MASSACHUSETTS WATER RESOURCES AUTHORITY

SEPTEMBER 20 1999

WATER QUALITY UPDATE

An Analysis of August, 1999 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. 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.

MWRA Water Quality Update Highlights
August 1999

- **Quabbin reservoir levels**, at 87% of capacity as of 9/3, remained above normal levels for this time of year and only about 1% lower than levels for the same time in 1998. Cumulative rainfall at Wachusett Reservoir for the year, approximately 20", is about half that for a comparable period in 1998, and about 75% of that for a comparable period in 1997. Nevertheless, because of the availability of Quabbin water, supplies remain adequate for future demand.

- **MWRA treated Wachusett Reservoir water with copper sulfate** to reduce levels of *Synura* and *Uroglena* algae on August 24. *Synura* may cause a "fishy" taste and odor. At high levels, *Uroglena* may also create taste and odor problems. Treatment took place before complaints came in from cities and towns in hopes of preventing any complaints. Details appear on Page B.

- **MWRA's DBP Action Plan advanced.** Quabbin water transfers to Wachusett Reservoir continued until August 30, lowering levels of reactive organic matter in water there. Using the three-point CT calculation methodology, MWRA satisfied CT requirements for unfiltered water systems while lowering the chlorine dose from 1.3 mg/L on 7/31 to 1.2 mg/L on 8/11 and 1.1 mg/L on 8/25. These doses are lower than they were one year ago. Average TTHMs for August 1999 were down slightly from July averages and also down noticeably from August 1998 levels. Details appear on Page F.

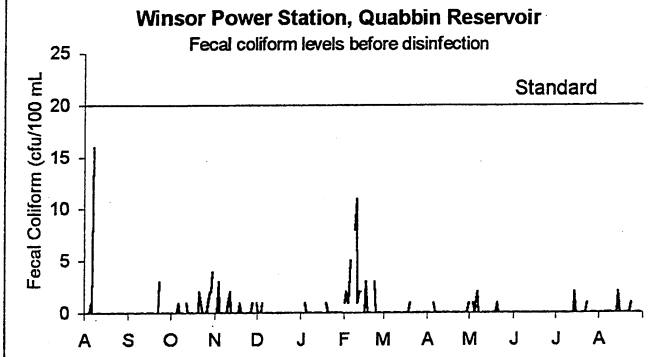
- **Coliforms measured at Wachusett Reservoir remained low.** The six-month running average for coliforms was 0.0% for August, reflecting no exceedances of the coliform standard since January 29. Details appear on Page B.

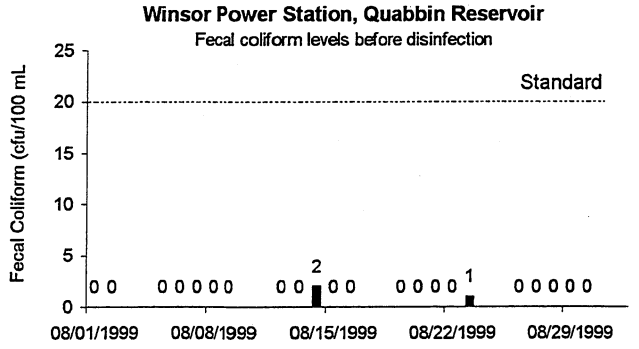
MWRA
Source Water – Chicopee Valley Aqueduct
Fecal Coliform and Turbidity Levels At Quabbin Reservoir
(Winsor Power Station)
August 1999

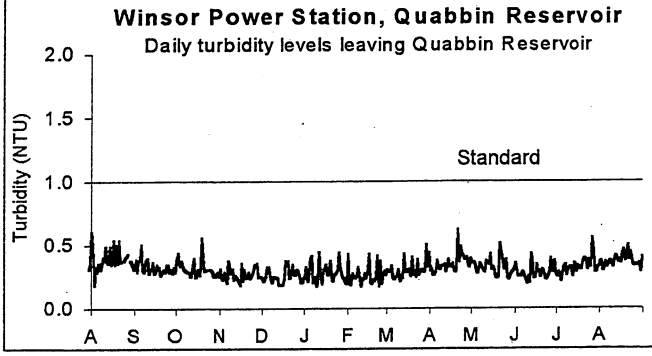
Quabbin Reservoir water sampled at Winsor Power Station before chlorination represents reservoir water entering the Chicopee Valley Aqueduct (CVA). The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have over 20 fecal coliforms 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. This month, levels remain below standards.

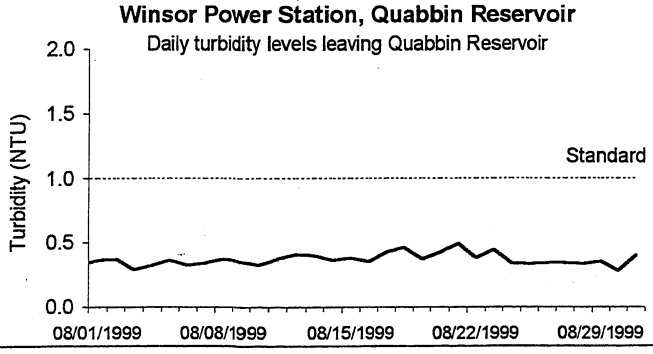
Samples for turbidity are collected at Winsor Power Station before chlorination and represent reservoir water entering the CVA. The Massachusetts Department of Environmental Protection standard for source water turbidity for unfiltered water supply systems is a maximum of 1.0 NTU; the EPA standard is a maximum of 5.0 NTU. Turbidity levels are well below DEP standards.

Results presented here cover the last thirteen months and the most recent month.





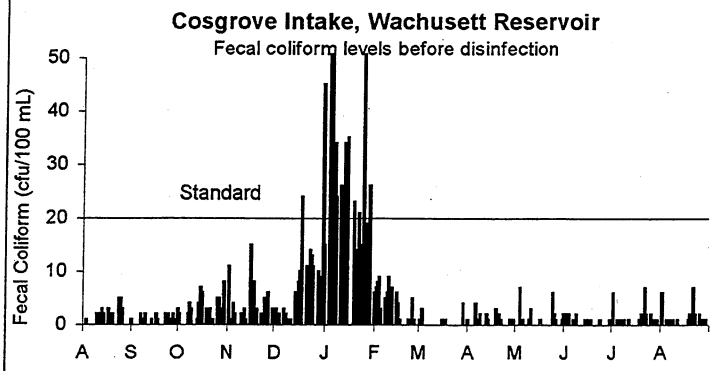


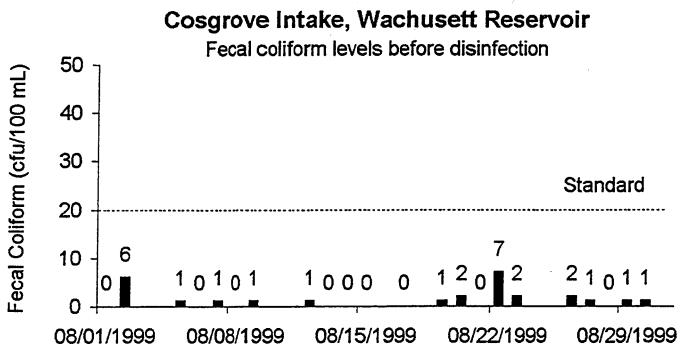


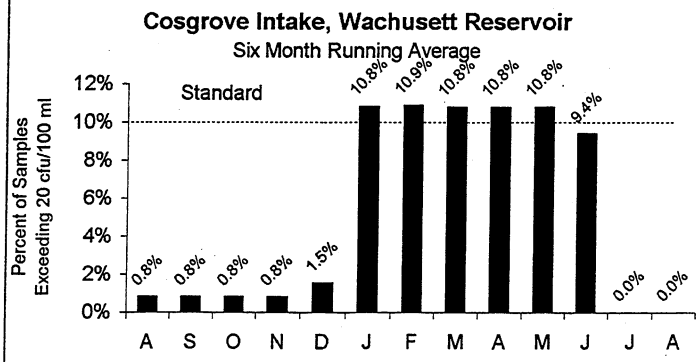
MWRA
Source Water
Fecal Coliform Levels and Primary Disinfection at Wachusett Reservoir
August 1999

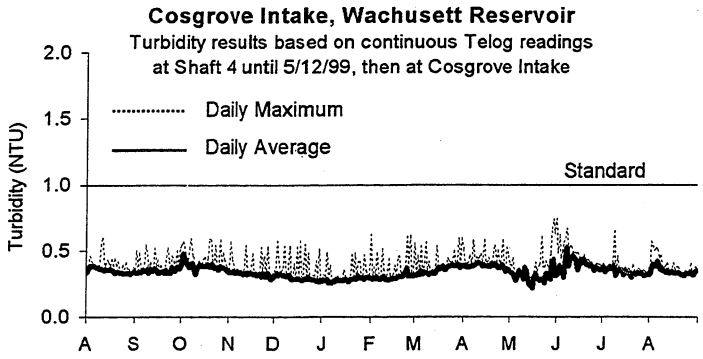
Samples from Wachusett Reservoir are collected at a location inside the Cosgrove Intake facility and represent water entering the Cosgrove Aqueduct. The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have more than 20 fecal 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 were collected at Shaft 4, after primary disinfection and corrosion control treatment, until May 12. Samples are now collected at 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. Turbidity results were below the DEP standard.

Fecal coliform counts for the month were all well below the 20 cfu/100 ml standard. The six-month running average this month is 0.0%; the standard is 10%. Seasonal variations in fecal coliform levels occur each year, usually related to icing over of nearby water bodies and birds visiting Wachusett, which tends to freeze later in the year. In February, DEP noted that the MWRA uses laboratory methods that are significantly more sensitive than required and ordered MWRA to evaluate the sensitivity of those methods. DEP also found that MWRA's disinfection system worked adequately and that the higher coliform levels in December and January raised no public health concern.





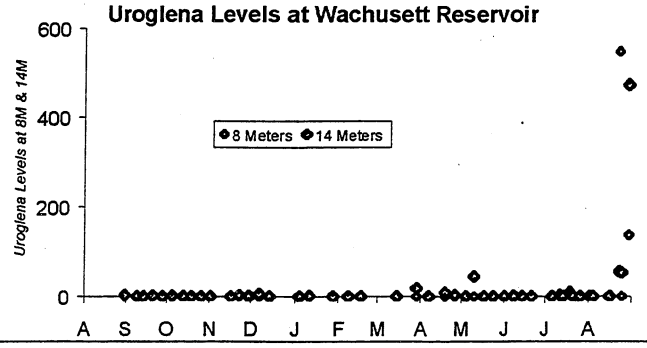


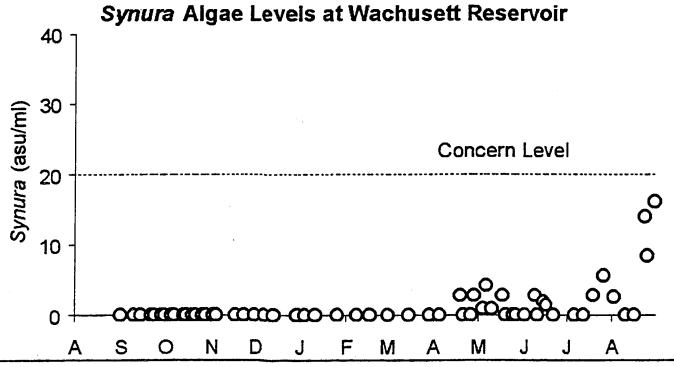


Algae Levels at Wachusett Reservoir

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 water at Wachusett Dam with copper sulfate on August 24 to reduce levels of *Synura* and *Uroglena* algae. *Synura* is of particular concern due to "fishy" taste and odor problems. When present at high levels, *Uroglena* can also cause taste and odor problems in the water. Treatment took place to prevent any complaints. These algae grow 8-14 meters deep in the reservoir and required a depth application of copper sulfate.



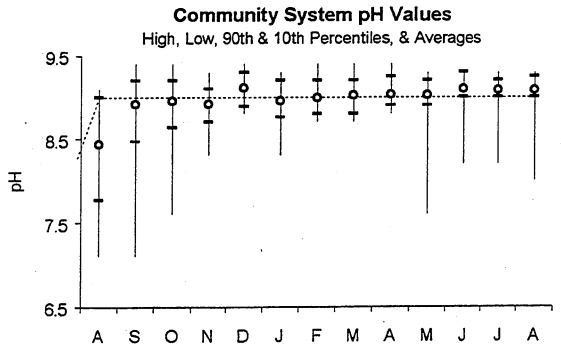


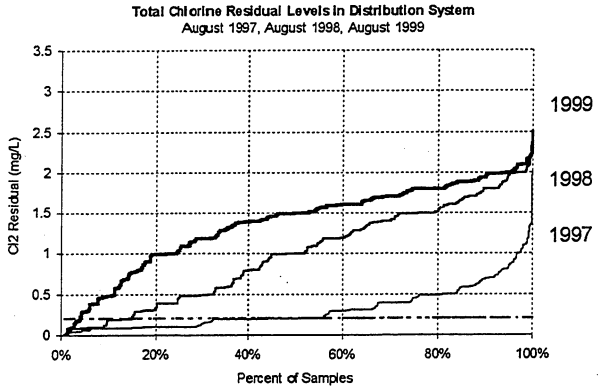
MWRA
Treated Water
pH and Chlorine Residual Levels in Communities
August 1999

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. 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. As noted on Page A, 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 results appear on the left below. Low pH results for May, June, July, and August were recorded in Wakefield, a partially-served community.

The chart below on the right compares Metropolitan Boston total chlorine residuals for community systems in August 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 August 1997, about 67% of the samples met the chlorine residual target of 0.2 mg/L. By August 1998, 90% of all samples met this target. Last month, 96.9% of all samples met this target. 98.2% of all samples in August 1999 had residuals at or above 0.1 mg/L.

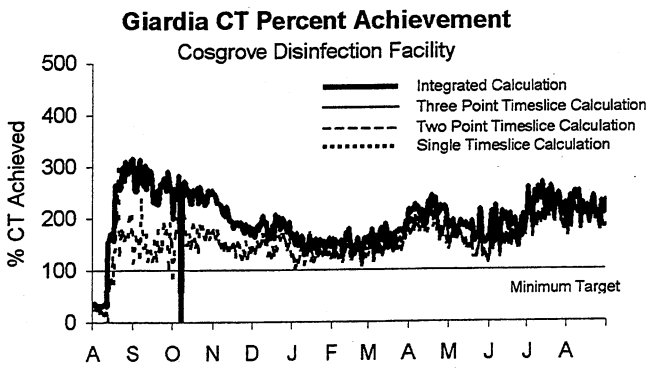
MWRA must meet regulations that require either that chlorine residuals in at least 95% of samples be detectable or that HPCs (Heterotrophic Plate Counts) be lower than 500 cfu/ml. In August, sample results from all communities participating in the MWRA program satisfied requirements for both chlorine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

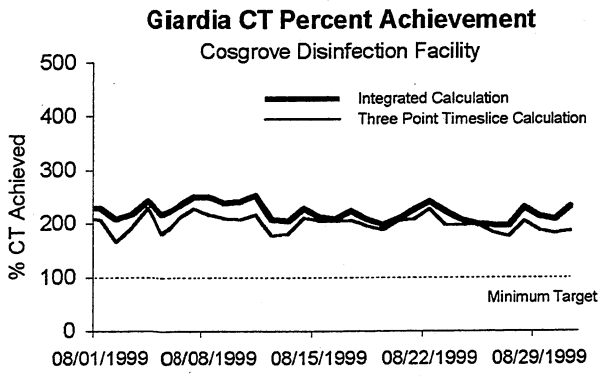




Primary Disinfection
Cosgrove Disinfection Facility

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. This more precise calculation method allows MWRA to meet disinfection requirements while lowering chlorine dose, reducing the formation of disinfection by-products. 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 was met each day this month.





MWRA
Tocal Coliform Rule Results for Communities Participating in MWRA Testing Program
August 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
Only one of the 1825 samples tested was positive for coliform during the month of August. Repeat samples were negative for total coliform and for *E. coli*.

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 all communities remained at or above last year's levels, which were themselves significantly above chlorine residual levels for the preceding year.

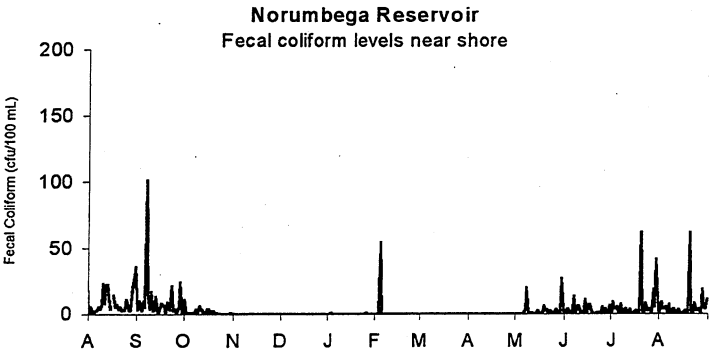
Town	Samples Tested for Coliform (a)	Total Coliform % Positive	E. coli % Positive	Public Notification Required?	August 1999 Minimum Chlorine Residual (mg/L)	August 1999 Average Chlorine Residual (mg/L)	August 1998 Average Chlorine Residual (mg/L)
ARLINGTON	53				0.02	1.05	0.53
BELMONT	40				0.10	1.11	0.71
BOSTON	252				0.23	1.58	1.28
BROOKLINE	85				0.70	1.80	1.38
CAMBRIDGE	92				0.20	1.73	
CHELSEA	40				0.06	1.41	1.17
EVERETT	50				0.00	1.54	1.68
FRAMINGHAM (c)	69				0.04	1.27	0.71
LEXINGTON	45				1.50	1.91	1.52
LYNNFIELD	6				0.55	1.35	0.64
MALDEN	75				0.00	1.15	0.86
MARBLEHEAD	24				0.76	1.73	1.17
MARLBOROUGH (b) (c)	48				0.76	1.09	
MEDFORD	85				0.10	0.99	0.57
MELROSE	45				0.10	1.30	0.75
MILTON	40				0.69	1.28	0.36
NAHANT	10				0.01	0.94	0.38
NEEDHAM (b)	51				0.01	0.73	0.45
NEWTON	88				0.70	1.60	1.39
NORWOOD	50				0.00	0.75	0.51
QUINCY	102				0.20	1.34	0.63
REVERE	52				0.30	0.91	0.89
SAUGUS	40				1.50	1.73	0.42
SOMERVILLE	80	1.3%		No (d)	0.20	1.11	1.12
SOUTHBORO (c)	9				0.60	1.28	0.86
STONEHAM	28				1.10	1.50	1.09
SWAMPSCOTT	18				0.46	1.03	0.95
WAKEFIELD (b)	44				0.10	1.54	0.97
WALTHAM	67				1.00	1.53	1.15
WATERTOWN	40				0.02	1.21	0.54
WELLESLEY (b)	35				0.30	0.49	0.48
WESTON (c)	13				0.71	1.28	0.50
WINCHESTER (b)	25				0.13	1.05	0.60
WINTHROP	24				0.40	1.46	0.58
Total:	1825						

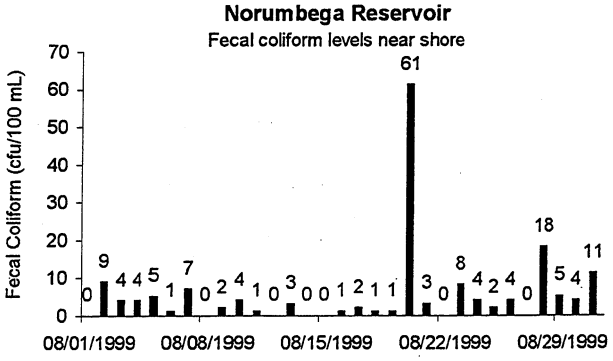
(a) The number of samples collected depends on the population served and the number of repeat samples required.
(b) These communities are partially supplied, and may mix their chlorinated supply with MWRA chloraminated supply.
(c) These communities re-chloraminate (since July/August 1998).
(d) Less than 5% total coliform positive, therefore public notification not required. Repeat samples were negative.

D

MWRA
Distribution Water
Fecal Coliform Levels in Norumbega Reservoir
August 1999

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. In response to one high fecal coliform result in late May, MWRA stepped up shoreline patrols and increased transect monitoring throughout the reservoir. With the exception of a sample taken on 8/20, fecal coliform results along the shore and throughout the reservoir were low in August. Samples taken before and after the high result on 8/20 were low, as were results from transect samples taken on 8/20. Samples taken from the sampling site near shore late in the month tended to be higher than transect samples taken on 8/25.

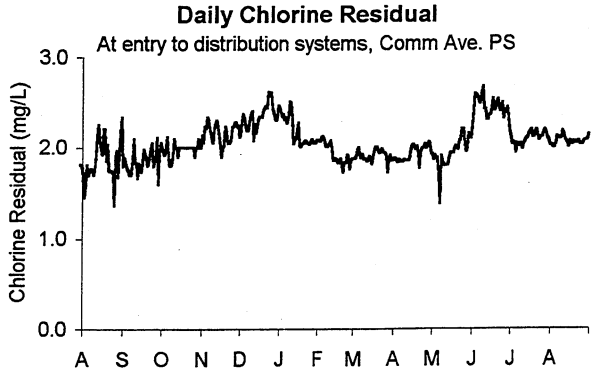


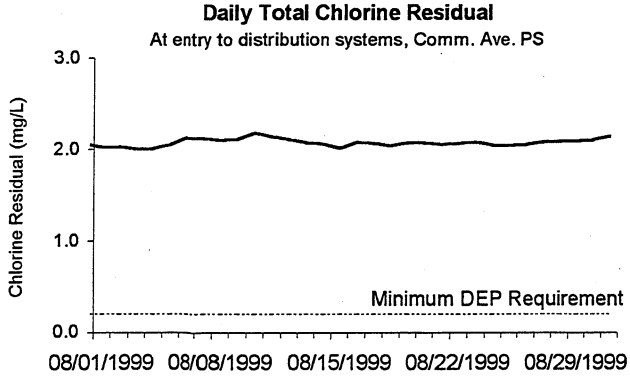


Treated Water
Disinfectant Levels in Hultman Aqueduct at Norumbega Disinfection Facility and Commonwealth Avenue Pump Station (Entry Point to Customer Distribution Systems)

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). MWRA Operations has formed a process improvement team to optimize chloramination at Norumbega 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. Total chlorine residuals averaged 2.1 mg/l for the month.





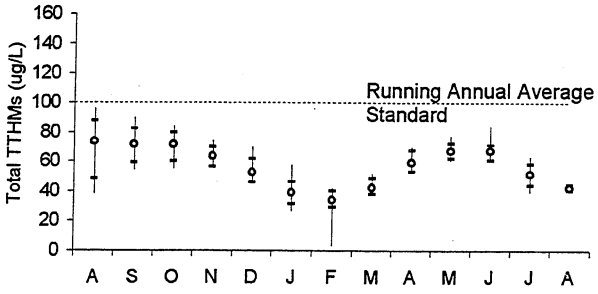
MWRA
Treated Water
Disinfection By-Product (DBP) Levels in Communities
August 1999

Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAAs) are by-products of disinfection treatment with chlorine. Bromodichloromethane (BDCM) is one THM compound. 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 that will take effect in 2001. DEP requires that samples be collected quarterly; MWRA samples weekly at some locations, quarterly at others. These graphs report results both on a monthly and quarterly basis. The graphs of quarterly and running annual averages illustrate MWRA's compliance with the DEP standard.

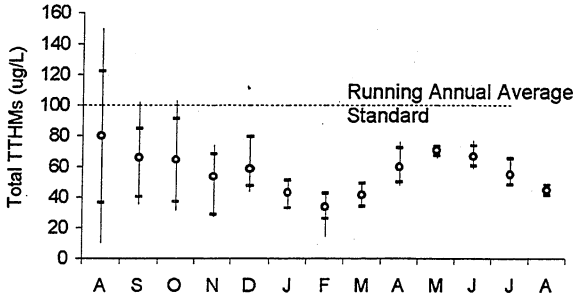
Average TTHM levels declined from July levels, remaining below current standards and standards that take effect in 2001. MWRA implemented its DBP Control Action Plan in May to minimize DBP formation while satisfying disinfection requirements. The main points of the Plan appear in the Water Quality Update for May 1999 (Page A). Achievements for August are summarized in this issue.

TTHMs

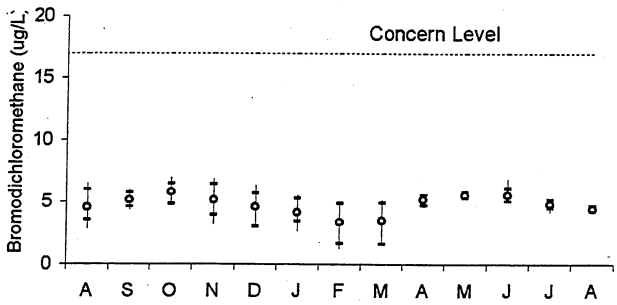
Metropolitan Boston Locations
High, Low, 90th & 10th Percentiles, & Averages

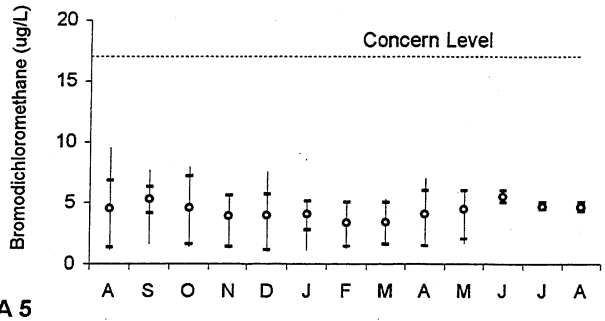


MetroWest Locations
High, Low, 90th & 10th Percentiles, & Averages

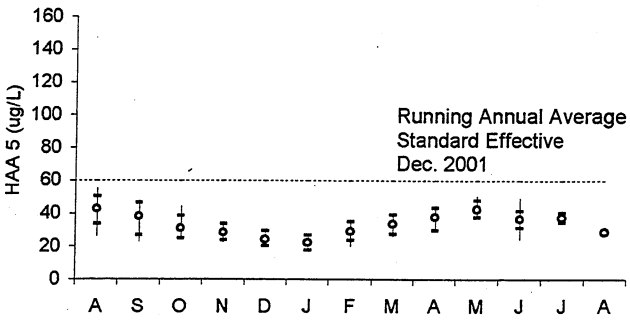


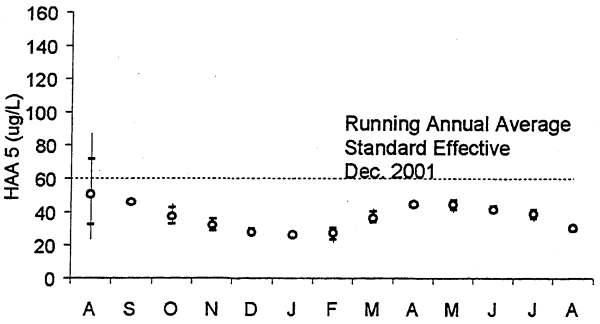
Bromodichloromethane



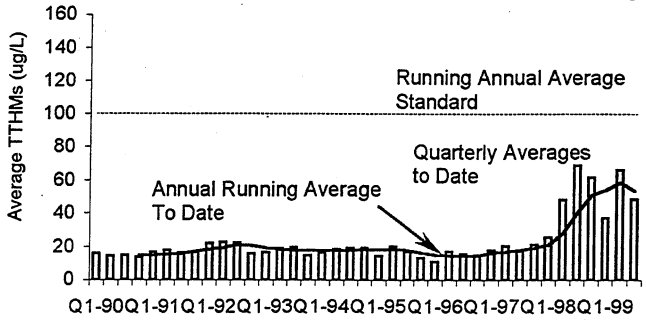


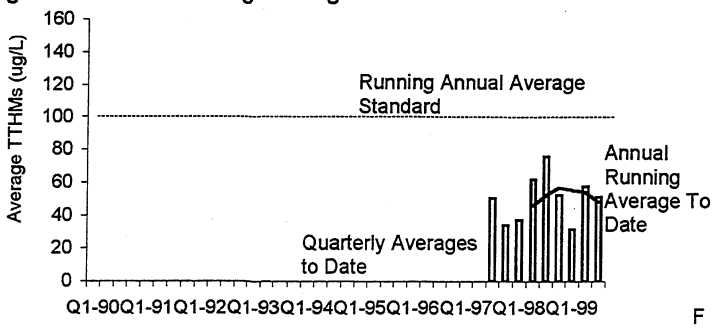
HAA 5





TTHMs : Quarterly Averages & Annual Running Average





MWRA Monthly Mineral Analysis

August 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	4.4	29.3	31.5	29.0		MG/L	
Aluminum	< 15	< 15	< 15	< 15	50-200 (a)	UG/L	NO
Ammonia	0.005	< 0.005	0.433	0.430		MG/L	
Antimony	< 1.5	< 1.5	< 1.5	< 1.5		UG/L	
Arsenic	< 0.8	< 0.8	< 0.8	< 0.8	50 (b)	UG/L	NO
Barium	7.38	7.42	7.46	7.37	2000 (b)	UG/L	NO
Beryllium	< 0.1	< 0.1	< 0.1	< 0.1	4 (b)	UG/L	NO
Cadmium	< 0.2	< 0.2	< 0.2	< 0.2	5 (b)	UG/L	NO
Calcium	3.32	3.35	3.39	3.39		MG/L	
Chloride	11.4	12.5	13.6	13.2	250 (a)	MG/L	NO
Chlorine, Free	-	0.10	0.05	0.05		MG/L	
Chlorine, Total	-	0.59	2.03	1.92		MG/L	
Chromium	< 0.6	< 0.6	< 0.6	< 0.6	100 (b)	UG/L	NO
Coliform, Total, MF Method	0	0	0	0	0 (d)	CFU/100 mL	NO
Color	12	9	8	11	15 (a)	C.U.	NO
Copper	3.52	4.53	40.40	3.62	1300 (b)	UG/L	NO
Cyanide	< 0.01	< 0.01	< 0.01	< 0.01	0.2 (b)	MG/L	NO
Fluoride	0.1	1.1	1.1	1.1	4 (b)	MG/L	NO
Hardness	11.0	11.0	11.1	11.1		MG/L	
Iron	17.8	22.6	20.7	19.6	300 (a)	UG/L	NO
Lead	< 2.4	< 2.4	< 2.4	< 2.4	15 (b)	UG/L	NO
Magnesium	0.649	0.650	0.652	0.643		MG/L	
Manganese	11.60	9.84	10.40	9.86	50 (a)	UG/L	NO
Mercury	< 0.01	< 0.01	< 0.01	< 0.01	2 (b)	UG/L	NO
Nickel	< 1	< 1	< 1	< 1		UG/L	
Nitrate-N	0.0160	0.0197	0.0297	0.0236	10 (b)	MG/L	NO
Orthophosphate	0.005	0.009	0.011	0.009		MG/L	
Potassium	0.678	0.686	0.693	0.688		MG/L	
Selenium	< 0.9	< 0.9	< 0.9	< 0.9	50 (b)	UG/L	NO
Silica (SiO2)	1.62	2.17	2.13	2.19		MG/L	
Silver	< 0.4	< 0.4	< 0.4	< 0.4	100 (a)	UG/L	NO
Sodium	6.96	19.3	19.3	19.4		MG/L	
Specific Conductance	75	121	119	89		UMHOS	
Standard Plate Count, HPC (48 Hrs @ 35C)	1270	62	66	13	500 (d)	CFU/mL	NO*
Sulfate (SO4)	6.27	6.25	7.76	6.3	250 (a)	MG/L	NO
Thallium	< 1	< 1	< 1	< 1	2 (b)	UG/L	NO
Total Dissolved Solids	35	60	65	62	500 (a)	MG/L	NO
Trihalomethanes, Total (TTHMS) (f)	-	19	42	39	100 (b) (e)	UG/L	NO
Turbidity	0.34	0.33	0.35	0.32	1 (c)	NTU	NO
Zinc	1.16	0.998	18.7	1.17	5000 (a)	UG/L	NO

* This is not a violation, since a chlorine residual was detected in the sample.

(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 July 1999.

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

These results are based on single grab samples collected August 3, 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.

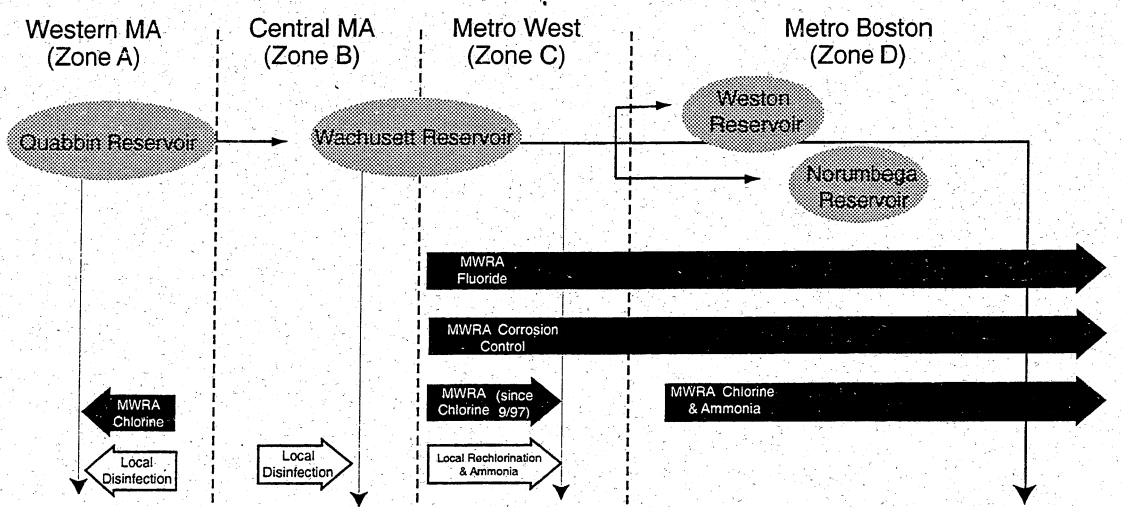
Safe Drinking Water Act (SDWA): Federal drinking water quality regulations.

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.



Chicopee
S.Hadley FD1
Wilbraham

These communities do not receive treated water from MWRA.

Framingham
Marlborough*
Southborough
Weston[1]

Arlington
Bedford*
Belmont
Boston
Brookline
Cambridge
Canton*
Chelsea
Everett
Lexington
Lynn (GE plant only)
Lynnfield WD
Malden
Marblehead
Medford
Melrose
Milton
Nahant
Needham*
Newton
Norwood
Peabody*
Quincy
Revere
Saugus
Somerville
Stoneham
Swampscott
Wakefield*
Waltham
Watertown
Wellesley*
Winchester*
Winthrop
Woburn*

Clinton - Treats water drawn from Wachusett.
Leominster* - Standby. Uses and treats Wachusett water only in emergencies.
Northborough* - Draws and treats raw water from a service connection on the Wachusett Aqueduct.
Worcester* - Standby. Uses and treats water drawn from the Quabbin Aqueduct only in emergencies.

During 1998, these communities began using chlorinamines for residual disinfection beginning in late July/early August, 1998.

* Partially supplied communities mix their supplies with MWRA chloraminated supply.
[1] Weston Reservoir has been off line since June, 1985.

October1998

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