1,3-Dichloropropene Occupational Safety Regulation Economic Impact Report

Prepared for the Department of Pesticide Regulation by the California Department of Food and Agriculture's Office of Pesticide Consultation and Analysis, and the University of California, Davis

Kevi Mace[1,2], Fatemeh Ganjisaffar[1,2], Sam Rabourn[2], Rachael Goodue[2]

[1]California Department of Food and Agriculture
[2]University of California, Davis

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Executive Summary

1,3-dichloropropene (1,3-D) is a pre-plant soil fumigant used to control soil-borne pests such as nematodes, insects, and disease-causing organisms in various California crops. Human health risks associated with 1,3-D emissions resulted in restrictions on its use within the state beginning in the mid-1990s. Currently, it is a restricted use material requiring a permit for application from the County Agricultural Commissioners (CACs).

To minimize human exposure to 1,3-D emissions from agricultural applications, the Department of Pesticide Regulation (DPR) implemented regulations to establish setbacks around occupied structures including minimum setback distances and durations, and maximum application rates and block sizes. These became effective on January 1, 2024.

On December 13, 2023, the Office of Environmental Health Hazard Assessment (OEHHA) provided DPR with health-based recommendations to address potential cancer risks to occupational bystanders from the use of 1,3-D. Based on a joint risk determination by DPR and OEHHA, DPR proposed new regulations that will change buffer zone distances and duration periods based on field fumigation method (FFM) groups and crops.

We examine the cost of complying with the new proposed regulation. The estimated total initial compliance costs, including the one-time learning of the newly proposed buffer zone distances and duration periods and the annual cost of acquiring written agreements from neighboring properties, range from $125,971 in 2019 to $84,136 in 2023. The average recurring annual cost was estimated at $94,893. There is a 26% reduction in total costs from 2022 ($113,608) to 2023, which is primarily driven by the decrease in FFM groups 1 and 2 applications. For these estimates, we assume that neighboring properties will allow the proposed buffers on their land.

Table ES-1: Estimated Cost of Compliance with New Proposed Buffer Zone Distances and Durations for Statewide 1,3-D Applications

Year	One-time Learning Cost	Annual Cost	Total Initial Cost
2019	$22,105	$103,866	$125,971
2020	$22,105	$100,427	$122,532
2021	$20,522	$102,665	$123,187
2022	$17,766	$95,842	$113,608
2023	$12,472	$71,664	$84,136

This report is part of the interagency consultation between DPR and the Office of Pesticide Consultation and Analysis (OPCA) in the California Department of Food and Agriculture (CDFA). CDFA was presented with the new proposed mitigation options on July 17, 2024, and completed this analysis at the request of DPR.

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Introduction

1,3-dichloropropene (1,3-D) is a pre-plant soil fumigant used to control soil-borne pests such as nematodes, insects, disease-causing organisms, and weeds in a variety of California crops. Human health risks associated with 1,3-D emissions resulted in restrictions on its use in California beginning in the mid-1990s. It is currently a restricted use material that requires a permit for application from the County Agricultural Commissioners (CACs). The Department of Pesticide Regulation (DPR) implemented regulations to minimize human exposure to 1,3-D emissions from agricultural applications, which went into effect on January 1, 2024. These regulations established setbacks around occupied structures including minimum setback distances and durations, and maximum application rates and block sizes. These regulations remain in effect.

Based on the Office of Environmental Health Hazard Assessment (OEHHA)'s health-based recommendations for additional control measures beyond those established by DPR's residential bystander regulations, and in a joint mutual process, DPR has proposed new regulations that will change buffer zone distances and duration periods for different fumigation methods (FFM groups) and crops to mitigate potential cancer risks to occupational bystanders (Table 1). Our analysis evaluates the potential cost of complying with the proposed regulation.

Methods and Data

Using 1,3-D application data obtained from Agrian Inc. (now TELUS Agriculture) via DPR, we calculated the total acreage treated with products containing the active ingredient 1,3-D, either alone or in combination with chloropicrin, and number of applications, for each year from 2019 to 2023.

During the proposed 48-hour buffer duration for the field fumigation method (FFM) groups 1-3, and for tree/grape crops in FFM groups 4-8 (Table 1), all non-handlers, including field workers, residents, pedestrians, and other bystanders, must be excluded from the buffer zone except for transit. In addition, the buffer zone must not include any property operated by persons other than the operator of the application block, unless the operator of the other property provides written agreement to the certified applicator that everyone in the property will stay out of the buffer zone while it is in effect. The certified applicator shall provide a copy of this agreement to the commissioner with each notice of intent.

The U.S. EPA estimates 30 minutes to learn/refresh understanding of soil fumigation labels (EPA, 2022). We used this as a proxy to estimate the potential cost for growers associated with planning and implementing new buffers on neighboring fields. However, since growers must also obtain a written agreement from neighboring property owners annually, we estimate an additional hour for this process. Therefore, 1.5 hours are required for the first year, followed by 1 hour annually thereafter. Combined with the Bureau of Labor Statistics loaded mean hourly wage rate of $54.58/hour for farmers and ranchers in California (BLS, 2023), we estimate the one-time learning cost to be $27.29 per grower/business, and the annual cost of acquiring agreement to be $54.58 per 1,3-D application. Table 1 shows our analysis plan to estimate this cost for each FFM group.

Table 1: Buffer Zone Distances and Duration Periods Proposed for Each FFM Group to Mitigate Risks to Occupational Bystanders and Our Analysis Plan

FFM Group	FFM Codes	Inland	Coastal	Analysis Plan
1: Standard nontarped and non-TIF tarp shallow (12 inch) methods	1201, 1202, 1203, 1204, 1205	100 ft for 48 hrs	100 ft for 48 hrs	All applications require new buffer procedures.
2: Standard nontarped and non-TIF tarp deep (18 inch) methods	1206, 1207, 1208, 1210, 1211	100 ft for 48 hrs	100 ft for 48 hrs	All applications require new buffer procedures.
3: Chemigation (drip)/non-TIF tarp method	1209	100 ft for 48 hrs	100 ft for 48 hrs	All applications require new buffer procedures.
4: 24-inch injection methods	1224, 1225, 1226	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: All applications require new buffer procedures. Other crops: No change
5: TIF methods – broadcast and drip	1242, 1247, 1249	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: All applications require new buffer procedures. Other crops: No change
6: TIF methods – bed and strip	1243, 1245, 1259	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: All applications require new buffer procedures. Other crops: No change
7: 40% TIF with 18-inch injection depth method	1250	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: All applications require new buffer procedures. Other crops: No change
8: 40% TIF with 24-inch injection depth method	1264	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: 100 ft for 48 hrs; Other: None needed	Tree/Grape: All applications require new buffer procedures. Other crops: No change

FFM 1290 is available in the dataset as unknow/other method and was excluded from our analysis.

Results

On average, 162 applications were made per year to treat an annual average of 5,553 acres using the standard nontarped and non-TIF tarp shallow (12 inch) methods (FFM group 1). The standard nontarped and non-TIF tarp deep (18 inch) methods (FFM group 2) saw the greatest acreage treated, with an annual average of 33,588 acres and 1,542 applications. The annual acreage treated with 1,3-D products using chemigation (FFM group 3) and TIF-broadcast and drip methods (FFM group 5) was 505 and 29 acres, respectively. The 24-inch injection (FFM group 4), and the 40% TIF with 18-inch (FFM group 7) and 24-inch (FFM group 8) injection depth methods were not created until 2024, so data were not available for this analysis. TIF-bed and strip methods (FFM group 6) had zero acreage of tree/grape crops using 1,3-D products, not requiring any learning and costs associated with that (Table 2).

Table 2: Estimated Treated Acreage and Number of 1,3-D Applications for Each FFM Group

FFM Group	FFM Codes	Treated Acres (Number of Applications)				
		2019	**2020**	**2021**	**2022**	**2023**
1: Standard nontarped and non-TIF tarp shallow (12 inch) methods	1201, 1202, 1203, 1204, 1205	7,986 (261)	5,779 (168)	5,125 (160)	5,100 (129)	3,776 (94)
2: Standard nontarped and non-TIF tarp deep (18 inch) methods	1206, 1207, 1208, 1210, 1211	36,662 (1,603)	39,051 (1,623)	36,077 (1,695)	32,256 (1,600)	23,894 (1,189)
3: Chemigation (drip)/non-TIF tarp method	1209	572 (37)	929 (43)	372 (23)	402 (26)	249 (24)
*4: 24-inch injection methods	1224, 1225, 1226	-	-	-	-	-
5: TIF methods – broadcast and drip	1242, 1247, 1249	9 (2)	70 (6)	45 (3)	2 (1)	18 (6)
6: TIF methods – bed and strip	1243, 1245, 1259	0	0	0	0	0
*7: 40% TIF with 18-inch injection depth method	1250	-	-	-	-	-
*8: 40% TIF with 24-inch injection depth method	1264	-	-	-	-	-
TOTAL		**45,229 (1,903)**	**45,829 (1,840)**	**41,619 (1,881)**	**37,760 (1,756)**	**27,937 (1,313)**

*FFM groups 4, 7 and 8 were not created until 2024, so data are not currently available.

For FFM group 1 methods, the estimated one-time learning cost ranged from $1,556 in 2019 to $655 in 2023, with an annual average of $977. The one-time learning cost for growers applying FFM group 2 methods ranged from $20,740 in 2020 to $11,653 in 2023, with an annual average of $17,744. Due to small number of growers using FFM groups 3 and 5, the average one-time learning cost for growers using these methods was $191 and $82, respectively (Table 3).

Table 3: Number of Growers Applying 1,3-D and Estimated One-time Learning Cost for Each FFM Group

FFM Group	FFM Codes	$ One-time Learning Cost (Number of Growers)				
		2019	**2020**	**2021**	**2022**	**2023**
1: Standard nontarped and non-TIF tarp shallow (12 inch) methods	1201, 1202, 1203, 1204, 1205	$1,556 (57)	$928 (34)	$846 (31)	$901 (33)	$655 (24)
2: Standard nontarped and non-TIF tarp deep (18 inch) methods	1206, 1207, 1208, 1210, 1211	$20,195 (740)	$20,740 (760)	$19,458 (713)	$16,674 (611)	$11,653 (427)
3: Chemigation (drip)/non-TIF tarp method	1209	$300 (11)	$300 (11)	$136 (5)	$164 (6)	$55 (2)
*4: 24-inch injection methods	1224, 1225, 1226	-	-	-	-	-
5: TIF methods – broadcast and drip	1242, 1247, 1249	$55 (2)	$136 (5)	$82 (3)	$27 (1)	$109 (4)
6: TIF methods – bed and strip	1243, 1245, 1259	0	0	0	0	0
*7: 40% TIF with 18-inch injection depth method	1250	-	-	-	-	-
*8: 40% TIF with 24-inch injection depth method	1264	-	-	-	-	-

*FFM groups 4, 7 and 8 were not created until 2024, so data are not currently available.

The estimated average annual cost of obtaining a written agreement from neighbors for FFM group 1 methods ranged from $14,245 in 2019 to $5,131 in 2023, with an annual average of $8,864. The annual cost for growers using FFM group 2 methods was highest in 2021 ($92,513) and lowest in 2023 ($64,896), with an annual average of $84,162. The average annual cost was estimated $1,670 for FFM group 3 and $196 for FFM group 5 (Table 4).

Table 4: Estimated Annual Cost of Acquiring Written Agreement from Neighboring Properties for 1,3-D Applications for Each FFM Group

FFM Group	FFM Codes	Cost ($)				
		2019	2020	2021	2022	2023
1: Standard nontarped and non-TIF tarp shallow (12 inch) methods	1201, 1202, 1203, 1204, 1205	$14,245	$9,169	$8,733	$7,041	$5,131
2: Standard nontarped and non-TIF tarp deep (18 inch) methods	1206, 1207, 1208, 1210, 1211	$87,492	$88,583	$92,513	$87,328	$64,896
3: Chemigation (drip)/non-TIF tarp method	1209	$2,019	$2,347	$1,255	$1,419	$1,310
*4: 24-inch injection methods	1224, 1225, 1226	-	-	-	-	-
5: TIF methods – broadcast and drip	1242, 1247, 1249	$109	$327	$164	$55	$327
6: TIF methods – bed and strip	1243, 1245, 1259	0	0	0	0	0
*7: 40% TIF with 18-inch injection depth method	1250	-	-	-	-	-
*8: 40% TIF with 24-inch injection depth method	1264	-	-	-	-	-

*FFM groups 4, 7 and 8 were not created until 2024, so data are not currently available.

Estimated compliance cost declined from $125,971 in 2019 to $84,136 in 2023, with the sharpest decrease (26%) occurring between 2022 and 2023 (Table 5). This is primarily driven by the decrease in the acreage using FFM groups 1 and 2.

Table 5: Estimated Cost of Compliance with New Proposed Buffer Zone Distances and Durations for Statewide 1,3-D Applications

Year	One-time Learning Cost	Annual Cost	Total Initial Cost
2019	$22,105	$103,866	$125,971
2020	$22,105	$100,427	$122,532
2021	$20,522	$102,665	$123,187
2022	$17,766	$95,842	$113,608
2023	$12,472	$71,664	$84,136

This cost estimate assumes that all neighboring properties will agree to buffer implementation and growers do not face additional expenses. This only applies to neighboring properties without a structure within 500ft of the application; regulations related to setback distances from structures are already in effect. Currently, chloropicrin applications require a similar buffer, but no written agreement submitted with the notice of intent. There are few reported issues with neighboring agricultural landowners. While unlikely in most cases, if a neighbor refuses, the grower will need to adopt alternative compliance measures. In such a scenario, TIF application would be the lowest-cost option. We calculated the total acreage of tree/ grapes and other crops that did not use the TIF tarp application methods (FFMs 1242, 1243, 1245, 1247, 1249, and 1259) between 2019 and 2023 and estimated the cost increase using 2024

costs. For trees and grapes, the cost of switching was estimated at $1,644 per acre. This cost considers the price difference between TIF tarped ($687) and non-tarped ($126) application methods ($561), the cost of TIF film ($844), and glue ($239). For row crops, the estimated cost of switching to TIF tarp application included adding or removing the tarp ($207), TIF film ($844), and drip tape ($238 if needed). This resulted in an estimated cost of $1,289 and $1,051 per acre with and without the drip tape, respectively. We found an average of 13,997 acres (ranging from 7,973 to 16,880 acres) for trees and grapes and 20,276 acres (ranging from 16,628 to 22,431 acres) for row crops statewide that might need to switch to TIF tarp. The estimated average annual cost increases are $23,010,410 for trees/grapes, $26,135,764 for row crops including the cost of drip tape and $21,310,076 excluding the drip tape cost (Table 6) (CDFA memo, 2024). This would only be necessary if all neighbors refused to provide permission.

Table 6: Acreage of Crops without TIF Tarp Applications between 2019 and 2023 and Estimated Cost of Switching to TIF Tarp Applications

Year	Crop	Crop Acreage	Cost Increase
2019	Tree/Grape	16,446	$27,037,224
	Row crops	21,966	$23,086,266 - $28,314,174
2020	Tree/Grape	16,880	$27,750,720
	Row crops	22,431	$23,574,981 - $28,913,559
2021	Tree/Grape	15,513	$25,503,372
	Row crops	20,276	$21,310,076 - $26,135,764
2022	Tree/Grape	13,171	$21,653,124
	Row crops	20,079	$21,103,029 - $25,881,831
2023	Tree/Grape	7,973	$13,107,612
	Row crops	16,628	$17,476,028 - $21,433,492

Literature Cited

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