CALIFORNIA OZONE STATE IMPLEMENTATION PLAN
PESTICIDE ELEMENT

ENCLOSURE 6

EMISSION INVENTORY METHODOLOGY

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MEMORANDUM

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SUBJECT: UPDATE TO THE PESTICIDE VOLATILE ORGANIC INVENTORY: ESTIMATED EMISSIONS 1990–2006, AND PRELIMINARY ESTIMATES FOR 2007

I. OVERVIEW

This memorandum summarizes the Department of Pesticide Regulation's (DPR's) update of estimated pesticide volatile organic compound (VOC) emission data, for the May–October "ozone season" in California's five nonattainment areas (NAAs): (1) Sacramento Metro, (2) San Joaquin Valley, (3) Southeast Desert, (4) Ventura, and (5) South Coast. An electronic file containing detailed statewide 1990–2006 data is available by download from DPR's Web page at <http://www.cdpr.ca.gov/docs/pur/vocproj/vocmenu.htm> along with a variety of VOC documentation.

The 1990–2007 VOC inventories incorporate new emission potential (EP) data for several hundred products, and DPR's 2007 pesticide use data. Inventory calculations for 2005–2006 are based on the final report of pesticide use data for those years. Data for 2007 has yet to be finalized and should be, for the purposes of this memorandum, considered draft. These EP data reflect new thermogravimetric analyses (TGA) requested by DPR in 2005. Thermogravimetric analysis is currently the most accurate method for estimating the VOC content of pesticide products. DPR requested the data for most liquid products included in the inventory that had not been tested previously. The VOC emissions described here incorporate the TGA data submitted, reviewed, and approved as of August 2007.

The emissions are compared to two sets of NAA goals (Table 1). The first set of goals are those required by an April 26, 2006, federal district court order (now overturned), and reflected in Title 3, California Code of Regulations section 6452.2. These are the goals shown as the "VOC regulation benchmarks" and represent a 20 percent reduction from the pesticide VOC emissions in 1991 for all NAAs. The VOC regulations also show benchmarks specific to Ventura that incorporate a phase-in of the 20 percent VOC reductions from 1991 levels between 2008 and 2012. On August 20, 2008, the Ninth Circuit Court of Appeals reversed the district court action, finding that it had no jurisdiction to issue its order. The second set goals are those described in the 1994

California's State Implementation Plan (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, and South Coast NAAs; a 12 percent reduction from 1990 for the San Joaquin Valley NAA; and a phase-in of the reductions for the Ventura NAA, with a final reduction for Ventura of 20 percent from 1990 by 2012.

Table 1: Nonattainment Area Goals for 2009–2012.

NAA	VOC Regulation Benchmark (tons/day) 2009–2012				SIP Goal (tons/day) 2009–2012			
1–Sacramento Metropolitan	2.4				2.234			
2–San Joaquin Valley	16.0				18.139			
3–Southeast Desert	0.62				0.923			
4–Ventura	**2009**	**2010**	**2011**	**2012**	**2009**	**2010**	**2011**	**2012**
	3.630	3.230	2.930	2.600	4.030	3.630	3.330	3.029
5–South Coast	4.1				8.672			

To date, DPR has reported an unadjusted emission inventory that assumes the entire volatile portion of a fumigant product eventually volatilizes, contributing to atmospheric VOC loadings. However, 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.

Procedure for Calculating Unadjusted and Adjusted Volatile Organic Compound 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 EP (Spurlock, 2002; 2006).

$$emission = lbs\_use \times EP$$

In the adjusted inventory the emission from a single application of a **fumigant** active ingredient (AI) is equal to the amount of AI used times the EP times 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 application method- and fumigant-specific they yield more refined estimates of fumigant VOC emissions than previous (unadjusted) assumptions. Emission ratings for application methods not found on Tables A1-2 through A1-6 pertaining to the 1990 application methods may be modified based on more recent data.

$$emission = lbs\_use \times EP \times AMAF$$

At this time **nonfumigant** product emissions calculations use the same procedure as in 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 MUFs are used for the baseline year (1990) as opposed to more recent inventory years. MUFs are determined in a number of different ways. For 1,3-dichloropropene (1,3-D) the MUFs 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 MUFs are 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 MUF and AMAFs are calculated can be found in the September 29, 2007, memorandum by Barry et al. Tables detailing the AMAFs and method use fractions for 1990, 2005, 2006, and 2007 in each of the nonattainment areas are included in the appendix of this document (Tables A1–1 to A1–21). The AMAFs are unchanged from the Barry et al. memorandum.

VOC emissions were calculated for each nonattainment area and summed according to primary AI, application site, and emission category as defined by the Air Resources Board (ARB). The primary AI is defined as the pesticide AI present at the highest percentage in a product. If a pesticide product contains 20 percent of AI "A" and 10 percent of AI "B," all estimated emissions from that product are assigned to the primary AI "A." This approach prevents "double-counting" of emissions from products containing two AIs. Both unadjusted and adjusted emission inventory data for the top ten primary AIs contributing to May–October ozone in 2005, 2006 and 2007 are included in this memorandum. Emissions attributed to application sites (or commodities), however, are *unadjusted* because it is not possible to determine the adjusted emissions with the currently available data. The ARB defines four VOC emission categories: methyl bromide emissions from agricultural applications, nonmethyl bromide emissions from agricultural applications, methyl bromide emissions from structural applications, and nonmethyl bromide emissions from structural applications. Emissions were calculated for May–October, the ozone season, and are reported as U.S. tons per day (tpd).

Revised Emission Potential Values

Propylene oxide is used exclusively for post-harvest fumigation, and is widely used in the Sacramento Metro and San Joaquin Valley NAAs. In the past DPR has included these applications in its VOC inventory. Since the Air Pollution Control Districts also include these uses in their inventories emissions are being double counted. In addition, DPR has concluded that the use of propylene oxide is not an agricultural use, and therefore its products have been eliminated from DPR's VOC inventory.

EPs for all sulfur products with dust/powder formulations that do not contain any organic components have been set to zero. Most of these products had low or zero EP values in previous inventories, but recent findings by U.S. Department of Agriculture (McConnell et al., 2008) have shown that 132 products have zero EP.

Stakeholders raised concerns to an earlier draft version of this memo because the EP value assigned to a certain high use spray oil product was anomalously high. DPR re-reviewed the initial TGA of the oil products 10951-15 (Britz 415 Supreme Spray Oil and Britz Citrus Supreme Spray Oil; EP = 23.95) and 11656-97 (First Choice Narrow Range 415 Spray Oil and Leaf Life Gavicide Green 415; EP = 19.98) and determined that the TGA data were unacceptable because the TGA experimental conditions deviated significantly from DPR's experimental protocol (McKinney, 2008). In response, the EP values for these products have been set to the spray oil special default value of 1.53 until valid TGA data is received. A TGA data reporting error was also identified for product 48813-1 (Saf-T-Side products and Synergy Super Fine Spray Oil Emulsion. After correctly accounting for the water content of the product, the experimental TGA-measured VOC EP value of the product and all of its ten sub-registration products are equal to zero (water is not a VOC). The net effect of this latter change on the inventory was minor because these products have very low use.

II. VOLATILE ORGANIC COMPOUND INVENTORY RESULTS

The main text of this document summarizes the *adjusted* pesticide VOC emission inventory data for 2005, 2006, and 2007. Data for the *unadjusted* emission inventory are given in Appendix 2. Previous reports included a summary of pesticide VOC emissions by commodity/site. At this time it is not possible to determine the breakdown of adjusted emissions by commodity, so only the unadjusted emissions are shown by commodity in Appendix 2. Tables 2a and 2b and Figure 1 summarize the adjusted pesticide VOC emissions for 2004 through 2007, and compare them to the 1990 base year and goals. Emissions from 1991 used to determine the regulation benchmarks are shown for comparison.

TABLE 2a: May–October (ozone season) *adjusted* pesticide VOC emissions and goals.

NAA	1990 Emissions (tons/day)	1991 Emissions (tons/day)	SIP Goal (tons/day)	VOC Regulation Benchmark (tons/day)	2004 Emissions (tons/day)	2005 Emissions (tons/day)	2006 Emissions (tons/day)	2007 Emissions (tons/day)
1 – Sacramento Metropolitan	2.792	3.056	2.234	2.4	1.238	1.246	1.359	1.062
2 – San Joaquin Valley	20.612	19.847	18.139	16.0	17.327	20.828	21.419	17.279
3 – Southeast Desert	1.154	0.784	0.923	0.62	0.995	0.741	0.635	0.764
4 – Ventura	3.787	3.320	3.029 a	2.6 a	3.924	3.616	3.682	3.361
5 – South Coast	10.840	5.020	8.672	4.1	1.922	1.984	1.492	1.495

[a] These numbers reflect the SIP goal and VOC Regulation Benchmark for 2012 in Ventura, and do not reflect the phase in of reductions between 2008 and 2012.

Since 2004, even after adjusting for field conditions (AMAFs), fumigants continue to contribute the most pesticide VOC emissions in the Southeast Desert and Ventura NAAs. Also consistent with previous years, pesticides formulated as emulsifiable concentrates are the other major pesticide VOC contributors, particularly in the San Joaquin Valley NAA. In almost all cases, it is the solvents included as inert ingredients of emulsifiable concentrates that contribute most of the VOCs, not the AIs

TABLE 2b: May–October (ozone season) fumigant and nonfumigant pesticide VOC emissions.

NAA	1990 Emissions (tons/day)	1991 Emissions (tons/day)	2004 Emissions (tons/day)	2005 Emissions (tons/day)	2006 Emissions (tons/day)	2007 Emissions (tons/day)
1 – Sacramento Metro						
Fumigants	0.384 (14%)	0.317 (10%)	0.111 (9%)	0.085 (7%)	0.162 (12%)	0.191 (18%)
NonFumigants	2.408 (86%)	2.739 (90%)	1.126 (91%)	1.161 (93%)	1.197 (88%)	0.871 (82%)
2 - San Joaquin Valley						
Fumigants	5.536 (27%)	7.164 (36%)	6.362 (37%)	6.910 (33%)	6.808 (32%)	6.146 (36%)
NonFumigants	15.076 (73%)	12.682 (64%)	10.965 (63%)	13.918 (67%)	14.611 (68%)	11.134 (64%)
3 - Southeast Desert						
Fumigants	0.840 (73%)	0.401 (51%)	0.762 (77%)	0.474 (64%)	0.413 (65%)	0.575 (75%)
NonFumigants	0.313 (27%)	0.383 (49%)	0.233 (23%)	0.267 (36%)	0.222 (35%)	0.189 (25%)
4 - Ventura						
Fumigants	3.140 (83%)	2.751 (83%)	3.302 (84%)	3.119 (86%)	3.175 (86%)	2.933 (87%)
No-Fumigants	0.647 (17%)	0.568 (17%)	0.622 (16%)	0.497 (14%)	0.508 (14%)	0.428 (13%)
5 – South Coast						
Fumigants	9.372 (86%)	3.614 (72%)	0.702 (37%)	0.597 (30%)	0.422 (28%)	0.411 (28%)
NonFumigants	1.468 (14%)	1.406 (28%)	1.220 (63%)	1.387 (70%)	1.069 (72%)	1.084 (72%)

In comparison to 2004:

- Sacramento Metro NAA: VOC emissions increased between 2004 and 2006 but decreased in 2007. Emissions remain well below the SIP goal and the VOC regulation benchmark. In 2007, 82 percent of emissions were derived from nonfumigants.
- San Joaquin Valley NAA: VOC emissions increased in 2005 and 2006 and then decreased to below 2004 levels in 2007. The 2007 emissions are below the SIP goal but exceed the VOC regulation benchmark by 1.279 tpd. Two thirds of emissions are derived from nonfumigants.
- Southeast Desert NAA: VOC emissions decreased annually through 2006, but then increased in 2007. Emissions in this NAA meet the SIP goal but exceed the VOC regulation benchmark. Emissions from fumigants account for approximately two thirds of total.
- Ventura NAA: VOC emissions have decreased, but do not meet the regulation benchmark and SIP goal for 2012, but do meet the regulation benchmark 2009 of 3.63 tpd. More than 85 percent of emissions are derived from fumigants.
- South Coast NAA: VOC emissions decreased and remain well below the emission targets.

1. Sacramento Metropolitan Area–NAA 1

The emissions in NAA 1 in 2007 are below those of the three previous years. Adjusted emissions in 2004 were 1.238 tpd, increased to 1.359 tpd in 2006 and decreased to 1.062 tpd in 2007 (Table 2a, Figure 1). Chlorpyrifos, a widely used insecticide, was the primary contributor and accounted for an average of 11.4 percent of the emissions over the three years (Tables 3a, 3b, and 3c). Emissions from chlorpyrifos use decreased from 0.186 tpd in 2005 to 0.116 tpd in 2007 (Tables 3a and 3c). The rice herbicide molinate accounted for the second highest amount of emissions in 2005 (0.093 tpd), down from 0.198 tpd in 2004. Molinate use is being phased out, and this is reflected by a further reduction in emissions in 2007 to 0.011 tpd. This is consistent with reported use in NAA 1, which decreased from over 150,000 pounds AI used in 2004 to 52,000 pounds in 2005, just over 30,000 lbs in 2006, and 14,000 lbs in 2007. Emissions from metam-sodium, a pre-plant fumigant, increased from 0.028 tpd in 2005 to 0.063 tpd in 2006, but decreased to 0.022 tpd in 2007 (Tables 3a and 3b). Major commodities/sites include processing tomatoes, structural pest control, walnuts, and rice (Appendix 2).

TABLE 3a: Top ten primary AIs contributing to **2005** May–October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 1 May–Oct 2005 Adjusted Emissions
CHLORPYRIFOS	0.186	14.93
MOLINATE	0.093	7.49
THIOBENCARB	0.070	5.64
TRIFLURALIN	0.064	5.11
PERMETHRIN	0.057	4.58
ETHALFLURALIN	0.048	3.83
CYPERMETHRIN	0.044	3.50
SETHOXYDIM	0.039	3.11
DIMETHOATE	0.038	3.08
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.037	2.94

TABLE 3b: Top ten primary AIs contributing to **2006** May–October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 1 May–Oct 2006 Adjusted Emissions
TRIFLURALIN	0.123	9.06
CHLORPYRIFOS	0.115	8.43
ETHALFLURALIN	0.082	6.03
METAM-SODIUM	0.063	4.66
1,3-D	0.055	4.02
HYDROPRENE	0.047	3.48
MOLINATE	0.046	3.38
THIOBENCARB	0.040	2.97
OXYFLUORFEN	0.040	2.94
CYPERMETHRIN	0.035	2.57

TABLE 3c: Top ten primary AIs contributing to **2007** May–October ozone season *adjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 1 May–Oct 2007 Adjusted Emissions
CHLORPYRIFOS	0.116	10.95
1,3-D	0.109	10.26
TRIFLURALIN	0.057	5.40
METHYL BROMIDE	0.055	5.19
DIMETHOATE	0.049	4.66
THIOBENCARB	0.039	3.70
OXYFLUORFEN	0.038	3.57
PROPANIL	0.029	2.72
PENOXSULAM	0.027	2.51
ETHALFLURALIN	0.025	2.40

2. San Joaquin Valley–NAA 2

Adjusted emissions in 2004 were 17.327 tpd and increased in 2005 to 20.828 tpd, and 21.419 tpd in 2006. However, 2007 emissions showed a marked decline to 17.279 tpd (Table 2a). All three years' emissions are above the VOC regulation benchmark of 16 tpd (Table 2a and Figure 1), but the 2007 emissions are below the SIP goal of 18.139 tpd. Fumigants accounted for between 31.8 and 35.6 percent of adjusted emissions for the 3 years (Tables 2b, 4a, 4b and 4c). The top emission contributor for 2005 through 2007 was the nonfumigant, chlorpyrifos, which accounted for 3.868 and 3.990 tpd in 2005 and 2006, respectively, but fell to 2.263 tpd in 2007. Major commodities/sites include carrots, cotton, almonds, and oranges (Appendix 2). It should be noted that unadjusted emissions from cotton fell sharply between 2006 and 2007 from 2.609 tpd to 1.049 tpd, respectively (Tables A2-2e and A2-2f).

TABLE 4a: Top ten primary AIs contributing to **2005** May–October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 2 May–Oct 2005 Adjusted Emissions
CHLORPYRIFOS	3.868	18.57
METAM-SODIUM	2.843	13.65
1,3-D	2.364	11.35
METHYL BROMIDE	1.073	5.15
OXYFLUORFEN	0.749	3.60
DIMETHOATE	0.650	3.12
GIBBERELLINS	0.628	3.02
ACROLEIN	0.572	2.75
ABAMECTIN	0.523	2.51
TRIFLURALIN	0.467	2.24

TABLE 4b: Top ten primary AIs contributing to **2006** May–October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 2 May–Oct 2006 Adjusted Emissions
CHLORPYRIFOS	3.990	18.63
METAM-SODIUM	2.572	12.01
1,3-D	2.059	9.61
METHYL BROMIDE	1.121	5.23
OXYFLUORFEN	0.779	3.64
POTASSIUM N-METHYLDITHIOCARBAMATE	0.770	3.59
GIBBERELLINS	0.679	3.17
TRIFLURALIN	0.677	3.16
DIMETHOATE	0.645	3.01
ACROLEIN	0.600	2.80

TABLE 4c: Top ten primary AIs contributing to **2007** May–October ozone season *adjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 2 May–Oct 2007 Adjusted Emissions
CHLORPYRIFOS	2.263	13.10
1,3-D	2.169	12.55
METAM-SODIUM	2.088	12.08
METHYL BROMIDE	1.005	5.82
OXYFLUORFEN	0.944	5.46
GIBBERELLINS	0.712	4.12
POTASSIUM N-METHYLDITHIOCARBAMATE	0.650	3.76
DIMETHOATE	0.643	3.72
ABAMECTIN	0.542	3.14
ACROLEIN	0.455	2.63

3. Southeast Desert–NAA 3

Total adjusted emissions for the Southeast Desert declined steadily from 0.995 tpd in 2004 to 0.635 tpd in 2006 (Table 2a and Figure 1), but increased to 0.754 tpd in 2007. The 2007 rate is below the SIP goal of 0.923 tpd, but above the VOC regulation benchmark of 0.62 tpd. Metam-sodium is the primary contributor, accounting for an average of 46.3 percent of the adjusted emissions over the 3 years (Tables 5a, 5b, and 5c). The increased percentage to 53.2 percent in 2006 corresponds to a reduction in the adjusted methyl bromide emissions from 0.048 tpd in 2005 to less than 0.008 tpd in 2006. Methyl bromide emissions increased to 0.170 tpd in 2007 and are responsible for the increase in total adjusted emissions in this NAA. Major commodities/sites include carrots, strawberries, peppers, and structural pest control (Appendix 2).

TABLE 5a: Top ten primary AIs contributing to **2005** May–October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 3 May–Oct 2005 Adjusted Emissions
METAM-SODIUM	0.323	43.53
PERMETHRIN	0.079	10.61
METHYL BROMIDE	0.048	6.46
1,3-D	0.035	4.76
POTASSIUM N-METHYLDITHIOCARBAMATE	0.031	4.19
MALATHION	0.011	1.47
EPTC	0.011	1.45
BENSULIDE	0.010	1.41
TRICLOPYR, BUTOXYETHYL ESTER	0.009	1.28
MEFENOXAM	0.009	1.21

TABLE 5b: Top ten primary AIs contributing to **2006** May–October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 3 May–Oct 2006 Adjusted Emissions
METAM-SODIUM	0.338	53.27
1,3-D	0.041	6.40
PERMETHRIN	0.032	4.97
BENSULIDE	0.028	4.40
GLYPHOSATE, ISOPROPYLAMINE SALT	0.009	1.40
MEFENOXAM	0.009	1.38
GIBBERELLINS	0.009	1.35
PENDIMETHALIN	0.008	1.22
MALATHION	0.008	1.21
METHYL BROMIDE	0.008	1.21

TABLE 5c: Top ten primary AIs contributing to **2007** May–October ozone season *adjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 3 May–Oct 2007 Adjusted Emissions
METAM-SODIUM	0.323	42.32
METHYL BROMIDE	0.170	22.22
1,3-D	0.036	4.74
PERMETHRIN	0.020	2.65
BENSULIDE	0.017	2.18
EPTC	0.010	1.26
GLYPHOSATE, ISOPROPYLAMINE SALT	0.008	1.09
MALATHION	0.008	1.05
MEFENOXAM	0.007	0.94
METHOMYL	0.006	0.84

4. Ventura–NAA 4

Ozone season adjusted emissions decreased from 3.924 tpd in 2004 to 3.616 tpd in 2005, increased to 3.682 tpd in 2006 and decreased to 3.361 tpd in 2007 (Table 2a and Figure 1). Emissions did not meet the SIP goal for 2012 (3.029 tpd), but did meet the SIP goal for 2009 (4.029 tpd) and the VOC regulation benchmark for 2009 (3.63 tpd). As in previous years, fumigants dominate the pesticide inventory for this NAA, accounting for upward of 85 percent of the emissions (Table 2b, 6a, 6b, and 6c). The adjusted emissions for NAA 4 in 2004 differ significantly from those estimated by Barry, et al. (2007), due to a revision of the MUFs. For 2004 in NAA 4, the adjusted emissions changed from 4.826 tpd to 3.924 tpd. The difference is due to information indicating more frequent use of lower emission fumigation methods than previously estimated. Major commodities/sites include strawberries, tomatoes, raspberries, and lemons (Appendix 2).

TABLE 6a: Top ten primary AIs contributing to **2005** May–October ozone season *adjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 4 May–Oct 2005 Adjusted Emissions
METHYL BROMIDE	1.227	33.93
CHLOROPICRIN	1.166	32.25
1,3-D	0.659	18.21
CHLORPYRIFOS	0.086	2.37
METAM-SODIUM	0.060	1.66
PETROLEUM OIL, UNCLASSIFIED	0.046	1.27
OXAMYL	0.029	0.80
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.029	0.80
ABAMECTIN	0.027	0.73
MINERAL OIL	0.026	0.71

TABLE 6b: Top ten primary AIs contributing to **2006** May–October ozone season *adjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 4 May–Oct 2006 Adjusted Emissions
METHYL BROMIDE	1.218	33.07
CHLOROPICRIN	1.164	31.60
1,3-D	0.723	19.63
METAM-SODIUM	0.069	1.89
CHLORPYRIFOS	0.066	1.79
PETROLEUM OIL, UNCLASSIFIED	0.047	1.28
OXAMYL	0.036	0.98
AZADIRACHTIN	0.035	0.95
ABAMECTIN	0.027	0.72
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.023	0.64

TABLE 6c: Top ten primary AIs contributing to **2007** May–October ozone season *adjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 4 May–Oct 2007 Adjusted Emissions
CHLOROPICRIN	1.252	37.26
METHYL BROMIDE	0.934	27.80
1,3-D	0.674	20.04
METAM-SODIUM	0.071	2.12
CHLORPYRIFOS	0.045	1.33
MINERAL OIL	0.035	1.06
PETROLEUM OIL, UNCLASSIFIED	0.032	0.96
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.032	0.94
ABAMECTIN	0.025	0.74
OXAMYL	0.024	0.70

5. South Coast–NAA 5

In the South Coast NAA, adjusted emissions have declined steadily since 2004. Adjusted emissions were 1.922 tpd in 2004, and although they increased slightly to 1.984 tpd in 2005, they declined to 1.495 tpd in 2007, well below the SIP goal of 8.672 tpd and the VOC regulation benchmark of 4.1 tpd. The fumigants methyl bromide, chloropicrin and 1,3-D, contributed to 28.96 percent of 2005 adjusted emissions, 27.46 percent of 2006 adjusted emissions and 26.04 percent of 2007 adjusted emissions (Tables 7a, 7b, and 7c). Permethrin, an insecticide used on a wide range of commodities, was the largest single contributor to the adjusted inventory accounting for approximately 20 percent of the emissions. Major commodities/sites include structural pest control, strawberries, and landscape maintenance.

TABLE 7a: Top ten primary AIs contributing to **2005** May–October ozone season *adjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 5 May–Oct 2005 Adjusted Emissions
PERMETHRIN	0.455	22.95
METHYL BROMIDE	0.348	17.53
CHLOROPICRIN	0.147	7.43
BIFENTHRIN	0.081	4.07
IMIDACLOPRID	0.081	4.06
1,3-D	0.079	4.00
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.068	3.45
LIMONENE	0.056	2.85
PIPERONYL BUTOXIDE	0.053	2.66
CYFLUTHRIN	0.051	2.59

TABLE 7b: Top ten primary AIs contributing to **2006** May–October ozone season *adjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 5 May–Oct 2006 Adjusted Emissions
PERMETHRIN	0.279	18.73
METHYL BROMIDE	0.247	16.56
CHLOROPICRIN	0.119	8.00
IMIDACLOPRID	0.096	6.44
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.072	4.83
BIFENTHRIN	0.067	4.48
FIPRONIL	0.045	3.00
CYFLUTHRIN	0.044	2.94
1,3-D	0.043	2.90
CYPERMETHRIN	0.039	2.60

TABLE 7c: Top ten primary AIs contributing to **2007** May–October ozone season *adjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Adjusted Emissions (tons/day)	Percent of All NAA 5 May–Oct 2007 Adjusted Emissions
PERMETHRIN	0.275	18.40
METHYL BROMIDE	0.235	15.72
LIMONENE	0.121	8.11
CHLOROPICRIN	0.107	7.13
BIFENTHRIN	0.077	5.14
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.069	4.59
1,3-D	0.048	3.19
CYFLUTHRIN	0.042	2.81
CYPERMETHRIN	0.042	2.80
DISODIUM OCTABORATE TETRAHYDRATE	0.042	2.78

III. PRELIMINARY PROJECTION FOR 2009 VOLATILE ORGANIC COMPOUND EMISSIONS IN THE SAN JOAQUIN VALLEY, SOUTHEAST DESERT, AND VENTURA NONATTAINMENT AREAS

Regulations require DPR to establish a fumigant limit for NAAs that exceed 80 percent of the pesticide VOC benchmark. (NOTE: Benchmark is 20 percent reduction or 80 percent of 1991 emissions and a phase-in of reductions for Ventura. Trigger for fumigant limit is 64 percent [80 percent of 80 percent] of 1991 emissions). The regulations also require DPR to determine the fumigant limit for the upcoming year by subtracting the nonfumigant emissions from the regulatory benchmark. DPR proposes to determine nonfumigant emissions for the upcoming year by using the data from the single most recent year. For example, DPR proposes to use the nonfumigant emissions for 2007 to determine the fumigant limit for 2009. At the time of this memo, DPR has released pesticide use data for 2005 and 2006, and is awaiting publication of the 2007 pesticide use report. For the purposes of this memorandum, preliminary projected emissions for 2009 are based on a draft edition of 2007 data, and should be regarded merely as a guideline (Table 8). Projections for 2009 will be revised once the final version of the 2007 data has been released.

TABLE 8: Preliminary projection for 2009 VOC emissions for NAAs 2, 3, and 4. The 2009 projected fumigant limits are determined by subtracting the 2007 nonfumigant emissions from the SIP goals and VOC regulation benchmarks.

NonAttainment Area	SIP Goal (tons/day)	VOC Regulation Benchmark (tons/day)	2007 Nonfumigant Emissions (tons/day)	2009 Projected Fumigant Limit, Based on SIP Goal (tons/day)	2009 Projected Fumigant Limit, Based on Regulation Benchmark (tons/day)	2007 Adjusted Fumigant Emissions (tons/day)
2–San Joaquin Valley	18.139	16.0	11.134	7.005	4.866	6.146
3–Southeast Desert	0.923	0.62	0.189	0.734	0.431	0.575
4–Ventura	4.030 a	3.63 a	0.428	3.602	3.202	2.933

[a] The Ventura SIP Goal and VOC Regulation Benchmark for 2009 are shown.

Based on the available data, the San Joaquin Valley, Southeast Desert, and Ventura NAAs are likely to exceed their fumigant limit triggers based on VOC regulation benchmarks for 2009 (Table 8 and Figure 1).

In 2007, fumigant emissions in the San Joaquin Valley nonattainment area were calculated to be 6.146 tpd (Table 8), more than the projected fumigant limit based on the VOC regulation benchmark of 4.866 tpd. In the Southeast Desert NAA, a reduction in fumigant emissions of 0.144 tpd or more from 2007 levels would meet the projected fumigant limit for 2009 based on the VOC regulation benchmark. Overall emissions have declined for NAA 4 (Ventura) between 2004 and 2007. The total adjusted fumigant emissions for 2007 were 2.933 tpd, which is below the projected fumigant limit for 2009.

IV. CONCLUSIONS

In 2005, 2006 and 2007 NAA 1 (Sacramento Metropolitan) and NAA 5 (South Coast) were the only regions with emission rates below their respective VOC regulation benchmarks. The South Coast NAA continues a downward trend, whereas Sacramento NAA emissions increased in both 2005 and 2006, but decreased in 2007. Emission rates for NAA 3 (Southeast Desert) were significantly lower in 2007 than those in 2004, but are up compared to emissions in 2006. NAA 2 (San Joaquin Valley) produced successively higher emissions from 2004 to 2006, with most of the increase due to nonfumigants (Figure 2). Total adjusted emissions in 2007 were largely due to nonfumigants that declined by over three tpd. It may be necessary to address the issue of nonfumigant emissions if VOC regulation benchmark emission goals are to be met in this NAA. Emissions declined for NAA 4 (Ventura) between 2004 and 2007. NAA 4 emissions meet the 2009 regulation benchmark for 2009. Fumigants were a major source of emissions in NAA 3 and NAA 4, whereas nonfumigants contributed significantly to the Sacramento Metro, San Joaquin Valley, and South Coast nonattainment areas. Unless these emissions are significantly reduced, especially the increased use of emulsifiable concentrate formulations in the San Joaquin Valley, NAA 2 may continue to fail to meet its attainment goal.

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V. REFERENCES

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FIGURE 1: Annual ozone season pesticide VOC emissions by NAA. These figures show adjusted emissions, VOC regulation benchmarks (reductions from 1991 emissions) and SIP goals (reductions from 1990 emissions).

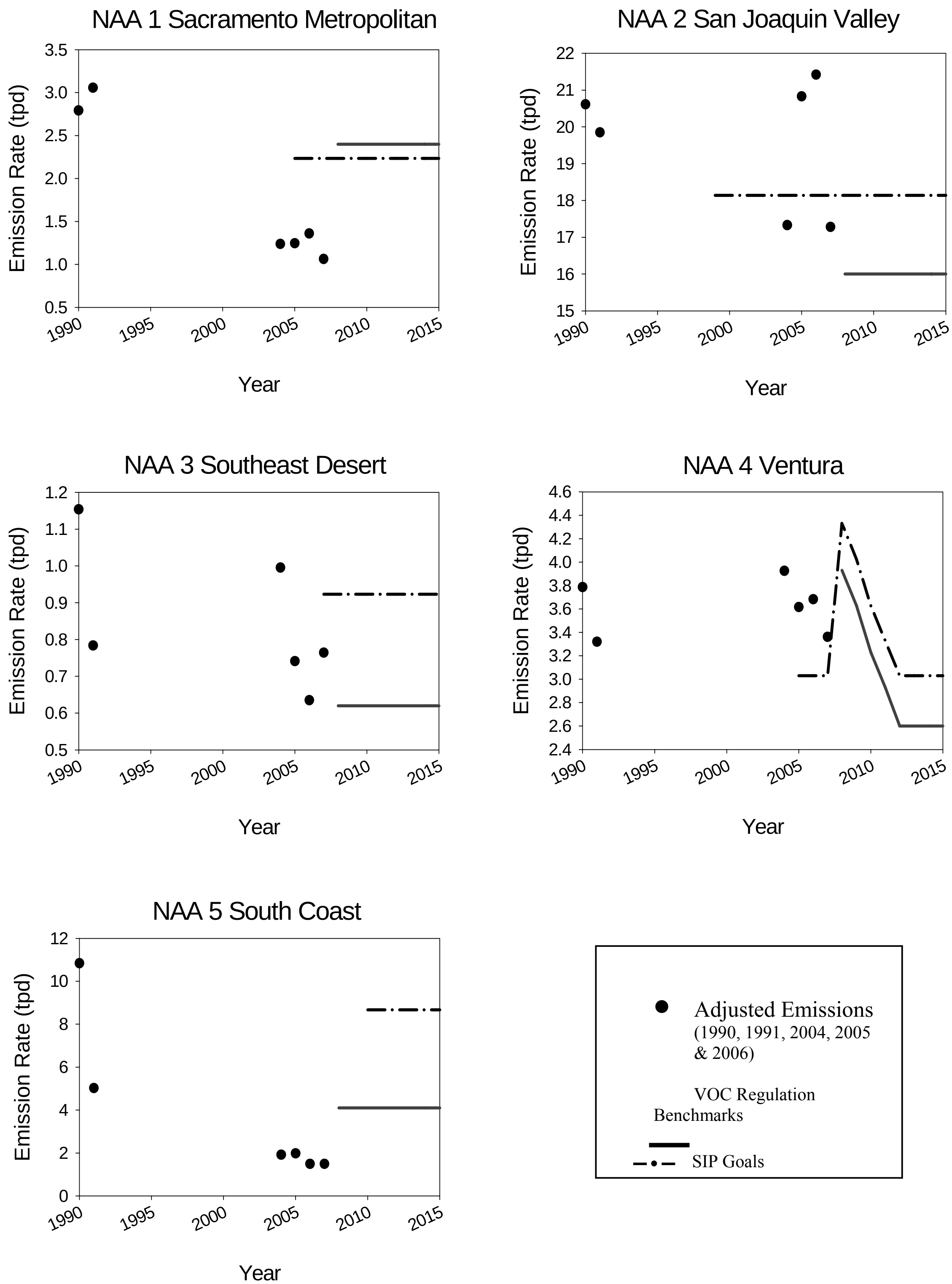
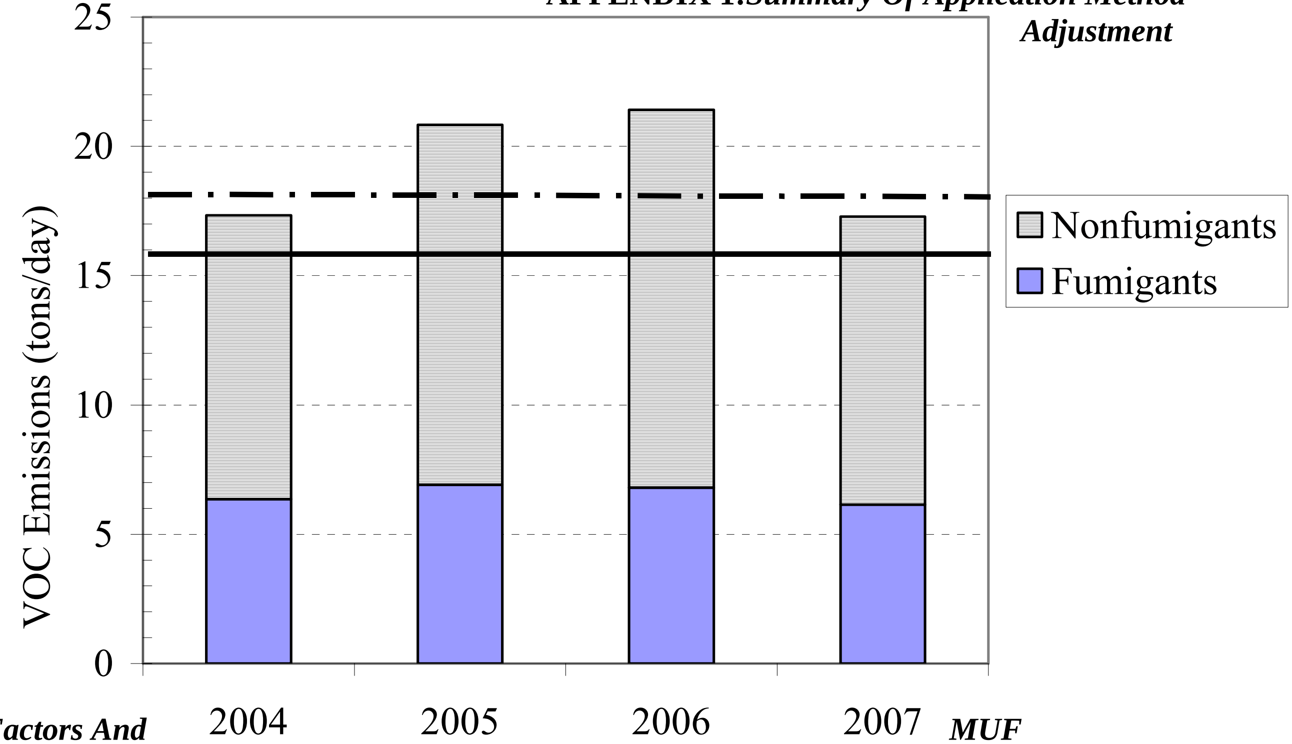


FIGURE 2: Pesticide VOC emissions for the San Joaquin Valley NAA, May–October. Emissions for each year are divided into fumigants and nonfumigants. Fumigant emissions are adjusted to account for fumigation method. Emissions for 2004 are shown for comparison. The solid line indicates the emissions benchmark specified in VOC regulations (20 percent reduction from 1991).



APPENDIX 1:*Summary Of Application Method Adjustment Factors And MUF*

Table A1–1: Application Method Adjustment Factors.

	AMAF					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam**	**Dazomet**	**Na Tetrathio carbonate**
Shallow injection w/ high permeability tarp or no tarp-broadcast	61*	64*	74*	not applicable	not applicable	not applicable
Shallow injection w/ low permeability tarp-broadcast	not applicable	44	48	not applicable	not applicable	not applicable
Shallow injection w/ high permeability tarp or no tarp-bed	not applicable	64*	100*	77*	not applicable	not applicable
Shallow injection w/ low permeability tarp-bed	not applicable	64*	100*	not applicable	not applicable	not applicable
Shallow injection w/ water treatments	41	20	not applicable	21	not applicable	not applicable
Shallow injection w/ soil cap	not applicable	not applicable	not applicable	14	not applicable	not applicable
Deep injection w/ high permeability tarp or no tarp-broadcast	41	64*	74*	not applicable	not applicable	not applicable
Deep injection w/ low permeability tarp-broadcast	not applicable	44	48	not applicable	not applicable	not applicable
Deep injection w/ water treatments	27	20	not applicable	not applicable	not applicable	not applicable
Rotovate/rototill	not applicable	not applicable	not applicable	14	17	not applicable
Sprinkler	not applicable	not applicable	not applicable	77*	not applicable	10
Sprinkler w/ water treatments	not applicable	not applicable	not applicable	21	not applicable	not applicable
Flood	not applicable	not applicable	not applicable	77*	not applicable	10
Drip w/ high permeability tarp or no tarp	29	not applicable	not applicable	9	not applicable	10
Drip w/ low permeability tarp	not applicable	15	not applicable	9	not applicable	not applicable
Nonfield soil (structural/post-harvest)	not applicable	100	100	not applicable	not applicable	not applicable

* These are considered "high-emission" fumigation methods and are prohibited within the San Joaquin Valley, Southeast Desert, and Ventura NAAs during May–October.

Table A1–2; 1990 frequency of fumigation methods used (MUFs) in the Sacramento Metro nonattainment area.[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**[2]	**Chloropicrin**	**Methyl Bromide**	**Metam**[3]	**Dazomet**[3]	**Na Tetrathio carbonate**[4]
Shallow injection w/ high permeability tarp or no tarp-broadcast		42	37			
Shallow injection w/ low permeability tarp-broadcast						
Shallow injection w/ high permeability tarp or no tarp-bed		42	36	3		
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				15		
Deep injection w/ high permeability tarp or no tarp-broadcast		16	14			
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill				2	100	
Sprinkler				55		33
Sprinkler w/ water treatments						
Flood				10		33
Drip w/ high permeability tarp or no tarp				10		34
Drip w/ low permeability tarp				5		
Nonfield soil (structural/post-harvest)			13			

[2] Use of 1,3-D was suspended in early 1990.

[3] DPR assumes 100 pecent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.

[4] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–3: **1990 frequency of fumigation methods used (MUFs) in the San Joaquin Valley nonattainment area.**

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D[2]**	**Chloropicrin**	**Methyl Bromide**	**Metam[3]**	**Dazomet[3]**	**Na Tetrathio carbonate[4]**
Shallow injection w/ high permeability tarp or no tarp-broadcast		29	29			
Shallow injection w/ low permeability tarp-broadcast						
Shallow injection w/ high permeability tarp or no tarp-bed		29	29	8		
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				25		
Deep injection w/ high permeability tarp or no tarp-broadcast		42	42			
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill				3	100	
Sprinkler				60		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp				2		34
Drip w/ low permeability tarp				2		
Nonfield soil (structural/post-harvest)						

[1] Fumigation methods are described in detail in the memo Barry et al., 2007.
[2] Use of 1,3-D was suspended in early 1990.
[3] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[4] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–4: **1990 frequency of fumigation methods used (MUFs) in the Southeast Desert nonattainment area.**

	Perceny of Amount Applied					
Fumigation Method[1]	**1,3-D[2]**	**Chloropicrin**	**Methyl Bromide**	**Metam[3]**	**Dazomet[3]**	**Na Tetrathio carbonate[4]**
Shallow injection w/ high permeability tarp or no tarp-broadcast		50	35			
Shallow injection w/ low permeability tarp-broadcast						
Shallow injection w/ high permeability tarp or no tarp-bed		50	34	10		
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast						
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				30		33
Sprinkler w/ water treatments						
Flood				50		33
Drip w/ high permeability tarp or no tarp				5		34
Drip w/ low permeability tarp				5		
Non-field soil (structural/post-harvest)			31			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] Use of 1,3-D was suspended in early 1990.
[3] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[4] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–5: 1990 frequency of fumigation methods used (MUFs) in the Ventura nonattainmetn area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D[2]**	**Chloropicrin**	**Methyl Bromide**	**Metam[3]**	**Dazomet[3]**	**Na Tetrathio carbonate[4]**
Shallow injection w/ high permeability tarp or no tarp-broadcast		50	49			
Shallow injection w/ low permeability tarp-broadcast						
Shallow injection w/ high permeability tarp or no tarp-bed		50	49	20		
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast						
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				50		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp				15		34
Drip w/ low permeability tarp				15		
Nonfield soil (structural/post-harvest)			3			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] Use of 1,3-D was suspended in early 1990.
[3] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[4] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–6: 1990 frequency of fumigation methods used (MUFs) in the South Coast nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D[2]**	**Chloropicrin**	**Methyl Bromide**	**Metam[3]**	**Dazomet[3]**	**Na Tetrathio carbonate[4]**
Shallow injection w/ high permeability tarp or no tarp-broadcast		50	3			
Shallow injection w/ low permeability tarp-broadcast						
Shallow injection w/ high permeability tarp or no tarp-bed		50	3	20		
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast						
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				50		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp				15		34
Drip w/ low permeability tarp				15		
Nonfield soil (structural/post-harvest)			95			

[1] Fumigation methods are described in detail in the memo Barry et al., 2007.
[2] Use of 1,3-D was suspended in early 1990.
[3] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[4] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–7. 2005 frequency of fumigation methods used (MUFs) in the Sacramento Metro nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		56.0	11.3			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed		33.0	6.3			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				15		
Deep injection w/ high permeability tarp or no tarp-broadcast	99					
Deep injection w/ low permeability tarp-broadcast			11.4			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				45		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	1			9		34
Drip w/ low permeability tarp		11.0		10		
Nonfield soil (structural/post-harvest)			70.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–8: **2005 frequency of fumigation methods used (MUFs) in the San Joaquin Valley nonattainment area.**

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	2					
Shallow injection w/ low permeability tarp-broadcast		97.0	79.5			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed			0.6			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				20		
Deep injection w/ high permeability tarp or no tarp-broadcast	97	1.0				
Deep injection w/ low permeability tarp-broadcast		1.0	16.3			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				35		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	1			14		34
Drip w/ low permeability tarp				10		
Nonfield soil (structural/post-harvest)		1.0	3.7			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–9: **2005 frequency of fumigation methods used (MUFs) in the Southeast Desert nonattainment area.**

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam**[2]	**Dazomet**[2]	**Na Tetrathio-carbonate**[3]
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		88	77.1			
Shallow injection w/ high permeability tarp or no tarp-bed				6		
Shallow injection w/ low permeability tarp-bed			18.9			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	10					
Deep injection w/ low permeability tarp-broadcast			1.1			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				75		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	90	5		7		34
Drip w/ low permeability tarp		5		12		
Nonfield soil (structural/post-harvest)		2	2.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–10: 2005 frequency of fumigation methods used (MUFs) in the Ventura nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	1					
Shallow injection w/ low permeability tarp-broadcast		67	100.0			
Shallow injection w/ high permeability tarp or no tarp-bed						
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments				25		
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	4					
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler						33
Sprinkler w/ water treatments				20		
Flood						33
Drip w/ high permeability tarp or no tarp	95			5		34
Drip w/ low permeability tarp		33		50		
Nonfield soil (structural/post-harvest)						

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–11: 2005 frequency of fumigation methods used (MUFs) in the South Coast nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		40	60.9			
Shallow injection w/ high permeability tarp or no tarp-bed				25		
Shallow injection w/ low permeability tarp-bed		36	30.8			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	2					
Deep injection w/ low permeability tarp-broadcast			0.5			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				20		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	98			5		34
Drip w/ low permeability tarp		24		50		
Nonfield soil (structural/post-harvest)			7.8			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–12: 2006 frequency of fumigation methods used (MUFs) in the Sacramento Metro nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	3					
Shallow injection w/ low permeability tarp-broadcast		56.0	11.3			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed		33.0	6.3			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				15		
Deep injection w/ high permeability tarp or no tarp-broadcast	95					
Deep injection w/ low permeability tarp-broadcast			11.4			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				45		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	2			9		34
Drip w/ low permeability tarp		11.0		10		
Nonfield soil (structural/post-harvest)			70.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–13: 2006 frequency of fumigation methods used (MUFs) in the San Joaquin Valley nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	2					
Shallow injection w/ low permeability tarp-broadcast		97.0	79.5			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed			0.6			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				20		
Deep injection w/ high permeability tarp or no tarp-broadcast	97	1.0				
Deep injection w/ low permeability tarp-broadcast		1.0	16.3			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				35		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	1			14		34
Drip w/ low permeability tarp				10		
Nonfield soil (structural/post-harvest)		1.0	3.7			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–14: **2006 frequency of fumigation methods used (MUFs) in the Southeast Desert nonattainment area.**

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		88.0	77.1			
Shallow injection w/ high permeability tarp or no tarp-bed				6		
Shallow injection w/ low permeability tarp-bed			18.9			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	16					
Deep injection w/ low permeability tarp-broadcast		0.2	1.1			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				75		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	84	5.0		7		34
Drip w/ low permeability tarp		5.0		12		
Nonfield soil (structural/post-harvest)		2.0	2.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–15: 2006 frequency of fumigation methods used (MUFs) in the Ventura nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		67.0	100.0			
Shallow injection w/ high permeability tarp or no tarp-bed						
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments				25		
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	7					
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler						33
Sprinkler w/ water treatments				20		
Flood						33
Drip w/ high permeability tarp or no tarp	93			5		34
Drip w/ low permeability tarp		33.0		50		
Nonfield soil (structural/post-harvest)						

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–16: 2006 frequency of fumigation methods used (MUFs) in the South Coast nonattainment area.

	percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		40.0	60.9			
Shallow injection w/ high permeability tarp or no tarp-bed				25		
Shallow injection w/ low permeability tarp-bed		36.0	30.8			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast						
Deep injection w/ low permeability tarp-broadcast			0.5			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				20		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	100			5		34
Drip w/ low permeability tarp		24.0		50		
Nonfield soil (structural/post-harvest)			7.8			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–17: 2007 frequency of fumigation methods used (MUFs) in the Sacramento Metro nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	0.0					
Shallow injection w/ low permeability tarp-broadcast		56.0	11.3			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed		33.0	6.3			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				15		
Deep injection w/ high permeability tarp or no tarp-broadcast	99.9					
Deep injection w/ low permeability tarp-broadcast			11.4			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				45		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	0.1			9		34
Drip w/ low permeability tarp		11.0		10		
Nonfield soil (structural/post-harvest)			70.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–18: 2007 frequency of fumigation methods used (MUFs) in the San Joaquin Valley nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam**[2]	**Dazomet**[2]	**Na Tetrathio-carbonate**[3]
Shallow injection w/ high permeability tarp or no tarp-broadcast	0.3					
Shallow injection w/ low permeability tarp-broadcast		97.0	79.5			
Shallow injection w/ high permeability tarp or no tarp-bed				21		
Shallow injection w/ low permeability tarp-bed			0.6			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap				20		
Deep injection w/ high permeability tarp or no tarp-broadcast	99.3	1.0				
Deep injection w/ low permeability tarp-broadcast		1.0	16.3			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				35		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	0.4			14		34
Drip w/ low permeability tarp				10		
Nonfield soil (structural/post-harvest)		1.0	3.7			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–19: **2007 frequency of fumigation methods used (MUFs) in the Southeast Desert nonattainment area.**

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast	0.4					
Shallow injection w/ low permeability tarp-broadcast		88.0	77.1			
Shallow injection w/ high permeability tarp or no tarp-bed				6		
Shallow injection w/ low permeability tarp-bed			18.9			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	0.0					
Deep injection w/ low permeability tarp-broadcast		0.2	1.1			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				75		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	99.6	5.0		7		34
Drip w/ low permeability tarp		5.0		12		
Nonfield soil (structural/post-harvest)		2.0	2.9			

[1] Fumigation methods are described in detail in the memorandum Barry et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–20: 2007 frequency of fumigation methods used (MUFs) in the Ventura nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		67.0	100.0			
Shallow injection w/ high permeability tarp or no tarp-bed						
Shallow injection w/ low permeability tarp-bed						
Shallow injection w/ water treatments				25		
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast	5.0					
Deep injection w/ low permeability tarp-broadcast						
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler						33
Sprinkler w/ water treatments				20		
Flood						33
Drip w/ high permeability tarp or no tarp	94.9			5		34
Drip w/ low permeability tarp		33.0		50		
Nonfield soil (structural/post-harvest)						

[1] Fumigation methods are described in detail in the memorandum Bary et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

Table A1–21: 2007 frequency of fumigation methods used (MUFs) in the South Coast nonattainment area.

	Percent of Amount Applied					
Fumigation Method[1]	**1,3-D**	**Chloropicrin**	**Methyl Bromide**	**Metam[2]**	**Dazomet[2]**	**Na Tetrathio-carbonate[3]**
Shallow injection w/ high permeability tarp or no tarp-broadcast						
Shallow injection w/ low permeability tarp-broadcast		40.0	60.9			
Shallow injection w/ high permeability tarp or no tarp-bed				25		
Shallow injection w/ low permeability tarp-bed		36.0	30.8			
Shallow injection w/ water treatments						
Shallow injection w/ soil cap						
Deep injection w/ high permeability tarp or no tarp-broadcast						
Deep injection w/ low permeability tarp-broadcast			0.5			
Deep injection w/ water treatments						
Rotovate/rototill					100	
Sprinkler				20		33
Sprinkler w/ water treatments						
Flood						33
Drip w/ high permeability tarp or no tarp	100.0			5		34
Drip w/ low permeability tarp		24.0		50		
Nonfield soil (structural/post-harvest)			7.8			

[1] Fumigation methods are described in detail in the memorandum Bary et al., 2007.
[2] DPR assumes 100 percent conversion of metam and dazomet to MITC and percentages are relative to the amount of MITC applied.
[3] DPR assumes 100 percent conversion of sodium (Na) tetrathiocarbonate to carbon disulfide and percentages are relative to the amount of carbon disulfide applied.

APPENDIX 2–SUMMARY OF UNADJUSTED PESTICIDE VOC EMISSIONS

1. Sacramento Metropolitan Area–NAA 1

TABLE A2-1a: Top ten primary AIs contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 1 May–Oct 2005 emissions
CHLORPYRIFOS	0.186	14.17
MOLINATE	0.093	7.11
THIOBENCARB	0.070	5.36
TRIFLURALIN	0.064	4.85
1,3-D	0.062	4.74
PERMETHRIN	0.057	4.34
METAM-SODIUM	0.051	3.91
ETHALFLURALIN	0.048	3.63
CYPERMETHRIN	0.044	3.32
SETHOXYDIM	0.039	2.96

TABLE A2–1b: Top ten primary AIs contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 1 May–Oct 2006 emissions
1,3-D	0.143	9.45
TRIFLURALIN	0.123	8.14
METAM-SODIUM	0.116	7.64
CHLORPYRIFOS	0.115	7.58
ETHALFLURALIN	0.082	5.42
HYDROPRENE	0.047	3.13
MOLINATE	0.046	3.04
THIOBENCARB	0.040	2.67
OXYFLUORFEN	0.040	2.64
METHYL BROMIDE	0.040	2.62

TABLE A2–1c: Top ten primary AIs contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 1, the Sacramento Metropolitan Area.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 1 May–Oct 2007 emissions
1,3-D	0.274	21.77
CHLORPYRIFOS	0.116	9.25
METHYL BROMIDE	0.068	5.37
TRIFLURALIN	0.057	4.56
DIMETHOATE	0.049	3.94
METAM-SODIUM	0.041	3.24
THIOBENCARB	0.039	3.13
OXYFLUORFEN	0.038	3.01
PROPANIL	0.029	2.30
PENOXSULAM	0.027	2.12

TABLE A2–1d: Top ten pesticide application sites contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 1.

Application Site	Emissions (tons/day)	Percent of all NAA 1 May–Oct 2005 emissions
RICE	0.229	17.48
STRUCTURAL PEST CONTROL	0.219	16.70
WALNUT	0.164	12.50
TOMATO, PROCESSING	0.131	9.96
GRAPE, WINE	0.064	4.88
RIGHTS OF WAY	0.063	4.82
ALFALFA	0.059	4.51
SOIL FUMIGATION/PREPLANT	0.054	4.13
LANDSCAPE MAINTENANCE	0.044	3.37
SUNFLOWER	0.041	3.12

TABLE A2–1e: Top ten pesticide application sites contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 1.

Application Site	Emissions (tons/day)	Percent of all NAA 1 May–Oct 2006 emissions
TOMATO, PROCESSING	0.247	16.33
STRUCTURAL PEST CONTROL	0.218	14.41
WALNUT	0.177	11.71
RICE	0.176	11.67
SOIL FUMIGATION/PREPLANT	0.094	6.24
SUNFLOWER	0.083	5.52
RIGHTS OF WAY	0.073	4.84
ALFALFA	0.044	2.94
LANDSCAPE MAINTENANCE	0.043	2.87
GRAPE, WINE	0.040	2.63

TABLE A2–1f: Top ten pesticide application sites contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 1.

Application Site	Emissions (tons/day)	Percent of all NAA 1 May–Oct 2007 emissions
WALNUT	0.300	23.86
RICE	0.160	12.73
TOMATO, PROCESSING	0.143	11.39
RIGHTS OF WAY	0.076	6.03
STRUCTURAL PEST CONTROL	0.066	5.28
SOIL FUMIGATION/PREPLANT	0.061	4.83
N-OUTDR PLANTS IN CONTAINERS	0.053	4.23
LANDSCAPE MAINTENANCE	0.047	3.71
UNCULTIVATED AG	0.045	3.60
GRAPE, WINE	0.043	3.39

TABLE A21g: *Unadjusted* **2005** May–October VOC emissions in NAA1 by ARB emission inventory classification (tpd).

NAA 1–2005	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.035	0.000
NONMETHYL BROMIDE EMISSIONS	1.055	0.219

TABLE A2–1h: *Unadjusted* **2006** May–October VOC emissions in NAA1 by ARB emission inventory classification (tpd).

NAA–2006	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.037	0.000
NONMETHYL BROMIDE EMISSIONS	1.255	0.218

TABLE A2–1i: *Unadjusted* **2007** May–October VOC emissions in NAA1 by ARB emission inventory classification (tpd).

NAA 1–2007	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.062	0.000
NONMETHYL BROMIDE EMISSIONS	1.124	0.066

2. San Joaquin Valley–NAA 2

TABLE A2–2a: Top ten primary AIs contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 2 May–Oct 2005 emissions
1,3-D	5.938	20.25
METAM-SODIUM	5.912	20.17
CHLORPYRIFOS	3.868	13.19
METHYL BROMIDE	2.461	8.39
POTASSIUM N-METHYLDITHIOCARBAMATE	0.928	3.16
OXYFLUORFEN	0.749	2.56
DIMETHOATE	0.650	2.22
GIBBERELLINS	0.628	2.14
ACROLEIN	0.572	1.95
ABAMECTIN	0.523	1.78

TABLE A2–2b: Top ten primary AIs contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 2 May–Oct 2006 emissions
METAM-SODIUM	5.350	18.05
1,3-D	5.094	17.18
CHLORPYRIFOS	3.990	13.46
METHYL BROMIDE	2.645	8.92
POTASSIUM N-METHYLDITHIOCARBAMATE	1.601	5.40
OXYFLUORFEN	0.779	2.63
GIBBERELLINS	0.679	2.29
TRIFLURALIN	0.677	2.29
DIMETHOATE	0.645	2.17
ACROLEIN	0.600	2.02

TABLE A2–2c: Top ten primary AIs contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 2, the San Joaquin Valley.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 2 May–Oct 2007 emissions
1,3-D	5.465	22.02
METAM-SODIUM	4.342	17.49
METHYL BROMIDE	2.319	9.34
CHLORPYRIFOS	2.263	9.12
POTASSIUM N-METHYLDITHIOCARBAMATE	1.351	5.44
OXYFLUORFEN	0.944	3.80
GIBBERELLINS	0.712	2.87
DIMETHOATE	0.643	2.59
ABAMECTIN	0.542	2.18
ACROLEIN	0.455	1.83

TABLE A2–2d: Top ten pesticide application sites contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 2.

Application Site	Emissions (tons/day)	Percent of all NAA 2 May–Oct 2005 emissions
CARROT	5.096	17.38
COTTON	3.017	10.29
ALMOND	2.641	9.01
ORANGE	1.945	6.63
N-OUTDR PLANTS IN CONTAINERS	1.857	6.33
GRAPE, WINE	1.175	4.01
GRAPE	1.152	3.93
WALNUT	1.114	3.80
ALFALFA	1.013	3.46
POTATO	0.878	2.99

TABLE A2–2e: Top ten pesticide application sites contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 2.

Application Site	Emissions (tons/day)	Percent of all NAA 2 May–Oct 2006 emissions
CARROT	4.308	14.53
ALMOND	3.816	12.87
COTTON	2.609	8.80
N-OUTDR PLANTS IN CONTAINERS	1.597	5.39
ORANGE	1.569	5.29
SOIL FUMIGATION/PREPLANT	1.152	3.89
POTATO	1.105	3.73
WALNUT	1.079	3.64
ALFALFA	1.029	3.47
GRAPE	0.975	3.29

TABLE A2–2f: Top ten pesticide application sites contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 2.

Application Site	Emissions (tons/day)	Percent of all NAA 2 May–Oct 2007 emissions
CARROT	3.943	15.89
ALMOND	3.922	15.80
GRAPE	1.400	5.64
ORANGE	1.303	5.25
N-OUTDR PLANTS IN CONTAINERS	1.068	4.30
WALNUT	1.063	4.28
COTTON	1.049	4.23
POTATO	0.942	3.79
SOIL FUMIGATION/PREPLANT	0.774	3.12
TOMATO, PROCESSING	0.764	3.08

TABLE A2–2g: *Unadjusted* **2005** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tpd).

NAA 2–2005	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	2.126	0.008
NONMETHYL BROMIDE EMISSIONS	26.490	0.367

TABLE A2–2h: *Unadjusted* **2006** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tpd).

NAA 2–2006	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	2.200	0.029
NONMETHYL BROMIDE EMISSIONS	26.707	0.293

TABLE A2–2i: *Unadjusted* **2007** May–October VOC emissions in NAA 2 by ARB emission inventory classification (tpd).

NAA 2–2007	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	1.905	0.012
NONMETHYL BROMIDE EMISSIONS	22.210	0.291

3. Southeast Desert–NAA 3

TABLE A2–3a: Top ten primary AIs contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 3 May–Oct 2005 emissions
METAM-SODIUM	0.503	44.50
1,3-D	0.181	15.98
METHYL BROMIDE	0.106	9.39
PERMETHRIN	0.079	6.96
POTASSIUM N-METHYLDITHIOCARBAMATE	0.048	4.28
DAZOMET	0.025	2.17
MALATHION	0.011	0.96
EPTC	0.011	0.95
BENSULIDE	0.010	0.92
TRICLOPYR, BUTOXYETHYL ESTER	0.009	0.84

TABLE A2–3b: Top ten primary AIs contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 3 May–Oct 2006 emissions
METAM-SODIUM	0.527	54.26
1,3-D	0.201	20.72
PERMETHRIN	0.032	3.25
BENSULIDE	0.028	2.87
METHYL BROMIDE	0.015	1.52
GLYPHOSATE, ISOPROPYLAMINE SALT	0.009	0.91
MEFENOXAM	0.009	0.90
GIBBERELLINS	0.009	0.88
PENDIMETHALIN	0.008	0.80
MALATHION	0.008	0.79

TABLE A2–3c: Top ten primary AIs contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 3, the Southeast Desert.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 3 May–Oct 2007 emissions
1,3-D	3.705	40.80
METHYL BROMIDE	2.995	32.97
CHLOROPICRIN	1.446	15.92
METAM-SODIUM	0.496	5.46
CHLORPYRIFOS	0.045	0.49
MINERAL OIL	0.035	0.39
PETROLEUM OIL, UNCLASSIFIED	0.032	0.36
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.032	0.35
ABAMECTIN	0.025	0.27
OXAMYL	0.024	0.26

TABLE A2–3d: Top ten pesticide application sites contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 3.

Application Site	Emissions (tons/day)	Percent of all NAA 3 May–Oct 2005 emissions
CARROT	0.196	17.31
STRAWBERRY	0.161	14.25
STRUCTURAL PEST CONTROL	0.129	11.39
PEPPER, FRUITING	0.125	11.05
UNCULTIVATED AG*	0.086	7.65
GRAPE	0.081	7.21
LANDSCAPE MAINTENANCE	0.054	4.76
CELERY	0.048	4.28
POTATO	0.046	4.04
CAULIFLOWER	0.041	3.65

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

TABLE A2–3e: Top ten pesticide application sites contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 3.

Application Site	Emissions (tons/day)	Percent of all NAA 3 May–Oct 2006 emissions
UNCULTIVATED AG*	0.205	21.07
PEPPER, FRUITING	0.188	19.34
STRAWBERRY	0.163	16.80
STRUCTURAL PEST CONTROL	0.072	7.43
CARROT	0.047	4.80
WATERMELON	0.043	4.42
POTATO	0.039	4.05
LANDSCAPE MAINTENANCE	0.039	4.05
CELERY	0.031	3.22
LETTUCE, LEAF	0.024	2.49

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

TABLE A2–3f: Top ten pesticide application sites contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 3.

Application Site	Emissions (tons/day)	Percent of all NAA 3 May–Oct 2007 emissions
PEPPER, FRUITING	0.311	24.39
TURF/SOD	0.207	16.19
STRAWBERRY	0.184	14.44
POTATO	0.121	9.46
UNCULTIVATED AG	0.083	6.54
GRAPE	0.073	5.70
STRUCTURAL PEST CONTROL	0.059	4.65
WATERMELON	0.043	3.37
LANDSCAPE MAINTENANCE	0.023	1.84
CELERY	0.019	1.49

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

TABLE A2–3e: *Unadjusted* **2005** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tpd).

NAA 3–2005	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.081	0.000
NONMETHYL BROMIDE EMISSIONS	0.894	0.130

TABLE A2–3f: *Unadjusted* **2006** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tpd).

NAA 3–2006	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.013	0.000
NONMETHYL BROMIDE EMISSIONS	0.884	0.074

TABLE A2–3g: *Unadjusted* **2007** May–October VOC emissions in NAA 3 by ARB emission inventory classification (tpd).

NAA 3–2007	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.286	0.000
NONMETHYL BROMIDE EMISSIONS	0.897	0.061

4. Ventura–NAA 4

TABLE A2–4a– Top ten primary AIs contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 4 May–Oct 2005 emissions
METHYL BROMIDE	3.734	39.99
1,3-D	3.633	38.90
CHLOROPICRIN	1.008	10.80
METAM-SODIUM	0.418	4.47
CHLORPYRIFOS	0.086	0.92
PETROLEUM OIL, UNCLASSIFIED	0.046	0.49
POTASSIUM N-METHYLDITHIOCARBAMATE	0.034	0.36
OXAMYL	0.029	0.31
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.029	0.31
ABAMECTIN	0.027	0.28

TABLE A2–4b: Top ten primary AIs contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 4 May–Oct 2006 emissions
1,3-D	3.970	41.26
METHYL BROMIDE	3.868	40.21
CHLOROPICRIN	0.787	8.18
METAM-SODIUM	0.482	5.01
CHLORPYRIFOS	0.066	0.68
PETROLEUM OIL, UNCLASSIFIED	0.047	0.49
OXAMYL	0.036	0.37
AZADIRACHTIN	0.035	0.37
ABAMECTIN	0.027	0.28
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.023	0.24

TABLE A2–4c: Top ten primary AIs contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 4, Ventura.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 4 May–Oct 2007 emissions
1,3-D	3.705	40.80
METHYL BROMIDE	2.995	32.97
CHLOROPICRIN	1.446	15.92
METAM-SODIUM	0.496	5.46
CHLORPYRIFOS	0.045	0.49
MINERAL OIL	0.035	0.39
PETROLEUM OIL, UNCLASSIFIED	0.032	0.36
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.032	0.35
ABAMECTIN	0.025	0.27
OXAMYL	0.024	0.26

TABLE A2–4d:. Top ten pesticide application sites contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 4.

Application Site	Emissions (tons/day)	Percent of all NAA 4 May–Oct 2005 emissions
STRAWBERRY	6.644	71.15
SOIL FUMIGATION/PREPLANT	1.579	16.91
LEMON	0.207	2.22
RASPBERRY	0.190	2.03
TOMATO	0.180	1.93
UNCULTIVATED AG	0.131	1.40
PEPPER, FRUITING	0.094	1.00
N-OUTDR FLOWER	0.062	0.67
CELERY	0.035	0.37
STRUCTURAL PEST CONTROL	0.035	0.37

TABLE A2–4e:. Top ten pesticide application sites contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 4.

Application Site	Emissions (tons/day)	Percent of all NAA 4 May–Oct 2006 emissions
STRAWBERRY	6.363	66.15
SOIL FUMIGATION/PREPLANT	2.200	22.86
TOMATO	0.237	2.47
LEMON	0.179	1.86
RASPBERRY	0.099	1.03
CELERY	0.099	1.03
PEPPER, FRUITING	0.086	0.90
N-OUTDR FLOWER	0.059	0.62
PEPPER, SPICE	0.054	0.57
ARTICHOKE, GLOBE	0.036	0.38

TABLE A2–4f: Top ten pesticide application sites contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 4.

Application Site	Emissions (tons/day)	Percent of all NAA 4 May–Oct 2007 emissions
STRAWBERRY	5.117	56.34
SOIL FUMIGATION/PREPLANT	3.459	38.09
LEMON	0.152	1.67
TOMATO	0.098	1.08
RASPBERRY	0.052	0.57
STRUCTURAL PEST CONTROL	0.038	0.42
PEPPER, FRUITING	0.024	0.26
CELERY	0.018	0.20
TURF/SOD	0.018	0.19
AVOCADO	0.017	0.18

TABLE A2–4g: *Unadjusted* **2005** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tons per day, tpd).

NAA 4–2005	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	2.556	0.000
NONMETHYL BROMIDE EMISSIONS	5.400	0.035

TABLE A2–4h: *Unadjusted* **2006** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tpd).

NAA 4–2006	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	2.537	0.000
NONMETHYL BROMIDE EMISSIONS	5.729	0.024

TABLE A2–4i: *Unadjusted* **2007** May–October VOC emissions in NAA 4 by ARB emission inventory classification (tpd).

NAA 4–2007	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	1.946	0.000
NONMETHYL BROMIDE EMISSIONS	6.049	0.038

5. South Coast - NAA 5

TABLE A2–5a: Top ten primary AIs contributing to **2005** May–October ozone season *unadjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 5 May–Oct 2005 emissions
METHYL BROMIDE	0.688	25.56
PERMETHRIN	0.455	16.92
1,3-D	0.446	16.57
CHLOROPICRIN	0.082	3.06
BIFENTHRIN	0.081	3.00
IMIDACLOPRID	0.081	2.99
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.068	2.54
LIMONENE	0.056	2.10
DAZOMET	0.056	2.09
PIPERONYL BUTOXIDE	0.053	1.96

TABLE A2–5b: Top ten primary AIs contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 5 May–Oct 2006 emissions
METHYL BROMIDE	0.487	24.77
PERMETHRIN	0.279	14.20
1,3-D	0.245	12.46
CHLOROPICRIN	0.127	6.48
IMIDACLOPRID	0.096	4.88
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.072	3.66
BIFENTHRIN	0.067	3.40
FIPRONIL	0.045	2.28
CYFLUTHRIN	0.044	2.23
CYPERMETHRIN	0.039	1.97

TABLE A2–5c: Top ten primary AIs contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 5, South Coast.

Primary AI	Total Product Emissions (tons/day)	Percent of all NAA 5 May–Oct 2007 emissions
METHYL BROMIDE	0.473	24.04
PERMETHRIN	0.275	13.99
1,3-D	0.271	13.77
LIMONENE	0.121	6.17
CHLOROPICRIN	0.078	3.95
BIFENTHRIN	0.077	3.91
N-OCTYL BICYCLOHEPTENE DICARBOXIMIDE	0.069	3.49
CYFLUTHRIN	0.042	2.14
CYPERMETHRIN	0.042	2.13
DISODIUM OCTABORATE TETRAHYDRATE	0.042	2.11

TABLE A2–5d: Top ten pesticide application sites contributing to **2005** May-October ozone season *unadjusted* VOC emissions in NAA 5.

Application Site	Emissions (tons/day)	Percent of all NAA 5 May–Oct 2005 emissions
STRUCTURAL PEST CONTROL	1.041	38.67
STRAWBERRY	0.856	31.80
LANDSCAPE MAINTENANCE	0.214	7.95
TURF/SOD	0.213	7.89
FUMIGATION, OTHER	0.068	2.51
RIGHTS OF WAY	0.050	1.85
N-OUTDR PLANTS IN CONTAINERS	0.048	1.77
SOIL FUMIGATION/PREPLANT	0.038	1.42
PEPPER, FRUITING	0.036	1.34
COMMODITY FUMIGATION	0.026	0.95

TABLE A2–5e: Top ten pesticide application sites contributing to **2006** May–October ozone season *unadjusted* VOC emissions in NAA 5.

Application Site	Emissions (tons/day)	Percent of all NAA 5 May–Oct 2006 emissions
STRUCTURAL PEST CONTROL	0.781	39.68
STRAWBERRY	0.747	37.98
LANDSCAPE MAINTENANCE	0.163	8.30
FUMIGATION, OTHER	0.087	4.42
RIGHTS OF WAY	0.036	1.83
N-OUTDR PLANTS IN CONTAINERS	0.032	1.65
SOIL FUMIGATION/PREPLANT	0.029	1.48
COMMODITY FUMIGATION	0.019	0.99
PEPPER, FRUITING	0.012	0.64
AVOCADO	0.008	0.41

TABLE A2–5f: Top ten pesticide application sites contributing to **2007** May–October ozone season *unadjusted* VOC emissions in NAA 5.

Application Site	Emissions (tons/day)	Percent of all NAA 5 May–Oct 2007 emissions
STRUCTURAL PEST CONTROL	0.786	39.94
STRAWBERRY	0.752	38.21
LANDSCAPE MAINTENANCE	0.161	8.18
FUMIGATION, OTHER	0.058	2.94
N-OUTDR PLANTS IN CONTAINERS	0.043	2.17
RIGHTS OF WAY	0.036	1.83
SOIL FUMIGATION/PREPLANT	0.033	1.68
COMMODITY FUMIGATION	0.027	1.38
AVOCADO	0.009	0.44
GRAPEFRUIT	0.008	0.40

TABLE A2–5g: *Unadjusted* **2005** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tpd).

NAA 5–2005	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.508	0.003
NONMETHYL BROMIDE EMISSIONS	0.963	1.041

TABLE A2–5h: *Unadjusted* **2006** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tpd).

NAA 5–2006	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.360	0.003
NONMETHYL BROMIDE EMISSIONS	0.698	0.782

TABLE A2–5i: *Unadjusted* **2007** May–October VOC emissions in NAA 5 by ARB emission inventory classification (tpd).

NAA 5–2007	Agricultural Applications	Structural Applications
METHYL BROMIDE EMISSIONS	0.344	0.002
NONMETHYL BROMIDE EMISSIONS	0.707	0.788