Notification of Intent to Develop Draft Performance Specifications for Showerheads and Related Devices

I. Introduction

Indoor water use accounts for approximately one half to two thirds of all residential water use. Showering is one of the leading uses of water, representing approximately 17 percent of residential indoor water use, or more than 1.2 trillion gallons of water[1] consumed in the United States each year. To raise consumer awareness and improve the water efficiency of showerheads, WaterSense intends to develop a specification for labeling water-efficient showerheads.

Currently there is heightened interest from many stakeholders to pursue the development of performance based showerhead criteria to address water and energy savings, encourage new and emerging technology, and ensure consumer satisfaction. Specifically, the California Energy Commission (CEC) and the American Society of Mechanical Engineers/Canadian Standards Association Joint Harmonization Task Group (ASME/CSA JHTG) on water-efficient showerheads are studying showerhead efficiency and performance. The ASME/CSA JHTG is working to develop showerhead efficiency and performance criteria through the consensus-based standards development process. WaterSense intends to collaborate with the ASME/CSA JHTG and will rely on this group to inform the WaterSense specification development process. This cooperative relationship will 1) engage experts from the manufacturing, utility, and certification communities, 2) work through an existing public process established in the United States for developing standards and specifications for plumbing fittings, and 3) provide WaterSense with access to and input from a variety of interested parties. The ASME/CSA JHTG will be instrumental in providing information regarding product efficiency and performance, health and safety considerations, testing protocols, and for the resolution of technical issues.

WaterSense has preliminarily identified water efficiency and performance criteria that need to be more fully defined as well as several technical issues that must be resolved prior to the development of a draft WaterSense specification for showerheads. WaterSense intends to work with the ASME/CSA JHTG on the resolution of these issues, detailed below, but is also requesting input from other interested parties. Interested parties can provide input to WaterSense regarding any of the issues presented in this notice by submitting written comments to watersense_showerheads@erg.com. The timeline for the development of a draft specification is largely dependent on the progress made by the ASME/CSA JHTG and the resolution of the technical issues described below. WaterSense will post updates on the Web

[1] Aquacraft Engineering's study, *Residential End Uses of Water*, found that the average per capita water use for a shower is 11.6 gallons per day. According to the U.S. Census Bureau, there are 300 million persons in the United States. Therefore, average annual water consumption attributed to residential showerhead use is approximately 1.2 trillion gallons.

site, www.epa.gov/watersense, every four months regarding the progress of the ASME/CSA JHTG, the resolution of technical issues, and the development of a draft specification.

II. Scope

WaterSense has identified two showerhead product categories to consider for inclusion in a WaterSense specification—fixed and handheld showerheads. Fixed showerheads include fittings that are permanently attached to the shower wall or ceiling or are attached to a pivotal arm. Handheld showerheads include fittings that are connected to the wall via a flexible tube or hose. These can either screw directly into the shower arm, into a diverter valve between the standard showerhead and the shower arm, or onto a deck-mounted diverter on the bathtub.

WaterSense is seeking to further clarify or refine the definitions for fixed and handheld showerheads. In addition, WaterSense is seeking to understand the fundamental differences in their design and operation and how those differences can affect performance. This will inform whether fixed and handheld showerheads require unique performance criteria.

III. Water Efficiency

The goal of the WaterSense program is to label products that are about 20 percent more water-efficient than average comparable products. To meet or exceed this water efficiency goal, WaterSense is seeking to establish a maximum flow rate for showerheads.

In participating in the ASME/CSA JHTG consensus-based process and discussing the appropriate maximum flow rate with stakeholders, WaterSense anticipates establishing a single maximum flow rate somewhere between 1.5 gallons per minute (gpm) and 2.0 gpm (measured at 80 pounds per square inch (psi)of pressure). A maximum flow rate that falls within this range would represent between a 20 to 40 percent reduction from the current federally allowable maximum flow rate of 2.5 gpm established by the Energy Policy Act of 1992. WaterSense settled on this potential range after examining the currently available products with flow rates within this proposed range and the water savings and user satisfaction data collected from water utilities that have distributed these types of water-efficient showerheads to their customers. To help inform this decision making process, WaterSense is seeking additional input regarding the appropriate maximum flow rate that will allow the program to achieve the maximum amount of water savings, while ensuring that all other considerations are adequately addressed.

One issue of concern with showerheads more efficient than the current federal 2.5 gpm standard is the potential for thermal shock or scalding. Thermal shock or scalding can be caused when a cold water-using device is activated while the shower is running. Cold water is diverted away from the shower, causing a pressure drop in the cold water supply line to the shower. As a consequence, the balance of hot and cold water is shifted to mostly hot water. This sudden increase in temperature can either cause a user to have an abrupt physical reaction that could result in a serious injury or fall, or if the temperature change is severe enough, can actually cause scalding. Because more-efficient fittings use lower volumes of water than standard fittings, they are more sensitive to changes in water pressure. As a consequence, temperature change is amplified even when the same amount of cold water is

diverted from the shower. When more-efficient showerheads are retrofit into existing homes, the existing plumbing might not be equipped with appropriate mixing valve controls that can protect against temperature changes when water pressure fluctuates. WaterSense is seeking to balance these health and safety concerns with its water efficiency goals.

IV. Performance

Establishing performance-based criteria for WaterSense labeled showerheads is critical to ensuring user satisfaction. Currently, showerheads only are tested in terms of their maximum flow rate. While there are some widely considered measures of showerhead performance (e.g., pressure compensation, spray pattern, and effectiveness), there are no universally agreed upon testing protocols for these parameters or measures that adequately define levels of user satisfaction. WaterSense is considering including four areas of showerhead performance in its high-efficiency showerhead specification—pressure compensation, spray pattern, effectiveness, and temperature drop. WaterSense is working with the ASME/CSA JHTG to help define the levels that reflect user satisfaction and identify the appropriate testing protocols for each of these performance criteria. The following sections discuss the associated issues of concern and potential approaches to testing for each of these four parameters.

Pressure Compensation

Pressure compensation within the showerhead is a necessary attribute to ensure adequate flow rate and user satisfaction in homes with low or varying water pressures. Options for specifying pressure compensation within the showerhead include:

- Establishing a minimum flow rate, or
- Prescriptively defining that showerheads must contain some means of pressure compensation flow control

Showerheads currently are tested for maximum flow rate at a pressure of 80 psi following procedures outlined in ASME A112.18.1-2005/CSA B125.1-05. To establish a minimum flow rate that accurately defines the ability of a showerhead to provide pressure compensation, the showerhead flow rate also would need to be tested at a lower water pressure. This involves determining how a typical showerhead's flow rate varies with changes in water pressure and defining the pressure at which the minimum flow rate is to be tested. The ASME A112.18.1/CSA B125.1 standard requires other fixture fittings (e.g., service sinks) with a defined minimum flow rate to be tested at a pressure of 20 psi. WaterSense is seeking to determine which approach is the most appropriate means for specifying pressure compensation in order to ensure end user satisfaction across a broad range of household conditions.

Spray Pattern (Water Distribution)

Spray pattern is an important user satisfaction feature and is based on both the shape and cross-sectional distribution of the spray. There has been no widely accepted consensus, however, as to how to accurately measure spray pattern in a manner that can be correlated with user satisfaction. WaterSense is seeking to establish a mechanism for measuring spray pattern and to better understand user satisfaction related to this criteria before defining the appropriate performance level. WaterSense will work through the ASME/CSA JHTG to collect the

necessary data and to inform the appropriate measure for the spray pattern performance criteria.

Temperature Drop

Many showerheads with flow rates less than the 2.5 gpm federal standard inject air into the shower stream (aerate) to create a flow that feels similar to that of a less water-efficient showerhead. Some experts have argued that this embedded air can cause the water to cool more rapidly at a distance from the showerhead. As a result, the user might increase the amount of hot water to achieve the desired water temperature. Because data with respect to this phenomenon are limited, WaterSense is uncertain about the actual impact temperature drop has on water and energy savings and user satisfaction. In addition, manufacturers have raised some concern regarding how temperature drop should be accurately measured, and might be hesitant to simply rely on a thermocouple temperature gauge. Recognizing the uncertainty associated with the impact of temperature drop on user satisfaction and water and energy efficiency and the current lack of consensus for how it should be measured, WaterSense is seeking input as to whether it should consider including temperature drop as a performance measure in a specification. In addition, WaterSense is seeking data comparing temperature drop experienced with showerheads with 2.5 gpm maximum flow rates versus those with 2.0 gpm maximum flow rates or less and methods for accurately measuring it.

Effectiveness

The effectiveness of a showerhead is an important performance criteria that affects user satisfaction. Effectiveness represents the ability of a showerhead to perform its intended functions such that the user can remove soap and shampoo and feel adequately cleaned by the shower. Effectiveness is a function of both water velocity and the water distribution or spray pattern. Currently, however, there is no established means to directly measure this criteria. WaterSense will rely on the ASME/CSA JHTG to define the testing protocol for effectiveness and the appropriate measure(s) that reflect general user satisfaction.

References

Aquacraft, Inc. Water Engineering and Management. *Residential End Uses of Water*. American Water Works Association Research Foundation, 1998.

H.R. 776. Energy Policy Act of 1992. Subtitle C, Section 123, *Energy Conservation Requirements for Certain Lamps and Plumbing Products*.

Showerhead Flow Rates and Safety Issues. 2006. Plumbing Manufacturers Institute. 8 March 2007. <http://www.pmihome.org/positionstatements/showerheads.aspx>.

Australian/New Zealand Standard. *Performance of Showers for Bathing*. AS/NZS 3662:2005.