The Debate Over Waterless Urinals

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Introduction

Waterless urinals are among the most effective strategies for conserving water in buildings. Despite best efforts on the part of some merchandisers and advocates, future adoption of these urinals as a conservation strategy is uncertain due to many real and perceived barriers to implementation. A combination of code problems, industry resistance and health concerns have tended to slow the adoption of this promising technology. By exploring benefits and problems associated with waterless urinal application in specific case studies, this paper will discuss and analyze strategies to overcome these barriers.

Waterless Urinals: The Market Context

Water efficiency has a major impact on energy efficiency, since a great deal of energy is used to source, purify, convey and treat the very water that gets flushed down our toilets and urinals every day. Additionally, clean water is becoming an increasingly scarce commodity. While some regions of the U.S. have abundant water resources, many others – especially those in the rapidly developing west and southwest – do not.

Toilets account for about half of a typical building's water consumption in the United States.[1] Low flow toilets and urinals use water more efficiently than standard fixtures, but water is still used in flushing. Also, low-flow toilet users may flush more than once, since these lower-pressure fixtures do not always flush waste completely. Newer low-flow fixtures are being designed to better address this problem, but there is still a stigma associated with these fixture due to past performance problems.[2]

Composting toilets are another alternative waste disposal technology. These toilets maximize energy efficiency because they require no water and process their own waste, thus diverting this waste from municipal water treatment systems or from a septic system. However, these toilets have been slow to catch on because they have high first costs, and because they require building users to dispose of the resulting waste themselves. Consequently, composting toilets are used mainly in locations where water conservation is an extremely high priority and these drawbacks constitute an acceptable trade-off.[3]

Unlike low-flow fixtures and composting toilets, waterless urinals should face lower barriers to adoption because they do not require users to behave any differently than they do with flush fixtures. Waterless fixtures are priced competitively with flush

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[1] Gary Bristow, James McClure, & David Fisher, "Waterless Urinals; Features, Benefits, and Applications." Presented at the Fourteenth Symposium on Improving Building Systems in Hot and Humid Climates – May 17-18, 2004. 2.

[2] Jay Romano, "Your Home; Reducing Water Use in the Home," *New York Times*, April 14, 2002. Online.

[3] AlexWilson, "Green Restrooms." *HPAC Engineering*, April 2003. 54.

fixtures, and in some places, rebates may cover all or part of the fixture cost.[4] Moreover, installation is cheaper than standard urinal installation because there is no need for flush valves, handles, sensors, water supply piping or freeze protection. When installed, waterless urinals save 1-5 gallons per flush, depending on the age of the urinal being replaced.[5] Waterless urinals reduce water treatment and septic system loads, thus reducing water and sewer costs, and also alleviate the electricity costs of pumping water.[6] Finally, the maintenance cost associated with periodically replacing sealant and sealant traps on these urinals ($70 per year, per urinal) is quite small compared to realized water savings.[7] Because of these benefits, the popularity of waterless urinals is growing and more manufacturers are now offering this product.[8]

How Waterless Urinals Function

All waterless urinal models make use of a sealant fluid with a lower specific density than urine that acts as a sanitary trap. Urine passes through this fluid and continues down the drain, while the sealant fluid remains in place to trap odors and keep them from leaking into the restroom. Depending on sealant trap design, the trap may also capture sediment in the urine.[9] These urinals can be installed in both new construction and in retrofits, but for retrofits the height of the existing drain piping may need to be changed to accommodate the new fixture. Also, copper piping cannot be used with waterless urinals, since the urine can react with copper to cause corrosion.[10]

One might worry about health risks involved with non-flushing fixtures. Actually, urine is about 96% liquid, so waterless manufacturers claim that no additional water is really needed to flush it down the drain.[11] In fact, some health experts agree that waterless urinals are *more* sanitary than flushing urinals. Not only does water used by conventional urinals afford germs in the restroom a moist environment in which to grow, but splashing water from flushing urinals also creates airborne microbes. Furthermore, waterless urinals eliminate the need for flushing handles, which often harbor bacteria.[12] Waterless urinals, then, appear to be superior to standard urinal technology from an environmental, economical, and hygienic standpoint. The LEED Green Building Rating System has made this technology even more attractive to new-construction and retrofit builders. Water efficiency constitutes an entire LEED credit category in this rating system, which has become the de facto standard for energy efficient new construction and major renovation projects in the United States. In a study of 61 LEED projects,

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[4] Scott Horsley, "California Plumbers Stall plans for waterless urinals." *NPR Morning Edition* March 1, 2006.
[5] Wilson, 57.
[6] Annette Stumpf, "Waterless Urinals: A Technical Evaluation," US Army Corps of Engineers, Engineer Research and Development Center. April 2006.
[7] Horsley.
[8] Waterless Co. and Falcon Waterfree urinals dominate this market, but other manufacturers like Duravit and Ecotech have entered the market recently.
[9] Bristow, McClure, & Fisher, 2.
[10] Bristow, McClure, & Fisher, 2.
[11] Bristow, McClure, & Fisher, 1.
[12] Bristow, McClure, & Fisher, 3.

researchers have found that "the preponderance of projects that achieved … the wastewater point, did so by installing waterless urinals and low-flow toilets."[13]

Although the market for waterless urinals has been growing since their introduction in 1992, it is perhaps surprising that such an ideal technological solution has not become more popular among users, architects, developers and other market actors. There are, however, several overlapping and mutually reinforcing barriers to implementation of this technology, which fall into three general categories: first, existing plumbing codes; second, political pressure from plumbers' unions; and third, confusion about the public health implications of waterless urinals. These barriers are closely related to the relative newness of this technology. We discuss these issues, and then illustrate how waterless urinals are and are not functioning and accepted in specific case studies.

Plumbing Codes, Union Opposition & Public Health Concerns

In a recent article from *Maintenance Solutions* discussing the pros and cons of waterless urinals, the only real drawback to this technology the authors identified was that some waterless urinals "might not comply with ANSI Standard Z124.9," making it a good idea to consider this limitation when specifying [waterless urinal] products."[14] Indeed, managers specifying waterless urinals must take code compliance into consideration; many plumbing codes simply do not mention or otherwise account for waterless urinals.[15]

Traditional plumbing codes specify that urine must be flushed with water. This distinction made sense in the past because the only urinals that did not use water were outhouses and other "pit toilets." Today, of course, thanks to growing affluence and dramatic improvements in basic sanitation, such "pit toilets" are no longer installed in North America. For this reason, more than two dozen states have now amended their plumbing codes to specifically approve waterless urinals. However, some states like California, where waterless universals have been a highly contested issue, still follow the Uniform Plumbing Code, which does *not* approve of waterless urinals. Fortunately, even in cases like these, local governments can make exceptions to this code. Waterless urinals have been installed in a wide range of buildings in California, including schools, universities, sports stadiums, restaurant chains like McDonalds, and retail chains like Wal-Mart.[16]

Unfortunately, changes to plumbing codes permitting waterless urinals have been slowed due to political pressure from local plumbers unions. For instance, when the San Diego County Water Authority considered changing its code to permit the installation of waterless urinals, the plumbers' union protested, warning that poor maintenance and infrequent changes of the urinals' sealant traps could allow dangerous sewer gases to

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[13] Lisa Fay Matthiessen, Peter Morris, "Costing Green: A Comprehensive Cost Database and Budgeting Methodology." Davis Langdon Adamson, 2004. 8.
[14] Westerkamp, Thomas. "Waterless plumbing: Outside of the Mainstream." *Maintenance Solutions,* February 2004.
[15] "Plumbing by the book," *Maintenance Solutions* February 2006. Online. FacilitiesNet.
[16] Celia Lamb, "Plumbers defeat waterless urinals, citing health concerns," Silicon Valley/San Jose Business Journal, December 16, 2005.

escape. Union officials also argued that without regular flushing, hazardous bacteria could build up on the surface of the urinals.[17] The International Association of Plumbing and Mechanical Officials Standards Council (IAPMO), which reviews the Uniform Plumbing Code every three years, has repeatedly sided with the plumbers' unions on this issue. The Association completed its last code revision in November of 2005, so a major decision cannot be made again until 2008.[18]

The health concerns voiced by IAPMO and the plumbers' unions are in direct opposition to the previously discussed manufacturers' claims that non-water urinals are actually *more* sanitary than water urinals. Before the last IAPMO standards change, the Pipes Trades Council hired a sanitary engineer, J. Phyllis Fox, PhD, to summarize literature on the health risks of these urinals.[19] In response to urinal manufacturers' appeal of the IAPMO waterless urinal standard, Fox wrote that "the no-flush urinal ignores hard-learned lessons on sanitation and reverses over a century of practice by failing to provide consistent cleaning of the urinal walls and replacing the permanent seal with one that has to be changed every 30 to 90 days."[20] The concern, then, which is potentially legitimate, is that without wall washing, bacteria and viruses will remain on urinal walls, encouraging the spread of disease and causing "uncontrollable odors." AJ Napolis of *Communities for a Better Environment* voiced similar concerns at the IAPMO appeal.[21]

While the final decision on this issue in San Diego is under review, San Francisco and Los Angeles plumbers' unions have successfully lobbied to ban waterless urinals. In Los Angeles, Marc Nathanson, a cable television millionaire who has provided financial support for the promotion of waterless urinals, does believe the union's health concerns. He argues, "What is this about? It's about money. The flush part is the only part that breaks down, and you have to call a plumber to fix it." The California State Pipe Trades Council, claims that money is *not* a concern, since maintenance workers, not plumbers, usually fix flushers.[22] Nevertheless, it is difficult to deny that job security is a major motivator for the union outcry. In California's Office of the State Architect, the union has agreed to allow state-funded buildings to install waterless urinals, provided that the supply side piping for flush urinals is also installed.[23]

Ultimately, this dispute pits one scientific opinion against another. Waterless urinal manufacturers maintain that urine itself is sterile, and thus wall washing is a non-issue. Klaus Reichardt, a managing partner of Waterless, Inc., calls the public health concerns "scare tactics," and believes that "the only thing going on here, from the union standpoint, is…they think they are losing installations."

It is important to keep in mind that although these barriers to adoption are important, the overarching difficulty is simply the newness of waterless urinal technology and the fact that the industry is also still new and and growing. Waterless urinal

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[17] Horsley.
[18] Lamb.
[19] Lamb.
[20] Tenoch Flores, "New research shows that with no-flush urinals, it's not just the odor that remains behind," *California State Pipes Trades Council Media Center,* November 17, 2005.
[21] Flores.
[22] Seth Lublove, "No-Flush Urinals, Cable Baron's Cause, Thwarted in Los Angeles," Bloomberg News Online, May 31 2006.
[23] Anothony Bernheim, telephone interview, 10/10/06.

technology is barely fifteen years old, and until quite recently there were only two waterless urinal manufacturers. There is not yet objective scientific research confirming the hygienic attributes of waterless urinals, positively or negatively. Consequently, there are unsubstantiated claims on both sides of the argument.

In the absence of definitive proof, some of those resistant to the new urinals are employing a rather circular logic. For example, in a Morning Edition piece on the controversy, NPR cited David Otterstein, business representative for the local San Diego plumber's union. Otterstein remarked, "You wash your hands when you're done using the restroom. Why would you not wash down the urinal?" Edward Keenan of the Philadelphia Plumbers Union voices a similar sentiment: "All major plumbing codes require urinals to have a water flush and trap."[24] Until there is objective research comparing flush and non-flush urinal hygiene, the industry will be stuck in this self-perpetuating cycle: the code has historically specified water flush urinals, so plumbers think that non-water urinals are not hygienic, and so they protest code amendments. Neither "side" in this debate has adequately supported its claims.

Hidden Maintenance Costs of Waterless Urinals: Surveys and Case Studies

How have project developers and urinal users reacted to waterless urinals, given the conflicting claims about the performance and health of these products? We first examine two US surveys targeting waterless urinal customers, and then study how waterless urinals have functioned and been accepted in specific applications. Importantly, the plumbing codes and the health concerns that have stalled code changes do *not* appear to have been a major concern in these case studies. The debates between waterless urinal proponents and detractors notwithstanding, proper maintenance is the most commonly cited "real world" problem with this technology.

Two rather large waterless urinal consumer surveys have been conducted. In a study conducted by Estes, McClure & Associates, Inc. (2003), respondents reported installing waterless urinals in schools and universities, offices and convention centers, and large public venues. The most important motivations for installation were water cost and maintenance savings, followed by hygienic, odor, and utility rebate benefits. About one third of respondents reported at least some odor problems, and noted that improved maintenance helped to alleviate these problems. Given this result, it is unsurprising that several respondents reported that it took additional time to train the custodial staff to maintain the urinals properly. By asking questions using a five-point scale, this survey found that the urinals had an overall positive impact in all areas except odor control, which was rated a neutral 3.0.[25]

A similar study conducted by the Seattle Public Utilities department also used a five-point rating scale, and found somewhat more positive results than the study conducted by Estes, McClure & Associates. In particular, the rating for "user acceptance" was a 4.2, quite high for a five-point scale mean value. Two thirds of respondents reported flushing the drain lines with water while changing the sealant traps, and one third noted salt build-up on the inside of their pipes.

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[24] Keenan, Edward. "Taking Exception." Editorial. Philadelphia Enquirer, Monday April 10, 2006. Online. .Philadelphia Council AFL-CIO.

[25] Gary Bristow, James McClure, & David Fisher, 5.

Although one third of respondents indicated their intention to install additional waterless urinals, it is important to note that four Seattle facilities *removed* waterless urinals, as did two facilities responding to Estes, McClure & Associates. It is also noteworthy that while mean responses in both studies were positive, some negative user feedback concerning waterless urinals was also received. Nonetheless, and importantly for the future growth of waterless urinal technology, both survey studies concluded that most of the identified problems with waterless urinals could be alleviated through improved urinal maintenance and staff training. Significantly, only two out of 27 respondents to the McClure survey mentioned building codes as a barrier to implementation, and the plumbing code issue was not mentioned at all in the Seattle survey.[26]

These survey studies indicate that maintenance, and odor in particular, is a major problem area in waterless urinal applications. This is a surprising result, since waterless urinal manufacturers claim that these maintenance costs are minimal. Specific case studies can shed more light on why maintenance might be difficult. Unfortunately, due to the newness of waterless urinal technology, there are few objective evaluations to draw lessons from. The academic community is one exception to this finding. While the case studies that follow are weighted toward universities, we also discuss office and public recreational facility applications.

Waterless Urinals: University Site-Specific Applications

Waterless urinals were installed at the University of Southern Maine beginning in 2001. Driving forces behind this university's decision to install urinals included concerns over the rising costs of water and sewer utilities, and the awareness of the environmental impact of school facilities. The department also hoped that these urinals would bring additional benefits, including ease of maintenance and more hygienic restrooms.

The university started with a test of 4 units in 2001, and expanded this test to 40 units in 10 buildings by early 2005. A survey of university students and staff demonstrated that the urinals were well-accepted overall. Survey respondents perceived the new urinals to be easier to keep clean, and believed they produced fewer odors than flush urinals. Additionally, most users enjoyed the touch-free aspect of these urinals. On the other hand, respondents noted that waterless urinals produced more odors than flush toilets when the cartridges needed changing, and that these urinals actually produced more splash than flush urinals.

An official in the university facilities department explained that "the cartridges have been the biggest sticking point … People just do not like to change them. Sometimes, supervisors end up doing it, but they shouldn't have to." In some instances, plumbers were even called to change cartridges, due to broken plastic extractors and other trap extraction issues. Periodic odor complaints were "more often than not…related to housekeeping methods rather than the units operation." University officials hope that additional user training will lesson these maintenance issues.[27]

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[26] Gary Bristow, James McClure, & David Fisher, 5.
[27] "Making Waterless Work," *Maintenance Solutions* January 2005, Online.

Like the University of Southern Maine, the Medical University of South Carolina (MUSC) also began a pilot test of waterless urinals in 2001.[28] In this project, implementers expressed pre-project concerns over building codes, but codes did not ultimately prove to be a problem. Citing lower maintenance costs, fewer odor problems, improved hygienic conditions and a positive conservation message for students, MUSC officials decided to install the urinals in all new construction projects. Again, proper maintenance ultimately constituted the largest obstacle to success. Despite the fact that detailed information provided for maintenance staff to ensure proper cleaning (including video and on-site training), waterless urinal sealant traps were not always changed in a punctual manner. Facilities staff recommend setting up a preventative maintenance routine for changing out traps.

Although proper maintenance is a concern with any new product, in a third study the UT Houston Health Science Center has found that, over time, waterless urinal maintenance *can* become routine. Facilities staff note that. "our experience with them [waterless urinals] has been very positive. They are now our standard for urinals … Financial and resource savings over the fixture life cycle make the decision to convert a no-brainer."[29]

Waterless Urinals: Institutional and Commercial Site-Specific Applications

In October 2003, the EPA's National Health and Environmental Effects Research Laboratory (NHEERL) Atlantic Ecology Division facility issued a water management plan to document and promote efficient use of water at the facility.[30] By Spring 2004, the Laboratory had replaced 9 urinals and 23 toilets with waterless urinals and dual flush toilets. In order to encourage employee acceptance, facility management placed placards above toilets and urinals, and also directed users to websites for further information. Russell Ahlgren, facilities manager, noted that the retrofit required a "cultural adjustment," but concluded that "the waterless urinals in particular have generated positive comments among employees and visitors." In speaking about the project's success, Ahlgren emphasizes the relatively short 5-year payback period and maintenance savings.

Waterless urinals have also been installed in public facilities such as sports stadiums, parks, and convention centers. In one of these projects, London's Millennium Dome, a large-scale study was conducted to gauge how facility users responded to various water conservation devices.[31] Although this facility is not located in the United States, the waterless urinal technology used is no different from that used domestically. Moreover, while the same plumbing codes do not apply, the behavioral component of this

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[28] United States Environmental Protection Agency. "Water Management; Waterless Urinals Pilot Project." *Best Management Practices for Colleges and Universities.* EPA New England Office, April 2003. Online.

[29] US EPA, "Water Management; Waterless Urinals Pilot Project," 4.

[30] United States Environmental Protection Agency. "Case Study: Sanitary Fixture Upgrades at EPA's NHEERL Facility; Narragansett, Rhode Island." EPA-200-F-06-002. August 2006.

[31] Hills, Sian, Rebecca Birks. "Washroom behavior and users perceptions of 'novel,' water-efficient appliances." Thames Water Research and Technology,

research (that is, the way in which users actually use and respond to waterless urinal technology) is easily translated to US applications.

Thames Water, the local London utility, implemented their "Watercycle" project at the Millennium Dome. In some buildings at the Dome, waterless urinals, dual flush toilets, and sensor-activated taps were installed; the use of these devices was then studied and compared to the use of standard fixtures installed in other Dome buildings. In addition to monitoring actual water usage, user interaction with appliances was studied using observation and interview techniques. Although the interviews, carried out between November and December 2000, did not ask specifically about the waterless urinals installed, none of the 500+ male interviewees made adverse remarks about the waterless urinals in the "additional comments" section of the study. Ten percent of males did specifically comment, however, that they had noticed the waterless features of the urinals.

The study found that operational and cleaning staff at the Dome actively *preferred* waterless urinals to the flush urinals because they found them easier to maintain and keep clean. This result differs from that generally found in US applications, but it re-affirms the notion that maintenance staff new to this technology may grow to accept it and even prefer it over time. Moreover, the Millennium Dome apparently did not experience any odor problems with waterless urinals, another problem cited in a number of U.S. studies and "real world" applications. Finally, and importantly, the Dome's Watercycle project also found that signage and labeling of water conservation fixtures contributed significantly to users' satisfaction with waterless urinal technology.

Conclusion

Waterless urinals may not only constitute a significant water conservation strategy, but also may be superior to standard flush urinals in terms of maintenance costs and hygiene. A number of barriers to the adoption of waterless urinals exist, however, including the presence of outdated plumbing codes, opposition from plumbers' unions, and public health concerns, to name a few. Without objective proof of health benefits of waterless urinals, union opposition may be especially difficult to overcome. Although some plumbing codes have been specifically modified to allow waterless urinals, in other locations unions have successfully lobbied to modify plumbing codes to discourage or even ban waterless urinal technology. The purported benefits of waterless universals will be, in practice, irrelevant if their installation is illegal.

Nevertheless, case studies suggest that stakeholders including architects, builders, facility managers and urinal users are generally *not* concerned with health risks. Instead, a common practical barrier has been training housekeeping staff to perform proper maintenance in order to prevent odor problems. In some cases, odor and other maintenance-related problems have contributed to decisions to remove waterless urinals from facilities. That there are not only political, but technical barriers to the market success of this product, demonstrates that this is still an emerging technology.

Strategies for encouraging the adoption of this technology should concentrate on two primary goals. First, scientific evidence must be presented that confirms the argument that waterless urinals are, indeed, equally or less likely than flush urinals to cultivate bacteria that may cause infection. This evidence would immediately influence

local governments to revise codes in favor of waterless urinals, and would support the argument for a waterless urinal provision in the Universal Plumbing Code review period in 2008. Second, waterless urinal manufacturers and facilities staff need to make maintenance of these urinals fool-proof, either through design changes or through more intensive training of maintenance staff. If these concerns can be addressed, and if these barriers can be overcome, waterless urinals may indeed prove to be a valuable water conservation strategy for buildings, and may come to be widespread. While waterless urinal technology appears promising, that time has not yet come.

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