ANNUAL REPORT ON VOLATILE ORGANIC COMPOUND EMISSIONS FROM PESTICIDES: EMISSIONS FOR 1990-2018

July 2020

California Environmental Protection Agency
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Air 20-01

Preface

Scope of Data

This report fulfills the requirements of Title 3, California Code of Regulations (3 CCR), section 6881, requiring the Director of the Department of Pesticide Regulation (DPR) to issue an annual emissions inventory report for the Sacramento Metro, San Joaquin Valley, South Coast, Southeast Desert, and Ventura ozone nonattainment areas (NAAs). This report presents data reported to or produced by DPR from May 1 to October 31, 2018 (the most recent year data is available). These months are the peak ozone season in California. In addition, data from the same months in 1990 are included for baseline comparisons, and from 2015, 2016, and 2017 for trend analysis.

The term "emissions" herein refers to volatile organic compound (VOC) emissions from pesticide applications. Unless otherwise stated, all emissions from fumigants are reported as adjusted emissions. Nonfumigant emissions are always unadjusted. See "Procedure for Calculating Unadjusted and Adjusted Volatile Organic Compound Emissions."

Background

Under the federal Clean Air Act, California must meet national standards for airborne pollutants and must specify how it plans to achieve these goals in a federally approved State Implementation Plan (SIP). SIPs require the control of emissions of nitrogen oxides and VOCs because they are precursors to ozone. Under California's SIP, approved by the U.S. Environmental Protection Agency (U.S. EPA), DPR must track and control VOC emissions from pesticide products used in agriculture and by commercial structural applicators in five regions that do not attain the federal air quality standard for ozone (i.e., ozone NAAs). The SIP requires DPR to reduce emissions by 20% from the 1990 base year in four ozone NAAs—Sacramento Metro, South Coast, Southeast Desert, and Ventura, and by 12% in a fifth ozone NAA—San Joaquin Valley.

DPR's emissions inventory database includes only pesticide applications that are made between May 1 and October 31, the peak ozone season in California. DPR updates its emissions inventory when annual pesticide use report (PUR) data from the previous year becomes available. DPR's PUR database contains data for every year from 1990 to 2018. Each year contains about 3.8 million pesticide use records and emission potential (EP) values for approximately 7,500 products. The EP is that fraction of a product that is assumed to contribute to atmospheric VOCs.

Beginning in 2008, DPR adopted a series of regulations to reduce emissions from fumigant pesticides. 3 CCR section 6452.2 includes specific emission target levels ("benchmarks") for each of the five NAAs, equivalent to the SIP reduction goals. The regulations reduce emissions by requiring low-emission fumigation methods in certain NAAs. If, in spite of these application method requirements, emissions equal or exceed 95% of the benchmark for a NAA, the regulations specify that DPR will ensure that the benchmark is achieved by establishing a fumigant limit. The fumigant limit is determined by subtracting the estimated nonfumigant emissions from the benchmark.

Because a significantly higher proportion of emissions in the San Joaquin Valley NAA are from nonfumigants, in May 2013 (and effective November 1, 2013) DPR replaced the fumigant limit required when the 95% trigger level is exceeded in that NAA with prohibitions on the use of certain nonfumigant products designated as high-VOC.

Report Summary

In 2018, all five ozone NAAs were in compliance with the SIP goals.

- Sacramento Metro NAA (1): 2018 emissions decreased by 5% (-0.059 tpd), from 1.299 tpd in 2017 to 1.239 tpd. Emissions in 2018 were 55% lower than the 1990 base year and remain in compliance with the SIP goal.
- San Joaquin Valley NAA (2): 2018 emissions decreased by 5% (-0.798 tpd), from 16.972 tpd in 2017 to 16.174 tpd. Emissions in 2018 were 21% lower than the 1990 base year and remain in compliance with the SIP goal. Prohibitions on the use of certain nonfumigant products went into effect in 2015 (3 CCR section 6884) and pesticide applications subject to these restrictions accounted for 30% of the total nonfumigant emissions for the year prior to restrictions (2014), compared to 15% in 2018. VOC regulations require DPR to calculate hypothetical emissions for 2018. The calculated hypothetical emissions exceed the trigger level of 95% of the SIP goal, or 17.2 tpd. Therefore, VOC regulations require that the nonfumigant prohibitions that went into effect in 2015 remain in effect during the May 1 through October 31 period for 2020 and 2021 in this NAA, as per 3 CCR section 6452.2[f].
- Southeast Desert NAA (3): 2018 emissions decreased by 26% (-0.092 tpd), from 0.357 tpd in 2017 to 0.265 tpd. Emissions in 2018 were 77% lower than the 1990 base year and remain in compliance with the SIP goal.
- Ventura NAA (4): 2018 emissions decreased by 8% (-0.104 tpd), from 1.241 tpd in 2017 to 1.138 tpd. Emissions in 2018 were 70% lower than the 1990 base year and remain in compliance with the SIP goal.
- South Coast NAA (5): 2018 emissions decreased by 3% (-0.031 tpd), from 1.105 tpd in 2017 to 1.075 tpd. Emissions in 2018 were 90% lower than the 1990 base year and remain in compliance with the SIP goal.

3 CCR section 6881(b) requires a 45-day public comment period of the draft report. Comments received during the comment period ending on June 1, 2020 are included in Appendix 5.

Abbreviations

AI	Active Ingredient
AMAF	Application Method Adjustment Factor
APCD	Air Pollution Control District
ARB	California Air Resources Board
EC	Emulsifiable Concentrate
EP	Emission Potential
ER	Emission Rating
DPR	Department of Pesticide Regulation
FFM	Field Fumigation Methods
GIS	Geographic Information System
MUF	Method Use Fraction
NAA	Nonattainment Area
PUR	Pesticide Use Report
SIP	State Implementation Plan
TGA	Thermogravimetric Analysis
TIF	Totally Impermeable Film
tpd	Tons Per Day
VOC	Volatile Organic Compounds

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Acknowledgements

The authors wish to thank the reviewers whose unique perspectives and experiences helped ensure the accuracy and readability of this report. We gratefully acknowledge the staff of DPR and cooperating federal, state, local, and private agencies for contributing to the database.

Disclaimer

The mention of commercial products, their source, or their use in this report is not to be construed as either an actual or an implied endorsement of such product.

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Overview

Introduction

The State Implementation Plan (SIP) for pesticides requires the California Department of Pesticide Regulation (DPR) to develop and maintain an emissions inventory to track volatile organic compound (VOC) emissions and to reduce emissions by 20% from a base year in four out of five California ozone nonattainment areas (NAAs), and by 12% in the fifth ozone NAA. These five NAAs are defined as areas that do not meet the National Ambient Air Quality Standards for ozone as designated in the Clean Air Act. The scope of the VOC emissions inventory allows DPR to estimate emissions from agricultural and commercial structural pesticide applications within the state. To do this, DPR calculates emissions for each year beginning with 1990, and updates these calculations annually based on most recent data. The inventory focuses on the peak ozone period between May 1 and October 31 for each year.

The emissions inventory is estimated based on pesticide use reports (PURs) that are collected by DPR. The inventory includes applications that are made for agricultural and structural use as defined by law. Included are all applications with the exception of home use, industrial use, institutional use, applications made for vector control purposes and veterinarian uses. Production agricultural use covers applications to approximately 400 commodities/crops. Non-production agricultural use includes applications to approximately 20 sites including cemeteries, golf courses, parks, rights-of-way, etc. Structural use includes all applications by structural pest control businesses, regardless of site treated.

The key PUR data used to calculate emissions is given in Table 1.

Table 1: Key information included in pesticide use reports (PURs) that form the basis of DPR's volatile organic compound emissions inventory.

Information	**Production Agriculture Reports**	**Non-production Agriculture and Non-agricultural Reports**
Product Applied	Yes	Yes
Crop/Site Treated	Yes	Yes
Amount Applied	Yes - each application	Monthly Total
Date Applied	Date and Time	Month
Application Method	Yes	No
Acres/Units Treated	Yes	Monthly Total
Location of Application	Township/Range/Section	County
Fumigant Method Code	Yes*	No

* Field fumigant use reports only

California's five ozone NAAs included in the emissions inventory are Sacramento Metro (1), San Joaquin Valley (2), Southeast Desert (3), Ventura (4), and South Coast (5). The boundaries of these NAAs, as defined by Title 40 of the Code of Federal Regulations (CFR) Part 81, and a listing of counties that fall within the boundaries are shown in Figure 1 and Table 2, respectively.

In January 2008, DPR adopted Title 3, California Code of Regulations (3 CCR), section 6452.4 requiring an annual emissions inventory report that includes the following information:

- Total agricultural and structural emissions for the previous years;
- Evaluation of whether emissions are in compliance with SIP goals (equivalent to the regulatory benchmarks specified in 3 CCR section 6452.2);
- Fumigant emission limits for the upcoming year, if necessary, according to 3 CCR section 6452.2;
- Emission ratings (or application method adjustment factors, the percentage of fumigant applied) for each fumigation method.

In May 2013 (and effective November 1, 2013), DPR amended the VOC regulations, moving the requirements for the annual report from 3 CCR section 6452.4 to 3 CCR section 6881, and adding the following report elements:

- Prohibitions on high-VOC nonfumigant products pursuant to 3 CCR section 6452.2(f), and if applicable, determination of whether prohibitions remain in effect pursuant to 3 CCR section 6884(c);
- List of nonfumigant products that are designated as low-VOC pursuant to 3 CCR section 6880;
- List of actively registered nonfumigant products that are designated as high-VOC pursuant to 3 CCR section 6880.

Section 6881 also requires a 45-day public comment period of the draft report. This report contains all of the information specified above, including emission estimates for 1990-2018 and whether the 2018 emissions exceed levels that trigger additional VOC restrictions.

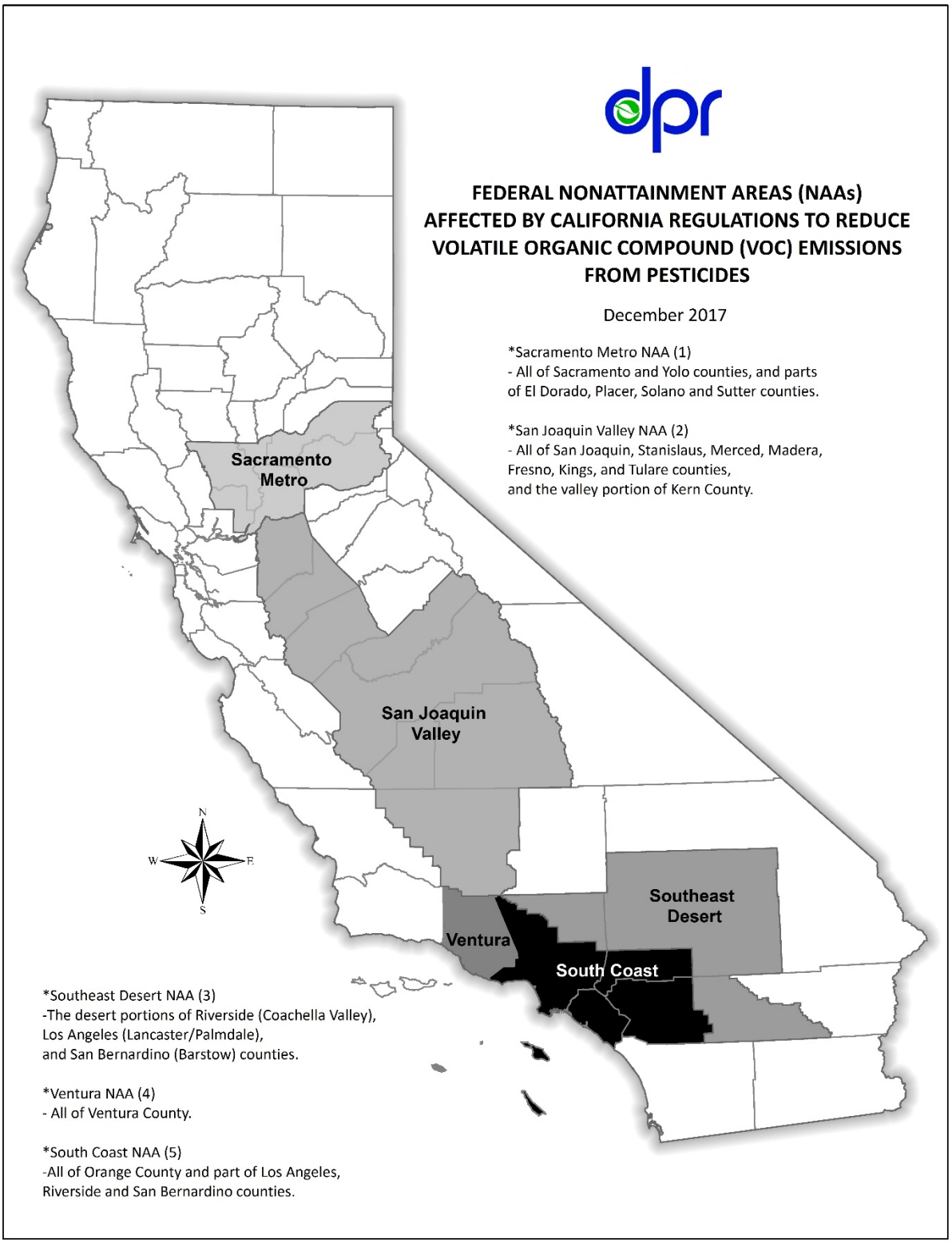

Figure 1: Federal ozone NAAs affected by California regulations to reduce volatile organic compound (VOC) emissions from pesticides.

Table 2: A listing of counties wholly or partially within five ozone NAAs in California.

NAA	Counties within the NAA
1 - Sacramento Metro	All of Sacramento, Yolo. Parts of Sutter, Solano, Placer, El Dorado
2 - San Joaquin Valley	All of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare, Western Part of Kern
3 - Southeast Desert	Parts of Los Angeles, San Bernardino, Riverside
4 - Ventura	All of Ventura
5 - South Coast	All of Orange. Western Parts of Los Angeles, San Bernardino, Riverside

Nonattainment Area Goals

The emissions in DPR's VOC inventory are compared to the NAA goals listed in Table 3, which are described in California's original 1994 SIP (62 Fed. Reg. at 1170, 1997) and Appendix H to the 2007 SIP (73 Fed. Reg. 41277, 2008). These SIP goals are a 20% reduction from 1990 levels for the Sacramento Metro, Southeast Desert, Ventura and South Coast NAAs, and a 12% reduction from the 1990 baseline for the San Joaquin Valley NAA. In August 2012, U.S. EPA approved DPR's SIP amendment for the San Joaquin Valley. This amendment includes a SIP goal of 18.1 tons per day (tpd), equivalent to a 12% reduction relative to the 1990 baseline. Prior to the amendment, the SIP described the reduction commitment only as 12% less than the 1990 baseline. Because the 18.1 tpd represents the 12% reduction from the 1990 baseline calculated using a specific methodology, that methodology must continue to be used to calculate future emissions to assure a legitimate comparison to measure SIP compliance. Therefore, emission estimates for application methods that were used in 1990 cannot be modified, absent a SIP revision. Similarly, nonfumigant pesticide emission potentials of formulations that were used in the base year cannot be changed, absent a SIP revision.

The annual report includes DPR's determination if emissions exceed levels that trigger additional VOC restrictions. As specified in 3 CCR section 6452.2, additional restrictions are triggered if emissions in a NAA exceed 95% of its SIP goal (Table 3). For the Sacramento Metro, Southeast Desert, South Coast, and Ventura NAAs the additional restrictions are a fumigant emissions limit, enforced by DPR and county agricultural commissioners through grower allowances or other methods. The 2013 regulations revised the additional restrictions for the San Joaquin Valley because nonfumigant products contribute more emissions than fumigant products in this NAA; therefore, additional restrictions on nonfumigant products are a more efficient method to ensure that the SIP goal is achieved. If emissions exceed the trigger level for the San Joaquin Valley, certain uses of high-VOC products are prohibited (3 CCR section 6884). For all five NAAs, the additional restrictions are triggered for the upcoming May-October period based on the most recent emissions inventory. For example, the 2018 emissions inventory is used to determine if additional VOC restrictions will go into effect for May-October 2020. Additional information on the 2013 regulations and changes to the additional restrictions is available at http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/reduce_nonfumigant.htm.

Table 3: State Implementation Plan (SIP) goals and triggers for the five ozone NAAs in California.

NAA	SIP Goal (tpd)	Trigger Levels (95% of SIP Goal [tpd])
1 - Sacramento Metro	2.2	2.1
2 - San Joaquin Valley	18.1	17.2
3 - Southeast Desert	0.92	0.87
4 - Ventura	3.0	2.85
5 - South Coast	8.7	8.3

Procedure for Calculating Unadjusted and Adjusted Emissions

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% (Majewski et al., 1995; Wang et al., 1997; Williams et al., 1999; Yagi et al., 1993). DPR has developed an adjustment procedure to account for the effect of application method on reducing fumigant 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) (Spurlock, 2002; 2006).

$$\text{emission} = \text{lbs of product used} \cdot \text{EP}$$

In the adjusted inventory, the emission from a single application of a fumigant active ingredient (AI) is reduced by an additional factor called the Application Method Adjustment Factor (AMAF), also referred to as the emission rating. AMAFs have been determined from field study data and are AI and application method specific (Barry et al., 2007). Since the AMAFs are based on field measured data for specific application methods and fumigants, they yield more refined estimates of fumigant emissions than the previous unadjusted emission estimates.

$$\text{emission} = \text{lbs of product used} \cdot \text{EP} \cdot \text{AMAF}$$

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.

Usually there are several different types of application methods used for a particular fumigant in any particular NAA. Each method of use (e.g., drip, sprinkler, shank, or tarp) represents a fraction of the total number of methods used and is referred to as the Method Use Fraction (MUF). Prior to 2008, field fumigations did not report application method; instead MUFs were derived from surrogate data and used in addition to AMAFs to adjust emissions in these years. The sum of all MUFs for any particular (NAA/fumigant AI) combination is one. Use practices change over time so that different MUFs are used for the baseline year (1990) and later years. MUFs for 2007 and

earlier years were determined in a number of different ways. For 1,3-dichloropropene, the MUFs were determined from use data collected by the registrant in support of DPR's township application caps; for metam sodium and metam potassium, grower/applicator surveys were conducted to determine types of applications for different crops and areas. Methyl bromide and chloropicrin MUFs were based on expert opinion and regulatory history. Finally, MUFs for dazomet and sodium tetrathiocarbonate equal one because the AMAFs for each of these two fumigants are constant, independent of application method. A detailed discussion of how MUFs and AMAFs were determined is given by Barry et al. (2007). Appendix 1a contains summaries of the AMAFs and MUFs used for emissions inventory data prior to 2009.

Additionally, regulations that went into effect in 2008 facilitated calculation of adjusted inventories by requiring reporting of each field fumigation's method (FFM) which, along with the AI, uniquely determines an AMAF value. In 2018, one (<1%) of the 3,057 field fumigant applications had no or a non-existent fumigation method code reported. This missing record originated in the Sacramento Metro NAA (1). For any such records, DPR uses a conservative approach by assuming that the application method with the highest AMAF allowed by the regulations for that fumigant was used, creating a complete dataset from which adjusted emissions can be calculated (Table 4). Appendix 1b contains current FFMs, FFM codes for pesticide use reporting, and corresponding AMAFs.

Table 4: Default application method adjustment factor (AMAF) fumigant codes assigned to fumigant applications with either no or non-existent fumigant codes.

Active Ingredient	**Default AMAF**
Methyl Bromide with or without Chloropicrin	48%
1,3-Dichloropropene with or without Chloropicrin	44%
Chloropicrin Only	44%
Metam-Sodium or Potassium N-Methyldithiocarbamate	28%
Dazomet	17%
Sodium Tetrathiocarbonate	10%

In addition to the emissions derived from fumigant AIs, inert ingredients for products that contain chloropicrin, methyl bromide, and 1,3-dichloropropene are assumed to be volatile and are included in the inventory calculations. For the highest use products containing metam sodium, metam potassium, sodium tetrathiocarbonate and dazomet, analysis of their confidential statements of formula determined that the composition of inerts are non-volatile and so do not contribute to the EP of these products.

Non-production agriculture and non-agricultural pesticide applications are reported to DPR as "monthly summary data" with no geographic location information beyond the county of application (Table 1). These include commercial structural, landscape maintenance, rights-of-way, and commodity fumigations. In cases where two or more air basins, one of which may be in a NAA, are present within a single county, these applications must be proportionally allocated. DPR allocates these monthly summary applications using surrogate data that are assumed to have similar geographic distributions. In 2012, the surrogate data was updated to provide the most accurate estimated geographic distribution of emissions, reflecting changes in California's population and transportation infrastructure. U.S. Census data for the 2010 decennial census together with TIGER/Line shapefiles

for roads, rail roads, and linear hydrography were used as surrogates for commercial structural, landscape maintenance, and rights-of-way applications. Commodity fumigation data were provided by California county agricultural commissioners (Neal and Spurlock, 2012).

Emissions are calculated for each NAA and allocated by primary AI, application site, and emissions inventory category as defined by the Air Resources Board (ARB). The primary AI is defined as the AI present at the highest percentage in a pesticide product. If a product contains 20% of AI "A" and 10% of AI "B", all estimated emissions from that product are assigned to the primary AI "A".

ARB Emissions Inventory Classification

ARB defines four emission categories: methyl bromide emissions from agricultural applications, non-methyl bromide emissions from agricultural applications, methyl bromide emissions from structural applications, and non-methyl bromide emissions from structural applications. Emissions are calculated according to these categories, and are reported as U.S. tpd in the results section of this report.

Data Revisions

DPR continually evaluates PUR data, EP values, MUFs, and AMAFs to ensure the VOC inventory includes the most reliable data. As requested by DPR, registrants provide thermogravimetric analysis (TGA) data, DPR's preferred data to determine EPs, for new and existing products. Previous inventories have shown that changes in a widely used product's EP can significantly influence the emissions inventory. Table 5 shows products that had EP values that changed significantly since the previous VOC inventory report as a result of recent TGA submissions.

Changes to a product's listed EP value can occur when EP values that have been determined by alternative methods are replaced by an EP value derived from registrant-submitted TGA data evaluated by DPR. If DPR finds the TGA data contains errors, DPR may request additional TGA data from the registrant in order to perform a re-evaluation of the data to verify or update the product's EP. In addition to these changes, data entry corrections in DPR's Product/Label database may change the product formulations of registered pesticide products. Products that do not have TGA data are assigned default EP values using the default median for the type of product formulation (e.g., emulsifiable concentrate or flowable concentrate). Changes to estimated EP values that resulted from assigned default medians for corrected formulation codes are not included in Table 5. Lastly, DPR staff continuously evaluates the emissions inventory data for any past errors in assigned EP values (e.g., incorrect use of deficient TGA data or erroneous bridging of one product's EP data to another "substantially similar" product). If any such errors are discovered by DPR staff, registrants are requested by DPR to provide new TGA data for the product in question and a new EP determination is performed by DPR staff with the newly received TGA data. The VOC inventory report includes EP values that were updated in the year prior to its release.

Table 5: Substantial changes in emission potential (EP) values since the 2017 inventory.

		2017 Inventory		2018 Inventory		
Product	**Registration Number**	**EP**	**Method**	**EP**	**Method**	**Change in EP**
EPI-MEK SCL	100-1439-AA	3.08	TGA	6.48	TGA	3.40
DREXEL DUPLICATOR 6 HERBICIDE	19713-700-AA	5.71	default median	0.00	TGA	-5.71

Volatile Organic Compound Inventory Results

The main text of this report summarizes the emissions inventory data for 2018 only. Unadjusted and adjusted emission data for 2015-2018 are summarized by AI and application site (or commodity) in Appendices 2 and 3, respectively. Inventory data for prior years are in previous inventory reports and are made available by DPR upon request.

Figure 2 illustrates the changes in unadjusted emissions from 1990 to 2018. These values are unadjusted and do not consider MUFs and AMAFs that are only applied to emissions in 1990 and 2004 through 2018, due to data limitations. The figure is useful in that it compares emissions for the entire history of the inventory and shows trends in five NAAs. Figure 3 summarizes adjusted emissions for the same years and compares them to the SIP goals that are based on a percentage reduction from the 1990 baseline.

Tables 6 through 9 present emissions for 1990 and 2007 through 2018. Table 6, like Figure 3, summarizes adjusted emissions in each NAA. Table 7 compares fumigant and nonfumigant emissions. Table 8 compares unadjusted and adjusted fumigant emissions. Table 9 compares emissions from emulsifiable concentrate formulated nonfumigants and all other nonfumigant formulations.

The following summarizes these tables and figures for the current and previous report years:

- Sacramento Metro NAA (1): 2018 emissions decreased by 5% (-0.059 tpd), from 1.299 tpd in 2017 to 1.239 tpd. Emissions in 2018 were 55% lower than the 1990 base year and remain in compliance with the SIP goal.
- San Joaquin Valley NAA (2): 2018 emissions decreased by 5% (-0.798 tpd), from 16.972 tpd in 2017 to 16.174 tpd. Emissions in 2018 were 21% lower than the 1990 base year and remain in compliance with the SIP goal. Prohibitions on the use of certain nonfumigant products went into effect in 2015 (3 CCR section 6884) and pesticide applications subject to these restrictions accounted for 30% of the total nonfumigant emissions for the year prior to restrictions (2014), compared to 15% in 2018. VOC regulations require DPR to calculate hypothetical emissions for 2018. The calculated hypothetical emissions exceed the trigger level of 95% of the SIP goal, or 17.2 tpd. Therefore, VOC regulations require that the nonfumigant prohibitions that went into effect in 2015 remain in effect during the May 1 through October 31 period for 2020 and 2021 in this NAA, as per 3 CCR section 6452.2[f].
- Southeast Desert NAA (3): 2018 emissions decreased by 26% (-0.092 tpd), from 0.357 tpd in 2017 to 0.265 tpd. Emissions in 2018 were 77% lower than the 1990 base year and remain in compliance with the SIP goal.
- Ventura NAA (4): 2018 emissions decreased by 8% (-0.104 tpd), from 1.241 tpd in 2017 to 1.138 tpd. Emissions in 2018 were 70% lower than the 1990 base year and remain in compliance with the SIP goal.
- South Coast NAA (5): 2018 emissions decreased by 3% (-0.031 tpd), from 1.105 tpd in 2017 to 1.075 tpd. Emissions in 2018 were 90% lower than the 1990 base year and remain in compliance with the SIP goal.

Pesticide use varies from year to year depending on factors such as weather, drought, pest problems, economics, and types of crops planted. Increases and decreases in pesticide use from one year to the next or in the span of a few years do not necessarily indicate a trend. Such variances are and will continue to be a normal occurrence. For example, extremely heavy rains result in excessive weeds,

thus more pesticides may be used; drought conditions may give rise to fewer planted acres and less pesticide use. A more detailed explanation of pesticide use patterns is given in DPR's annual summary of pesticide use reports at http://www.cdpr.ca.gov/docs/pur/purmain.htm.

The 2013 and earlier VOC regulations include additional restrictions that are triggered if emissions in a NAA exceed 95% of its SIP goal. None of the five NAAs exceeded their trigger levels in 2018. However, San Joaquin Valley NAA exceeded its trigger level in 2013, requiring certain uses of the designated high-VOC products to be prohibited during May-October for that NAA beginning in 2015 and remaining in effect for at least two years (3 CCR section 6452.2[f]).

The nonfumigant regulations designate certain products containing abamectin, chlorpyrifos, gibberellins, and oxyfluorfen as high-VOC products (3 CCR sections 6880). San Joaquin Valley growers must obtain a recommendation from a pest control adviser prior to certain uses of these high-VOC products, and pest control advisers are required to recommend low-VOC products when feasible (3 CCR sections 6883, 6884). DPR continues to register reformulated products with lower EPs, including products containing abamectin, chlorpyrifos, gibberellins, and oxyfluorfen that are major VOC contributors. The criteria and specific products designated as high-VOC and low-VOC are discussed in a later section.

DPR adopted additional fumigant regulations, which became effective on January 1, 2008, that required the use of specific "low-emission" fumigant application methods. Those regulations are also included in 3 CCR section 6452, which describes the interim and rulemaking process DPR can use to evaluate and approve new low-emission fumigant application methods. In April 2013, DPR granted interim approval that allowed the use of U.S. EPA-approved totally impermeable film (TIF) tarp method for certain fumigants. The regulation that gave permanent approval for TIF tarp methods became effective on April 1, 2016. The continued increase in adoption of lower emission application methods and products by growers, registrants, and others significantly contributes to SIP compliance and reducing emissions.

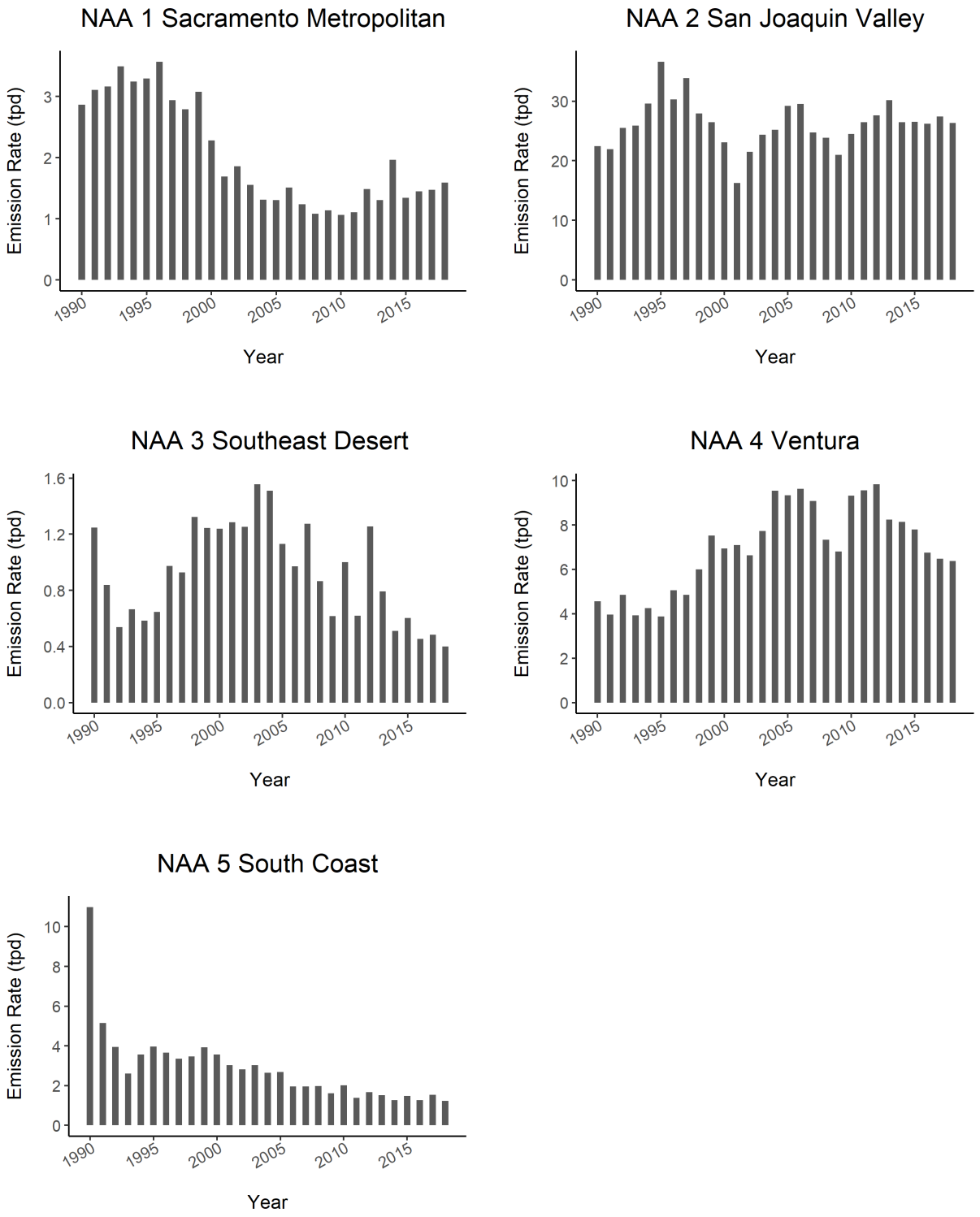

Figure 2: Unadjusted emissions by nonattainment area (NAA) from 1990 to 2018.

Table 6: Emissions, goals, and triggers during 1990 and 2007-2018.

	Emissions (tpd)														
NAA	**1990**	**SIP Goal***	**Trigger Level†**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1 - Sacramento Metro	2.784	2.2	2.1	1.041	0.903	0.910	0.980	1.004	1.303	1.175	1.332	1.192	1.315	1.299	1.239
2 - San Joaquin Valley	20.517	18.1	17.2	17.093	14.525	12.965	15.228	16.376	16.921	19.520	16.815	15.368	15.425	16.972	16.174
3 - Southeast Desert	1.153	0.92	0.87	0.762	0.286	0.284	0.460	0.215	0.473	0.370	0.289	0.357	0.257	0.357	0.265
4 - Ventura	3.786	3.0	2.85	3.363	1.739	2.174	2.789	3.003	3.063	1.707	1.620	1.668	1.365	1.241	1.138
5 - South Coast	10.840	8.7	8.3	1.487	1.283	1.240	1.740	1.121	1.374	1.312	1.167	1.335	1.002	1.105	1.075

* For Ventura, the SIP goal was phased in between 2008 and 2012, with a final goal of 3.0 tpd in 2012.
† Trigger level is 95% of SIP Goal.

Table 7: Fumigant and nonfumigant emissions during 1990 and 2007-2018.

	Emissions (tpd)												
NAA	**1990**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1 - Sacramento Metro													
Fumigants	0.384	0.189	0.064	0.134	0.097	0.061	0.083	0.068	0.246	0.098	0.106	0.145	0.193
	(14%)	(18%)	(7%)	(15%)	(10%)	(6%)	(6%)	(6%)	(18%)	(8%)	(8%)	(11%)	(16%)
Nonfumigants	2.400	0.851	0.838	0.775	0.883	0.944	1.221	1.106	1.086	1.094	1.209	1.153	1.046
	(86%)	(82%)	(93%)	(85%)	(90%)	(94%)	(94%)	(94%)	(82%)	(92%)	(92%)	(89%)	(84%)
2 - San Joaquin Valley													
Fumigants	5.536	6.123	3.370	3.078	3.700	4.001	4.265	4.353	4.026	4.777	4.237	4.219	3.951
	(27%)	(36%)	(23%)	(24%)	(24%)	(24%)	(25%)	(22%)	(24%)	(31%)	(27%)	(25%)	(24%)
Nonfumigants	14.981	10.970	11.154	9.887	11.528	12.375	12.656	15.167	12.789	10.591	11.188	12.752	12.223
	(73%)	(64%)	(77%)	(76%)	(76%)	(76%)	(75%)	(78%)	(76%)	(69%)	(73%)	(75%)	(76%)
3 - Southeast Desert													
Fumigants	0.840	0.575	0.119	0.137	0.273	0.078	0.258	0.169	0.085	0.095	0.073	0.106	0.041
	(73%)	(75%)	(42%)	(48%)	(59%)	(36%)	(55%)	(46%)	(29%)	(27%)	(28%)	(30%)	(16%)
Nonfumigants	0.313	0.187	0.167	0.146	0.186	0.137	0.215	0.201	0.204	0.262	0.184	0.251	0.223
	(27%)	(25%)	(58%)	(52%)	(41%)	(64%)	(45%)	(54%)	(71%)	(73%)	(72%)	(70%)	(84%)
4 - Ventura													
Fumigants	3.140	2.935	1.252	1.720	2.312	2.577	2.681	1.311	1.188	1.211	0.942	0.725	0.733
	(83%)	(87%)	(72%)	(79%)	(83%)	(86%)	(88%)	(77%)	(73%)	(73%)	(69%)	(58%)	(64%)
Nonfumigants	0.647	0.428	0.486	0.454	0.477	0.425	0.382	0.397	0.432	0.457	0.423	0.517	0.405
	(17%)	(13%)	(28%)	(21%)	(17%)	(14%)	(12%)	(23%)	(27%)	(27%)	(31%)	(42%)	(36%)
5 - South Coast													
Fumigants	9.372	0.411	0.377	0.312	0.375	0.196	0.381	0.285	0.208	0.257	0.273	0.190	0.168
	(86%)	(28%)	(29%)	(25%)	(22%)	(17%)	(28%)	(22%)	(18%)	(19%)	(27%)	(17%)	(16%)
Nonfumigants	1.468	1.075	0.906	0.927	1.365	0.926	0.993	1.027	0.959	1.079	0.728	0.915	0.907
	(14%)	(72%)	(71%)	(75%)	(78%)	(83%)	(72%)	(78%)	(82%)	(81%)	(73%)	(83%)	(84%)

Table 8: Unadjusted and adjusted fumigant emissions during 1990 and 2007-2018. VOC/applied (tons of VOCs emitted for each ton of fumigant applied) was calculated by dividing the adjusted fumigant emissions by the unadjusted fumigant emissions. The trends over time and between NAAs indicate if the fumigants and/or fumigation methods used are lower-emitting or higher-emitting.

	Emissions (tpd)												
NAA	**1990**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1 - Sacramento Metro													
Unadjusted	0.461	0.383	0.243	0.363	0.181	0.162	0.263	0.197	0.876	0.247	0.237	0.320	0.543
Adjusted	0.384	0.189	0.064	0.134	0.097	0.061	0.083	0.068	0.246	0.098	0.106	0.145	0.193
VOC/Applied (tons/ton)	0.834	0.495	0.265	0.369	0.536	0.375	0.314	0.346	0.281	0.395	0.449	0.454	0.355
2 - San Joaquin Valley													
Unadjusted	7.491	13.750	12.695	11.119	12.944	14.116	14.969	15.002	13.666	15.937	14.990	14.663	14.099
Adjusted	5.536	6.123	3.370	3.078	3.700	4.001	4.265	4.353	4.026	4.777	4.237	4.219	3.951
VOC/Applied (tons/ton)	0.739	0.445	0.265	0.277	0.286	0.283	0.285	0.290	0.295	0.300	0.283	0.288	0.280
3 - Southeast Desert													
Unadjusted	0.933	1.086	0.697	0.469	0.814	0.482	1.041	0.591	0.308	0.341	0.270	0.232	0.176
Adjusted	0.840	0.575	0.119	0.137	0.273	0.078	0.258	0.169	0.085	0.095	0.073	0.106	0.041
VOC/Applied (tons/ton)	0.901	0.530	0.170	0.293	0.336	0.162	0.248	0.286	0.275	0.280	0.270	0.456	0.234
4 - Ventura													
Unadjusted	3.909	8.658	6.838	6.345	8.844	9.126	9.442	7.846	7.705	7.335	6.324	5.970	5.968
Adjusted	3.140	2.935	1.252	1.720	2.312	2.577	2.681	1.311	1.188	1.211	0.942	0.725	0.733
VOC/Applied (tons/ton)	0.803	0.339	0.183	0.271	0.261	0.282	0.284	0.167	0.154	0.165	0.149	0.121	0.123
5 - South Coast													
Unadjusted	9.514	0.883	1.066	0.694	0.647	0.449	0.672	0.492	0.308	0.394	0.545	0.629	0.324
Adjusted	9.372	0.411	0.377	0.312	0.375	0.196	0.381	0.285	0.208	0.257	0.273	0.190	0.168
VOC/Applied (tons/ton)	0.985	0.466	0.354	0.450	0.580	0.435	0.566	0.580	0.674	0.651	0.501	0.302	0.518

Table 9: Nonfumigant emissions derived from emulsifiable concentrate (EC) formulations and all other nonfumigants during 1990 and 2007-2018. The adjusted and unadjusted emissions for nonfumigants are equivalent.

	Emissions (tpd)												
NAA	**1990**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
1 - Sacramento Metro													
EC	1.129	0.470	0.487	0.379	0.411	0.400	0.537	0.503	0.485	0.536	0.535	0.579	0.444
	(47%)	(55%)	(58%)	(49%)	(47%)	(42%)	(44%)	(45%)	(45%)	(49%)	(44%)	(50%)	(42%)
Other	1.271	0.382	0.351	0.397	0.472	0.543	0.684	0.603	0.601	0.558	0.673	0.575	0.602
	(53%)	(45%)	(42%)	(51%)	(53%)	(58%)	(56%)	(55%)	(55%)	(51%)	(56%)	(50%)	(58%)
2 - San Joaquin Valley													
EC	12.162	7.547	7.491	5.921	6.608	6.854	7.263	8.760	7.298	6.300	6.517	7.041	6.198
	(81%)	(69%)	(67%)	(60%)	(57%)	(55%)	(57%)	(58%)	(57%)	(59%)	(58%)	(55%)	(51%)
Other	2.819	3.423	3.663	3.966	4.921	5.521	5.392	6.407	5.491	4.291	4.671	5.711	6.025
	(19%)	(31%)	(33%)	(40%)	(43%)	(45%)	(43%)	(42%)	(43%)	(41%)	(42%)	(45%)	(49%)
3 - Southeast Desert													
EC	0.217	0.105	0.089	0.073	0.092	0.071	0.091	0.090	0.098	0.121	0.089	0.109	0.102
	(69%)	(56%)	(53%)	(50%)	(49%)	(52%)	(42%)	(45%)	(48%)	(46%)	(48%)	(44%)	(46%)
Other	0.096	0.083	0.078	0.074	0.094	0.066	0.124	0.111	0.106	0.141	0.095	0.142	0.121
	(31%)	(44%)	(47%)	(50%)	(51%)	(48%)	(58%)	(55%)	(52%)	(54%)	(52%)	(56%)	(54%)
4 - Ventura													
EC	0.402	0.210	0.237	0.227	0.224	0.184	0.161	0.130	0.147	0.172	0.167	0.210	0.155
	(62%)	(49%)	(49%)	(50%)	(47%)	(43%)	(42%)	(33%)	(34%)	(38%)	(40%)	(41%)	(38%)
Other	0.245	0.218	0.250	0.227	0.253	0.242	0.221	0.267	0.285	0.285	0.256	0.307	0.250
	(38%)	(51%)	(51%)	(50%)	(53%)	(57%)	(58%)	(67%)	(66%)	(62%)	(60%)	(59%)	(62%)
5 - South Coast													
EC	0.921	0.459	0.339	0.379	0.421	0.346	0.305	0.274	0.302	0.352	0.210	0.213	0.199
	(63%)	(43%)	(37%)	(41%)	(31%)	(37%)	(31%)	(27%)	(32%)	(33%)	(29%)	(23%)	(22%)
Other	0.547	0.616	0.567	0.548	0.944	0.580	0.688	0.753	0.657	0.727	0.518	0.702	0.708
	(37%)	(57%)	(63%)	(59%)	(69%)	(63%)	(69%)	(73%)	(68%)	(67%)	(71%)	(77%)	(78%)

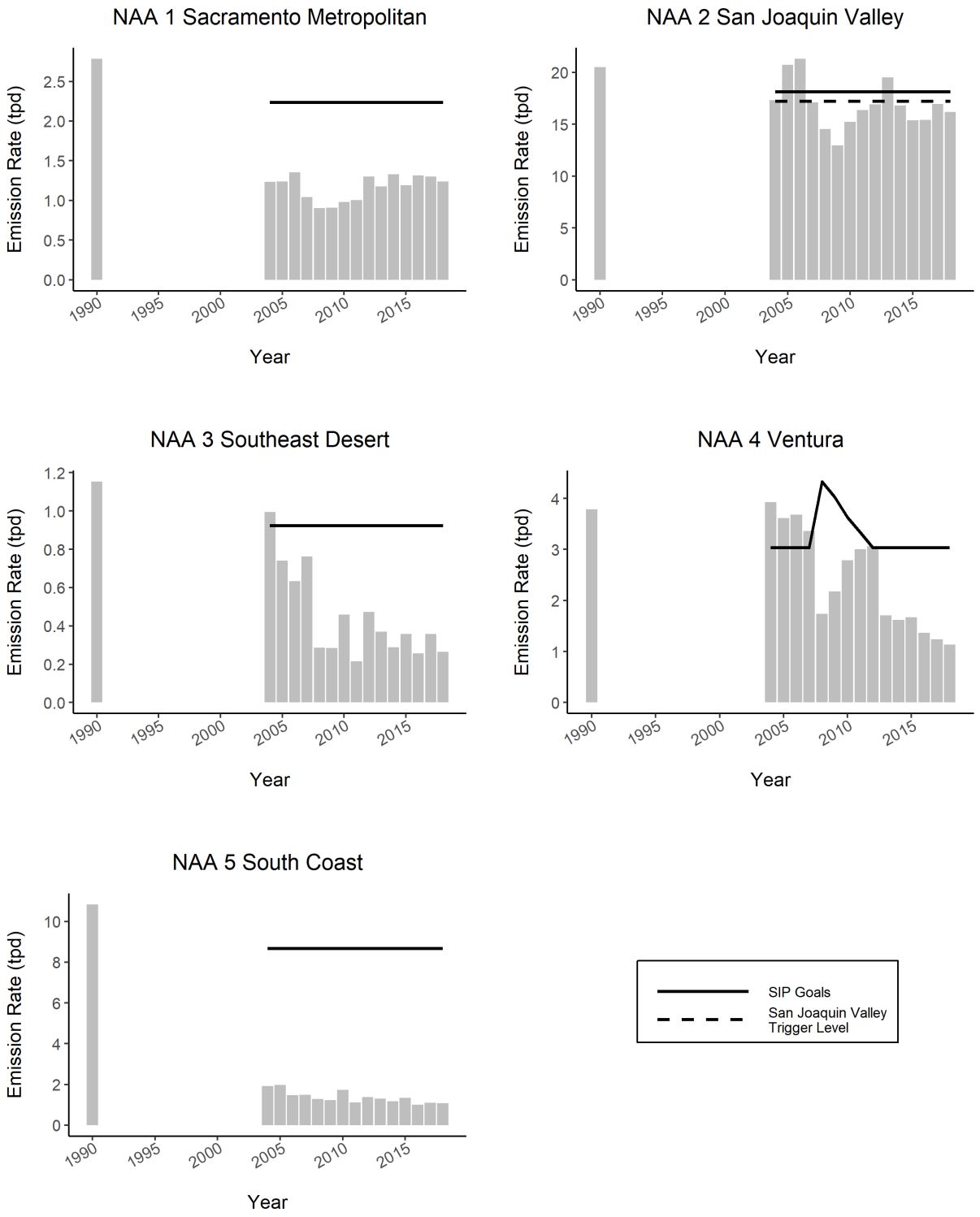

Figure 3: Emissions by nonattainment area (NAA) during 1990 and 2004-2018. These figures show annual emissions and SIP goals (reduction goals from 1990 emissions).

Sacramento Metro NAA (1)

In the Sacramento Metro NAA (1), 2018 emissions decreased by 5% (-0.059 tpd) from 1.299 tpd in 2017 to 1.239 tpd. Emissions in 2018 were 41% (-0.851 tpd) below the regulatory trigger level (95% of the SIP goal) of 2.1 tpd (Figure 3; Table 6).

Figure 4 and Tables 7 and 9 illustrate emissions in 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations, and all other nonfumigants. In 2018, nonfumigants contributed 84% of emissions; fumigants contributed 16%. Nonfumigant emissions decreased by 9% (-0.107 tpd), from 1.153 tpd in 2017 to 1.046 tpd. Fumigant emissions increased by 33% (0.048 tpd), from 0.145 tpd in 2017 to 0.193 tpd. Products with emulsifiable concentrate formulations accounted for 42% and 36%, respectively, of nonfumigant and total emissions. Emissions from these products decreased by 23% (-0.134 tpd), from 0.579 tpd in 2017 to 0.444 tpd.

Table 10 shows emissions from products whose AIs were the top ten contributors to 2018 emissions in the Sacramento Metro NAA (1), representing 46% of total emissions. Figure 5 and Tables A3-1a to A3-1d illustrate trends in emissions for these AIs between 2015 and 2018. Seven of the top ten emitting AIs in 2018 were also among the top ten in 2017. Of these, four AIs increased emissions: thiobencarb; propanil; bifenthrin; and glyphosate, isopropylamine salt. Propanil had the largest increase in emissions for this group: 23% (0.012 tpd). Three of these AIs decreased emissions: abamectin, trifluralin, and oxyfluorfen. Trifluralin had the largest decrease in emissions for this group: 43% (-0.032 tpd). At 8% of total emissions, 1,3-dichloropropene had the highest emissions (0.100 tpd) of any other AI used in this NAA. 1,3-dichloropropene had the largest percentage change in emissions: 794% (0.089 tpd).

Table 11 shows emissions from the top ten contributing crops/sites in 2018 in the Sacramento Metro NAA (1), representing 84% of total emissions. Figure 6 and Tables A3-1e to A3-1h illustrate trends in emissions for these sites between 2015 and 2018. Nine of the top ten emitting sites in 2018 were also among the top ten in 2017. Of these, three sites increased emissions: rice (all or unspecified), walnut, and almond. Walnut had the largest increase in emissions for this group: 83% (0.121 tpd). Six of these sites decreased emissions: tomatoes (processing/canning), grapes (wine), structural pest control, landscape maintenance, sunflower, and soil application (preplant-outdoor). Sunflower had the largest decrease in emissions for this group: 60% (-0.047 tpd). At 22% of total emissions, rice (all or unspecified) had the highest emissions (0.273 tpd) of any other site in this NAA. Walnut had the largest percentage change in emissions: 83% (0.121 tpd).

Tables 12 and A2-1i to A2-1l show this NAA's unadjusted 2018 emissions using the ARB California Emissions Inventory Development and Reporting System (CEIDARS) emissions inventory classifications. Unadjusted emissions from agricultural applications of methyl bromide decreased 80% (-0.174 tpd), from 0.217 tpd in 2017 to 0.043 tpd. Unadjusted emissions from agricultural applications of non-methyl bromide products increased 31% (0.353 tpd), from 1.125 tpd to 1.479 tpd. Emissions from structural applications of methyl bromide continued to be below a reportable level. Unadjusted emissions from structural applications of non-methyl bromide products decreased 29% (-0.022 tpd), from 0.076 tpd to 0.054 tpd.

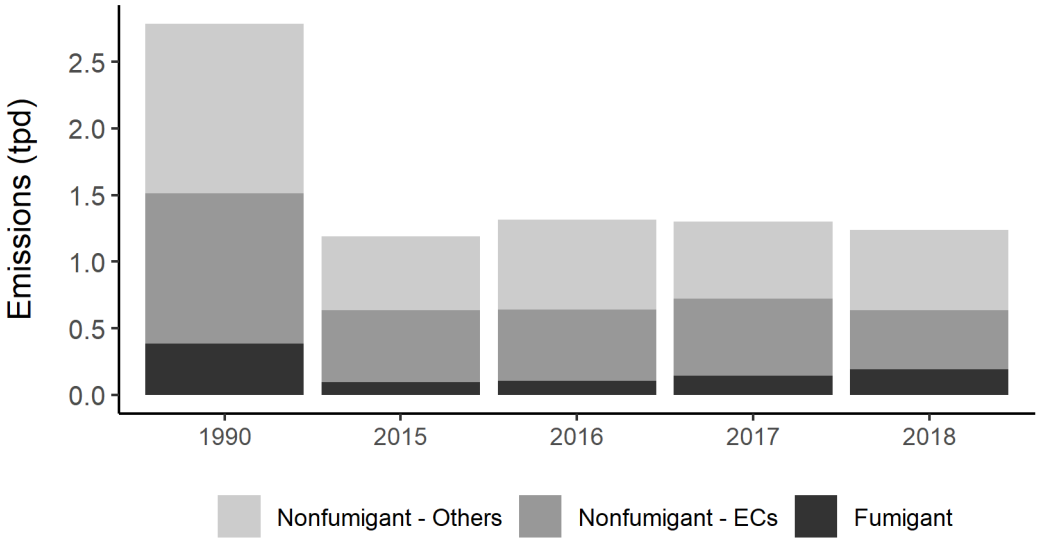

Figure 4: Emissions for the Sacramento Metro NAA (1) during 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are adjusted to account for fumigation method. The adjusted and unadjusted emissions for nonfumigants are equivalent.

Table 10: Top ten primary active ingredients (AIs) contributing to emissions in the Sacramento Metro NAA (1) during 2018.

Primary AI	**Product Emissions (tpd)**	**Percent of Total Emissions**	**Percent Change from 2017 to 2018**	**Change from 2017 to 2018 (tpd)**
1,3-DICHLOROPROPENE	0.100	8.18	794	0.089
THIOBENCARB	0.074	6.04	5	0.004
PROPANIL	0.062	5.08	23	0.012
ABAMECTIN	0.055	4.52	-22	-0.015
BIFENTHRIN	0.054	4.36	1	0.001
CHLOROPICRIN	0.053	4.35	125	0.030
GLYPHOSATE, ISOPROPYLAMINE SALT	0.043	3.49	7	0.003
TRIFLURALIN	0.042	3.43	-43	-0.032
OXYFLUORFEN	0.040	3.27	-2	-0.001
GLUFOSINATE-AMMONIUM	0.040	3.26	27	0.009

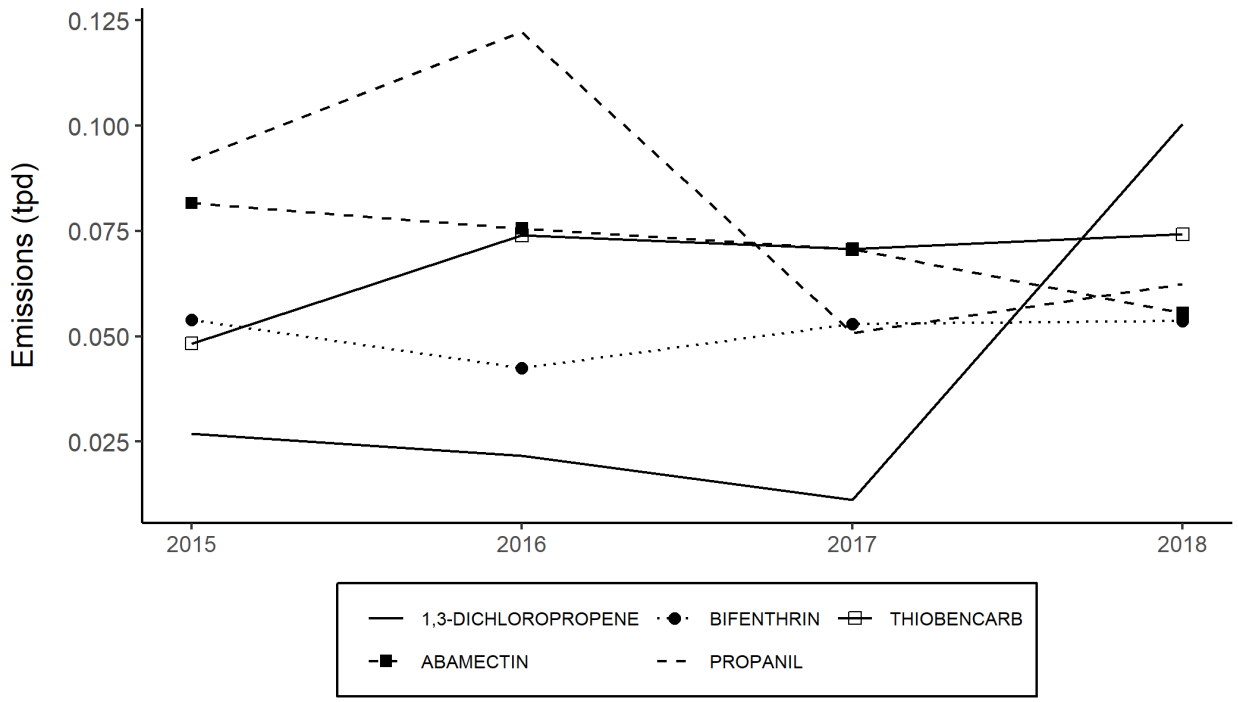

Figure 5: Emissions from products containing the top five active ingredients (AIs) by emissions in the Sacramento Metro NAA (1) from 2015 to 2018.

Table 11: Top ten application sites contributing to emissions in the Sacramento Metro NAA (1) during 2018.

Application Sites	**Product Emissions (tpd)**	**Percent of Total Emissions**	**Percent Change from 2017 to 2018**	**Change from 2017 to 2018 (tpd)**
RICE (ALL OR UNSPECIFIED)	0.273	22.04	33	0.068
WALNUT	0.267	21.55	83	0.121
ALMOND	0.121	9.75	9	0.010
TOMATOES (PROCESSING/CANNING)	0.094	7.56	-23	-0.027
GRAPES (WINE)	0.090	7.27	-23	-0.027
STRUCTURAL PEST CONTROL	0.054	4.34	-30	-0.023
LANDSCAPE MAINTENANCE	0.046	3.74	-7	-0.003
RIGHTS OF WAY	0.033	2.67	-11	-0.004
SUNFLOWER	0.031	2.51	-60	-0.047
SOIL APPLICATION (PREPLANT-OUTDOOR)	0.026	2.09	-60	-0.039

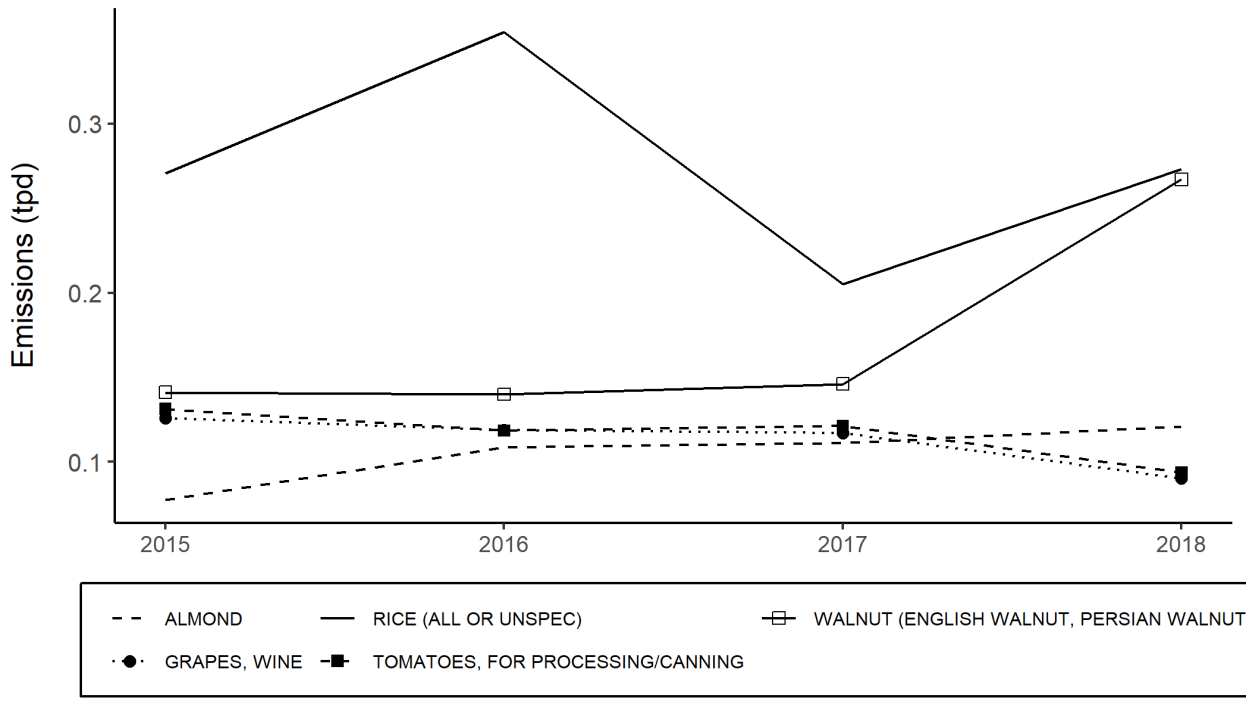

Figure 6: Emissions from the top five crops by emissions in the Sacramento Metro NAA (1) from 2015 to 2018.

Table 12: Unadjusted emissions in the Sacramento Metro NAA (1) during 2018, categorized by the Air Resources Board (ARB) emissions inventory classification.

	Emissions (tpd)	
	Agricultural Applications	**Structural Applications**
METHYL BROMIDE	0.043	<0.001
NON-METHYL BROMIDE	1.479	0.054

San Joaquin Valley NAA (2)

In the San Joaquin Valley NAA (2), 2018 emissions decreased by 5% (-0.798 tpd) from 16.972 tpd in 2017 to 16.174 tpd. Emissions in 2018 were 6% (-1.021 tpd) below the regulatory trigger level (95% of the SIP goal) of 17.2 tpd (Figure 3; Table 6).

Figure 7 and Tables 7 and 9 illustrate emissions in 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations, and all other nonfumigants. In 2018, nonfumigants contributed 76% of emissions; fumigants contributed 24%. Nonfumigant emissions decreased by 4% (-0.529 tpd), from 12.752 tpd in 2017 to 12.223 tpd. Fumigant emissions decreased by 6% (-0.268 tpd), from 4.219 tpd in 2017 to 3.951 tpd. Products with emulsifiable concentrate formulations accounted for 51% and 38%, respectively, of nonfumigant and total emissions. Emissions from these products decreased by 12% (-0.844 tpd), from 7.041 tpd in 2017 to 6.198 tpd.

Table 13 shows emissions from products whose AIs were the top ten contributors to 2018 emissions in the San Joaquin Valley NAA (2), representing 52% of total emissions. Figure 8 and Tables A3-2a to A3-2d illustrate trends in emissions for these AIs between 2015 and 2018. The top ten emitting AIs in 2018 were also the top ten in 2017. Of these, five AIs increased emissions: 1,3-dichloropropene; abamectin; glyphosate, isopropylamine salt; bifenthrin; and glufosinate-ammonium. Bifenthrin had the largest increase in emissions for this group: 17% (0.123 tpd). Five of these AIs decreased emissions: hexythiazox, methyl bromide, chlorpyrifos, potassium n-methyldithiocarbamate, and mineral oil. Chlorpyrifos had the largest decrease in emissions for this group: 39% (-0.336 tpd). At 13% of total emissions, 1,3-dichloropropene had the highest emissions (2.082 tpd) of any other AI used in this NAA. Chlorpyrifos had the largest percentage change in emissions: 39% (-0.336 tpd).

Table 14 shows emissions from the top ten contributing crops/sites in 2018 in the San Joaquin Valley NAA (2), representing 74% of total emissions. Figure 9 and Tables A3-2e to A3-2h illustrate trends in emissions for these sites between 2015 and 2018. The top ten emitting sites in 2018 were also the top ten in 2017. Of these, three sites increased emissions: almond, pistachio, and walnut. Almond had the largest increase in emissions for this group: 9% (0.416 tpd). Seven of these sites decreased emissions: cotton (general), orange, grapes, carrots, soil application (preplant-outdoor), grapes (wine), and tomatoes (processing/canning). Cotton (general) had the largest decrease in emissions for this group: 16% (-0.328 tpd). At 33% of total emissions, almond had the highest emissions (5.257 tpd) of any other site in this NAA. Soil application (preplant-outdoor) had the largest percentage change in emissions: 30% (-0.202 tpd).

Tables 15 and A2-2i to A2-2l show this NAA's unadjusted 2018 emissions using the ARB CEIDARS emissions inventory classifications. Unadjusted emissions from agricultural applications of methyl bromide decreased 6% (-0.057 tpd), from 0.952 tpd in 2017 to 0.895 tpd. Unadjusted emissions from agricultural applications of non-methyl bromide products decreased 4% (-0.990 tpd), from 26.114 tpd to 25.124 tpd. Emissions from structural applications of methyl bromide continued to be below a reportable level. Unadjusted emissions from structural applications of non-methyl bromide products increased 9% (0.017 tpd), from 0.195 tpd to 0.212 tpd.

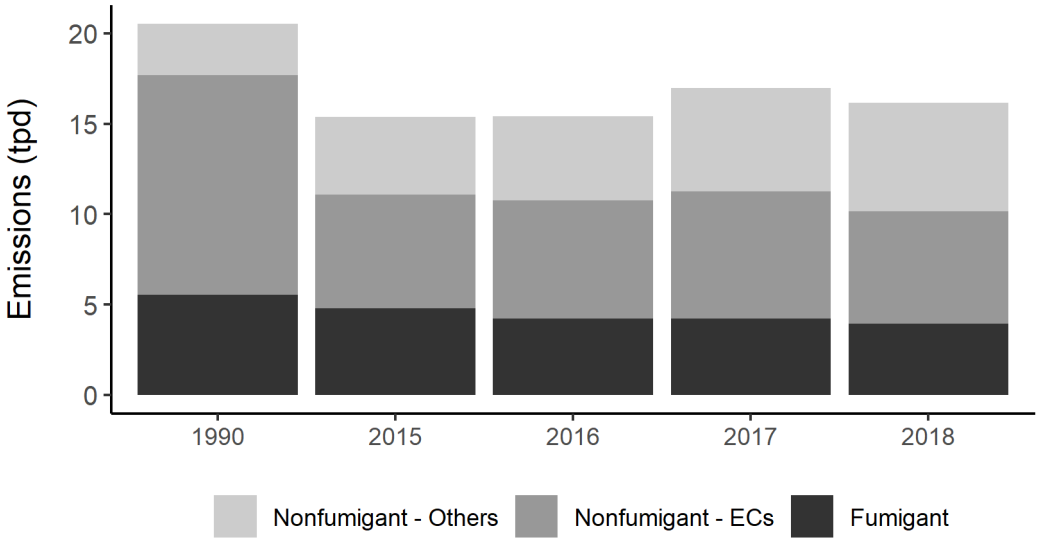

Figure 7: Emissions for the San Joaquin Valley NAA (2) during 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are adjusted to account for fumigation method. The adjusted and unadjusted emissions for nonfumigants are equivalent.

Table 13: Top ten primary active ingredients (AIs) contributing to emissions in the San Joaquin Valley NAA (2) during 2018.

Primary AI	**Product Emissions (tpd)**	**Percent of Total Emissions**	**Percent Change from 2017 to 2018**	**Change from 2017 to 2018 (tpd)**
1,3-DICHLOROPROPENE	2.082	13.06	5	0.095
ABAMECTIN	1.041	6.53	4	0.036
GLYPHOSATE, ISOPROPYLAMINE SALT	0.934	5.86	2	0.019
BIFENTHRIN	0.843	5.29	17	0.123
GLUFOSINATE-AMMONIUM	0.719	4.51	13	0.080
HEXYTHIAZOX	0.639	4.01	-1	-0.008
METHYL BROMIDE	0.527	3.31	-3	-0.018
CHLORPYRIFOS	0.518	3.25	-39	-0.336
POTASSIUM N-METHYLDITHIOCARBAMATE	0.503	3.15	-37	-0.300
MINERAL OIL	0.444	2.79	-1	-0.006

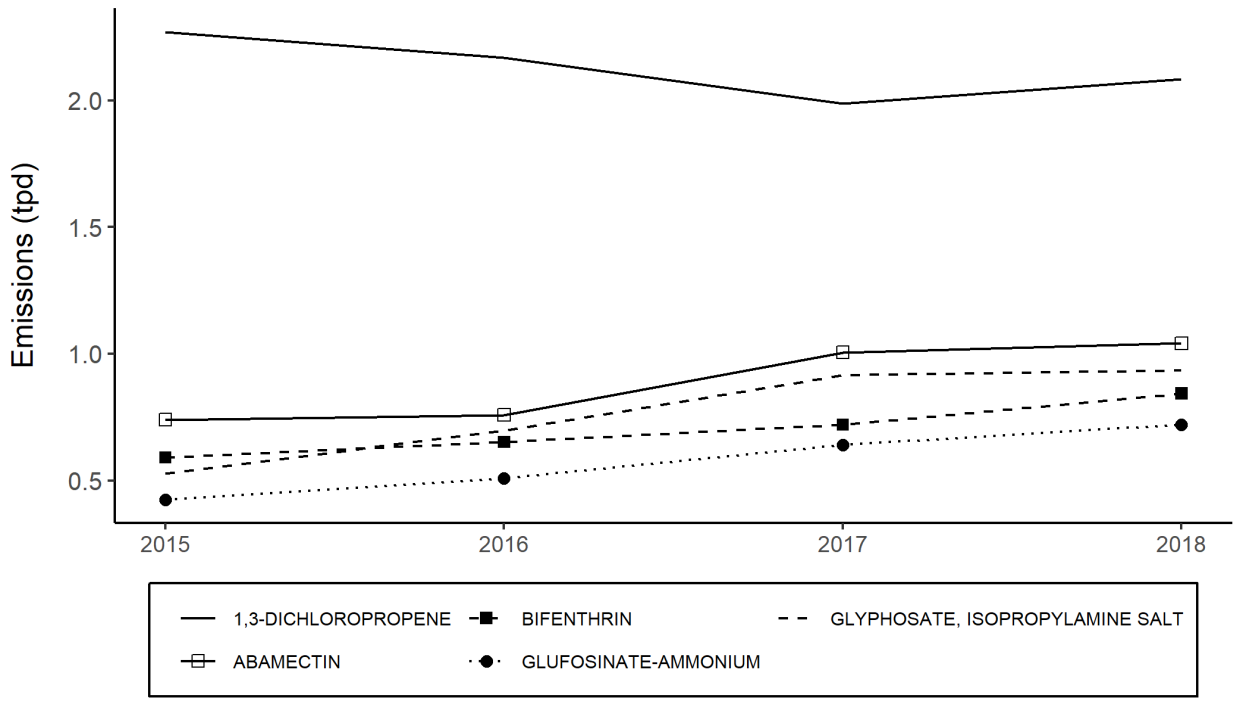

Figure 8: Emissions from products containing the top five active ingredients (AIs) by emissions in the San Joaquin Valley NAA (2) from 2015 to 2018.

Table 14: Top ten application sites contributing to emissions in the San Joaquin Valley NAA (2) during 2018.

Application Sites	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018	Change from 2017 to 2018 (tpd)
ALMOND	5.257	32.50	9	0.416
COTTON (GENERAL)	1.718	10.62	-16	-0.328
PISTACHIO	1.145	7.08	18	0.174
WALNUT	0.713	4.41	7	0.049
ORANGE	0.621	3.84	-15	-0.111
GRAPES	0.594	3.67	-17	-0.123
CARROTS	0.578	3.57	-21	-0.155
SOIL APPLICATION (PREPLANT-OUTDOOR)	0.472	2.92	-30	-0.202
GRAPES (WINE)	0.444	2.75	-1	-0.007
TOMATOES (PROCESSING/CANNING)	0.396	2.45	-16	-0.076

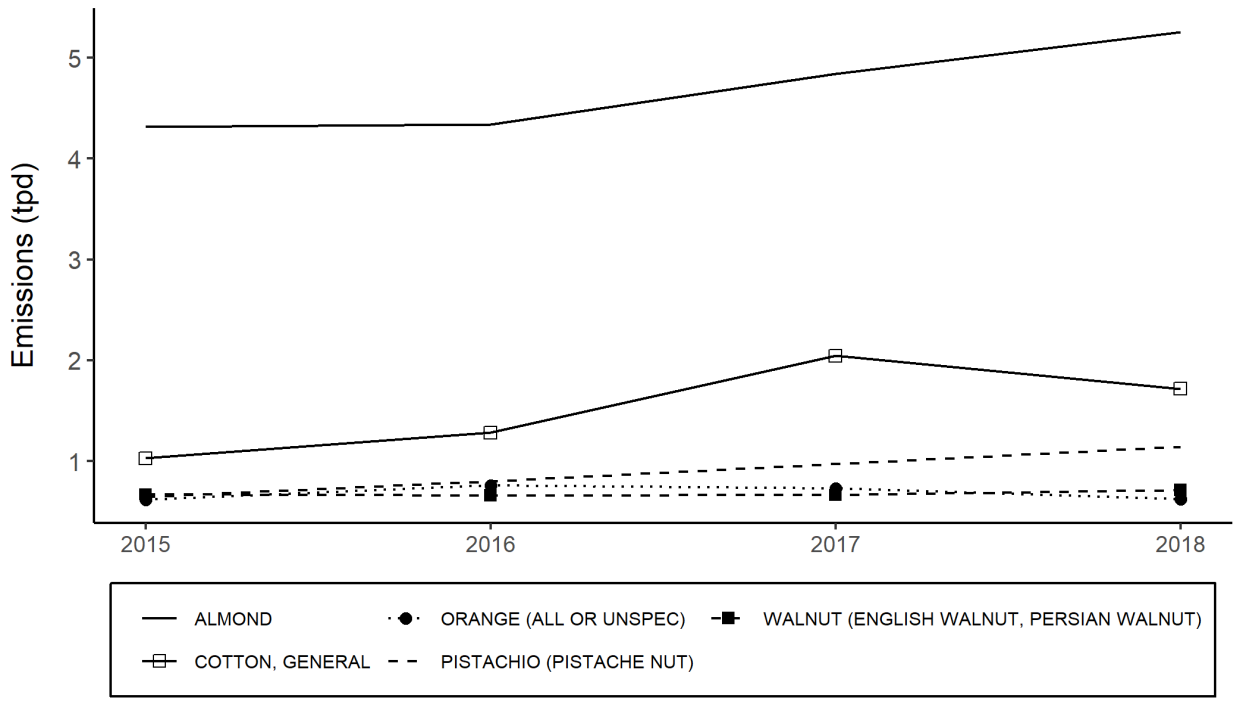

Figure 9: Emissions from the top five crops by emissions in the San Joaquin Valley NAA (2) from 2015 to 2018.

Table 15: Unadjusted emissions in the San Joaquin Valley NAA (2) during 2018, categorized by the Air Resources Board (ARB) emissions inventory classification.

	Emissions (tpd)	
	Agricultural Applications	**Structural Applications**
METHYL BROMIDE	0.895	<0.001
NON-METHYL BROMIDE	25.124	0.212

Southeast Desert NAA (3)

In the Southeast Desert NAA (3), 2018 emissions decreased by 26% (-0.092 tpd) from 0.357 tpd in 2017 to 0.265 tpd. Emissions in 2018 were 70% (-0.609 tpd) below the regulatory trigger level (95% of the SIP goal) of 0.87 tpd (Figure 3; Table 6).

Figure 10 and Tables 7 and 9 illustrate emissions in 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations, and all other nonfumigants. In 2018, nonfumigants contributed 84% of emissions; fumigants contributed 16%. Nonfumigant emissions decreased by 11% (-0.028 tpd), from 0.251 tpd in 2017 to 0.223 tpd. Fumigant emissions decreased by 61% (-0.064 tpd), from 0.106 tpd in 2017 to 0.041 tpd. Products with emulsifiable concentrate formulations accounted for 46% and 39%, respectively, of nonfumigant and total emissions. Emissions from these products decreased by 7% (-0.007 tpd), from 0.109 tpd in 2017 to 0.102 tpd.

Table 16 shows emissions from products whose AIs were the top ten contributors to 2018 emissions in the Southeast Desert NAA (3), representing 58% of total emissions. Figure 11 and Tables A3-3a to A3-3d illustrate trends in emissions for these AIs between 2015 and 2018. Six of the top ten emitting AIs in 2018 were also among the top ten in 2017. Of these, two AIs increased emissions: caprylic acid and EPTC. Caprylic acid had the largest increase in emissions for this group: 46% (0.004 tpd). Four of these AIs decreased emissions: metam-sodium; n-octyl bicycloheptene dicarboximide; glyphosate, isopropylamine salt; and bensulide. Metam-sodium had the largest decrease in emissions for this group: 46% (-0.034 tpd). At 15% of total emissions, metam-sodium had the highest emissions (0.040 tpd) of any other AI used in this NAA. Pyriproxyfen had the largest percentage change in emissions: 2,631% (0.007 tpd).

Table 17 shows emissions from the top ten contributing crops/sites in 2018 in the Southeast Desert NAA (3), representing 82% of total emissions. Figure 12 and Tables A3-3e to A3-3h illustrate trends in emissions for these sites between 2015 and 2018. Eight of the top ten emitting sites in 2018 were also among the top ten in 2017. Of these, two sites increased emissions: landscape maintenance and lemon. Lemon had the largest increase in emissions for this group: 109% (0.011 tpd). Six of these sites decreased emissions: structural pest control, peppers (fruiting vegetable), carrots, rights of way, uncultivated agricultural areas, and lettuce (leaf). Peppers (fruiting vegetable) had the largest decrease in emissions for this group: 44% (-0.029 tpd). At 25% of total emissions, structural pest control had the highest emissions (0.067 tpd) of any other site in this NAA. Eggplant had the largest percentage change in emissions: 1,583% (0.005 tpd).

Tables 18 and A2-3i to A2-3l show this NAA's unadjusted 2018 emissions using the ARB CEIDARS emissions inventory classifications. Unadjusted emissions from agricultural applications of methyl bromide decreased >99% (-0.034 tpd), from 0.034 tpd in 2017 to <0.001 tpd. Unadjusted emissions from agricultural applications of non-methyl bromide products decreased 10% (-0.039 tpd), from 0.371 tpd to 0.333 tpd. Emissions from structural applications of methyl bromide continued to be below a reportable level. Unadjusted emissions from structural applications of non-methyl bromide products decreased 13% (-0.010 tpd), from 0.077 tpd to 0.067 tpd.

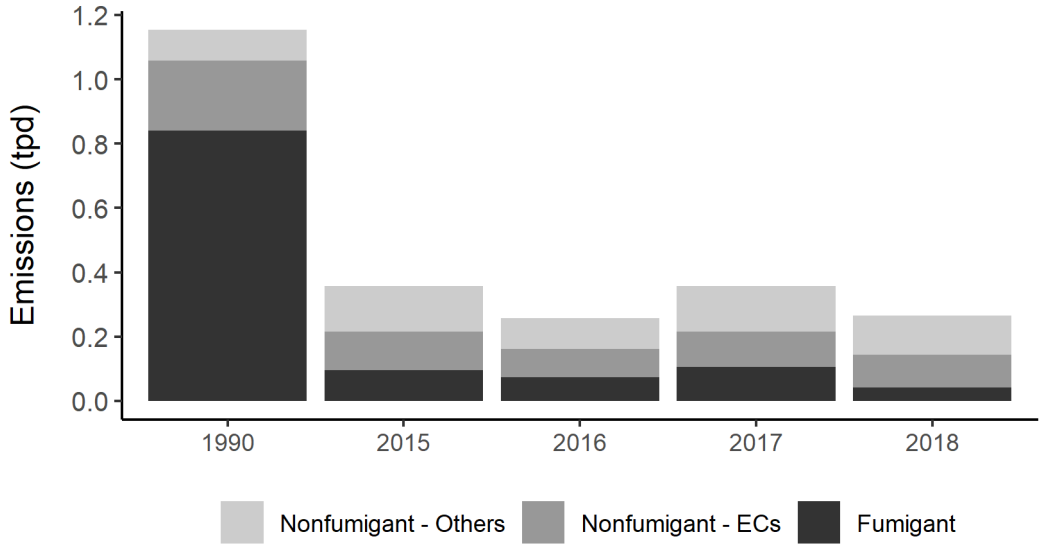

Figure 10: Emissions for the Southeast Desert NAA (3) during 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are adjusted to account for fumigation method. The adjusted and unadjusted emissions for nonfumigants are equivalent.

Table 16: Top ten primary active ingredients (AIs) contributing to emissions in the Southeast Desert NAA (3) during 2018.

Primary AI	**Product Emissions (tpd)**	**Percent of Total Emissions**	**Percent Change from 2017 to 2018**	**Change from 2017 to 2018 (tpd)**
METAM-SODIUM	0.040	15.29	-46	-0.034
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.026	9.96	-18	-0.006
GLYPHOSATE, ISOPROPYLAMINE SALT	0.019	7.15	-22	-0.005
BENSULIDE	0.013	4.83	-25	-0.004
CAPRYLIC ACID	0.012	4.53	46	0.004
EPTC	0.011	4.03	36	0.003
IMIDACLOPRID	0.009	3.53	153	0.006
MEFENOXAM	0.009	3.44	35	0.002
PYRIPROXYFEN	0.007	2.70	2,631	0.007
BIFENTHRIN	0.007	2.62	13	0.001

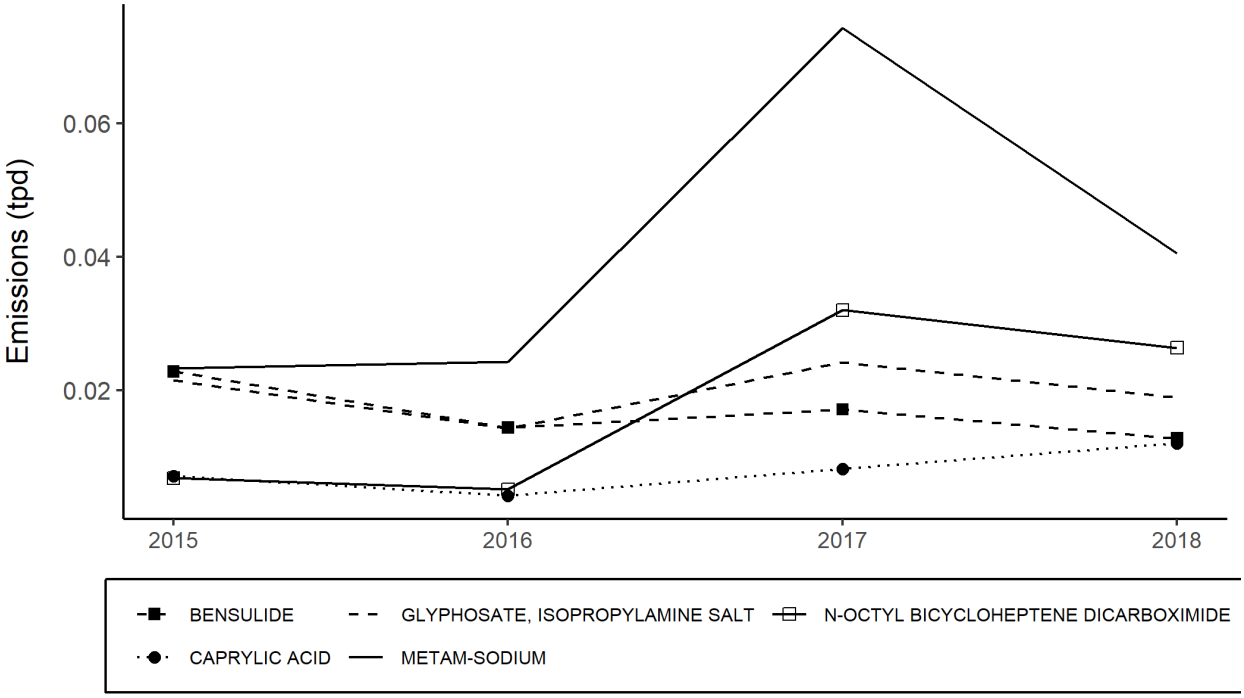

Figure 11: Emissions from products containing the top five active ingredients (AIs) by emissions in the Southeast Desert NAA (3) from 2015 to 2018.

Table 17: Top ten application sites contributing to emissions in the Southeast Desert NAA (3) during 2018.

Application Sites	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018	Change from 2017 to 2018 (tpd)
STRUCTURAL PEST CONTROL	0.067	25.20	-13	-0.010
PEPPERS (FRUITING VEGETABLE)	0.037	14.04	-44	-0.029
LANDSCAPE MAINTENANCE	0.025	9.32	3	0.001
LEMON	0.021	7.93	109	0.011
CARROTS	0.019	7.03	-7	-0.001
RIGHTS OF WAY	0.015	5.81	-56	-0.019
UNCULTIVATED AGRICULTURAL AREAS	0.013	4.98	-17	-0.003
DATE	0.008	3.08	-19	-0.002
LETTUCE (LEAF)	0.007	2.62	-66	-0.013
EGGPLANT	0.005	1.81	1,583	0.005

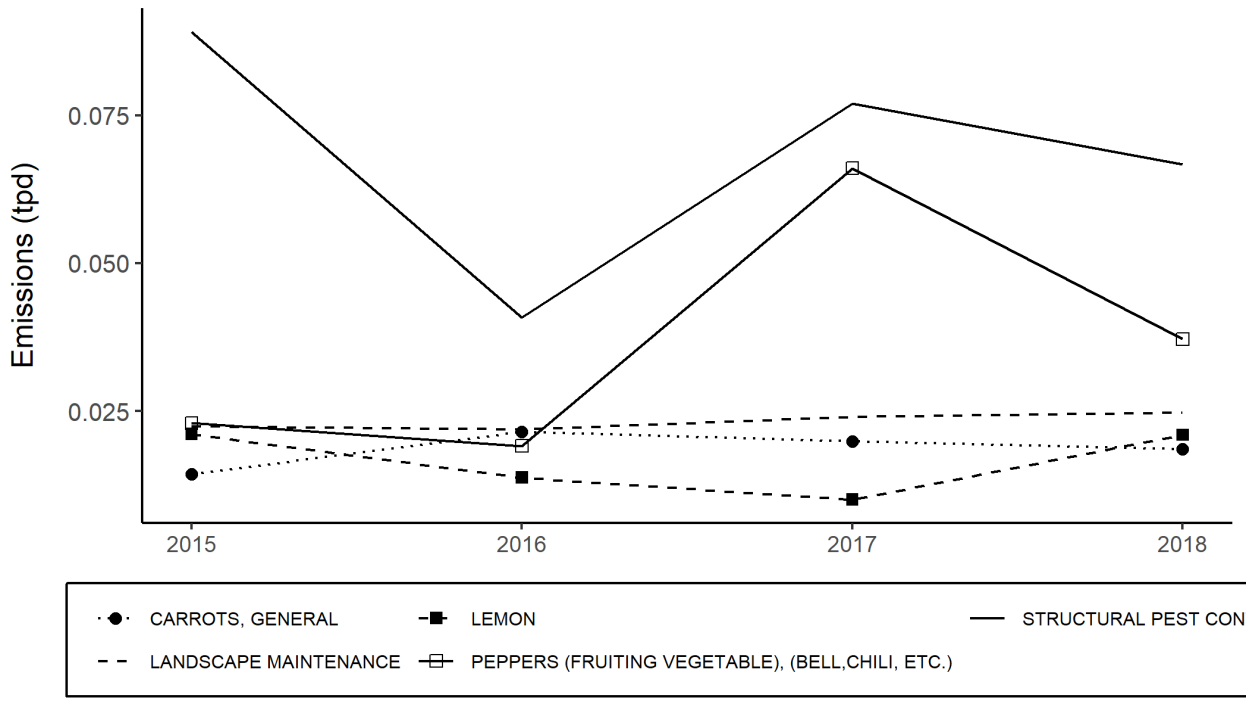

Figure 12: Emissions from the top five crops by emissions in the Southeast Desert NAA (3) from 2015 to 2018.

Table 18: Unadjusted emissions in the Southeast Desert NAA (3) during 2018, categorized by the Air Resources Board (ARB) emissions inventory classification.

	Emissions (tpd)	
	Agricultural Applications	**Structural Applications**
METHYL BROMIDE	<0.001	<0.001
NON-METHYL BROMIDE	0.333	0.067

Ventura NAA (4)

In the Ventura NAA (4), 2018 emissions decreased by 8% (-0.104 tpd) from 1.241 tpd in 2017 to 1.138 tpd. Emissions in 2018 were 60% (-1.712 tpd) below the regulatory trigger level (95% of the SIP goal) of 2.85 tpd (Figure 3; Table 6).

Figure 13 and Tables 7 and 9 illustrate emissions in 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations, and all other nonfumigants. In 2018, nonfumigants contributed 36% of emissions; fumigants contributed 64%. Nonfumigant emissions decreased by 22% (-0.112 tpd), from 0.517 tpd in 2017 to 0.405 tpd. Fumigant emissions increased by 1% (0.008 tpd), from 0.725 tpd in 2017 to 0.733 tpd. Products with emulsifiable concentrate formulations accounted for 38% and 14%, respectively, of nonfumigant and total emissions. Emissions from these products decreased by 26% (-0.055 tpd), from 0.210 tpd in 2017 to 0.155 tpd.

Table 19 shows emissions from products whose AIs were the top ten contributors to 2018 emissions in the Ventura NAA (4), representing 72% of total emissions. Figure 14 and Tables A3-4a to A3-4d illustrate trends in emissions for these AIs between 2015 and 2018. Eight of the top ten emitting AIs in 2018 were also among the top ten in 2017. Of these, three AIs increased emissions: 1,3-dichloropropene; metam-sodium; and glyphosate, isopropylamine salt. 1,3-dichloropropene had the largest increase in emissions for this group: 14% (0.016 tpd). Five of these AIs decreased emissions: chloropicrin, mineral oil, thiram, abamectin, and potassium n-methyldithiocarbamate. Abamectin had the largest decrease in emissions for this group: 71% (-0.048 tpd). At 34% of total emissions, chloropicrin had the highest emissions (0.307 tpd) of any other AI used in this NAA. Imidacloprid had the largest percentage change in emissions: 583% (0.012 tpd).

Table 20 shows emissions from the top ten contributing crops/sites in 2018 in the Ventura NAA (4), representing 89% of total emissions. Figure 15 and Tables A3-4e to A3-4h illustrate trends in emissions for these sites between 2015 and 2018. Eight of the top ten emitting sites in 2018 were also among the top ten in 2017. Of these, two sites increased emissions: strawberry and structural pest control. Strawberry had the largest increase in emissions for this group: 2% (0.019 tpd). Six of these sites decreased emissions: lemon, avocado, celery, raspberry, peppers (fruiting vegetable), and cabbage. Lemon had the largest decrease in emissions for this group: 35% (-0.041 tpd). At 69% of total emissions, strawberry had the highest emissions (0.779 tpd) of any other site in this NAA. Citrus fruits had the largest percentage change in emissions: 2,255% (0.012 tpd).

Tables 21 and A2-4i to A2-4l show this NAA's unadjusted 2018 emissions using the ARB CEIDARS emissions inventory classifications. Unadjusted emissions from agricultural applications of methyl bromide decreased 20% (-0.001 tpd), from 0.006 tpd in 2017 to 0.004 tpd. Unadjusted emissions from agricultural applications of non-methyl bromide products decreased 2% (-0.114 tpd), from 6.454 tpd to 6.340 tpd. Emissions from structural applications of methyl bromide continued to be below a reportable level. Unadjusted emissions from structural applications of non-methyl bromide products increased 10% (0.002 tpd), from 0.025 tpd to 0.028 tpd.

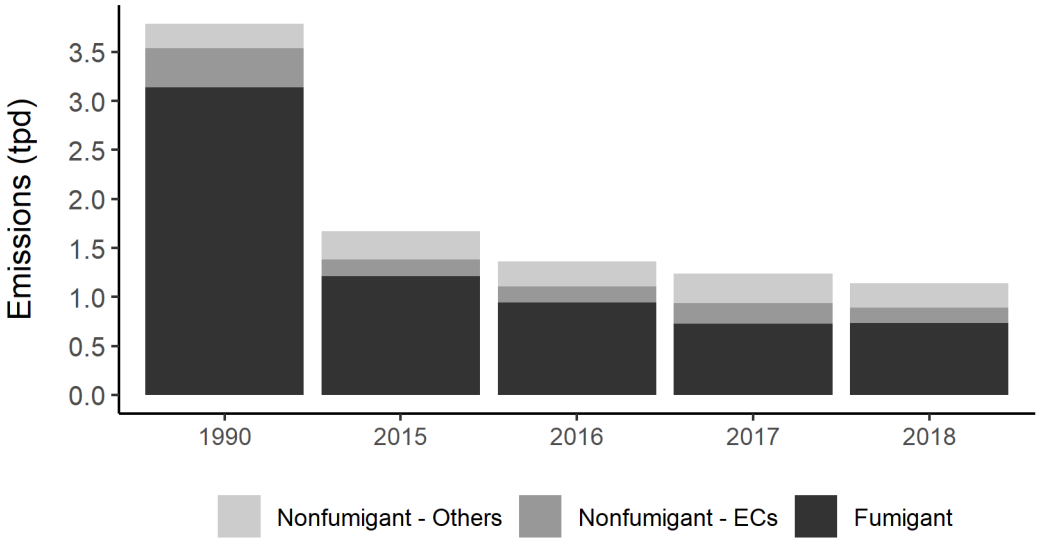

Figure 13: Emissions for the Ventura NAA (4) during 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are adjusted to account for fumigation method. The adjusted and unadjusted emissions for nonfumigants are equivalent.

Table 19: Top ten primary active ingredients (AIs) contributing to emissions in the Ventura NAA (4) during 2018.

Primary AI	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018	Change from 2017 to 2018 (tpd)
CHLOROPICRIN	0.307	33.68	-7	-0.022
1,3-DICHLOROPROPENE	0.130	14.26	14	0.016
MINERAL OIL	0.056	6.19	-17	-0.012
METAM-SODIUM	0.050	5.51	39	0.014
GLYPHOSATE, ISOPROPYLAMINE SALT	0.027	3.01	58	0.010
THIRAM	0.022	2.47	-19	-0.005
ABAMECTIN	0.019	2.11	-71	-0.048
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.017	1.90	28	0.004
POTASSIUM N-METHYLDITHIOCARBAMATE	0.016	1.74	-27	-0.006
IMIDACLOPRID	0.014	1.59	583	0.012

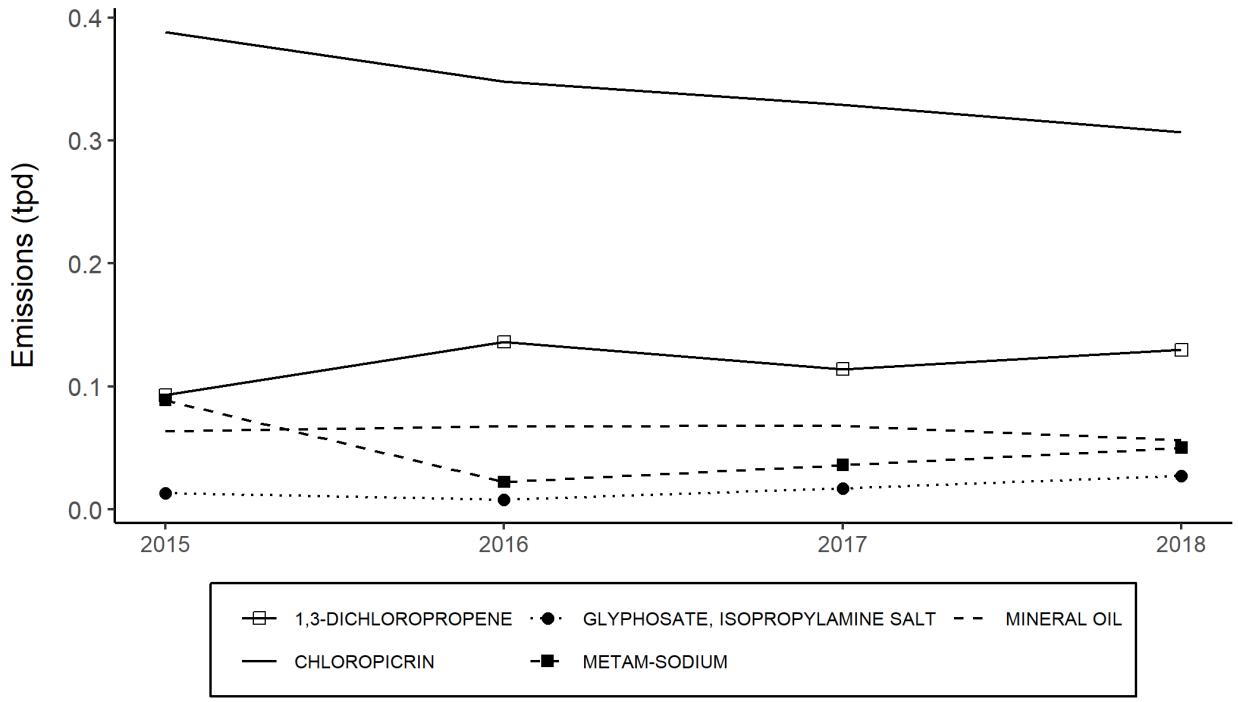

Figure 14: Emissions from products containing the top five active ingredients (AIs) by emissions in the Ventura NAA (4) from 2015 to 2018.

Table 20: Top ten application sites contributing to emissions in the Ventura NAA (4) during 2018.

Application Sites	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018	Change from 2017 to 2018 (tpd)
STRAWBERRY	0.779	68.51	2	0.019
LEMON	0.078	6.86	-35	-0.041
STRUCTURAL PEST CONTROL	0.028	2.43	10	0.002
AVOCADO	0.027	2.35	-60	-0.041
CELERY	0.023	2.05	-8	-0.002
RASPBERRY	0.021	1.81	-28	-0.008
PEPPERS (FRUITING VEGETABLE)	0.020	1.72	-8	-0.002
CABBAGE	0.015	1.28	-12	-0.002
ORNAMENTAL TURF	0.013	1.12	-11	-0.002
CITRUS FRUITS	0.012	1.06	2,255	0.012

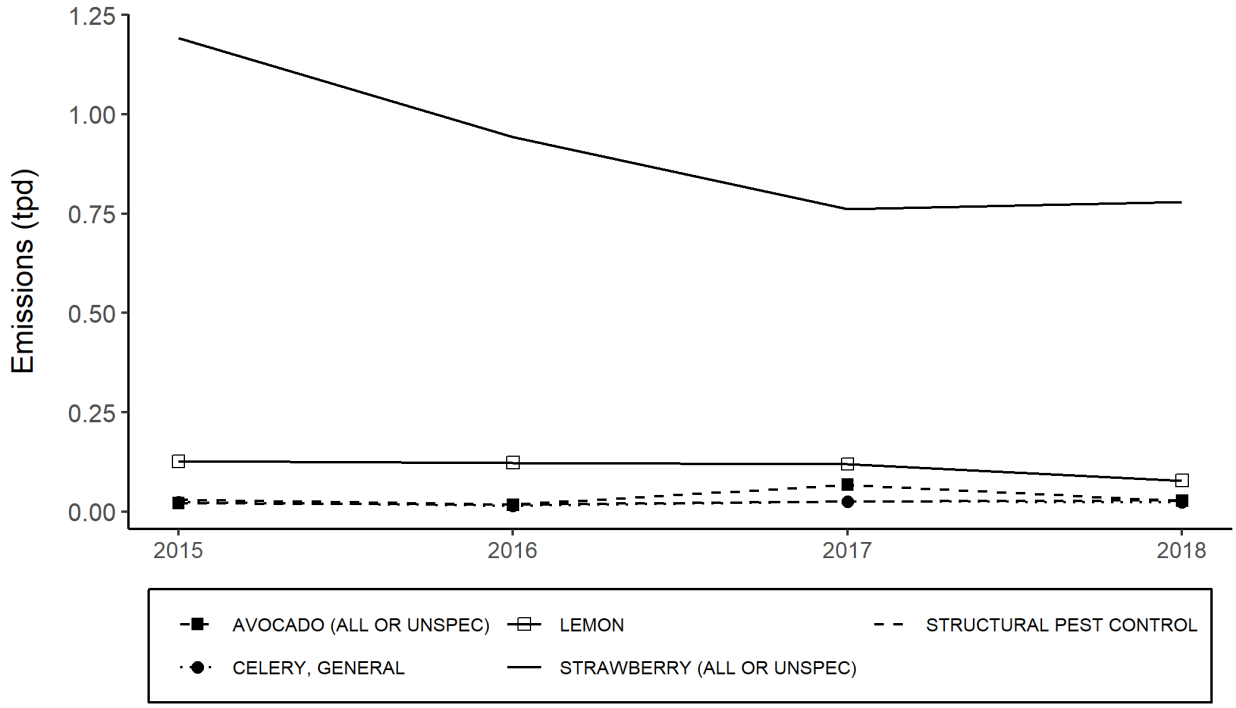

Figure 15: Emissions from the top five crops by emissions in the Ventura NAA (4) from 2015 to 2018.

Table 21: Unadjusted emissions in the Ventura NAA (4) during 2018, categorized by the Air Resources Board (ARB) emissions inventory classification.

	Emissions (tpd)	
	Agricultural Applications	**Structural Applications**
METHYL BROMIDE	0.004	<0.001
NON-METHYL BROMIDE	6.340	0.028

South Coast NAA (5)

In the South Coast NAA (5), 2018 emissions decreased by 3% (-0.031 tpd) from 1.105 tpd in 2017 to 1.075 tpd. Emissions in 2018 were 87% (-7.190 tpd) below the regulatory trigger level (95% of the SIP goal) of 8.3 tpd (Figure 3; Table 6).

Figure 16 and Tables 7 and 9 illustrate emissions in 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations, and all other nonfumigants. In 2018, nonfumigants contributed 84% of emissions; fumigants contributed 16%. Nonfumigant emissions decreased by 1% (-0.008 tpd), from 0.915 tpd in 2017 to 0.907 tpd. Fumigant emissions decreased by 12% (-0.022 tpd), from 0.190 tpd in 2017 to 0.168 tpd. Products with emulsifiable concentrate formulations accounted for 22% and 19%, respectively, of nonfumigant and total emissions. Emissions from these products decreased by 7% (-0.014 tpd), from 0.213 tpd in 2017 to 0.199 tpd.

Table 22 shows emissions from products whose AIs were the top ten contributors to 2018 emissions in the South Coast NAA (5), representing 60% of total emissions. Figure 17 and Tables A3-5a to A3-5d illustrate trends in emissions for these AIs between 2015 and 2018. Seven of the top ten emitting AIs in 2018 were also among the top ten in 2017. Of these, four AIs increased emissions: methyl bromide, piperonyl butoxide, bifenthrin, and permethrin. Methyl bromide had the largest increase in emissions for this group: 73% (0.048 tpd). Three of these AIs decreased emissions: n-octyl bicycloheptene dicarboximide, disodium octaborate tetrahydrate, and metam-sodium. Disodium octaborate tetrahydrate had the largest decrease in emissions for this group: 54% (-0.048 tpd). At 20% of total emissions, n-octyl bicycloheptene dicarboximide had the highest emissions (0.218 tpd) of any other AI used in this NAA. Pyriproxyfen had the largest percentage change in emissions: 644% (0.020 tpd).

Table 23 shows emissions from the top ten contributing crops/sites in 2018 in the South Coast NAA (5), representing 96% of total emissions. Figure 18 and Tables A3-5e to A3-5h illustrate trends in emissions for these sites between 2015 and 2018. Eight of the top ten emitting sites in 2018 were also among the top ten in 2017. Of these, four sites increased emissions: structural pest control, fumigation (other), commodity fumigation, and nursery-outdoor container/field grown plants. Fumigation (other) had the largest increase in emissions for this group: 119% (0.048 tpd). Four of these sites decreased emissions: landscape maintenance, rights of way, strawberry, and avocado. Rights of way had the largest decrease in emissions for this group: 39% (-0.040 tpd). At 58% of total emissions, structural pest control had the highest emissions (0.627 tpd) of any other site in this NAA. Turf had the largest percentage change in emissions: 202% (0.004 tpd).

Tables 24 and A2-5i to A2-5l show this NAA's unadjusted 2018 emissions using the ARB CEIDARS emissions inventory classifications. Unadjusted emissions from agricultural applications of methyl bromide increased 73% (0.048 tpd), from 0.065 tpd in 2017 to 0.113 tpd. Unadjusted emissions from agricultural applications of non-methyl bromide products decreased 45% (-0.396 tpd), from 0.887 tpd to 0.491 tpd. Emissions from structural applications of methyl bromide continued to be below a reportable level. Unadjusted emissions from structural applications of non-methyl bromide products increased 6% (0.035 tpd), from 0.592 tpd to 0.628 tpd.

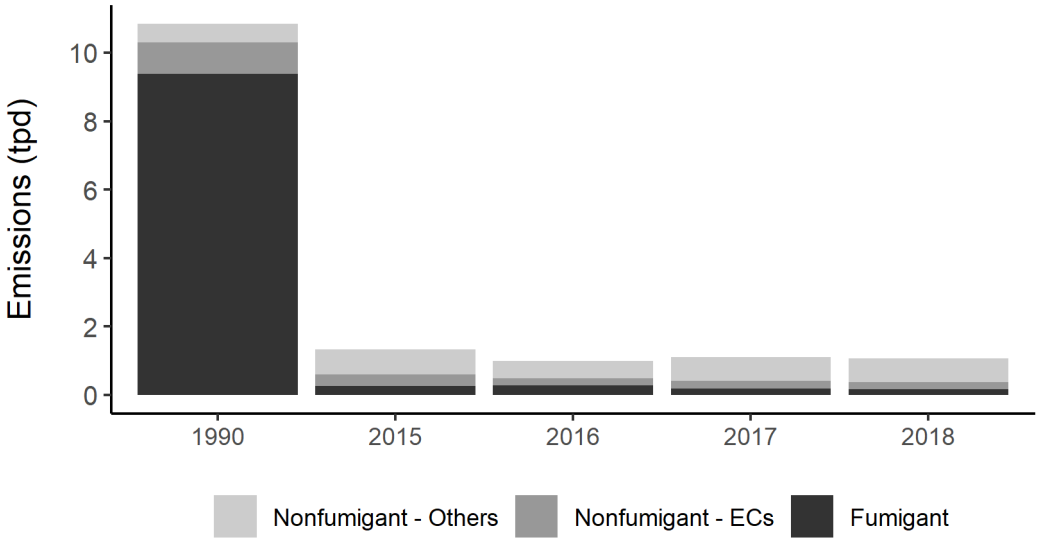

Figure 16: Emissions for the South Coast NAA (5) during 1990 and 2015-2018, categorized as fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are adjusted to account for fumigation method. The adjusted and unadjusted emissions for nonfumigants are equivalent.

Table 22: Top ten primary active ingredients (AIs) contributing to emissions in the South Coast NAA (5) during 2018.

Primary AI	**Product Emissions (tpd)**	**Percent of Total Emissions**	**Percent Change from 2017 to 2018**	**Change from 2017 to 2018 (tpd)**
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.218	20.30	-10	-0.024
METHYL BROMIDE	0.113	10.51	73	0.048
FIPRONIL	0.054	5.08	372	0.043
PIPERONYL BUTOXIDE	0.052	4.89	36	0.014
BIFENTHRIN	0.050	4.67	14	0.006
DISODIUM OCTABORATE TETRAHYDRATE	0.042	3.88	-54	-0.048
METAM-SODIUM	0.032	2.99	-49	-0.031
PERMETHRIN	0.030	2.82	26	0.006
IMIDACLOPRID	0.028	2.60	33	0.007
PYRIPROXYFEN	0.023	2.19	644	0.020

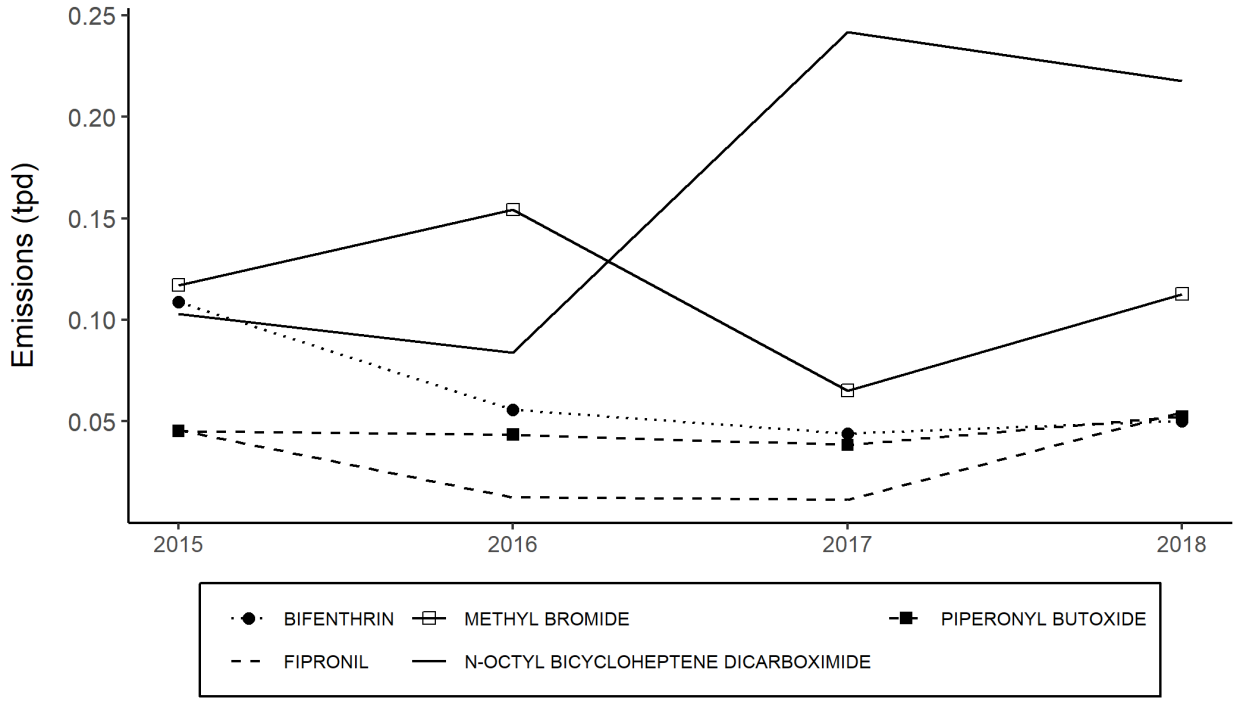

Figure 17: Emissions from products containing the top five active ingredients (AIs) by emissions in the South Coast NAA (5) from 2015 to 2018.

Table 23: Top ten application sites contributing to emissions in the South Coast NAA (5) during 2018.

Application Sites	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018	Change from 2017 to 2018 (tpd)
STRUCTURAL PEST CONTROL	0.627	58.35	6	0.035
LANDSCAPE MAINTENANCE	0.173	16.09	-9	-0.016
FUMIGATION (OTHER)	0.087	8.13	119	0.048
RIGHTS OF WAY	0.063	5.90	-39	-0.040
COMMODITY FUMIGATION	0.026	2.39	1	<0.001
STRAWBERRY	0.017	1.54	-58	-0.023
NURSERY-OUTDOOR CONTAINER/FIELD GROWN PLANTS	0.016	1.53	8	0.001
AVOCADO	0.008	0.78	-20	-0.002
ORANGE	0.007	0.69	1	<0.001
TURF	0.007	0.61	202	0.004

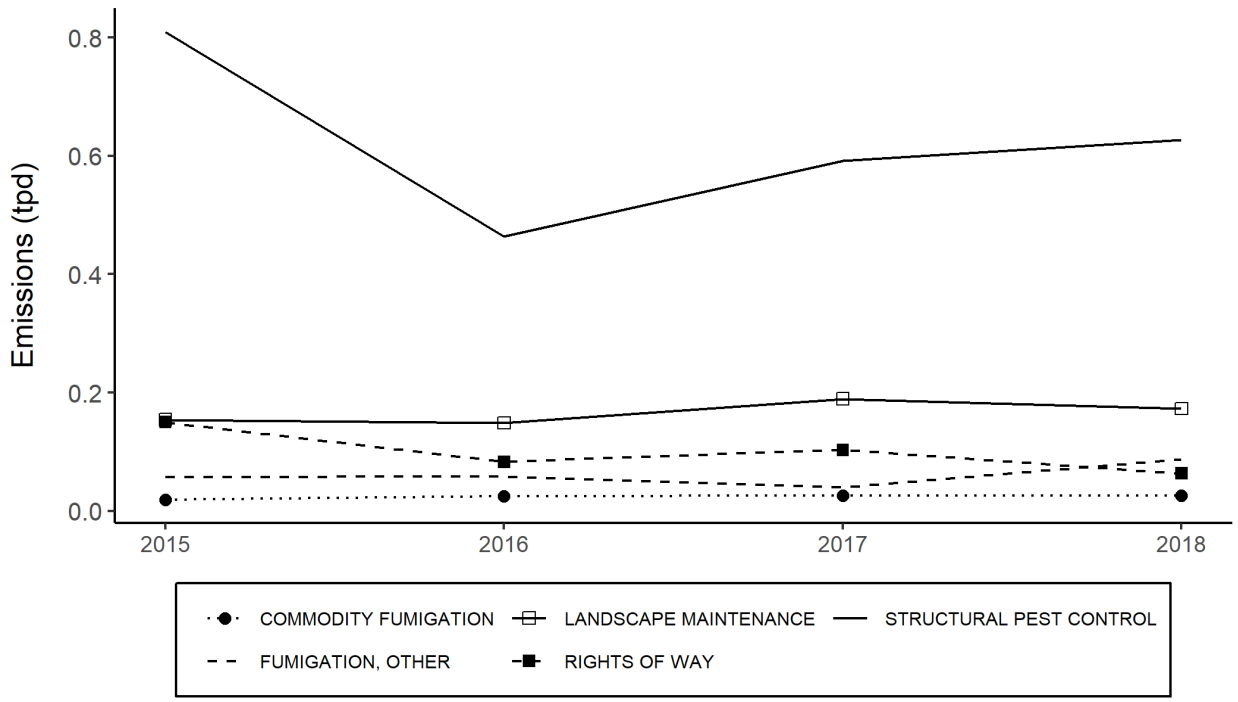

Figure 18: Emissions from the top five crops by emissions in the South Coast NAA (5) from 2015 to 2018.

Table 24: Unadjusted emissions in the South Coast NAA (5) during 2018, categorized by the Air Resources Board (ARB) emissions inventory classification.

	Emissions (tpd)	
	Agricultural Applications	**Structural Applications**
METHYL BROMIDE	0.113	<0.001
NON-METHYL BROMIDE	0.491	0.628

Emissions Relative to Levels that Trigger Additional Restrictions

DPR is required to implement additional VOC restrictions if emissions exceed the trigger levels (95% of the SIP goals) specified in 3 CCR section 6452.2. As shown in Table 25, emissions in 2018 were less than 95% of the benchmarks that trigger additional restrictions in all five NAAs.

Table 25: Trigger levels and 2018 emissions.

NAA	SIP Goal (tpd)	Trigger Level (95% of SIP Goal) (tpd)	2018 Emissions (tpd)
1 - Sacramento Metro	2.2	2.1	1.239
2 - San Joaquin Valley	18.1	17.2	16.174
3 - Southeast Desert	0.92	0.87	0.265
4 - Ventura	3.0	2.85	1.138
5 - South Coast	8.7	8.3	1.075

Emissions reported in the 2013 VOC Emissions Inventory Report for the San Joaquin Valley NAA (2) exceeded the SIP goal by 0.183 tpd. In the 2014 Inventory, calculations for 2013 emissions in the San Joaquin Valley NAA (2) increased to 19.518 tpd, which is 1.418 tpd above the SIP Goal. This increase was largely due to revised thermogravimetrically derived EP values for fenpyroximate and hexythiazox products with emulsifiable concentrate formulations. Exceedance of the trigger level required a prohibition of certain uses of designated nonfumigant high-VOC products. These prohibitions are discussed in the next section.

Nonfumigant Products Designated as High-VOC and Low-VOC and Restrictions for the San Joaquin Valley

Regulations to reduce emissions from certain nonfumigant pesticide products establish criteria to designate certain agricultural products as high-VOC, and these products have restrictions on sales and prohibitions on use when emission limits are triggered. 3 CCR section 6880 establishes the following EP thresholds to designate agricultural products as high-VOC or low-VOC:

Table 26: Emission potential (EP) thresholds for agricultural products with abamectin, chlorpyrifos, gibberellins, or oxyfluorfen as the primary active ingredient (AI).

Primary AI	EP Threshold
ABAMECTIN	35%
CHLORPYRIFOS	25%
GIBBERELLINS	25%
OXYFLUORFEN	15%

If a product contains more than one AI, the primary AI is the one present at the highest percentage in a product. These criteria do not apply to products that contain an AI listed above, but not as the primary AI, including products with one or more AIs present at the same percentage.

Products labeled only for non-agricultural uses are excluded from the proposed regulations. Non-agricultural uses include: a) home use; b) use in structural pest control; c) industrial or institutional use; d) control of an animal pest under the written prescription of a veterinarian; or e) vector control. All other uses are considered agricultural. DPR classifies products containing any of the four pesticides listed above into three groups:

- **High-VOC product**: a) contains any of the four pesticides as a primary AI; and b) labeled for agricultural use; and c) the EP is greater than the threshold.
- **Low-VOC product**: a) contains any of the four pesticides as a primary AI; and b) labeled for agricultural use; and c) the EP is equal to or less than the threshold.
- **Excluded product**: a) contains any of the four pesticides, but not as a primary AI; or b) labeled for non-agricultural use only.

Appendix 4 lists the currently registered products designated as high-VOC or low-VOC.

A key restriction (3 CCR section 6883) requires growers to obtain a recommendation from a pest control adviser for the following:

- High-VOC products containing abamectin, chlorpyrifos, gibberellins, or oxyfluorfen; and
- Applied in San Joaquin Valley; and
- Applied between May 1 and October 31; and
- Application made to alfalfa, almonds, citrus, cotton, grapes, pistachios, or walnuts.

DPR's 2013 emissions inventory for the San Joaquin Valley NAA (2) exceeded the SIP goal. Therefore, in 2014, DPR enacted prohibitions of certain uses of designated high-VOC products from May 1 through October 31 of 2015 and 2016, as required by 3 CCR section 6452.2(f), with the following exceptions included in the regulations:

- Use of chlorpyrifos products to control aphids on cotton.
- Use of gibberellins products when applied at an application rate of 16 grams of AI per acre or less.
- Use of oxyfluorfen products when applied at an application rate of 0.125 (1/8) pounds of AI per acre or less.
- Uses for which the U.S. EPA has issued an emergency exemption from registration under Section 18 of the Federal Insecticide, Fungicide, and Rodenticide Act.
- Uses registered as a Special Local Need under Section 24(c) of the Federal Insecticide, Fungicide, and Rodenticide Act.
- Applications made by or under the direction of the U.S. Department of Agriculture, the California Department of Food and Agriculture, or county agricultural commissioner to control, suppress, or eradicate pests.
- Applications using precision spray technology meeting the criteria of the California Office of the Natural Resources Conservation Service's Environmental Quality Incentives Program.

Prohibitions on the use of high-VOC products with abamectin, chlorpyrifos, gibberellins, and oxyfluorfen AIs on alfalfa, almonds, citrus, cotton, grapes, pistachios and walnuts were in effect between May 1 and October 31 during 2017 and 2018.

Table 27 shows contributions to 2018 emissions of each of the four primary AIs subject to San Joaquin Valley NAA (2) nonfumigant regulations: abamectin, chlorpyrifos, gibberellins, and oxyfluorfen. These four primary AIs contributed a combined 13% of the total emissions in this NAA in 2018.

Table 28 shows the 2017 and 2018 emissions from products designated as high- and low-VOC for each primary AI subject to the nonfumigant regulations (3 CCR section 6880), as well as the combined high- and low-VOC product emissions totals. In 2018, combined emissions from high-VOC products increased 10% (0.066 tpd), from 0.644 tpd in 2017 to 0.710 tpd. During the same period, combined emissions from low-VOC products decreased by 21% (-0.356 tpd), from 1.689 tpd in 2017 to 1.333 tpd.

Table 29 shows 2017 and 2018 emissions from high- and low-VOC products applied to seven target crops/sites subject to the nonfumigant regulatory restrictions in the San Joaquin Valley NAA (2). The greatest decrease in high-VOC product emissions was a 65% (-0.166 tpd) decrease in emissions from applications of chlorpyrifos products on citrus. The greatest increase in high-VOC product

emissions was a 147% (0.034 tpd) increase in emissions from applications of abamectin products on almond.

Table 30 shows increases in the use of gibberellins and oxyfluorfen in 2018. Roughly 2.8 million pounds of products containing abamectin, chlorpyrifos, gibberellin and oxyfluorfen as the primary AI were used in the San Joaquin Valley NAA (2), compared to 3.3 million pounds in 2017.

Table 27: Emissions from applications of products containing the active ingredients (AIs) abamectin, chlorpyrifos, gibberellins, and oxyfluorfen on all commodity sites in the San Joaquin Valley NAA (2) during 2018.

Primary AI	Product Emissions (tpd)	Percent of Total Emissions	Percent Change from 2017 to 2018
ABAMECTIN	1.041	6.53	4
CHLORPYRIFOS	0.518	3.25	-39
GIBBERELLINS	0.067	0.42	-1
OXYFLUORFEN	0.418	2.62	2

Table 28: Emissions from applications of products containing the active ingredients (AIs) abamectin, chlorpyrifos, gibberellins, and oxyfluorfen on all commodity sites in the San Joaquin Valley NAA (2) during 2017 and 2018, categorized as high- or low-VOC.

	Emissions (tpd)		Percent of Emissions from All Products with this Active Ingredient		Percent of Total Nonfumigant Emissions	
Primary AI	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**
ABAMECTIN						
High-VOC	0.130	0.200	12.9%	19.2%	1.0%	1.6%
Low-VOC	0.875	0.841	87.1%	80.8%	6.9%	6.9%
CHLORPYRIFOS						
High-VOC	0.136	0.126	16.0%	24.3%	1.1%	1.0%
Low-VOC	0.717	0.392	84.0%	75.7%	5.6%	3.2%
GIBBERELLINS						
High-VOC	0.010	0.007	14.5%	9.9%	0.1%	0.1%
Low-VOC	0.057	0.060	85.5%	90.1%	0.4%	0.5%
OXYFLUORFEN						
High-VOC	0.368	0.378	90.2%	90.4%	2.9%	3.1%
Low-VOC	0.040	0.040	9.8%	9.6%	0.3%	0.3%
COMBINED						
Low-VOC	1.689	1.333	72.4%	65.2%	13.2%	10.9%
High-VOC	0.644	0.710	27.6%	34.8%	5.1%	5.8%

Table 29: Emissions from applications of products containing the active ingredients (AIs) abamectin, chlorpyrifos, gibberellins, and oxyfuorfen on alfalfa, almonds, citrus, cotton, grapes, pistachios, and walnuts in the San Joaquin Valley NAA (2) during 2017 and 2018, categorized by crop and as high- or low-VOC.

	Emissions from High- and Low-VOC Products (tpd)																	
	Alfalfa		Almond		Citrus†		Cotton		Grape†		Pistachio		Walnut		Total		All Crops	
Primary AI	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**	**2017**	**2018**
High-VOC																		
ABAMECTIN	<0.001		0.023	0.057	0.028	0.026	0.002	0.014	0.012	0.010	<0.001		<0.001	0.001	0.066	0.108	0.130	0.200
CHLORPYRIFOS	0.001	<0.001	0.022	0.021	<0.001	<0.001	0.108	0.100	<0.001				0.001	<0.001	0.133	0.123	0.136	0.126
GIBBERELLINS					0.001	0.002			0.008	0.004					0.009	0.006	0.010	0.007
OXYFLUORFEN	<0.001	<0.001	0.249	0.249	0.001	0.002	0.002	0.001	0.013	0.009	0.028	0.042	0.037	0.039	0.330	0.343	0.368	0.378
COMBINED	0.001	0.001	0.295	0.328	0.030	0.030	0.113	0.115	0.033	0.024	0.028	0.042	0.039	0.040	0.537	0.580	0.644	0.710
Low-VOC																		
ABAMECTIN	<0.001	<0.001	0.403	0.422	0.051	0.046	0.140	0.102	0.128	0.131	0.004	0.004	0.048	0.054	0.775	0.760	0.875	0.841
CHLORPYRIFOS	0.067	0.018	0.144	0.130	0.255	0.089	0.132	0.091	0.053	0.048			0.048	0.011	0.700	0.385	0.717	0.392
GIBBERELLINS					0.038	0.037			0.017	0.020	<0.001				0.055	0.057	0.057	0.060
OXYFLUORFEN			0.019	0.019	<0.001	<0.001	0.001	0.001	0.006	0.006	0.005	0.006	0.004	0.003	0.034	0.035	0.040	0.040
COMBINED	0.067	0.018	0.567	0.571	0.344	0.172	0.273	0.193	0.205	0.205	0.009	0.011	0.100	0.068	1.564	1.238	1.689	1.333

* Citrus comprises the following commodity sites reported in 2018: citrus fruits, grapefruit, lemon, lime, orange, pomelo, tangelo, tangerine (mandarin, satsuma, murcott, etc.).

† Grape comprises the following commodity sites reported in 2018: grapes; grapes, wine.

Table 30: Pounds of product and active ingredient (AI) used and emissions in the San Joaquin Valley NAA (2) during 2018.

Primary AI		**2017**	**2018**	**Change**
ABAMECTIN	Products (lbs x 10^3)	1,350	1,388	39
	Active ingredient (lbs x 10^3)	34	33	-1
	VOC/product (lbs/lb)	0.273	0.274	0.002
CHLORPYRIFOS	Products (lbs x 10^3)	1,439	854	-585
	Active ingredient (lbs x 10^3)	575	350	-225
	VOC/product (lbs/lb)	0.217	0.222	0.005
GIBBERELLINS	Products (lbs x 10^3)	156	175	20
	Active ingredient (lbs x 10^3)	13	15	2
	VOC/product (lbs/lb)	0.158	0.139	-0.019
OXYFLUORFEN	Products (lbs x 10^3)	389	396	7
	Active ingredient (lbs x 10^3)	116	119	3
	VOC/product (lbs/lb)	0.384	0.386	0.002
COMBINED	Products (lbs x 10^3)	3,334	2,814	-520
	Active ingredient (lbs x 10^3)	738	517	-221
	VOC/product (lbs/lb)	0.256	0.266	0.010

If prohibitions for high-VOC nonfumigant products are in effect, those prohibitions must remain in effect until the hypothetical emissions shown in the Annual VOC Emissions Inventory Report comply with the trigger level of 17.2 tpd specified in 3 CCR section 6452.2(f) for at least two consecutive years. The hypothetical emissions during a year of prohibitions shall be calculated for each AI used on each crop specified in 3 CCR section 6884. The hypothetical emissions shall be calculated by assuming the relative mixture of high- and low-VOC products used in the current year of prohibitions would have been the same as in the most recent year without prohibitions. The emissions are then calculated using that product mixture for the amount of AI used in the current year.

The following formula is used to calculate the hypothetical emissions described above for each pesticide-crop combination:

$$\text{Hypothetical emissions for a pesticide-crop combination listed in 3 CCR section 6884 during May-Oct for the year of prohibition (Table 31 column D)} = \frac{\text{Emissions for the pesticide-crop combination during May-Oct for the most recent year without prohibitions (Table 31 column A)}}{\text{Pounds AI for the crop during May-Oct for the most recent year without prohibitions (Table 31 column B)}} \cdot \text{Pounds AI for the crop during May-Oct for the year of prohibitions (Table 31 column C)}$$

Table 31 details the hypothetical emissions for 2018 calculated using the formula above. The total hypothetical emissions for the pesticides and crops listed in section 6880 are 3.785 tpd, which is 1.968 tpd more than the actual inventory emissions. Total hypothetical emissions equal the sum of

the hypothetical emissions for each pesticide-crop combination, plus the actual emissions for the remaining pesticides and crops not listed in 3 CCR section 6880:

$$\text{Total hypothetical emissions} = 3.785 + 16.174 - 1.818 \text{ tpd}$$

Therefore, the total 2018 hypothetical emissions are equal to 18.142 tpd, which exceeds the trigger level of 17.2 tpd by 6% (0.947 tpd).

As specified in 3 CCR section 6452.2(f), the hypothetical emissions must be less than the trigger level for at least two consecutive years before DPR can lift the high-VOC prohibitions. Therefore, the prohibition on the use of high-VOC products for abamectin, chlorpyrifos, gibberellins, and oxyfluorfen on certain crops in the San Joaquin Valley NAA as specified in 3 CCR section 6884 that went into effect during 2015 remain in effect between the May 1 through October 31 period during 2020 and 2021.

Table 31: Calculation of hypothetical emissions in the San Joaquin Valley NAA (2), as described in Title 3, California Code Of Regulations, section 6884(c): D = (A / B) * C.

Active Ingredient	Crop	2014 Emissions (tpd) (A)	2014 Pounds AI (B)	2018 Pounds AI (C)	2018 Hypothetical Emissions (tpd) (D)	2018 Actual Emissions	Difference between Hypothetical and Actual (tpd)
ABAMECTIN	ALFALFA	<0.001	69	64	<0.001	<0.001	<0.001
	ALMOND	0.687	10,288	15,797	1.056	0.479	0.577
	CITRUS	0.074	1,151	2,616	0.167	0.072	0.095
	COTTON	0.109	1,509	3,416	0.246	0.116	0.130
	GRAPES	0.325	4,743	4,795	0.329	0.141	0.187
	PISTACHIO	0.002	25	221	0.016	0.004	0.011
	WALNUT	0.108	1,719	1,878	0.118	0.055	0.063
CHLORPYRIFOS	ALFALFA	0.138	59,071	7,658	0.018	0.018	<0.001
	ALMOND	0.403	181,926	114,194	0.253	0.151	0.102
	CITRUS	0.408	172,834	62,005	0.146	0.089	0.058
	COTTON	0.255	95,094	112,830	0.302	0.191	0.111
	GRAPES	0.025	20,173	38,053	0.048	0.048	<0.001
	WALNUT	0.113	65,398	8,250	0.014	0.011	0.003
GIBBERELLINS	CITRUS	0.255	6,287	6,067	0.246	0.039	0.207
	GRAPES	0.250	8,702	7,872	0.226	0.024	0.202
OXYFLUORFEN	ALFALFA	<0.001	10	12	<0.001	<0.001	<0.001
	ALMOND	0.469	80,138	66,473	0.389	0.268	0.121
	CITRUS	0.002	224	506	0.003	0.002	0.002
	COTTON	0.014	4,752	1,433	0.004	0.001	0.003
	GRAPES	0.072	10,302	12,778	0.089	0.016	0.073
	PISTACHIO	0.063	17,802	15,980	0.057	0.049	0.008
	WALNUT	0.065	11,268	10,223	0.059	0.042	0.016
COMBINED	COMBINED	3.835	753,484	493,121	3.785	1.818	1.968

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