

## PROTECT AND CONSERVE WATER - WATER

**Finding Number: WATER-14-001**

**Finding:** Faucets, toilets, and urinals throughout the Missoula Field Office are not water saving fixtures.

**Repeat Finding:** No

**Recurring Issue:** No

**Priority Level:** Class IC

**Discussion:** The SI CASHE Team flow tested and inspected faucets, showerheads, toilets, and urinals, throughout the Missoula Field Office to determine their flow rates in gallons per minute (gpm) and flush volumes in gallons per flush (gpf). The flow rate of faucets and showers was measured using a flow measurement bag and stop watch. The flush volume for toilets and urinals was determined from the markings on the china and by timing how long each fixture flushed. The table below identifies the fixtures that do not meet the water-efficiency standard established by the EPA WaterSense Program or other nationally recognized standard:

Location	Fixtures Needing to be Replaced or Retrofitted	Fixtures to be Replaced or Retrofitted With
Women's Warehouse Bathroom	Sink flow tested at 1.0 gpm  Toilet china labeled 3.5 gpf with infrared flushometer	0.5 gpm aerator  Replace existing china with 1.6 gpf china and replace flushometer diaphragm with a diaphragm with a green colored relief valve designed to flow at 1.6 gpf
Men's Warehouse Bathroom	Sink flow tested at 1.0 gpm  Toilet china labeled 3.5 gpf with infrared flushometer	0.5 gpm aerator  Replace existing china with 1.6 gpf china and replace flushometer diaphragm with a diaphragm with a green colored relief valve designed to flow at 1.6 gpf
Women's Office Bathroom	Two sinks flow tested at 1.0 gpm  Two toilets china labeled 3.5 gpf with infrared flushometer toilets	0.5 gpm aerator  Replace existing china with 1.6 gpf china and replace flushometer diaphragm with a diaphragm with a green colored relief valve designed to flow at 1.6 gpf
Men's Office Bathroom	Two sinks flow tested at 1.0 and 1.5 gpm each  Two toilets china labeled 3.5 gpf with infrared flushometer toilets	0.5 gpm aerators  Replace existing china with 1.6 gpf china and replace flushometer diaphragm with a diaphragm with a green colored relief valve designed to flow at 1.6 gpf

The SI CASHE Team came on the audit with male-threaded 0.5 gpm aerators to retrofit public bath room faucets. When the SI CASHE Team found a public lavatory sink that could be retrofitted with a 0.5 gpm aerator that was done. Unfortunately none bathroom lavatory sinks could be retrofitted as they require female-threaded aerators.

The following fixtures were flow tested by the SI CASHE Team and determined they do not need to be replaced or retrofitted:

- Break Room kitchen sink faucet flow tested at 1.5 gpm
- Women's Warehouse Bathroom shower flow tested at 1.5 gpm
- Men's Warehouse Bathroom shower flow tested at 2.0 gpm

- Men's Office Bathroom two urinals with infrared flush and china rated for 0.5 gpf

Water used in office buildings accounts for approximately 9 percent of the total water use in commercial and institutional facilities in the United States. For a building to meet the Guiding Principle requirement to conserve water it must use a minimum of 20 percent less potable water than the indoor water use baseline calculated for the building, after meeting the Energy Policy Act of 1992, Uniform Plumbing Codes 2006, and the International Plumbing Codes 2006 fixture performance requirements. Installation of water-efficient fixtures meeting the EPA's WaterSense standard and other applicable water-efficiency standards is the best way to reduce indoor water use by 20 percent. A fixture cannot achieve a WaterSense rating without meeting stringent performance standards and a 20 percent reduction in water use. The table below is a summary of the fixture types and the WaterSense flow rate or flush volume for each.

Fixture Type	Maximum Flow Rate or Volume
Public lavatory faucet	0.5 gpm
Public lavatory faucet metering type	0.25 gallons per cycle
Private use lavatory faucet	1.5 gpm
Kitchen faucet	2.2 gpm
Showerhead	2.0 gpm
Toilet - tank	1.28 gpf
Toilet - flushometer	1.6 gpf
Urinal	0.125 gpf to 0.5 gpf*

\*BLM's Senior Engineer has determined that BLM will purchase and specify 0.125 gpf urinals

The WaterSense standard for tank toilets is 1.28 gpf. The current WaterSense standard for flushometer toilets is 1.6 gpf; however there is a draft 1.28 gpf flushometer standard that the EPA is currently evaluating.

#### **Why 1.6 gpf Toilets Versus 1.28 gpf Toilets?**

The SI CASHE Team recommends using 1.6 gpf toilets, regardless of whether they are tank or flushometer models, in BLM offices particularly if they were built prior to 2005 and have long drain runs. The primary concern with reducing flush volume from 1.6 gpf to 1.28 gpf is drain line carry of the solids to the sanitary sewer main in the street as the drain line in commercial office space is typically much longer than a residence. This recommendation is consistent with a recommendation from Maximum Performance (MaP). MaP is an independent toilet and urinal testing laboratory funded by 22 U.S. and Canadian government agencies. MaP specifically states: "we would still recommend caution when using HETs [High Efficiency Toilets with 1.28 gpf] in older, aging commercial facilities with long drain runs if they have little in the way of supplemental wastewater flows." For more information on the impact reduced flush volume has on drain line carry and MaP's recommendation use the following hyperlink: <http://www.map-testing.com/questions/with-the-maximum-toilet-gallons-per-flush-gpf-reduced-from-3.5-to-1.6-and-now-to-1.28-gpf-in-several-locations-what-effect-is-this-having-on-drain-line-carry-and-also-flushing-of-existing-drain-pipes-that-are-generally-4-in-diameter.html>.

The MaP website also has a link to a "Caution Statement" about using HETs in non-residential applications which lists the following reasons for caution when considering installation of 1.28 gpf toilets in commercial space.

- Commercial fixtures are often installed on 4-inch diameter drain pipes set at a 1-percent slope whereas residential fixtures are typically installed on 3-inch diameter pipes set at a 2-percent slope.
- Commercial toilets, which are often required to flush paper toilet seat covers, paper towels, large amounts of toilet paper, etc., are typically subjected to a much greater waste loading than residential toilets.

- The lengths of drain runs are often much longer in commercial installations.
- Supplemental flows are often much less in commercial installations (supplemental flows from bathing, clothes washing, etc., in residential applications help transport waste through drain lines).

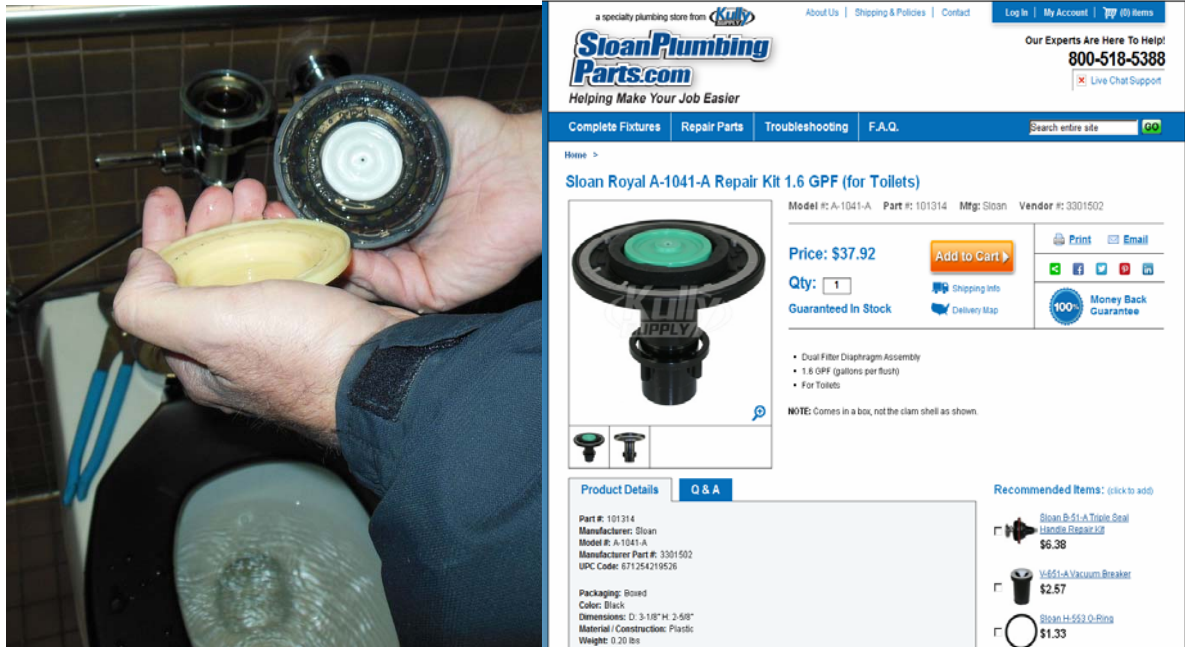
The two page “Caution Statement” may be downloaded using the following hyperlink: <http://www.map-testing.com/assets/files/Caution-High-Efficiency-Toilets-In-Non-Residential-Applications.pdf>.

**Toilet China and Flushometers Diaphragms are Not Low Consumption Models**

The toilet china on many of the toilets throughout the Missoula Field Office is labeled 3.5 gpf. Each toilet has a flushometer controlled by an infrared sensor. While the infrared sensor determines when to flush the flush volume is controlled by the flushometer’s diaphragm.

The SI CASHE Team observed most toilets at the Missoula Field Office were flushing for 6 seconds or longer. Toilets at typical building water pressure of 50 to 80 pounds per square inch utilize about a half-gallon of water per second. Therefore a 1.6 gpf toilet should flush for 3 to 4 seconds maximum. A toilet flushing for 6 seconds or more is likely flowing at 3.5 gpf which is what the china is designed to flow at. The SI CASHE Team did not try to take the infrared controlled flushometers apart to inspect their flushometer diaphragms because of concern for damaging the infrared controller. Because many of the toilets at the field office are labeled 3.5 gpf and the toilets flush so long the SI CASHE Team surmises that their flushometers have 3.5 gpf diaphragms in them.

The photo below on the left (see below) is a flushometer that was taken apart in a BLM office in Oregon. The flushometer’s diaphragm is in the right hand of an SI CASHE Team member. The white center identifies the diaphragm as rated for a 3.5 gpf flush volume. The photo below on the right is a web site screen shot of a 1.6 gpf retrofit for Sloan Royal flushometers. Notice the green center which is a specific design feature allowing plumbers in the field to easily tell if the flushometer is rated for 1.6 gpf. Many older flushometers can be equipped with a 1.6 gpf. However, because the toilets in the Missoula Field Office are hydraulically designed for 3.5 gpf volume retrofitting those toilets with 1.6 gpf flushometers will likely result in them clogging. Therefore, the toilet china must be replaced with china designed to flush using 1.6 gpf and the existing flushometers retrofitted with 1.6 gpf diaphragms. [Note: The SI CASHE Team is not stating that the specific retrofit shown in the photo on the right is the correct retrofit for use in the Missoula Field Office building. Additional research by field office personnel or a plumber is necessary to select the correct retrofit for the existing flushometers.]



### **Public versus Private Use Faucets and Kitchen Faucets**

Public lavatory faucets have two standards: 0.5 gallons per minute (gpm) for traditional faucets and 0.25 gallons/cycle for metering faucets. The EPA WaterSense flow rate standard for private use bathrooms (referred to as a lavatory in the standards) is 1.5 gpm at 60 psi, down from 2.2 gpm. By installing WaterSense faucets or the aerator retrofit the average household can save 500 gallons a year. Reducing the energy needed to heat water is the primary source of monetary savings. [Note: The standard for kitchen faucets remains unchanged at 2.2 gpm.]

There are different standards for public use versus private use lavatory faucets because of the differences in the uses and performance expectations between public restroom faucets and private use bathroom faucets.

Public restroom faucets, for example, are used almost exclusively for hand washing or simple rinsing, compared to lavatory faucets in homes and in other private bathrooms that face a myriad of uses. As a consequence, the maximum flow rate for these public restroom and metering fixtures can be set significantly lower than the flow rate for private lavatory faucets without negatively impacting user satisfaction. EPA did not create a WaterSense standard for public lavatory faucets because the Department of Energy and ASME already have established standards for them.

Private use lavatory faucets are used primarily for hand washing and other sanitary activities, such as teeth brushing, face washing, and shaving. For these activities, discussions with faucet manufacturers and water utility representatives provided a general consensus that a reduction in the maximum flow rate from 2.2 gpm (the current federal water-efficiency standard) to 1.5 gpm, as established by the WaterSense standard, is not very noticeable for most users. The most noticeable differences are increased wait times when filling the basin or waiting for hot water. While decreasing a faucet's maximum flow rate increases user wait time for these activities, the EPA determined the potential water savings gained from the primary use of lavatory faucets (i.e., washing and rinsing) outweigh any potential inconvenience caused by increased wait times and will not negatively impact overall user satisfaction.

Kitchen sink faucets were excluded from the WaterSense specification for faucets because the different uses and user expectations require other considerations for defining performance. One major performance consideration is a kitchen faucet's ability to effectively rinse dishes. Kitchen faucets also are commonly used for pot or container filling, and significantly increased wait times might not be acceptable to most users. The EPA determined that reducing the maximum flow rates of kitchen faucets would create issues of user satisfaction and be counter to its program goals of increasing efficiency while maintaining or improving performance.

### **Green Purchasing Mandates**

The Federal Acquisition Regulations (FAR) states the following: "The Government's policy is to acquire supplies and services that promote energy and water efficiency, advance the use of renewable energy products, and help foster markets for emerging technologies. This policy extends to all acquisitions, including those below the simplified acquisition threshold." This means any purchase, including credit card purchases, of energy or water consuming products must be energy and water efficient. In addition two Executive Orders (EO) mandate Federal agencies reduce their water consumption. EO 13423 requires agencies to specify and purchase water-efficient products. EO 13514 requires agencies to improve water use efficiency and management by reducing potable water consumption intensity by 2 percent annually through fiscal year 2020, or 26 percent by the end of fiscal year 2020, relative to a baseline of the agency's water consumption in fiscal year 2007 by using water-efficient and low-flow fixtures.

The Energy Policy Act of 1992 mandated that tank toilets and flushometer toilets manufactured after January 1, 1994 have a maximum water use of 1.6 gpf. Toilets with a water use of 3.5 gpf could be used in commercial buildings until January 1, 1997. Tank toilets typically have manufactured date stamped inside the tank. Therefore if a tank toilet has a date before January 1, 1994 or if the toilet was installed prior to January 1, 1994 it is likely a 3.5 gpf toilet.

**Recommendation:** A) Replace all toilet china labeled 3.5 gpf with new china designed for 1.6 gpf; B) Open all chrome flushometers on toilets to determine if the diaphragms are designed for 3.5 gpf or 1.6 gpf; C) Replace all diaphragms designed for 3.5 gpf with 1.6 gpf diaphragms; and D) Retrofit all public use lavatory faucets with 0.5 gpm aerators.

**Driving Reference(s):** FAR 23.202 – acquire supplies and services that promote energy and water efficiency  
Executive Order 13423, Section 2(d) – water-efficient products must be specified and purchased  
Executive Order 13514, Section 2(d)(i) – agencies must reduce their water use by 26% from the FY 2007 baseline by 2020 and use water-efficient fixtures  
ASME A112.18.1/CSA B125.1, Plumbing Supply Fittings, Section 5.4.1 Table 1 – public lavatory faucet maximum flow rate (other than metering faucets) is 0.5 gpm.  
10 CFR Part 430.32(o) – metering faucet maximum flow rate is 0.25 gallons/cycle.  
EPA WaterSense Standard – private use lavatory maximum faucet flow rate is 1.5 gpm  
10 CFR 430.32 – kitchen faucet maximum flow rate is 2.2 gpm at 60 psi  
EPA WaterSense Standard – showerhead maximum flow rate is 2.0 gpm  
EPA WaterSense Standard – urinal maximum flush volume is 0.5 to 0.125 gpf  
EPA WaterSense Standard – tank toilet maximum flush volume is 1.28 gpf  
EPA WaterSense Standard – flushometer toilet maximum flush volume is 1.6 gpf  
BLM IM 2009-166 - Green Purchasing Plan (GPP)  
GPP Section 4.2 – purchase of water efficient products is mandatory  
GPP Section 8.2.2 – summary of FAR requirements for green purchasing  
Energy Policy Act of 1992, Title I, Subtitle C, Section 123(k), Standards for Water Closets and Urinals – toilets manufactured after January 1, 1994 must have a maximum flush volume of 1.6 gpf

**Point(s) of Contact:** \_\_\_\_\_  
(First and Last names, no groups or committees)

**Status of Corrective Action:** \_\_\_\_\_  
(e.g., Scheduled for completion by MM/DD/YY; Completed on MM/DD/YY; Funding requested, scheduled for completion by...; Preliminary planning, scheduled for completion by...)

**Facility Name:** Missoula Field Office  
**Facility Category:** District/Field Office