ACEEE Hot Water Forum

Addressing Today's Water Use Patterns in Plumbing Codes and Standards

Hugo Aguilar, P.E
Senior VP of Codes and Standards
Hugo.Aguilar@iapmo.org

How Much Have Flows Been Reduced?

Water consumption by water-using plumbing products and appliances – 1980s to 2017[1]

Water-using Fixture or Appliance	1980s Water Use	1990 Requirement	EPAct 1992 Requirement	2015 Baseline Plumbing Code	'Green Code' Requirements	% 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	1.8 gpm	49%
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	96%
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 (EPAct 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%

GPM = US Gallons Per Minute
GPF = US Gallons Per Flush

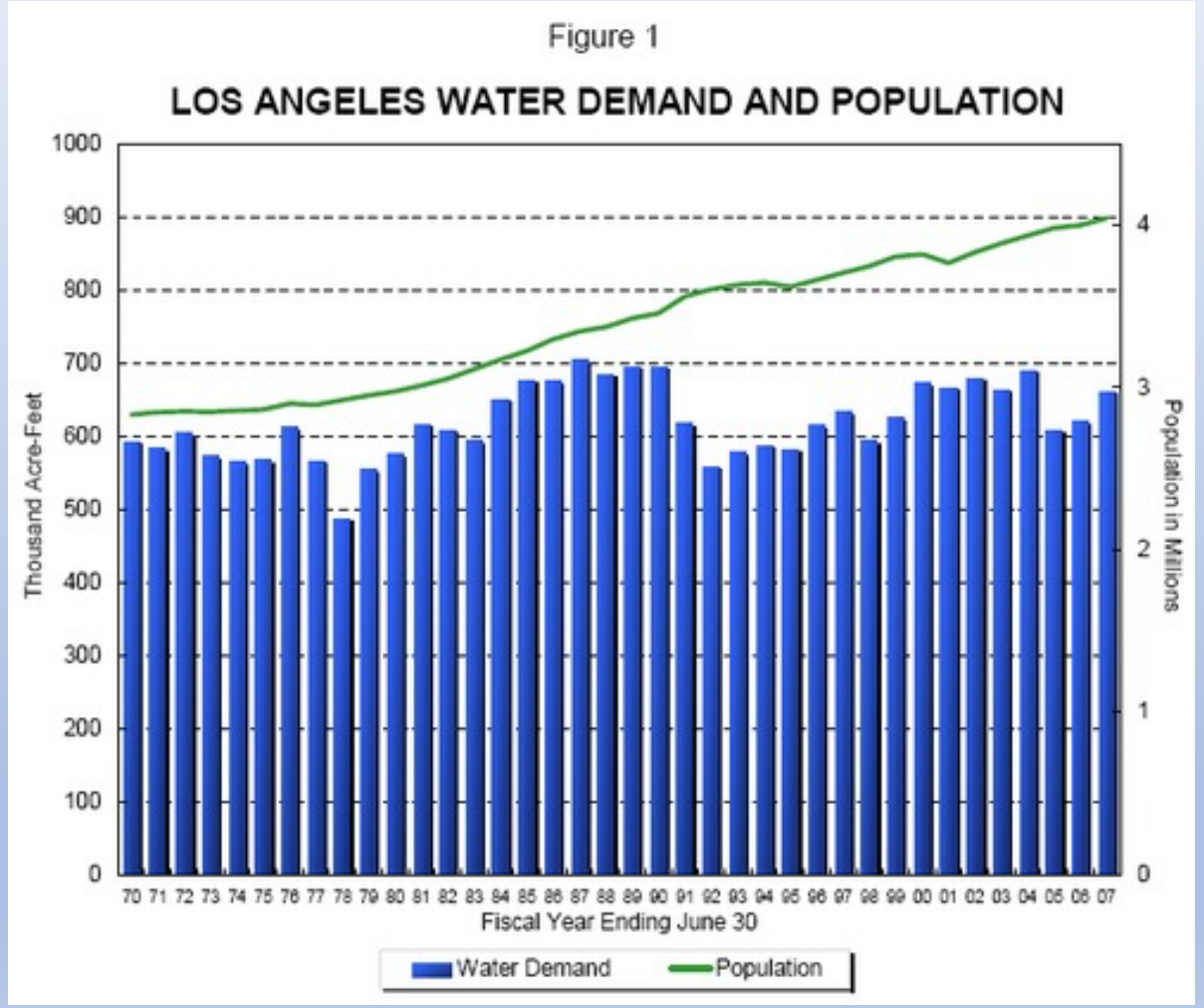
[1] *The Drainline Transport of Solid Waste in Buildings*, PERC 1 Report - J. Koeller, P. DeMarco (updated)

How Have the Codes Responded?

IAPMO's Technical Responses

The Energy Policy Act (EPAct) in the Codes - 1994 - 2000

- EPAct signed into law by President G.H.W. Bush in 1992
- Took effect between 1994 (residential) and 1997 (commercial)
- Represented the single biggest driver of water efficiency in the history of the United States
- Codes were updated with EPAct requirements in the 1997 UPC. The codes have progress overtime to address EPAct requirements.



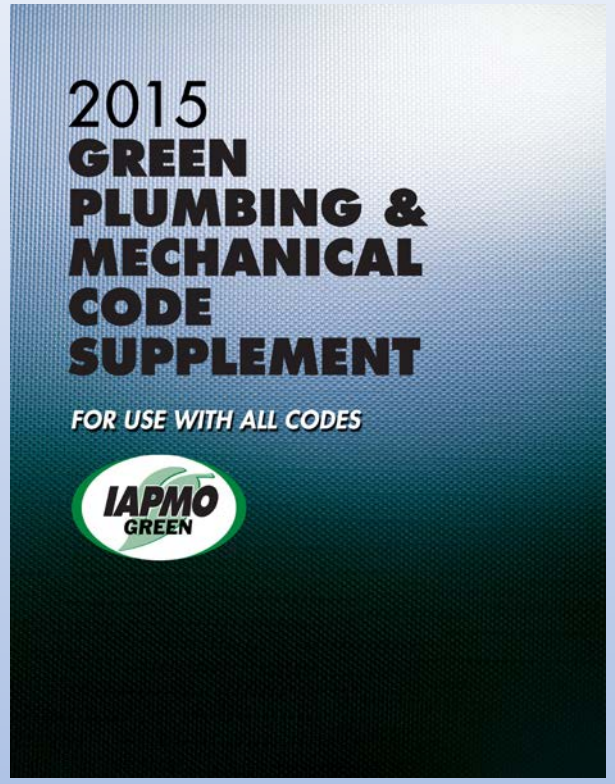
Codifying EPAct levels in the UPC

- The National Energy Policy Act of 1992 (EPAct 92) set maximum water consumption standards for showerheads, faucets, urinals, and toilets; pre-rinse spray valves.
- The table illustrates the water consumption for various fixtures as shown in the 2018 UPC which meet EPAct levels.
- First incorporated in the UPC in 1994. In 2012, the UPC was expanded to include more progressive WaterSense requirements.

Water Consumption Requirements 2018 UPC	
Showerheads (408.2)	2.5 gpm
Lavatories, public (407.2.1)	0.5 gpm
Lavatories, private (407.2.1)	2.2 gpm
Water Closet (411.2)	1.6 gpf
Urinals (412.1)	1.0 gpf
Pre-Rinse Spray Valve (420.3)	1.6 gpm

IAPMO's Green Plumbing & Mechanical Code Supplement

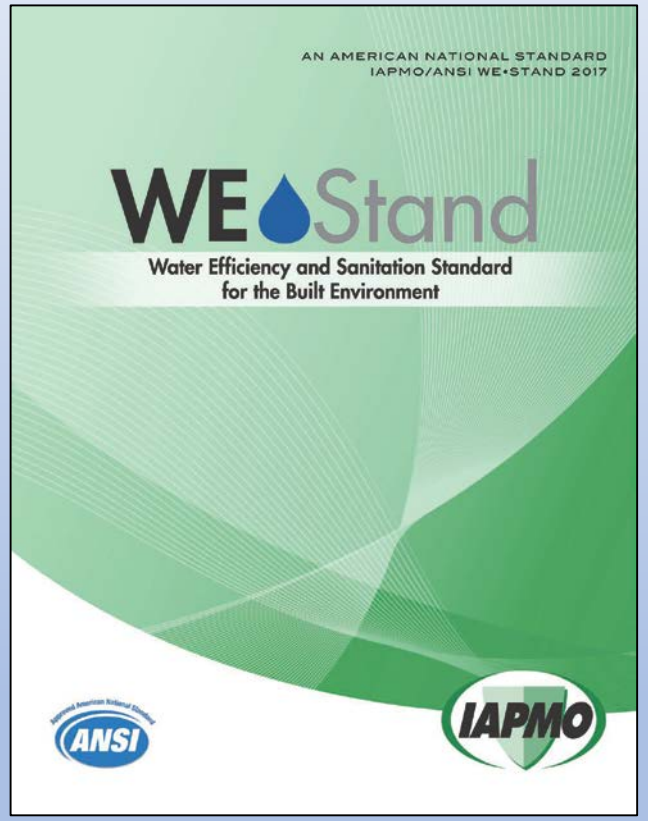
- The FIRST Water Efficiency Code Published in the USA
- Designed to Overlay code designed to work with *any* baseline plumbing and mechanical code, not just IAPMO codes
- First published in February, 2010
- Intended as a repository for emerging technologies and code provisions – eventual incorporation into the baseline plumbing and mechanical codes
- Addressed: Indoor and outdoor water efficiency, Alternate water sources, Hot water efficiency, Mechanical applications, Installer qualifications



IAPMO's Water Efficiency and Sanitation Standard

WE Stand

- First American National Standard (ANSI Accredited) for Water Efficiency
- Standard based and developed upon the 2015 GPMCS water efficiency provisions
- First published in December 2017
- Key Provisions: New Water Demand Calculator, composting toilets and urine diversion, landscape irrigation, alternate water sources, indoor water efficiency, water heating conservation, commercial food services, pools



IAPMO

Formation of PERC

- Formed in January 2009 explicitly to address research pertaining to water efficiency
- MoU Signed at EPA HQ
- First Project: Drainline Transport
- MoU with Australia's AS-Flow in 2010

Plumbing Efficiency Research Coalition

ASFlow

Alliance for Water Efficiency

ASPE American Society of Plumbing Engineers

IAPMO

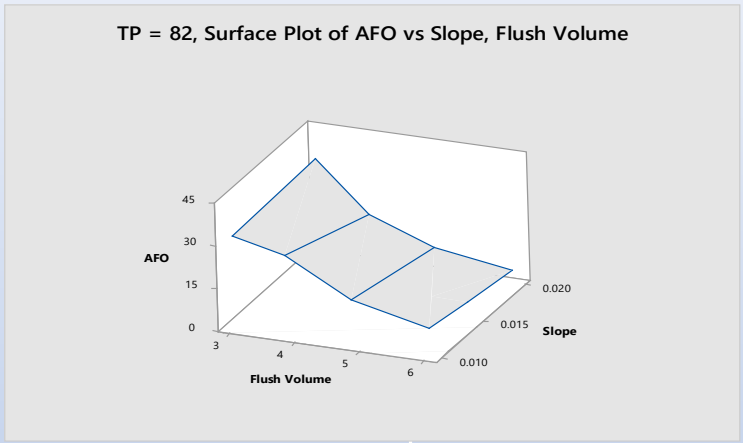
ICC INTERNATIONAL CODE COUNCIL

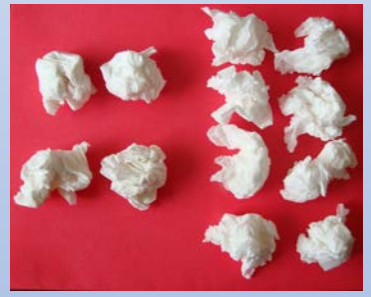
PHCC PLUMBING-HEATING-COOLING CONTRACTORS ASSOCIATION

pmi PLUMBING MANUFACTURERS INTERNATIONAL

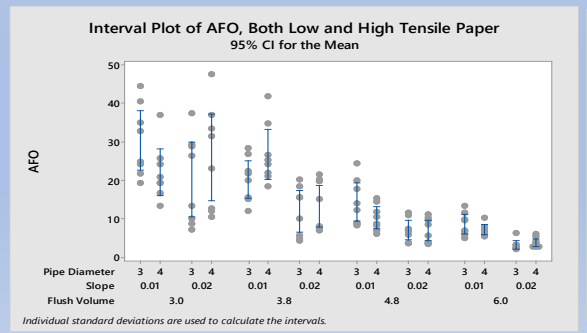
PERC's DLT Findings - Significance

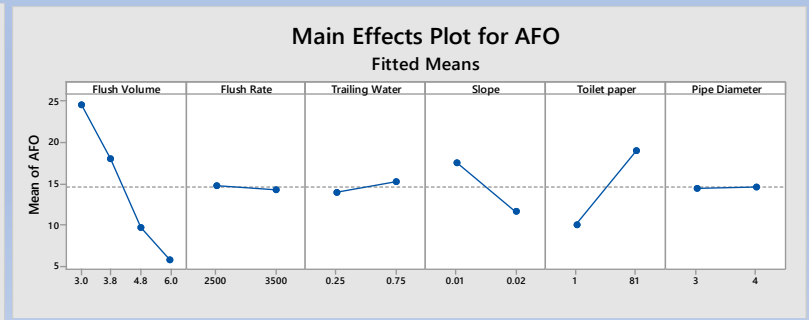
- Determined potential for chronic drainline blockages at low volume toilet flush levels
- Measured the relative significance of drainline slope, diameter, toilet flush volume, toilet design and toilet paper tensile strength
- Found that there was no need to revise drainline sizing in the codes
- Much more!





Variable	P Value
Volume	0.000*
Flush Rate	0.472
Trailing Water	0.182
Slope	0.000*
Paper	0.000*
Pipe Diameter	0.533

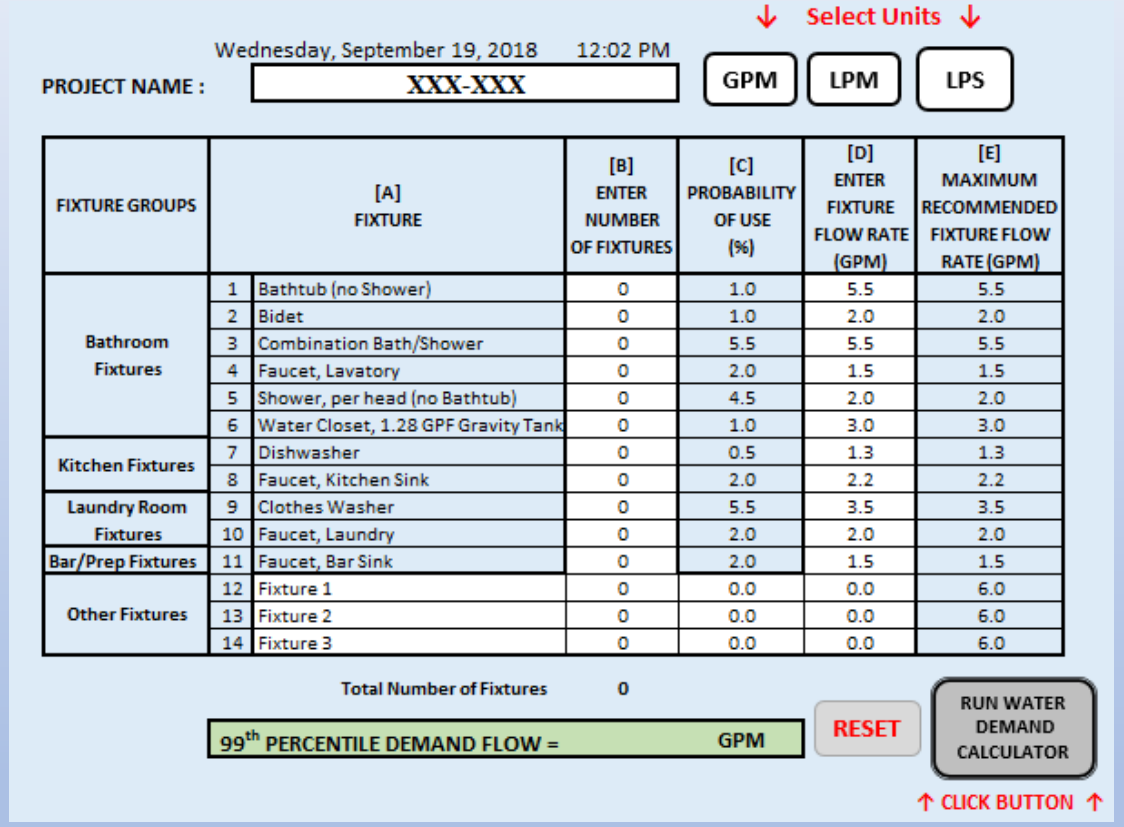




To review the PERC studies, go to www.plumbingefficiencyresearchcoalition.org

Water Demand Calculator

- First update since Hunter's 1940 Curves to estimate peak water demand for single and multi-family dwellings using efficient fixtures
- Reduces meter and pipe sizes
- Increased cost savings
- Replaces the use of Fixture Units
- An easy to use calculator designed on an Excel Spreadsheet
- Based on statistical data and sound probability models



↓ Select Units ↓

Wednesday, September 19, 2018 12:02 PM

PROJECT NAME : XXX-XXX

GPM | LPM | LPS

FIXTURE GROUPS		[A] FIXTURE	[B] ENTER NUMBER OF FIXTURES	[C] PROBABILITY OF USE (%)	[D] ENTER FIXTURE FLOW RATE (GPM)	[E] MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
Bathroom Fixtures	1	Bathtub (no Shower)	0	1.0	5.5	5.5
	2	Bidet	0	1.0	2.0	2.0
	3	Combination Bath/Shower	0	5.5	5.5	5.5
	4	Faucet, Lavatory	0	2.0	1.5	1.5
	5	Shower, per head (no Bathtub)	0	4.5	2.0	2.0
	6	Water Closet, 1.28 GPF Gravity Tank	0	1.0	3.0	3.0
Kitchen Fixtures	7	Dishwasher	0	0.5	1.3	1.3
	8	Faucet, Kitchen Sink	0	2.0	2.2	2.2
Laundry Room Fixtures	9	Clothes Washer	0	5.5	3.5	3.5
	10	Faucet, Laundry	0	2.0	2.0	2.0
Bar/Prep Fixtures	11	Faucet, Bar Sink	0	2.0	1.5	1.5
Other Fixtures	12	Fixture 1	0	0.0	0.0	6.0
	13	Fixture 2	0	0.0	0.0	6.0
	14	Fixture 3	0	0.0	0.0	6.0

Total Number of Fixtures 0

99th PERCENTILE DEMAND FLOW = GPM

RESET

RUN WATER DEMAND CALCULATOR

↑ CLICK BUTTON ↑

ASPE American Society of Plumbing Engineers

IAPMO

University of CINCINNATI

WQRF Water Quality Research Foundation

ISO PC-316 - Purpose and Status

Title: ISO 31600, *Water Efficiency Products-Rating*

U.S TAG: IAPMO selected as the U.S TAG Administrator and to represent the position of the United States in the ISO PC 316.

Purpose: The purpose of ISO 31600 Water Efficient Products – Rating is to provide water efficiency ratings for plumbing products and appliances. The scope will include the establishment of water efficiency flow rates and consumption values along with key performance test requirements for plumbing products and appliances, specifically: showerheads and mixing valves, faucets/taps, flow control devices, toilets (all types), urinals, flushometer valves, dishwashers for domestic use, clothes washers for domestic use, and the dryer function of combination washer/dryers, where water is used to dry washing loads.

Participants: 13 participating countries, 19 observing members

Status: The standard is currently in the preparatory phase. Will be designed to work seamlessly with existing national-based consumer labeling programs already in place, such as the WaterSense and national adopted standards such as ASME/CSA/ASSE.

Participation on ASHRAE 188 & Guideline 12

- IAPMO's prime directive is the codification of technical requirements for safe and efficient plumbing systems.
- Threats from Legionella and other opportunistic pathogens represent a major concern
- The only Code developing organization to have participated as a contributing voting member of ASHRAE 188
- Provided needed expertise on pluming system design and operation

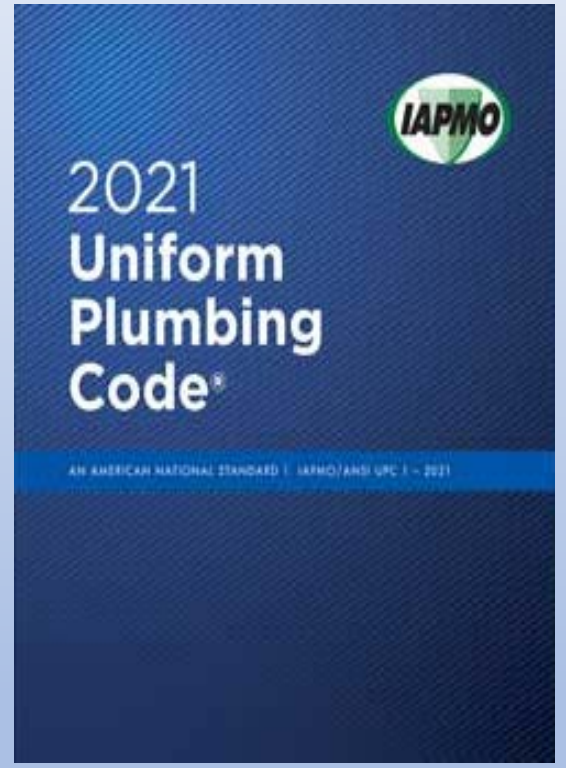
Photo courtesy of the CDC

Legionella Task Group for the UPC

Need: The UPC Committee saw a need where having known temperature ranges and having those responsible for plumbing design, implementation and code enforcement to understand the health and safety risks associated with Legionella and scald risk exposure. This need lead to the formation of the Legionella Task Group.

Task Group Results: The efforts of the Task Group resulted in the submission of two public comments for single-family residential buildings. The public comments focuses on the water distribution system's water temperature, the potential exposure for Legionella growth and scald potential. The task group also generated requirements for construction document and provisions for commissioning of buildings.

Significance: The Task Group development has the potential of being the first to include enforceable codified language into a national code. It is structure such that the enforceable provisions can be implemented while allowing latitude to implement risk management guidance such as ASHRAE 188 and ASHRAE Guideline 12.



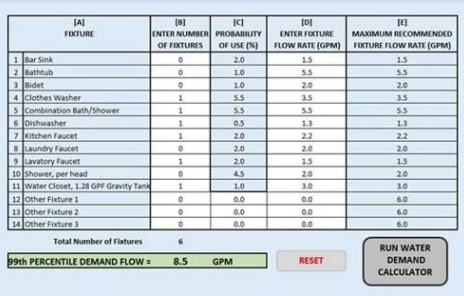
How Has IAPMO Responded?

IAPMO's Advocacy Responses

Bringing the Plumbing Industry Together - Industry Outreach

- **PERC**: IAPMO acted as the founding member and created PERC to address research needs related to water efficiency
- **Pipe Sizing TG**: IAPMO acted as the founding member along with the **American Society of Plumbing Engineers** (ASPE) and **Water Quality Research Foundation** (WQRF) to research methods to address modern pipe sizing calculations
- **The Plumbing Industry Leadership Coalition (PILC):** Along with ASPE and **Plumbing Manufacturers Institute** (PMI), IAPMO convenes an annual meeting for the CEO's and other leaders of plumbing and water efficiency associations to discuss policy and research initiatives
- **Emerging Water Technology Symposium (EWTS):** Convened with ASPE, the **Alliance for Water Efficiency** (AWE), and PMI, A biennial symposium that discusses new water technologies, pathogen risk management practices, efficient hot water designs for plumbing systems, policy initiatives and more… (join us in San Antonio, May 12-13, 2020!)

Plumbing Efficiency Research Coalition



	[A] FIXTURE	[B] ENTER NUMBER OF FIXTURES	[C] PROBABILITY OF USE (%)	[D] ENTER FIXTURE FLOW RATE (GPM)	[E] MAXIMUM RECOMMENDED FIXTURE FLOW RATE (GPM)
1	Bar Sink	0	2.0	1.5	1.5
2	Bathtub	0	1.0	5.5	5.5
3	Bidet	0	1.0	2.0	2.0
4	Clothes Washer	1	5.5	3.5	3.5
5	Combination Bath/Shower	1	5.5	5.5	5.5
6	Dishwasher	1	0.5	1.3	1.3
7	Kitchen Faucet	1	2.0	2.2	2.2
8	Laundry Faucet	0	2.0	2.0	2.0
9	Lavatory Faucet	1	2.0	1.5	1.5
10	Shower, per head	0	4.5	2.0	2.0
11	Water Closet, 1.28 GPF Gravity Tank	1	1.0	3.0	3.0
12	Other Fixture 1	0	0.0	0.0	6.0
13	Other Fixture 2	0	0.0	0.0	6.0
14	Other Fixture 3	0	0.0	0.0	6.0

Total Number of Fixtures 6

99th PERCENTILE DEMAND FLOW = 8.5 GPM

RESET

RUN WATER DEMAND CALCULATOR

PILC
PLUMBING INDUSTRY LEADERSHIP COALITION

EWTS
Emerging Water Technology Symposium

Please visit www.ewts.org to learn more about the **Emerging Water Technology Symposium**

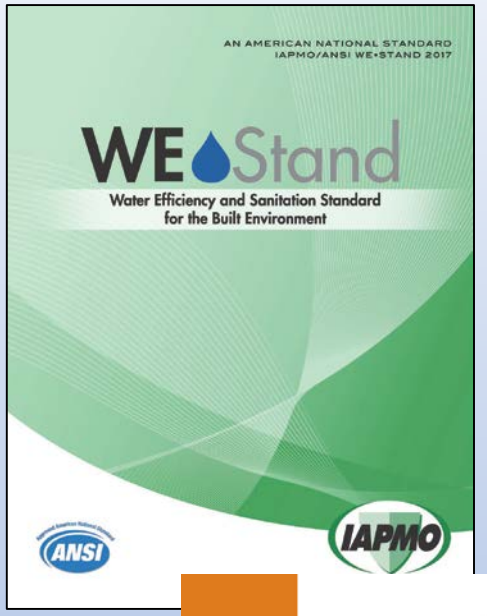
IAPMO

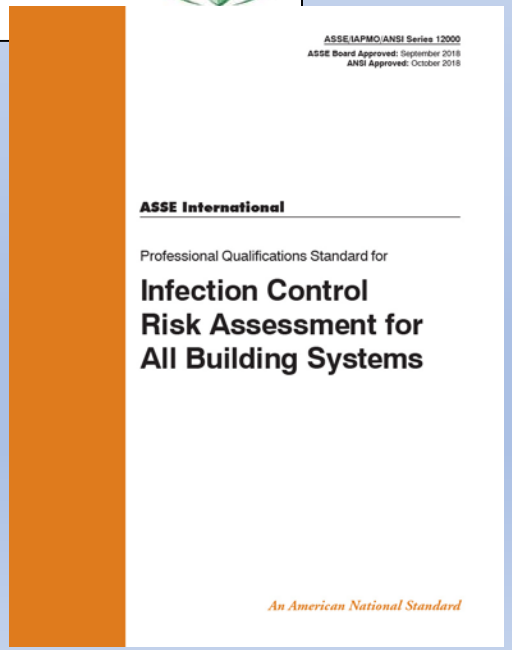
Bringing the Plumbing Industry Together - Legislative / Policy

- **WaterSense:** Along with our partners at AWE, ASPE and PMI, IAPMO's GR Dept. helped lead the industry efforts to save WaterSense from budget cuts in 2016 and 2017 and led to the authorization of WaterSense!
- **National Institute of Building Sciences (NIBS)** - IAPMO acted as the primary author of plumbing and water efficiency content in the NIBS *Moving Forward* Reports, including recommendations on:
  - Indoor Water Efficiency
  - The need for new pipe sizing methods
  - The unintended consequences of water efficiency
  - Repeated calls to reconstitute the Plumbing Research Lab at the National Institute of Standards and Technology (NIST)
  - Research gaps pertaining to Alternate Water Sources

Going Forward! What's Next for Our Technical Efforts?

- IAPMO's WE-Stand - Already hard at work for the 2020 revision
  - Current Task Group Initiatives to Advance Water Efficiency include:
    - Onsite Blackwater Treatment Systems
    - Onsite Stormwater Treatment Systems
    - Non-sewered Sanitation Systems
    - Reverse Osmosis Water Efficiency
    - New FOG technology
    - Premise Water Supply System Design
    - Composting Toilet and Urine Diversion Inspection Check List
- Training programs for building Water Management Teams and trade professionals (ASSE)
- Development of ANSI standard for adoption of ISO 30500 - Non-sewered Sanitation Systems: Toilets of the future?
- And a lot more…





Going Forward! What's Next for Our Policy Related Efforts?

- Working with NIST and others on the research needs for applying the Water Demand Calculator for non-residential applications
  - Select the most common non-residential building types (office buildings, schools, hotels, and healthcare)
  - Prioritize by complexity
  - Monitor fixture use for a given number of days
  - Provide demographics and survey data
  - Install sub-meters, data loggers and sensors as buildings are constructed
  - Verify the accuracy of the WDC predictability or edit as required
- Now that WaterSense is authorized, IAPMO will advocate for increased funding
- Advocating for increased research on Legionella
- And a lot more…

Thank You!

Hugo Aguilar, P.E
Senior VP of Codes and Standards
Hugo.Aguilar@iapmo.org