



# Department of Pesticide Regulation



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Director

## MEMORANDUM

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TO: Susan Edmiston  
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**HSM-06013**

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SUBJECT: BACKGROUND FOR EXPOSURE MONITORING WITH DUST  
FORMULATIONS USED IN AGRICULTURE PRODUCTION IN  
CALIFORNIA

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Few active ingredients formulated as dusts are actively registered and used compared to other more widely used formulations. Elemental sulfur is the most commonly used pesticide in California (DPR, 2005) both in acres treated and pounds applied. It is an important and effective fungicide for managing powdery mildew, one of the major diseases affecting grapes throughout the world. Other fungal diseases controlled are brown rot, scab, mildew, leafspots and rusts (Farm Chemical Handbook, 2005). It is also used for the control of mites and insects (leafhoppers). Many registered sulfur pesticide product labels have a vast array of crops listed. Human exposure to sulfur can cause eye and skin irritation and breathing difficulty. It has become an important component in IPM systems since it can be used in organic farming. The main crops on which sulfur is used in California are grapes, tomatoes, and sugarbeet. It is generally applied to crops as a dust, at rates of approximately 10 – 100 lbs. per application per acre. A Department of Pesticide Regulation (DPR) Pesticide Use Report query found annual use of sulfur dust on grapes ranged from 31.13 to 40.02 million pounds in 2000 through 2004. The annual use of sulfur dust on tomatoes ranged from 4.21 to 6.5 million pounds.

The Worker Health and Safety (WHS) Branch Pesticide Illness Surveillance Program (PISP) maintains a database of pesticide-related illnesses and injuries. A query of the PISP database from 1992-2003 found 80 occupational illness/injuries occurring among dust/powder handlers in agricultural settings (Mehler, 2005). Thirty-one (38.7%) cases were related to dilute application and forty-nine (61.25%) cases involved a sulfur dust formulation.

WHS requires accurate exposure and environmental concentration estimates to develop realistic exposure assessments and set appropriate health-protective standards. The degree to which individual workers are potentially exposed while handling pesticides depends on worker's specific activities, the application equipment and the active ingredients.



Data are lacking for handlers of dust formulations using hand-held, backpack and ground equipment (Beauvais, 2004) and available data are inadequate for developing meaningful worker exposure estimates. WHS handler research includes a study of M/L/As dusting captan on grapes (O'Connell, *et al.*, 1990). A study of greenhouse M/L/As (Brouwer et al., 1992) indicates that respiratory exposures may be higher during dusting than during spraying.

WHS has proposed to conduct a monitoring study to evaluate agricultural handler exposure to pesticides formulated as dusts. The memo summarizes use for dust formulation products and active ingredients. The minimum criteria for recommending suitable pesticides for an exposure monitoring study is the use on at least 25,000 acres annually. The monitoring data will provide WHS exposure assessors with more realistic estimates of worker exposures to pesticide dust formulations.

A DPR Product Label Database query (DPR, 2006) by method of application shows approximately one hundred and sixty nine actively registered dust/powder products. The query does not sort for agriculture uses only.

A DPR Pesticide Use Report Database query shows one hundred fifteen active ingredients (a.i.) formulated as dusts/powders are used in California production agriculture. Query parameters were for products formulated as dusts (Table 1). Furthermore, Table 1 presents a.i.'s with greater than 800 acres treated for consecutive years since 2001, except for copper oxychloride, captan, carbaryl and dicofol. Copper oxychloride was not used prior to 2003. Use increased from 36 acres in 2003 to 2,428 acres in 2004. Annual captan use was less than 800 acres treated from 1997 to 2003 but increased to 965 acres treated in 2004. On the other hand, use of carbaryl and dicofol in 2004 decreased significantly to less than 800 acres treated (36 acres treated and 143 acres treated respectively).

**Table 1.**  
**Dust Formulations**  
**California Production Ag – Acres Treated\***

Active Ingredient	Total Acres Treated							
	1997	1998	1999	2000	2001	2002	2003	2004
Bacillus Thuringiensis, Subsp. Kurstaki, Strain HD-1	2,616	1,059	7,172	7,013	3,530	892	3,390	1,119
Bacillus Thuringiensis (Berliner), Subsp. Kurstaki, Serotype 3A,3B	29,928	31,494	28,528	37,258	27,128	12,812	18,624	19,108
Captan	294	710	80	318	42	195	58	965
Carbaryl	3,792	1,893	572	1,534	2,486	1,425	938	36
Copper	33,218	56,506	67,781	48,797	16,969	13,575	29,979	25,581
Copper Oxychloride Sulfate	97,332	155,505	95,040	95,888	75,091	72,261	106,419	51,792
Copper Oxychloride	0	0	0	0	0	0	36	2428
Copper Sulfate (Basic)	0	0	0	689	4,678	3,032	11,669	2,602
Cryolite	0	0	35	1,749	5,308	5,804	2,829	3,071
Dicloran	29,792	39,367	17,462	17,210	7,149	2,468	12,182	4,632
Dicofol	140	1,160	3,042	2,626	1,565	1,184	1,259	143
Malathion	4,922	2,686	2,636	2,492	4,304	3,227	3,265	2,915
Myclobutanil	0	81,781	28,130	36,762	12,880	85,089	55,660	83,188
Pyrethrins	396	81	2,793	2,657	1,564	1,032	883	8,151
Sulfur	NQ	NQ	NQ	3,666,270	2,898,273	3,291,452	3,220,715	3,306,041

\* Active ingredients formulated as dusts actively registered for agriculture production.  
 NQ - Not queried for 1997 – 1999

Appendixes 1, 3 and 4 show use data for each registered product whose a.i. is listed in Table 1. Only products used to treat more than 100 acres between 2002 and 2004 are listed. Furthermore, some products are formulated in combination with sulfur. In agriculture production, users prefer non-dust formulations when available (anecdotal information gathered from farm advisors, PCAs and growers), with the exception of sulfur dust formulations. Non-dust formulations are preferred because they are safer and easier to use. Cryolite is an example. From 1997 through 2004, growers used dilute applications of cryolite to treat 145,509 to 453,753 acres but only treated 35 - 5,804 acres with dust formulations (DPR 2005).

The following discussion is presented by a.i.'s in order of the highest acres treated:  
Sulfur: Elemental sulfur is an acaricide and fungicide widely used on orchard, ornamental, vegetable, grain, and other crops. It is formulated as dust in various particle sizes and applied as such, or it may be formulated with various minerals to improve flowability, or applied as an aqueous emulsion or wettable powder. As an active ingredient, sulfur is the leading pesticide used in California agriculture. In 2005, sulfur use increased by 7.3 million pounds (13%) and by 3,572,274 acres treated. The eight commodities with the highest acres treated with sulfur dust formulations are listed in Table 2. Table, raisin, and wine grapes (88 – 90.5%) account for the majority of sulfur dust use, followed by processing tomatoes (4.6 – 6.8%) and sugarbeets (1.5 – 3.3%). Specific sulfur dust products for table, raisin, and wine grapes are listed in Appendixes 3 and 4, respectively. Sulfur is the strongest candidate for a worker exposure study because of the large acreage treated with dust formulations and because there is only limited use of dust formulations other than sulfur.

**Table 2.**  
**Total Acres Treated With Sulfur Dust for Commodities With the Highest Use**

Commodity	Total Acres Treated Per Year					
	2000	2001	2002	2003	2004	2005
Table & Raisin Grape	1,532,743	1,152,677	1,378,488	1,384,043	1,367,924	1,434,912
Wine Grape	1,722,406	1,469,491	1,576,387	1,467,215	1,540,956	1,754,673
Tomato	12,105	5,251	8,779	12,178	18,070	10,733
Processing Tomato	169,610	127,322	185,734	185,191	208,711	211,951
Strawberry	13,412	7,500	12,832	13,236	31,232	26,562
Sugarbeet	120,651	50,952	48,998	56,543	62,741	56,453
Pistachio	1,316	914	1,471	796	264	80
Peach	3,134	1,945	3,149	4,627	3,328	2,135
<b>Total Acreage*</b>	<b>3,575,377</b>	<b>2,816,053</b>	<b>3,215,838</b>	<b>3,123,829</b>	<b>3,233,225</b>	<b>3,497,499</b>

\*for commodities presented on the table

Greenhouses: Use of dust products including sulfur in greenhouses is extremely limited (Table 3) and would not support an exposure monitoring study. The majority of the sulfur dust used in greenhouses was applied on flowers until 2002. However, its use on flowers dramatically declined to less than 500 acres treated in 2003 and less than 42 acres, both in 2004 and 2005 (Table 4). This is probably due to the loss of the rose market to Colombia. The acres treated for containers have remained stable since 2002.

**Table 3.  
 Dust/Powder Formulation Used In California Greenhouses**

Active Ingredient	Total Acres Treated				
	2000	2001	2002	2003	2004
Sulfur	2,005	2,348	2,454	947	624
Mancozeb	837	457	74	22	33
Cryolite	42	24	3	36	480
IBA	41	18	156	122	8
Fenoxycarb	79	48	29	20	18
Thiophanate-Methyl	56	51	44	39	0
Pyrethrins	53	22	82	30	1
Diatomaceous Earth	53	22	82	30	0
Piperonyl Butoxide, Other Related	53	22	82	30	0
Piperonyl Butoxide	53	22	82	30	
Cyfluthrin	20	8	0	7	9
Copper	0	0	0	0	29
Permethrin	0	16	0	0	0
Diazinon	0	1	0	13	0

**Table 4  
 Total Acres Treated With Sulfur Dust on Greenhouse**

Greenhouse	Total Acres Treated					
	2000	2001	2002	2003	2004	2005
Flowers	1,687	1,938	1,879	402	42	33
Containers	52	280	438	406	463	488
Transplants	0	0	2	0	0	0
Grand Total	1,740	2,218	2,319	809	505	521

Myclobutanil: Myclobutanil is one of several commonly used fungicides for control of powdery mildew. Appendix 1 lists three product labels used on grapes and all contain 96.75% sulfur, 0.50% myclobutanil and 2.75% inerts. Of these three products, Premium Sulfur Dust was most heavily used - from 11,965 acres treated in 2001 to 82,240 acres treated in 2004. A query of CalPIP (DPR 2006) showed that in 2004 almost all applications were ground applications although there were some aerial applications in Madera County. Since it is extensively used (large acreage treated), myclobutanil seems to be the only possible other candidate, aside from sulfur dust formulations, for a handler exposure study.

Copper Oxychloride Sulfate: In 2004, PUR data reports 51,792 acres treated with copper oxychloride sulfate dust and grapes accounted for 97% of its use (Table 5). In addition, most of the acreage was treated with Clean Crop C-O-C-S 15 Sulfur 25 Dust (EPA registration No. 34704-393-AA), and was highly used on table and raisin grapes (42,484 acres) followed by wine grapes (7,985 acres) (Appendix 4). Another product, Clean Crop C-O-C-S Copodust (EPA registration No. 34704-320-AA) was used in pears (821 acres), oranges (392 acres), raspberries (50 acres) and peaches (16 acres) in 2004 (Appendix 2). Other acres treated are reported in Table 6 and Appendix 2.

**Table 5.**  
**Acres Treated With Copper Oxychloride Sulfate Dust On Grapes\***

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Dust** - All	80,240	70,149	97,335	155,505	95,040	95,888	75,091	72,225	106,419	51,792
Dust - Grapes	58,630	54,348	91,488	146,340	90,330	92,048	72,323	71,209	104,231	50,484
Percent -Grapes	73	77	94	94	95	96	96	99	98	97

\* Grapes = Wine, Table and Raisin

\*\* Active ingredients formulated as dusts actively registered for agriculture production.

**Table 6.**  
**Copper Oxychloride – Acres Treated With Dust Formulations**

Commodity*	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Wine Grape	14,044	14,638	18,653	55,558	22,442	25,990	10,975	6,645	13,108	7,999
Raisin & Table Grape	44,586	39,710	72,835	90,781	67,888	66,058	61,348	64,563	91,123	42,484
Pear	18,244	13,761	4,379	5,737	4,104	3,062	2,351	986	1,994	821
Raspberry	2,487	1,665	1,417	1,341	414	265	324	6	46	50
Walnut	765	348	30	1,537	40	50	90	25	0	0
Apple	90	4	0	105	0	0	0	0	130	0
Lettuce Leaf	5	0	0	0	0	0	0	0	0	5
Orange	0	0	0	0	20	0	0	0	0	392
Peach	0	0	0	92	80	0	0	0	16	16

\*Commodities: only commodities with highest acres treated are shown on table

Bacillus Thuringiensis (Bt): Several strains of *Bacillus thuringiensis* are pathogenic to some insects. The spores are formulated as wettable powders, flowable concentrates, granules, and dust for application to field crops and for control of mosquitoes and black flies. BT Sulfur15-50 Dust was used to treat 23,384 acres 2000, but use declined to 6,373 acres in 2002 and to 6,315 acres treated in 2004 (Appendix 1). Some formulations have sulfur in

addition to Bt, but acres treated are declining too and other sulfur dust formulations are better candidates. The acres treated do not support an exposure monitoring study.

Dicloran: Dicloran is a broad-spectrum fungicide used to protect perishable produce. It is formulated as a wettable powder, dusts, and flowable powders. Several products under Botran labels are shown on Appendix 1: in 2004 only 2,909 A were treated with Botran 6% dust. This label has a limited use on grapes grown West of the Rocky Mountains: a cool wet year promoted botrytis and acres treated increased to 39,367, but only 4,632 acres were treated with dicloran in 2004. The acres treated are not sufficient to proceed with an exposure monitoring.

Malathion: Malathion is an insecticide formulated as a wettable powder, dusts, emulsifiable concentrate, oil solution, powder and ULV concentrate. The two products registered in California are for use on dates only. An average of approximately 3,000 acres per year are treated in Riverside County with malathion dust formulations. The acres treated do not support a worker exposure study (Appendix 1).

Pyrethrins: Pyrethrins are used as insecticides formulated as concentrates in oil and water, and in impregnated and stabilized dust concentrates. Diatect Multipurpose Insecticide II (Appendix 1) accounted for most of the acres treated with pyrethrin dust formulations. Diatect Multipurpose Insecticide II is used both as a dust and a wettable powder (WP). Although, acres treated with pyrethrins increased from 883 in 2003 to 8,151 acres treated in 2004, this is still not enough acreage to support a monitoring study. Furthermore, since some products could be used as dust or WP, it is difficult to determine how many acres were actually treated as a dust.

Cryolite: Sodium fluoaluminate (Cryolite) is a stable mineral containing fluoride. It is used as an insecticide on some vegetables and some fruits. In 2004, as much as 136,489 acres were treated with dilute applications, but only 3,071 acres were treated with dust formulation – (DPR 2005). Also, the use of cryolite dust formulations is declining (Table 1 and Appendix 1) and does not support a worker exposure study.

Dicofol: According to Appendix 1, Gowan Dicofol 3 Dust is the most commonly used dicofol product; it is used on grapes, cucumbers, melons and squash. Use has been declining and growers prefer new ovicidal miticides: the 143 acres treated in 2004 are a good indicator, down from 1,259 the previous year. The decreasing use of dicofol does not support using it as a target dust formulation in a worker exposure study.

Captan: Captan is a broad-spectrum fungicide widely used to protect seed, field crops, and stored produce. It is formulated as dust and wettable powder. Also, it is primarily applied by ground (Table 7 and 8). Furthermore, the corn and cotton acreage treated includes seed treatments. However, with less than 10,000 acres treated in 2004, it is not a good candidate for an exposure monitoring study.

**Table 7.**  
**Captan Dust Formulation Used In California Ag Production\***

Commodity	Total Acres Treated by Ground, Air or Other				
	2000	2001	2002	2003	2004
Corn (forage – fodder)	9,729	8,174	4,363	4,361	7,670
Corn (human consumption)	966	1,710	712	786	1,376
Cotton	508	1,018	1,030	2,804	88
Strawberry	0	0	0	8	810
Grape (table & raisin)	195	34	195	50	155
Grape (wine)	123	0	80	0	0

**Table 8.**  
**Captan Dust Formulation Used In California Ag Production and Applied by Ground**

Commodity	Total Acres Treated by Ground				
	2000	2001	2002	2003	2004
Corn (forage – fodder)	9,729	8,094	4,363	3,946	7,382
Corn (human consumption)	966	445	712	377	1,376
Cotton	481	1,018	922	2,318	88
Strawberry	0	0	0	8	0
Grape (table & raisin)	130	34	195	50	155
Grape (wine)	123	0	80	0	0

Carbaryl: Grapes are the only commodities where carbaryl has been used every year since 2000. The highest use occurred in 1997 with 3,792 acres treated (Appendix 1). Total use for grapes ranged from 158 – 3,358 acres treated in 2004 and 2000, respectively. In addition, on pistachios, all 540 acres were treated by air in 2004 (Table 9 and 10). Since very few acres of any commodity are treated with carbaryl dust, it is not feasible to conduct an exposure monitoring study.

**Table 9.**  
**Carbaryl Dust Formulation Used In California Ag Production**

Commodity	Total Acres Treated by Ground, Air & Other.					
	2000	2001	2002	2003	2004	2005
Grape	2,014	1,729	472	112	41	35
Grape, Wine	1,344	791	472	895	117	20
Corn (forage – Fodder)	40	0	756	0	0	0
Corn, Human Consumption	0	10	9	0	10	0
Pistachio	0	0	0	0	540	0
Cotton	0	173	0	75	0	0

**Table 10.**  
**Carbaryl Dust Formulation Used In California Ag Production**

Commodity	Total Acres Treated by Ground				
	2000	2001	2002	2003	2004
Grape	2,014	1,670	472	112	41
Grape, Wine	1,344	791	472	895	117
Corn (forage – Fodder)	0	0	756	0	0
Corn, Human Consumption	0	10	9	0	10
Pistachio	0	0	0	0	0
Cotton	0	155	0	75	0

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**APPENDIXES**

**Appendix 1. Ag Production Acres Treated With Dust Formulations Other Than Sulfur In California (\*)**

Active Ingredient	Product Name	1997	1998	1999	2000	2001	2002	2003	2004
Cryolite	Prokil Cryolite 50 Dust	0	0	35	1,609	4,779	5,583	2,436	2,745
	Britz Cryolite 50 Dust	0	0	0	0	529	15	113	163
	Cryolite 30 Sulfur 30 Dust	0	0	0	140		136	232	63
	Cryolite 40 Dust	0	0	0	0	0	70	48	25
	Cryolite Dust No. 50	0	0	0	0	0	0	0	75
Copper Oxychloride Sulfate	Clean Crop C-O-C-S 15 Sulfur 25 Dust	91,488	146,313	90,452	92,022	72,251	71,132	104,231	50,495
	Oxycop Dust No. 3	3,284	4,009	3,619	2,640	2,046	303	406	0
	Clean Crop C-O-C-S Copodust	2,533	5,183	969	1,226	794	791	1,783	1,297
Copper Oxychloride	Zinc Coposil Sulfur 15-30 Dust	0	0	0	0	0	0	36	1,365
	Zinc Coposil Sulfur Dust	0	0	0	0	0	0	0	1,063
Copper	Britz Copper Sulfur 15-25 Dust	18,159	43,479	52,110	36,806	12,446	10,741	24,702	21,939
	Oxycop Dust No.3	15,059	13,027	13,742	9,820	2,119	767	186	630
	First Choice Copper Sulfur 15-25 Dust	0	0	785	879	1,326	1,866	2,856	1,777
	PHT 15-25 Copper Sulfur Dust	0	0	1,145	1,292	1,078	202	113	258
	C-O-C-S 3 Dust	0	0	0	0	0	0	2,123	308
	COCS 15 Sulfur 25 Dust	0	0	0	0	0	0	0	424
	IAP Copper Sulfur 15-25 Dust	0	0	0	0	0	0	0	244
Copper Sulfate (Basic)	CSC Copper Sulfur Dust	0	0	0	689	4,678	3,032	11,669	2,602
Myclobutanil	Premium Sulfur Dust	0	0	21,766	27,847	11,965	79,883	53,977	82,240
	Rh-144228 Fungicide	0	81,781	1,052	729	377	3,739	777	920
	CSC Ultimate Dusting Sulfur	0	0	5,311	8,186	538	1,467	907	28
Dicloran	Britz Botran 6 Dust	7,655	25,138	2,066	2,131	1,837	240	2,866	248
	Botran 6 Dust	8,389	0	11,813	9,849	3,038	340	3,308	262
	Botran 6% Dust	6,511	3,441	972	3,085	1,086	797	2,594	2,909
	Britz Botran Sulfur 6-25 Dust	3,666	0	578	471	234	36	834	867
	Clean Crop Botran 6 Dust	768	983	543	666	373	438	1,696	185
	Red-Top Botran 6 Dust	1,825	2,645	656	50	235	0	0	0
	Botran 6 Sulfur 25 Dust	40	4,115	249	580	127	162	40	0
	Red-Top Botran 6 Sulfur 25 Dust	412	2,476	0	180	0	415	549	118
	Botran Sulfur 6-25 Dust	254	159	528	183	24	0	214	44
	Botran 6 Dust	273	411	58	15	195	40	80	0
Captan	Captan 10 Dust	294	710	0	318	42	195	58	155
	Captan Sulfur 10-25 Dust	0	0	0	0	0	0	0	675
	Captan Sulfur 10-50 Dust	0	0	80	0	0	0	0	135
Malathion	Gowan Malathion 5 Dust	2,973	1,613	608	623	3,944	3,183	2,954	2,843
	Malathion 5 Dust Insecticide	1,949	1,074	2,028	1,869	360	44	311	73
Carbaryl	Red-Top Sevin 10 Dust	2,096	1,893	219	408	1,315	283	46	10
	Wilbur-Ellis Sevin 10 Dust	1,696	0	353	1,125	1,161	418	892	26
	Sevin 10 Dust	0	0	0	2	10	724	0	0
Dicofol	Gowan Dicofol 3 Dust	0	82	2,103	2,361	1,520	1,184	1,259	143
	Stoker Dicofol Dust No. 3	140	1,078	940	265	45	0	0	0

\* Ag Production, All Commodities, Air and Ground Application.

**Appendix 1. (continuation)**

Active Ingredient	Product Name	1997	1998	1999	2000	2001	2002	2003	2004
Bacillus Thuringiensis, Subsp. Kurstaki, Strain HD-1	Britz Bt 25 Sulfur Dust	2,616	1,059	3,010	5,493	1,905	892	1,434	999
	Britz Bt Dust	0	0	4,163	1,521	1,625	0	1,956	120
Bacillus Thuringiensis Serotype 3A, 3B	Bt Sulfur 15-50 Dust	18,021	19,506	14,456	23,384	16,318	6,373	7,529	6,315
	Wilbur-Ellis Bt 320 Dust	2,595	11,988	10,605	12,086	8,600	6,076	5,214	9,754
	Red-Top Bt 320 Dust	9,312	0	3,468	1,788	2,210	363	4,334	3,039
	Wilbur-Ellis Bt 320 Sulfur 25 Dust	0	0	0	0	0	0	1,547	0
Pyrethrins	Diatect Multipurpose Insecticide Ii	0	81	1,281	1,600	193	136	51	5,638
	Diatect Insecticide V	0	0	0	133	1,018	880	647	2,505
	Diatect Multipurpose Insecticide	396	0	1,512	923	299	15	184	8
	Diatect D-20 Insecticide	0	0	0	0	55	0	0	0

\* Ag Production, All Commodities, Air and Ground Application.

**Appendix 2. Copper Oxychloride Acres Treated with Dust Formulation\***

Commodity & Product	Registration No.	Acres Treated									
		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
<b>Wine</b>											
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	14,044	14,638	18,653	55,429	22,442	25,990	10,903	6,568	13,108	7,985
Clean Crop C-O-C-S Copodust	34704-320-AA	0	0	0	129	0	0	72	77	0	14
<b>Raisin &amp; Table Grape</b>											
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	44,586	39,710	72,835	90,662	67,870	65,954	61,348	64,563	91,123	42,484
Clean Crop C-O-C-S Copodust	34704-320-AA	0	0	0	119	18	104	0	0	0	0
<b>Raspberry</b>											
Clean Crop C-O-C-S Copodust	34704-320-AA	2,487	1,665	1,417	1,341	414	265	324	6	46	50
<b>Pear</b>											
Oxycop Dust No. 3	5967-50167-ZA	9,531	11,352	3,236	3,863	3,619	2,346	1,680	0	403	0
	66196-50167-AA	5,590	1,512	48	121	0	294	366	303	0	0
Clean Crop C-O-C-S Copodust	34704-320-AA	3,123	897	1,095	1,753	485	422	305	683	1,591	821
<b>Apple</b>											
Clean Crop C-O-C-S Copodust	34704-320-AA	90	4	0	0	0	0	0	0	130	0
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	0	0	0	105	0	0	0	0	0	0
<b>Walnut</b>											
Clean Crop C-O-C-S Copodust	34704-320-AA	403	278		1,492	40	50	90	25	0	0
Oxycop Dust No. 3	5967-50167-ZA	137	70	0	0	0	0	0	0	0	0
	66196-50167-AA	225	0	0	25	0	0	0	0	0	0
C-O-C-S Copodust	279-80-ZA	0	0	30	0	0	0	0	0	0	0
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	0	0	0	20	0	0	0	0	0	0
<b>Lettuce Leaf</b>											
Clean Crop C-O-C-S Copodust	34704-320-AA	5	0	0	0	0	0	0	0	0	5
<b>Orange</b>											
Clean Crop C-O-C-S Copodust	34704-320-AA	0	0	0	0	0	0	0	0	0	392
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	0	0	0	0	20	0	0	0	0	0
<b>Peach</b>											
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	0	0	0	92	80	0	0	0	0	0
Clean Crop C-O-C-S Copodust	34704-320-AA	0	0	0	0	0	0	0	0	16	16
C-O-C-S Copodust	279-80-ZA	0	0	0	0	0	0	0	0	0	0

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**Appendix 3. Table and Raisin Grape Acres Treated with Sulfur Dust Formulation\***

Product	Registration No.	Acres Treated					
		2000	2001	2002	2003	2004	2005
Special Electric Refined Super-Adhesive Dusting Sulfur	2935-503-AA	334,972	203,871	257,542	235,523	265,312	245,685
Red-Top Dusting Sulfur	2935-48-AA	370,026	232,508	300,469	160,522	214,273	217,599
Dusting Sulfur	34704-735-AA	16,363	19,597	10,036	14,046	18,534	13,799
	45002-11-AA	0	0	352	162	141	791
	55429-3-AA	220,967	186,755	253,004	240,513	245,244	211,770
	56576-9-AA	0	0	0	0	60	0
	5967-65-AA	969	456	813	16	0	0
	7001-181-AA	1,195	510	160	0	0	0
Britz Magic Sulfur Dust	10951-9-AA	186,881	137,288	167,350	217,563	167,647	207,659
Signal Dusting Powder	2935-504-AA	26,391	23,236	39,389	61,117	117,359	127,007
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	65,964	61,348	64,599	91,123	42,484	55,150
Wilbur-Ellis Dusting Sulfur	2935-48-ZA	14,798	37,775	19,156	109,398	65,234	73,123
Signal Dusting Sulfur	10182-143-AA	76,920	63,003	71,408	61,315	1,533	790
Yellow Jacket Special Dusting Sulfur	6325-17-AA	5,050	6,049	15,645	63,250	93,972	80,203
Britz Brand Dusting Sulfur	476-197-AA-10951	50,652	28,209	39,368	14,836	39,976	57,735
First Choice Dusting Sulfur	11656-3-ZA	31,525	31,010	43,864	22,366	7,185	8,134
Britz Copper Sulfur 15-25 Dust	10951-11-AA	29,742	10,701	9,662	23,060	21,464	21,205
Clean Crop Dusting Sulfur Fungicide/Miticide	34704-724-AA	14,138	28,165	21,645	2,574	8,962	6,678
Premium Sulfur Dust	62719-435-AA-2935				1,004	9,059	6,511
	707-261-AA-2935	5,770	2,990	7,396	12,209	673	6,045
Special Electric Refined Super-Adhesive Dusting Sulfur	476-197-AA	6,429	6,444	4,441	1,207	1,144	31,136
Cavalry Dusting Sulfur	34704-733-AA	21,425	13,082	8,382	2,374	195	165
Dusting Sulphur	279-1721-AA	5,034	6,611	2,573	3,403	3,754	2,332
	279-1721-ZB	4,451	3,286	581	566	656	900
Clean Crop Dusting Sulfur 98	5481-122-AA-34704	6,715	8,093	2,467	1,424	1,367	6,197
CSC Copper Sulfur Dust	55429-5-AA	689	1,879	2,415	10,226	2,573	7,763
Britz Sulfur Dust	10163-77-AA-10951	7,974	3,555	3,460	4,812	4,079	1,216
IAP Dusting Sulfur	2935-48-AA-71058	0	0	0	0	0	18,643
Western Farm Service Dusting Sulfur	11656-3-AA	920	4,183	7,395	5,010	567	243
CSC Dusting Sulfur	55429-1-ZB	10	1,202	3,009	4,717	7,157	1,572
Valor Brand Products Dusting Sulphur	11169-50011-AA	45	781	1,407	1,228	401	1,673
	11169-9-AA	1,942	3,043	2,667	924	917	1,978
Britz Dryout Dust	10951-18-AA	0	0	0	2,669	8,958	3,911
Dusting Sulfur 98	34704-735-AA-2935	84	1,342	269	739	146	0
	5481-122-AA	7,110	1,341	160	220	401	0
Wilbur-Ellis Bt 320 Sulfur 25 Dust	2935-399-ZA	628	10,706	1,594	1,255	480	730
CSC Thioben 90	55429-1-ZC	3,789	3,449	400	638	683	3,935
Bt Sulfur 15-50 Dust	34704-722-AA	2,202	1,871	1,453	1,507	2,235	112
First Choice Copper Sulfur 15-25 Dust	10951-11-AA-11656	867	1,042	1,721	2,313	1,378	413
Britz Dusting Sulfur	279-1721-ZB-10951	1,884	828	1,307	523	440	711
Wilbur-Ellis Ben-Sul 85	2935-506-AA	1,063	125	178	207	3,784	232
Britz Bt 25 Sulfur Dust	10951-10-AA	930	1,472	624	749	615	805
Britz Dusting Sulfur 98	2935-48-AA-10951	145	64	214	851	1,710	1,398
Poppy Brand E Dusting Sulfur	10182-142-AA-1202	782	367	691	1,668	0	74
Kolodust Fungicide Insecticide	34704-733-ZA	0	360	2,084	445	0	0
Zinc Coposil Sulfur Dust	74307-1-AA	0	0	0	0	1,063	1,462
Ben-Sul 60 Dust	2935-246-ZA	320	571	377	280	913	0

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**Appendix 3. (continuation)**

Product	Registration No.	Acres Treated					
		2000	2001	2002	2003	2004	2005
Micron Dusting Sulfur 44	10163-77-AA-72408	0	0	2,071	145	237	0
CSC Ultimate Dusting Sulfur	707-261-AA-55429	468	247	1,407	57	0	0
PHT 15-25 Copper Sulfur Dust	10951-11-AA-65343	151	1,078	202	113	258	327
Zinc Coposol Sulfur 15-30 Dust	74307-1-ZA	0	0	0	36	1,237	833
RH-144228 Fungicide	62719-435-AA	0	0	0	0	24	0
	707-261-AA	560	83	1,190	130	0	0
Gowan Dusting Sulfur	10163-77-AA	750	261	0	38	406	197
PHT Copper Sulfur Dust	55429-5-AA-7001	0	0	0	1,472	0	27
Poppy Brand Dusting Sulfur	2935-48-AA-1202	422	485	184	0	150	108
Red-Top Ben-Sul 60 Dust	2935-246-AA	0	200	10	0	0	894
Red-Top Botran 6 Sulfur 25 Dust	2935-403-AA	120	0	415	549	0	15
IAP Copper Sulfur 15-25 Dust	10951-11-AA-71058	0	0	0	0	244	575
Signal Brand Dusting Sulfur Made With Anchor Flowers	476-199-AA	349	381	25	0	0	0
Britz Botran Sulfur 6-25 Dust	10951-14-AA	76	194	36	328		60
Chemstar Dusting Sulfur 98	5481-122-AA-64788	630	14	14	0	0	0
Dusting Sulfur Fungicide	34704-724-ZA	0	0	0	0	0	540
Red-Top Thiodan 5 Sulfur 25 Dust	2935-305-AA	120	147	250	0	0	0
C-O-C-S 15 Sulfur 25 Dust	34704-393-ZA	0	0	0	0	419	56
Botran Sulfur 6-25 Dust	10951-4-AA	183	24	0	214	44	0
Valor Brand Products Dithane M-45-S Dust	11169-8-AA	418	0	0	0	0	0
Cryolite 30 Sulfur 30 Dust	2935-50141-AA	0	0	136	172	63	27
Botran 6 Sulfur 25 Dust	10951-14-AA-2935	0	127	162	40	0	5
Valor Brand Products Bt Sulfur 15-50	11169-6-AA	290	0	9	0	0	30
Kolodust	279-126-ZA	0	23	289	0	0	0
WFSI Sevin Sulfur 10-50 Dust	11656-50052-AA	197	0	0	0	0	0
BF Refined Super-Adhesive Dusting Sulfur	476-197-AA-10938	120	66	0	0	0	0
Ben-Sul 84 Dust	34704-733-AA-2935	0	0	165	0	0	0
Magic Sulfur	55146-19-AA	0	0	70	77	0	14
BT 320 Sulfur 50 Dust	2935-485-AA	0	156	0	0	0	0
C-O-C-S 15 Sulphur 25 Dust	279-2297-ZA	18	7	40	80	0	0
Sulfur Special	476-197-AA-11656	0	0	90	40	0	0
Cryolite-Sulfur 45-35 Dust	9319-50071-AA	0	0	0	0	75	0
Copper, Sulfur 15-50	148-862-AA	0	0	0	0	0	40
Wil-Dry	2935-535-ZA	0	0	0	0	0	40
Red-Top Sevin 10 Sulfur 50 Dust	2935-308-AA	40	0	0	0	0	0
Clean Crop Dibrom-Sevin Sulfur Dust	34704-100-AA	0	0	0	0	40	0
Clean Crop Microfine Sulfur	6325-13-AA-34704	35	0	0	0	0	0
Orthocide-Botran-Sulfur 15-6-35 Dust	239-50682-AA	19	0	0	0	0	0
Clean Crop Dibrom-Sulfur Dust No. 4-25	34704-92-AA	0	18	0	0	0	0
Prokil Dusting Sulfur	7001-181-AA-10163	15	0	0	0	0	0
<b>Total</b>		1,532,743	1,152,677	1,378,488	1,384,043	1,367,924	1,434,912

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**Appendix 4. Wine Grape Acres Treated with Sulfur Dust Formulation\***

Product	Registration No.	Acres Treated					
		2000	2001	2002	2003	2004	2005
Red-Top Dusting Sulfur	2935-48-AA	459,498	312,210	370,097	343,779	383,832	427,924
Special Electric Refined Super-Adhesive Dusting Sulfur	2935-503-AA	309,173	272,490	284,563	284,034	304,683	363,019
Dusting Sulfur	34704-735-AA	68,097	60,200	68,249	54,036	61,859	44,058
	45002-11-AA					110	7,882
	55429-3-AA	234,544	216,632	269,034	188,396	172,316	146,904
	5967-65-AA	179	0	0	0	0	100
	7001-181-AA	0	0	0	0	0	460
Britz Magic Sulfur Dust	10951-9-AA	202,965	170,440	151,692	224,049	160,026	128,565
Wilbur-Ellis Dusting Sulfur	2935-48-ZA	98,002	162,687	46,467	90,874	127,676	182,025
First Choice Dusting Sulfur	11656-3-ZA	90,478	98,896	167,015	94,845	28,491	37,681
Yellow Jacket Special Dusting Sulfur	6325-17-AA	4,326	8,513	3,341	36,395	121,806	134,778
Premium Sulfur Dust	62719-435-AA-2935	0	0	0	122	1,089	1,171
	707-261-AA-2935	22,136	9,008	72,542	40,669	71,483	55,160
Britz Brand Dusting Sulfur	476-197-AA-10951	32,358	22,900	29,703	7,688	27,342	64,201
Dusting Sulphur	279-1721-AA	1,755	819	4,814	10,809	6,155	11,592
	279-1721-ZB	16,098	17,453	17,151	8,304	4,636	2,380
Clean Crop C-O-C-S 15 Sulfur 25 Dust	34704-393-AA	25,990	10,939	6,568	13,108	7,985	12,351
Clean Crop Dusting Sulfur Fungicide/Miticide	34704-724-AA	28,995	13,924	12,075	7,499	5,398	6,474
Clean Crop Dusting Sulfur 98	5481-122-AA-34704	9,636	7,974	6,222	16,319	22,746	6,580
IAP Dusting Sulfur	2935-48-AA-71058	0	0	0	0	0	67,440
Signal Dusting Sulfur	10182-143-AA	18,996	16,604	15,786	9,514	1,253	92
Bt Sulfur 15-50 Dust	34704-722-AA	21,181	14,447	4,920	6,023	4,080	4,205
Signal Dusting Powder	2935-504-AA	4,118	4,714	7,033	6,524	9,368	9,042
CSC Thioben 90	55429-1-ZC	10,018	12,018	10,261	1,882	0	5,469
Dusting Sulfur 98	34704-735-AA-2935	142	185	9	0	11	106
	5481-122-AA	19,529	5,306	3,000	3,329	3,398	2,350
Special Electric Refined Super-Adhesive Dusting Sulfur	476-197-AA	1,284	3,007	2,713	4,634	4,781	14,909
Western Farm Service Dusting Sulfur	11656-3-AA	1,296	5,467	7,833	2,411	2,508	1,027
Britz Copper Sulfur 15-25 Dust	10951-11-AA	7,064	1,745	1,079	1,642	471	2,434
Cavalry Dusting Sulfur	34704-733-AA	7,243	2,171	1,739	151	532	0
Wilbur-Ellis Ben-Sul 85	2935-506-AA	6,086	1,234	967	933	1,010	1,558
CSC Ultimate Dusting Sulfur	707-261-AA-55429	7,718	291	60	850	28	61
Wilbur-Ellis Bt 320 Sulfur 25 Dust	2935-399-ZA	1,954	5,338	608	291	14	741
Valor Brand Products Dusting Sulphur	11169-50011-AA	190	2,039	2,949	1,163	952	175
	11169-9-AA	295	435	435	0	0	255
Britz Bt 25 Sulfur Dust	10951-10-AA	4,494	423	235	160	384	513
CSC Copper Sulfur Dust	55429-5-AA	0	2,799	617	1,433	29	908
RH-144228 Fungicide	62719-435-AA	0	0	0	0	20	0
	707-261-AA	169	294	2,549	595	876	808
Britz Botran Sulfur 6-25 Dust	10951-14-AA	395	40	0	506	867	2,189
Britz Dusting Sulfur 98	2935-48-AA-10951	149	160	60	640	20	2,297

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**Appendix 4. (continuation)**

Product	Registration No.	Acres Treated					
		2000	2001	2002	2003	2004	2005
CSC Dusting Sulfur	55429-1-ZB	00	238	545	1,724	341	457
Britz Sulfur Dust	10163-77-AA-10951	582	103	759	779	0	429
Ben-Sul 60 Dust	2935-246-ZA	111	826	1,074	131	246	100
Clean Crop Microfine Sulfur	6325-13-AA-34704	1,799	333	0	0	207	0
Gowan Dusting Sulfur	10163-77-AA	195	536	774	80	250	214
First Choice Copper Sulfur 15-25 Dust	10951-11-AA-11656	12	284	145	543	399	387
Britz Dusting Sulfur	279-1721-ZB-10951	327	896	0	0	0	0
Britz Dryout Dust	10951-18-AA	0	0	0	0	492	655
PHT 15-25 Copper Sulfur Dust	10951-11-AA-65343	1,141	0	0	0	0	0
Ben-Sul 84 Dust	34704-733-AA-2935	790	0	0	0	310	0
Kolodust Fungicide Insecticide	34704-733-ZA	0	600	0	0	0	0
Chemstar Dusting Sulfur 98	5481-122-AA-64788	0	589	0	0	0	0
IAP copper sulfur 15-25 dust	10951-11-AA-71058	0	0	0	0	0	581
Botran 6 Sulfur 25 Dust	10951-14-AA-2935	580	0	0	0	0	0
Helena Brand Sulfur Dust	5905-50007-AA	0	511	0	0	0	0
Zinc Coposil Sulfur 15-30 Dust	74307-1-ZA	0	0	0	0	128	360
Poppy Brand E Dusting Sulfur	10182-142-AA-1202	26	175	0	170	60	0
Bt 320 Sulfur 50 Dust	2935-485-AA	69	153	196	0	0	0
Red-Top Thiodan 5 Sulfur 25 Dust	2935-305-AA	0	75	0	0	149	130
COCS 15 Sulfur 25 Dust	34704-393-ZA	0	0	0	0	5	333
BTB Sulfur 150-75 Dust Insecticide Fungicide	11656-53-ZA	0	0	306	0	0	0
Wil-Dry	2935-535-ZA	0	0	0	0	0	298
Poppy Brand Dusting Sulfur	2935-48-AA-1202	85	184	0	0	4	0
Dusting Sulfur Fungicide	34704-724-ZA	0	0	0	0	0	265
Red-Top Ben-Sul 60 Dust	2935-246-AA	0	0	0	182	0	64
C-O-C-S 15 Sulphur 25 Dust	279-2297-ZA	0	0	0	0	0	197
Red-Top Botran 6 Sulfur 25 Dust	2935-403-AA	60	0	0	0	118	0
Zinc Coposil Sulfur Dust	74307-1-AA	0	0	0	0	0	166
Clean Crop Ben Sul Dust	34704-97-AA	0	0	128	0	0	0
BF Refined Super-Adhesive Dusting Sulfur	476-197-AA-10938	46	50	0	0	0	0
Sulfur Special	476-197-AA-11656	0	90	0	0	0	0
Clean Crop Dibrom-Sevin Sulfur Dust	34704-100-AA	0	0	0	0	0	66
Micron Dusting Sulfur 44	10163-77-AA-72408	0	0	52	0	0	0
Captan Sulfur 10-50 Dust	7001-50011-AA	0	0	0	0	0	47
Grant's Sulfur Dust	5887-161-AA-1663	0	6	22	0	2	15
Kolodust	279-126-ZA	0	42	0	0	0	0
Wfsi Sevin Sulfur 10-50 Dust	11656-50052-AA	34	0	0	0	0	0
Botran Sulfur 6-25 Dust	10951-4-AA	0	0	0	0	0	25
Copper, Sulfur 15-50	148-862-AA	0	0	0	0	10	0
Cryolite 30 Sulfur 30 Dust	2935-50141-AA	0	0	0	0	0	3
<b>Total</b>		<b>1,722,406</b>	<b>1,469,491</b>	<b>1,576,387</b>	<b>1,467,215</b>	<b>1,540,956</b>	<b>1,754,673</b>

\*Air and Ground Application.