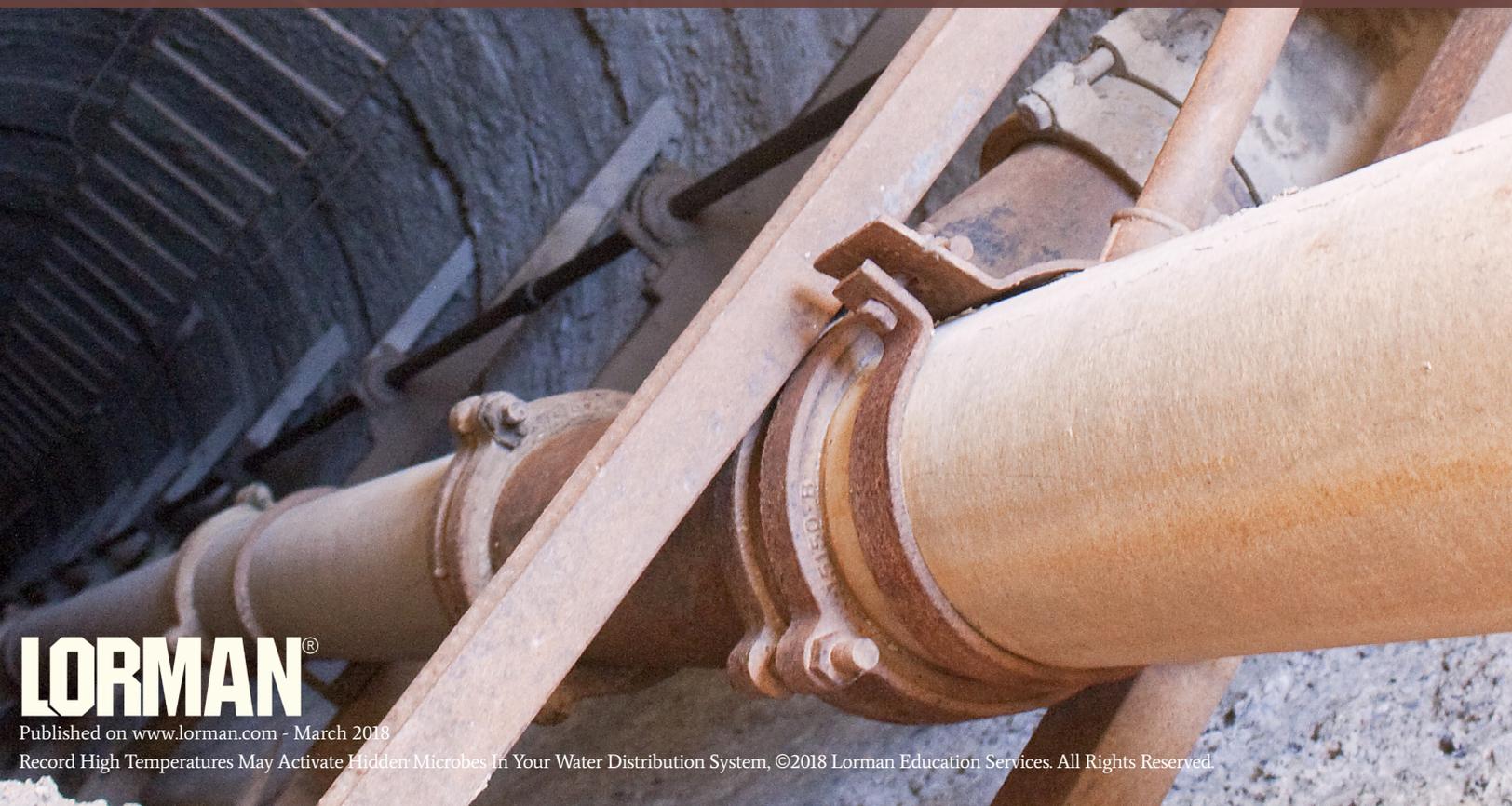




Record High Temperatures May Activate Hidden Microbes In Your Water Distribution System

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By Ron Perrin
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Record High Temperatures May Activate Hidden Microbes in your Water Distribution System

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What is hiding in Your Potable Water Storage Tanks?

Half-way through 2014 and more than half the country has already seen new record high temperatures. Warmer water in storage tanks and towers may trigger unexpected growth of some microbes. Sediment on the floor of water storage tanks can become a safe habitat for a wide range of living organisms. If your chlorine use is increasing during warmer months, you may already be fighting this battle.

My company inspected more than 500 water storage facilities in 2013 using underwater cameras, remotely operated vehicles, and commercial divers. This view into so many different water systems has given me a very unique perspective, along with an understanding of the weaknesses, of our current distribution infrastructure.

Most communities have outstanding water treatment systems and practices that remove microbes and other contaminants. The problems begin when that near perfect water is pushed through aging, often antique infrastructure to storage facilities that are rarely, if ever, cleaned. If your tanks are on a cleaning schedule your water system is among the best in the nation. Unfortunately, that is not currently the norm for many systems.

Sediment slowly builds up in most water tanks. After a few years of service a quarter to a half inch is common, at between five and ten years of service we see a half inch to two inches, and at ten to twenty years without cleaning, tanks can often accumulate three or more inches. Despite the water being near perfect at the treatment stage, it often travels through miles of water main pipes that are 20, 30 or even 50 years or older.



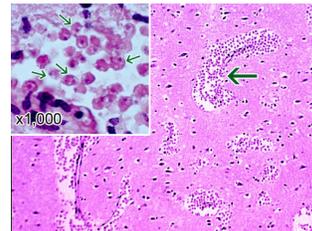
Left: Photo Shows Sediment being removed from water storage tank.

Occasionally there are main breaks, where water is lost but dirt and other contaminants can be sucked into the system. Many inspection engineers concerned with the structural safety of the tanks dismiss the sediment on the floor as unimportant. Water utility managers and operators should view water tank sediment in an entirely different way. The sediment offers protection and food to living contaminants that make their way into the storage tank.

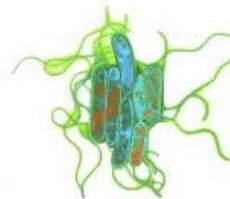
Over time a harmless amount of bacteria can grow to the point where it is depleting chlorine reserves and forcing the use of additional disinfectants.

The soft sediment that accumulates on the interior floors allows a habitat where bacteria, protozoa, or even viruses can grow and become a threat to public health. Now, record high temperatures are creating a warmer environment that may spur more activity and leave tanks at an even greater risk of chlorine depletion from the growth of microorganisms – including pathogens.

In January of this year I was invited to speak at the U.S. Environmental Protection Agency (EPA) Region Six, Five-State Meeting, On Drinking Water Quality in Dallas, Texas. My presentation titled, “Out of Sight Out of Mind”, covered what I had found inspecting and cleaning water tanks across Texas, and in many other states. I also showed a video of divers removing sediment and reviewed what sort of microbes can use tank sediment to get a foothold in distribution systems. Some participants acknowledged that microbial growth in tank sediment was something they had never thought about.



Right Top: Image of Naegleria fowleri
Center: Legionella bacteria
Right Bottom: Cryptosporidium



The program was well received, and gave both state and federal regulators a different take on an often hidden problem. At this time, the EPA has no rules requiring potable water storage tanks to be cleaned or inspected – just a recommendation to clean “as needed.” Similarly, The American Water Works Association recommends cleaning every three to five years, or “as needed.” That leaves ample room for interpretation, so utility managers are not motivated to include tank cleaning in maintenance budgets. Few states require scheduled cleaning, and many don’t even require regular inspection. But what are the potential consequences of the failure to inspect and clean?



Example:

In August 2013, the death of a 4-year-old boy near Violet, LA., was linked to the *Naegleria fowleri* amoeba. The child had been playing on a backyard slip-n-slide that used water from the St. Bernard Parish water system, that was later found to be contaminated with the amoeba.

Naegleria fowleri infects people when water containing the amoeba enters the body through the nose. This typically occurs when people go swimming or diving in warm freshwater places, like lakes and rivers. The *Naegleria fowleri* amoeba then travels up the nose to the brain, where it destroys the brain tissue.

After the boy's death, the Louisiana Department of Health and Hospitals (DHH) asked the U.S. Centers for Disease Control and Prevention (CDC) for help, since the department could not find a lab to test for the amoeba. The CDC usually does not test drinking water but did in this case because of two additional deaths related to the amoeba that occurred in Louisiana in 2011. The CDC also tested DeSoto Parish Waterworks District No. 1 because it was near the site of one of the 2011 deaths.

The CDC confirmed the presence of the rare amoeba in five locations in the district's water system. Now that this amoeba has been found in a public water system, will more stringent regulations be forthcoming?

One reason *Naegleria fowleri* had not been found in U.S. water systems is that tests for it (and many other bacteria, protozoa and viruses) are not routinely performed. The amoeba has been found only in the south half of the country, where high temperatures enable it to become active. With climate change, it may not be long before it is seen in the north as well.

Since water utilities cannot test for every known contaminant, much less those not yet found in water tanks, a coliform test is used to determine whether other fecal pathogens are likely to be present. The new Revised Total Coliform Rule (RTCR) requires assessment and corrective action when there are indications of coliform contamination. The RTCR no longer includes a monthly maximum contaminant level violation for multiple total coliform detections. Instead, systems that have indicators of coliform contamination in the distribution system must assess the problem and take corrective action.



Aging tanks and record high temperatures

As Texas continues to grow we build more and more water storage tanks and towers, and at the same time the ones we have, and the infrastructure that support them, are getting older. Some modern-looking welded steel water towers have been standing for more than 50 years, while others built in the 1920s and

1930s give their age away with their steeple roofs and riveted legs and sidewalls. Hundreds, if not thousands, of water storage structures are still in use after 75 to 100 years of service.

While there is nothing wrong with older facilities that are well maintained, many tanks and towers rarely, if ever, have had their interiors cleaned. My crews often meet water utility workers who have been on the job for five years or more and have never seen a tank cleaned.

Meanwhile, summers seem to be getting longer and record high temperatures are increasingly common. That combination can make soft sediment on the floor of tanks into breeding grounds for a host of different microbes allowing them to get a foothold in the distribution system. Ideal conditions occurring more regularly can enable these organisms to bloom out on a record hot day, overtaking chlorine and other disinfectants.

With more aging water storage facilities, holding warmer water, conditions are perfect for triggering growth of more dangerous contaminants than have ever been reported. The *Naegleria fowleri* amoeba may have been our first warning of increased contaminant growth in water tanks.

Is current testing enough?

While pathogens increase in strength and number under the safety of a blanket of sediment, testing at the tap may not reveal a problem. In the warmest part of the summer, perhaps on a record hot day, is when a standard test may find that chlorine seems to have been suddenly depleted and the entire system is now at risk. In reality, the problem has been festering under the sediment undetected, for months, or in some cases, years.



Texas has had a rule requiring potable water tanks to be inspected for over twenty years. TAC 290.46 requires a number of inspection points be covered, but the assessment of sediment on tank floors is often overlooked. This is a very important part of the inspection process and should not be taken lightly. The EPA is now considering requiring

tank inspections under the new RTCR. This will be a big advancement for states without current rules for inspection. Water utility managers should be sure that tank inspections include the interior tank floor. Smaller systems can often check for sediment by simply lowering the water level enough to see the floor and looking inside the top hatch of the tank.

If you do not want to take your facilities out of service to conduct the inspections in-house, there are contractors eager to assist you. A growing number of contractors offering Underwater Camera, Remotely Operated Vehicle (ROV) or Commercial Diver Inspections allow utilities to get excellent documentation on their storage facilities that include photos of inspection points and underwater video clearly showing if you have sediment on the floor. There have never been more choices to get tanks and towers inspected without disrupting your water service.

Housekeeping pays

Basic housekeeping is important. Every water tank should be on a schedule to be cleaned

at least once every five years. If tank inspections reveal extensive sediment, or records indicate that the facility has not been cleaned in the past five years, it is likely that the sediment needs to be removed. Should you get a violation under the new RTCR,



inspection of your storage facilities is the first thing I would do to assess the problem. If no other obvious problems are found, cleaning the storage tanks may prove to be one of the more effective corrective actions a utility can take.

The fact is, keeping your tanks clean will likely prevent you from getting a RTCR violation in the first place. What we have found is this: Once the sediment is removed, our utility customers discover that chlorine costs are reduced because the chlorine is no longer losing the war with the microbes that were growing in the sediment.

However you choose to do it, just get it done. Do not let it go year after year, out of sight and out of mind. Knowing what is in your facilities with a good inspection is your first line of defense. If an accumulation of sediment is found, don't think of it as "just a little dirt." Know that it is a broken barrier that can allow contaminants to compromise the entire water supply and the health of the community.



About the Author:

Ron Perrin is a Certified Safety and Health Official (CSHO), a member of the Texas Water Utilities Association, AWWA, and the owner of *Ron Perrin Water Technologies* in Fort Worth, Texas. Since 1997 his company has inspected over seven thousand water storage tanks and towers in 14 states. Ron may be contacted through his web site at www.ronperrin.com.

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“Out of Sight Out of Mind” has been presented under “Special Topics” at several Regional Schools and is available for regional schools or monthly meetings with ample notice.

This Article was featured in the August 2014 issue of the Texas Water Utility Journal, page 20-22.



Reference Notes and links:

Page Four Images from “Out of Sight Out of Mind” Power point presentation.

Health Risks From Microbial Growth and Biofilms in Drinking Water Distribution Systems. EPA White paper published JUNE 17, 2002. Page 12 Algae and algal toxins. Page 13 Fungi. Page 35 Tank cleaning.

Revised Total Coliform Rule (RTCR). On 2-13-13 the EPA published the RTCR in the Federal Register. http://water.epa.gov/lawsregs/rulesregs/sdwa/tcr/regulation_revisions.cfm

U.S. Centers for Disease Control and Prevention (CDC) <http://www.cdc.gov/>
http://wwwnc.cdc.gov/eid/article/14/9/07-1076_article

Naegleria fowleri, a protozoon found in hot springs and warm surface water, can cause primary amebic meningoencephalitis in humans.

<http://www.cdc.gov/parasites/naegleria/public-water-systems-louisiana.html>

NBC NEWS:

Deadly Brain Amoeba Infects US Tap Water For The First Time

<http://www.nbcnews.com/health/kids-health/deadly-brain-amoeba-infects-us-tap-water-first-time-f8C11172643>

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