



Area Source Methodology Technical Documentation

Section 7.1

Residential Wood Combustion

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Area Source Improvement & Community Inventory Development Section

Air Quality Planning and Science Division

Emission Inventory Source Category

Miscellaneous Processes/Residential Fuel Combustion

Emission Inventory Codes and Description

EIC Code	Description
610-600-0230-0000	Residential Wood Combustion - Wood Stoves - Unspecified
610-600-0230-0132*	Residential Wood Combustion - Wood Stoves - Wood Stoves (Uncertified)
610-600-0230-0133*	Residential Wood Combustion - Wood Stoves - Wood Stoves (Certified-Catalytic)
610-600-0230-0134*	Residential Wood Combustion - Wood Stoves - Wood Stoves (Certified-Non-Catalytic)
610-600-0230-0137*	Residential Wood Combustion - Wood Stoves - Fireplace Insert (Uncertified)
610-600-0230-0138*	Residential Wood Combustion - Wood Stoves - Fireplace Insert (Certified-Catalytic)
610-600-0230-0139*	Residential Wood Combustion - Wood Stoves - Fireplace Insert (Certified-Non-Catalytic)
610-602-0230-0000	Residential Wood Combustion - Fireplaces - Unspecified
610-602-0230-0135*	Residential Wood Combustion - Fireplaces - Cordwood
610-602-0230-0136*	Residential Wood Combustion - Fireplaces - Manufactured Logs
610-603-0230-0000*	Residential Wood Combustion - Pellet Stoves - Pellets
610-604-0230-0000	Residential Wood Combustion - Unspecified

* New EICs

Federal Sources Classification Codes and Description

SCC Code	Description
2104008100	Wood; Fireplace: general
2104008210	Wood; Woodstove: fireplace inserts; non-EPA certified
2104008220	Wood; Woodstove: fireplace inserts; EPA certified; non-catalytic
2104008230	Wood; Woodstove: fireplace inserts; EPA certified; catalytic
2104008300	Wood; Woodstove: freestanding, general
2104008310	Wood; Woodstove: freestanding, non-EPA certified
2104008320	Wood; Woodstove: freestanding, EPA certified, non-catalytic
2104008330	Wood; Woodstove: freestanding, EPA certified, catalytic
2104008400	Wood; Woodstove: pellet-fired, general (freestanding or FP insert)

Table of Contents

Overview.....	6
I. Types of Devices and Their Classification	6
II. Classification based on Technology	7
III. District Submittals.....	7
Emissions Estimation Method.....	8
I. Activity Data	9
II. Spatial Allocation.....	14
III. Emission Factors	15
IV. Emissions.....	16
Speciation Profiles and Weight Fractions	16
Temporal Activity.....	17
Growth Forecasting.....	19
Controls	19
Sample Calculations.....	19
Changes in This Update	21
Assumptions and Limitations.....	22
Comments and Recommendations	23
References.....	24
Appendix A	28
I. Wood-Burning Device Usage Fraction	28
II. Burn Rates.....	30
III. Random Forest Regression for Data Imputation	31
IV. Imputation Results.....	32
A. Imputed Burn Rates and their Predictors.....	32
B. Geographic Patterns	36
C. Model Performance Evaluation.....	38
Appendix B.....	40

- I. Split Between Supplemental Heating and Aesthetic Use40
 - A. Classify households into heating-context zones40
 - B. Assign zone-level purpose fractions40
 - C. Blend to county level40
- II. Device Split for Primary, Supplemental, and Aesthetic Use43
 - A. Zone-level device splits43
 - B. Pellet-fraction correction43
 - C. Zone blending to county level44
- III. Burn-Rate Ratios (Supplemental & Aesthetic).....48
 - A. Extract primary burn rates48
 - B. Derive zone-level ratios48
 - C. Zone blending to county level49
- Appendix C52

Overview

Residential Wood Combustion (RWC) refers to the use of wood for home heating in devices such as fireplaces, wood stoves, fireplace inserts, pellet stoves, and central heaters (including indoor furnaces and hydronic heaters). These appliances are among the largest contributors to wintertime air pollution in California, particularly fine particulate matter (PM_{2.5}), reactive organic gases (ROGs), and toxic air contaminants (TACs). Emissions from RWC can significantly affect local air quality and pose health risks to nearby communities.

This methodology estimates criteria pollutant emissions from different types of wood-burning devices used in homes across each county in the state. It focuses on wood-fueled appliances only – natural gas fireplaces or unspecified RWC sources are not included.

At the time of this methodology's development/update, several other RWC methodologies were in use or under development by other agencies, including the San Joaquin Valley Air Pollution Control District (SJVAPCD) [1], a draft United States Environmental Protection Agency (U.S. EPA) methodology, a draft Bay Area Air Quality Management District (BAAQMD) methodology and a draft South Coast Air Quality Management District (SCAQMD) methodology. These served as useful references for the development/update of this methodology.

I. Types of Devices and Their Classification

The main wood-burning appliances included in this inventory are:

1. *Fireplaces*: Traditional, open-faced enclosures made of masonry or metal. They are generally designed for ambience rather than efficient heating. Most burn cordwood and manufactured logs (e.g., Duraflame, Pine Mountain). Due to their open design, fireplaces typically emit higher levels of PM and ROG per unit of wood burned compared to other devices.
2. *Wood Stoves*: Enclosed, freestanding units that radiate heat into living spaces. They are commonly used as primary or supplemental heat sources in colder regions. Most stoves burn cordwood and can achieve greater combustion efficiency than open fireplaces.
3. *Fireplace Inserts*: Wood stoves designed to fit into existing fireplaces. They improve heating efficiency compared to open fireplaces but otherwise function like wood stoves.
4. *Pellet Stoves*: Devices that burn compressed pellets made from sawdust or other biomass by-products. They are equipped with automated fuel-feeding and combustion controls. Most pellet stoves meet EPA performance standards, although some are exempt due to design (e.g., high air-to-fuel ratio). Pellet stoves emit substantially lower particulate matter than cordwood appliances, though ROG and toxic emissions remain relevant.

II. Classification based on Technology

Wood stoves and fireplace inserts are classified based on their emission control design. Table 1 summarizes the main categories, their key features, and relative emission performance.

Table 1 Wood stove and fireplace insert classification based on technology

Category	Description	Typical Design Features	Relative Emissions	Notes
Uncertified	Manufactured before EPA's 1988 standards: no emission controls	Basic combustion chamber; no catalyst; no secondary air injection	Highest (up to 4-5x certified units)	Still in use in some rural areas; targeted by change-out programs
EPA-Certified Non-Catalytic	Certified by the EPA to comply with the performance and emissions standards as defined in Title 40 Code of Federal Regulations, Part 60, Subpart AAA, February 28, 1988, or any subsequent revisions and labeled pursuant to those regulations using improved combustion design	Firebox insulation, secondary combustion air, longer gas flow paths	Moderate	Easier to operate and maintain than catalytic units
EPA-Certified Catalytic	Certified by the EPA to comply with the performance and emissions standards as defined in Title 40 Code of Federal Regulations, Part 60, Subpart AAA, February 28, 1988, or any subsequent revisions and labeled pursuant to those regulations using a catalytic or hybrid combustor	Catalyst (platinum/palladium) burns pollutants at lower temps	Lowest	Requires catalyst replacement

III. District Submittals

Following CARB approval, district-specific emission estimates submitted by the South Coast Air Quality Management District (SCAQMD), San Joaquin Valley Air Pollution Control District (SJVAPCD), Bay Area Air Quality Management District (BAAQMD), Sacramento Metropolitan Air Quality Management District (SMAQMD), Air Quality Management District, and San Luis Obispo County Air Pollution Control District (SLOAPCD) will replace the statewide emission estimates presented in this document. Each district provided data

reflecting local usage and activity patterns. District methodology documents for the 2023 base-year inventory are posted under the “District Methodologies”.

Emissions Estimation Method

The earlier version of this methodology relied on two approaches to estimate Residential Wood Combustion (RWC) emissions [2]:

- Preferred Method – This approach used locally collected survey data as the primary source of activity information. Several air districts conducted surveys while developing or implementing rules related to RWC [2]. These surveys provided data on the use of wood-burning fireplaces, wood stoves, fireplace inserts, and pellet stoves (devices). The preferred method was applied in regions where such local data was available.
- Alternative Method – In areas where local survey data were not available, activity data were drawn from the U.S. Census Bureau’s American Housing Survey (AHS). This approach was primarily used for Southern California, where fewer surveys had been conducted. The AHS provides data on the number of housing units with wood-burning appliances and, through American FactFinder, includes additional information such as the number of homes using wood as a primary heating fuel. This method has also been used by EPA to generate national estimates [3] [4].

Both the preferred and alternative method had limitations. The preferred method suffered from outdated survey data, incomplete geographic coverage, and inconsistent questionnaires across districts. While the AHS data for the alternative method offers reasonable estimates for the number of devices used for primary heating but they do not reliably capture devices used for supplemental heating, (e.g., for aesthetics, heating only part of a home, or intermittent use to reduce heating costs), and its geographic coverage is limited to regions within SCAQMD and BAAQMD.

This update introduces new device fractions (the fraction of households where a particular device is in use), newer emission factors and a regression-based modeling approach for burn rates:

- Device Fractions – The device fractions were obtained from EPA’s 2023 Wagon Wheel BETA [5].
- Inclusion of Supplemental Heating – A key enhancement in the revised methodology is its ability to estimate both primary and supplemental wood heating. AHS data provides counts of households using wood as a primary heating fuel [6]. By comparing this with estimates of total device use, the number of households using wood for supplemental heating can be inferred – addressing a major gap in the previous approach.
- Updated Emission Factors – Emission factors have been updated using the latest test data, particularly from work conducted by Northeast States for Coordinated Air Use Management (NESCAUM) [7]. These updated values are included in the EPA’s 2023

Wagon Wheel compendium, which serves as the consistent reference for all emission factor inputs in this version.

- Updated Burn Rates – The burn rates were based on old survey data. They were updated using the latest survey data from woodsmoke reduction programs for certain regions of California that participated in the survey. The survey data for the other regions was imputed using a regression model. This model estimates activity levels based on variables such as population density, heating degree days, and other relevant regional characteristics.

I. Activity Data

The activity data for RWC is the amount of wood-burned in different wood burning devices. The activity data uses device fractions for different wood burning appliances from the EPA's 2023 Wagon Wheel BETA [5]. The device fraction is the fraction of households where a particular device is in use. These are based on a regression model developed by EPA for National Emission Inventory (NEI) based on a Commission for Environmental Cooperation (CEC) survey which received 2984 responses from the Northern Eastern US states. Based on this regression model EPA estimates device fractions for all the counties across all states in the U.S including California. The appliance fraction data was validated by CARB using a regression model based on a random forest framework to confirm its suitability for use in California. Please note that the device fractions for different wood-burning appliances are used solely to estimate the *total*/number of residential wood-burning devices. Although Step 1 produces counts for each appliance type based on these fractions, those appliance-specific counts are not used directly in the emission calculations. The emission estimation relies instead on the device counts derived through the subsequent steps of the methodology. Please refer to the sample calculation section for further clarification.

The activity data also relies on the total number of occupied housing units as well as number of households that use wood as primary heating fuel from the US census bureau's 2023 5-year average (2019-2023) AHS data [6] [Appendix C]. The number of households, the device fraction data, together with the AHS data on wood as a primary heating fuel, allows us to differentiate between primary heating and supplemental heating (details in Appendix B). Total number of households that use wood as primary heating fuel, when subtracted from number of households where a wood burning device was in use will give us the number of households that use wood as a supplemental heating fuel.

Fireplaces can use both cordwood and manufactured logs as fuel (Table 2). In this analysis, we distinguish between these two fuels by assuming that manufactured logs are used exclusively for aesthetic heating and are therefore treated separately from

cordwood. Cordwood use in fireplaces is allocated across primary, supplemental, and aesthetic heating based on device-specific and climate-zone-specific burn rate ratios (Appendix B), whereas manufactured log use is limited to fireplace aesthetic activity only. The number of households using manufactured logs is estimated using the device fraction specific to manufactured log use in fireplaces [5]. This separation ensures that cordwood and manufactured log consumption are not double-counted and that emissions associated with manufactured logs are captured distinctly within the overall residential wood combustion inventory.

Burn rates, which represent the average amount of wood burned in each device, are based on survey data from the Woodsmoke Reduction Program. The outliers in the raw survey data were removed using Tukey IQR method. Then, the data was averaged at the county level to get burn rates for fireplaces and wood stoves. For fireplace inserts, wood stove burn rates were used as is, due to their structural and functional similarities to wood stoves. Since there was no data on pellet stove burn rates from this survey, we assigned a max usage of 3 tons/year for pellet stoves in the county with maximum wood stove burn rate and then distributed it to the rest of the counties based on wood stove burn rate distribution [2]. These burn rates corresponded to the primary heating. For supplemental and aesthetic heating, burn rates ratios were calculated based on device type, climatic zone type using a method explained in Appendix B. For regions without the survey data, the burn rates were imputed using a regression model based on the random forest framework (details in Appendix A).

Once we have all this information, we determine the wood-burning activity in a county in 5 steps.

Step 1: Determine the number of wood-burning devices that are in-use.

The device fractions are multiplied with the occupied homes in each county from the AHS [6] to estimate the number of in-use devices in each county.

$$N_{dev} = N_{hh} \times DF_{dev}$$

Where

- dev = Wood burning device type as in Table 2
- N_{dev} = Number of wood-burning devices of type dev
- N_{hh} = Number of occupied housing units in the county (Table C - 1)
- DF_{dev} = Fraction of housing units with the wood burning device of type dev (Table A - 1)

This update considers 4 wood-burning devices used for residential heating. Device type and fuel assumptions are shown in Table 2.

Table 2 Wood burning devices and their fuels.

Device	Fuel Assumptions
Fireplaces (<i>fp</i>)	Burn both cordwood and manufactured logs (e.g., Duraflame, Pine Mountain, etc.)
Wood Stoves (<i>ws</i>)	Burn cordwood only; manufactured logs are not recommended
Fireplace Inserts (<i>fi</i>)	Same as wood stoves (cordwood only)
Pellet Stoves (<i>ps</i>)	Burn compressed wood pellets exclusively

Step 2: Split the total heating into primary vs supplemental and aesthetic heating

To estimate the split between primary and supplemental heating, we first sum the devices identified in the first step. Subtracting the number of homes that use wood as a primary fuel [4] from this total yields the number of wood-burning devices not used for primary heating. This remainder is then allocated between supplemental and aesthetic heating, based on the fraction of non-primary devices designated for supplemental and aesthetic use.

$$N_{tot} = N_{fp} + N_{ws} + N_{fi} + N_{ps}$$

$$N_{tot,supp} = (N_{tot} - N_{tot,main}) \times F_{supp}$$

$$N_{tot,aes} = (N_{tot} - N_{tot,main}) \times F_{aes}$$

Where

- N_{tot} = Total number of wood-burning devices in use
- N_{dev} = Number of wood burning devices of type *dev*
- $N_{tot,main}$ = Total number of wood-burning devices used for primary heating (Table C - 1)
- $N_{tot,supp}$ = Total number of wood-burning devices used for supplemental heating
- $N_{tot,aes}$ = Total number of wood-burning devices used for aesthetic heating
- F_{supp} = Fraction of non-primary wood-burning devices designated for supplemental heating (Table B - 1)
- F_{aes} = Fraction of non-primary wood-burning devices designated for aesthetic use (Table B - 1)

Step 3: Split the total primary, supplemental, and aesthetic heating into the device types

The total number of devices for each heating type is allocated to device categories using the corresponding device split.

$$N_{dev,p} = N_{tot,p} \times DS_{dev,p}$$

Where

- p = Heating type: primary (*main*), supplemental (*supp*) and aesthetic (*aes*)
- $N_{dev,p}$ = Number of wood-burning devices of type dev and heating type p
- $N_{tot,p}$ = Total number of devices for heating type p
- $DS_{dev,p}$ = Device split for device dev and heating type p (Table B - 3, Table B - 4)

Please note that the sum of primary, supplemental, and aesthetic use categories for a given wood-burning device type calculated in Step 3 does not necessarily match the N_{dev} value calculated in Step 1. The N_{dev} value is only an intermediate quantity used to estimate the total number of devices in use. All subsequent fuel-burn calculations and emission estimations should be based on the device counts derived in Step 3.

Step 4: Determine the amount of wood burning activity for different devices.

Number of devices and burn rates are multiplied to estimate the amount of wood burned in each county, in cords or tons, depending on whether the appliance burns cordwood or pellets. For devices that burn cordwood, the estimated number of cords are multiplied by a wood density factor of 1.54 tons/cord which is based on the local survey data for California. Burn rate ratio and Technology Factor is applied to the base burn rate to account for non-primary wood burning and technology respectively.

$$WB_{dev,p} = N_{dev,p} \times BR_{dev,p} \times BRR_{dev,p} \times F_{dev}$$

$$WB_{dev} = \sum_p WB_{dev,p}$$

Where

- WB_{dev} = Total amount of wood burned in device dev (tons)
- $WB_{dev,p}$ = Total amount of wood burned in device dev and heating type p (tons)
- $N_{dev,p}$ = Number of wood-burning devices of device type dev and heating type p
- $BR_{dev,p}$ = Amount of wood burned per device for device type dev and heating type p (cords/year for fireplaces, wood stoves and fireplace inserts, and tons/year for pellet stoves, Table C - 2)
- $BRR_{dev,p}$ = Burn Rate Ratio for device dev and heating type p to account for the purpose of device use (Table B - 6, $BRR_{dev,main}=1$)
- F_{dev} = Conversion Factor: 1 for pellet stoves, and 1.54 tons/cord for other device types

Step 4.1: Determine the amount of manufactured wood burnt in fireplaces

Manufactured logs are treated separately from cordwood because they are assumed to be used exclusively for aesthetic heating in fireplaces. First, the number of households that use manufactured logs for aesthetic fireplace use is estimated by applying a manufactured log device fraction to the total number of occupied homes

in each county. This count is then multiplied by an annual burn rate for manufactured logs to obtain the total manufactured log consumption.

$$N_{fp,aes,ml} = N_{hh} \times DF_{ml}$$

$$WB_{fp,aes,ml} = N_{fp,aes,ml} \times BR_{fp,aes,ml}$$

Where

- $N_{fp,aes,ml}$ = Number of households using manufactured logs for aesthetic heating in fireplaces
- N_{hh} = Number of occupied housing units in the county (Table C - 1)
- DF_{ml} = Fraction of housing units that use manufactured logs in fireplaces (Table A - 1)
- $WB_{fp,aes,ml}$ = Total amount of manufactured logs burned in fireplaces for aesthetic heating (tons)
- $BR_{fp,aes,ml}$ = Annual burn rate of manufactured logs per household using fireplaces for aesthetic heating (tons/year, Table C - 2)

Step 5: Account for control technology for wood stoves and fireplace inserts

The burn rates calculated in the previous step were further distributed based on control technology only for wood stoves and fireplace inserts. The burn rates are apportioned to three levels: non-EPA certified, EPA certified non-catalytic, and EPA certified catalytic.

For wood stoves and fireplace inserts, EPA used distribution profiles based on a combination of data from the 2015 EIA Residential Energy Consumption Survey (RECS) and the state of Minnesota's 2014/2015 residential wood survey. Previously, CARB used distribution profiles that were based on the old local survey data, but recent survey data from Mammoth Lakes APCD and several changeout-out programs throughout the state suggest that EPA based distribution profiles are more realistic. Table 3 presents these distribution fractions.

Table 3 Distribution fraction based on control technology for wood stoves and fireplace inserts.

Certification Type (<i>c</i>)	Technology Split (<i>TS</i>)
Uncertified (<i>uncert</i>)	0.31
EPA Certified - Catalytic (<i>cat</i>)	0.138
EPA Certified Non-Catalytic (<i>noncat</i>)	0.552

Based on findings from RWC surveys and wood stove changeout program data, it is well established that uncertified wood stoves and fireplace inserts are less efficient and tend to consume more wood than their certified counterparts to produce the same amount of heat. Since the baseline burn rates used in this methodology are derived from data on certified devices, an adjustment is necessary to reflect the higher wood usage of uncertified units. The burn rates for uncertified wood stoves were scaled by a factor of 1.26, calculated as the ratio of average wood consumption between uncertified and certified wood stoves:

$$AF_{\text{uncert}} = 68 \text{ (lbs/day, uncertified)} \div 54 \text{ (lbs/day, certified)} = 1.26$$

This adjustment ensures a more accurate representation of total wood burned, particularly in areas where uncertified devices remain in use.

$$WB_{\text{dev},c} = WB_{\text{dev}} \times TS_c \times AF_c$$

Where

- $WB_{\text{dev},c}$ = Total amount of wood burned in device *dev* with certification type *c* (tons)
- WB_{dev} = Total amount of wood burned in device *dev* (tons)
- TS_c = Technology split factor for certification type *c* (Table 3)
- AF_c = Burn rate adjustment factor for certification type *c* ($AF_{\text{uncert}} = 1.26$, $AF_{\text{cat}} = AF_{\text{uncat}} = 1$)

II. Spatial Allocation

To comply with the California Emissions Inventory Data Analysis and Reporting System's (CEIDARS) emissions inventory requirements, RWC emissions must be reported at the COABDIS (County-Air Basin-District) level. Although emissions are initially estimated at the county level, spatial reallocation is necessary to align with CEIDARS' regional reporting framework.

This is done using a GIS-based spatial allocation process, in which census tract-level data from the American Housing Survey (AHS) - specifically, the number of households using

wood as a primary heating fuel - are aggregated to their corresponding COABDIS regions. This approach ensures that emission estimates accurately reflect population distribution and housing density patterns within each air basin, enabling more precise air quality planning and regulation.

III. Emission Factors

Emission factors have been updated to reflect the most recent and representative test data available. In particular, new data generated through studies conducted by the NESCAUM have been incorporated. These studies provide improved characterization of emissions from a range of wood-burning device types under different operating conditions. The updated emission factors have been compiled and standardized in the EPA's 2023 Wagon Wheel BETA [5]. The emission factors for the different pollutants are listed in Table 4.

Table 4 Emission factors (lbs/ton fuel burnt) for the pollutants emitted from residential wood combustion.

Device	Type	CO	NO _x	SO _x	PM _{2.5}	ROG	NH ₃
Fireplace	Conventional	149	2.6	0.4	23.6	18.9	1.8
Wood stove /Fireplace Inserts	EPA Certified - Non Catalytic	97	1.28	0.4	17.96	33.6	0.6658
Wood stove /Fireplace Inserts	EPA Certified - Catalytic/Hybrid	43	2.1	0.4	6.76	19.76	0.6706
Wood stove /Fireplace Inserts	Uncertified	175	1.12	0.4	29.2	65.4	1.7
Pellet Stove	All	26	3.16	0.32	1.72	3.66	0.3
Fireplace	Manufactured Log	125	7.684	0.4	28.42	39.56	1.8

IV. Emissions

Criteria pollutant emissions from RWC are calculated by multiplying the county specific amount of wood burnt annually in each device type, by device and pollutant-specific emissions factors.

$$E_{dev,pol} = WB_{dev} \times EF_{dev,pol} \div C_f$$

Where,

$E_{dev,pol}$ = Pollutant specific wood-burning emissions for each device, tons/year

WB_{dev} = Total amount of wood burned in each device (tons/year)

$EF_{dev,pol}$ = Pollutant specific emission factor for each device (lbs pollutant/ton fuel burned)

C_f = 2000 (Conversion factor from pounds to tons)

Table 5 summarizes statewide 2023 RWC emissions at the EIC level by pollutant. More detailed emission tables are provided in Appendix C (Table C - 3 through Table C - 8).

Table 5 Statewide Emissions (tons) from RWC in 2023.

Device	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
Fireplace - Cordwood	33667.60	587.49	90.38	5332.59	4270.59	406.72
Fireplace - Manufactured Logs	1887.14	116.01	6.04	428.76	597.24	27.17
Wood Stove - Uncertified	15682.27	100.37	35.85	2616.70	5860.69	152.34
Wood Stove - Non Catalytic	12291.50	162.20	50.69	2275.83	4257.68	84.37
Wood Stove - Catalytic	1362.20	66.53	12.67	214.15	625.98	21.24
Fireplace Insert - Uncertified	13246.02	84.77	30.28	2210.19	4950.23	128.68
Fireplace Insert - Non Catalytic	10382.01	137.00	42.81	1922.28	3596.24	71.26
Fireplace Insert - Catalytic	1150.58	56.19	10.70	180.88	528.73	17.94
Pellet Stove	548.79	66.70	6.75	36.30	77.25	6.33
Total	90218.11	1377.25	286.17	15217.68	24764.63	916.06

Speciation Profiles and Weight Fractions

CARB has established default speciation profiles to characterize emissions from residential wood combustion (RWC) sources. These profiles are essential for air quality modeling and emissions inventory development, as they allow for the allocation of total emissions into individual chemical species.

The default speciation profiles for residential wood combustion are as follows:

- Organic Gas Profile Number 5491
- Particulate Matter Profile Number: 426

While the default emission factors presented in Table 4 are generally applicable to both PM2.5 and PM10, there may be instances where estimating PM size fractions requires

reliance on alternative data sources. Additionally, air quality modeling programs often require emissions to be disaggregated into specific chemical components. The speciation profiles listed above facilitate the application of weight fractions and the identification of chemical species within both organic gas and particulate matter emissions. Table 6 provides the default weight fractions for Total Organic Gases (ROG), PM, and PM10 for residential wood combustion.

Table 6 Default weight fractions for ROG, PM10 and PM2.5

EIC	TOG Weight Fraction	PM Weight Fraction	PM10 Weight Fraction
All EICs	ROG/0.7219	PM2.5×1	PM2.5×1

Temporal Activity

Most residential wood burning occurs during the cold season (typically in the fall, winter and early spring). To determine monthly emissions throughout the year, multiply annual average emissions by the monthly temporal factors. Daily emissions (tons/day) are calculated by CARB's emission forecasting system, based on the applicable temporal profile and the season (annual average, winter, or summer). Table 7 provides the default temporal factors for all EICs. Several districts have established local temporal profiles that differ from the defaults. These are shown in Table 8.

Table 7 Default temporal factors for RWC

EIC	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
All EICs	18.2	18.2	12.7	9.1	0	0	0	0	0	9.1	14.5	18.2

Table 8 District specific temporal profiles.

DIS	County	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
NS	Sonoma	17.8	17.8	14.3	10.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	14.3
SHA	Shasta	17.8	17.8	14.3	10.7	3.6	3.6	3.6	3.6	3.6	3.6	3.6	14.3
SJU	Fresno	25.2	16.6	1.1	0.5	0.4	0.5	0	0	0.2	1.7	27.5	26.3
SJU	Kern	25.7	16	2.6	0.5	0.5	0.3	0	0	0	2	23.5	28.9
SJU	Kings	24.9	16.1	1.8	0.5	0.5	0.3	0	0	0.1	1.8	26	28
SJU	Madera	25	16.3	1.8	0.5	0.5	0.5	0	0	0.2	1.8	27.5	25.9
SJU	Merced	25	17.3	1.8	0.5	0.5	0.4	0	0	0.1	1.8	26.6	26
SJU	San Joaquin	23.6	16.9	1.8	0.5	0.5	0.5	0	0	0.3	1.8	28	26.1
SJU	Stanislaus	25.4	17	1.8	0.5	0.5	0.5	0	0	0.2	1.8	25.3	27
SJU	Tulare	25	16.3	1.8	0.5	0.5	0.5	0	0	0.1	1.8	26.3	27.2

To estimate emissions for the summer and winter seasons, multiply annual average emissions by the seasonal temporal factors. Default seasonal temporal factors are 0.183 for summer (May - October) and 1.818 for winter (November - April). The statewide temporal cycle codes for wood stoves and fireplaces are shown in Table 9.

Table 9 Statewide temporal cycle codes for RWC.

District	Description	Cycle Code	Definition
Default	Hours/Day	33	Max activity 7-9 a.m. & 7-11 p.m., average during day, low at night
Default	Days/Week	7	7 days per week - uniform activity every day of the week

Growth Forecasting

CARB's default growth parameters for fireplace and wood stove emissions are based on historical residential wood combustion survey data published by the U.S. Energy Information Agency's State Energy Data System (U.S. EIA SEDS) and residential wood burning forecasts from the EIA's Annual Energy Outlook (U.S. EIA, 2011). These default growth factors are used for most districts, but some districts have submitted alternative growth data based on local information and updated rules that limit growth of wood-burning appliances.

Controls

The emissions estimated using this methodology are uncontrolled emissions. CARB did not apply statewide control factors because there are no statewide regulations controlling emissions from residential wood burning devices. Some local air districts have adopted regulations that control emissions from certain types residential wood burning devices. These local controls are not incorporated into the statewide methodology or the uncontrolled emissions estimates presented in Table 5. Applicable district-specific controls were applied separately when the emissions were incorporated into the California Emission Inventory Development and Reporting System (CEIDARS) and the California Emissions Projection Analysis Model (CEPAM). Therefore, the controlled emissions in CEIDARS and CEPAM may differ from the uncontrolled estimates presented in this document.

Sample Calculations

The steps below summarize the data computations necessary to estimate the annual PM_{2.5} emissions (tons) in Marin County from fireplaces and wood stoves. Note that the final emissions will slightly differ from emissions in Table C - 3, Table C - 4 and Table C - 5 due to rounding.

Step1: Determine the number of wood burning devices in use.

$$N_{dev} = N_{hh} \times DF_{dev}$$

$$N_{fp} = 103,201 \times 0.1006 = 10,379.02$$

$$N_{ws} = 103,201 \times 0.0503 = 5,191.01$$

$$N_{fi} = 103,201 \times 0.0328 = 3,384.99$$

$$N_{ps} = 103,201 \times 0.0220 = 2,270.42$$

$$N_{tot} = N_{fp} + N_{ws} + N_{fi} + N_{ps} = 21,225.44$$

Step 2: Split between primary and supplemental heating

$$N_{\text{tot,supp}} = (N_{\text{tot}} - N_{\text{tot,main}}) \times F_{\text{supp}} = (21,225.44 - 1,038) \times 0.37 = 7,469.35$$

$$N_{\text{tot,aes}} = (N_{\text{tot}} - N_{\text{tot,main}}) \times F_{\text{aes}} = (21,225.44 - 1,038) \times 0.63 = 12,718.09$$

Step 3: Split the total primary, supplemental, and aesthetic heating into the device types

$$N_{\text{fp,main}} = N_{\text{tot,main}} \times DS_{\text{fp,main}} = 1,038 \times 0.085 = 88.23$$

$$N_{\text{fp,supp}} = N_{\text{tot,supp}} \times DS_{\text{fp,supp}} = 7,469.35 \times 0.48 = 3,585.29$$

$$N_{\text{fp,aes}} = N_{\text{tot,aes}} \times DS_{\text{fp,aes}} = 12,718.09 \times 0.847 = 10,772.22$$

$$N_{\text{ws,main}} = N_{\text{tot,main}} \times DS_{\text{ws,main}} = 1,038 \times 0.424 = 440.11$$

$$N_{\text{ws,supp}} = N_{\text{tot,supp}} \times DS_{\text{ws,supp}} = 7,469.35 \times 0.232 = 1,732.89$$

$$N_{\text{ws,aes}} = N_{\text{tot,aes}} \times DS_{\text{ws,aes}} = 12,718.09 \times 0.046 = 585.03$$

Step 4: Determine wood burning activity in tons

$$WB_{\text{fp,main}} = N_{\text{fp,main}} \times BR_{\text{fp}} \times BRR_{\text{fp,main}} \times F_{\text{dev}} = 88.23 \times 1.694 \times 1 \times 1.54 = 230.17$$

$$WB_{\text{fp,supp}} = N_{\text{fp,supp}} \times BR_{\text{fp}} \times BRR_{\text{fp,supp}} \times F_{\text{dev}} = 3,585.29 \times 1.694 \times 0.175 \times 1.54 = 1636.80$$

$$WB_{\text{fp,aes}} = N_{\text{fp,aes}} \times BR_{\text{fp}} \times BRR_{\text{fp,aes}} \times F_{\text{dev}} = 10,772.22 \times 1.694 \times 0.064 \times 1.54 = 1798.54$$

$$WB_{\text{ws,main}} = N_{\text{ws,main}} \times BR_{\text{ws}} \times BRR_{\text{ws,main}} \times F_{\text{dev}} = 440.11 \times 2.320 \times 1 \times 1.54 = 1,572.42$$

$$WB_{\text{ws,supp}} = N_{\text{ws,supp}} \times BR_{\text{ws}} \times BRR_{\text{ws,supp}} \times F_{\text{dev}} = 1,732.89 \times 2.320 \times 0.21 \times 1.54 = 1,300.17$$

$$WB_{\text{ws,aes}} = N_{\text{ws,aes}} \times BR_{\text{ws}} \times BRR_{\text{ws,aes}} \times F_{\text{dev}} = 585.03 \times 2.320 \times 0.035 \times 1.54 = 73.16$$

Step 4.1: Determine wood burning activity for manufactured logs (only for fireplaces)
in tons

$$N_{\text{fp,aes,ml}} = N_{\text{hh}} \times DF_{\text{ml}} = 103,201 \times 0.0478 = 4,933.01$$

$$WB_{\text{fp,aes,ml}} = N_{\text{fp,aes,ml}} \times BR_{\text{fp,aes,ml}} = 4,933.01 \times 0.06 = 295.98$$

$$WB_{\text{fp}} = WB_{\text{fp,main}} + WB_{\text{fp,supp}} + WB_{\text{fp,aes}} = 3,665.51$$

$$WB_{\text{ws}} = WB_{\text{ws,main}} + WB_{\text{ws,supp}} + WB_{\text{ws,aes}} = 2,945.75$$

Step 5: Account for control technology (only for wood stoves and fireplace inserts)

$$WB_{ws,uncert} = WB_{ws} \times TS_{uncert} \times AF_{uncert} = 2,945.75 \times 0.31 \times 1.26 = 1,150.61$$

$$WB_{ws,noncat} = WB_{ws} \times TS_{uncert} \times AF_{uncert} = 2,945.75 \times 0.552 \times 1 = 1,626.05$$

$$WB_{ws,cat} = WB_{ws} \times TS_{uncert} \times AF_{uncert} = 2,945.75 \times 0.138 \times 1 = 406.51$$

Step 6: Determine PM2.5 emissions in tons

$$E_{fp,PM2.5} = WB_{fp} \times EF_{fp,PM2.5} \div 2000 = 3,665.51 \times 23.6 \div 2000 = 43.25$$

$$E_{ml,PM2.5} = WB_{fp,aes,ml} \times EF_{ml,PM2.5} \div 2000 = 295.98 \times 28.42 \div 2000 = 4.21$$

$$E_{ws,uncert,PM2.5} = WB_{ws,uncert} \times EF_{ws,uncert,PM2.5} \div 2000 = 1,150.61 \times 29.2 \div 2000 = 16.80$$

$$E_{ws,noncat,PM2.5} = WB_{ws,noncat} \times EF_{ws,noncat,PM2.5} \div 2000 = 1,626.05 \times 17.96 \div 2000 = 14.60$$

$$E_{ws,cat,PM2.5} = WB_{ws,cat} \times EF_{ws,cat,PM2.5} \div 2000 = 406.51 \times 6.76 \div 2000 = 1.37$$

$$E_{ws,PM2.5} = E_{ws,uncert,PM2.5} + E_{ws,noncat,PM2.5} + E_{ws,cat,PM2.5} = 32.77$$

Changes in This Update

The updated methodology introduces several improvements over the previous version, which was based on data from 2005 and applied uniformly across all regions in the state. Key enhancements include:

- Updated Activity Data: The new methodology is based on 2023 data, providing a more current representation of wood-burning activity across the state.
- Improved Estimation of Device Usage: The earlier approach relied on usage fractions from local surveys to estimate the number of in-use wood-burning devices by county. However, data gaps existed in several regions, and the data was outdated. These shortcomings were addressed by using the appliance fractions from EPA's 2023 Wagon Wheel BETA [5].
- Updated Emission Factors: While the previous method used emission factors derived from various testing studies and AP-42, the revised methodology incorporates emission factors from the EPA's 2023 Wagon Wheel BETA [5], ensuring greater consistency and accuracy.

- **Refined Burn Rate Assumptions:** Burn rates in the earlier methodology were taken from older survey data. The updated method adopts burn rates from the latest survey data from woodsmoke reduction programs throughout the state. However, these surveys didn't cover the whole state. The gaps are filled in using a regression model (random forest framework) for the rest of the state. Fireplace burn rates are used directly as provided. For wood stoves and fireplace inserts, the wood stove burn rate is applied. Pellet stove usage is capped at 3 tons/year in the county with the highest wood stove burn rate and then proportionally distributed using the wood stove burn rate distribution.
- **Differentiation of Primary vs. Supplemental and Aesthetic Heating:** A major advancement in this methodology is the explicit separation of primary and supplemental and aesthetic wood heating. Data from the American Housing Survey (AHS) on homes using wood as a primary heat source were combined with the EPAs 2023 Wagon Wheel BETA [5] Activity Factors to estimate the number of homes and devices used for supplemental heating.
- **Incorporation of New Wood stove Emission Factors:** The method integrates updated emission factors for wood stoves developed by NESCAUM, now included in the EPAs 2023 Wagon Wheel BETA [5].
- **Updated Device Type Distributions:** The prior methodology used outdated local survey data to estimate the distribution of wood stoves and fireplace inserts among uncertified, certified catalytic, and certified non-catalytic types. The revised approach adopts updated device splits.
- **Scaling for Uncertified Devices:** To account for higher wood usage in uncertified wood stoves compared to certified catalytic and non-catalytic devices, this methodology applies a scaling factor specifically for uncertified units.

Assumptions and Limitations

- It is assumed that the patterns of wood-burning behavior captured is captured by the EPAs 2023 Wagon Wheel BETA [5] Activity Factors.
- County-level burn rates from the woodsmoke reduction program survey data are assumed to be representative of wood consumption patterns in California.
- All wood stoves and fireplace inserts are assumed to burn only seasoned cordwood.
- It is assumed that all wood-burning devices not used for primary heating are used for supplemental and aesthetic heating.
- A uniform statewide device split is applied to categorize wood stoves and fireplace inserts into uncertified, certified catalytic, and certified non-catalytic types, without accounting for regional variation.
- The methodology may not fully capture all local control measures or district-specific programs currently in place.

Comments and Recommendations

- A comprehensive, statewide wood-burning survey should be conducted to update and validate key activity data inputs. Incorporating these findings would improve the accuracy of emissions estimates.
- The survey should aim to determine California-specific burn rates, which would help replace assumptions based on regression models.
- Region or county-level data on the distribution of uncertified vs. certified (catalytic and non-catalytic) wood stoves and inserts would improve the spatial resolution of emissions estimates.
- More detailed data on the prevalence of primary versus supplemental & aesthetic wood heating would allow for better differentiation in emissions modeling and improve overall estimation accuracy.
- Explore the use of AHS data in regions where climatic conditions differ significantly from those used to derive EPA Wagon Data.

References

- [1] San Joaquin Valley Air Pollution Control District, "2015 Area Source Emissions Inventory Methodology, Residential Wood Combustion," 18 October 2016. [Online]. Available: https://ww3.arb.ca.gov/ei/areasrc/districtmeth/sjvalley/sjvrwc2016_oct18.pdf.
- [2] California Air Resources Board, "Emission Estimation Methodology: Residential Wood Combustion," October 2015. [Online]. Available: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-1_2011.pdf.
- [3] J. E. Houck, J. Mangino and G. Brooks, "Recommended Procedure for Compiling Emission Inventory National, Regional and County Level Activity Data for the Residential Wood Combustion Source Category," In proceedings from U.S. Environmental Protection Agency Emission Inventory Conference, 2001. [Online]. Available: <http://www.omni-test.com/publications/Compiling Emission.pdf>.
- [4] J. E. Houck, "Recommended Procedure for Compiling Emission Inventory Data for Manufactured Wax/Sawdust Fireplace Logs," 2001.
- [5] U. S. Environmental Protection Agency, "Wagon Wheel 2023 BETA v3.1," [Online]. Available: https://gaftp.epa.gov/Air/nei/2023/doc/supporting_data/nonpoint/.
- [6] U.S. Census Bureau, U.S. Department of Commerce, ""Selected Housing Characteristics." American Community Survey, ACS 5-Year Estimates Data Profiles, Table DP04," [Online]. Available: [https://data.census.gov/table/ACSDP5Y2023.DP04?q=ACSDP5Y2023.DP04&g=040X00US06,06\\$0500000&moe=true&tp=true](https://data.census.gov/table/ACSDP5Y2023.DP04?q=ACSDP5Y2023.DP04&g=040X00US06,06$0500000&moe=true&tp=true).
- [7] N. Traviss, G. Allen and M. Ahmadi, "Criteria, Greenhouse Gas, and Hazardous Air Pollutant Emissions Factors from Residential Cordwood and Pellet Stoves Using an Integrated Duty Cycle Test Protocol," *ES&T Air*, vol. 1, no. 9, 13 9 2024.
- [8] G. Carina, P. Clarke and L. Gypin, "National Neighborhood Data Archive (NaNDA): PRISM Climate of Census Tracts, United States, 1981-2024. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]," 4 August 2025. [Online]. Available: <https://doi.org/10.3886/E230941V2>.

- [9] U.S. Census Bureau, ""RACE." Decennial Census, DEC Redistricting Data (PL 94-171), Table P1,," 2020. [Online]. Available:
[https://data.census.gov/table/DECENNIALPL2020.P1?q=United+States&t=Population+s+and+People&g=010XX00US_040XX00US06\\$0500000](https://data.census.gov/table/DECENNIALPL2020.P1?q=United+States&t=Population+s+and+People&g=010XX00US_040XX00US06$0500000).
- [10] marsha5813, "2022 Census tract dataset derived from U.S. Census data," [Online]. Available:
<https://gist.github.com/marsha5813/1fcdb8299a20e83cb2ea0e699d95ca8a>.
- [11] US Census Bureau, "American Community Survey," 2023. [Online]. Available:
<https://www.census.gov/programs-surveys/acs/data/data-tables.html>.
- [12] California Air Resources Board, "Emission Estimation Methodology: Residential Wood Combustion, Appendix A," 2005. [Online]. Available:
<https://ww3.arb.ca.gov/ei/areasrc/fullpdf/7-1appendixa.pdf>.
- [13] . U.S. Environmental Protection Agency, "Guidance for Quantifying and Using Emission Reductions from Voluntary Woodstove Changeout Programs in State Implementation Plans," 2006.
- [14] . U.S. Environmental Protection Agency, "Draft Technical Support Document: Preparation of Emissions Inventories for the Version 4, 2005-based Platform," 2010.
- [15] . U.S. Environmental Protection Agency, "AP-42, Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 1.0, 1.9 Residential Fireplaces," 1996.
- [16] . U.S. Environmental Protection Agency, "AP-42, Compilation of Air Pollutant Emission Factors, Fifth Edition, Volume I: Stationary Point and Area Sources, Section 1.0, 1.10 Residential Wood Stoves," 1996.
- [17] . U.S. Energy Information Administration, "Annual Energy Outlook 2011," 2011.
- [18] . San Joaquin Valley Unified Air Pollution Control District, "Draft Staff Report, Amendments to Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters)," 2008.
- [19] . Sacramento Metropolitan Air Quality Management District, "2007 Wood Burn Research Study, Final Report," 2007.

- [20] . Northern California Research Associates, "The California Residential Wood Consumption Survey, Draft," 1988.
- [21] J. E. Houck and B. N. Eagle, "Task 6, Technical Memorandum 4 (Final Report), Control Analysis and Documentation for Residential Wood Combustion in the MANE-VU Region," 2006.
- [22] J. E. Houck and P. E. Tiegs, "Review of Fireplace Use and Technology," 1998.
- [23] J. E. Houck and B. N. Eagle, "Residential Wood Combustion Emission Inventory, South Coast Air Basin and Coachella Portion of Salton Sea Air Basin, 2002 Base Year," 2006.
- [24] J. E. Houck and D. R. Broderick, "PM2.5 Emission Reduction Benefits of Replacing Conventional Uncertified Cordwood Stoves with Certified Cordwood Stoves or Modern Pellet Stoves," 2005.
- [25] J. D. Franz, "San Joaquin Valley Unified Air Pollution Control District, Residential Wood Combustion Survey, Final Draft Report," 1997.
- [26] . Emission Inventory Improvement Program, "Estimating Ammonia Emissions From Anthropogenic Nonagricultural Sources - Draft Final Report," 2004.
- [27] . EC/R Incorporated, "Development of Emissions Inventory Methods for Wildland Fire, Final Report," 2002.
- [28] . E.H. Pechan & Associates Inc., "Documentation for the Final 2002 Nonpoint Sector (Feb. 06 Version) National Emission Inventory for Criteria and Hazardous Air Pollutants," 2006.
- [29] . E.H. Pechan & Associates Inc., "Development of Emission Growth Surrogates and Activity Projections Used in Forecasting Point and Area Source Emissions, Final Report," 2001.
- [30] D. R. Broderick and J. E. Houck, "Results of Wood Burning Survey - Sacramento, San Joaquin, and San Francisco Areas, University of California Berkeley/California Air Resources Board - GIS Study," 2003.

- [31] D. R. Broderick, J. E. Houck and J. Crouch, "Development of a Fireplace Baseline Particulate Emission Factor Database," 2005.
- [32] S. G. Barnett and R. D. Bighouse, "In-Home Demonstration of the Reduction of Woodstove Emissions from the Use of Densified Logs," 1992.

Appendix A

I. Wood-Burning Device Usage Fraction

The fractions of homes using wood-burning devices (fireplaces, wood stoves, fireplace inserts, and pellet stoves) were obtained from EPAs 2023 Wagon Wheel BETA [5] at the county level (Table A - 1). These fractions were multiplied by housing unit data to estimate the total number of devices in use per county.

As the Wagon Wheel dataset is derived from national surveys conducted outside California, its applicability to the state was validated using a statistical model. A random forest regression was constructed to predict device fractions using four key county-level predictors: heating degree days, the percentage of homes using wood as a primary heating fuel, population, and land area. The model performance was strong, with high coefficients of determination (R^2) for all device types: fireplaces (0.68), wood stoves (0.91), fireplace inserts (0.89), and pellet stoves (0.83). This high correlation confirms that the national dataset accurately reflects California's climatic and demographic drivers of wood-burning device adoption, justifying its use.

Table A - 1 Fraction of homes with wood burning device in use based on the EPAs 2023 Wagon Wheel BETA [5].

County	Fireplaces	Wood Stoves	Fireplace Inserts	Pellet Stoves	Manufactured Logs
Alameda	0.0948	0.0287	0.0249	0.0161	0.0279
Alpine	0.0471	0.1774	0.0608	0.0384	0.0795
Amador	0.0882	0.1184	0.0718	0.0419	0.0607
Butte	0.1078	0.0696	0.0504	0.0245	0.0332
Calaveras	0.0789	0.1394	0.0824	0.0454	0.0425
Colusa	0.0867	0.0818	0.0486	0.0332	0.0332
Contra Costa	0.1059	0.0373	0.0330	0.0209	0.0384
Del Norte	0.0821	0.1326	0.0909	0.0292	0.0697
El Dorado	0.1098	0.1060	0.0708	0.0342	0.0332
Fresno	0.0926	0.0541	0.0424	0.0242	0.0245
Glenn	0.0833	0.0912	0.0553	0.0325	0.0332
Humboldt	0.1611	0.0840	0.0578	0.0288	0.0509
Imperial	0.0442	0.0565	0.0465	0.0242	0.0083
Inyo	0.0346	0.0842	0.0598	0.0296	0.0572
Kern	0.0891	0.0517	0.0389	0.0258	0.0245
Kings	0.0955	0.0476	0.0347	0.0256	0.0245
Lake	0.0583	0.1221	0.0832	0.0302	0.0425
Lassen	0.0502	0.1711	0.0683	0.0394	0.0732
Los Angeles	0.0771	0.0251	0.0227	0.0148	0.0237
Madera	0.0863	0.0926	0.0650	0.0339	0.0245

Section 7.1
Residential Wood Combustion

County	Fireplaces	Wood Stoves	Fireplace Inserts	Pellet Stoves	Manufactured Logs
Marin	0.1006	0.0503	0.0328	0.0220	0.0478
Mariposa	0.0576	0.1555	0.0854	0.0439	0.0425
Mendocino	0.1095	0.1164	0.0720	0.0341	0.0614
Merced	0.0795	0.0639	0.0474	0.0281	0.0245
Modoc	0.0475	0.1499	0.0785	0.0428	0.0641
Mono	0.0363	0.0947	0.0349	0.0204	0.0837
Monterey	0.0783	0.0470	0.0380	0.0227	0.0368
Napa	0.1124	0.0637	0.0421	0.0260	0.0385
Nevada	0.1139	0.1129	0.0738	0.0361	0.0425
Orange	0.0892	0.0239	0.0218	0.0143	0.0377
Placer	0.1419	0.0702	0.0513	0.0284	0.0382
Plumas	0.0709	0.1663	0.0928	0.0434	0.0770
Riverside	0.0833	0.0379	0.0333	0.0232	0.0339
Sacramento	0.0818	0.0412	0.0321	0.0206	0.0391
San Benito	0.0923	0.0576	0.0425	0.0308	0.0385
San Bernardino	0.0819	0.0391	0.0337	0.0244	0.0341
San Diego	0.0627	0.0319	0.0273	0.0170	0.0301
San Francisco	0.1127	0.0058	0.0052	0.0032	0.0201
San Joaquin	0.1056	0.0511	0.0396	0.0254	0.0245
San Luis Obispo	0.0868	0.0470	0.0368	0.0252	0.0449
San Mateo	0.1104	0.0336	0.0299	0.0177	0.0445
Santa Barbara	0.0892	0.0336	0.0294	0.0200	0.0456
Santa Clara	0.1013	0.0333	0.0295	0.0168	0.0272
Santa Cruz	0.1263	0.0500	0.0440	0.0231	0.0517
Shasta	0.1126	0.0884	0.0617	0.0295	0.0332
Sierra	0.0694	0.1864	0.0931	0.0504	0.0702
Siskiyou	0.0709	0.1586	0.0912	0.0387	0.0735
Solano	0.0899	0.0505	0.0349	0.0239	0.0357
Sonoma	0.1244	0.0623	0.0418	0.0253	0.0367
Stanislaus	0.1202	0.0519	0.0411	0.0264	0.0245
Sutter	0.0930	0.0601	0.0395	0.0269	0.0332
Tehama	0.0695	0.1049	0.0627	0.0321	0.0332
Trinity	0.0880	0.1920	0.1034	0.0440	0.0854
Tulare	0.1259	0.0582	0.0452	0.0281	0.0245
Tuolumne	0.0698	0.1233	0.0856	0.0365	0.0425
Ventura	0.0983	0.0348	0.0308	0.0212	0.0325
Yolo	0.0765	0.0478	0.0320	0.0208	0.0391
Yuba	0.1040	0.0798	0.0533	0.0288	0.0332

II. Burn Rates

County level burn rates for Fireplaces and Wood Stoves are presented in Table A - 2. All burn rate data was initially obtained from the Woodsmoke Reduction Program. Significant gaps in the data were addressed through imputation, as described in the next section.

Table A - 2 County-level burn rates for fireplaces and wood stoves

County	Fireplaces	Wood Stoves
Alameda		
Alpine	2.90	3.02
Amador		2.82
Butte	2.37	2.76
Calaveras	3.56	3.24
Colusa	2.04	3.24
Contra Costa		
Del Norte	4.00	3.08
El Dorado		2.15
Fresno		
Glenn	2.55	2.53
Humboldt	4.00	3.08
Imperial		
Inyo	2.90	3.02
Kern	2.05	2.26
Kings		
Lake	5.00	2.84
Lassen	4.45	4.76
Los Angeles		
Madera		
Marin		
Mariposa	3.00	3.47
Mendocino	3.50	3.21
Merced		
Modoc		
Mono	2.90	3.02
Monterey	1.51	1.73
Napa		
Nevada	3.89	3.84
Orange		
Placer	2.00	2.26
Plumas	3.89	3.84
Riverside		
Sacramento		

County	Fireplaces	Wood Stoves
San Benito	1.51	1.73
San Bernardino		
San Diego		
San Francisco		
San Joaquin		
San Luis Obispo	1.14	1.64
San Mateo		
Santa Barbara	1.21	1.00
Santa Clara		
Santa Cruz	1.51	1.73
Shasta	2.91	3.47
Sierra	3.89	3.84
Siskiyou	3.00	4.51
Solano	1.50	1.72
Sonoma		
Stanislaus		
Sutter	2.50	3.04
Tehama	3.16	2.80
Trinity	4.00	3.08
Tulare		
Tuolumne	2.64	3.13
Ventura	1.67	
Yolo	1.50	1.72
Yuba	2.50	3.04

III. Random Forest Regression for Data Imputation

To address missing burn rates, we employed a random forest regression model. The model was trained on counties with complete data using the following predictors:

- Heating Degree Days (HDD, Four-year aggregated [8]).
- Wood usage fraction for primary heating [6],
- Forest Cover,
- Mean Elevation, and
- Population Density (the latter 3 were obtained from US Census Bureau [9] [10] [11]).

The model was trained on counties with complete data and then applied to predict the missing burn rates for counties where data was absent, using their respective predictor variables. This approach ensures that the imputed values are consistent with the observed climatic, geographic, and demographic trends in the dataset.

HDD and Elevation values were calculated as weighted averages, with weights corresponding to the number of occupied housing units in each census tract. This method ensures that the predictors accurately reflect the residential distribution within each county, thereby improving the reliability of the imputed burn rates.

IV. Imputation Results

A. Imputed Burn Rates and their Predictors

The imputed burn rates along with the predictors used are presented in Table A - 3 and Table A - 4 for fireplaces and wood stoves respectively.

Table A - 3 County-level imputed burn rates and the predictors used for fireplaces.

County	Burn Rate	HDD	Wood Usage	Forest Cover	Elevation	Population Density
Alameda	1.84	10377	0.002	11.98	58.98	2281.28
Alpine	2.90	31864	0.378	24.94	2366.00	1.63
Amador	3.22	12349	0.191	28.05	535.86	68.07
Butte	2.37	10288	0.073	27.18	155.86	129.32
Calaveras	3.56	12382	0.221	28.24	542.13	44.40
Colusa	2.04	10257	0.052	13.26	98.61	18.98
Contra Costa	1.84	10402	0.005	12.17	79.89	1626.35
Del Norte	3.07	19352	0.165	63.58	152.39	27.57
El Dorado	3.47	15332	0.115	38.06	776.56	111.95
Fresno	1.72	9139	0.011	11.27	122.37	169.28
Glenn	2.55	9528	0.107	14.92	95.22	22.01
Humboldt	3.21	18005	0.168	63.68	179.80	38.25
Imperial	1.99	3883	0.001	0.92	-14.47	43.04
Inyo	2.90	17646	0.303	2.15	1492.88	1.86
Kern	2.05	9586	0.014	5.52	288.24	111.77
Kings	1.99	9541	0.003	3.11	84.69	109.63
Lake	3.14	13144	0.138	24.25	531.66	54.31
Lassen	4.45	25238	0.319	14.66	1536.23	7.21
Los Angeles	1.64	5640	0.002	9.64	161.06	2466.36
Madera	2.32	11312	0.078	12.88	322.88	73.12
Marin	1.69	11074	0.010	30.52	67.29	504.33
Mariposa	3.34	13112	0.361	19.44	800.84	11.82
Mendocino	3.50	14451	0.207	53.52	356.17	26.12
Merced	1.98	9955	0.010	5.62	52.16	145.10
Modoc	3.57	26971	0.453	11.93	1451.74	2.20
Mono	2.90	31864	0.336	10.92	2517.53	4.33
Monterey	1.51	11996	0.017	15.77	86.87	133.78
Napa	1.96	11126	0.017	18.50	72.87	183.54
Nevada	3.89	16502	0.122	41.29	915.50	106.75

Section 7.1
Residential Wood Combustion

County	Burn Rate	HDD	Wood Usage	Forest Cover	Elevation	Population Density
Orange	1.87	5692	0.002	12.95	71.72	4019.61
Placer	1.95	11473	0.034	34.30	237.98	287.64
Plumas	3.89	24572	0.380	34.24	1562.34	7.75
Riverside	2.00	6414	0.005	3.63	353.17	335.43
Sacramento	1.87	9891	0.004	7.05	25.03	1642.07
San Benito	1.51	10875	0.042	9.60	164.34	46.24
San Bernardino	2.12	8196	0.014	1.73	573.74	108.71
San Diego	1.63	6327	0.006	10.79	129.12	783.44
San Francisco	1.72	11267	0.000	8.31	52.23	18714.45
San Joaquin	1.87	9923	0.009	10.33	11.40	559.70
San Luis Obispo	1.14	11053	0.027	9.94	171.00	85.56
San Mateo	1.69	10805	0.004	34.54	59.99	1704.04
Santa Barbara	1.21	8936	0.005	15.02	99.20	163.95
Santa Clara	1.89	9465	0.002	20.39	59.44	1499.72
Santa Cruz	1.51	12948	0.037	46.69	99.68	608.53
Shasta	2.91	11626	0.124	36.48	305.27	48.24
Sierra	3.89	25286	0.265	43.42	1750.00	3.39
Siskiyou	3.86	22768	0.340	35.12	1213.01	7.02
Solano	1.50	9984	0.008	6.91	41.58	551.87
Sonoma	1.96	12180	0.031	31.64	83.85	310.32
Stanislaus	1.87	9806	0.010	9.37	35.75	369.53
Sutter	2.50	9974	0.023	14.56	19.03	165.31
Tehama	3.16	10636	0.199	19.55	203.24	22.32
Trinity	3.87	20995	0.483	47.16	1220.28	5.07
Tulare	1.84	9735	0.015	14.91	144.35	98.08
Tuolumne	2.64	14564	0.240	27.49	864.11	25.04
Ventura	1.64	7533	0.004	13.29	172.48	458.42
Yolo	1.50	9853	0.011	7.48	21.61	213.63
Yuba	2.50	10346	0.055	29.24	89.95	129.07

Section 7.1
Residential Wood Combustion

Table A - 4 County-level imputed burn rates and the predictors used for wood stoves.

County	Burn Rate	HDD	Wood Usage	Forest Cover	Elevation	Population Density
Alameda	2.17	10377	0.002	11.98	58.98	2281.28
Alpine	3.02	31864	0.378	24.94	2366.00	1.63
Amador	2.82	12349	0.191	28.05	535.86	68.07
Butte	2.76	10288	0.073	27.18	155.86	129.32
Calaveras	3.24	12382	0.221	28.24	542.13	44.40
Colusa	3.24	10257	0.052	13.26	98.61	18.98
Contra Costa	2.14	10402	0.005	12.17	79.89	1626.35
Del Norte	3.08	19352	0.165	63.58	152.39	27.57
El Dorado	2.15	15332	0.115	38.06	776.56	111.95
Fresno	2.39	9139	0.011	11.27	122.37	169.28
Glenn	2.53	9528	0.107	14.92	95.22	22.01
Humboldt	3.08	18005	0.168	63.68	179.80	38.25
Imperial	2.20	3883	0.001	0.92	-14.47	43.04
Inyo	3.02	17646	0.303	2.15	1492.88	1.86
Kern	2.26	9586	0.014	5.52	288.24	111.77
Kings	2.11	9541	0.003	3.11	84.69	109.63
Lake	2.84	13144	0.138	24.25	531.66	54.31
Lassen	4.76	25238	0.319	14.66	1536.23	7.21
Los Angeles	1.77	5640	0.002	9.64	161.06	2466.36
Madera	2.83	11312	0.078	12.88	322.88	73.12
Marin	2.32	11074	0.010	30.52	67.29	504.33
Mariposa	3.47	13112	0.361	19.44	800.84	11.82
Mendocino	3.21	14451	0.207	53.52	356.17	26.12
Merced	2.14	9955	0.010	5.62	52.16	145.10
Modoc	3.66	26971	0.453	11.93	1451.74	2.20
Mono	3.02	31864	0.336	10.92	2517.53	4.33
Monterey	1.73	11996	0.017	15.77	86.87	133.78
Napa	2.70	11126	0.017	18.50	72.87	183.54
Nevada	3.84	16502	0.122	41.29	915.50	106.75
Orange	2.36	5692	0.002	12.95	71.72	4019.61
Placer	2.26	11473	0.034	34.30	237.98	287.64
Plumas	3.84	24572	0.380	34.24	1562.34	7.75
Riverside	1.79	6414	0.005	3.63	353.17	335.43
Sacramento	1.84	9891	0.004	7.05	25.03	1642.07
San Benito	1.73	10875	0.042	9.60	164.34	46.24
San Bernardino	2.19	8196	0.014	1.73	573.74	108.71
San Diego	2.03	6327	0.006	10.79	129.12	783.44
San Francisco	1.79	11267	0.000	8.31	52.23	18714.45
San Joaquin	1.80	9923	0.009	10.33	11.40	559.70

Section 7.1
Residential Wood Combustion

County	Burn Rate	HDD	Wood Usage	Forest Cover	Elevation	Population Density
San Luis Obispo	1.64	11053	0.027	9.94	171.00	85.56
San Mateo	2.28	10805	0.004	34.54	59.99	1704.04
Santa Barbara	2.67	8936	0.005	15.02	99.20	163.95
Santa Clara	2.34	9465	0.002	20.39	59.44	1499.72
Santa Cruz	1.73	12948	0.037	46.69	99.68	608.53
Shasta	3.47	11626	0.124	36.48	305.27	48.24
Sierra	3.84	25286	0.265	43.42	1750.00	3.39
Siskiyou	4.51	22768	0.340	35.12	1213.01	7.02
Solano	1.72	9984	0.008	6.91	41.58	551.87
Sonoma	2.36	12180	0.031	31.64	83.85	310.32
Stanislaus	1.80	9806	0.010	9.37	35.75	369.53
Sutter	3.04	9974	0.023	14.56	19.03	165.31
Tehama	2.80	10636	0.199	19.55	203.24	22.32
Trinity	3.08	20995	0.483	47.16	1220.28	5.07
Tulare	2.67	9735	0.015	14.91	144.35	98.08
Tuolumne	3.13	14564	0.240	27.49	864.11	25.04
Ventura	2.34	7533	0.004	13.29	172.48	458.42
Yolo	1.72	9853	0.011	7.48	21.61	213.63
Yuba	3.04	10346	0.055	29.24	89.95	129.07

B. Geographic Patterns

Figure A - 1, and Figure A - 2 show the relationship between the burn rates and HDD for fireplaces and wood stoves respectively. Burn rates for fireplaces and wood stoves show clear positive correlations with HDD, exhibiting highest usage rates in northern and northeastern California where heating demand is greatest.

Section 7.1
Residential Wood Combustion

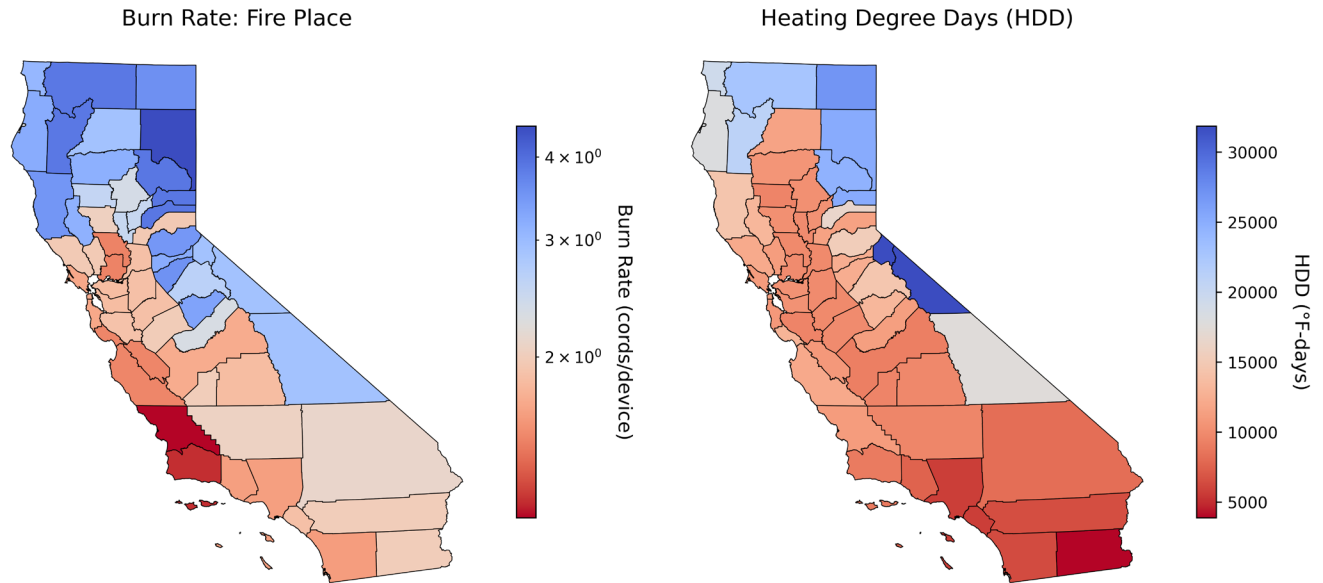


Figure A - 1 Relationship between Heating Degree Days (HDD) and fireplace usage rates (%) across counties.

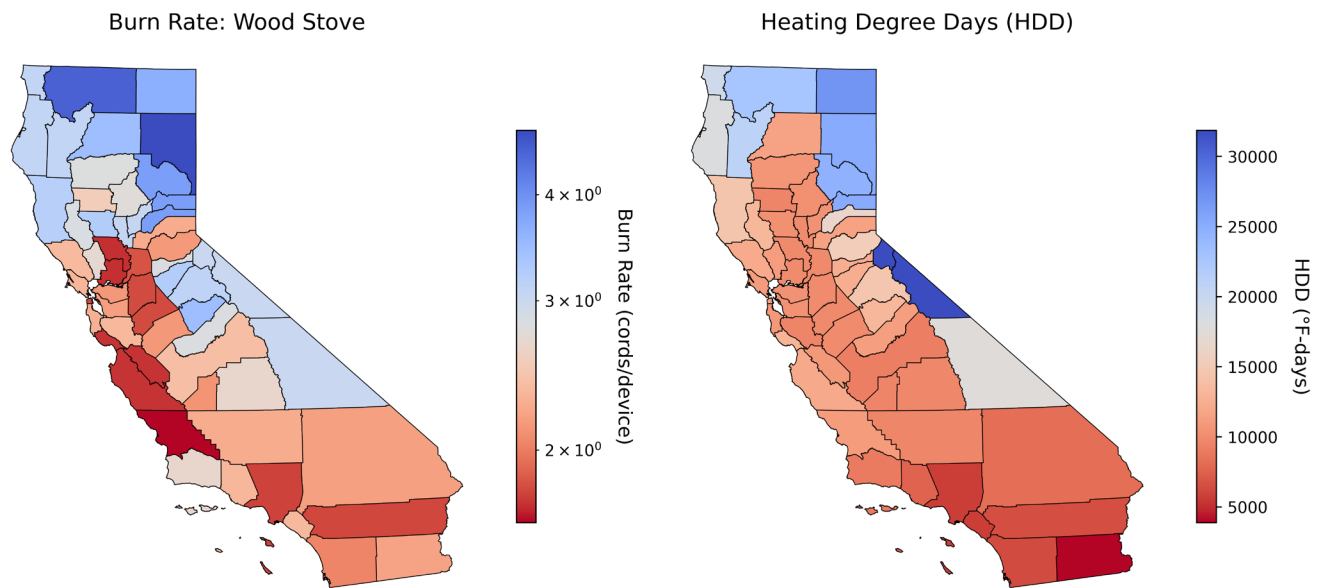


Figure A - 2 Relationship between Heating Degree Days (HDD) and wood stove usage rates (%) across counties.

C. Model Performance Evaluation

1. Model Fit

We first evaluated how well the model fits the training dataset. The model performed well for both fireplaces and wood stoves, with R^2 of 0.87 and 0.78 respectively (Figure A - 3, left). The Root Mean Squared Error (RMSE) was 0.33 and 0.36 for fireplaces and wood stoves respectively (Figure A - 3, right).

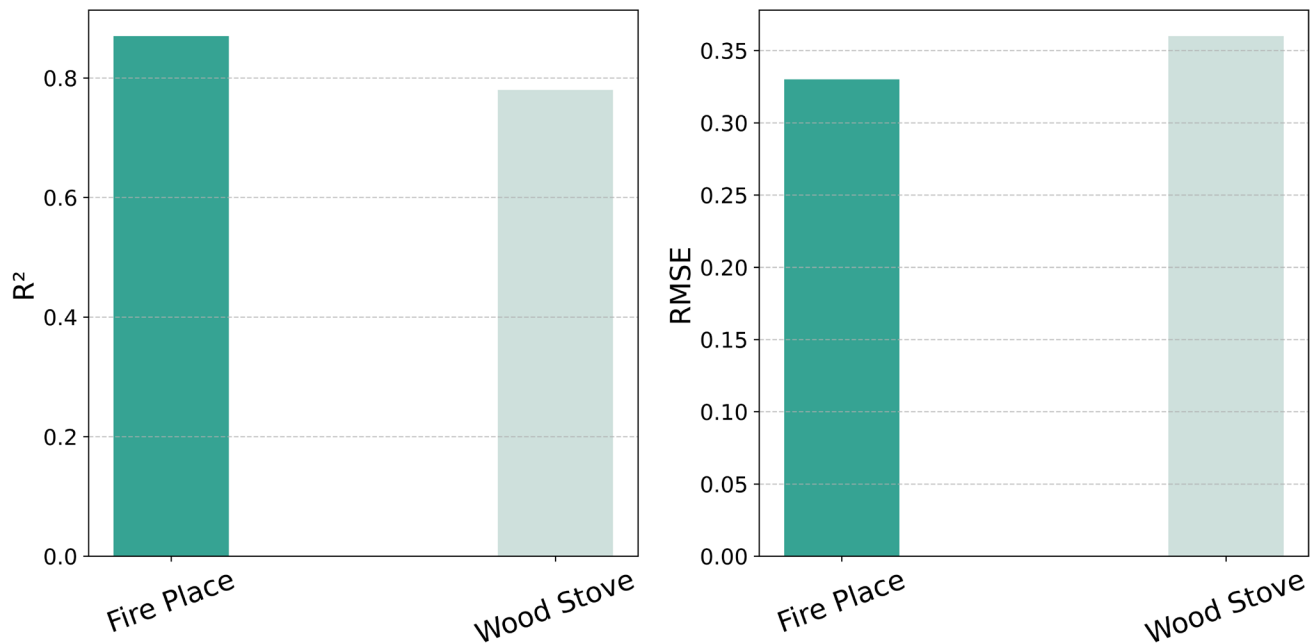


Figure A - 3 Bar plots showing model fit metrics: coefficient of determination (R^2) and Root Mean Squared Error (RMSE).

2. Cross validation

While model fit metrics describe performance on the training data, we assessed the model's ability to predict new values using two cross-validation (CV) methods: Leave-One-Out Cross-Validation (LOOCV) and 5-Fold Cross-Validation (KFCV). LOOCV trains the model on all data points except one, which is then predicted; this process is repeated for every data point. KFCV randomly partitions the data into five folds, iteratively training on four folds and predicting the fifth.

The predictive R^2 from LOOCV was 0.57 for fireplaces and 0.38 for wood stoves (Figure A - 4; left). The R^2 from KFCV was 0.51 and 0.35, respectively (Figure A - 4, right). The strong agreement between these two methods indicates robust model stability and that the performance is not sensitive to the specific validation technique.

The cross-validated R^2 values indicate a moderate level of predictive power for both device types. This suggests the models capture meaningful, generalizable relationships between

the predictors and the outcome. The remaining unexplained variance highlights the complexity of the systems and the likely influence of factors not included in the dataset. The consistency between CV methods, coupled with the sensible geographic patterns observed in Figure A - 1 and Figure A - 2, provides strong confidence in the reliability of the imputed data.

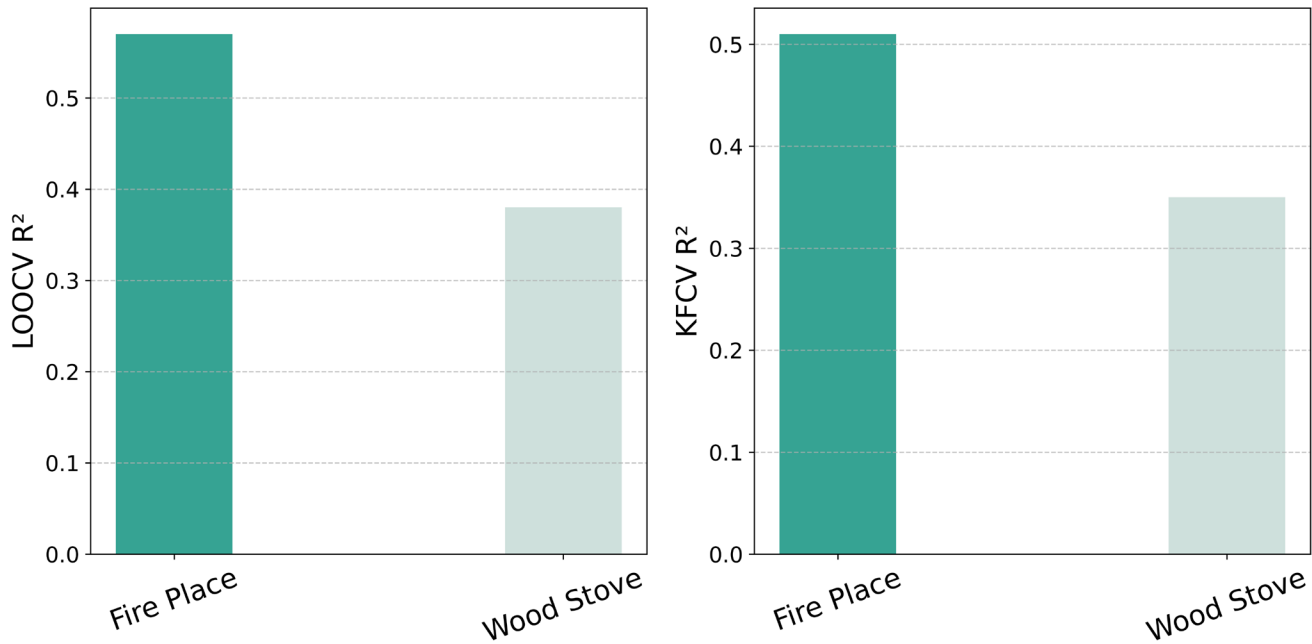


Figure A - 4 Bar plots comparing model cross validation from LOOCV and KFCV methods.

Appendix B

I. Split Between Supplemental Heating and Aesthetic Use

A. Classify households into heating-context zones

Each household is classified into one of four “heating-context” zones based on geography and settlement pattern:

- *Mountain*: Elevation $\geq 2,500$ feet ($\approx 4,000$ Heating Degree Days). Zones identified by intersecting 2020 Census Census-Designated Place (CDP) polygons with USGS 30 m Digital Elevation Model (DEM).
- *Urban, Suburban, Rural*: Remaining households classified according to the 2023 USDA Rural-Urban Continuum Codes (RUCC):
 - RUCC 1-2 (Urban base): 80% Urban, 15% Suburban, 5% Rural
 - RUCC 3-4 (Suburban base): 25% Urban, 55% Suburban, 20% Rural
 - RUCC ≥ 5 (Rural base): 10% Urban, 25% Suburban, 65% Rural

B. Assign zone-level purpose fractions

Purpose fractions for wood-burning events (aesthetic vs. supplemental heating) are assigned using the EPA’s 2017 National Residential Wood-Combustion Survey (NRWCS). The NRWCS shows aesthetic fires dominate in dense metropolitan areas, while supplemental heating dominates in colder or sparsely settled areas.

Adopted baseline aesthetic shares (health-protective mid-points of NRWCS interquartile ranges):

- Urban: 0.80
- Suburban: 0.65
- Rural: 0.35
- Mountain: 0.25

C. Blend to county level

County-level aesthetic and supplemental shares are calculated by weighing the zone-level fractions with the proportion of households in each zone:

$$F_{\text{aes},c} = U_c (0.80) + S_c (0.65) + R_c (0.35) + M_c (0.25)$$

$$F_{\text{supp},c} = 1 - F_{\text{aes},c}$$

Where:

Section 7.1
Residential Wood Combustion

- U_c , S_c , R_c and M_c = Fraction of Urban, Suburban, Rural, Mountain zones, respectively in county c .
- $F_{aes,c}$ = Fraction of non-primary wood burning for aesthetic use at county c
- $F_{supp,c}$ = Fraction of non-primary wood burning for supplemental heating at county c

This blended approach ensures that counties with large urban populations are assigned higher aesthetic use, while rural and mountain counties reflect a higher prevalence of supplemental heating. Table B - 1 lists these fractions for counties in California.

Table B - 1 Fraction of non-primary wood burning for supplemental heating and aesthetic use.

County	U_c	S_c	R_c	M_c	F_{supp}	F_{aes}
Alameda	0.784	0.147	0.049	0.02	0.211	0.789
Alpine	0	0	0	1	0.75	0.25
Amador	0.055	0.138	0.358	0.45	0.695	0.305
Butte	0.09	0.225	0.585	0.1	0.66	0.34
Calaveras	0.06	0.15	0.39	0.4	0.69	0.31
Colusa	0.09	0.225	0.585	0.1	0.66	0.34
Contra Costa	0.784	0.147	0.049	0.02	0.211	0.789
Del Norte	0.09	0.225	0.585	0.1	0.66	0.34
El Dorado	0.163	0.358	0.13	0.35	0.49	0.51
Fresno	0.098	0.245	0.637	0.02	0.652	0.348
Glenn	0.09	0.225	0.585	0.1	0.66	0.34
Humboldt	0.095	0.237	0.617	0.05	0.655	0.345
Imperial	0.1	0.25	0.65	0	0.65	0.35
Inyo	0	0	0	1	0.75	0.25
Kern	0.237	0.522	0.19	0.05	0.37	0.63
Kings	0.1	0.25	0.65	0	0.65	0.35
Lake	0.07	0.175	0.455	0.3	0.68	0.32
Lassen	0	0	0	1	0.75	0.25
Los Angeles	0.76	0.142	0.048	0.05	0.228	0.772
Madera	0.085	0.212	0.552	0.15	0.665	0.335
Marin	0.237	0.522	0.19	0.05	0.37	0.63
Mariposa	0.04	0.1	0.26	0.6	0.71	0.29
Mendocino	0.09	0.225	0.585	0.1	0.66	0.34
Merced	0.1	0.25	0.65	0	0.65	0.35
Modoc	0	0	0	1	0.75	0.25
Mono	0	0	0	1	0.75	0.25
Monterey	0.237	0.522	0.19	0.05	0.37	0.63
Napa	0.232	0.511	0.186	0.07	0.378	0.622
Nevada	0.05	0.125	0.325	0.5	0.7	0.3
Orange	0.784	0.147	0.049	0.02	0.211	0.789

Section 7.1
Residential Wood Combustion

County	U_c	S_c	R_c	M_c	F_{supp}	F_{aes}
Placer	0.188	0.413	0.15	0.25	0.45	0.55
Plumas	0	0	0	1	0.75	0.25
Riverside	0.744	0.139	0.046	0.07	0.239	0.761
Sacramento	0.8	0.15	0.05	0	0.2	0.8
San Benito	0.095	0.237	0.617	0.05	0.655	0.345
San Bernardino	0.736	0.138	0.046	0.08	0.244	0.756
San Diego	0.76	0.142	0.048	0.05	0.228	0.772
San Francisco	0.8	0.15	0.05	0	0.2	0.8
San Joaquin	0.25	0.55	0.2	0	0.35	0.65
San Luis Obispo	0.237	0.522	0.19	0.05	0.37	0.63
San Mateo	0.237	0.522	0.19	0.05	0.37	0.63
Santa Barbara	0.237	0.522	0.19	0.05	0.37	0.63
Santa Clara	0.76	0.142	0.048	0.05	0.228	0.772
Santa Cruz	0.225	0.495	0.18	0.1	0.39	0.61
Shasta	0.07	0.175	0.455	0.3	0.68	0.32
Sierra	0	0	0	1	0.75	0.25
Siskiyou	0.02	0.05	0.13	0.8	0.73	0.27
Solano	0.25	0.55	0.2	0	0.35	0.65
Sonoma	0.237	0.522	0.19	0.05	0.37	0.63
Stanislaus	0.25	0.55	0.2	0	0.35	0.65
Sutter	0.1	0.25	0.65	0	0.65	0.35
Tehama	0.095	0.237	0.617	0.05	0.655	0.345
Trinity	0	0	0	1	0.75	0.25
Tulare	0.098	0.245	0.637	0.02	0.652	0.348
Tuolumne	0.04	0.1	0.26	0.6	0.71	0.29
Ventura	0.225	0.495	0.18	0.1	0.39	0.61
Yolo	0.25	0.55	0.2	0	0.35	0.65
Yuba	0.09	0.225	0.585	0.1	0.66	0.34

II. Device Split for Primary, Supplemental, and Aesthetic Use

A. Zone-level device splits

Device splits are drawn from the EPA’s 2017 National Residential Wood Combustion Survey (NRWCS), which reports the proportion of households by appliance type (Fireplaces, Wood stoves, Fireplace Inserts, Pellet stoves) for each purpose:

- Primary heating
- Supplemental heating
- Aesthetic use

Pellet stove shares are updated using the 2023 EPA BurnWise consumer tracker, which indicates higher pellet adoption in rural and colder regions ($\approx 4\%$ urban; $\approx 10\%$ rural).

B. Pellet-fraction correction

Because pellet shares have increased since the 2017 NRWCS, the zone-level device distributions are adjusted upward to reflect 2023 conditions:

- Urban: 6% pellet
- Suburban: 8% pellet
- Rural: 10% pellet
- Mountain: 12% pellet

After updating the pellet share, the non-pellet fractions (Fireplaces, Wood stoves, Fireplace Inserts) are scaled proportionally so that the device shares for each zone and purpose sum to 1 as shown in Table B - 2.

Table B - 2 Zone level device splits.

Zone	Fireplace	Wood Stove	Fireplace Insert	Pellet Stove
Urban	0.050	0.350	0.540	0.060
Suburban	0.074	0.324	0.522	0.080
Rural	0.089	0.402	0.409	0.100
Mountain	0.044	0.440	0.396	0.120

C. Zone blending to county level

Final county-level device splits are calculated by weighing the zone-level splits (Table B - 2) by the county-specific zone fractions (Table B - 1):

$$DS_{dev,p,c} = U_c \times D_{U,d,p} + S_c \times D_{S,d,p} + R_c \times D_{R,d,p} + M_c \times D_{M,d,p}$$

Where:

- $DS_{dev,p,c}$ = Device Splits for device type dev for heating purpose p at county c (Table B - 3, Table B - 4)
- U_c , S_c , R_c and M_c = Fraction of Urban, Suburban, Rural, Mountain zones, respectively in county c (Table B - 1)
- $D_{zone,d,p}$ = Zone level device split for device type dev and heating purpose p (Table B - 2)

This ensures each county's device mix reflects its demographic and geographic composition.

Table B - 3 Device splits for wood burning devices intended for primary heating.

County	DS _{fp,main}	DS _{ws,main}	DS _{fi,main}	DS _{ps,main}
Alameda	0.066	0.415	0.453	0.066
Alpine	0.052	0.518	0.311	0.12
Amador	0.077	0.481	0.338	0.104
Butte	0.093	0.458	0.355	0.094
Calaveras	0.079	0.478	0.34	0.103
Colusa	0.093	0.458	0.355	0.094
Contra Costa	0.066	0.415	0.453	0.066
Del Norte	0.093	0.458	0.355	0.094
El Dorado	0.074	0.454	0.378	0.093
Fresno	0.097	0.453	0.359	0.092
Glenn	0.093	0.458	0.355	0.094
Humboldt	0.095	0.455	0.357	0.092
Imperial	0.098	0.451	0.36	0.091
Inyo	0.052	0.518	0.311	0.12
Kern	0.085	0.424	0.41	0.081
Kings	0.098	0.451	0.36	0.091
Lake	0.084	0.471	0.345	0.1
Lassen	0.052	0.518	0.311	0.12
Los Angeles	0.065	0.418	0.448	0.068
Madera	0.091	0.461	0.352	0.095
Marin	0.085	0.424	0.41	0.081
Mariposa	0.07	0.491	0.33	0.108
Mendocino	0.093	0.458	0.355	0.094

Section 7.1
Residential Wood Combustion

County	DS _{fp,main}	DS _{ws,main}	DS _{fi,main}	DS _{ps,main}
Merced	0.098	0.451	0.36	0.091
Modoc	0.052	0.518	0.311	0.12
Mono	0.052	0.518	0.311	0.12
Monterey	0.085	0.424	0.41	0.081
Napa	0.084	0.426	0.408	0.082
Nevada	0.075	0.485	0.335	0.106
Orange	0.066	0.415	0.453	0.066
Placer	0.078	0.444	0.389	0.089
Plumas	0.052	0.518	0.311	0.12
Riverside	0.065	0.421	0.446	0.069
Sacramento	0.066	0.413	0.456	0.065
San Benito	0.095	0.455	0.357	0.092
San Bernardino	0.065	0.422	0.444	0.069
San Diego	0.065	0.418	0.448	0.068
San Francisco	0.066	0.413	0.456	0.065
San Joaquin	0.086	0.419	0.415	0.079
San Luis Obispo	0.085	0.424	0.41	0.081
San Mateo	0.085	0.424	0.41	0.081
Santa Barbara	0.085	0.424	0.41	0.081
Santa Clara	0.065	0.418	0.448	0.068
Santa Cruz	0.083	0.429	0.405	0.083
Shasta	0.084	0.471	0.345	0.1
Sierra	0.052	0.518	0.311	0.12
Siskiyou	0.061	0.504	0.32	0.114
Solano	0.086	0.419	0.415	0.079
Sonoma	0.085	0.424	0.41	0.081
Stanislaus	0.086	0.419	0.415	0.079
Sutter	0.098	0.451	0.36	0.091
Tehama	0.095	0.455	0.357	0.092
Trinity	0.052	0.518	0.311	0.12
Tulare	0.097	0.453	0.359	0.092
Tuolumne	0.07	0.491	0.33	0.108
Ventura	0.083	0.429	0.405	0.083
Yolo	0.086	0.419	0.415	0.079
Yuba	0.093	0.458	0.355	0.094

Section 7.1
Residential Wood Combustion

Table B - 4 Device splits for wood burning devices intended for supplemental and aesthetic heating.

County	DS _{fp,supp}	DS _{ws,supp}	DS _{fi,supp}	DS _{ps,supp}	DS _{fp,aes}	DS _{ws,aes}	DS _{fi,aes}	DS _{ps,aes}
Alameda	0.561	0.182	0.203	0.054	0.884	0.028	0.085	0.003
Alpine	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Amador	0.354	0.321	0.24	0.085	0.777	0.092	0.109	0.022
Butte	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017
Calaveras	0.362	0.317	0.238	0.083	0.783	0.088	0.108	0.021
Colusa	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017
Contra Costa	0.561	0.182	0.203	0.054	0.884	0.028	0.085	0.003
Del Norte	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017
El Dorado	0.412	0.275	0.237	0.075	0.805	0.073	0.105	0.017
Fresno	0.424	0.283	0.22	0.073	0.826	0.059	0.099	0.016
Glenn	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017
Humboldt	0.419	0.286	0.222	0.073	0.822	0.062	0.1	0.016
Imperial	0.427	0.281	0.22	0.072	0.828	0.058	0.099	0.016
Inyo	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Kern	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Kings	0.427	0.281	0.22	0.072	0.828	0.058	0.099	0.016
Lake	0.378	0.308	0.233	0.08	0.794	0.08	0.106	0.02
Lassen	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Los Angeles	0.552	0.188	0.205	0.055	0.879	0.031	0.086	0.004
Madera	0.403	0.295	0.226	0.076	0.811	0.069	0.102	0.018
Marin	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Mariposa	0.33	0.335	0.247	0.089	0.76	0.103	0.113	0.024
Mendocino	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017
Merced	0.427	0.281	0.22	0.072	0.828	0.058	0.099	0.016
Modoc	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Mono	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Monterey	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Napa	0.476	0.235	0.226	0.064	0.844	0.048	0.097	0.011
Nevada	0.346	0.326	0.242	0.086	0.771	0.095	0.111	0.023
Orange	0.561	0.182	0.203	0.054	0.884	0.028	0.085	0.003
Placer	0.435	0.261	0.233	0.071	0.819	0.064	0.102	0.015
Plumas	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Riverside	0.546	0.192	0.206	0.056	0.876	0.033	0.087	0.004
Sacramento	0.567	0.178	0.202	0.053	0.888	0.026	0.084	0.002
San Benito	0.419	0.286	0.222	0.073	0.822	0.062	0.1	0.016
San Bernardino	0.543	0.194	0.207	0.057	0.874	0.034	0.087	0.005
San Diego	0.552	0.188	0.205	0.055	0.879	0.031	0.086	0.004
San Francisco	0.567	0.178	0.202	0.053	0.888	0.026	0.084	0.002

Section 7.1
Residential Wood Combustion

County	DS_{fp,supp}	DS_{ws,supp}	DS_{fi,supp}	DS_{ps,supp}	DS_{fp,aes}	DS_{ws,aes}	DS_{fi,aes}	DS_{ps,aes}
San Joaquin	0.492	0.224	0.223	0.062	0.854	0.041	0.095	0.01
San Luis Obispo	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
San Mateo	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Santa Barbara	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Santa Clara	0.552	0.188	0.205	0.055	0.879	0.031	0.086	0.004
Santa Cruz	0.469	0.239	0.227	0.065	0.84	0.05	0.098	0.012
Shasta	0.378	0.308	0.233	0.08	0.794	0.08	0.106	0.02
Sierra	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Siskiyou	0.297	0.353	0.256	0.094	0.737	0.118	0.118	0.027
Solano	0.492	0.224	0.223	0.062	0.854	0.041	0.095	0.01
Sonoma	0.48	0.232	0.225	0.063	0.847	0.046	0.097	0.011
Stanislaus	0.492	0.224	0.223	0.062	0.854	0.041	0.095	0.01
Sutter	0.427	0.281	0.22	0.072	0.828	0.058	0.099	0.016
Tehama	0.419	0.286	0.222	0.073	0.822	0.062	0.1	0.016
Trinity	0.265	0.371	0.265	0.1	0.715	0.133	0.123	0.03
Tulare	0.424	0.283	0.22	0.073	0.826	0.059	0.099	0.016
Tuolumne	0.33	0.335	0.247	0.089	0.76	0.103	0.113	0.024
Ventura	0.469	0.239	0.227	0.065	0.84	0.05	0.098	0.012
Yolo	0.492	0.224	0.223	0.062	0.854	0.041	0.095	0.01
Yuba	0.411	0.29	0.224	0.075	0.817	0.065	0.101	0.017

III. Burn-Rate Ratios (Supplemental & Aesthetic)

A. Extract primary burn rates

Baseline primary burn rates (tons/device/yr) for each county and device type were computed directly from the survey data of Woodsmoke changeout program. But this data was not available for all counties. The burn rates for the missing counties were imputed using a regression model based on the Random Forest framework (Appendix A). These represent average annual consumption for households using wood as primary heating fuel.

B. Derive zone-level ratios

To estimate consumption for supplemental and aesthetic use, relative burn-rate ratios are applied to the primary values. Ratios are informed by multiple data sources:

- NRWCS (2017): Cord-consumption tables indicating differences between primary, supplemental, and aesthetic use.
- BAAQMD (2024) Woodsmoke White Paper: Regional survey and rule-development data for supplemental and decorative use.
- San Joaquin Valley APCD (Rule 4901 staff analysis): Observed load reductions for supplemental-use households.

These sources suggest that supplemental devices typically supplement 15-30 % of the primary load, while aesthetic fires account only for 2-7 % of the primary load. Thus, the burn rates should also reflect these usage patterns. The zone-level burn rate ratios for supplemental heating and aesthetic use are shown in Table B - 5.

Table B - 5 Zone level burn rate ratios by purpose and device type.

Purpose	Zone	Fireplace	Wood stove	Fireplace Insert	Pellet Stove
Supplemental	Urban	0.15	0.18	0.18	0.2
	Suburban	0.17	0.2	0.2	0.22
	Rural	0.2	0.25	0.22	0.25
	Mountain	0.25	0.3	0.25	0.3
Aesthetic	Urban	0.06	0.03	0.04	0.02
	Suburban	0.065	0.035	0.045	0.025
	Rural	0.07	0.04	0.05	0.03
	Mountain	0.05	0.03	0.04	0.02

C. Zone blending to county level

Zone-level burn rate ratios are blended to county-level by weighing with the zone shares within a county (Table B - 1).

$$BRR_{dev,p,c} = U_c \times R_{U,dev,p} + S_c \times R_{S,dev,p} + R_c \times R_{R,dev,p} + M_c \times R_{M,dev,p}$$

Where:

$BRR_{dev,p,c}$ = Burn rate ratio for device type dev , heating purpose p and county c (Table B - 6)

U_c , S_c , R_c and M_c = Fraction of Urban, Suburban, Rural, Mountain zones, respectively in county c (Table B - 1)

$R_{zone,dev,p}$ = Burn rate fraction for each zone for device type dev and purpose p (Table B - 5)

This ensures that county-specific burn-rate ratios reflect the demographic and geographic composition of each county, while still grounded in zone-level survey evidence.

Section 7.1
Residential Wood Combustion

Table B - 6 Burn rate Ratios for wood burning devices intended for supplemental heating and aesthetic use.

County	BRR_{fp,supp}	BRR_{fp,aes}	BRR_{ws,supp}	BRR_{ws,aes}	BRR_{fi,supp}	BRR_{fi,aes}	BRR_{ps,supp}	BRR_{ps,aes}
Alameda	0.157	0.061	0.189	0.031	0.186	0.041	0.207	0.021
Alpine	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Amador	0.216	0.06	0.262	0.034	0.229	0.044	0.266	0.024
Butte	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027
Calaveras	0.213	0.061	0.258	0.035	0.227	0.045	0.263	0.025
Colusa	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027
Contra Costa	0.157	0.061	0.189	0.031	0.186	0.041	0.207	0.021
Del Norte	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027
El Dorado	0.199	0.06	0.238	0.033	0.217	0.043	0.249	0.023
Fresno	0.189	0.067	0.232	0.038	0.212	0.048	0.239	0.028
Glenn	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027
Humboldt	0.191	0.067	0.234	0.037	0.213	0.047	0.241	0.027
Imperial	0.188	0.068	0.231	0.038	0.211	0.048	0.238	0.028
Inyo	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Kern	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Kings	0.188	0.068	0.231	0.038	0.211	0.048	0.238	0.028
Lake	0.206	0.062	0.251	0.035	0.223	0.045	0.256	0.025
Lassen	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Los Angeles	0.16	0.061	0.192	0.031	0.188	0.041	0.21	0.021
Madera	0.197	0.065	0.241	0.037	0.217	0.047	0.247	0.027
Marin	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Mariposa	0.225	0.057	0.272	0.033	0.234	0.043	0.275	0.023
Mendocino	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027
Merced	0.188	0.068	0.231	0.038	0.211	0.048	0.238	0.028
Modoc	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Mono	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Monterey	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Napa	0.177	0.064	0.212	0.034	0.203	0.044	0.227	0.024
Nevada	0.219	0.059	0.265	0.034	0.231	0.044	0.269	0.024
Orange	0.157	0.061	0.189	0.031	0.186	0.041	0.207	0.021
Placer	0.191	0.061	0.229	0.034	0.212	0.044	0.241	0.024
Plumas	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Riverside	0.162	0.06	0.194	0.031	0.19	0.041	0.212	0.021
Sacramento	0.155	0.061	0.186	0.031	0.185	0.041	0.206	0.021
San Benito	0.191	0.067	0.234	0.037	0.213	0.047	0.241	0.027
San Bernardino	0.163	0.06	0.196	0.031	0.19	0.041	0.213	0.021
San Diego	0.16	0.061	0.192	0.031	0.188	0.041	0.21	0.021
San Francisco	0.155	0.061	0.186	0.031	0.185	0.041	0.206	0.021

Section 7.1
Residential Wood Combustion

County	BRR_{fp,supp}	BRR_{fp,aes}	BRR_{ws,supp}	BRR_{ws,aes}	BRR_{fi,supp}	BRR_{fi,aes}	BRR_{ps,supp}	BRR_{ps,aes}
San Joaquin	0.171	0.065	0.205	0.035	0.199	0.045	0.221	0.025
San Luis Obispo	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
San Mateo	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Santa Barbara	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Santa Clara	0.16	0.061	0.192	0.031	0.188	0.041	0.21	0.021
Santa Cruz	0.179	0.063	0.215	0.034	0.204	0.044	0.229	0.024
Shasta	0.206	0.062	0.251	0.035	0.223	0.045	0.256	0.025
Sierra	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Siskiyou	0.237	0.054	0.286	0.032	0.242	0.042	0.287	0.022
Solano	0.171	0.065	0.205	0.035	0.199	0.045	0.221	0.025
Sonoma	0.175	0.064	0.21	0.035	0.202	0.045	0.225	0.025
Stanislaus	0.171	0.065	0.205	0.035	0.199	0.045	0.221	0.025
Sutter	0.188	0.068	0.231	0.038	0.211	0.048	0.238	0.028
Tehama	0.191	0.067	0.234	0.037	0.213	0.047	0.241	0.027
Trinity	0.25	0.05	0.3	0.03	0.25	0.04	0.3	0.02
Tulare	0.189	0.067	0.232	0.038	0.212	0.048	0.239	0.028
Tuolumne	0.225	0.057	0.272	0.033	0.234	0.043	0.275	0.023
Ventura	0.179	0.063	0.215	0.034	0.204	0.044	0.229	0.024
Yolo	0.171	0.065	0.205	0.035	0.199	0.045	0.221	0.025
Yuba	0.194	0.066	0.237	0.037	0.215	0.047	0.244	0.027

Appendix C

Table C - 1 Homes with wood as primary fuel for heating ($N_{tot,main}$)

DIS	AB	CO	# of households	Household with wood as primary heating fuel
AMA	MC	Amador	16066	3071
AV	MD	Los Angeles	119692	1673
BA	SF	Alameda	593117	1417
BA	SF	Contra Costa	411662	1919
BA	SF	Marin	103201	1038
BA	SF	Napa	49663	820
BA	SF	San Francisco	362650	167
BA	SF	San Mateo	264424	1011
BA	SF	Santa Clara	654467	1513
BA	SF	Solano	105415	718
BA	SF	Sonoma	168240	3359
BUT	SV	Butte	82345	6019
CAL	MC	Calaveras	17897	3950
COL	SV	Colusa	7466	386
ED	LT	El Dorado	13028	379
ED	MC	El Dorado	62691	8345
FR	SV	Sutter	33240	765
FR	SV	Yuba	28063	1551
GBU	GBV	Alpine	473	179
GBU	GBV	Inyo	7923	2403
GBU	GBV	Mono	5521	1853
GLE	SV	Glenn	9763	1047
IMP	SS	Imperial	48844	67
KER	MD	Kern	48205	2873
LAK	LC	Lake	26364	3629
LAS	NEP	Lassen	9060	2892
MBU	NCC	Monterey	132046	2272
MBU	NCC	San Benito	20188	839
MBU	NCC	Santa Cruz	96873	3539
MEN	NC	Mendocino	34570	7173
MOD	NEP	Modoc	3264	1478
MOJ	MD	Riverside	5457	57
MOJ	MD	San Bernardino	177553	7134
MPA	MC	Mariposa	7515	2710
NCU	NC	Del Norte	9621	1592
NCU	NC	Humboldt	54878	9215
NCU	NC	Trinity	5373	2593
NS	NC	Sonoma	22258	2464
NSI	MC	Nevada	41873	5100
NSI	MC	Plumas	8055	3062
NSI	MC	Sierra	1206	320

Section 7.1
Residential Wood Combustion

DIS	AB	CO	# of households	Household with wood as primary heating fuel
PLA	LT	Placer	3672	76
PLA	MC	Placer	10476	2295
PLA	SV	Placer	141274	2857
SAC	SV	Sacramento	568753	2090
SB	SCC	Santa Barbara	148960	713
SC	MD	Riverside	205	0
SC	SC	Los Angeles	3270562	4825
SC	SC	Orange	1074654	1692
SC	SC	Riverside	581454	2938
SC	SC	San Bernardino	490451	2071
SC	SS	Riverside	175083	528
SD	SD	San Diego	1159822	7285
SHA	SV	Shasta	71473	8890
SIS	NEP	Siskiyou	18907	6437
SJU	SJV	Fresno	322163	3400
SJU	SJV	Kern	233211	1074
SJU	SJV	Kings	43736	153
SJU	SJV	Madera	44513	3474
SJU	SJV	Merced	84605	812
SJU	SJV	San Joaquin	241373	2277
SJU	SJV	Stanislaus	176457	1763
SJU	SJV	Tulare	142026	2061
SLO	SCC	San Luis Obispo	108897	2910
TEH	SV	Tehama	24526	4890
TUO	MC	Tuolumne	22809	5481
VEN	SCC	Ventura	278045	987
YS	SV	Solano	50385	566
YS	SV	Yolo	76110	876

Section 7.1
Residential Wood Combustion

Table C - 2 Burn Rates for different devices by county

County	Fireplace (cords/device)	Wood stoves (cords/ device)	Pellet Stove (tons/device)	Manufactured logs (tons/device)
Alameda	1.842	2.173	1.369	0.080
Alpine	2.900	3.021	1.903	0.030
Amador	3.222	2.824	1.779	0.030
Butte	2.367	2.763	1.741	0.030
Calaveras	3.556	3.244	2.044	0.030
Colusa	2.040	3.243	2.043	0.030
Contra Costa	1.842	2.144	1.350	0.080
Del Norte	3.066	3.081	1.941	0.030
El Dorado	3.473	2.146	1.352	0.030
Fresno	1.717	2.391	1.506	0.060
Glenn	2.550	2.533	1.595	0.030
Humboldt	3.210	3.081	1.941	0.030
Imperial	1.994	2.200	1.386	0.030
Inyo	2.900	3.021	1.903	0.030
Kern	2.054	2.256	1.421	0.060
Kings	1.994	2.109	1.328	0.060
Lake	3.141	2.842	1.790	0.030
Lassen	4.455	4.763	3.000	0.030
Los Angeles	1.639	1.775	1.118	0.080
Madera	2.320	2.830	1.782	0.030
Marin	1.694	2.320	1.462	0.060
Mariposa	3.336	3.470	2.186	0.030
Mendocino	3.500	3.208	2.021	0.030
Merced	1.981	2.141	1.349	0.060
Modoc	3.565	3.665	2.309	0.030
Mono	2.900	3.021	1.903	0.030
Monterey	1.509	1.729	1.089	0.060
Napa	1.957	2.695	1.698	0.060
Nevada	3.889	3.839	2.418	0.030
Orange	1.870	2.357	1.485	0.080
Placer	1.951	2.260	1.424	0.060
Plumas	3.889	3.839	2.418	0.030
Riverside	1.995	1.786	1.125	0.080
Sacramento	1.870	1.838	1.158	0.080
San Benito	1.509	1.729	1.089	0.060
San Bernardino	2.117	2.189	1.379	0.080
San Diego	1.629	2.033	1.280	0.080

Section 7.1
Residential Wood Combustion

County	Fireplace (cords/device)	Wood stoves (cords/ device)	Pellet Stove (tons/device)	Manufactured logs (tons/device)
San Francisco	1.716	1.787	1.126	0.080
San Joaquin	1.870	1.803	1.136	0.060
San Luis Obispo	1.144	1.643	1.035	0.060
San Mateo	1.694	2.282	1.438	0.080
Santa Barbara	1.212	2.666	1.680	0.060
Santa Clara	1.885	2.342	1.475	0.080
Santa Cruz	1.509	1.729	1.089	0.060
Shasta	2.912	3.466	2.183	0.030
Sierra	3.889	3.839	2.418	0.030
Siskiyou	3.862	4.513	2.843	0.030
Solano	1.500	1.722	1.085	0.060
Sonoma	1.957	2.359	1.486	0.060
Stanislaus	1.870	1.804	1.136	0.060
Sutter	2.500	3.043	1.917	0.030
Tehama	3.156	2.801	1.764	0.030
Trinity	3.865	3.081	1.941	0.030
Tulare	1.844	2.666	1.680	0.060
Tuolumne	2.643	3.125	1.969	0.030
Ventura	1.639	2.337	1.472	0.080
Yolo	1.500	1.722	1.085	0.060
Yuba	2.500	3.043	1.917	0.030

Table C - 3 Fireplace - Annual Cordwood Consumption and Emissions in tons

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	1929.46	143.74	2.51	0.39	22.77	18.23	1.74
AV	MD	Los Angeles	2643.45	196.94	3.44	0.53	31.19	24.98	2.38
BA	SF	Alameda	16947.08	1262.56	22.03	3.39	199.98	160.15	15.25
BA	SF	Contra Costa	14095.41	1050.11	18.32	2.82	166.33	133.20	12.69
BA	SF	Marin	3673.45	273.67	4.78	0.73	43.35	34.71	3.31
BA	SF	Napa	2437.38	181.58	3.17	0.49	28.76	23.03	2.19
BA	SF	San Francisco	7410.86	552.11	9.63	1.48	87.45	70.03	6.67
BA	SF	San Mateo	8694.60	647.75	11.30	1.74	102.60	82.16	7.83
BA	SF	Santa Clara	21201.27	1579.49	27.56	4.24	250.18	200.35	19.08
BA	SF	Solano	3211.84	239.28	4.18	0.64	37.90	30.35	2.89
BA	SF	Sonoma	8604.55	641.04	11.19	1.72	101.53	81.31	7.74
BUT	SV	Butte	6108.01	455.05	7.94	1.22	72.07	57.72	5.50
CAL	MC	Calaveras	2718.10	202.50	3.53	0.54	32.07	25.69	2.45
COL	SV	Colusa	448.30	33.40	0.58	0.09	5.29	4.24	0.40
ED	LT	El Dorado	1466.98	109.29	1.91	0.29	17.31	13.86	1.32
ED	MC	El Dorado	7592.37	565.63	9.87	1.52	89.59	71.75	6.83
FR	SV	Sutter	2096.50	156.19	2.73	0.42	24.74	19.81	1.89
FR	SV	Yuba	2263.61	168.64	2.94	0.45	26.71	21.39	2.04
GBU	GBV	Alpine	41.57	3.10	0.05	0.01	0.49	0.39	0.04
GBU	GBV	Inyo	615.12	45.83	0.80	0.12	7.26	5.81	0.55
GBU	GBV	Mono	494.37	36.83	0.64	0.10	5.83	4.67	0.44
GLE	SV	Glenn	825.67	61.51	1.07	0.17	9.74	7.80	0.74
IMP	SS	Imperial	1855.78	138.26	2.41	0.37	21.90	17.54	1.67
KER	MD	Kern	2309.44	172.05	3.00	0.46	27.25	21.82	2.08
LAK	LC	Lake	2920.01	217.54	3.80	0.58	34.46	27.59	2.63
LAS	NEP	Lassen	1258.87	93.79	1.64	0.25	14.85	11.90	1.13
MBU	NCC	Monterey	3850.64	286.87	5.01	0.77	45.44	36.39	3.47
MBU	NCC	San Benito	811.17	60.43	1.05	0.16	9.57	7.67	0.73
MBU	NCC	Santa Cruz	3735.39	278.29	4.86	0.75	44.08	35.30	3.36
MEN	NC	Mendocino	5717.25	425.93	7.43	1.14	67.46	54.03	5.15
MOD	NEP	Modoc	428.35	31.91	0.56	0.09	5.05	4.05	0.39
MOJ	MD	Riverside	182.86	13.62	0.24	0.04	2.16	1.73	0.16
MOJ	MD	San Bernardino	6642.41	494.86	8.64	1.33	78.38	62.77	5.98
MPA	MC	Mariposa	1136.65	84.68	1.48	0.23	13.41	10.74	1.02
NCU	NC	Del Norte	1281.21	95.45	1.67	0.26	15.12	12.11	1.15
NCU	NC	Humboldt	8044.05	599.28	10.46	1.61	94.92	76.02	7.24
NCU	NC	Trinity	924.49	68.87	1.20	0.18	10.91	8.74	0.83
NS	NC	Sonoma	1324.12	98.65	1.72	0.26	15.62	12.51	1.19
NSI	MC	Nevada	5962.58	444.21	7.75	1.19	70.36	56.35	5.37
NSI	MC	Plumas	1109.23	82.64	1.44	0.22	13.09	10.48	1.00
NSI	MC	Sierra	166.48	12.40	0.22	0.03	1.96	1.57	0.15
PLA	LT	Placer	211.86	15.78	0.28	0.04	2.50	2.00	0.19
PLA	MC	Placer	726.29	54.11	0.94	0.15	8.57	6.86	0.65

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	8173.07	608.89	10.62	1.63	96.44	77.24	7.36
SAC	SV	Sacramento	17580.50	1309.75	22.85	3.52	207.45	166.14	15.82
SB	SCC	Santa Barbara	3150.67	234.72	4.10	0.63	37.18	29.77	2.84
SC	MD	Riverside	6.84	0.51	0.01	0.00	0.08	0.06	0.01
SC	SC	Los Angeles	71043.48	5292.74	92.36	14.21	838.31	671.36	63.94
SC	SC	Orange	28259.32	2105.32	36.74	5.65	333.46	267.05	25.43
SC	SC	Riverside	19489.49	1451.97	25.34	3.90	229.98	184.18	17.54
SC	SC	San Bernardino	17601.40	1311.30	22.88	3.52	207.70	166.33	15.84
SC	SS	Riverside	5859.49	436.53	7.62	1.17	69.14	55.37	5.27
SD	SD	San Diego	25038.62	1865.38	32.55	5.01	295.46	236.61	22.53
SHA	SV	Shasta	7608.07	566.80	9.89	1.52	89.78	71.90	6.85
SIS	NEP	Siskiyou	2879.81	214.55	3.74	0.58	33.98	27.21	2.59
SJU	SJV	Fresno	13309.28	991.54	17.30	2.66	157.05	125.77	11.98
SJU	SJV	Kern	9971.11	742.85	12.96	1.99	117.66	94.23	8.97
SJU	SJV	Kings	1974.68	147.11	2.57	0.39	23.30	18.66	1.78
SJU	SJV	Madera	3531.12	263.07	4.59	0.71	41.67	33.37	3.18
SJU	SJV	Merced	4124.40	307.27	5.36	0.82	48.67	38.98	3.71
SJU	SJV	San Joaquin	10240.60	762.93	13.31	2.05	120.84	96.77	9.22
SJU	SJV	Stanislaus	8082.97	602.18	10.51	1.62	95.38	76.38	7.27
SJU	SJV	Tulare	7588.11	565.31	9.86	1.52	89.54	71.71	6.83
SLO	SCC	San Luis Obispo	2580.02	192.21	3.35	0.52	30.44	24.38	2.32
TEH	SV	Tehama	3349.08	249.51	4.35	0.67	39.52	31.65	3.01
TUO	MC	Tuolumne	2210.23	164.66	2.87	0.44	26.08	20.89	1.99
VEN	SCC	Ventura	8498.51	633.14	11.05	1.70	100.28	80.31	7.65
YS	SV	Solano	1545.69	115.15	2.01	0.31	18.24	14.61	1.39
YS	SV	Yolo	2098.44	156.33	2.73	0.42	24.76	19.83	1.89

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).

Table C - 4 Fireplaces - Annual Manufactured Log Consumption and Emission in tons

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	29.24	1.83	0.11	0.01	0.42	0.58	0.03
AV	MD	Los Angeles	227.41	14.21	0.87	0.05	3.23	4.50	0.20
BA	SF	Alameda	1325.95	82.87	5.09	0.27	18.83	26.23	1.19
BA	SF	Contra Costa	1265.99	79.12	4.86	0.25	17.98	25.04	1.14
BA	SF	Marin	295.84	18.49	1.14	0.06	4.20	5.85	0.27
BA	SF	Napa	114.62	7.16	0.44	0.02	1.63	2.27	0.10
BA	SF	San Francisco	583.32	36.46	2.24	0.12	8.28	11.54	0.52
BA	SF	San Mateo	940.30	58.77	3.61	0.19	13.35	18.60	0.85
BA	SF	Santa Clara	1422.72	88.92	5.47	0.28	20.20	28.14	1.28
BA	SF	Solano	225.74	14.11	0.87	0.05	3.21	4.47	0.20
BA	SF	Sonoma	370.24	23.14	1.42	0.07	5.26	7.32	0.33
BUT	SV	Butte	82.08	5.13	0.32	0.02	1.17	1.62	0.07
CAL	MC	Calaveras	22.81	1.43	0.09	0.00	0.32	0.45	0.02
COL	SV	Colusa	7.45	0.47	0.03	0.00	0.11	0.15	0.01
ED	LT	El Dorado	12.99	0.81	0.05	0.00	0.18	0.26	0.01
ED	MC	El Dorado	62.50	3.91	0.24	0.01	0.89	1.24	0.06
FR	SV	Sutter	33.12	2.07	0.13	0.01	0.47	0.66	0.03
FR	SV	Yuba	27.99	1.75	0.11	0.01	0.40	0.55	0.03
GBU	GBV	Alpine	1.13	0.07	0.00	0.00	0.02	0.02	0.00
GBU	GBV	Inyo	13.61	0.85	0.05	0.00	0.19	0.27	0.01
GBU	GBV	Mono	13.86	0.87	0.05	0.00	0.20	0.27	0.01
GLE	SV	Glenn	9.74	0.61	0.04	0.00	0.14	0.19	0.01
IMP	SS	Imperial	12.12	0.76	0.05	0.00	0.17	0.24	0.01
KER	MD	Kern	70.80	4.43	0.27	0.01	1.01	1.40	0.06
LAK	LC	Lake	33.63	2.10	0.13	0.01	0.48	0.67	0.03
LAS	NEP	Lassen	19.90	1.24	0.08	0.00	0.28	0.39	0.02
MBU	NCC	Monterey	291.41	18.21	1.12	0.06	4.14	5.76	0.26
MBU	NCC	San Benito	46.58	2.91	0.18	0.01	0.66	0.92	0.04
MBU	NCC	Santa Cruz	300.65	18.79	1.16	0.06	4.27	5.95	0.27
MEN	NC	Mendocino	63.72	3.98	0.24	0.01	0.90	1.26	0.06
MOD	NEP	Modoc	6.28	0.39	0.02	0.00	0.09	0.12	0.01
MOJ	MD	Riverside	14.81	0.93	0.06	0.00	0.21	0.29	0.01
MOJ	MD	San Bernardino	485.05	30.32	1.86	0.10	6.89	9.59	0.44
MPA	MC	Mariposa	9.57	0.60	0.04	0.00	0.14	0.19	0.01
NCU	NC	Del Norte	20.12	1.26	0.08	0.00	0.29	0.40	0.02
NCU	NC	Humboldt	83.75	5.23	0.32	0.02	1.19	1.66	0.08
NCU	NC	Trinity	13.76	0.86	0.05	0.00	0.20	0.27	0.01
NS	NC	Sonoma	48.98	3.06	0.19	0.01	0.70	0.97	0.04
NSI	MC	Nevada	53.40	3.34	0.21	0.01	0.76	1.06	0.05
NSI	MC	Plumas	18.62	1.16	0.07	0.00	0.26	0.37	0.02
NSI	MC	Sierra	2.54	0.16	0.01	0.00	0.04	0.05	0.00
PLA	LT	Placer	8.43	0.53	0.03	0.00	0.12	0.17	0.01
PLA	MC	Placer	24.04	1.50	0.09	0.00	0.34	0.48	0.02

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	324.18	20.26	1.25	0.06	4.60	6.41	0.29
SAC	SV	Sacramento	1776.86	111.05	6.83	0.36	25.23	35.15	1.60
SB	SCC	Santa Barbara	407.58	25.47	1.57	0.08	5.79	8.06	0.37
SC	MD	Riverside	0.56	0.03	0.00	0.00	0.01	0.01	0.00
SC	SC	Los Angeles	6213.99	388.37	23.87	1.24	88.24	122.91	5.59
SC	SC	Orange	3243.40	202.71	12.46	0.65	46.06	64.15	2.92
SC	SC	Riverside	1578.00	98.62	6.06	0.32	22.41	31.21	1.42
SC	SC	San Bernardino	1339.85	83.74	5.15	0.27	19.03	26.50	1.21
SC	SS	Riverside	475.15	29.70	1.83	0.10	6.75	9.40	0.43
SD	SD	San Diego	2789.77	174.36	10.72	0.56	39.61	55.18	2.51
SHA	SV	Shasta	71.25	4.45	0.27	0.01	1.01	1.41	0.06
SIS	NEP	Siskiyou	41.68	2.61	0.16	0.01	0.59	0.82	0.04
SJU	SJV	Fresno	473.20	29.58	1.82	0.09	6.72	9.36	0.43
SJU	SJV	Kern	342.54	21.41	1.32	0.07	4.86	6.78	0.31
SJU	SJV	Kings	64.26	4.02	0.25	0.01	0.91	1.27	0.06
SJU	SJV	Madera	32.67	2.04	0.13	0.01	0.46	0.65	0.03
SJU	SJV	Merced	124.27	7.77	0.48	0.02	1.76	2.46	0.11
SJU	SJV	San Joaquin	354.53	22.16	1.36	0.07	5.03	7.01	0.32
SJU	SJV	Stanislaus	259.21	16.20	1.00	0.05	3.68	5.13	0.23
SJU	SJV	Tulare	208.58	13.04	0.80	0.04	2.96	4.13	0.19
SLO	SCC	San Luis Obispo	293.42	18.34	1.13	0.06	4.17	5.80	0.26
TEH	SV	Tehama	24.46	1.53	0.09	0.00	0.35	0.48	0.02
TUO	MC	Tuolumne	29.07	1.82	0.11	0.01	0.41	0.57	0.03
VEN	SCC	Ventura	722.68	45.17	2.78	0.14	10.26	14.29	0.65
YS	SV	Solano	107.90	6.74	0.41	0.02	1.53	2.13	0.10
YS	SV	Yolo	178.37	11.15	0.69	0.04	2.53	3.53	0.16

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).

Table C - 5 Wood stoves - Annual Cordwood Consumption and Emissions in tons per year

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	7570.71	447.75	5.02	1.51	77.94	163.99	3.94
AV	MD	Los Angeles	2468.72	146.01	1.64	0.49	25.42	53.48	1.28
BA	SF	Alameda	4888.21	289.10	3.24	0.98	50.33	105.88	2.54
BA	SF	Contra Costa	5083.88	300.68	3.37	1.02	52.34	110.12	2.64
BA	SF	Marin	3186.47	188.46	2.11	0.64	32.81	69.02	1.66
BA	SF	Napa	2572.53	152.15	1.71	0.51	26.49	55.72	1.34
BA	SF	San Francisco	1196.09	70.74	0.79	0.24	12.31	25.91	0.62
BA	SF	San Mateo	5226.91	309.14	3.47	1.05	53.81	113.22	2.72
BA	SF	Santa Clara	6556.35	387.76	4.35	1.31	67.50	142.02	3.41
BA	SF	Solano	1849.99	109.41	1.23	0.37	19.05	40.07	0.96
BA	SF	Sonoma	8534.43	504.75	5.66	1.71	87.87	184.87	4.44
BUT	SV	Butte	16012.57	947.03	10.62	3.20	164.86	346.85	8.33
CAL	MC	Calaveras	11030.83	652.40	7.32	2.21	113.57	238.94	5.74
COL	SV	Colusa	1328.85	78.59	0.88	0.27	13.68	28.78	0.69
ED	LT	El Dorado	1066.23	63.06	0.71	0.21	10.98	23.10	0.55
ED	MC	El Dorado	15000.12	887.15	9.95	3.00	154.43	324.92	7.80
FR	SV	Sutter	3167.39	187.33	2.10	0.63	32.61	68.61	1.65
FR	SV	Yuba	5058.02	299.15	3.36	1.01	52.07	109.56	2.63
GBU	GBV	Alpine	466.05	27.56	0.31	0.09	4.80	10.10	0.24
GBU	GBV	Inyo	6349.01	375.50	4.21	1.27	65.37	137.53	3.30
GBU	GBV	Mono	4928.33	291.48	3.27	0.99	50.74	106.75	2.56
GLE	SV	Glenn	2330.13	137.81	1.55	0.47	23.99	50.47	1.21
IMP	SS	Imperial	1418.16	83.87	0.94	0.28	14.60	30.72	0.74
KER	MD	Kern	5105.45	301.95	3.39	1.02	52.56	110.59	2.66
LAK	LC	Lake	9181.14	543.00	6.09	1.84	94.52	198.87	4.77
LAS	NEP	Lassen	12248.35	724.40	8.13	2.45	126.10	265.31	6.37
MBU	NCC	Monterey	4001.74	236.68	2.66	0.80	41.20	86.68	2.08
MBU	NCC	San Benito	1582.87	93.62	1.05	0.32	16.30	34.29	0.82
MBU	NCC	Santa Cruz	5594.24	330.86	3.71	1.12	57.59	121.18	2.91
MEN	NC	Mendocino	18903.77	1118.03	12.54	3.78	194.62	409.48	9.83
MOD	NEP	Modoc	4678.58	276.71	3.10	0.94	48.17	101.34	2.43
MOJ	MD	Riverside	97.55	5.77	0.06	0.02	1.00	2.11	0.05
MOJ	MD	San Bernardino	11904.46	704.07	7.90	2.38	122.56	257.87	6.19
MPA	MC	Mariposa	7864.58	465.14	5.22	1.57	80.97	170.36	4.09
NCU	NC	Del Norte	4148.32	245.34	2.75	0.83	42.71	89.86	2.16
NCU	NC	Humboldt	23898.03	1413.40	15.86	4.78	246.04	517.66	12.43
NCU	NC	Trinity	7035.69	416.11	4.67	1.41	72.44	152.40	3.66
NS	NC	Sonoma	4364.18	258.11	2.90	0.87	44.93	94.53	2.27
NSI	MC	Nevada	19404.42	1147.64	12.87	3.88	199.78	420.32	10.09
NSI	MC	Plumas	10368.82	613.24	6.88	2.07	106.75	224.60	5.39
NSI	MC	Sierra	1161.30	68.68	0.77	0.23	11.96	25.16	0.60
PLA	LT	Placer	232.05	13.72	0.15	0.05	2.39	5.03	0.12
PLA	MC	Placer	3933.60	232.65	2.61	0.79	40.50	85.21	2.05

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	8836.41	522.61	5.86	1.77	90.97	191.41	4.60
SAC	SV	Sacramento	4818.11	284.96	3.20	0.96	49.60	104.37	2.51
SB	SCC	Santa Barbara	3448.75	203.97	2.29	0.69	35.51	74.70	1.79
SC	MD	Riverside	1.05	0.06	0.00	0.00	0.01	0.02	0.00
SC	SC	Los Angeles	17934.01	1060.67	11.90	3.59	184.64	388.47	9.33
SC	SC	Orange	7698.25	455.30	5.11	1.54	79.26	166.75	4.00
SC	SC	Riverside	6568.78	388.50	4.36	1.31	67.63	142.29	3.42
SC	SC	San Bernardino	6335.26	374.69	4.20	1.27	65.22	137.23	3.29
SC	SS	Riverside	1541.34	91.16	1.02	0.31	15.87	33.39	0.80
SD	SD	San Diego	14987.87	886.43	9.94	3.00	154.31	324.66	7.79
SHA	SV	Shasta	28408.08	1680.14	18.85	5.68	292.47	615.35	14.77
SIS	NEP	Siskiyou	25185.17	1489.53	16.71	5.04	259.29	545.54	13.10
SJU	SJV	Fresno	17536.45	1037.16	11.63	3.51	180.54	379.86	9.12
SJU	SJV	Kern	5063.24	299.46	3.36	1.01	52.13	109.68	2.63
SJU	SJV	Kings	1559.03	92.21	1.03	0.31	16.05	33.77	0.81
SJU	SJV	Madera	9702.02	573.81	6.44	1.94	99.89	210.16	5.05
SJU	SJV	Merced	4013.52	237.37	2.66	0.80	41.32	86.94	2.09
SJU	SJV	San Joaquin	5477.31	323.95	3.63	1.10	56.39	118.65	2.85
SJU	SJV	Stanislaus	4285.56	253.46	2.84	0.86	44.12	92.83	2.23
SJU	SJV	Tulare	10827.56	640.38	7.18	2.17	111.47	234.54	5.63
SLO	SCC	San Luis Obispo	4343.15	256.87	2.88	0.87	44.71	94.08	2.26
TEH	SV	Tehama	11022.49	651.90	7.31	2.20	113.48	238.76	5.73
TUO	MC	Tuolumne	14825.93	876.85	9.84	2.97	152.64	321.15	7.71
VEN	SCC	Ventura	5786.75	342.25	3.84	1.16	59.58	125.35	3.01
YS	SV	Solano	1140.89	67.48	0.76	0.23	11.75	24.71	0.59
YS	SV	Yolo	1671.18	98.84	1.11	0.33	17.21	36.20	0.87

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).

Table C - 6 Fireplace Inserts - Annual Cordwood Consumption and Emission in tons

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	5297.80	313.33	3.51	1.06	54.54	114.76	2.76
AV	MD	Los Angeles	2731.16	161.53	1.81	0.55	28.12	59.16	1.42
BA	SF	Alameda	6047.50	357.67	4.01	1.21	62.26	131.00	3.15
BA	SF	Contra Costa	6127.49	362.40	4.07	1.23	63.08	132.73	3.19
BA	SF	Marin	3171.44	187.57	2.10	0.63	32.65	68.70	1.65
BA	SF	Napa	2513.93	148.68	1.67	0.50	25.88	54.45	1.31
BA	SF	San Francisco	1621.52	95.90	1.08	0.32	16.69	35.12	0.84
BA	SF	San Mateo	5272.55	311.83	3.50	1.05	54.28	114.21	2.74
BA	SF	Santa Clara	7890.58	466.67	5.24	1.58	81.24	170.92	4.10
BA	SF	Solano	1917.64	113.41	1.27	0.38	19.74	41.54	1.00
BA	SF	Sonoma	8431.14	498.64	5.59	1.69	86.80	182.63	4.38
BUT	SV	Butte	12238.33	723.81	8.12	2.45	126.00	265.10	6.36
CAL	MC	Calaveras	7816.42	462.29	5.19	1.56	80.47	169.31	4.06
COL	SV	Colusa	1010.55	59.77	0.67	0.20	10.40	21.89	0.53
ED	LT	El Dorado	884.73	52.33	0.59	0.18	9.11	19.16	0.46
ED	MC	El Dorado	12479.28	738.06	8.28	2.50	128.48	270.32	6.49
FR	SV	Sutter	2447.00	144.72	1.62	0.49	25.19	53.00	1.27
FR	SV	Yuba	3844.71	227.39	2.55	0.77	39.58	83.28	2.00
GBU	GBV	Alpine	279.81	16.55	0.19	0.06	2.88	6.06	0.15
GBU	GBV	Inyo	3812.08	225.46	2.53	0.76	39.25	82.57	1.98
GBU	GBV	Mono	2959.15	175.01	1.96	0.59	30.47	64.10	1.54
GLE	SV	Glenn	1790.05	105.87	1.19	0.36	18.43	38.77	0.93
IMP	SS	Imperial	1057.20	62.53	0.70	0.21	10.88	22.90	0.55
KER	MD	Kern	4969.15	293.89	3.30	0.99	51.16	107.64	2.58
LAK	LC	Lake	6677.66	394.94	4.43	1.34	68.75	144.65	3.47
LAS	NEP	Lassen	7354.64	434.98	4.88	1.47	75.72	159.31	3.82
MBU	NCC	Monterey	3944.17	233.27	2.62	0.79	40.61	85.44	2.05
MBU	NCC	San Benito	1215.67	71.90	0.81	0.24	12.52	26.33	0.63
MBU	NCC	Santa Cruz	5327.36	315.08	3.53	1.07	54.85	115.40	2.77
MEN	NC	Mendocino	14581.58	862.40	9.67	2.92	150.12	315.86	7.58
MOD	NEP	Modoc	2808.98	166.13	1.86	0.56	28.92	60.85	1.46
MOJ	MD	Riverside	108.26	6.40	0.07	0.02	1.11	2.35	0.06
MOJ	MD	San Bernardino	12683.49	750.14	8.42	2.54	130.58	274.74	6.60
MPA	MC	Mariposa	5281.03	312.34	3.50	1.06	54.37	114.39	2.75
NCU	NC	Del Norte	3194.08	188.91	2.12	0.64	32.88	69.19	1.66
NCU	NC	Humboldt	18620.15	1101.25	12.35	3.72	191.70	403.34	9.68
NCU	NC	Trinity	4224.49	249.85	2.80	0.84	43.49	91.51	2.20
NS	NC	Sonoma	4236.05	250.53	2.81	0.85	43.61	91.76	2.20
NSI	MC	Nevada	13294.86	786.30	8.82	2.66	136.88	287.98	6.91
NSI	MC	Plumas	6225.87	368.22	4.13	1.25	64.10	134.86	3.24
NSI	MC	Sierra	697.47	41.25	0.46	0.14	7.18	15.11	0.36
PLA	LT	Placer	203.62	12.04	0.14	0.04	2.10	4.41	0.11
PLA	MC	Placer	3446.63	203.84	2.29	0.69	35.48	74.66	1.79

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	7753.93	458.59	5.14	1.55	79.83	167.96	4.03
SAC	SV	Sacramento	5979.89	353.67	3.97	1.20	61.57	129.53	3.11
SB	SCC	Santa Barbara	3462.66	204.79	2.30	0.69	35.65	75.01	1.80
SC	MD	Riverside	1.31	0.08	0.00	0.00	0.01	0.03	0.00
SC	SC	Los Angeles	21749.34	1286.32	14.43	4.35	223.92	471.12	11.31
SC	SC	Orange	9677.05	572.33	6.42	1.94	99.63	209.62	5.03
SC	SC	Riverside	7500.90	443.63	4.98	1.50	77.22	162.48	3.90
SC	SC	San Bernardino	7195.47	425.56	4.77	1.44	74.08	155.86	3.74
SC	SS	Riverside	1797.87	106.33	1.19	0.36	18.51	38.94	0.93
SD	SD	San Diego	17053.28	1008.58	11.31	3.41	175.57	369.40	8.87
SHA	SV	Shasta	20624.77	1219.81	13.68	4.12	212.34	446.76	10.73
SIS	NEP	Siskiyou	15980.88	945.16	10.60	3.20	164.53	346.17	8.31
SJU	SJV	Fresno	13248.36	783.55	8.79	2.65	136.40	286.98	6.89
SJU	SJV	Kern	5099.40	301.59	3.38	1.02	52.50	110.46	2.65
SJU	SJV	Kings	1169.10	69.14	0.78	0.23	12.04	25.32	0.61
SJU	SJV	Madera	7294.23	431.40	4.84	1.46	75.10	158.00	3.79
SJU	SJV	Merced	3048.68	180.31	2.02	0.61	31.39	66.04	1.59
SJU	SJV	San Joaquin	5650.88	334.21	3.75	1.13	58.18	122.41	2.94
SJU	SJV	Stanislaus	4423.24	261.60	2.93	0.88	45.54	95.81	2.30
SJU	SJV	Tulare	8200.35	484.99	5.44	1.64	84.43	177.63	4.26
SLO	SCC	San Luis Obispo	4258.59	251.87	2.83	0.85	43.84	92.25	2.21
TEH	SV	Tehama	8612.95	509.40	5.71	1.72	88.67	186.57	4.48
TUO	MC	Tuolumne	9942.92	588.05	6.60	1.99	102.37	215.38	5.17
VEN	SCC	Ventura	5618.67	332.31	3.73	1.12	57.85	121.71	2.92
YS	SV	Solano	1169.84	69.19	0.78	0.23	12.04	25.34	0.61
YS	SV	Yolo	1708.72	101.06	1.13	0.34	17.59	37.01	0.89

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).

Section 7.1
Residential Wood Combustion

Table C - 7 Pellet Stoves – Annual pellets consumption and Emissions in tons

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	631.95	8.22	1.00	0.10	0.54	1.16	0.09
AV	MD	Los Angeles	173.17	2.25	0.27	0.03	0.15	0.32	0.03
BA	SF	Alameda	445.10	5.79	0.70	0.07	0.38	0.81	0.07
BA	SF	Contra Costa	428.58	5.57	0.68	0.07	0.37	0.78	0.06
BA	SF	Marin	283.14	3.68	0.45	0.05	0.24	0.52	0.04
BA	SF	Napa	222.71	2.90	0.35	0.04	0.19	0.41	0.03
BA	SF	San Francisco	126.71	1.65	0.20	0.02	0.11	0.23	0.02
BA	SF	San Mateo	505.48	6.57	0.80	0.08	0.43	0.93	0.08
BA	SF	Santa Clara	617.74	8.03	0.98	0.10	0.53	1.13	0.09
BA	SF	Solano	170.60	2.22	0.27	0.03	0.15	0.31	0.03
BA	SF	Sonoma	721.52	9.38	1.14	0.12	0.62	1.32	0.11
BUT	SV	Butte	1319.73	17.16	2.09	0.21	1.13	2.42	0.20
CAL	MC	Calaveras	915.77	11.91	1.45	0.15	0.79	1.68	0.14
COL	SV	Colusa	111.73	1.45	0.18	0.02	0.10	0.20	0.02
ED	LT	El Dorado	95.69	1.24	0.15	0.02	0.08	0.18	0.01
ED	MC	El Dorado	1205.68	15.67	1.90	0.19	1.04	2.21	0.18
FR	SV	Sutter	274.85	3.57	0.43	0.04	0.24	0.50	0.04
FR	SV	Yuba	426.07	5.54	0.67	0.07	0.37	0.78	0.06
GBU	GBV	Alpine	40.88	0.53	0.06	0.01	0.04	0.07	0.01
GBU	GBV	Inyo	558.14	7.26	0.88	0.09	0.48	1.02	0.08
GBU	GBV	Mono	433.69	5.64	0.69	0.07	0.37	0.79	0.07
GLE	SV	Glenn	188.06	2.44	0.30	0.03	0.16	0.34	0.03
IMP	SS	Imperial	138.60	1.80	0.22	0.02	0.12	0.25	0.02
KER	MD	Kern	388.12	5.05	0.61	0.06	0.33	0.71	0.06
LAK	LC	Lake	759.32	9.87	1.20	0.12	0.65	1.39	0.11
LAS	NEP	Lassen	1079.51	14.03	1.71	0.17	0.93	1.98	0.16
MBU	NCC	Monterey	332.98	4.33	0.53	0.05	0.29	0.61	0.05
MBU	NCC	San Benito	132.06	1.72	0.21	0.02	0.11	0.24	0.02
MBU	NCC	Santa Cruz	451.68	5.87	0.71	0.07	0.39	0.83	0.07
MEN	NC	Mendocino	1499.84	19.50	2.37	0.24	1.29	2.74	0.22
MOD	NEP	Modoc	410.49	5.34	0.65	0.07	0.35	0.75	0.06
MOJ	MD	Riverside	7.40	0.10	0.01	0.00	0.01	0.01	0.00
MOJ	MD	San Bernardino	786.35	10.22	1.24	0.13	0.68	1.44	0.12
MPA	MC	Mariposa	658.22	8.56	1.04	0.11	0.57	1.20	0.10
NCU	NC	Del Norte	331.64	4.31	0.52	0.05	0.29	0.61	0.05
NCU	NC	Humboldt	1883.61	24.49	2.98	0.30	1.62	3.45	0.28
NCU	NC	Trinity	619.18	8.05	0.98	0.10	0.53	1.13	0.09
NS	NC	Sonoma	324.98	4.22	0.51	0.05	0.28	0.59	0.05
NSI	MC	Nevada	1670.83	21.72	2.64	0.27	1.44	3.06	0.25
NSI	MC	Plumas	912.74	11.87	1.44	0.15	0.78	1.67	0.14
NSI	MC	Sierra	103.27	1.34	0.16	0.02	0.09	0.19	0.02
PLA	LT	Placer	20.82	0.27	0.03	0.00	0.02	0.04	0.00
PLA	MC	Placer	301.65	3.92	0.48	0.05	0.26	0.55	0.05

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	794.85	10.33	1.26	0.13	0.68	1.45	0.12
SAC	SV	Sacramento	408.98	5.32	0.65	0.07	0.35	0.75	0.06
SB	SCC	Santa Barbara	324.06	4.21	0.51	0.05	0.28	0.59	0.05
SC	MD	Riverside	0.12	0.00	0.00	0.00	0.00	0.00	0.00
SC	SC	Los Angeles	1730.79	22.50	2.73	0.28	1.49	3.17	0.26
SC	SC	Orange	733.40	9.53	1.16	0.12	0.63	1.34	0.11
SC	SC	Riverside	556.40	7.23	0.88	0.09	0.48	1.02	0.08
SC	SC	San Bernardino	557.42	7.25	0.88	0.09	0.48	1.02	0.08
SC	SS	Riverside	140.94	1.83	0.22	0.02	0.12	0.26	0.02
SD	SD	San Diego	1168.28	15.19	1.85	0.19	1.00	2.14	0.18
SHA	SV	Shasta	2366.12	30.76	3.74	0.38	2.03	4.33	0.35
SIS	NEP	Siskiyou	2169.18	28.20	3.43	0.35	1.87	3.97	0.33
SJU	SJV	Fresno	1613.91	20.98	2.55	0.26	1.39	2.95	0.24
SJU	SJV	Kern	484.95	6.30	0.77	0.08	0.42	0.89	0.07
SJU	SJV	Kings	149.58	1.94	0.24	0.02	0.13	0.27	0.02
SJU	SJV	Madera	803.35	10.44	1.27	0.13	0.69	1.47	0.12
SJU	SJV	Merced	369.31	4.80	0.58	0.06	0.32	0.68	0.06
SJU	SJV	San Joaquin	493.03	6.41	0.78	0.08	0.42	0.90	0.07
SJU	SJV	Stanislaus	386.61	5.03	0.61	0.06	0.33	0.71	0.06
SJU	SJV	Tulare	988.14	12.85	1.56	0.16	0.85	1.81	0.15
SLO	SCC	San Luis Obispo	348.50	4.53	0.55	0.06	0.30	0.64	0.05
TEH	SV	Tehama	858.51	11.16	1.36	0.14	0.74	1.57	0.13
TUO	MC	Tuolumne	1249.54	16.24	1.97	0.20	1.07	2.29	0.19
VEN	SCC	Ventura	565.41	7.35	0.89	0.09	0.49	1.03	0.08
YS	SV	Solano	99.44	1.29	0.16	0.02	0.09	0.18	0.01
YS	SV	Yolo	143.46	1.87	0.23	0.02	0.12	0.26	0.02

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).

Table C - 8 All Devices – Annual Fuel Consumption and Emissions in tons

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
AMA	MC	Amador	15459.16	914.87	12.16	3.07	156.21	298.72	8.55
AV	MD	Los Angeles	8243.91	520.94	8.03	1.64	88.11	142.43	5.31
BA	SF	Alameda	29653.85	1997.99	35.08	5.91	331.77	424.07	22.20
BA	SF	Contra Costa	27001.34	1797.88	31.30	5.38	300.10	401.88	19.72
BA	SF	Marin	10610.34	671.87	10.58	2.11	113.25	178.80	6.92
BA	SF	Napa	7861.18	492.47	7.34	1.56	82.95	135.89	4.98
BA	SF	San Francisco	10938.50	756.86	13.94	2.18	124.85	142.84	8.68
BA	SF	San Mateo	20639.85	1334.06	22.68	4.11	224.48	329.12	14.21
BA	SF	Santa Clara	37688.66	2530.88	43.59	7.51	419.65	542.56	27.97
BA	SF	Solano	7375.80	478.44	7.81	1.47	80.04	116.74	5.08
BA	SF	Sonoma	26661.88	1676.95	25.00	5.30	282.08	457.45	17.01
BUT	SV	Butte	35760.72	2148.18	29.08	7.10	365.23	673.71	20.46
CAL	MC	Calaveras	22503.92	1330.51	17.57	4.46	227.22	436.07	12.41
COL	SV	Colusa	2906.88	173.68	2.34	0.58	29.58	55.26	1.64
ED	LT	El Dorado	3526.61	226.73	3.40	0.70	37.66	56.56	2.36
ED	MC	El Dorado	36339.94	2210.43	30.25	7.22	374.42	670.43	21.36
FR	SV	Sutter	8018.86	493.88	7.01	1.59	83.25	142.58	4.88
FR	SV	Yuba	11620.39	702.46	9.63	2.31	119.13	215.57	6.76
GBU	GBV	Alpine	829.43	47.81	0.62	0.16	8.22	16.65	0.43
GBU	GBV	Inyo	11347.95	654.89	8.48	2.25	112.54	227.20	5.93
GBU	GBV	Mono	8829.39	509.82	6.61	1.75	87.61	176.59	4.62
GLE	SV	Glenn	5143.64	308.25	4.14	1.02	52.46	97.59	2.92
IMP	SS	Imperial	4481.86	287.21	4.32	0.89	47.67	71.65	2.99
KER	MD	Kern	12842.96	777.37	10.57	2.55	132.31	242.16	7.44
LAK	LC	Lake	19571.76	1167.45	15.65	3.88	198.86	373.17	11.02
LAS	NEP	Lassen	21961.27	1268.44	16.42	4.35	217.89	438.89	11.51
MBU	NCC	Monterey	12420.95	779.36	11.92	2.47	131.67	214.88	7.91
MBU	NCC	San Benito	3788.35	230.57	3.30	0.75	39.16	69.45	2.25
MBU	NCC	Santa Cruz	15409.32	948.89	13.97	3.06	161.18	278.65	9.38
MEN	NC	Mendocino	40766.16	2429.84	32.26	8.09	414.40	783.37	22.84
MOD	NEP	Modoc	8332.68	480.48	6.20	1.65	82.58	167.11	4.35
MOJ	MD	Riverside	410.88	26.82	0.44	0.08	4.49	6.49	0.29
MOJ	MD	San Bernardino	32501.75	1989.60	28.05	6.47	339.09	606.41	19.32
MPA	MC	Mariposa	14950.06	871.31	11.28	2.96	149.45	296.89	7.97
NCU	NC	Del Norte	8975.36	535.27	7.14	1.78	91.28	172.16	5.04
NCU	NC	Humboldt	52529.59	3143.66	41.96	10.43	535.47	1002.12	29.71
NCU	NC	Trinity	12817.62	743.75	9.70	2.54	127.56	254.05	6.79
NS	NC	Sonoma	10298.32	614.58	8.13	2.05	105.14	200.37	5.76
NSI	MC	Nevada	40386.08	2403.21	32.29	8.01	409.20	768.77	22.67
NSI	MC	Plumas	18635.28	1077.13	13.97	3.69	184.99	371.98	9.78
NSI	MC	Sierra	2131.06	123.84	1.62	0.42	21.23	42.08	1.13
PLA	LT	Placer	676.77	42.35	0.63	0.13	7.12	11.64	0.43
PLA	MC	Placer	8432.21	496.02	6.41	1.67	85.15	167.76	4.56

Section 7.1
Residential Wood Combustion

DIS	AB	County	Fuel Burnt	CO	NO _x	SO _x	PM2.5	ROG	NH ₃
PLA	SV	Placer	25882.43	1620.69	24.13	5.14	272.53	444.47	16.39
SAC	SV	Sacramento	30564.34	2064.74	37.49	6.10	344.20	435.93	23.10
SB	SCC	Santa Barbara	10793.72	673.17	10.76	2.15	114.40	188.14	6.85
SC	MD	Riverside	9.87	0.69	0.01	0.00	0.11	0.13	0.01
SC	SC	Los Angeles	118671.61	8050.61	145.29	23.67	1336.59	1657.03	90.43
SC	SC	Orange	49611.43	3345.19	61.88	9.89	559.03	708.92	37.50
SC	SC	Riverside	35693.58	2389.95	41.61	7.12	397.71	521.17	26.36
SC	SC	San Bernardino	33029.40	2202.54	37.89	6.58	366.51	486.95	24.17
SC	SS	Riverside	9814.78	665.55	11.88	1.96	110.39	137.36	7.46
SD	SD	San Diego	61037.82	3949.94	66.37	12.16	665.95	987.99	41.88
SHA	SV	Shasta	59078.29	3501.97	46.43	11.72	597.63	1139.75	32.77
SIS	NEP	Siskiyou	46256.72	2680.04	34.64	9.16	460.26	923.72	24.36
SJU	SJV	Fresno	46181.20	2862.80	42.09	9.17	482.10	804.92	28.66
SJU	SJV	Kern	20961.24	1371.61	21.79	4.17	227.57	322.03	14.64
SJU	SJV	Kings	4916.65	314.42	4.86	0.98	52.43	79.30	3.28
SJU	SJV	Madera	21363.40	1280.76	17.26	4.24	217.80	403.65	12.17
SJU	SJV	Merced	11680.18	737.52	11.11	2.32	123.46	195.09	7.55
SJU	SJV	San Joaquin	22216.36	1449.65	22.84	4.42	240.87	345.74	15.40
SJU	SJV	Stanislaus	17437.58	1138.47	17.89	3.47	189.05	270.86	12.09
SJU	SJV	Tulare	27812.74	1716.57	24.85	5.52	289.25	489.81	17.06
SLO	SCC	San Luis Obispo	11823.68	723.81	10.74	2.35	123.47	217.15	7.11
TEH	SV	Tehama	23867.49	1423.50	18.83	4.74	242.76	459.03	13.38
TUO	MC	Tuolumne	28257.69	1647.63	21.39	5.60	282.57	560.27	15.08
VEN	SCC	Ventura	21192.02	1360.21	22.29	4.22	228.45	342.70	14.32
YS	SV	Solano	4063.76	259.85	4.11	0.81	43.65	66.98	2.70
YS	SV	Yolo	5800.18	369.24	5.88	1.15	62.22	96.83	3.83

Note: For the following Air Districts, SC, BA, SLO, and SJU, the emissions shown will be replaced with the respective district-submitted estimates (Refer District Submittals).