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SUBJECT: ECONOMIC ANALYSIS OF PROPOSED REGULATIONS AND AMENDMENTS TO REDUCE VOLATILE ORGANIC COMPOUND EMISSIONS

The Department of Pesticide Regulation (DPR) requested an economic analysis of a proposed regulation. DPR proposes to adopt sections 6883 and 6884 of Title 3, California Code of Regulations. The proposed action would restrict the application of highly volatile organic compound nonfumigant products in the San Joaquin Valley between May 1 and October 31 unless the written recommendation of a licensed pest control advisor is obtained.

The Economic Studies Section (ESS) reviewed the Initial Statement of Reasons and corresponded with staff of the California Department of Food and Agriculture (CDFA), University of California Cooperative Extension (UCCE), and DPR to receive additional information on the proposed regulation. After reviewing material provided by DPR, UCCE, and CDFA, economic research staff has reached agreement with DPR on estimated costs of the proposed regulation.

<u>Summary of Findings</u>

The prohibition of the relevant high-VOC (volatile organic compounds) products on the listed crops could affect nearly 17,000 producers in the San Joaquin NAA. The total cost for producers from using low-VOC products instead of high-VOC products on the relevant crops is estimated to be about $1.58 million annually. The average change in expenditures differs by crop, ranging from an average annual savings of $39 for citrus producers to an average additional annual cost of $359 for almond producers.

ESS economic analysis shows that the adoption of this regulation is unlikely to have a significant cost impact on representative private persons or businesses. The additional costs faced by producers should not significantly affect their operations or have a significant adverse economic impact on the sector.

The economic analysis of the proposed regulation is detailed in the attachment, and estimated costs faced by representative agricultural producers are reported in table 4 of the attachment.

If you have any questions, you can contact me at (916) 323 1509, ffeizoll@arb.ca.gov or Tom Rosen-Molina at (916) 323 1182, trosenmo@arb.ca.gov.

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ECONOMIC ANALYSIS OF PROPOSED REGULATIONS AND AMENDMENTS TO REDUCE VOLATILE ORGANIC COMPOUND EMISSIONS

Pesticide products containing abamectin, chlorpyrifos, gibberellins, or oxyfluorfen are among the highest nonfumigant VOC contributors in the San Joaquin Valley. Products with lower VOC emissions are available for these active ingredients. DPR proposes to prohibit most uses of high-VOC products containing these active ingredients during May-October, the peak ozone season in California, to achieve the SIP reduction goal for the San Joaquin NAA. The proposed regulation would prohibit application on alfalfa, almond, citrus, cotton, grape, pistachio, and walnut crops. However, due to the low efficacy of low-VOC alternative products on some crops, certain exemptions are noted in the regulation. Low-VOC products would not face restrictions.

These nonfumigant VOC restrictions would only occur if pesticide VOC emissions exceeded a trigger level for the San Joaquin Valley during May-October. The trigger level for the San Joaquin Valley NAA is currently 6,365,000 lbs of emissions between May 1 and October 31 or about 17.2 tons per day. Due to the lag in pesticide use reporting, restrictions would be implemented for an upcoming year if pesticide VOC emissions exceeded the trigger level in a preceding year. DPR expects the limit to be exceeded in 2011, which would trigger a fumigant limit for 2013 in the San Joaquin Valley.

Summary of Methodology

Economic Studies Section of ARB estimated total costs to agricultural producers by county and by crop, using a cost study of low-VOC alternatives conducted by UC Cooperative Extension specialists under contract to CDFA's Office of Pesticide Consultation & Analysis (OPCA). ESS adjusted the average per-acre costs from the UC study to 2010 values according to a producer price index. ESS also estimated average costs per farm within each county by dividing overall county costs by farm number estimates from the National Agricultural Statistics Service.

Estimating the Costs of Switching from High-VOC to Low-VOC Products on a Per-acre Basis

Under contract to the CDFA, the University of California cooperative extension specialists evaluated the cost and efficacy of alternative products with lower VOC emissions for the major pesticides used on selected crops, including alfalfa, almonds, cotton, grapes, pistachios, oranges, and walnuts. Average cost estimates for 2005-2007 are available in the UC study, *Emulsifiable Concentrate Alternatives Analysis*. Table 1 shows the estimates.

Table 1: Estimated Cost Per Acre of Switching from High-VOC to Low-VOC Products, by Crop and Chemical

	Alfalfa	Almond	Citrus	Cotton	Grapes	Pistachio	Walnuts
	($/Acre)						
Abamectin*	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chlorpyrifos	0.02	10.77	0.00	0.00	6.58	0.00	4.10
Gibberellins	0.00	0.00	-1.40	0.00	1.20	0.00	0.00
Oxyfluorfen	0.00	1.19	1.19	1.19	1.19	1.19	1.19
Total	**0.02**	**11.96**	**-0.21**	**1.19**	**8.97**	**1.19**	**5.29**

* Recently registered low-VOC products not evaluated.
Note: Table grapes, raisin grapes, and wine grapes are grouped together. Per acre costs for oranges are assumed to be representative of all citrus.

Negative values in Table 1 indicate estimated savings, which result from the use of new low-VOC products with lower per-acre costs than existing high-VOC products. For example, gibberellins are growth regulators used primarily on citrus and grapes. UC specialists determined that the range of effective low-VOC alternatives had a lower cost than the high-VOC formulation for citrus applications. The low-emission formulations were also judged to be as efficacious as the high-emission formulations in regulating plant growth. The widespread usage of the high-VOC formulation despite a slightly higher cost is explained by the UC specialists as the result of familiarity with the product and perceived ease of use, since the high-VOC formulations are in a liquid form that allows growers to easily adjust the amount of product per acre. Unfamiliarity with the low-VOC formulation and the difficulty in adjusting pesticide amounts with the dry product have held back usage despite slightly lower costs.

As shown in table 1, almonds face the highest per-acre cost of switching to low-VOC products at nearly $12 per acre. The major portion of this cost increase is the result of low-VOC alternatives to chlorpyrifos. Alternatives to chlorpyrifos also contribute a high portion of the per-acre costs for grapes. Citrus costs are expected to decrease with the switch to low-VOC alternatives due to the lower price of alternatives to gibberellin for citrus. The other crops have per-acre costs of switching that range from about $0.02 for alfalfa to about $5.29 for walnuts.

Costs for low-VOC alternatives to abamectin are not included in the analysis because UC and CDFA specialists indicated that producers can simply switch from an emulsifiable concentrate formulation of the product to a suspension concentrate formulation. The cost and efficacy are estimated to be about the same for both formulations, indicating lack of any negligible effect on producers' costs.

Adjustments to Per-acre Costs for Differences in Efficacy of Low-VOC Oxyfluorfen Products

UCCE and CDFA note that the low-VOC formulation of oxyfluorfen will require the use of an additional herbicide. Low-VOC oxyfluorfen is not as effective as a post-emergence herbicide as the high-VOC formulation, so it is necessary to apply a low dose of a low-VOC post-emergence herbicide such as paraquat, flumioxazin, carfentrazone, glyphosate, or glufosinate to achieve the

same level of efficacy. UCCE evaluated costs of these additional post-emergence herbicides, which range from $1.19/acre for glyphosate to $19.30/acre for saflufenacil. For the cost calculations performed below, it is assumed that all tracreage that is treated with low-VOC oxyfluorfen is treated with the lowest cost post-emergence herbicide, glyphosate, at about $1.19 per acre.

Estimating Crop Acreage that will Switch from High-VOC to Low-VOC Products

Data on treated acreage by crop and chemical were provided by DPR. Acreage data include adjustments for the exceptions for chlorpyrifos on cotton for aphids, gibberellins applied at <5 grams/acre, and Section 24c applications. Combined, these exceptions account for about 35,300 acres that do not have to switch to low-VOC products. The estimates in table 2 are based on the assumption that the emissions potential (EP) thresholds for abamectin and gibberellins products are set at the highest level of 35% and 25%, respectively. DPR indicates that these estimates would change little if the lowest EP thresholds were assumed instead.

As shown in table 2, almond acreage would change the most from the switch to low-VOC products, with about 760,000 acres switching to alternative products. A major share of the affected almond acreage (about 425,000 acres) would switch to low-VOC abamectin alternatives which are estimated to have the similar prices as high-VOC abamectin products. About 230,000 acres of almonds would switch to low-VOC oxyfluorfen alternatives. After almonds, grapes would see the next largest shift in acreage, with about 270,000 acres going from high-VOC to low-VOC products. More than 130,000 acres of grapes would shift to low-VOC gibberellins products. Pistachios would see the smallest shift in acreage, with about 52,000 acres switching to low-VOC products.

Table 2: Estimated Treated Acreage that would Switch to Low-VOC Products, by Crop and Chemical

	Alfalfa	Almond	Citrus	Cotton	Grapes	Pistachio	Walnuts
	(1000 acres)						
Abamectin	2.1	424.6	50.2	166.3	115.1	0.1	41.8
Chlorpyrifos	70.5	67.6	20.0	77.0	0.0	0.0	18.1
Gibberellins	0.0	0.0	65.4	0.0	135.6	0.0	0.0
Oxyfluorfen	0.0	235.1	0.8	7.4	18.2	51.5	28.3
Total	**72.6**	**762.6**	**136.4**	**250.7**	**268.9**	**51.6**	**88.2**

Note: Table grapes, raisin grapes, and wine grapes are grouped together. Citrus includes lemons, oranges, tangerines, tangelos and grapefruit.

Estimating Changes in Expenditures from the Switch to Low-VOC Products

ESS calculated changes in total expenditures by chemical and crop by multiplying estimates of treated acreage by the estimated change in per acre costs from the UC study. These expenditures are adjusted from the 2005-2007 average prices by inflating values to 2010 dollars according to

the Producer Price Index for "Pesticide, fertilizer, and other agricultural chemical mfg" (see table 3). This index is maintained by the Bureau of Labor Statistics, Department of Labor. (http://data.bls.gov)

Table 3 shows that almonds account for the largest share of the increase in expenditures that would result from switching to low-VOC products. Expenditures for almond producers would increase by more than $1.24 million, or nearly 80 percent of the total estimated increase in expenditures. Chlorpyrifos alternatives are responsible for about $900 million of the increased expenditures on almonds, while oxyflurofen alternatives (and the associated post-emergence herbicides) will raise almond expenditures by about $345 million. Low-VOC alternatives for grapes add another $227,000 to total expenditures, with gibberellins accounting for more than $200,000 of this figure. Alfalfa and cotton both face relatively small increases in expenditures of about $1,700 and $10,800, respectively. Due to lower estimated costs for gibberellins alternatives for citrus, expenditures on citrus are expected to decrease by about $112,000 in the San Joaquin NAA.

Table 3: Total Change in Expenditures for All Producers in the San Joaquin NAA from Switching from High-VOC to Low-VOC Products, by Crop and Chemical

	Alfalfa	Almond	Citrus	Cotton	Grapes	Pistachio	Walnuts
	(1000 dollars)						
Abamectin	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorpyrifos	1.7	897.5	0.0	0.0	0.0	0.0	91.7
Gibberellins	0.0	0.0	-112.8	0.0	200.6	0.0	0.0
Oxyfluorfen	0.0	344.9	1.2	10.8	26.7	75.5	41.6
Total	**1.7**	**1,242.3**	**-111.7**	**10.8**	**227.3**	**75.5**	**133.3**

Note: Table grapes, raisin grapes, and wine grapes are grouped together. Citrus includes lemons, oranges, tangerines, tangelos and grapefruit.

Changes in average expenditures faced by producers in the San Joaquin Valley NAA are calculated by dividing total expenditures by the estimated number of farms for each crop (see table 4). When counting farms, the San Joaquin NAA is considered to include all of Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus and Tulare counties. Data on number of farms by crop and county is available from the 2007 USDA *Census of Agriculture*. (http://www.agcensus.usda.gov/Publications/2007/index.asp) More recent data on the number of producers by crop and county are not readily available.

Table 4 shows changes in average expenditures from switching to low-VOC products for the affected crops in the San Joaquin NAA. There are more than 3,400 almond producers in the region, and they are expected to face an average increase in expenditures of about $360 per year. Grape producers face the second largest total increase in expenditures, but the relatively high number of producers means that the average increase in expenditures is estimated to be around $50 per year. Pistachio producers face a lower total increase in expenditures, but since there are fewer than 900 producers in the region, the average annual increase in expenditures is about $87.

Average expenditures are expected to fall by about $40 for citrus producers due to the lower prices for low-VOC alternatives. Increases in average cotton and alfalfa expenditures are relatively low, at about $14 and $1, respectively.

Table 4: Total and Average Change in Expenditures for All Producers in the San Joaquin NAA from Switching from High-VOC to Low-VOC Products, by Crop

	Total change in expenditures (1000 dollars)	Estimated number of farms	Average change in expenditures (dollars)
Alfalfa	1.7	1,939	1
Almond	1,242.3	3,462	359
Citrus	-111.7	2,872	-39
Cotton	10.8	798	14
Grapes	227.3	4,512	50
Pistachio	75.5	871	87
Walnuts	133.3	2,470	54
Total	**1,579.2**	**16,924**	**93**

Note: Table grapes, raisin grapes, and wine grapes are grouped together. Citrus includes lemons, oranges, tangerines, tangelos and grapefruit.

Assumptions Made by ESS in Conducting the Economic Analysis

In estimating the costs faced by agricultural producers, it is assumed that use of the low-VOC alternatives will cause no change in producers' yields. Cost estimates in the UCD study are adjusted to account for differences in efficaciousness on a per acre basis. Therefore, in using those cost estimates, this analysis includes only the estimated costs of switching from a high-VOC to a low-VOC regimen of products, and does not account for any other costs that may arise. The cost to producers of obtaining the written recommendation of a licensed pest control advisor (PCA) is considered to be negligible. Most producers already employ a PCA and the largest operations often have a PCA on their payroll. There is little, if any, marginal cost for PCAs to provide written recommendation to use the relevant products.

Alternatives to the Proposed Regulation

DPR has identified several alternatives to the proposed regulatory action. DPR could deny or cancel registrations for high-VOC products and limit registrations to low-VOC products statewide, year-round. This would extend the costs outlined above to agricultural producers across the state and increase aggregate costs substantially. Alternatively, DPR could reclassify the active-ingredients in high-VOC products as restricted materials, which means that high-VOC products would undergo the permitting process and would be evaluated by individual agricultural commissioners for use within each county. This process would limit costs associated with switching from high-VOC to low-VOC products to counties that are close to meeting the VOC trigger level. However, administrative costs for agricultural commissioners would be increased

across the state and unnecessary regulatory burden would be placed on growers across the state, who would need to obtain a restricted materials permit to use the high-VOC products.

Discussion of Results

ESS's initial determination is that the lowest cost option is the one that prohibits the use of certain nonfumigant high-VOC products in the San Joaquin Valley NAA during May-October, with exceptions. The alternatives would not lessen any adverse statewide impacts, including impacts on small businesses.

The results of the analysis are summarized in tables 3 and 4. The prohibition of the relevant high-VOC products on the listed crops could affect nearly 17,000 producers in the San Joaquin NAA. This estimate should be considered an upper bound because it includes all producers of the listed crops in Kern County, whereas the San Joaquin NAA includes only a portion of Kern County. Sub-county data on the number of producers are not readily available.

It is difficult to estimate the share of farms in the San Joaquin NAA that can be classified as small businesses because sub-state estimates of revenue distribution by crop are not readily available. Statewide, the share of farms that have annual gross receipts of less than $1 million is about 93 percent and the share in the San Joaquin NAA should be similar. Applying this share to the San Joaquin NAA, approximately 15,740 of the affected farms would be classified as small businesses.

Conclusions

The total cost for producers from using low-VOC products instead of high-VOC products on the relevant crops is estimated to be about $1.58 million annually. The average change in expenditures differs by crop, ranging from an average annual savings of $39 for citrus producers to an average additional annual cost of $359 for almond producers. These representative costs are given in table 4. The additional costs faced by producers should not significantly affect their operations or have a significant adverse economic impact on the sector.

ESS has made an initial determination that the adoption of this regulation is unlikely to have a significant cost impact on representative private persons or businesses. Costs may fluctuate as pesticide product prices change, but in the long-run, it is likely that prices will fall after newer low-VOC products have been on the market for some time. If the emissions trigger level for the San Joaquin Valley NAA is not exceeded, producers would face no high-VOC pesticide restrictions and thus no additional costs.