Department of Pesticide Regulation

Paul Helliker
Director

Arnold Schwarzenegger
Governor

June 3, 2004

TO: Interested Persons

SUBJECT: VOLATILE ORGANIC COMPOUND EMISSION INVENTORY

The Department of Pesticide Regulation (DPR) completed the annual pesticide volatile organic compound (VOC) emission inventory based on the 2002 pesticide use data for the five non-attainment areas. DPR has prepared the inventory as part of its commitment to reduce pesticide VOC emissions under the 1994 State Implementation Plan (SIP) for Agricultural and Commercial Structural Pesticides.

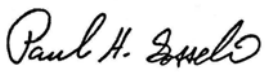
As expected, the 2002 pesticide VOC emission inventory mirrors the 2002 pesticide use report that showed an increase from 2001. For the Sacramento Metropolitan and South Coast non-attainment areas, the 2002 pesticide VOC emission inventory continues to meet commitments made in the 1994 State Implementation Plan. The pesticide VOC emission inventory for the Ventura and Southeast Desert nonattainment areas does not currently meet the target goals. However, we have until 2005 and 2007, respectively, to meet the commitment for these non-attainment areas. We will continue to evaluate the trends for these nonattainment areas.

For the San Joaquin nonattainment area, we committed to reduce pesticide VOC emissions by 12 percent by 1999. For the past five years, the pesticide VOC emission inventory trend for the San Joaquin Valley has shown considerable and steady progress toward meeting the 12 percent reduction goal. The 2001 pesticide VOC emission inventory showed that the 12 percent target reduction goal was met. However, the 2002 pesticide VOC emission inventory for the San Joaquin Valley showed an increase that placed the inventory approximately ten percent above the 1999 target. The increase is not cause for imminent concern or action, but will require DPR to take appropriate steps over the next year to bring the San Joaquin Valley emissions back to the 1999 target level.

We have begun evaluating the causes of the increase and various reduction options that will fulfill our pesticide VOC emission reduction target for the San Joaquin Valley. We expect to have various VOC reduction options prepared for public discussion in the next few months, with the expectation to implement various reduction strategies soon thereafter. The reduction

strategies will consider what can be done feasibly in the short-term, in addition to options that will take longer to implement. The means of carrying out the strategies will rely on the legally enforceable regulatory tools afforded to DPR, as well as verifiable nonregulatory strategies. We will balance the scope and timing of our reduction measures in meeting the 1999 reduction target with the need to ensure the viability of pest management, recognition of voluntary measures, and the need to maintain our VOC reduction commitment. We look forward to your participation in our efforts.

Sincerely,



Paul H. Gosselin
Chief Deputy Director
(916) 445-4330

Department of Pesticide Regulation

Paul Helliker
Director

M E M O R A N D U M

Arnold Schwarzenegger
Governor

TO: John S. Sanders, Ph.D., Chief
Environmental Monitoring Branch

FROM: Frank Spurlock, Ph.D. [Original signed by Frank Spurlock]
Senior Environmental Research Scientist
Environmental Monitoring Branch
(916) 324-4124

DATE: May 17, 2004

SUBJECT: 2004 UPDATE TO THE PESTICIDE VOC INVENTORY: ESTIMATED EMISSIONS 1990-2002

I. OVERVIEW

This memorandum summarizes the Department of Pesticide Regulation's (DPR's) 2004 update of estimated pesticide volatile organic compound (VOC) emission data, with particular attention to May-October "ozone season" emissions in California's five non-attainment areas (NAA). An electronic file containing detailed statewide 1990-2002 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.

DPR recently updated their VOC NAA boundary data files to conform to U.S. Environmental Protection Agency's most recent 1-hour ozone standard NAA boundaries <http://www.epa.gov/region9/air/maps/r9_o3.html>. Consequently, all annual VOC inventories (1990-2002) were re-calculated based on these current NAA boundaries. Several other revisions to the VOC calculation procedure were proposed in January, 2004 (Spurlock, 2004). Briefly, these included (1) modifying default emission potentials for certain methyl isothiocyanate–generating fumigant products, (2) including additional agricultural-use products that had previously been excluded from the inventory, and (3) modifying procedures used to determine probable outliers in the pesticide use report upon which the VOC inventory is based. These revisions were not implemented in this version of DPR's VOC inventory, but may be adopted in the next VOC inventory update. With the exception of the modified NAA boundaries, calculation procedures utilized were essentially the same as those employed in previous inventories (Spurlock, 2002a; 2002b). The 2002 VOC emissions reported are based on DPR's preliminary 2002 pesticide use data, released in October 2003 (DPR, 2003). The NAA attainment goals discussed are those listed in the January 8, 1997 Federal Register (Federal Register, 1997). The attainment goals are based on the 1990 pesticide emissions inventory (Table 1).

TABLE 1: 1990 May–October (ozone season) pesticide VOC emissions in NAAs 1–5.

NAA	Emissions – tons total organic gases per day
1 – Sacramento Metropolitan	2.972
2 – San Joaquin Valley	24.118
3 – Southeast Desert	1.269
4 – Ventura	4.589
5 – South Coast	11.152

II. VOC INVENTORY RESULTS BY NON-ATTAINMENT AREA (NAA)

A. NAA 1, Sacramento Metropolitan Area

Although 2002 ozone season VOC emissions in NAA 1 of 1.90 tons total organic gases per day (tpd) were 6.8 percent greater than the 2001 emissions of 1.78 tpd, the 2002 emissions remained well below the 2005 target of 2.41 tpd (Figure 1).

Approximately 91 percent of ozone season VOC emissions in NAA 1 were attributable to agricultural pesticide use as compared to 9 percent from commercial structural pesticide applications. Unlike most other areas of California where the largest contributors to VOC emissions are fumigants, the rice herbicides molinate and thiobencarb contributed substantially to NAA 1 emissions (Table 2). Rice was the highest contributing application site with more than 41 percent of emissions (Table 3). Products containing the three top fumigants 1,3-dichloropropene, methyl bromide, and metam-sodium accounted for a relatively modest 12.5 percent of 2002 ozone season NAA 1 VOC emissions.

Table 4 summarizes NAA 1 emissions based on four of Air Resource Board's (ARB's) emission inventory 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.

TABLE 2: Top ten "primary active ingredients" contributing to 2002 May-October ozone season VOC emissions in NAA 1, the Sacramento Metropolitan Area, listed in descending order of total emissions of products containing the primary active ingredient. The primary active ingredient is defined as the pesticidal 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.

Primary AI	Total product emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 1
MOLINATE	0.604	31.8%
CHLORPYRIFOS	0.118	6.2%
THIOBENCARB	0.109	5.8%
1,3-DICHLOROPROPENE	0.099	5.2%
METHYL BROMIDE	0.093	4.9%
CYPERMETHRIN	0.076	4.0%
TRIFLURALIN	0.064	3.4%
GLYPHOSATE, ISOPROPYLAMINE SALT	0.053	2.8%
SULFUR	0.049	2.6%
METAM-SODIUM	0.046	2.4%

TABLE 3: Top ten pesticide application sites contributing to 2002 May-October ozone season VOC emissions in NAA 1.

Application site	emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 1
RICE	0.783	41.2%
STRUCTURAL PEST CONTROL	0.167	8.8%
PROCESSING TOMATOES	0.158	8.3%
WALNUT	0.116	6.1%
GRAPES	0.074	3.9%
SOIL APPLICATION	0.068	3.6%
RIGHTS OF WAY	0.065	3.4%
ALFALFA	0.052	2.7%
STRAWBERRY	0.041	2.2%
LANDSCAPE MAINTENANCE	0.040	2.1%

TABLE 4: 2002 May–October NAA 1 emissions by emission inventory classification (tons per day, tpd).

	Agricultural applications	**Structural applications**
methyl bromide emissions	0.086	0.000
non-methyl bromide emissions	1.647	0.166

B. NAA 2, San Joaquin Valley

The 2002 ozone season NAA 2 emissions of 23.2 tpd represented an increase over 2001 emissions of 34 percent and exceeded the 1999 goal of 21.2 tpd by 10 percent (Figure 1). Approximately 98.5 percent of 2002 NAA 2 VOC emissions were attributable to agricultural pesticide uses with the remaining 1.5 percent resulting from commercial structural pesticide applications. Similar to previous years, the principal contributors to NAA 2 emissions were fumigants, 49 percent of NAA 2 VOC emissions were attributable to fumigant products in which metam-sodium, 1,3-dichloropropene, methyl bromide or potassium N-methyl dithiocarbamate (metam potassium) were the primary active ingredient (Table 5). The two highest-contributing pesticide application sites were carrots and cotton, each contributing more than 10 percent to NAA 2 ozone season emissions (Table 6).

Table 7 summarizes NAA 2 emissions based on four of ARB's emission inventory 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.

TABLE 5: Top ten "primary active ingredients" contributing to 2002 May-October ozone season VOC emissions in NAA 2, the San Joaquin Valley, listed in descending order of total emissions of products containing the primary active ingredient. The primary active ingredient is defined as the pesticidal 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.

Primary AI	Total product emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 2
METAM-SODIUM	6.228	26.9%
1,3-DICHLOROPROPENE	3.299	14.2%
CHLORPYRIFOS	1.965	8.5%
GLYPHOSATE, ISOPROPYLAMINE SALT	1.481	6.4%
METHYL BROMIDE	1.480	6.4%
ACROLEIN	0.535	2.3%
SULFUR	0.509	2.2%
TRIFLURALIN	0.369	1.6%
ENDOSULFAN	0.369	1.6%
GIBBERELLINS	0.367	1.6%

TABLE 6: Top ten pesticide application sites contributing to 2002 May-October ozone season VOC emissions in NAA 2.

Application site	emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 2
CARROTS	4.441	19.2%
COTTON	3.084	13.3%
ALMOND	1.778	7.7%
GRAPES	1.421	6.1%
POTATO	1.332	5.8%
ORANGE	1.205	5.2%
RIGHTS OF WAY	0.766	3.3%
NURSERY OUTDR CONTAINER/FLD GRWN PLANTS	0.732	3.2%
ALFALFA	0.596	2.6%
ONION	0.587	2.5%

TABLE 7: 2002 May–October NAA 2 emissions by emission inventory classification (tons per day, tpd).

	Agricultural applications	**Structural applications**
methyl bromide emissions	1.255	0.018
non-methyl bromide emissions	21.306	0.579

C. NAA 3, Southeast Desert

The 2002 NAA 3 ozone season VOC emissions of 1.23 tpd were nearly identical to those in 2001, and emissions in NAA 3 continued to remain well above the 2007 ozone season target of 1.02 tpd (Figure 1).

Approximately 95 percent of 2002 NAA 3 VOC emissions were attributable to agricultural uses with the remaining 5 percent, a result of commercial structural pesticide applications. Emissions in NAA 3 are driven largely by fumigants, more than 78 percent of 2002 NAA 3 emissions were attributable to products in which metam-sodium, 1,3-dichloropropene, potassium N-methyl dithiocarbamate, methyl bromide or chloropicrin was the primary active ingredient (Table 8). The highest contributing sites to 2002 NAA 3 emissions were carrots and peppers jointly contributing 42 percent to NAA 3 emissions (Table 9).

Table 10 summarizes NAA 3 emissions based on four of ARB's emission inventory 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.

TABLE 8: Top ten "primary active ingredients" contributing to 2002 May-October ozone season VOC emissions in NAA 3, the Southeast Desert, listed in descending order of total emissions of products containing the primary active ingredient. The primary active ingredient is defined as the pesticidal 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.

Primary AI	Total product emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 3
METAM-SODIUM	0.704	57.3%
1,3-DICHLOROPROPENE	0.162	13.2%
METHYL BROMIDE	0.072	5.9%
GLYPHOSATE, ISOPROPYLAMINE SALT	0.054	4.4%
CHLORPYRIFOS	0.023	1.9%
CHLOROPICRIN	0.017	1.4%
ENDOSULFAN	0.016	1.3%
PERMETHRIN	0.014	1.1%
EPTC	0.012	1.0%
MALATHION	0.012	0.9%

TABLE 9: Top ten pesticide application sites contributing to 2002 May-October ozone season VOC emissions in NAA 3.

Application site	emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 3
CARROTS	0.346	28.2%
PEPPERS	0.172	14.0%
STRAWBERRY	0.075	6.1%
CELERY	0.070	5.7%
STRUCTURAL PEST CONTROL	0.060	4.9%
UNCULTIVATED AGRICULTURAL AREAS	0.056	4.6%
ARTICHOKE	0.052	4.2%
WATERMELONS	0.050	4.1%
ONION	0.041	3.3%
CANTALOUPE	0.040	3.3%

TABLE 10: 2002 May–October NAA 3 emissions by emission inventory classification (tons per day, tpd)

	Agricultural applications	**Structural applications**
methyl bromide emissions	0.059	0.000
non-methyl bromide emissions	1.105	0.066

D. NAA 4, Ventura

NAA 4 2002 ozone season emissions declined 3 percent from 2001 with emissions of 7.30 and 7.08 tpd for 2001 and 2002, respectively. However, 2002 emissions remained well above the 2005 target, exceeding the target of 3.67 tpd by 93 percent (Figure 1). Nearly 100 percent of 2002 NAA 4 emissions resulted from agricultural pesticide uses with commercial structural pesticide applications accounting for only 0.1 percent of ozone season emissions.

As in previous years, 2002 NAA 4 VOC emissions were dominated by fumigants, more than 93 percent of total emissions were attributable to products in which methyl bromide, chloropicrin, metam-sodium, 1,3-dichloropropene, or potassium N-methyl dithiocarbamate were the primary active ingredient (Table 11). Emissions in NAA 4 were dominated by applications to one site: strawberries (Table 12).

Table 13 summarizes NAA 4 emissions based on four of ARB's emission inventory 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.

TABLE 11: Top ten "primary active ingredients" contributing to 2002 May-October ozone season VOC emissions in NAA 4, Ventura, listed in descending order of total emissions of products containing the primary active ingredient. The primary active ingredient is defined as the pesticidal 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.

Primary AI	Total product emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 4
METHYL BROMIDE	5.517	77.9%
CHLOROPICRIN	0.656	9.3%
METAM-SODIUM	0.341	4.8%
CHLORPYRIFOS	0.136	1.9%
1,3-DICHLOROPROPENE	0.080	1.1%
PETROLEUM OIL, UNCLASSIFIED	0.069	1.0%
GLYPHOSATE, ISOPROPYLAMINE SALT	0.039	0.5%
METALDEHYDE	0.022	0.3%
AVERMECTIN	0.016	0.2%
ALACHLOR	0.014	0.2%

TABLE 12. Top ten pesticide application sites contributing to 2002 May-October ozone season VOC emissions in NAA 4.

Application site	emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 4
STRAWBERRY	5.992	84.6%
LEMON	0.279	3.9%
SOIL APPLICATION	0.248	3.5%
NURSERY OUTDR GRWN CUT FLWRS OR GREENS	0.130	1.8%
RASPBERRY	0.111	1.6%
PEPPERS	0.053	0.7%
CELERY	0.044	0.6%
CARROTS	0.039	0.6%
AVOCADO	0.026	0.4%
LETTUCE, LEAF	0.021	0.3%

TABLE 13: 2002 May–October NAA 4 emissions by emission inventory classification (tons per day, tpd).

	Agricultural applications	**Structural applications**
methyl bromide emissions	3.809	0.000
non-methyl bromide emissions	3.264	0.010

E. NAA 5, South Coast

At 2.92 tpd, 2002 ozone season VOC emissions in NAA 5 were slightly lower than those in the previous year (Figure 1), but were far below the 2010 attainment goal of 8.92 tpd. Approximately 76 percent of 2002 emissions in NAA 5 were attributable to agricultural uses with commercial structural pesticide applications accounting for the remaining 24 percent.

Fumigants contributed approximately 60 percent of 2002 NAA 5 emissions with products containing methyl bromide and chloropicrin contributing more than 53 percent of all emissions (Table 14). Strawberry and structural pest control were the highest contributors to NAA 5 emissions representing nearly two-thirds of all emissions (Table 15).

Table 16 summarizes NAA 5 emissions based on four of the ARB's emission inventory 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.

TABLE 14: Top ten "primary active ingredients" contributing to 2002 May-October ozone season VOC emissions in NAA 5, South Coast, listed in descending order of total emissions of products containing the primary active ingredient. The primary active ingredient is defined as the pesticidal 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.

Primary AI	Total product emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 5
METHYL BROMIDE	1.145	39.2%
CHLOROPICRIN	0.421	14.4%
PERMETHRIN	0.196	6.7%
METAM-SODIUM	0.107	3.7%
GLYPHOSATE, ISOPROPYLAMINE SALT	0.100	3.4%
BIFENTHRIN	0.088	3.0%
1,3-DICHLOROPROPENE	0.082	2.8%
CYFLUTHRIN	0.065	2.2%
CHLORPYRIFOS	0.062	2.1%
CLARIFIED HYDROPHOBIC EXTRACT OF NEEM OIL	0.061	2.1%

TABLE 15: Top ten pesticide application sites contributing to 2002 May-October ozone season VOC emissions in NAA 5.

Application site	emissions (tons/day)	% of all May - Oct 2002 pesticide emissions in NAA 5
STRAWBERRY	1.301	44.6%
STRUCTURAL PEST CONTROL	0.671	23.0%
TOMATO	0.212	7.3%
FUMIGATION, OTHER	0.193	6.6%
LANDSCAPE MAINTENANCE	0.133	4.6%
RIGHTS OF WAY	0.094	3.2%
NURSERY OUTDR CONTAINER/FLD GRWN PLANTS	0.054	1.8%
SOIL APPLICATION, PREPLANT-OUTDOOR	0.053	1.8%
CARROTS, GENERAL	0.041	1.4%
COMMODITY FUMIGATION	0.025	0.9%

TABLE 16: 2002 May–October NAA 5 emissions by emission inventory classification (tons per day, tpd).

	Agricultural applications	**Structural applications**
methyl bromide emissions	0.844	0.004
non-methyl bromide emissions	1.382	0.686

III. SUMMARY

Both NAA 1 (Sacramento Metropolitan) and NAA 5 (South Coast) 2002 May-October emissions were below their respective attainment goals. These goals were exceeded by 10, 21, and 93 percent in NAAs 2–4, respectively. It is unlikely that NAA 2 (San Joaquin Valley), NAA 3 (Southeast Desert) or NAA 4 (Ventura) will meet their goals without a marked change in fumigant use because fumigants contributed 49, 78, and 93 percent, respectively, of 2002 ozone season emissions in these NAAs.

IV. REFERENCES

Department of Pesticide Regulation. 2003. News Release 03-020: DPR Releases Pesticide Use Statistics for 2002, October 13, 2003. available on-line: <http://www.cdpr.ca.gov/docs/pressrls/november13.htm> , verified November 1, 2003.

Federal Register, January 8, 1997. Volume 62, No. 5, p. 1170.

Spurlock, F., 2002a. February 4, 2002 memorandum to J. Sanders. Summary of 1990–2000 Voc Emissions Inventory Data, version 01.12. available online: <http://www.cdpr.ca.gov/docs/pur/vocproj/vocsumm.htm>, verified April 14, 2004.

Spurlock, F., 2002b. November 8, 2002 memorandum to J. Sanders. Pesticide Volatile Organic Compound Emissions Inventory 2002 Update: Estimated Emissions January–December 2001. available online: <http://www.cdpr.ca.gov/docs/pur/vocproj/vocsumm.htm>, verified April 14, 2004.

Spurlock, F. 2004. January 8, 2004, memorandum to J. Sanders: Revisions to Procedures for Estimating Volatile Organic Compound Emissions from Pesticides

Attachment

cc: Mr. Randy Segawa, Senior Environmental Research Scientist (w/Attachment)
Mr. Mark Pepple, Senior Environmental Research Scientist (w/Attachment)

bcc: Spurlock Surname File (w/Attachment)

Figure 1. 1990 - 2002 May - October (ozone season) pesticide VOC emissions in nonattainment areas 1 - 5.