What's In *Your* Water?

By Katie Rotella

In this age of pipeline replacement and maintenance, are we prepared to secure our drinking water from harmful bacteria?

Your customers want to trust that what comes out of their taps is the safest possible drinking water. And in the United States, they're probably right; the U.S. public water system — including more than 56,000 community water providers — is arguably the most dependable in the world today.

But accidents happen. Breakdowns occur. The unexpected takes place, and water drinkers become at risk.

We're not talking simply discolored or foul-tasting H2O. What could leach into a pipe system after it leaves a treatment plant could contain, at the least, something to make daily drinking activity a hassle, at the most, disease devastation.

But there's no need to turn to scare tactics in this article (in a post-9/11 world, we've all been awakened to the grim possibilities), but we can face facts that we live in a society that's rested on its laurels for too long where our water systems' pipelines are concerned.

This month we'll discuss what today's water treatment professionals face as our underground pipes reach the end of their lifespan, and homeowners become more informed about what's in their water and how to treat it.

Understanding Water

Humans' thirst for the nectar of life has spawned water conservation movements and water-quality-awareness legislation. We're even combing the surface of Mars for frozen ice caps (we have to keep our options open, after all).

Water is a wondrous thing. It is so precious to our Mother Earth that two-thirds of her surface is water. And she keeps it all flowing endlessly through a natural filtration process. The planet's surface water (lakes and rivers) only makes up 3 percent of drinkable water. The rest — roughly 90 percent — is provided by ground water. Ground water is precipitation that has soaked into the soil, moving downward through the Earth through rock and sand, breaking up and dissolving minerals it comes into contact with — and picking up stuff along the way.

As it is naturally filtered, pollutants, including — but not limited to — microbial agents, can contaminate water. A bacterium commonly found is fecal coliform, which is present in human and animal waste. Seepage from septic tanks and sewage treatment plants is one way coliform finds its way into drinking water. But it's important to note here that the presence of coliform does not mean water contains pathogenic (disease-causing) microorganisms, but the potential for such contaminants exists. The amount of coliform found in a sample of water (total coliform) is the way labs test for water quality and safety from bacterial contamination.

When pathogenic organisms are present, they can cause intestinal infections and dysentery. A nuisance in healthy adults, but possibly fatal in infants, the unborn, elderly and immune-deficient. Waterborne viruses may be responsible for flu and cold outbreaks. Pathogens also can carry other illnesses, such as:

Viruses: polio, rotavirus, hepatitis, typhoid fever, cholera and smallpox.

Protozoa/Cysts: *giardia lamblia, cryptosporidium parvum,* and *toxoplasma gondii.*

Bacteria: Anthrax, *salmonella, klebsiella terrigena, Escherichia coli (E. coli)* and *legionella.*

The U.S. Environmental Protection Agency, since the inception of the Safe Drinking Water Act in 1974, has been the acting authority in protecting public water supplies. It sets a Maximum Contaminant Level (MCL), or enforceable level, that a contaminant must not exceed. The EPA MCL of coliform bacteria in drinking water is zero total coliform per 100 ml of water.

Removal of bacteria is mostly executed when chlorine is added through the nation's public water systems, which is defined by EPA regulations as "a system with at least 15 service connections or regularly serves an average of 25 individuals daily for at least 60 days out of the year." This means that the hand of the EPA does not extend to private wells.

Which leads us to the end user's responsibility in making sure his drinking water is as safe as it can be.

Treating Water In Today's World

"Obviously, the higher quality the water, the less likely your exposure to bacterial risks," says Dr. Kelly Reynolds, PhD, a microbiologist and environmental researcher at the University of Arizona. "Minimizing this risk is beneficial all-around. But the quality of water at the tap is only as good as the quality of its subsequent distribution system."

In the Golden Age (late-1800s), as America's cities grew upwards and outwards, thousands of miles of pipe was laid to transport drinking and waste waters. This initial buried infrastructure of cast-iron pipe has an average life expectancy of about 120 years. Technology and changing material gave pipe in the 1920s an average life of 100 years. The longevity only decreases with more recently laid pipe, existing roughly 75 years before needing repair and/or replacement.

Today there are approximately 1 million miles of pipelines and aqueducts that carry water in the United States and Canada. Enough to circle the globe 40 times. *Tick, tock. Tick, tock.*

A recent research survey by the American Water Works Association, “Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure,” reports that 21st century water utilities face “significant economic challenges,” with a projection that expenditures could reach $250 billion over 30 years nationwide for worn-out drinking water pipes and associated structures. (This figure does not include wastewater infrastructure, or the cost of new drinking water standards.)

So as these buried systems decay and face replacement, the quality of the water at the tap comes into question.

An early-2001 survey by the Water Quality Association showed that 86 percent of Americans had concerns about their home’s water supply. Since that time, the occurrence of 9/11 has probably increased that percentage, with biological and chemical tampering with the nation’s water supply one of the chief concerns not only of the Department of Homeland Security, but of your customers, too.

The first defense against any potential health risk (natural or deliberate) is in the hands of local water utility management and their treatment processes. But as previously stated, diminishing materials means that even water leaving a treatment plant could be at risk by the time it reaches a consumer’s faucet.

In fact, as recently as February, the WQA issued a statement about its concerns over EPA findings that scaling in household plumbing “could literally cause the home’s water pipe system to exceed the federal government’s toxicity characterization leaching procedure (TCLP) limits — making those deposits, by definition, a ‘hazardous waste.’”

Also within those same findings:

“A related adverse reaction in household plumbing that is actually being created by the increasing use of chloramination for public water system disinfection. Chlorine typically dissipates from chloramines as water resides in home water pipes. This auto-decomposition creates ammonia, which can then change to nitrites. This ‘nitrification’ lowers water pH in low alkalinity waters — which can lead to iron and copper corrosion in home plumbing.”

The market for point-of-use water treatment equipment never looked brighter.

Let’s take a quick look at treatment options currently on the market that can stand up to these new — but real — threats of pipe corrosion, infrastructure upkeep and even bioterrorism.

- **Distillation** most directly replicates nature’s way of filtration. Water is boiled and evaporates. The vapor collected and condensed is separated from any solids in the water. Distillation removes contaminants such as algae, viruses, cysts, bacteria, arsenic, benzene, chloride, chlorine, copper, fluoride, lead, mercury, nitrates, and even odors, pesticides, rust, salt and sulfates.

  Effective as it is, however, the process is very slow and limited in its applications for residential usage.

- **Ultraviolet** processes pass water through a transparent tube where it's treated with UV radiation. UV does not add chemicals to the water during the process, such as in chlorination. But while UV is effective against bacteria and viruses, it needs to contact 100 percent of the water. Smaller particles can "hide" behind sediment, and some pathogens are less sensitive to UV light than others.

  The oftentimes-large UV systems require electricity, which inhibits its usefulness during power outages or emergency situations — a time when you usually need clean water the most.

- **Reverse osmosis** removes most water contaminants through a semi-permeable membrane, thus diluting a concentrated solution. RO is nonelectric, and is usually used in conjunction with activated carbon filters and a special faucet fitted with an internal drain line air gap or filtered water storage tank. It fits easily under a sink.

"The U.S. does a fantastic job of keeping its public drinking water safe," says Dave Krupinski, manager of residential systems for Kinetico Inc., a water treatment manufacturer. "But breakdowns do happen." He goes on to list dangers that can occur within a home's fence line: old or aging plumbing and pipes, back siphoning, outdoor water hose contamination, or septic tank leaching.

His company's recent collaboration with Pall Corp., a microbiological membrane manufacturer, has produced a seven-stage, multibarrier process to remove pathogens (and anything else) from water, making it "biopure."

Purefecta™, a certified water purifier for residential, healthcare facilities and light commercial applications, incorporates RO membranes and a carbon block filter, as well as Pall's 0.02-micron virus filter.

"Our industrial customers use our products for high-purity applications in the manufacturing process," says Krupinski.

Water's Future

By June of this year, all water utilities — large and small — are required to conduct vulnerability assessments put forth by the 2002 Bioterrorism Act.

The EPA provided $53 million in grants to over 400 large water utilities that primarily used the grant money to hire water security consultants to assist in conducting vulnerability assessments, according to a recent "Survey of Water Security." The EPA also provided $21 million in grants to provide drinking water security training to more than 8,000 small and medium water utilities.

Purefecta Drinking Water Purifier

Microbiological membranes such as the ones produced by Pall Corp. and future manufacturer collaborations could be the answer to providing the best residential and light commercial water treatment options. And with an upward trend of pipeline replacement scheduled to take up the rest of this century, offering end-users an added security of POU water treatment isn't just a good option, it's the right thing to do.