



## 2007 Area Sources Emission Inventory Methodology 670-AGRICULTURAL BURNING

### I. Purpose

This document describes the Area Source Methodology used to estimate emissions of carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), fine particulate matter less than 10 microns (PM<sub>10</sub>), volatile organic compounds (VOC) and sulfur oxides (SO<sub>x</sub>), from Agricultural Burning - Pruning, Agricultural Burning - Field Crops and Weed Abatement in the San Joaquin Valley Air Basin. An area source category is a collection of similar emission units within a geographic area (ie., a County). An area source category collectively represent individual sources that are small and numerous, and that may not have been inventoried as specific point, mobile, or biogenic sources. The California Air Resources Board (CARB) has grouped these individual sources with other like sources into area source categories. These source categories are grouped in such a way that they can be estimated collectively using one methodology.

### II. Applicability

The emission calculations from this Area Source Methodology apply to agricultural burning of waste and debris identified by the following Category of Emission Source (CES) codes and Reconciliation Emission Inventory Codes (REIC):

**Table 1. Emission inventory codes.**

CES	REIC	Description
47241	670-660-0262-0000	Agricultural Burning - Pruning
47258	670-662-0262-0000	Agricultural Burning -Field Crops
47266	670-668-0200-0000	Weed Abatement

**Table 2 Emission Inventory Codes (EIC) that reconcile to REIC 670-660-0262-0000 (Agricultural Burning - Prunings - Agricultural Waste).**

CES	EIC	Description
47241	670-660-0262-9884	Tree Prunings
	670-660-0262-9856	Grape Vines/Stumps
	670-660-0262-9862	Orchard Removal
	670-660-0262-9874	Raisin Trays
	670-660-0262-9842	Attrition
	670-660-0262-9888	Untreated Grape Stakes
	670-660-0262-9892	Vineyard Removal

**Table 3 Emission Inventory Codes (EIC) that reconcile to REIC 670-662-0262-0000 (Agricultural Burning - Field Crops - Agricultural Waste).**

CES	EIC	Description
47258	670-662-0262-9882	Stubble
	670-662-0262-9878	Rice Stubble
	670-662-0262-9866	Paper Hot Caps

**Table 4 Emission Inventory Codes (EIC) that reconcile to REIC 670-668-020-0000 (Weed Abatement - Solid Fuel Unspecified).**

CES	EIC	Description
47266	670-668-0200-9894	Weed Abatement
	670-668-0200-9872	Ponding/Levee Banks/Ditchbank/Canal
	670-668-0200-9858	Noxious Weeds
	670-668-0200-9886	Tumbleweed

### III. Point Source Reconciliation

Emissions from the area source inventory and point source inventory are reconciled against each other to prevent double counting. This is done using relationships created by the California Air Resources Board (CARB) between the area source REIC and the point sources' Standard Industry Classification (SIC) code and emissions process Source Category Code (SCC) combinations. The area sources in this methodology are not represented within the District's point source inventory so reconciliation is not necessary.

### IV. Methodology Description

This methodology estimates emissions from the burning of:

- A. Pruning: of almond, apple, apricot, avocado, bush berry, cherry, Christmas trees, citrus, date, eucalyptus, fig, grape, kiwi, nectarine, nursery plants, olive, pasture or corral trees, peach, pear, pecan, persimmon, pistachio, plum, pluot, pomegranate, prune, quince, rose, and walnut. This category also includes

## 670-Agricultural Burning

vineyard materials, orchard removals, and other agricultural materials such as attrition.

- B. Field Crops: including alfalfa, asparagus, barley stubble, beans, corn, cotton, flower straw, hay, lemon grass, oat stubble, paper hot caps, pea vines, peanuts, rice stubble, safflower, sugar cane, vegetable crops, and wheat stubble.
- C. Weeds: including tules, tumbleweed, grass, thistle, star thistle, dodder weed, lemon grass, noxious weeds, and weeds growing along ditch bank and canals, berms, and fence rows.

All open burning, as defined in Rule 4103, requires a valid burn permit and authorization for the specific event. The District authorizes burning events based on predicted meteorological conditions and whether the total tonnage to be emitted would cause a public nuisance, impact smoke sensitive areas, or create or contribute to an exceedance of an ambient air quality standard. Activity data for each authorized burn event is entered into the District's *Smoke Management System* (SMS) database. Emissions are calculated by multiplying the activity data by crop specific emission factors.

### V. Activity Data

Activity data for agricultural burning was obtained from the San Joaquin Valley Unified Air Pollution Control District's *Smoke Management System* (SMS). Activity data for each burn event includes the following:

- A. ACRES: Acres is defined as the area from which the agricultural waste was produced, in acres. For example, if prunings came from 40 acres of orchard, 40 acres should be entered into the database. The Smoke Management System directs the burn permit holder to enter ACRES into the Smoke Management System database in this manner.
- B. FUEL LOADING: Fuel loading is a factor that defines the tonnage of burn material that is generated from an acre of a particular crop or tons reported in the Smoke Management System.
- C. TONS: Tons of burn material is calculated by multiplying ACRES by FUEL LOADING. If the burn permit holder reports TONS only, TONS are used to calculate emissions.

### VI. Emission Factors

The Air Resources Board compiled a list of emission factors by crop type based on AP-42 values, and from a study conducted by B.M. Jenkins (Gaffney, 2000). Fuel loading values from AP-42 (EPA, 1992) are also associated with each emission

factor. Some of the factors and values were adjusted as needed by the District to better reflect the conditions in the San Joaquin Valley. The emission factors can be found in Appendix B.

## VII. Emissions Calculations

The Smoke Management System allows information regarding a burn to be reported in acreage or individual fuel loading capacity if known. On an individual crop type basis, Equation A is used when the actual fuel loading is not known. Otherwise, Equation B is used. Then, the emissions from each burn are computed, summed and totaled by county and year.

### Equation A:

$$Emission (tons) = Acreage Burned \times \frac{Tons Fuel}{Acre} \times \frac{Pounds of Emissions}{Ton of Fuel} \times \frac{1 Ton}{2,000 Pounds}$$

### Equation B:

$$Emission (tons) = Tons Fuel Burned \times \frac{Pounds of Emissions}{Ton of Fuel} \times \frac{1 Ton}{2,000 Pounds}$$

### Example PM10 Emissions, Burn #1:

Given that 20 acres of nut tree prunings was burned with a fuel loading of 1 ton per acre and an emission factor of 7 pounds per ton.

$$Emission (tons) = Acreage Burned \times \frac{Tons Fuel}{Acre} \times \frac{Pounds of Emissions}{Ton of Fuel} \times \frac{1 Ton}{2,000 Pounds}$$

$$PM10 Emission (tons) = 20 Acreage Burned \times \frac{1 Tons Fuel}{Acre} \times \frac{7 Pounds of Emissions}{Ton of Fuel} \times \frac{1 Ton}{2,000 Pounds}$$

$$PM10 Emission = 0.07 tons$$

### Example PM10 Emissions, Burn #2:

Given that 2.8 tons of nut tree prunings was burned with an emission factor of 7 pounds per ton.

$$Emission (tons) = Tons Fuel Burned \times \frac{Pounds of Emissions}{Ton of Fuel} \times \frac{1 Ton}{2,000 Pounds}$$

## 670-Agricultural Burning

$$PM10 \text{ Emission (tons)} = 2.8 \text{ Tons Fuel Burned} \times \frac{7 \text{ Pounds of Emissions}}{\text{Ton of Fuel}} \times \frac{1 \text{ Ton}}{2,000 \text{ Pounds}}$$

$$PM10 \text{ Emission} = 0.0098 \text{ tons}$$

### VIII. Temporal Variation

#### A. Daily

CARB Code 24. 24 hours per day - uniform activity during the day

#### B. Weekly

CARB Code 7. 7 days per week - uniform activity every day of the week

#### C. Monthly

Monthly temporal variation for agricultural burning was extracted from the San Joaquin Valley Unified Air Pollution Control District's *Smoke Management System* and is presented in Appendix A.

### IX. Spatial Variation

Burn locations are defined by street address in the *Smoke Management System*. The street addresses are converted to Latitude and Longitudes, and UTM's.

### X. Growth Factor

Growth factors are developed by either the District's Planning Department or CARB for each EIC. These factors are used to estimate emissions in future years. The growth factors associated with this emissions category may be obtained from the Air Quality Analysis Section of the District's Planning Department.

### XI. Control Level

Control levels are developed by either the District's Planning Department or CARB for each EIC. Control levels are used to estimate emissions reductions in future years due to implementation of District rules. These control levels take into account the effect of control technology, compliance and exemptions at full implementation of the rules.

Agricultural burning in the San Joaquin Valley is subject to District Rule 4103 (Open Burning). Control measures specified in Rule 4103 are reflected in the reduction in amount of material burned. Control levels associated with this emissions category

may be obtained from the Air Quality Analysis Section of the District's Planning Department.

## XII. CARB Chemical Speciation

CARB has developed organic gas profiles in order to calculate reactive organic gasses (ROG), volatile organic compounds (VOC) or total organic gas (TOG) given any one of the three values. For each speciation profile, the fraction of TOG that is ROG and VOC is given. The organic gas profile codes can also be used to lookup associated toxics. CARB's organic gas speciation profile for agricultural burning is presented in Table 5.

**Table 5. CARB chemical speciation profile for agricultural burning.**

Profile Description	CARB Organic Gas Profile#	Fractions	
		ROG	VOC
Forest Fires	307	0.5698	0.5698

CARB has also developed particulate matter speciation profiles in order to calculate particulate matter (PM), particulate matter with a diameter less than or equal to 10 microns (PM<sub>10</sub>) or particulate matter with a diameter less than or equal to 2.5 microns (PM<sub>2.5</sub>) given any one of the three values. For each speciation profile, the fraction of PM that is PM<sub>10</sub> and PM<sub>2.5</sub> is given. The particulate matter profile codes can also be used to lookup associated toxics. CARB's particulate matter speciation profile for agricultural burning is presented in Table 6.

**Table 6. CARB chemical speciation profile for agricultural burning.**

Profile Description	CARB PM Profile#	Fractions	
		PM <sub>10</sub>	PM <sub>2.5</sub>
Orchard Prunings Burning	450	0.9814	0.9252

## XIII. Assessment of Methodology

Emissions calculations are based on amount of material burned. This method is deemed to be an accurate method for calculating emissions, provided that the characterization of the amount of burn material is accurate.

## XIV. Emissions

The 2007 area source emissions inventory for agricultural burning can be found in Appendix C. Since the District created subcategories for Waste Burning and Disposal of Agricultural Burning of Pruning (EIC 670-660-0262-0000), Field Crops (EIC 670-662-0262-0000), and of Weed Abatement (EIC 670-668-0200-0000) in 2006, this inventory is not directly comparable to previously reported inventories.

## XV. Revision History

2007. Process rates were updated.

2006. The methodology was reformatted to the new District standard. Process rates were updated.

2004. This is a new district methodology.

## XVI. Update Schedule

In an effort to provide inventory information to CARB and other District programs and maximize limited resources, the District has developed an update cycle based on emissions within the source category as shown in Table 7.

**Table 7. Area source update frequency criteria.**

Total Emissions (Tons/Day)	Update Cycle (Years)
<1	4
>1 and <= 2.5	3
>2.5 and <=5	2
>5	1

Since emissions for these source categories exceed 5 ton per day, these area source estimates will be updated every year.

## XVII. References:

1. Environmental Protection Agency. 1992. AP-42 Chapter 2, Section 2.5.2.3: Open burning, agricultural waste.
2. Gaffney, Patrick. 2000. Draft Memorandum to Bill Sandman, Colusa County Air Pollution Control District from Patrick Gaffney, Emission Inventory Branch, California Air Resources Board dated May 23, 2000.
3. Jenkins, B., 1996. Atmospheric pollutant emission factors from open burning of agricultural and forest biomass by wind tunnel simulations. April 1996, UC Davis. Tables 4.1.1 to 4.1.8.

## XVIII. Appendices

Appendix A: Temporal Variation

Appendix B: Emission Factors

Appendix C: 2007 Emissions

Appendix D: EIC - SMS Crop Code Map

## Appendix A. Temporal Variation

Table 8. Monthly agricultural burning activity (2007).

Category	Activity Level by Month (% of annual)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<b>Agricultural Burning - Prunings</b>												
670-660-0262-9884 - Tree Prunings	15.7%	15.9%	10.2%	7.8%	7.4%	2.5%	1.6%	1.5%	3.5%	5.2%	9.6%	19.1%
670-660-0262-9856 - Grapes Vines/Stumps	7.9%	31.2%	18.5%	11.5%	4.2%	1.6%	1.8%	2.9%	1.6%	5.5%	2.5%	10.8%
670-660-0262-9862 - Orchard Removal	27.1%	24.2%	19.8%	14.3%	14.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
670-660-0262-9874 - Raisin Trays	0.0%	2.2%	0.0%	0.0%	0.0%	0.0%	0.0%	11.3%	59.4%	26.0%	0.9%	0.2%
670-660-0262-9842 - Attrition	8.9%	12.8%	14.1%	8.5%	4.3%	2.3%	2.3%	1.7%	5.7%	12.1%	9.5%	17.8%
670-660-0262-9888 - Untreated Grape Stakes	0.0%	8.3%	55.0%	5.9%	9.0%	3.3%	0.0%	0.0%	0.0%	0.0%	0.0%	18.5%
670-660-0262-9892 - Vineyard Removal	18.2%	21.0%	13.2%	6.0%	5.5%	3.8%	1.1%	0.3%	3.1%	5.9%	4.6%	17.3%
<b>Agricultural Burning - Field Crops</b>												
670-662-0262-9882 - Stubble	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
670-662-0262-9878 - Rice Stubble	6.0%	0.0%	20.6%	16.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.6%	33.3%	3.5%
670-662-0262-9866 - Paper Hot Caps	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
<b>Weed Abatement</b>												
670-668-0200-9894 - Weed Abatement	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
670-668-0200-9872 - Ponding/Levee Banks/Ditchbank/Canal	11.5%	15.5%	17.8%	7.0%	6.2%	2.8%	1.6%	2.1%	5.7%	7.8%	4.1%	17.9%
670-668-0200-9858 - Noxious Weeds	20.9%	1.9%	13.0%	2.5%	3.3%	2.6%	15.3%	13.4%	10.5%	8.8%	3.8%	4.0%
670-668-0200-9886 - Tumble Weed	20.7%	10.5%	11.6%	6.0%	4.5%	2.4%	2.8%	1.2%	4.5%	7.2%	10.9%	17.7%



## Appendix B. Emission Factors

Table 9. Agricultural burning emission factors.

Crop	Emissions (lb/ton)					Fuel Loading Ton/Acre	Source of Data
	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	VOC		
<b>Prunings (EIC 670-660-0262-0000)</b>							
Almond	7	6.7	5.9	0.1	5.2	52.2	Jenkins (EF)
Apple	3.9	3.7	5.2	0.1	2.3	42	AP-42, Jenkins NOx & SO2
Apricot	5.9	5.6	5.2	0.1	4.6	49	AP-42, Jenkins NOx & SO2
Avocado	20.6	19.4	5.2	0.1	18.5	116	AP-42, Jenkins NOx & SO2
Bamboo	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Bushberry	7.8	7.3	5.2	0.1	6.3	66	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Cherry	7.9	7.4	5.2	0.1	6	44	AP-42, Jenkins NOx & SO2
Christmas trees	8.67	7.76	4.27	0.14	4.35	64.69	Ponderosa Pine, Jenkins; use CARB's (Patrick Gaffney) fuel loading of 1 ton per acre
Citrus	5.9	5.6	5.2	0.1	6.8	81	AP-42, Jenkins NOx & SO2
Date palm	9.8	9.3	5.2	0.1	3.8	56	AP-42, Jenkins NOx & SO2
Dried flowers	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Eucalyptus	7.8	7.3	5.2	0.1	6.3	66	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Fig	6.9	6.5	5.2	0.1	6	57	AP-42, Jenkins NOx & SO2
Flower straw	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Grape	4.9	4.6	5.2	0.1	3.8	51	AP-42, Jenkins NOx & SO2
Grape stumps/stakes	7.8	7.3	5.2	0.1	6.3	66	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter); Fuel Loading increased to 30 tons per acre based on consultations with compliance

Table 9. Agricultural burning emission factors.

Crop	Emissions (lb/ton)						Fuel Loading Ton/Acre	Source of Data
	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	VOC	CO		
Kiwi	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Nectarine	3.9	3.7	5.2	0.1	2.3	33	2	AP-42, Jenkins NOx & SO2
Olive	11.8	11.1	5.2	0.1	10.3	114	1.2	AP-42, Jenkins NOx & SO2
Orchard removal	7.8	7.3	5.2	0.1	6.3	66	30	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter); Fuel Loading increased to 30 tons per acre based on consultations with compliance
Other prunings	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Pasture trees	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Peach	5.9	5.6	5.2	0.1	3	42	2.5	AP-42, Jenkins NOx & SO2
Pear	8.8	8.3	5.2	0.1	5.1	57	2.6	AP-42, Jenkins NOx & SO2
Pecan	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Persimmon	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Pistachio	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Plum	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Pluot(plum-apricot)	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)

Table 9. Agricultural burning emission factors.

Crop	Emissions (lb/ton)						Fuel Loading Ton/Acre	Source of Data
	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	VOC	CO		
Pomegranate	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Prune	2.9	2.8	5.2	0.1	4.6	47	1.2	AP-42, Jenkins NOx & SO2
Quince	7.8	7.3	5.2	0.1	6.3	66	1.7	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter)
Raisin trays	0.78	0.74	4.27	0.14	4.35	64.69	0.03	PM & loading from UCD/Asbaugh, NOx, etc from Jenkins pine
Rose pruning	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Vineyard removal	7.8	7.3	5.2	0.1	6.3	66	15	Average of Almond, Apple, Apricot, Avocado, Bean/Pea, Date Palm, Fig, Grape, Nectarine, Olive, Peach, Pear, Prune, and Walnut (as of 9/12/00, Patrick Gaffney's letter); Fuel Loading increased to 15 tons per acre based on consultations with compliance
Walnut	4.2	4	4.5	0.2	4.8	67	1.2	Jenkins (EF)
<b>Field Crops (EIC 670-662-0262-0000)</b>								
Alfalfa	28.5	27.2	4.5	0.6	21.7	119	0.8	AP-42, Jenkins NOx & SO2
Asparagus	40	39.34	4.49	0.61	66	150	1.5	AP-42, Jenkins NOx & SO2
Barley	14.3	13.8	5.1	0.1	15	183.7	1.7	Jenkins (EF)
Bean/pea	13.7	13	5.2	0.1	14.2	148	2.5	AP-42, Jenkins NOx & SO2
Corn	11.4	10.9	3.3	0.4	6.6	70.9	4.2	Jenkins (EF)
Cotton	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Dried flowers	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Flax	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Flower straw	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Nursery prunings	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)

Table 9. Agricultural burning emission factors.

Crop	Emissions (lb/ton)						Fuel Loading Ton/Acre	Source of Data
	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	VOC	CO		
Oats	20.7	19.7	4.5	0.6	10.3	136	1.6	AP-42, Jenkins NOx & SO2
Other field crops	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Pea vines	13.7	13	5.2	0.1	14.2	148	2.5	AP-42, Jenkins NOx & SO2
Peanuts	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Rice	6.3	5.9	5.2	1.1	4.7	57.4	3	Jenkins (EF)
Rye	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Safflower	17.7	16.9	4.5	0.6	14.8	144	1.3	AP-42, Jenkins NOx & SO2
Sorghum	17.7	16.9	4.5	0.6	5.1	77	2.9	AP-42, Jenkins NOx & SO2
Sudan	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Sugar cane	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Vegetable crops	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Wheat	10.6	10.1	4.3	0.9	7.6	123.6	1.9	Jenkins (EF)
Wild hay	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
<b>Weed Abatement (EIC 670-668-0200-0000)</b>								
Berms	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Brush	18	16.25	4	0.35	12.55	133.85	13.1	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter) and Jenkins fir & pine; Hardy, 1996, NOx & SO2 avg.
Ditchbank & canal	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Dodder weed	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Fence rows	15.9	15.18	4.49	0.61	10.73	113.95	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Daflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)

670-Agricultural Burning

Table 9. Agricultural burning emission factors.

Crop	Emissions (lb/ton)					Fuel Loading Ton/Acre	Source of Data
	PM <sub>10</sub>	PM <sub>2.5</sub>	NOx	SO <sub>2</sub>	VOC		
Grass	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Lemon grass	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Noxious weeds	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Ponding/levee banks	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Star thistle	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Thistle	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Tules	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
Tumbleweed	15.9	15.18	4.49	0.61	10.73	113.95	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)

## Appendix C. 2007 Emissions

Table 10. Total emissions for Agricultural Burning - Pruning (2007).

County	Process Rate (Tons)	Emissions (tons/year)				
		NOx	SOx	CO	PM10	VOC <sup>(1)</sup>
<b>670-660-0262-9884 - Tree Prunings</b>						
Fresno	10,872	31.46	0.64	288.61	36.90	27.96
Kern	6,436	18.83	0.36	169.77	22.23	16.73
Kings	1,971	4.88	0.16	61.22	5.02	4.84
Madera	5,337	15.53	0.31	141.36	18.42	13.98
Merced	15,981	46.00	0.97	429.70	53.67	41.33
San Joaquin	20,086	52.75	1.51	585.89	56.59	49.18
Stanislaus	21,085	58.80	1.42	586.47	66.68	53.65
Tulare	5,705	14.39	0.45	175.20	15.47	14.28
<b>Total</b>	<b>87,473</b>	<b>242.65</b>	<b>5.82</b>	<b>2438.21</b>	<b>274.98</b>	<b>221.96</b>
<b>670-660-0262-9856 - Grape Vines/Stumps</b>						
Fresno	21,745	56.54	1.10	554.52	53.28	41.34
Kern	3,744	9.73	0.19	95.46	9.17	7.12
Kings	85	0.22	0.00	2.17	0.21	0.16
Madera	6,496	16.89	0.33	165.64	15.92	12.35
Merced	315	0.82	0.02	8.02	0.77	0.60
San Joaquin	3,299	8.58	0.17	84.13	8.08	6.27
Stanislaus	351	0.91	0.02	8.95	0.86	0.67
Tulare	1,728	4.49	0.09	44.07	4.23	3.29
<b>Total</b>	<b>37,762</b>	<b>98.18</b>	<b>1.90</b>	<b>962.96</b>	<b>92.53</b>	<b>71.79</b>
<b>670-660-0262-9862 - Orchard Removal</b>						
Fresno	42,364	110.15	2.12	1,398.01	165.22	133.45
Kern	4,198	10.91	0.21	138.53	16.37	13.22
Kings	9,334	24.27	0.47	308.02	36.40	29.40
Madera	11,474	29.83	0.57	378.64	44.75	36.14
Merced	10,016	26.04	0.50	330.53	39.06	31.55
San Joaquin	4351	11.31	0.22	143.58	16.97	13.71
Stanislaus	13,071	33.98	0.65	431.34	50.98	41.17
Tulare	41,018	106.65	2.05	1353.59	159.97	129.21
<b>Total</b>	<b>135,826</b>	<b>353.15</b>	<b>6.79</b>	<b>4,482.26</b>	<b>529.72</b>	<b>427.85</b>

## 670-Agricultural Burning

County	Process Rate (Tons)	Emissions (tons/year)				
		NOx	SOx	CO	PM10	VOC <sup>(1)</sup>
<b>670-660-0262-9874 - Raisin Trays</b>						
Fresno	841	1.79	0.01	27.23	0.31	1.86
Kern	63	0.13	0.00	2.03	0.02	0.14
Kings	13	0.03	0.00	0.41	0.01	0.03
Madera	106	0.23	0.00	3.42	0.04	0.23
Merced	0	0.00	0.00	0.01	0.00	0.00
San Joaquin	0	0.00	0.00	0.00	0.00	0.00
Stanislaus	0	0.00	0.00	0.00	0.00	0.00
Tulare	53	0.11	0.00	1.70	0.02	0.12
<b>Total</b>	<b>1,075</b>	<b>2.29</b>	<b>0.01</b>	<b>34.81</b>	<b>0.39</b>	<b>2.38</b>
<b>670-660-0262-9842 - Attrition</b>						
Fresno	2,744	5.88	0.13	60.42	6.66	5.23
Kern	474	1.06	0.02	13.59	1.40	1.25
Kings	382	0.88	0.02	9.02	1.16	0.81
Madera	332	0.82	0.02	10.59	1.20	1.00
Merced	937	2.02	0.04	20.73	2.28	1.92
San Joaquin	1,483	3.81	0.09	33.31	5.76	4.32
Stanislaus	905	1.88	0.04	16.25	2.22	1.38
Tulare	2,753	6.19	0.15	80.55	8.32	7.26
<b>Total</b>	<b>10,011</b>	<b>22.55</b>	<b>0.51</b>	<b>244.45</b>	<b>28.99</b>	<b>23.16</b>
<b>670-660-0262-9888 - Untreated Grape Stakes</b>						
Fresno	495	4.00	0.08	50.75	6.00	4.85
Kern	0	0.00	0.00	0.00	0.00	0.00
Kings	5	0.03	0.00	0.40	0.05	0.04
Madera	18	0.05	0.00	0.59	0.07	0.06
Merced	0	0.00	0.00	0.00	0.00	0.00
San Joaquin	4	0.03	0.00	0.36	0.04	0.03
Stanislaus	0	0.00	0.00	0.00	0.00	0.00
Tulare	126	1.09	0.02	13.86	1.64	1.32
<b>Total</b>	<b>648</b>	<b>5.2</b>	<b>0.1</b>	<b>66.0</b>	<b>7.8</b>	<b>6.3</b>
<b>670-660-0262-9892 - Vineyard Removal</b>						
Fresno	94,653	246.10	4.74	3,123.55	369.15	298.17
Kern	23,958	62.29	1.20	790.61	93.44	75.47
Kings	4,395	11.43	0.22	145.04	17.14	13.84
Madera	51,999	135.20	2.60	1,715.97	202.80	163.80
Merced	6,349	16.51	0.32	209.52	24.76	20.00
San Joaquin	16,035	41.69	0.80	529.16	62.54	50.51
Stanislaus	4,922	12.80	0.25	162.43	19.20	15.51
Tulare	46,093	119.84	2.31	1,521.07	179.76	145.20
<b>Total</b>	<b>248,404</b>	<b>645.85</b>	<b>12.44</b>	<b>8,197.33</b>	<b>968.78</b>	<b>782.49</b>
<b>GRAND TOTAL</b>	<b>521,198</b>	<b>1,369.87</b>	<b>27.57</b>	<b>16,426.02</b>	<b>1,903.19</b>	<b>1,535.93</b>

670-Agricultural Burning

Table 11. Total emissions for Agricultural Burning - Field Crops (2007).

County	Process Rate (Tons)	Emissions (tons/year)				
		NOx	SOx	CO	PM10	VOC <sup>(1)</sup>
<b>670-662-0262-9882 - Stubble</b>						
Fresno	0	0.00	0.00	0.00	0.00	0.00
Kern	0	0.00	0.00	0.00	0.00	0.00
Kings	0	0.00	0.00	0.00	0.00	0.00
Madera	0	0.00	0.00	0.00	0.00	0.00
Merced	0	0.00	0.00	0.00	0.00	0.00
San Joaquin	0	0.00	0.00	0.00	0.00	0.00
Stanislaus	0	0.00	0.00	0.00	0.00	0.00
Tulare	0	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>0</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>670-662-0262-9878 - Rice Stubble</b>						
Fresno	2,076	5.40	1.14	59.58	6.54	4.88
Kern	0	0.00	0.00	0.00	0.00	0.00
Kings	0	0.00	0.00	0.00	0.00	0.00
Madera	165	0.43	0.09	4.74	0.52	0.39
Merced	873	2.27	0.48	25.06	2.75	2.05
San Joaquin	3,099	8.06	1.71	88.94	9.76	7.28
Stanislaus	2,262	5.88	1.24	64.92	7.13	5.32
Tulare	0	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>8,475</b>	<b>22.04</b>	<b>4.66</b>	<b>243.23</b>	<b>26.70</b>	<b>19.92</b>
<b>670-662-0262-9866 - Paper Hot Caps</b>						
Fresno	0	0.00	0.00	0.00	0.00	0.00
Kern	0	0.00	0.00	0.00	0.00	0.00
Kings	0	0.00	0.00	0.00	0.00	0.00
Madera	0	0.00	0.00	0.00	0.00	0.00
Merced	0	0.00	0.00	0.00	0.00	0.00
San Joaquin	0	0.00	0.00	0.00	0.00	0.00
Stanislaus	0	0.00	0.00	0.00	0.00	0.00
Tulare	0	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>0</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
<b>GRAND TOTAL</b>	<b>8,475</b>	<b>22.04</b>	<b>4.66</b>	<b>243.23</b>	<b>26.70</b>	<b>19.92</b>



## 670-Agricultural Burning

**Table 12. Total emissions for Agricultural Burning - Weed Abatement (2007).**

County	Process Rate (Tons)	Emissions (tons/year)				
		NOx	SOx	CO	PM10	VOC <sup>(1)</sup>
<b>670-668-0200-9894 - Weed Abatement</b>						
Fresno	210	0.55	0.01	6.93	0.82	0.66
Kern	0	0.00	0.00	0.00	0.00	0.00
Kings	0	0.00	0.00	0.00	0.00	0.00
Madera	0	0.00	0.00	0.00	0.00	0.00
Merced	0	0.00	0.00	0.00	0.00	0.00
San Joaquin	0	0.00	0.00	0.00	0.00	0.00
Stanislaus	0	0.00	0.00	0.00	0.00	0.00
Tulare	0	0.00	0.00	0.00	0.00	0.00
<b>Total</b>	<b>210</b>	<b>0.55</b>	<b>0.01</b>	<b>6.93</b>	<b>0.82</b>	<b>0.66</b>
<b>670-668-0200-9872 - Ponding/Levee Banks/Ditchbank/Canal</b>						
Fresno	1,139	2.56	0.35	64.86	9.05	6.11
Kern	1,095	2.46	0.34	62.37	8.71	5.87
Kings	1,009	2.27	0.31	57.47	8.02	5.42
Madera	442	0.99	0.14	25.20	3.52	2.37
Merced	1,985	4.46	0.61	113.08	15.79	10.65
San Joaquin	1,245	2.80	0.38	70.95	9.90	6.68
Stanislaus	802	1.80	0.25	45.69	6.38	4.30
Tulare	427	0.96	0.13	24.34	3.40	2.29
<b>Total</b>	<b>8,144</b>	<b>18.29</b>	<b>2.50</b>	<b>463.97</b>	<b>64.77</b>	<b>43.70</b>
<b>670-668-0200-9858 - Noxious Weeds</b>						
Fresno	266	0.60	0.08	15.17	2.12	1.43
Kern	98	0.22	0.03	5.57	0.78	0.52
Kings	501	1.12	0.15	28.54	3.98	2.69
Madera	3	0.01	0.00	0.17	0.02	0.02
Merced	127	0.29	0.04	7.26	1.01	0.68
San Joaquin	203	0.45	0.06	11.48	1.60	1.08
Stanislaus	63	0.14	0.02	3.57	0.50	0.34
Tulare	92	0.21	0.03	5.25	0.73	0.49
<b>Total</b>	<b>1,352</b>	<b>3.03</b>	<b>0.41</b>	<b>77.02</b>	<b>10.75</b>	<b>7.26</b>

## 670-Agricultural Burning

	Process Rate (Tons)	Emissions (tons/year)				
		NOx	SOx	CO	PM10	VOC <sup>(1)</sup>
<b>670-668-0200-9886 - Tumbleweeds</b>						
Fresno	2,192	4.92	0.67	124.86	17.43	11.76
Kern	3,438	7.72	1.05	195.92	27.35	18.45
Kings	694	1.56	0.21	39.55	5.52	3.73
Madera	360	0.81	0.11	20.51	2.86	1.93
Merced	2,271	5.10	0.69	129.41	18.06	12.19
San Joaquin	520	1.17	0.16	29.60	4.13	2.79
Stanislaus	191	0.43	0.06	10.88	1.52	1.03
Tulare	570	1.28	0.17	32.50	4.54	3.06
Total	10,237	22.99	3.14	583.23	81.41	54.93
<b>GRAND TOTAL</b>	<b>19,942</b>	<b>44.86</b>	<b>6.06</b>	<b>1,131.15</b>	<b>157.75</b>	<b>106.55</b>

(1) The District only reports ROG to CARB. As noted in Section XII, ROG is the same as VOC.

Table 13. Net emissions change for agricultural burning (2007-2006).

County	Emissions (tons/year)				
	NOx	SOx	CO	PM <sub>10</sub>	VOC <sup>(1)</sup>
<b>Agricultural Burning – Pruning - 670-660-2162-000</b>					
Fresno	-57.35	-1.10	-640.73	-75.93	-59.63
Kern	-12.19	-0.20	-123.26	-15.25	-11.62
Kings	-40.57	-0.82	-517.93	-59.89	-48.86
Madera	28.45	0.55	388.64	45.74	37.08
Merced	-42.59	-0.82	-514.39	-61.76	-49.41
San Joaquin	8.24	0.15	110.45	12.96	10.52
Stanislaus	-25.93	-0.51	-333.91	-39.02	-31.80
Tulare	-143.29	-2.82	-1,804.06	-210.29	-170.67
<b>TOTAL</b>	<b>-285.23</b>	<b>-5.57</b>	<b>-3,435.19</b>	<b>-403.44</b>	<b>-324.39</b>
<b>Agricultural Burning – Field Crops – 670-662-262-000</b>					
Fresno	-2.36	-0.47	-37.38	-6.75	-9.11
Kern	0.00	0.00	0.00	0.00	0.00
Kings	0.00	0.00	0.00	0.00	0.00
Madera	0.43	0.09	4.74	0.52	0.39
Merced	-2.80	-0.59	-30.91	-3.39	-2.53
San Joaquin	3.24	0.71	28.27	1.34	-1.72
Stanislaus	3.95	0.83	43.57	4.79	3.57
Tulare	0.00	0.00	0.00	0.00	0.00
<b>TOTAL</b>	<b>2.46</b>	<b>0.57</b>	<b>8.29</b>	<b>-3.49</b>	<b>-9.40</b>
<b>Weed Abatement – 670-668-200-000</b>					
Fresno	-1.18	-0.24	-36.13	-5.21	-3.39
Kern	-1.24	-0.19	-31.38	-4.42	-2.96
Kings	-0.34	-0.01	-7.09	-1.02	-0.67
Madera	-0.33	-0.09	-8.26	-1.16	-0.78
Merced	-1.12	-0.19	-27.12	-3.75	-2.58
San Joaquin	0.73	0.10	18.95	2.61	1.78
Stanislaus	-0.16	-0.04	-4.90	-0.69	-0.46
Tulare	0.84	0.01	8.56	1.23	0.81
<b>TOTAL</b>	<b>-2.80</b>	<b>-0.65</b>	<b>-87.37</b>	<b>-12.41</b>	<b>-8.25</b>
<b>GRAND TOTAL</b>	<b>-285.57</b>	<b>-5.65</b>	<b>-3,514.27</b>	<b>-419.34</b>	<b>-342.04</b>

(1) The District only reports ROG to CARB. As noted in Section XII, ROG is the same as VOC.

## Appendix D. EIC - SMS Crop Code Map

Table 14. EIC SMS crop code map.

EIC	SMS Crop Code	Crop Name
670-660-0262-9884	101	Almond Pruning
	102	Apple Pruning
	103	Apricot Pruning
	104	Avocado Pruning
	105	Bushberry
	106	Cherry Pruning
	107	Citrus Pruning
	108	Date Pruning
	109	Fig Pruning
	111	Kiwi Pruning
	112	Nectarine Pruning
	113	Olive Pruning
	115	Peach Pruning
	116	Pear Pruning
	117	Pecan Pruning
	118	Persimmon Pruning
	119	Pistachio Pruning
	120	Plum Pruning
	121	Pomegranate Pruning
	122	Prune Pruning
	123	Quince
	125	Walnut Pruning
	126	Other Prunings
	127	Palm Trees
	128	Chestnut Pruning
	129	Pluot Pruning
	131	Jujube
602	Christmas Trees	
607	Pasture	
608	Eucalyptus	
611	Rose Pruning	
612	Nursery Prunings	
710	Pasture/Corral Trees	
720	Bamboo	
670-660-0262-9856	110	Grape Vines/Stumps
670-660-0262-9862	114	Orchard Removal
670-660-0262-9874	124	Raisin Trays

## 670-Agricultural Burning

EIC	SMS Crop Code	Crop Name
670-660-0262-9842	153	Apricot Attrition
	154	Avocado Attrition
	155	Bushberry Attrition
	156	Cherry Attrition
	157	Citrus Attrition
	161	Kiwi Attrition
	162	Nectarine Attrition
	163	Olive Attrition
	164	Peach Attrition
	166	Persimmon Attrition
	170	Plum Attrition
	171	Pomegranate Attrition
	172	Prune Attrition
	179	Pluot Attrition
	180	Eucalyptus Attrition
181	Nursery Attrition	
182	Pistachio Attrition	
670-660-0262-9888	603	Untreated Grape Stakes
670-660-0262-9892	614	Vineyard Removal
	241	Alfalfa
	242	Barley Stubble
	243	Bean
	244	Corn
	247	Asparagus
	248	Oat Stubble
	254	Wheat Stubble
	259	Hay
670-662-0262-9878	250	Rice Stubble
670-662-0262-9866	261	Paper Hot Caps
670-668-0200-9894	361	Brush
	471	Slash
	584	Grass
	585	Fence Rows
	601	Berms
670-668-0200-9872	581	Ditchbank & Canal
	606	Ponding/Levee Banks
670-668-0200-9858	582	Noxious Weeds
	586	Bermuda Grass
	587	Star Thistle
	604	Dodder Weed
670-668-0200-9886	583	Tumbleweed