MASSACHUSETTS WATER RESOURCES AUTHORITY
*100 First Avenue, Charlestown Navy Yard, Boston, MA 02129*

# WATER QUALITY UPDATE

## An Analysis of May 2008 Sampling Data

*For more information, please contact MWRA at (617) 242-5323, or visit www.mwra.com.*

## May 2008 Highlights

•**MWRA achieved CT disinfection requirements for the month** at the Ware Disinfection Facility and the Carroll Water Treatment Plant. CT results appear on Page 5. No community violated the Total Coliform Rule criteria. See Page 7.

•**Tap Water Delivers! MWRA began mailing the Annual Water Quality Report to consumers early June.** A copy is also available on-line at **www.mwra.com**.

•**As of June 19th, summer mono-chloramine residual levels have been increased.** MetroWest communities may see levels up to about 3 mg/l and metroBoston communities as high as 2.5 mg/l.

•**Annual Review of Giardia and Cryptosporidium testing**. See Page 10.

•**Did you know** that MWRA's web site has an archive of Monthly Water Quality Updates from 2001 onward at **http://www.mwra.com/monthly/wqupdate/qual3wq.htm**?

•**Be a green reader – get your copy electronically.** E-mail Joshua.Das@mwra.state.ma.us.

**We are continually updating the report. Let us know what you think *(617) 242-5323***

**Call *(617) 242-5323 or email Joshua.Das@mwra.state.ma.us***

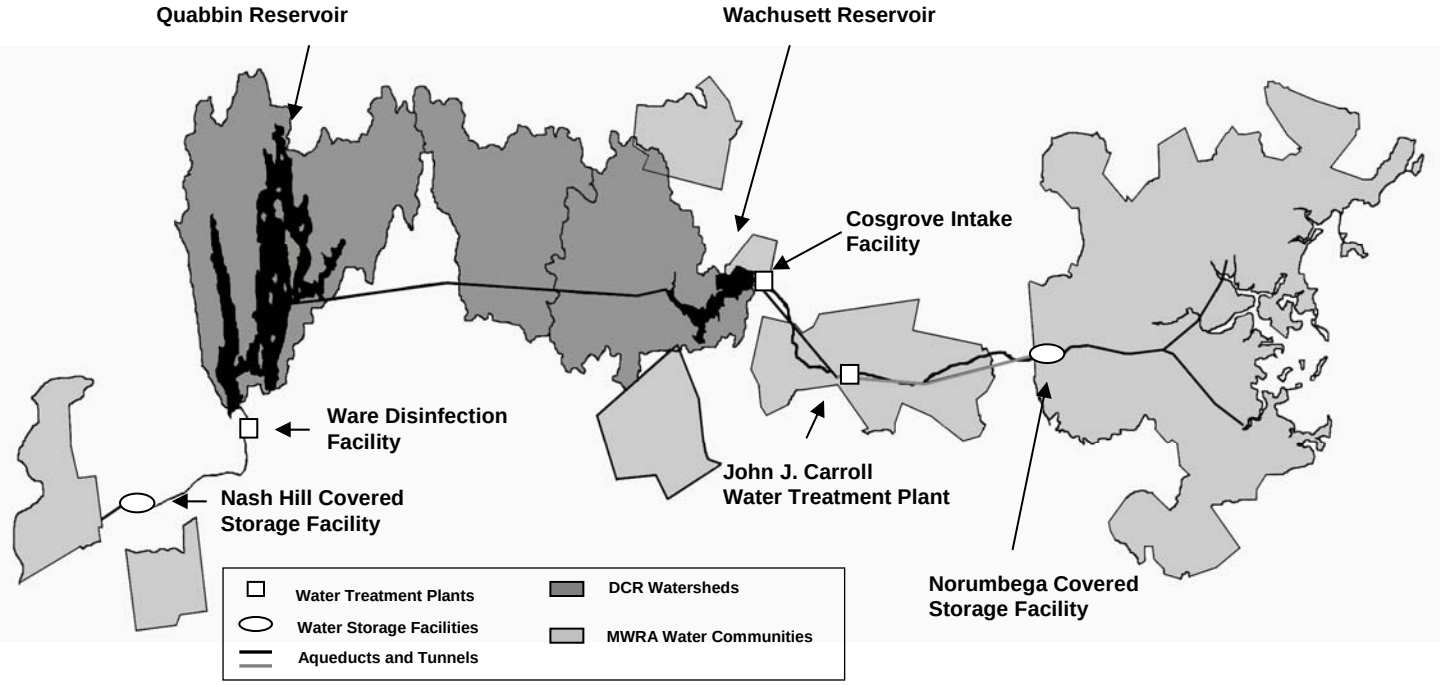
**Release Date: June 20, 2008**

**Water Quality Update**
This is a monthly report containing information about the quality of water supplied by MWRA. It provides a more detailed review of water quality than the annual water quality report that is mailed each June to customers in our service area. The report is available at www.mwra.com.

**The Water System**
The MWRA supplies wholesale water to local water departments in 50 communities, 44 in greater Boston and MetroWest, three in Western Massachusetts, and as a back-up supply for three others. Each municipality is responsible for distributing the water within its own community. More than two million people are served by the MWRA water supply system.

Quabbin Reservoir is the primary source of water for our system and one of the country's largest water supply impoundments, with a capacity of 412 billion gallons. Quabbin water represents source water for the Chicopee Valley Aqueduct (CVA) system. Water is transferred from Quabbin Reservoir to the 65 billion gallon Wachusett Reservoir in Clinton via the Quabbin Aqueduct. Wachusett water represents source water for MetroWest and Metropolitan Boston communities. The watershed areas of the Quabbin and Wachusett Reservoirs total 401 square miles. The Department of Conservation and Recreation (DCR), which manages the watersheds, and MWRA are committed to protection of the water supply through aggressive watershed protection as the first line of defense against water contamination. Three-quarters of the watersheds are protected lands and over 80% are either forest or wetlands.

The map below indicates the location of reservoirs, treatment facilities, and service communities.




**Indicators of Water Quality**

Tests are conducted on water sampled at the source reservoirs (source or “raw water”) and also on water after treatment (‘treated water”). MWRA routinely uses six general indicators of water quality: microbial, corrosiveness, disinfection by-products, turbidity and algae, disinfectant residual, and mineral analysis. Testing frequencies vary by parameter.

The Federal Safe Drinking Water Act (SDWA) sets standards for source and treated water quality. The standards relate to coliform, turbidity, watershed protection, disinfection and disinfection by-products, over 120 potential chemical contaminants, and waterborne disease outbreaks. MWRA monitors for these parameters on schedules ranging from daily to annually.

Customer communities must also meet certain standards under the SDWA concerning distribution of treated drinking water. The Total Coliform Rule (TCR) helps to alert communities to possible microbial contamination as well as the adequacy of residual disinfection within the local distribution system. MWRA tests over 2000 samples per month. Under the SDWA, a violation of the TCR occurs when greater than 5% of the samples in a community are positive for total coliform during a month.

# Source Water – Microbial Results
## May 2008

**Source Water - Microbial Results**

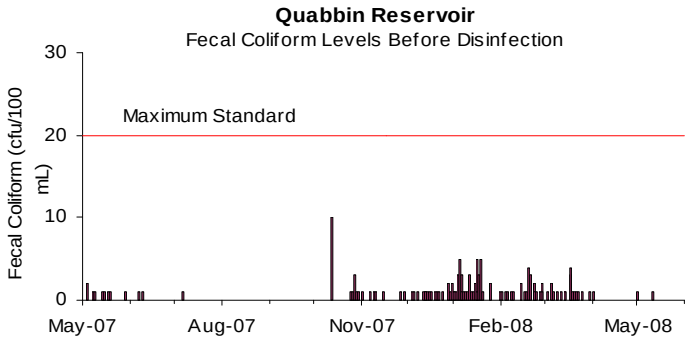
Total coliform bacteria are monitored in both source and treated water to provide an indication of overall bacteriological activity. Most coliforms are harmless. Fecal coliform, a subclass of the coliform group, are identified by their growth at temperatures comparable to those in the intestinal tract of mammals. They act as indicators of possible fecal contamination. The Surface Water Treatment Rule for unfiltered supplies requires that no more than 10% of source water samples prior to disinfection over a six-month period have more than 20 fecal coliforms per 100ml.

**Sample Site: Quabbin Reservoir**

Quabbin Reservoir water is sampled at the Ware Disinfection Facility (WDF) raw water tap before entering the CVA system. MWRA met the six-month running average standard for fecal coliform continuously at this location during the last year.

Two of the 30 samples were positive during April. None of the samples exceeded a count of 20 cfu/100ml.

For the current six-month period, 0.0% of the samples have exceeded a count of 20 cfu/100ml.



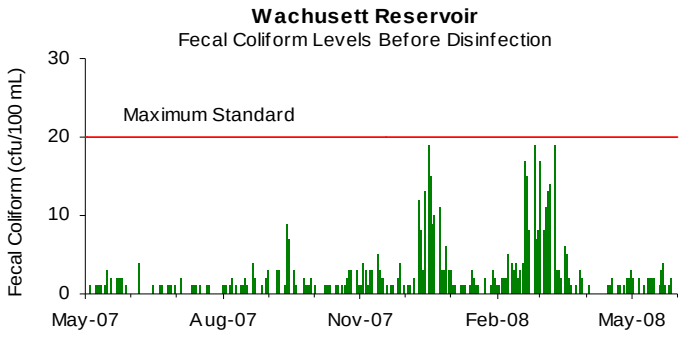

**Sample Site: Wachusett Reservoir**

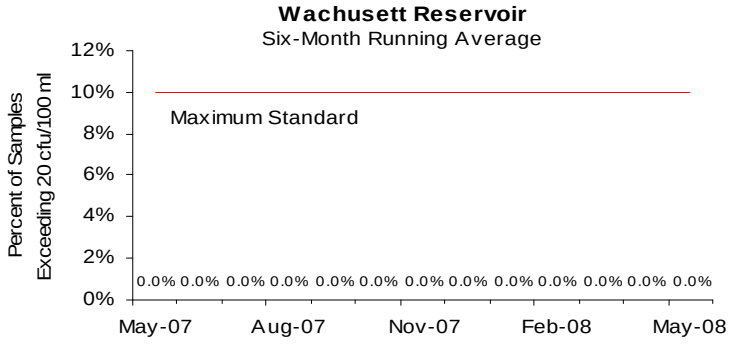
Wachusett Reservoir water is sampled before it enters the MetroWest/Metropolitan Boston systems at the Carroll Water Treatment Plant raw water tap in Marlborough.

Fecal coliform levels tend to increase during the winter because, when water bodies near Wachusett ice over, waterfowl seek open water. Many roost at Wachusett, which tends to freeze later in the year than smaller ponds nearby. DCR has an active bird harassment program to move the birds away from the intake area.

Eleven of the 22 samples were positive during April. None of the samples exceeded a count of 20 cfu/100ml.

For the current six-month period, 0.0% of the samples have exceeded a count of 20 cfu/100ml.



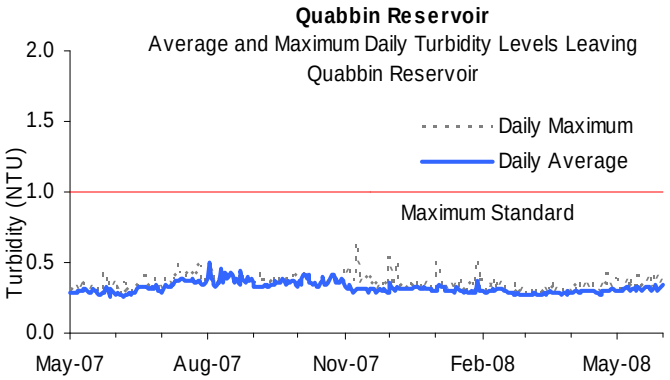



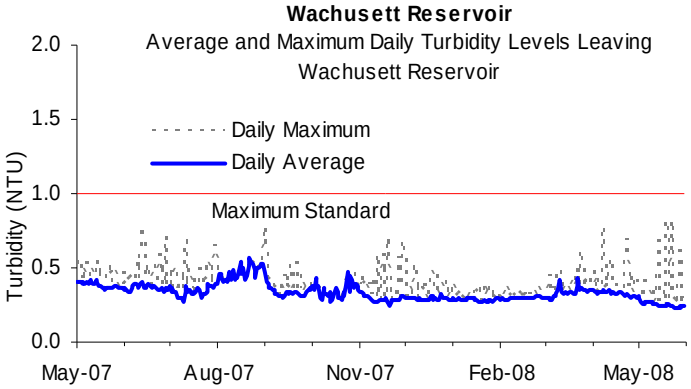
# Source Water – Turbidity and Algae Results
## May 2008

### Source Water – Turbidity Results

Turbidity is a measure of suspended and colloidal particles including clay, silt, organic and inorganic matter, algae and microorganisms. The effects of turbidity depend on the nature of the matter that causes the turbidity. High levels of particulate matter may have a higher chlorine demand or may protect bacteria from the disinfectant effects of chlorine, thereby interfering with the disinfectant residual throughout the distribution system.

Turbidity of Quabbin Reservoir water is monitored continuously using on-line analyzers at the Ware Disinfection Facility before chlorination. Turbidity of Wachusett Reservoir is monitored continuously at the Carroll Water Treatment Plant inlet (raw water line) before treatment. The Massachusetts Department of Environmental Protection standard for source water turbidity for unfiltered water supply systems is a maximum of 1.0 NTU; the EPA standard is a maximum of 5.0 NTU. Maximum turbidity results at Quabbin and Wachusett were within DEP standards for the month.

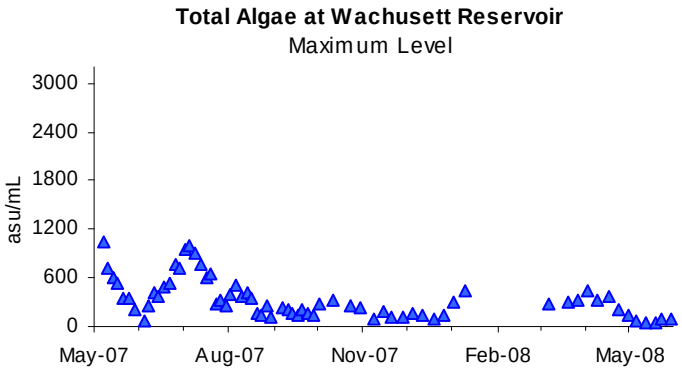


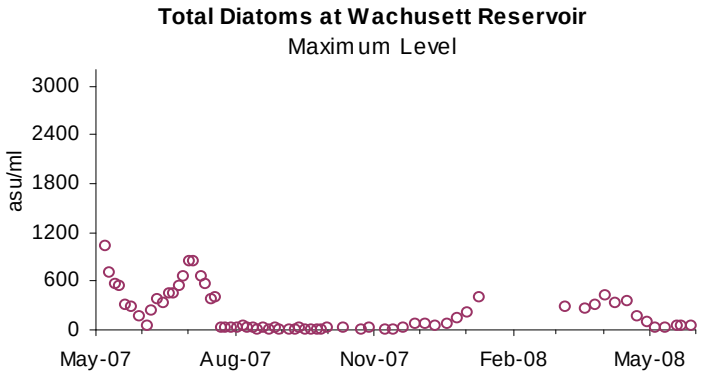




### Source Water – Algae Levels

Algal levels in Wachusett Reservoir are monitored by DCR and MWRA. These levels, along with taste and odor complaints, are used to make decisions on source water treatment for algae control. Taste and odor complaints at the tap may be due to algae, which originate in source reservoirs, typically in trace amounts. Occasionally, a particular species grows rapidly, increasing its concentration in water. When *Synura, Anabaena*, or other nuisance algae blooms, MWRA may treat the reservoir with copper sulfate, an algaecide.

None of the community complaints received during May from local water departments concerned taste and odor that may be due to algae.



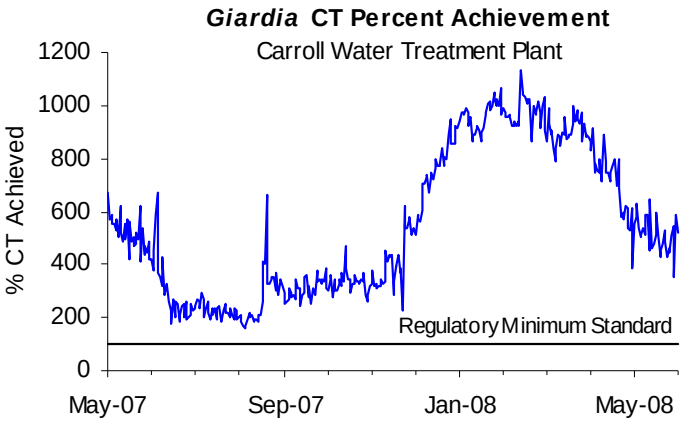
# Treated Water – Disinfection Results
## May 2008

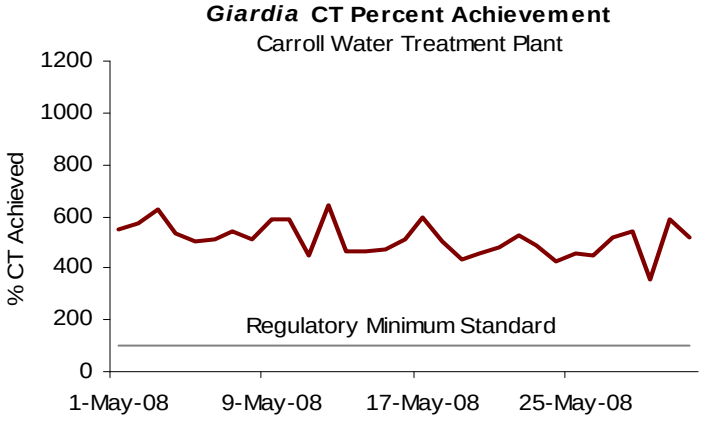
**Treated Water - Primary Disinfection**

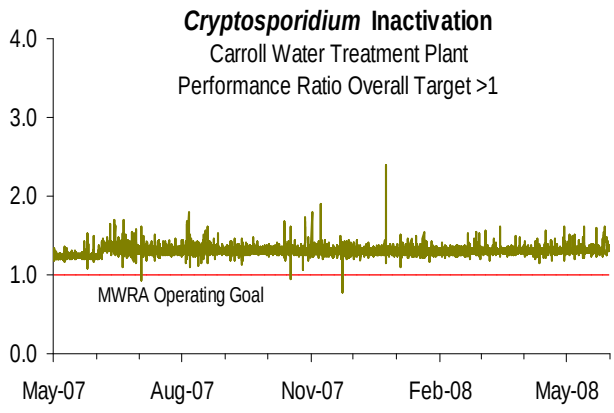
For Carroll Water Treatment Plant, MWRA reports on both regulatory required 99.9% inactivation for *Giardia*, and our voluntary operating goal of 99% inactivation for *Cryptosporidium*. The concentration (C) of the disinfectant over time (T) yields a measure of the effectiveness of disinfection. CT achievement for *Giardia* assures CT achievement for viruses, which have a lower CT requirement. The required CT for ozonated water varies with water temperature. MWRA calculates hourly CT inactivation rates and reports daily CT inactivation rates at maximum flow, as specified by EPA regulations.

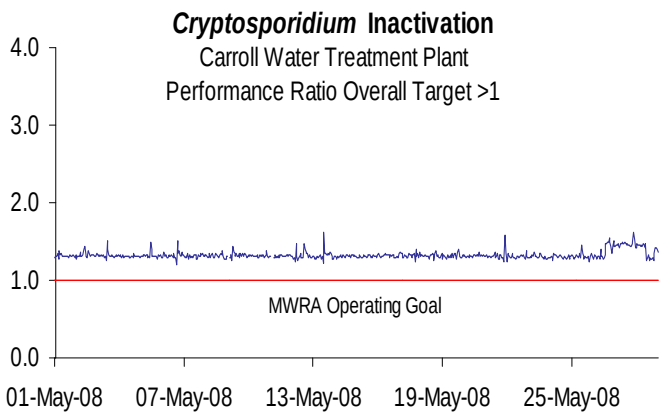
**Wachusett Reservoir – MetroWest/MetroBoston Supply:**
*Cryptosporidium* inactivation is reported as Performance Ratio (PR) to avoid confusion with the regulatory requirements. A PR of 1 demonstrates inactivation of 99% of *Cryptosporidium* based on site-specific data. PR was maintained above 1 at all times the plant was providing water into the system. CT calculation for *Giardia* is conservative; subsequently, more inactivation occurs than is being reported. Compliance with the *Giardia* standard is expressed as percent of required CT achieved; 100% is the minimum allowed.

CT was met each day in May, as well as every day for the last year. Ozone dose at Carroll Water Treatment Plant (CWTP) varied between 2.4 to 2.9 mg/L for May.



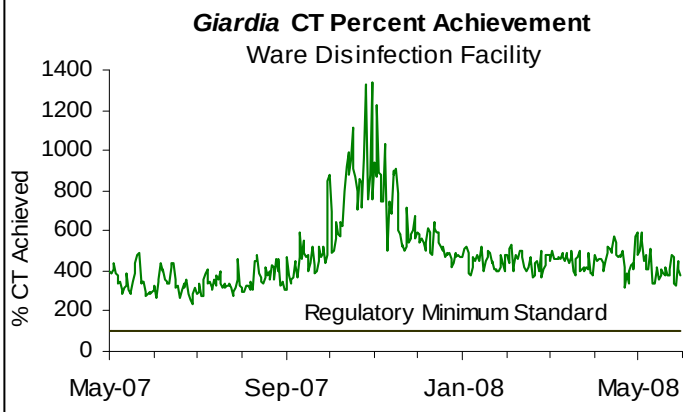



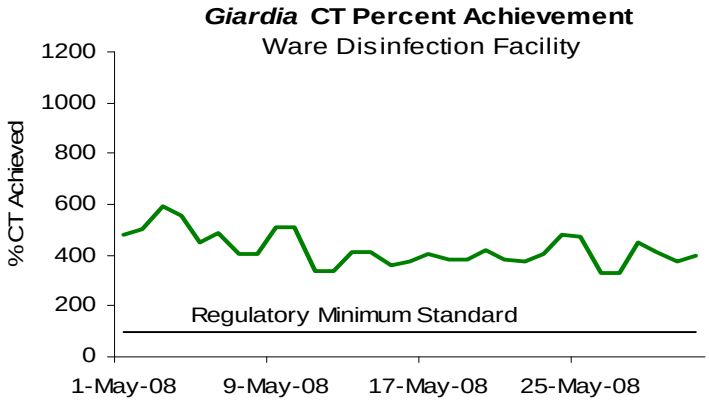



# Treated Water – Disinfection, pH and Alkalinity Results
## May 2008

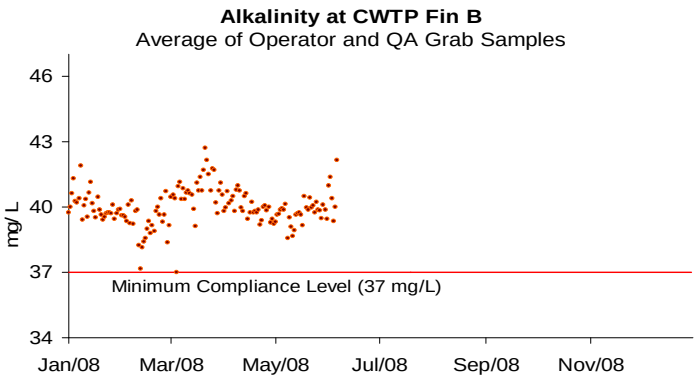
**Quabbin Reservoir at Ware Disinfection Facility (CVA Supply):**
Chlorine dose remained at 1.3 mg/L. CT was met each day in May, as well as every day for the last year.

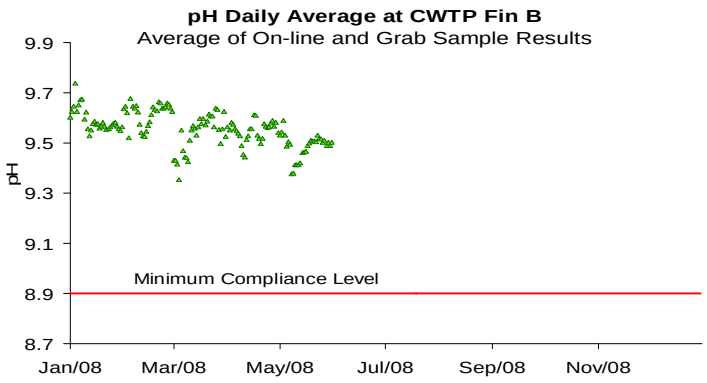



**pH and Alkalinity Compliance:**
MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity to minimize the leaching of lead and copper from service lines and home plumbing systems into the water. MWRA's target for distribution system pH is 9.3 and alkalinity is 40 mg/l. Per DEP requirements, daily samples from Carroll Water Treatment Plant (CWTP) Fin B site have a minimum compliance level of 8.9 for pH and 37 mg/L for alkalinity. In addition, quarterly samples from 27 distribution system taps have a minimum compliance level of 8.8 for pH and 37 mg/L for alkalinity. For no more than nine days in a six-month period may results be below these levels. Quality Assurance and operator staff test pH and alkalinity daily at CWTP Fin B. Distribution system samples are collected during March, June, September, and December.

In May and over the past six-months, no sample results were below the target levels.



# Bacteria & Chlorine Residual Results for Communities in MWRA Testing Program
## May 2008

While all communities collect bacteria samples for the Total Coliform Rule (TCR), 39 systems (including Deer Island and Westboro State Hospital) use MWRA's Laboratory for TCR compliance testing. These systems collect samples for bacteriological analysis and measure water temperature and chlorine residual at the time of collection. The other ten MWRA customer communities (including Lynn's GE plant) have their samples tested elsewhere and these towns should be contacted directly for their monthly results.

There are 141 sampling locations for which MWRA is required to report TCR results. These locations include a subset of the community TCR locations, as well as sites along MWRA's transmission system, water storage tanks and pumping stations.

The Safe Drinking Water Act (SDWA) requires that no more than 5% of all samples June be total coliform positive in a month (or that no more than one sample be positive when less than 40 samples are collected each month). Public notification is required if this standard is exceeded.

*Escherichia coli* (*E.coli*) is a specific coliform species that is almost always present in fecal material and whose presence indicates likely bacterial contamination of fecal origin. If *E. coli* are detected in a drinking water sample, this is considered evidence of a critical public health concern. Additional testing is conducted immediately and joint corrective action by DEP, MWRA, and the community is undertaken. Public notification is required if follow-up tests confirm the presence of *E. coli* or total coliform. MWRA considers a disinfectant residual of 0.2 mg/L a minimum target level at all points in the distribution system.

**Highlights**

None of the 1,813 community samples (0.0%) system-wide tested positive for confirmed total coliform during the month of May. None of the 714 MWRA samples (0.0%) tested positive for confirmed total coliform. No sample tested positive for *E.coli*. All 39 systems that submitted chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/L. Only 1.4% of the system samples had a disinfectant residual lower than 0.2 mg/L.

**TCR results by Community**

| Town | Samples Tested for Coliform (a) | Total Coliform # (%) Positive | *E.coli* % Positive | Public Notification Required? | May 2008 Minimum Chlorine Residual (mg/L) | May 2007 Minimum Chlorine Residual (mg/L) | May 2008 Average Chlorine Residual (mg/L) | May2007 Average Chlorine Residual (mg/L) |
|---|---|---|---|---|---|---|---|---|
| ARLINGTON | 69 | 0 (0%) | 0.0% | | 0.90 | 0.42 | 1.51 | 1.47 |
| BELMONT | 32 | 0 (0%) | 0.0% | | 1.14 | 0.77 | 1.53 | 1.46 |
| BOSTON | 239 | 0 (0%) | 0.0% | | 1.12 | 1.27 | 1.76 | 1.74 |
| BROOKLINE | 68 | 0 (0%) | 0.0% | | 0.80 | 1.27 | 1.72 | 1.77 |
| CHELSEA | 40 | 0 (0%) | 0.0% | | 1.10 | 0.58 | 1.65 | 1.65 |
| DEER ISLAND | 16 | 0 (0%) | 0.0% | | 1.42 | 1.40 | 1.66 | 1.69 |
| EVERETT | 40 | 0 (0%) | 0.0% | | 1.01 | 0.54 | 1.10 | 0.85 |
| FRAMINGHAM | 72 | 0 (0%) | 0.0% | | 0.66 | 0.67 | 1.62 | 1.57 |
| LEXINGTON | 36 | 0 (0%) | 0.0% | | 1.39 | 1.51 | 1.80 | 1.75 |
| LYNNFIELD | 6 | 0 (0%) | 0.0% | | 0.65 | 0.56 | 1.00 | 1.29 |
| MALDEN | 60 | 0 (0%) | 0.0% | | 1.20 | 1.09 | 1.25 | 1.20 |
| MARBLEHEAD | 24 | 0 (0%) | 0.0% | | 0.74 | 0.21 | 1.48 | 1.53 |
| MARLBOROUGH (b) | 53 | 0 (0%) | 0.0% | | 1.41 | 1.30 | 1.73 | 1.61 |
| MEDFORD | 68 | 0 (0%) | 0.0% | | 0.75 | 0.45 | 1.69 | 1.58 |
| MELROSE | 36 | 0 (0%) | 0.0% | | 0.01 | 0.06 | 0.91 | 0.92 |
| MILTON | 32 | 0 (0%) | 0.0% | | 1.17 | 0.46 | 1.49 | 1.36 |
| NAHANT | 10 | 0 (0%) | 0.0% | | 0.09 | 0.08 | 1.14 | 1.21 |
| NEEDHAM (b) | 43 | 0 (0%) | 0.0% | | 0.09 | 0.12 | 0.52 | 0.65 |
| NEWTON | 92 | 0 (0%) | 0.0% | | 1.20 | 1.16 | 1.85 | 1.90 |
| NORTHBOROUGH | 16 | 0 (0%) | 0.0% | | 0.94 | 0.60 | 1.54 | 1.39 |
| NORWOOD | 36 | 0 (0%) | 0.0% | | 0.98 | 0.51 | 1.48 | 1.33 |
| QUINCY | 92 | 0 (0%) | 0.0% | | 0.44 | 0.24 | 1.61 | 1.50 |
| READING | 40 | 0 (0%) | 0.0% | | 1.25 | 1.07 | 1.59 | 1.55 |
| REVERE | 65 | 0 (0%) | 0.0% | | 1.21 | 1.17 | 1.59 | 1.56 |
| SAUGUS | 32 | 0 (0%) | 0.0% | | 1.03 | 1.10 | 1.57 | 1.57 |
| SOMERVILLE | 81 | 0 (0%) | 0.0% | | 0.34 | 0.09 | 1.72 | 1.48 |
| SOUTH HADLEY FD1 (c) | 16 | 0 (0%) | 0.0% | | 0.05 | 0.03 | 0.34 | 0.28 |
| SOUTHBOROUGH | 10 | 0 (0%) | 0.0% | | 0.38 | 0.24 | 1.25 | 1.36 |
| STONEHAM | 35 | 0 (0%) | 0.0% | | 1.32 | 1.15 | 1.69 | 1.57 |
| SWAMPSCOTT | 18 | 0 (0%) | 0.0% | | 0.20 | 0.62 | 1.40 | 1.49 |
| WAKEFIELD (b) | 55 | 0 (0%) | 0.0% | | 0.53 | 0.61 | 1.25 | 1.34 |
| WALTHAM | 70 | 0 (0%) | 0.0% | | 0.10 | 0.41 | 1.68 | 1.45 |
| WATERTOWN | 50 | 0 (0%) | 0.0% | | 0.54 | 0.26 | 1.54 | 1.44 |
| WELLESLEY (b) | 36 | 0 (0%) | 0.0% | | 0.14 | 0.07 | 0.82 | 0.79 |
| WESTBORO HOSPITAL | 6 | 0 (0%) | 0.0% | | 1.09 | 1.16 | 1.49 | 1.48 |
| WESTON | 16 | 0 (0%) | 0.0% | | 1.07 | 0.16 | 1.70 | 1.44 |
| WINCHESTER (b) | 20 | 0 (0%) | 0.0% | | 0.15 | 0.15 | 0.87 | 0.81 |
| WINTHROP | 24 | 0 (0%) | 0.0% | | 0.50 | 0.18 | 1.43 | 1.10 |
| WOBURN (b) | 59 | 0 (0%) | 0.0% | | 0.04 | 0.26 | 0.81 | 0.92 |
| Total: | 1813 | | | | | | | |
| MASS. WATER RESOURCES AUTHORITY (d) | 714 | 0 (0%) | 0.0% | | 0.15 | 0.15 | 1.64 | 1.66 |

(a) The number of samples collected depends on the population served and the number of repeat samples required.

(b) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.

(c) Part of the Chicopee Valley Aqueduct System. Free chlorine system.

(d) MWRA sampling program includes a subset of community TCR sites as well as sites along the transmission system, tanks and pumping stations. Some MWRA TCR sites which are entry points to the community had low chlorine residuals due to various reasons.

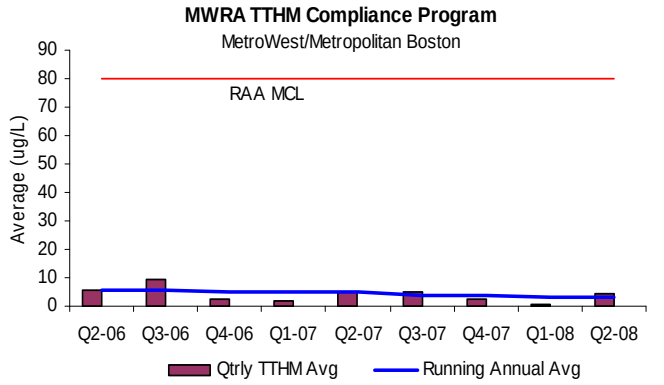
# Treated Water - Disinfection By-Product (DBP) Levels in Communities
## May 2008

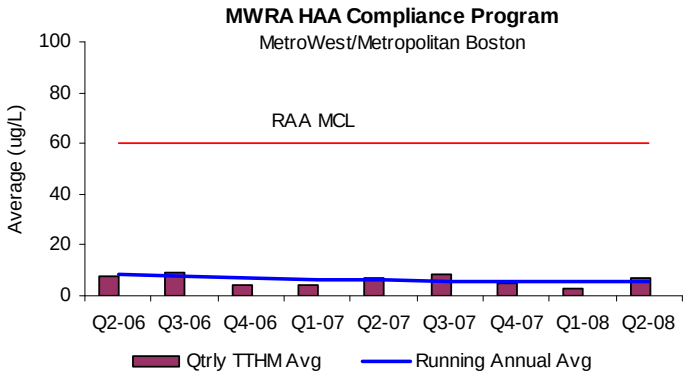
Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAA5s) are by-products of disinfection treatment with chlorine. Chlorination levels, the presence of organic precursors, pH levels, the contact time of water with chlorine used for disinfection, and temperature all affect TTHM and HAA5 levels. DBPs are of concern due to their potential adverse health effects at high levels. EPA's running annual average (RAA) standards are 80 ug/L for TTHMs and 60 ug/L for HAA5. DEP requires that compliance samples be collected quarterly. Partially served communities are responsible for their own compliance monitoring and reporting and must be contacted directly for their results.

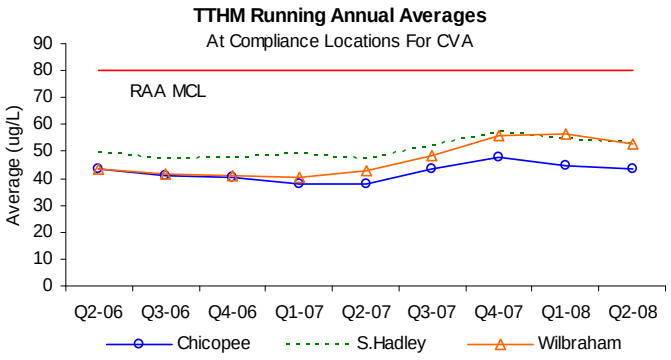
Absorbance, measured as UV-254, is a surrogate measure of reactive organic matter. Regulated DBP levels have dropped to very low levels with Carroll Water Treatment Plant (CWTP) coming on-line. However, UV-254 levels remain useful for estimating ozone dosage and serving as a trigger for Quabbin transfer consideration.

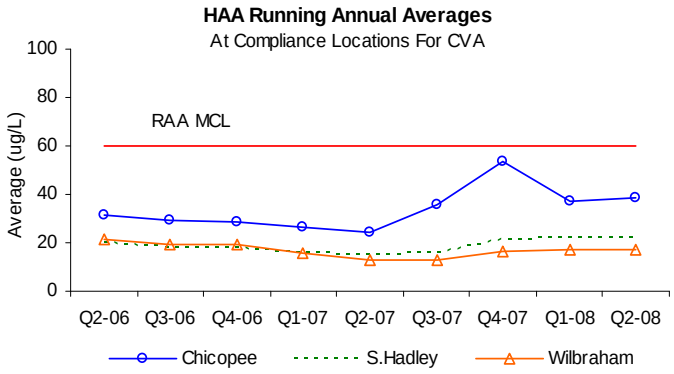
Bromate is tested monthly per DEP requirements for water systems that treat with ozone. Bromide in the raw water may be converted into bromate following ozonation. EPA's RAA Maximum Contaminant Level (MCL) standard for bromate is 10 ug/L. The current RAA for Bromate = 0.0 ug/L.

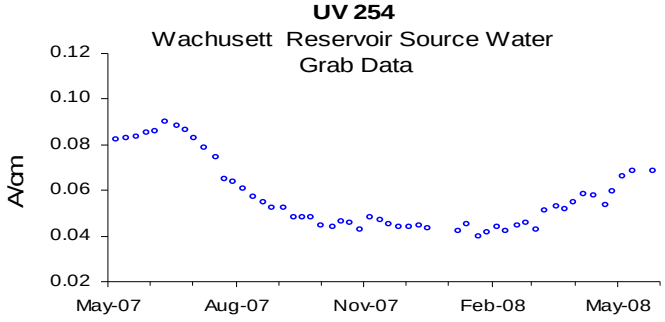
The RAA for TTHMs and HAA5s at compliance locations (represented as the line in the top two graphs below) remained below current standards. HAA5 and TTHM levels at all sampling locations for MetroWest/Metropolitan Boston communities have declined dramatically since August 2005 following activation of the Carroll Water Treatment Plant which uses ozone, rather than chlorine for primary disinfection. The RAA for TTHMs = 3.1 ug/L; HAA5s = 5.7 ug/L. CVA's DBP levels continue to be below the standards. UV-254 levels are currently around 0.07 A/cm.



# MWRA Monthly Water Quality Analysis
## May 2008

This page provides information on water quality at five locations in the MWRA transmission system. Results reflect a "snapshot" in time and may not represent typical conditions. Monitoring for parameters indicated in bold is quarterly as they either have minimal variability or are always below detection limits. The "Wachusett System" locations represent: raw water from the Wachusett Reservoir (CWTP inlet), finished water leaving the treatment plant (CWTP Finished water tap), and a location at an endpoint in the main transmission system (Shaft 9A, Malden).

| | CVA System | | Wachusett System → | | | Standards → | | |
|---|---|---|---|---|---|---|---|---|
| **Component** | **Quabbin Res. at Ware Disinfection Facility (Raw)** | **Ludlow Monitoring Station (Treated)** | **Carroll Water TP Inlet (Raw)[1]** | **Carroll Water TP Fin. Water Tap (Treated)[1]** | **Shaft 9A, Malden (Treated)** | **Standard** | **Units** | **Exceedanc** |
| Alkalinity | 2.3 | 3.0 | 5.3 | 41.2 | 41.3 | | MG/L | |
| Aluminum | < ***15.0*** | ***15.8*** | < ***15.0*** | < ***15.0*** | ***27.2*** | 50-200 (e) | UG/L | NO |
| Ammonia-N, Total | ***0.01*** | ***0.01*** | 0.01 | 0.63 | 0.49 | | MG/L | |
| Antimony | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 6 (a) | UG/L | NO |
| Arsenic | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 10 (a) | UG/L | NO |
| Barium | ***6.2*** | ***6.0*** | ***9.1*** | ***8.9*** | ***8.6*** | 2000 (a) | UG/L | NO |
| Beryllium | < ***0.3*** | < ***0.3*** | < ***0.3*** | < ***0.3*** | < ***0.3*** | 4 (a) | UG/L | NO |
| Bromate | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 10 (a) | UG/L | NO |
| Bromide | 9.6 | 5.8 | 14.7 | 15.8 | ***16.0*** | | UG/L | |
| Cadmium [1] | < ***0.5*** | < ***0.5*** | < ***0.5*** | < ***0.5*** | < ***0.5*** | 5 (a) | UG/L | NO |
| Calcium | ***2030*** | ***2100*** | 4960 | 4960 | 4840 | | UG/L | |
| Chloride | ***7.5*** | ***8.9*** | 27.3 | 28.9 | 30.5 | 250 (e) | MG/L | NO |
| Chlorine, Free | NA | 0.73 | NA | 0.00 | 0.1 | 4 (c)(d) | MG/L | NO |
| Chlorine, Total | NA | NA | NA | 1.8 | 1.6 | 4 (c)(d) | MG/L | NO |
| Chromium | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 100 (a) | UG/L | NO |
| Coliform, Fecal, MF Method | 0 | NA | 0 | NA | NA | 20 (b) | CFU/100 mL | NO |
| Coliform, Total, MF Method [h] | 12 | 0 | 75 | 0 | 0 | 100 (b) 0 (c) | CFU/100 mL | NO |
| Copper ** | < ***3.0*** | < ***3.0*** | < 3.0 | < 3.0 | < 3.0 | 1300 (f) 1000 (g) | UG/L | NO |
| Cyanide | < 0.01 | < 0.01 | < ***0.01*** | NS | NA | 0.2 (a) | MG/L | NO |
| Fluoride | ***0.06*** | ***0.05*** | ***0.07*** | ***1.03*** | ***1.03*** | 4 (a) | MG/L | NO |
| Hardness [2] | ***7.1*** | ***7.3*** | ***14.2*** | ***14.1*** | ***14.4*** | | MG/L | |
| Iron ** | ***9.3*** | ***6.1*** | 53.5 | 21.0 | 21.0 | 300 (e) | UG/L | NO |
| Lead | < ***1.2*** | < ***1.2*** | < ***1.2*** | < ***1.2*** | < ***1.2*** | 15 (f) | UG/L | NO |
| Magnesium | ***488*** | ***490*** | ***843*** | ***841*** | ***831*** | | UG/L | |
| Manganese | ***4.1*** | ***2.6*** | 27.7 | 9.5 | 10.3 | 50 (e) | UG/L | NO |
| Mercury [1] | < ***0.01*** | < ***0.01*** | < ***0.01*** | < ***0.01*** | < ***0.01*** | 2 (a) | UG/L | NO |
| Nickel | < ***3.0*** | < ***3.0*** | < ***3.0*** | < ***3.0*** | < ***3.0*** | | UG/L | |
| Nitrate-N | ***0.015*** | ***0.015*** | 0.150 | 0.159 | 0.150 | 10 (a) | MG/L | NO |
| Nitrite | < ***0.005*** | < ***0.005*** | < 0.005 | < 0.005 | < 0.005 | 1 (a) | MG/L | NO |
| Orthophosphate | ***0.008*** | ***0.007*** | 0.007 | 0.010 | 0.010 | | MG/L | |
| pH | 6.8 | 7.2 | 7.1 | 9.6 | 9.6 | | S.U. | |
| Potassium | ***537*** | ***502*** | ***913*** | ***945*** | ***926*** | | UG/L | |
| Selenium | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 50 (a) | UG/L | NO |
| Silica (SiO2) | ***1860*** | ***1870*** | 3420 | 3820 | 3700 | | UG/L | |
| Silver | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 100 (e) | UG/L | NO |
| Sodium | ***5.1*** | ***5.9*** | 16.6 | 34.2 | 34.2 | | MG/L | |
| Specific Conductance | 47 | 52 | 130 | 206 | 205 | | UMHO/cm | |
| Standard Plate Count, HPC (48 Hrs @ 35C) | NA | NA | 66 | 0 | 0 | 500 (c) | CFU/mL | NO |
| Sulfate (SO4) | ***4.6*** | ***4.5*** | 8.0 | 8.4 | 8.3 | 250 (e) | MG/L | NO |
| Thallium | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | < ***1.0*** | 2 (a) | UG/L | NO |
| Total Dissolved Solids | < ***25.0*** | ***26.0*** | ***70.0*** | ***105.0*** | ***99.0*** | 500 (e) | MG/L | NO |
| Total Organic Carbon | ***1.7*** | ***1.7*** | 2.1 | 2.6 | 2.1 | | MG/L | |
| Total Phosphorus | < ***0.005*** | ***0.007*** | ***0.008*** | ***0.017*** | ***0.012*** | | MG/L | |
| UV-254 | 0.022 | ***0.018*** | 0.066 | 0.036 | 0.030 | | A/cm | |
| Zinc ** | ***1.9*** | < ***1.5*** | 4.5 | 2.1 | 2.5 | 5000 (e) | UG/L | NO |

(a) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00.

(b) = Primary MCL standard (health related), applies to source (raw) water only. DEP "Drinking Water Regulations", 310CMR 22.00.

(c) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00. Applies to samples of treated water downstream of Wachusett and Quabbin Reservoirs.

(d) = Maximum Residual Disinfectant Level. DEP "Drinking Water Regulations", 310CMR 22.00.

(e) = Secondary MCL standard (aesthetic related). DEP "Drinking Water Regulations", 310CMR 22.00.

(f) = Refers to 90th percentile Action Level

(g) = Refers to a single sample, secondary MCL

(h) = Confirmed results only are reported

MCL = Maximum Contaminant Level
CFU = Colony Forming Unit
S.U. = Standard Units
UG/L = micrograms per liter = parts per billion
MG/L = milligrams per liter = parts per million

NA = Not Applicable
NS = No Sample
NTU = Nephelometric Turbidity Unit
HPC = Heterotrophic Plate Count
< = less than method detection limit

Inv Res = Invalid sample result
** = Metal results may be elevated due to local plumbing at the sample ta
***Bold Italics = Quarterly samples from April***
Regular Font = Samples from May

Most results are based on single grab samples collected on May 5 and 6, 2008 and analyzed by MWRA and contract laboratories.

**NOTES**:

**(1)** MWRA tests for cadmium and mercury are more sensitive than the EPA-set levels of detection and reporting. For cadmium any level below 1.0 ug/L and for mercury any level below 0.2 ug/L are under the EPA minimum detection limits. MWRA will continue to report any result below these detection limits here in the monthly report but will follow EPA

**(2)** MWRA water is considered soft. Water is measured by hardness - which is the amount of dissolved minerals in the water. MWRA water has a hardness of about 15-20 mg/l or about 1 grain/gallon (1 grain/gallon = 17.1 mg/L). For comparison, hard water would have greater than 75 mg/l hardness.

# Pathogen Monitoring Program - 2007 Review
## May 2008

Even though testing for *Giardia* and *Cryptosporidium* was not required by EPA until 2006, MWRA has been monitoring for them in source waters since 1994. EPA hass set inactivation requirements for *Giardia*, while requirements for *Cryptosporidium* will not come into effect until 2014. MWRA provides disinfection for both *Giardia* and *Cryptosporidium*.

*Giardia* and *Cryptosporidium* results are reported as number of cysts per 100 L. Until March 2004, MWRA used the EPA-approved method, ASTM D19 (ICR) with 100 L samples. Under this method, identifications were grouped into 2 categories: presumed (no internal structures identified) and confirmed (one or more internal structures identified). From July 1997 to March 2004, no samples confirmed positive for *Giardia*, and no samples were presumptive or confirmed positive for *Cryptosporidium*. In April 2004, MWRA began testing samples using the newly approved EPA Method 1623 with 50 L samples, which is about twice as sensitive as the ICR method (3 to 4 times the recovery rate with half the volume.) Under the new method, identifications are grouped into the 3 categories: empty (no internal structures), amorphous structure (structure not consistent with a normal organism), and one or more internal structures. The results for 2006 using Method 1623 are listed below.

### *Cryptosporidium* Results for MetroBoston: January 2007 – December 2007

| Number of Samples | Number of Positive Samples | Total Number of Oocysts Detected | # with One or More Internal Structures | Average (oocysts/100L) | Range of Detects (oocysts/100L) |
|---|---|---|---|---|---|
| 52 | 0 | 0 | 0 | 0 | - |

### *Giardia* Results for MetroBoston: January 2007 – December 2007

| Number of Samples | Number of Positive Samples | Total Number of Cysts Detected | # with One or More Internal Structures | Average (cysts/100L) | Range of Detects (cysts/100L) |
|---|---|---|---|---|---|
| 52 | 9 | 10 | 0 | 0.38 | 2 - 4 |

### *Cryptosporidium* Results for Chicopee Valley Aqueduct: January 2007 – December 2007

| Number of Samples | Number of Positive Samples | Total Number of Oocysts Detected | # with One or More Internal Structures | Average (oocysts/100L) | Range of Detects (oocysts/100L) |
|---|---|---|---|---|---|
| 26 | 0 | 0 | 0 | 0 | - |

### *Giardia* Results for Chicopee Valley Aqueduct: January 2007 – December 2007

| Number of Samples | Number of Positive Samples | Total Number of Cysts Detected | # with One or More Internal Structures | Average (cysts/100L) | Range of Detects (cysts/100L) |
|---|---|---|---|---|---|
| 26 | 0 | 0 | 0 | 0 | - |

*Note: A complete record of results can be found on the MWRA website at www.mwra.com.*

### Research Efforts

MWRA is currently engaged in a voluntary, joint research effort with Tufts University looking at levels of *Cryptosporidium* and *Giardia* in drinking water using a high volume sample (1000 liters). This monitoring is part of a larger multi-city study looking at levels of *Cryptosporidium* exposure in the population and potentially related levels in drinking and recreational waters. Since the routine, EPA-approved ICR method previously used by the MWRA had few detects, no statistical comparisons of human exposure to drinking water were possible. As a result, MWRA and Tufts decided to use a more sensitive method to determine the variability, if any, of levels of *Cryptosporidium* and *Giardia*.

The research monitoring uses a weekly composite sample (some water each day for the entire week) of 1,000 liters at Shaft 9A, a site within the water system that is representative of water delivered to customers in the MetroBoston system[1]. The water is then evaluated using a test method basically the same as Method 1623. All *Cryptosporidium* oocysts and *Giardia* cysts, both confirmed and empty, are counted. This method, using a large sample volume, is more than 20 times more sensitive than the present sampling protocol with Method 1623 now used by MWRA, and at least 40 times as sensitive as the previous ICR method.

The data collected so far is generally consistent with MWRA's past data. As was expected, the much higher sample volumes and the more sensitive testing have yielded some positive samples; all but one of the positives has been below the nominal detection limit of Method 1623 (1-oocyst/50 liters), and the overall average for all samples since 2001 is 0.037 oocysts/100 liters. Tufts has also tested for *Giardia* using the same testing method as above, and the overall average is 0.026 cysts/100 liters since 2002.

**Research Sampling - *Cryptosporidium* Results: January 2007 – December 2007**

| Number of Samples | Number of Positive Samples | Total Number of Oocysts Detected | # with One or More Internal Structures | Average (oocysts/100L) | Range of Detects (oocysts/100L) |
|---|---|---|---|---|---|
| 36 | 9 | 20 | 0 | 0.06 | 0.1 - 0.3 |

**Research Sampling - *Giardia* Results: January 2007 – December 2007**

| Number of Samples | Number of Positive Samples | Total Number of Cysts Detected | # with One or More Internal Structures | Average (cysts/100L) | Range of Detects (cysts/100L) |
|---|---|---|---|---|---|
| 36 | 8 | 18 | 3 | 0.05 | 0.1 – 0.4 |

### Testing Limitations and Response Protocol

It is important to note that *Cryptosporidium* and *Giardia* monitoring has significant limitations. The tests do not clearly distinguish between live and dead cysts, cannot determine if an organism is in fact infectious to humans, and the infectious dose of various strains of *Cryptosporidium* is not well understood. Generally, empty cysts are regarded as less likely to be live or infectious than those with internal features. Nonetheless, in 1996, MWRA adopted a trigger level of 10 oocysts per 100 liters (recommended by Rose and Haas, leading researchers in pathogen and risk/health analysis) above which notification and other actions would be undertaken. Total number of positives, both confirmed (with any amorphous or internal features) and empty, are included in this trigger level. No special actions are required for levels below this level. Even with the new, more sensitive testing method, the average level found is well below the 10-oocyst per 100 liter trigger level. Furthermore, MWRA's new treatment with ozone at the Carroll Treatment Plant is capable of inactivating (killing) at least 99.9% of any *Giardia* and at least 99% of any *Cryptosporidium* which may be present and viable.

[1] Starting in 2008, bi-weekly composite samples are being used.