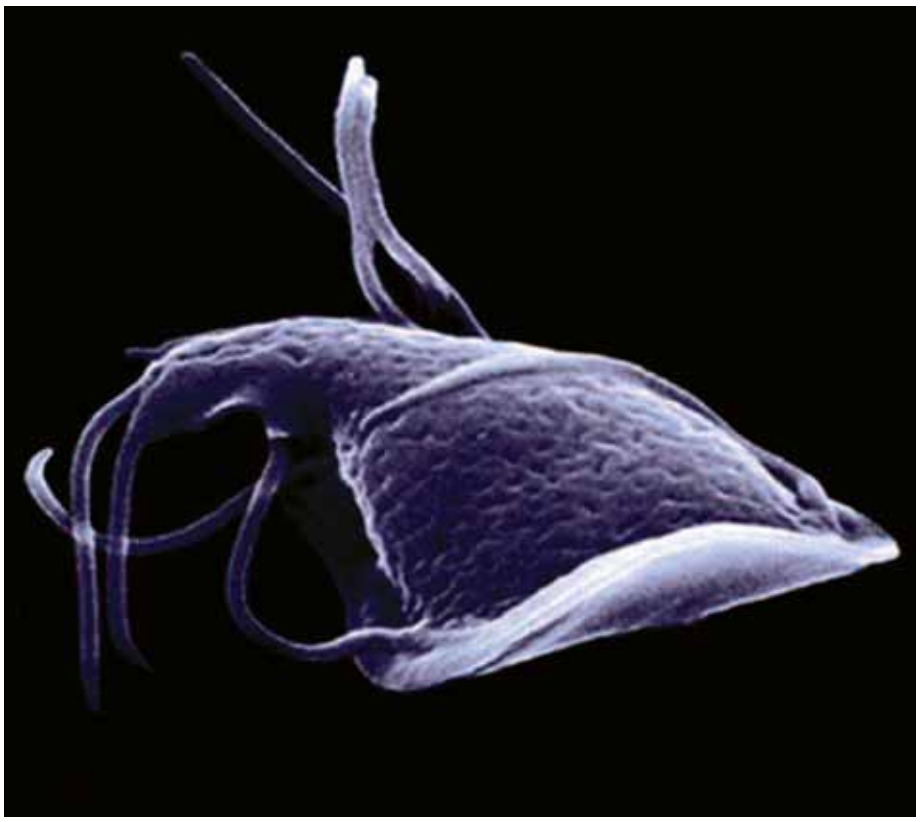
# The Multi-Barrier Approach

**By Diane Arnott**

The advantages of combining chemical and physical processes

*Safe drinking water is a privilege in North America. Though essential to good health, it is often taken for granted. It is delivered to our homes or offices for our enjoyment with little thought given to where it originated or how it got there. We expect water to come forth as required. We expect water to both look and taste good. We expect our health to be protected. It is only in times of crises that our awareness is devoted to this invaluable resource.*

The multi-barrier approach to safe drinking water is applied on many levels. It is used by governments and municipalities and is equally applicable to small drinking water systems. The general premise is that delivering safe drinking water requires a number of key factors to be woven together and work in tandem, one of the most critical factors being water treatment and ultimately disinfection.



***Giardia lamblia*** **is a parasite that causes intestinal infection.**

A multi-barrier approach for a small drinking water system involves facets both managerial and technical. It begins with the selection of the best source water available, protection of that source water, application of appropriate water treatment and vigilant monitoring. In this way, small drinking water systems can manage the risk of contamination and waterborne disease.

Regardless of the source, water can become contaminated with biological organisms. In this event, avoiding a disease outbreak becomes fully dependent on disinfection, which refers to improving water quality and safety by killing or inactivating disease-causing microorganisms in the water supply. Successful disinfection is dependent on a number of factors.

The first of these is filtration, which will always be necessary to remove suspended particles and reduce turbidity. Second, it must eliminate any or all harmful organisms, including bacteria like fecal coliform or *E.coli*, adenoviruses and also destroy cysts like *Giardia lamblia* or *Cryptosporidium sp*. In addition, it must deliver on the promise of water quality—meeting the aesthetic expectations of good taste and minimal odor. And all of this must be achieved in a cost-effective manner. That is a lot to expect from any one disinfection system. But, again, consider a multi-barrier disinfection approach.

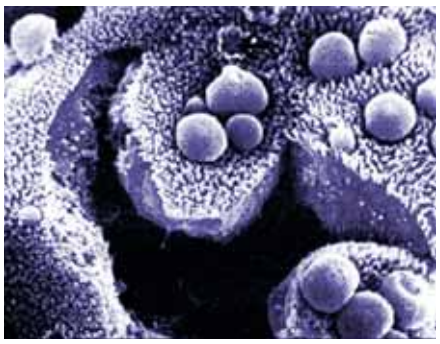
## Assessing the Benefits

Historically, the common approach to disinfection has been a chemical process. Chlorination devices disinfect water through the constant addition of chlorine. Though effective against many organisms, this approach also generates disinfection byproducts. These are harmful chemicals that result from the reaction of chlorine with organic substances in water, which may potentially introduce another public health risk. Chlorine is not a good solution when addressing chlorine-resistant organisms like *Giardia*. These challenges, however, are manageable with the simple addition of a physical disinfection technology: ultraviolet (UV) light.

A UV device emits radiation that passes through the water. When this radiation is absorbed by any microorganisms present, it alters their DNA, rendering them incapable of reproduction—effectively inactivating them. There is a time and intensity relationship that delivers the appropriate UV dose; however, the inactivation of most organisms can be achieved in a relatively short timeframe. UV disinfection typically offers a 4-log reduction (99.99%) for bacteria and most viruses. As only energy has been applied (no chemicals), there is no negative impact to the water.

UV disinfection systems are easy to install or retrofit to an existing system. As no holding tank is necessary, the system takes up little space and requires little maintenance. UV lamps offer a useful life of about 9,000 hours, which means replacement is done on an annual basis.

These two approaches—chemical and physical—while both effective independently, naturally complement



***Crytosporidium*** **is a harmful organism that must be destroyed with successful disinfection.**

each other and create an effective multi-barrier disinfection approach. UV is highly effective against chlorine-resistant organisms, and chlorine is highly effective against UV-resistant organisms. By introducing a UV disinfection unit as the primary technology, chlorine use can be minimized. This significantly reduces disinfection byproducts and improves taste and odor while maintaining the benefit of low-level residual chlorine levels to protect the water as it is delivered to the tap.

If your business or premise provides drinking water for public consumption that does not originate from a municipal system, consider multi-barrier disinfection for your small drinking water system. Community centers, motels and restaurants can all benefit from this approach. Using UV light in combination with reduced chlorine levels will cost-effectively deliver a safe and more palatable product. *wqp*

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