the Bulletin

BROOKHAVEN NATIONAL LABORATORY

2005 BNL Water Quality Consumer Confidence Report

May 31, 2005

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

Last year, as in the past, Brookhaven Lab's drinking water was in full compliance with all county, state, and federal regulations. 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 exceeded 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 has 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 or secondary MCLs were reached or exceeded by BNL's drinking water in 2004, and there were no violations of any government regulations. Of the 113 drinking-water contaminants for which testing is required, only 13 compounds (see discussion on page 2 and tables on page 3) were detected in the Lab's drinking water in 2004.

Environmental Group Awards 2nd A+ to BNL's Water Report

For a second time, the independent Citizens Campaign for the Environment (CCE) has assigned the "outstanding" grade of A+ to BNL's annual Water Quality Consumer Confidence Report.

As CCE Executive Director Adrienne Esposito told the Lab's Community Advisory Council this January, in her opinion, BNL's consumer confidence report "is one of the best in the state."

CCE evaluated 78 reports issued by New York State drinking-water suppliers in 2004, which summarize water-quality data gathered in 2003. Grades ranged from A+ to F, and only seven reports state-wide, including the Lab's, received the highest mark.

In Nassau and Suffolk Counties, the 15 reports reviewed earned A+ to C+ grades, with the average being a little better than a grade of B. BNL's report was one of only three Long Island reports to earn the A+ grade.

In 2001, the last time that the CCE evaluated Brookhaven Lab's consumer confidence report, the CCE also awarded an A+ to the Laboratory's annual water-quality summary.

"The Citizens Campaign for the Environment has very high standards for the annual drinking-water quality consumer confidence reports, so Brookhaven Lab is very proud to have again received an A+," says the Laboratory's Deputy Director for Operations, Michael Bebon.

According to CCE, the highest grades are only given to water suppliers who are most effective in communicating legally required and other important water-quality information in an easy-to-read format.

CCE based its grades on an evaluation of up to 23 key components, including completeness of the information disclosed, clarity of the definitions, report readability, and its layout.

The CCE's full evaluation of consumer confidence reports is described in its document entitled "Annual Water Supply Statement Reports: A Report Card for the 2003 New York State Annual Water Supply Statements," which is available from CCE at (516) 390-7150 or at www. citizenscampaign.org/report_card_2003.htm.

Citizens Campaign for the Environment is an 80,000-member, not-for-profit, non-partisan advocacy organization working for the protection of public health and the natural environment.

— Marsha Belford

Bulletin Special Edition

2005 BNL Water Quality Consumer Confidence Report

This special edition of The Bulletin is Brookhaven National Laboratory's seventh annual Consumer Confidence Report, which is published to provide an overview of BNL drinking-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 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 for 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 local, state, and federal quality standards, PE has BNL's drinking water regularly tested using a state-approved independent laboratory. Testing results are reviewed by the Lab's Environmental & Waste Management Services (EWMS) Division, to ensure compliance with all regulatory standards. 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 2004 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

Pictured are the members of BNL's Drinking Water Quality Committee who make up the editorial board of BNL's "A+" annual consumer confidence report. They are: (from left) Bob Lee, Environmental & Waste Management Services (EWMS) Division; Marsha Belford, Community Relations Office; Bill Chaloupka, Plant Engineering Division; and Marcia Allocco, EWMS.

BNL Compiles With New Rule for Disinfectants, By-Products

Signed into law in 1974, the U.S. Safe Drinking Water Act (SDWA) established the nation's first-ever, mandatory regulation of public drinking-water supply systems. All public water systems are regulated by the SDWA, including Brookhaven's.

As of last January 1, 2004, BNL's water has been subject to compliance with a new SDWA requirement: the Stage 1 Disinfectants and Disinfection By-Products Rule.

Used to purify drinking water before it is distributed to consumers, disinfectants kill unwanted microorganisms found in source water. Worldwide, the most commonly used and effective disinfectants include chlorine, chloramine, and chlorine dioxide. A form of chlorine, sodium hypochlorite, is used at BNL for water disinfection.

The new rule establishes "maximum residual disinfectant levels" (MRDLs) and "maximum residual disinfectant level goals" (MRDLGs) for three chemical disinfectants: chlorine, chloramine and chlorine dioxide. In addition, the rule sets new "maximum contaminant levels" (MCLs) and "maximum contaminant level goals" (MCLGs) for four sets of by-products: total trihalomethanes, haloacetic acids, chlorite, and bromate.

As defined on page 2, a maximum residual disinfectant level is the highest concentration of disinfectant that is allowed in drinking water. The maximum residual disinfectant level goal is the concentration of disinfectant below which there is no known or expected health risk.

(continued on page 3)

MAXIMUM LEVELS AND GOALS FOR BNL'S DISINFECTANT AND BY-PRODUCTS

DISINFECTANT RESIDUAL	MRDLG mg/l	MRDL mg/l	COMPLIANCE BASED ON	BNL 2004 ANNUAL AVERAGE
chlorine	4	4	running annual average	0.8 mg/l
DISINFECTION BY-PRODUCTS	**MCLG mg/l**	**MCL mg/l**	**COMPLIANCE BASED ON**	**BNL 2004 ANNUAL AVERAGE**
total trihalomethanes[1] —		0.08	annual average	0.01 mg/l
• chloroform				
• bromodichloromethane	0.0			
• dibromochloromethane	0.06			
• bromoform	0			
haloacetic acids (five)[2] —		0.06	annual average	0.01 mg/l
• mono, di- & trichloroacetic acids	0.0			
• mono- & dibromoacetic acids	0.3			

[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.

What Is in Our Drinking Water?

While rivers, lakes, streams, ponds, and reservoirs are all sources of tap and bottled drinking water, BNL and the rest of Long Island draws drinking water from groundwater wells tapping into the aquifer (see story on page 3).

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 eliminating problem insects and plants, respectively; 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, 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, below).

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 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.

13 Parameters Detected in BNL's Drinking Water in 2004

As marked with an asterisk in the analytical data on page 3, the 13 parameters discussed below were detected in BNL's drinking water in 2004.

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. However, the presence of contaminants does not necessarily indicate that the water poses a health risk (see story, above).

The 13 parameters detected in BNL drinking water in 2004 were found at concentrations well below what are called the maximum contaminant level (MCL; see term definitions, below), so no violation of the Safe Drinking Water Act or any other applicable regulation occurred.

For more information on these contaminants, go to EPA's Web site: www.epa.gov/safewater/hfacts.html.

WATER-QUALITY INDICATORS

• CHLORIDES

MCLG: none | BNL max.: 29.2 mg/l | detected: July 9, 2004
MCL: 250 mg/l | BNL range: 10.8-29.2 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.

• COLOR

MCLG: none | BNL max: 50 units | detected: June 4, 2004
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. Color was noted in well water before its treatment at the Water Treatment Facility, where well water is finished to reduce iron concentration before it is distributed around site. The results from all samples collected at the tap were less than the MCL.

• NITRATES

MCLG: 10 mg/l | BNL max: 0.49 mg/l | detected: June 4, 2004
MCL: 10 mg/l | BNL range: <0.10-0.49 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 | BNL max.: 12.7 mg/l | detected: June 4, 2004
MCL: 250 mg/l | BNL range: 9.9-12.7 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 sulfates 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

• 1,1,1-TRICHLOROETHANE

MCLG: none | BNL max: 0.6 µg/l | detected: April 9, 2004
MCL: 5 µg/l | BNL range: <0.05-0.6 µg/l | violation?: No

- ***major sources in drinking water:*** Discharge from metal degreasing sites and other industrial facilities.
- ***possible health effects:*** Some people who drink water containing 1,1,1-trichloroethane in excess of the MCL over many years could have problems with their liver, nervous system or circulatory system.

• HALOACETIC ACIDS (FIVE)

MCLG: none | BNL max: 9 µg/l | detected: August 6, 2004
MCL: 60 µg/l | BNL range: 9 µg/l | violation?: No

- ***major sources in drinking water:*** By-product of water chlorination, which is performed to kill harmful organisms. Haloacetic acids (five) are formed when source water contains large amounts of organic matter. Haloacetic acids (five) is the sum of mono-, di- and trichloracetic acids, and mono- and dibromoacetic acids (see story, page 1).
- ***possible health effects:*** Some people who drink water containing haloacetic acids in excess of the MCL over many years may have an increased risk of getting cancer.

• TOTAL TRIHALOMETHANES

MCLG: none | BNL max: 43.3 µg/l | detected: April 9, 2004
MCL: 80 µg/l | BNL range: <1-43.3 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 (see story, page 1).
- ***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 | BNL max.: 4.33 mg/l | detected: April 9, 2004
MCL: 0.3 mg/l | BNL range: <0.02-4.33 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. Color was noted in well water before its treatment at BNL's Water Treatment Facility, where well water is finished to reduce iron concentration before it is distributed around site. The results from all samples collected at the tap were less than the MCL.

• LEAD

MCLG: 0 µg/l | BNL max.: 2.54 µg/l | detected: June 4, 2004
MCL: 15 µg/l | BNL range: <1.0-2.54 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.

• MANGANESE

MCLG: none | BNL max.: 0.21 mg/l | detected: July 9, 2004
MCL: 0.3 mg/l | BNL range: <0.01-0.21 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 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. 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.

• SODIUM

MCLG: none | BNL max.: 17.6 mg/l | detected: January 8, 2004
MCL: none | BNL range: 11.1-17.6 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

• BETA PARTICLE & PHOTON ACTIVITY

MCLG: 0 pCi/l | BNL max.: 2.4 pCi/l | detected: January 8, 2004
MCL: 4 mrem/yr | BNL range: <1.9-2.4 pCi/l | violation?: No

- ***major sources in drinking water:*** Decay of natural deposits and man-made emissions.
- ***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 particles and photon emitters in excess of the MCL over many years may have an increased risk of getting cancer. In 2003, the MCL was changed from a maximum concentration of 50 pCi/l to a dose 4 mrem/yr. Some 168 beta particles and photo emitters may be used to calculate compliance with the MCL. Since gross beta activity does not identify specific radionuclides, a dose-equivalent cannot be calculated.

• TRITIUM

MCLG: 0 pCi/l | BNL max.: 340 pCi/l | detected: April 21, 2004
MCL: 20,000 pCi/l | BNL range: <310-340 pCi/l | violation?: No

- ***major sources in drinking water:*** By-product of nuclear facility operations
- ***possible health effects:*** A radioactive isotope of hydrogen, tritium emits beta radiation and has a half-life of 12.26 years. Some people who drink water containing tritium in excess of the MCL over many years may have an increased risk of getting cancer.

Definition of Terms

- **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 disin-

LI's 'Sole Source' Aquifer Is BNL's Water Source

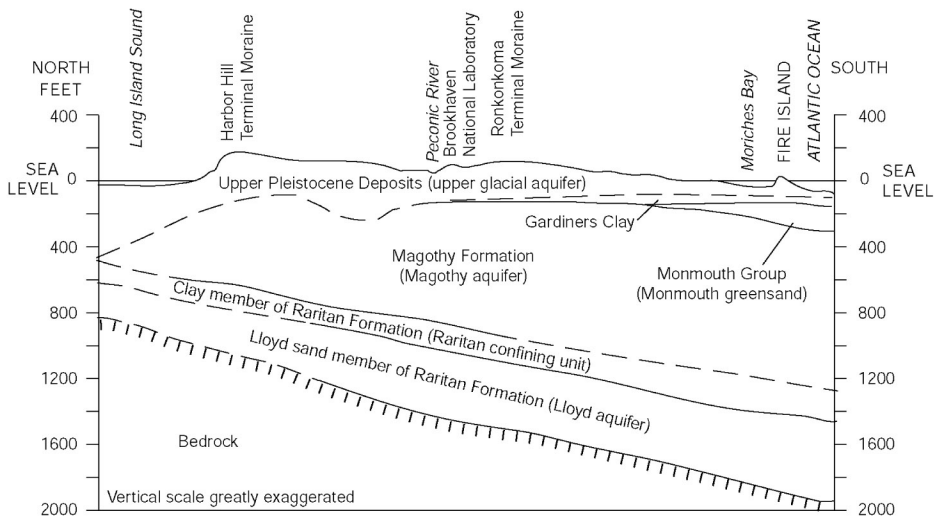
The Long Island aquifer system is made up of three primary formations, one lying on top of the other (see map, right). From the surface to about 150 feet down is the Upper Glacial aquifer, from 150 to 1,000 feet is the Magothy, and from 1,000 to about 2,000 feet is the Lloyd.

An aquifer is an underground, geological formation that contains water. Water in the aquifer originates as precipitation that percolated down through the soil, and this groundwater may be the source for natural springs or man-made wells.

Tapping into just 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, and fire protection. Last year, BNL pumped 509,927,000 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 made to the EPA by the Environmental Defense Fund.

To be designated, an aquifer must serve as the principle drinking-water source for more than 50 percent of the population in the area overlying the aquifer, and there must be no other drinking-water source that could physically, legally, or economically serve that population. — M.B.



2004 Analytical Data
Inorganic Chemicals, Bacteria, Radioactivity

The following values for water-quality indicators, metals and other parameters were measured in samples of well or finished water. Data for radioactivity are the maximum values obtained from samples drawn at BNL's six potable drinking-water wells. The 10 parameters noted in this table as being detected in BNL water are discussed on page 2.

WATER-QUALITY INDICATORS

indicator	*BNL sample*	*MCL*
total coliform	ND	ND
color*	50 units	15 units
odor	0 units	3 units
chlorides*	25.7 mg/l	250 mg/l
sulfates*	12.7 mg/l	250 mg/l
nitrates*	0.49 mg/l	10 mg/l
nitrites	<MDL	1.0 mg/l
alkalinity	48.2 mg/l	NS
ammonia	<MDL	NS
calcium	10.2 mg/l	NS
conductivity	256 µmhos/cm	NS
cyanide	<MDL	NS
pH	5.9-6.5 SU	NS
methylene blue active substances	<MDL	NS

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*	4.33 mg/l	0.3 mg/l
lead*	2.54 µg/l	15 µg/l
manganese*	0.21 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*	17.6 mg/l	NS
thallium	<MDL	2.0 µg/l
zinc	<MDL	5.0 mg/l

OTHER

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

RADIOACTIVITY

parameter	*BNL well max.*	*MCL*
gross alpha	<MDL	15 pCi/l
beta*	2.4 pCi/l	4 mrem/yr
tritium*	340 pCi/l	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 "The 13 Compounds Detected in BNL's Drinking Water in 2004," on page 2.

Source-Water Assessment Summarized

As required by the 1996 amendments to the Safe Drinking Water Act, the New York State Department of Health (NYSDOH) completed what is called a source-water assessment (SWA) of all public water systems, including BNL's.

In summary, the NYSDOH SWA of the area surrounding BNL's six drinking-water wells rates two of those wells to have 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 page 4) before the water is delivered to the consumer.

In addition, BNL has also identified that another well is susceptible to radionuclide contamination. To reduce the potential for impact, the Lab controls water-pumping operations in the source-water area. Besides testing 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 all standards, then it will immediately be removed from service .

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

New Disinfectants, By-Products Rule

continued

Reason for the New Rule

Daily, more than 200 million people in the U.S. consume water that has been disinfected. Animal research and epidemiological studies have found minor health risks due to the ingestion of disinfectants and their by-products.

As a result, amendments to the SDWA in 1996 required EPA to develop rules to balance the health risks of microbial pathogens versus those from chemical disinfectants and the by-products that are produced when disinfectants react with naturally occurring material in water.

Thus, to reduce drinking-water consumers' exposure to the three chlorine-based chemical disinfectants and many disinfection by-products, EPA put forth the Stage 1 Disinfectants and Disinfection By-Products Rule. It applies to all community water systems, such as BNL's, that add a chemical disinfectant in any part of the drinking-water treatment process.

To comply with the new rule, the Environmental & Waste Management Services Division amended the Lab's drinking-water sampling plan to ensure appropriate sampling of tap water, analysis and reporting of residual chlorine, the disinfectant used at the Lab, and of haloacetic acids and trihalomethanes, the by-products of disinfection that can be produced within BNL's potable-water system (see table, page 1).

Disinfection of U.S. Water Since 1908

Although disinfection of drinking water is common in the developed world, elsewhere it is not. As a result, microorganisms that cause life-threatening waterborne illnesses such as cholera, typhoid fever, and dysentery are found in the drinking water of many developing nations.

Around the world, these illnesses kill more than 25,000 people per day, or more than 9 million people each year, according to the World Health Organization. For instance, in the tsunami-affected areas of South Asia, these diseases threaten the disaster survivors because of the lack of clean, disinfected water.

Since 1908, when chlorine was first used in New Jersey to disinfect water, such highly communicable, epidemic-causing illnesses have virtually been wiped out in the United States. — Marsha Belford

fectant 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 (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).
- **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.

2004 Analytical Data
Organic Compounds, Pesticides, Micro-Extractables

With three exceptions noted in the table below and discussed on page 2, the following compounds were not detected in the water from the Lab's six drinking-water wells or 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*	0.6	5
carbon tetrachloride	<MDL	5
1,1-dichloropropene	<MDL	5
1,2-dichloroethane	<MDL	5
trichloroethane	<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*	43.3	100
haloacetic acids (five)*	9	60
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 "The 13 Compounds Detected in BNL's Drinking Water in 2004," on page 2.

BNL Drinking Water: Produced With Pride by the WTF's Certified Staff

While BNL's "raw" water comes from six on-site drinking-water wells tapped 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. They employ "federal public water system no. 511891" to make what is called potable water for BNL's daily transient and resident population of approximately 3,300 people.

The centerpiece of the Lab's drinking-water system is the WTF, 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.

Because it is high in iron, water from three wells (numbered 4, 6, and 7), which are located in the western part of the site, is delivered to the WTF.

Water from the other three wells (numbered 10, 11, and 12), which are located in the eastern part of the site, is low in iron, so it does not require treatment. Therefore, after passing through activated carbon filters and being chlorinated and pH-adjusted, that water is directly delivered to the system for distribution around site.

Drinking-water production is the responsibility of Water System Supervisor Tony Ross, who holds a New York State Department of Health (NYSDOH) grade IA certification. Ross is assisted by seven water-treatment engineers, each having NYSDOH grade IIA certification. In alphabetical order, they are: Steve Barcelo, Tom Boucher, Jack Kulesa, Richard Lutz, Phil Pizzo, Greg Stawski, and Joe Tullo. WTF operations are overseen by Bill Chaloupka, PE, who is Plant Engineering's 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's certified staff are shown in photos taken by Roger Stoutenburgh.

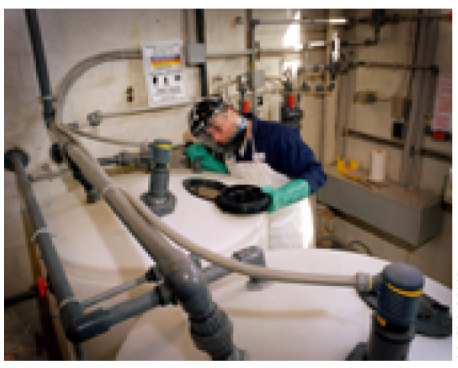
— Marsha Belford


CN10-144-00

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.


CN10-147-00

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.


CN10-143-01

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.


CN10-143-00

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.


CN10-36-00

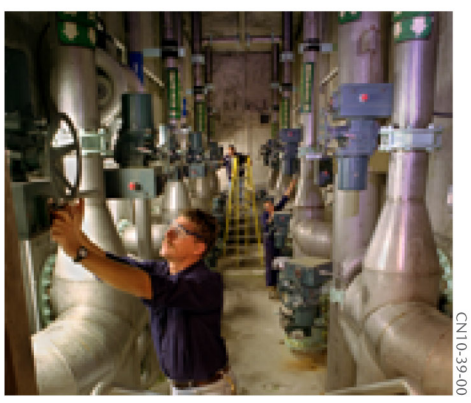
4. LIME is added after aeration (no. 3) and before retention (no. 6) to raise the pH and soften the water. Feeding lime into the hopper is Steve Barcelo.


CN10-37-00

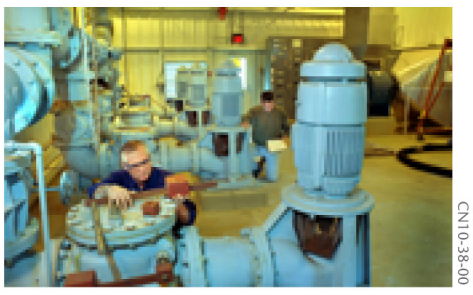
5. POLYMER is also added to the water after aeration to aid in a process called flocculation, whereby very small hydroxide particles stick together to form larger particles, called floc, which are more easily settled and removed (see no. 6). The polymer is mixed with the water in a rapid-mix tank. Steve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


CN10-35-00

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.


CN10-39-00

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


CN10-38-00

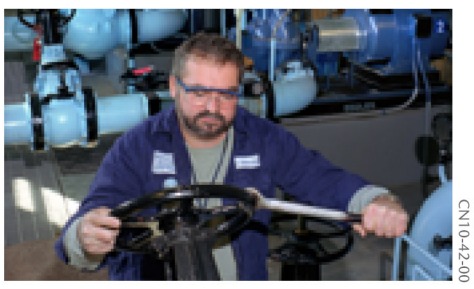
8. WET WELL stores the filtered water before it is pumped into the air-stripping towers. While Jack Kulesa (background) inspects the wet-well pump seals, Richard Lutz works on a check valve.


CN10-34-00

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.


CN10-146-00

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 Richard Lutz (left) and Jack Kulesa.


CN10-42-00

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.


CN10-44-00

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. Water from the two towers is delivered on site at a pressure of 55 to 70 pounds per square inch via 45 miles of distribution pipe. The piping is a mix of cast iron dating from World War II Camp Upton, transite, plastic, and cement-lined ductile iron. When pipe is added or replaced, cement-line ductile iron is used.


CN10-41-00

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 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 public water systems in the county. BNL results are also delivered to BNL's Environmental & Waste Management 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.

BNL Water Quality Consumer Confidence Report

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