Evaluation of Potential Best Management Practices - Pre-Rinse Spray Valves for the Food Service Industry

Prepared for

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IV. Pre-Rinse Spray Valves for the Food Service Industry

1. Background

Food Service Application

Food service operations in the commercial sector including restaurants, cafeterias, institutional kitchens and food preparation companies exhibit significant water conservation potential. For example, the dishwashing operation in a typical restaurant consumes over two-thirds of all of the water used by that establishment. In some cases, nearly one-half of the water used in dishwashing is consumed by a pre-rinse spray valve (PRSV) used to remove food from dishware, utensils, and pans prior to placing them in the dishwasher.

Differences and Options for the Food Service Operator

Pre-rinse spray valves can be purchased with a variety of rated flow rates: up to 1.6-gallons per minute (gpm) for the water- and energy-efficient units and over 3.0-gpm for the most common non-efficient units. With completion of the Council's Phase 1 PRSV Replacement Program, we estimate that about 80 percent of the currently installed valves in California remain of the non-efficient type.

Because most operational uses of these valves involve pre-rinsing with heated water, any reduction in flow rates and water usage has the potential to reduce energy consumption as well.

Design differences between the non-efficient and efficient valves also contribute to operating efficiencies. The older non-efficient valves employ a traditional "showerhead" type of spray pattern. That is, water flows through multiple small orifices in a wide spray pattern (similar to a residential showerhead) that is used to remove food residue from dishware and other items to be cleaned. Over time, these orifices tend to become restricted due to mineral buildup or other material in the supply water (including residue from the hot water heater). Thus, the effectiveness of the spray in rinsing or cleaning dishes can deteriorate significantly over the life of the unit.

On the other hand, the new efficient valves employ a different type of head, which does not use multiple orifices. Instead, the head design provides a "knife-like" continuous spray pattern that is much more efficient in removing food from dishware, utensils and other items, and is not subject to the effects of mineral buildup that occur with the "showerhead" design. Therefore, the valve can perform the cleaning task more effectively. Informal studies by the Food Service Technology Center (FSTC) in San Ramon, CA have shown that operators are able to reduce the time required to pre-rinse or clean dishes as a result of changing out the valve.

Currently, there is no maximum flow rate established for these units in any codes or standards; the food service operator has the choice, when replacing a valve, between an inefficient and an efficient unit. Further confusing the matter (for the operator) is the fact that some manufacturers label their valve products as "low-flow" or "water-efficient" or "energy-efficient" when, in fact, the valves are only marginally more efficient than the valves they are replacing[3].

[3] For example, pre-rinse spray valves that flow at 1.9 to 2.5-gpm are "efficient" when compared with those that flow at 3.0-gpm and above. In the absence of an accepted benchmark definition of "water-efficient", the manufacturers are thus able to freely label their products with an efficient designation.

Performance Requirements and Specifications

With the creation and implementation (in 2002) of the Council's Pre-Rinse Spray Valve Replacement Program[4] (Program), it became necessary to create a threshold definition of "water-efficiency" and a performance specification to determine which valves meet this definition. Product performance tests were conducted at the FSTC to determine what flow-rate threshold would yield cleaning performance equal or superior to existing non-efficient valves. As a result of that research, the maximum flow rate of the efficient pre-rinse spray valves specified for this California Program was established at 1.6 gpm. In addition, the specification requires that the cleaning performance of the valve meet certain criteria as well[5]. These requirements, along with the Standard Test Method by which compliance is determined, are detailed in the Program's valve specification[6], which can be downloaded from the Council website:

http://www.cuwcc.org/Uploads/product/Pre_Rinse_Valve_Spec.pdf

Only valves that comply with the stringent criteria described within the specification are qualified for installation through the Council's Program. As of this date, three firms have submitted valves for qualification; two valves have met the requirements of the specification.

Useful Life

A major manufacturer of pre-rinse spray valves indicates that the typical life expectancy of these units is about five (5) years. The return rate for pre-rinse valves that fail within the normal one-year warranty period is less than 15 per 50,000 valves shipped[7]. Unless the unit is of substandard manufacture, is improperly installed, is abused, or is installed in a facility with very poor water quality, there is no reason to believe that a typical pre-rinse spray valve would last less then the expected five years.

[4] The Phase 1 Program was implemented by the Council in 2002 and 2003; 16,896 existing pre-rinse spray valves in hot water applications were replaced in California; that Program was funded by (1) the California Public Utilities Commission (CPUC) with funds from the public goods charge levied on natural gas customers and (2) participating water providers. The existing Program consists of direct installation of the efficient valve in all applications where hot water is used (with certain limitations imposed by the CPUC). The inefficient valve is removed from the premises of the establishment so that it cannot be re-installed by the operator.

[5] Generally speaking, the minimum cleaning performance defined within the specification is equal to or better than the cleaning performance of the typical high-flow 2.65- to 4.0-gpm unit.

[6] Specification developed by the Food Service Technology Center, working in conjunction with the Council.

[7] Personal communication, Ray Fisher, President, Fisher Manufacturing Company.

2. Water Savings Estimates

Although other entities outside of California are beginning to implement PRSV replacement programs, the acknowledged pioneer in such an undertaking is the Council. As such, the documentation of water savings associated with valve replacements has progressed beyond the "estimate" stage. In 2003, the Council commissioned SBW Consulting Inc., Bellevue WA, to measure and evaluate the effectiveness of actual PRSV installations through the Program. By the end of Phase 1 of the Program, 19 such field measurement projects had been completed. These served as a basis for the water savings estimates for the Phase 1 Program and are further described below.

The measurement of water consumption consisted of individually metering water use by each PRSV for 30 days both before and after retrofit. Additionally, water temperatures were measured and hours of actual spray valve use determined. Finally, flow rates of the old inefficient valves and the new efficient valves were measured by the FSTC at various water pressure levels. The difference in flow rates between the inefficient and efficient valves remains relatively constant from 30 to 60 pounds per square inch of water pressure. Thus, the water savings to be achieved through valve replacement at any given establishment can be assumed to be nearly the same regardless of the establishment's line pressure.

Some water agencies outside of California have chosen to set their efficiency standard at 1.8-gpm rather than the 1.6-gpm called for in the Council's Program in order to qualify more valve models for their particular programs[8].

Water and energy savings per valve were measured at the 19 metered sites[9] and extrapolated to the universe of installations under the Phase 1 Program[10]. The majority of restaurants used water heated with gas, although an unexpectedly significant portion of California installations use electric water heating (determined by SBW as approximately 27 percent, based upon data from the Pacific Gas and Electric Company). Phase 1 Program results were as follows:

Water Savings		
CCF[11]/year	Gallons/year	Acre-Feet/year
66.4	50,000	0.153
Energy Savings – method of water heating		
Natural Gas		Electricity
335 therms/year		7,634 kWh/year

[8] Personal communication, Al Dietemann, Seattle Public Utilities.
[9] Other than an Applebee's Restaurant, all of the other sites were small individually owned restaurants.
[10] SBW Consulting, 2004. *Evaluation, Measurement & Verification Report for the CUWCC Pre-Rinse Spray Head Distribution Program.* May 2, 2004
[11] CCF: hundred cubic feet of water, equivalent to 748 gallons and a common volume of measurement used by water utilities.

It must be noted that the above water and energy savings estimates are based predominantly upon field measurements within small establishments[12]. It is very likely that future outreach into food service chains and larger volume establishments will yield savings estimates that are much higher, due to the more intense use of the PRSV in the restaurant dish room. For example, prior to start-up of the Phase 1 Program, laboratory estimates indicated that water savings across all types of food service establishments would average approximately 73,000 gallons per year. This figure was never achieved due to the types of restrictions placed upon the Program[12]. As such, documented savings data for the higher volume installations is not available.

4. Product and Program Cost

The current cost of the PRSV ranges from approximately $30 to $60 each, depending upon the quantities purchased and the sources through which the product is obtained. There is no substantial difference in cost between an efficient PRSV that meets the requirements of the Program and a typical non-efficient PRSV.

For the Council's Program, total cost of implementation is approximately $181, divided as follows:

	Unit Cost
Valve Purchase, Warehousing, Distribution	$ 50
Field Marketing and Installation	100
Evaluation, Measurement, and Verification (EM&V by SBW)	5
Technical and Laboratory Support (by FSTC and others)	7
Program/Contract Administration (by the Council)	19
Total cost (16,896 installations)	$ 181

Other standard vehicles exist for outreach into the food service sector and accomplishing pre-rinse spray valve replacements. Most, if not all, would never achieve the volumes that can be attained through a massive direct install effort such as demonstrated by the Council's Program. Examples of other implementation vehicles are:

Rebate or voucher program[13]
Dealer/distributor incentive program
Food service commercial audit program

5. Cost Effectiveness

With an estimated water savings of approximately 50,000 gallons per year and a physical (useful) life of 5 years, aggregated savings would amount to about 250,000 gallons per valve

[12] Due to conditions imposed by the California Public Utilities Commission (CPUC), the Council's Phase 1 Pre-Rinse Spray Valve Program was focused primarily upon very small, small and "hard-to-reach" customers of the Investor Owned Utilities.

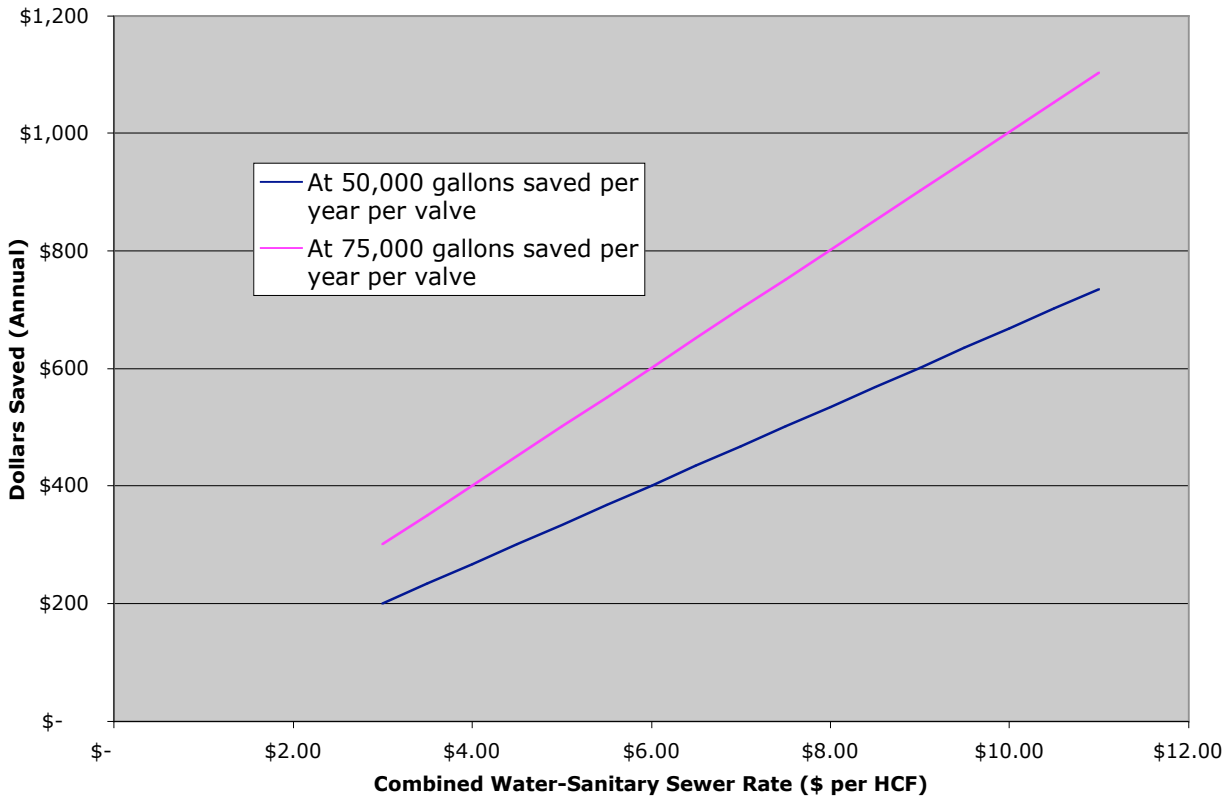
[13] A $50 rebate for PRSVs was implemented by the Metropolitan Water District of Southern California in the late 1990s in connection with its Regionwide Commercial Rebate Program. Few rebates have been provided by their program, even with the active promotion by a manufacturer to potential customers for a replacement valve. For example, the manufacturer pre-packaged rebate forms with the valves at their point-of-sale in order to stimulate purchases of the efficient product, yet customers did not respond and rebates were few.

(0.767 acre-feet) when installed in a very small or small establishment. If a statewide retrofit program was to be implemented throughout California in a structure similar to the Council's Phase 1 Program[14], water savings could therefore be expected to be achieved at a cost of about $196 per acre-foot[15].

From the viewpoint of the customer or end-user, the water savings achieved through the installation of an efficient valve in a typical food service application yields two significant benefits (in addition to energy use reductions): reduced water consumption and reduced flows to the sanitary sewer. Depending upon the specific application (breakfast, lunch, and/or dinner operations by the restaurant), peak flows would likely be reduced as well.

Because water and sewer rates vary significantly throughout the state, the economic benefits will likewise vary. Over a small range of rates, however, benefits to the food service operator would be as follows:

Figure 1. Water & Sewer Cost Savings from PRSV at Various Combined Water-Sewer Rates



[14] The Council's Phase 1 Pre-Rinse Spray Valve Replacement Program was a full-service direct-install program that cost approximately $181 per installed valve as noted above. Of this cost, approximately $31 could be attributed to the very strict regulatory and administrative requirements of the CPUC. As such, a similar program implemented exclusively by the water industry (without CPUC participation, funding, and conditions) could therefore be expected to cost about $150 per installed valve.

[15] Calculated as follows: $150 divided by 0.767 acre-feet of water = $196 per acre-foot

6. California Potential

As of 2002, the California State Board of Equalization had issued sales tax permits to 77,916 restaurants and similar food establishments in the state[16]. This figure does not include food service operations within a larger commercial or industrial entity (such as company cafeterias or within hospitals or schools, for example), firms whose business is to manufacture and/or prepare food for sale by others[17], and other similar operations. On the other hand, this figure does include very small restaurants and bars that do not use a PRSV.

With very limited information on the current number of installed PRSVs in California, the above inventory information was coupled with the experience[18] gained through the Council's Phase 1 Program to arrive at an estimate of approximately 102,000 installed hot water valves in California, with a range between 90,000 and 110,000. Additional valves are also installed on cold-water applications[19], but the number is exceedingly small.

Through implementation of the Council's Program, it was discovered that approximately four (4) percent of the food service sites visited were already equipped with water-efficient PRSVs. The Program resulted in another 17 percent of the inventory being converted to water-efficient units, for an estimated saturation rate (as of 2003) of approximately 21 percent.

We estimate the potential water-savings benefit of replacing the remaining 79 percent of the 102,000 valves in California to be as follows:

79% x 102,000 valves x 0.767 acre-feet = 61,800 acre-feet
Or approximately 12,400 acre-feet per year

This figure assumes that the water savings documented through the Council's Phase 1 Program would prevail for the entire state, although we expect that this would be a very conservative estimate if all sizes of food service establishments were to be included in a program outreach.

Based upon the very successful market penetration of Phase 1 of the Program, we estimate that at least 80 percent of these potential savings is "capturable" through initiatives and cost-effective incentives by the water industry. Phase 2 of the Council's Program is targeted to replace another 24,700 valves in California in 2004 and 2005. This phase will likely yield additional market and technical information that will permit a better assessment of the installed inventory and replacement potential.

[16] California State Board of Equalization, *Taxable Sales in California (Sales & Use Tax), 2002 Fourth Quarter*, no date.
[17] Food product processors and manufacturers, catering firms, etc.
[18] The Phase 1 Program's average replacement rate was 1.3 PRSVs per establishment.
[19] An on-premises survey of 89 food service operations was conducted by the Council in connection with the EM&V task for the Program. Within these 89 facilities, the Program installed 124 new pre-rinse spray valves. The survey found that only one of the 124 valves was being used in a cold-water application.