BMP 5: WATER USE BY URINALS

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INTRODUCTION

Urinals are found in men's bathrooms of the commercial, industrial, and institutional (CII) sectors of society. If men's restrooms account for a significant portion of a facility's water budget and the urinals are older, a urinal retrofit may provide significant water savings for the facility. The types of urinals and their water use characteristics are described in this report. Information on the expected prevalence of these urinals is also presented along with information on urinal retrofit programs.

TYPES OF URINALS

Conventional urinals, installed before 1994, use 1.5 to 5.0 gallons per flush (gpf) (Vickers 2001). Conventional urinals will be assumed to use 2.5 gpf.

Ultra low flush (ULF) urinals use 1.0 gpf or less. This maximum water use standard for new buildings was mandated by the United States Energy Policy Act of 1992 and went into effect on January 1, 1994. Water use per flush by urinal fixtures is certified by the American National Standards Institute (ANSI), but flush performance testing protocols for urinals are still in development (Koeller 2007). ULF urinals will be assumed to use 1.0 gpf.

High-efficiency urinals (HEU) flush with 0.5 gpf or less (Koeller 2007). The mechanism for flushing, the flushometer valve, is the same as for conventional and ULF urinals, but requires a higher pressure and higher velocity for the supply water and a smaller orifice in the diaphragm of the flush valve. HEU's will be assumed to use 0.5 gpf.

Non-water urinals are similar in appearance to others, but require neither water nor a valve. They use a dry drainage system as shown in Figure 1. The first component on figure 1 is the sealant liquid, the second is where the sediment collects to be passed, and the third is where the waste passes into the drain. Since urine is about 96% liquid, no additional water is needed to wash it down the drain (Bristow 2004). Instead, these fixtures have a cartridge that houses a sealant liquid which is less dense than water. Urine sinks below the sealant liquid and the weight of the liquid pushes the waste into the drainage pipe. When the sealant becomes depleted, the cartridge does not work effectively and may result in an unpleasant odor. For proper maintenance, excess amounts of water should not be poured through the cartridge. The drain should be flushed with a bucket of water when the cartridge is removed for changing (Bristow 2004). In practice, the custodial staff may not commit to an increased maintenance schedule. Non-water urinals have the potential for significant waste line deposits and blockages (van Gelder, 2008). Non-water urinals will be assumed to use 0 gpf.

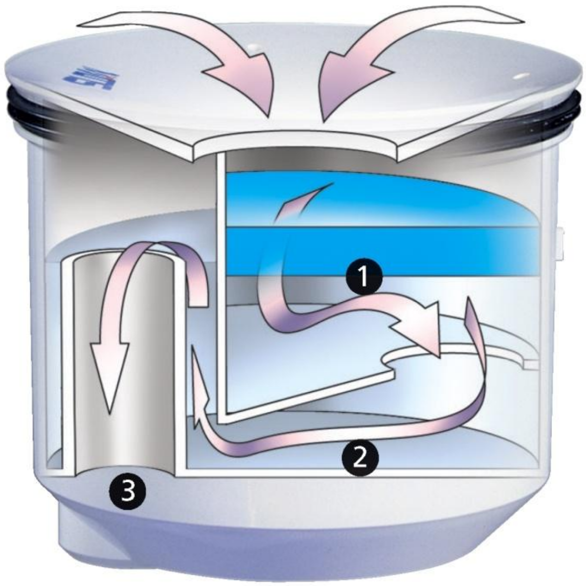

Figure 1. Non-Water Urinal Technology (Sloan Valve Company 2008)

How Flushing Valves Work

A urinal with a flushometer valve utilizes pressure from the main water supply system to discharge a high volume of water very quickly into the bowl. The Florida Plumbing Code requires a minimum flow rate of 15 gallons per minute (gpm) and flow pressure of 15 pounds per square inch (psi) to supply urinals with flushometer valves (Florida Building Code 2004). A higher pressure does not necessarily result in a higher flush volume (Veritec 2005).

Flushometer valves (see Figure 2) can combine with any fixture and achieve minimum flush volume requirements. Independent of the fixture, the flush volume is adjusted via the control stop, and if improperly set, could be at a volume exceeding the maximum flush standard (Veritec 2005). The main water supply comes through the control stop. When the handle is pushed, the valve opens for a regulated amount of time.

Figure 2. Flushometer valve (Sloan Valve Company 2008)

COST AND LIFE CYCLE

The cost of a urinal can range from $60 to $100 and the fixture can require up to two hours of labor to install. Fixture life for all categories of urinals can be estimated at 30 years (Koeller 2005). Urinal fixture replacement valves and flushometer components are sold separately. A worn valve, leaky seal, or misadjusted control stop may negate the water savings of a water conserving urinal. A full life cycle cost analysis needs to be conducted for all urinal types that includes initial capital cost, operation and maintenance costs, and disposal costs (Koeller 2007).

POPULARITY AND MARKET TRENDS

Demand for ULF and non-water fixtures first grew in the late 1980's and early 1990's and manufacturers responded with an increase in research and development. The first generations of these urinals were controversial due to concerns regarding their performance and reliability. Third-party flush performance testing protocols are being developed to help consumers verify the performance and reliability of new technologies.

ULF urinals are the current national standard and the demand for these fixtures will grow with nonresidential construction. The extent of HEUs in the market is unknown, but some manufacturers are gearing their entire lines to the high-efficiency performance level, which exceeds the ULF efficiency standard of 1.0 gpf. A variety of HEU models are available to customers that flush 0.5 gallon, 1 quart, 1 pint, and ¾ pint (volumes are per flush) (Koeller 2007).

WATER USAGE

ESTIMATE PER NON-RESIDENTIAL ACCOUNT (THE FLORIDA *GUIDE*)

Hazen and Sawyer (2003) estimate the savings for replacing a 2.5 gpf conventional urinal with a 1.0 gpf ULF or 0 gpf non-water urinal. These savings rates are used in the Florida *Guide* (Conserve Florida Water Clearinghouse 2007) and are derived from the assumptions that there is one urinal per account and each male flushes a urinal four times per day (Ayres 1998). The resulting savings are 6 gallons per male employee per day (gped) when retrofitting a conventional urinal with an ULF model, and 10 gped with a non-water fixture. The potential savings per account when retrofitting a conventional urinal are 70 gpad with an ULF urinal and 117 gpad with a non-water fixture. A compiled list of the average number of male employees per non-residential account in the six member governments of Tampa Bay Water and their estimated urinal water use is presented in Table 1.

		Savings with ULF urinal		**Savings with non-water urinal**	
Member Government	**Male employees per account**	**Gallons per employee per day**	**Gallons per account per day**	**Gallons per employee per day**	**Gallons per account per day**
Hillsborough County	11.1	6.0	67	10.0	111
City of Tampa	14.2		85		142
Pinellas County	12.9		77		129
City of St. Petersburg	11.7		70		117
Pasco County	12.3		74		123
City of New Port Richey	8.1		49		81
Average	**11.7**		**70**		**117**

Table 1. Average water savings per non-residential accounts from retrofitting urinals in six member governments of Tampa Bay Water (adapted from Hazen & Sawyer 2003).

ESTIMATE PER INDUSTRY

Commercial and institutional facilities use water in common applications, such as restrooms. Industrial facilities primarily use water in manufacturing, where urinals are a smaller fraction of the facility's water budget. All CII facilities are heterogeneous with regard to size and function and it is difficult to determine a reliable number of urinals and urinal types within a utility district. East Bay Municipal Utility District (EBMUD) in the Oakland, California area performed a regional CII audit to determine the total number of times urinals are flushed per day. The number of flushes per day by CII sector is displayed in Table 2. Commercial and institutional facilities experience a greater number of total flushes per day compared to industrial facilities. Urinals that experience a higher number of flushes/day have more conservation potential when retrofitted with a water conserving fixture. The results in Table 2 indicate that prime candidates for urinal retrofits are schools, offices, restaurants, and retail establishments.

CII	Total Flushes/Day (1,000)	Percentage of Total Urinal Use
Commercial		
Office	5,360	26.6
Restaurants	2,970	14.8
Retail	2,480	12.3
Hotels	227	1.1
Laundries	55	0.3
Total Commercial	**11,092**	**55.0%**
Institutional		
Schools	7,480	37.1
Hospitals	536	2.7
Total Institutional	**8,016**	**39.7%**
Industrial		
High Tech	669	3.3
Paper and Pulp	37	0.2
Meat	24	0.1
Other Industrial	335	31.4
Total Industrial	**1065**	**5.3%**
Total	**20,173**	**100**

Table 2. Urinal flushes per day in East Bay Municipal Utility District (adapted from Gleick et al., 2003).

Marella (2004) estimates that commercial (19%) and industrial (4%) sectors use 23% of the total public water supply. These estimates are based on multiplying the number of employees by the estimated gallons per employee per day usage rate. Institutional usage is not estimated directly.

A more direct measure of CII water use can be obtained from customer billing data. Using Marella's data, a reasonable average of CII water use is about 30% of public water supply. However, much CII use is self-supplied and private usage is not included in the numbers presented here.

REBATE AND RETROFIT PROGRAMS

Utilities may use rebates as an economic incentive in a public program to retrofit conventional urinals with water saving fixtures. The rebate is typically a fixed price for the cost of the fixture and is voluntary for the public. A manager may choose to participate and exchange the urinals in a facility depending on the reputation of the low-flow technology, the condition of the existing fixtures, the cost of installation, and the impact of savings on the operational budget (Koeller 2005). If restroom usage is a significant portion of a facility's water budget, then a water-saving urinal retrofit may affect its operational budget. The retrofit program can be more appealing if the rebate is offered in conjunction with other improvements such as providing full-service installation (Koeller 2005).

Estimates of the amount of water used by the restrooms in selected commercial and institutional sectors are provided in Table 3. If CII is 30% of public water supply use, restrooms use is 25% of that total, and urinals use is 30% of restroom use, then urinal use is in the range of 2% of total public water use; a relatively small amount.

Category	% Restroom	% Other
Hotels	48%	52%
Restaurants	30%	70%
Retail	22%	78%
Hospitals	20%	80%
K-12 Schools	16%	84%
Grocery Stores	13%	87%

Table 3. Proportion of water used in restrooms in selected commercial and industrial facilities (adapted from Gleick et al. 2003)

When a facility uses water primarily for common end uses, like restrooms, one can identify general usage patterns and, subsequently, conservation measures (Gleick et al. 2003). Retrofit programs should target the commercial and institutional facilities that experience high restroom usage as a component of overall water use: schools, offices, restaurants, and retail.

IMPACT OF CONSERVATION PROGRAMS

A CII audit will determine a reliable number of urinals and water usage per urinal for the facility being analyzed. Facilities that have a high employees/visitors per urinal ratio are preferred targets for a retrofit or rebate program.

It is difficult to forecast the impact of water efficient urinals in the CII sectors due to the heterogeneity of various facilities. Water savings may be significant for an individual facility if restrooms use a significant amount of water.

Total CII water use is estimated to account for 30% of all urban water demand and restrooms can account for 5-51% of a facility's water demand (Gleick et al., 2003). Urinals may use a noticeable portion of a facility's water budget, but are relatively insignificant in a city's aggregate water demand.

ADDITIONAL INFORMATION

Frequent updates of information on urinals is available from the California Urban Water Conservation Council's web site: http://www.cuwcc.org/urinal_fixtures.lasso.

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