CALIFORNIA AIR RESOURCES BOARD
OFFROAD MODELING CHANGE TECHNICAL MEMO
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SUBJECT: REVISIONS TO THE PORTABLE FUEL CONTAINERS (PFC OR GAS CANS) EMISSION INVENTORY

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EXECUTIVE SUMMARY

Estimates of evaporative emissions from portable fuel containers (PFC or gas cans) in California were revised in the Air Resources Board's (ARB or Board) OFFROAD2007 model. The PFC emission inventory was developed as an independent module since the added details of PFC inventory are no longer compatible with OFFRAOD2007's model structure.

ARB is responsible for developing the reactive organic gas (ROG) emission inventory associated with gas cans. Accordingly, two surveys about gas cans were initiated in 1998 and 2004 to collect real world gas can population and usage information of PFCs in California. The two survey results were used in estimating statewide commercial and residential-gas-can populations, and for gaining a better understanding of typical usage and storage practices.

Gas can emission rates for various emission modes (e.g., evaporation, permeation) that occur during typical usage were determined by using diurnal evaporative and gravimetric test methods. Survey results of population and usage were analyzed and combined with the emission test results to produce the PFC inventory. This inventory is used in estimating past and future ROG emissions to support air quality planning and modeling.

Table ES-1 shows the PFC emission inventory summary in tons-per-day (tpd) in California in recent years. Seasonal temperature correction factors were also included in the inventory calculation. This emission inventory reflects the most recent PFC regulation the Board adopted in September 2005:

- The statewide PFC emissions show a decreasing trend (See Figure ES-1). This is due to the decreasing PFC population based on ARB staff's observation. The more stringent emission standards proposed in 1999 and 2005 PFC regulation have also contributed to overall reduction of ROG emissions from the PFC.

- The use of reformulated gasoline 3(RFG3I, with ethanol oxygenate) results in more permeation and diurnal emissions from plastic PFC than the reformulated

gasoline 2 (RFG2, with methyl-tertiary-butyl-ether, or MTBE). This causes an increase in PFC evaporative emissions in year 2005 when RFG II was being phased out.

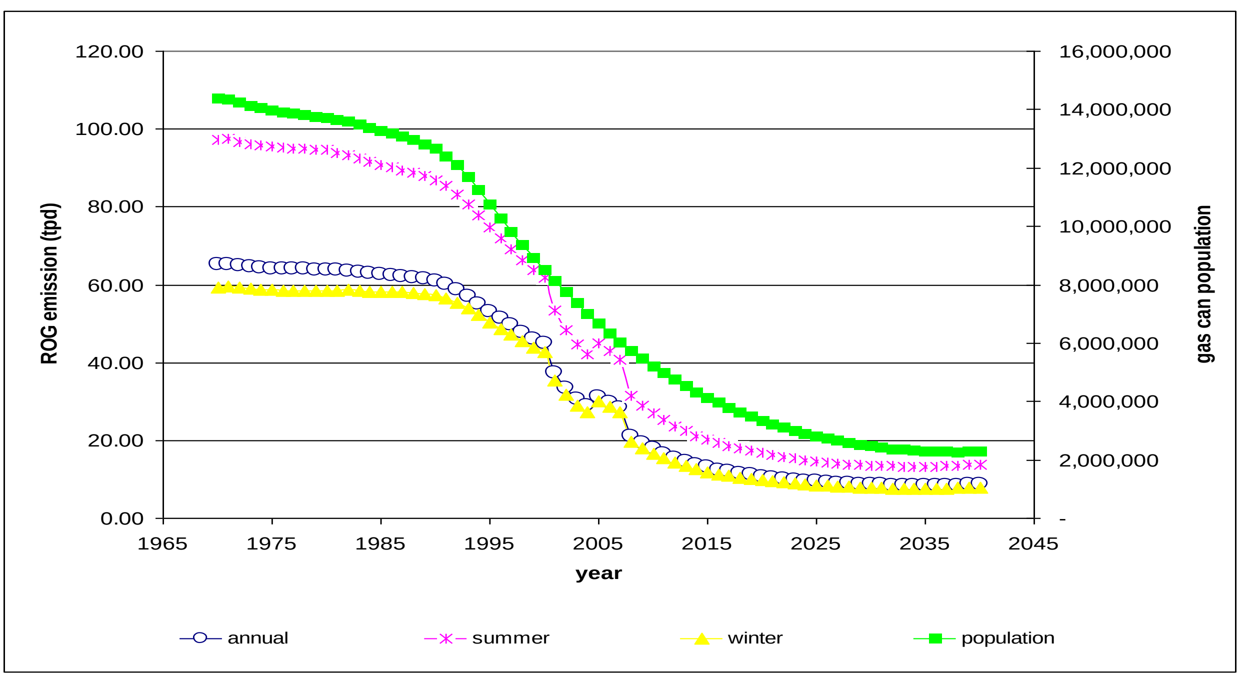
- Residential PFC population decreases over the years while the commercial PFC population increases. However, the magnitude of residential PFC population is higher than commercial's (10^6 versus 10^5), thus the overall PFC population shows a decreasing trend as well as the overall emissions from PFCs. Commercial PFC population growth rate will overcome the declining rate of residential PFC starting in year 2035; by that time, PFC emission will slowly increase again.

- A detailed residential and commercial PFC inventory is listed in Appendix A.

Table ES-1 Summary of the California PFC Emission Inventory (ROG in tpd).

Year	PFC Population	Annual	Summer	Winter
1990	12,652,635	60.89	86.78	57.21
2000	8,513,294	44.83	61.69	42.70
2005	6,681,154	31.27	45.03	30.14
2010	5,217,939	17.93	26.99	16.53
2015	4,133,452	13.09	20.18	11.92
2020	3,347,704	10.81	16.74	9.83

Figure ES-1. Comparison of PFC Emissions in California for Different Seasons



BACKGROUND

PFCs are made of either high-density polyethylene (HDPE or plastic) or metal and are sold in a variety of shapes and sizes that typically range from one to five gallons in capacity. PFCs are used to store and dispense fuel into on-road and off-road mobile equipment, including a broad range of small engines and equipment (e.g., lawnmowers, leaf blowers, personal watercraft, all-terrain vehicles). ROG emissions from PFCs come from evaporation and spillage. Even though the emissions from a single PFC are small, over 10 million PFCs are used in California so the overall emissions are significant.

PFC emissions are classified by six emission processes:

- Permeation emissions are produced after fuel has been stored long enough in a gas can such that fuel molecules saturate the can material and infiltrate the container.
- Diurnal emissions result when stored fuel vapors escape to the outside of a gas can through any possible opening while the gas can is subjected to a daily cycle of increasing and decreasing ambient temperature changes.
- Transport spillage emissions arise when fuel escapes from gas cans that are in transit.
- Refill spillage emissions are produced when fuel is dispensed from a gas can to an equipment/vehicle's fuel tank, another gas can, etc., and fails to either be delivered into the intended reservoir or remain inside the reservoir.
- Refueling-vapor displacement emissions result when fuel vapor is displaced from equipment and vehicle fuel tanks, gas cans, etc., by fuel dispensed from gas cans.
- Burp emissions are produced by spill-proof gas cans through automatic vapor release due to increasing internal pressure.

The PFC inventory is further sub-classified by the specific can materials (metal or plastic) and can types. In the plastic category, there are red plastic can, kerosene can (blue gas can), five- gallon utility jugs and spill-proof gas cans. Depending on the gas can's activity and usage, the inventory also divides PFC emissions from either residential cans or from commercial cans. Fuel correction factors for RFG II and RFG III are included. Seasonal corrections for annual, summer, winter, and summer ozone are included for temperature dependent emission processes such as diurnal and permeation.

SURVEYS

In 1998, residential gas can information was solicited by mail from randomly selected California households by ARB staff. Those addresses were selected from the 1998 database of InfoUSA Inc. (of Omaha, NE.), which maintains nationwide databases of residential and commercial addresses. ARB contracted with California Environmental Engineering of Santa Ana, CA, to prepare and implement the survey. Commercial gas can usage and storage information was solicited by ARB staff directly from various

Northern and Southern California businesses. Targeted businesses included agricultural, automotive club and tow services, service stations, lawn and garden maintenance services, general contractors, and construction and rental yards. On-site survey interviews and observations of gas can usage in typical business activities were conducted in Southern California. Either an on-site or telephone interview was conducted for businesses in Northern California.

In 2004, the Institute for Social Research of Cal State University of Sacramento (CSUS) conducted another survey for residential gas cans. The sample was a random digit sample for California and included households listed in telephone directories and those with unlisted or non-published numbers. The majority of the telephone interviews were conducted May 1, 2004 through May 10, 2004. In order to offset non-response bias in some of the more urban counties and to provide an adequate number of interviews, one hundred additional interviews were conducted with households in Los Angeles, Orange, Riverside, San Bernardino, San Diego, and San Francisco counties on June 9, 2004 and June 10, 2004. CSUS also conducted commercial gas can surveys for commercial businesses that use gas cans. In order to describe the ownership and use patterns for each industry category, the sample was stratified and quotas were set for the number of interviews to be completed in each category. Table 1 below shows the two survey response statistics.

Table 1. 1998 and 2004 Survey Response Statistics

	1998 Survey		2004 Survey	
	Residential	**Commercial**	**Residential**	**Commercial**
Total Number of Interviews	1,167	161	1,734	1,209
Incomplete Responses	510	9	31	32
Refusal	333	-	977	302
Completed Responses	324	152	726	875
Completion Percentage	28%	94%	42%	72%

Gas can emissions are a function of the can material (i.e., plastic or metal) and the storage conditions. Gas cans are stored in either an “open” or a “closed” condition. An open condition, or system, exists when a can is stored with an open breathing (vent) hole and/or an uncapped main-filler opening or nozzle. A closed system exists when the vent hole is closed and the main-filler opening or spout is capped. In general, a metal can produces less permeation emissions than a plastic can. However, traditional metal cans have breathing vents that produce more diurnal emissions than plastic cans that have an automatic venting valve. Table 2 below lists the survey responses for cans material and storage characteristics.

Table 2. Survey Results on Storage Characteristics of PFC

	1998 Survey		2004 Survey	
	Residential	Commercial	Residential	Commercial
Percentage of Household/Business with at Least One Gas Cans	46%	100%	32.80%	53.40%
Number of Gas Cans per Household/Business	1.8	6.9	1.66	2.73
Percentage of Plastic/Metal Gas Cans	76%/24%	72%/28%	85%/15%	79%/21%
Weighted Average Gas Can Capacity (gal.)	2.34	3.43	2.34	3.63
Percentage of Gas Cans Stored with Fuel	70%	100%	70%	100%
Weighted Average Stored Fuel Volume (% of Total Capacity)	49%	49%	49%	49%
Percentage of Plastic Gas Cans Stored Open/Closed	23%/53%	39%/33%	23%/53%	39%/33%
Percentage of Metal Gas Cans Stored Open/Closed	11%/13%	10%/18%	11%/13%	10%/18%
Percentage of All Gas Cans Stored Open/Closed	34%/66%	49%/51%	34%/66%	49%/51%

METHODOLOGY

PFC population is divided to residential and commercial categories based on their application and activity. Can types are subdivided into metal cans and plastics cans. Plastic cans are further divided into red plastic cans, kerosene cans, utility jugs, and spill-proof cans.

Depending on both the population and emission process (i.e., permeation, diurnal, transported spillage, refill spillage, refuel vapor displacement or burp), total emissions can be calculated for each type of can.

The PFC emission inventory at any given year can be expressed as the following equation:

PFC Emission

$$= \Sigma_{i,j} (\text{population of different type cans}_i * \text{different types of emissions}_j) \quad \text{(Eq. 1)}$$

Where

i = metal cans, red plastic cans, blue kerosene plastic cans, 5-gal utility jugs, spill-proof cans

j = permeation, diurnal, transport spillage, refill spillage, vapor displacement, burp

INPUT FACTORS

The PFC emission inventory is constructed with six major input factors:

- Population and growth: the population of PFCs in any given year is calculated through the use of growth factors. The PFC inventory uses a composite growth rate that depends on occupied household (or business units), percent of households (or businesses) with gas cans, and average number of gas cans per household (or business) units.

- Age distribution and survival rates (scrappage): age distribution and survival rates are static functions of PFC age and use.
- Emission factors and formulas: there are six total types of emission types depending on the emission process.
- Allocation factors: The PFC emission inventory model distributes the statewide PFC population and emissions to a specific county/air basin/air district according to sets of calculated allocation factors.
- Seasonal temperature correction factors: temperature correction factors are applied to the inventory in responds to the emission variation based on the temperature fluctuation throughout the year.
- Fuel correction factors: Fuel correction factors are applied to describe the evaporative emission difference between RFG II and RFG III.

Population and Growth

The PFC emission inventory uses calendar year 2005 as the baseline year for the calculation. As a result, growth rate calculation is normalized to 2005. In PFC inventory, population is subdivided into residential and commercial based on the difference in usage. Because their growth rates are calculated differently, the following two sections show the methodology for residential PFC growth and commercial PFC growth.

A. Residential PFCs

Residential PFC population is a function of three variables; occupied household units, percentage of household with gas cans, and average number of gas cans per household or business unit. Since the three variables all time dependent, the function can be expressed as:

Residential PFC Population = Occupied household
*** Percent household with cans**
*** Average number of gas cans per household**

(Eq. 2)

1.) Occupied Household Units

California occupied household units are calculated with the following equation.

California Occupied Household Unit
= California Population * Household Size * Household Occupancy (Eq. 3)

For details of California populations, please visit website: **http://www.dof.ca.gov/Research/Research.asp**[1]

[1] Source: California Department of Finance (DOF), Demographic Research Unit

For the residential PFC population and growth calculation, actual DOF demographic data from year 1970 to 2005 are used. From year 2006 to 2040, individual county population is projected based on its own growth and then combined for an overall state population.

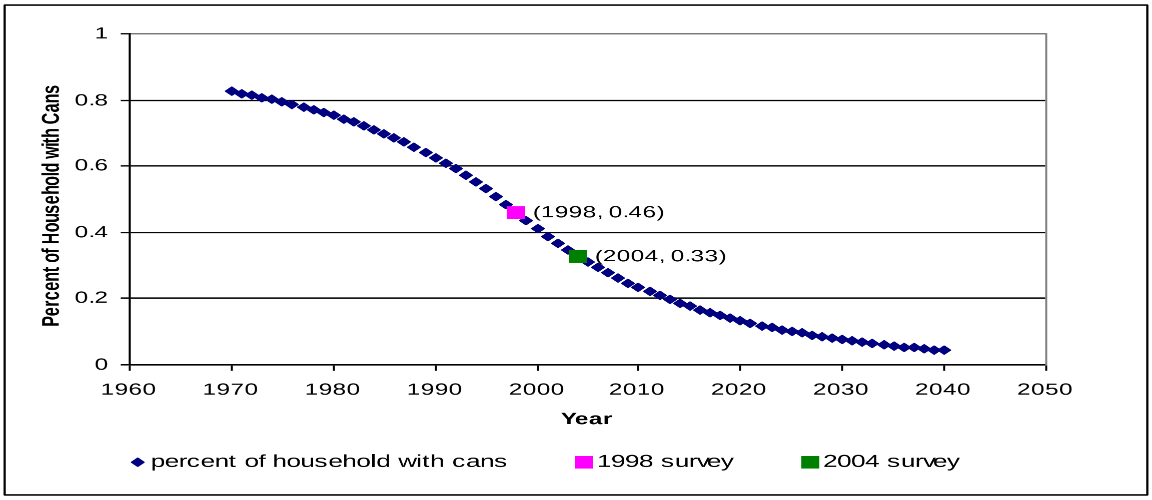
According to DOF's Census 2000 data, the average household size in California is **2.87** persons/ household.[2] About **5.8%** of households are vacant due to real estate transaction and vocational house, etc..[3]

Appendix B lists California occupied household units for calendar year 1970 to 2040. A sample calculation is also included.

2.) Percentage of Households with Cans

The percentage of household with cans fluctuates annually. The 1998 survey stated 46% of household has gas can(s). The 2004 survey showed 33% percent of households had cans. The two survey results showed that fewer households own gas cans over the years. Further research showed that as more electric-powered lawn and garden (L&G) equipments became available on the market, gasoline-powered L&G equipment became less popular. Because there are only two available data points, staff derived an "S" curve to approximate the percentage change of households with cans over time (see Figure 1Figure 1). Appendix C lists the corresponding values for the "S" curve.

Figure 1. Percentage of Household with Cans



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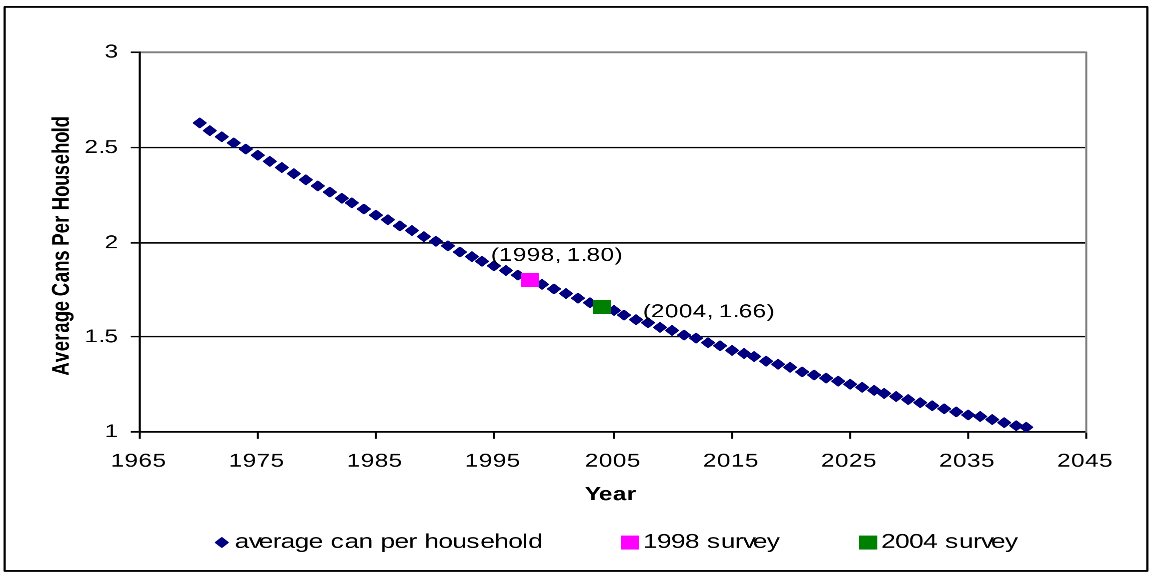
[2] http://www.dof.ca.gov/HTML/DEMOGRAP/CSDC/SF4CA.pdf

[3] Source: California Department of Finance (DOF), Demographic Research Unit

3.) Average Cans per Household

Average cans per household also show a declining trend based on the survey results. In 1998, there were 1.8 cans per household. That value was lowed to 1.66 in year 2004. Figure 2 below shows the changes of average number of cans per household over time. The curve is derived from the exponential function in Microsoft Excel.

Figure 2. Percentage of Household with Cans



4.) Growth Normalization

PFC emission inventory uses 2005 as a base year for the calculation. Growth rate at time t is derived from PFC population at time t and is expressed as:

Residential PFC Growth Rate (t)
= Can population (t) / Can population (2005) (Eq. 4)

Residential PFC population and growth rates are listed in Appendix C.

B. Commercial PFCs

Commercial PFCs are used in both non-L&G applications and L&G applications depending on the usage of the cans. For non-L&G, the main applications are agricultural, forestry and logging, construction, retail, motor vehicle towing, extermination and pest control services, educational services, sports and recreation, accommodation repairs and maintenance services, cemeteries and crematories.[4] L&G applications are mainly applied to the commercial L&G maintenance services.

1.) Baseline Year Commercial PFC Population

The 2004 CSUS commercial gas can survey listed a total 81,927 businesses in California that use gas can, including L&G, in 2004. Staff believes that the amount of L&G business units listed in this survey is underestimated. However, staff decided to use the non-L&G business units from this report until other information becomes available.

The non-L&G business units that used gas cans in 2005
= (81,927-7,826) / (0.962) = 77,033

Where: California business in 2004 = 81,927
Landscaping business in 2004 = 7,826
Growth rate of 2004 = 0.962

In order to normalize the population to baseline year 2005,[5] 2004's growth factor, 0.962, is applied for the baseline population calculation. Commercial PFC growth rates derivation is discussed in the next section.

From the California Commercial L&G Equipment Report,[6] there were 295,423 lawn mowers in California in 2005. Staff assumed that on average, there were two lawn mowers per commercial L&G business. As a result, the 2005 population for commercial L&G business is:

L&G business units in 2005 = 295,423 / 2 = 147,712

Commercial PFC population is calculated as:

Commercial PFC Population = Business Units
*** Percent Business with PFC**
*** Average Number of PFC per Business**
(Eq. 5)

The baseline year commercial PFC population is summarized in Table 3 below.

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4 http://www.arb.ca.gov/pfc/archive/arch05/commercial_analysis.pdf
Analysis of the 2004 California Commercial Portable Fuel Container Survey
5 Normalized growth factor equals to 1 in year 2005.
6 ftp://ftp.erg.com/outgoing/ARB_Offroad/L&G/
California Commercial Lawn and Garden Equipment Report

Table 3. Baseline year 2005 Commercial PFC Population

	L&G	Non-L&G	Total
Business units	147,712	77,033	224,745
Percent Business with PFC	100%	53.40%	
Average PFC per Business	2.73	2.73	
PFC Population	**403,254**	**112,300**	**515,554**

2). <u>Commercial PFC Growth Factors</u>

Growth factors for commercial PFCs are derived from socio-economic indicators. Personal income, median household income, population, Regional Economic Models Inc. (REMI) emission growth surrogates, and landscaping employment are used for commercial PFC growth calculation.

Personal income and median household income were chosen as the economic indicators for the estimation of amount of households that use commercial landscaping services. Landscaping employment information[7] and the growth rates for the service sector from REMI were chosen for the indicators of L&G industry growth. Lastly, California population growth is also included into the overall growth rate calculation. Because the prediction of economy shows exponential growth in future years, staff believes it may cause over-estimation of commercial PFC population. Therefore, California population was added as another parameter to serve as a constraint.

Thus, the OFFROAD model uses five sets of data to predict commercial PFC growth. It is a composite growth rate that depends on personal income, median household income, REMI, landscaping employment and California population growth. All five variables are time dependent and interact with each other, which in turn contribute to the commercial PFC composite growth rate.

The composite growth rate for commercial PFC at any given year is expressed as follows:

$$\text{Composite GR}(t)_{\text{commercial PFC}} = [k(t) * GR(t)]_{\text{personal income}} + [k(t) * GR(t)]_{\text{household income}} + [k(t) * GR(t)]_{\text{California population}} + [k(t) * GR(t)]_{\text{REMI}} + [k(t) * GR(t)]_{\text{employment of Landscaping}} \quad \text{(Eq. 6)}$$

[7] California Employment Development Department, Occupational Projections of Employment of Landscaping and Grounds-Keeping Workers, http://www.labormarketinfo.edd.ca.gov/cgi/dataAnalysis/AreaSelection.asp?tableName=OCCPRJ&GeogArea=0601000000

Where:

Composite GR $(t)_{commercial\ PFC}$

$= $ growth rate of commercial PFC at time t

GR $(t)_i$ = growth rate of an variable i at time t

k $(t)_i$ = growth rate contribution of the variable i at time t

$= \Delta i(t) / \sum_{1\rightarrow x} \Delta i(t)$

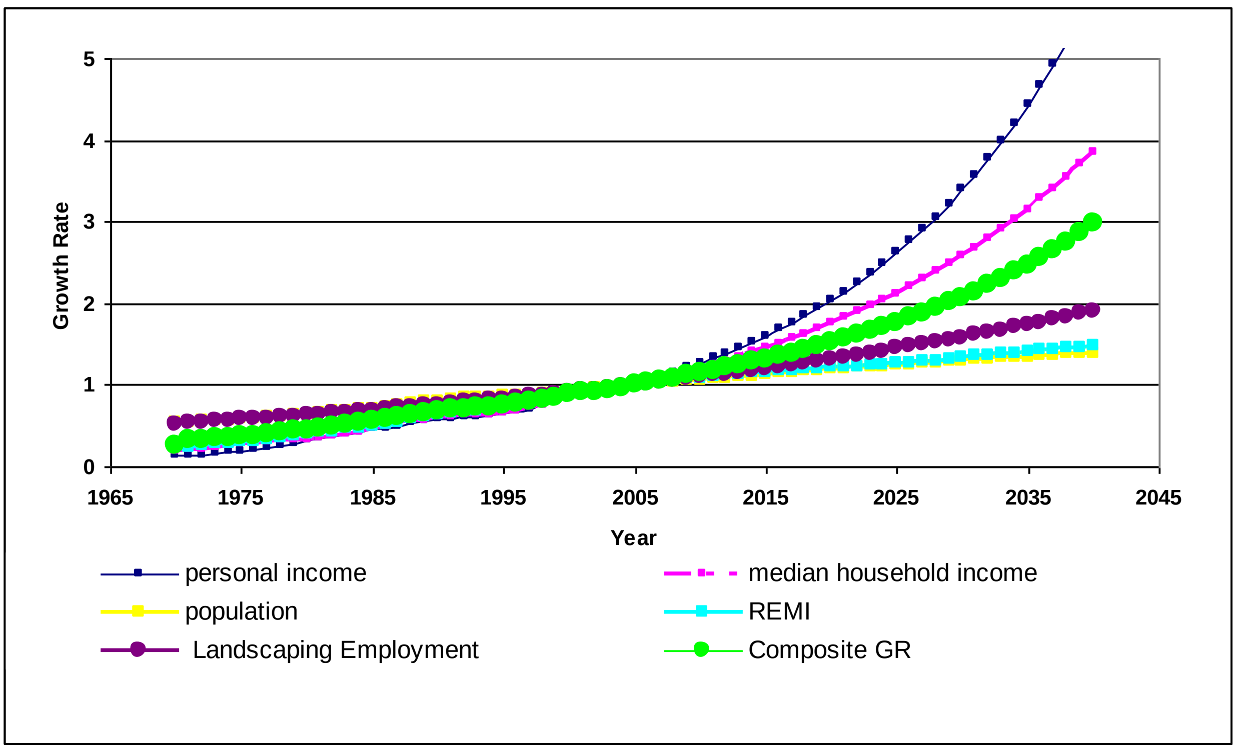
Where:

$\Delta i(t)$ = rate of change of the variable

$= i(t) / i(t-1)$

Figure 3 below shows the comparison of five components' growth rates and the composite growth rate of commercial PFC. Appendix D lists the step-by-step calculation for commercial PFC growth rates.

Figure 3. Comparison of Composite Commercial PFC Growth Rate and Five Individual Growth Rate Components



Survival Rate (Scrappage) and Age Distribution

The PFC emission inventory model estimates future year can populations as the sum of sales-scrappage for all years up to the calendar year of interest. Future year sales are derived from growth rates applied to the base year's can population, and scrappage is a static function of can's age and use.

OFFROAD2007 applies a survival rate function to its base year equipment populations to determine the expected equipment population in future years. PFC emission inventory model applies a similar function to arrive at its population estimates. This section describes how the PFC inventory model calculates the annual survival rate for the base year PFC populations, and how the model calculated the model year distribution of the baseline PFC population.

A. Survival Rate

The survey results from 1998 and 2004 summarized in Table 4 below shows metal cans are slowly being replaced by plastic cans. Major PFC manufacturers also confirm that no new metal PFC cans have been produced since 2006. In addition, the PFC regulation was implemented starting in January 2001. The regulation requires that all conventional non-spill-proof PFCs meet the new emission standard by 2001 and all kerosene cans and utility jugs meet the emission requirement by 2007.

Table 4. Survey Comparisons for PFC Can Type Distribution

	1998 Survey		2004 Survey	
Percentage Distribution	**Residential**	**Commercial**	**Residential**	**Commercial**
Metal Cans	24.0%	28.0%	15.0%	20.7%
Red Plastic Cans	76.0%	72.0%	32.8%	39.4%
Kerosene Cans	N/A	N/A	3.5%	2.2%
5-gal Utility Jug	N/A	N/A	8.0%	3.9%

Staff uses the exponential function to fit the two data points from the survey to derive the metal PFC survival rate. The assumption is that only metal cans were originally available, the plastic cans were slowly introduced to the market and eventually replaced metal cans. Appendix E lists sample calculation for scrappage of metal cans.

Percentage of total plastic cans at time t then is equals to: 1 - percentage of metal can at time t. Plastic cans are distributed to each can type according to the weighted percentage of the 2004 survey results.

B. Age Distribution

In order to estimate the population percentage of regulated cans that are introduced to the market in years 2001 and 2007, the survival rate and age distribution for each type of regulated can need to be calculated. From the 2004 PFC survey, the median useful life for conventional PFCs and spill-proof PFCs is three years. Kerosene cans and utility jugs have a median useful life of five years. Table 5 below lists the age distribution and survival rate values for equipment ages three and five. These are standard values used in OFFROAD2007.

Table 5. Survival Rate and Age Distribution Information

Survival Rate										
Life	**Age0**	**Age1**	**Age2**	**Age3**	**Age4**	**Age5**	**Age6**	**Age7**	**Age8**	**Age9**
3	0.97	0.92	0.87	0.29	0.5	0.27	0	0	0	0
5	0.95	0.91	0.89	0.85	0.83	0.78	0.73	0.79	0.79	0.53
Age Distribution										
3	0.17	0.17	0.17	0.17	0.17	0.17	0	0	0	0
5	0.2	0.2	0.18	0.16	0.14	0.05	0.04	0.02	0.01	0

C. Baseline Model Year Distribution

The model year PFC distribution is calculated using the data shown in Table 5, which is the numerical representation of the survival curve for PFCs with expected median useful lives of one to five years. Since PFCs can last as long as twice the expected life, six or ten model years have to be accounted for. First, the PFC fraction remaining in use is summed over the period covering two times the expected PFC life. This sum is a surrogate for the total number of pieces of PFC sold in the years leading up to the current year, and is referred to as the *Sales Population Surrogate*. Appendix F shows a sample baseline model year distribution calculation for PFCs.

model year specific PFC population $_{\textbf{baseline year}}$
= expected fraction remaining in year * the Sales Population Surrogate (Eq. 7)

Appendix F shows a sample baseline model year distribution calculation for PFCs.

<u>Emission Processes: Factors and Formulas</u>

As mentioned earlier, PFC emissions consist of the following six emission processes. The overall emission inventory sums all emissions from the six different emission processes.

A. Permeation

An average daily permeation-emission rate for a closed system was derived from test data obtained from thirteen plastic-gas cans and three metal-gas cans. The plastic-gas cans did not have a barrier-surface treatment. Each plastic-gas can was sealed with a metal-filled epoxy and an overcoat of a non-permeable two-part epoxy resin. Additionally, any plastic caps and plugs were replaced with metal ones whenever possible. Also, all secondary vents were plugged with brass fittings and coated with sealant. Lastly, the gas cans were leak-checked and reworked as necessary. The gas cans were filled with RFG II fuel and subjected to a diurnal-variable temperature profile in a sealed housing for evaporative determination unit

(SHED). This temperature profile is the same as the one currently required for on-highway motor-vehicle-evaporative emissions testing (ozone episode days, 65-105-65 Fahrenheit degrees in a 24-hour period.) Gravimetric measurements were made of the gas cans after each 24-hour test period. The average daily permeation rate from a plastic-gas can (closed system) was calculated to be **1.57 grams per gallon per day** (g/gal-day). A permeation rate for metal-gas cans was determined with similar test methods to be **0.06 g/gal-day**. Permeation-emission rates for open systems are undefined due to the experimental impracticality of determining such emissions at this time. The magnitude of the contribution from these emissions to the emissions inventory is likely negligible compared to the interrelated diurnal emissions (See next section). Accordingly, open-system permeation emissions are not included in the current inventory.

Statewide residential-gas-can-permeation emissions are computed as follows:

$$HC_{PR} = \Sigma (Pop_R)(S)(EF_P)(B_R)(Size_R)(Level) \qquad \text{(Eq. 8)}$$

where:

HC_{PR} = Permeation Emissions in tons per day (tpd)

Pop_R = Statewide PFC Population

EF_P = Appropriate Permeation-Emission Factor (g/gal-day)

S = Percentage of Gas Cans Stored with Fuel

B_R = Percentage of Cans Stored in Closed Condition with respect to Material

$Size_R$ = Weighted Average Capacity of Residential-Gas

Level = Weighted Average Amount of Stored Fuel

The values for S, B_R, $Size_R$ and Level are listed in Table 2. Substituting these values into Equation 8, summing the resultant products, and converting grams to tons ($9.08*10^5$ grams per ton) produces a statewide total permeation emissions value for residential and commercial PFCs.

B. Diurnal

Diurnal emissions result when stored fuel vapors escape to the outside of a gas can through any possible opening while the gas can is subjected to the daily cycle of increasing and decreasing ambient temperatures. Diurnal emissions are dependent on the closed- or open-storage condition of a gas can. Accordingly, emission rates were determined for both conditions.

Diurnal emissions from both open- and closed-system-residential-gas cans are calculated as follows:

$$HC_{DR} = (Pop_R)(S)(EF_D)(B_R)(Size_R)(Level) \qquad \text{(Eq. 9)}$$

where: HC_{DR} = Diurnal Emissions (tpd) for PFC with respect to Storage Condition (Open or Closed) and Material (Plastic or Metal)

Pop_R = Statewide PFC Population

S = Percentage of PFC Population Stored with

EF_D = Appropriate Diurnal-Emission Factor with respect to Storage Condition and Material (g/gal-day or g/day)

B_R = Percentage of PFC Population with respect to Storage Condition and Material

$Size_R$ = Weighted Average Capacity of PFC (*Applies to "Closed" condition only)*

Level = Weighted Average Amount of Stored Fuel (*Applies to "Closed" condition only)*

Closed-System

Plastic-gas-can test data were gathered from two 2-gallon-8-ounce-sized gas cans, and two five-gallon-sized gas cans. These gas cans were filled with certification test fuel to one-half of the total capacity. The cans were subjected to a diurnal-variable temperature profile in a SHED. An average diurnal-emission rate was first calculated using each individual gas-can average daily-emission rate. The average-daily plastic-gas-can permeation rate of 1.57 g/gal-day (determined earlier for closed systems) was then subtracted from that value to yield the resultant diurnal-emission rate for plastic. Closed-system gas can have diurnal emission of **1.38 g/gal-day**. In addition, the PFC regulation stated that all controlled PFCs need to meet the diurnal emission standard of **0.69 g/gal-day** starting in 2001, while kerosene cans and utility jugs need to meet this requirement in 2007. Similar diurnal SHED tests of three metal-gas cans produced an average daily emission rate of **0.44 g/gal-day**.

Open-System

The same sets of gas cans from the closed-system testing were tested again. The gas cans were stored with open vent and breathing holes. Each gas can was weighed after each subsequent 24-hour period for sixteen consecutive days. The average diurnal-emission rate over the test period was **21.8 g/day**. This diurnal-emission rate is applicable for both plastic- and metal-gas cans that are stored in an open condition.

C. Transport Spillage

Transport-spillage emissions arise when fuel escapes (e.g., spills,) from gas cans that are in transit. The transport-emission-spillage factor was determined from data provided by the U. S. Environmental Protection Agency (U.S. EPA) fuel transport spillage survey of hydrocarbon losses from L&G equipment. Analysis of these data revealed that the emission rates for a gas can (i.e., pump-to-pump losses) were **23.0 grams per gas-can-refill**-at-the-pump (g/refill) for a closed system, and **32.5 g/refill** for an open system. Analyses of responses from the residential PFC survey showed that the frequency of average residential PFCs is **0.0174 refill/day-can**, non-L&G commercial PFCs is **0.12 refill/day-can** and for L&G commercial PFCs is **0.964 refill/day-can**. Accordingly, transport spillage emissions are determined as:

$$\mathbf{HC_{TR} = (Pop_R)(S)(Refill_R)(EF_T)(B_R)} \qquad \text{(Eq. 10)}$$

where:
- HC_{TR} = PFC Transport-Spillage Emissions (tpd)
- Pop_R = Statewide PFC Population
- S = Percentage of Gas Cans Stored with Fuel
- $Refill_R$ = Average Number of PFC at Pump Refills Per Day per Can
- EF_T = Transport Spillage Emission Factor with Respect Storage Condition (g/refill)
- B_R = Percentage of Gas Cans with respect to Storage Condition and Material (see Table 2)

D. Refill Spillage

Spillage emissions are produced when fuel is dispensed from a gas can to an equipment/vehicle fuel tank, another gas can, etc., and fails to either be delivered into the intended reservoir or to remain inside the reservoir. Spillage data provided by the Outdoor Power Equipment Institute (OPEI) in conjunction with the U. S. EPA's Non-road Engine and Vehicle Emission Study (NEVES) report indicate that the spillage-emission rate for equipment refills from a gas can is 17 g/refill per equipment unit.[8] This estimate assumes that every refill results in a replenishment of the fuel tank's entire capacity. The spillage-emission rate is applied to only equipment or vehicles that are typically fueled from a gas can (e.g., lawn care equipment, sometimes recreational equipment), and not typically from a pump. Discrete values of specific equipment/vehicle fuel consumptions and populations were determined by ARB's OFFROAD2007**.** The amount of daily spillage emissions from all applicable residential- and commercial-gas cans is calculated as follows:

$$\mathbf{HC_S = \Sigma \frac{(Fuel)(Spill)}{(Tank)}} \qquad \text{(Eq. 11)}$$

where:
- HC_S = Daily Spillage Emission from All Gas Cans (g/day)
- Fuel = Applicable Equipment/Vehicle Type Fuel

[8] Nonroad Engine and Vehicle Emission Study – Report," U. S. EPA, November 1991

Consumption (gal/day)

Spill = Spillage-Emission Rate per Refill of Gas Can Refueled Equipment/Vehicles (17 g/refill)

Tank = Applicable Equipment/Vehicle Fuel-Tank Capacity (gal/refill)

Substituting the appropriate values into Equation 11, summing up the individual results for specific equipment, yields an average of **0.693 g/day** for PFC refill spillage emissions factor. The controlled PFC refill spillage emission factor is **0.173 g/day** (75% control).

E. Refueling Vapor Displacement

Refueling-displacement-vapor emissions result when fuel vapor is displaced from equipment and vehicle fuel tanks, gas cans, etc., by fuel dispensed from gas cans. The NEVES report of refueling emissions presented a formula to compute the refueling-vapor-displacement-emission factor. This formula is:

$$DISP = [-5.909 + (0.0884)(TD) + (0.485)(RVP)] \quad \text{(Eq. 12)}$$

where: DISP =Daily Spillage-Emission Rate for All Gas Cans (g/gal)

TD =Temperature (°F) of the Dispensed Fuel (ambient temperature <u>*of 75 °F*</u>)

RVP = Reid Vapor Pressure (RVP) of Dispensed Fuel (<u>*7.83*</u> psi)

Substituting the appropriate values into Equation 12 yields a refueling vapor-displacement emission rate of **4.52 g/gal**. The amount of daily refueling vapor-displacement emissions from all applicable residential-and commercial-gas cans is calculated as follows:

$$HC_{DISP} = (Pop_R)(DISP) \quad \text{(Eq. 13)}$$

where: HC_{DISP} =Total Refueling-Vapor-Displacement Emissions from PFC (tpd)

Pop_R = Statewide PFC Population

DISP = Refueling Vapor Displacement Emission Rate

The vapor-displacement-emission rate is applied only to equipment or vehicles that are typically fueled from a gas can, not from a pump dispenser. The specific equipment and vehicle fuel-consumption values used in the calculations were produced by OFFROAD2007.

F. Burp Emission

Burp emissions are produced by spill-proof PFC. The automatic vapor release valve in these cans open automatically and release gasoline vapor when internal pressure reach critical point due to increase in temperature.

$$HC_{Burp} = (Pop_R)(S)(EF_{Burp})(\text{Burp Frequency}))(\text{Refill Frequency}) \quad \text{(Eq. 14)}$$

where: HC_{Burp} = PFC Burp Emissions
Pop_R = Statewide PFC Population
S = Percentage of Gas Cans Stored with Fuel
EF_T = Burp Emission Factor (3.64 g/Burp)
Burp Frequency = Average Number of Burps per Can Per Refill (4 Burps/Refill)
$Refill_R$ = Average Number of PFC at Pump Refills Per Day per Can

Allocation Factors

Statewide emissions are allocated to each county/air basin/air district in California. County specific allocation factors were developed based on Census 2000 information from DOF.

$$HC_{county} = HC_{statewide} * \text{Allocation Factor}_{county} \quad \text{(Eq. 15)}$$

Where: HC_{county} = PFC Emission Inventory for a County
HC statewide = Statewide PFC Emission Inventory
Allocation Factor $_{county}$ = Allocation Factor for the County

Values for allocation factors can be found in Appendix G.

Seasonal Temperature Correction Factors

The testing to determine the emission factors for PFC was done by summer ozone temperature profile (65-105-65 ^oF in 24 hour cycle). Runs from OFFROAD2007 L&G emission inventory were used to determine the seasonal temperature correction factor for PFC. Correction factors are applied to the temperate sensitive emission process such as permeation and diurnal. Temperature correction factors for vapor displacement and burp are not available at this current time. Table 6 below shows the seasonal temperature correction factors for summer, winter and annual average.

Table 6. Seasonal Temperature Correction Factors for PFC Emission Inventory

Temperature Profile	RVP	24-Hour Temperature Cycle (ºF)	Permeation Temperature Correction Factor	Diurnal Temperature Correction Factor
Summer Ozone	7 psi	65-105-65	1.000	1.000
Summer Average	7 psi	62-92-62	0.940	0.660
Winter Average	9 psi	45-65-45	0.854	0.327
Annual Average	7.9 psi	60-85-60	0.758	0.377

Fuel Correction Factors

Faced with evidence that MTBE found in ground and surface water posed a significant health threat to California citizens, the ARB at the instruction of the Governor began phasing-out its use in 2003 and with a full phase-out by 2005.

In 1999, several gas cans were tested for relative emissions when filled with gasoline containing MTBE (RFG2) compared to emissions when filled with gasoline containing ethanol (RFG3). Each can was filled to a standardized level (40% of tank capacity), sealed, and allowed to sit for several days. The emissions were calculated by comparing the initial weight of the container and fuel to the resulting weight of the container and fuel. On average, RFGIII increases **82%** in diurnal emission and **30%** in permeation emissions. Closed system and metal cans are not affected by fuel correction factors.

FUTURE IMPROVEMENT

ARB does not have a scheduled update for the PFC inventory at this current time.

APPENDIX

Appendix A-1. Residential PFC Emission (tons/day of ROG)

Year	Population	Summer Ozone	Annual	Summer	Winter
1970	14,248,177	132.75	62.41	94.39	56.81
1971	14,177,418	132.09	62.10	93.92	56.53
1972	14,051,221	130.92	61.55	93.09	56.02
1973	13,947,145	129.95	61.09	92.40	55.61
1974	13,849,364	129.04	60.66	91.75	55.22
1975	13,779,049	128.38	60.35	91.28	54.94
1976	13,718,447	127.82	60.09	90.88	54.70
1977	13,656,033	127.24	59.81	90.47	54.45
1978	13,620,535	126.90	59.66	90.23	54.31
1979	13,532,418	126.08	59.27	89.65	53.96
1980	13,488,794	125.44	59.07	89.26	53.81
1981	13,410,968	123.66	58.68	88.31	53.64
1982	13,332,637	121.98	58.29	87.39	53.45
1983	13,237,469	120.22	57.83	86.40	53.18
1984	13,096,438	118.13	57.17	85.14	52.72
1985	12,989,278	116.42	56.66	84.13	52.38
1986	12,889,905	114.85	56.20	83.20	52.07
1987	12,772,018	113.18	55.65	82.18	51.68
1988	12,632,911	111.37	55.02	81.05	51.19
1989	12,497,344	109.66	54.40	79.96	50.70
1990	12,305,123	107.49	53.54	78.53	49.99
1991	12,060,721	104.93	52.46	76.79	49.05
1992	11,748,899	101.83	51.08	74.65	47.83
1993	11,337,372	97.91	49.27	71.89	46.20
1994	10,864,828	93.53	47.20	68.76	44.31
1995	10,367,973	88.98	45.03	65.50	42.32
1996	9,873,164	84.49	42.87	62.28	40.33
1997	9,427,142	80.47	40.92	59.38	38.54
1998	8,928,975	76.03	38.75	56.16	36.53
1999	8,467,263	71.94	36.74	53.19	34.66
2000	8,056,633	68.30	34.95	50.55	33.00
2001	7,664,075	61.68	30.72	45.22	28.93
2002	7,271,977	56.91	27.95	41.52	26.29
2003	6,895,686	52.96	25.77	38.53	24.24
2004	6,522,547	49.73	24.15	36.16	22.72
2005	6,165,602	51.84	26.21	38.53	25.24
2006	5,814,988	48.81	24.69	36.29	23.79
2007	5,493,728	45.90	23.16	34.11	22.33
2008	5,188,743	35.66	16.66	25.46	15.41
2009	4,899,340	32.57	15.01	23.11	13.80
2010	4,624,842	30.10	13.72	21.27	12.58
2011	4,364,591	27.87	12.58	19.61	11.49

Appendix A-1 Continued

Year	Population	Summer Ozone	Annual	Summer	Winter
2012	4,117,948	25.85	11.56	18.12	10.53
2013	3,884,291	24.04	10.68	16.81	9.70
2014	3,663,020	22.42	9.90	15.63	8.97
2015	3,453,555	20.94	9.20	14.57	8.33
2016	3,255,334	19.60	8.59	13.63	7.77
2017	3,067,816	18.41	8.06	12.80	7.28
2018	2,890,483	17.30	7.57	12.02	6.84
2019	2,722,833	16.26	7.11	11.30	6.43
2020	2,564,386	15.29	6.68	10.62	6.04
2021	2,414,680	14.37	6.28	9.98	5.67
2022	2,273,275	13.50	5.90	9.38	5.33
2023	2,139,747	12.69	5.54	8.81	5.01
2024	2,013,691	11.92	5.20	8.28	4.70
2025	1,894,719	11.20	4.89	7.78	4.42
2026	1,782,463	10.53	4.59	7.31	4.15
2027	1,676,569	9.89	4.31	6.86	3.90
2028	1,576,701	9.29	4.05	6.45	3.66
2029	1,482,537	8.73	3.80	6.06	3.44
2030	1,393,772	8.19	3.57	5.69	3.23
2031	1,310,115	7.70	3.35	5.34	3.03
2032	1,231,289	7.23	3.15	5.02	2.84
2033	1,157,030	6.79	2.96	4.71	2.67
2034	1,087,088	6.37	2.77	4.42	2.51
2035	1,021,226	5.98	2.60	4.15	2.35
2036	959,216	5.62	2.44	3.90	2.21
2037	900,846	5.27	2.29	3.66	2.07
2038	845,911	4.95	2.15	3.43	1.94
2039	794,219	4.64	2.02	3.22	1.82
2040	745,586	4.36	1.90	3.02	1.71

Appendix A-2. Commercial PFC Emission (tons/day of ROG)

Year	Population	Summer Ozone	Annual	Summer	Winter
1970	139,121	3.23	2.67	2.92	2.63
1971	166,606	3.88	3.20	3.51	3.15
1972	171,791	4.04	3.33	3.66	3.28
1973	178,248	4.24	3.48	3.83	3.42
1974	184,438	4.44	3.63	4.00	3.57
1975	191,708	4.66	3.80	4.19	3.73
1976	198,832	4.88	3.96	4.38	3.90
1977	206,649	5.11	4.14	4.59	4.07
1978	216,197	5.39	4.36	4.83	4.28
1979	226,472	5.69	4.59	5.10	4.51
1980	235,675	5.97	4.80	5.34	4.72
1981	244,241	6.23	5.00	5.56	4.91
1982	254,753	6.54	5.24	5.84	5.15
1983	263,784	6.81	5.45	6.08	5.35
1984	273,993	7.12	5.68	6.34	5.58
1985	286,921	7.49	5.97	6.67	5.87
1986	299,022	7.85	6.25	6.99	6.14
1987	311,074	8.21	6.52	7.30	6.41
1988	324,183	8.59	6.82	7.64	6.70
1989	333,586	8.88	7.04	7.89	6.91
1990	347,513	9.29	7.35	8.25	7.22
1991	357,074	9.58	7.58	8.50	7.44
1992	363,215	9.79	7.73	8.68	7.59
1993	369,677	9.99	7.88	8.86	7.74
1994	374,655	10.16	8.01	9.01	7.87
1995	383,019	10.42	8.21	9.23	8.06
1996	394,641	10.77	8.47	9.54	8.32
1997	406,674	11.13	8.75	9.85	8.59
1998	420,303	11.54	9.06	10.21	8.90
1999	436,526	12.01	9.43	10.63	9.26
2000	456,661	12.60	9.88	11.14	9.70
2001	467,605	9.49	6.79	8.04	6.61
2002	474,621	8.33	5.62	6.88	5.44
2003	484,893	7.68	4.92	6.20	4.74
2004	495,932	7.60	4.76	6.08	4.58
2005	515,552	8.10	5.06	6.50	4.90
2006	532,471	8.30	5.14	6.63	4.98
2007	547,207	8.36	5.11	6.65	4.95
2008	562,015	7.63	4.48	5.93	4.25
2009	577,283	7.55	4.33	5.81	4.09
2010	593,097	7.51	4.21	5.72	3.96
2011	609,423	7.49	4.10	5.65	3.84
2012	626,234	7.48	4.01	5.60	3.74
2013	643,542	7.51	3.94	5.57	3.67

Appendix A-2 Continued

Year	Population	Summer Ozone	Annual	Summer	Winter
2014	661,406	7.57	3.90	5.58	3.62
2015	679,897	7.66	3.89	5.61	3.60
2016	699,012	7.78	3.89	5.67	3.60
2017	718,815	7.93	3.94	5.76	3.63
2018	739,432	8.11	4.00	5.88	3.68
2019	760,910	8.30	4.06	6.00	3.73
2020	783,319	8.50	4.13	6.12	3.79
2021	806,630	8.71	4.20	6.26	3.85
2022	830,908	8.93	4.28	6.40	3.92
2023	856,350	9.16	4.36	6.55	3.99
2024	882,992	9.40	4.45	6.71	4.07
2025	910,812	9.66	4.54	6.88	4.15
2026	939,848	9.93	4.64	7.05	4.23
2027	970,129	10.21	4.75	7.24	4.33
2028	1,001,879	10.50	4.86	7.43	4.42
2029	1,035,250	10.81	4.98	7.64	4.53
2030	1,070,298	11.14	5.10	7.86	4.64
2031	1,107,238	11.49	5.24	8.09	4.76
2032	1,146,576	11.86	5.38	8.34	4.88
2033	1,186,921	12.24	5.53	8.59	5.01
2034	1,229,240	12.64	5.69	8.86	5.15
2035	1,273,649	13.06	5.85	9.14	5.30
2036	1,320,270	13.51	6.03	9.44	5.45
2037	1,369,232	13.97	6.21	9.76	5.62
2038	1,420,675	14.47	6.41	10.09	5.79
2039	1,474,742	14.98	6.62	10.43	5.97
2040	1,531,589	15.53	6.83	10.80	6.17

APPENDIX B

OCCUPIED HOUSEHOLD UNITS

Appendix B-1. California Population

Year	Population	Year	Population	Year	Population
1970	20,039,002	1994	31,523,690	2018	43,020,135
1971	20,346,000	1995	31,711,849	2019	43,457,241
1972	20,585,001	1996	31,962,949	2020	43,889,873
1973	20,868,002	1997	32,452,789	2021	44,318,032
1974	21,174,003	1998	32,862,965	2022	44,741,716
1975	21,538,000	1999	33,418,578	2023	45,160,927
1976	21,935,999	2000	34,098,740	2024	45,575,665
1977	22,352,000	2001	34,784,382	2025	45,985,928
1978	22,836,000	2002	35,392,960	2026	46,391,718
1979	23,257,001	2003	35,989,983	2027	46,793,034
1980	23,782,000	2004	36,505,743	2028	47,189,877
1981	24,277,600	2005	37,004,908	2029	47,582,246
1982	24,804,899	2006	37,425,917	2030	47,970,141
1983	25,336,301	2007	37,916,708	2031	48,353,562
1984	25,816,001	2008	38,403,024	2032	48,732,510
1985	26,402,401	2009	38,884,867	2033	49,106,984
1986	27,052,399	2010	39,362,236	2034	49,476,984
1987	27,716,898	2011	39,835,131	2035	49,842,511
1988	28,393,099	2012	40,303,553	2036	50,203,563
1989	29,142,001	2013	40,767,501	2037	50,560,143
1990	29,828,496	2014	41,226,975	2038	50,912,248
1991	30,458,613	2015	41,681,976	2039	51,259,880
1992	30,987,385	2016	42,132,503	2040	51,603,038

Source: the California Department of Finance, Demographic Research Unit
http://www.dof.ca.gov/Research/Research.asp

Household Size = 2.87persons/household

Household Occupancy = 1 - vacant household percentage = 1- 5.8% = 94.2%

Substitute the above values to equation 3, yield California occupied household units.

Appendix B-2. California Occupied Household Units

Year	Occupied Household Units	Year	Occupied Household Units	Year	Occupied Household Units
1970	6,577,261	1994	10,346,800	2018	14,120,198
1971	6,678,025	1995	10,408,558	2019	14,263,666
1972	6,756,471	1996	10,490,975	2020	14,405,666
1973	6,849,358	1997	10,651,752	2021	14,546,197
1974	6,949,795	1998	10,786,381	2022	14,685,260
1975	7,069,267	1999	10,968,746	2023	14,822,855
1976	7,199,899	2000	11,191,991	2024	14,958,981
1977	7,336,440	2001	11,417,034	2025	15,093,639
1978	7,495,300	2002	11,616,783	2026	15,226,829
1979	7,633,483	2003	11,812,740	2027	15,358,550
1980	7,805,799	2004	11,982,024	2028	15,488,803
1981	7,968,467	2005	12,145,862	2029	15,617,587
1982	8,141,538	2006	12,284,047	2030	15,744,903
1983	8,315,957	2007	12,445,135	2031	15,870,751
1984	8,473,405	2008	12,604,756	2032	15,995,130
1985	8,665,875	2009	12,762,908	2033	16,118,041
1986	8,879,219	2010	12,919,591	2034	16,239,484
1987	9,097,323	2011	13,074,806	2035	16,359,458
1988	9,319,268	2012	13,228,553	2036	16,477,964
1989	9,565,075	2013	13,380,831	2037	16,595,002
1990	9,790,398	2014	13,531,641	2038	16,710,571
1991	9,997,217	2015	13,680,983	2039	16,824,671
1992	10,170,772	2016	13,828,856	2040	16,937,304
1993	10,278,037	2017	13,975,261		

APPENDIX C

Residential PFC Population and Growth Rate

Year	Occupied household	Percentage Household with Cans	Average Cans per Household	can population	Growth Rate
1970	6,577,261	0.83	2.63	14,248,177	2.31
1971	6,678,025	0.82	2.59	14,177,418	2.30
1972	6,756,471	0.81	2.56	14,051,221	2.28
1973	6,849,358	0.81	2.52	13,947,145	2.26
1974	6,949,795	0.80	2.49	13,849,364	2.25
1975	7,069,267	0.79	2.45	13,779,049	2.23
1976	7,199,899	0.79	2.42	13,718,447	2.22
1977	7,336,440	0.78	2.39	13,656,033	2.21
1978	7,495,300	0.77	2.36	13,620,535	2.21
1979	7,633,483	0.76	2.33	13,532,418	2.19
1980	7,805,799	0.75	2.29	13,488,794	2.19
1981	7,968,467	0.74	2.26	13,410,968	2.18
1982	8,141,538	0.73	2.23	13,332,637	2.16
1983	8,315,957	0.72	2.20	13,237,469	2.15
1984	8,473,405	0.71	2.17	13,096,438	2.12
1985	8,665,875	0.70	2.14	12,989,278	2.11
1986	8,879,219	0.69	2.12	12,889,905	2.09
1987	9,097,323	0.67	2.09	12,772,018	2.07
1988	9,319,268	0.66	2.06	12,632,911	2.05
1989	9,565,075	0.64	2.03	12,497,344	2.03
1990	9,790,398	0.63	2.00	12,305,123	2.00
1991	9,997,217	0.61	1.98	12,060,721	1.96
1992	10,170,772	0.59	1.95	11,748,899	1.91
1993	10,278,037	0.57	1.93	11,337,372	1.84
1994	10,346,800	0.55	1.90	10,864,828	1.76
1995	10,408,558	0.53	1.87	10,367,973	1.68
1996	10,490,975	0.51	1.85	9,873,164	1.60
1997	10,651,752	0.49	1.82	9,427,142	1.53
1998	10,786,381	0.46	1.80	8,928,975	1.45
1999	10,968,746	0.43	1.78	8,467,263	1.37
2000	11,191,991	0.41	1.75	8,056,633	1.31

2001	11,417,034	0.39	1.73	7,664,075	1.24
2002	11,616,783	0.37	1.71	7,271,977	1.18
2003	11,812,740	0.35	1.68	6,895,686	1.12
2004	11,982,024	0.33	1.66	6,522,547	1.06
2005	**12,145,862**	**0.31**	**1.64**	**6,165,602**	**1.00**
2006	12,284,047	0.29	1.62	5,814,988	0.94
2007	12,445,135	0.28	1.59	5,493,728	0.89
2008	12,604,756	0.26	1.57	5,188,743	0.84
2009	12,762,908	0.25	1.55	4,899,340	0.79
2010	12,919,591	0.23	1.53	4,624,842	0.75
2011	13,074,806	0.22	1.51	4,364,591	0.71
2012	13,228,553	0.21	1.49	4,117,948	0.67

Appendix C Continued

Year	Occupied household	Percentage Household with Cans	Average Cans per Household	can population	Growth Rate
2013	13,380,831	0.20	1.47	3,884,291	0.63
2014	13,531,641	0.19	1.45	3,663,020	0.59
2015	13,680,983	0.18	1.43	3,453,555	0.56
2016	13,828,856	0.17	1.41	3,255,334	0.53
2017	13,975,261	0.16	1.39	3,067,816	0.50
2018	14,120,198	0.15	1.37	2,890,483	0.47
2019	14,263,666	0.14	1.36	2,722,833	0.44
2020	14,405,666	0.13	1.34	2,564,386	0.42
2021	14,546,197	0.13	1.32	2,414,680	0.39
2022	14,685,260	0.12	1.30	2,273,275	0.37
2023	14,822,855	0.11	1.28	2,139,747	0.35
2024	14,958,981	0.11	1.27	2,013,691	0.33
2025	15,093,639	0.10	1.25	1,894,719	0.31
2026	15,226,829	0.09	1.23	1,782,463	0.29
2027	15,358,550	0.09	1.22	1,676,569	0.27
2028	15,488,803	0.08	1.20	1,576,701	0.26
2029	15,617,587	0.08	1.18	1,482,537	0.24
2030	15,744,903	0.08	1.17	1,393,772	0.23
2031	15,870,751	0.07	1.15	1,310,115	0.21
203	15,995,130	0.07	1.14	1,231,289	0.20

2					
2033	16,118,041	0.06	1.12	1,157,030	0.19
2034	16,239,484	0.06	1.11	1,087,088	0.18
2035	16,359,458	0.06	1.09	1,021,226	0.17
2036	16,477,964	0.05	1.08	959,216	0.16
2037	16,595,002	0.05	1.06	900,846	0.15
2038	16,710,571	0.05	1.05	845,911	0.14
2039	16,824,671	0.05	1.04	794,219	0.13
2040	16,937,304	0.04	1.02	745,586	0.12

Sample Calculation

Can Population = Occupied Household * Percent of Household with Cans
* Average Number of Can per Household

Can Population (2007) = 12,441,535 * 0.28 * 1.59
= 5,493,728 Cans

Growth Rate (t) = Can Population (t) / Can Population (2005)

Growth Rate (2007) = Can Population (2007) / Can Population (2005)
= 5,493,728 / 6,165,602
= 0.89

APPENDIX D

Commercial PFC Population and Composite Growth Rates

Appendix D-1. Statistics for Personal Income, Median Household Income, Population, REMI Service Sector, and Landscaping Employment

Year	Personal Income	Median Household Income	Population	REMI Service Sector	Landscaping Employment
1970	$ 4,810	$ 10,493	20,039,002	0.23	88,398
1971	$ 5,034	$ 11,302	20,346,000	0.24	90,039
1972	$ 5,454	$ 12,126	20,585,001	0.26	91,711
1973	$ 5,944	$ 12,965	20,868,002	0.27	93,414
1974	$ 6,552	$ 13,819	21,174,003	0.28	95,149
1975	$ 7,129	$ 14,690	21,538,000	0.30	96,916
1976	$ 7,825	$ 15,578	21,935,999	0.31	98,716
1977	$ 8,570	$ 16,485	22,352,000	0.33	100,549
1978	$ 9,580	$ 17,410	22,836,000	0.36	102,416
1979	$ 10,753	$ 18,355	23,257,001	0.38	104,318
1980	$ 11,951	$ 17,442	23,782,000	0.40	106,255
1981	$ 13,175	$ 19,600	24,277,600	0.41	108,228
1982	$ 13,763	$ 20,442	24,804,899	0.43	110,238
1983	$ 14,556	$ 21,273	25,336,301	0.46	112,285
1984	$ 15,994	$ 22,736	25,816,001	0.47	114,371
1985	$ 16,956	$ 25,200	26,402,401	0.50	116,495
1986	$ 17,668	$ 27,000	27,052,399	0.52	118,658
1987	$ 18,549	$ 29,000	27,716,898	0.55	120,861
1988	$ 19,599	$ 30,200	28,393,099	0.59	123,106
1989	$ 20,585	$ 30,300	29,142,001	0.60	125,392
1990	$ 21,638	$ 33,300	29,828,496	0.64	127,721
1991	$ 21,750	$ 33,500	30,458,613	0.66	130,092
1992	$ 22,492	$ 33,900	30,987,385	0.67	132,508
1993	$ 22,635	$ 35,100	31,314,189	0.68	134,969
1994	$ 23,203	$ 34,100	31,523,690	0.71	137,475
1995	$ 24,161	$ 35,300	31,711,849	0.74	140,028
1996	$ 25,312	$ 37,100	31,962,949	0.77	142,629
1997	$ 26,490	$ 39,000	32,452,789	0.78	145,277
1998	$ 28,374	$ 40,600	32,862,965	0.81	147,975
1999	$ 29,828	$ 43,800	33,418,578	0.84	150,723
2000	$ 32,463	$ 46,900	34,098,740	0.87	153,522
2001	$ 32,882	$ 47,177	34,784,382	0.90	156,373
2002	$ 32,803	$ 47,500	35,392,960	0.92	159,277
2003	$ 33,400	$ 49,320	35,989,983	0.95	162,235
2004	$ 35,219	$ 49,185	36,505,743	0.97	165,248
2005	$ 37,036	$ 54,389	37,004,908	1.00	168,316
2006	$ 39,080	$ 56,459	37,425,917	1.03	171,442
2007	$ 40,900	$ 58,605	37,916,708	1.04	174,626

Appendix D-1 Continued

Year	Personal Income	Median Household Income	Population	REMI Service Sector	Landscaping Employment
2008	$ 42,813	$ 60,831	38,403,024	1.06	177,869
2009	$ 44,826	$ 63,140	38,884,867	1.07	181,172
2010	$ 46,944	$ 65,537	39,362,236	1.09	184,536
2011	$ 49,175	$ 68,026	39,835,131	1.10	187,963
2012	$ 51,526	$ 70,610	40,303,553	1.12	191,453
2013	$ 54,003	$ 73,296	40,767,501	1.13	195,009
2014	$ 56,616	$ 76,088	41,226,975	1.14	198,630
2015	$ 59,373	$ 78,992	41,681,976	1.15	202,319
2016	$ 62,282	$ 82,011	42,132,503	1.17	206,076
2017	$ 65,353	$ 85,153	42,578,556	1.18	209,903
2018	$ 68,598	$ 88,423	43,020,135	1.19	213,801
2019	$ 72,026	$ 91,828	43,457,241	1.20	217,771
2020	$ 75,649	$ 95,374	43,889,873	1.21	221,815
2021	$ 79,480	$ 99,068	44,318,032	1.22	225,934
2022	$ 83,531	$ 102,917	44,741,716	1.23	230,130
2023	$ 87,818	$ 106,929	45,160,927	1.24	234,404
2024	$ 92,353	$ 111,111	45,575,665	1.25	238,757
2025	$ 97,154	$ 115,473	45,985,928	1.27	243,190
2026	$ 102,237	$ 120,023	46,391,718	1.28	247,707
2027	$ 107,620	$ 124,769	46,793,034	1.29	252,307
2028	$ 113,321	$ 129,722	47,189,877	1.30	256,992
2029	$ 119,362	$ 134,892	47,582,246	1.32	261,764
2030	$ 125,763	$ 140,289	47,970,141	1.33	266,625
2031	$ 132,547	$ 145,925	48,353,562	1.35	271,577
2032	$ 139,738	$ 151,811	48,732,510	1.37	276,620
2033	$ 147,363	$ 157,959	49,106,984	1.38	281,757
2034	$ 155,448	$ 164,382	49,476,984	1.40	286,989
2035	$ 164,022	$ 171,094	49,842,511	1.41	292,319
2036	$ 173,118	$ 178,109	50,203,563	1.42	297,747
2037	$ 182,766	$ 185,440	50,560,143	1.44	303,276
2038	$ 193,003	$ 193,105	50,912,248	1.45	308,908
2039	$ 203,866	$ 201,119	51,259,880	1.47	314,645
2040	$ 215,394	$ 209,500	51,603,038	1.48	320,488

Appendix D-2. Individual Growth Rate for Personal Income, Median Household Income, Population, REMI Service Sector, and Landscaping Employment

Year	Personal Income	Median Household Income	Population	REMI Service Sector	Landscaping Employment
1970	0.1299	0.1929	0.5415	0.2331	0.5252
1971	0.1359	0.2078	0.5498	0.2417	0.5349
1972	0.1473	0.2230	0.5563	0.2623	0.5449
1973	0.1605	0.2384	0.5639	0.2737	0.5550
1974	0.1769	0.2541	0.5722	0.2835	0.5653
1975	0.1925	0.2701	0.5820	0.2997	0.5758
1976	0.2113	0.2864	0.5928	0.3101	0.5865
1977	0.2314	0.3031	0.6040	0.3275	0.5974
1978	0.2587	0.3201	0.6171	0.3577	0.6085
1979	0.2903	0.3375	0.6285	0.3807	0.6198
1980	0.3227	0.3207	0.6427	0.4034	0.6313
1981	0.3557	0.3604	0.6561	0.4127	0.6430
1982	0.3716	0.3758	0.6703	0.4342	0.6549
1983	0.3930	0.3911	0.6847	0.4601	0.6671
1984	0.4319	0.4180	0.6976	0.4749	0.6795
1985	0.4578	0.4633	0.7135	0.4995	0.6921
1986	0.4770	0.4964	0.7310	0.5206	0.7050
1987	0.5008	0.5332	0.7490	0.5459	0.7181
1988	0.5292	0.5553	0.7673	0.5880	0.7314
1989	0.5558	0.5571	0.7875	0.6002	0.7450
1990	0.5842	0.6123	0.8061	0.6381	0.7588
1991	0.5873	0.6159	0.8231	0.6647	0.7729
1992	0.6073	0.6233	0.8374	0.6713	0.7873
1993	0.6112	0.6454	0.8462	0.6848	0.8019
1994	0.6265	0.6270	0.8519	0.7097	0.8168
1995	0.6524	0.6490	0.8570	0.7385	0.8319
1996	0.6834	0.6821	0.8637	0.7665	0.8474
1997	0.7153	0.7171	0.8770	0.7833	0.8631
1998	0.7661	0.7465	0.8881	0.8084	0.8791
1999	0.8054	0.8053	0.9031	0.8356	0.8955
2000	0.8765	0.8623	0.9215	0.8661	0.9121
2001	0.8878	0.8674	0.9400	0.8976	0.9290
2002	0.8857	0.8733	0.9564	0.9246	0.9463
2003	0.9018	0.9068	0.9726	0.9486	0.9639
2004	0.9509	0.9043	0.9865	0.9738	0.9818
2005	1.0000	1.0000	1.0000	1.0000	1.0000
2006	1.0552	1.0381	1.0114	1.0264	1.0186
2007	1.1043	1.0775	1.0246	1.0428	1.0375
2008	1.1560	1.1184	1.0378	1.0578	1.0568
2009	1.2103	1.1609	1.0508	1.0729	1.0764
2010	1.2675	1.2050	1.0637	1.0884	1.0964
2011	1.3278	1.2507	1.0765	1.1035	1.1167
2012	1.3912	1.2983	1.0891	1.1176	1.1375

Appendix D-2 Continued

Year	Personal Income	Median Household Income	Population	REMI Service Sector	Landscaping Employment
2013	1.4581	1.3476	1.1017	1.1307	1.1586
2014	1.5287	1.3990	1.1141	1.1430	1.1801
2015	1.6031	1.4523	1.1264	1.1550	1.2020
2016	1.6817	1.5079	1.1386	1.1658	1.2243
2017	1.7646	1.5656	1.1506	1.1762	1.2471
2018	1.8522	1.6258	1.1626	1.1871	1.2702
2019	1.9448	1.6884	1.1744	1.1980	1.2938
2020	2.0426	1.7536	1.1861	1.2095	1.3178
2021	2.1460	1.8215	1.1976	1.2196	1.3423
2022	2.2554	1.8922	1.2091	1.2304	1.3672
2023	2.3711	1.9660	1.2204	1.2427	1.3926
2024	2.4936	2.0429	1.2316	1.2548	1.4185
2025	2.6232	2.1231	1.2427	1.2671	1.4448
2026	2.7605	2.2067	1.2537	1.2780	1.4717
2027	2.9058	2.2940	1.2645	1.2893	1.4990
2028	3.0598	2.3851	1.2752	1.3020	1.5268
2029	3.2229	2.4801	1.2858	1.3157	1.5552
2030	3.3957	2.5794	1.2963	1.3306	1.5841
2031	3.5789	2.6830	1.3067	1.3540	1.6135
2032	3.7730	2.7912	1.3169	1.3681	1.6435
2033	3.9789	2.9042	1.3270	1.3821	1.6740
2034	4.1972	3.0223	1.3370	1.3961	1.7051
2035	4.4287	3.1457	1.3469	1.4101	1.7367
2036	4.6743	3.2747	1.3567	1.4241	1.7690
2037	4.9348	3.4095	1.3663	1.4381	1.8018
2038	5.2112	3.5504	1.3758	1.4522	1.8353
2039	5.5045	3.6978	1.3852	1.4662	1.8694
2040	5.8158	3.8519	1.3945	1.4802	1.9041

Above five components' individual growth rates are all normalized to year 2005.

Sample Calculation

Growth Rate of Personal Income (1970)
= Personal Income (1970)) / Personal Income (2005)
= $37,036 / $4,810
= 0.1299

Appendix D-3. Rate of change (Δ) for Personal Income, Median Household Income, Population, REMI Service Sector, and Landscaping Employment

Year	Δ(Personal Income)	Δ (Median Household Income)	Δ (Population)	Δ(REMI Service Sector)	Δ (Landscaping Employment)
1970	1.0466	1.0771	1.0153	0.9786	1.0186
1971	1.0466	1.0771	1.0153	1.0369	1.0186
1972	1.0834	1.0729	1.0117	1.0853	1.0186
1973	1.0898	1.0692	1.0137	1.0434	1.0186
1974	1.1023	1.0659	1.0147	1.0360	1.0186
1975	1.0881	1.0630	1.0172	1.0570	1.0186
1976	1.0976	1.0605	1.0185	1.0347	1.0186
1977	1.0952	1.0582	1.0190	1.0560	1.0186
1978	1.1179	1.0561	1.0217	1.0925	1.0186
1979	1.1224	1.0543	1.0184	1.0643	1.0186
1980	1.1114	0.9502	1.0226	1.0595	1.0186
1981	1.1024	1.1237	1.0208	1.0232	1.0186
1982	1.0446	1.0430	1.0217	1.0519	1.0186
1983	1.0576	1.0407	1.0214	1.0597	1.0186
1984	1.0988	1.0688	1.0189	1.0322	1.0186
1985	1.0601	1.1084	1.0227	1.0518	1.0186
1986	1.0420	1.0714	1.0246	1.0423	1.0186
1987	1.0499	1.0741	1.0246	1.0486	1.0186
1988	1.0566	1.0414	1.0244	1.0771	1.0186
1989	1.0503	1.0033	1.0264	1.0207	1.0186
1990	1.0512	1.0990	1.0236	1.0632	1.0186
1991	1.0052	1.0060	1.0211	1.0417	1.0186
1992	1.0341	1.0119	1.0174	1.0099	1.0186
1993	1.0064	1.0354	1.0105	1.0202	1.0186
1994	1.0251	0.9715	1.0067	1.0364	1.0186
1995	1.0413	1.0352	1.0060	1.0405	1.0186
1996	1.0476	1.0510	1.0079	1.0380	1.0186
1997	1.0465	1.0512	1.0153	1.0219	1.0186
1998	1.0711	1.0410	1.0126	1.0320	1.0186
1999	1.0512	1.0788	1.0169	1.0337	1.0186
2000	1.0883	1.0708	1.0204	1.0365	1.0186
2001	1.0129	1.0059	1.0201	1.0363	1.0186
2002	0.9976	1.0068	1.0175	1.0301	1.0186
2003	1.0182	1.0383	1.0169	1.0260	1.0186
2004	1.0545	0.9973	1.0143	1.0265	1.0186
2005	1.0516	1.1058	1.0137	1.0270	1.0186
2006	1.0552	1.0381	1.0114	1.0264	1.0186
2007	1.0466	1.0380	1.0131	1.0159	1.0186
2008	1.0468	1.0380	1.0128	1.0144	1.0186
2009	1.0470	1.0380	1.0125	1.0143	1.0186
2010	1.0473	1.0380	1.0123	1.0145	1.0186
2011	1.0475	1.0380	1.0120	1.0138	1.0186

Appendix D-3 Continued

Year	Δ(Personal Income)	Δ (Median Household Income)	Δ (Population)	Δ(REMI Service Sector)	Δ (Landscaping Employment)
2012	1.048	1.038	1.012	1.013	1.019
2013	1.048	1.038	1.012	1.012	1.019
2014	1.048	1.038	1.011	1.011	1.019
2015	1.049	1.038	1.011	1.010	1.019
2016	1.049	1.038	1.011	1.009	1.019
2017	1.049	1.038	1.011	1.009	1.019
2018	1.050	1.038	1.010	1.009	1.019
2019	1.050	1.039	1.010	1.009	1.019
2020	1.050	1.039	1.010	1.010	1.019
2021	1.051	1.039	1.010	1.008	1.019
2022	1.051	1.039	1.010	1.009	1.019
2023	1.051	1.039	1.009	1.010	1.019
2024	1.052	1.039	1.009	1.010	1.019
2025	1.052	1.039	1.009	1.010	1.019
2026	1.052	1.039	1.009	1.009	1.019
2027	1.053	1.040	1.009	1.009	1.019
2028	1.053	1.040	1.008	1.010	1.019
2029	1.053	1.040	1.008	1.011	1.019
2030	1.054	1.040	1.008	1.011	1.019
2031	1.054	1.040	1.008	1.018	1.019
2032	1.054	1.040	1.008	1.010	1.019
2033	1.055	1.040	1.008	1.010	1.019
2034	1.055	1.041	1.008	1.010	1.019
2035	1.055	1.041	1.007	1.010	1.019
2036	1.055	1.041	1.007	1.010	1.019
2037	1.056	1.041	1.007	1.010	1.019
2038	1.056	1.041	1.007	1.010	1.019
2039	1.056	1.042	1.007	1.010	1.019
2040	1.057	1.042	1.007	1.010	1.019

Sample Calculation

Δ Personal Income (1972)
= Personal Income (1972)) / Personal Income (1971)
= $5,454 / $5,034
= 1.083

Appendix D-4. Growth Rate Contribution (k) for Personal Income, Median Household Income, Population, REMI Service Sector, and Landscaping Employment

Year	k(Personal Income)	k (Median Household Income)	k (Population)	k(REMI Service Sector)	k (Landscaping Employment)
1970	0.2038	0.2097	0.1977	0.1905	0.1983
1971	0.2506	0.2579	0.2431	0.2483	0.1961
1972	0.2547	0.2522	0.2379	0.2552	0.1932
1973	0.2585	0.2536	0.2404	0.2475	0.1946
1974	0.2613	0.2527	0.2405	0.2456	0.1945
1975	0.2575	0.2516	0.2407	0.2502	0.1942
1976	0.2606	0.2518	0.2418	0.2457	0.1948
1977	0.2590	0.2503	0.2410	0.2497	0.1941
1978	0.2607	0.2463	0.2383	0.2548	0.1919
1979	0.2635	0.2475	0.2391	0.2499	0.1930
1980	0.2682	0.2293	0.2468	0.2557	0.1973
1981	0.2582	0.2632	0.2391	0.2396	0.1926
1982	0.2510	0.2506	0.2455	0.2528	0.1966
1983	0.2531	0.2490	0.2444	0.2536	0.1960
1984	0.2605	0.2533	0.2415	0.2447	0.1945
1985	0.2499	0.2612	0.2410	0.2479	0.1936
1986	0.2493	0.2563	0.2451	0.2493	0.1959
1987	0.2501	0.2559	0.2441	0.2498	0.1953
1988	0.2516	0.2480	0.2439	0.2565	0.1952
1989	0.2561	0.2447	0.2503	0.2489	0.1990
1990	0.2481	0.2594	0.2416	0.2509	0.1938
1991	0.2467	0.2469	0.2506	0.2557	0.2000
1992	0.2539	0.2484	0.2498	0.2479	0.2000
1993	0.2471	0.2542	0.2481	0.2505	0.2001
1994	0.2538	0.2405	0.2492	0.2566	0.2014
1995	0.2526	0.2511	0.2440	0.2524	0.1981
1996	0.2528	0.2536	0.2432	0.2504	0.1973
1997	0.2531	0.2542	0.2455	0.2471	0.1976
1998	0.2577	0.2504	0.2436	0.2483	0.1968
1999	0.2515	0.2580	0.2432	0.2473	0.1959
2000	0.2581	0.2540	0.2420	0.2459	0.1946
2001	0.2486	0.2468	0.2503	0.2543	0.2000
2002	0.2462	0.2485	0.2511	0.2542	0.2009
2003	0.2484	0.2533	0.2481	0.2503	0.1990
2004	0.2577	0.2437	0.2478	0.2508	0.1993
2005	0.2505	0.2634	0.2415	0.2446	0.1953
2006	0.2554	0.2513	0.2448	0.2485	0.1978
2007	0.2544	0.2523	0.2463	0.2470	0.1985
2008	0.2546	0.2524	0.2463	0.2467	0.1985
2009	0.2546	0.2524	0.2463	0.2467	0.1985
2010	0.2547	0.2524	0.2462	0.2467	0.1985
2011	0.2548	0.2525	0.2462	0.2466	0.1986

Appendix D-4 Continued

Year	k(Personal Income)	k (Median Household Income)	k (Population)	k(REMI Service Sector)	k (Landscaping Employment)
2012	0.2549	0.2525	0.2461	0.2464	0.1986
2013	0.2551	0.2526	0.2462	0.2462	0.1986
2014	0.2552	0.2527	0.2461	0.2460	0.1987
2015	0.2553	0.2527	0.2461	0.2460	0.1987
2016	0.2554	0.2528	0.2461	0.2457	0.1987
2017	0.2555	0.2528	0.2461	0.2457	0.1987
2018	0.2555	0.2528	0.2460	0.2457	0.1987
2019	0.2556	0.2528	0.2459	0.2457	0.1987
2020	0.2556	0.2528	0.2458	0.2457	0.1987
2021	0.2558	0.2529	0.2458	0.2455	0.1987
2022	0.2558	0.2529	0.2457	0.2456	0.1987
2023	0.2558	0.2528	0.2456	0.2458	0.1986
2024	0.2559	0.2528	0.2456	0.2457	0.1986
2025	0.2560	0.2529	0.2455	0.2457	0.1986
2026	0.2561	0.2529	0.2455	0.2455	0.1986
2027	0.2561	0.2530	0.2454	0.2455	0.1986
2028	0.2561	0.2529	0.2453	0.2456	0.1986
2029	0.2562	0.2529	0.2452	0.2458	0.1985
2030	0.2562	0.2529	0.2451	0.2459	0.1985
2031	0.2558	0.2525	0.2447	0.2470	0.1982
2032	0.2563	0.2530	0.2451	0.2457	0.1985
2033	0.2564	0.2530	0.2450	0.2456	0.1985
2034	0.2565	0.2530	0.2450	0.2456	0.1985
2035	0.2565	0.2530	0.2449	0.2455	0.1985
2036	0.2566	0.2531	0.2449	0.2455	0.1985
2037	0.2566	0.2531	0.2448	0.2455	0.1985
2038	0.2567	0.2531	0.2448	0.2454	0.1985
2039	0.2567	0.2531	0.2447	0.2454	0.1984
2040	0.2568	0.2532	0.2447	0.2454	0.1984

Sample Calculation

K personal income (1972)
= Δ Personal Income$_{1972}$ **/** (Δ Personal Income + Δ Median Household Income + Δ Population + Δ REMI Service Sector + Δ Landscaping Employment)$_{1972}$

= 1.0834 / (1.0834 + 1.0729 + 1.0117 + 1.0853 + 1.0186)

= 0.2547

Appendix D-5. Composite Growth Rates for Commercial PFC

Year	Composite Growth Rate	Growth Rate Normalized to 2005	Year	Composite Growth Rate	Growth Rate Normalized to 2005
1970	0.3225	**0.2698**	2006	1.2345	**1.0328**
1971	0.3863	**0.3232**	2007	1.2686	**1.0614**
1972	0.3983	**0.3332**	2008	1.3030	**1.0901**
1973	0.4133	**0.3457**	2009	1.3384	**1.1197**
1974	0.4276	**0.3577**	2010	1.3750	**1.1504**
1975	0.4445	**0.3718**	2011	1.4129	**1.1821**
1976	0.4610	**0.3857**	2012	1.4519	**1.2147**
1977	0.4791	**0.4008**	2013	1.4920	**1.2483**
1978	0.5012	**0.4193**	2014	1.5334	**1.2829**
1979	0.5251	**0.4393**	2015	1.5763	**1.3188**
1980	0.5464	**0.4571**	2016	1.6206	**1.3559**
1981	0.5662	**0.4737**	2017	1.6665	**1.3943**
1982	0.5906	**0.4941**	2018	1.7143	**1.4343**
1983	0.6116	**0.5117**	2019	1.7641	**1.4759**
1984	0.6352	**0.5315**	2020	1.8160	**1.5194**
1985	0.6652	**0.5565**	2021	1.8701	**1.5646**
1986	0.6933	**0.5800**	2022	1.9264	**1.6117**
1987	0.7212	**0.6034**	2023	1.9854	**1.6610**
1988	0.7516	**0.6288**	2024	2.0471	**1.7127**
1989	0.7734	**0.6470**	2025	2.1116	**1.7667**
1990	0.8057	**0.6741**	2026	2.1789	**1.8230**
1991	0.8278	**0.6926**	2027	2.2491	**1.8817**
1992	0.8421	**0.7045**	2028	2.3228	**1.9433**
1993	0.8571	**0.7171**	2029	2.4001	**2.0080**
1994	0.8686	**0.7267**	2030	2.4814	**2.0760**
1995	0.8880	**0.7429**	2031	2.5670	**2.1477**
1996	0.9149	**0.7655**	2032	2.6582	**2.2240**
1997	0.9428	**0.7888**	2033	2.7518	**2.3022**
1998	0.9744	**0.8152**	2034	2.8499	**2.3843**
1999	1.0120	**0.8467**	2035	2.9528	**2.4705**
2000	1.0587	**0.8858**	2036	3.0609	**2.5609**
2001	1.0841	**0.9070**	2037	3.1744	**2.6559**
2002	1.1004	**0.9206**	2038	3.2937	**2.7556**
2003	1.1242	**0.9405**	2039	3.4190	**2.8605**
2004	1.1498	**0.9619**	2040	3.5508	**2.9708**
2005	1.1953	**1.0000**			

Sample Calculation

Composite Growth Rate of Commercial PFC $_{1972}$

$=(k_{\text{Personal Income}} * \text{Growth Rate}_{\text{Personal Income}} + k_{\text{Median Household Income}} * \text{Growth Rate}_{\text{Median Household Income}} + k_{\text{Population}} * \text{Growth Rate}_{\text{Population}} + k_{\text{REMI Service Sector}} * \text{Growth Rate}_{\text{REMI Service Sector}} + k_{\text{Landscaping Employment}} * \text{Growth Rate}_{\text{Landscaping Employment}})_{1972}$

= 0.2547 * 0.173 + 0.2522 * 0.2229 + 0.2379 * 0.5563 + 0.2552 * 0.2623 + 0.1932 * 0.5449

= 0.3983

The composite growth rate values are needed to normalized to year 2005, Thus:

Normalized Growth Rate for Commercial PFC at 1972

= Composite Growth Rate of Commercial PFC $_{1972}$ / Composite Growth Rate of Commercial PFC $_{2005}$

= 0.3983 / 1.1953

= 0.3332

APPENDIX E

Residential PFC Metal Can Survival Rate Calculation

Solve metal can's survival rate

$$dy/dt = kt$$
$$y(t)= y(0) * \exp(kt)$$

Assumption: once only metal cans
then plastic cans started to replace metal cans
then regulated cans started to replace non-regulated cans

Initial condition: $y(0) = 1$ when 100% metal cans
$y(t1) = 0.24$, when metal can is 24% of total can population in 1998

$y(t2) = 0.15$, when metal can is 15% of total population in 2004.

Solve for the equation:

$$0.24=1*\exp (kt)$$
$$0.15=1*\exp k(t+6)) \qquad 6=2004-1998$$

Solve for k: $k= -0.0783$
Solve for t: $t=18.218$ represent year 1998.
$t=18.218+6$ represent year 2004.

Conclusion

Metal cans from 1980 and before has 100% of the entire gas can population decrease exponentially at rate of 0.0783, become almost distinct from market in year 2039.

APPENDIX F

Age Distribution and Survival Rate for PFC

Appendix F-1. Spill-Proof PFC (Replacing Conventional Red PFC, median useful life =3 years) Population Distribution Calculation

				CY[9]	2000	2001	2002	2003	2004	2005
MY[10]	Age	Age Dist.	Survival Rate							
2000	0	0.1670	0.9700		0.0983					
1999	1	0.1670	0.9200		0.0983	0.0904				
1998	2	0.1670	0.8700		0.0983	0.0855	0.0786			
1997	3	0.1670	0.2900		0.0983	0.0285	0.0248	0.0228		
1996	4	0.1660	0.5000		0.0977	0.0491	0.0142	0.0124	0.0114	
					Old Cans	**0.2799**	**0.1309**	**0.039**	**0.0148**	**0.0031**

Appendix F-2. Regulated Kerosene Cans (Replacing Unregulated Kerosene Cans, median useful life =5 years) Population Distribution Calculation

				CY	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
MY	Age	Age Dist.	Survival Rate											
2007	0	0.2032	0.9450		0.0142									
2006	1	0.2030	0.9070		0.0141	0.0128								
2005	2	0.1770	0.8889		0.0123	0.0126	0.0114							
2004	3	0.1588	0.8487		0.0111	0.0105	0.0107	0.0097						
2003	4	0.1388	0.8295		0.0097	0.0092	0.0087	0.0088	0.0080					
2002	5	0.0470	0.7757		0.0033	0.0075	0.0071	0.0067	0.0069	0.0062				
2001	6	0.0389	0.7349		0.0027	0.0024	0.0055	0.0052	0.0049	0.0050	0.0046			
2000	7	0.0198	0.7869		0.0014	0.0021	0.0019	0.0043	0.0041	0.0039	0.0040	0.0036		
1999	8	0.0104	0.7917		0.0007	0.0011	0.0017	0.0015	0.0034	0.0033	0.0031	0.0031	0.0029	
1998	9	0.0029	0.5263		0.0002	0.0004	0.0006	0.0009	0.0008	0.0018	0.0017	0.0016	0.0017	0.0015
					Old Cans	**0.0585**	**0.0475**	**0.0372**	**0.0282**	**0.0202**	**0.0133**	**0.0084**	**0.0045**	**0.0015**

[9] Calendar Year
[10] Model Year

Appendix F-3. Regulated Utility Jug (Replacing Unregulated Utility jug, median useful life =5 years) Population Distribution Calculation

				CY	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
MY	Age	Age Dist.	Survival Rate											
2006	0	0.2032	0.9450		0.0320									
2005	1	0.2030	0.9070		0.0320	0.0290								
2004	2	0.1770	0.8889		0.0279	0.0284	0.0258							
2003	3	0.1588	0.8487		0.0250	0.0237	0.0241	0.0219						
2002	4	0.1388	0.8295		0.0218	0.0207	0.0196	0.0200	0.0182					
2001	5	0.0470	0.7757		0.0074	0.0169	0.0161	0.0152	0.0155	0.0141				
2000	6	0.0389	0.7349		0.0061	0.0054	0.0125	0.0118	0.0112	0.0114	0.0103			
1999	7	0.0198	0.7869		0.0031	0.0048	0.0043	0.0098	0.0093	0.0088	0.0090	0.0081		
1998	8	0.0104	0.7917		0.0016	0.0025	0.0038	0.0034	0.0078	0.0074	0.0070	0.0071	0.0064	
1997	9	0.0029	0.5263		0.0005	0.0009	0.0013	0.0020	0.0018	0.0041	0.0039	0.0037	0.0037	0.0034
					Old Cans	**0.1324**	**0.1075**	**0.0841**	**0.0637**	**0.0457**	**0.0302**	**0.0189**	**0.0102**	**0.0034**

Explanation

Appendix F-1 to F-3 uses the same concept of the inter-relation between age distribution and survival rate.

For example, in Appendix F-3,

in calendar year 2007, the amount of cans that age =1 from 2006's population survived 90.7%,

$0.0290_{\text{age =1 at CY2007}} = 0.0320_{\text{2006's population}} * 0.9070_{\text{survival rate for age = 1}}$

Appendix G

California Air Basin and Air District's Name and its Code

Air Basin Name	Code
Great Basin Valleys	GBV
Lake County	LC
Lake Tahoe	LT
Mojave Desert	MD
Mountain Counties	MC
North Central Coast	NCC
North Coast	NC
Northeast Plateau	NEP
Sacramento Valley	SV
Salton Sea	SS
San Diego	SD
San Francisco Bay Area	SF
San Joaquin Valley	SJV
South Central Coast	SCC
South Coast	SC

Air District Name	Code
Amador County APCD	AMA
Antelope Valley APCD	AV
Bay Area AQMD	BA
Butte County AQMD	BUT
Calaveras County AQMD	CAL
Colusa County APCD	COL
El Dorado County APCD	ED
Feather River AQMD	FR
Glenn County APCD	GLE
Great Basin Unified APCD	GBU
Imperial County APCD	IMP
Kern County APCD	KER
Lake County AQMD	LAK
Lassen County APCD	LAS
Mariposa County APCD	MPA
Mendocino County AQMD	MEN
Modoc County APCD	MOD
Mojave Desert AQMD	MOJ
Monterey Bay Unified APCD	MBU
North Coast Unified APCD	NCU
Northern Sierra AQMD	NSI
Northern Sonoma County APCD	NS
Placer County APCD	PLA
Sacramento Metropolitan AQMD	SAC
San Diego County APCD	SD
San Joaquin Valley Unified APCD	SJU
San Luis Obispo County APCD	SLO
Santa Barbara County APCD	SB
Shasta County AQMD	SHA
Siskiyou County APCD	SIS
South Coast AQMD	SC
Tehama County APCD	THE
Tuolumne County APCD	TUO
Ventura County APCD	VEN
Yolo/Solano AQMD	YS

APPENDIX H

California PFC Allocation Factors

Appendix H-1. Allocation Factors from 1970 to 1980

Air Basin	Air District	County	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MC	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
MC	NSI	Plumas	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	KER	Kern (partial)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MD	AV	Los Angeles (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MD	MOJ	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
NC	MEN	Mendocino	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	NS	Sonoma (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001
NCC	MBU	Monterey	0.012	0.012	0.012	0.013	0.013	0.013	0.012	0.013	0.012	0.012	0.012
NCC	MBU	San Benito	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NCC	MBU	Santa Cruz	0.006	0.006	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SC	SC	Los Angeles (partial)	0.348	0.345	0.340	0.336	0.333	0.330	0.326	0.321	0.317	0.314	0.311
SC	SC	Orange	0.071	0.073	0.075	0.077	0.079	0.080	0.080	0.081	0.081	0.082	0.082
SC	SC	Riverside (partial)	0.018	0.018	0.019	0.019	0.019	0.019	0.020	0.020	0.021	0.021	0.022
SC	SC	San Bernardino (partial)	0.028	0.028	0.028	0.027	0.027	0.027	0.027	0.028	0.029	0.030	0.031
SCC	SLO	San Luis Obispo	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007
SCC	SB	Santa Barbara	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
SCC	VEN	Ventura	0.019	0.019	0.020	0.020	0.020	0.020	0.021	0.021	0.022	0.022	0.022
SD	SD	San Diego	0.068	0.068	0.069	0.071	0.072	0.074	0.075	0.077	0.078	0.079	0.079
SF	BA	Alameda	0.054	0.053	0.053	0.052	0.052	0.051	0.050	0.050	0.049	0.047	0.047
SF	BA	Contra Costa	0.028	0.028	0.028	0.028	0.027	0.027	0.027	0.028	0.028	0.028	0.028
SF	BA	Marin	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.009
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.036	0.035	0.034	0.034	0.033	0.032	0.031	0.031	0.030	0.029	0.029
SF	BA	San Mateo	0.028	0.028	0.027	0.027	0.027	0.027	0.026	0.026	0.026	0.025	0.025
SF	BA	Santa Clara	0.054	0.054	0.054	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
SF	BA	Solano (partial)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SF	BA	Sonoma (partial)	0.009	0.009	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011
SJV	SJU	Fresno	0.021	0.021	0.021	0.021	0.021	0.021	0.022	0.022	0.022	0.022	0.022
SJV	SJU	Kern (partial)	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.014
SJV	SJU	Kings	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SJV	SJU	Madera	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003
SJV	SJU	Merced	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SJV	SJU	San Joaquin	0.015	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.015
SJV	SJU	Stanislaus	0.010	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011
SJV	SJU	Tulare	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SS	IMP	Imperial	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SS	SC	Riverside (partial)	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006	0.006	0.006
SV	BUT	Butte	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004
SV	SAC	Sacramento	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.033	0.033	0.033	0.033
SV	SHA	Shasta	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
SV	FR	Sutter	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	TEH	Tehama	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix H-2. Allocation Factors from 1981 to 1990

Air Basin	Air District	County	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002
MD	KER	Kern (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MD	AV	Los Angeles (partial)	0.004	0.005	0.005	0.006	0.006	0.006	0.007	0.007	0.007	0.008
MD	MOJ	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.007	0.007	0.008	0.008	0.008	0.009	0.009	0.010	0.010	0.011
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.005	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
NC	MEN	Mendocino	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
NCC	MBU	San Benito	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NCC	MBU	Santa Cruz	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.309	0.308	0.307	0.306	0.304	0.303	0.301	0.297	0.293	0.289
SC	SC	Orange	0.083	0.082	0.082	0.082	0.082	0.082	0.082	0.082	0.081	0.081
SC	SC	Riverside (partial)	0.022	0.023	0.023	0.024	0.025	0.026	0.027	0.028	0.029	0.031
SC	SC	San Bernardino (partial)	0.031	0.031	0.032	0.032	0.032	0.033	0.034	0.035	0.036	0.037
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.012	0.013	0.012
SCC	VEN	Ventura	0.022	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.022
SD	SD	San Diego	0.079	0.079	0.079	0.080	0.080	0.081	0.082	0.082	0.083	0.084
SF	BA	Alameda	0.046	0.046	0.046	0.046	0.045	0.045	0.044	0.044	0.044	0.043
SF	BA	Contra Costa	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027	0.027
SF	BA	Marin	0.009	0.009	0.009	0.009	0.008	0.008	0.008	0.008	0.008	0.008
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.028	0.028	0.028	0.028	0.028	0.027	0.027	0.026	0.025	0.024
SF	BA	San Mateo	0.024	0.024	0.024	0.024	0.023	0.023	0.023	0.022	0.022	0.022
SF	BA	Santa Clara	0.054	0.054	0.054	0.054	0.053	0.052	0.052	0.051	0.051	0.050
SF	BA	Solano (partial)	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008
SF	BA	Sonoma (partial)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
SJV	SJU	Fresno	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
SJV	SJU	Kern (partial)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.015
SJV	SJU	Kings	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SJV	SJU	Madera	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SJV	SJU	Merced	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SJV	SJU	San Joaquin	0.015	0.015	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016
SJV	SJU	Stanislaus	0.011	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.013
SJV	SJU	Tulare	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.010
SS	IMP	Imperial	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SS	SC	Riverside (partial)	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.008	0.008
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
SV	SAC	Sacramento	0.033	0.034	0.034	0.034	0.034	0.034	0.034	0.035	0.035	0.035
SV	SHA	Shasta	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SV	FR	Sutter	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix H-3. Allocation Factors from 1991 to 2000

Air Basin	Air District	County	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004
MC	MPA	Mariposa	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
MC	NSI	Nevada	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MD	KER	Kern (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003
MD	AV	Los Angeles (partial)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009
MD	MOJ	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
NC	MEN	Mendocino	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.012	0.012	0.012	0.011	0.011	0.011	0.012	0.012	0.012	0.012
NCC	MBU	San Benito	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002
NCC	MBU	Santa Cruz	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.286	0.284	0.282	0.281	0.279	0.277	0.275	0.273	0.272	0.272
SC	SC	Orange	0.081	0.081	0.081	0.082	0.082	0.083	0.083	0.084	0.084	0.084
SC	SC	Riverside (partial)	0.032	0.033	0.033	0.033	0.034	0.034	0.034	0.035	0.035	0.035
SC	SC	San Bernardino (partial)	0.038	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
SCC	VEN	Ventura	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
SD	SD	San Diego	0.084	0.084	0.083	0.083	0.082	0.082	0.083	0.083	0.083	0.083
SF	BA	Alameda	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.043	0.043	0.043
SF	BA	Contra Costa	0.027	0.027	0.027	0.027	0.028	0.028	0.028	0.028	0.028	0.028
SF	BA	Marin	0.008	0.008	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.024	0.024	0.024	0.024	0.023	0.023	0.023	0.023	0.023	0.023
SF	BA	San Mateo	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
SF	BA	Santa Clara	0.050	0.049	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050
SF	BA	Solano (partial)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
SF	BA	Sonoma (partial)	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
SJV	SJU	Fresno	0.023	0.023	0.023	0.024	0.024	0.024	0.024	0.024	0.024	0.024
SJV	SJU	Kern (partial)	0.015	0.015	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
SJV	SJU	Kings	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Madera	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Merced	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SJV	SJU	San Joaquin	0.016	0.016	0.016	0.016	0.016	0.017	0.017	0.017	0.017	0.017
SJV	SJU	Stanislaus	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
SJV	SJU	Tulare	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
SS	IMP	Imperial	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SS	SC	Riverside (partial)	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006
SV	SAC	Sacramento	0.035	0.035	0.035	0.035	0.035	0.036	0.035	0.035	0.036	0.036
SV	SHA	Shasta	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004
SV	FR	Sutter	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix H-4. Allocation Factors from 2001 to 2010

Air Basin	Air District	County	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MD	KER	Kern (partial)	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.003	0.003	0.003
MD	AV	Los Angeles (partial)	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.008
MD	MOJ	Riverside (partial)	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.003	0.003	0.003
NC	MEN	Mendocino	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.012	0.012	0.012	0.012	0.011	0.012	0.012	0.012	0.012	0.012
NCC	MBU	San Benito	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NCC	MBU	Santa Cruz	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.271	0.271	0.270	0.269	0.268	0.266	0.264	0.262	0.260	0.258
SC	SC	Orange	0.084	0.084	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.082
SC	SC	Riverside (partial)	0.036	0.037	0.038	0.039	0.040	0.040	0.041	0.042	0.042	0.043
SC	SC	San Bernardino (partial)	0.040	0.040	0.040	0.041	0.042	0.042	0.042	0.042	0.042	0.042
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
SCC	VEN	Ventura	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022
SD	SD	San Diego	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
SF	BA	Alameda	0.042	0.042	0.041	0.041	0.041	0.041	0.041	0.041	0.042	0.042
SF	BA	Contra Costa	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.029
SF	BA	Marin	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.006	0.006
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.023	0.022	0.022	0.022	0.021	0.021	0.021	0.021	0.021	0.021
SF	BA	San Mateo	0.021	0.020	0.020	0.020	0.019	0.019	0.019	0.019	0.019	0.019
SF	BA	Santa Clara	0.049	0.049	0.048	0.048	0.048	0.047	0.047	0.047	0.047	0.047
SF	BA	Solano (partial)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
SF	BA	Sonoma (partial)	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.012	0.012
SJV	SJU	Fresno	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
SJV	SJU	Kern (partial)	0.016	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
SJV	SJU	Kings	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Madera	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Merced	0.006	0.006	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SJV	SJU	San Joaquin	0.017	0.017	0.017	0.018	0.018	0.018	0.018	0.019	0.019	0.019
SJV	SJU	Stanislaus	0.013	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
SJV	SJU	Tulare	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.012
SS	IMP	Imperial	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005
SS	SC	Riverside (partial)	0.010	0.010	0.010	0.011	0.011	0.011	0.011	0.011	0.011	0.012
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008
SV	SAC	Sacramento	0.037	0.037	0.037	0.037	0.037	0.038	0.038	0.039	0.039	0.040
SV	SHA	Shasta	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.004	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.004	0.004
SV	FR	Sutter	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.006
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix H-5. Allocation Factors from 2011 to 2020

Air Basin	Air District	County	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.002	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001
MD	KER	Kern (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MD	AV	Los Angeles (partial)	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
MD	MOJ	Riverside (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	MEN	Mendocino	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
NCC	MBU	San Benito	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NCC	MBU	Santa Cruz	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.256	0.254	0.252	0.251	0.249	0.247	0.245	0.244	0.242	0.241
SC	SC	Orange	0.082	0.082	0.082	0.082	0.081	0.081	0.081	0.081	0.080	0.080
SC	SC	Riverside (partial)	0.043	0.044	0.044	0.045	0.045	0.046	0.046	0.047	0.047	0.047
SC	SC	San Bernardino (partial)	0.042	0.042	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.010	0.010
SCC	VEN	Ventura	0.022	0.022	0.022	0.021	0.021	0.021	0.021	0.021	0.021	0.021
SD	SD	San Diego	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
SF	BA	Alameda	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
SF	BA	Contra Costa	0.029	0.029	0.029	0.029	0.030	0.030	0.030	0.030	0.030	0.030
SF	BA	Marin	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.020	0.020	0.020	0.020	0.020	0.019	0.019	0.019	0.019	0.019
SF	BA	San Mateo	0.019	0.019	0.019	0.019	0.018	0.018	0.018	0.018	0.018	0.018
SF	BA	Santa Clara	0.047	0.047	0.047	0.047	0.046	0.046	0.046	0.046	0.046	0.046
SF	BA	Solano (partial)	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009
SF	BA	Sonoma (partial)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
SJV	SJU	Fresno	0.024	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.026
SJV	SJU	Kern (partial)	0.017	0.017	0.017	0.017	0.018	0.018	0.018	0.018	0.018	0.018
SJV	SJU	Kings	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Madera	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SJV	SJU	Merced	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008
SJV	SJU	San Joaquin	0.020	0.020	0.020	0.021	0.021	0.021	0.022	0.022	0.022	0.023
SJV	SJU	Stanislaus	0.014	0.014	0.014	0.014	0.015	0.015	0.015	0.015	0.015	0.015
SJV	SJU	Tulare	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
SS	IMP	Imperial	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SS	SC	Riverside (partial)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.013	0.013
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.008	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009
SV	SAC	Sacramento	0.040	0.041	0.041	0.042	0.042	0.043	0.043	0.044	0.044	0.044
SV	SHA	Shasta	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SV	FR	Sutter	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Appendix H-6. Allocation Factors from 2021 to 2030

Air Basin	Air District	County	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	ED	El Dorado (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	KER	Kern (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MD	AV	Los Angeles (partial)	0.008	0.008	0.008	0.007	0.007	0.007	0.007	0.007	0.007	0.007
MD	MOJ	Riverside (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.013
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	MEN	Mendocino	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.012	0.012	0.012
NCC	MBU	San Benito	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NCC	MBU	Santa Cruz	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.239	0.238	0.236	0.235	0.233	0.232	0.230	0.229	0.228	0.226
SC	SC	Orange	0.080	0.079	0.079	0.079	0.078	0.078	0.078	0.077	0.077	0.076
SC	SC	Riverside (partial)	0.048	0.048	0.049	0.049	0.050	0.050	0.051	0.051	0.051	0.052
SC	SC	San Bernardino (partial)	0.043	0.043	0.043	0.044	0.044	0.044	0.044	0.044	0.044	0.044
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SCC	VEN	Ventura	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.020
SD	SD	San Diego	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
SF	BA	Alameda	0.042	0.042	0.042	0.042	0.043	0.043	0.043	0.043	0.043	0.043
SF	BA	Contra Costa	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.032	0.032	0.032
SF	BA	Marin	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.018	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.017	0.017
SF	BA	San Mateo	0.018	0.018	0.018	0.018	0.017	0.017	0.017	0.017	0.017	0.017
SF	BA	Santa Clara	0.046	0.046	0.046	0.045	0.045	0.045	0.045	0.045	0.045	0.045
SF	BA	Solano (partial)	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010
SF	BA	Sonoma (partial)	0.012	0.012	0.012	0.013	0.013	0.013	0.013	0.013	0.013	0.013
SJV	SJU	Fresno	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.027	0.027	0.027
SJV	SJU	Kern (partial)	0.018	0.018	0.018	0.018	0.019	0.019	0.019	0.019	0.019	0.019
SJV	SJU	Kings	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
SJV	SJU	Madera	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005
SJV	SJU	Merced	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009
SJV	SJU	San Joaquin	0.023	0.023	0.023	0.024	0.024	0.024	0.025	0.025	0.025	0.025
SJV	SJU	Stanislaus	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.016
SJV	SJU	Tulare	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
SS	IMP	Imperial	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SS	SC	Riverside (partial)	0.013	0.013	0.013	0.013	0.013	0.013	0.014	0.014	0.014	0.014
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010	0.010	0.010
SV	SAC	Sacramento	0.045	0.045	0.045	0.046	0.046	0.046	0.047	0.047	0.047	0.048
SV	SHA	Shasta	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SV	YS	Solano (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SV	FR	Sutter	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.006	0.006	0.006	0.006	0.006	0.006	0.007	0.007	0.007	0.007
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**	**1.000**

Appendix H-7. Allocation Factors from 2031 to 2040

Air Basin	Air District	County	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
GBV	GBU	Alpine	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Inyo	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GBV	GBU	Mono	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LC	LAK	Lake	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LT	ED	El Dorado (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
LT	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	AMA	Amador	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	CAL	Calaveras	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MC	ED	El Dorado (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MC	MPA	Mariposa	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Nevada	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MC	PLA	Placer (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MC	NSI	Plumas	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	NSI	Sierra	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MC	TUO	Tuolumne	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	KER	Kern (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
MD	AV	Los Angeles (partial)	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
MD	MOJ	Riverside (partial)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
MD	SC	Riverside (partial)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MD	MOJ	San Bernardino (partial)	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
NC	NCU	Del Norte	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NC	NCU	Humboldt	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
NC	MEN	Mendocino	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NS	Sonoma (partial)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NC	NCU	Trinity	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NCC	MBU	Monterey	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
NCC	MBU	San Benito	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
NCC	MBU	Santa Cruz	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
NEP	LAS	Lassen	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NEP	MOD	Modoc	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NEP	SIS	Siskiyou	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SC	SC	Los Angeles (partial)	0.225	0.224	0.222	0.221	0.220	0.219	0.217	0.216	0.215	0.214
SC	SC	Orange	0.076	0.076	0.075	0.075	0.074	0.074	0.074	0.073	0.073	0.072
SC	SC	Riverside (partial)	0.052	0.053	0.053	0.054	0.054	0.054	0.055	0.055	0.056	0.056
SC	SC	San Bernardino (partial)	0.044	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.046
SCC	SLO	San Luis Obispo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SCC	SB	Santa Barbara	0.010	0.010	0.010	0.010	0.010	0.010	0.009	0.009	0.009	0.009
SCC	VEN	Ventura	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
SD	SD	San Diego	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083	0.083
SF	BA	Alameda	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043
SF	BA	Contra Costa	0.032	0.032	0.032	0.032	0.032	0.033	0.033	0.033	0.033	0.033
SF	BA	Marin	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SF	BA	Napa	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SF	BA	San Francisco	0.016	0.016	0.016	0.016	0.016	0.016	0.015	0.015	0.015	0.015
SF	BA	San Mateo	0.017	0.017	0.017	0.017	0.016	0.016	0.016	0.016	0.016	0.016
SF	BA	Santa Clara	0.045	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
SF	BA	Solano (partial)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SF	BA	Sonoma (partial)	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
SJV	SJU	Fresno	0.027	0.027	0.027	0.028	0.028	0.028	0.028	0.028	0.028	0.029
SJV	SJU	Kern (partial)	0.020	0.020	0.020	0.020	0.020	0.020	0.021	0.021	0.021	0.021
SJV	SJU	Kings	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SJV	SJU	Madera	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
SJV	SJU	Merced	0.009	0.009	0.009	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SJV	SJU	San Joaquin	0.026	0.026	0.026	0.027	0.027	0.027	0.027	0.028	0.028	0.028
SJV	SJU	Stanislaus	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016
SJV	SJU	Tulare	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.015
SS	IMP	Imperial	0.005	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006
SS	SC	Riverside (partial)	0.014	0.014	0.014	0.014	0.014	0.015	0.015	0.015	0.015	0.015
SV	BUT	Butte	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	COL	Colusa	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	GLE	Glenn	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
SV	PLA	Placer (partial)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
SV	SAC	Sacramento	0.048	0.048	0.048	0.049	0.049	0.049	0.049	0.050	0.050	0.050
SV	SHA	Shasta	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
SV	YS	Solano (partial)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SV	FR	Sutter	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
SV	TEH	Tehama	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SV	YS	Yolo	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
SV	FR	Yuba	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Grand Total			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000