MASSACHUSETTS WATER RESOURCES AUTHORITY

SEPTEMBER 20 2000

WATER QUALITY UPDATE

An Analysis of August, 2000 Sampling Data.

IN THIS ISSUE. . .

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) 788-1170.
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 CO_2 (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. 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 since 1992 been exempt from the filtration requirement. In October 1998, MWRA's Board of Directors voted to build an ozonation facility at MWRA's new 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 plan was approved by the Massachusetts Department of Environmental Protection but challenged by the U.S. Environmental Protection Agency. After trial, the Federal Court found that MWRA now met the standards for unfiltered systems, and that MWRA's new plant will improve inactivation of *Giardia*, viruses, *Cryptosporidium* and other pathogens, and reduce levels of disinfection byproducts.

MWRA Water Quality Update Highlights
August 2000

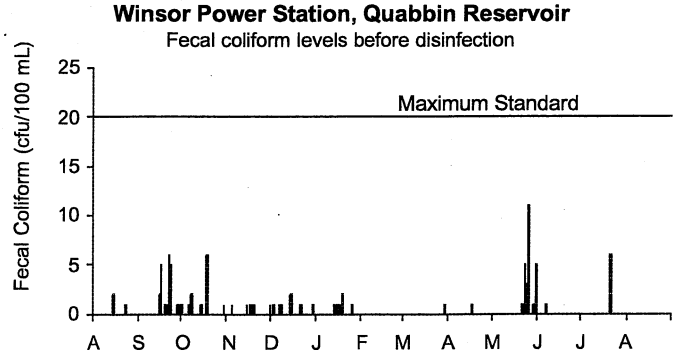
- **MWRA met CT requirements at its new Ware Disinfection Facility (WDF) during August.** WDF began a 30-day startup test on 7/24. Initially, chlorine dose was 1.2 mg/L. Dose increased to 1.5 mg/L as a precaution due to elevated total coliform results in Quabbin, then was reduced to 1.4 mg/L on 8/31. Regular water quality results concerning this facility will appear in future updates.
- **Total coliform presumptive positives declined in Wachusett and Norumbega** after copper sulfate treatments for algae were conducted at each of these reservoirs in July. Total coliform positives in treated water were lower than during early July, and were low during August. Total coliform presumptive positives were elevated at Quabbin, but many presumptive positives did not confirm as coliforms. Fecal coliform levels in all reservoirs were either not detected in samples or present at very low levels. See results on Pages A, B and E.
- **Average TTHMs rose above July levels**, but the running annual average for TTHMs remained below both the current standard of 100 ug/L and more stringent standards that take effect in 2001. TTHMs should decline as chlorine dose and temperatures decline.
- **Transferred Quabbin water reached Cosgrove Intake, helping to lower TOC and UV-254 levels and reduce DBPs.** Slight adjustments in pH treatment were required daily to respond to pH variations in the mixed water. Operators have noted that pH at the Intake also varies with wind changes, heavy rainfall, and generator operations. In addition, the pH target at Shaft 4 increased to 9.4 to adjust for higher chlorine doses and keep pH levels in communities at target levels. See Page C for pH results, Page F for DBPs.
- **Chlorine dose at Cosgrove Disinfection Facility was lowered** from 2.3 to 2.0 mg/L on 8/14 and to 1.8 mg/L on 8/30 to reduce DBPs. The dose at Norumbega was lowered from 2.3 to 2.0 mg/L on 8/30. See Pages C, D and E for chlorine levels in towns and at Comm Ave.
- **Results from one sample from Arlington Covered Reservoir were *E. coli* positive on 8/7.** Beginning 8/8, the tank was isolated from the system, and it remains isolated. Repeat samples taken from this tank, Belmont Pump Station, and sample locations in Arlington, Belmont, and Watertown that receive water from this covered reservoir were all negative for *E. coli* and total coliform. A new sample tap was installed at this covered reservoir to eliminate concerns with sample contamination.
- **One town violated the TCR due to two total coliform positives in the month.** No *E. coli* positives appeared in TCR samples.

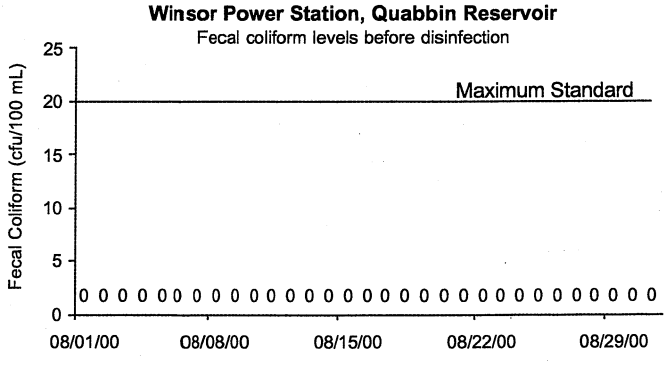
Source Water – Chicopee Valley Aqueduct
Fecal Coliform and Turbidity Levels At Quabbin Reservoir (Winsor Power Station)

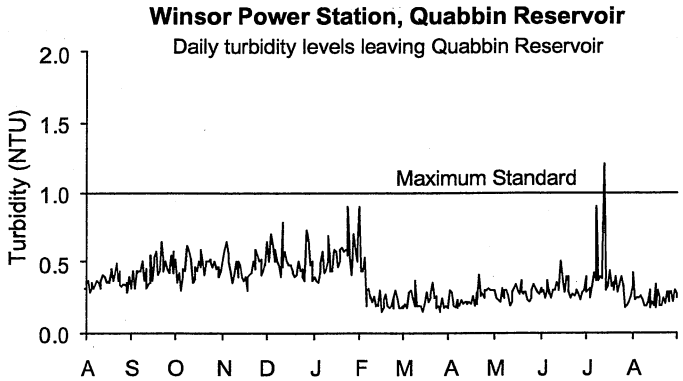
Quabbin Reservoir water sampled at Winsor Power Station before chlorination represents reservoir water entering the Chicopee Valley Aqueduct (CVA), serving South Hadley Fire District 1, Chicopee, and Wilbraham. The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have over 20 fecal coliforms per 100 ml. Fecal coliform levels tend to be low at the Winsor location. MWRA met the six-month running average standard for fecal coliform continuously at this location over the last year. In August, levels remained below standards.

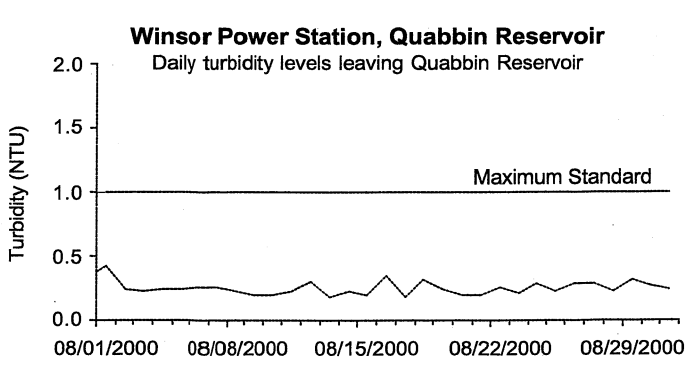
Samples for turbidity are collected at Winsor Power Station before chlorination and represent reservoir water entering the CVA. The Massachusetts Department of Environmental Protection standard for source water turbidity for unfiltered water supply systems is a maximum of 1.0 NTU; the EPA standard is a maximum of 5.0 NTU. Turbidity results beginning in February reflect improved procedures in calibrating the turbidimeter used to measure this important parameter. An unusually high turbidity result from a grab sample on July 12th was not corroborated by a continuous analyzer at the site and may have resulted from sampling error. Turbidity results for August were at normal levels.

Results presented here cover monthly trends for the last thirteen months (left) and daily trends for the most recent month (right).







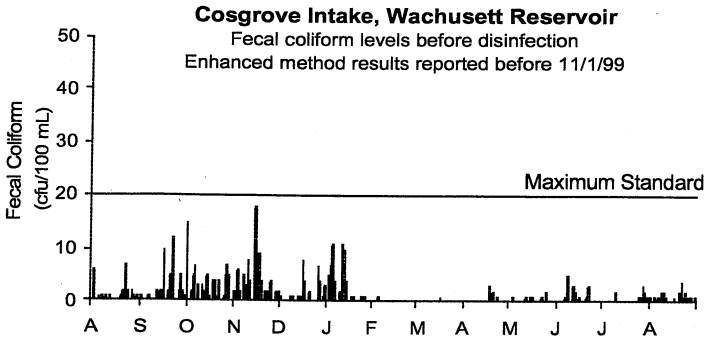


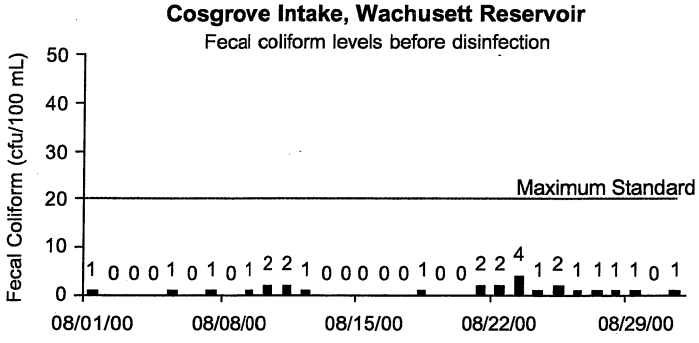
Source Water -- Serving Metropolitan Boston
Fecal Coliform Levels and Primary Disinfection at Wachusett Reservoir
August 2000

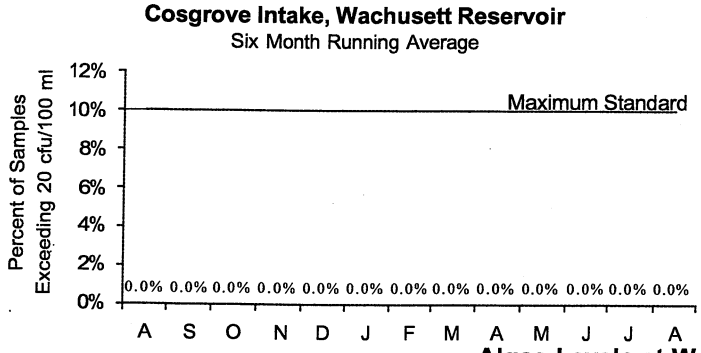
Samples from Wachusett Reservoir are collected at a location inside the Cosgrove Intake facility and represent water entering the Cosgrove Aqueduct. The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have more than 20 fecal 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. Turbidity samples are also taken from Cosgrove Intake, representing water quality before primary disinfection and corrosion control treatment. The DEP 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.

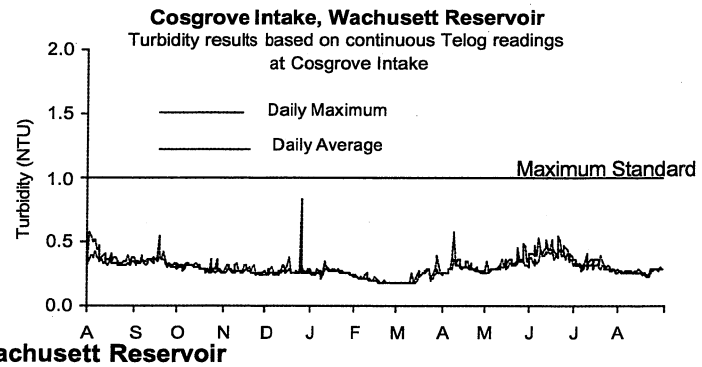
Fecal coliform counts for the month were all below the 20 cfu/100 ml standard. Fecal coliform levels tend to increase during the winter, usually related to icing over of nearby water bodies and birds visiting Wachusett, which tends to freeze later in the year. The six-month running average this month is 0.0%; the standard is 10%. Results reported since November, 1999 derive from the standard method of measuring fecal coliform levels. Turbidity results were well within DEP standards.

Results presented here cover monthly trends for the last thirteen months (left) and daily trends for the most recent month (right).





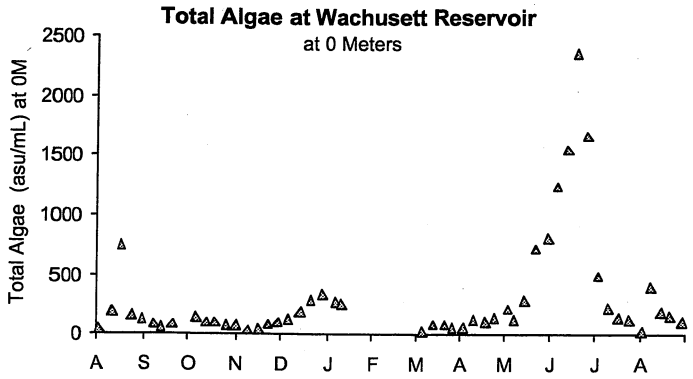


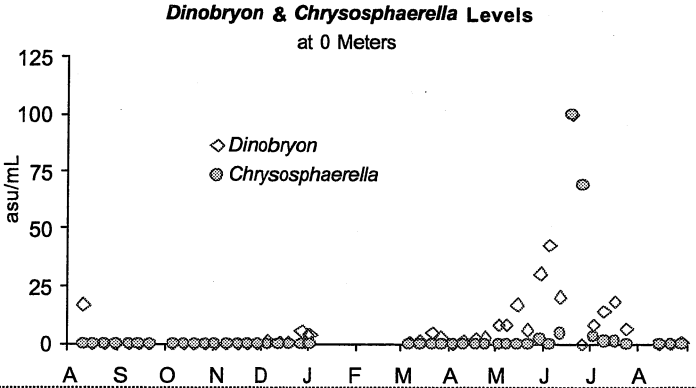


Algae Levels at Wachusett Reservoir

Taste and odor complaints at the tap are usually 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 treats the reservoirs with copper sulfate, an algaecide.

MWRA treated Wachusett for algae on 7/7. Sample results for algae levels after treatment are comparable to last year at this time. Of 189 complaints received during the month from local water departments, 6 concerning taste and odor or clogged filters may be due to algae. MDC and MWRA staff monitor algae levels closely to determine whether to treat.





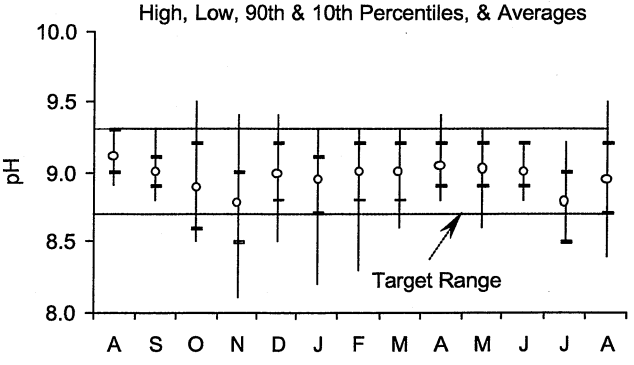
Treated Water
pH and Chlorine Residual Levels in Communities
August 2000

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; this facility provides corrosion control to communities east of and including Marlborough. MWRA targets pH levels between 8.7 and 9.3 to minimize leaching of lead. MWRA staff have worked at improving processes for pH addition at the ICC with promising results for greater consistency in pH levels in communities. MWRA staff collect and analyze pH samples from 26 community locations on a biweekly schedule. The pH results for August on the left below show the effect of changes to both the chlorine dose and chlorine:ammonia ratio at Norumbega during the month.

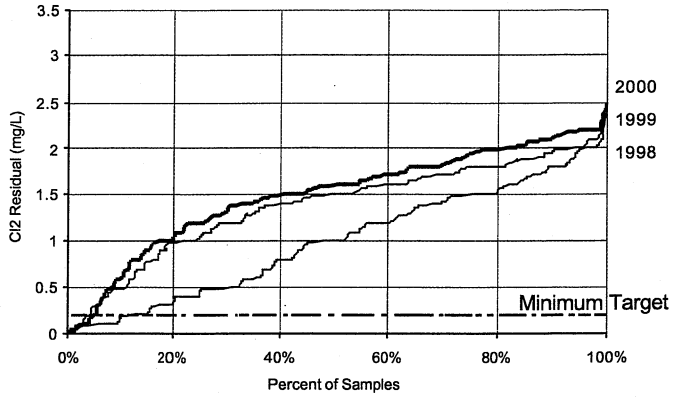
The chart below on the right compares community total chlorine residuals in August of 1998, 1999, and 2000. Each line on the chart describes the cumulative percentage of samples (on the x-axis) at various levels of total chlorine residual (on the y-axis) for a given year. MWRA has established a target 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 last several 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 August 1998, about 85% of the samples met the chlorine residual target of 0.2 mg/L. By August 1999, 96% of all samples met this target. Last month, 95% of all samples met this target. A little over 96% of all samples in August 2000 had residuals at or above 0.1 mg/L.

MWRA must meet regulations that require either detectable chlorine residuals in at least 95% of samples or that HPCs (Heterotrophic Plate Counts) be lower than 500 cfu/ml. In August, sample results from all communities participating in the MWRA program satisfied requirements for both chlorine residuals and HPCs.

Community System pH Values
High, Low, 90th & 10th Percentiles, & Averages



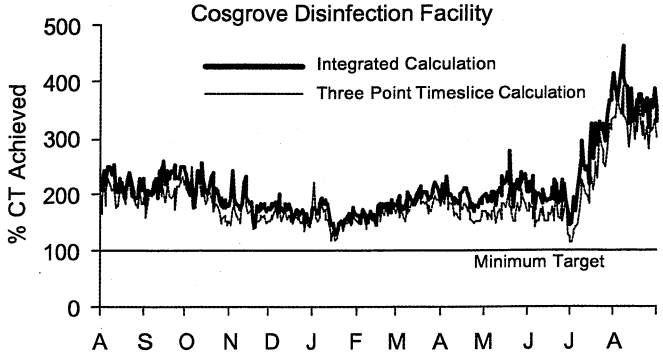
Total Chlorine Residual Levels in Distribution System
August 1998, August 1999, August 2000



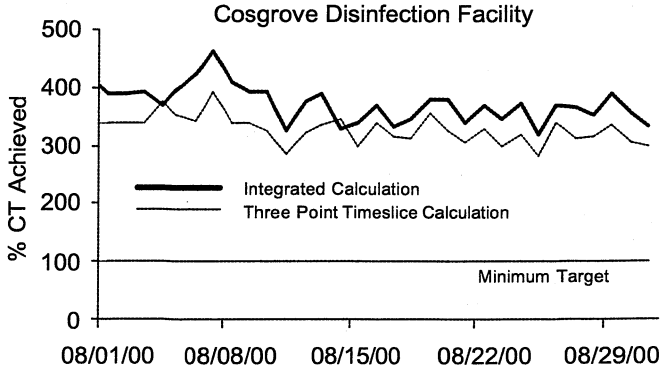
Primary Disinfection
Cosgrove Disinfection Facility

In August, 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 using a calculation based on three sample points that DEP approved in June, 1999. This calculation method generally allows MWRA to meet disinfection requirements while lowering chlorine dose, reducing the formation of disinfection by-products. 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 was met each day this month, as well as every day for the last year. CT achievement increased noticeably in July due to chlorine dose adjustments that helped to improve disinfection treatment for total coliforms.

Giardia CT Percent Achievement
Cosgrove Disinfection Facility



Giardia CT Percent Achievement
Cosgrove Disinfection Facility



C

Tocal Coliform Rule Results for Communities Participating in MWRA Testing Program

August 2000

Background

Thirty-four 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

Five of the 1924 samples tested were positive for total coliform during the month of August. Public notification was required for the Town of Swampscott.

All of the thirty-five communities that submitted chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/L. 14 communities had one or more samples with a disinfectant residual lower than 0.2 mg/L. 24 fully-served communities had average residuals higher than or near last year's averages. 3 fully-served communities had average residuals lower than last year by 15% or more; averages for 2 of these towns were still above 1.0 mg/L. Swampscott exceeded the TCR standard with two coliform positives at two different sites, one on 8/16, one on 8/30. Repeat samples on 8/17 and 8/31 were negative for total coliform.

Town	Samples Tested for Coliform (a)	Total Coliform % Positive	E.coli % Positive	Public Notification Required?	August 2000 Minimum Chlorine Residual (mg/L)	August 2000 Average Chlorine Residual (mg/L)	August 1999 Average Chlorine Residual (mg/L)
ARLINGTON	71				0.05	1.18	1.05
BELMONT	32				0.05	1.27	1.11
BOSTON	266				0.13	1.84	1.58
BROOKLINE	85				0.80	2.01	1.80
CAMBRIDGE	92				0.03	1.96	1.73
CHELSEA	32				0.67	1.69	1.41
EVERETT	40				0.50	1.56	1.54
FRAMINGHAM (c)	72				0.37	1.62	1.33
LEXINGTON	37				1.02	1.84	1.91
LYNNFIELD	6				0.85	1.34	1.35
2 MALDEN	68	2.9%	0.0%	No	0.01	1.33	1.15
MARBLEHEAD	24				0.52	1.68	1.73
MARLBOROUGH (b) (c)	51				0.23	1.22	1.09
MEDFORD	85				0.10	1.11	0.99
MELROSE	36				0.10	1.11	1.30
MILTON	43				0.78	1.43	1.28
NAHANT	10				0.00	0.95	0.94
NEEDHAM (b)	51				0.01	0.35	0.73
NEWTON	88				0.89	1.58	1.60
NORWOOD	40				0.05	0.65	0.75
QUINCY	115				0.10	1.41	1.34
REVERE	65				0.43	1.67	0.91
SAUGUS	40				1.60	1.71	1.73
1 SOMERVILLE	103	1.0%	0.0%	No	0.30	1.20	1.12
SOUTHBORO (c)	10				0.30	0.95	1.28
STONEHAM	35				1.10	1.63	1.50
2 SWAMPSCOTT	33	6.1%	0.0%	Yes	0.71	1.56	1.03
WAKEFIELD (b)	55				0.28	1.64	1.54
WALTHAM	84				0.60	1.50	1.53
WATERTOWN	52				0.70	1.58	1.21
WELLESLEY (b)	36				0.10	0.33	0.48
WESTON (c)	18				0.24	1.17	1.28
WINCHESTER (b)	25				0.05	0.83	1.05
WINTHROP	24				0.50	1.62	1.46
WOBURN	67				0.09	1.05	
Total:	1924						

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

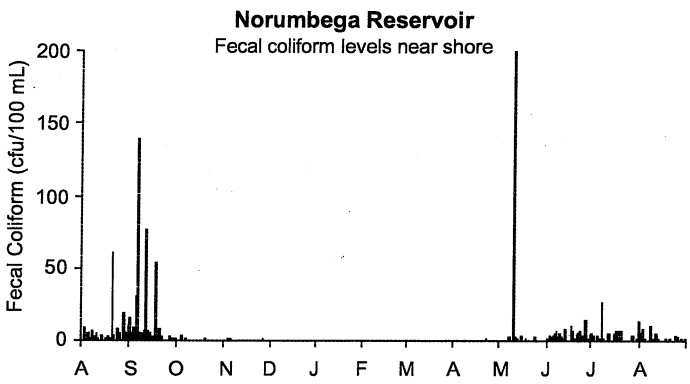
(b) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.

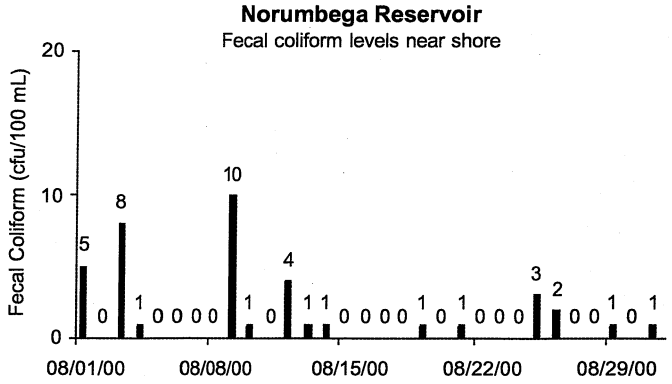
(c) These communities chloraminate since July/August 1998.

Distribution Water
Fecal Coliform Levels in Norumbega Reservoir
August 2000

Flow from Norumbega Reservoir supplements flows from Wachusett Reservoir daily at times of high demand. Norumbega receives flows from Wachusett for temporary storage at times of low demand. Fecal coliform samples from Norumbega Reservoir are collected from the shore near the gatehouse before disinfection. 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. A fence has also been built around the reservoir to keep deer away from the water. Fecal coliform results along the shore were positive about half the time during August, but mostly at low concentrations. These results are comparable to those of last August, as seen in the chart on the left below.

Results presented here cover monthly trends for the last thirteen months (left) and daily trends for the most recent month (right).



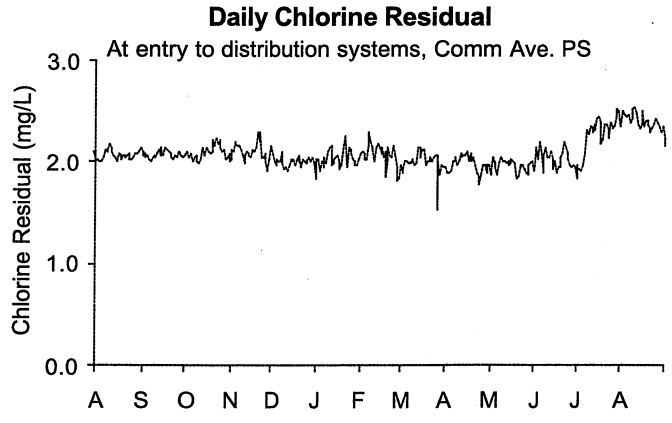


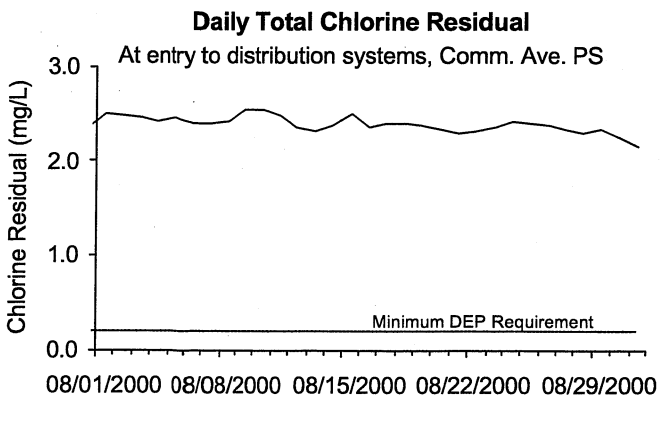
Treated Water
Disinfectant Levels in Hultman Aqueduct at Norumbega Disinfection Facility and Commonwealth Avenue Pump Station (Entry Point to Customer Distribution Systems)

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 provided at Wachusett Reservoir/Cosgrove Intake). Process improvements to optimize chloramination at Norumbega are being tested so that ammonia additions ensure a stable chlorine residual throughout the distribution system without affecting taste and odor.

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. Chlorine residual sample results at this site represent levels of chlorine residuals in treated water at the entry to community distribution systems. Higher chlorine residuals after July 7, 2000 reflect increased dosages at Cosgrove and at Norumbega Reservoir. Total chlorine residuals averaged 2.4 mg/l for the month. Dose was reduced to 2.0 mg/L on 8/30.

Results presented here cover monthly trends for the last thirteen months (left) and daily trends for the most recent month (right).



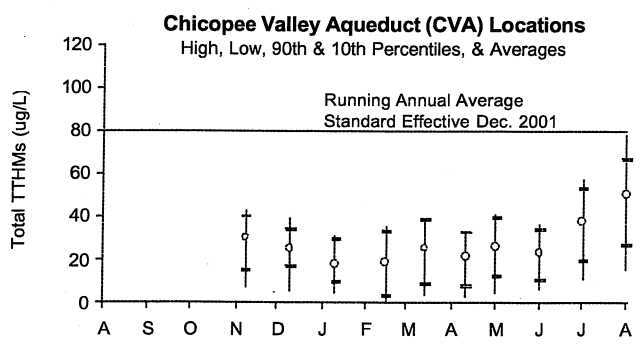


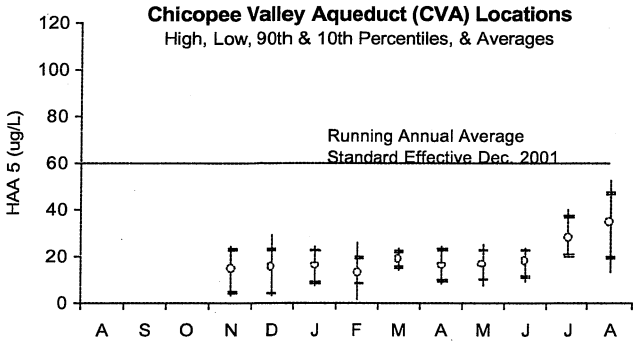
Treated Water
Disinfection By-Product (DBP) Levels in Communities
August 2000

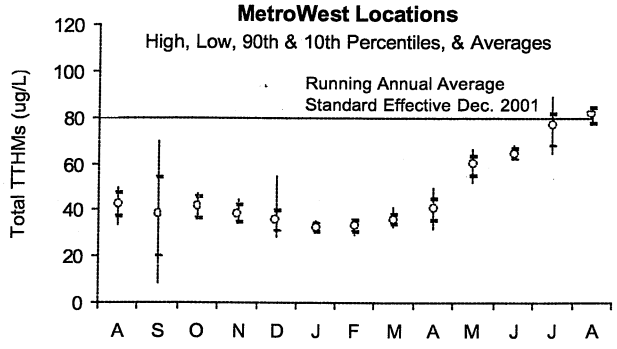
Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAAs) are by-products of disinfection treatment with chlorine. Chlorination levels, the presence of organic precursors, pH levels, the contact time of water with chlorine used for disinfection, and temperature all affect TTHM and HAA levels. TTHMs are 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 recently established a new standard of 80 ug/L for TTHMs and 60 ug/L for HAA 5 that will take effect in 2001. DEP requires that samples be collected quarterly; MWRA samples weekly at some locations, monthly and quarterly at others. These graphs report results on a monthly, quarterly, and running annual average basis.

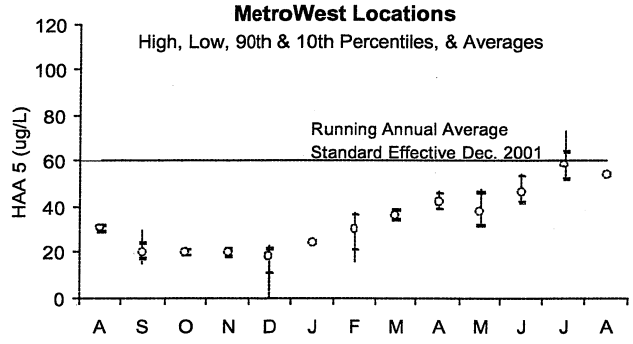
Average DBP levels rose in August to levels above those of last year. Nonetheless, the running annual average for TTHMs, represented by the solid line in the two graphs at the bottom of the page, remained below both the current standard of 100 ug/L and more stringent standards that take effect in 2001. The difference in DBP levels in MetroWest and Metropolitan Boston locations between this year and last is due both to higher levels of TOC and UV-254 at Wachusett this year and to increased chlorine doses. Increased TTHMs at CVA sites are due to higher chlorine doses during August at the Ware Disinfection Facility. TTHM levels should decline as dose and temperature decline.

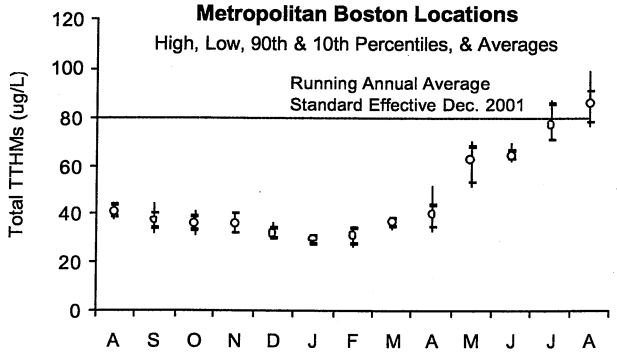
TTHMs | **HAA 5**

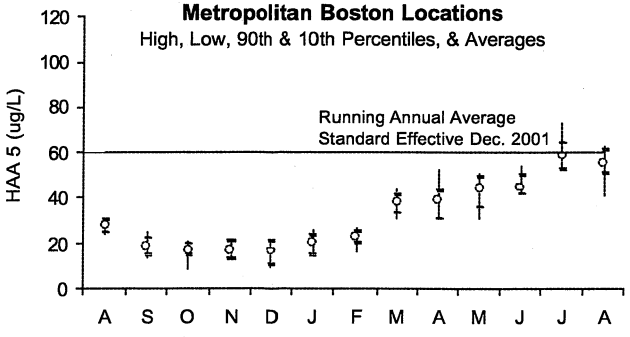




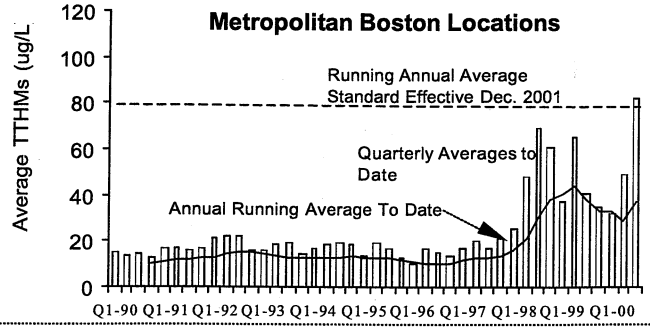


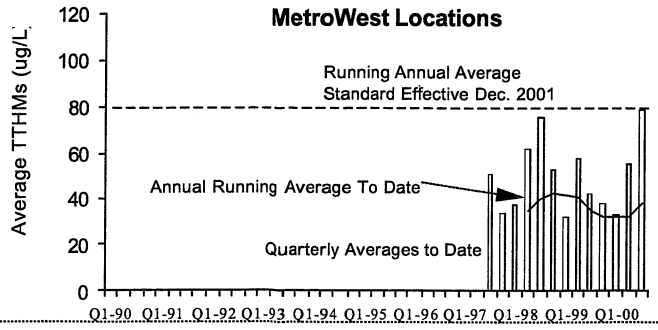






TTHMs : Quarterly Averages & Annual Running Average





MWRA Monthly Mineral Analysis

August 2000

This page provides information on water quality at six locations in the MWRA transmission system. Results reflect a "snapshot" in time and may not represent typical conditions. Elevated levels of a particular parameter may occur from time to time. MWRA staff review these numbers carefully and follow-up unusual results by re-analyzing samples, collecting new samples, or auditing sample sites. More rigorous daily or weekly monitoring of select parameters at these and other locations provides a better overall picture of water quality. MWRA reports many of these results elsewhere in this document.

Component	Winsor Power Station at Quabbin Reservoir (Raw)	Nash Hill Storage Tank (Treated)	Cosgrove Intake at Wachusett Reservoir (Raw)	ICC, Marlboro (Treated)	Comm Ave., Newton (Treated)	Shaft 9A, Malden (Treated)	MCL Standard	Units	Exceedance
Alkalinity	2.7	3.5	5.5	30	29	27.8		MG/L	
Aluminum	< 15	20.7	22.1	21.7	29.1	26.1	50-200 (a)	UG/L	NO
Ammonia-N	< 0.005	< 0.005	0.030	< 0.005	0.522	0.498		MG/L	
Antimony	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9		UG/L	
Arsenic	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	50 (b)	UG/L	NO
Barium	6.54	6.11	8.67	8.64	8.56	9.34	2000 (b)	UG/L	NO
Beryllium	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	4 (b)	UG/L	NO
Bromate	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	10	UG/L	
Bromide	9.9	2.6	< 2.5	4.83	4.6	5.4		UG/L	
Cadmium	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	5 (b)	UG/L	NO
Calcium	2130	2300	4050	4130	4150	4150		UG/L	
Chloride	5.1	6.5	14.7	17.3	18.1	17.9	250 (a)	MG/L	NO
Chlorine, Free	-	0.23	-	0.45	0.14	0.09		MG/L	
Chlorine, Total	-	-	-	0.79	2.18	2.19		MG/L	
Chromium	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	100 (b)	UG/L	NO
Coliform, Total, MF Method	0	0	0	0	0	0	0 (d)	CFU/100 mL	NO
Color	3	2	8	7	9	9	15 (a)	C.U.	NO
Copper **	50.9	14.2	2.5	5.6	18.1	7.5	1300 (b)	UG/L	NO
Cyanide	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.2 (b)	MG/L	NO
Fluoride	0.04	0.05	0.06	1.01	1.06	1.01	4 (b)	MG/L	NO
Hardness	7.4	7.8	13.3	13.6	13.6	13.6		MG/L	
Iron **	11.8	9.1	30	31	33.7	56.5	300 (a)	UG/L	NO
Lead	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	15 (b)	UG/L	NO
Magnesium	516	510	785	793	787	792		UG/L	
Manganese	2.2	2.1	8.6	7.2	9.2	20.3	50 (a)	UG/L	NO
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	2 (b)	UG/L	NO
Nickel	< 1	< 1	< 1	< 1	< 1	< 1		UG/L	
Nitrate-N	< 0.005	< 0.005	0.075	0.091	0.086	0.084	10 (b)	MG/L	NO
Nitrite	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005		MG/L	
Orthophosphate	< 0.0025	< 0.0025	< 0.0025	0.007	0.006	0.005		MG/L	
pH	6.6	6.8	7.0	9.0	9.0	8.8		S.U.	
Potassium	460	449	778	800	849	802		UG/L	
Selenium	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	50 (b)	UG/L	NO
Silica (SiO2)	1050	1150	2220	2740	2470	2650		UG/L	
Silver	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	100 (a)	UG/L	NO
Sodium	3.0	4.0	8.0	20.0	20.8	19.7		MG/L	
Specific Conductance	-	-	87	108	137	103		UMHOS	
Standard Plate Count, HPC (48 Hrs @ 35C)	99	34	> 500	1	0	140	500 (d)	CFU/mL	NO
Sulfate (SO4)	5.3	5.4	6.7	6.7	6.7	6.9	250 (a)	MG/L	NO
Thallium	< 1	< 1	< 1	< 1	< 1	< 1	2 (b)	UG/L	NO
Total Dissolved Solids	25	34	31	85	92	85	500 (a)	MG/L	NO
Trihalomethanes, Total (TTHMS) (f)	-	31	-	41	81	75	100 (b) (e)	UG/L	NO
Turbidity	0.26	0.21	0.45	0.98	0.47	0.43	1 (c)	NTU	NO
Zinc **	2.3	2.1	2.2	2.7	6.0	10.0	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. A new standard of 80 UG/L goes into effect in December 2001.

(f) = Average TTHM result for weekly samples collected in the month of March 2000.

MCL = Maximum Contaminant Level
CFU = Colony Forming Unit
S.U. = Standard Units
UG/L = micrograms per liter = parts per billion
NS = No sample
C.U. = Color Unit
NTU = Nephelometric Turbidity Unit
MG/L = milligrams per liter = parts per million
< = less than method detection limit
** = Metal results may be elevated due to local plumbing at the sample tap.
HPC = Heterotrophic Plate Count
umhos = ohms/1000

Most results are based on single grab samples collected August 7 & 8, 2000 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.

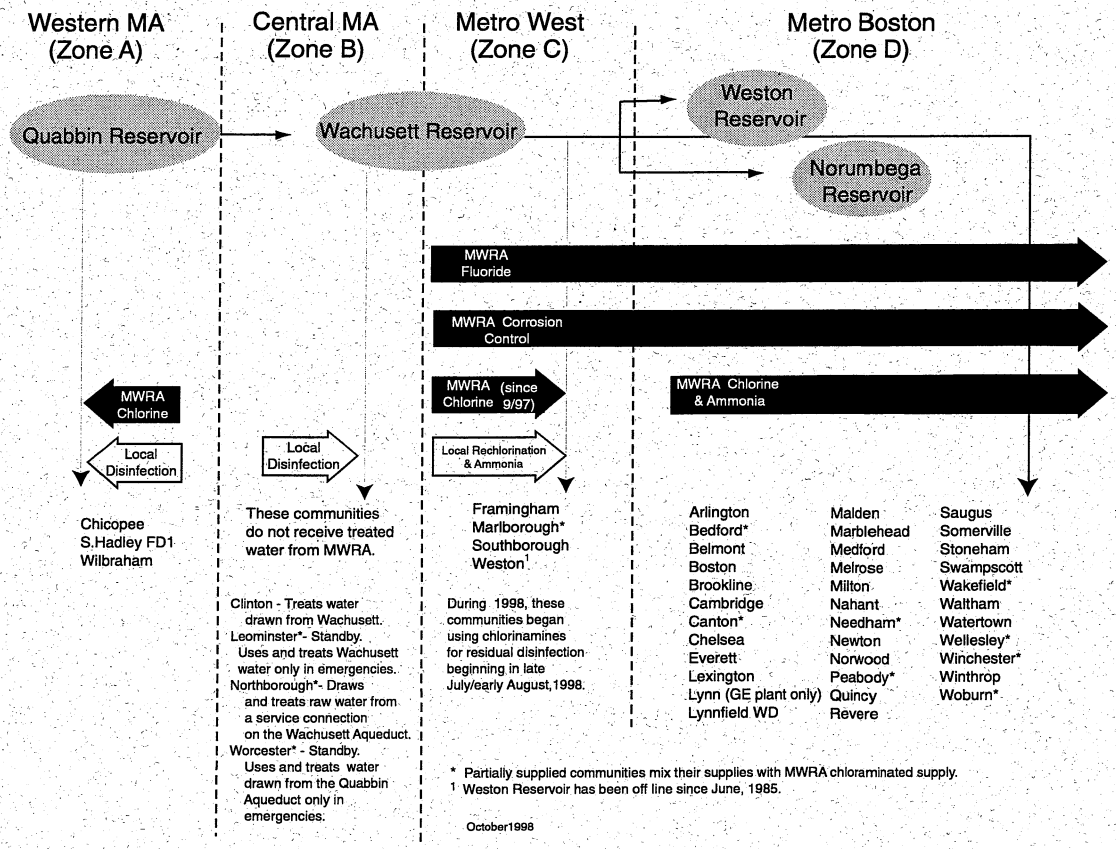
Safe Drinking Water Act (SDWA): Federal drinking water quality regulations.

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 • MICHAEL J. HORNBROOK, CHIEF OPERATING OFFICER
WILLIAM A. BRUTSCH, DEPUTY CHIEF OPERATING OFFICER • D. KELLY O'DAY • WATERWORKS OPERATIONS DIRECTOR