorite for water disinfection. BNL's 2007 averages for chlorine residual and by-products are based on results from finished tap water:

disinfection residual	*2007 BNL running average*	*MRDLG*
chlorine*	0.6 mg/l	4 mg/l
disinfection by-products	*2007 BNL annual average*	*MCL*
total trihalomethanes[1] *	10 µg/l	80 µg/l
haloacetic acids (five)[2]	<MDL	60 µg/l

* Discussed in "2007: 16 Parameters Detected in BNL's Drinking Water," above.
[1] Total trihalomethanes are the sum of the concentrations 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.