Workpaper WPSCGNRWH150827A
Revision # 0

Southern California Gas Company

Customer Programs Department

Laminar Flow Restrictors

For Hospitals and Health Care Facilities

September 14, 2015

Revision History

Revision No.	Date	Description	Author
0	08/20/2015	Initial Workpaper Write Up	Julianna Colwell, SCG Jesse Martinez, SCG

Measure Summary Table A

Measure ID	Measure Description	Pre-Existing Description	Code/Standard Description	Sector	App Type(s)	Delivery Meth-od(s)	EUL ID	NTG ID(s)	GSIA ID
ShwFlr001	Laminar Flow Restrictor for Health Care Clincs - .5 GPM Flow Rate	3.74 GPM flow rate with no flow restriction present	Faucet with no flow restriction device pre-sent	Com	REA	PreReb	WtrHt-WH-Aertr	All-De-fault<=2yrs	Def-GSIA
ShwFlr002	Laminar Flow Restrictor for Health Care Clincs - 1 GPM Flow Rate	3.74 GPM flow rate with no flow restriction present	Faucet with no flow restriction device pre-sent	Com	REA	PreReb	WtrHt-WH-Aertr	All-De-fault<=2yrs	Def-GSIA
ShwFlr003	Laminar Flow Restrictor for Health Care Clincs - 1.5 GPM Flow Rate	3.74 GPM flow rate with no flow restriction present	Faucet with no flow restriction device pre-sent	Com	REA	PreReb	WtrHt-WH-Aertr	All-De-fault<=2yrs	Def-GSIA
ShwFlr004	Laminar Flow Restrictor for Health Care Clincs - 2.2 GPM Flow Rate	3.74 GPM flow rate with no flow restriction present	Faucet with no flow restriction device pre-sent	Com	REA	PreReb	WtrHt-WH-Aertr	All-De-fault<=2yrs	Def-GSIA

Note: For the complete list of Measures, refer to the accompanying calculation spreadsheet as Attachment A

Measure Summary Table B

Measure ID	Descriptors					Above Preexisting/ Customer-Average Savings			Above Code/ Standard Savings			Cost		
	Bldg Type	Bldg Vint	Bldg Loc	Bldg HVAC	Norm Unit	kWh/ unit	kW/unit	therm	kWh/ unit	kW/unit	therm	Code/ Standard ($/unit)	Measure ($/unit)	Incremental Measure ($/unit)
ShwFlr001	Cnc	Any	Any	N/A	Each	N/A	N/A	86.04	N/A	N/A	N/A	$0.00	$14.27	$14.27
ShwFlr002	Cnc	Any	Any	N/A	Each	N/A	N/A	72.77	N/A	N/A	N/A	$0.00	$14.27	$14.27
ShwFlr003	Cnc	Any	Any	N/A	Each	N/A	N/A	59.49	N/A	N/A	N/A	$0.00	$14.27	$14.27
ShwFlr004	Cnc	Any	Any	N/A	Each	N/A	N/A	40.9	N/A	N/A	N/A	$0.00	$14.27	$14.27

Note: For the complete list of Measures, refer to the accompanying calculation spreadsheet as Attachment A

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SECTION 1 - GENERAL MEASURE & BASELINE DATA

1.01 MEASURE & DELIVERY DESCRIPTION

A. Measure Description

1. Laminar Flow Restrictors (LFR) also known as laminar flow devices, are “add-on” devices that are installed at the faucet spout. In practice LFR’s differ from aerators in that they produce a clear stream of water without introducing air into the water; whereas introduce no outside air to the exiting water.
2. LFR have specific applications in the health care industry. The health care industry for the purpose of this workpaper consists of any facility that adheres to OSHPD regulations in the state of California. These can include but are not limited to:
    a. Large regional hospitals
    b. Local hospitals
    c. Emergency rooms
    d. Inpatient and outpatient facilities connected or free standing to main hospitals
    e. Doctor’s offices such as general practitioners, pediatricians, optometrists, chiropractors, ect.
3. Currently OSHPD specifically bans the use of aerators in the health care industry due to their functionality. The entrainment of air behind the aerator, that meters the flow of water exiting the faucet head, leads to bacterial and biofilm growth inside the faucet neck.
4. Laminars are intrinsically different in how they meter flow then existing aerator technology. This allows them to fit into the health care industry as a niche technology.
    a. Laminar
        i. Approved for health care use.
        ii. Water restriction is achieved by using laminar flow principles with small “nozzles” that separate the internal faucet stream into many smaller streams which combine again after exiting the faucet head to form a smooth clear flow.
        iii. The reduction in water flow comes from the nozzle’s themselves replacing the free space of the faucet outlet, which would normally have water flowing through it. The nozzles are shaped to make this transition smooth and keep turbulence from forming behind the Laminar. Thus keeping air from entering the faucet.
            a) A faucet without a LFR would have a cross sectional area at the faucet outlet of A.
            b) A faucet with a LFR would have a cross sectional area at the faucet outlet that is a fraction of the original A area.
        iv. Options are available for a Zeolite coating to further inhibit bacterial/bio film growth.
    b. Aerators
        i. Banned in health care environments.
        ii. Commonly used in residential and other applications.
        iii. Aerators restrict water by using screens to introduce air bubbles into the flow of water; the stream from an aerator is soft and white.
5. Gas IOUs would claim their savings via the hot water supply. With a reduced flow rate over a similar operating time frame, less hot water is used by each individual faucet after installation of this device.
6. The current program implementation choice is for a prescriptive rebate offering to all health care sectors.

B. Code/Standard Description

1. A code baseline for this technology would be the faucet flow rates stipulated in Title 20 of the California Code of Regulations[1] Table H-1 as seen in Figure 1.

Figure 1 - **Title 20 Table H-1**

Table H-1

Standards for Plumbing Fittings

Appliance	*Maximum Flow Rate*
Showerheads	2.5 gpm at 80 psi
Lavatory faucets	2.2 gpm at 60 psi
Kitchen faucets	2.2 gpm at 60 psi
Replacement aerators	2.2 gpm at 60 psi
Wash fountains	2.2x $\frac{\text{rim space (inches)}}{20}$ gpm at 60 psi
Metering faucets	0.25 gallons/cycle
Metering faucets for wash fountains	0.25x $\frac{\text{rim space (inches)}}{20}$ gpm at 60 psi

2. It is worth noting that Title 20 is due for a revision in 2016 with new flow rates that are lower than those listed in the Figure 1.
3. Title 20 code is not considered an appropriate baseline flow rate due to strong evidence of a higher preexisting/in situ flow rate.

C. Preexisting Description
   1. The preexisting flow rate of health care faucets has been deemed to be 3.74 GPM per a study done by Water Saver Solutions. Please see Attachment B for the raw shared survey results.
      a. Water Saver Solutions choose 20 hospitals, 1 medical office building, and 1 nursing home in SCG territory to make up the shared survey.
      b. The shared results can be considered a snap shot of the health care industry in SCG territory.
   2. 3.74 GPM is considered to be the valid in situ baseline flow rate for existing health care facilities, excluding new construction.
   3. The study results that were shared with SCG included hospital names, counts and types of faucets surveyed, and the measured flow rates.
   4. Flow rates were taken using a measuring cup and timer.
      a. A premeasured cup was stuck underneath the faucet and turned on.
      b. The time for the cup to fill up to its designated mark was recorded.
      c. Then the gallons caught dived by the minutes it took with proper units conversions were calculated and recorded.
      d. The hand and foot operated faucets were fully engaged to take the flow rate amounts.
      e. In cases were a fully engaged faucet produced too much flow to be considered reasonable for washing hands the throttling values(handles or peddles) were

turned down till the surveyor believed a person could reasonably wash their hands without annoyance.

f. Over the year of 2015 Water Saver Solutions has migrated some of their surveys to a digital flow meter; it is attached to the end of the faucet and gives a digital read out of the faucet flow.

5. 3.74 GPM is considered to be a weighted average across SCG territory by types of faucets observed.
   a. Hand operated, foot operated, and motion censored faucet types are seen in varying quantities.
   b. The weighted average is calculated in the following way

$$* Weighted\ Avg = \frac{(AvgFlow_{hand} \times Count_{hand} + AvgFlow_{foot} \times Count_{foot} + AvgFlow_{sensor} \times Count_{sensor}}{Count_{hand} + Count_{foot} + Count_{sensor}}$$

D. Measure Descriptors[2] [3]

Table 1 - Measure Descriptors

MeasureID	Use-Category	UseSub-Category	Tech Group	Tech Type	PreTech Group	PreTech Type	StdTech Group	StdTech Type
ShwFlr001-004	**Shw**	**Distrib-ute**	**Water-Fixt**	**Flow-Restrict**	**Water-Fixt**	**None**	**Water-Fixt**	**None**

E. Delivery Type

Table 2 - Delivery Types

Delivery Type	Description
PreReb	*Prescriptive Rebate*

F. Measure Application Type

Table 3 - Measure Application Type

Code	Description	Comment
REA	*Retrofit Add-On*	*Measure did not exist and is not required by code*

G. Eligibility Requirements
1. Rebates are restricted to the Health Care Industry to avoid any confusion with aerator programs for the residential or the double counting of savings.
2. Rebates do not apply to New Construction due to this being a REA measure.
3. They must be installed on a faucet that does not have a detachable metered flow device already installed.

H. Implementation Requirements
1. The commercial sector can be broken down into 3 subsectors that all deal with various aspects of the health care industry. As seen below in Table 4.

Table 4 - Sector and Subsector (Building Type)

Measure ID	Sector	Subsector	Subsector(Building Type) Description
ShwFlr001	*Com*	*Cnc*	*Health/Medical – Clinics*
ShwFlr001	*Com*	*Hsp*	*Health/Medical - Hospital*
ShwFlr001	*Com*	*Nrs*	*Health/Medical – Nursing Home*
ShwFlr002	*Com*	*Cnc*	*Health/Medical – Clinics*
ShwFlr002	*Com*	*Hsp*	*Health/Medical - Hospital*
ShwFlr002	*Com*	*Nrs*	*Health/Medical – Nursing Home*
ShwFlr003	*Com*	*Cnc*	*Health/Medical – Clinics*
ShwFlr003	*Com*	*Hsp*	*Health/Medical - Hospital*
ShwFlr003	*Com*	*Nrs*	*Health/Medical – Nursing Home*
ShwFlr004	*Com*	*Cnc*	*Health/Medical – Clinics*
ShwFlr004	*Com*	*Hsp*	*Health/Medical - Hospital*
ShwFlr004	*Com*	*Nrs*	*Health/Medical – Nursing Home*

I. Documentation Requirements
1. Proof of purchase must be provided and can include all or any one of the following: the manufacturer's name and equipment make and model number, retailer information, equipment cost, and invoice/receipt with payment in full.
2. Must provide flow rate identification from packaging.
3. Only models labeled as "Vandal Proof" or are not removable without a proprietary tool are considered for the rebate.
   a. There are currently at the time of writing 37 "Vandal Proof" Laminars in the appropriate size options available for purchase from Neopearl.
   b. There is no requirement that rebated laminars must only be Neopearl branded.
4. The date purchased and the date installed.

J. Terms and Conditions
1. The Laminar Flow Restrictors are meant only for the Health Care Industry and facilities that are subject to OSHPD code and regulation/inspection.
2. General terms and conditions for SCG measures can be found at http://www.socalgas.com/for-your-home/rebates/terms-conditions.shtml

1.02 DEER DIFFERENCES ANALYSIS[4]

A. There is no DEER measure for the faucet Laminar Flow Restrictors (LFR). The most similar measure applicable for the LFR is the faucet aerator. In DEER the faucet aerator Measure ID is WtrHt-WH-Aertr.

B. There are two Non-DEER workpapers that target the installation of faucet aerators. One is the *Faucet Aerators for Bathroom/Kitchen Sinks in Residential Buildings (WPSCGREWH120618A),* and the other is the *Therm Savings Kit (SCGWP100309A.)*

C. This Workpaper intends to depart from the Non-DEER workpapers for faucet aerators in that LFR's are not traditional aerators since no outside air is introduced into the water flow exiting an LFR. Straightening vanes are used in LFR's water flow path in lieu of the screen mesh assembly that is implemented in traditional aerators. The straightening vanes in introduced into the flow path in order to keep the water flow "laminar," and the inlet-end of the vanes are furnished with radii in order to minimize the shear stress observed at the inlet to the LFR. The reduction in shear stress at the inlet of the LFR prevents the development of air bubble entrainment in the exiting water flow. The net result is that the water flow through the LFR remains "laminar" at every major cross section of the water flow way.

D. Water flow is said to be laminar if the Reynolds Number, Re < 2100. The Reynolds Number, Re, is shown below[5]

$$\boldsymbol{Re = \frac{D_e * v * \rho}{g_c * \mu}}$$

1. $\mathbf{D_e}$ = Equivalent Diameter
2. **v** = velocity of fluid
3. **ρ** = fluid density
4. **μ** = absolute viscosity of the fluid
5. $\mathbf{g_c}$ = gravitational constant

E. The Darcy Friction Factor, f, is a parameter used in calculating friction loss. The friction factor is not dependent on any material, but rather determined by the Relative Roughness, ϵ, divided by the internal diameter, D and the Reynolds number[6]. These values will be plotted on a Moody Chart and a Friction Factor will be determined.

$$Relative\ Roughness = \frac{\epsilon}{D}$$

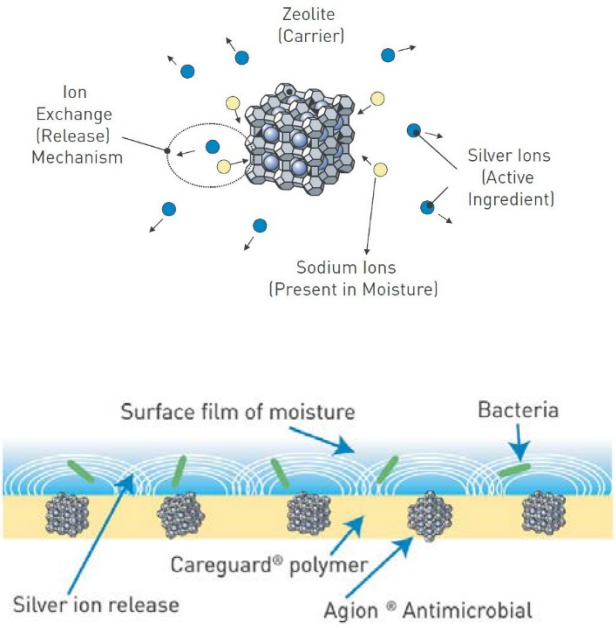
F. The Friction Factor, f, is an indicator used in determining whether the flow is laminar or turbulent. When combined with the Relative Roughness and a Moody Chart, the Friction Factor can provide a Reynolds Number. The Friction Factor for Laminar Flow is[7]

$$f = \frac{64}{Re}$$

G. When water exiting the LFR retains a Re < 2100 there is significant mitigation of air bubble development within the LFR. The significant advantage of mitigated air bubble development in LFR's is that there is little or no opportunity for bacteria growth within the restrictor as a result of turbulent changes in the water flow allowing bacteria in air to entrain itself in the water flow. "Bryers and Characklis (1981) have shown that the rate of overall bacterial film development on surfaces in turbulent flow conditions increases with the biomass concentration dispersed in the bulk phase[8]. It is also important to add that some LFR's are

coated with a Silver-Zeolite Coating which has demonstrated the ability to kill harmful bacterial when in contact with said coated surfaces[910]. The purpose of LFR's coated or impregnated with Zeolite® is to create an environment inside the LFR's flow path that is non-conducive to bacteria growth. This is accomplished by the Silver Ion being released into the moisture film on the Laminar Flow Restrictor's surface. It is for these reasons that faucet aerators are banned in Hospitals, Medical Offices, and Health Care Facilities within the purview of the Office of Statewide Health Planning and Development (OSHPD.)

Figure 2 - **Silver Zeolite Coating Molecular Behavior**



H. When observing the exiting water flow out of a "non-laminar" aerator - it can be discerned that air has been entrained in the water that has entered the aerator, and exits as "a whiter stream" that is soft to the touch. Air is entrained or captured in the exiting water stream due to viscous shear forces that are introduced by the water crossing the wire mesh of the screen filters (or honeycomb openings) and also due to the pressure drop across the aerator. The net result is the production of bubbles in the water stream exiting an aerator. See Figure 3.

Figure 3 - **Aerator (left) vs. Laminar Flow Restrictor (right)**

Table 5 - DEER Difference Summary

Modified DEER Methodology	No
Scaled DEER Measure	No
DEER Building Prototypes Used	Yes
Deviation from DEER	No existing measure type for Laminar Flow Restrictors in DEER
DEER Version	IOU Workpaper
DEER Run ID and Measure Name	N/A

1.03 CODE ANALYSIS

A. Due to the use of a preexisting/in situ baseline as defined in section 1.01 (C), Title 20 flow rates are not considered applicable to this measure.

Table 6 - Code Summary

Code	Applicable Code Reference	Effective Dates
N/A	N/A	N/A

1.04 MEASURE EFFECTIVE USEFUL LIFE

A. The Effective Useful Life (EUL) of Laminar Flow Restrictors is 10 years, based on the closest DEER reference for faucet aerators. Installers typically provide a 10 year warranty when customers sign up for annual maintenance program.

Table 7 - Effective Useful Life

MeasureID	EUL ID	EUL Yrs	RUL Yrs	Description
ShwFlr001	WtrHt-WH-Aertr	10	3.33	Faucet Aerators
ShwFlr002	WtrHt-WH-Aertr	10	3.33	Faucet Aerators
ShwFlr003	WtrHt-WH-Aertr	10	3.33	Faucet Aerators
ShwFlr004	WtrHt-WH-Aertr	10	3.33	Faucet Aerators

1.05 NET-TO-GROSS RATIOS FOR DIFFERENT PROGRAM STRATEGIES

Table 8 - Net-to Gross Ratio

MeasureID	NTGR ID	NTGR_therm	Description	Delivery Type
ShwFlr001	All-Default<=2yrs	.7	All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years	Prescriptive
ShwFlr002	All-Default<=2yrs	.7	All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years	Prescriptive
ShwFlr003	All-Default<=2yrs	.7	All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years	Prescriptive
ShwFlr004	All-Default<=2yrs	.7	All other EEM with no evaluated NTGR; new technology in program for 2 or fewer years	Prescriptive

A. The NTGR chosen was directly from version 2.3.0 of the DEER database.

1.06 TIME-OF-USE ADJUSTMENT FACTOR

A. N/A

1.07 GROSS SAVINGS AND INSTALLATION ADJUSTMENT (GSIA)****

A. LFRs are a relatively new technology and are not represented in DEER or as an IOU rebate in California as of yet.

B. GSIA values for residential aerators were not used, because they do not realistically represent the commercial health care market.

C. Vandal proof LFRs will allow installations to remain installed for their entire EUL.
   1. A vandal proof LFR requires a proprietary tool to install and/or remove the device.
   2. This keeps individuals from uninstalling the device without the knowledge of the maintenance staff of the health care facility.

Table 9 - GSIA Table

MeasureID	GSIA ID	GSIA Type	GSIA Value	Description
ShwFlr001	Def-GSIA	Annual Installation Rate	1	Default GSIA Value
ShwFlr002	Def-GSIA	Annual Installation Rate	1	Default GSIA Value
ShwFlr003	Def-GSIA	Annual Installation Rate	1	Default GSIA Value
ShwFlr004	Def-GSIA	Annual Installation Rate	1	Default GSIA Value

1.08 EM&V, MARKET POTENTIAL, AND OTHER STUDIES – BASE CASE AND MEASURE CASE INFORMATION

A. Market Potential

1. There are currently 15,000 SCG customers that could be considered part of the health care industry. The Table 10 below breaks down the estimated numbers of sinks/faucets available in SCG territory.

Table 10 - Estimated Market

Type	*NAICS Count*	*Est. # of Sinks*	*Est. # of Sinks Rounded*
Outpatient Buildings	*12,000*	*187,897*	*200,000*
Nursing Care Facilities	*2,000*	*66,501*	*70,000*
Hospitals	*800*	*97,200*	*100,000*
Total	***14,800***		***370,000***

2. A combination of NAICS codes, LA County assessor data, and published bed counts allowed for a rough estimation of available sinks.
   a. Bed counts made the assumption of 1 sink with faucet per every 2 beds reported.
3. This data is highly conservative and it is expected the true market potential will turn out to be larger when the program goes through Ex Post review.
   a. The data does not cover other operations of some health care facilities such as surgery, food service, and public restrooms.

B. All other relevant studies have been mentioned in their appropriate sections within the workpaper.

SECTION 2 - ENERGY SAVINGS & DEMAND REDUCTION CALCULATIONS

2.01 LOAD SHAPES

A. There are no current load shapes available in DEER2011 Updated Impact Profiles[11] that would match LFRs.

B. LFRs are a commercial measure dealing with water heating.
   1. The currently available load shapes that are for non-residential deal with lighting and HVAC.
   2. These are not appropriate to model the annual energy usage and thus savings.

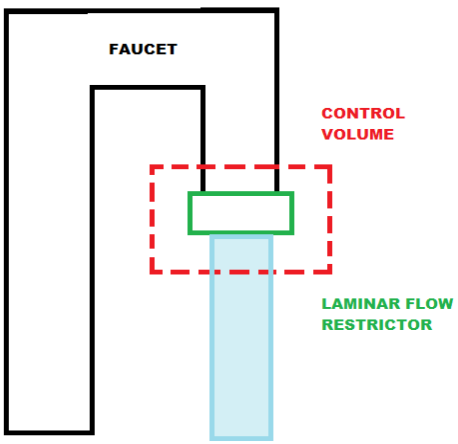
C. There are also no appropriate base case load shapes available for use in the DEER2011 Updated Impact Profiles worksheet.

2.02 ENERGY SAVINGS

A. This is considered a new technology and therefore has no savings values on record in DEER.

B. Savings were calculated using the first law of thermodynamics solved for the energy difference.
   1. The control volume was drawn around the end of the faucet only, please see Figure 4. This essentially cuts out the need to normalize the hot water production and delivery system in the health care industry.
      a. It is believed that piping systems are too varied from building to building to allow for an appropriate normalized system assumption.
      b. There are too many types of boilers and hot water production systems to allow for a reasonable assumption of efficiency to be made.

Figure 4 - **Control Volume**



2. The equation methodology is as follows

$$\dot{Q} = [\dot{m} C_P T]\tau$$

a. $\dot{Q} = Energy$

b. $\dot{m} = Mass\ flow\ rate\ accross\ vontrol\ volume = \rho(\dot{V}_2 - \dot{V}_1)$

   i. $\rho = Density\ of\ water\ at\ T\ \left[\frac{lbm}{ft^3}\right]$

   ii. $\dot{V}_2 - \dot{V}_1 =$ $change\ in\ flow\ from\ before\ and\ after\ the\ installation\ of\ the\ LFR\ \left[\frac{gal}{min}\right]$

c. $C_P = Specific\ heat\ of\ water\ [\frac{Btu}{lbm°F}]$

d. $T = Temperature\ of\ water\ at\ faucet\ outlet\ [°F]$

e. $\tau = operating\ time\ \left[\frac{min}{yr}\right]$

f. Final result being the following equation

g.

$$\dot{Q} = [\rho(\dot{V}_2 - \dot{V}_1) C_P T]\tau$$

3. The units work out in the following way

$$\dot{Q} = \left[\rho\left[\frac{lbm}{ft^3}\right] x\ \dot{V}_2 - \dot{V}_1\left[\frac{gal}{min}\right]\ x\ C_P\left[\frac{Btu}{lbm°F}\right]\ x\ T[°F]\ x\ \frac{.1337 ft^3}{1\ gal}\ x\ \frac{1\ therm}{100{,}000\ Btu}\right] x\ \tau\left[\frac{min}{yr}\right]$$

$$\dot{Q} = \left[\frac{therm}{yr}\right]$$

4. A sample calculation using the above $\dot{Q}$ equation is as follows for the 2.2 gpm LFR

$$\frac{\dot{Q}}{1} = \left[61.84\left[\frac{lbm}{ft^3}\right] x\ 3.74 - 2.2\left[\frac{gal}{min}\right]\ x\ 1\left[\frac{Btu}{lbm°F}\right]\ x\ 110[°F]\ x\ \frac{.1337 ft^3}{1\ gal}\ x\ \frac{1\ therm}{100{,}000\ Btu}\right] x\ 2920\left[\frac{min}{yr}\right]$$

$$\boxed{\dot{Q} = 40.8975\ \frac{therm}{yr}}$$

5. Savings values for each of the four chosen LFR sizes are tabulated below. Each was done in the exact same manner as shown in section 2.02 B (5).

Table 11 - Savings Values

MeasureID	LFR Flow Rate (gpm)	Baseline Flow Rate (gpm)	Assumed Temperature of Water (°F)	Minutes Oper-ated per Year	Savings ($\frac{therm}{yr}$)
ShwFlr001	.5	3.74	110	2920	86.04
ShwFlr002	1	3.74	110	2920	72.77
ShwFlr003	1.5	3.74	110	2920	59.49
ShwFlr004	2.2	3.74	110	2920	40.90

C. Assumptions that were made.
   1. $\boldsymbol{\rho}$ of water is considered to be 61.84 $\frac{lbm}{ft^3}$ at a temperature of 110 °F
   2. $\dot{\boldsymbol{V}}_{\boldsymbol{2}}$ is the baseline flow rate
   3. $\dot{\boldsymbol{V}}_{\boldsymbol{1}}$ is the new flow rate of the installed LFR
   4. $\boldsymbol{C_P}$ of water at a temperature of 110 °F is 1 $\frac{Btu}{lbm°F}$
      a. 110 °F is considered an appropriate assumption based on CA plumbing code section 613. The appropriate range is 105-120 °F. 110 °F is considered a good medium on the lower end of the range. The lower end was chosen to avoid possible scalding issues.
   5. There is $.1337 ft^3$ of water in 1 gal
   6. There is 1 therm in 100,000 Btu
   7. Operating minutes per year ($\boldsymbol{\tau}$) were calculated with an assumption of use being 8 min/day for 365 days a year.
      a. 8 min a day was the medium value of the range of 4-12 min a day. This was considered the conservative choice.
      b. The 4-12 min range was gathered through survey results from Water Saver Solutions during their installations over the last 4 years.
      c. Health care facilities are considered to run close to 365 days a year.

SECTION 3 - BASE CASE & MEASURE COSTS

3.01 BASE CASE COST

A. This measure is to be implemented for the following:
   1. Retrofit Add-On (REA) for existing faucets at hospitals, outpatient, and nursing care facilities in the health care sector.

B. Baseline costs are $0 due to it being an REA measure of the base case would be to “do nothing” to the faucet.

3.02 GROSS MEASURE COST

A. The proposed measure cost is seen in Table 12.

Table 12 - Gross Measure Cost

Description	Equipment Cost	Labor / Installation Cost	Maintenance / Other Cost	Total Measure Cost
Faucet Laminar Flow Restrictor (tamper proof)	$7.27 / ea	$7 /ea	TBD	$14.27 / ea

B. The equipment cost was developed using entire set of vandal proof laminar flow Neoperl 2014 Wholesale Price List. The average price for the entire array of vandal proof faucet laminar flow restrictors is $7.27[ref] per laminar flow restrictor.

C. The labor or installation cost is based upon the costs charged by third party contractors installing aerators for the direct install program for residential faucet aerators. The minimum cost charged during the direct install program was $7 per aerator. Being that the installation procedure for installing aerators is very similar to installing Laminar Flow Restrictors; it follows that this cost is the most applicable cost for installing Laminar Flow Restrictors.

3.03 INCREMENTAL MEASURE COST

A. The Incremental Measure Cost (IMC) for this measure is the Gross Measure Cost (GMC) minus the Baseline Cost. Therefore the IMC for REA is equal to the GMC.

Table 13 - Incremental Measure Cost

Description	Equipment Cost	Labor / Installation Cost	Maintenance / Other Cost	Total Measure Cost
Faucet Laminar Flow Restrictor (tamper proof)	$7.27 / ea	$7 /ea	TBD	$14.27 / ea

Attachments

Attachment A – ECM Measure Upload Template and Complete Measure Sheet

Laminar Flow
Measure Upload Shee

Attachment B – Water Saver Solutions Raw Survey Data

Hot Water Fixture
Flow Survey Data rev

Attachment C – Support for Bacteria Entrainment in Turbulent Flow

Support for Bacteria
Entrainment in Turbul

Attachment D – Care Guard Silver-Zeolite Coating

care_guard spec
sheet AgIon descripti

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[2] (READI, 2014), ftp://deeresources.com/DEER/READI_v2.0.1.zip (September 8, 2015)

[3] (Ex Ante Data Specification, 2014), http://eestats.cpuc.ca.gov/EEGA2010Files/GuidanceDocuments/ex_ante_specification_20140401.accdb (September 10, 2015)

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