Massachusetts Water Resources Authority

AUGUST 20 1999

WATER QUALITY UPDATE

An Analysis of July, 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
July 1999

- **Quabbin Reservoir was 90% full as of July 30, within normal ranges for July.** Average daily demand for July 1999 measured at Shaft 4 was 292.8 MGD, compared to 265.7 MGD for July 1998 and 295.9 MGD for July 1997. MWRA started serving Cambridge in August 1998, adding demand compared to previous years. Worcester purchased water for a short time in July.

- **MWRA's DBP Action Plan advanced.** The dry weather allows continuous transfers of Quabbin water to Wachusett, lowering the presence of reactive organic matter in water there. The three-point timeslice CT calculation method replaced the two-point method, allowing MWRA both to lower chlorine dosage and satisfy CT requirements for unfiltered water systems. Chlorine dose declined from 1.55 mg/L on July 1 to 1.5 mg/L on July 15, 1.4 mg/L on July 21, and 1.3 mg/L on July 28. Chlorine dose during July 1998 was 1.2 mg/L, short of what was required to meet CT. Average TTHM levels declined from June levels. Details appear on Page F.

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

- **Watershed protection efforts at Wachusett Reservoir continue.** MDC purchased a Hoverguard 800 watercraft to make bird harassment more effective. Adjustments to the bird harassment program are also planned. New docking facilities and additional boat ramps for this program will be constructed near summer's end. Designs for installing an in-reservoir barrier are under way.

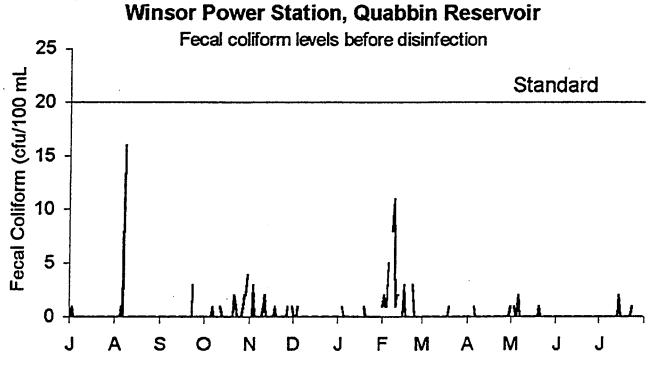
- **Improvements at MWRA's Interim Corrosion Control Facility (ICCF) established greater control of pH treatment.** Over the course of several months, Waterworks staff upgraded equipment, introduced improvements to chemical addition processes, and re-built automated controls to achieve consistent pH levels in treated water. This greater consistency in corrosion treatment should have some impact on lowering lead levels in communities. (See enclosed update to MWRA Board on lead levels.)

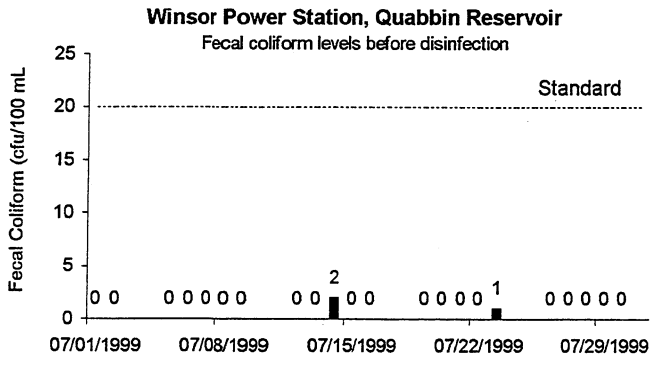
Source Water – Chicopee Valley Aqueduct
Fecal Coliform and Turbidity Levels At Quabbin Reservoir
(Winsor Power Station)
July 1999

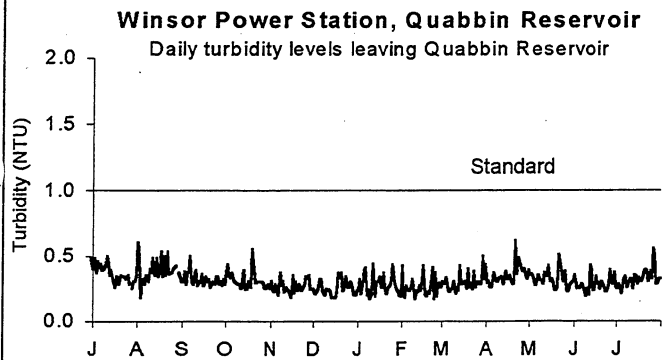
Quabbin Reservoir water sampled at Winsor Power Station before chlorination represents reservoir water entering the Chicopee Valley Aqueduct (CVA). The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have over 20 fecal coliforms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

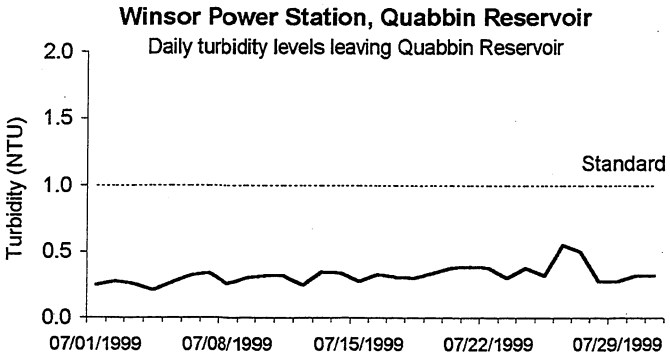
Samples for turbidity are collected at Winsor Power Station before chlorination and represent reservoir water entering the CVA. The Massachusetts Department of Environmental Protection standard for source water turbidity for unfiltered water supply systems is a maximum of 1.0 NTU; the EPA standard is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





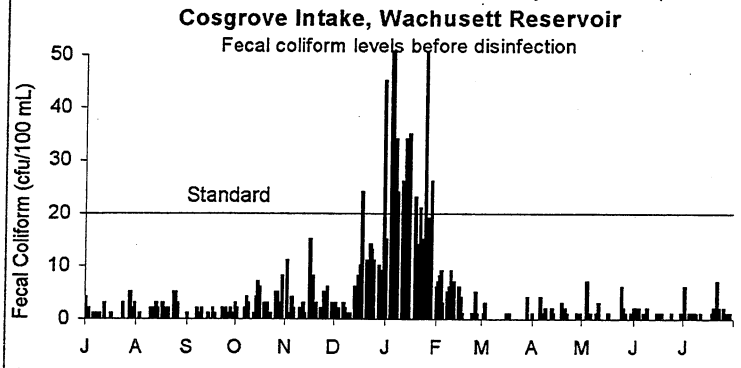


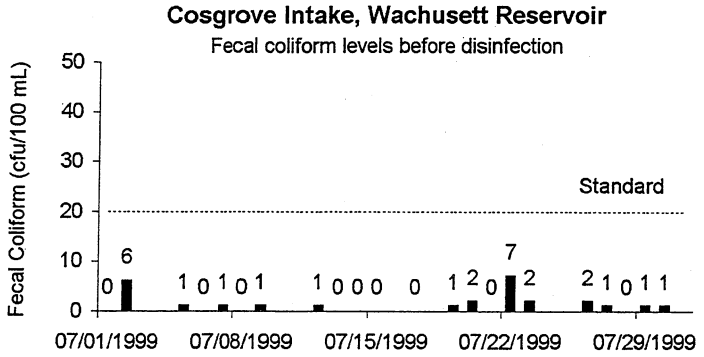


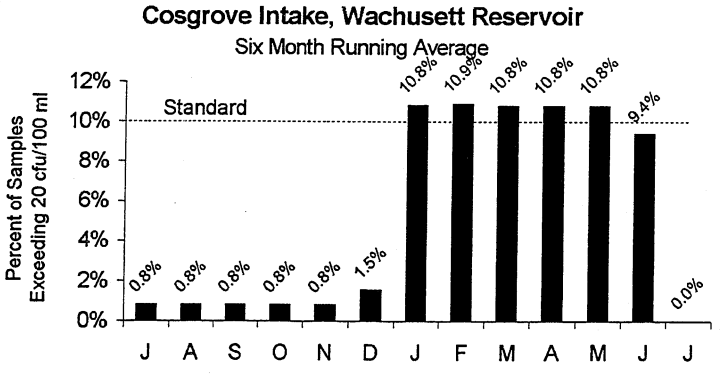
MWRA
Source Water
Fecal Coliform Levels and Primary Disinfection at Wachusett Reservoir
July 1999

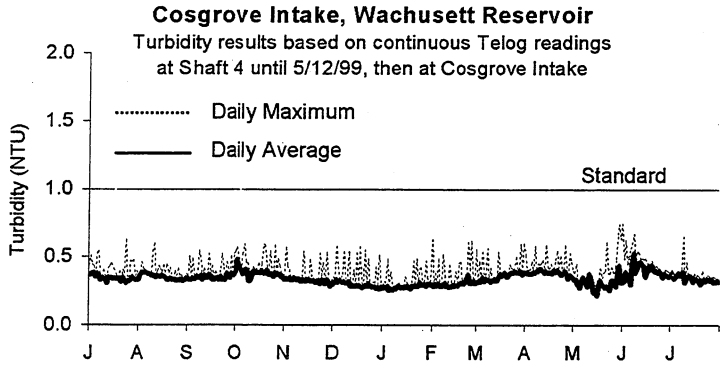
Samples from Wachusett Reservoir are collected at a location inside the Cosgrove Intake facility and represent water entering the Cosgrove Aqueduct. The Surface Water Treatment Rule (SWTR) for unfiltered supplies requires that no more than 10% of samples over any six-month period have more than 20 fecal 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. As noted in the highlights on Page A, MWRA and MDC are working this summer to upgrade facilities at Wachusett in order to minimize the effect of birds on water quality near the intake this winter. 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.





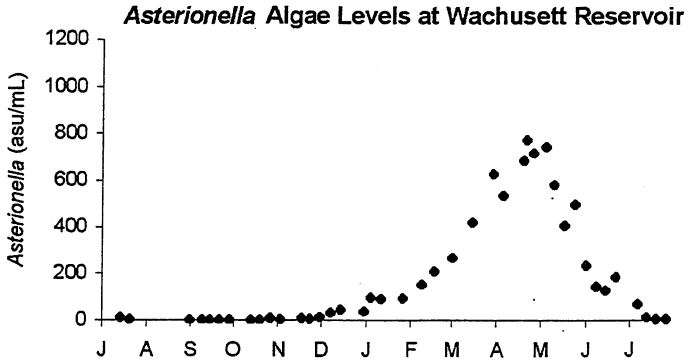


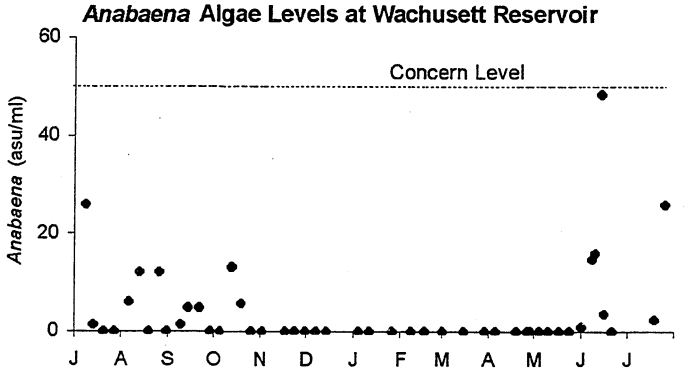


Algae Levels at Wachusett Reservoir

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.

Asterionella, a filter-clogging species, declined in May after reservoir waters stratified. *Dinobryon*, which can cause fishy odors, rapidly exceeded the level of concern, quickly declined, then remained at low levels, perhaps because of weather conditions. *Anabaena* bloomed in June; treatment prevented the bloom from affecting water quality. Levels in July were comparable to those of July 1998. MDC and MWRA will continue to monitor these levels closely.



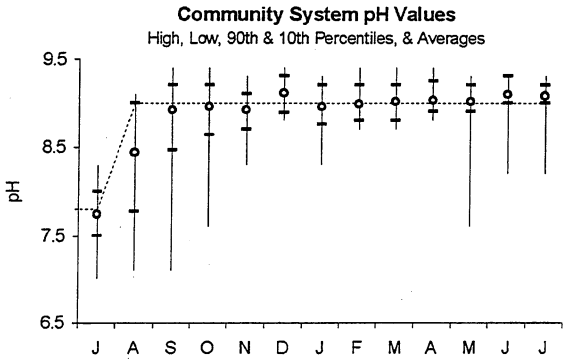


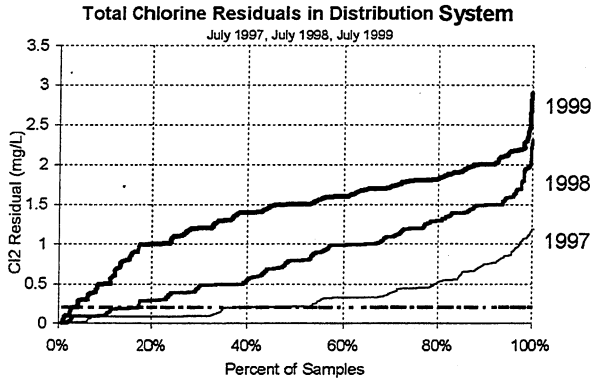
MWRA
Treated Water
pH and Chlorine Residual Levels in Communities
July 1999

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, and July were recorded in Wakefield, a partially-served community.

The chart below on the right compares Metropolitan Boston total chlorine residuals for community systems in July 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 July 1997, about 65% of the samples met the chlorine residual target of 0.2 mg/L. By July 1998, 88.8% of all samples met this target. Last month, 95.9% of all samples met this target. 98.6% of all samples in July 1999 had residuals at or above 0.1 mg/L.

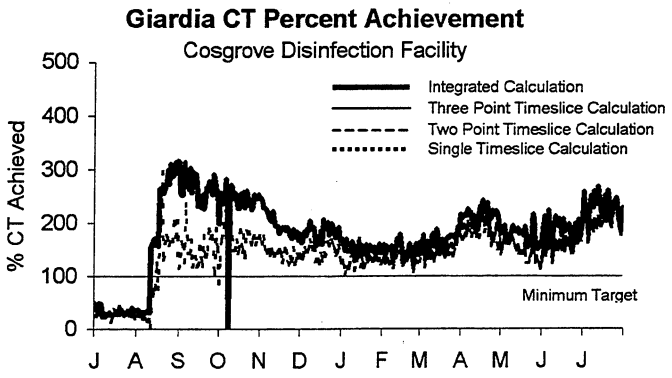
MWRA must meet regulations that require either that chlorine residuals in at least 95% of samples be detectable or that HPCs (Heterotrophic Plate Counts) be lower than 500 cfu/ml. In July, sample results from all communities participating in the MWRA program satisfied requirements for both chlorine residuals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

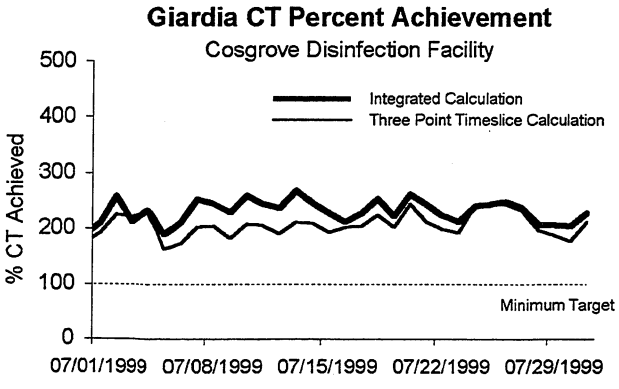




Primary Disinfection
Cosgrove Disinfection Facility

In July, 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
July 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 1716 samples tested were positive for coliform during the month of July.

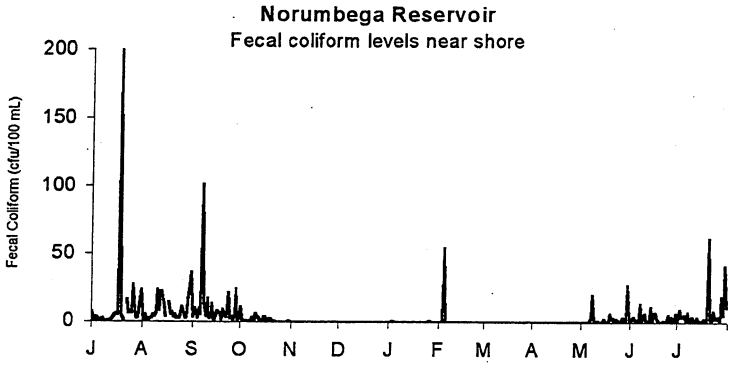
All thirty-four communities that submitted chlorine residual data maintained an average disinfectant residual of at least 0.2 mg/L. Fifteen communities had one or more samples with a disinfectant residual lower than 0.2 mg/L. Average chlorine residuals in all communities remained at or above last year's levels, which were themselves significantly above chlorine residual levels for the preceding year. In most towns, average chlorine residuals for 1999 were well above averages for 1998.

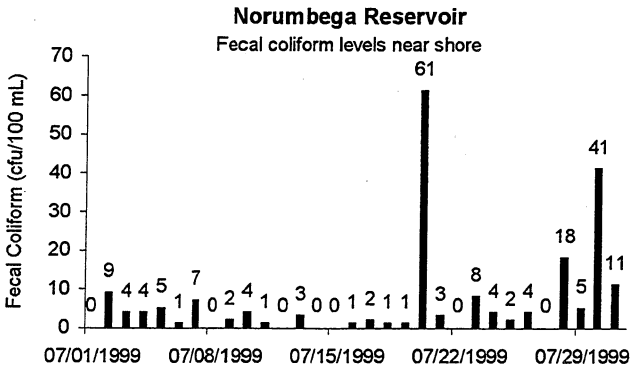
Town	Samples Tested for Coliform (a)	Total Coliform % Positive	E. coli % Positive	Public Notification Required?	July 1999 Minimum Chlorine Residual (mg/L)	July 1999 Average Chlorine Residual (mg/L)	July 1998 Average Chlorine Residual (mg/L)
ARLINGTON	71				0.05	0.98	0.37
BELMONT	32				0.10	1.37	0.52
BOSTON	238				0.40	1.65	1.00
BROOKLINE	68				0.80	2.05	1.17
CAMBRIDGE	92				0.10	1.85	
CHELSEA	32				0.10	1.50	0.80
EVERETT	40				0.00	1.53	1.51
FRAMINGHAM (c)	71				0.09	1.30	
LEXINGTON	36				1.50	1.92	1.22
LYNNFIELD	6				1.20	1.63	0.56
MALDEN	60				0.00	1.23	0.81
MARBLEHEAD	24				0.84	1.73	0.97
MARLBOROUGH (b) (c)	49				0.41	1.03	
MEDFORD	68				0.00	1.02	0.42
MELROSE	36				0.10	1.31	0.63
MILTON	32				0.72	1.32	0.41
NAHANT	10				0.42	0.98	0.37
NEEDHAM (b)	41				0.04	1.04	0.24
NEWTON	88				1.25	1.69	1.03
NORWOOD	40				0.00	0.76	0.48
QUINCY	92				0.20	1.29	0.63
REVERE	52				0.10	0.91	0.66
SAUGUS	32				0.90	1.19	0.43
SOMERVILLE	82				0.05	1.07	0.81
SOUTHBORO (c)	9				0.50	1.13	0.13
STONEHAM	35				1.30	1.70	0.82
SWAMPSCOTT	18				1.09	1.42	1.03
WAKEFIELD (b)	55				0.51	1.60	0.70
WALTHAM	67				0.80	1.55	1.07
WATERTOWN	50				0.10	1.20	0.51
WELLESLEY (b)	33				0.30	0.52	0.51
WESTON (c)	13				0.75	1.26	0.06
WINCHESTER (b)	20				0.15	1.04	0.49
WINTHROP	24				0.50	1.31	0.44
Total:	1716						

(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.

MWRA
Distribution Water
Fecal Coliform Levels in Norumbega Reservoir
July 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 samples taken on 7/20 and 7/30, fecal coliform results along the shore and throughout the reservoir were low in July. Samples taken before and after the high result on 7/20 were low, as were results from transect samples taken on 7/21. Samples taken from the sampling site near shore late in the month tended to be higher than transect samples taken at that time.

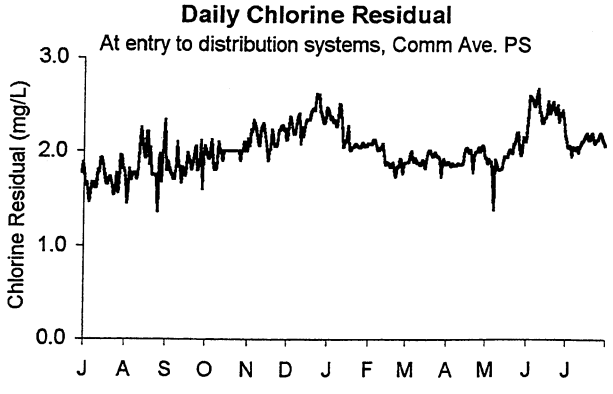


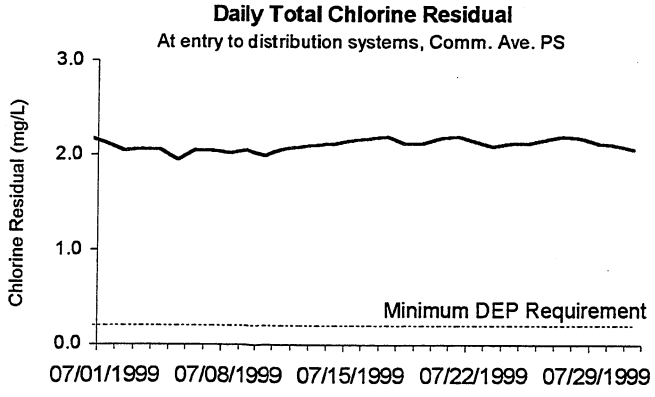


Treated Water
Disinfectant Levels in Hultman Aqueduct at Norumbega Disinfection Facility and Commonwealth Avenue Pump Station (Entry Point to Customer Distribution Systems)

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, a result of dosage increases at Norumbega to ensure adequate disinfection during periods of high demand.



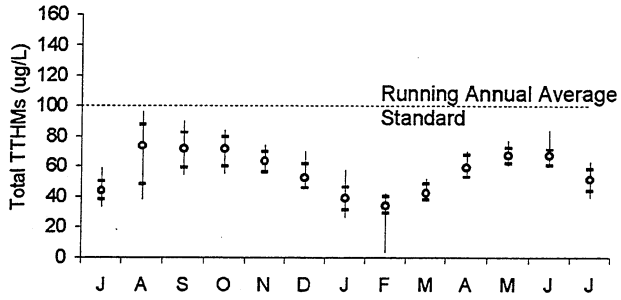


MWRA
Treated Water
Disinfection By-Product (DBP) Levels in Communities
July 1999

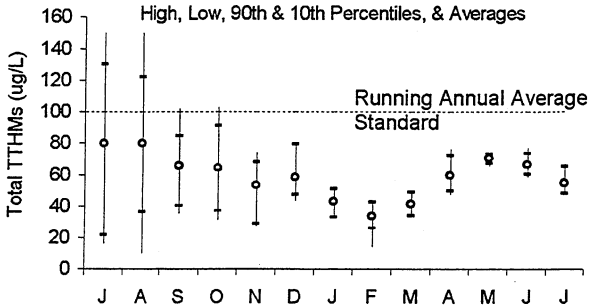
Total Trihalomethanes (TTHMs) and Haloacetic Acids (HAAs) are by-products of disinfection treatment with chlorine. Bromodichloromethane is one THM compound. Chlorination levels, the presence of organic precursors, pH levels, the contact time of water with chlorine used for disinfection, and temperature 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 June 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 July are summarized in this issue (Page A).

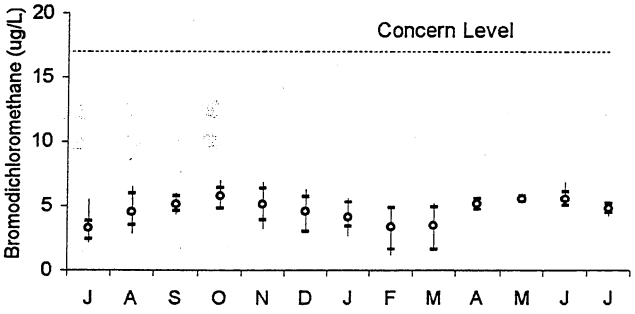
Metropolitan Boston Locations
High, Low, 90th & 10th Percentiles, & Averages



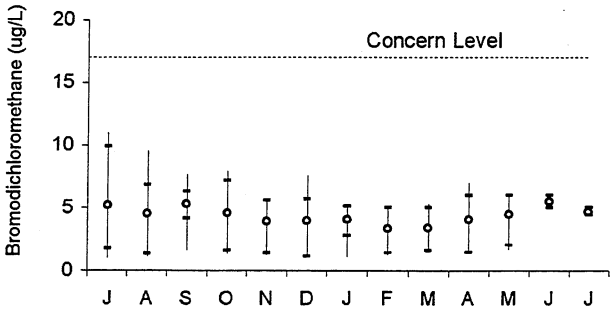
MetroWest Locations
Marlboro, Southboro, Framingham, & Weston
High, Low, 90th & 10th Percentiles, & Averages



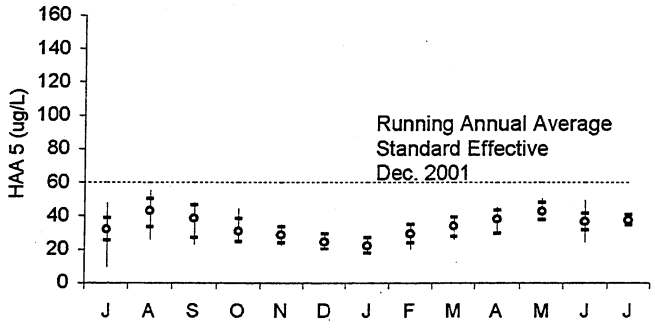
Metropolitan Boston Locations
High, Low, 90th & 10th Percentiles, & Averages



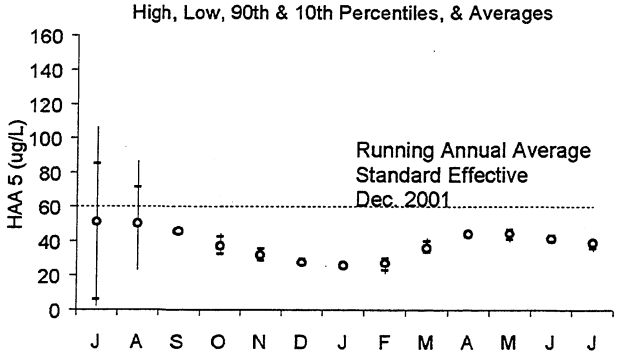
MetroWest Locations
High, Low, 90th & 10th Percentiles, & Averages



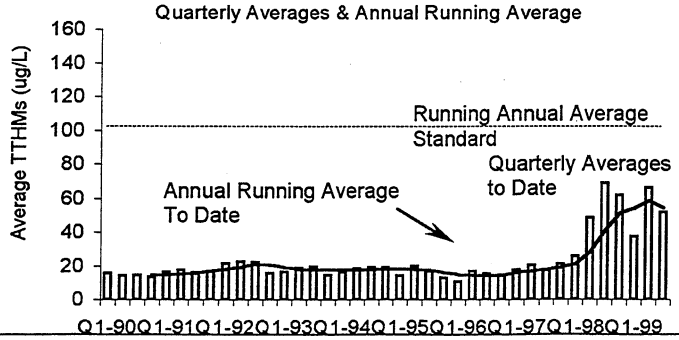
Metropolitan Boston Locations
High, Low, 90th & 10th Percentiles, & Averages



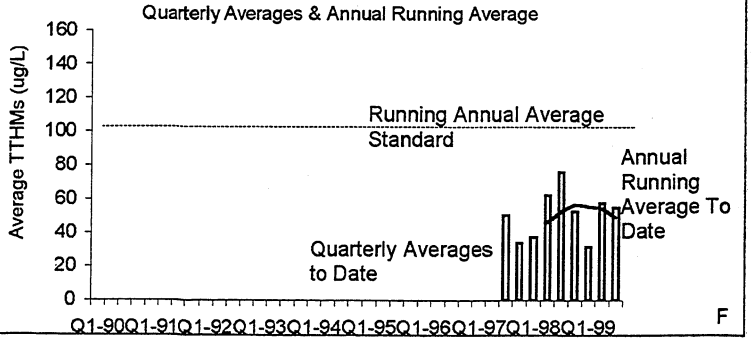
MetroWest Locations
High, Low, 90th & 10th Percentiles, & Averages



Metropolitan Boston Locations
Quarterly Averages & Annual Running Average



MetroWest Locations
Quarterly Averages & Annual Running Average



MWRA Monthly Mineral Analysis

July 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	5.78	30.3	29.5	27.7		MG/L	
Aluminum	21.3	43.3	22.1	18.2	50-200 (a)	UG/L	NO
Ammonia	< 0.005	< 0.005	0.469	0.463		MG/L	
Antimony	< 1.5	< 1.5	< 1.5	< 2		UG/L	
Arsenic	< 0.80	1.09	1.17	0.86	50 (b)	UG/L	NO
Barium	7.49	7.91	7.50	7.45	2000 (b)	UG/L	NO
Beryllium	< 0.1	< 0.1	< 0.1	< 0.1	4 (b)	UG/L	NO
Cadmium	< 0.1	< 0.1	< 0.1	< 0.1	5 (b)	UG/L	NO
Calcium	3.71	3.81	3.71	3.76		MG/L	
Chloride	13.6	15.4	15.4	16.0	250 (a)	MG/L	NO
Chlorine, Free	-	0.05	0.04	0.06		MG/L	
Chlorine, Total	-	0.59	2.05	2.13		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	2.68	4.09	3.42	3.21	1300 (b)	UG/L	NO
Cyanide	< 0.01	< 0.01	< 0.01	< 0.01	0.2 (b)	MG/L	NO
Fluoride	0.07	0.96	0.92	0.96	4 (b)	MG/L	NO
Hardness	12.3	12.6	12.2	12.4		MG/L	
Iron	14.2	16.0	17.8	16.6	300 (a)	UG/L	NO
Lead	< 2.4	< 2.4	< 2.4	< 2.4	15 (b)	UG/L	NO
Magnesium	0.731	0.737	0.716	0.721		MG/L	
Manganese	6.49	6.05	7.22	6.5	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	0.033	0.041	0.032	0.036	10 (b)	MG/L	NO
Orthophosphate	0.003	0.006	0.006	0.008		MG/L	
Potassium	0.744	0.762	0.758	0.758		MG/L	
Selenium	< 0.9	< 0.9	< 0.9	< 0.9	50 (b)	UG/L	NO
Silica (SiO2)	1.64	2.24	2.07	2.15		MG/L	
Silver	< 0.4	< 0.4	< 0.4	< 0.4	100 (a)	UG/L	NO
Sodium	8.42	20.9	21.2	20.6		MG/L	
Specific Conductance	84	137	140	126		UMHOS	
Standard Plate Count, HPC (48 Hrs @ 35C)	>300	4	>300	3	500 (d)	CFU/mL	NO*
Sulfate (SO4)	6.57	6.60	6.02	6.46	250 (a)	MG/L	NO
Thallium	< 1	< 1	< 1	< 1	2 (b)	UG/L	NO
Total Dissolved Solids	39	76	70	71	500 (a)	MG/L	NO
Trihalomethanes, Total (TTHMS) (f)	-	27	50	49	100 (b) (e)	UG/L	NO
Turbidity	0.35	0.32	0.48	0.32	1 (c)	NTU	NO
Zinc	2.5	3.8	3.42	1.58	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 July 7, 1999 and analyzed by MWRA and contract laboratories.

UPDATE ON LEAD LEVELS

Lead Levels Show Continued Decline

Results from lead and copper sampling conducted in June 1999 show continued reductions in lead and copper levels at consumers' taps. In over 400 samples taken in early June, average lead levels had gone down by one half from sampling in 1997 and 1998, from 20 parts per billion (ppb) to 10 ppb, and by about two-thirds from the 1992 average level (31 ppb). About 85 percent of high-risk homes now have levels below 15 parts per billion (the action level).

Background

MWRA source waters contain virtually no lead, but lead can leach from lead service pipes connecting homes to water mains and from lead solder and brass fixtures in homes. In 1991, the EPA issued new standards which set new action levels of 15 parts per billion (ppb) for lead and 1300 ppb for copper, and required that 90 percent of targeted high risk homes be below that level. In response, MWRA conducted two rounds of sampling for lead and copper at consumer's taps. The samples must be first flush samples taken at homes and locations most likely to have high levels of lead after the water has sat stagnant overnight. These worst case samples showed lead levels above the new standards in about half the homes. None of the copper samples exceeded the standards.

After consulting with physicians and public health professionals in the spring of 1993, MWRA Board of Directors approved a fast-track program to improve treatment to reduce lead levels at consumers' taps, along with new education efforts targeted to the most vulnerable populations (children under 6, pregnant women and new mothers). During the course of planning, several meetings and workshops were held with the Public Health Working Group, Community Corrosion Control Committee and panel of experts in water treatment. These were formed especially for responding to the lead issue and the potential impacts of treatment options on public health, water quality and sensitive industrial users such as computer chip manufacturers and biotech industries. Public notifications were sent to over 6000 businesses and health care/dialysis facilities for their preparedness to treatment changes.

In March 1993, the Board approved the recommendation to proceed as promptly as possible to design and construct an interim facility to be used until the new Walnut Hill Water Treatment Plant would be completed in 2003.

Plant Start Up and Initial Operations

The Interim Corrosion Control facility came on-line in June 1996 several months ahead of EPA's deadline for "optimizing" corrosion control, a requirement MWRA probably could have satisfied with a far less aggressive and beneficial program than that which MWRA actually implemented.

Start-up and operation of the new plant were planned carefully with communities and water treatment experts' input and conducted in several small incremental steps to avoid significant disruption to the distribution system and the possibility of discolored water. The ICC was initially operated to provide a pH of 7.5 and an alkalinity of 20 mg/l. In February 1997, the pH was adjusted up to 7.8 and the alkalinity was adjusted to 30 mg/l. Initial results in 1997 and 1998 indicated that the new treatment plant reduced lead levels by about 30 percent, thereby resulting in the percentage of homes meeting the action level rising from 51% to 69%.

Staff continued to optimize operation of the plant. After extensive research, including consideration of the potential impacts on iron corrosion and discolored water, and the potential impacts to Boston Harbor from changes in the drinking water chemistry, MWRA decided in June of 1998 to further optimize treatment by adjusting the pH to 9.0 and maintaining the alkalinity of 30 to 35 mg/l.

Results of Testing

These changes in treatment were made in July 1998, and after a period of system acclimation, additional lead samples were taken this past June. These most recent results, shown in the table below, indicate that these final adjustments have further reduced the levels of lead at consumers' taps. The average has now dropped to about one third of what it was in 1992, and 85 percent of homes tested now meet the action level, as compared to 51 percent in 1992 and 69% in the intermediate treatment phase (recall that this is not a representative sample of homes, but to the likely "worst case" homes).

Over the next several years as the system acclimates to the new treatment, and as lead services lines connecting homes to water mains continue to be replaced, levels are expected to continue to drop. Copper levels have always been below the action level, but the recent results show even lower levels. Sampling will continue twice a year in pursuit of the goal that 90% of the homes will exhibit tap water samples at less than the 15 ppb lead action level.

Lead Levels in Worst Case Samples, parts per billion

	1992	1997	1998	1999
Average	31	20	20	10
90th percent	71	48	44	25
Percent below Action Level of 15	51%	69%	69%	85%

Further Along the Water Cycle

The benefits of the interim corrosion control program in reducing lead and copper levels in older homes across the service area is a significant public health advance that has particular merit in reducing lead exposures for sensitive users especially young children.

Reduction of lead and copper discharge into the environment is a broader objective and there are at least two other critical aspects in which the corrosion control program, by reducing the leaching of lead from plumbing systems, has benefited the environment.

Lead and Copper in Deer Island Treatment Plant Effluent

Concentration of metals in wastewater plant effluent discharges from Boston Harbor treatment plants has been declining for years. Much of the explanation for this decline lies in the industrial pre-treatment program administered by MWRA's TRAC Department. The corrosion control program has extended this trend; one might even conceptualize the benefits from reducing the leaching from home plumbing systems as a kind of "household hazardous waste" reduction program.

The progress made on this trend is reinforced, of course, by the benefits of secondary treatment at the Deer Island Treatment Plant. Secondary treatment achieves a higher proportionate level of lead or copper removal from wastewater that the old primary treatment processes. This is because the metals will tend to become bound up with other wastewater solids taken into the increased volume of sludge that is captured by secondary treatment.

That is why the second part of this trend, described in the next paragraph, is so noteworthy.

Lead and Copper in MWRA Sludge Pellets

Lead and copper levels in the sludge pellets produced at the Fore River pelletizing plant have also dropped. Lead levels in June 1999 were 230 parts per million (ppm), about one-third below the EPA standard for unrestricted use of 300 ppm. Copper levels were 790 ppm, below the EPA standard for unrestricted use of 1000 ppm.

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.

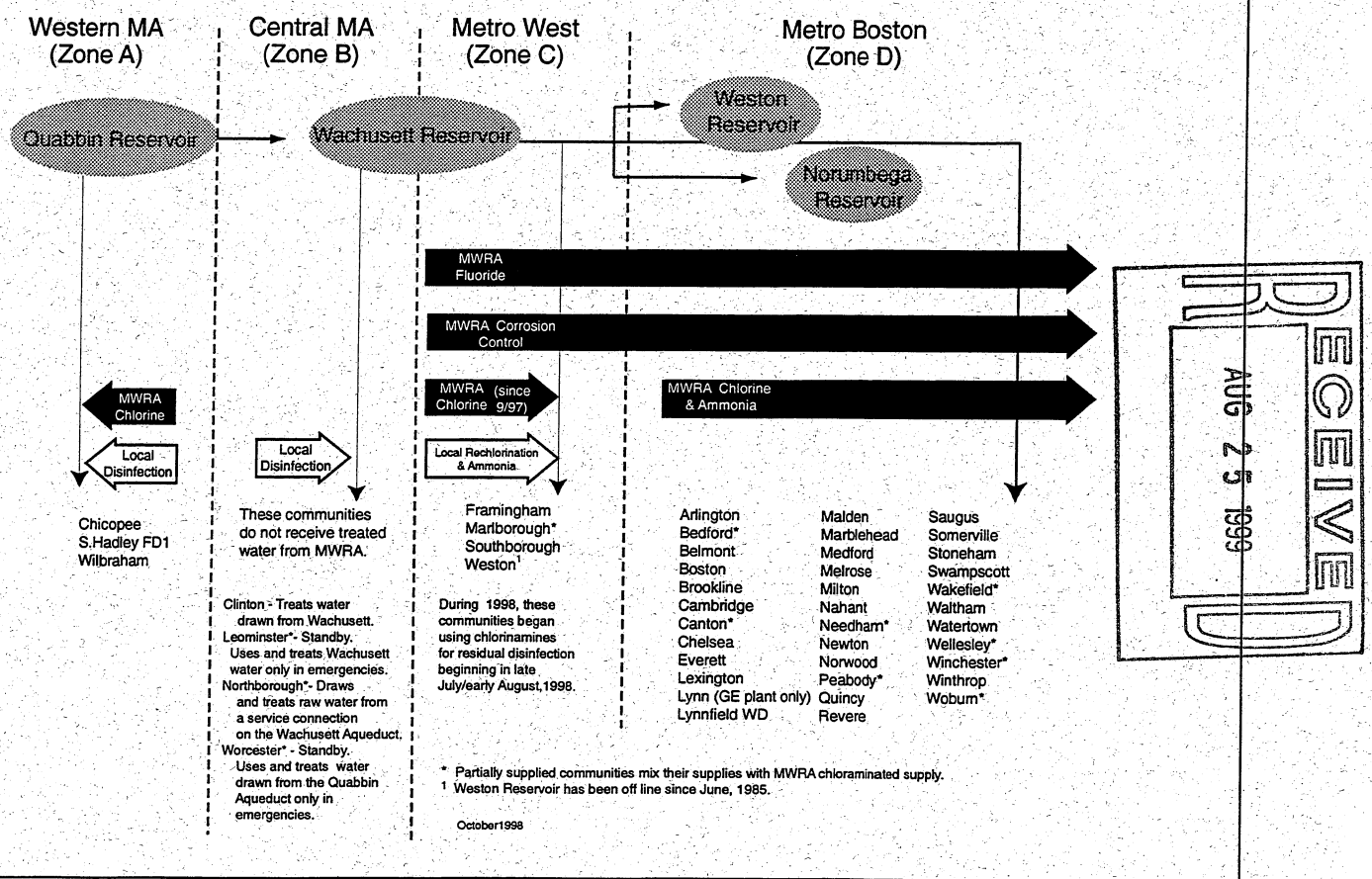
Safe Drinking Water Act (SDWA): Federal drinking water quality regulations.

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.



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