the Bulletin

BROOKHAVEN NATIONAL LABORATORY

2003 BNL Water Quality Consumer Confidence Report | May 30, 2003

*2003 BNL Water Quality Report*

## BNL's Drinking Water Is in Full Compliance With All Regulations

Last year, as in the past, BNL's drinking water was in full compliance with all county, state, and federal regulations. In fact, the Lab's Plant Engineering (PE) Division, which is responsible for the Lab's drinking-water supply system, is proud to report that BNL's water has not violated a primary maximum contaminant level.

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. To provide the same protection to those who drink bottled water, the U.S. Food & Drug Administration and NYSDOH have established regulations to limit contaminants in bottled water. Each drinking-water contaminant has an allowable maximum contaminant level (MCL). Drinking water that exceeds MCLs for one or more compounds is in violation of the law.

No primary MCLs were reached or exceeded by BNL's drinking water in 2002, and there were no violations of any government regulations. Of the more than 80 drinking water contaminants for which testing is required, only 14 compounds (see pages 2 and 4) were detected in the Lab's drinking water in 2002.

*Bulletin Special Edition*

# 2003 BNL Water Quality Consumer Confidence Report

This special edition of The Bulletin is Brookhaven National Laboratory's fifth annual Consumer Confidence Report, which is published to provide an overview of water quality during calendar year 2002. 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 analytical tests are conducted to ensure its safety
- what those tests reveal about the water
- 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 and a reliable drinking-water supply while they are on site. To do so, PE operates BNL's drinking-water supply system, which includes the six wells used exclusively for drinking water and the Water Treatment Facility in Bldg. 624 (see story and photo essay on page 3).

To ensure that the Lab's drinking water meets all local, state, and federal quality standards, PE has BNL's drinking water regularly tested using approved independent and in-house laboratories. Testing results are reviewed by the Lab's Environment & Waste Management Services (E&WMS) Division, to ensure compliance with all regulatory standards. In addition, PE and E&WMS work with BNL's Environmental Restoration Projects Directorate to ensure that the Lab's potable water supply is not impacted by groundwater contamination on site.

For more information and/or copies of the complete analysis of BNL's 2002 drinking-water samples, contact those listed below. This report is also available at www.bnl.gov/bnlweb/pubaf/bulletin.html.

- Ed Murphy, PE Division Manager, Ext. 3466 or etmurphy@bnl.gov
- William Chaloupka, PE Assistant Division Manager for Operations & Environment, Ext. 7136 or chaloupka@bnl.gov
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## 2003 Water-Main Flushing Began This Spring; to Continue Summer, Fall

Water Treatment Engineer Joe Tullo helps to eliminate the site's "rusty" water by systematically flushing BNL's water mains.

For one week this spring, April 28-May 2, the water-treatment engineers of BNL's Water Treatment Facility (WTF) again worked their way systematically around the site to flush BNL's hydrants. With the goal of reducing the "rusty" water on site, the hydrants will again be flushed over a week this summer and fall.

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 the system and to improve water quality.

Much of Long Island's groundwater is naturally high in iron as a result of dissolved iron-containing minerals, such as iron oxides from the Upper Glacial aquifer. At BNL, water from three drinking-water wells is low in iron; water from the three other drinking-water wells is high in iron and so requires "finishing" (see page 3).

Despite water treatment, 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 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. 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 4).

When the hydrant flushing schedule is known, water-users around site will be informed via e-mail, and on-site residents will be notified via a flyer.

## Follow-up Continues in Response to Last Year's Water-Quality Survey

Responding to the results from the first BNL Water-Quality Survey (see the Bulletin of May 31, 2002), which was conducted over two days during Healthfest 2001 and voluntarily completed by 214 BNL employees and guests, the BNL Drinking Water Quality Committee has implemented many of the participants' suggestions and is following up on others.

As the first documentation of the internal community's comments, questions, and concerns regarding BNL water quality, the informal, eight-question survey was undertaken by the committee, which is made up of representatives from the Plant Engineering Division, Environment & Waste Management Services Division, and the Community, Education, Government & Public Affairs (CEGPA) Directorate. Under an ongoing community-involvement project overseen by the Lab's Community Relations Office, the survey and its follow-up are part of the committee's effort to improve communication on BNL drinking-water issues, and to increase the internal BNL community's involvement in drinking-water operations and management.

As most BNLers agree, it is unusual to work for an employer other than a water company that has its own drinking-water wells, water treatment facility, and water engineering staff dedicated to the safe and reliable supply of potable water. What is also unusual for BNL as a water suppler is that it not only owns the supply system, but that it — and not the consumer — also owns the indoor drinking-water plumbing systems.

From the answers to the survey, it was learned that, while 70 percent of BNL employees and guests feel that the Lab's water is safe to drink, only 55 percent of them drink it. And, of the 75 percent of BNLers who think that the safety of the Lab's drinking water is or may be an issue of concern to the BNL community, some 97 percent believe that it is an issue that is somewhat to very important.

Of the 34 percent of survey-takers who made recommendations, 51 percent advocated more publications and signs. Toward providing more readily accessible articles and photographs regarding BNL water quality, a water-quality Web site (www.bnl.gov/bnlweb/pubaf/water/quality.htm) has been developed by John Galvin, CEGPA.


Among the water-quality information posted on the Web are the PDFs of five fact sheets, developed to answer the inquiries posed by the 14 percent of the survey-takers who noted questions. In paper form, the fact sheets are available in the CEGPA lobby, Bldg. 134, and approximately 300 copies of each fact sheet were handed out at the BNL Drinking-Water Quality Booth during the two-day 2002 Healthfest fair.

Fact sheets and other materials were also distributed to the employees and guests who participated in a lunchtime tour of the Water Treatment Facility, organized last November by Elaine Lowenstein, CEGPA.

Two of the fact sheets answer the following frequently asked questions:

- Since BNL is a Superfund site, how can the lab produce water that is safe enough for everyone — including children — to drink?
- Why are some drinking-water fountains on site out of service, and why is the only drinking water in some work areas bottled water?
- How often is the Lab's drinking water tested, who tests it, what is it tested for, and what is found in the water?
- Is BNL's drinking-water supply safe from terrorist attack?
- Why is chlorine added to the Lab's water?

Three of the fact sheets discuss the following water-quality issues:

- Getting the iron out of our water mains: Regular hydrant flushing is reducing "rusty" water around site.
- Getting the lead out of your faucet: Let your cold-water tap run before using it for drinking or cooking.
- Keeping your water cooler contamination-free: Clean your bottled-water cooler with every bottle change *(see story on page 2)*.

Also for Healthfest 2002, a small display and companion flyer were developed on lead leaching from plumbing brass, specifically the water faucets and supply valves installed in household and other plumbing systems before the 1986 and 1996 amendments to the federal Safe Water Drinking Act.

Some 11 percent of survey participants suggested fixing or replacing the plumbing, something which is being done if problems are found either through site-wide compliance testing

*(continued on page 2)*

*2002 Analytical Data*

## Inorganic Chemicals, Bacteria, Radioactivity

*The following values for water-quality indicators, metals, and other compounds were measured in samples of finished BNL drinking water. Data for radioactivity are the maximum values obtained from samples drawn at BNL's six potable drinking-water wells. The ten compounds noted in this table as being detected in BNL water are discussed on page 4.*

**WATER-QUALITY INDICATORS**

| *compound* | *BNL sample* | *MCL* |
|---|---|---|
| tot. coliform | ND | ND |
| color | <MDL | 15 units |
| odor | 0 units | 3 units |
| chlorides | 27.3 mg/l* | 250 mg/l |
| sulfates | 8.5 mg/l* | 250 mg/l |
| nitrates | 0.4 mg/l* | 10 mg/l |
| nitrites | <MDL | 1.0 mg/l |
| alkalinity | 39.0 mg/l | NS |
| ammonia | <MDL | NS |
| calcium | 11.0 mg/l | NS |
| conductivity | 285 μmhos/cm | NS |
| cyanide | <MDL | NS |
| pH | 6.3-9.1 SU | NS |
| methylene blue active substances | <MDL | NS |

**METALS**

| *compound* | *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 | 0.17 mg/l* | 0.3 mg/l |
| lead | 6.2 μg/l* | 15 μg/l |
| manganese | 0.12 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 | 15.6 mg/l* | NS |
| thallium | <MDL | 2.0 μg/l |
| zinc | 0.04 mg/l* | 5.0 mg/l |

**OTHER**

| *compound* | *BNL sample* | *MCL* |
|---|---|---|
| asbestos | <MDL | 7 MFL |

**RADIOACTIVITY**

| *compound* | *BNL well max.* | *MCL* |
|---|---|---|
| gross alpha | 2.49 pCi/l* | 15 pCi/l |
| beta | 3.12 pCi/l* | 50 pCi/l |
| 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.
SU: standard units.
* discussed in "14 Compounds Detected in BNL's Drinking Water," on page 4.

*3rd Annual BNL Drinking-Water Taste-Test*

## On-Site Nature's Best Bottled Water Takes Top Honors, Beating Three 'City' Brands

After two days of water tasting last October, Culligan Nature's Best, which is the bottled water used on site in areas without plumbing or where plumbing problems prohibit the use of faucet water for drinking or cooking, emerged in first place out of the four "brands" of drinking water that were competed in the Lab's third annual blind taste-test of drinking water. Held during Healthfest 2002, the contest was judged by 200 BNL employees, facility-users, guests, and on-site residents who had visited the BNL Drinking-Water Quality Booth during the health, fitness & safety fair in Berkner Hall on October 23 & 24, 2002.

This is the first time in the three years that the contest has been held that a bottled water has earned top honors. It is also the first year that Culligan Nature's Best has competed, since, at the time of the previous two contests, Aqua Cool was the bottled water provided on site.

In 2000, the winning water came from Dix Hills Water District, while the 2001 first-place water was drawn from the Greenlawn Water District.

Nature's Best water is "city" water that is bottled at facilities certified by the New York State Health Department. For this contest, the municipal water supply that was the source of the water was Suffolk County Water Authority (SCWA), and the water was bottled in Commack. It is interesting that, when SCWA water that came directly from the tap was put to the taste test in 2000, it placed second, behind Dix Hills, but ahead of BNL water, which placed third that year.

The three "city" water entries in the most recent contest were Village of Greenport Water Supply and Riverhead Water District, plus water from the BNL water supply system. While the other three waters offered for tasting were from the same source during each of the two days of the contest, the BNL water offered was from a different source each day: On Wednesday, October 23rd, the BNL water was drawn from well 12, while on Thursday, October 24th, water from the Lab's Water Treatment Facility (WTF) was offered for tasting.

BNL has six drinking-water wells (see page 3): Wells 4, 6, and 7 provide source water that is high in iron, so it must be "finished" at the Water Treatment Facility before distribution. Source water from wells 10, 11, and 12 is low in iron; so, while it does not need to be treated at the WTF, it is passed through carbon filters as a precaution and is chlorinated before entering the supply system. Last year, the majority of water supplied to the site came from wells 4, 6, and 7 via the WTF.

So, the line up of 2002 taste-test contestants and their final scores were:

| **Wednesday, October 23** | **Thursday, October 24** |
|---|---|
| A: BNL well 12 — 176 | A: BNL Water Treatment Facility — 254 |
| B: Greenport — 268 | B: Greenport — 248 |
| C: Nature's Best — 333 | C: Nature's Best — 265 |
| D: Riverhead — 306 | D: Riverhead — 223 |

While Nature's Best finished first both days, on the first day, the second, third, and fourth place finishers, respectively, were: Riverhead, Greenport, and BNL well 12 water. On the second day, BNL water from the WTF placed second, followed by, respectively, Greenport and Riverhead.

So why, as noted on the taste-test ballots, was BNL well-12 water criticized for tasting "earthy" and having a "definite after-taste," while the Lab's WTF water was praised for being "pleasant" and "good"? The WTF staff is looking into the taste difference, with the current theory being that the cause is a reaction between the carbon filter material and the chlorine.

*2002 Analytical Data*

## Organic Compounds, Pesticides, Micro-Extractables

*With two exceptions, as noted in the table below and discussed on page 4, the following compounds were not detected in the water from the Lab's six drinking-water wells and the finished water from 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 |
| trichloroethane | <MDL | 5 |
| 1,2-dichloropropane | <MDL | 5 |
| dibromomethane | 1.5* | 5 |
| trans-1,3-dichloropropene | <MDL | 5 |
| cis-1,3-dichloropropene | <MDL | 5 |
| 1,1,2-trichloroethane | <MDL | 5 |
| trihalomethanes | 17.1* | 100 |
| 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 tert. butylether | <MDL | 50 |
| lindane | <MDL | 0.2 |
| heptaclor | <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 |
| hexachlorcyclopentadiene | <MDL | 5 |
| di(2-ethylhexyl)phthalate | <MDL | 50 |
| di(2-ehtylhexyl)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 |
| carbarl | <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 |
| alachor | <MDL | 2 |
| simazine | <MDL | 50 |
| atrazine | <MDL | 3 |
| metolachor | <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 "14 Compounds Detected in BNL's Drinking Water," on page 4.

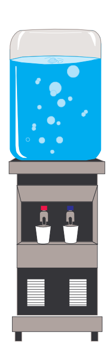
## Lesson Learned: Keep Your Water Cooler Free of Contamination

For the past three years, the ever popular drinking-water taste-test has been held by the BNL Drinking-Water Quality Committee during the two-day Healthfest health, safety, and fitness fair. So, that means that, every year in preparation for the taste-test, the staff of the Water Treatment Facility (WTF) collects samples of the "brands" of the water to be tasted and borrows water coolers from around site to dispense the different water.

Before being used for the taste-test, each and every one of these coolers, however, has required and received a thorough cleaning because of the build-up of dirt and mold.

Some of the on-loan coolers are less hygienic than others, but none was worse than one of the coolers borrowed two years ago. To put it mildly, that cooler was grossly contaminated. Upon its return, the problem was pointed out to the staff of the office that owned it.

Following that revelation, a Lesson Learned Communication has been published (https://sbms.bnl.gov/lessons/ll72/ll72d321.htm). As part of learning that lesson Lab-wide, a water-cooler cleaning procedure was developed by Ken Erickson of the Safety & Health Services Division (www.bnl.gov/esh/shsd/ih/PDF/Bottled_Water_Hygiene_Procedure.pdf) and a fact sheet was prepared on the importance of keeping water coolers contamination-free (www.bnl.gov/bnlweb/pubaf/water/quality.htm). Links to this procedure and fact sheet will now be distributed annually, when a memo will be issued to all BNL bottled-water requesters, reminding them that coolers should be cleaned regularly.



As the now-published Lessons Learned Communication, in part, notes:

- Never assume that a bottled water cooler is clean and/or disinfected
- Ensure that regular and effective cleaning and disinfection of the bottled-water cooler is performed, using an effective and approved procedure on the recommended schedule
- Wash hands before using a water cooler; keep hands, glasses, cups, sports bottles, and other containers out of contact with the water cooler's spigots; and encourage other cooler users to do likewise.

## Water-Quality Survey Follow-up

*continued*

or through the committee's new quality assurance program, that was instituted following this recommendation.

Another 8 percent of survey-takers recommended continued testing, something which, in addition to being performed for compliance or quality assurance, is also done when departments request and pay for testing of specific water fountains or taps.

Seven percent urged continued participation in Healthfest, a suggestion that has been accepted by the committee. Another 7 percent advocated removing bottled water, while some 6 percent urged the use of only bottled water. Since, in most locations, bottled water is provided because there is no plumbing or because the type or condition of the plumbing has resulted in water problems, as discussed earlier, removing bottled water is not always feasible. In buildings with compliant plumbing, bottled water is not necessary, since BNL's tap water is of high quality.

Taking the bottled-water issue one step further (see story above), the committee considered how better to ensure the quality of bottled water from coolers, as required by the U.S. Occupational Safety & Health Administration. As a result, the committee expanded its membership to include the Safety & Health Services Division, which has produced a water-cooler cleaning procedure as a companion to the Lesson Learned Communication and fact sheet on water-cooler cleanliness.

Some 6 percent of survey participants suggested replacing non-working water fountains and/or installing more water fountains around site. BNL fountains taken out of service in 1988, following a proposed federal recall of fountains leaching lead from their plumbing, have not been replaced due to a lack of funding, which is something that the committee is also exploring.

**BNL Water Quality Consumer Confidence Report**

This annual issue of The Bulletin is published by the Community, Education, Government & Public Affairs Directorate with the assistance of the Environment & Waste Management Services Division and the Plant Engineering Division, for distribution to the approximately 3,500 on-site drinking-water consumers served 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.

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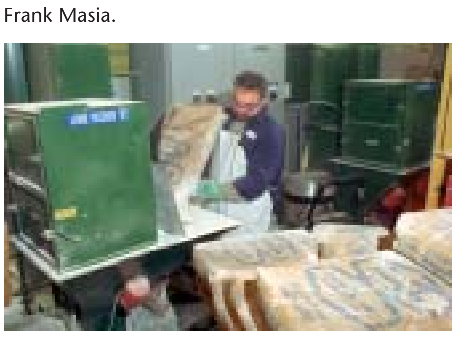
# Where Does BNL's Water Come From? How Is Our Water 'Finished'?

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

**1B. CARBON FILTRATION AT WELLS 10, 11, and 12** is designed to remove volatile organic compounds before the low-iron water from these three wells directly enters the drinking-water distribution system. Noting the pressure of the carbon filtration system is Richard Lutz. CN10-147-00

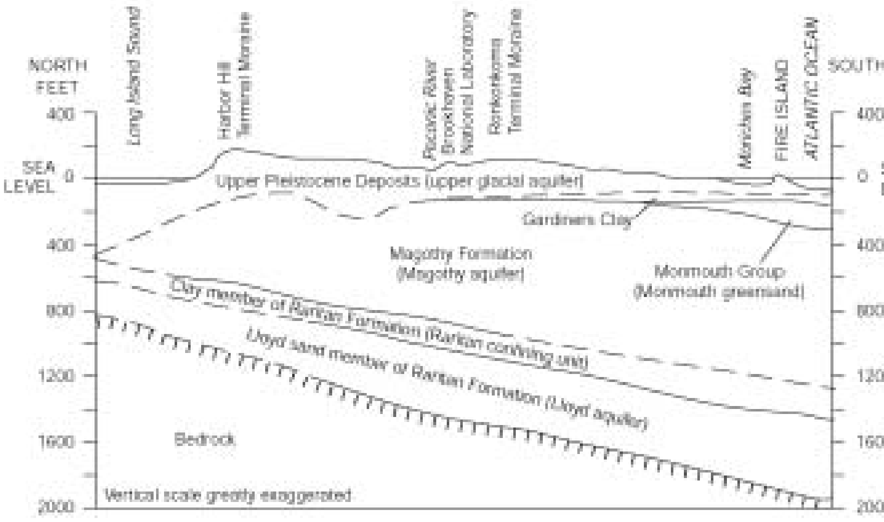
**2. CHLORINATION** of water from wells 4,6, and 7 is performed at this point using sodium hypochlorite to kill bacteria and oxidize the iron in the water. Iron removal by oxidation and filtration reduces the water's iron concentration from 3 to 4 milligrams per liter (mg/l) to the "finished" water's 0.03 mg/l. Inspecting a liquid sodium hypochlorite storage tank is Joe Tullo. CN10-143-01

**3. AERATION TANK** reduces carbon dioxide gas and aids in the oxidation of iron. At the aeration tank, Steve Barcelo (right) describes the action to Frank Masia. CN10-143-00



**4. LIME** is added after aeration (no. 3) and before retention (no. 6) to raise the pH and soften the water. Feeding lime into the hopper is Steve Barcelo. CN10-36-00

**5. POLYMER** is also added to the water after aeration to aid in a process called flocculation, whereby very small hydroxide particles stick together to form larger particles, called floc, which are more easily settled and removed (see no. 6). The polymer is mixed with the water in a rapid-mix tank. Steve Barcelo (left) is seen measuring the polymer, while Tom Boucher prepares to mix. CN10-37-00




All of the water supplied by BNL comes from beneath the ground, and so is referred to as groundwater. Groundwater is stored in a sandy, geological formation known as an aquifer. Water in the aquifer originates as precipitation that percolated down through the soil.

The Long Island aquifer system is made up of three primary formations lying one on top of the other (see diagram above): from the surface to about 150 feet down is the Upper Glacial, from 150 to 1,000 feet is the Magothy, and from 1,000 to 2,000 feet is the Lloyd. Drawing up to 1,000 gallons per minute, the Lab's six drinking-water wells tap into the Glacial aquifer.

The Lab's "finished" water is produced with pride by the staff of BNL's Water Treatment Facility (WTF) of the Plant Engineering (PE) Division, using "federal public water system No. 511891." This is the only source on site of what is called potable water for BNL's transient and resident population of approximately 3,500 people.

The centerpiece of the Lab's drinking-water system is the Water Treatment Facility (WTF), located in and around Bldg. 624 on Upton Road. Able to handle 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. Only the water from three wells (numbered 4, 6, and 7) is delivered to the WTF because that water is high in iron. Water from the other three wells (numbered 10, 11, and 12) is low in iron, so that water is distributed directly, after passing through activated carbon filters.

Drinking-water production is the role and responsibility of Water System Supervisor Tony Ross, who holds a New York State Department of Health (NYSDOH) grade IA certification. Ross is assisted by six water-treatment engineers, each having NYSDOH grade IIA certification. They are: Steve Barcelo, Tom Boucher, Jack Kulesa, Richard Lutz, Phil Pizzo, and Joe Tullo. Also on the WTF staff is Greg Stawski, who is an operator in training. WTF operations are overseen by William Chaloupka, PE Assistant Division Manager for Operations & Environment.

The flow of water through the Lab's treatment system and the on-the-job performance of the WTF staff are shown in photos by Roger Stoutenburgh and described starting at top left.

**6. RETENTION TANK** holds the water long enough to allow the chemicals time to react and form floc. To aid in the formation of floc, the water is then sent to a slow-mix tank. At the retention tank are: (from left) Steve Barcelo, Jack Kulesa (who is checking for floc particles), and Richard Lutz, plus Frank Masia. CN10-35-00

**7. FILTRATION** is performed, using what is called a rapid sand filter made up of eight filter cells containing sand and anthracite. Inspecting the valves in the filtration valve gallery are: (front to back) Jack Kulesa, Richard Lutz, and Steve Barcelo. CN10-39-00

**8. WET WELL** stores the filtered water before it is pumped into the air-stripping towers. While Jack Kulesa (background) inspects the wet-well pump seals, Richard Lutz works on a check valve. CN10-38-00

**9. AIR-STRIPPING TOWERS** remove any volatile organic compounds (VOCs) from the water undergoing the WTF process by spraying the water down over whiffle ball-like fill while air flows upward through the water spray. Inspecting the towers from the top is Steve Barcelo. Frank Masia looks on from below. CN10-34-00

**10. CLEAR WELL** stores up to 250,000 gallons of what is now called "finished" water before its final chlorination and distribution. Seen taking a water sample at the clear well are Jack Kulesa (left) and Richard Lutz. CN10-146-00

**11. HIGH-SERVICE PUMPS** send finished water from the WTF to the two water towers on site. Adjusting the flow rate of a high-service pump is Steve Barcelo. CN10-42-00

**12. ONE-MILLION-GALLON WATER STORAGE TOWER**, as viewed from its base, is the larger of the Lab's two water towers. Built in 1985, and located at Cornell and North Sixth Street, this tank is 126 feet above the ground; its bowl is 75.5 feet in diameter. Located next to Police Headquarters, Bldg. 50, the other water storage tank holds 300,000 gallons and was built for the U.S. Army in 1941, when the site was Camp Upton. At a pressure of 55 to 70 pounds per square inch, water from the two towers is delivered on site via 45 miles of distribution pipe, which is a mix of cast iron dating from World War II Camp Upton, transite, plastic, and cement-lined ductile iron. When distribution pipe is added or replaced, cement-line ductile iron is used. CN10-44-00

**13. TESTING THE QUALITY OF BNL'S DRINKING WATER** at the WTF is Tom Boucher. The Lab's drinking water is tested in various locations weekly, monthly, quarterly, semi-annually, and annually, depending upon the specific test. Test samples are analyzed by certified laboratories, and results are reported to the Suffolk County Department of Health Services, which conducts its own annual tests of all county water systems. In addition, the results are delivered to BNL's Environmental Services Division, which ensures that the Lab's water is in compliance with all applicable regulations. The results are summarized in this publication, the Lab's annual Water Quality Consumer Confidence Report. CN10-41-00

## *Definitions of Terms Used in the Confidence Report*

- **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.
- **Treatment technique:** A required process intended to reduce the level of a contaminant in drinking water.
- **Micromhos per centimeter (μmhos/cm):** A measure of the ability of water to conduct electricity. Conductivity effectively is a measure of the concentration of ions, such as dissolved salts, in the water.
- **Milligrams per liter (mg/l):** Equals one part of liquid per million parts of liquid, or parts per million (ppm).
- **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 the presence of asbestos fibers longer than 10 micrometers.

# What Is in Our Drinking Water?

While sources of tap and bottled drinking water include rivers, lakes, streams, ponds, reservoirs, and springs, Long Island — including BNL — draws its drinking water from wells tapping into the aquifer (see story and diagram on page 4). As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, 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, and wildlife.
- **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, and/or farming.
- **Pesticides & herbicides:** substances for eliminating problem insects and plants, respectively; may come from a variety of sources such as agricultural operations, storm-water runoff, and/or residential uses.
- **Organic chemical contaminants:** natural and synthetic compounds, including volatile organic compounds (VOCs). These chemicals are by-products of industrial processes and petroleum production, and can also come from gas stations, storm-water runoff, and septic systems.
- **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 3). Regardless, drinking water — including bottled water — may reasonably be expected to contain at least small amounts of contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk (see below).

Some people may be more vulnerable to disease-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 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 lessen the risk of infection by cryptosporidium, giardia, and other microbial pathogens is 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.

# The 14 Compounds Detected in BNL's Drinking Water in 2002

As marked with an asterisk in the analytical data on page 2, the following 14 compounds were detected in BNL's drinking water in 2002. 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. As discussed above, the presence of contaminants does not necessarily indicate that the water poses a health risk.

The 14 compounds detected in BNL drinking water in 2002 were found at concentrations well below what are called the maximum contaminant level goal (MCLG) and the maximum contaminant level (MCL) (see definitions, page 3). Below is a discussion of the specific contaminants that were detected, the EPA's standards for each, and the likely sources and possible health effects. For more information, go to www.epa.gov/safewater/hfacts.html.

## MICROBES

**• TOTAL COLIFORM BACTERIA**

MCLG: 0 — MCL: any positive sample*
BNL max: 6 positive samples** — detected: July 11 & 15, 2002
BNL range: not detected to positive** — violation?: No

- ***major sources in drinking water:*** Naturally present in the environment
- ***possible health effects:*** Coliform are bacteria that are naturally present in the environment and are used as an indicator that other, potentially harmful bacteria may be present.

*NOTE: A violation occurs at systems collecting less than 40 samples per month when two or more samples of finished water are positive for total coliform bacteria.
**NOTE: The positive results were in samples of raw, not finished, water and resulted from the contamination of the sampling point.

## WATER-QUALITY INDICATORS

**• COLOR**

MCLG: none — MCL: 15 units
BNL max: 20 units*** — detected: July 11, 2002
BNL range: <5-20 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.

***NOTE: Color was noted in well water before its treatment at the Water Treatment Facility, where well water is finished to reduce color and iron concentration prior to its distribution around the site.

**• CHLORIDES**

MCLG: none — MCL: 250 mg/l
BNL max.: 24.4 mg/l — detected: July 11, 2002
BNL range: 14.1-24.4 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.

**• NITRATES**

MCLG: 10 mg/l — MCL: 10 mg/l
BNL max: 0.48 mg/l — detected: January 3, 2002
BNL range: 0.31-0.48 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:*** 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 blue baby syndrome.

**• SULFATES**

MCLG: none — MCL: 250 mg/l
BNL max.: 12.7 mg/l — detected: January 3, 2002
BNL range: 8.5-12.7 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 sulfate tends to form hard scales 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 nearer 750 mg/l.

## ORGANIC COMPOUNDS

**• DIBROMOMETHANE**

MCLG: none — MCL: 5 µg/l
BNL max: 1.5 µg/l — detected: July 11, 2002
BNL range: <MDL-1.5 µg/l — violation?: No

- ***major sources in drinking water:*** Dibromomethane is used in chemical synthesis, as a solvent, and as a component in fire-extinguisher fluids. It can be released to the environment during its production, transport, and/or use.
- ***possible health effects:*** Although the effects of its ingestion in drinking water have not been determined, dibromomethane is regulated as a principal organic contaminant by New York State, with n MCL of 5 µg/l.

**• TRIHALOMETHANES**

MCLG: none — MCL: 80 µg/l
BNL max: 17.1 µg/l — detected: July 11, 2002
BNL range: <MDL-17.1 µg/l — violation?: No

- ***major sources in drinking water:*** By-product of drinking-water chlorination, which is performed to kill harmful organisms. Trihalomethanes are formed when source water contains large amounts of organic matter.
- ***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 may have an increased risk of getting cancer.

## METALS

**• IRON**** †**

MCLG: none — MCL: 0.3 mg/l
BNL max.: 1.83 mg/l — detected: July 11, 2002
BNL range: 0.03-1.83 mg/l — violation?: No

- ***major sources in drinking water:*** Naturally occurring.
- ***possible health effects:*** Iron usually has no health effects. When iron reaches 1,000 µg/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 rust color. Staining can result at levels of 50 µg/l, which is lower than those detectable to taste buds. Therefore, MCL of 300 µg/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.

****NOTE: Color was noted in well water before its treatment at the Water Treatment Facility to reduce color and iron concentration prior to distribution around the site.
†NOTE: If iron and manganese are present, then the total concentration of both should not exceed 0.5 mg/l.

**• LEAD††**

MCLG: 0 µg/l — MCL: 15 µg/l
BNL max.: 1.5 µg/l — detected: July 2001
BNL range: <1.0-1.5 µg/l — violation?: No

- ***major sources in drinking water:*** Corrosion of household plumbing.
- ***possible health effects:*** 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: Sampling for lead and copper as regulated at the consumers' tap was done in 2000, and results were reported in the confidence report of 2001. Sampling will be repeated in July 2003 and reported in 2004.

**• MANGANESE†††**

MCLG: none — MCL: 0.3 mg/l
BNL max.: 0.04 mg/l — detected: July 11, 2002
BNL range: <0.01-0.04 mg/l — violation?: No

- ***major sources in drinking water:*** Naturally occurring; indicative of landfill contamination.
- ***possible health effects:*** An estimated safe and adequate daily dietary intake of manganese is 20-50 mg/l for adults. Those who consume large amounts of vegetables often consume even higher amounts of manganese. 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. 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 laundered clothing.

†††NOTE: If iron and manganese are present, then the total concentration of both should not exceed 0.5 mg/l.

**• NICKEL**

MCLG: none — MCL: none
BNL max.: 0.39 mg/l — detected: July 11, 2002
BNL range: <0.04-0.39 mg/l — violation?: No

- ***major sources in drinking water:*** As found in weathered ores and minerals, nickel is a potential atmospheric and surface-water pollutant that can enter groundwater as a result of surface runoff or percolation. Nickel is also a by-product produced and emitted by various energy and industrial processes.
- ***possible health effects:*** In 1995, pending EPA reconsideration of the limits on nickel, the MCL of 0.1mg/l and MCLG of 0.1 mg/l for nickel were remanded. This means that, while many water suppliers continue to monitor for nickel levels in their drinking water, there currently is no EPA legal limit on the amount of nickel in drinking water. The EPA has not found nickel to cause health effects from acute exposures above the previous MCL. Following chronic exposure to nickel above the former MCL, nickel has the potential to cause decreased body weight, heart or liver damage, or dermatitis. There is no evidence that nickel has the potential to cause cancer from lifetime exposures in drinking water.

**• SODIUM**

MCLG: none — MCL: none
BNL max.: 25.6 mg/l — detected: July 11, 2002
BNL range: 12.9-25.6 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.

## RADIOACTIVITY

**• GROSS ALPHA**

MCLG: 0 pCi/l — MCL: 15 pCi/l
BNL max.: 2.86 pCi/l — detected: October 23, 2002
BNL range: <0.58-2.86 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 getting cancer.

**• BETA/PHOTON EMITTERS**

MCLG: 0 pCi/l — MCL: 50 pCi/l††††
BNL max.: 1.86 pCi/l — detected: April 18, 2002
BNL range: <1.69-1.86 pCi/l — violation?: No

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

††††Note: The U.S. EPA and New York State consider 50 pCi/l to be of concern for beta particles.