



San Joaquin Valley Unified Air Pollution Control District

Emission Inventory Methodology

670-Waste Burning Unspecified

I. Purpose

This document describes the Area Source Methodology used to estimate emissions of criteria pollutants (NO, SOX, VOC, CO, and PM10) from Unspecified Waste Burning within the San Joaquin Valley.

II. Applicability

This Area Source Methodology applies to the burning of Unspecified Waste products that are identified by the following CES and REIC code:

CES	REIC	Description
82131	670-995-0240-0000	Waste Burning Unspecified

III. Methodology Description

For the purpose of this methodology, the burning of unspecified waste products within the San Joaquin Valley Air Basin is broken into seven subcategories identified by the following EIC codes:

EIC	Point Source Type
670-995-0240-0001	Waste Burning Unspecified – Fertilizer Sacks
670-995-0240-0002	Waste Burning Unspecified – Pesticide/Seed Sacks
670-995-0240-0003	Waste Burning Unspecified – Other
670-995-0240-0004	Waste Burning Unspecified – Diseased Bee Hives
670-995-0240-0005	Waste Burning Unspecified – Diseased Animals
670-995-0240-0006	Waste Burning Unspecified – Diseased Field Crops
670-995-0240-0007	Waste Burning Unspecified – Brooder Paper

The District utilizes an internal database known as the Smoke Management System (SMS) to record all permitted burn activity within the San Joaquin Valley. With information provided by the permit holder (crop type, amount of acreage or fuel loading, and location), the SMS calculates and records the emissions of each criteria pollutant into the proper EIC subcategory and county.

IV. Activity Data

The activity data for this area source category is defined by:

ACRES - Acres is defined as the area from which the agricultural waste was produced, in acres. For example, if pruning 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.

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.

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.

V. Emission Factors

Patrick Gaffney of the California Air Resources Board compiled a table of emission factors per crop type based on the fifth edition of AP-42^b, "Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources," and from a study conducted by B.M. Jenkins from U.C Davis^c, "Atmospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulations." Other emission factors in the table were obtained from two other studies done by the USDA Forest Service, Pacific Northwest Research Station^{d,e}. This table of emission factors can be found in Appendix A of this document. The table below shows the emission factors utilized for this area source methodology.

EIC Code	Crop Name	Emission Factors (lbs/ton)				
		NOX	SOX	CO	VOC	PM10
670-995-0240-0001	Fertilizer Sacks	4.49	0.61	113.95	10.73	15.90
670-995-0240-0002	Pesticide/Seed Sacks	4.49	0.61	113.95	10.73	15.90
670-995-0240-0003	Other	Case by case basis				
670-995-0240-0004	Diseased Bee Hives	4.49	0.61	113.95	10.73	15.90
670-995-0240-0005	Diseased Animals	Case by case basis				
670-995-0240-0006	Diseased Field Crops	Case by case basis				
670-995-0240-0007	Brooder Paper	4.27	0.14	64.69	4.35	0.78

VI. Assumptions

This methodology is base on the assumption that the information provided by the permit holders to the Districts Smoke Management System is true and accurate.

VII. Sample Calculations

The equations shown below are used by the District's Smoke Management System to calculate emissions from this area source category. The Smoke Management System allows information regarding the 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:

$$\text{Emission (tons)} = \text{Acreage} \times \text{Fuel Loading (tons/ acre)} \times \text{Emission Factor (lbs/ton)} / 2000 \text{ (lbs/ton)} \quad \text{OR}$$

Equation B:

$$\text{Emission (tons)} = \text{Fuel Loading (tons)} \times \text{Emission Factor (lbs/ton)} / 2000 \text{ (lbs/ton)}$$

Where:

- Acreage = Acreage if reported by applicant
- Emission Factor = Emission Factor per type of crops
- Fuel Loading = Quantity/residue burned in tons per acre, as reported or see

VIII. Temporal Variation

The table found in Appendix B of this document shows the 2005 monthly temporal variation obtained from the Districts Smoke Management System based on burn dates provided to the District by the permit holders.

IX. Spatial Variation

Burn locations are defined by street address in the District's Smoke Management System. The street address is converted to Latitude and Longitude or UTM based on software needs.

X. Growth Factor

The growth factors associated with this emissions category are presented in Appendix D

XI. Control Factor

Emissions under this area source category are subject to District Rule 4103 - Open Burning.

XII. ARB Chemical Speciation

Profile Description	ARB Profile#		Fractions			
	Organic Gas	PM	ROG	VOC	PM ₁₀	PM _{2.5}
Waste Burning	NA	462	NA	NA	0.9825	0.9316
Species unknown - all category composite	600	NA	0.6986	0.6986	NA	NA

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 for this area source category, provided that the characterization of amount of burn material is true and accurate.

XIV. Emissions Comparison

District staff refined the existing REIC code used for this emissions source category. Due to this enhancement, the data in District’s current emissions inventory database is not comparable to the 2004 data in CEIDARs, which uses the main REIC noted above. However, the 2005 emissions inventory for each new EIC category is available and can be found in Appendix C.

XV. Update Schedule

Due to the readily available and collected data by the Districts Smoke Management System, this area source methodology is to be updated annually.

XVI. References

- a. Patrick Gaffney, California Air Resources Board pgaffney@arb.ca.gov (916) 322-7303 <http://www.arb.ca.gov/ei/see/mngdburnemissionfactors.pdf>
- b. Jenkins, B., *Atmospheric Pollutant Emission Factors from Open Burning of Agricultural and Forest Biomass by Wind Tunnel Simulation*, April 1996, UC Davis
- c. *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, Fifth Edition, AP-42, January 1995, U.S. EPA. Table 2.5-5. Fuel loadings and Efs.
- d. Hardy, C.C., et al., *Smoke Emissions from Prescribed Burning of Southern California Chapparral*, February 1996, USDA Forest Service, Pacific Northwest Research Station.
- e. Peterson, J., Ward, D., *An Inventory of Particulate Matter and Air Toxic Emissions From Prescribed Fires in the United States for 1989, Final Report*. USDA Forest Service, Pacific Northwest Research Station, Fire and Environmental Research Applications, Seattle, WA.

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XVI. Appendix:

A.

Crop Code	Crop Name	EIC Description	EIC Code	Emission Factors (lbs/ton)							Fuel Loading (tons/acre)	Source of Data
				PM10	PM25	NOX	SO2	VOC	CO	NH3		
Other												
703	Brooder paper	Other	670-995-0240-0007	0.78	0.74	4.27	0.14	4.35	64.69	1.02	0.030	PM & loading from UCD/Asbaugh, NOx, etc from Jenkins pine; using raisin tray
701	Diseased bee hives	Other	670-995-0240-0004	15.90	15.18	4.49	0.61	10.73	113.95	1.80	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
258	Pesticide/seed sacks	Other	670-995-0240-0002	15.90	15.18	4.49	0.61	10.73	113.95	1.80	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)
257	Fertilizer sacks	Other	670-995-0240-0001	15.90	15.18	4.49	0.61	10.73	113.95	1.80	2.175	Average of Alfalfa, Barley, Corn, Oats, Rice, Dafflower, Sorghum, and Wheat (as of 9/12/00, Patrick Gaffney's letter)

B.

EIC Category	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
670-995-0240-0001	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
670-995-0240-0002	3.1%	3.1%	2.0%	10.2%	15.3%	22.4%	10.2%	11.2%	9.2%	7.15	3.1%	3.1%
670-995-0240-0003	0.0%	0.0%	100%	0.0%	0.0%	0.0%	0.0%	0.05%	0.0%	0.0%	0.0%	0.0%
670-995-0240-0004	4.2%	8.3%	12.5%	16.7%	15.3%	6.9%	1.4%	4.2%	11.1%	9.7%	4.2%	5.6%
670-995-0240-0005	16.1%	16.1%	6.5%	9.7%	9.7%	9.7%	6.5%	9.7%	0.0%	3.2%	6.5%	6.5%
670-995-0240-0006	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	50.0%	37.5%
670-995-0240-0007	0.0%	0.0%	0.0%	25.0%	12.5%	25.0%	0.0%	0.0%	12.5%	12.5%	12.5%	0.0%

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C.

EIC Subcategory: 670-995-0240-0001 (Fertilizer Sacks)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	1	0.00	0.00	0.06	0.01	0.01
Total	1	0.00	0.00	0.06	0.01	0.01

EIC Subcategory: 670-995-0240-0002 (Pesticide/Seed Sacks)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	1084.23	2.43	0.33	61.77	8.62	5.82
Kern	422.78	0.95	0.13	24.09	3.36	2.27
Kings	1.00	0.00	0.00	0.06	0.01	0.01
Madera	121.80	0.27	0.04	6.94	0.01	0.01
San Joaquin	39.15	0.09	0.01	0.23	0.31	0.21
Tulare	157.25	0.35	0.05	8.96	1.25	0.84
Total	1826.21	4.10	0.56	104.05	14.52	9.80

EIC Subcategory: 670-995-0240-0003 (Other)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	3	15.00	15.00	15.00	12.97	15.00
Total	3	15.00	15.00	15.00	12.97	15.00

EIC Subcategory: 670-995-0240-0004 (Diseased Bee Hives)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	96.53	0.22	0.03	5.50	0.77	0.52
Kings	35.93	0.08	0.01	2.05	0.29	0.19
Madera	3.00	0.01	0.00	0.17	0.02	0.02
Merced	21.75	0.05	0.01	1.24	0.17	0.12
San Joaquin	2.18	0.00	0.00	0.12	0.02	0.01
Stanislaus	74.60	0.17	0.02	4.25	0.59	0.40
Tulare	51.85	0.12	0.02	2.95	0.41	0.28
Total	285.84	0.64	0.09	16.28	2.27	1.54

EIC Subcategory: 670-995-0240-0005 (Diseased Animals)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	42.75	0.12	0.00	1.09	0.15	0.11
Kings	1.00	0.00	0.00	0.03	0.00	0.00
Total	43.75	0.12	0.00	1.12	0.15	0.11

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EIC Subcategory: 670-995-0240-0006 (Diseased Field Crops)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Fresno	1228.88	0.00	0.00	0.00	0.00	0.00
Kern	50.03	0.11	0.02	2.85	0.40	0.27
Madera	2.00	0.00	0.00	0.00	0.00	0.00
Total	1280.91	0.11	0.02	2.85	0.40	0.27

EIC Subcategory: 670-995-0240-0007 (Brooder Paper)						
County	Process Rate (tons)	NOX	SOX	CO	PM10	VOC
Madera	5.24	0.01	0.00	0.17	0.00	0.01
Total	5.24	0.01	0.00	0.17	0.00	0.01

D.

California Air Resources Board growth parameters for REIC: 670-995-0240-0000

Year	Growth Activity Parameter by County							
	Fresno	Kern	Kings	Madera	Merced	San Joaquin	Stanislaus	Tulare
2000	806100	666900	130300	127400	210200	567600	450900	369700
2001	822000	681900	132700	130000	216400	590900	465600	375800
2002	839825	704250	136925	135650	222275	604575	479875	387350
2003	857650	726600	141150	141300	228150	618250	494150	398900
2004	875475	748950	145375	146950	234025	631925	508425	410450
2005	893300	771300	149600	152600	239900	645600	522700	422000
2006	908820	791360	152740	157860	245260	662040	535680	431560
2007	924340	811420	155880	163120	250620	678480	548660	441120
2008	939860	831480	159020	168380	255980	694920	561640	450680
2009	955380	851540	162160	173640	261340	711360	574620	460240
2010	970900	871600	165300	178900	266700	727800	587600	469800
2015	1043100	972700	180800	203000	292400	803400	646800	515600
2020	1134600	1088600	198700	229200	322700	887600	712100	570900
2025	1226100	1204500	216600	255400	353000	971800	777400	626200
2030	1317600	1320400	234500	281600	383300	1056000	842700	681500