

Massachusetts Water Resources Authority

FEBRUARY 20 1999

WATER QUALITY UPDATE

An Analysis of January, 1999 Sampling Data.

In this issue . . .

January, 1999 Sampling Data pp. A-G
Special Supplement: Community-Average Total Chlorine Residuals, TTHM Levels & MWRA Monthly Mineral Analysis

This is a periodic report containing important information about the quality of water supplied by MWRA. We hope this report is useful to you as a local water supplier, public health official, water consumer or observer of MWRA's system performance.

MWRA provides about 250 million gallons of water each day to 46 cities and towns in eastern and central Massachusetts. Each municipality is responsible for distributing the water in its own community. Twenty-five of the customer communities are fully supplied by MWRA. The other communities use MWRA water to augment their own supplies, either on a regular basis or in times of water shortage. More than two million people are served by the MWRA water supply system.

THE WATER 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. Water is transferred from the Quabbin Reservoir to the 65 billion gallon Wachusett Reservoir in Clinton via the Quabbin Aqueduct. The watersheds serving the Quabbin and Wachusett Reservoirs total 294 square miles. MWRA and the Metropolitan District Commission (MDC) are committed to protection of the water supply through aggressive watershed management as the first line of defense against water contamination.

Water is next piped from the Wachusett Reservoir to Norumbega and Weston Reservoirs in Weston via the Hultman and Weston Aqueducts respectively.

Municipalities in the MWRA service area receive drinking water distributed directly from the Hultman Aqueduct, the Norumbega Reservoir and the Weston Reservoir.

INDICATORS OF WATER QUALITY

MWRA routinely uses six general indicators of water quality:

- Microbial (bacteria and algae)
- Turbidity
- Corrosiveness (pH and alkalinity)
- Disinfectant
- Chemical (inorganic and organic)
- Radionuclides

Tests are conducted on water sampled at the source reservoirs (source water) and also on water after treatment sampled from MWRA or community lines (treated water). Testing frequencies vary by parameter.

Microbial: Algal levels in reservoirs are monitored by MDC and MWRA. These results, along with taste and odor complaints, are used to make decisions on source water treatment for algae control.

Total coliform bacteria are monitored in both source and treated water to provide an indication of overall bacteriological activity. Since many members of the coliform bacteria group originate from the non-intestinal environment, such as soil, many coliform are harmless. A subclass of the coliform group which are identified by their growth at temperatures consistent with intestinal environments, the "fecal coliform bacteria," are indicators of possible intestinal contamination. *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 intestinal origin.

For more information, please contact MWRA Public Affairs at (617) 242-6000
100 First Avenue, Charlestown Navy Yard, Boston, MA 02129.

For further information regarding health concerns, please contact the Department of Public Health/Division of Epidemiology at (617) 983-6800 or Boston Public Health Commission at (617) 534-5611.

Turbidity: 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 which causes the turbidity. Particulate matter may have a chlorine demand or may protect bacteria from the disinfectant effects of chlorine, thereby interfering with the maintenance of a disinfectant residual throughout the distribution system.

Corrosiveness: In order to minimize the leaching of lead and copper in plumbing systems, the pH, or corrosivity, is monitored and adjusted. Water provided by MWRA is basically lead free when it leaves the reservoirs but individual building service lines that carry water from street mains, as well as household plumbing fixtures, can contain lead that is susceptible to corrosion and leaching into tap water. In June 1996, MWRA's Interim Corrosion Control (ICC) facility in Marlborough went on-line. MWRA believes the ICC provides the optimal corrosion control treatment now achievable for all MWRA customer communities east of and including Marlborough. The chemicals sodium carbonate (soda ash) and CO₂ (carbon dioxide) are added to increase the pH and buffering capacity of the water which should considerably reduce the lead levels found when you first use your tap.

Disinfectant: MWRA treats the water supplied using disinfection facilities at Quabbin, Wachusett, Norumbega and Weston Reservoirs. At Wachusett Reservoir, chlorine is added to provide primary disinfection necessary to inactivate pathogens that may be present in the source water. At Norumbega and Weston Reservoirs, chlorine also provides some additional primary disinfection. With the further addition of ammonia, chloramines are formed to establish a sufficient level of residual disinfectant to protect against any new contaminants that may enter the distribution system.

Chemical: Inorganics are measured at Quabbin and Wachusett Reservoirs. Analyses of disinfection byproducts such as trihalomethanes are performed at various locations throughout the distribution system. Volatile organic compounds are measured at the distribution reservoirs: Norumbega and Weston. Synthetic organic compounds are measured at Wachusett Reservoir. MWRA generally meets applicable standards.

Radionuclides: Radionuclides are measured at three distribution locations. MWRA generally meets applicable standards.

SAMPLING AND ANALYSIS

MWRA conducts all water sampling and testing required by federal and state law. We also conduct baseline and periodic research to help us improve water quality. Results of testing are compared to standards and guidelines prepared by DEP and recommendations for further action are made if reported levels are above the standards.

Source water: MWRA collects samples from the source water supply and reservoirs which are tested for coliform bacteria, turbidity, pH, chemical constituents and radionuclides.

Treated water: MWRA collects treated water samples throughout the system and conducts tests for pH, temperature, disinfectant residual and coliform bacteria. In addition, customer communities routinely collect treated water samples in compliance with federal Safe Drinking Water Act (SDWA) testing requirements including the Total Coliform Rule. These samples are analyzed for disinfectant residual and coliform bacteria.

Communities may bring their samples to the MWRA Water Quality Laboratory for analysis, or they may have samples analyzed elsewhere. MWRA Laboratories test samples for all customer communities except Bedford, Cambridge, Canton, Chicopee, Clinton, Leominster, Lynn, Marlborough, Northborough, Peabody, South Hadley, Wilbraham, Woburn and Worcester. Community data for these communities are not presented in this report.

FEDERAL SAFE DRINKING WATER ACT (SDWA)

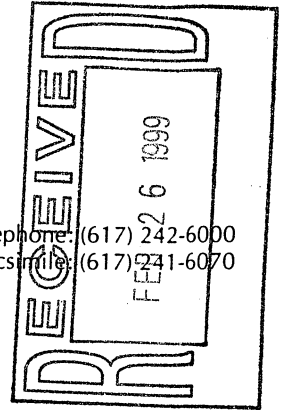
The Surface Water Treatment Rule (SWTR) of the SDWA sets standards for unfiltered use of MWRA's source waters from the Quabbin and Wachusett Reservoirs. If such standards are not met, filtration could be required. The standards relate to coliform, turbidity, watershed protection, disinfection byproducts and the absence of waterborne disease outbreaks. Quabbin Reservoir has demonstrated compliance with the standards and has therefore been found to be exempt from the filtration requirement. On October 21, 1998, MWRA's Board of Directors voted to build an ozonation facility at the new MWRA water treatment plant to be constructed at Walnut Hill. This decision enables MWRA to add filtration technology at a later date, if the need arises, and to begin upgrading and replacing local pipes in MWRA and community distribution systems. The Board decision was approved by the Massachusetts Department of Environmental Protection but challenged by the U.S. Environmental Protection Agency, and is currently before the federal district court for decision.



MASSACHUSETTS WATER RESOURCES AUTHORITY

Charlestown Navy Yard
100 First Avenue
Boston, Massachusetts 02129

Telephone: (617) 242-6000
Facsimile: (617) 241-6070



February 23, 1999

Dear Readers:

As a recipient of the MWRA Water Quality Update, you are likely interested in last fall's MWRA treatment technology decision for the new water treatment plant at Walnut Hill. An important feature of that decision was the success of watershed protection efforts for the Wachusett Reservoir and the excellent source water results obtained since 1993. We want to provide you some background concerning recent sampling results from the Wachusett Reservoir, which you may have read about in the newspapers.

From mid-December to late January, fourteen of the daily samples from the reservoir have shown fecal coliform indications above 20 CFU/100 ml. The federal regulations tally these counts and the criteria provide for a maximum of ten percent in any six-month period, in this case, 13 of 130. The attached table shows all the recent testing results. Seasonal patterns involving the roosting habits of bird populations and the annual freezing of the reservoir have caused a handful of these exceedances in December and January in prior years. However, this year's unusually warm weather, the failure of the reservoir to freeze over, and the temperature and wind conditions that have affected reservoir waters all appear to be factors that have caused this season to depart from our usual experience.

It is very important to keep in mind that disinfection inactivates bacteria before the water reaches the customers. In this regard I enclose the actual sampling results under the Total Coliform Rule testing that we perform for Safe Drinking Water Act compliance purposes on the drinking water taken from numerous points in the customer distribution system. These samples are taken after the water has passed through the required disinfection and other treatment processes. In the 4,714 samples (300-500 samples per week) taken between December 14, 1998 and February 23, 1999, not a single positive or "hit" has been recorded. (No positives have been reported in the first 3 weeks of February.)

We face, therefore, a regulatory issue concerning the reservoir, not a problem of public health shortcomings in the water that reaches the communities. We have confidence in our current treatment effectiveness and we know that the new treatment plant at Walnut Hill will further strengthen our drinking water protection. But we do know that the reservoir testing results are important and we want to tell you about some immediate steps that are being taken.

First, we have redoubled our consultation efforts with DEP and the Department of Public Health to make sure that they are informed about all aspects of the situation. At their urging we have expedited sampling programs that were already scheduled for implementation, in order that the quality of water delivered to customers be examined not only under the federally-required Total Coliform Rule but also by weekly in-system sampling for *giardia* and *cryptosporidium*. During this period we have seen none of either. The current disinfection system itself continues to more than meet the "CT" requirements contained in federal regulations for unfiltered water supplies.

Second, we have assisted and supported intensive efforts by the Metropolitan District Commission to deal effectively with the special bird control issues at the reservoir during this unusual winter and to assure that lessons learned can be applied if called for in future years. The bird and wildlife control programs, along with other watershed protection and management efforts, have produced such dramatic results in basic drinking water protection over the past six years that we have great confidence in the program's ability to meet challenges of this kind. Some of the steps already taken include increased bird harassment, stepped-up inspection of landfills and farms in the region, and consultation with state and federal wildlife officials.

Third, we have continued to move ahead on every prong of the drinking water improvement strategies comprising last October's decision by the MWRA Board of Directors, including the efforts to bring new financial and program resources to the critical issues of distribution system rehabilitation and repair. Those of you who follow industry journals will undoubtedly have been struck, as we have, by the rapidly growing attention that distribution system water quality issues have been getting all over the country.

It is also important, of course, that the new Walnut Hill Treatment Plant itself continues on an aggressive delivery track. The construction contract for the first phase of the project (over \$60 million for initial site work and the storage tank) was awarded last week to meet the scheduled construction commencement date contained in the comprehensive consent order under which the entire program is overseen by DEP. The significant costs of the new treatment plant, the MetroWest Water Supply Tunnel (now 36% complete), and distribution system improvements, continue to remind us that wise use of financial resources is a very important component of maintaining ratepayer support for our forward progress.

Today we received DEP's initial response to our "Report on Wachusett Reservoir Source Water Fecal Coliform Testing" and were gratified to see that DEP intends to consider additional data before it decides whether revocation of its concurrence with MWRA's "ozonation-but-not-filtration" is appropriate. In its letter, DEP noted that it "remains confident that the water distributed by the MWRA is adequately protected and safe." Meanwhile, the federal district court hearing on EPA's attempt to overturn DEP's concurrence with the MWRA's approach will be heard in March.

You can be certain that we are keeping our own Board of Directors, as well as regulatory agencies, the Advisory Board, state health officials and others, fully advised on all these matters. We also want you to have this information and invite your continued interest and support, as well as encourage you to continue to share comments and suggestions with us.

Sincerely,

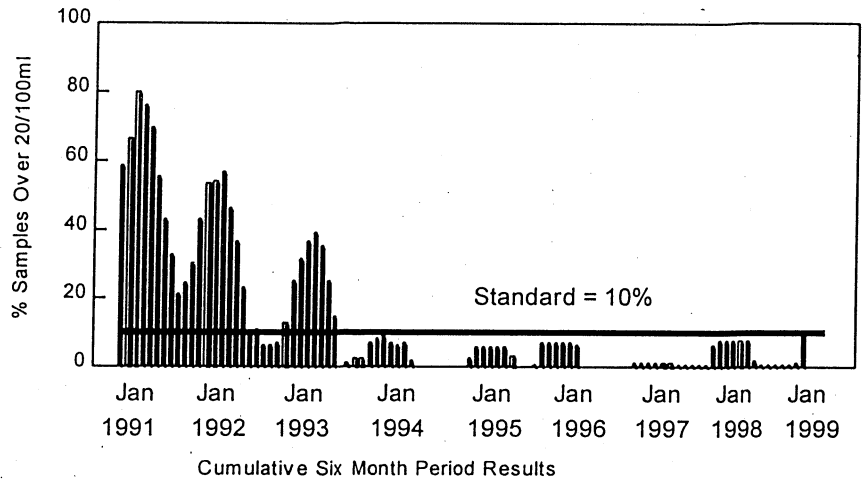


Douglas B. MacDonald
Executive Director

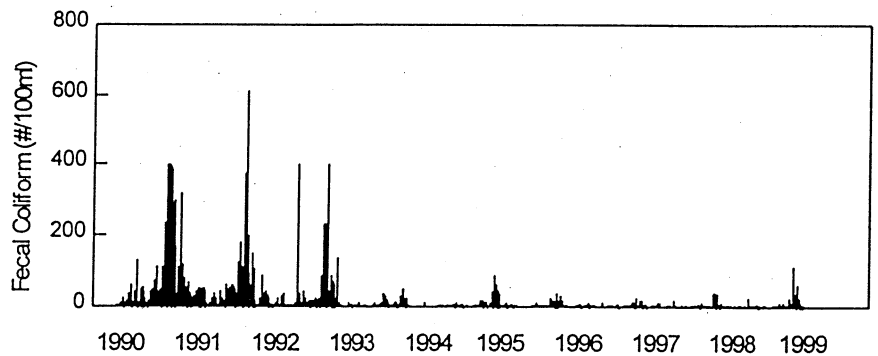
**Wachusett Reservoir
Fecal Coliform**

Date	CFU/ 100ml*	Exceedance Count**
12/14	6	
12/15	4	
12/16	8	
12/17	10	
12/18	24	1
12/21	11	
12/22	9	
12/23	14	
12/24	13	
12/25	11	
12/28	10	
12/29	9	
12/30	9	
12/31	45	2
1/1	15	
1/4	113	3
1/5	54	4
1/6	27	5
1/7	34	6
1/8	24	7
1/11	26	8
1/12	18	
1/13	34	9
1/14	17	
1/15	35	10
1/19	23	11
1/20	14	
1/21	12	
1/22	21	12
1/23	15	
1/25	60	13
1/26	16	
1/27	18	
1/28	8	
1/29	26	14
2/1	6	
2/2	7	
2/3	8	
2/4	9	
2/5	3	
2/8	5	
2/9	6	
2/10	9	
2/11	6	
2/12	7	
2/15	6	
2/16	4	
2/17	1	
2/18	0	
2/19	0	
2/22	0	
2/23	1	

**Fecal Coliform Compliance at Wachusett Reservoir
October 1990 - January 1999**



**Wachusett Reservoir Daily Fecal Coliform Results
May 1990 - February 19, 1999**



Total Coliform Results in MWRA Communities

(TCR Rule stipulates positives not to exceed 5 percent of samples)

December 1998 - February 1999

Week Ending	# Samples	# Positives	Week Ending	# Samples	# Positives	Week Ending	# Samples	# Positives
Dec 4	361	0	Jan 1	346	0	Feb 5	392	0
Dec 11	361	0	Jan 8	442	0	Feb 12	430	0
Dec 18	378	0	Jan 15	340	0	Feb 19	354	0
Dec 25	426	0	Jan 22	373	0			
			Jan 29	511	0			
						Total	4714	0

* The analytical method for fecal coliform used by MWRA includes an enhancement not required by state/federal regulations. This may lead to higher fecal counts. MWRA is currently analyzing the differences between the current method and a standard method without enhancements.

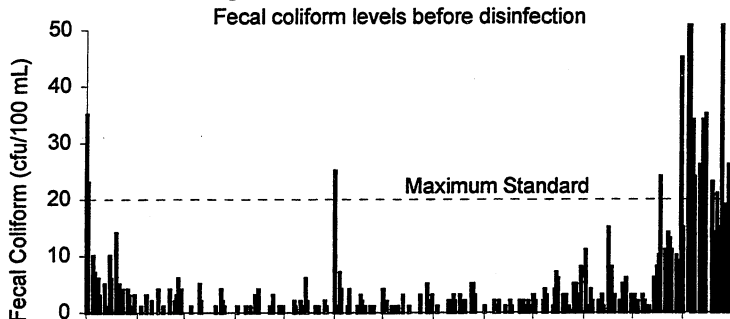
** # of exceedances over the 6 month September-February Period.

MWRA
Source Water
Fecal Coliform Levels and Primary Disinfection at Wachusett Reservoir
January 1999

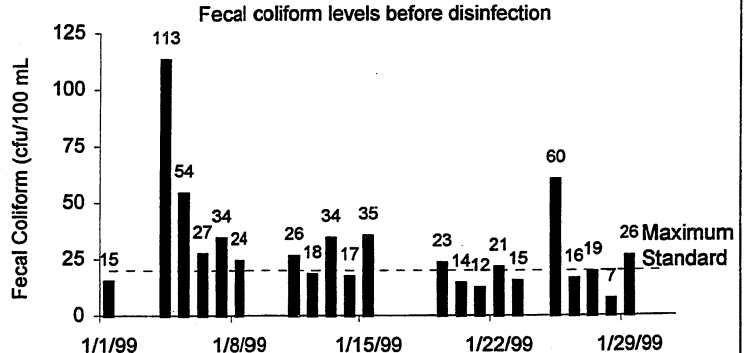
Samples from Wachusett Reservoir are collected at a location inside the Cosgrove Intake facility and represent water entering the Cosgrove Aqueduct. The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have more than 20 fecal coliforms per 100 ml. The six-month running average results represent the percent of samples exceeding 20 cfu/100 ml during the previous 6-months. Samples for turbidity are collected at Shaft 4 in Southboro, after primary disinfection and corrosion control treatments. The DEP standard for source water turbidity is 1.0 NTU.

Fecal coliform levels exceeded the standard for the first time since 1993, when bird control and other protection efforts brought MWRA into regulatory compliance. During the six months ending in January, 14 of 130 samples exceeded the standard. Over each year, seasonal variations in fecal coliform levels are observed, usually related to icing over of nearby water bodies and birds visiting Wachusett, which tends to freeze later in the year.

Cosgrove Intake, Wachusett Reservoir

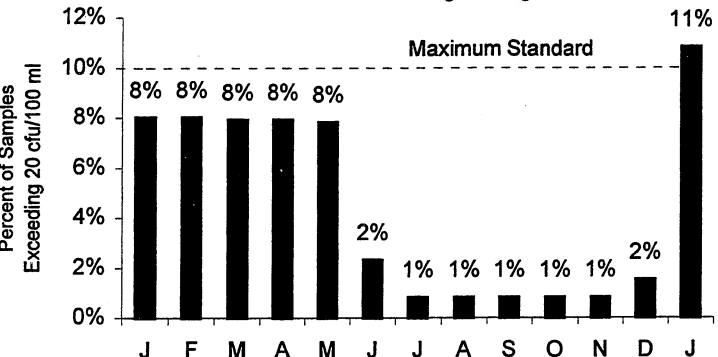


Cosgrove Intake, Wachusett Reservoir



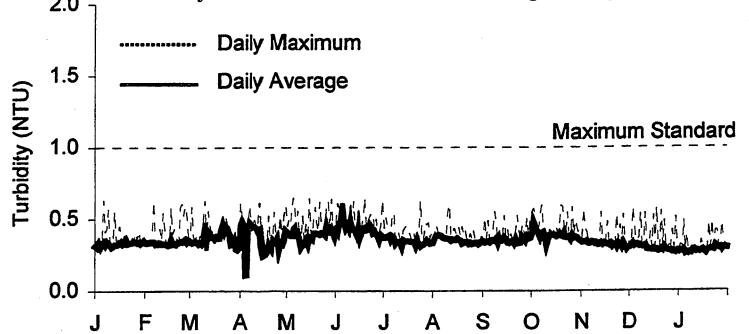
Cosgrove Intake, Wachusett Reservoir

Six Month Running Average



Shaft 4, Wachusett Reservoir

Turbidity results based on continuous Telog readings

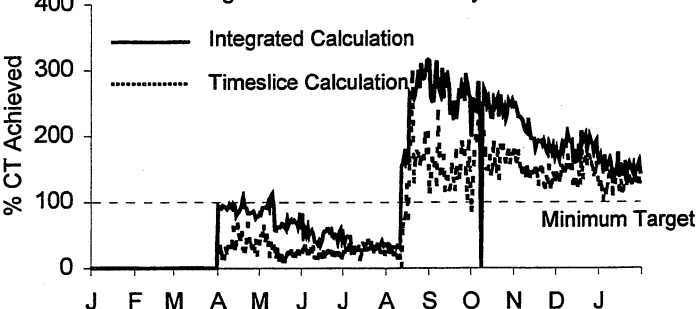


Primary Disinfection
Cosgrove Disinfection Facility

MWRA provided disinfection adequate to achieve EPA's requirement of 99.9% inactivation of giardia cysts and 99.99% inactivation of viruses in drinking water. Since September 1997, MWRA has added sodium hypochlorite to source water at Cosgrove Intake to achieve primary disinfection. The concentration (C) of the disinfectant in the water over time (T) yields a measure of the effectiveness of disinfection, CT. The required CT varies with water temperature, pH, and other factors. MWRA calculates daily CT inactivation rates at maximum flow, as specified by EPA regulations. CT based on a single measurement, or 'timeslice', gives a lower disinfection credit than CT based on an integrated calculation, a more precise measurement. The integrated calculation method would permit a lower chlorine dose, which minimizes disinfection by-products in treated water. MWRA and DEP are together discussing the possibility of using this method of calculation to determine regulatory compliance in the future.

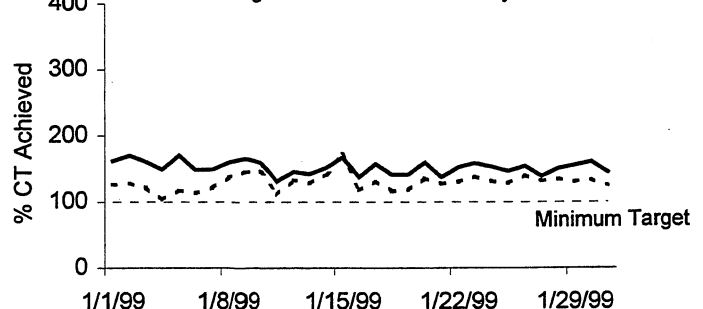
Giardia CT Percent Achievement

Cosgrove Disinfection Facility



Giardia CT Percent Achievement

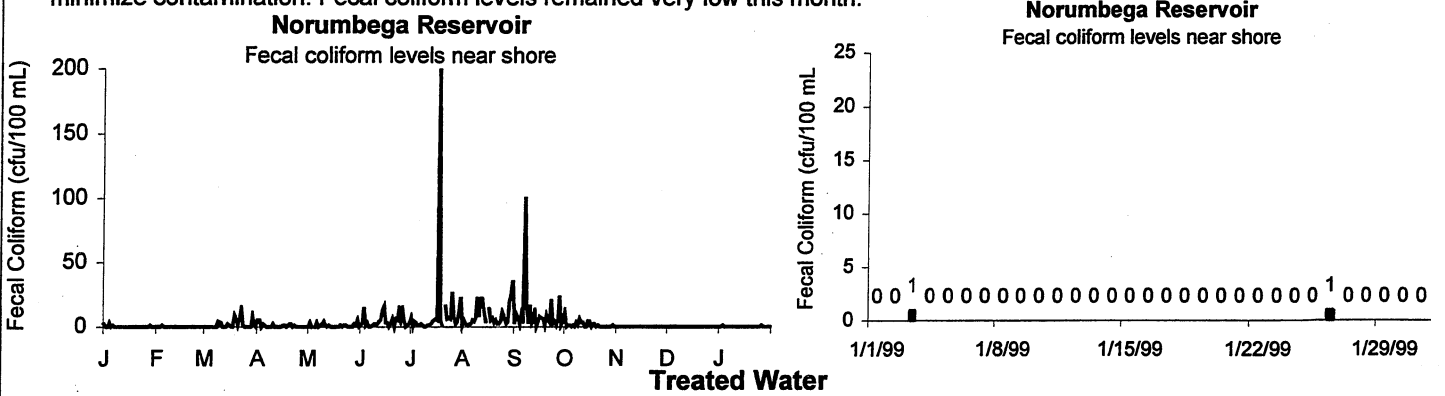
Cosgrove Disinfection Facility



**MWRA
Distribution Water
Fecal Coliform Levels in Norumbega Reservoir
January 1999**

Fecal coliform samples from Norumbega Reservoir are collected from the shore near the gatehouse. Flow from Norumbega Reservoir supplements flows from Wachusett Reservoir daily to meet peak demand.

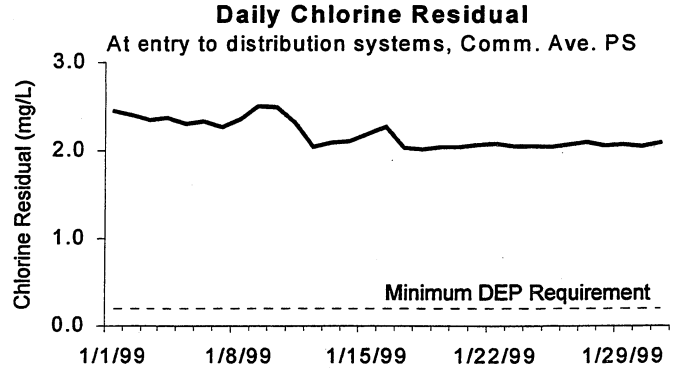
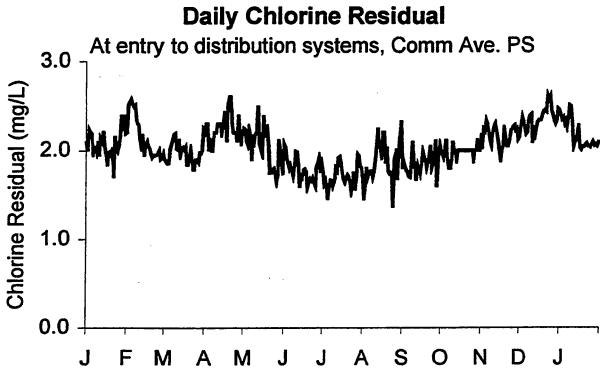
Fecal coliform levels are elevated periodically, partly because samples collected from the shore of this small reservoir are more susceptible to local disturbances. Bird harassment and watershed protection programs were stepped up in September 1998 to minimize contamination. Fecal coliform levels remained very low this month.



**Disinfectant Levels in Hultman Aqueduct at Norumbega Disinfection Facility and
Commonwealth Avenue Pump Station (Entry Point to Customer Distribution Systems)**

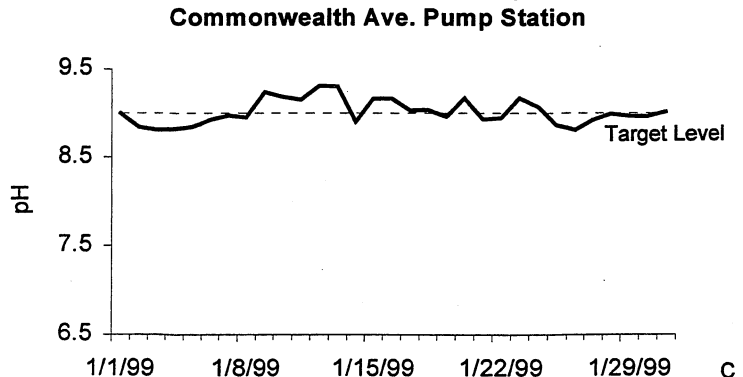
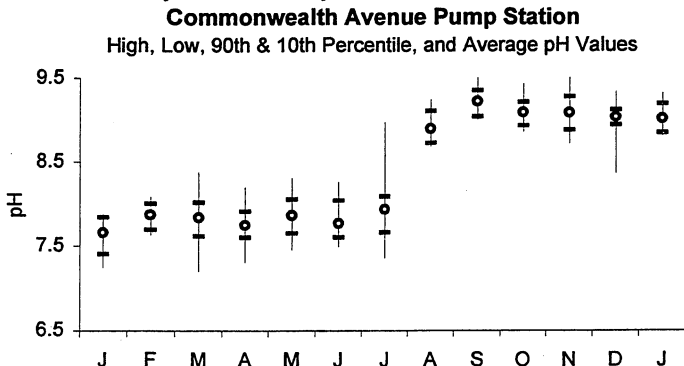
Chloramination at Norumbega Disinfection Facility provides 3-8 minutes of contact time with free chlorine before ammonia addition. Chloramination provides residual disinfection to minimize bacterial regrowth in the distribution system (primary disinfection is now provided at Wachusett Reservoir/Cosgrove Intake).

The target for total chlorine residual at Commonwealth Avenue Pump Station is adjusted periodically in an effort to optimize disinfection while minimizing concerns with nitrification, taste and odor, and disinfection by-product (DBP) formation. Seasonally, chlorine residuals fluctuate due to temperature and dosage changes. Total chlorine residuals averaged 2.4 mg/l for the month.



**Treated Water
pH Levels at Entrance to Distribution System**

MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity in order to minimize the leaching of lead and copper from service lines and home plumbing systems into the water. In June 1996, the Interim Corrosion Control (ICC) facility went on-line and is providing corrosion control to communities east of and including Marlborough. Initial pH targets were 7.5 in June 1996, then 7.8 in February 1997. On July 27, 1998, the pH was adjusted from a target of 7.8 to 9.0 to further minimize leaching of lead.



MWRA
Water Quality Update for Communities Participating in
MWRA Testing Program
 January 1999

Background

Thirty-three cities and towns use the MWRA Laboratory for Total Coliform Rule compliance testing. These communities collect samples for bacteriological analysis and measure chlorine residual at the time of collection. Cambridge conducts their own monitoring and provides their data to MWRA. The other 12 MWRA customer communities have their samples tested elsewhere and these towns should be contacted directly for their results.

The SDWA requires that no more than 5% of all samples may be total coliform positive in a month (or that no more than 1 sample be positive when less than 40 samples are collected each month). Public notification is required if this standard is exceeded.

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 1,666 samples tested was positive for coliform during the month of January.

All thirty-four communities that submitted chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/L. Fifteen communities had one or more samples with a disinfectant residual lower than 0.2 mg/L. Average chlorine residuals in these communities remained significantly above last year's levels.

Town	Samples Tested for Coliform (a)	Total Coliform % Positive	E. coli % Positive	Public Notification Required?	Minimum Chlorine Residual (mg/L)	Jan. 1999 Average Chlorine Residual (mg/L)	Jan. 1998 Average Chlorine Residual (mg/L)
ARLINGTON	56				0.07	1.17	0.76
BELMONT	32				0.10	0.85	0.50
BOSTON	224				0.23	1.81	1.56
BROOKLINE	68				0.70	1.92	1.76
CAMBRIDGE	95				0.07	2.07	
CHELSEA	32				0.07	1.62	0.29
EVERETT	40				1.00	2.00	0.90
FRAMINGHAM (c)	72				0.05	1.38	
LEXINGTON	36				1.80	1.89	1.46
LYNNFIELD	14				0.40	1.05	0.83
MALDEN	60				0.00	0.91	0.61
MARBLEHEAD	24				0.21	1.65	1.48
MARLBOROUGH (b) (c)	46				0.51	1.24	
MEDFORD	68				0.10	0.91	0.37
MELROSE	36				0.10	1.37	0.81
MILTON	32				0.30	0.48	0.30
NAHANT	10				0.40	1.05	0.37
NEEDHAM (b)	41				0.01	0.45	0.21
NEWTON	88				0.94	1.54	0.77
NORWOOD	40				0.10	0.87	0.34
QUINCY	91				0.10	1.24	0.77
REVERE	52				0.50	1.52	0.32
SAUGUS	32				0.30	0.48	0.28
SOMERVILLE	80				0.05	1.40	1.15
SOUTHBORO (c)	7				0.50	0.96	
STONEHAM	28				1.50	1.80	1.49
SWAMPSCOTT	18				1.00	1.79	
WAKEFIELD (b)	44				0.30	1.78	1.00
WALTHAM	68				1.00	1.51	1.29
WATERTOWN	40				0.10	0.34	0.44
WELLESLEY (b)	36				0.29	0.92	0.30
WESTON (c)	12				0.81	1.28	0.78
WINCHESTER (b)	20				0.10	0.69	0.28
WINTHROP	24				0.01	1.12	0.55
Total:	1666						

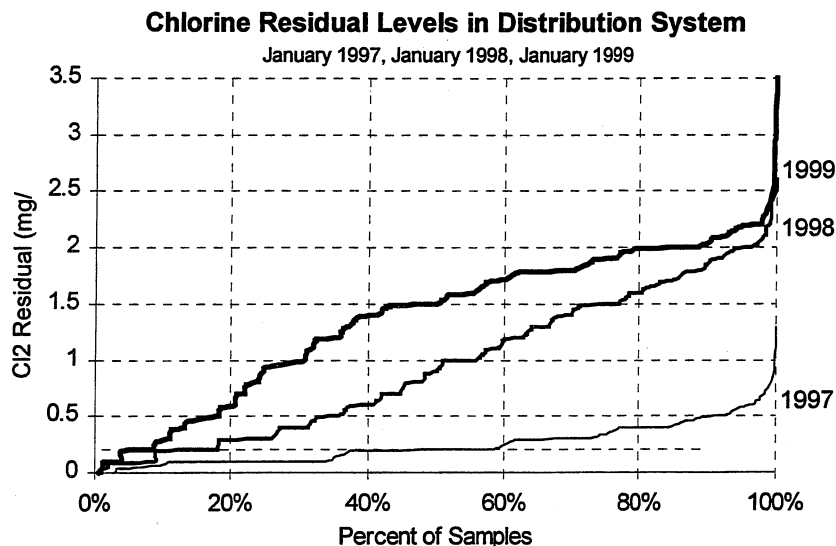
- (a) The number of samples collected depends on the population served and the number of repeat samples required.
- (b) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.
- (c) These communities re-chloramine (since July/August 1998).

**MWRA
Treated Water
Chlorine Residual Levels in Communities
January 1999**

The following chart compares Metropolitan Boston total chlorine residuals for community systems in January of 1997, 1998, and 1999. Each line on the chart describes the cumulative percentage of samples (on the x-axis) at various levels of total chlorine residual (on the y-axis) for a given year. MWRA has established a target for chlorine residuals throughout community distribution systems of 0.2 mg/L to control pipeline biofilm and bacterial regrowth in the distribution system. The graph shows how MWRA has progressed toward meeting this target.

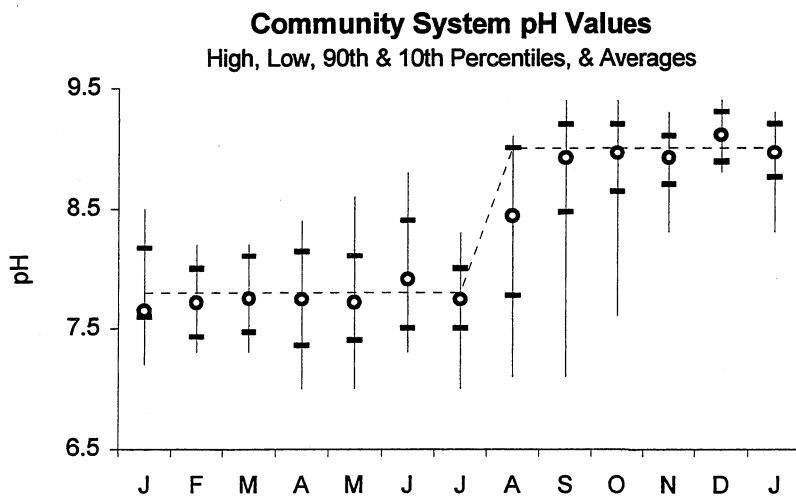
Results vary by month due to changes in chlorine dose, chlorine decay, and temperature. The trend over the years shows a significant increase in total chlorine residuals. These improvements are related to disinfection changes: chlorine ramp-up during summer 1997; ammonia separation in August 1997; and chlorine:ammonia ratio optimization begun in August 1997. In 1997, about 60% of the samples met the chlorine residual target of 0.2 mg/L; by 1999, between 90% and 95% of all samples met this target.

MWRA must meet regulations that require either that chlorine residuals in at least 95% of samples be detectable or that HPCs (Heterotrophic Plate Counts) be lower than 500 cfu/ml. Samples collected by communities satisfied this requirement during January.



**Treated Water
pH Levels in Communities**

MWRA adjusts the alkalinity and pH of Wachusett water to reduce its corrosivity in order to minimize the leaching of lead and copper from service lines and home plumbing systems into the water. In June 1996, the Interim Corrosion Control (ICC) facility went on-line and is providing corrosion control to communities east of and including Marlborough. Initial pH targets were 7.5 in June 1996, then 7.8 in February 1997. On July 27, 1998, the pH was adjusted from a target of 7.8 to 9.0 to further minimize leaching of lead. MWRA staff collect and analyze samples from 26 community locations on a biweekly. The results appear below.



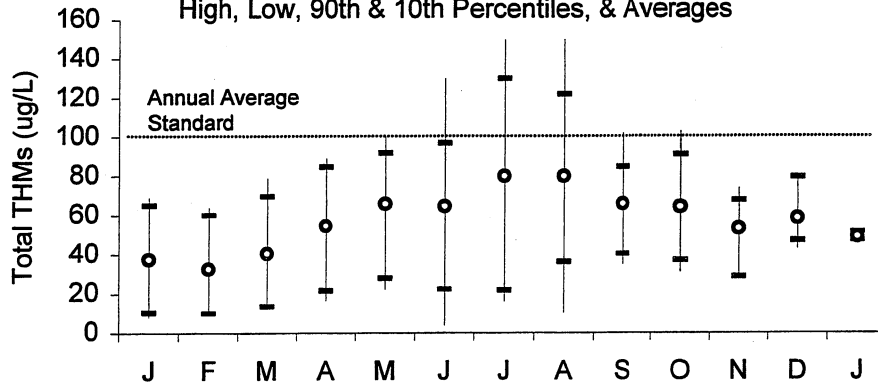
**MWRA
Treated Water
TTHM Levels in Communities
January 1999**

Total Trihalomethanes (TTHMs) are by-products of water treatment with chlorine. Chlorination levels, the presence of organic precursors, pH levels, the contact time of water with chemicals used for disinfection, and temperature all affect TTHM levels. TTHMs are of concern due to their potential adverse health effects at high levels. The TTHM standard currently is an annual running average of 100 ug/L for all sample locations combined. EPA issued new rules which will be effective in November 2001 that will reduce the TTHM standard to 80 ug/L. DEP requires samples to be collected quarterly; MWRA samples weekly at some locations, quarterly at others.

TTHM levels increased as the chlorine dose at the Cosgrove Disinfection Facility increased early in the year. TTHM levels have generally declined with optimized operations and with declining temperatures. TTHM results in MetroWest communities declined partly due to chloramination, which was introduced in all four communities during July and August. The annual running averages for both MetroWest and Metropolitan Boston regions meet both the current and the newly issued standards that take effect in 2001.

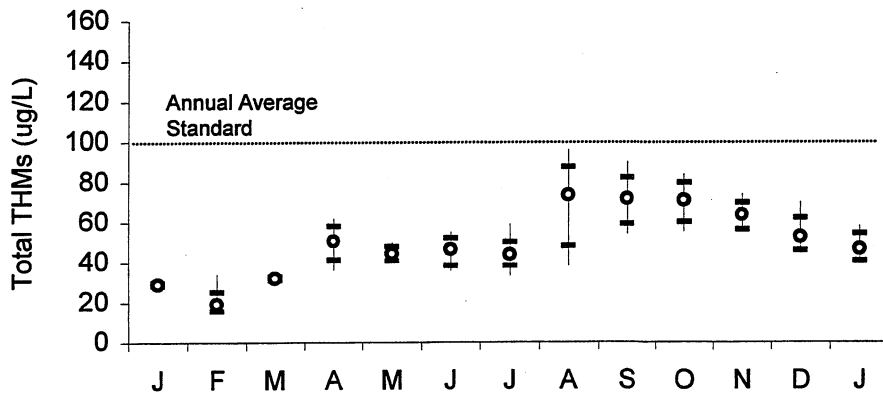
MetroWest Locations

Marlboro, Southboro, Framingham, & Weston
High, Low, 90th & 10th Percentiles, & Averages



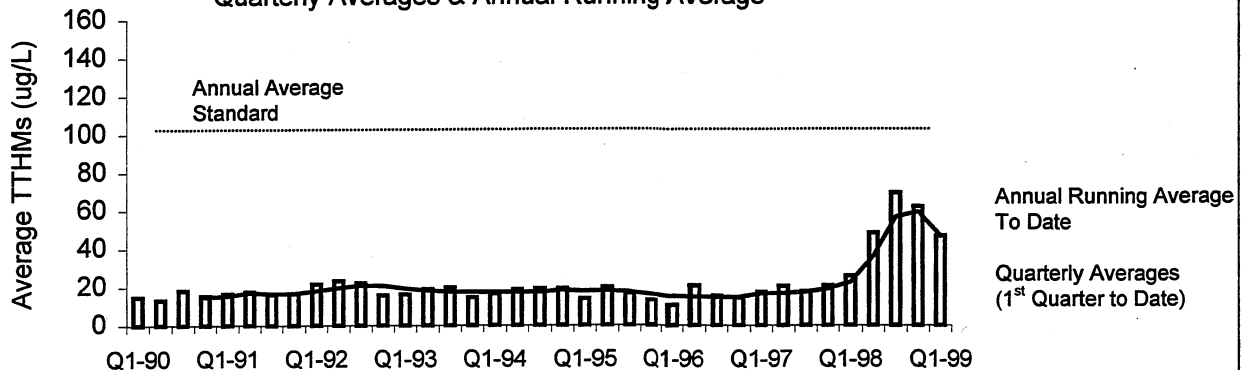
Metropolitan Boston Locations

High, Low, 90th & 10th Percentiles, & Averages



Metropolitan Boston Locations

Quarterly Averages & Annual Running Average



MWRA Monthly Mineral Analysis

January 1999

This monthly mineral analysis provides information on water quality at four locations in the MWRA transmission system.

Component	Cosgrove Intake at Wachusett Reservoir	ICC, Marlboro	Comm Ave., Newton	Shaft 9A, Malden	MCL Standard	Units	Exceedance
Alkalinity	5.32	32.7	31.4	37.4		MG/L	
Aluminum	< 90	< 90	< 90	< 90	50-200 (a)	UG/L	NO
Ammonia	0.0138	0.0131	0.543	0.488		MG/L	
Antimony	< 20	< 20	< 20	< 20		UG/L	
Arsenic	< 0.8	< 0.8	0.87	< 0.8	50 (b)	UG/L	NO
Barium	< 8	< 8	< 8	8.04	2000 (b)	UG/L	NO
Beryllium	< 0.5	< 0.5	< 0.5	< 0.5	4 (b)	UG/L	NO
Cadmium	< 2	< 2	< 2	< 2	5 (b)	UG/L	NO
Calcium	3.7	3.64	3.68	3.72		MG/L	
Chloride	13.5	14.6	15.9	15.6	250 (a)	MG/L	NO
Chlorine, Free	-	0.07	0.08	0.01		MG/L	
Chlorine, Total	-	0.88	2.18	2.16		MG/L	
Chromium	< 4	< 4	< 4	< 4	100 (b)	UG/L	NO
Coliform, Total, MF Method	50	0	0	0	0 (d)	CFU/100 mL	NO
Color	7	9	10	8	15 (a)	C.U.	NO
Copper	< 10	< 10	< 10	< 10	1300 (b)	UG/L	NO
Cyanide	< 0.01	< 0.01	< 0.01	< 0.01		MG/L	
Fluoride	0.115	1.15	1.08	1.12	4 (b)	MG/L	NO
Hardness	12.2	12	12.1	12.2		MG/L	
Iron	< 30	< 30	< 30	< 30	300 (a)	UG/L	NO
Lead	< 2.4	< 2.4	< 2.4	< 2.4	15 (b)	UG/L	NO
Magnesium	722	704	709	710		UG/L	
Manganese	6.31	6.01	6.85	7.27	50 (a)	UG/L	NO
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	2 (b)	UG/L	NO
Nickel	< 3	< 3	< 3	< 3		UG/L	
Nitrate-N	0.0271	0.0319	0.0997	0.0431	10 (b)	MG/L	NO
Orthophosphate	0.00306	0.00769	0.00729	0.00761		MG/L	
Potassium	811	817	821	863		UG/L	
Selenium	< 0.9	< 0.9	< 0.9	< 0.9	50 (b)	UG/L	NO
Silica (SiO ₂)	2.18	2.73	2.73	2.7		MG/L	
Silver	< 2	< 2	< 2	< 2	100 (a)	UG/L	NO
Sodium	8.63	22	21.7	21.8		MG/L	
Specific Conductance	107	162	152	181		UMHOS	
Standard Plate Count, HPC (48 Hrs @ 35C)	7	2	0	1	500 (b)	CFU/mL	NO
Sulfate (SO ₄)	6.85	6.83	6.84	6.75	250 (a)	MG/L	NO
Thallium	< 1	< 1	< 1	< 1	2 (b)	UG/L	NO
Total Dissolved Solids	47	68	73	78	500 (a)	MG/L	NO
Trihalomethanes, Total (TTHMS) (f)	-	17	35.5	44	100 (b) (e)	UG/L	NO
Turbidity	0.18	0.34	0.18	0.18	1 (c)	NTU	NO
Zinc	< 6	< 6	< 6	< 6	5000 (a)	UG/L	NO

- (a) = Secondary MCL standard (aesthetic related). DEP "Drinking Water Regulations", 310CMR 22.00.
- (b) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00.
- (c) = Primary MCL standard (health related), applies to Wachusett Reservoir only (source water). DEP "Drinking Water Regulations", 310CMR 22.00.
- (d) = Primary MCL standard (health related). DEP "Drinking Water Regulations", 310CMR 22.00. Applies to samples downstream of Wachusett Reservoir.
- (e) = THM compliance is based on a running annual average of samples collected at DEP approved locations.
- (f) = Average TTHM result for weekly samples collected in the month of January 1999.

MCL = Maximum Contaminant Level

CFU = Colony Forming Unit

S.U. = Standard Units

ug/L = micrograms per liter = parts per billion

C.U. = Color Unit

NTU = Nephelometric Turbidity Unit

Mg/L = milligrams per liter = parts per million

< = less than method detection limit

These results are based on single grab samples collected January 5, 1999 and analyzed by MWRA and contract laboratories.

FREQUENCY OF SOURCE WATER QUALITY SAMPLING PROGRAM

PARAMETER	MWRA SAMPLES
Total and Fecal coliform	daily at source reservoirs, weekly in distribution reservoirs
Turbidity	daily at source and distribution reservoirs
pH	daily at distribution reservoirs
Chemical analyses	periodically as required under SDWA
Radionuclides	as required, currently every five years

FREQUENCY OF TREATED WATER QUALITY SAMPLING PROGRAM

PARAMETER	MWRA SAMPLES	COMMUNITY SAMPLES
Total coliform	weekly at select locations	frequency and number depends on population served
Disinfectant Residual	weekly at select locations	collected with total coliform samples
pH	weekly at select locations	

Customer communities must also meet certain standards under the SDWA concerning distribution of treated drinking water. The Total Coliform Rule (TCR) helps to alert the local water suppliers to possible local distribution system issues as well as the adequacy of residual disinfection. MWRA provides testing services for many of the communities, and tests over 1500 samples per month. Under the SDWA, a violation of the TCR occurs when greater than 5% of the samples are positive for total coliform.

DISINFECTANT RESIDUAL

The effectiveness of disinfection is calculated by determining the length of time water is in contact with a specific dosage of disinfectant. This calculated value is commonly called CT (Concentration multiplied by Time) and is derived mathematically from assumptions about the residual disinfectant dosage in the water as it reaches the user multiplied by the travel time from the point of application of the disinfectant.

The required CT to provide target inactivation varies somewhat due to ambient pH or temperature conditions, as well as the strength of the disinfectant, *e.g.* free chlorine has greater pathogen inactivation properties than chloramines in the same concentration. The calculated CT of the disinfection system is then compared to the required values necessary to achieve the desired level of inactivation of key pathogens such as bacteria, viruses, and protozoa. In this classification of pathogens, bacteria are the most prevalent and are the first focus of disinfection. Fortunately, harmful bacteria are relatively easily inactivated by chlorination. Viruses are more resistant to chlorination. *Giardia* and *cryptosporidium* are examples of pathogenic protozoa that are particularly difficult to inactivate using normal dosages of chlorine but are less commonly found in source waters.

The reduction of residual disinfectant levels within a pipeline system is affected by a variety of factors including temperature, presence of organic matter in the water or on the pipe surface and corrosion of the pipe surface. For residual disinfection, MWRA uses a chlorine-ammonia combination to form chloramines, a longer-lasting residual disinfectant than free chlorine alone. The level of the residual disinfectant is measured throughout the distribution system using a colorimetric test by which a color change in the sample is compared to a color chart in order to estimate the disinfectant concentration within a reasonable degree of accuracy.

GLOSSARY

Chlorination: Disinfection by adding chlorine.

Chloramination: Disinfection by adding a mixture of chlorine and ammonia.

Coliform bacteria: Group of bacteria that indicate the possibility of contamination in a water supply. A subclass of the coliform group, fecal coliform bacteria, indicate possible contamination from intestinal sources.

Corrosion control facility: Water quality facility that helps to stabilize both the water's pH and alkalinity by adding soda ash and carbon dioxide.

Cryptosporidium: Microscopic protozoa which, when ingested, can result in diarrhea and other flu-like symptoms.

Escherichia coli (E. coli): A bacterium that is a primary indicator of fecal contamination in a water supply. E. coli is a member of the coliform group of bacteria.

Giardia lamblia: Microscopic protozoa which, when ingested, can result in diarrhea and other flu-like symptoms.

NTU: Nephelometric turbidity unit. A standard measure of turbidity in a water sample.

Pathogens: Disease-causing organisms.

Reservoir: A natural or human-made basin where water is collected and stored in large quantities before being supplied to a community.

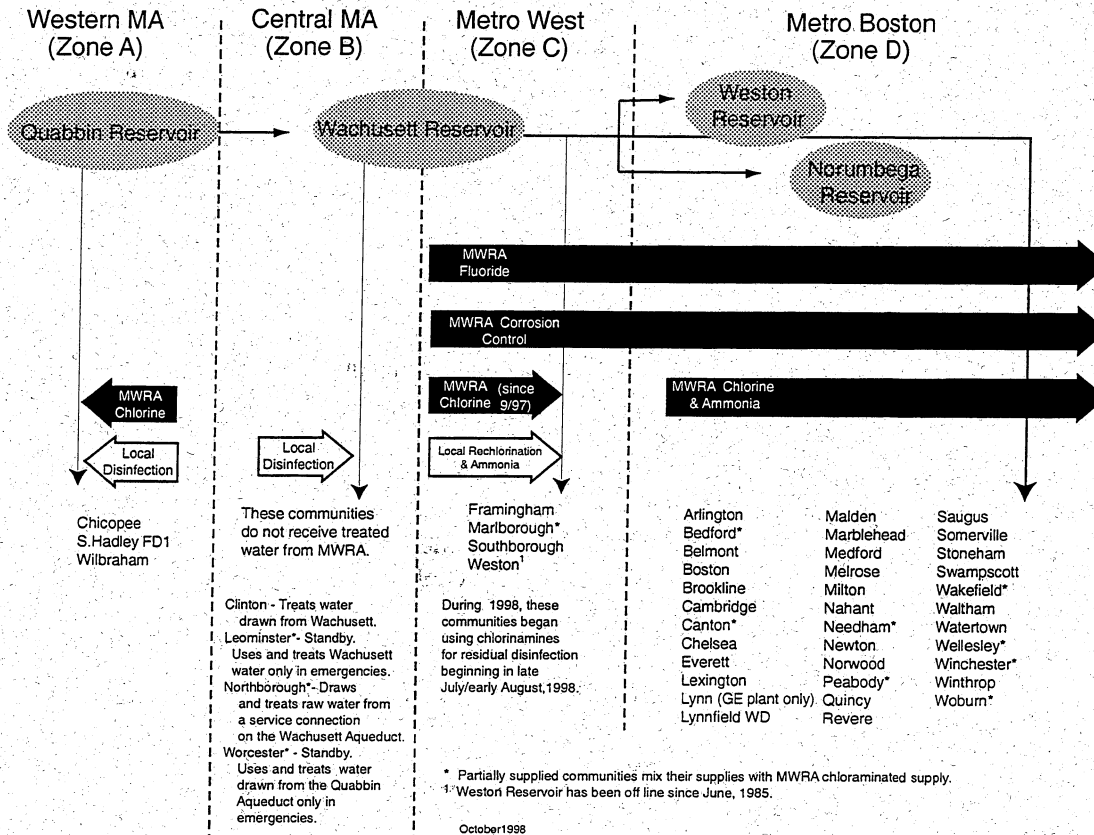
Safe Drinking Water Act (SDWA): Federal drinking water quality regulations.

Total Coliform Rule (TCR): SDWA standard that limits the level of total coliform positive results allowed each month in a community.

Turbidity: Measure of the particulate matter in a water sample.

MWRA WATER SUPPLY AND TREATMENT

Communities that are fully supplied by MWRA receive water treated with chloramines. In those communities that are partially supplied by MWRA, information on treatment should be obtained from the local water department. To view the level of treatment your water has received, locate your community on the chart.



Prepared under the direction of: Douglas B. MacDonald, Executive Director
 William A. Brutsch, Waterworks Director, D. Kelly O'Day, Operations Director, Waterworks