Eliminating Public Health Threats

By Jon McClean

City of Berea, Ohio, becomes the first in the state to seek Cryptosporidium credit

First settled in 1836, the city of Berea, Ohio, originally gained acclaim as being the source for dimensioned stone formed from locally quarried sandstone, notably grindstones. The grindstones were originally shipped to Cleveland by ox cart, and later, as demand grew, by a purpose-built railroad to the Big Four Railroad across the Midwest. Now many of the former quarry pits are better known as Baldwin Lake, Wallace Lake and Coe Lake.

Today the city of Berea public water system uses surface water drawn from the East Branch of the Rocky River; however supplies also can be drawn from Coe Lake and Baldwin Creek as required. Because these are open surface water sources, they are vulnerable to runoff and other forms of contamination. The city was keen to ensure the best possible water quality for its residents, so, from 2008 to 2010, it monitored the quality of the water sources. *Cryptosporidium* was found in 10 of 24 samples collected from the East Branch of the Rocky River, which is typical for this type of surface water.

Understanding the Threat

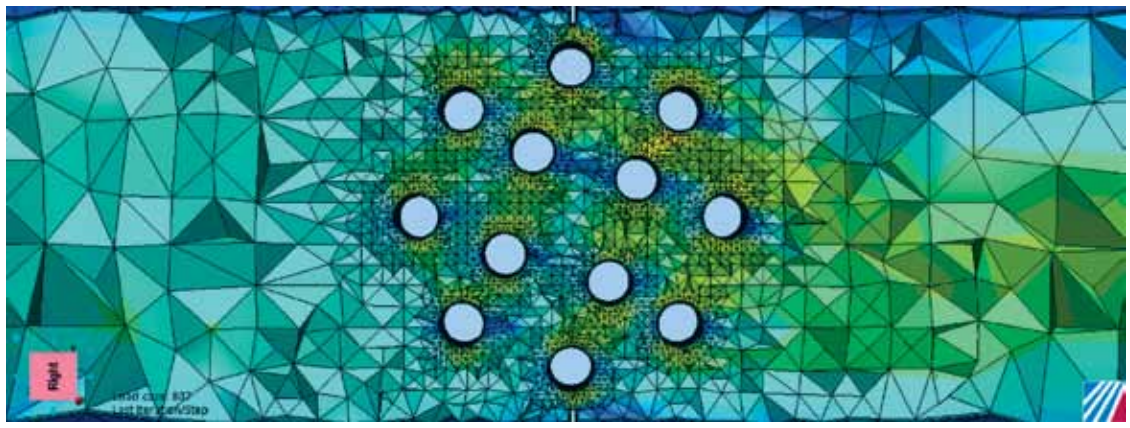
Cryptosporidium is a chlorine-tolerant organism that is ubiquitous and persistent. It can survive for months in water or soil as an oocyst that has been shed by an infected host, and being parasitic, it requires a host to multiply. When people drink water containing the oocysts, the oocysts quickly multiply and infection follows.

The organism first gained prominence in 1987 from an outbreak in Carrollton, Ga., when 13,000 people became sick. In 1993, an outbreak at the Howard Avenue Water Purification Plant in Milwaukee caused more than 403,000 people to become sick, and 104 fatalities were linked to the event. In 1998, a major public health event occurred in Australia, and between July and September 1998 customers of Sydney Water were issued with boil notices. Outbreaks have since occurred in Europe, Asia and South America, with immunocompromised patients and the elderly most vulnerable.

This threat to public health is effectively deactivated using ultraviolet (UV) light, which has become an important barrier worldwide to ensure that drinking water is free from harmful organisms. UV systems are now being installed into municipal drinking water facilities to deactivate *Cryptosporidium* and *Giardia*, both organisms that chlorine cannot kill.

UV systems offered for municipal drinking water are independently and rigorously validated by a third party using a bioassay technique to ensure that they will perform as the manufacturer claims under the worst conditions: highest flow rate, lowest transmittance and at the end of the expected lamp life. The bioassay testing methods involve the use of surrogates that are introduced into the water, and the actual disinfection level achieved of the water is studied by taking samples before and after the UV system. These tests ensure that the UV systems will perform as expected and demonstrate how well the manufacturer is able to size equipment to accommodate a matrix of varying flow and water quality conditions.

Most UV manufacturers use computational fluid dynamics to design and understand how the machines will perform. These tools are accurate and ensure few, if any, surprises. They allow machines to be designed to deliver the highest performance for the least power and headloss.



Left: Sandra Vozar, P.E., service director for the city of Berea, with the ETS UV systems. Above: A computational fluid dynamics model helps assess different disinfection methods.

A UV Solution

To assist with ongoing water quality improvements, the city of Berea had initially installed granular activated carbon (GAC) filters to its Dr. Dimiter Ramadanoff Water Treatment Plant. The GAC system provides high-quality water filtration, eliminating periodic taste and odor events from the water. An 800,000-gal aboveground tank was added to ensure continuity of service when the older 1-million-gal tank was out of service for maintenance and cleaning.

The city retained Stantec to oversee the selection of the UV manufacturer to ensure reliability, regulatory compliance, ease of use and value. This facility will become the first in Ohio to seek credit for the use of UV to deactivate *Cryptosporidium* oocysts.

Neptune Benson ETS UV systems were selected after an evaluation of UV suppliers. Following manufacture at the Wisconsin Neptune Benson factory, two ETS SX-425-10 validated systems were installed at the Dr. Dimiter Ramadanoff facility. A duty and standby arrangement typically is required to ensure that an adequate level of treatment always is achieved. The standby machine is operated when the duty machine is down for annual maintenance, for example. An online transmittance monitor measures the transmittance of the water, and a record of this important parameter is maintained. The water plant operators already keep detailed records of water quality, and now they will be required to maintain a record of the performance of the UV system to ensure public safety.

Each of the UV systems contains a number of medium-pressure UV lamps, automatic wiping systems and UV monitor cameras. A flowmeter signal is provided by the facility to the Neptune Benson control panels, and the system control panel is able to alter the power to each lamp to ensure that the correct UV dose is always delivered to the water. Automatic wiping systems keep the quartz free from fouling, which would prevent proper treatment of the water and is typical for a surface water source that can contain iron or manganese. The UV monitor cameras are used to measure how much UV light is being emitted by the lamps. UV light is invisible to the naked eye, so the monitor cameras are a critical component. The monitors are sealed and not operator-adjustable. They precisely measure the amount of UV light that the water receives, and it is critical that water is not permitted to be sent into distribution. The plant operators are required to perform periodic checks to ensure that the lamps are producing as much UV as is expected by using a handheld reference monitor. The plant will be required to maintain detailed records that document a number of important parameters such as UV dose, lamp intensity and flow rate.

"We've been impressed so far with the quality of manufacturing of the ETS machines, their responsiveness and particularly their knowledgeable technical staff," said Sandra Vozar, P.E., service director for the city of Berea. "It is important that we maintain the highest quality water from our facility, and the ETS UV system will supplement our conventional disinfection process. Our facility is a state-of-the-art water treatment facility, and we are proud that it will be the first in the state to disinfect water using UV light to get disinfection credits for deactivating *Cryptosporidium*." W&WD

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