

SECTION 6.4

AGRICULTURAL/STRUCTURAL PESTICIDES

(Revised August 2019)

EMISSION INVENTORY SOURCE CATEGORY

Solvent Evaporation: Agricultural/Structural Pesticides

EMISSION INVENTORY CODES (CES CODES) AND DESCRIPTION

530-530-3225-0000 (83550)	Agricultural Pesticides – Methyl Bromide
530-530-5702-0000 (83568)	Agricultural Pesticides – Non-Methyl Bromide
530-540-3225-0000 (83576)	Structural Pesticides – Methyl Bromide
530-540-5702-0000 (83584)	Structural Pesticides – Non-Methyl Bromide

METHODS AND SOURCES

This category includes estimates of total organic gases (TOG) and reactive organic gases (ROG) resulting from the application of pesticides. The application of agricultural and structural pesticides is separated into four emission inventory categories: methyl bromide emissions from agricultural pesticides, non-methyl bromide emissions from agricultural pesticides, methyl bromide emissions from structural pesticides, and non-methyl bromide emissions from structural pesticides.

The California Department of Pesticide Regulation (DPR) requires reporting of agricultural and structural pesticide applications. This includes applications to parks, golf courses, rangeland, pastures, cemeteries, and along roadside and railroad rights-of-way. In addition, all postharvest pesticide treatments of agricultural commodities must be reported, along with all pesticide treatments in poultry and fish production and some livestock related applications. Commercial pesticide applications including structural fumigation, pest control, and turf applications must also be reported. Consumer application of pesticides is not tracked by DPR but the California Air Resources Board (CARB) estimates volatile organic compound (VOC) emissions for these pesticides. The methodology for the estimation of consumer product VOCs is available in Section 6.1 of *Methods for Assessing Area Source Emissions*, or online at www.CARB.ca.gov/ei/areasrc/fullpdf/full6-1.pdf.

EMISSIONS ESTIMATION METHODOLOGY

The pesticide VOC inventory is calculated using information reported to the annual Pesticide Use Reporting (PUR) program, the pesticide product emission potential (EP) data, and, if applicable, the Application Method Adjustment Factor (AMAF) data, all maintained by DPR. More information on the procedure for calculating VOC emissions is available in DPR's *Annual Report on Volatile Organic Compound Emissions from Pesticides: Emissions for 1990 – 2017*, or online at https://www.cdpr.ca.gov/docs/emon/vocs/vocproj/2017_voc_annual_report.pdf.

Application. Growers are required to report to the agricultural commissioner the amount of pesticides they apply each month. In turn, DPR contracts with the county agricultural commissioners for the submittal of their pesticide use data, which is processed into the

annual PUR. Records are flagged to indicate if the application was agricultural or structural, whether the product applied contained methyl bromide, and the month in which the product was applied. The agricultural determination is made based on the site or commodity receiving the application. The methyl bromide determination is made by comparing the product applied to a list of all products known to contain methyl bromide.

Emission Potential. The EP is the fraction of a product that is assumed to potentially contribute to atmospheric VOCs. The pesticidal VOC emissions for any particular time period and/or geographic area are then taken as the sum of potential emissions from all reported agricultural and commercial structural pesticide applications during the time period and area of interest. The preferred method for determining EPs is thermogravimetric analysis (TGA). However, only about 20 percent of the total mass of applied pesticides that are included in DPR's 2017 VOC inventory consists of products for which TGA EPs have been measured. The other 80 percent of the total mass of applied pesticides have EPs that were calculated by DPR chemists or that were assigned a default value equal to the median TGA-based EP in each formulation category. The EPs are lab-based measurements, rather than field measurements. Therefore, they likely overestimate the emissions since they do not account for soil degradation. Additionally, there are no TGA data for pressurized products due to technical difficulties in conducting TGA for pressurized products. Consequently, default EPs for all pressurized products are defined as 100.

Products included in the inventory are assigned an EP and placed in the EP lookup table. Inventoried products include those with both active and inactive registrations. Active registrations are products that are currently registered for legal use in California, whereas inactive registrations are products that are no longer being produced but existing stocks are still being used. Products with inactive registrations automatically receive default EPs unless they have previously received an experimental or calculated EP as an active product. Some active products can also receive default EPs if experimental and calculated values are not available.

CHANGES IN METHODOLOGY

The 2005 CARB methodology for agricultural and structural pesticides used 2003 DPR data. Prior to 2008, DPR reported an unadjusted emissions inventory that assumed the entire volatile portion of a fumigant product eventually volatilizes, contributing to atmospheric VOC loadings. However, several dozen field studies have shown that actual emissions from soil-applied fumigants such as methyl bromide vary by application method and are generally less than 100%. DPR has developed an adjustment procedure to account for the effect of application method on reducing fumigant VOC emissions. The unadjusted inventory is based on the premise that the VOC emission from a single application of fumigant or nonfumigant product is equal to the amount used times the Emission Potential (EP). In the adjusted inventory, the emission from a single application of a fumigant active ingredient (AI) is reduced by an additional factor, the AMAF, also referred to as the emission rating. AMAFs have been determined from field study data and are AI and application method specific. Since the AMAFs are based on field measured data for specific application methods and fumigants, they yield more refined estimates of fumigant VOC emissions than the previous unadjusted emission estimates. In the adjusted inventory, nonfumigant product emissions are not currently adjusted for application method or other field factors due to a lack of data to support such adjustments. Consequently, their emissions are calculated using the same procedure as the unadjusted inventory.

TEMPORAL ACTIVITY

Table 1 shows the 2017 monthly percentage of agricultural and structural pesticide emissions statewide. The emissions are based on DPR's PUR database and VOC inventory. The timing of pesticide fumigant applications does not coincide with the application of most other pesticides, therefore, the monthly emissions from fumigants (1,3-dichloropropene, chloropicrin, metam-sodium, metam-potassium, dazomet, sodium tetrathiocarbonate, and methyl bromide) peak in the late summer and early fall with a drop in emissions in the spring, whereas, emissions from the application of all other pesticides generally peak in the spring and summer months and decrease in the winter.

Table 1. Percentage of Annual Statewide Agricultural and Structural Pesticide Emissions

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Fumigants	0.7	4.8	10.8	9.3	6.0	4.6	7.2	12.6	15.7	13.2	11.6	3.5
All Other Pesticides	5.9	7.5	9.4	9.1	12.0	11.4	12.6	8.8	6.4	6.2	5.5	5.2

SPATIAL DISTRIBUTION

In 2017, 42 percent of the statewide emissions from agricultural and structural pesticides were in the San Joaquin Valley with the highest emissions in Kern and Fresno counties. The majority (54 percent) of pesticide emissions were from the application of pesticides on almonds, carrots, and grapes.

EMISSIONS ESTIMATES BY COUNTY

Statewide 2017 TOG emissions, broken down by use of methyl bromide and application type, are summarized in Tables I,II,III, and IV. These tables contain the EIC code, a description of the category, and available emissions for all counties. Because DPR does not distinguish between TOG, ROG, and VOC, they are assumed to be equal.

REFERENCES

1. Department of Pesticide Regulation. VOC Emissions Inventory, 2017 Digital Data Compact Disc (CD-ROM). May 2019.
2. Department of Pesticide Regulation. Annual Report on Volatile Organic Compound Emissions from Pesticides: Emissions for 1990-2017. April 2019.
3. Department of Pesticide Regulation. 1990-2003 Pesticide Use Reports and VOC Emissions Inventory. April 2005.
4. Department of Pesticide Regulation. Analysis of the Historical and Revised Base Year 1990 Volatile Organic Compound Emission Inventories. December 16, 2002.
5. Spurlock, F.C. Methodology for Determining VOC Emission Potentials of Pesticide Products. Department of Pesticide Regulation. January 7, 2002.
6. Department of Pesticide Regulation. An Overview of California's Unique Full Reporting System. May 2000.

REVISED BY

Amy Castello
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Tiffanie Be
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TABLE I			
2017 Non Consumer Pesticides - Emissions			
EIC 530-530-3225-0000, Agricultural Pesticides - Methyl Bromide			
DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
ANTELOPE VALLEY AQMD	0.0	0.0	0.0
LOS ANGELES	0.0	0.0	0.0
BAY AREA AQMD	3.6	3.6	3.6
ALAMEDA	2.9	2.9	2.9
CONTRA COSTA	0.7	0.7	0.7
BUTTE COUNTY AQMD	0.8	0.8	0.8
BUTTE	0.8	0.8	0.8
COLUSA COUNTY APCD	3.7	3.7	3.7
COLUSA	3.7	3.7	3.7
EASTERN KERN APCD	0.0	0.0	0.0
KERN	0.0	0.0	0.0
FEATHER RIVER AQMD	27.8	27.8	27.8
SUTTER	26.0	26.0	26.0
YUBA	1.8	1.8	1.8
GLENN COUNTY APCD	1.4	1.4	1.4
GLENN	1.4	1.4	1.4
LASSEN COUNTY APCD	9.6	9.6	9.6
LASSEN	9.6	9.6	9.6
MOJAVE DESERT AQMD	0.0	0.0	0.0
RIVERSIDE	0.0	0.0	0.0
SAN BERNARDINO	0.0	0.0	0.0
MONTEREY BAY AIR RESOURCES DISTRICT	4.2	4.2	4.2
MONTEREY	1.1	1.1	1.1
SAN BENITO	0.0	0.0	0.0
SANTA CRUZ	3.0	3.0	3.0
PLACER COUNTY APCD	5.6	5.6	5.6
PLACER	5.6	5.6	5.6
SAN DIEGO COUNTY APCD	7.5	7.5	7.5
SAN DIEGO	7.5	7.5	7.5
SAN JOAQUIN VALLEY APCD	184.5	184.5	184.5
FRESNO	4.1	4.1	4.1
KERN	7.2	7.2	7.2
KINGS	0.0	0.0	0.0
MADERA	14.3	14.3	14.3
MERCED	57.5	57.5	57.5
SAN JOAQUIN	45.4	45.4	45.4
STANISLAUS	49.3	49.3	49.3
TULARE	6.7	6.7	6.7
SAN LUIS OBISPO COUNTY APCD	4.7	4.7	4.7
SAN LUIS OBISPO	4.7	4.7	4.7
SHASTA COUNTY AQMD	26.4	26.4	26.4
SHASTA	26.4	26.4	26.4
SISKIYOU COUNTY APCD	496.5	496.5	496.5
SISKIYOU	496.5	496.5	496.5
SOUTH COAST AQMD	54.8	54.8	54.8
LOS ANGELES	45.9	45.9	45.9
RIVERSIDE	8.7	8.7	8.7
SAN BERNARDINO	0.1	0.1	0.1
TEHAMA COUNTY APCD	41.8	41.8	41.8
TEHAMA	41.8	41.8	41.8
VENTURA COUNTY APCD	21.8	21.8	21.8
VENTURA	21.8	21.8	21.8
YOLO-SOLANO AQMD	14.5	14.5	14.5
SOLANO	13.6	13.6	13.6
YOLO	0.9	0.9	0.9
Total	909.1	909.1	909.1

TABLE II
2017 Non Consumer Pesticides - Emissions
EIC 530-530-5702-0000, Agricultural Pesticides - Non-Methyl Bromide

DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
AMADOR COUNTY APCD	3.6	3.6	3.6
AMADOR	3.6	3.6	3.6
ANTELOPE VALLEY AQMD	76.0	76.0	76.0
LOS ANGELES	76.0	76.0	76.0
BAY AREA AQMD	249.2	249.2	249.2
ALAMEDA	15.3	15.3	15.3
CONTRA COSTA	29.9	29.9	29.9
MARIN	3.9	3.9	3.9
NAPA	17.4	17.4	17.4
SAN FRANCISCO	1.4	1.4	1.4
SAN MATEO	26.5	26.5	26.5
SANTA CLARA	126.2	126.2	126.2
SOLANO	8.6	8.6	8.6
SONOMA	19.9	19.9	19.9
BUTTE COUNTY AQMD	305.7	305.7	305.7
BUTTE	305.7	305.7	305.7
CALAVERAS COUNTY APCD	2.3	2.3	2.3
CALAVERAS	2.3	2.3	2.3
COLUSA COUNTY APCD	187.8	187.8	187.8
COLUSA	187.8	187.8	187.8
EASTERN KERN APCD	17.5	17.5	17.5
KERN	17.5	17.5	17.5
EL DORADO COUNTY AQMD	3.7	3.7	3.7
EL DORADO	3.7	3.7	3.7
FEATHER RIVER AQMD	236.7	236.7	236.7
SUTTER	55.3	55.3	55.3
YUBA	181.4	181.4	181.4
GLENN COUNTY APCD	204.6	204.6	204.6
GLENN	204.6	204.6	204.6
GREAT BASIN UNIFIED APCD	13.8	13.8	13.8
ALPINE	0.0	0.0	0.0
INYO	1.4	1.4	1.4
MONO	12.4	12.4	12.4
IMPERIAL COUNTY APCD	679.5	679.5	679.5
IMPERIAL	679.5	679.5	679.5
LAKE COUNTY AQMD	19.2	19.2	19.2
LAKE	19.2	19.2	19.2
LASSEN COUNTY APCD	2.5	2.5	2.5
LASSEN	2.5	2.5	2.5
MARIPOSA COUNTY APCD	0.3	0.3	0.3
MARIPOSA	0.3	0.3	0.3
MENDOCINO COUNTY AQMD	12.0	12.0	12.0
MENDOCINO	12.0	12.0	12.0
MODOC COUNTY APCD	8.8	8.8	8.8
MODOC	8.8	8.8	8.8
MOJAVE DESERT AQMD	76.7	76.7	76.7
RIVERSIDE	66.2	66.2	66.2
SAN BERNARDINO	10.5	10.5	10.5
MONTEREY BAY AIR RESOURCES DISTRICT	2587.3	2587.3	2587.3
MONTEREY	1953.4	1953.4	1953.4
SAN BENITO	70.9	70.9	70.9
SANTA CRUZ	563.1	563.1	563.1

TABLE II			
2017 Non Consumer Pesticides - Emissions			
EIC 530-530-5702-0000, Agricultural Pesticides - Non-Methyl Bromide			
DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
NORTH COAST UNIFIED AQMD	82.8	82.8	82.8
DEL NORTE	81.2	81.2	81.2
HUMBOLDT	1.0	1.0	1.0
TRINITY	0.6	0.6	0.6
NORTHERN SIERRA AQMD	6.4	6.4	6.4
NEVADA	5.6	5.6	5.6
PLUMAS	0.8	0.8	0.8
SIERRA	0.1	0.1	0.1
NORTHERN SONOMA COUNTY APCD	28.8	28.8	28.8
SONOMA	28.8	28.8	28.8
PLACER COUNTY APCD	20.9	20.9	20.9
PLACER	20.9	20.9	20.9
SACRAMENTO METROPOLITAN AQMD	69.7	69.7	69.7
SACRAMENTO	69.7	69.7	69.7
SAN DIEGO COUNTY APCD	111.6	111.6	111.6
SAN DIEGO	111.6	111.6	111.6
SAN JOAQUIN VALLEY APCD	6346.5	6346.5	6346.5
FRESNO	1401.0	1401.0	1401.0
KERN	1488.0	1488.0	1488.0
KINGS	544.3	544.3	544.3
MADERA	398.0	398.0	398.0
MERCED	794.9	794.9	794.9
SAN JOAQUIN	482.8	482.8	482.8
STANISLAUS	603.4	603.4	603.4
TULARE	634.1	634.1	634.1
SAN LUIS OBISPO COUNTY APCD	622.4	622.4	622.4
SAN LUIS OBISPO	622.4	622.4	622.4
SANTA BARBARA COUNTY APCD	1347.2	1347.2	1347.2
SANTA BARBARA	1347.2	1347.2	1347.2
SHASTA COUNTY AQMD	12.3	12.3	12.3
SHASTA	12.3	12.3	12.3
SISKIYOU COUNTY APCD	25.0	25.0	25.0
SISKIYOU	25.0	25.0	25.0
SOUTH COAST AQMD	262.2	262.2	262.2
LOS ANGELES	42.8	42.8	42.8
ORANGE	46.4	46.4	46.4
RIVERSIDE	162.0	162.0	162.0
SAN BERNARDINO	11.1	11.1	11.1
TEHAMA COUNTY APCD	203.0	203.0	203.0
TEHAMA	203.0	203.0	203.0
TUOLUMNE COUNTY APCD	1.8	1.8	1.8
TUOLUMNE	1.8	1.8	1.8
VENTURA COUNTY APCD	308.7	308.7	308.7
VENTURA	308.7	308.7	308.7
YOLO-SOLANO AQMD	221.1	221.1	221.1
SOLANO	67.3	67.3	67.3
YOLO	153.8	153.8	153.8
Total	14357.5	14357.5	14357.5

TABLE III			
2017 Non Consumer Pesticides - Emissions			
EIC 530-540-3225-0000, Structural Pesticides - Methyl Bromide			
DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
ANTELOPE VALLEY AQMD	0.0	0.0	0.0
LOS ANGELES	0.0	0.0	0.0
BAY AREA AQMD	0.0	0.0	0.0
SAN MATEO	0.0	0.0	0.0
SAN LUIS OBISPO COUNTY APCD	0.1	0.1	0.1
SAN LUIS OBISPO	0.1	0.1	0.1
SOUTH COAST AQMD	0.0	0.0	0.0
LOS ANGELES	0.0	0.0	0.0
Total	0.1	0.1	0.1

TABLE IV			
2017 Non Consumer Pesticides - Emissions			
EIC 530-540-5702-0000, Structural Pesticides - Non-Methyl Bromide			
DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
AMADOR COUNTY APCD	0.3	0.3	0.3
AMADOR	0.3	0.3	0.3
ANTELOPE VALLEY AQMD	3.8	3.8	3.8
LOS ANGELES	3.8	3.8	3.8
BAY AREA AQMD	63.7	63.7	63.7
ALAMEDA	16.5	16.5	16.5
CONTRA COSTA	8.5	8.5	8.5
MARIN	1.8	1.8	1.8
NAPA	1.1	1.1	1.1
SAN FRANCISCO	5.1	5.1	5.1
SAN MATEO	5.4	5.4	5.4
SANTA CLARA	21.0	21.0	21.0
SOLANO	2.4	2.4	2.4
SONOMA	1.9	1.9	1.9
BUTTE COUNTY AQMD	1.6	1.6	1.6
BUTTE	1.6	1.6	1.6
CALAVERAS COUNTY APCD	0.6	0.6	0.6
CALAVERAS	0.6	0.6	0.6
COLUSA COUNTY APCD	0.1	0.1	0.1
COLUSA	0.1	0.1	0.1
EASTERN KERN APCD	2.4	2.4	2.4
KERN	2.4	2.4	2.4
EL DORADO COUNTY AQMD	1.8	1.8	1.8
EL DORADO	1.8	1.8	1.8
FEATHER RIVER AQMD	1.3	1.3	1.3
SUTTER	0.0	0.0	0.0
YUBA	1.2	1.2	1.2
GLENN COUNTY APCD	0.1	0.1	0.1
GLENN	0.1	0.1	0.1
GREAT BASIN UNIFIED APCD	0.5	0.5	0.5
ALPINE	0.0	0.0	0.0
INYO	0.4	0.4	0.4
MONO	0.1	0.1	0.1
IMPERIAL COUNTY APCD	1.8	1.8	1.8
IMPERIAL	1.8	1.8	1.8
LAKE COUNTY AQMD	1.3	1.3	1.3
LAKE	1.3	1.3	1.3
LASSEN COUNTY APCD	0.0	0.0	0.0
LASSEN	0.0	0.0	0.0
MARIPOSA COUNTY APCD	0.1	0.1	0.1
MARIPOSA	0.1	0.1	0.1
MENDOCINO COUNTY AQMD	1.4	1.4	1.4
MENDOCINO	1.4	1.4	1.4
MODOC COUNTY APCD	0.0	0.0	0.0
MODOC	0.0	0.0	0.0
MOJAVE DESERT AQMD	10.5	10.5	10.5
RIVERSIDE	0.3	0.3	0.3
SAN BERNARDINO	10.1	10.1	10.1

TABLE IV			
2017 Non Consumer Pesticides - Emissions			
EIC 530-540-5702-0000, Structural Pesticides - Non-Methyl Bromide			
DISTRICT AND COUNTY	ROG (TPY)	TOG (TPY)	VOC (TPY)
MONTEREY BAY AIR RESOURCES DISTRICT	6.1	6.1	6.1
MONTEREY	2.9	2.9	2.9
SAN BENITO	0.6	0.6	0.6
SANTA CRUZ	2.6	2.6	2.6
NORTH COAST UNIFIED AQMD	0.8	0.8	0.8
DEL NORTE	0.1	0.1	0.1
HUMBOLDT	0.7	0.7	0.7
TRINITY	0.0	0.0	0.0
NORTHERN SIERRA AQMD	0.6	0.6	0.6
NEVADA	0.5	0.5	0.5
PLUMAS	0.1	0.1	0.1
SIERRA	0.0	0.0	0.0
NORTHERN SONOMA COUNTY APCD	0.3	0.3	0.3
SONOMA	0.3	0.3	0.3
PLACER COUNTY APCD	4.9	4.9	4.9
PLACER	4.9	4.9	4.9
SACRAMENTO METROPOLITAN AQMD	27.3	27.3	27.3
SACRAMENTO	27.3	27.3	27.3
SAN DIEGO COUNTY APCD	44.1	44.1	44.1
SAN DIEGO	44.1	44.1	44.1
SAN JOAQUIN VALLEY APCD	60.3	60.3	60.3
FRESNO	13.3	13.3	13.3
KERN	11.1	11.1	11.1
KINGS	3.2	3.2	3.2
MADERA	3.2	3.2	3.2
MERCED	5.9	5.9	5.9
SAN JOAQUIN	11.2	11.2	11.2
STANISLAUS	5.0	5.0	5.0
TULARE	7.4	7.4	7.4
SAN LUIS OBISPO COUNTY APCD	2.2	2.2	2.2
SAN LUIS OBISPO	2.2	2.2	2.2
SANTA BARBARA COUNTY APCD	5.2	5.2	5.2
SANTA BARBARA	5.2	5.2	5.2
SHASTA COUNTY AQMD	1.5	1.5	1.5
SHASTA	1.5	1.5	1.5
SISKIYOU COUNTY APCD	0.1	0.1	0.1
SISKIYOU	0.1	0.1	0.1
SOUTH COAST AQMD	199.3	199.3	199.3
LOS ANGELES	101.0	101.0	101.0
ORANGE	36.7	36.7	36.7
RIVERSIDE	34.4	34.4	34.4
SAN BERNARDINO	27.1	27.1	27.1
TEHAMA COUNTY APCD	0.5	0.5	0.5
TEHAMA	0.5	0.5	0.5
TUOLUMNE COUNTY APCD	0.5	0.5	0.5
TUOLUMNE	0.5	0.5	0.5
VENTURA COUNTY APCD	7.4	7.4	7.4
VENTURA	7.4	7.4	7.4
YOLO-SOLANO AQMD	3.9	3.9	3.9
SOLANO	1.0	1.0	1.0
YOLO	2.9	2.9	2.9
Grand Total	456.3	456.3	456.3