SBW Consulting, Inc.
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EVALUATION, MEASUREMENT & VERIFICATION REPORT

for the

CUWCC Pre-Rinse Spray Head Distribution Program

Submitted to the

California Urban Water Conservation Council

Submitted by

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Background

The California Urban Water Conservation Council's Pre-Rinse Spray Head Distribution Program installs high-efficiency pre-rinse spray heads in food service establishments throughout the natural gas service areas of Pacific Gas & Electric, Southern California Gas, and San Diego Gas & Electric. Replacing old heads with this type saves energy by reducing the gas and electric energy required to heat hot water. The program set goals of achieving 7.39 million therms/year of gas savings by installing 16,903 spray heads. No electric savings goal was set.

This evaluation, measurement, and verification effort was designed to accomplish multiple objectives, including assessing energy savings achieved, measuring program cost-effectiveness, providing ongoing feedback on program implementation, and assessing overall performance, success, and continuing need for the program.

Methodology

This evaluation relied on a variety of techniques and data sources to assess the energy savings and effectiveness of the program. These included telephone surveys, short-term metering and one-time measurements at installation sites. They also included laboratory bench tests, industry standards, and engineering calculations. We developed a stratified random sampling approach to select sites to administer telephone surveys to over 200 sites, selected in four rounds throughout program implementation. These surveys both determined whether the new spray heads were still in service and screened sites for short-term metering of spray head hot water use. Engineering data collected from 19 such metering sites was combined with additional measurements of old spray head flowrates, mixed water temperatures, water supply temperatures, and building characteristics data to develop robust estimates of average energy savings per spray head across the program. Finally, we used results from the retention surveys to adjust spray head counts and calculate total energy savings for each gas utility and the program overall.

Results

The program installed 16,975 spray heads at over 13,000 sites. About 58% of the heads were installed at establishments served by SoCalGas. The remaining 26% and 16% of the heads were installed in PG&E and San Diego Gas & Electric service territories, respectively. A majority of the spray heads (53%) was found in "very small" establishments. Another 43% were in "small" facilities, and only 5% were in "medium" ones.

At the 19 metered sites, the average spray head flow reduction was 2.24 gallons/minute, and the average daily usage was 1.27 hours/day. Incorporating additional data, we determined the average mixed water and cold water supply temperatures were 119.3°F and 66.8°F, respectively, for an average temperature rise of 52.5°F. The overall energy savings per spray head were 20.9 kWh/day/head for electric heating and 0.92 therms/day/head for gas heating.

We estimated from survey data that over the first year, the spray head retention rate is 94.8%. Combining this with the assumption from published studies that 27% of commercial water heating in the state is electric, we calculated overall savings shown in the table below. The gas equivalent savings expresses all savings as if all spray head installations had gas water heating. The gas savings realization rate is 53%, and increases to 73% if the electric savings are included as gas equivalent. The actual electric savings are quite substantial.

	Number of spray heads installed*	Gas savings (therms/year)	Gas equivalent savings (therms/year)	Electric savings (kWh/year)
Program goal	16,903	7,386,611	7,386,611	0
Evaluated actuals	16,975	3,945,075	5,389,520	32,917,002
Realization rate	**100.4%**	**53.4%**	**73.0%**	**N/A**

Conclusions

The program is successfully providing significant energy savings to the State of California. These savings are on the order of nearly 4 million therms of natural gas and 33 million kilowatt-hours of electricity annually. The fact that the revised TRC benefit-cost ratios are higher than the original ones indicates that the program is even more cost-effective that was originally predicted. It is important to note, however, that the program originally did not expect any electric savings, and that these electric savings come at the expense of gas savings. Fortunately, the evaluated energy savings shows a high rate of retention, with only about 5% of the efficient spray heads being removed from service over the first year. This is consistent with the high levels of customer satisfaction that the retention surveys uncovered.

1. Introduction

1.1 Program Description

Pre-rinse spray heads are ubiquitous in food service establishments. They are used by kitchen staff to remove food particles prior to the cookware or dishes entering the wash cycle, which can be hand washing or by dishwasher. Typically, both hot and cold water supply lines feed the spray head, and the operator can adjust the mixed water temperature leaving the spray head. Low-flow, high-efficiency pre-rinse spray heads are available that produce a fan-like spray pattern that removes the food particles just as effectively as standard heads. These high-efficiency heads generally have a much lower flowrate than standard models. Replacing old heads with this type saves energy by reducing the gas or electric energy required to heat the hot water.

The California Urban Water Conservation Council's Pre-Rinse Spray Head Distribution Program installs high-efficiency pre-rinse spray heads in food service establishments throughout the natural gas service areas of the three largest investor-owned utilities in the state, Pacific Gas & Electric, Southern California Gas, and San Diego Gas & Electric. The program implementer relies on direct installation of these heads by trained field staff. At participating establishments, the installer removes the old head and replaces it with a high-efficiency unit, free of charge to the establishment.

1.2 EM&V Objectives

Our Evaluation, Measurement, and Verification (EM&V) effort was designed to meet the objectives listed in the California Public Utilities Energy Efficiency Policy Manual[1]. These objectives, and the manner in which we achieved them, are as follows:

1. **Measuring level of energy and peak demand savings achieved**.

   The primary objective was to verify energy savings from this program for each energy utility service territory. We accomplished this by gathering data on the retention rates for the efficient spray heads and by measuring hot water usage and other performance parameters. This approach is consistent with the International Performance Measurement and Verification Protocol (IPMVP), Option B – Retrofit Isolation, which calls for short-term metering at the device level.

2. **Measuring cost-effectiveness**.

   We applied verified gas energy savings to re-assess program cost-effectiveness. This included computing new total resource cost (TRC) values using the workbook developed by the program implementer for its program implementation plan (PIP).

3. **Providing ongoing feedback, corrective/constructive guidance regarding implementation of programs.**

   After each of the first three rounds of sampling, we reported spray head retention rates, customer levels of satisfaction with spray head performance, and preliminary estimates of gas savings for that round on an unweighted basis.

[1] Version 2, prepared by the Energy Division, and released in August 2003.

4. **Providing up-front market assessments and baseline analysis.**

   The program implementer and the Food Service Technology Center (FSTC) performed "up-front" analyses of market potential and baseline usage to develop their proposal. Based on additional data provided by the program implementer as the program has taken its course, as well as evaluation data, we refined and adjusted estimated baseline conditions.

5. **Measuring indicators of effectiveness.**

   The program implementer has evaluated the program's marketing effectiveness and penetration levels on an ongoing basis. Extensive data gathered by field installers provided the implementer with effectiveness measures and with guidance for corrective action as warranted.

6. **Assessing the overall levels of performance and success.**

   Our evaluation of retention rates, savings per head, and program savings and cost-effectiveness provides a complete assessment of the program's performance and success from an energy perspective.

7. **Informing decisions regarding compensation and final payments.**

   To the extent that the CPUC finds these EM&V results to be useful, the EM&V efforts satisfy this objective.

8. **Helping to assess whether there is a continuing need for the program.**

   This CUWCC program is a pilot designed to test the outreach approach, realized savings, and cost effectiveness of free distribution of an inexpensive device. Energy savings results will be considered together with market saturation and customer satisfaction to assess whether it is worthwhile to continue the program.

1.3 Report Overview

The report is organized as follows:

Chapter 2:	Describes the sources of data used in the evaluation, and the methodology for developing samples, determining spray head retention rates, and calculating savings at the head, site, and program levels.
Chapter 3:	Presents evaluation findings on spray head performance, retention rates, per head savings, and program-level savings. Also documents program cost-effectiveness and market barriers.
Chapter 4:	Provides conclusions based on the analysis results.
Chapter 5 (Appendix):	Contains details of field data and savings calculations retention survey instruments and.

2. Methodology

2.1 Overview

This evaluation relied on a variety of techniques and data sources to assess the energy savings and effectiveness of the program. These included telephone surveys, short-term metering and one-time measurements at installation sites. They also included laboratory bench tests, industry standards, and engineering calculations. The evaluation methodology was designed to answer the following questions:

1. What is the average hot water energy savings per spray head? Estimates of gas and electric savings (depending on the water heating source) were developed based on flow metering performed at 19 randomly selected sites.

2. What is the retention rate for efficient pre-rinse spray heads? Preliminary data were gathered in the first three rounds of sampling to provide early feedback to the program implementer. A fourth round was conducted at the conclusion of the installation period. Respondents for the first three rounds were re-contacted in February 2004 to gather the information needed to determine the final first-year retention rate.

3. What are the total program energy savings for each of the energy utility service areas served by this program? Estimates of spray head retention rates and average unit savings were derived for various strata in the random sample design. These were applied to the total installed spray head counts for these strata in each utility area and summed to derive total savings.

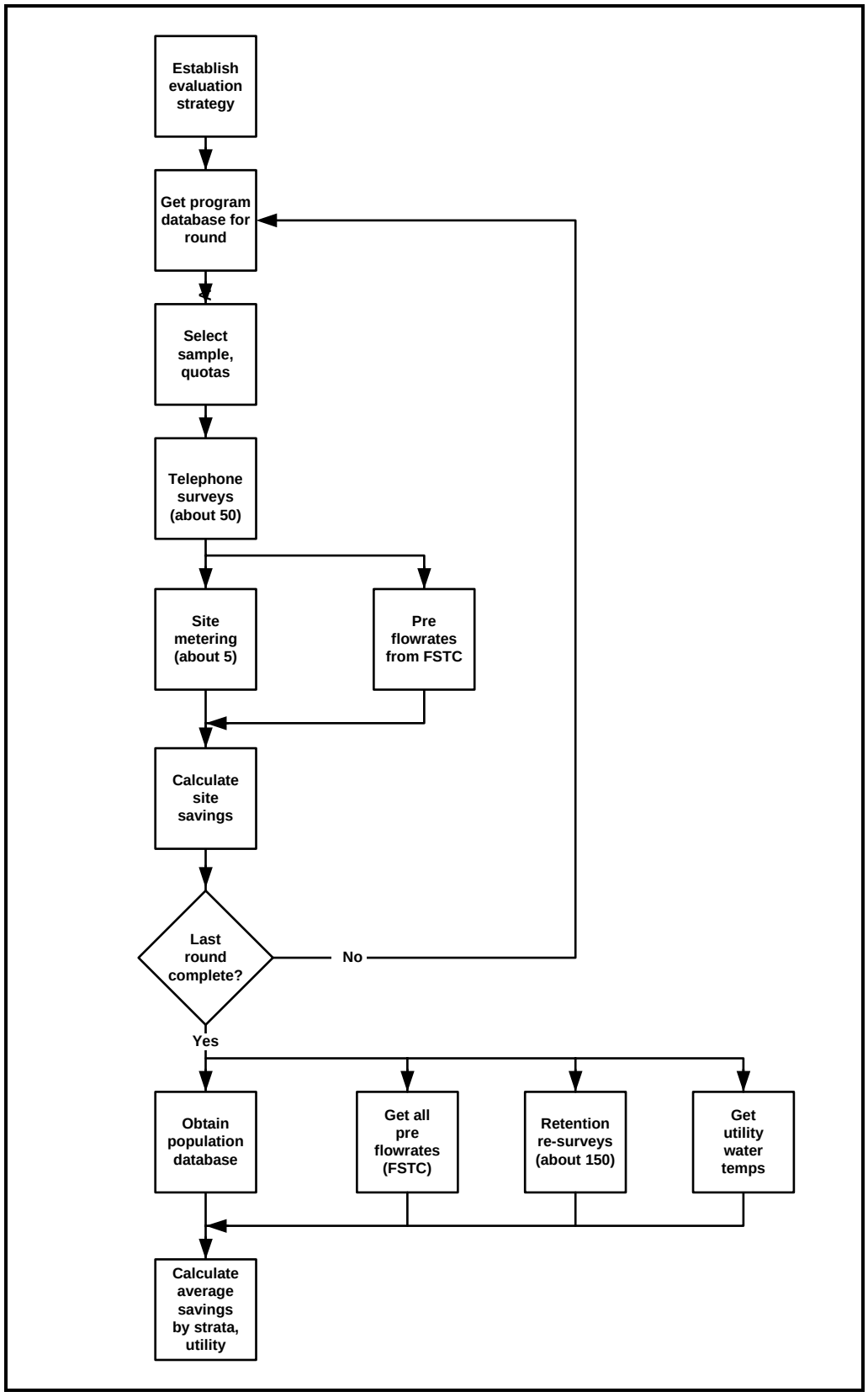
4. What is the program's cost-effectiveness? The verified unit savings and retained units were entered in the program implementer's PIP workbook and new TRC values were calculated to determine cost-effectiveness.

5. What are the major market barriers? The program implementer documented major findings from their continuous market barrier assessment process that was based on tracking data collected by the sales force.

This EM&V methodology is consistent with the requirements of the IPMVP Option B: Retrofit Isolation. Savings were based on direct measurements of the affected hot water end use for a random sample of participants. Figure 2-1 illustrates major steps in the evaluation process.

There are two possible sources of error in the savings calculations that are not addressed by our measurement and analysis design. The first is the "washing" effectiveness of the efficient pre-rinse head. If they are less effective at cleaning dishes, then the possibility exists that operators would have to spend more time rinsing, thus reducing potential savings. Research conducted by FSTC, however, provides ample evidence that efficient heads are at the least, equally effective in cleaning dishes as the head they replace, so our estimates of saving should be conservative. The second is the assumption that the one-time measured hot water temperatures are constant. The likely variations in the hot water temperature did not justify the expense of logging hot water supply temperature over the measurement period, as this would have resulted in a reduction in the number of installations metered. Since one-time measured hot water temperatures are inevitably the same or lower than the water heater setpoint, these values should also provide conservative savings estimates.

Figure 2-1: Evaluation Flowchart



2.2 Sources of Data

Our evaluation relied on eight key data sources, each of which is described below:

A. **Implementer program database** listing all sites at which at least one spray head was installed, along with the number of heads installed, address, phone number, contact information, gas utility, water service provider, and the stratification variables (establishment size and hours of use).

B. **Evaluation telephone retention surveys**, which measured customer satisfaction with the efficient spray heads, as well as the rate at which they removed or modified them. The appendix contains copies of the survey instruments.

C. **Evaluation field measurements** of efficient spray head flowrates, spray head hot (and sometimes cold) water usage over an extended period (generally about five weeks), water pressures and temperatures, hot water heating type, and any special circumstances that affected savings estimates. We collected these measurements at 19 sites that had been pre-qualified during the telephone surveying.

D. **FSTC test lab measurements** at standard conditions of old spray head flowrates for sampled sites. These included all but one of the old spray heads at the 19 metered sites, as well as 153 additional, randomly-selected heads. The FSTC also provided curves of water pressure vs. spray head flowrate for standard spray heads, developed from numerous lab measurements of spray heads that the program implementer used to establish baseline flowrates.

E. **CUWCC "cold water" field surveys** of a random sampling of 121 installed spray heads at 89 sites, undertaken to establish a more robust estimate of the number of establishments that used strictly cold water for their spray heads. These surveys also provided mixed water temperatures to supplement those taken at the 19 metering sites.

F. **Water providers' average supply temperatures**, for which program administrators attempted to obtain the best available data on annual water supply temperatures for all regions of California. These temperatures served as estimates of average annual cold water temperature that the hot water heater serving the spray heads actually "sees." The quality and availability of this information varied widely.

G. **1999 Commercial Building Survey Report**. This document, prepared by PG&E, summarizes the results of nearly a thousand onsite surveys of commercial facilities in buildings throughout northern and central California. It provided the best available estimate of the split between electric and gas domestic water heating in commercial buildings, including food service establishments. No such document was available for southern California, but it seemed safe to assume that regional differences in water heating practices between the north/central and southern parts of the state are relatively minor.

H. **FSTC gas and electric water heating system efficiencies.** The FSTC provided their standard assumptions about the overall system fuel conversion efficiency for gas and electric domestic water heating systems. Their conservative estimates of 70% and 90%, respectively, included idling losses, line losses, and heater efficiencies. These values are consistent with efficiency ranges published by the U.S. Department of Energy / NREL.

2.3 Sampling Approach

The sample sizes were constrained by the available budget. We allocated funds based on the degree of uncertainty in various factors that determine savings from this measure. We felt that the greatest uncertainty in estimating savings is related to the operating time (or total hot water flow) for the pre-rinse heads. Therefore we assigned the largest share of the data collection budget to direct metering of hot water flows for 19 installations. Other important factors for the savings calculation are the change in flow rate (old versus new heads) and the retention rate for important strata of the participant population. We devoted the balance of our budget to the getting this data for about 200 sites, which was as large a sample as the budget would allow.

We selected a stratified random sample of participants to be contacted for the retention surveys. To determine the strata, we first examined an extract from the implementer's tracking database early in the project that contained the first 20% of the sites. The variables that appeared best able to explain the variation in savings among installations were the average hours per day the spray head was in use, as reported by the customer, and establishment size (very small, small, and medium) classified according to the number of employees. Initial data showed that medium-sized facilities were quite uncommon, so we classified small and medium-sized facilities together. Thus we defined the four strata shown in Table 2-1.

Table 2-1: Evaluation Strata Definitions

Stratum	**Spray head hours of use** (reported by customer)	**Establishment size** (based on # of employees)
1	Low (≤ 3 hours/day)	Very small (VS)
2	High (> 3 hours/day)	Very small (VS)
3	Low (≤ 4 hours/day)	Small (S) or Medium (M)
4	High (> 4 hours/day)	Small (S) or Medium (M)

We then allocated the telephone sample in proportion to the likely savings in each stratum. For this allocation, the surrogate for site-level savings was the product of the heads installed at the site and the reported spray head hours of use. We then randomly selected samples for the four rounds of telephone surveys at four points during installation activity (after approximately 26%, 37%, 71% and 100% complete). These samples were sufficiently large to permit the telephone surveys to complete 50 surveys in each round, for a total of 200 surveys. They contained randomly generated rankings, so that surveyors could select a replacement by simply going to the next entry on the list.

The telephone survey served to develop the samples for baseline flow measurements as well as for post-installation metering. Pre-rinse spray heads removed from sites that successfully completed the telephone survey constituted the sample of baseline spray heads used to determine baseline spray head flow rates. The telephone survey asked respondents questions to qualify and recruit sites for end use metering.

For each of the four rounds, we repeated the following process to select sites for end use metering. We took the subset of qualified, willing sites, and excluded any sites that were so geographically far removed that the cost of end use metering would have been prohibitively expensive. Overall, the number of such sites was small. Out of the remaining sites, we randomly ranked them within their respective strata. We

established strata quotas for each round so that overall, each stratum would be reasonably well-represented, and the strata with the highest counts would receive proportionally more metering. The metering installer then contacted and visited the sites in the specified order to meet the quotas. If a given site proved unsuitable because of plumbing issues, then the metering installer moved on to the next site until he reached the quotas. Overall, we metered 19 sites--five each in Rounds 1-3, and four in Round 4.

2.4 Retention Rates

We assessed the annual retention rate for efficient pre-rinse spray heads installed by the program, that is, our estimate of the percentage of heads installed by the program that still remain in place after one year. The primary source of data was the retention surveys described above. These were administered in four rounds (after approximately 26%, 37%, 71% and 100% of installations complete). Each round of surveying occurred at least 45 days after the efficient heads were installed at the sites, so that food service staff could become accustomed to the new head before answering questions. Key retention questions in the survey included:

- How satisfied are you with the performance of the pre-rinse spray heads?
- Of the pre-rinse spray heads installed, how many have been removed?
- If any were removed, what is the primary reason you removed the spray head(s)?
- Have any of these pre-rinse spray heads been modified in any way by physically altering or replacing any part? (for example, have any of the heads been drilled out or had the brass nozzles replaced?)

Aggregated responses to these questions were submitted to the implementer after each round of telephone surveying.

In February 2004, we recontacted respondents from the first three rounds of surveys in all cases where the site had not removed all installed heads. This resurveying occurred approximately three to 11 months after the initial surveying, and asked the same questions to assess further reductions in retention rates or satisfaction levels. These results, combined with the original survey results, yielded a final annual retention rate that could be applied to estimate program savings. This rate includes not only instances when survey respondents explicitly stated that they removed heads, but also includes a small allowance for sites where the original business could no longer be reached. Common sense, as well as observations in the field, dictates that some unreachable establishments are no longer open as food service establishments.

2.5 Site-Specific Savings

2.5.1 Field Data Collection

We conducted data collection, end use metering, and analysis for 19 sites qualified through the telephone survey. These sites met several criteria, including (a) willingness for us to install short-term metering, (b) temperature adjustment valves dedicated to the spray head, so that the metering does not capture faucet use, and (c) flexible hose connections underneath the sink suitable for installing a temporary flow meter. Our field data collection staff visited each of these sites and collected the following data for the one of the pre-rinse spray heads at the site:

General business operation

- Business hours
- Nominal annual operating days
- Seasonal changes in hours of operation

Efficient spray head information

- Flowrate (measured twice)
- Spray head mixed water temperature
- Signs of spray head removal or tampering
- Customer comments on performance,
- Any notes related to savings quantification

Short-term flow measurements (using evaluation water meters)

- Flowmeter serial number(s)
- Hot water meter initial and final gallon readings
- Cold water meter initial and final gallon readings (when applicable)
- Dates and times of initial and final readings
- Distance between meter and spray hose flex connection

Water system characteristics

- Pressure at evaluation water meter
- Kitchen cold and hot water temperatures
- Water heater type

At each of the 19 sites, we left the water flow meters in place for approximately five weeks, then returned to remove the meter and restore the plumbing connections to the pre-rinse spray head to their original condition.

2.5.2 Savings for Metered Sites

For each sampled site at which we installed flow meters, we calculated annual gas savings in the following manner:

1. For each metered spray head, we consolidated all field observations, measurements, and metering results. We then calculated daily and annual gas use for the post-installation case. In cases where electricity was the source of domestic hot water for the spray head, we assumed gas water heating for this step, then made adjustments to account for the overall distribution of gas and electric heating at the program level (as described in Section 2.6). As necessary, we adjusted results to account for anomalous field conditions, seasonal effects, and missing data so that calculated usage best represents "typical" conditions. Key equations for calculating post gas usage are:

    - *Post daily hot water use (gallons/day) = Metered hot water usage (gallons) ÷ elapsed metering time (days)*

    - *Post annual hot water use (gallons/year) = Post daily hot water use (gallons/day) × equivalent annual operating days (days/year)*

- *Post annual gas use (therms/year) = [Post annual hot water use (gal/yr) × Density (8.29 lb/gal) × Specific heat (1.0 Btu/lb/°F) × (Spray head hot water temp (°F) – Average cold water supply temp (°F))] ÷ [(100,000 therm/Btu) × 70%[2] Gas system efficiency)]*

From measured hot/mixed temperature readings, measured post flowrate, and an assumed average cold water supply temperature, we also calculated the average hours of spray head use per day, as follows:

- *Daily time of use (hours/day) = [Post daily hot water use (gal/day) × (Hot water temp (°F) – Cold water temp (°F)) ÷ (Mixed water temp (°F) – Cold water temp (°F))])] ÷ [(60 minutes/hour) × Post spray head flowrate (gal/min)]*

2. We obtained the flowrate for the corresponding old spray head at the site (the spray head replaced by the one that we metered). This came from FSTC lab testing under standard conditions at a pressure of 60 psig. We then applied standardized water supply pressure vs. flow curves developed by the FSTC, as well as standard hydraulic engineering calculations to estimate the pre (baseline) flowrate at the actual water supply pressure at each site.

3. Annual gas use for the pre-installation case was determined by multiplying the annual post gas usage by the ratio of the pre and post flowrates. Gas savings equaled the difference between post and pre usage.

- *Post annual gas use (therms/year) = (Pre spray head flowrate (gal/min) ÷ Post spray head flowrate (gal/min)) × Post annual gas use (therms/year)*

4. We then summarized results for all 19 metered sites by calculating averages for each of the four strata of the following quantities: pre flowrates, post flowrates, mixed water temperatures, hot water temperatures, water supply pressures, and gas savings.

2.6 Program Savings and Cost-Effectiveness

Extrapolating the site-level savings results to the program as a whole required six discrete steps that incorporated all remaining data sources. Each step is described in detail below.

A. **Adjust average savings to include all measured pre flowrates:** The FSTC provided flowrates for 171 old spray heads. We calculated average flowrates per site, since some sites had more than one affected spray head. For each stratum, the average flowrate was calculated, and this average was adjusted, as described previously, to account for the average supply pressure measured in the field for the strata. We then calculated a supply pressure savings adjustment factor for each stratum, and multiplied the raw savings by this factor:

Pre flow savings adjustment factor = (average pre flowrate for all FSTC measurement sites in stratum - average post flowrate for all metered sites in stratum) / (avg pre gpm for all metered sites in stratum – average post flowrate for all metered sites in stratum).

B. **Apply additional mixed water temperature measurements:** We combined the independent random sample commissioned by the program implementer of mixed water temperatures for 121 spray heads with the mixed water temperatures for the 19 metered sites, to get a total of 140 data points from which to determine the best possible estimate of average mixed water temperature for

[2] Value provided by the Food Service Technology Center.

all sites. Since no additional hot and cold water temperatures beyond those obtained at metering sites were available, we used the average values for these. The resulting savings adjustment factor was calculated thusly:

> *Mixed temperature savings adjustment factor = (combined average mixed water temp – metered average cold water temp) / (metered average mixed water temp – metered average cold water temp).*

Gas savings for each stratum were adjusted by multiplying by this factor.

C. **Adjust for regional differences in water supply temperatures**: We determined average annual water supply temperatures for five California regions based on available water utility data (Contra Costa, East Bay, Sacramento, South Bay, and Southern California south of Santa Barbara). The average water supply temperature for the first three regions listed is below the standard 68°F that was assumed for the metered sites and all of Southern California. We applied still another factor to increase gas savings for sites in the three regions. This factor was calculated as follows:

> *Water supply temperature savings adjustment factor = (metered average hot water temp – regional average cold water temp) / (metered average hot water temp – 68°F)*

D. **Calculate average unit savings per strata**: All sites in the final program database were assigned to one of four strata based on their reported hours of spray head operation and establishment size. We summed gas savings by strata, and determined average gas savings per spray head for each strata. From the PG&E CBECS data, we estimated that about 74% of all sites heat domestic water with natural gas, and the remaining 24% used electric resistance heat. From FSTC values of 70% and 90% efficiencies for gas and electricity, respectively, we calculated the corresponding percentages of gas savings in therms/year/head and therms/day/head, and electric savings in kWh/year/head and kWh/day/head for each stratum.

E. **Apply spray head retention rate:** From the telephone retention survey and re-survey data, we estimated the first-year retention rate—that is, the percentage of installed spray heads still providing savings one year after the start of the program. Because of the small numbers of attrition detected by the surveys, we did not attempt to calculate retention rates by stratum. Instead, we developed a program-wide retention rate, and multiplied the final database counts of spray heads by utility by this rate to estimate the retained spray head counts.

F. **Calculate total utility and program savings:** For each utility, we summed the gas and electric savings and database spray head counts across all strata. The total utility savings divided by the total utility spray head count provided the average per head savings for the utility. We then multiplied the utility database spray head count by the retention rate, apportioned the retained count into gas- and electrically-heated counts by strata and utility, and multiplied these by the corresponding unit savings to determine overall program and utility-level savings estimates.

Finally, we used the evaluated savings to determine program cost-effectiveness. The program implementer updated the PIP workbook to include evaluation findings. This involved adjusting the total verified number of spray heads installed (based on final tracking database information and the results of the retention analysis) and the savings per spray head for each energy utility.

2.7 Program Market Barriers

The program implementer and contractor collected information on program market barriers throughout implementation. The need to define the market, to assess barriers, to determine strategies for overcoming those barriers, and to collect participant feedback existed from its inception and was critical to its success. Field staff collected data by observing equipment installed at customer sites and staff reactions to their sales efforts. The food service operators that permit the installations were not familiar with the program, having been contacted on a "cold call" basis, and neither were they willing to set aside much time for a survey. Both participants and non-participants were asked at the time of the "cold call" for their reasons for participating or not. The program implementer documented major findings from this continuous process of market barrier assessment—their summary is included in the results section of this report.

3. Results

This section presents key findings of the evaluation, including program baselines, sample dispositions, summaries of engineering data, and savings results per head, per utility, and for the program overall.

3.1 Program Goals

The implementer's ex ante estimate of savings per spray head are shown in Table 3-1 for spray heads installed in "very small," "small," and "medium" sized restaurants served by this program. The program based establishment size designations on the number of employees at the facility.

Table 3-1: Ex ante savings per head

Establishment size	Hours of usage per day	Water savings per spray head (gal/day)	Gas savings per spray head* (therms/day)
Medium	6	300	2.0
Small	4	200	1.3
Very small	2	100	0.7

*Assumes a water heating efficiency of 70% and a 55°F temperature rise.

The program implementation plan laid out goals of 16,903[3] spray heads installed and 7.39 million therms/year of gas savings (based on an assumption of 437 therms/year of gas savings per spray head). The program implementer provided databases that documented all spray head installations that occurred during the program. We checked these databases, eliminated a few instances of duplicate data, filled in some missing values when possible, and developed a final combined program database. Table 3-2 summarizes our final accounting of program installations from this edited database. By applying the ex ante gas savings per head to the final spray head counts, we also developed a revised estimate of projected savings for each utility and the entire program.

As the table shows, the program installed 16,975 spray heads at over 13,000 sites. The number of installed heads slightly exceeds the goal of 16,900 heads. Note that this site count is rather rough, since the definition of a "site" varied considerably in the database. Over half of the heads were installed at establishments served by SoCalGas. Another quarter of the heads were installed at sites with Pacific Gas & Electric service, and the last 16% at San Diego Gas & Electric sites. About half of the spray heads (53%) were found in "very small" establishments, and only 5% were in "medium" facilities. Apparently, this distribution is weighted more heavily towards "very small" and "small" facilities than the program first envisioned.

The revised program gas savings based on the final establishment size distribution is about 6,305,000 therms annually. This is about 85% of the program gas savings goal of 7,400,000 therms/year. This result indicates that difference in establishment size distribution alone reduced the gas savings by nearly 1.1 million therms/year (15%). Other reasons for differences between evaluation and program estimates of savings are discussed further below.

[3] Broken out by gas utility as follows: PG&E--4,290, SCGC--9,907, SDG&E--2,706 installed heads.

Table 3-2: Breakdown of Final Program Installations

Gas utility	Establishment size	# of sites	# of spray heads	% of all spray heads	Ex ante gas savings (therms/year)
Pacific Gas & Electric	M	179	277	2%	202,210
	S	1,222	1,651	10%	783,400
	VS	2,256	2,434	14%	621,887
	Subtotal	**3,657**	**4,362**	**26%**	**1,607,497**
San Diego Gas & Electric	M	62	165	1%	120,450
	S	717	1,120	7%	531,440
	VS	1,259	1,422	8%	363,321
	Subtotal	**2,038**	**2,707**	**16%**	**1,015,211**
SoCalGas	M	146	376	2%	274,480
	S	3,157	4,444	26%	2,108,678
	VS	4,720	5,086	30%	1,299,473
	Subtotal	**8,023**	**9,906**	**58%**	**3,682,631**
PROGRAM TOTAL	M	387	818	5%	597,140
	S	5,096	7,215	43%	3,423,518
	VS	8,235	8,942	53%	2,284,681
	TOTALS	**13,718**	**16,975**	**100%**	**6,305,339**

*Based on the following per head savings assumptions for a given site:

	therms/day
M (medium)	2.0
S (small)	1.3
VS (very small)	0.7

3.2 Sample Disposition

Table 3-3 summarizes the samples taken to support the various evaluation activities. We randomly selected, at different points during implementation, four sample groups on which to conduct telephone retention surveys. We completed a total of 207 surveys that accounted for 249 spray heads (about 1.5% of all installed spray heads). The program implementer shipped most of the original spray heads at these sites to the FSTC so the latter could determine average flowrates for each head at standard conditions. The FSTC ultimately tested 171 spray heads (1.0% of all installed heads). We installed short-term metering at 19 sites (each with one spray head) that had been pre-screened for suitability during the retention survey. During field visits, we also determined that many pre-screened sites were actually unsuitable for hot water metering for a variety of reasons, such as lack of independent water controls for the spray head, soldered copper plumbing, and change in business status. As a result, it was a challenge to find 19 sites for metering, even with a population of 207 surveyed sites.

Early results from the metered sites showed an unusually high number of spray heads using cool water for washing. To obtain a better sense of how prevalent this practice was, the program implementers commissioned a third party firm to perform unannounced visits at randomly selected sites to determine the mixed water temperature at that point in time. This firm visited 89 sites and took temperature measurements for 121 spray heads to supplement the 19 metered spray heads.

Table 3-3: Sample disposition

Strata	Establishment size	Reported hours of spray head use	Program totals		Retention survey		Measured pre flowrates*		Onsite metering	Measured mixed water temperatures**	
			# of sites	# of spray heads	# of sites	# of spray heads	# of sites	# of spray heads	# of sites/spray heads	# of sites	# of spray heads
1	VS (very small)	3 hours/day or less	6,779	7,271	68	80	51	62	6	--	--
2	VS (very small)	More than 3 hours/day	1,456	1,674	35	35	24	24	4	--	--
3	S (small) or M (medium)	4 hours/day or less	4,674	6,652	72	102	48	58	6	--	--
4	S (small) or M (medium)	More than 4 hours/day	809	1,378	32	32	27	27	3	--	--
PROGRAM TOTAL			**13,718**	**16,975**	**207**	**249**	**150**	**171**	**19**	**89**	**121**
% of program total					1.5%	1.5%	1.1%	1.0%	0.1%	0.6%	0.7%

* Heads selected by evaluator, measured by Food Service Technology Center.

** Heads randomly selected and temperatures measured by independent contractor hired by program implementer.

3.3 Engineering Measurements

3.3.1 Metered Sites

Measured conditions varied widely at the 19 sites where we installed flow meters. Table 3-4 shows average, maximum, and minimum values for relevant pressures, flows, and temperature, as well as intermediate calculated results. Many of the extreme values are most likely the result of anomalies peculiar to a site. For example, low pre flowrates could result from a clogged or malfunctioning spray head. The lowest post flowrate sprung from a flow restriction upstream of the spray head. Negative flow reduction probably occurred at one site because the old head was clogged, resulting in degraded performance. The new head used slightly more water, but provided superior cleaning performance. Further details of results at metered sites can be found in Table 5-1 in the appendix.

Table 3-4: Summary of Raw Results for Metered Sites

Number of sites / heads	***19***		
	Average	Maximum	Minimum
Pre flowrate (at 60 psig in lab)	**3.34**	5.84	1.25 gpm
Water pressure	**61**	100	33 psig
Pre flowrate (adjusted)	**3.35**	7.08	0.74 gpm
Post flowrate	**1.11**	1.60	0.43 gpm
Flow reduction	**2.24**	5.71	-0.04 gpm
Cold water temperature	**72.8**	81.0	63.5 F
Mixed water temperature	**108.6**	135.0	76.0 F
Hot water temperature	**134.4**	174.5	112.0 F
Daily spray head use	**1.27**	4.10	0.16 hours/day
Daily hot water use	**47.7**	108.0	5.6 gal/day/head

3.3.2 Pre flowrates

The FSTC measured flowrates for 171 old spray heads at a standard pressure of 60 psig. Flowrates ranged from 0.84 to 7.37 gallons per minute, with an average of 3.21 gpm. This latter value is slightly less than the laboratory value (3.34 gpm) for the subset of 19 old heads at the metered sites. For each stratum, we determined the average site pressure for metered sites, and applied that pressure to the average FSTC flowrate to estimate the corresponding "field" flowrate. The net effect of incorporating the larger sample of pre flowrates was relatively small—the maximum adjustment to savings that was necessary was only 6%. Table 5-2 in the appendix contains the FSTC data and calculation summaries.

3.3.3 Mixed water temperatures

The effect of incorporating additional mixed temperature measurements was considerably larger. The combined sample of 140 spray heads included 19 heads at metering sites and 121 heads from the supplemental sample. The average mixed temperature for the metering sites was 108.6°F, while at the other sites it was 121.4°F. The weighted average mixed temperature was 119.3°F. Incorporating the latter mixed temperature with the average hot and cold water temperatures at the metered sites, we calculated a gas savings adjustment factor of 126% to account for the additional savings that higher mixed water temperatures would yield. Mixed temperature data and the calculations underlying the factor can be found in Table 5-3 in the appendix.

3.3.4 Water supply temperatures

Information collected from a variety of water providers throughout the state suggested that a sizeable difference in the average annual water supply temperatures exists between northern and southern California. Many northern sources are snowmelt-fed reservoirs, leading to cooler supply temperatures. Table 3-5 lists the supply temperatures, by water regions defined by the evaluator, that we used to adjust the average savings estimates from the metered sites. Since all SoCalGas and SDG&E spray head installations fell within the SOCAL water region, no adjustment was necessary, since the average temperature was assumed to be 68°F, as it was in the metered site savings calculations. The average temperature across the water regions served by PG&E, however, had an average temperature (weighted by number of spray heads installed in each water provider) of 63.3°F. We increased the gas savings by as much as 17%, depending on the water provider, to account for the additional savings that colder supply water would yield. Over the entire program, the average water supply temperature was 66.8°F. Details of supply temperatures assigned to each water agency can be found in Table 5-4 in the appendix.

Table 3-5: Average Annual Water Supply Temperatures

Water Region Code	Water Region (as defined by evaluator based on available data)	Average annual temperature (F)
CONTRA	Contra Costa	64.3
EBAY	East Bay	61.0
SACTO	Sacramento	56.4
SBAY	South Bay	68.0
SOCAL	Southern California (sou	68.0
--	**ALL***	**66.8**

*Average weighted by installed spray head count

3.4 Unit Energy Savings

Table 3-6 shows the evaluated energy savings per spray head, by strata and for the entire program. These savings are expressed in therms for heads with gas water heating, and kWh for heads with electric water heating. Interestingly, savings per head are considerably higher for Strata 1 and 3 (0.88-1.03 therms/day/head) than they are for Strata 2 and 4 (0.67-0.72 therms/day/head). The Strata 1/3 sites are those with lower self-reported hours of spray head use than the Strata 2/4 sites. This suggests that the hours of spray head use reported by operators have little value in predicting relative savings at a site.

It is also worth noting that the evaluated average hours of spray head operation (1.27 hours/day) are considerably lower than the program assumption. The latter ranges from 2 to 6 hours/day.

Table 3-6: Evaluated Energy Savings per Spray Head

				Gas savings			Electric savings*	
Gas utility	**Strata**	**# of sites**	**# of spray heads**	Equivalent gas savings before retention adjustment (therms/year)	therms/ year/head	therms/ day/head	kWh/year/ head	kWh/day/ head
ALL	1	6,779	7,271	2,343,004	322	0.88	7,343	20.1
	2	1,456	1,674	448,937	263	0.72	5,993	16.4
	3	4,674	6,652	2,552,655	376	1.03	8,580	23.5
	4	809	1,378	341,722	245	0.67	5,573	15.3
TOTALS		**13,718**	**16,975**	**5,686,319**	**335**	**0.92**	**7,634**	**20.9**

*Gas savings converted to equivalent electrical savings assuming:

Gas efficiency	70%	per FSTC
Electric efficiency	90%	per FSTC

3.5 Retention Rates

In four rounds of surveying, we attempted to contact a total of 1,048 sites in order to complete 207 retention telephone surveys. These 207 sites account for 249 installed spray heads, of which we discovered that seven had been removed at the time of the survey. A re-survey of the first three rounds of surveys (151 sites) yielded 118 completed surveys at sites that accounted for 133 spray heads. We uncovered four additional heads that had been removed since the initial survey. In addition, we were unable to complete about 4% of the surveys because a phone number was incorrect or disconnected. We conservatively assumed that 5% of these bad phone numbers occurred because the site was no longer in business as a food service establishment. By synthesizing these findings, we developed a spray head first-year attrition rate of 5.2%, which corresponds to a retention rate of 94.8%. Table 5-5 in the appendix contains a summary of the retention survey data and the assumptions and calculations underlying this rate.

3.6 Program and Utility Energy Savings

We applied the first-year retention rate developed above to the installed spray head counts for each gas utility. This reduced the program spray head count from 16,975 to 16,089 heads. We then split the retained spray head count into those with electric and gas water heat, based on information from the PG&E commercial building survey that suggested a 27% electric / 73% gas split. Lastly, we multiplied the counts by fuel type and utility by the corresponding savings per spray head, and summed these values to determine program and utility energy savings. These are shown in Table 3-7. A more detailed breakdown of savings by utility and strata can be found in Table 5-6 in the appendix. Note that the savings per spray head are slightly higher for PG&E, primarily because of the lower water supply temperatures.

Table 3-7: Evaluated Energy Savings by Gas Utility

	SAVINGS PER SPRAY HEAD				SPRAY HEAD COUNTS						EVALUATED SAVINGS		
	Gas water heat		*Electric water heat*										
Gas Utility	therms/ year/ head	therms/ day/ head	kWh/ year/ head	kWh/ day/ head	# of heads installed*	First-year retention rate	Retained # of heads	% of all retained heads	# heads w/ gas heat***	# heads w/ electric heat***	Gas savings (therms/yr)	Gas equivalent savings**** (therms/year)	Electric savings (kWh/yr)
Pacific Gas & Electric	351	0.96	8,004	21.9	4,362	94.8%	4,134	26%	3,026	1,108	1,062,790	1,451,941	8,868,242
San Diego Gas & Electric	337	0.92	7,684	21.1	2,707	94.8%	2,566	16%	1,878	688	633,230	865,212	5,286,565
SoCalGas**	327	0.90	7,457	20.4	9,906	94.8%	9,389	58%	6,873	2,516	2,249,055	3,072,367	18,762,195
PROGRAM TOTAL	**335**	**0.92**	**7,634**	**20.9**	**16,975**	**94.8%**	**16,089**	**100%**	**11,777**	**4,312**	**3,945,075**	**5,389,520**	**32,917,002**

* From final program database.

** Utility electric savings in SoCalGas service territory would primarily accrue to Southern California Edison, LADWAP, and other electric utilities in the area.

*** Per PG&E 1999 Commercial Building Survey Report (Table 18), estimated domestic hot water heating fuel split for food service establishments is:

% gas	73.2%	6263800 gallons total capacity
% electric	26.8%	2293400 gallons total capacity

**** "Gas equivalent" consists of actual gas savings plus electric savings converted to savings had they been gas instead.

3.7 Realization Rates

Table 3-8 compares evaluation results with program estimates, showing realization rates—that is, the ratio of evaluated savings to program ex ante savings. This comparison is limited to gas savings, since the program did not estimate electric savings. For actual realized gas savings, the realization rate is 53%. If we convert the electric savings to gas savings—that is, essentially assuming as the program did that all water heating is gas-fired, the realization rate rises to 73%. This rate is less than unity for a variety of reasons—the most significant most likely being that the evaluated daily hours of spray head use (1.27 hours/day) are substantially lower than the program originally assumed (>2 hours/day). The realization rate is undefined for electric savings, but nonetheless, the quantity of realized electric savings is very large indeed.

Table 3-8: Realization Rates

	Number of spray heads installed*	Gas savings (therms/year)	Gas equivalent savings (therms/year)	Electric savings (kWh/year)
Program goal	16,903	7,386,611	7,386,611	0
Evaluated actuals	16,975	3,945,075	5,389,520	32,917,002
Realization rate	**100.4%**	**53.4%**	**73.0%**	**N/A**

* Program number based on 4,290 heads for PG&E, 9,907 for SCGC, and 2,706 for SDG&E.

** Program savings based on 437 therms/year/head.

3.8 Program Cost-effectiveness

The program implementer updated the PIP workbook to include evaluation findings summarized in Table 3-7, as well as final program costs. The cost-effectiveness modeling showed that TRC benefit-cost ratios for each gas utility were in fact higher than was originally projected in each case.

Table 3-9: Program Cost-Effectiveness Ratios

Gas utility	Original TRC ratio	Revised TRC ratio
Pacific Gas & Electric	10.07	10.34
SoCalGas	10.07	13.74
San Diego Gas & Electric	10.06	14.20

3.9 Market Barriers

Although the overall program response was exceedingly high at 39.6%, field staff did encounter program barriers that discouraged customer participation. The barriers were a mixed bag with some being "people-related", some being equipment and facility issues, and others being procedural limitations. As each barrier was encountered, program management attempted to mitigate its negative impact by designing a "fix" for the problem, whenever possible.

3.9.1 Language

Although 96.3 percent of all participants responded that they spoke English as a primary language, we still faced issues with communication and cultural barriers in specific communities. These barriers affected the response to the program offerings. The field crew was comprised of an ethnic and language mix of employees, which helped with the customer outreach process but did not eliminate the barriers.

Program management found that it was a straightforward task to hire qualified Spanish-speaking field staff to market the Program within the Latino communities. On the other hand, the Asian neighborhoods had an array of dialects spoken, as well a social attitude of a close-knit community that was closed to non-Asians. As such, it was extremely difficult to bridge the communication gap and closed circle of these Asian communities. However, we found that when a field canvasser of Asian descent entered into the Asian communities, regardless of the language spoken (Korean, Chinese, Japanese, etc.), the business owners were much more receptive.

Knowing that this avenue into Asian businesses would work, we then adopted it as our plan of attack. An Asian field installer was hired to handle most of the Asian communities. The installer had a much higher level of success and response rates went up as a result.

3.9.2 Skepticism

Non-English speaking communities, and in particular the Asian community, had a higher-than-average level of skepticism towards a program that offered free products and services. Believing that there was a "catch", these customers would turn down the program offer in order to protect themselves from a business offering that they believed was suspect and (in the end) costly.

To remedy this problem, the marketing materials and customer forms were overhauled to state even more clearly that there would never be a charge to the customer for the product and service offered. Additionally, language was added to the field installers' scripts to clearly explain this point to the customers and to tell them that the monies were awarded in a grant through the CPUC. All field installers received additional training and were required to participate in role playing to solidify the new elements regarding the program.

3.9.3 Health Inspectors and Fire Marshals

There were customers who did not want to participate in the program because they believed that the field installer was, in some way, connected with the city's health inspectors and/or fire marshals. The customer thought that saying "yes" to the program meant that the field installer would inspect the premise for code violations and report them to the authorities. Their suspicions increased when the installer asked questions about water temperature at the tap, thinking that this was a health issue. Furthermore, questions about the gas meter and account numbers exacerbated the situation.

Program staff designed new language to incorporate into the field installers' to ease customer concerns about the installer's role. Field staff provided additional training about this issue and conducted role playing to more effectively address customer fears.

3.9.4 Kitchen Performance

There were a few instances when the design of the restaurant sink or the water pressure at the sink caused a problem with the performance of the pre-rinse spray head. Customers tended to complain when the customer's spray head was installed at a round sink. Field staff realized that the new low-flow spray head's flat spray pattern was incompatible with the sink design because the spray was wide and needle-like and caused excessive amounts of overspray with small round sinks.

The second circumstance that caused performance problems occurred at sites with extremely low water pressure or extremely high water pressure. In low water pressure situations, the diminished pressure caused a weak spray pattern, lacking the water velocity to effectively clean food particles off the dishes. Conversely, water pressure that was too high caused over-spray that was unsatisfactory to the users.

Once staff recognized the problems causes by round sinks and low water pressure, installations were no longer performed in these circumstances.

All in all, 100 new low-flow spray heads were removed due to customer's dissatisfaction with the performance of the new spray head.

3.9.5 Three Sites Limitation

The largest participation barrier that burdened the Rinse & Save Program was the three sites per owner restriction. If an owner had multiple sites, they were limited in their participation to only three sites regardless of where the location crossed participating IOU territories, or whether the owner's sites were franchise or corporate backed. The field staff was contractually required to walk away from all sites where the owner that was listed on the business license had already reached their site "cap" despite its energy and water savings potential. The energy and water saving opportunity existed because there was a need for an efficient spray head. The customer's desire to participate existed, but field canvassers were not allowed to perform the installations. This caused some customer satisfaction issues, reduced the efficiency of the field crew, and left high water and energy use spray heads in the market.

Over time, this limitation gradually snowballed into a major challenge for the field canvassing staff. Two thirds of the way through the program, so many prime opportunity customers had reached the three-site limit that our canvassing response was driven down very dramatically, from 70% to 39%. Our field crews were bogged down with the responsibility of researching and cross-checking a potential customer only to find that the site was ineligible for program products and services. Even well-known chains had to be handled individually on a store-by-store basis. This is because most restaurant chains have both corporate-owned stores and franchisee-owned stores within the same geographic region. Additionally, with program borders spanning the entire state, real-time tracking and communication of owner names and limits to active field canvassers and installers was a tremendous challenge.

3.9.6 Territory Borders

Geography and boundaries impacted program response. In areas that fringed the energy utility service area boundaries and participating water agency boundaries, it was difficult to determine which restaurants were in-territory and which sites were out-of-territory. For example, neighboring restaurants located on the same side of the street would have different water providers, or one would be served by IOU gas, and

the other heated water with propane. Customers in these fringe or cross-over territories had to be carefully inspected and screened in order to determine which utilities were servicing the location. In order to perform within the appropriate boundaries, field installers erred on the conservative side, which resulted in less sites serviced.

3.9.7 Gas Account and Meter Numbers

Unlike the IOUs, the CUWCC had no available gas account and meter information when performing services at each site. Instead, the field installer was required to hunt down the information, which took a significant amount of time and labor. There were instances where meters were locked and there was no label identifying the service site. If we couldn't find the account or meter number we couldn't install the product or bill for the installation.

Southern California Gas Company, contractually obligated to provide account number support, was unavailable to help in these instances and was generally slow to provide the CUWCC with any account information.

3.10 Spray Head Washing Effectiveness

The Food Service Technology Center, as part of the development of this program, performed extensive testing on the "washing" effectiveness of the efficient pre-rinse heads. These tests served to confirm that the latter could clean dishes as quickly and effectively as standard spray heads. Staff at the FSTC developed a standard, ASTM-approved test procedure that controls for water pressure and temperature, piping configuration, dish orientation, and type of soiling on the dish. They then tested two types of standard spray heads with a circular spray pattern, as well as two types of efficient heads with the fan-shaped spray pattern. Staff used each type of spray head to fully clean a standardized soiled plate for sixty test runs, and then calculated average elapsed times. The average cleaning times for the two standard heads ranged from 19.1 to 24.9 seconds per plate, while the averages for the efficient heads ranged from 21.0 to 26.5 seconds per plate. The difference in averages was only about 8%. This fact, plus the significant overlap in ranges, was sufficient for the program to conclude that the washing effectiveness of the efficient spray heads is nearly the same as that of standard heads. Based on this development work, the FSTC and the program implementer developed a specification to quality efficient spray heads for the program.

4. Conclusions

Based on our evaluation, the CUWCC Pre-Rinse Spray Head Distribution Program is successfully providing significant energy savings to the State of California. These savings are on the order of nearly 4 million therms of natural gas and 33 million kilowatt-hours of electricity annually. The fact that the revised TRC benefit-cost ratios are higher than the original ones indicates that the program is even more cost-effective that was originally predicted.

It is important to note, however, that the program originally did not expect any electric savings, and that these electric savings come at the expense of gas savings. Fortunately, the evaluated energy savings shows a high rate of retention, with only about 5% of the efficient spray heads being removed from service over the first year. This is consistent with the high levels of customer satisfaction that the retention surveys uncovered.

5. Appendix

5.1 Measured data and key results

Table 5-1: Summary of Findings for 19 Metered Sites

FINAL RESULTS - 19 METERED SITES

Program tracking number	Strata*	Adjusted pre flowrate (gpm)	Post flowrate (gpm)	Mixed water temp (F)	Hot water temp (F)	Water pressure (psig)	Daily hot water use (gal/day/head)	Daily gas savings (therms/ day/head)	Annual gas savings (therms/ year/head)
W005369396	1	7.08	1.38	108.6	121.5	100	12.9	0.34	124
W005544789	1	1.78	1.10	108.0	135.0	48	23.2	0.11	41
W005550878	1	2.89	1.38	129.2	136.0	48	13.8	0.12	45
W005538547	1	2.64	1.00	87.8	113.0	65	30.0	0.26	96
W005615316	1	2.42	0.88	120.0	129.0	33	85.3	1.08	396
W005596836	1	5.02	1.25	135.0	135.0	60	96.2	2.30	841
W005614680	2	3.51	0.80	105.0	131.0	48	5.6	0.14	51
W005378726	2	0.74	0.43	110.0	135.0	56	35.3	0.21	76
W005363540	2	2.99	1.40	110.7	174.5	62	51.9	0.74	271
W005545710	2	2.83	1.00	97.5	125.0	42	108.0	1.34	488
W005608781	3	1.56	1.60	115.0	130.0	61	71.6	-0.01	-5
W005363205	3	3.27	1.10	105.0	130.0	61	29.7	0.43	157
W005353127	3	7.01	1.38	123.0	132.0	92	27.6	0.86	313
W005371274	3	3.24	1.03	132.0	156.0	72	47.2	1.05	384
W005364794	3	2.77	1.00	112.0	135.0	52	84.9	1.07	392
E25628814	3	6.81	1.60	105.0	112.0	100	73.8	1.25	457
W005363547	4	3.79	1.00	91.0	154.0	63	13.9	0.40	144
W005545897	4	2.11	0.75	76.0	140.0	40	47.7	0.73	268
W005359436	4	1.18	1.00	92.0	130.0	52			
Unweighted averages		**3.35**	**1.11**	**108.6**	**134.4**	**61**	**47.7**	**0.69**	**252**

AVERAGES BY STRATUM

N	Strata*	Adjusted pre flowrate (gpm)	Post flowrate (gpm)	Mixed water temp (F)	Hot water temp (F)	Water pressure (psig)	Daily hot water use (gal/day/head)	Daily gas savings (therms/ day/head)	Annual gas savings (therms/ year/head)
6	1	3.64	1.16	114.8	128.3	59	44	0.70	257
4	2	2.52	0.91	105.8	141.4	52	50	0.61	222
6	3	4.11	1.28	115.3	132.5	73	56	0.78	283
3	4	2.36	0.92	86.3	141.3	52	21	0.38	206

* Strata definitions:
1 - Very small establishment, <= 3 hours/day of spray head use.
2- Very small establishment, >3 hours/day of spray head use.
3 - Small or medium establishment, <= 4 hours/day of spray head use.
4 - Small or medium establishment, >4 hours/day of spray head use.

Table 5-2: Savings Adjustments for 171 Measured Pre Flowrates

SAVINGS ADJUSTED FOR ALL MEASURED PRE FLOWRATES

Strata*	Number of measured pre flowrates	Raw average flowrate (gpm)	Flowrate adjusted for average pressure (gpm)	Savings adjustment factor**	Annual gas savings (therms/ year/head)	Savings w/larger sample of pre flows (therms/ year/head)
1	62	3.39	3.31	0.97	257	250
2	24	3.15	2.95	0.94	222	208
3	58	3.32	3.49	1.05	283	298
4	27	2.85	2.67	0.94	206	193
Total =	**171**					
Avg. for all heads =		**3.21**				

* Strata definitions:
1 - Very small establishment, <= 3 hours/day of spray head use.
2- Very small establishment, >3 hours/day of spray head use.
3 - Small or medium establishment, <= 4 hours/day of spray head use.
4 - Small or medium establishment, >4 hours/day of spray head use.

** Factor = adjusted flowrate / raw flowrate

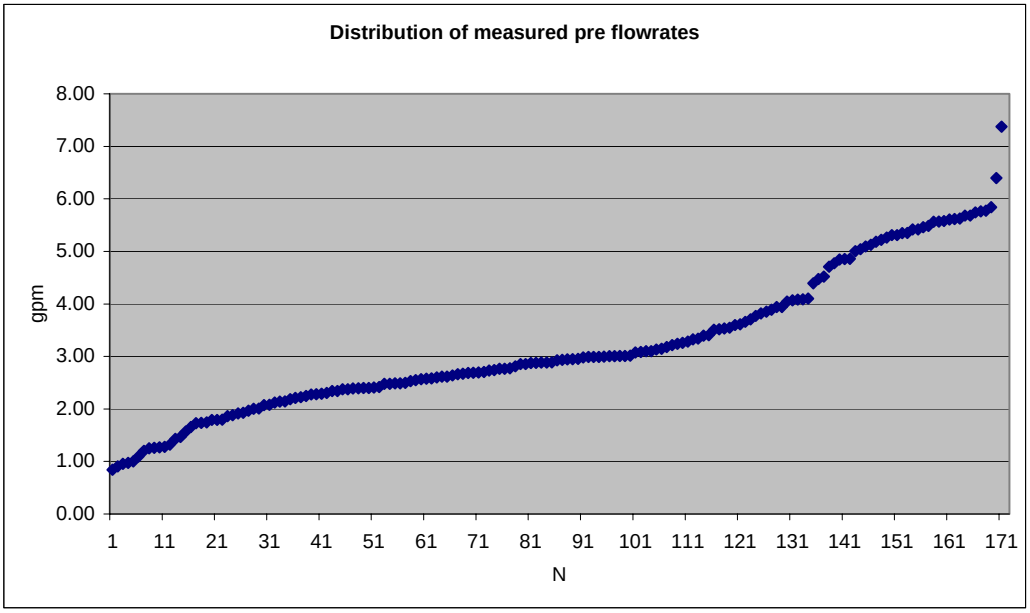


Table 5-3: Savings Adjustments for 140 Measured Mixed Water Temperatures

SAVINGS ADJUSTED FOR ALL MEASURED MIXED WATER TEMPERATURES

Strata*	Savings w/larger sample of pre flows (therms/ year/head)	Mixed water temperature adjustment factor	Savings w/larger sample of mixed water temperatures (therms/year/ head)**
1	250	126%	317
2	208	126%	263
3	298	126%	376
4	193	126%	245

* Strata definitions:
1 - Very small establishment, <= 3 hours/day of spray head use.
2- Very small establishment, >3 hours/day of spray head use.
3 - Small or medium establishment, <= 4 hours/day of spray head use.
4 - Small or medium establishment, >4 hours/day of spray head use.

** Equals savings multiplied by mixed water temperature adjustment factor (see details of factor calculation below).

Mixed temperature adjustment factor

Sample	Sample N	Temperature parameter	Variable/ formula	Value
All metered sites	N,a= 19	Cold water	T,ac	68.0 F
		Mixed water, not including 1 cold site	T,amn	108.6 F
		Mixed water for all metered sites	T,am	106.2 F
		Hot water	T,ah	134.4 F
Supplemental sample	N,s= 121	Mixed water (see distribution graph below)	T,sm	121.4 F
Combined (weighted)	N,c= 140	Mixed water	T,cm = ((N,a*T,am)+(N,s*T,sm))/N,c	119.3 F
Gas savings adjustment factor (combined/SBW delta T ratio)			=(T,cm-T,ac)/(T,amn-T,ac)	**126%**

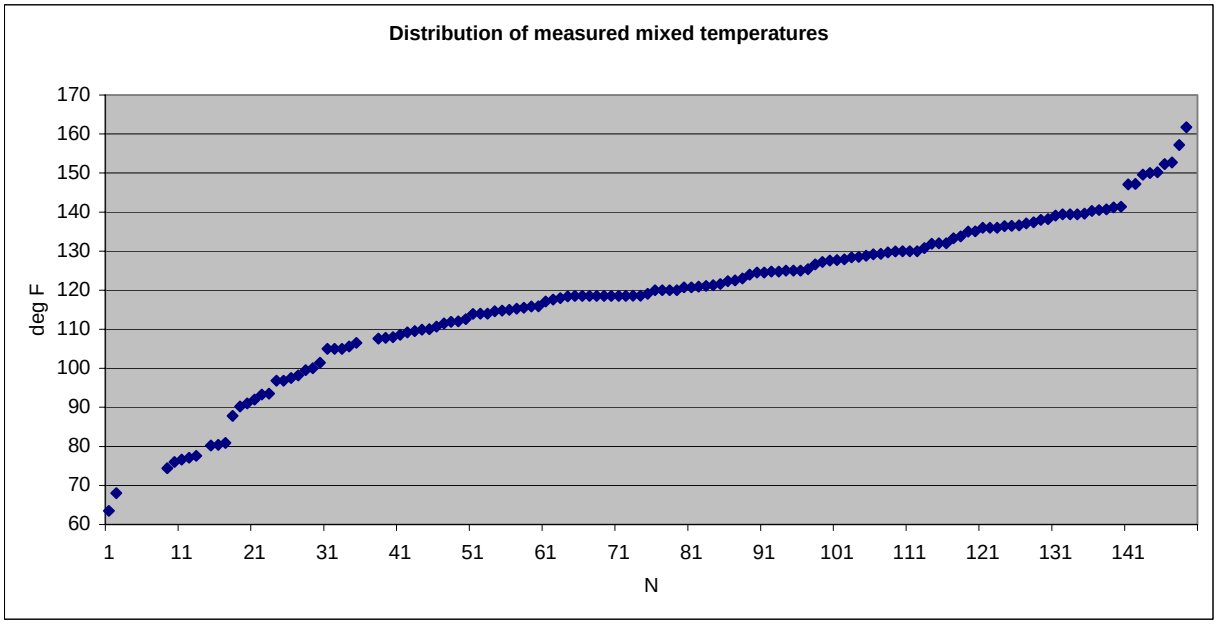


Table 5-4: Supply Water Temperatures Assumed for Each Water Agency

water_agency	gasprovider	SumOfnewprsv	Water Region	Water temp
Alameda County WD	PG&E	306	EBAY	61.0
Calleguas MWD	SoCal Gas	417	SOCAL	68.0
Central West Basin MWD	SoCal Gas	1411	SOCAL	68.0
City of Anaheim	SoCal Gas	300	SOCAL	68.0
City of Beverly Hills	SoCal Gas	161	SOCAL	68.0
City of Burbank	SoCal Gas	191	SOCAL	68.0
City of Compton	SoCal Gas	37	SOCAL	68.0
City of Fullerton	SoCal Gas	110	SOCAL	68.0
City of Glendale	SoCal Gas	170	SOCAL	68.0
City of Pasadena	SoCal Gas	281	SOCAL	68.0
City of Santa Ana	SoCal Gas	175	SOCAL	68.0
City of Santa Barbara	SoCal Gas	199	SOCAL	68.0
City of Santa Monica	SoCal Gas	58	SOCAL	68.0
City of Santa Rosa	PG&E	163	SBAY	68.0
City of Torrance	SoCal Gas	167	SOCAL	68.0
Contra Costa Water District	PG&E	298	CONTRA	64.3
Eastern MWD	SoCal Gas	223	SOCAL	68.0
EBMUD	PG&E	1322	EBAY	61.0
El Dorado ID	PG&E	18	SACTO	56.4
Foothill MWD	SoCal Gas	35	SOCAL	68.0
Inland Empire Utilities	SoCal Gas	437	SOCAL	68.0
LADWP	SoCal Gas	2674	SOCAL	68.0
Lake Arrowhead Community Serv. Dist.	SoCal Gas	16	SOCAL	68.0
Las Virgenes MWD	SoCal Gas	92	SOCAL	68.0
Marin MWD	PG&E	151	SBAY	68.0
MWD of Orange County	SoCal Gas	1608	SOCAL	68.0
North Of The River MWD	SoCal Gas	5	SOCAL	68.0
San Diego Water Auth.	San Diego Gas	2707	SOCAL	68.0
Santa Clara Valley WD	PG&E	1094	SBAY	68.0
SCWA-City of Petaluma	PG&E	89	SBAY	68.0
SCWA-City of Rohnert Park	PG&E	38	SBAY	68.0
SCWA-North Marin WD	PG&E	59	SBAY	68.0
SCWA-Sonoma County Water Agency	PG&E	45	SBAY	68.0
SFPUC	PG&E	300	EBAY	61.0
SRWA - Arden Cordova Water Service	PG&E	18	SACTO	56.4
SRWA - Carmichael WD	PG&E	8	SACTO	56.4
SRWA - Citrus Heights WD	PG&E	18	SACTO	56.4
SRWA - City of Roseville	PG&E	88	SACTO	56.4
SRWA - Fair Oaks WD	PG&E	12	SACTO	56.4
SRWA - Placer County Water Agency	PG&E	36	SACTO	56.4
SRWA - Sacramento City Water	PG&E	228	SACTO	56.4
SRWA - Sacramento Suburban WD	PG&E	19	SACTO	56.4
SRWA - San Juan Water District	PG&E	4	SACTO	56.4
SRWA- Orange Vale Water	PG&E	3	SACTO	56.4
SRWA-City of Folsom	PG&E	15	SACTO	56.4
SRWA-Del Paso Manor WD	PG&E	1	SACTO	56.4
SRWA-Elk Grove WSvc	PG&E	19	SACTO	56.4
SRWA-Rio Linda/Elverta CSD	PG&E	4	SACTO	56.4
SRWA-Sacramento County DWR	PG&E	6	SACTO	56.4
Three Valleys MWD	SoCal Gas	340	SOCAL	68.0
USGVMWD	SoCal Gas	437	SOCAL	68.0
West Muni WD of Riverside County	SoCal Gas	362	SOCAL	68.0
TOTAL		**16975**		

Table 5-5: Summary of Retention Rate Data and Calculations

FIRST-YEAR RETENTION RATE

Round	Approximate survey date	Install date in round: Earliest	Latest	Average	Days between averages	# sites - survey contact attempted	# sites- bad phone number	% of attempted sites w/bad phone #	n,sites surveyed	% contacted who were surveyed	Ratio - bad # to surveyed	n,heads surveyed	n, heads removed	% of heads removed
1	10-Apr-03	4-Oct-02	11-Feb-03	15-Dec-02	--	363	3	0.8%	55	15%	5%	55	1	1.8%
2	30-May-03	21-Nov-02	4-Apr-03	10-Mar-03	85	349	7	2.0%	51	15%	14%	59	0	0.0%
3	17-Nov-03	26-Nov-02	18-Sep-03	14-May-03	65	218	16	7.3%	51	23%	31%	65	4	6.2%
4	9-Feb-04	21-Feb-03	9-Dec-03	23-Oct-03	163	118	9	7.6%	50	42%	18%	70	2	2.9%
R1-3 combined				3-Mar-03		930	26	2.8%	157	17%	17%	179	5	2.8%
R1-4 combined						1048	35	3.3%	207	20%	17%	249	7	2.8%
5 (resurveys of R1-3)	8-Mar-04	4-Oct-02	17-Sep-03	6-Mar-03	*348*	151	10	6.6%	118	78%	8%	**133**	4	3.0%
R1-3 + R5 resurveys														**5.0%**

Steps in developing final attrition rate and retention rate

Average install date for Rounds 1-3 is March 2003, resurvey date is March 2004, so these surveys are a good representation of the entire first year.
Round 4 results agree well with Round 1-3 aggregate, and thus validate them.

First-year attrition (% of heads removed over entire year for sites surveyed)	**5.0%**	
Total sites in Rounds 1-3 - contact attempted	930	
Total sites in Rounds 1-3 - bad phone # discovered	36	
Total % of sites in Rounds 1-3 - bad phone # discovered	3.9%	
Assume these have switched to non-spray head use (e.g., change in building type, vacancy) at a rat	5.0%	(same as removal rate--conservative assumption)
Additional attrition estimated among sites with bad phone numbers	0.2%	
Final attrition rate	5.2%	
FINAL RETENTION RATE	**94.8%**	

Table 5-6: Energy Savings per Spray Head, by Gas Utility and Strata

				Gas savings			Electric savings*	
Gas utility	**Strata**	**# of sites**	**# of spray heads**	Equivalent gas savings before retention adjustment (therms/year)	therms/ year/head	therms/ day/head	kWh/year/ head	kWh/day/ head
PG&E	1	1,775	1,881	635,682	338	0.93	7,701	21.1
	2	479	549	153,063	279	0.76	6,354	17.4
	3	1,251	1,651	669,826	406	1.11	9,246	25.3
	4	152	281	73,449	261	0.72	5,957	16.3
San Diego Gas	1	1,122	1,244	394,046	317	0.87	7,218	19.8
	2	138	184	48,392	263	0.72	5,993	16.4
	3	721	1,194	449,530	376	1.03	8,580	23.5
	4	57	85	20,787	245	0.67	5,573	15.3
SoCal Gas	1	3,882	4,146	1,313,277	317	0.87	7,218	19.8
	2	839	941	247,482	263	0.72	5,993	16.4
	3	2,702	3,807	1,433,300	376	1.03	8,580	23.5
	4	600	1,012	247,487	245	0.67	5,573	15.3
ALL	1	6,779	7,271	2,343,004	322	0.88	7,343	20.1
	2	1,456	1,674	448,937	263	0.72	5,993	16.4
	3	4,674	6,652	2,552,655	376	1.03	8,580	23.5
	4	809	1,378	341,722	245	0.67	5,573	15.3
TOTALS		**13,718**	**16,975**	**5,686,319**	**335**	**0.92**	**7,634**	**20.9**

*Gas savings converted to equivalent electrical savings assuming:

Gas efficiency	70% per FSTC
Electric efficiency	90% per FSTC

5.2 Final Retention Survey

California Urban Water Conservation Council
Pre-Rinse Spray Head Distribution Program
Retention and Recruiting Survey

Introduction

Hello, may I please speak with [CONTACT]?

(Probe: I am calling on behalf of [PROVIDER] to follow-up on installation of high-efficiency pre-rinse spray heads at your establishment.)

Hello, my name is _____. I am calling on behalf of the [PROVIDER] to follow-up on the installation of a high-efficiency pre-rinse spray head at your establishment. I would like to ask you a few questions about the spray head, which should take no more than 5 minutes.

(Interviewer Note: The high-efficiency pre-rinse spray heads are use to spray dishes before they go into the dishwasher, and should have a blue rubber ring on them. Let the respondent know that the [PROVIDER] is simply interested in receiving some feedback about the spray heads, which is the purpose for this call. If now is not a good time to complete the survey, schedule a call back.)

Retention

Our records indicate that [INSTALL] pre-rinse spray head(s) was/were installed at your location on [DATE].

(Interviewer Note: If the respondent does not recall the installed pre-rinse spray head(s), terminate the interview.)

[Programming Note: Ask if INSTALL > 5, otherwise skip to TEXT2Q1a]

Q5Pb. How satisfied are you with the performance of the pre-rinse spray heads? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q5Pc. Of the [INSTALL] pre-rinse spray heads installed, how many have been removed?

ENTER NUMBER _____
98. (Don't know) →Terminate Interview

[Programming Note: Ask if Q5Pc >0]

Q5Pd. What is the primary reason you removed the spray head(s)?

ENTER VERBATIM _____

[Programming Note: Ask if INSTALL - Q5Pc > 0, otherwise skip to BYE]
Q5Pf. Have any of these pre-rinse spray heads been modified in any way by physically altering or replacing any part?

(Probe: Have any of these pre-rinse spray heads been drilled out or have the brass nozzles been replaced or have any other parts been replaced or modified?)

1. Yes →Skip to BYE
2. No→Skip to BYE
98. (Don't know) →Skip to BYE

[Programming Note: Use TEXT2Q1a if INSTALL > 1, otherwise skip to TEXT1Q1a]
TEXT2Q1a. I would like to address each pre-rinse spray head installed separately. After you describe the location for each spray head, I will ask you a couple of questions about that particular spray head, and then we will move on to another location. Where was the first high-efficiency pre-rinse spray head installed? [ENTER RESPONSE IN Q1a]

TEXT1Q1a. Where was this high-efficiency pre-rinse spray head installed? [ENTER RESPONSE IN Q1a]

(Interviewer Note: The goal with this question is to get the respondent to provide the "station" name or typical reference for each location of spray head installation. Probe for a "station" reference.)

Q1a.

ENTER STATION NAME _____

Q1b. How satisfied are you with the performance of this pre-rinse spray head? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q1c. Is this pre-rinse spray head still installed or did you remove it?

1. Installed →Skip to Q1e
2. Removed
98. (Don't know) →Skip to Q2a

Q1d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q2a

Q1e. Are you able to adjust the water temperature for this pre-rinse spray head independent from the faucet at this workstation or location?

(Probe: Can the water temperature for this pre-rinse spray head be adjusted separately from the faucet, or do you use the same adjustment (knob) for both the pre-rinse spray head and the faucet?)

1. Yes
2. No
98. (Don't know)

Q1e2. Are there flexible hose connections underneath the sink where the spray head standpipe is connected?

(Probe: We're trying to find out if an installer can put a water meter on the water supply line for the spray head. If the respondent is not certain, accept a qualified answer like "I think so." If the respondent is near the sink and cooperative, ask them if they would take a quick look to verify.)

1. Yes
2. No
3. (I think so)
4. (I don't think so)
98. (Don't know)

Q1f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

1. Yes
2. No
98. (Don't know)

[Programming Note: Ask if INSTALL >1, otherwise skip to Q11a]
Q2a. Where is the next high-efficiency pre-rinse spray head installed?

(Interviewer Note: The goal with this question is to get the respondent to provide the "station" name or typical reference for each location of spray head installation. Probe for a "station" reference.)

ENTER STATION NAME _____

Q2b. How satisfied are you with the performance of this pre-rinse spray head? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q2c. Is this pre-rinse spray head still installed or did you remove it?

1. Installed →Skip to Q2e
2. Removed
98. (Don't know) →Skip to Q3a

Q2d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q3a

Q2e. Are you able to adjust the water temperature for this pre-rinse spray head independent from the faucet at this workstation or location?

(Probe: Can the water temperature for this pre-rinse spray head be adjusted separately from the faucet, or do you use the same adjustment (knob) for both the pre-rinse spray head and the faucet?)

1. Yes
2. No
98. (Don't know)

Q2e2. Are there flexible hose connections underneath the sink where the spray head standpipe is connected?

(Probe: We're trying to find out if an installer can put a water meter on the water supply line for the spray head. If the respondent is not certain, accept a qualified answer like "I think so." If the respondent is near the sink and cooperative, ask them if they would take a quick look to verify.)

1. Yes
2. No
3. (I think so)
4. (I don't think so)
98. (Don't know)

Q2f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

1. Yes
2. No
98. (Don't know)

[Programming Note: Ask if INSTALL >2, otherwise skip to Q11a]
Q3a. Where is the next high-efficient pre-rinse spray head installed?

(Interviewer Note: The goal with this question is to get the respondent to provide the "station" name or typical reference for each location of spray head installation. Probe for a "station" reference.)

ENTER STATION NAME _____

Q3b. How satisfied are you with the performance of this pre-rinse spray head? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q3c. Is this pre-rinse spray head still installed or did you remove it?

1. Installed →Skip to Q3e
2. Removed
98. (Don't know) →Skip to Q4a

Q3d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q4a

Q3e. Are you able to adjust the water temperature for this pre-rinse spray head independent from the faucet at this workstation or location?

(Probe: Can the water temperature for this pre-rinse spray head be adjusted separately from the faucet, or do you use the same adjustment (knob) for both the pre-rinse spray head and the faucet?)

1. Yes
2. No
98. (Don't know)

Q3e2. Are there flexible hose connections underneath the sink where the spray head standpipe is connected?

(Probe: We're trying to find out if an installer can put a water meter on the water supply line for the spray head. If the respondent is not certain, accept a qualified answer like "I think so." If the respondent is near the sink and cooperative, ask them if they would take a quick look to verify.)

1. Yes
2. No
3. (I think so)
4. (I don't think so)
98. (Don't know)

Q3f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

1. Yes
2. No
98. (Don't know)

[Programming Note: Ask if INSTALL >3, otherwise skip to Q11a]
Q4a. Where is the next high-efficient pre-rinse spray head installed?

(Interviewer Note: The goal with this question is to get the respondent to provide the "station" name or typical reference for each location of spray head installation. Probe for a "station" reference.)

ENTER STATION NAME _____

Q4b. How satisfied are you with the performance of this pre-rinse spray head? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q4c. Is this pre-rinse spray head still installed or did you remove it?

1. Installed →Skip to Q4e
2. Removed
98. (Don't know) →Skip to Q5a

Q4d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q5a

Q4e. Are you able to adjust the water temperature for this pre-rinse spray head independent from the faucet at this workstation or location?

(Probe: Can the water temperature for this pre-rinse spray head be adjusted separately from the faucet, or do you use the same adjustment (knob) for both the pre-rinse spray head and the faucet?)

1. Yes
2. No
98. (Don't know)

Q4e2. Are there flexible hose connections underneath the sink where the spray head standpipe is connected?

(Probe: We're trying to find out if an installer can put a water meter on the water supply line for the spray head. If the respondent is not certain, accept a qualified answer like "I think so." If the respondent is near the sink and cooperative, ask them if they would take a quick look to verify.)

1. Yes
2. No
3. (I think so)
4. (I don't think so)
98. (Don't know)

Q4f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

1. Yes
2. No
98. (Don't know)

[Programming Note: Ask if INSTALL >4, otherwise skip to Q11a]
Q5a. Where is the next high-efficient pre-rinse spray head installed?

(Interviewer Note: The goal with this question is to get the respondent to provide the "station" name or typical reference for each location of spray head installation. Probe for a "station" reference.)

ENTER STATION NAME _____

Q5b. How satisfied are you with the performance of this pre-rinse spray head? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

1. Very satisfied
2. Somewhat satisfied
3. Neutral
4. Somewhat dissatisfied
5. Very dissatisfied
98. (Don't know)

Q5c. Is this pre-rinse spray head still installed or did you remove it?

1. Installed →Skip to Q5e
2. Removed
98. (Don't know) →Skip to Q11a

Q5d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q11a

Q5e. Are you able to adjust the water temperature for this pre-rinse spray head independent from the faucet at this workstation or location?

(Probe: Can the water temperature for this pre-rinse spray head be adjusted separately from the faucet, or do you use the same adjustment (knob) for both the pre-rinse spray head and the faucet?)

1. Yes
2. No
98. (Don't know)

Q5e2. Are there flexible hose connections underneath the sink where the spray head standpipe is connected?

(Probe: We're trying to find out if an installer can put a water meter on the water supply line for the spray head. If the respondent is not certain, accept a qualified answer like "I think so." If the respondent is near the sink and cooperative, ask them if they would take a quick look to verify.)

1. Yes
2. No
3. (I think so)
4. (I don't think so)
98. (Don't know)

Q5f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

1. Yes
2. No
98. (Don't know)

Recruiting

[Programming Note: Ask if any one of Q1e through Q5e = 1, otherwise skip to BYE]

Q11a. We would like to conduct some onsite measurements. These would require us to measure the hot water flow through your pre-rinse spray head for about a month. This would not affect the operation of the spray head, and would not interfere with activities at your business. These measurements are an important part of understanding how much hot water is saved by using the high-efficiency spray head, and we would sincerely appreciate your participation. Would you be willing to authorize us to install a hot water flow meter?

(Probe: The meter will be installed at a time that does not interfere with your business operation. It will only take about 1 hour to install the meter and the meter will not affect the operation of the pre-rinse spray head. After one month of metering, we will return at a time that is convenient to you and your business operation to remove the meter.)

(Interviewer Note: You may experience some resistance to participation in the metering. Assure the respondent that we are only interested in measuring the amount of hot water that flows through the spray head, and will not be conducting any other type of inspection or metering.)

1. Yes
2. No →Skip to BYE
3. (Respondent does not have the proper authority) →Skip to Q12b

Q11b. Who should we contact to schedule the installation?

ENTER NAME _____

Q11c. What phone number should we use?

ENTER PHONE NUMBER _____

Q11d. What email address should we use?

ENTER EMAIL ADDRESS _____ →Skip to Q13a

Q12b. Who should we contact to authorize the installation?

ENTER NAME _____
98. (Don't know) →Skip to BYE
99. (Refused) →Skip to BYE

Q12c. What phone number should we use?

ENTER PHONE NUMBER _____

Q12d. What email address should we use?

ENTER EMAIL ADDRESS _____

Q13a. Are there seasonal changes in your business that affect the amount of dishwashing that is required?

(Probe: Is there any particular time of the year that you do more dishwashing than the rest of the year? For example: large fluctuation in the number customers patronizing your establishment or changes in your menu that affect the required amount of dishwashing.)

1. Yes
2. No
98. (Don’t know)

Q13. We will only be installing meters at a few randomly selected establishments. We appreciate your willingness to participate in this important study, but please be aware that there is a chance we will not be calling to install the meter at your establishment.

BYE. Those are all the questions I have for you. On behalf of the California Urban Water Conservation Council, we appreciate your time. Thank you.

5.3 Retention Survey (for Re-survey)

California Urban Water Conservation Council
Pre-Rinse Spray Head Distribution Program
Retention Re-Survey

Introduction

Hello, may I please speak with [CONTACT]?

(Probe: I am calling on behalf of [PROVIDER] to follow-up on installation of high-efficiency pre-rinse spray heads at your establishment.)

Hello, my name is _____. I am calling on behalf of the [PROVIDER] to follow-up on the installation of a high-efficiency pre-rinse spray head at your establishment. We surveyed you about the spray head some time last year. I would like to ask you a few follow-up questions, which should take no more than a few minutes.

(Interviewer Note: The high-efficiency pre-rinse spray heads are use to spray dishes before they go into the dishwasher, and should have a blue rubber ring on them. Let the respondent know that the [PROVIDER] is simply interested in receiving some feedback about the spray heads, which is the purpose for this call. If now is not a good time to complete the survey, schedule a call back.)

Retention

Our records indicate that [INSTALL] pre-rinse spray head(s) was/were installed at your location on [DATE] and that we surveyed you about them last [MONTH]

[Programming Note: Ask if INSTALL > 5, otherwise skip to Q1b]

Q5Pb. How satisfied are you with the performance of the pre-rinse spray heads? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q5Pc. Of the [INSTALL] pre-rinse spray heads installed, how many have been removed?

ENTER NUMBER _____

99. (Don't know) →Terminate Interview

[Programming Note: Ask if Q5Pc >0]

Q5Pd. What is the primary reason you removed the spray head(s)?

ENTER VERBATIM _____

[Programming Note: Ask if INSTALL - Q5Pc > 0, otherwise skip to BYE]
Q5Pf. Have any of these pre-rinse spray heads been modified in any way by physically altering or replacing any part?

(Probe: Have any of these pre-rinse spray heads been drilled out or have the brass nozzles been replaced or have any other parts been replaced or modified?)

3. Yes →Skip to BYE
4. No→Skip to BYE
99. (Don't know) →Skip to BYE

Q1b. How satisfied are you with the performance of the pre-rinse spray head installed by the [Q1a]? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q1c. Is this pre-rinse spray head still installed or did you remove it?

3. Installed →Skip to Q1e
4. Removed
99. (Don't know) →Skip to Q2a

Q1d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q2a

[Programming Note: Ask if MODIFIED NE 1, otherwise skip to Q2b]
Q1f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

3. Yes
4. No
99. (Don't know)

[Programming Note: Ask if INSTALL >1, otherwise skip to Q14a]
Q2b. How satisfied are you with the performance of the pre-rinse spray head installed by the [Q2a]? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q2c. Is this pre-rinse spray head still installed or did you remove it?

3. Installed →Skip to Q2e
4. Removed
99. (Don't know) →Skip to Q3a

Q2d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q3a

[Programming Note: Ask if MODIFIED NE 1, otherwise skip to Q3b]
Q2f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

3. Yes
4. No
99. (Don't know)

[Programming Note: Ask if INSTALL >2, otherwise skip to Q14a]
Q3b. How satisfied are you with the performance of the pre-rinse spray head installed by the [Q3a]? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q3c. Is this pre-rinse spray head still installed or did you remove it?

3. Installed →Skip to Q3e
4. Removed
99. (Don't know) →Skip to Q4a

Q3d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q4a

[Programming Note: Ask if MODIFIED NE 1, otherwise skip to Q4b]
Q3f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

3. Yes
4. No
99. (Don't know)

[Programming Note: Ask if INSTALL >3, otherwise skip to Q14a]
Q4b. How satisfied are you with the performance of the pre-rinse spray head installed by the [Q4a]? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q4c. Is this pre-rinse spray head still installed or did you remove it?

3. Installed →Skip to Q4e
4. Removed
99. (Don't know) →Skip to Q5a

Q4d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q5a

[Programming Note: Ask if MODIFIED NE 1, otherwise skip to Q5b]
Q4f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

3. Yes
4. No
99. (Don't know)

[Programming Note: Ask if INSTALL >4, otherwise skip to Q14a]
Q5b. How satisfied are you with the performance of the pre-rinse spray head installed by the [Q5a]? Would you say you are very satisfied, somewhat satisfied, neutral, somewhat dissatisfied, or very dissatisfied with this pre-rinse spray head?

6. Very satisfied
7. Somewhat satisfied
8. Neutral
9. Somewhat dissatisfied
10. Very dissatisfied
98. (Don't know)

Q5c. Is this pre-rinse spray head still installed or did you remove it?

3. Installed →Skip to Q5e
4. Removed
99. (Don't know) →Skip to Q11a

Q5d. Why did you remove this spray head?

ENTER VERBATIM _____ →Skip to Q11a

[Programming Note: Ask if MODIFIED NE 1, otherwise skip to Q14a]
Q5f. Has this pre-rinse spray head been modified in any way by physically altering or replacing any part?

(Probe: Has the pre-rinse spray head been drilled out or has the brass nozzle been replaced or has any other part been replaced or modified?)

3. Yes
4. No
99. (Don't know)

Q14a. Is/are the high-efficiency spray head(s) performing as well now as when first installed?

1. Yes →Skip to Q15
2. No
98. (Don't know) →Skip to Q15

Q14b. Please explain

(Probe: Why is/are the high-efficiency spray head(s) performing different now as opposed to when first installed?)

ENTER VERBATIM

Q15. How well does the high-efficiency spray head clean dishes compared to the old head? Would you say much better, somewhat better, about the same, somewhat worse, or much worse?

1. Much better
2. Somewhat better
3. About the same
4. Somewhat worse
5. Much worse
98. (Don't know)

Q16. How much time does it take to clean dishes with the high-efficiency spray head compared to the old head? Would your say much more time, somewhat more time, about the same, somewhat less time, or much less time?

1. Much more time
2. Somewhat more time
3. About the same
4. Somewhat less time
5. Much less time
98. (Don't know)

BYE. Those are all the questions I have for you. On behalf of the California Urban Water Conservation Council, we appreciate your time. Thank you.