



**Department of Pesticide Regulation
Environmental Monitoring Branch
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Addendum: Modeling for mitigation measures to reduce acute exposure from 1,3-Dichloropropene, Applications with a minimum soil moisture of 25% of field capacity

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1 Introduction

The report is an addendum to the initial modeling report for the mitigation measures to reduce acute exposure from 1,3-Dichloropropene (1,3-D) (Luo, 2022). To mitigate acute exposure from 1,3-D applications, Department of Pesticide Regulation (DPR) proposed setbacks from occupied structures and associated limits on application rates and block sizes (DPR, 2023). The previous calculations assumed the implementation of the 3 CCR section 6448.2(b) which requires, except for drip chemigation, the application block to have a minimum soil moisture of 50% of field capacity (FC) at a depth of three to nine inches below the surface when the fumigation occurs.

This study tests an alternative minimum soil moisture of 25% FC and estimates the new setback distances and application block size limits to mitigate acute exposure from 1,3-D.

2 Methods and materials

2.1 Field fumigation methods and flux time series

In total 24 field fumigation methods (FFMs) are considered in this study (Table 1). The FFMs are categorized into 8 groups according to injection depth, tarpaulin type, and emission ratio (Table 1). For each group of FFMs, a representative FFM is selected by considering the associated uses and 72-hour peak flux. For the representative FFMs, their flux time series with hourly flux rates ($\mu\text{g}/\text{m}^2/\text{s}$) were generated by HYDRUS model (Brown, 2022, 2023).

Table 1. Groups of field fumigation methods (FFMs) and the representative method

Group of FFMs	FFMs in the group
1-Standard nontarped and non-TIF tarp shallow (12 inch) methods	1201 , 1202, 1203, 1204, 1205
2-Standard nontarped and non-TIF tarp deep (18 inch) methods	1206 , 1207, 1208, 1210, 1211
3-Chemigation (drip)/non-TIF tarp method	1209
4-24-inch injection methods	1224 , 1225, 1226, 1227
5-TIF methods – broadcast and strip	1242 , 1247, 1249
6-TIF methods – bed and drip	1243 , 1245, 1248, 1259
7-40% TIF with 18-inch injection depth method	1250
8-40% TIF with 24-inch injection depth method	1264

Notes: TIF = Totally Impermeable Film. Highlighted is the representative FFM for the group.

For each FFM, the flux time series are generated from 21 distinct sets of soil conditions sampled in the previous fumigant field studies. The modeled soil conditions represent a wide range of soil moisture from 25% to 116% FC (Brown, 2022) (Figure 1). There are 7 soils (#4, 8, 12, 13, 15, 19, and 21) with measured moisture close to 50% FC (49–54%). The previous modeling results showed that the median of predicted setback distances over the 7 soils were similar to the median over all 21 soils (Luo and Brown, 2022). Therefore, the 21 individual soils and the associated flux time series were used in the previous study, and the median values of their modeling results were reported for the soil moisture of 50% FC.

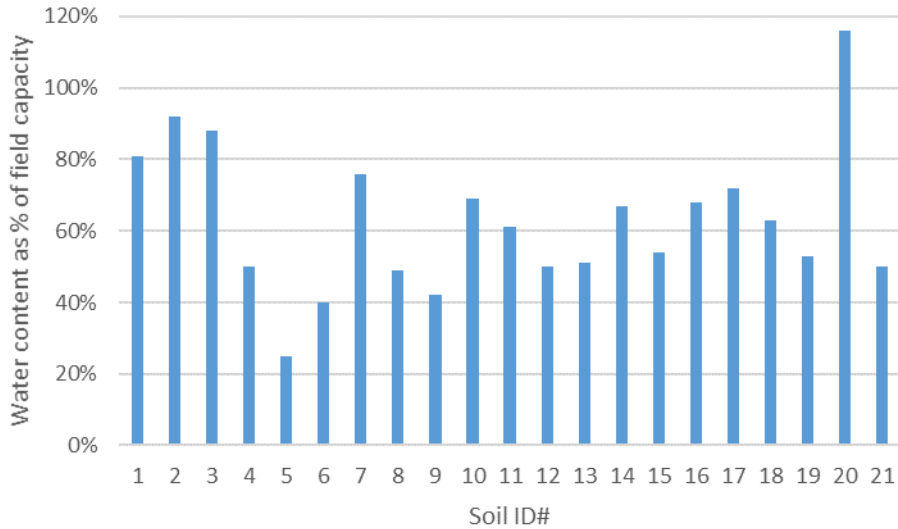


Figure 1. Observed soil moisture (as percentage of field capacity) for each of 21 soils in the DPR soil variability dataset (Brown, 2022)

In this study, the flux time series for soil #5 are used to model the minimum required soil moisture of 25% FC. Soil #5 has the lowest soil moisture of 25% in the 21 distinct sets of soil conditions. There is no other soil in the data set with similar soil moisture (Figure 1).

Soil #5 is associated with the highest 1,3-D emissions over the 21 soils in terms of the max 24-h flux, max 72-h flux, and emission ratio (Brown, 2022). Compared to the previously reported median values, therefore, the modeling results with soil #5 in this study would have higher setback distances and lower application block sizes.

2.2 Modeling approach and input data

The air concentrations of 1,3-D are predicted by AERFUM, an integrated air dispersion modeling system for soil fumigants developed by DPR (Luo, 2019). The modeling approach and simulation design for determining setbacks and application block sizes have been documented in the previous studies (Luo, 2022, 2023). This study only uses the flux time series generated for soil #5 in the modeling.

To be consistent with the definition of seasons in the modeling of application factors of 1,3-D (Luo and Brown, 2022), the modeling results are summarized for the two seasons of March to October and November to February. Specifically, the model predictions from March to October are used to calculate setbacks for the season of March to October. For the season of November to February, only the results in December and January are used in the setback calculation, representing a conservative estimation over the season (November to February).

3 Modeling results

3.1 Setback settings under the worst-case condition

Setback distances and durations are first modeled for the worst-case applications (the maximum application rate of 332 lb/ac and the maximum application block size of 80 ac) and the flux time series for soil #5 (Table 2). The predicted setback distances with a minimum soil moisture of 25% FC range from <100 ft (FFM1242, inland counties, March to October) to 10,362 ft (FFM1201, coastal counties, November to February). Compared to the previous results with a minimum soil moisture of 50% FC (Luo, 2022, 2023), the setback distances are significantly increased. The ratios range from 1 to 12.2 with a median value of 2.7 over the modeled methods, regions, and seasons.

Table 2. Setback settings required for 1,3-D application under the worst-case applications (application rate of 332lb/ac and application block size of 80ac)

Inland counties:

FFM	Applications during March to October		Applications during November to February	
	Distance (ft)	Duration (day)	Distance (ft)	Duration (day)
1201	5233	1	8096	1
1206	3356	2	5211	3
1209	2842	1	4989	1
1224	2209	4	3664	4
1242	67	10	1080	11
1243	1428	3	2667	3
1250	2021	2	3405	3
1264	1222	4	2372	5

Coastal counties:

FFM	Applications during March to October		Applications during November to February	
	Distance (ft)	Duration (day)	Distance (ft)	Duration (day)
1201	8049	1	10363	1
1206	5688	2	7132	2
1209	4786	1	6666	1
1224	3907	4	5142	4
1242	216	11	1705	11
1243	2692	3	3936	3
1250	3611	2	4672	2
1264	2306	4	3250	4

With a minimum soil moisture of 25% FC, the required setback durations for FFM1242 (representing TIF broadcast and strip methods, Table 1) are up to 11 days due to the peak emissions during tarp cutting. For this method, the hourly peak flux for soil #5 is predicted as 26.6 $\mu\text{g}/\text{m}^2/\text{s}$, about 3 times of the median value (8.8 $\mu\text{g}/\text{m}^2/\text{s}$) over the 21 soils (Brown, 2022). For other methods, the predicted setback durations are less than 7 days, so the label requirement for a setback duration of 7 days is adequate.

3.2 Restrictions on application rate and block size

At a given set of setback distance (one of the 5 predefined distances of 100, 200, 300, 400 or 500 ft) and application rate (80 to 332 lb/ac with an interval of 10), the maximum application block sizes are tabulated for each group of FFMs (Table 3). The results are rounded down to the nearest 5 (or down to the nearest integer if the prediction is less than 5). For example, a predicted value of 7.5 ac is reported as 5 ac in the table. Two special conditions are considered:

- 1) If the estimated application block size is less than 1 ac, the corresponding application (by FFM, application rate, month of application, and setback distance) is “Not Allowed” (NA).
- 2) If the estimated application block size is larger than 80 ac, “no restriction” (NR) is required for the corresponding application in addition to the minimum requirements (i.e., setback distance = 100 ft).

The block sizes in this study are generally smaller than those predicted with a minimum soil moisture of 50% FC (Luo, 2022, 2023). The ratios range from 0.05 to 1 with a median value of 0.31, varying with application methods, application rates, setback distances, regions, and seasons.

Table 3. Maximum application block sizes (ac)

(a) Standard nontarped and non-TIF tarp shallow (12-inch) methods

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	5	5	15	20	30	2	4	5	5	5
90 lbs/ac	4	5	10	15	20	2	3	4	5	5
100 lbs/ac	3	5	10	10	15	1	3	4	4	5
110 lbs/ac	3	5	5	10	15	1	2	3	4	5
120 lbs/ac	3	4	5	10	10	NA	2	3	4	5
130 lbs/ac	2	4	5	5	10	NA	2	3	4	4
140 lbs/ac	2	4	5	5	10	NA	1	3	3	4
150 lbs/ac	2	3	4	5	5	NA	1	2	3	4
160 lbs/ac	1	3	4	5	5	NA	1	2	3	4
170 lbs/ac	1	3	4	5	5	NA	NA	2	3	3
180 lbs/ac	NA	3	4	5	5	NA	NA	2	3	3
190 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3
200 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3
210 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3
220 lbs/ac	NA	2	3	4	4	NA	NA	1	2	3
230 lbs/ac	NA	2	3	4	4	NA	NA	NA	2	3
240 lbs/ac	NA	1	3	3	4	NA	NA	NA	2	2
250 lbs/ac	NA	1	3	3	4	NA	NA	NA	1	2
260 lbs/ac	NA	1	2	3	4	NA	NA	NA	1	2
270 lbs/ac	NA	1	2	3	4	NA	NA	NA	1	2
280 lbs/ac	NA	NA	2	3	4	NA	NA	NA	1	2
290 lbs/ac	NA	NA	2	3	4	NA	NA	NA	1	2
300 lbs/ac	NA	NA	2	3	3	NA	NA	NA	1	2
310 lbs/ac	NA	NA	2	3	3	NA	NA	NA	NA	2
320 lbs/ac	NA	NA	2	3	3	NA	NA	NA	NA	1
332 lbs/ac	NA	NA	1	2	3	NA	NA	NA	NA	1

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	3	4	5	5	10	2	3	4	4	5
90 lbs/ac	2	4	5	5	5	1	2	3	4	5
100 lbs/ac	2	3	4	5	5	1	2	3	4	4
110 lbs/ac	1	3	4	4	5	NA	1	3	3	4
120 lbs/ac	1	2	3	4	5	NA	1	2	3	4
130 lbs/ac	NA	2	3	4	4	NA	1	2	3	3
140 lbs/ac	NA	2	3	4	4	NA	NA	2	2	3
150 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
160 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
170 lbs/ac	NA	1	2	3	3	NA	NA	1	2	3
180 lbs/ac	NA	NA	2	3	3	NA	NA	NA	1	2
190 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
200 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
210 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
220 lbs/ac	NA	NA	1	2	3	NA	NA	NA	NA	2
230 lbs/ac	NA	NA	NA	2	2	NA	NA	NA	NA	1
240 lbs/ac	NA	NA	NA	2	2	NA	NA	NA	NA	1
250 lbs/ac	NA	NA	NA	1	2	NA	NA	NA	NA	1
260 lbs/ac	NA	NA	NA	1	2	NA	NA	NA	NA	1
270 lbs/ac	NA	NA	NA	1	2	NA	NA	NA	NA	1
280 lbs/ac	NA	NA	NA	1	2	NA	NA	NA	NA	NA
290 lbs/ac	NA	NA	NA	1	2	NA	NA	NA	NA	NA
300 lbs/ac	NA	NA	NA	NA	1	NA	NA	NA	NA	NA
310 lbs/ac	NA	NA	NA	NA	1	NA	NA	NA	NA	NA
320 lbs/ac	NA	NA	NA	NA	1	NA	NA	NA	NA	NA
332 lbs/ac	NA	NA	NA	NA	1	NA	NA	NA	NA	NA

(b) Standard nontarped and non-TIF tarp deep (18 inch) methods

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	15	30	40	55	75	4	5	10	15	20
90 lbs/ac	10	20	30	40	55	4	5	10	10	15
100 lbs/ac	5	15	25	35	40	3	5	5	10	10
110 lbs/ac	5	10	20	25	35	3	4	5	5	10
120 lbs/ac	5	10	15	20	30	2	4	5	5	10
130 lbs/ac	4	5	10	20	25	2	4	4	5	5
140 lbs/ac	4	5	10	15	20	2	3	4	5	5
150 lbs/ac	4	5	10	15	15	1	3	4	5	5
160 lbs/ac	3	5	5	10	15	1	3	4	4	5
170 lbs/ac	3	5	5	10	15	1	3	4	4	5
180 lbs/ac	3	4	5	10	10	NA	2	3	4	5
190 lbs/ac	3	4	5	5	10	NA	2	3	4	5
200 lbs/ac	2	4	5	5	10	NA	2	3	4	4
210 lbs/ac	2	4	5	5	10	NA	2	3	4	4
220 lbs/ac	2	4	5	5	10	NA	1	3	3	4
230 lbs/ac	2	3	4	5	5	NA	1	3	3	4
240 lbs/ac	2	3	4	5	5	NA	1	2	3	4
250 lbs/ac	1	3	4	5	5	NA	1	2	3	4
260 lbs/ac	1	3	4	5	5	NA	1	2	3	4
270 lbs/ac	1	3	4	5	5	NA	NA	2	3	4
280 lbs/ac	1	3	4	4	5	NA	NA	2	3	3
290 lbs/ac	NA	2	4	4	5	NA	NA	2	3	3
300 lbs/ac	NA	2	3	4	5	NA	NA	2	3	3
310 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3
320 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3
332 lbs/ac	NA	2	3	4	5	NA	NA	1	2	3

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	5	10	15	20	30	4	5	5	10	15
90 lbs/ac	5	5	10	15	20	3	4	5	5	10
100 lbs/ac	4	5	10	10	15	3	4	5	5	10
110 lbs/ac	4	5	5	10	15	3	4	4	5	5
120 lbs/ac	3	4	5	5	10	2	3	4	5	5
130 lbs/ac	3	4	5	5	10	2	3	4	4	5
140 lbs/ac	3	4	5	5	5	1	3	3	4	5
150 lbs/ac	2	3	4	5	5	1	2	3	4	4
160 lbs/ac	2	3	4	5	5	1	2	3	4	4
170 lbs/ac	2	3	4	4	5	NA	2	3	3	4
180 lbs/ac	1	3	4	4	5	NA	1	3	3	4
190 lbs/ac	1	2	3	4	5	NA	1	2	3	4
200 lbs/ac	1	2	3	4	4	NA	1	2	3	4
210 lbs/ac	NA	2	3	4	4	NA	1	2	3	3
220 lbs/ac	NA	2	3	4	4	NA	NA	2	3	3
230 lbs/ac	NA	1	3	3	4	NA	NA	2	2	3
240 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
250 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
260 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
270 lbs/ac	NA	NA	2	3	3	NA	NA	1	2	3
280 lbs/ac	NA	NA	2	3	3	NA	NA	NA	2	2
290 lbs/ac	NA	NA	2	3	3	NA	NA	NA	2	2
300 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
310 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
320 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2
332 lbs/ac	NA	NA	1	2	3	NA	NA	NA	1	2

(c) Chemigation (drip)/non-TIF tarp method

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	20	40	65	NR	NR	5	5	15	20	25
90 lbs/ac	15	30	45	65	NR	4	5	10	15	20
100 lbs/ac	10	25	35	50	65	4	5	5	10	15
110 lbs/ac	5	15	30	40	50	3	5	5	10	15
120 lbs/ac	5	15	25	35	40	3	4	5	5	10
130 lbs/ac	5	10	20	25	35	2	4	5	5	10
140 lbs/ac	5	10	15	20	30	2	4	5	5	10
150 lbs/ac	4	5	10	20	25	2	3	4	5	5
160 lbs/ac	4	5	10	15	25	1	3	4	5	5
170 lbs/ac	4	5	10	15	20	1	3	4	5	5
180 lbs/ac	3	5	10	10	15	1	3	4	5	5
190 lbs/ac	3	5	5	10	15	NA	2	3	4	5
200 lbs/ac	3	5	5	10	15	NA	2	3	4	5
210 lbs/ac	3	4	5	10	10	NA	2	3	4	5
220 lbs/ac	3	4	5	10	10	NA	2	3	4	4
230 lbs/ac	2	4	5	5	10	NA	2	3	4	4
240 lbs/ac	2	4	5	5	10	NA	2	3	4	4
250 lbs/ac	2	4	5	5	10	NA	1	3	3	4
260 lbs/ac	2	3	5	5	10	NA	1	2	3	4
270 lbs/ac	2	3	4	5	5	NA	1	2	3	4
280 lbs/ac	1	3	4	5	5	NA	1	2	3	4
290 lbs/ac	1	3	4	5	5	NA	1	2	3	4
300 lbs/ac	1	3	4	5	5	NA	NA	2	3	3
310 lbs/ac	1	3	4	5	5	NA	NA	2	3	3
320 lbs/ac	NA	3	4	5	5	NA	NA	2	3	3
332 lbs/ac	NA	3	4	4	5	NA	NA	1	2	3

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	10	15	25	35	45	4	5	5	10	15
90 lbs/ac	5	10	20	25	35	4	5	5	10	10
100 lbs/ac	5	10	15	20	25	3	4	5	5	10
110 lbs/ac	5	5	10	15	20	3	4	5	5	5
120 lbs/ac	4	5	10	10	15	2	3	4	5	5
130 lbs/ac	4	5	5	10	15	2	3	4	5	5
140 lbs/ac	3	5	5	10	10	2	3	4	4	5
150 lbs/ac	3	4	5	5	10	1	3	3	4	5
160 lbs/ac	3	4	5	5	10	1	2	3	4	5
170 lbs/ac	2	4	5	5	5	1	2	3	4	4
180 lbs/ac	2	3	4	5	5	NA	2	3	4	4
190 lbs/ac	2	3	4	5	5	NA	1	3	3	4
200 lbs/ac	2	3	4	5	5	NA	1	2	3	4
210 lbs/ac	1	3	4	4	5	NA	1	2	3	4
220 lbs/ac	1	3	3	4	5	NA	1	2	3	3
230 lbs/ac	1	2	3	4	5	NA	NA	2	3	3
240 lbs/ac	NA	2	3	4	4	NA	NA	2	3	3
250 lbs/ac	NA	2	3	4	4	NA	NA	1	2	3
260 lbs/ac	NA	2	3	4	4	NA	NA	1	2	3
270 lbs/ac	NA	2	3	3	4	NA	NA	1	2	3
280 lbs/ac	NA	1	3	3	4	NA	NA	1	2	3
290 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
300 lbs/ac	NA	1	2	3	4	NA	NA	1	2	3
310 lbs/ac	NA	1	2	3	4	NA	NA	NA	2	2
320 lbs/ac	NA	1	2	3	3	NA	NA	NA	1	2
332 lbs/ac	NA	NA	2	3	3	NA	NA	NA	1	2

(d) 24-inch injection methods

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	55	NR	NR	NR	NR	10	20	30	40	55
90 lbs/ac	35	65	NR	NR	NR	5	15	25	30	40
100 lbs/ac	25	45	70	NR	NR	5	10	15	25	35
110 lbs/ac	20	35	55	75	NR	5	10	15	20	25
120 lbs/ac	15	30	40	60	75	4	5	10	15	20
130 lbs/ac	10	20	35	50	65	4	5	10	15	20
140 lbs/ac	10	20	30	40	55	4	5	5	10	15
150 lbs/ac	5	15	25	35	45	3	5	5	10	15
160 lbs/ac	5	10	20	30	40	3	4	5	10	10
170 lbs/ac	5	10	15	25	35	3	4	5	5	10
180 lbs/ac	5	10	15	20	30	3	4	5	5	10
190 lbs/ac	5	10	15	20	25	2	4	5	5	10
200 lbs/ac	4	5	10	15	25	2	3	5	5	5
210 lbs/ac	4	5	10	15	20	2	3	4	5	5
220 lbs/ac	4	5	10	15	20	2	3	4	5	5
230 lbs/ac	4	5	10	10	15	2	3	4	5	5
240 lbs/ac	3	5	5	10	15	1	3	4	5	5
250 lbs/ac	3	5	5	10	15	1	3	4	4	5
260 lbs/ac	3	5	5	10	15	1	3	4	4	5
270 lbs/ac	3	4	5	10	10	1	2	3	4	5
280 lbs/ac	3	4	5	10	10	NA	2	3	4	5
290 lbs/ac	3	4	5	5	10	NA	2	3	4	5
300 lbs/ac	3	4	5	5	10	NA	2	3	4	5
310 lbs/ac	2	4	5	5	10	NA	2	3	4	4
320 lbs/ac	2	4	5	5	10	NA	2	3	4	4
332 lbs/ac	2	4	5	5	10	NA	2	3	4	4

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	20	35	50	65	NR	10	15	20	30	35
90 lbs/ac	15	25	35	45	60	5	10	15	20	30
100 lbs/ac	10	20	30	35	45	5	5	10	15	20
110 lbs/ac	10	15	20	30	40	5	5	10	15	15
120 lbs/ac	5	10	15	25	30	4	5	5	10	15
130 lbs/ac	5	10	15	20	25	4	5	5	10	10
140 lbs/ac	5	5	10	15	20	3	4	5	5	10
150 lbs/ac	4	5	10	15	20	3	4	5	5	10
160 lbs/ac	4	5	5	10	15	3	4	5	5	5
170 lbs/ac	4	5	5	10	15	3	4	4	5	5
180 lbs/ac	3	5	5	10	10	2	3	4	5	5
190 lbs/ac	3	4	5	5	10	2	3	4	5	5
200 lbs/ac	3	4	5	5	10	2	3	4	4	5
210 lbs/ac	3	4	5	5	10	2	3	3	4	5
220 lbs/ac	3	4	5	5	5	1	2	3	4	5
230 lbs/ac	2	3	4	5	5	1	2	3	4	4
240 lbs/ac	2	3	4	5	5	1	2	3	4	4
250 lbs/ac	2	3	4	5	5	1	2	3	4	4
260 lbs/ac	2	3	4	5	5	NA	2	3	3	4
270 lbs/ac	1	3	4	4	5	NA	2	3	3	4
280 lbs/ac	1	3	4	4	5	NA	1	2	3	4
290 lbs/ac	1	2	3	4	5	NA	1	2	3	4
300 lbs/ac	1	2	3	4	5	NA	1	2	3	4
310 lbs/ac	1	2	3	4	4	NA	1	2	3	3
320 lbs/ac	NA	2	3	4	4	NA	1	2	3	3
332 lbs/ac	NA	2	3	4	4	NA	NA	2	3	3

(e) Totally Impermeable Film (TIF) methods – broadcast and strip

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
90 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
100 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
110 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
120 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
130 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
140 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
150 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
160 lbs/ac	NR	NR	NR	NR	NR	70	NR	NR	NR	NR
170 lbs/ac	NR	NR	NR	NR	NR	55	NR	NR	NR	NR
180 lbs/ac	NR	NR	NR	NR	NR	45	75	NR	NR	NR
190 lbs/ac	NR	NR	NR	NR	NR	40	60	NR	NR	NR
200 lbs/ac	NR	NR	NR	NR	NR	35	50	75	NR	NR
210 lbs/ac	NR	NR	NR	NR	NR	30	45	65	NR	NR
220 lbs/ac	NR	NR	NR	NR	NR	25	40	55	75	NR
230 lbs/ac	NR	NR	NR	NR	NR	20	35	50	65	NR
240 lbs/ac	NR	NR	NR	NR	NR	20	30	40	60	75
250 lbs/ac	NR	NR	NR	NR	NR	15	25	40	50	65
260 lbs/ac	NR	NR	NR	NR	NR	15	25	35	45	60
270 lbs/ac	NR	NR	NR	NR	NR	10	20	30	40	55
280 lbs/ac	NR	NR	NR	NR	NR	10	20	30	40	50
290 lbs/ac	NR	NR	NR	NR	NR	10	15	25	35	45
300 lbs/ac	NR	NR	NR	NR	NR	10	15	25	30	40
310 lbs/ac	NR	NR	NR	NR	NR	10	15	20	30	35
320 lbs/ac	NR	NR	NR	NR	NR	5	10	20	25	35
332 lbs/ac	NR	NR	NR	NR	NR	5	10	15	25	30

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
90 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
100 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
110 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
120 lbs/ac	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
130 lbs/ac	NR	NR	NR	NR	NR	70	NR	NR	NR	NR
140 lbs/ac	NR	NR	NR	NR	NR	55	NR	NR	NR	NR
150 lbs/ac	NR	NR	NR	NR	NR	45	65	NR	NR	NR
160 lbs/ac	NR	NR	NR	NR	NR	35	50	70	NR	NR
170 lbs/ac	NR	NR	NR	NR	NR	30	45	60	NR	NR
180 lbs/ac	NR	NR	NR	NR	NR	25	35	50	65	NR
190 lbs/ac	NR	NR	NR	NR	NR	20	35	45	55	70
200 lbs/ac	NR	NR	NR	NR	NR	20	30	40	50	60
210 lbs/ac	NR	NR	NR	NR	NR	15	25	35	40	50
220 lbs/ac	NR	NR	NR	NR	NR	15	20	30	35	45
230 lbs/ac	NR	NR	NR	NR	NR	10	20	25	35	40
240 lbs/ac	NR	NR	NR	NR	NR	10	15	20	30	35
250 lbs/ac	NR	NR	NR	NR	NR	10	15	20	25	35
260 lbs/ac	NR	NR	NR	NR	NR	10	15	15	25	30
270 lbs/ac	NR	NR	NR	NR	NR	5	10	15	20	30
280 lbs/ac	NR	NR	NR	NR	NR	5	10	15	20	25
290 lbs/ac	70	NR	NR	NR	NR	5	10	15	20	25
300 lbs/ac	60	NR	NR	NR	NR	5	10	10	15	20
310 lbs/ac	55	NR	NR	NR	NR	5	10	10	15	20
320 lbs/ac	50	NR	NR	NR	NR	5	5	10	15	20
332 lbs/ac	45	75	NR	NR	NR	5	5	10	10	15

(f) Totally Impermeable Film (TIF) methods – bed and drip

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	NR	NR	NR	NR	NR	30	45	70	NR	NR
90 lbs/ac	NR	NR	NR	NR	NR	20	35	50	70	NR
100 lbs/ac	NR	NR	NR	NR	NR	15	25	35	50	65
110 lbs/ac	60	NR	NR	NR	NR	10	20	30	40	55
120 lbs/ac	40	75	NR	NR	NR	5	15	25	35	40
130 lbs/ac	35	60	NR	NR	NR	5	10	20	25	35
140 lbs/ac	25	50	75	NR	NR	5	10	15	25	30
150 lbs/ac	20	40	60	NR	NR	5	10	15	20	25
160 lbs/ac	15	35	50	70	NR	5	5	10	15	25
170 lbs/ac	15	30	40	60	NR	4	5	10	15	20
180 lbs/ac	10	25	35	50	70	4	5	10	10	15
190 lbs/ac	10	20	35	45	60	4	5	5	10	15
200 lbs/ac	10	20	30	40	55	3	5	5	10	15
210 lbs/ac	5	15	25	35	45	3	5	5	10	10
220 lbs/ac	5	15	25	35	40	3	4	5	10	10
230 lbs/ac	5	10	20	30	40	3	4	5	5	10
240 lbs/ac	5	10	20	25	35	3	4	5	5	10
250 lbs/ac	5	10	15	25	35	3	4	5	5	10
260 lbs/ac	5	10	15	20	30	2	4	5	5	10
270 lbs/ac	5	10	15	20	25	2	4	4	5	5
280 lbs/ac	4	5	10	20	25	2	3	4	5	5
290 lbs/ac	4	5	10	15	25	2	3	4	5	5
300 lbs/ac	4	5	10	15	20	2	3	4	5	5
310 lbs/ac	4	5	10	15	20	1	3	4	5	5
320 lbs/ac	4	5	10	15	20	1	3	4	5	5
332 lbs/ac	4	5	10	10	15	1	3	4	5	5

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	60	NR	NR	NR	NR	20	30	40	55	70
90 lbs/ac	40	65	NR	NR	NR	10	20	30	40	50
100 lbs/ac	30	50	70	NR	NR	10	15	25	30	40
110 lbs/ac	25	35	55	70	NR	5	10	20	25	35
120 lbs/ac	15	30	40	55	70	5	10	15	20	25
130 lbs/ac	15	25	35	45	60	5	5	10	15	25
140 lbs/ac	10	20	30	40	50	5	5	10	15	20
150 lbs/ac	10	15	25	30	40	4	5	10	10	15
160 lbs/ac	5	10	20	25	35	4	5	5	10	15
170 lbs/ac	5	10	15	25	30	4	5	5	10	10
180 lbs/ac	5	10	15	20	25	3	4	5	10	10
190 lbs/ac	5	10	10	15	25	3	4	5	5	10
200 lbs/ac	5	5	10	15	20	3	4	5	5	10
210 lbs/ac	4	5	10	15	20	3	4	5	5	5
220 lbs/ac	4	5	10	10	15	3	4	5	5	5
230 lbs/ac	4	5	5	10	15	2	3	4	5	5
240 lbs/ac	4	5	5	10	15	2	3	4	5	5
250 lbs/ac	3	5	5	10	10	2	3	4	5	5
260 lbs/ac	3	4	5	5	10	2	3	4	4	5
270 lbs/ac	3	4	5	5	10	2	3	4	4	5
280 lbs/ac	3	4	5	5	10	1	3	4	4	5
290 lbs/ac	3	4	5	5	10	1	2	3	4	5
300 lbs/ac	3	4	5	5	5	1	2	3	4	5
310 lbs/ac	2	4	5	5	5	1	2	3	4	4
320 lbs/ac	2	3	4	5	5	1	2	3	4	4
332 lbs/ac	2	3	4	5	5	NA	2	3	4	4

(g) 40% TIF with 18-inch injection depth method

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	65	NR	NR	NR	NR	10	25	35	50	65
90 lbs/ac	45	75	NR	NR	NR	10	15	25	35	45
100 lbs/ac	35	55	NR	NR	NR	5	10	20	30	35
110 lbs/ac	25	40	65	NR	NR	5	10	15	25	30
120 lbs/ac	20	35	50	70	NR	5	5	15	20	25
130 lbs/ac	15	30	40	55	75	4	5	10	15	20
140 lbs/ac	10	20	35	45	65	4	5	10	15	20
150 lbs/ac	10	20	30	40	55	4	5	5	10	15
160 lbs/ac	5	15	25	35	45	3	5	5	10	15
170 lbs/ac	5	15	20	30	40	3	4	5	10	10
180 lbs/ac	5	10	20	25	35	3	4	5	5	10
190 lbs/ac	5	10	15	25	30	3	4	5	5	10
200 lbs/ac	5	10	15	20	30	2	4	5	5	10
210 lbs/ac	4	5	10	20	25	2	4	5	5	5
220 lbs/ac	4	5	10	15	25	2	3	4	5	5
230 lbs/ac	4	5	10	15	20	2	3	4	5	5
240 lbs/ac	4	5	10	15	20	2	3	4	5	5
250 lbs/ac	4	5	10	10	15	1	3	4	5	5
260 lbs/ac	3	5	5	10	15	1	3	4	5	5
270 lbs/ac	3	5	5	10	15	1	3	4	4	5
280 lbs/ac	3	5	5	10	15	1	2	4	4	5
290 lbs/ac	3	4	5	10	10	1	2	3	4	5
300 lbs/ac	3	4	5	10	10	NA	2	3	4	5
310 lbs/ac	3	4	5	10	10	NA	2	3	4	5
320 lbs/ac	3	4	5	5	10	NA	2	3	4	4
332 lbs/ac	2	4	5	5	10	NA	2	3	4	4

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	25	40	60	NR	NR	10	15	25	35	40
90 lbs/ac	20	30	45	60	75	5	10	20	25	35
100 lbs/ac	15	25	35	45	55	5	10	15	20	25
110 lbs/ac	10	15	25	35	45	5	5	10	15	20
120 lbs/ac	5	15	20	30	35	4	5	10	10	15
130 lbs/ac	5	10	15	20	30	4	5	5	10	15
140 lbs/ac	5	10	15	20	25	4	5	5	10	10
150 lbs/ac	5	5	10	15	20	3	4	5	5	10
160 lbs/ac	4	5	10	15	15	3	4	5	5	10
170 lbs/ac	4	5	5	10	15	3	4	5	5	5
180 lbs/ac	4	5	5	10	15	3	4	4	5	5
190 lbs/ac	3	5	5	10	10	2	3	4	5	5
200 lbs/ac	3	4	5	5	10	2	3	4	5	5
210 lbs/ac	3	4	5	5	10	2	3	4	5	5
220 lbs/ac	3	4	5	5	10	2	3	4	4	5
230 lbs/ac	3	4	5	5	5	1	3	3	4	5
240 lbs/ac	2	3	4	5	5	1	2	3	4	5
250 lbs/ac	2	3	4	5	5	1	2	3	4	4
260 lbs/ac	2	3	4	5	5	1	2	3	4	4
270 lbs/ac	2	3	4	5	5	NA	2	3	4	4
280 lbs/ac	2	3	4	5	5	NA	2	3	3	4
290 lbs/ac	1	3	4	4	5	NA	2	3	3	4
300 lbs/ac	1	3	4	4	5	NA	1	2	3	4
310 lbs/ac	1	2	3	4	5	NA	1	2	3	4
320 lbs/ac	1	2	3	4	5	NA	1	2	3	4
332 lbs/ac	1	2	3	4	4	NA	1	2	3	4

(h) 40% TIF with 24-inch injection depth method

Inland counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	NR	NR	NR	NR	NR	45	NR	NR	NR	NR
90 lbs/ac	NR	NR	NR	NR	NR	35	55	NR	NR	NR
100 lbs/ac	NR	NR	NR	NR	NR	25	40	60	NR	NR
110 lbs/ac	NR	NR	NR	NR	NR	15	30	45	65	NR
120 lbs/ac	65	NR	NR	NR	NR	15	25	35	50	65
130 lbs/ac	50	NR	NR	NR	NR	10	20	30	40	55
140 lbs/ac	40	70	NR	NR	NR	10	15	25	35	45
150 lbs/ac	30	55	NR	NR	NR	5	10	20	30	40
160 lbs/ac	25	45	70	NR	NR	5	10	15	25	35
170 lbs/ac	20	40	60	NR	NR	5	10	15	20	30
180 lbs/ac	20	35	50	70	NR	5	5	10	20	25
190 lbs/ac	15	30	45	60	NR	4	5	10	15	20
200 lbs/ac	15	25	40	55	75	4	5	10	15	20
210 lbs/ac	10	20	35	50	65	4	5	10	15	20
220 lbs/ac	10	20	30	45	55	4	5	10	10	15
230 lbs/ac	10	15	30	40	50	4	5	5	10	15
240 lbs/ac	5	15	25	35	45	3	5	5	10	15
250 lbs/ac	5	15	20	35	45	3	5	5	10	10
260 lbs/ac	5	10	20	30	40	3	4	5	10	10
270 lbs/ac	5	10	20	30	35	3	4	5	5	10
280 lbs/ac	5	10	15	25	35	3	4	5	5	10
290 lbs/ac	5	10	15	25	30	3	4	5	5	10
300 lbs/ac	5	10	15	20	30	2	4	5	5	10
310 lbs/ac	5	5	15	20	25	2	4	5	5	10
320 lbs/ac	4	5	10	20	25	2	4	5	5	5
332 lbs/ac	4	5	10	15	25	2	3	4	5	5

Coastal counties:

Broadcast Equivalent a.i. App Rate	Maximum Application Block Size (ac), Month of Application, and Setback Distance (ft)									
	March to October					November to February				
	100 ft	200 ft	300 ft	400 ft	500 ft	100 ft	200 ft	300 ft	400 ft	500 ft
80 lbs/ac	NR	NR	NR	NR	NR	30	50	70	NR	NR
90 lbs/ac	70	NR	NR	NR	NR	25	35	50	65	NR
100 lbs/ac	50	75	NR	NR	NR	15	25	35	50	65
110 lbs/ac	35	55	NR	NR	NR	10	20	30	40	50
120 lbs/ac	30	45	65	NR	NR	10	15	25	30	40
130 lbs/ac	20	35	50	70	NR	5	15	20	25	35
140 lbs/ac	15	30	40	55	70	5	10	15	25	30
150 lbs/ac	15	25	35	45	60	5	10	15	20	25
160 lbs/ac	10	20	30	40	50	5	5	10	15	25
170 lbs/ac	10	15	25	35	40	5	5	10	15	20
180 lbs/ac	10	15	20	30	35	4	5	10	10	15
190 lbs/ac	5	10	20	25	35	4	5	5	10	15
200 lbs/ac	5	10	15	20	30	4	5	5	10	15
210 lbs/ac	5	10	15	20	25	4	5	5	10	10
220 lbs/ac	5	5	10	15	25	3	5	5	5	10
230 lbs/ac	5	5	10	15	20	3	4	5	5	10
240 lbs/ac	5	5	10	15	20	3	4	5	5	10
250 lbs/ac	4	5	10	10	15	3	4	5	5	10
260 lbs/ac	4	5	5	10	15	3	4	5	5	5
270 lbs/ac	4	5	5	10	15	3	4	4	5	5
280 lbs/ac	4	5	5	10	10	2	3	4	5	5
290 lbs/ac	3	5	5	10	10	2	3	4	5	5
300 lbs/ac	3	4	5	10	10	2	3	4	5	5
310 lbs/ac	3	4	5	5	10	2	3	4	5	5
320 lbs/ac	3	4	5	5	10	2	3	4	4	5
332 lbs/ac	3	4	5	5	10	2	3	4	4	5

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Appendix I. 1,3-Dichloropropene field fumigation methods

Table 4. 1,3-Dichloropropene field fumigation methods in California

Method Group	Method Name	Field Fumigation Method (FFM) Code
1	Nontarp/shallow/broadcast or bed	1201
1	Tarp/shallow/broadcast	1202
1	Tarp/shallow/bed	1203
1	Nontarp/shallow/broadcast or bed/3 water treatments	1204
1	Tarp/shallow/bed/3 water treatments	1205
2	Nontarp/18 inches deep/broadcast or bed	1206
2	Tarp/18 inches deep/broadcast	1207
2	Tarp/18 inches deep/bed	1208
3	Chemigation (drip system)/tarp	1209
2	Nontarp/18 inches deep/strip	1210
2	Nontarp/18 inches deep/GPS targeted	1211
4	Nontarp/24 inches deep/broadcast	1224
4	Tarp/24 inches deep/broadcast	1225
4	Nontarp/24 inches deep/strip	1226
4	Nontarp/24 inches deep/GPS targeted	1227
5	Totally Impermeable Film (TIF) tarp/shallow/broadcast	1242
6	TIF tarp/shallow/bed	1243
6	TIF tarp/shallow/bed/3 water treatments	1245
5	TIF tarp/deep/broadcast	1247
6	TIF tarp/deep/bed	1248
5	TIF tarp/deep/strip	1249
7	40% TIF tarp/18 inches deep/broadcast	1250
6	Chemigation (drip)/ TIF tarp	1259
8	40% TIF tarp/24 inches deep/broadcast	1264