

## 7.4 Showerhead, Aerator, and Toilet Flapper Retrofit

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### *Applicability*

This BMP is intended for a Municipal Water User Group (“utility”) that has at least 20 percent of the homes and apartment units it serves constructed prior to 1995 and for which there has not been an active retrofit program for efficient showerheads and faucet aerators. This BMP is often implemented in conjunction with Residential ULFT Replacement BMP and/or the Water Survey for Single-Family and Multi-Family Customers BMP. Once a utility decides to adopt this BMP, the utility should follow the BMP closely in order to achieve the maximum water efficiency benefit from this BMP.

### *Description*

Plumbing retrofits have usually included showerheads and kitchen and bathroom faucet aerators. Recent studies have shown that replacing toilet flappers<sup>1</sup> is also an effective method of conserving water in the residential sector. Four types of high quality, low flow plumbing devices are to be installed under this program: showerheads rated at 2.0 gallons per minute (“gpm”) or less; kitchen faucet aerators of 2.2 gpm or less, bathroom faucet aerators of 1.5 gpm or less, and toilet flappers that flush the toilet at the design flush volume for that toilet model.

Studies have shown that many 1.6 gallons per flush (“gpf”) toilets that have been installed are flushing at more than 1.6 gpf. If 1.6 gpf toilets are installed, the flush volume should be checked and, if needed, the water level in the tank should be adjusted to restore the flush volume to 1.6 gpf. If after the water level in the tank is adjusted, the flush volume is still well above 1.6 gpf, it is likely that the toilet originally had an early closure flapper. Using the model number, usually located on the inside of the tank and the research on compatibility of flappers<sup>2</sup> the flapper required to restore the flush volume to 1.6 gpf can often be determined. If the flapper is one of several early models of closure flappers, the flapper could be replaced during the survey and/or the information on the correct replacement flapper should be provided to the customer.

The utility may meet the requirements of this BMP through enforceable ordinances and inspection programs requiring replacement of inefficient plumbing when ownership of the property transfers or by date certain no later than five years.

### *Implementation*

Under this BMP, the utility should:

- 1) Identify single-family (“SF”) and multi-family (“MF”) residences constructed prior to 1995. The utility may have data showing the number of SF homes existing at the end of 1994 or census data can be used. The 2000 Census data can be used to determine the total number of housing units constructed prior to 1995. The only drawback is that the construction data cannot be separated into SF and MF

units. Another approach would be to use the Census data from 1990 and 2000, which includes the number of housing units by type for 1990 and 2000. This data can be used to estimate SF Units (detached units in the Census data) at the end of 1994. A linear growth assumption yields the following approach. Take the difference (2000 detached units-1990 detached units) and multiply by 40 percent (4 years) and add this to the 1990 detached units. This produces an estimate of SF units at the end of 1994. A similar calculation can be done for MF units.

- 2) Develop a plan to directly install plumbing devices in single-family homes and multi-family residential facilities or, alternatively, provide kits for installation with follow up inspections; and
- 3) If feasible, include a program to restore the flush volume of 1.6 gpf toilets to the design flush volume.

After determining the potential number of participants, select at least one of these approaches:

- 1) Direct Install and Kit Distribution Program
- 2) Ordinance Approach: Upon Change of Ownership of Property
- 3) Ordinance Approach: By Date Certain

### *Schedule*

Based on the approach(es) selected, the following schedule should be followed:

- 1) Direct Install and Kit Distribution Approach  
In the first twelve (12) months: Plan a program including stakeholder meetings as needed. Locate plumbing contractors or retrofit companies who may be interested in bidding on this program. Determine plan for educating homeowners, apartment owners and managers, plumbers, and realtors about this program. Solicit bids and initiate the program. Include inspections by utility personnel or third party to verify plumbing device installation. Each year 10 percent of eligible single-family homes and 10 percent of eligible multi-family units should be retrofitted to maintain program development. Continue program until 50 percent of eligible single-family houses and multi-family units are retrofitted.
- 2) Ordinance Approach: Upon Change of Ownership of Property  
In the first twelve (12) months: Plan a program including stakeholder meetings as needed. Consider offering rebates for all or a portion of the time this program will be in place. For example, offer rebates for five years and publicize this so customers can take advantage of rebates and retrofit in the early stages of the program. Develop a plan for educating realtors and title companies about this requirement. Determine how change of ownership can be obtained from County Appraisal Districts. Plan follow up inspection program or buyer/seller

certification program to assure compliance. Develop and pass ordinance. Implement ordinance and tracking plan for number of units retrofitted. In the second year of the program, continue implementation and outreach program for realtors and title companies. As long as the program is in place, continue compliance program.

3) Ordinance Approach By Date Certain

In the first twelve (12) months: Plan a program including stakeholder meetings as needed. Consider offering rebates for all or a portion of the time this program will be in place. For example, offer rebates up to Year 4 and publicize this so customers can take advantage of rebates and reduce the enforcement required in Year 5. Determine plan for educating homeowners, apartment owners and managers, plumbers, and realtors about this requirement. Plan follow up inspection program or buyer/seller certification program to assure compliance. Develop and pass ordinance. Implement ordinance and tracking plan for number of units retrofitted.

Years 2, 3, and 4: Continue implementation. Continue educating homeowners, apartment owners and managers, plumbers, and realtors about this ordinance.

Year 5: If 50 percent of eligible households have not been retrofitted, prepare education campaign about upcoming deadline and fines that may occur if retrofit does not take place by said deadline. Prepare compliance program. After deadline, issue citations for those not complying.

### *Scope*

To accomplish this BMP, the utility should do the following:

- 1) Develop and implement a plan to distribute or directly install high quality, efficient plumbing devices to single-family and multi-family units constructed prior to 1995.
- 2) Implement the distribution or installation programs to achieve retrofits on at least 10 percent of eligible single-family units and 10 percent of eligible multi-family units each year. Utilities with more than 200,000 connections should retrofit at least 20,000 eligible homes and units each year.
- 3) Within five years of implementing this program, retrofit at least 50 percent of eligible single-family houses and multi-family units with the specified devices. For utilities with more than 200,000 connections, at least 100,000 eligible homes and units should be retrofitted within five years. Or,

Adopt an enforceable ordinance or rules requiring replacement of inefficient plumbing fixtures, including toilets greater than 1.6 gallons per flush, when ownership of the property transfers or by date certain no later than five years

from adoption of the BMP, and implement the ordinance or rules including a compliance program.

### *Documentation*

To track the progress of this BMP, the utility should gather and have available the following documentation:

- 1) An inventory of the number of single-family and multi-family buildings completed prior to 1995, which are targeted by this BMP;
- 2) If applicable, certified copies of adopted ordinances and rules requiring retrofit of plumbing fixtures upon transfer of property ownership or by date certain for each utility that has selected this program option;
- 3) For each year of implementation, maintain records of the number of showerheads, bathroom faucet aerators, kitchen faucet aerators and toilet flappers (by category) installed in single-family and multi-family units.

### *Determination of Water Savings*

Calculate water savings as follows:

Water Savings = *Number of Devices Retrofitted* x *Device Savings*

Where Device Savings may be found in the Retrofit Device Savings Table, and Number of Devices Retrofitted = 1.0 x *Number Devices installed* (when using Ordinance Approach or Direct Installation Approach), or

Number of Devices Retrofitted = 0.3 x *Number Devices installed* (when using Kit Distribution Approach)

**Retrofit Device Savings Table**

Device	Initial Savings (gpd per device)	Device Life Span (Savings)
Showerheads and Faucet Aerators	5.5 gpd	Permanent*
Toilet Flapper	Up to 12.8 gpd**	5 years

Notes: (\*) The actual device life span is 5 to 15 years; the savings are permanent because inefficient equipment can no longer be purchased. The Texas Performance Standards for Plumbing Fixtures<sup>3</sup> forbids importation or sale of inefficient fixtures into Texas. Plumbing standard provisions of the Energy Policy Act took effect in 1994 thereby ensuring that inefficient fixtures would not be manufactured in neighboring states<sup>4</sup>.

(\*\*) Residential End Use Study<sup>5</sup> average for toilet leakage was 9.5 gpcd, which can be translated to gpd per toilet by multiplying by average household size (2.7) and dividing by average number of bathrooms (2) per single-family

house. The utility should try to estimate actual savings based on measured leakage rate.  $(9.5\text{gpcd} \times 2.7) / 2 = 12.8$  gpd per toilet

### *Cost-Effectiveness Considerations*

The significant expenses associated with this BMP will be the costs of purchasing the devices, the distribution costs, and administrative costs. Usually contractors have been hired to conduct kit installation and door-to-door distribution programs. Labor costs are usually bid based on a unit cost per showerhead, aerator or flapper installed or per kit delivered. There will be labor costs for utility staff to bid the project, oversee the contractor and conduct spot inspections of the contractor's work. Utility staff often run programs where customers pick up kits. Labor costs range from \$10 to \$30 per SF customer for showerhead and aerator installation and an additional \$5 to \$20 per toilet for replacement. MF customers will usually use their own staff for installation.

High quality showerheads purchased in bulk are available starting at less than \$2 each with aerators costing less than \$1 each. Flappers range in cost from \$3 to \$10. When choosing between models of equipment that have varying degrees of water efficiency, only the incremental cost of the more water efficient equipment should be compared with the benefits to the utility in order that the maximum water efficiency benefit can be developed.

Administration of the program can be conducted by utility staff or contracted out. If a utility chooses to implement the ordinance approach there may be costs for inspections in order to verify installation and discourage fraud. Marketing and outreach costs may range from \$5 to \$10 per SF customer. Administrative and overhead costs range from 10 to 20 percent of labor costs. If this program is combined with the Residential ULFT Replacement BMP, there should be efficiencies in these costs.

To calculate the total cost per unit, total all costs and divide by the number of units being retrofitted.

### *References for Additional Information*

- 1) Department of Energy 1998 Plumbing Product Rules  
[http://www.eere.energy.gov/buildings/appliance\\_standards/residential/pdfs/plmrul.pdf](http://www.eere.energy.gov/buildings/appliance_standards/residential/pdfs/plmrul.pdf)
- 2) *Maximum Performance Testing of Popular Toilet Models*, William Gauley and John Koeller, May 2004.  
[http://www.cuwcc.org/Uploads/product/Map\\_Update\\_No\\_1\\_June\\_2004.pdf](http://www.cuwcc.org/Uploads/product/Map_Update_No_1_June_2004.pdf)
- 3) *BMP Cost Savings and Guide*, California Urban Water Conservation Council, July 2000.
- 4) Texas Performance Standards for Plumbing Fixtures  
[http://www.capitol.state.tx.us/statutes/docs/HS/content/word/hs.005.00.00037\\_2.00.doc](http://www.capitol.state.tx.us/statutes/docs/HS/content/word/hs.005.00.00037_2.00.doc)
- 5) *Residential End Uses of Water*, AWWA Research Foundation, 1999.

- 6) *Handbook of Water Use and Conservation*, Amy Vickers, Waterplow Press, May 2001.
- 7) *Impacts of Demand Reduction on Water Utilities*, AWWA Research Foundation, 1996.
- 8) *Residential End Uses of Water*, AWWA Research Foundation, 1999.
- 9) *Quantifying the Effectiveness of Various Water Conservation Techniques in Texas*, Texas Water Development Board, May 2002.
- 10) *Waste Not, Want Not: The Potential for Urban Water Conservation in California*, Pacific Institute, November 2003.  
[http://www.pacinst.org/reports/urban\\_usage/waste not want not full report.pdf](http://www.pacinst.org/reports/urban_usage/waste_not_want_not_full_report.pdf)
- 11) *Lower Colorado River Authority Frequently Asked Questions about its On-Sewage Rules* [http://www.lcra.org/water/faq\\_septic.html](http://www.lcra.org/water/faq_septic.html)
- 12) *Marin Municipal Water District Plumbing Fixture Certificate*  
<http://www.marinwater.org/TOSforms.pdf>
- 13) *Summary of Residential End Use Study*  
<http://www.aquacraft.com/Publications/resident.htm>
- 14) *Toilet Flappers: A Weak Link in Conservation*, John Koeller, P.E. , CUWCC, March 2002. [http://www.cuwcc.com/Uploads/product/Flappers Weak Link.pdf](http://www.cuwcc.com/Uploads/product/Flappers_Weak_Link.pdf)