ANNUAL REPORT ON VOLATILE ORGANIC COMPOUND EMISSIONS FROM PESTICIDES: EMISSIONS FOR 1990 – 2014

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EXECUTIVE SUMMARY

Preface

This report fulfills the requirements of Title 3, California Code of Regulations (3 CCR), section 6452.4 which requires the Director of 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, 2014, to October 31, 2014, the peak ozone season in California. In addition, data from the same months in 1990 are included for baseline comparisons, and from 2011, 2012 and 2013 for trend analysis.

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 (ozone nonattainment areas, NAAs). The SIP requires DPR to reduce emissions by 20 percent from the 1990 base year in four ozone nonattainment areas (NAAs)—Sacramento Metro, South Coast, Southeast Desert, and Ventura, and by 12 percent in a fifth NAA—San Joaquin Valley.

DPR's VOC emission inventory database includes only pesticide applications that are made between May 1 and October 31, the peak ozone season in California. The database is updated when annual pesticide use report data from the previous year becomes available, and contains data for every year since 1990. Each year contains about 2.5 million pesticide use records (PUR) and emission potential (EP) values for approximately 5,000 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 VOC emissions from fumigant pesticides. Title 3, California Code of Regulations, section 6452.2, includes specific emission target levels (VOC regulation benchmarks) for each of the five NAAs, equivalent to the SIP obligation of a 12 percent or 20 percent reduction. The regulations reduce VOC emissions by requiring low-emission fumigation methods in certain NAAs. If, in spite of these application method requirements, pesticide VOC emissions exceed 95 percent of the benchmark for a NAA, the regulations specified 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 regulatory benchmark, basing the nonfumigant emissions estimate on VOC emission inventory data from previous years.

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 amended the VOC regulations by replacing the fumigant limit required when the 95 percent trigger level is

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exceeded in that NAA with prohibitions on the use of certain nonfumigant products designated as high VOC.

Report Summary

With the exception of the Sacramento Metro nonattainment area, VOC emissions in four of the five NAAs decreased in 2014, and all nonattainment areas are in compliance with the SIP goals and are below the VOC regulation benchmarks.

- Sacramento Metro NAA: VOC emissions increased by 18 percent from 1.172 tons per day in 2013 to 1.385 tons per day in 2014. Emissions in 2014 were 50 percent lower than the 1990 base year and remain in compliance with the SIP goal and the VOC regulation benchmark. In 2014, 18 percent of emissions were derived from fumigants a significant increase compared to all previous years.
- San Joaquin Valley NAA: VOC emissions decreased between 2013 and 2014, from 19.525 tons per day to 16.690 tons per day, falling below the SIP goal by 1.410 tons per day. Pesticide VOC emissions in 2014 were 19 percent lower than the 1990 base year and comply with the SIP goal and VOC regulation benchmark. More than three quarters of pesticide emissions are derived from nonfumigants, consistent with values observed since 2007.
- Southeast Desert NAA: VOC emissions decreased by more than 22 percent from 0.370 tons per day in 2013 to 0.288 tons per day in 2014. Emissions in 2014 were 69 percent lower than the 1990 base year and continue to comply with the SIP goal and VOC regulation benchmark. Emissions from fumigants decreased by almost 50 percent, which accounted for almost all of the reductions observed.
- Ventura NAA: The implementation of fumigation methods that use totally impermeable film (tarps assigned 60 percent buffer zone credit on labels) in Ventura continued to result in a drop in fumigant emissions in 2014. Total VOC emissions decreased by almost 5 percent in 2014 to 1.624 tons per day, which is 1.376 tpd below the SIP goal for 2014. Pesticide VOC emissions in 2014 were 57 percent lower than the 1990 base year. Seventy-three percent (73%) of emissions were derived from fumigants, the lowest since 2008.
- South Coast NAA: VOC emissions decreased in 2014 by 11 percent compared to 2013, dropping to 1.163 tons per day, and continue to remain well below the emission targets. Pesticide VOC emissions in 2014 were 89 percent lower than the 1990 base year. Over 82 percent of emissions were derived from nonfumigants.

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Abbreviations and Definitions

AI	Active Ingredient
APCD	Air Pollution Control District
AMAF	Application Method Adjustment Factor
ARB	California Air Resources Board
EP	Emission Potential
GIS	Geographic Information System
MUF	Method Use Fraction
NAA	nonattainment area
PUR	pesticide use report
SIP	state implementation plan
TGA	thermogravimetric analysis
tpd	tons per day
TIF	totally impermeable film
VOC	Volatile Organic Chemical

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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.

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The mention of commercial products, their source, or their use in this report is not to be construed as either an actual or 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 emission inventory to track pesticide volatile organic compound (VOC) emissions and to reduce emissions by 20 percent from a base year in four out of five California nonattainment areas (NAA), and by 12 percent in the fifth 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 inventory allows DPR to estimate VOC 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 VOC emission 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 pesticide use report data used to calculate VOC emissions is given in Table 1.

Table 1. Key information included in pesticide use reports that form the basis of DPR's VOC emission inventory.

Information	Production Agriculture Reports (Each Application)	Non-Production Agriculture Reports and Non Agricultural Reports (Monthly Summary of Applications)
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

* fumigant use reports only

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California's five ozone NAAs included in the pesticide VOC emission 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 CFR 40 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 3 CCR section 6452.4 requiring an annual VOC emissions inventory report that includes the following information:

- report total agricultural and structural pesticide VOC emissions for the previous years,
- evaluate compliance with SIP goals (benchmarks specified in section 6452.2),
- establish fumigant emission limits for the upcoming year if necessary, according to section 6452.2, and
- establish an emission rating (or application method adjustment factor, the percentage of fumigant applied emitted to air) 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 section 6452.4 to section 6881, and adding the following report elements:

- establish prohibitions on high-VOC nonfumigant products pursuant to section 6452.2(f), and if applicable, determine if prohibitions remain in effect pursuant to section 6884(c);
- establish a list of the nonfumigant products that are designated as low-VOC pursuant to section 6880;
- establish a list of the actively registered nonfumigant products that are designated as high-VOC pursuant to 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 1990–2014 and whether the 2014 emissions exceed levels that trigger additional VOC restrictions.

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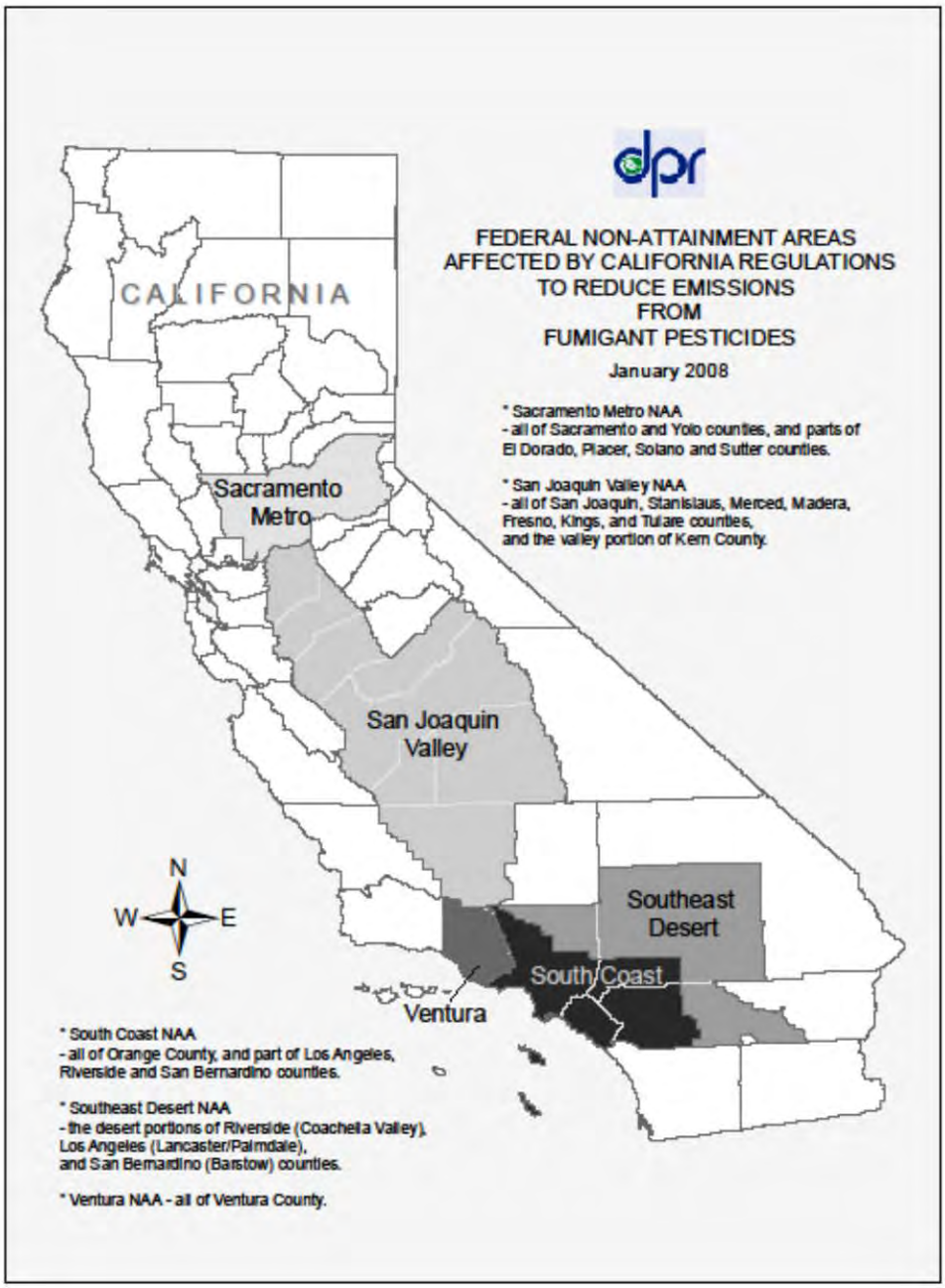

Figure 1. Federal nonattainment areas affected by California Regulations to reduce emissions from fumigant pesticides.

Table 2. A listing of counties wholly or partially within nonattainment areas 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 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 percent reduction from 1990 for the Sacramento Metro, Southeast Desert, Ventura and South Coast NAAs, and a 12 percent reduction from 1990 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/day, equivalent to a 12 percent reduction relative to 1990. Prior to the amendment, the SIP described the reduction commitment only as 12 percent less than 1990. Because the 18.1 tons/day represents the 12 percent 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 pesticides 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 pesticide VOC emissions in a NAA exceed 95 percent 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 VOCs than fumigant products in this NAA, so additional restrictions on nonfumigant products is a more efficient method to ensure that the SIP goal is achieved. If VOC 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 emissions inventory for the previous year. For example, the 2014 emissions inventory is used to determine if additional VOC restrictions will go into effect for May-October 2016. 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>.

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Table 3. Nonattainment Area Goals and Trigger Levels.

	NAA SIP Goal (tons/day)	Trigger Levels 95 % of SIP Goal (tons/day)
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 VOC Emissions

Prior to 2008, DPR reported an unadjusted emission 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 percent. 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) (Spurlock, 2002; 2006).

$$emission = lbs\ of\ product\ used \times EP$$

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 VOC emissions than the previous unadjusted emission estimates

$$emission = lbs\ of\ product\ used \times EP \times AMAF$$

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.

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, tarp, etc.) represents a fraction of the total number of methods used and is referred to as the Method Use Fraction (MUF). The sum of all *MUFs* for any particular (NAA/fumigant AI) combination is one. Use practices change over time so that different *MUF*s are used for the baseline year (1990) as opposed to more recent inventory years. For 2007 and earlier years, *MUF*s are determined in a number of different ways. For 1,3-dichloropropene the *MUF*s are 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 *MUF*s are based on expert opinion and regulatory history. Finally, *MUF*s for dazomet and sodium tetrathiocarbonate equal one because the *AMAF*s for each of these two fumigants are constant, independent of application method. A detailed discussion of how MUF and AMAFs were determined is given by Barry et al (2007).

The 2008 VOC regulations included a change to pesticide use reports that requires recording the specific application method for each fumigation within NAAs. The *MUFs* for 2008 and later years are calculated using the fumigation method documented in pesticide use reports rather than the surrogate data described above. The use of a fumigant code to identify the fumigant application method in the pesticide use report was implemented in 2009 (Ibewiro, 2008). For all NAAs combined, almost 5 percent of the pesticide use reports for 2014 are missing the identification of the application method (fumigant code). In these cases, DPR used a conservative approach by assuming that the application method with the highest AMAF allowed by the regulations for that fumigant was used. Field fumigation methods (FFM), FFM codes for pesticide use reporting, and corresponding emission ratings, and the AMAFs and method use fractions for 1990, 2005, 2006, 2007 and 2008 in each of the NAAs are included in the appendix of this document (Tables A1 – 1 to A1 – 27, Appendix 1b).

In addition to the VOC emissions derived from fumigant active ingredients, inert ingredients for products that contain chloropicrin, methyl bromide, 1,3-dichloropropene and methyl iodide are assumed to be volatile and are included in the inventory calculations. For the highest use products containing those fumigants, DPR analyzes their confidential statements of formula to determine the composition of inerts and decides whether those inerts are nonvolatile. Inert ingredients used in products containing metam sodium, metam potassium, sodium tetrathiocarbonate and dazomet are non-volatile and so do not contribute to the emission potential 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 nonattainment area (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 VOC 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).

VOC emissions were calculated for each NAA and summed according to primary active ingredient, application site, and emission category as defined by the Air Resources Board (ARB). The primary active ingredient is defined as the pesticide active ingredient present at the highest percentage in a product. If a pesticide product contains 20 percent of active ingredient "A" and 10 percent of active ingredient "B", all estimated emissions from that product are assigned to the primary active ingredient "A". This approach prevents "double-counting" of emissions from products containing two active ingredients.

For the 2014 inventory, fewer than five percent of the fumigant use reports had either no fumigant code or a non-existent fumigant code. For these records default AMAFs were assigned (Table 4a), creating a complete dataset from which adjusted emissions for both the active ingredients and application sites (or commodities) contributing to May-October 2014 ozone could be calculated. Appendix 2 contains summaries of *unadjusted* emissions attributable to specific application sites (or commodities) prior to 2013, when it was not possible to allocate adjusted emissions to specific application sites with the data available. Adjusted emissions for the top ten active ingredients in 2011, 2012 and 2013 are included in this report (Appendix 3).

Table 4a. Default 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%

VOC Emissions by ARB Emission Inventory Classification

ARB defines four VOC 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 for the May–October ozone season according to these categories, and are reported as U.S. tons per day (tpd) in this inventory report.

Data Revisions

DPR continually evaluates pesticide use report data, EP values, MUFs, and AMAFs to ensure the VOC inventory includes the most reliable data. In the past year, DPR received updated EP data for several high-use products for which it previously relied in default values. As requested by DPR, registrants provided thermogravimetric analysis (TGA) data for these products, DPR's preferred data to determine EPs. As shown in Table 4b, the EP values and resulting VOC emissions based on TGA is significantly different than the previous EP values and VOC emissions based on default assumptions. As discussed in later sections, the estimated VOC emissions for the San Joaquin Valley NAA in 2013 have been revised upward compared to last year's estimates due to the new EP data. Products containing fenpyroximate and hexythiazox account for a significantly higher proportion of the San Joaquin Valley NAA inventory than previously estimated.

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Table 4b. Changes in emission potential (EP) values of the top ten high-use nonfumigant products in San Joaquin Valley nonattainment area in 2013.

Product	Primary Active Ingredient	2013 Inventory		2014 Inventory		Change in EP	Change in Emissions, tpd
		EP	method	EP	method		
FUJIMITE 5 EC	FENPYROXIMATE	39.15	default_median	87.9	TGA	48.75	0.831
ONAGER MITICIDE	HEXYTHIAZOX	39.15	default_median	83.6	TGA	44.45	0.502
COTTONQUIK COTTON HARVEST AID/DEFOLIANT	UREA DIHYDROGEN SULFATE	6.91	default_median	17.63	TGA	10.72	0.176
INTREPID 2F	METHOXYFENOZIDE	4.80	default_median	5.6	TGA	0.80	0.018
PROWL H2O HERBICIDE	PENDIMETHALIN	5.71	default_median	9.52	Derived	3.81	0.039
LAMBDA-CY EC INSECTICIDE-RUP	LAMBDA-CYHALOTHRIN	39.15	default_median	77.36	TGA	38.21	0.038
ET HERBICIDE/DEFOLIANT	PYRAFLUFEN-ETHYL	39.15	default_median	89.77	TGA	50.62	0.037
PERM-UP 3.2 EC INSECTICIDE	PERMETHRIN	39.15	default_median	56.44	TGA	17.29	0.020
DUPONT STEWARD EC INSECTICIDE	INDOXACARB	39.15	default_median	72.69	TGA	33.54	0.030
ENVIDOR 2 SC MITICIDE	SPIRODICLOFEN	5.71	default_median	5.1	TGA	-0.61	-0.004

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VOLATILE ORGANIC COMPOUND INVENTORY RESULTS

The main text of this report summarizes the pesticide VOC emission inventory data for 2014 only. Adjusted and unadjusted emission data for 2011, 2012 and 2013 are summarized in Appendices 2 and 3. Inventory data for prior years can be found in previous inventory memos located at http://www.cdpr.ca.gov/docs/emon/vocs/vocproj/voc_data_analysis.htm.

Figure 2 illustrates the changes in *unadjusted* VOC emissions from 1990 to 2014. These values are *unadjusted* and so do not take in to consideration MUFs and AMAFs that can only be applied to emissions in 2004 through 2014, and 1990. The figure is useful in that it compares emissions for the entire history of the inventory and shows trends in five NAAs.

Tables 5 and 6a and Figure 3 summarize the adjusted pesticide VOC emissions for 2004 through 2014, and compare them to the SIP goals that are based on a percentage reduction from the 1990. Table 6b compares the unadjusted and adjusted fumigant VOC emissions for 2004 through 2014. Table 6c shows the amount of emissions that resulted from nonfumigant products with emulsifiable concentrate formulations compared to all other nonfumigant formulations. The emissions in the base year are also included to reflect the long term decrease or increase. Generally, what the tables and figure show can be summarized as follows:

- Adjusted emissions in 2014 in the Sacramento Metro (**1**) increased from 1.172 tpd in 2013 to 1.385 tpd, the highest level since 2006. This increase was largely due to the increased use of fumigants. Nonfumigants represented 82 percent of the total, the latter remaining 33 percent below the SIP goal of 2.2 tpd. Forty-two percent (0.481 tpd) of nonfumigant emissions were derived from products with emulsifiable concentrate formulations.
- In the San Joaquin Valley (**2**), total adjusted VOC emissions decreased by 14 percent from 2013 to 2014. Total adjusted emissions fell below the SIP goal of 18.1 tpd by 1.410 tpd. Nonfumigant emissions accounted for more than three-quarters of the total VOC emissions in the San Joaquin Valley in 2014, with emissions from products with emulsifiable concentrate formulations accounting for 56 percent of the total VOC emissions for this NAA. VOC emissions from emulsifiable concentrates decreased by 18 percent, from 8.674 tpd in 2013 to 7.123 tpd in 2014. Fumigant emissions decreased by 9 percent from 4.360 tpd in 2013 to 3.951 tpd in 2014.
- In 2014, fumigants accounted for less than 30 percent of VOC emissions in the Southeast Desert (**3**) compared to more than 45 percent in 2013. Total VOC emissions in 2014 decreased by more than 20 percent from 2013, to 0.288 tpd, continuing the downward trend from 2012 and are still well below (69 percent) the SIP goal (0.92 tpd).
- 2014 VOC emissions in the Ventura NAA (**4**) were significantly lower than in all previous years. Emissions decreased by almost five percent from 2013 to 1.624 tpd, meeting the regulatory goals for 2014. Seventy-three percent (73%) of emissions came from fumigants, the lowest percentage since 2008 when emissions from fumigants (0.1252 tpd) accounted for 72 percent of the total.
- Emissions in the South Coast NAA (**5**) decreased by 11 percent over 2013 values to 1.163 tpd in 2014, and continue to be well below the SIP goal of 8.7 tpd. Eighty-two

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percent (82%) of the total adjusted VOC emissions came from non-fumigants (0.955 tpd), of which 31 percent are attributable to products with emulsifiable concentrate formulations.

Pesticide use varies from year to year depending on many factors, including 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 result in fewer planted acres, thus less pesticide may be used. 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 decrease in emissions in four of the five NAAs in 2014 can be attributed to an overall decline in use together with the success DPR, growers, registrants, and others have achieved by taking steps to reduce VOC emissions by using lower emission methods and products. DPR continues to register reformulated products with lower EPs, including products containing chlorpyrifos and abamectin that are major VOC contributors. Nonfumigant pesticide products, particularly emulsifiable concentrates, contribute more VOC emissions than fumigants in the San Joaquin Valley. DPR adopted regulations for nonfumigant products in 2013 and most of the requirements went into effect beginning in May 2014. The nonfumigant regulations designate certain products containing abamectin, chlorpyrifos, gibberellins, and oxyfluorfen as high-VOC products. 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. The criteria and specific products designated as high-VOC and low-VOC are discussed in a later section.

The 2013 and earlier VOC regulations include additional restrictions that are triggered if pesticide VOC emissions in a NAA exceed 95 percent of its SIP goal. None of the five NAAs exceeded their trigger levels in 2014. However, San Joaquin Valley 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.

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Figure 2. Annual ***unadjusted*** ozone season pesticide VOC emissions by NAA from 1990 to 2014, inclusive.

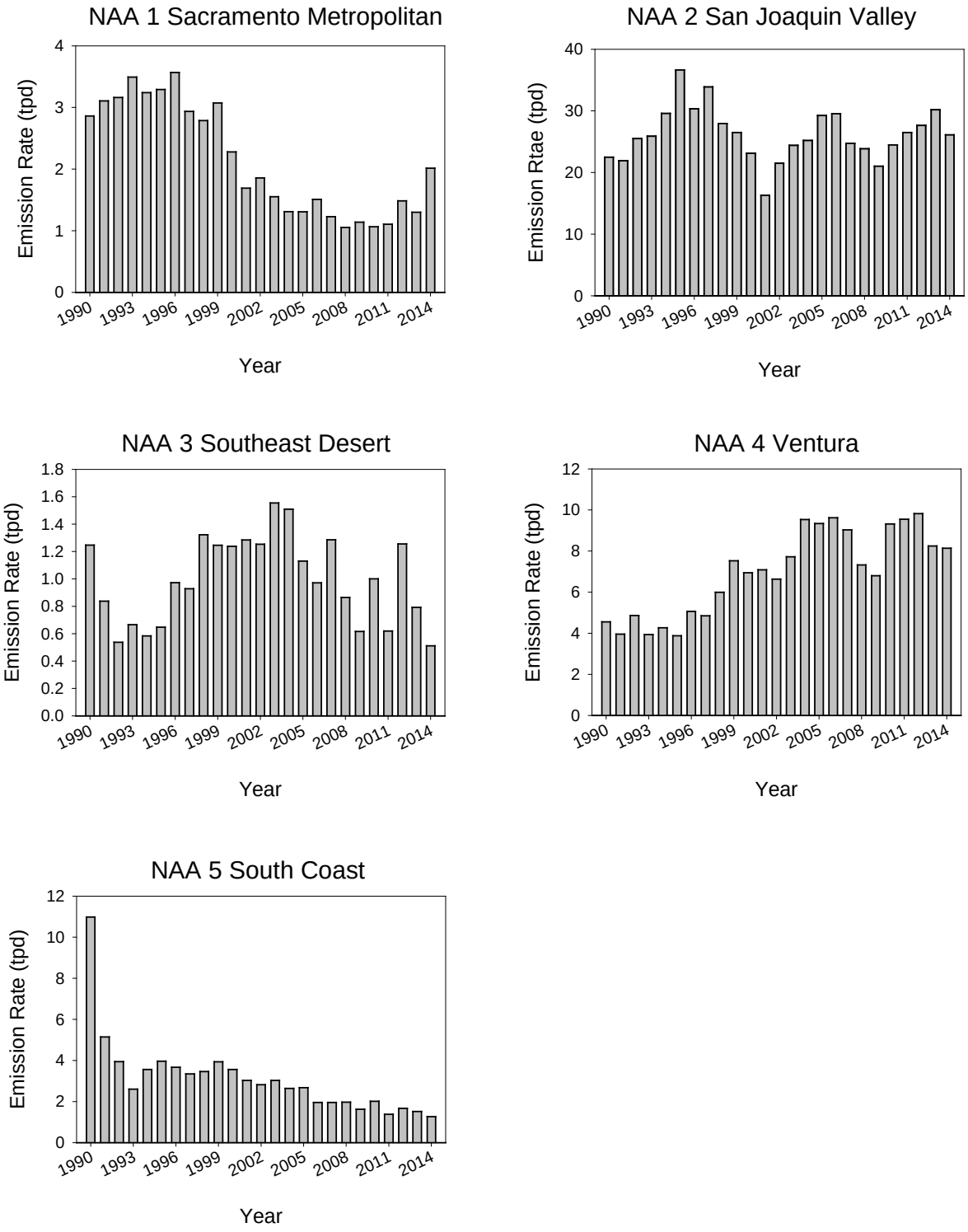

Table 5. May–October (ozone season) ***adjusted*** pesticide VOC emissions and goals. Exceedance of the trigger requires additional VOC restrictions.

	VOC Emissions (tons/day)													
NAA	**1990**	**SIP Goal**	**Trigger †**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
1 – Sacramento Metro	2.784	*2.2*	*2.1*	1.235	1.239	1.354	1.041	0.903	0.910	0.980	1.004	1.304	1.172	1.385
2 – San Joaquin Valley	20.517	*18.1*	*17.2*	17.322	20.740	21.305	17.093	14.525	12.965	15.228	16.376	16.927	19.525	16.690
3 – Southeast Desert	1.153	*0.92*	*0.87*	0.995	0.740	0.634	0.762	0.286	0.284	0.460	0.215	0.473	0.370	0.288
4 – Ventura	3.787	*3.0* ***a***	*2.85*	3.924	3.617	3.682	3.363	1.739	2.174	2.789	3.003 [a]	3.063	1.707	1.624
5 – South Coast	10.840	*8.7*	*8.3*	1.922	1.969	1.482	1.487	1.283	1.240	1.740	1.121	1.374	1.312	1.163

† Trigger Level is 95% of SIP Goal

a For Ventura, the SIP goal is phased in between 2008 and 2012, with a final goal of 3.0 tons/day in 2012. The goal for 2011 is 3.3 tons/day.

Table 6a. May–October (ozone season) ***adjusted*** fumigant and nonfumigant pesticide VOC emissions.

NAA	VOC Emissions (tons/day)											
	1990	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Sacramento Metro												
Fumigants	0.384	0.111	0.085	0.162	0.061	0.064	0.134	0.097	0.061	0.084	0.071	0.247
	(14%)	(9%)	(7%)	(12%)	(6%)	(7%)	(15%)	(10%)	(6%)	(6%)	(6%)	(18%)
Nonfumigants	2.400	1.124	1.154	1.192	0.944	0.838	0.775	0.883	0.944	1.220	1.102	1.138
	(86%)	(91%)	(93%)	(88%)	(94%)	(93%)	(85%)	(90%)	(94%)	(94%)	(94%)	(82%)
San Joaquin Valley												
Fumigants	5.536	6.362	6.910	6.808	4.399	3.370	3.078	3.700	4.001	4.272	4.360	3.951
	(27%)	(37%)	(33%)	(32%)	(26%)	(23%)	(24%)	(24%)	(24%)	(25%)	(22%)	(24%)
Nonfumigants	14.981	10.960	13.831	14.498	12.375	11.154	9.887	11.528	12.375	12.656	15.165	12.739
	(73%)	(63%)	(67%)	(68%)	(74%)	(77%)	(76%)	(76%)	(76%)	(75%)	(78%)	(76%)
Southeast Desert												
Fumigants	0.840	0.762	0.474	0.413	0.073	0.119	0.137	0.273	0.078	0.258	0.169	0.085
	(73%)	(77%)	(64%)	(65%)	(35%)	(42%)	(48%)	(59%)	(36%)	(55%)	(46%)	(29%)
Nonfumigants	0.313	0.233	0.266	0.221	0.137	0.167	0.146	0.186	0.137	0.215	0.201	0.203
	(27%)	(23%)	(36%)	(35%)	(65%)	(58%)	(52%)	(41%)	(64%)	(45%)	(54%)	(71%)
Ventura												
Fumigants	3.140	3.302	3.119	3.175	2.464	1.252	1.720	2.312	2.577	2.681	1.311	1.189
	(83%)	(84%)	(86%)	(86%)	(85%)	(72%)	(79%)	(83%)	(86%)	(88%)	(77%)	(73%)
Nonfumigants	0.647	0.622	0.497	0.508	0.425	0.486	0.454	0.477	0.425	0.382	0.396	0.435
	(17%)	(16%)	(14%)	(14%)	(15%)	(28%)	(21%)	(17%)	(12%)	(12%)	(23%)	(27%)
South Coast												
Fumigants	9.372	0.702	0.594	0.422	0.183	0.377	0.312	0.375	0.196	0.381	0.285	0.208
	(86%)	(37%)	(30%)	(28%)	(17%)	(29%)	(25%)	(22%)	(17%)	(28%)	(22%)	(18%)
Nonfumigants	1.468	1.220	1.375	1.060	0.926	0.906	0.927	1.365	0.926	0.994	1.027	0.955
	(14%)	(63%)	(70%)	(72%)	(83%)	(71%)	(75%)	(78%)	(83%)	(72%)	(78%)	(82%)

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Table 6b. May–October (ozone season) ***unadjusted and adjusted*** fumigant pesticide VOC emissions. VOC/applied (tons or pounds of VOCs emitted for each ton or pound 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.

NAA	Emissions											
	1990	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
1 – Sacramento Metro												
Unadjusted (tons/day)	0.461	0.186	0.151	0.315	0.383	0.241	0.363	0.181	0.162	0.263	0.197	0.876
Adjusted (tons/day)	0.384	0.111	0.085	0.162	0.189	0.064	0.134	0.097	0.061	0.084	0.071	0.247
VOC/applied (tons/ton)	0.833	0.597	0.563	0.514	0.493	0.266	0.369	0.536	0.375	0.320	0.357	0.282
2 - San Joaquin Valley												
Unadjusted (tons/day)	7.491	14.213	15.400	15.034	13.750	12.620	11.119	12.944	14.116	14.969	15.002	13.365
Adjusted (tons/day)	5.536	6.362	6.910	6.808	6.123	3.370	3.078	3.700	4.001	4.272	4.360	3.951
VOC/applied (tons/ton)	0.739	0.448	0.449	0.453	0.445	0.267	0.277	0.286	0.283	0.285	0.291	0.296
3 - Southeast Desert												
Unadjusted (tons/day)	0.933	1.275	0.863	0.750	1.086	0.684	0.469	0.814	0.482	1.041	0.591	0.308
Adjusted (tons/day)	0.840	0.762	0.474	0.413	0.575	0.119	0.137	0.273	0.078	0.258	0.169	0.085
VOC/applied (tons/ton)	0.900	0.598	0.549	0.551	0.529	0.174	0.293	0.336	0.162	0.248	0.286	0.275
4 - Ventura												
Unadjusted (tons/day)	3.909	8.916	8.841	9.113	8.658	6.543	6.345	8.844	9.126	9.442	7.846	7.705
Adjusted (tons/day)	3.140	3.302	3.119	3.175	2.935	1.252	1.720	2.312	2.577	2.681	1.311	1.189
VOC/applied (tons/ton)	0.803	0.370	0.353	0.348	0.339	0.191	0.271	0.261	0.282	0.284	0.167	0.154
5 – South Coast												
Unadjusted (tons/day)	9.514	1.418	1.301	0.898	0.883	1.043	0.694	0.647	0.449	0.672	0.492	0.308
Adjusted (tons/day)	9.372	0.702	0.594	0.422	0.411	0.377	0.312	0.375	0.196	0.381	0.285	0.208
VOC/applied (tons/ton)	0.985	0.495	0.457	0.470	0.465	0.361	0.450	0.580	0.435	0.566	0.580	0.674

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Table 6c. May-October (ozone season) nonfumigant pesticide VOC emissions derived from Emulsifiable Concentrate formulations (ECs) and all Others. The adjusted and unadjusted VOC emissions for nonfumigants are the same.

NAA	VOC Emissions tons/day (percentage of total)											
	1990	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
1 – Sacramento Metro												
ECs	1.129	0.534	0.642	0.640	0.470	0.487	0.379	0.411	0.400	0.534	0.499	0.481
	(47%)	(47%)	(56%)	(54%)	(55%)	(58%)	(49%)	(47%)	(42%)	(44%)	(45%)	(42%)
Others	1.271	0.590	0.513	0.552	0.382	0.351	0.397	0.472	0.543	0.687	0.603	0.657
	(53%)	(53%)	(44%)	(46%)	(45%)	(42%)	(51%)	(53%)	(58%)	(56%)	(55%)	(58%)
2 - San Joaquin Valley												
ECs	12.162	8.613	10.199	10.119	7.547	7.491	5.921	6.608	6.854	7.250	8.674	7.123
	(81%)	(79%)	(74%)	(70%)	(69%)	(67%)	(60%)	(57%)	(55%)	(57%)	(57%)	(56%)
Others	2.819	2.347	3.632	4.379	3.423	3.663	3.966	4.921	5.521	5.405	6.490	5.616
	(19%)	(21%)	(26%)	(30%)	(31%)	(33%)	(40%)	(43%)	(45%)	(43%)	(43%)	(44%)
3 - Southeast Desert												
ECs	0.217	0.150	0.185	0.131	0.105	0.089	0.073	0.092	0.071	0.091	0.090	0.097
	(69%)	(64%)	(69%)	(59%)	(56%)	(53%)	(50%)	(49%)	(52%)	(42%)	(45%)	(48%)
Others	0.096	0.083	0.082	0.091	0.083	0.078	0.074	0.094	0.066	0.124	0.111	0.106
	(31%)	(36%)	(31%)	(41%)	(44%)	(47%)	(50%)	(51%)	(48%)	(58%)	(55%)	(52%)
4 - Ventura												
ECs	0.402	0.263	0.286	0.272	0.210	0.237	0.227	0.224	0.184	0.161	0.129	0.149
	(62%)	(42%)	(58%)	(54%)	(49%)	(49%)	(50%)	(47%)	(43%)	(42%)	(33%)	(34%)
Others	0.245	0.360	0.211	0.236	0.218	0.250	0.227	0.253	0.242	0.221	0.267	0.285
	(38%)	(58%)	(42%)	(46%)	(51%)	(51%)	(50%)	(53%)	(57%)	(58%)	(67%)	(66%)
5 – South Coast												
ECs	0.921	0.647	0.762	0.514	0.459	0.339	0.379	0.421	0.346	0.305	0.274	0.299
	(63%)	(53%)	(55%)	(48%)	(43%)	(37%)	(41%)	(31%)	(37%)	(31%)	(27%)	(31%)
Others	0.547	0.573	0.613	0.546	0.616	0.567	0.548	0.944	0.580	0.688	0.753	0.656
	(37%)	(47%)	(45%)	(52%)	(57%)	(63%)	(59%)	(69%)	(63%)	(69%)	(73%)	(69%)

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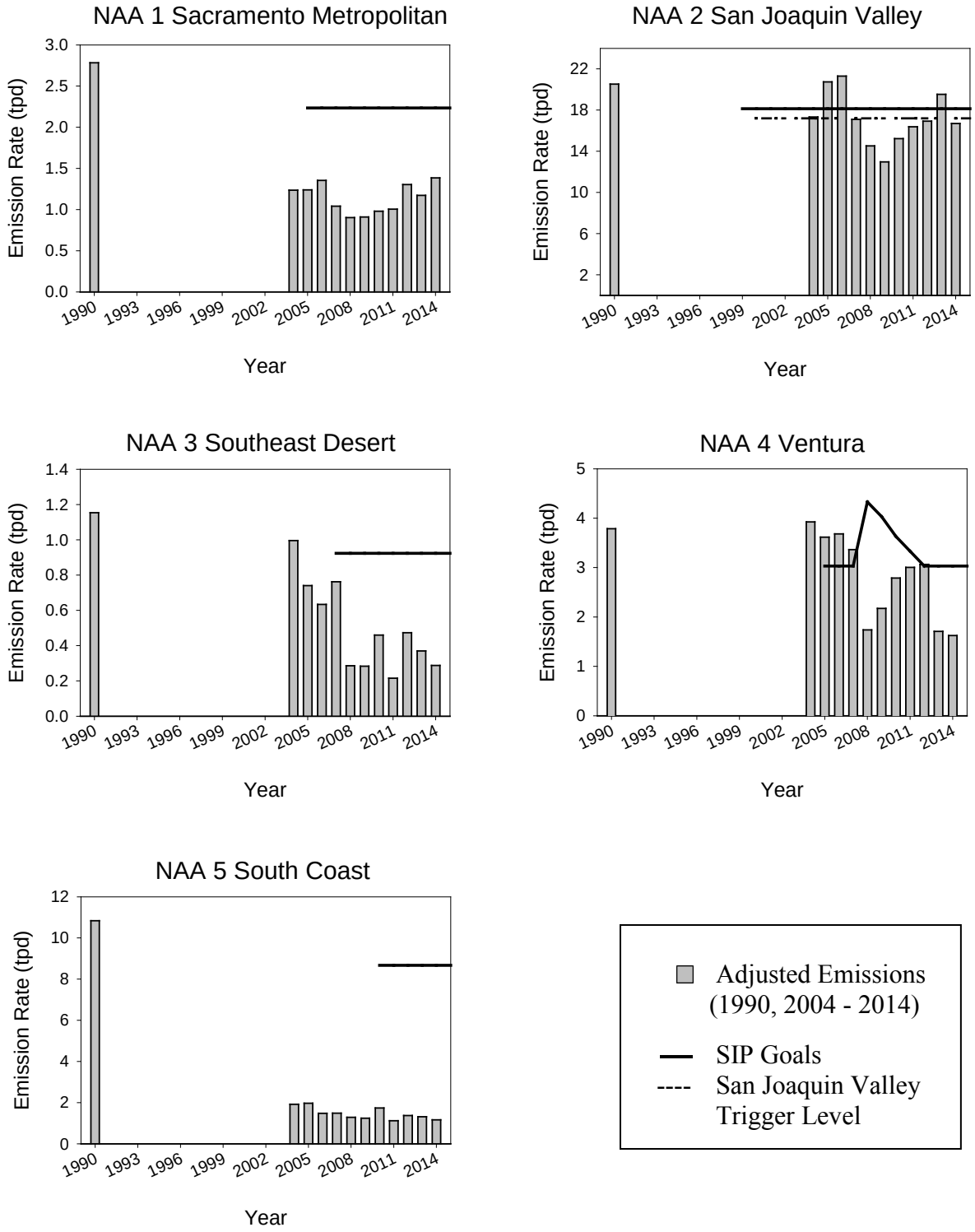
Figure 3. Annual ozone season pesticide VOC emissions by NAA. These figures show adjusted emissions and SIP goals (reductions from 1990 emissions).



Sacramento Metro Area - NAA 1

The Sacramento Metro NAA (1) 2014 adjusted emissions increased by 0.213 tpd from 2013 levels. Adjusted emissions in 2011 were 1.004 tpd which increased to 1.304 tpd in 2012, then decreased to 1.172 tpd in 2013 and then increased to 1.385 in 2014. Fumigant emissions, accounting for six percent of adjusted emissions in 2011 (0.061 tpd), 2012 (0.084 tpd) and 2013 (0.071 tpd) increased to 0.247 tpd in 2014, the highest level since adjusted emissions calculations were implemented in 2004. In 2014, 82 percent of emissions were attributable to nonfumigants, 42 percent (0.481 tpd) of which were from products with emulsifiable concentrate formulations. Total adjusted VOC emissions (1.385 tpd) continue to remain below the SIP goal of 2.2 tpd. (Tables 5, 6a, 6b, 6c, Figures 3, 4).

Emissions from the top six VOC contributing active ingredients increased in 2014, accounting for 45 percent of the total for this NAA. Increased emissions from 1,3-dichloropropene rose by 525 percent to 0.188 tpd, bifenthrin by 43 percent to 0.106 tpd and trifluralin by 37 percent to 0.054 tpd (Table 7). Emissions from the use of methyl bromide declined, from 0.002 tpd in 2013 to 0.001 tpd in 2014, while emissions from chlorpyrifos increased from 0.056 tpd in 2013 to 0.059 tpd in 2014, similar to the level seen in 2011. Between 2013 and 2014 emissions from abamectin increased by 20 percent to 0.120 tpd and emissions from propanil increased by 7 percent to 0.094 tpd, continuing the steady upward trend since 2011. (Tables 7, A3-1a to A3-1d, Figure 5).

For a second year sufficient fumigant method data was available to calculate adjusted VOC emissions by crop. In the Sacramento Metro Area NAA, the most noticeable impacts on emissions were from rice and almonds (accounting for more than 36 percent), with significant contributions from walnuts, structural pest control, processing tomatoes and wine grapes. Adjusted emissions from almonds increased by 385 percent from 0.047 tpd in 2013 to 0.227 tpd in 2014. Eighty-four percent of emissions from 1,3-dichloropropene were derived from almonds compared to no reported use in 2013. Increased emissions for abamectin in 2014 came from applications to wine grapes and walnuts. Adjusted emissions from the "soil application" category, which is often used when a field is treated before a commodity has been planted, increased by almost 30 times from 0.001 tpd in 2013 to 0.032 tpd in 2014. Uncertainty due to drought conditions may have contributed to this increase. Rice contributed almost 20 percent of the emissions in 2014, and remained relatively unchanged from 2013 at 0.276 tpd. While emissions from propanil, used almost exclusively on rice, increased from 0.088 tpd in 2013 to 0.094 tpd in 2014, there were corresponding reductions in emissions from propiconazole, clomazone and thiobencarb. Combined emissions from walnuts and tomatoes accounted for 21 percent of the total emissions in the Sacramento Metro Area NAA (0.147 tpd and 0.139 tpd, respectively), and both of these were significantly higher than in 2013. In 2014 sixty-nine percent of bifenthrin emissions were from structural pest control, compared to 30 percent in 2013. Emissions from wine grapes rose from 0.104 tpd in 2013 to 0.130 tpd in 2014, and from dried beans from 0.020 to 0.030 tpd. (Tables 8, A2-1e to A2-1h, Figure 6).

Since this NAA has complied with the SIP goal for several years, most provisions of the VOC regulations do not apply. Therefore, the regulations had little or no impact on emissions in this NAA.

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Using the ARB emission inventory classification, emissions from structural applications of methyl bromide continue to be below reportable levels. Agricultural applications decreased from 0.003 tpd in 2013 to 0.002 tpd in 2014. Emissions from non-methyl bromide agricultural applications increased from 1.134 tpd in 2013 to 1.867 tpd in 2014, and non-methyl bromide emissions from structural applications decreased from 0.160 tpd in 2013 to 0.144 tpd in 2014 (Tables 9, A2-1i - A2-1l), corresponding to the decrease in methyl bromide emissions shown in Figure 5.

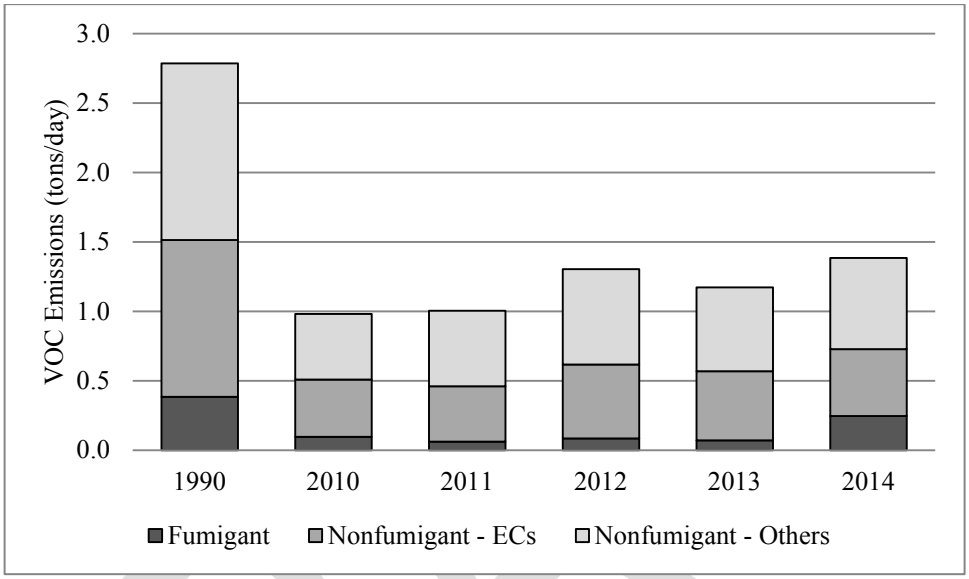

Figure 4. Pesticide VOC emissions for the Sacramento Metro NAA, May–October. Emissions for each year are divided into fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are *adjusted* to account for fumigation method.

Table 7. Top ten primary active ingredients contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metro Area.

Primary AI	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
1,3-DICHLOROPROPENE	0.188	13.75	525
ABAMECTIN	0.120	8.76	20
BIFENTHRIN	0.106	7.80	43
PROPANIL	0.094	6.90	7
CHLORPYRIFOS	0.059	4.29	5
TRIFLURALIN	0.054	3.96	37
HEXYTHIAZOX	0.042	3.07	-3
THIOBENCARB	0.040	2.92	-18
OXYFLUORFEN	0.039	2.87	-2
PENOXSULAM	0.038	2.80	-4

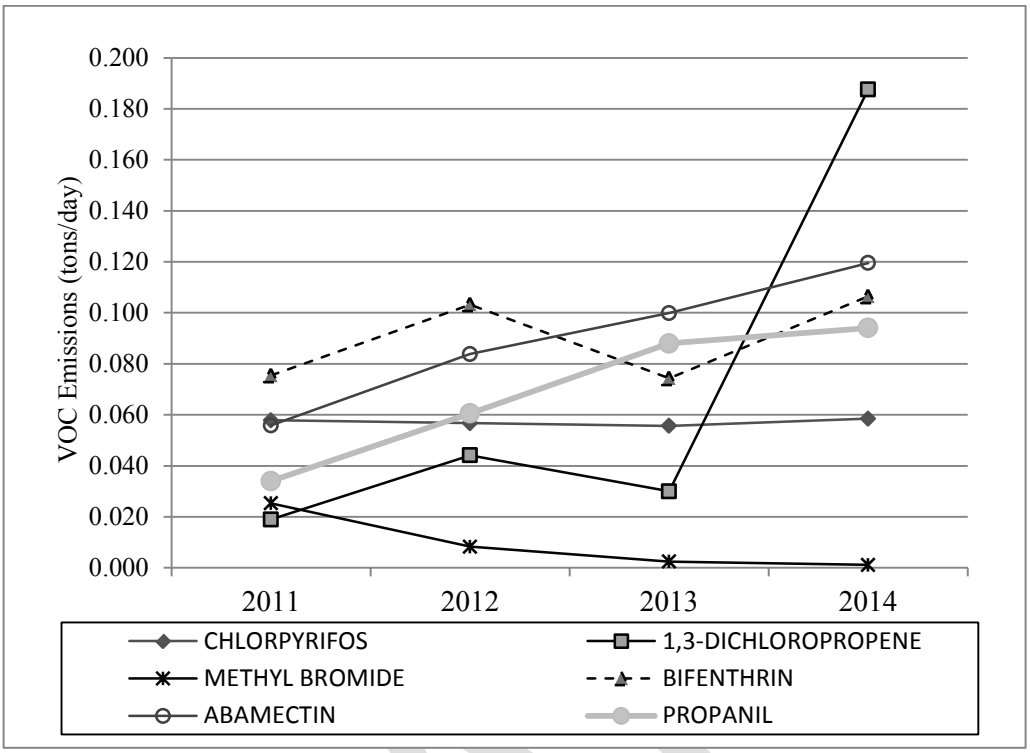

Figure 5. Changes in adjusted emissions of selected AIs in the Sacramento Metro NAA from 2011 to 2014.

Table 8. Top ten pesticide application sites contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 1.

Application Site	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
RICE	0.276	19.95	0
ALMOND	0.227	16.40	385
WALNUT	0.147	10.59	9
STRUCTURAL PEST CONTROL	0.144	10.39	-10
TOMATOES, FOR PROCESSING/CANNING	0.139	10.02	26
GRAPES, WINE	0.130	9.38	25
LANDSCAPE MAINTENANCE	0.044	3.20	-7
RIGHTS OF WAY	0.039	2.78	-16
SOIL APPLICATION, PREPLANT	0.032	2.31	2923
BEANS, DRIED	0.030	2.18	51

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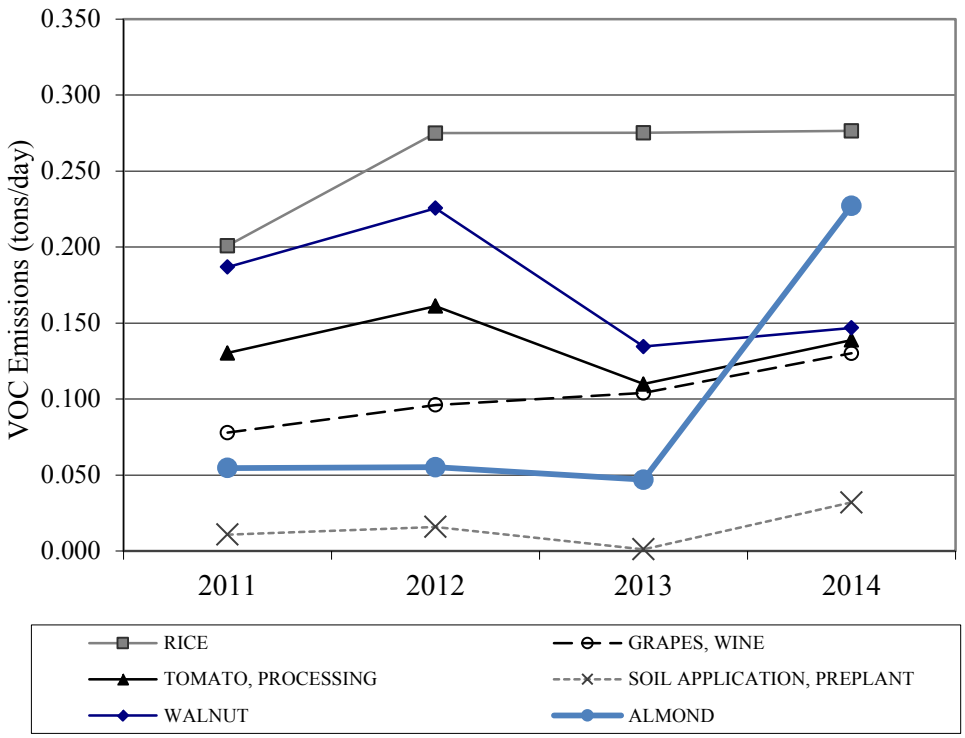

Figure 6. Changes in emissions from selected commodities/sites in the Sacramento Metro NAA from 2011 to 2014.

Table 9. *Unadjusted* **2014** May–October VOC emissions in NAA1 by ARB emission inventory classification (tons per day, tpd).

NAA 1 - 2014	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.002	0.000
NON-METHYL BROMIDE EMISSIONS	1.867	0.144

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San Joaquin Valley - NAA 2

In the San Joaquin Valley NAA, total VOC emissions decreased from 2013 to 2014 by almost 15 percent, and fell below the SIP goal by 1.410 tpd. Nonfumigant emissions accounted for more than three-quarters of the total VOC emissions in the San Joaquin Valley in 2014, with emissions from products with emulsifiable concentrate formulations accounting for 56 percent of the total VOC emissions for this NAA (Table 6c). VOC emissions from emulsifiable concentrates decreased by more than 17 percent, from 8.674 tpd in 2013 to 7.123 tpd in 2014. Fumigant emissions decreased by 9 percent from 4.360 tpd in 2013 to 3.951 tpd in 2014. (Tables 6a, 6b, Figure 3, 7).

Table 10 shows that VOC emissions from products containing the top 10 active ingredients in this NAA decreased between 2013 and 2014. Consistent with recent years, products containing chlorpyrifos, abamectin, and 1,3-dichloropropene were the top three pesticide VOC contributors in the San Joaquin Valley for 2014 (Table 10, Figure 8). As a percentage of total emissions fenpyroximate, chlorpyrifos and abamectin had the greatest decreases from 2013 to 2014, with declines of 42 percent, 26 percent and 22 percent, respectively (Table 10). Even though emissions from fenpyroximate, hexythiazox and glyphosate isopropylamine salt products declined in 2014, emissions (0.877 tpd, 0.911 tpd and 0.805 tpd, respectively) are still higher than for all years of the adjusted inventory prior to 2013. VOC emissions from fumigants fell to their lowest level since 2010, with emissions from methyl isothiocyanate (MITC) generators down to 1.093 tpd, the lowest since 2009.

As discussed in an earlier section, the EP values for several high-use products were revised. As a result, products containing hexythiazox and fenpyroximate account for a greater proportion of the inventory than previous estimates, ranked four and five, respectively. In last year's report, hexythiazox and fenpyroximate products were ranked eleven and eight, respectively, based on default EP values. Products containing these two active ingredients are also the greatest VOC contributors that are not subject to either the fumigant or nonfumigant regulations to reduce VOC emissions.

VOC emissions from pesticide products applied to the top ten crops/sites are shown in Table 11. For a second year sufficient fumigant method data was available to calculate adjusted VOC emissions by crop. VOC emissions from pesticides applied to pre-plant soil sites and carrots, are primarily from fumigant applications. VOC emissions for the remaining top 10 crops are mostly from nonfumigant applications. Emissions from almonds accounted for more than one quarter of the total adjusted emissions in this NAA. Seventy-seven percent of emissions from eight of the top ten active ingredients were derived from applications to almonds during 2014. Eighty percent of emissions from fenpyroximate, 60 percent of emissions from oxyfluorfen, 56 percent of emissions from hexythiazox, 46 percent of emissions from abamectin, and 29 percent of emissions from chlorpyrifos came from applications to almonds. An additional sixty-seven percent of emissions from chlorpyrifos, 41 percent of emissions from abamectin, 28 percent of emissions from oxyfluorfen and 93 percent of emissions from gibberellins came from use on alfalfa, citrus, cotton, grapes, pistachios and walnuts. Glyphosate isopropylamine salt products are the seventh highest nonfumigant VOC emitters, down 17 percent from 2013, but the emissions are likely overestimated due to lack of EP data for several of these products.

Thermogravimetric analysis is the preferred method to determine the EP for a product, but as yet only 15 percent of products have this data. DPR has assigned default values based on the formulation categories of the products. Information in the confidential statements of formula indicates that the default values assigned to almost 70 percent of glyphosate products likely overestimate the emission potential. DPR has requested that registrants submit thermogravimetric analysis data for glyphosate products.

Fumigant emissions decreased by 9 percent from 4.360 tpd in 2013 to 3.951 tpd in 2014. Use (unadjusted emissions) of fumigants decreased by 11 percent from 15.002 tpd to 13.365 tpd (Table 6b), indicating the use of low-emission fumigation methods required by the 2008 regulations is now well established. Although overall emissions in 2014 were below the trigger level of 17.2 tpd, the proportion of nonfumigant products with high EP values was essentially unchanged since 2013. Since overall emissions exceeded the trigger level in 2013, additional reductions in emissions from nonfumigant products, which contribute more than three quarters of emissions in this NAA, will come into effect in May-October 2015 and May-October 2016. These reductions are discussed in a later section on page 47.

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide were less than 0.001 tpd in 2014. Agricultural applications decreased from 1.597 tpd in 2013 to 1.278 tpd in 2014. Non-methyl bromide emissions from agricultural applications decreased from 28.096 tpd in 2013 to 24.398 tpd in 2014, while structural applications decreased from 0.241 tpd in 2013 to 0.215 tpd in 2014. (Tables 12, A2-2i to A2-2l).

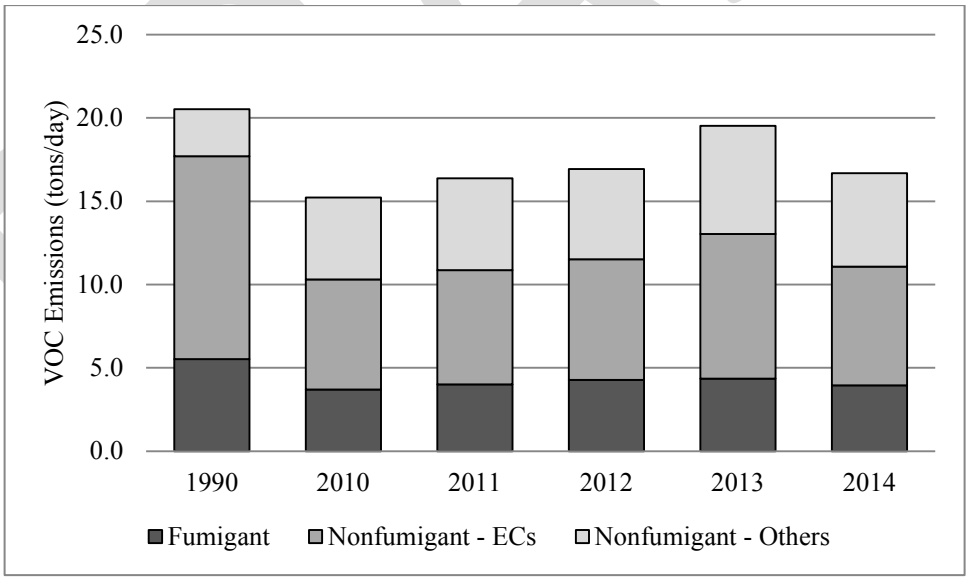

Figure 7. Pesticide VOC emissions for the San Joaquin Valley NAA, May–October. Emissions for each year are divided into fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are *adjusted* to account for fumigation method.

Table 10. Top ten primary active ingredients contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
1,3-DICHLOROPROPENE	1.711	10.38	-3
ABAMECTIN	1.477	8.95	-22
CHLORPYRIFOS	1.400	8.49	-26
HEXYTHIAZOX	0.911	5.53	-4
FENPYROXIMATE	0.877	5.32	-42
POTASSIUM N-METHYLDITHIOCARBAMATE	0.835	5.06	-12
GLYPHOSATE, ISOPROPYLAMINE SALT	0.805	4.88	-17
OXYFLUORFEN	0.762	4.62	-14
METHYL BROMIDE	0.733	4.45	-11
BIFENTHRIN	0.615	3.73	3

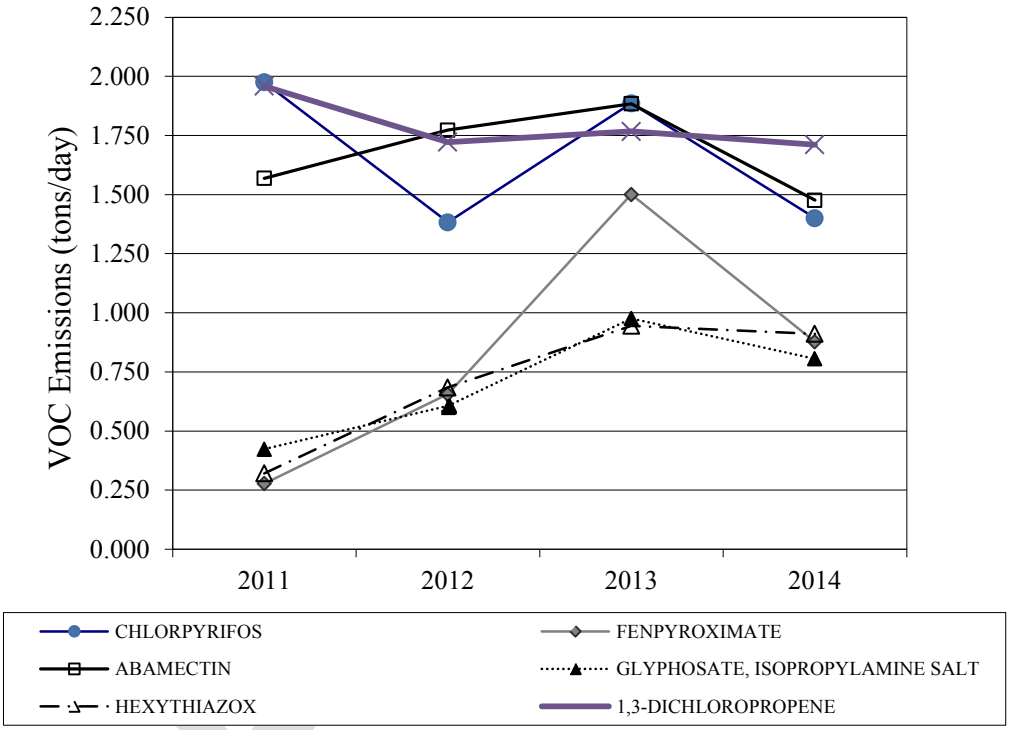

Figure 8. Changes in adjusted emissions of selected AIs in the San Joaquin Valley NAA from 2011 to 2014.

Table 11. Top ten pesticide application sites contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 2.

Application Site	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
ALMOND	4.792	28.71	-18
COTTON, GENERAL	1.267	7.59	-29
SOIL APPLICATION, PREPLANT	1.220	7.31	4
ORANGE	0.888	5.32	-10
CARROTS, GENERAL	0.794	4.76	-18
GRAPES	0.773	4.63	-11
TOMATOES, FOR PROCESSING/CANNING	0.657	3.94	-12
WALNUT	0.644	3.86	9
PISTACHIO	0.609	3.65	-10
GRAPES, WINE	0.573	3.43	-18

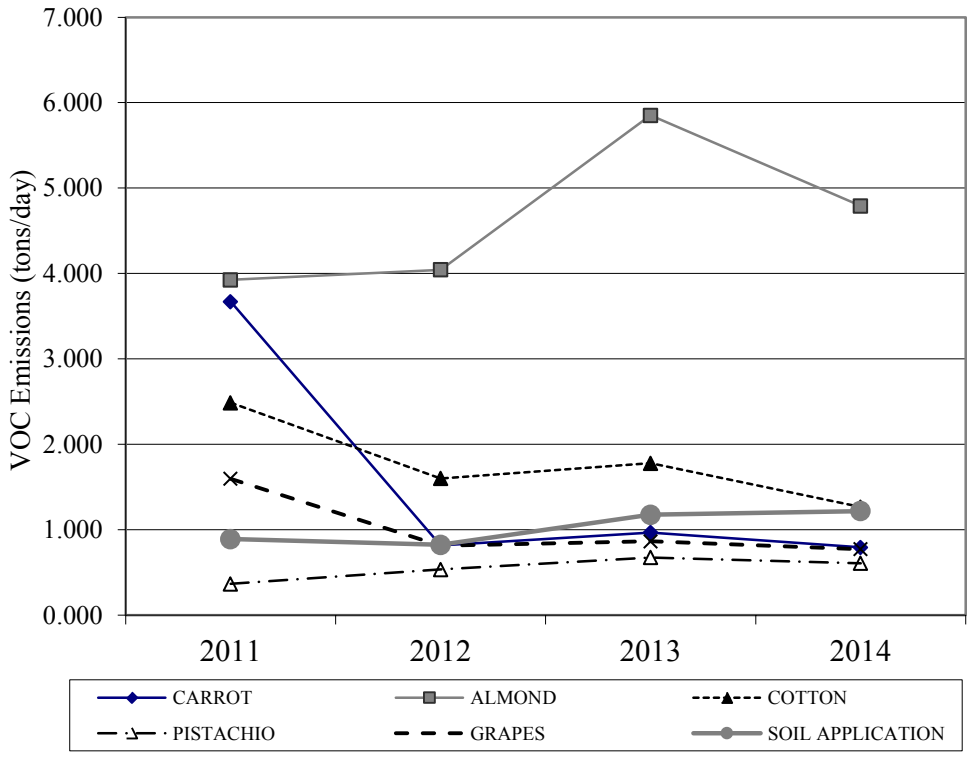

Figure 9. Changes in emissions from selected commodities/sites in the San Joaquin Valley NAA from 2011 to 2014.

Table 12. *Unadjusted* **2014** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tons per day, tpd).

NAA 2 - 2014	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	1.278	<0.001
NON-METHYL BROMIDE EMISSIONS	24.398	0.215

Southeast Desert - NAA 3

Total adjusted emissions for the Southeast Desert decreased from 0.370 tpd in 2013 to 0.288 tpd in 2014. The 2014 rate is well below the SIP goal of 0.92 tpd, (Tables 6a, 6b, Figures 3, 10).

Fumigants accounted for 29 percent of the emissions in this NAA in 2014, decreasing by almost 50 percent to 0.085 tpd. Emissions from metam-sodium, dazomet, chloropicrin and 1,3-dichloropropene all declined in 2014, while emissions from methyl bromide increased by more than 5000 percent from less than 0.001 tpd in 2013 to 0.037 tpd in 2014. There was no reported use of potassium n-methyldithiocarbamate in 2014 (Tables 13, A3-3a to A3-3d, Figure 11). Less than half of the emissions from nonfumigants came from products with emulsifiable concentrate formulations (0.097 tpd) (Table 6c). Emissions from cypermethrin, a pyrethroid insecticide, increased by almost 150 percent in 2014, coinciding with a decrease in emissions from permethrin, bifenthrin and deltamethrin which are also pyrethroid insecticides.

For a second year sufficient fumigant method data was available to calculate adjusted VOC emissions by crop. Adjusted emissions from seven of the top ten crops decreased from between 9 and 85 percent, however emissions from ornamental turf increased by almost three times from 0.001 tpd in 2013 to 0.037 tpd in 2014, and almost doubled from potatoes from less than 0.001 tpd in 2013 to 0.011 tpd in 2014. More than 96 percent of emissions derived from ornamental turf came from methyl bromide use. In 2014, unadjusted emissions from strawberries, turf and peppers totaled 0.301 tpd, however adjusted emissions in 2014 were 0.084 tpd because of the overwhelming use of low emission fumigation methods 1143 (chloropicrin ER 7 %, methyl bromide ER 48%), 1408 (metam-sodium ER 9%) and 1259 (chloropicrin ER 7 %, 1,3-dichloropropene ER 29%). Unadjusted emissions from uncultivated agricultural sites, which are applications that are made before the grower has made a decision about which commodity to plant, fell from 0.207 tpd in 2013 to 0.013 tpd in 2014, with low fumigant methods reducing the adjusted emissions to 0.009 tpd (Tables 14, a2- 3d to a2-3h, Figure 12).

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide continue to be below a calculable level, as they have since 2005. Agricultural applications of methyl bromide increased from 0.001 tpd in 2013 to 0.076 tpd in 2014. Non-methyl bromide emissions from agricultural applications declined by almost 50 percent from 0.712 tpd in 2013 to 0.366 tpd in 2014. Structural non-methyl bromide emissions decreased by 0.012 tpd from 0.080 tpd in 2013 to 0.068 tpd in 2014. (Tables 15, A2-3i to A2-3l).

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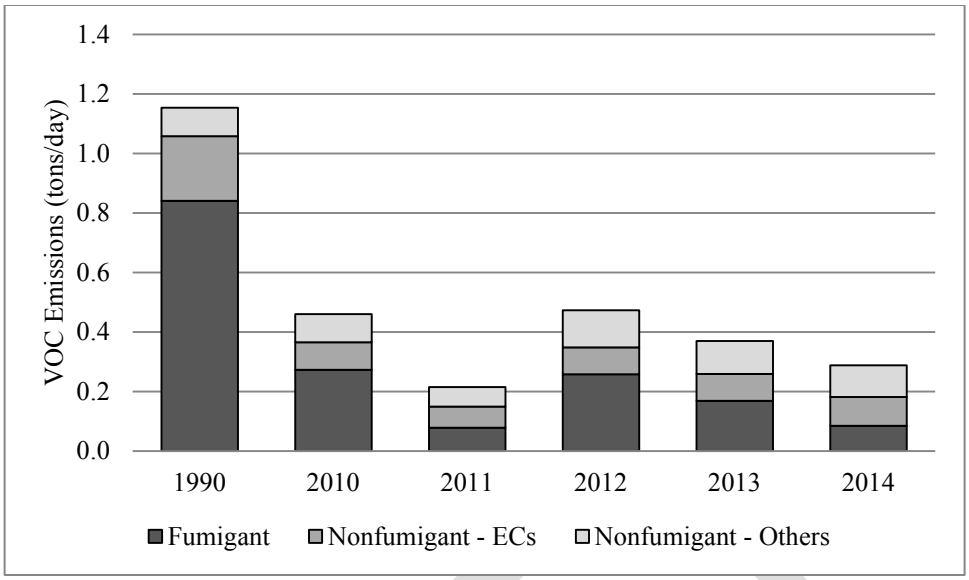

Figure 10. Pesticide VOC emissions for the Southeast Desert NAA, May–October. Emissions for each year are divided into fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are *adjusted* to account for fumigation method.

Table 13. Top ten primary active ingredients contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert

Primary AI	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
METHYL BROMIDE	0.037	13.35	5557
BENSULIDE	0.017	6.21	-9
METAM-SODIUM	0.017	6.07	-63
GLYPHOSATE, ISOPROPYLAMINE SALT	0.015	5.54	32
CYPERMETHRIN	0.014	5.14	143
BIFENTHRIN	0.014	5.05	-16
1,3-DICHLOROPROPENE	0.012	4.21	-81
EPTC	0.010	3.73	1
PERMETHRIN	0.009	3.13	-41
MEFENOXAM	0.009	3.07	-8

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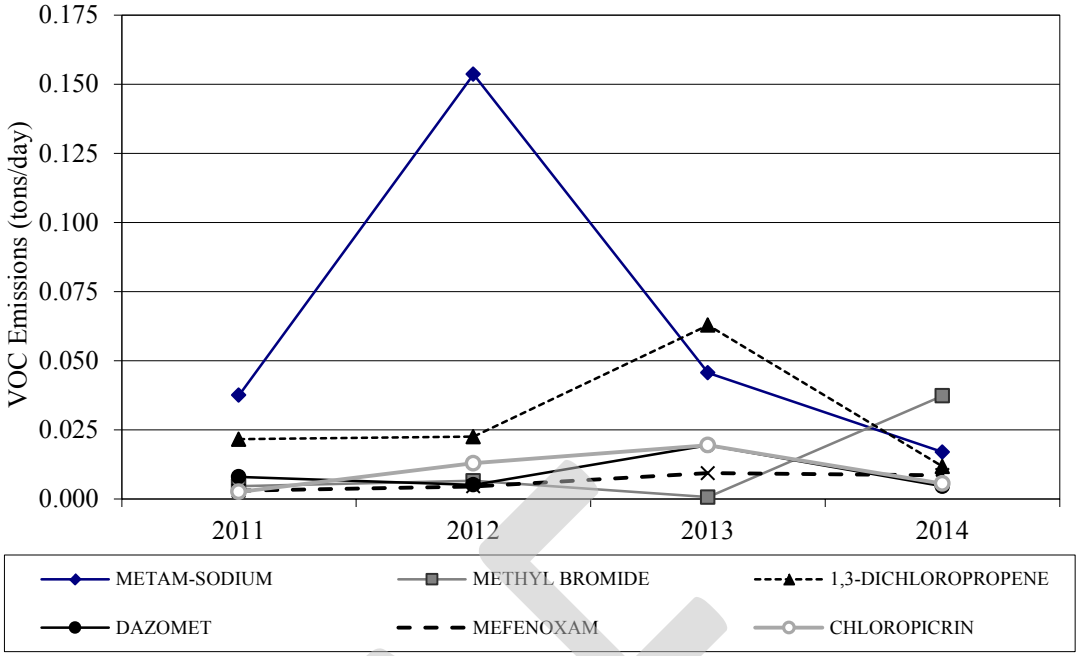

Figure 11. Changes in adjusted emissions of selected AIs in the Southeast Desert NAA from 2011 to 2014.

Table 14. Top ten pesticide application sites contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 3.

Application Site	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
STRUCTURAL PEST CONTROL	0.068	23.45	-15
ORNAMENTAL TURF	0.037	12.99	2881
STRAWBERRY	0.025	8.63	-50
PEPPERS	0.022	7.69	-56
LANDSCAPE MAINTENANCE	0.021	7.35	-13
CARROTS, GENERAL	0.020	6.78	0
RIGHTS OF WAY	0.015	5.16	-45
LETTUCE, LEAF	0.012	4.19	-9
POTATO	0.011	3.79	889
UNCULTIVATED AGRICULTURAL AREAS*	0.009	2.96	-85

* Treatment of an area prior to determining which crop will be planted.

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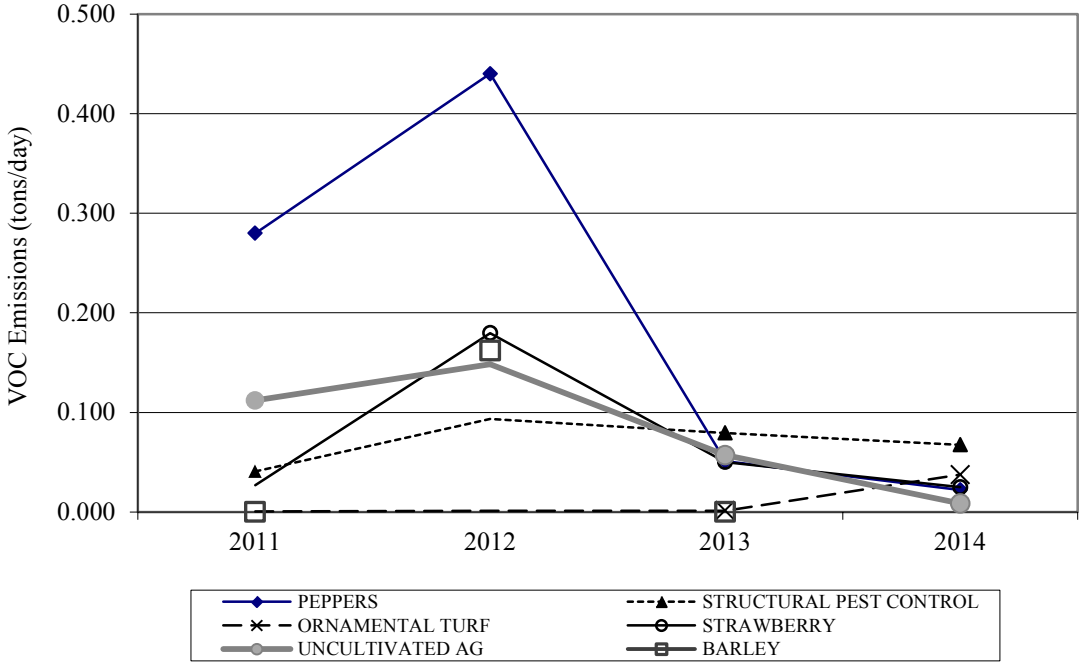

Figure 12. Changes in emissions from selected commodities/sites in the Southeast Desert NAA from 2011 to 2014.

Table 15. *Unadjusted* **2014** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tons per day, tpd).

NAA 3 - 2014	**Agricultural Applications**	**Structural Applications**
METHYL BROMIDE EMISSIONS	0.076	0.000
NON-METHYL BROMIDE EMISSIONS	0.366	0.068

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Ventura - NAA 4

Ozone season adjusted emissions in the Ventura NAA (NAA 4) decreased by 0.083 tpd from 1.707 tpd in 2013 to 1.624 tpd in 2014 (5 percent). Emissions were 1.376 tpd below the SIP goal for 2014 (3.0 tpd). (Tables 6a, 6b, Figure 3, 13).

The reduction in adjusted emissions can be directly attributed to the continued use of totally impermeable film (TIF) tarp methods, which became effective on May 1, 2013 (California Code of regulations, Title 3, section 6452) and an overall reduction in pesticide use. DPR's interim approval of TIF methods followed up U.S. EPA's revisions of most fumigant product labels in December 2012 requiring buffer zones for most applications. These label changes required buffer zones for chloropicrin (as a sole active ingredient and when used in combination with methyl bromide or 1,3-dichloropropene) statewide for the first time. The labels specify a 60% reduction in buffer distance when U.S. EPA-approved TIF tarps are used. As in previous years, fumigants dominate the pesticide inventory for this NAA. In 2014 fumigants accounted for 73 percent of the emissions, down significantly from 88 percent in 2012 and, with the exception of 2008 (72%), the lowest percentage seen since adjusted emission calculations began in 2004. The most heavily used fumigants in NAA 4 in 2014 were chloropicrin, methyl bromide and 1,3-dichloropropene, which together accounted for 64 percent of emissions (Tables 16, A3-4a to A3-4d, Figure 14). Of the 411 reported fumigations in 2014, 72 percent were made using TIF tarps, which have significantly lower emission ratings. Almost one hundred percent of all methyl bromide fumigations on strawberries used the fumigation method with the lowest emission rating of 48 percent (fumigation codes 1143 and 1147). Eighty-one percent of all chloropicrin applications used TIF tarp fumigation methods with the lowest emission rating of 7 percent (fumigation codes 1143, 1242 and 1259), while 54 percent (down from 80 percent in 2013) of 1,3-dichloropropene applications used non-TIF tarp method, chemigation with tarpaulin (fumigation code 1209), which has an emission rating of 29 percent compared to the alternative TIF tarp methods 1242 and 1247 that have emission ratings of 10 percent.

In 2014 adjusted emissions increased from chloropicrin (from 0.448 tpd in 2013 to 0.472 tpd in 2014), methyl bromide (from 0.243 tpd in 2013 to 0.284 tpd in 2014) and metam-sodium (from 0.045 tpd in 2013 to 0.053 tpd in 2014), while emissions from 1,3-dichloropropene decreased by 51 percent from the previous year. In 2014 seventy percent (70%) of emissions from fumigants came from applications to strawberries, and 8 percent from applications to raspberries. Other notable commodities/sites for emissions in 2014 include lemons, peppers, avocados and celery. (Tables 17, A2-4e to A2-4h, Figure 15). In 2014 thirty-four percent (34%) of nonfumigant emissions, which account for 27 percent of this NAA's total adjusted emissions, were from products with emulsifiable concentrate formulations (0.131 tpd) (Table 6c).

Using the ARB emission inventory classification, emissions from structural methyl bromide applications were below 0.001 tpd in 2014. Emissions from agricultural applications of methyl bromide increased from 0.498 tpd in 2013 to 0.590 tpd in 2014. These findings are consistent with the trend found for the increased use of methyl bromide on raspberries. Non-methyl bromide emissions from agricultural applications decreased from 7.222 tpd in 2013 to 6.964

tpd in 2014. Structural non-methyl bromide emissions decreased from 0.032 tpd in 2013 to 0.022 tpd in 2014 (Tables 18, A2-4i to A2-4l).

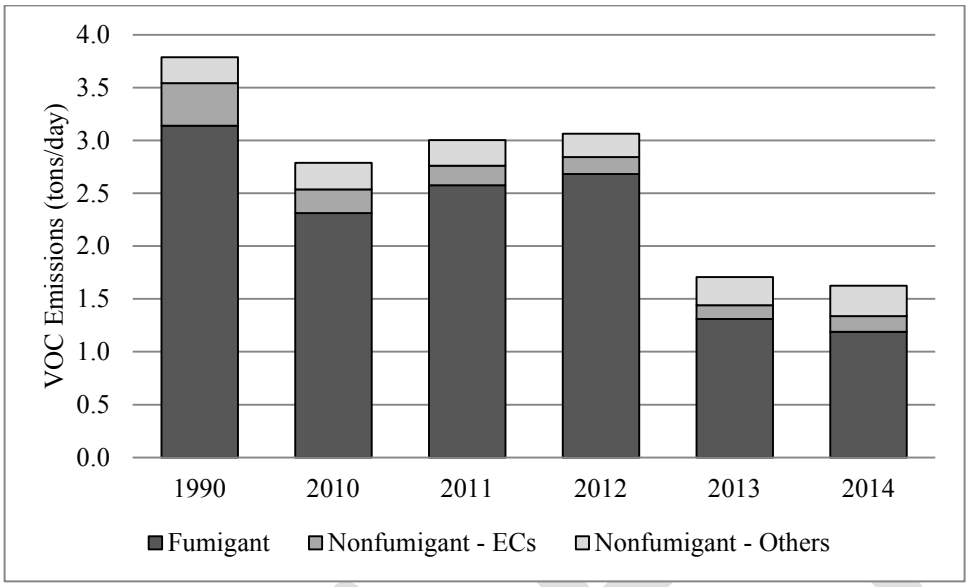

Figure 13. Pesticide VOC emissions for the Ventura NAA, May–October. Emissions for each year are divided into fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are *adjusted* to account for fumigation method.

Table 16. Top ten primary active ingredients contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 4, Ventura.

Primary AI	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
CHLOROPICRIN	0.472	33.73	5
METHYL BROMIDE	0.284	20.34	17
1,3-DICHLOROPROPENE	0.136	9.71	-51
METAM-SODIUM	0.053	3.79	17
MINERAL OIL	0.043	3.11	35
CHLORPYRIFOS	0.038	2.73	21
ABAMECTIN	0.034	2.45	-5
OXAMYL	0.019	1.34	20
PETROLEUM OIL, UNCLASSIFIED	0.018	1.30	-21
GLYPHOSATE, ISOPROPYLAMINE SALT	0.015	1.06	41

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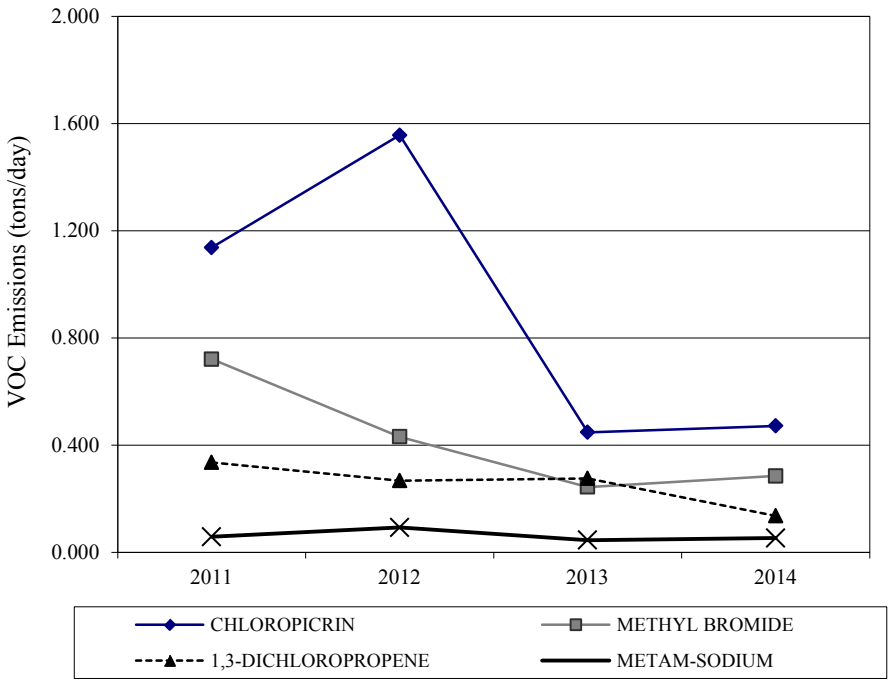

Figure 14. Changes in adjusted emissions of selected AIs in the Ventura NAA from 2011 to 2014.

Table 17. Top ten pesticide application sites contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 4.

Application Site	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
STRAWBERRY	1.111	68.42	-13
RASPBERRY	0.121	7.46	84
LEMON	0.113	6.94	9
PEPPERS	0.037	2.30	75
AVOCADO	0.027	1.65	0
CELERY, GENERAL	0.026	1.60	10
STRUCTURAL PEST CONTROL	0.022	1.33	-32
N-OUTDR GRWN CUT FLWRS OR GREENS	0.018	1.12	-16
RIGHTS OF WAY	0.014	0.86	-37
LANDSCAPE MAINTENANCE	0.012	0.76	24

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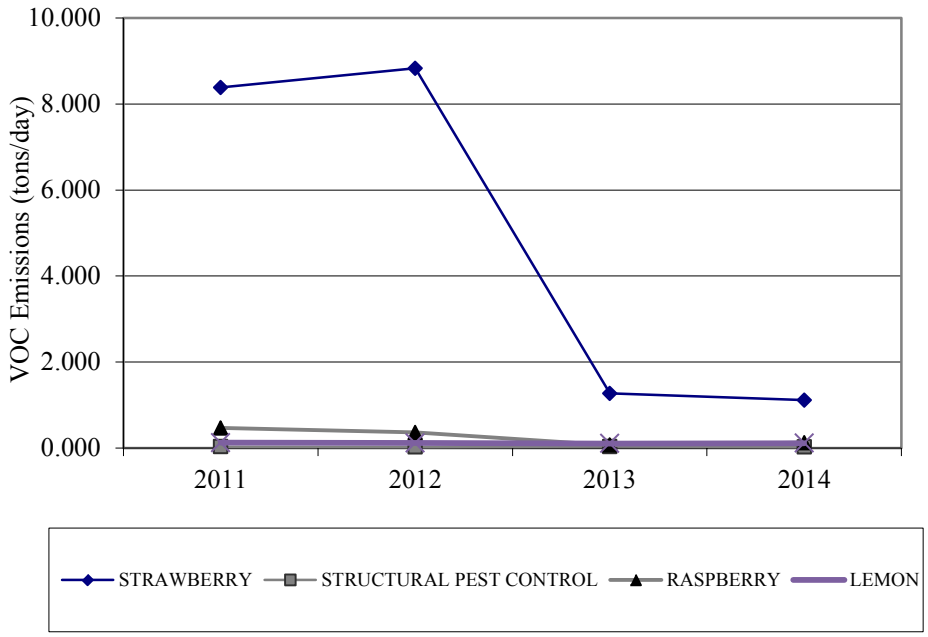

Figure 15. Changes in emissions from selected commodities/sites in the Ventura NAA from 2011 to 2014.

Table 18. *Unadjusted* **2014** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tons per day, tpd).

NAA 4 - 2014	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.590	<0.001
NON-METHYL BROMIDE EMISSIONS	6.964	0.022

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South Coast - NAA 5

In the South Coast NAA, adjusted emissions decreased from 1.312 tpd in 2013 to 1.163 tpd in 2014, eight-nine percent below the SIP goal of 8.7 tpd. In 2014, emissions from nonfumigants accounted for 82 percent of the total for the South Coast NAA, up from 78 percent in 2013. Emissions from nonfumigants with emulsifiable concentrate formulations accounted for 0.299 tpd, which is 26 percent of the nonattainment area's total adjusted emissions (Tables 6a, 6b, 6c, Figure 3, 16).

The fumigants methyl bromide, chloropicrin, metam-sodium and 1,3-dichloropropene contributed almost 15 percent of 2014 total adjusted emissions, down from 2013. Emissions from methyl bromide, chloropicrin and 1,3-dichloropropene decreased from between 17 and 46 percent, while emissions from metam-sodium increased from 0.004 tpd to 0.029 tpd (up 625 percent). Permethrin and N-octyl bicycloheptene dicarboximide, both active ingredients used to control pests in structural and landscape environments, continue to be the largest nonfumigant contributors to the adjusted inventory accounting for more than 16 percent of emissions, at 0.105 tpd and 0.095 tpd, respectively. While emissions from bifenthrin and permethrin decreased, emissions from cyfluthrin and cypermethrin increased by a combined total of 0.058 tpd 2014. Emissions from disodium octaborate tetrahydrate, an insecticide generally used for treating structural infestations, decreased from 0.119 tpd to 0.067 tpd in 2014 (Tables 19, A3-5a to A3-5d, Figure 17).

Almost 60 percent of emissions in NAA 5 in 2014 came from fumigant and nonfumigant use in structural pest control (0.693 tpd), a 9 percent decrease from 2013. A further 18 percent of total emissions came from landscape maintenance and rights-of-way treatments, 0.157 tpd and 0.052 tpd, respectively, a reflection of the predominantly urban environment in this NAA. Unadjusted emissions from strawberries (0.191 tpd) were down significantly from 0.359 tpd in 2013, and adjustment from fumigation method factors resulted in adjusted emissions of 0.090 tpd from this commodity. (Tables 20, A2-5e to A2-5h, Figure 18).

Since this NAA has complied with the SIP goal for several years, most provisions of the VOC regulations do not apply. Therefore, the regulations had little or no impact on emissions in this NAA.

Using the ARB emission inventory classification, emissions from structural applications of methyl bromide continue to be below a calculable level in 2014. Agricultural applications decreased from 0.138 tpd in 2013 to 0.103 tpd in 2014. Non-methyl bromide emissions from agricultural applications decreased from 0.582 tpd in 2013 to 0.446 tpd in 2014. Structural non-methyl bromide emissions reversed their upward trend and decreased from 0.757 tpd in 2013 to 0.693 tpd in 2014 (Tables 21, A2-5i to A2-5l).

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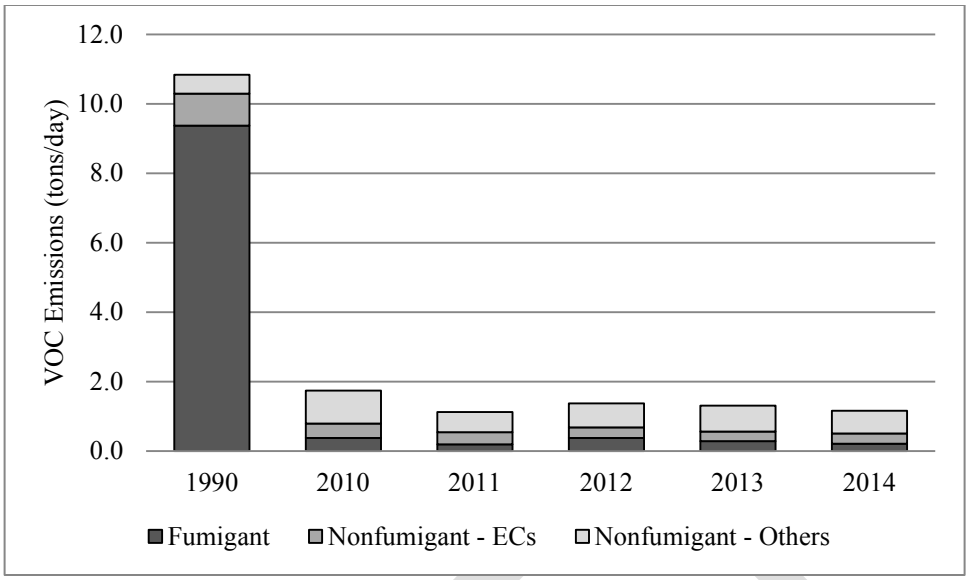

Figure 16. Pesticide VOC emissions for the South Coast NAA, May–October. Emissions for each year are divided into fumigants, nonfumigants with emulsifiable concentrate formulations (ECs) and other nonfumigants (Others). Fumigant emissions are *adjusted* to account for fumigation method.

Table 19. Top ten primary active ingredients contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 5, South Coast.

Primary AI	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
PERMETHRIN	0.105	9.12	-19
METHYL BROMIDE	0.096	8.34	-17
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.095	8.27	-21
BIFENTHRIN	0.081	7.05	-14
CYFLUTHRIN	0.068	5.88	86
DISODIUM OCTABORATE TETRAHYDRATE	0.067	5.83	-44
PIPERONYL BUTOXIDE	0.048	4.18	-23
CYPERMETHRIN	0.043	3.71	108
CHLOROPICRIN	0.042	3.63	-41
FIPRONIL	0.036	3.16	11

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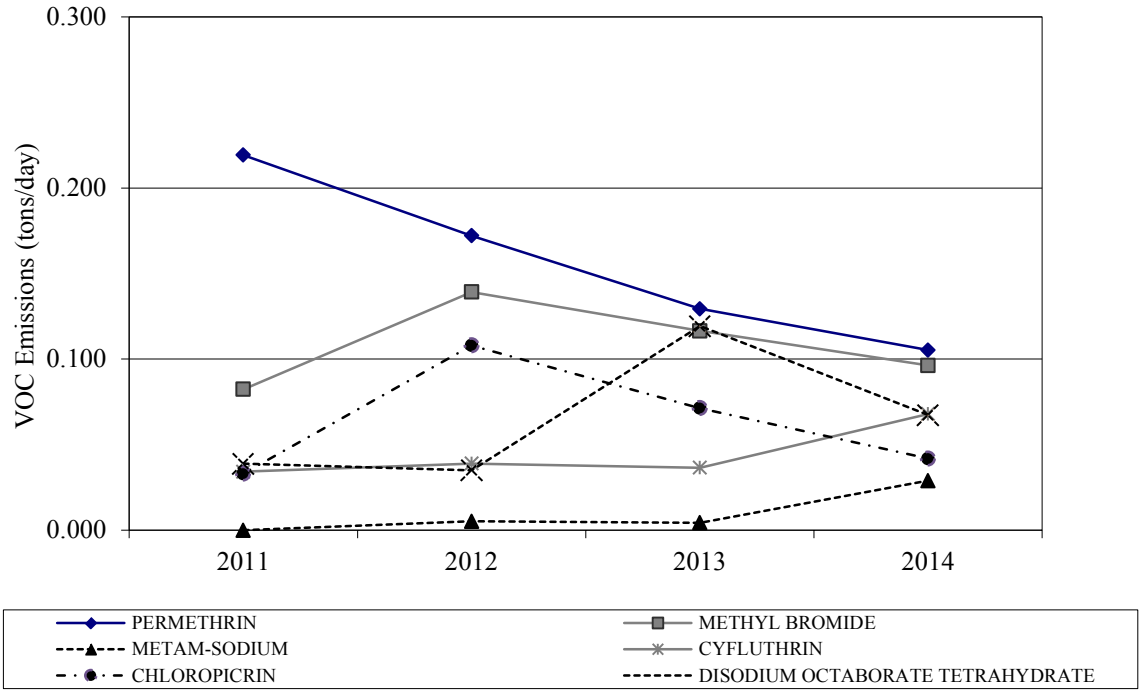

Figure 17. Changes in adjusted emissions of selected AIs in the South Coast NAA from 2011 to 2014.

Table 20. Top ten pesticide application sites contributing to **2014** May-October ozone season *adjusted* VOC emissions in NAA 5.

Application Site	2014 Total Product Adjusted Emissions (tons/day)	Percent of 2014 Adjusted Emissions	Percent Change from 2013 to 2014
STRUCTURAL PEST CONTROL	0.693	59.54	-9
LANDSCAPE MAINTENANCE	0.157	13.53	-3
STRAWBERRY	0.090	7.78	-41
FUMIGATION	0.061	5.21	-22
RIGHTS OF WAY	0.052	4.43	-7
N-OUTDR CONTAINER/FLD GRWN PLANTS	0.019	1.63	-23
COMMODITY FUMIGATION	0.015	1.30	-18
CABBAGE	0.007	0.64	9042
ORNAMENTAL TURF	0.007	0.62	140
ORANGE	0.007	0.62	-6

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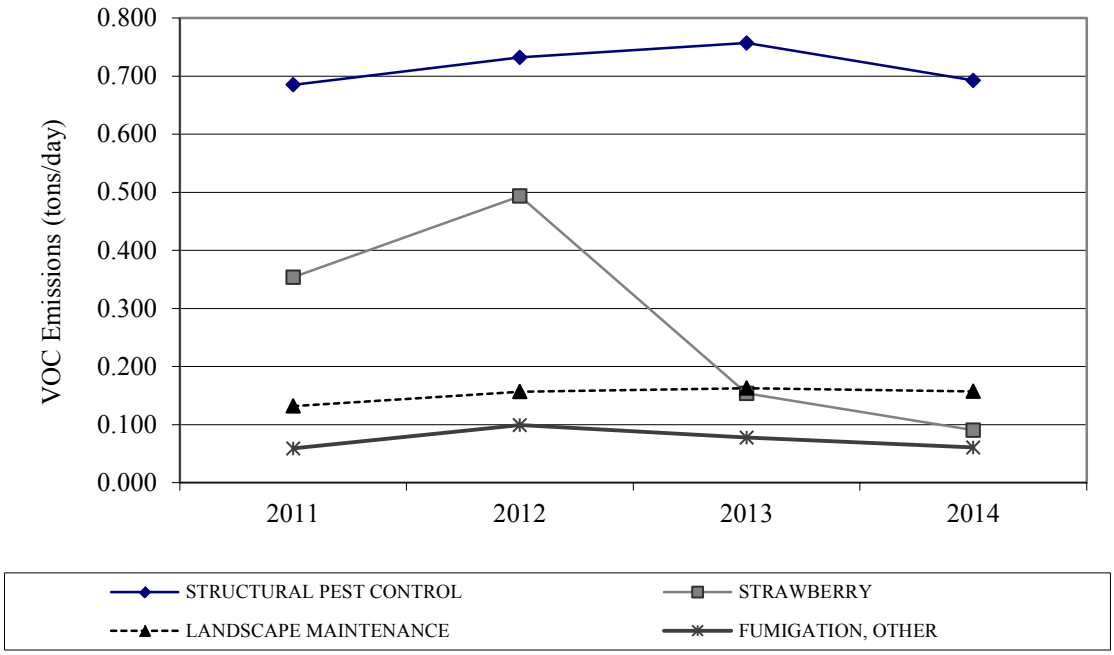

Figure 18. Changes in emissions from selected commodities/sites in the South Coast NAA from 2011 to 2014.

Table 21. *Unadjusted* **2014** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tons per day, tpd).

NAA 5 - 2014	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.103	0.000
NON-METHYL BROMIDE EMISSIONS	0.446	0.693

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VOC EMISSIONS RELATIVE TO LEVELS THAT TRIGGER ADDITIONAL RESTRICTIONS

DPR is required to implement additional VOC restrictions if pesticide VOC emissions exceed 95 percent of the benchmarks specified in 3 CCR section 6452.2. As shown in Table 22, pesticide VOC emissions in 2014 were less than 95 percent of the benchmarks that trigger additional restrictions in all nonattainment areas.

Table 22. Trigger levels and 2014 pesticide VOC emissions.

NAA	Benchmark and SIP Goal (tons/day)	Trigger Level (95% of Benchmark) (tons/day)	2014 Emissions (tons/day)
1 – Sacramento Metro	2.2	2.1	1.385
2 – San Joaquin Valley	18.1	17.2	16.690
3 – Southeast Desert	0.92	0.87	0.288
4 – Ventura	3.0	2.85	1.624
5 – South Coast	8.7	8.3	1.163

Adjusted emissions reported in the 2013 VOC Inventory Report for the San Joaquin Valley nonattainment area exceeded the trigger level by 0.183 tons per day. Inventory calculations for 2013 emissions in the San Joaquin Valley nonattainment area as calculated in the 2014 VOC Inventory increased to 19.525 tpd, 2.325 tpd above the trigger level. This increase is largely due to revised thermogravimetrically derived emission potential values (EPs) for fenpyroximate and hexythiazox products with emulsifiable concentrate formulations. Exceedance of the trigger level as reflected for San Joaquin Valley in the 2013 VOC invetory required a prohibition of certain uses of designated nonfumigant high-VOC products. These prohibitions are discussed in the next section.

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NONFUMIGANT PRODUCTS DESIGNATED AS HIGH-VOC AND LOW-VOC AND RESTRICTIONS FOR THE SAN JOAQUIN VALLEY

Regulations to reduce VOC 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 emission potential thresholds to designate agricultural products as high-VOC or low-VOC:

Table 23. Emission potential thresholds for agricultural products with abamectin, chlorpyrifos, giberellins or oxyfluorfen as the primary active ingredient.

Primary Active Ingredient	Emission Potential (EP) Threshold (%)
Abamectin	35
Chlorpyrifos	25
Gibberellins	25
Oxyfluorfen	15

If a product contains more than one active ingredient, the primary active ingredient is the one present at the highest percentage in a product. These criteria do not apply to products that contain an active ingredient listed above, but not as the primary active ingredient, including products with one or more active ingredients 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 active ingredient; 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 active ingredient; 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 active ingredient; or b) labeled for only for non-agricultural use.

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

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

- 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 to alfalfa, almonds, citrus, cotton, grapes, pistachios, or walnuts.

In 2013 the trigger level for high-VOC prohibitions (17.2 tons/day) was exceeded by 2.325 tons/day and so the high-VOC applications described above are prohibited for use in May-October 2015 and May-October 2016, 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 active ingredient per acre or less.
- Use of oxyfluorfen products when applied at an application rate of 0.125 (⅛) pounds of active ingredient per acre or less.
- Uses for which the U.S. Environmental Protection Agency 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.

The amount of VOC reductions achieved from nonfumigant prohibitions depend on four factors: the pesticide products (by A.I.) included, the EP thresholds selected, the crops included, and the exceptions included. Analysis of the VOC inventory data shows that had the nonfumigant prohibitions described above been in place in 2013 and 2014 in the San Joaquin Valley, emissions could potentially have been reduced by at least 2.378 tons/day and 1.790 tons/day, respectively, resulting in a hypothetical total emissions rate of 17.147 tons/day and 14.900 tons/day, below the trigger level of 17.2 tpd (Table 24). As discussed earlier, the total adjusted emissions and hypothetical emissions for 2013 are higher than estimated in last year's report due to new EP data for several high-use products.

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Table 24. Minimum hypothetical reduction in adjusted emissions in NAA2 had nonfumigant prohibitions been in place.

Year	Total Adjusted Emissions (tons/day)	Minimum Hypothetical Reduction (tons/day)	Hypothetical Adjusted Emissions (tons/day)
2013	19.525	2.378	17.147
2014	16.690	1.790	14.900

These hypothetical estimates are based on the following criteria:
All high-VOC product emission potentials were substituted with the highest low-VOC product emission potential as shown in Appendix 4:

Abamectin products, EP = 34.18%
Chlorpyrifos products, EP = 24.24%
Gibberellins products, EP = 22.95%
Oxyfluorfen products, EP = 10.63%

when applications of products containing these active ingredients were made to alfalfa, almonds, citrus, cotton, grapes, pistachios or walnuts;

with the exception of applications of:

a. gibberellin products that were less than 16 grams active ingredient per acre
b. oxyfluorfen products that were less than 0.125 pounds active ingredient per acre
c. chlorpyrifos products that were used to treat aphids on cotton.

The remaining exceptions to the high-VOC prohibitions listed above likely have negligible emissions and are not included in this calculation.

Use of Low-VOC products with emission potential values below those listed above would result in further reductions in emissions.

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