

Working to Keep Building Water Systems Safe and Efficient – The Vital Role of the Plumbing Industry

By: Peter DeMarco, Executive Vice President of Advocacy and Research, The IAPMO Group

Legionella Conference 2018

The way water is used in homes and non-residential buildings today has changed drastically over the course of the past three decades. In residences, every type of plumbing fixture and household appliance that consumes water has been rethought and redesigned to use only a fraction of the water consumed in the 1980s, while still providing excellent consumer satisfaction and functionality. In commercial and institutional buildings, manufacturing processes and industrial equipment, especially water consuming commercial food service equipment used in restaurants, have also been redesigned to be more efficient. Around the globe, manufacturers, engineers, trades people, water utilities, architects and all levels of government have rallied around the cause of increased water efficiency. According to a U.S. Department of the Interior U.S. Geological Survey reportⁱ, public water withdrawals in 2015 were 7% lower than in 2010 and those savings are directly attributed to urban water efficiency measures. And, despite the correlation to an increase in Legionella outbreaks over the same time frame, we have no choice but to continue to strive to be an increasingly water efficient society.

Water consumption by water-using plumbing products and appliances – 1980s to 2017ⁱⁱ

Water-using Fixture or Appliance	1980s Water Use	1990 Requirement	EPAAct 1992 Requirement	2015 Baseline Plumbing Code	'Green Code' Requirements (2017 WE-Stand and 2017 CalGreen)	% Reduction in since 1980s
Residential Bathroom Lavatory Faucet	3.5+ gpm	2.5 gpm	2.2 gpm	2.2 gpm	1.2 gpm	66%
Showerhead	3.5+ gpm	3.5 gpm	2.5 gpm	2.5 gpm	2.0 gpm	43%
Toilet – Residential	5.0+ gpf	3.5 gpf	1.6 gpf	1.6 gpf	1.28 gpf	74%
Toilet - Commercial	5.0+ gpf	3.5 gpf	1.6 gpf	1.6 gpm	1.28 gpm	74%
Urinal	1.5 to 3.0+ gpf	1.5 to 3.0 gpf	1.0 gpf	1.0 gpf	0.125 gpf	92%
Commercial Lavatory Faucet	3.5+ gpm	2.5 gpm	2.2 gpm	0.5 gpm	0.5 gpm	86%
Food Service Pre-Rinse Spray Valve	5.0+ gpm	No requirement	1.6 gpm (EPAAct 2005)	No requirement	1.3 gpm	74%
Residential Clothes Washer	51 gallons/load	No requirement	26 gallons/load (2012 standard)	No requirement	13 gallons/load (Energy Star)	75%
Residential Dishwasher	14 gallons/cycle	No requirement	6.5 gallons/cycle (2012 standard)	No requirement	3.5 gallons/cycle (Energy Star)	75%

Being increasingly efficient with our finite and shrinking water resources is a necessity if we are to meet the needs of a growing global population, especially in the many urban areas of the world that have profound water-related challenges. Sao Paulo, Brazil, narrowly missed running out of water in 2015 and Cape Town, South Africa, is working hard to avoid a “Day Zero” scenario —where a major metropolitan city runs out of water and the taps run dry. BBC News recently issued a reportⁱⁱⁱ detailing the 11 major cities that are most likely to run out of water, Miami among them. It’s a certainty that stresses on water resources will only increase as we

move forward in time. Thus, turning back the clock on water efficiency and increasing water flows in buildings as a possible measure to help keep our water systems safe from Legionella and other dangerous pathogens simply isn't an option.

Rather, all segments of the water related industries, in concert with government and academia, need to focus collective efforts on developing thoughtful research programs, new technologies, effective standards, and treatment methodologies leading to the codification of water system design and maintenance provisions that work to keep our water systems safe while taking lower water flows into account. Much will be discussed at the Legionella 2018 Conference pertaining to a better understanding on how to best mitigate legionellosis outbreaks from a water distribution and treatment perspective. This paper, in line with the session on Plumbing System Design that I am moderating at the conference, focuses on the quotient that the plumbing industry is already providing and will continue to work on toward these collective efforts. Much has already been done, and a great deal of continuing work is underway.

As will be presented, research organized and supported by the International Association of Plumbing and Mechanical Officials (IAPMO), the American Society of Plumbing Engineers (ASPE), and the Water Quality Association – Research Foundation (WQA-RF), working with Professor Steven Buchberger's team at the University of Cincinnati, has resulted in the development of a new alternative to Hunter's Curve^{iv} when estimating water supply demand for residential buildings. This work also resulted in a new "Water Demand Calculator" that better estimates pipe sizing based on current residential use patterns^v.

The significance of this work cannot be overstated, as it represents the first practical application of an improved, statistically based pipe-sizing method since the 1940s that does not result in excessive over design and oversizing of water pipes. The method is applicable for both single- and multi-family dwellings. A complimentary, easy-to-use Water Demand Calculator (WDC) estimates the supply demand for the whole building, as well as cold and hot water branches and risers for indoor water use based on today's plumbing fixtures and appliances and usage patterns. Research on this new approach for pipe-sizing continues so that it can be applied for non-residential buildings, as well; however, a coordinated effort amongst researchers to better understand how water is being used in various non-residential building types is needed to move forward with this work.

In early 2017, Purdue University was awarded a US\$2.5 million grant from the U.S. EPA to lead a group of researchers in a three-year project to bring together existing and experimental data on building plumbing into a risk assessment tool that can guide new water use and safety regulations. Working with researchers at Michigan State and San Jose State Universities, the program is focused on a better understanding of how lower water flows and reduced usage impacts water quality in premise plumbing systems. Work is well underway on this multifaceted program, including the monitoring of water usage and water quality in several buildings.^{vi}

As Christoph Lohr's presentation details, plumbing manufacturers are developing new water system technologies, some designed primarily for installation in health care facilities, that monitor water use, temperature and residual disinfectant levels such that treatments can be applied instantly when conditions become favorable for the amplification of legionella or other pathogens. In addition, new plumbing fittings and installation techniques that work to reduce stagnation, especially in seldom used sections of plumbing systems, are also gaining wide acceptance. Plumbing engineers, in addition to specifying and installing these new technologies, are designing building water systems around the current body of knowledge to

eliminate problematic features, such as “dead legs,”^{vii} and eliminating materials that are known to support biofilm growth.

The plumbing industry is also working to provide accurate and practical information to the public and to the building trades pertaining to Legionella. Plumbing Manufacturers International’s (PMI) safeplumbing.org website^{viii} has excellent information on Legionella, how water systems can become contaminated, and information on how water systems can be best maintained and tested to keep them free from contamination. The American Society of Sanitary Engineers (ASSE) recently published a certification standard^{ix} that details best practices for keeping building occupants and plumbers, pipefitters, sprinkler fitters, HVAC technicians and demolition workers safe from contracting Legionella when working on existing water and other industrial systems that have the potential to harbor dangerous pathogens.

On the policy front, the plumbing industry is united in calling for a temporary moratorium on further regulatory based water flow reductions on indoor, water consuming consumer products, plumbing fixtures and appliances until research can be conducted on the unintended consequences of water efficiency. Our nation has done such a great job at becoming more water efficient over the past three decades and there is little to be gained by trying to shave additional tenths of a gallon off already efficient products while risking further declines in water quality.

While much has been accomplished, much more work needs to be done to keep building occupants safe from the increasing threat of waterborne pathogens. Addressing the risks from Legionella while also taking the realities of water scarcity and dwindling safe water supplies into account will be a daunting challenge. As a result, the plumbing industry acknowledges its profound responsibility and the vital role it plays in addressing these complex problems.

ⁱ US Department of the Interior, U.S. Geological Survey, Open File Report 2017-1131

ⁱⁱ *The Drainline Transport of Solid Waste in Buildings*, Plumbing Efficiency Research Coalition Report - J. Koeller, P. DeMarco (updated)

ⁱⁱⁱ BBC News Report, *The 11 Cities Most Likely to Run Out of Water – Like Cape Town*, 11 February, 2018

^{iv} For information on Hunter Curve, See US Department of Congress, Report BMS65
<https://www.gpo.gov/fdsys/pkg/GOVPUB-C13-a13c5a2020dd0a7b1df8b91b165745ca/pdf/GOVPUB-C13-a13c5a2020dd0a7b1df8b91b165745ca.pdf>

^v See <http://www.iapmo.org/WESTand/Pages/default.aspx> for detailed information on the revised pipe sizing method, its implications and the Water Demand Calculator

^{vi} See <http://www.purdue.edu/newsroom/releases/2017/Q1/project-focuses-on-reducing-pathogen-threat-in-low-flow-water-systems.html> for additional information on the EPA funded research at Purdue University

^{vii} A “dead leg” is a portion of a plumbing system that is stagnant or has rare flow of water in the pipes (an emergency eye wash station, for example)

^{viii} See PMI’s Safe Plumbing Website <https://www.safeplumbing.org/health-safety/legionella-and-water-supply-systems>

^{ix} See ASSE/ IAPMO/ANSI Series 12000 – Health and Safety of Construction and Maintenance Personnel Certification Standard
<http://www.asse-plumbing.org/12000.html>