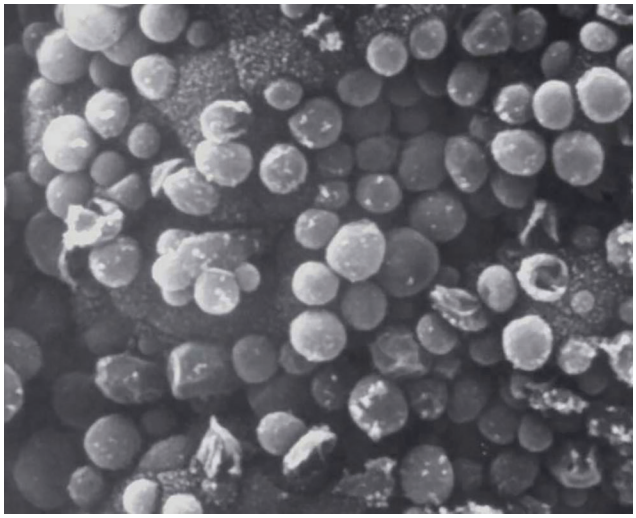
Cyst Removal, the Long Term 2 Enhanced Surface Water Treatment Rule

Cryptosporidium parvum and *Giardia lamblia* are protozoans, or single cell parasites, that are commonly found in the intestinal tract of humans and animals. As parasites, they can only grow within a living host and do not multiply in the environment, but rather exist as oocysts or spores. The parasites and spores are found in every region of the world and can be a contaminant in most water from lakes, streams and some groundwater sources under direct influence of surface water. Wastewater treatment facilities may discharge effluent containing the oocysts either due to overcapacity or inadequate treatment. Secondly, runoff from agricultural operations or from natural sources containing the spores can enter surface waters.

The organisms and the oocysts are very resistant to the commonly used chlorine disinfection methods and the oocysts themselves are typically 3 to 4 microns in size, creating a challenge for removal in many municipal and private water systems. The standard for removal was originally established by ANSI/NSF under Standard 53, Drinking Water Treatment Units — Health Effects. Aspects of this standard were applied by the United States Environmental Protection Agency (EPA) to the Safe Water Drinking Act in 2006 under The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR). The primary intent of the LT2 is to supplement existing microbial treatment requirements for systems where additional public health protection is needed due to elevated source water Cryptosporidium concentrations, mainly for water systems that utilize water from a surface water source or well systems could be impacted by surface water.

Under LT2, systems must meet Cryptosporidium treatment requirements by using one or a combination of the treatment options, with the treatment requirements are determined by the oocyte level in the source water. Cryptosporidium levels >0.075 oocytes/liter require total Cryptosporidium treatment of at least 4.0-log and as much as 5.5-log (>3 oocytes/liter). States will approve the method used to demonstrate performance based upon EPA requirements and must approve the log credit claimed by the components of the system as well as the overall system. Filters are permitted as part of the overall treatment process and therefore are tested and qualified to determine minimum performance standards.



Cryptosporidium parvum oocysts

SUMMARY OF TEST METHOD

The basis of the LT2 test method was modeled under the ANSI/NSF 53 specification, allowing a challenge of 3.0 micron polystyrene microspheres. The filter is challenged and the effluent measured at minimium of three points during the test at a minimum, using the initial, midpoint and terminal pressure values based upon maximum pressure drop recommneded by the filter manufacturer. Minimum goal for reduction as specificed by the EPA is 3 log (99.9%), although lower values would not pleclude use of the filter in the system, but the reduced performance would be considered in the overall reduction requirement.

Graver Technologies QCR 1-micron filters, which utilizes a 1 micron pleated polypropylene media, were submitted to an independent laboratory for testing to LT2 cyst reduction standards.

QCR 1 MICRON				
Differential Pressure (psid)	Spheres/L in:		% Reduction	Log Reduction
	Influent	Effluent		
Initial (3.2 psid)	40608	<5	>99.99	>3.9
15	41358	<5	>99.99	>3.9
20	41325	<5	>99.99	>3.9
25	33192	<5	>99.99	>3.8
30	34683	<5	>99.99	>3.8
35	37467	8	99.98	3.7

Some states are evaluating more robust requirements, requesting testing utilizing particles smaller than 3 micron as required for the EPA standard. As such Graver developed an alternate QCR rated at 0.8 micron utilizing a dual layer construction to achieve removal of >3 logs for particles as small as 1 micron.

QCR 0.8 MICRON				
Sample Point	Elements DP (psid)	Port	Counts/ Liter	
			1 µm	2 µm
Initial	1	Influent	9320	8320
		Effluent	3.4	1.1
		LRV	**3.44**	**3.88**
Midpoint	18	Influent	9680	8520
		Effluent	7.6	1.1
		LRV	**3.11**	**3.89**
Final	36	Influent	9440	8760
		Effluent	1.1	<1
		LRV	**3.93**	**>3.94**

Based upon the results, Graver Technologies QCR filters meet the minimum reduction level for the polystyrene microsphere challenge as low as 1 micron, demonstrating effective cyst reduction as specified under the LT2 standard.