**Robert Mowris & Associates**
P.O. Box 2141, Olympic Valley, CA 96146 ♦ (530) 448-6249 ♦ Fax (530) 581-0500 ♦ robert.mowris@rma-energy.com

**Date:** April 18, 2012



**To:** California Energy Commission
Dockets Office
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512

**Re:** Docket No. 12-BSTD-01

**From:** Robert Mowris, P.E.

To Whom It May Concern,

**Introduction**

Robert Mowris and Associates (RMA) is an energy and water efficiency engineering consulting company. The following comments are submitted regarding Section 110.3(c)7 Showerheads of the 45 Day Language of the Draft 2013 Building Energy Efficiency Standards (http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Draft_Language/Staff_Proposed_Draft_Language-Standards/2013_110-115_All_Mandatory_Equipment-45day.pdf).

**Background**

RMA performed a three-year Public Interest Energy Research (PIER) study from 2007 through March of 2010 to develop new testing protocols for measuring the performance of showerheads (Mowris 2012). The PIER study was performed under the auspices of the California Energy Commission. RMA worked with the American Society of Mechanical Engineers (ASME) and Canadian Standards Association (CSA) Joint Harmonization Task Force (JHTF). The JHTF was founded in 2007 with the intent of developing new showerhead test protocols and performance standards. The JHTF included showerhead manufacturers, water and energy utilities, testing laboratories, and consultants. The United States (US) Environmental Protection Agency (EPA) WaterSense® and their consultant, Eastern Research Group (ERG), worked with the JHTF to collaborate on new showerhead test protocols and the WaterSense® Specification for Showerheads (Tanner 2009). EPA published its WaterSense® Notice of Intent (NOI) to develop a specification for high-efficiency showerheads in August 2007. In its notice, WaterSense® identified its goal to label products that are 20% more water-efficient than average products.

The JHTF developed new showerhead test protocols to verify performance attributes in the laboratory. The JHTF conducted round-robin tests to evaluate the new test protocols with the same set of 22 showerheads at multiple test laboratories including RMA. ERG conducted consumer satisfaction testing on the same 22 showerhead models to determine whether there is a uniform preference or dislike of certain showerhead attributes and to determine whether the performance attributes adequately define user satisfaction (Wagoner 2008). RMA conducted

consumer satisfaction testing to verify the ERG consumer satisfaction results for these models. RMA performed additional laboratory and consumer satisfaction testing on 51 other showerheads referred to evaluate how the new test protocols performed on a larger sample of showerheads. If the consumer testing provided conclusive results, the JHTF correlated these attributes against the laboratory test protocols and used the results to establish performance criteria for the new showerhead test protocols.

The RMA PIER study found a strong correlation between laboratory tests and consumer satisfaction survey results for the flow rate criteria. There was less correlation between the laboratory tests and consumer satisfaction survey results for the force and coverage criteria. Laboratory tests performed by RMA of 41 fixed showerheads correlate to consumer satisfaction survey results for flow rate but not for force or coverage. Laboratory tests performed by RMA of 10 hand-held showerheads do not correlate to consumer satisfaction survey results with respect to flow rate, force, or coverage indicating the need for further research on test protocols for hand held showerheads.

Based on a survey of 25 manufacturers representing 80 to 90 percent of showerheads sold in the US, 96 percent support the voluntary WaterSense® showerhead specification. Eighty three percent of manufacturers sell efficient showerheads with rated flow rates less than 2.5 gpm at 80 psig and the average manufacturer offers 5 efficient models. The average retail cost for water saving showerheads is 26 percent less than conventional showerheads. Only one manufacturer reported receiving complaints (for another manufacturer valve) about thermal shock with their showerhead rated at less than 2.5 gpm at 80 psig.

Approximately 65 to 78 percent of the showerheads tested in the RMA study did not meet the WaterSense® specification for flow rate, force, or coverage. Based on this finding in 2010, RMA did not recommend that California adopt a flow rate standard lower than 2.5 gallons per minute at 80 psig flowing pressure for all showerheads installed in new or existing applications. Instead the study findings supported the voluntary EPA WaterSense® showerhead specification of 2.0 gpm at 80 psig flowing pressure to give manufacturers time to redesign their products.

**Comments on the Proposed 45-Day Language for Showerheads**

The proposed 45-day language is provided below.
**SECTION 110.3(c)7** Showerheads
7. Shower Heads. A single shower head must be installed directly on each pipe that terminates at a shower. Shower heads must be placed no closer than four feet from each other, as measured directly from one shower head to the next. Shower heads must have a rated flow rate of no more than 2.0 gallons per minute at 80 psi. Each mixing valve must supply only one shower head. The piping connecting the shower head to the heater or recirculation loop must be no wider than 1/2 inch at any point.

The second sentence of the 45-day language is as follows.

> "Shower heads must be placed no closer than four feet from each other, as measured directly from one shower head to the next."

This requirement is intended to prevent multi-head showers from being installed in a shower enclosure. This language is unnecessary since US DOE issued guidance on March 4, 2011 stating that multi-head showers must meet the maximum flow rate for single head showers (2.5gpm) per the "Showerhead Enforcement Guidance Issued: March 4, 2011." This information is available at the following URL: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/showerhead_guidance_3-4-2011.pdf.

US DOE provided a 2-year grace period regarding multi-head showers which ends on March 4, 2013. After that time the US DOE will require multi-head showers to meet the 2.5 gpm maximum. If the CEC adopts a requirement to reduce the flow rate to the ASME high efficiency specifications for new construction, then multi-head showers installed in California would be governed by the lower flow rate requirement.

The third sentence of the 45-day language is as follows.

"Shower heads must have a rated flow rate of no more than 2.0 gallons per minute at 80 psi."

This requirement is vague and inconsistent with the 2011 ASME/CSA standard for high efficiency showerheads and hand-held shower fittings. To be consistent with the 2011 ASME/CSA standard the maximum flow rate should be no greater than 2.0 gpm at flowing pressure of 80 psi and the minimum flow rate should be no less than 60% of the maximum flow rate at flowing pressure of 20 psi, and no less than 70% of the maximum flow rate at flowing pressures of 45 and 80 psi. The 45-day language should reference the following ASME standard: ASME A112.18.1-2011/CSA B125.1-11, Plumbing Supply Fittings, November 2011. High-efficiency shower head and hand-held shower, Clauses 5.13.2.1 and 5.13.2.2. This standard is available online at the following URL: http://standardebook.com/asme-a112181-2011csa-b125111-p-1113.html. This standard is consistent with the US Environmental Protection Agency (EPA) WaterSense® specification which is summarized in Appendix A (attached). The WaterSense® specification is available at the following URL: http://www.epa.gov/WaterSense/partners/showerhead_spec.html).

The fourth sentence of the 45-day language is as follows.

"Each mixing valve must supply only one shower head."

This requirement is inconsistent with American Disabilities Act (ADA) specifications for persons with physical disabilities to independently get to, enter, and use a shower enclosure that must provide both a fixed shower head and hand-held shower where each is separately operated from a single mixing valve either one or the other but not both simultaneously (ICC/ASNI A117.1 - 2009). The specifications in the ICC/ANSI A117.1 - 2009 standard makes sites, facilities, buildings and elements accessible to and usable by people with such physical disabilities as the inability to walk, difficulty walking, reliance on walking aids, blindness and visual impairment, deafness and hearing impairment, in coordination, reaching and manipulation disabilities, lack of stamina, difficulty interpreting and reacting to sensory information, and extremes of physical size. The intent of this standard is to allow a person with physical disability to independently get to, enter, and use a site, facility, building, or element.

USDOE waived the preemption concerning water efficiency standards as published in the Federal Register on 12/22/2010 per the Energy Efficiency Program for Consumer Products: Waiver of Federal Preemption of State Regulations Concerning the Water Use or Water Efficiency of Showerheads, Faucets, Water Closets and Urinals. The Federal Register document can be obtained at the following URL: https://www.federalregister.gov/articles/2010/12/22/2010-32116/energy-efficiency-program-for-consumer-products-waiver-of-federal-preemption-of-state-regulations.

**Recommendations for the Proposed 45-Day Language for Showerheads**

The recommended revision to the proposed 45-day language is as follows. Strike sentences two, three and four and insert the following sentences for reasons discussed above.
Shower heads must comply with the WaterSense® specification and the high-efficiency shower head and hand-held shower specification required in Clauses 5.13.2.1 and 5.13.2.2 of ASME A112.18.1-2011/CSA B125.1-11. The maximum shower head flow rate must be no greater than 2.0 gpm at flowing pressure of 80 psi and the minimum flow rate must be no less than 60% of the maximum flow rate at flowing pressure of 20 psi, and no less than 70% of the maximum flow rate at flowing pressures of 45 and 80 psi.

**SECTION 110.3(c)7** Showerheads (Recommended Revision)
7. Shower Heads. A single shower head must be installed directly on each pipe that terminates at a shower. ~~Shower heads must be placed no closer than four feet from each other, as measured directly from one shower head to the next. Shower heads must have a rated flow rate of no more than 2.0 gallons per minute at 80 psi. Each mixing valve must supply only one shower head.~~ Shower heads must comply with the WaterSense® specification and the high-efficiency shower head and hand-held shower specification required in Clauses 5.13.2.1 and 5.13.2.2 of ASME A112.18.1-2011/CSA B125.1-11. The maximum shower head flow rate must be no greater than 2.0 gpm at flowing pressure of 80 psi and the minimum flow rate must be no less than 60% of the maximum flow rate at flowing pressure of 20 psi, and no less than 70% of the maximum flow rate at flowing pressures of 45 and 80 psi. The piping connecting the shower head to the heater or recirculation loop must be no wider than 1/2 inch at any point.

**References**


1. Tanner, S., Remedios, S. 2009. WaterSense: A consensus-based, common sense approach for high-efficiency showerheads, February 2009. Northbrook, IL.: Plumbing Engineer.

2. US EPA. 2009. WaterSense® Specification for Showerheads. Washington, DC.: US Environmental Protection Agency (see Appendix A).

3. Wagoner, K. 2007. 2008. Showerhead User Satisfaction Study. Prepared for US EPA and ASME/CSA Joint Harmonization Task Force. Chantilly, VA.: Eastern Research Group (ERG).

4. Mowris, R., Woody, B. 2012. Development of New Testing Protocols for Measuring the Performance of Showerheads (Redacted). Prepared for California Energy Commission Public Interest Energy Research Program. Sacramento, Calif.: California Energy Commission.

5. Heschong Mahone Group (HMG). 2011. Codes and Standards Enhancement Initiative (CASE) Multi-Head Showers and Lower-Flow Shower Heads. California Utilities Statewide Codes and Standards Team. September 2011.

6. US Department of Energy (DOE). 2011. Showerhead Enforcement Guidance Issued: March 4, 2011." Available online: http://www1.eere.energy.gov/buildings/appliance_standards/residential/pdfs/showerhead_guidance_3-4-2011.pdf.

7. American Society of Mechanical Engineers (ASME). 2011. ASME A112.18.1-2011/CSA B125.1-11, Plumbing Supply Fittings. High-efficiency shower head and hand-held shower, Clause 5.13.2.2 and Clause 5.13.2.1. Available online: http://standardebook.com/asme-a112181-2011csa-b125111-p-1113.html.

8. USDOE, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 430, Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirements for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances; Final Rule., March 18, 1998, section 430.32, p. 13317 of the Federal Register.

9. Federal Register. 2010. Energy Efficiency Program for Consumer Products: Waiver of Federal Preemption of State Regulations Concerning the Water Use or Water Efficiency of Showerheads, Faucets, Water Closets and Urinals. Available online: https://www.federalregister.gov/articles/2010/12/22/2010-32116/energy-efficiency-program-for-consumer-products-waiver-of-federal-preemption-of-state-regulations.

10. International Codes Council (ICC) and American National Standards Institute (ASNI) ICC/ANSI A117.1 - 2009. Accessible and Usable Buildings and Facilities. Available online: http://www.iccsafe.org/Store/Pages/Product.aspx?id=9033S09.

## Appendix A: WaterSense® Specification Summary

### WaterSense® Water Efficiency Flow Rate Criteria

The WaterSense® Specification for Showerheads requires measuring showerhead flow rates at flowing pressures of 20, 45, and 80 ± 1 pounds per square inch gage (psig) (140, 310, and 550 ± 7 kilopascal [kPa]) with water temperature at 100 ± 10 °F (38 ± 6 °C) maintained for at least one minute (USEPA 2010). WaterSense® requires manufacturers to specify the maximum rated flow rate to be equal to or less than 2.0 gpm (7.6 liters per minute [L/min]) per the testing and verification protocols described in 10 CFR 430 Subpart F (USDOE 1998), at flowing pressures of 20, 45 and 80 ± 1 psig (140, 310 and 550 ± 7 kPa). The minimum flow rate value, determined through testing, at a flowing pressure of 20 ± 1 psig (140 ± 7 kPa), shall not be less than 60 percent of the maximum flow rate value. The minimum flow rate value, determined through testing, at flowing pressures of 45 ± 1 psig (310 ±7 kPa) and 80 ± 1 psig (550 ±7 kPa), shall not be less than 75 percent of the maximum flow rate value.

### WaterSense® Spray Force Criteria

The WaterSense® showerhead spray force is measured at a flowing pressure of 20 ± 1 psig (138 Pa ± 7 kPa). The minimum spray force shall not be less than 2.0 ounces (0.56N) at a pressure of 20 ± psig (140 ± kPa) at the inlet, when water is flowing.

### WaterSense® Spray Coverage Criteria

The WaterSense® showerhead spray coverage is measured at a water temperature of 100 ± 10 °F (38 ± 6 °C) maintained for at least one minute with water pressure at 45 ± 1 psig (310 ± 7 kPa) at the inlet when water is flowing per the new showerhead test protocol.[1] The total combined maximum volume of water collected in the 2 and 4 inch (50, 101 mm) annular rings shall not exceed 75 percent of the total volume of water collected and; total combined minimum volume of water collected in the 2, 4, and 6 inch (50, 101, 152 mm) annular rings shall not be less than 25 percent of the total volume of water collected.

[1] Drawings of the force balance test apparatus are available www.epa.gov/watersense/pp/showerheads.htm.