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Infusing technology into the drinking water industry's future

Contaminants in water offer opportunity, but how can you capitalize in coming years?

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June 1, 2013

There are approximately 161,000 public water systems in the U.S., including about 53,000 community water systems, the remainder are non community systems.[i] Of those, an alarmingly high number have been found violating maximum contaminant levels or treatment standards. In 2011, there were 8,322 reported violations of maximum contaminant levels affecting 14,915,599 people. There were 109,167 total violations from all categories in 2011 — a big increase from 2010 where there were only 75,857 total violations.[ii]

It should be noted that the EPA reported 93.2 percent of the population are on water supplies that meet all health related standards: 4,010 systems out of the 53,000 violated an MCL and 1,263 violated a treatment standard and the violations are somewhat reduced from 2010. The rest are primarily monitoring/reporting. The problems are predominantly among small systems.

In California, 680 community water systems are forced to rely solely upon a contaminated groundwater source. Nearly 40 percent of these water treatment systems have been in violation of standards, according to the California Department of Public Health.[iii]

Cost and a lack of expertise are the primary causes for these violations. Providing safe drinking water with a contaminated source water via centralized treatment facilities, especially in small rural communities with a few hundred or less services, is cost prohibitive until economies of scale are achieved. The costs to plan, build and maintain centralized treatment facilities are an unmanageable burden for small utilities. New and improved point-of-use (POU) and point-of-entry (POE) systems can be the best option to provide safe drinking water in these communities; however, many state regulators are hard to convince even though POU and POE are included for legal compliance for some contaminants under the Safe Drinking Water Act .

On one hand, the industry is poised for growth as more people become aware of contaminants in water and the benefits of reducing them with POU and sometimes POE systems. On the other hand, the industry is under attack due to the water wasted and salt discharged by our current systems — self-regenerating water softeners (SRWS) and under-sink reverse osmosis (RO).

A few years, ago Larry Wingate spoke at the WQA Convention in Las Vegas. After being introduced as an inspirational speaker by then WQA Executive Pete Censky, Wingate corrected Censky saying he was not an "inspirational speaker," but rather an "irritational speaker" because if he didn't "irritate" the audience enough to do something different tomorrow, he would have had no effect. My objective here is the same, to help professionals to think and act differently — with the ultimate goal of helping the industry to become more environmentally responsible.

The bad news: Paradox, scrutiny and the thirst for innovation

The POE/POU water treatment industry is nearing a tipping point.

- Government policy and regulation is looking at the industry due to its brine discharge and water wastage. This paradoxical message is clear. Many water treatment professionals think they provide the solution to water contamination; however, policy makers are beginning to realize these solutions may in fact be creating a larger problem.
- Consumers are becoming more aware of contaminants in their drinking water and some people have come to dislike additives, such as fluoride and the taste of chlorine.
- Consumers are looking for new "smarter" products — smart homes controlled from smart phones and other high tech devices.
- Consumer are increasingly buying green.
- For water treatment professionals, this means innovations, opportunities and new ways to think about business.

A brief look back and how the industry got "stuck"

Some industry professionals argue that traditional SRWS are the best solution to soften water, while turning a blind eye to the fact that they can waste a significant amount of the water in regeneration and over its useful life can dump 10-20 tons of salt into the wastewater depending on the salt efficiency setting, unit design and capacity, feedwater hardness, etc. A softener that regenerates every three days using nine pounds of salt per regeneration and 55 gallons of water will dump 21,900 pounds of salt and 133,833 gallons of water over a 20 year useful life.

Similarly, many choose to ignore the fact that the under-sink RO is likely to waste 90-95 percent of the water. [iv]

By and large we are stuck with old technologies that haven't changed much in years — since the under-sink RO was introduced in the 1970s. Remember the 1970s? People mailed letters, used rotary telephones, watched only three TV networks, used single tank, SRWS and under-sink ROs. Oh wait, we still use SRWS and ROs today.

Since the 1970s, the water treatment industry stood still, while the technology industry made incredible progress. What would Steve Jobs or other technology innovators do with the POE/ POU water treatment industry?

Leaping forward

We learn at a very young age to turn off the water when we are done washing our hands and to, “give a hoot, don’t pollute.” Despite that, we continue to sell products that might condition or purify water, but also waste water or pollute. The question we can no longer ignore is, “Do our products not only provide water purification and treatment, but are they also helping conserve and reuse it?”

And, what about improved features? They are important too. It is time we plugged in our products, booted up the software and delivered some technology.

Electrochemical deionization (DI), whole house RO with reject recovery and exchange tanks regenerated with zero liquid design (ZLD) can all provide softened water without any salt usage or water waste. Of course, deionized low TDS water is somewhat corrosive to the plumbing in homes so POU is probably the best option as these systems only treat water at the drinking water location and use compatible tubing and materials of construction. If POE, DI systems are used, water should be alkalinity and pH adjusted and stabilized to eliminate the corrosiveness.

Electrochemical DI can provide similar quality water as RO and at about the same cost, but with greatly reduced water wastage, and includes: A sediment pre-filter; TDS reduction cartridges use electricity to remove contaminants, such as nitrates, nitrites, lead, copper and arsenic; a carbon post-filter; optional UV or ultra filter; and corrosion control, if necessary.

The product costs about the same as a high end RO system, but without the massive water waste. No longer stuck in the 1970s, electrochemical DI systems offer dramatically improved technology such as:

- Programmable software that controls the system and allows performance to be optimized based upon feedwater quality. Adjusting for feedwater conditions, the installer can optimize performance and recovery.
- Ability to dial the taste of the water by increasing or decreasing the electrical current to the TDS cartridge, controlling the TDS level of the product water.
- System status notification using the on-board computer tells the consumer when service is needed and allows text messages or emails for service reminders.
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- Field Service Assistant (FSA) provides the technician with a complete system diagnosis and walks the technician through step-by-step processes.
- Leak detectors that shut down the system when a leak is detected, issues an audible alarm and can send a text message or email.

Looking at waste

John VanNewenhizen, a respected professional with 30 years at Culligan in technical management and product development, recently completed a study of the actual efficiency of various POU systems in simulated household use.[v] His findings show the best RO does is 14 percent recovery under very favorable conditions of 80 psi and 77° F. When water temperature drops to 50 degrees and the pressure to 50 psi, recovery drops to about 5 percent — 95 percent wastage. RO certification testing is done without a tank and that alone reduces recovery from 30 percent to 14 percent. Colder water at low feed pressure further reduces recovery.[vi]

The following tables from VanNewenhizen’s report show actual efficiency rates for an ion exchange system and

a typical RO with 400 ppm TDS feedwater.

Ion Exchange Percent Efficiency Projections

Over a Range of Temperatures and Pressures

Pressure and Temperature	% Recovery at 20 PSI	% Recovery at 40 PSI	% Recovery at 60 PSI	% Recovery at 80 PSI
77° F	72%	72%	71%	71%
70° F	72%	72%	71%	71%
64° F	72%	72%	71%	71%
60° F	72%	72%	71%	71%
54° F	72%	72%	71%	71%
48° F	72%	72%	71%	71%
40° F	72%	72%	71%	71%

Typical RO Efficiency Projections

Over a Range of Temperatures and Pressures

Pressure and Temperature	% Recovery at 20 PSI	% Recovery at 40 PSI	% Recovery at 60 PSI	% Recovery at 80 PSI
77° F	7%	10%	12%	14%

70° F	6%	9%	10%	13%
64° F	5%	8%	9%	11%
60° F	5%	7%	8%	10%
54° F	4%	6%	7%	9%
48° F	4%	5%	6%	8%
40° F	3%	4%	5%	6%

This data indicates that RO wastes water at a far greater rate than reported during certification. At the TDS level in the feedwater used in testing (~400 ppm TDS) the ion exchange system wasted only 0.5 gallons for every one gallon of drinking water and is indifferent to variances in feedwater pressure or temperature.

We must do better

New technologies and new approaches will win the day — both in POE and POU. Water managers and policy makers are catching on to the opportunity for water conservation and more efficient water reuse in POE/POU water treatment. They will be enacting new standards for us to meet. We can either embrace the change or fight.

Contaminants in water offer opportunity, but the industry will only be able to capitalize on the opportunity if our products don't contribute to the problem. The industry must introduce new products.

As a start, I encourage everyone in the industry to figure out how much water you could conserve or how much less salt you would put in the sewer, if you adopted new technologies. Everyone deserves quality water. New technologies are affordable, safe, offer new smart features and they are environmentally sustainable.

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[i] http://www.epa.gov/ogwdw/wot/pdfs/book_waterontap_full.pdf, Page 4, April 29, 2013.

[ii]http://water.epa.gov/scitech/datait/databases/drink/sdwisfed/upload/epa816r13003.pdf, Page 18, April 29, 2013.

[iii] http://www.waterboards.ca.gov/press_room/press_releases/2013/pr020413.pdfand http://www.waterboards.ca.gov/gama/ab2222/docs/ab2222.pdf, April 29, 2013.

[iv] http://www.linxwater.com/pdfs/Water-Savings.pdf, April 29, 2013.

[v] http://www.linxwater.com/pdfs/Water-Savings.pdf, April 29, 2013.

[vi] http://www.multipure.com/media/mp-ro-data.pdf Page

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