MASSACHUSSETS WATER RESOURCES AUTHORITY
http://www.mwra.com

Pathogen Monitoring Program - 2006 Review
January 2007

Samples at Cosgrove and CVA Intakes

Even though testing for *Giardia* and *Cryptosporidium* was not required by EPA until 2006, MWRA has been monitoring for them in source waters since 1994. EPA does set inactivation requirements for *Giardia*, while requirements for *Cryptosporidium* are still being developed. *Giardia* and *Cryptosporidium* sampling was initiated in 1994 (monthly samples at Shaft 4, later moved to Cosgrove Intake). In mid-January 1999, sampling was increased to weekly at Cosgrove Intake. Biweekly sampling is conducted at the CVA Intake.

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

Cosgrove Intake: *Cryptosporidium* Results for MetroBoston: January 2006- December 2006

Number of Samples	Number of Positive Samples	Total Number of Oocysts Detected	# with One or More Internal Structures	Average (oocysts/100L)	Range of Detects (oocysts/100L)
50	0	0	0	0	-

Cosgrove Intake: *Giardia* Results for MetroBoston: January 2006 – December 2006

Number of Samples	Number of Positive Samples	Total Number of Cysts Detected	# with One or More Internal Structures	Average (cysts/100L)	Range of Detects (cysts/100L)
50	9	16.5	2	0.66	2 - 10

CVA Intake: *Cryptosporidium* Results for Chicopee Valley Aqueduct: January 2006 – December 2006

Number of Samples	Number of Positive Samples	Total Number of Oocysts Detected	# with One or More Internal Structures	Average (oocysts/100L)	Range of Detects (oocysts/100L)
23	0	0	0	0	-

CVA Intake: *Giardia* Results for Chicopee Valley Aqueduct: January 2006- December 2006

Number of Samples	Number of Positive Samples	Total Number of Cysts Detected	# with One or More Internal Structures	Average (cysts/100L)	Range of Detects (cysts/100L)
23	0	0	0	0	-

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

Research Efforts

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

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

The data collected so far is generally consistent with MWRA's past data. As was expected, the much higher sample volumes and the more sensitive testing have yielded some positive samples; all but one of the positives has been below the nominal detection limit of Method 1623 (1-oocyst/50 liters), and the overall average for all samples since 2001 is 0.03 oocyst/100 liters. Tufts has also tested for *Giardia* using the same testing method as above, with the overall average is 0.02 cyst/100 liters since 2002.

Table 5 - Research Sampling - *Cryptosporidium* Results: January 2005 – December 2005

Number of Samples	Number of Positive Samples	Total Number of Oocysts Detected	# with One or More Internal Structures	Average (oocysts/100L)	Range of Detects (oocysts/100L)
50	6	14	3	0.04	0.1 - 0.6

Table 6 - Research Sampling - *Giardia* Results: January 2005 – December 2005

Number of Samples	Number of Positive Samples	Total Number of Cysts Detected	# with One or More Internal Structures	Average (cysts/100L)	Range of Detects (cysts/100L)
50	8	26	6	0.07	0.1 – 1.0

Testing Limitations and Response Protocol

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