1,3-DICHLOROPROPENE
FINAL REPORT FOR 2024

Air Program
Environmental Monitoring Branch
California Department of Pesticide Regulation
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1. TABLE OF CONTENTS

2. EXECUTIVE SUMMARY

Pursuant to Department of Pesticide Regulation (DPR) regulation 22-005 (Title 3, California Code of Regulations [CCR] section 6448.4), this annual report evaluates the effectiveness of the 1,3-dichloropropene (1,3-D) regulation effective January 2024. The report identifies and evaluates the ten highest-use townships in California and evaluates the air concentrations at all six DPR's 1,3-D monitoring stations. This first annual report also checks compliance with the 1,3-D regional use limit (township cap) of 136,00 adjusted total pounds (ATP)[1] temporarily in effect[2].

The townships identified and evaluated in this report represent the highest-use townships in each of the ten counties with the highest 1,3-D use, based on the ATP. The report identifies key factors influencing usage levels and air concentrations within the specified ten townships and includes detailed modeling to estimate the maximum 1,3-D air concentrations over periods of 24 hours, 72 hours, and 1 year average.

In 2024, 7,019,748 pounds of 1,3-D were used on 43,768 acres statewide, corresponding to 4,064,020 ATP and 1,300,112 pounds of emissions. This is the lowest 1,3-D use and acreage since 2009. The crops with the most use were almonds, strawberries, sweet potatoes, and carrots. Applications using field fumigation methods 1206 and 1210 (untarped, 18-inch minimum injection depth methods) largely transitioned to methods 1224 and 1226 (untarped, 24-inch minimum injection depth methods), resulting in a reduction in emissions following implementation of DPR Regulation 22-005, especially in almond crops. All townships complied with the township cap of 136,000 ATP, with the highest township having 113,628 ATP, which is in Merced County.

Modeling results showed that the highest estimated 24-hour, 72-hour, and 1-year air concentrations of 1,3-D are 26.8, 15.1, and 0.41 ppb, respectively, all of which were predicted in township M07S12E in Merced County. These concentrations were below DPR's regulatory target concentrations of 55 ppb (72-hour average) and 0.56 ppb (70-year average). The highest measured air concentrations at the monitoring stations were in Shafter, with 7.19 ppb and 0.21 ppb for the 24-hour and 1-year time periods, respectively. These concentrations were below the trigger thresholds of 55 ppb (24-hour average) and 0.27 ppb (1-year average) that trigger additional evaluation.

DPR posts on a quarterly basis, 1,3-D use data, typically the following month and monitoring data, which is currently posted six-month after end of the quarter. Much of the information included in this report has been available on DPR's website for several months and key stakeholders regularly analyze this data.

In summary, DPR's pesticide use report (PUR) data analyses of high-use townships and ambient air concentrations from air monitoring stations within DPR's Air Monitoring Network (AMN) and targeted 1,3-D study indicate that current regulatory measures are functioning as intended. There is

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1 Adjusted total pounds (ATP) is calculated for each application and refer to the amount of 1,3-D active ingredient multiplied by an application factor (AF) to account for differences in air concentrations due to emission differences between application methods, and weather differences between regions and seasons. ATP is the sum of adjusted pounds for all 1,3-D applications within a township during a calendar year. A township is a 6x6 mile area as defined by the Public Lands Survey System. The township cap is 136,000 ATP.

2 Pursuant to court order, DPR is maintaining the annual township cap of a maximum of 136,000 ATP and the prohibition on December applications until the formal rulemaking addressing cancer risks from 1,3-D to occupational bystanders is complete.

no evidence at this time to suggest that additional actions are necessary to meet regulatory goals of DPR Regulation 22-005.

3. INTRODUCTION

3.1. Background

California is the largest producer of specialty crops in the United States, accounting for 99% of production of almonds and walnuts, and 90% of grapes and strawberries nationwide. Soil fumigants are widely used to control soilborne pests and disease-causing organisms that may reduce agricultural yields and may be preferred over other options due to their broad-spectrum efficacy, simplicity of application, and affordability for growers. One major soil fumigant is 1,3-dichloropropene (1,3-D), sometimes referred to by its trade name Telone. 1,3-D is used to control a wide spectrum of pests, including soil nematodes and other soil pathogens, and is commonly applied as a pre-plant pesticide for orchards, strawberries, grapes, carrots, sweet potatoes, and other crops in California.

Registered as a soil fumigant for agricultural use in the United States in 1966 and in California in 1970, 1,3-D is a volatile organic compound listed as a carcinogen under California's Proposition 65. 1,3-D is listed as a toxic air contaminant and exposure above certain thresholds can lead to serious illness, or death at especially high concentrations. 1,3-D is also listed as a restricted material and requires special handling due to its potential toxicity or environmental impact. Restricted materials can only be purchased or used by certified applicators or those under their direct supervision.

Injected into the soil as a liquid, applied 1,3-D rapidly converts into a gas, allowing it to redistribute throughout the soil where it may encounter disease-causing organisms. This conversion into the gas phase also results in some 1,3-D emitting from the soil into the ambient air, where it may move away from application sites, increasing the probability of human exposure through inhalation. To protect public health and the environment, DPR established acute (72 hours) and lifetime (70 years) health threshold levels to mitigate the health effects of 1,3-D.

3.2. Regulations and air concentration thresholds

DPR regulation 22-005 (additions and amendments to Title 3, California Code of Regulations, sections 6448-6448.4, 6452, 6624, 6626, 6881) addresses 72-hour acute risk and 70-year lifetime cancer risk to residents and other non-occupational bystanders (adults and children) from 1,3-D (CDPR 2024). Regulation 22-005, hereafter the 2024 regulation, went into effect on January 1, 2024. Using worst-case application scenarios, computer models, and public comments, DPR developed rules and established requirements to minimize the release of 1,3-D in the air after its application in the soil. These mitigation measures include acreage limits, minimum setback distances from an occupied structure to a treated field, totally impermeable films, deeper fumigant injections, an increase in soil moisture requirements, quarterly use summaries, and an annual report, among other requirements.

Per 3 CCR section 6448.4, DPR is required to issue an annual report that identifies and assesses specific high-use townships. High-use townships are selected according to the ten townships with the highest use across the ten counties with the highest total use (Section 6.1). For these townships, DPR analyzes reported use, available emissions data, and local weather conditions using computer modeling to determine if the modeled air concentrations are within the expected range. The modeled air concentrations are compared to the "regulatory target concentrations" specified in DPR's 2016 and 2021 risk management directives (CDPR 2016, CDPR 2021) and shown in Table 1. Air concentrations that exceed a regulatory target concentration may indicate the need for additional mitigation measures.

DPR is also required to assess monitoring stations with measured air concentrations that exceed an "evaluation trigger" specified in 3 CCR section 6448.4(b)(1) and shown in Table 1. The assessment includes monitoring stations for DPR's AMN but could include other monitoring stations that have valid and representative data. The evaluation triggers are more stringent than regulatory target concentrations and provide an additional margin of safety for DPR to evaluate air monitoring data and consider the need for additional mitigation measures prior to exceeding a regulatory target concentration. Monitored air concentrations can also be compared to regulatory target concentrations; however, monitoring data for 72-hour air concentrations is not available and monitored air concentrations would normally exceed a more stringent evaluation trigger before exceeding a regulatory target concentration.

If any of the modeled or monitored air concentrations are higher than expected in comparison to previous data, the report includes a description of action(s) DPR will take to address the high levels and a timeline for taking the actions. A chart illustrating this evaluation process is shown in Appendix 1.

Table 1. DPR air concentration thresholds for 1,3-D. There are separate thresholds for monitored air concentrations and modeled air concentrations, and for different health risks.

Type of Risk	3 CCR 6448.4(b) Evaluation Trigger (for monitored air concentrations)	Regulatory Target Concentration (normally for modeled air concentrations)
Acute (short-term)	55 ppb as 24-hour average	55 ppb as 72-hour average
Cancer (lifetime)	0.27 ppb as 1-year average	0.56 ppb as 70-year average*

*Monitored air concentrations are one or multiple year averages depending on the availability of data. Modeled air concentrations are the most recent one to five-year averages depending on the availability of data. The one or multiple year averages are used as surrogates for lifetime 70-year averages.

4. PESTICIDE USE REPORT

State law requires a pesticide use report (PUR) to be submitted for each pesticide applied for the production of an agricultural commodity, including all 1,3-D applications. DPR's PUR database contains information on the product applied, amount applied, acres treated, crop, application date, application location, and other information. PUR information on 1,3-D use is posted on DPR's website on a quarterly basis and the full year of data and data summary is released annually for all reportable pesticide use in California.

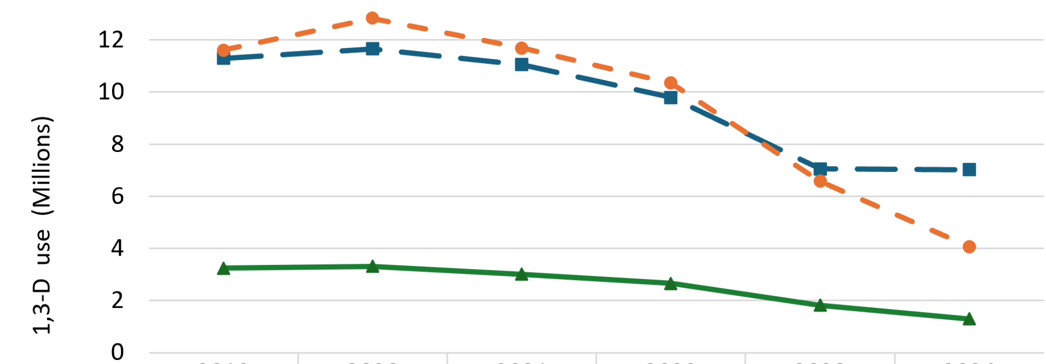
In addition to evaluating 1,3-D use, DPR also calculates and evaluates its emissions primarily for its volatile organic compound (VOC) program and adjusted total pounds (ATP) for its township cap program. DPR tracks and controls the VOC emissions from agricultural and structural pesticide applications because they contribute to the formation of ozone, a major air pollutant. For 1,3-D, DPR estimates the emissions for each application by multiplying the amount of active ingredient used by an emission ratio that ranges from 9 percent to 52 percent to account the effect of fumigation method on emissions (Brown, 2022).

Since the 1990s, DPR has required an annual regional use limit (township cap) for 1,3-D to mitigate cancer risk. The 2024 regulation does not include a township cap because DPR expects the setbacks and other requirements to mitigate both acute and cancer risk. However, due to a court order, the township cap remains in effect until DPR completes rulemaking for the occupational bystander regulation. A township is an area of 6x6 square miles used by the U.S. Bureau of Land Management as a way of subdividing and describing land in the United States as part of the Public Lands Survey System. Currently, the township cap limit is 136,000 ATP of 1,3-D during a calendar year (CDPR 2016). The quantity of ATP accounts for the relative proportion of 1,3-D emitted into the air as a result of the application method used, as well as the impact of those emissions on air concentrations based on regional and seasonal differences in meteorology (Luo and Brown 2022 & 2023). For each individual 1,3-D application, the equivalent ATP is calculated as the total mass of 1,3-D applied multiplied by an application factor which varies from 0.21 to 2.93 (Table 2). These application factors were developed using field data and computer models and are defined according to a combination of field fumigation method (FFM), season, and region (Luo and Brown 2022 & 2023). The same application factors were used for all years. DPR makes every effort to quality control the PUR and correct errors, including working with County Agricultural Commissioners, but in some cases PUR records with missing fumigation method codes are substituted with what is reported in registrant submitted use data. In the case that the fumigation method codes are missing in both datasets, fumigation code 1201 is inferred to provide the most conservative estimates of 1,3-D ATP.

Table 2. Application factors based on fumigation method, location, and month.

Field fumigation methods (FFM codes)	**Inland Nov-Feb**	**Inland Mar-Oct**	**Coastal Nov-Feb**	**Coastal Mar-Oct**
Standard nontarped and nonTIF tarp shallow 12-inch methods (1201, 1202, 1203, 1204, 1205)	2.93	1.40	2.42	1.78
Standard nontarped and nonTIF tarp deep 18-inch methods (1206, 1207, 1208, 1210, 1211)	1.73	0.83	1.42	1.04
Chemigation (drip)/nonTIF tarp method (1209)	2.15	1.02	1.74	1.21
24-inch injection methods (1224, 1225, 1226, 1227)	1.00	0.48	0.82	0.61
TIF methods - broadcast and strip (1242, 1247, 1249)	0.46	0.21	0.37	0.24
TIF methods - bed and strip (1243, 1245, 1248, 1259)	0.76	0.36	0.62	0.45
40% TIF with 18-inch injection depth method (1250)	1.16	0.56	0.95	0.70
40% TIF with 24-inch injection depth method (1264)	0.71	0.34	0.58	0.43

The use of 1,3-D has decreased in the last several years (Figure 1). In 2024, the unadjusted pounds, adjusted pounds and pounds of emissions of 1,3-D ATP were the lowest amounts since 2009. While 1,3-D use in 2024 was comparable to 2023, the emissions decreased by 29% and ATP decreased by 38% (Figure 1). Given that fumigation methods and weather conditions affect 1,3-D air concentrations, this report focuses on ATP of 1,3-D and compares 2024 data against previous years to elucidate changes once the 2024 regulation went into effect. Throughout this report, the year 19-23 represents the annual average for 2019-2023.



	2019	2020	2021	2022	2023	2024
Lb	11,295,402	11,662,135	11,056,265	9,794,435	7,053,178	7,019,748
ATP	11,611,615	12,822,838	11,683,671	10,347,579	6,573,086	4,064,020
Em	3,235,937	3,312,207	3,008,454	2,655,689	1,822,908	1,300,112

Figure 1. Pounds (Lb), adjusted total pounds (ATP), and emissions (Em) of 1,3-D in 2019-2024.

4.1. Acres treated

In 2024, 43,768 acres of land were treated with 1,3-D, which is the smallest acreage since at least 2019 (Figure 2). From 2019 to 2023, on average, 57,730 acres of land were treated with 1,3-D. Despite the 2024 regulation limiting the application field size to 80 acres, 20 out of 2,781 applications (or 0.7%) reported treated fields greater than 80 acres in 2024. DPR's Enforcement Branch confirmed with the County Agricultural Commissioner's offices that the PUR records exceeding 80 acres are associated with combined records of multiple smaller applications occurring on separate dates.

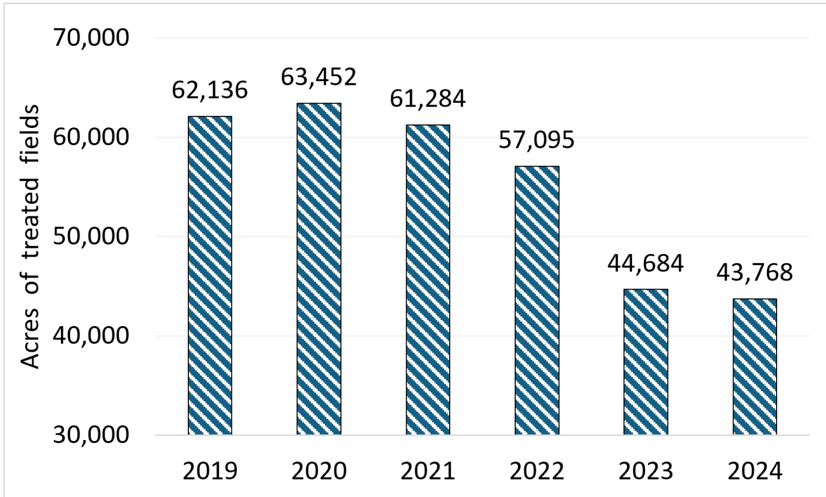


Figure 2. Acres of fields treated with 1,3-D from 2019 to 2024.

4.2. Adjusted pounds by crop and fumigation code

Since 2019, the ten non-generic crop categories with the most ATP of 1,3-D used were almonds, carrots, grapes, peaches, strawberries, sweet potato, tangerines, and walnuts (Table 3). In 2024, the ATP of 1,3-D was lower for every top crop in comparison to the 2019-2023 annual average. Two broad categories, pre-plant and uncultivated applications, also appeared in the top 10 listing. Broad categories such as uncultivated and pre-plant applications are flagged so that counties may update the record with a more specific application type in the future.

Table 3. ATP of 1,3-D for the top ten highest-use crops from 2019 to 2024.

Crop	2019	2020	2021	2022	2023	19-23	2024
Almond	3,278,896	3,703,192	3,301,571	2,195,516	1,147,425	2,725,320	895,456
Carrots	1,095,003	1,025,187	742,446	902,772	582,329	869,547	444,159
Grapes	1,099,501	1,469,407	1,321,222	1,650,963	562,219	1,220,662	299,767
Peach	214,473	224,990	324,861	239,506	335,775	267,921	267,895
Pre-Plant	2,069,093	2,395,175	1,642,256	1,295,120	1,056,099	1,691,549	86,308
Strawberry	524,466	617,504	653,872	670,126	639,927	621,179	586,993
Sweet Potato	741,087	952,405	1,017,532	1,011,692	704,768	885,497	515,342
Tangerine	291,117	283,414	392,785	229,553	41,259	247,626	47,972
Uncultivated	393,132	447,856	423,326	509,656	262,195	407,233	39,761
Walnut	450,040	459,748	311,650	394,405	212,076	365,584	145,662
Other	1,454,808	1,243,960	1,552,151	1,248,270	1,029,013	1,305,640	734,704

As of 2024, DPR has established 25 field fumigation methods (FFM) allowed for 1,3-D in California, each with an assigned FFM code. Applicators must select the appropriate FFM based on their region, month of application, acreage, crop type, and other factors. The FFM with the highest ATP of 1,3-D applied since 2019 are:

- 1201: non-tarpaulin, 12 inches deep injection, broadcast or bed
- 1206: non-tarpaulin, 18 inches deep injection, broadcast or bed
- 1210: non-tarpaulin, 18 inches deep injection, strip
- 1224: non-tarpaulin, 24 inches deep injection, broadcast
- 1226: non-tarpaulin, 24 inches deep injection, strip
- 1242: total impermeable film TIF, 12 inches deep injection, broadcast
- 1259: total impermeable film TIF, chemigation (drip)

When the most commonly used FFMs were split by crop type before and after the regulation went into effect, the data shows that applications that previously used ("legacy" methods) FFM 1206 and 1210 switched to 1224 and 1226 (Figure 3 & Table 4), especially almond growers (Figure 4).

Table 4. ATP of 1,3-D for the highest-use FFM from 2019 to 2024.

FFM	2019	2020	2021	2022	2023	19-23	2024
1201	1,467,534	1,090,754	889,175	830,014	623,928	980,281	273,477
1206	7,164,248	8,221,849	7,591,527	6,582,840	3,732,599	6,658,613	315,671
1210	2,200,408	2,331,729	2,372,327	1,930,873	1,461,629	2,059,393	NA
1224	NA	NA	NA	NA	NA	NA	1,685,212
1226	NA	NA	NA	NA	NA	NA	1,076,884
1242	186,718	174,116	203,365	205,524	223,026	198,550	309,463
1259	328,105	390,630	421,119	451,477	433,804	405,027	327,360
Other	264,602	613,760	206,158	346,852	98,099	305,894	75,953

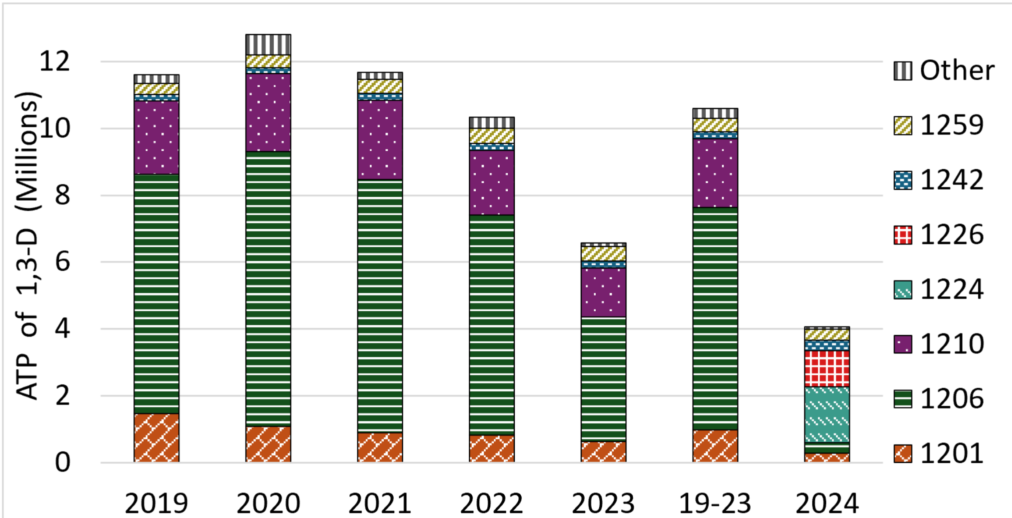


Figure 3. ATP of 1,3-D by year and FFM from 2019 to 2024. The year 19-23 represents the annual average for 2019-2023.

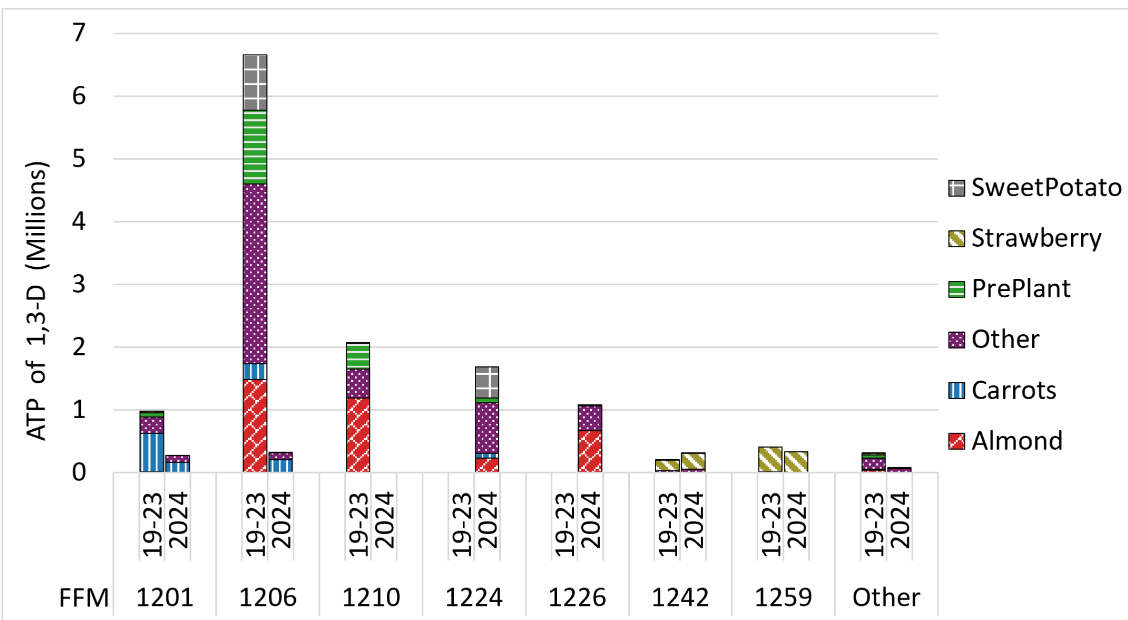


Figure 4. ATP of 1,3-D by FFM, year, and crop from 2019 to 2024. The year 19-23 represents the annual average for 2019-2023.

5. MONITORING STATIONS

DPR has six air monitoring stations deployed across the state that monitor for 1,3-D and other pesticides: Oxnard, Santa Maria, Shafter, and Watsonville are part of the Air Monitoring Network (AMN, study 257), and Delhi and Parlier (1,3-D Monitoring, study 309) (Figure 5).

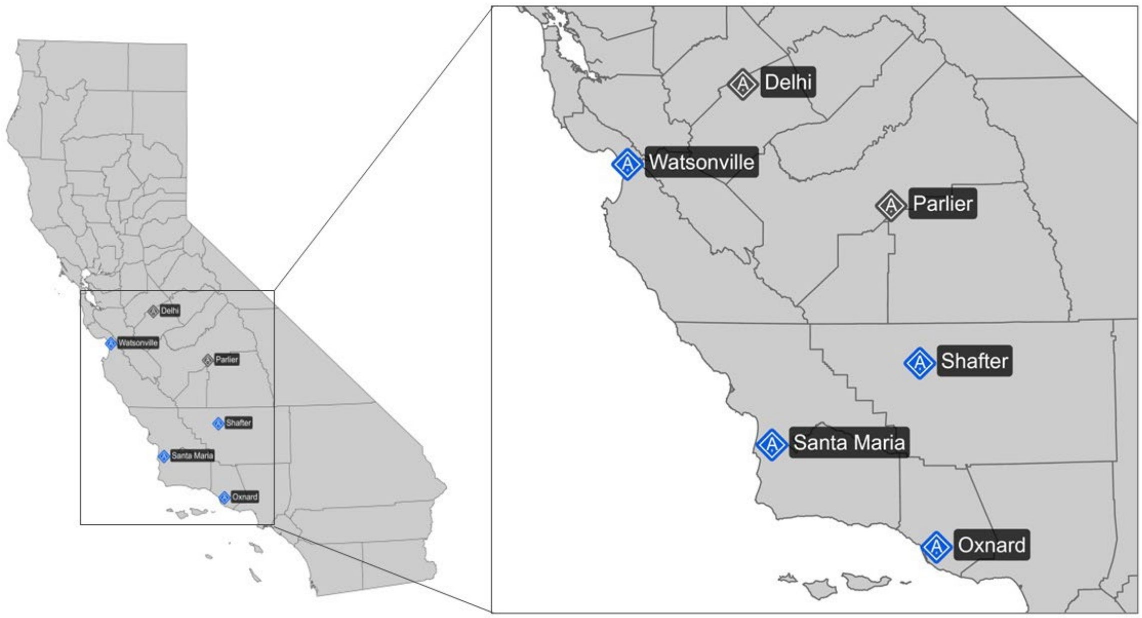


Figure 5. DPR stations monitoring the ambient air for 1,3-D in 2024.

5.1. Highest 24-hour and 1-year concentrations

The air samples collected in 2024 were analyzed by the California Department of Food and Agriculture's Center for Analytical Chemistry (CDFA). CDFA notified DPR that it had identified an error in the analyses conducted on samples collected via air canister which resulted in the underreporting of 1,3-D (CDFA 2025). 1,3-D concentrations in this report were corrected based on the correction factors provided by CDFA (CDPR 2025).

The 2024 regulation requires an assessment of the 24-hour and 1-year average air concentrations of 1,3-D from each of DPR's air monitoring stations that exceed the evaluation triggers shown in Table 1.

In 2024, none of the six air monitoring stations reported a 24-hour concentration exceeding 55 ppb evaluation trigger. The highest 24-hour concentration among all monitoring stations was 7.19 ppb in Shafter, which was below the 55 ppb threshold (Table 5). Similarly, none of the six air monitoring stations reported an annual average concentration higher than the evaluation trigger of 0.27 ppb. The highest 1-year concentration among all monitoring stations was 0.21 ppb in Shafter (Table 5).

Table 5. A comparison of the highest 24-hour and annual (1-year) air concentrations of 1,3-D in parts per billion (ppb) in 2024.

Location	Study	Date	24-hour concentration	1-year concentration
Delhi	309	04/02/24	1.42	0.11
Oxnard	257	07/25/24	0.96	0.04
Parlier	309	11/24/24	2.35	0.16
Santa Maria	257	09/30/24	0.40	0.04
Shafter	257	02/22/24	7.19	0.21
Watsonville	257	09/05/24	0.44	0.03

6. MODELING AIR CONCENTRATIONS

6.1. Highest-use townships

6.1.1. Township selection

As specified by 3 CCR section 6448.4(b)(1), the highest-use township in each of the top 10 highest-use counties was selected for evaluation. The selection was made based on the following criteria that provide a range of locations, crops, fumigation methods, and weather conditions for evaluation:

Step 1: To assign a township to one or more counties, calculate the fractional areas of a township in each county and apply a 10% cutoff threshold. For example, if Township X is located in three counties with fractional areas of 50% in County 1, 42% in County 2, and 8% in County 3, then County 3 is excluded, and Township X is considered only to be shared by Counties 1 and 2.

Step 2: Sort counties by 1,3-D ATP use. This list may have up to 58 ranked counties, depending on the number of counties reporting 1,3-D use in the year.

Step 3: To select the highest-use township in each county, three conditions were followed:

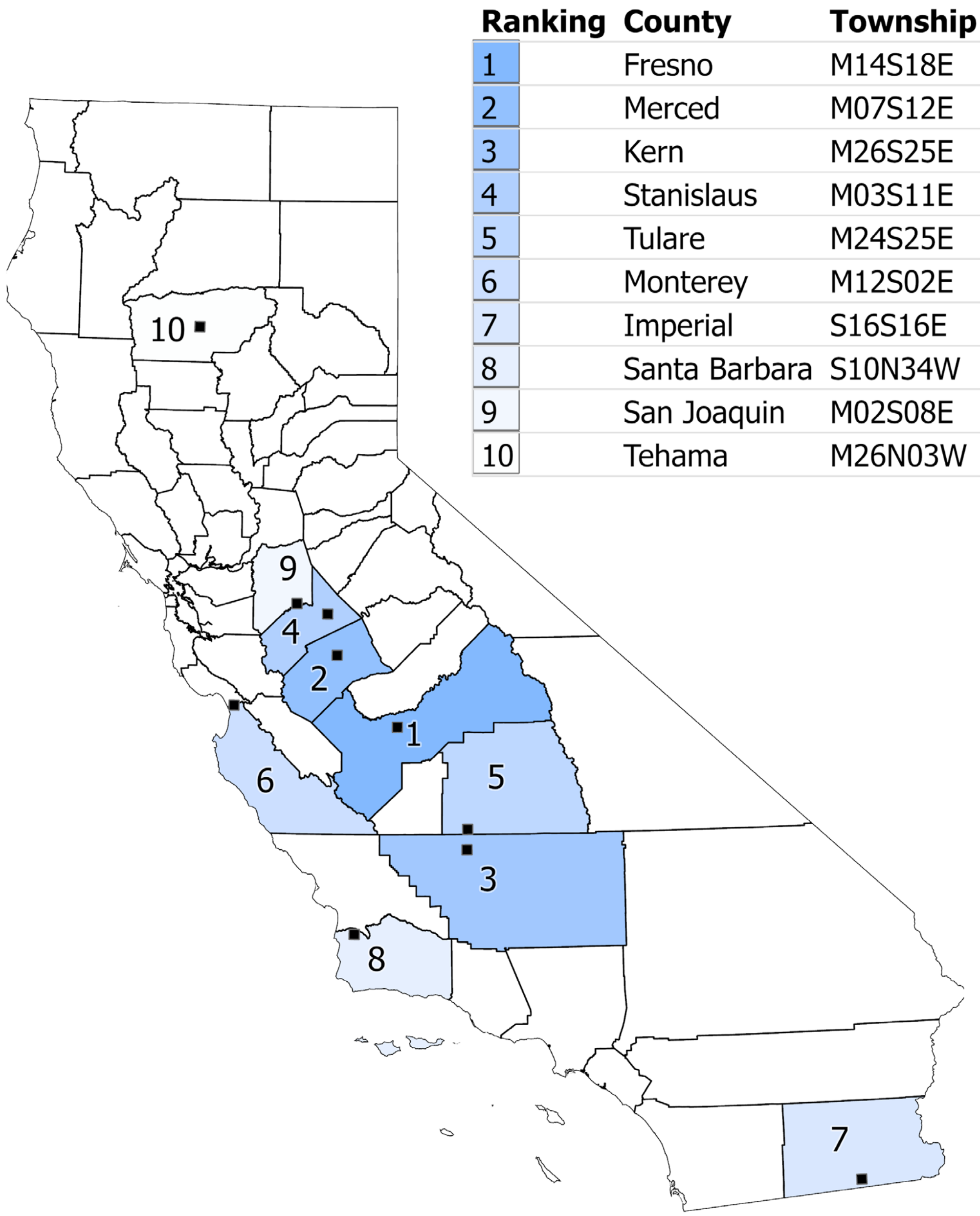
- Condition 1: if the highest-use township is located only in one county (not shared), then this township is selected to represent the county.
- Condition 2: if the highest-use township is located in more than one county (shared), then this township represents all the shared counties. The highest township from the next highest county is now included in the top 10 list. Additionally, all involved (shared) counties are removed from the “sorted list” (Step 2) and no longer participate in the township selection.
- Condition 3: if the highest-use township is adjacent to a township previously selected, the township with lower use and its county are removed from the county list. The highest township from the next highest county is now included in the top 10 list.

The above procedures are conducted based on the 1,3-D use data from 2024 in using ATP. The counties with the highest ATP of 1,3-D were Fresno, Merced, and Kern. The 10 selected townships for modeling and their represented counties are listed in Table 6 and Figure 6.

Table 6. Highest-use counties and their highest-use township, crop, and FFM in 2024.

Rank	County Name	County ATP	Township Location	Township ATP	Weather WBAN	Top Crop	Top FFM
1	Fresno	653,484	M14S18E	83,195	93193	Almonds	1226
2	Merced	560,800	M07S12E	113,628	23258	Sweet Potato	1224
3	Kern	407,851	M26S25E	71,283	23155	Almonds	1226
4	Stanislaus	334,060	M03S11E	65,641	23258	Almonds	1226
5	Tulare	295,351	M24S25E	67,422	23155	Grapes	1224
6	Monterey	285,349	M12S02E	73,541	23277	Strawberry	1242
7	Imperial	251,675	S16S16E	79,579	23199	Carrots	1201
8	Santa Barbara	167,289	S10N34W	62,861	23273	Strawberry	1259
9	San Joaquin	149,810	M02S08E	24,793	23237	Almonds	1224
10	Tehama	146,652	M26N03W	66,740	24216	Walnuts	1224

Weather-Bureau-Army-Navy (WBAN) is an identifier for stations operated by National Weather Service



Ranking	County	Township
1	Fresno	M14S18E
2	Merced	M07S12E
3	Kern	M26S25E
4	Stanislaus	M03S11E
5	Tulare	M24S25E
6	Monterey	M12S02E
7	Imperial	S16S16E
8	Santa Barbara	S10N34W
9	San Joaquin	M02S08E
10	Tehama	M26N03W

Figure 6. Map of California and the 10 highest-use counties of 1,3-D ATP in 2024. Black squares indicate the location of the highest-use townships in the county.

6.1.2. Modeling approach and results

Air concentrations of 1,3-D were simulated in AERFUM, an integrated air dispersion modeling system for soil fumigants developed by DPR (Luo, 2019). The current version of AERFUM uses the latest AERMOD v24142 (USEPA, 2024a). Meteorological data for 2024 are processed by the MetProc program (Luo, 2024) based on the latest data processor, AERSURFACE version 2024 (USEPA, 2024b), and the latest land use data, National Land Cover Dataset (NLCD) version 2021.

This study uses the same approach developed in the previous township cap modeling (Luo, 2022). The modeling results are presented as the 95th percentiles of the predicted annual average air concentrations, the highest 24-hour and 72-hour moving average air concentrations for each township. Using the highest-use townships along with weather data, modeling estimates show that the highest estimated 24-hour, 72-hour, and 1-year air concentrations of 1,3-D are 26.8, 15.1, and 0.41 ppb, respectively (Table 7); all of them were predicted in M07S12E (Merced County). None of the estimated air concentrations approached nor exceeded DPR's regulatory target concentrations of 55 ppb as a 72-hour average or 0.56 ppb as a 70-year average (only one year of data is available for comparison to the 70-year target).

Table 7. Highest-use townships and their estimated 95th percentile air concentrations in parts per billion (ppb) for the highest 24-hour, 72-hour average, and annual averages in 2024.

Rank	County	Township	1-year	72-hour	24-hour
1	Fresno	M14S18E	0.21	12.9	21.9
2	Merced	M07S12E	0.41	15.1	26.8
3	Kern	M26S25E	0.21	8.1	12.6
4	Stanislaus	M03S11E	0.12	7.2	13.6
5	Tulare	M24S25E	0.15	9.0	15.7
6	Monterey	M12S02E	0.18	4.8	8.3
7	Imperial	S16S16E	0.12	8.0	12.0
8	Santa Barbara	S10N34W	0.14	5.9	12.0
9	San Joaquin	M02S08E	0.09	5.6	10.7
10	Tehama	M26N03W	0.11	6.6	12.8

The 0.41 ppb annual value in Merced township M07S12E is higher than DPR's highest estimated one-year average of 0.35 ppb, estimated as part of an analysis of the impact of non-occupational bystander regulations on 1,3-D cancer risk (Segawa and Luo 2022). This prior estimate was informed by historical usage and meteorological data, paired with predictions of how usage patterns might shift following implementation of regulations. Per 3 CCR 6448.4(b)(2), DPR is required to describe actions that the department will take to address higher-than-expected levels with a timeline for action.

As required by regulation, DPR has performed refined modeling of usage within the township. The outcome of this refined evaluation is included in Appendix 3**.** This refined modeling takes into consideration actual field position data and the location of community boundaries, in comparison to the randomized placement used in the township cap modeling protocol used to develop those values in Table 7. The maximum observed 1-year value in this refined modeling was 0.25 ppb.

6.2. Monitoring stations

The 2024 regulation requires modeling the ambient air concentrations at the monitoring stations with 24-hour and 1-year exceedances. In 2024, no monitoring station exceeded either the 24-hour evaluation trigger of 55 ppb nor the 1-year evaluation trigger of 0.27 ppb (Table 5). Therefore, modeling of ambient air concentrations at monitoring stations is not included as part of this report.

7. CONTRIBUTING FACTORS

Per 3 CCR 6448.4(b)(2), the 1,3-D annual report is to evaluate the major factors affecting use levels and air concentrations in those townships and monitoring locations meeting criteria for inclusion in the annual report. Factors affecting use within a township may include crop type distribution, number of applications, average application size, and typical application rates. Factors affecting the degree to which 1,3-D usage will impact air concentrations include the prevailing application method within a township (Brown 2022) and seasonal distribution in 1,3-D application (Luo 2022). These factors can interact with one another in complex ways and no value taken alone may strongly predict air concentrations; however, these concepts are considered together in DPR's modeling process to predict township air concentrations (see Table 7), and the individual factors are discussed here in greater detail.

Because no monitoring sites met criteria for inclusion in this report, this evaluation is limited to the top 10 townships described in Table 6.

7.1. Factors affecting use levels

Crop distribution in each of the top townships was heavily weighted toward a single crop (see Table A2-1, Appendix 2). Top townships in Fresno, Kern, Stanislaus, Tulare, San Joaquin, and Tehama[3] counties were associated with tree and grape applications. Average application rates in these locations were near the per-acre maximum of 332 lbs/ac, while applications were primarily conducted with untarped deep field fumigation methods FFM 1224 or 1226 (see Table A2-2, Appendix 2). Average reported application block sizes in these townships varied widely, with top townships in Tulare and Stanislaus Counties characterized by low numbers of high-acreage applications (i.e., >40 acres), in contrast to the more numerous but smaller-acreage applications reported in other townships (Table 8).

[3] 65% of applications in Tehama county during 2024 did not specify crop, while the remaining 35% were attributed to walnut. However, application rates for records with unspecified crop type correspond to those used for tree and grape crops.

Table 8. Application statistics for each of the top 10 townships, including number of applications in 2024, average application acreage, average mass of 1,3-D applied, average application rate, and average ATP. Top townships are grouped by primary crop(s).

Main Crop	County	Township	Number of Apps.	Avg. Area (ac)	Avg. Applied (lbs)	Avg. Rate (lbs/ac)	Avg. ATP
Tree & Grape	Fresno	M14S18E	10	26	8,690	331	8,320
	Kern	M26S25E	26	19	6,215	326	2,742
	San Joaquin	M02S08E	11	10	3,174	328	2,254
	Stanislaus	M03S11E	5	70	22,984	330	13,128
	Tehama	M26N03W	25	17	5,578	330	2,670
	Tulare	M24S25E	6	45	14,861	328	11,237
Strawberry	Monterey	M12S02E	247	10	834	88	298
	Santa Barbara	S10N34W	43	31	3,504	115	1,462
Root Crops	Imperial	S16S16E	17	45	4,393	97	4,681
	Merced	M07S12E	65	23	2,668	117	1,748

Usage within the townships in Monterey and Santa Barbara counties was mainly for pre-plant applications to strawberries. Application rates in these locations averaged between 88 and 115 lbs/ac and were primarily conducted using FFM 1242, a lower-emission shallow injection broadcast application sealed with TIF tarp, and FFM 1259, a lower-emission method whereby 1,3-D is applied through drip lines in a raised bed system and the beds sealed under TIF tarp. Average block sizes varied, with an average block size of under 10 acres in Monterey County compared to an average field size of 31 acres in the Santa Barbara County township.

The last category of high-use townships was those associated with root vegetable crops, located in Merced and Imperial counties. Average application rates in these areas varied from 97 to 117 lbs/ac and were conducted mainly using untarped broadcast methods, mostly FFM 1201 (untarped shallow broadcast) or FFM 1206 (untarped deep broadcast) on carrots in Imperial County, or FFM 1224 (untarped 24-inch deep broadcast) and its variants being used on sweet potato applications in Merced County (see Table A2-3, Appendix 2). Average application block sizes were 45 acres in Imperial County and 23 acres in Merced County, with a total of 17 and 65 applications performed in each county, respectively.

7.2. Factors affecting air concentrations

Meteorology interacts with 1,3-D emissions in complex ways that may influence the degree to which emissions will affect air concentrations. Broadly, emissions in the winter will increase air concentrations more than if the same level of emissions were to occur in warmer months, due in part to the presence of inversion layers which inhibit the dilution and mixing of 1,3-D upward into the air column. The application factors developed by DPR (see Table 2) aim to quantify these relative impacts of meteorology depending on season and application site location, combined with the estimated proportion of fumigant emitted based on application method, thereby producing the quantity of ATP.

Table 9 summarizes the distribution of winter versus non-winter usage of 1,3-D within each of the top townships. The proportion of wintertime applications ranged from 0 to 92%, with the highest proportion of wintertime applications occurring in township M14S18E, located in Fresno County. In general, higher proportions of wintertime applications occurred in inland regions where use was mostly dedicated to pre-plant applications for tree and grape crops, but this varied by county and the top township in Kern had no reported wintertime usage. Applications in top townships where usage was primarily dedicated to strawberries likewise had near-zero wintertime usage.

Table 9. Relative winter versus non-winter usage in each township, and total use, reported as pounds of active ingredient applied. The ATP value is also provided, demonstrating how seasonal effects and application method choice are estimated to mediate the relationship between mass applied and air concentrations.

Rank	County	Township	Nonwinter Use	Winter Use	Total Use	Township ATP
1	Fresno	M14S18E	7,126	79,775	86,901	83,195
2	Merced	M07S12E	114,664	58,738	173,403	113,628
3	Kern	M26S25E	161,578	0	161,578	71,283
4	Stanislaus	M03S11E	94,765	20,153	114,918	65,641
5	Tulare	M24S25E	41,810	47,354	89,163	67,422
6	Monterey	M12S02E	205,927	0	205,927	73,541
7	Imperial	S16S16E	74,677	0	74,677	79,579
8	Santa Barbara	S10N34W	148,500	2,180	150,680	62,861
9	San Joaquin	M02S08E	19,464	15,451	34,915	24,793
10	Tehama	M26N03W	138,960	501	139,461	66,740

Differences in application method also contributed to variation in estimated air concentrations across the evaluated townships. For instance, township M12S02E, located in Monterey County, was associated with by far the greatest overall use in terms of 1,3-D mass applied; however, due to the use of lower-emission application methods, both ATP within the county and estimated annual air concentrations ranked fourth among those townships evaluated (Table 6). In contrast, township M14S18E, located in Fresno County, ranked eighth in terms of total 1,3-D mass applied, but the majority of applications were carried out in the winter using untarped application methods, and the township ultimately ranked second in terms of ATP and tied for second in estimated annual air concentration.

8. CONCLUSIONS

In accordance with Title 3 CCR §6448.4, this annual report evaluates the effectiveness of DPR Regulation 22-005 by identifying and assessing selected high-use townships and monitoring stations. Key findings from 2024 include:

- 7,019,748 pounds of 1,3-D were used on 43,768 acres statewide, resulting in 4,064,020 ATP and 1,300,112 pounds of emissions. These are the lowest amounts since 2009.
- The commodities with the highest 1,3-D usage were almonds, strawberries, sweet potatoes, and carrots.
- A majority of applications that historically used FFM 1206 and 1210 transitioned to FFM 1224 and 1226, especially among almond growers.
- Using computer modeling, estimated township concentrations for 1-year, 72-hours, and 24-hours did not exceed DPR's regulatory target concentrations.
- Estimated concentrations from refined modeling in township M07S12E were below chronic screening levels.
- No monitoring station exceeded the evaluation triggers of 55 ppb for a 24-hour period or 0.27 ppb as a 1-year average.

DPR regulation 22-005 addresses 72-hour acute risk and 70-year lifetime cancer risk to residents/non-occupational bystanders by implementing setback distances, requiring deeper injection, soil with higher moisture, and introducing new fumigation methods and tarp requirements.

DPR's PUR data analyses on high-use townships and ambient air concentrations from air monitoring stations indicate that current regulatory measures are effective. There is no evidence at this time to suggest that additional actions are necessary to meet the regulatory goals of DPR Regulation 22-005.

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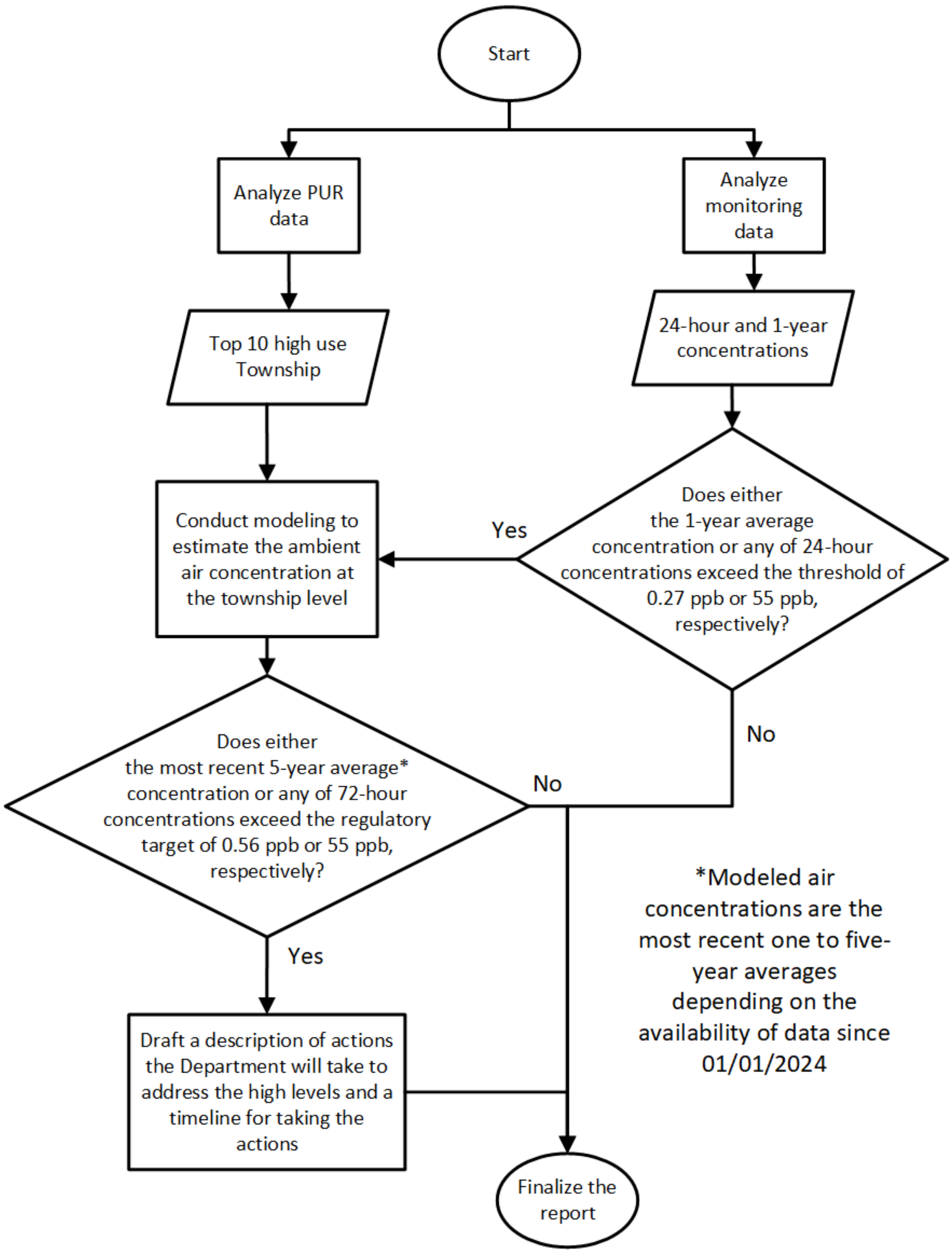
APPENDIX 1

Chart illustrating process to evaluate 1,3-D high-use townships and air monitoring data



APPENDIX 2

Table A2-1. Detailed breakdown of usage by crop within each top township during 2024. Table includes any crop accounting for 1% or more of total use within the township.

Rank	Township	County	Crop	Acreage Treated	1,3-D Applied (lbs)	Mean Rate (lbs/ac)	Fraction of Use
1	M14S18E	FRESNO	ALMOND	262	86,901	331	1.00
2	M07S12E	MERCED	SWEET POTATO	1,471	170,489	116	0.98
			PEACH	9	2,913	317	0.02
3	M26S25E	KERN	ALMOND	424	138,341	326	0.86
			N-OUTDR CONTAINER/FLD GRWN PLANTS	72	23,238	323	0.14
4	M03S11E	STANISLAUS	ALMOND	327	107,890	330	0.94
			WALNUT	21	7,028	332	0.06
5	M24S25E	TULARE	GRAPES	272	89,163	328	1.00
6	M12S02E	MONTEREY	STRAWBERRY (ALL OR UNSPEC)	2,193	197,344	90	0.96
			BRUSSELS SPROUTS	140	6,927	49	0.03
			RASPBERRY (ALL OR UNSPEC)	20	1,655	83	0.01
7	S16S16E	IMPERIAL	CARROTS	768	74,677	97	1.00
8	S10N34W	SANTA BARBARA	STRAWBERRY (ALL OR UNSPEC)	1,252	140,769	112	0.93
			N-OUTDR GRWN CUT FLWRS OR GREENS	60	9,827	165	0.07
9	M02S08E	SAN JOAQUIN	ALMOND	97	31,599	327	0.91
			WHEAT	10	3,315	332	0.09
10	M26N03W	TEHAMA	SOIL APPLICATION	273	90,066	330	0.65
			WALNUT	150	49,395	330	0.35

Table A2-2. Detailed breakdown of field fumigation methods used within each top township during 2024. Table includes any FFM accounting for 1% or more of total use within the township.

Rank	Township	County	FFM	Method Description	Acreage Treated	1,3-D Applied (lbs)	Fraction of Use
1	M14S18E	FRESNO	1226	Nontarpaulin/24 inches deep/strip	198	65,517	0.75
			1224	Nontarpaulin/24 inches deep/broadcast	65	21,383	0.25
2	M07S12E	MERCED	1224	Nontarpaulin/24 inches deep/broadcast	1,431	166,157	0.96
			1226	Nontarpaulin/24 inches deep/strip	25	4,814	0.03
			1225	Tarpaulin/24 inches deep/broadcast	19	1,880	0.01
3	M26S25E	KERN	1226	Nontarpaulin/24 inches deep/strip	424	138,341	0.86
			1242	Tarpaulin/shallow/broadcast (w/ TIF)	72	23,238	0.14
4	M03S11E	STANISLAUS	1226	Nontarpaulin/24 inches deep/strip	348	114,918	1.00
5	M24S25E	TULARE	1224	Nontarpaulin/24 inches deep/broadcast	272	89,163	1.00
6	M12S02E	MONTEREY	1242	Tarpaulin/shallow/broadcast (w/ TIF)	1,636	134,951	0.66
			1259	Chemigation (drip system)/TIF tarpaulin	577	64,048	0.31
			1201	Nontarpaulin/shallow/broadcast or bed	140	6,927	0.03
7	S16S16E	IMPERIAL	1206	Nontarpaulin/deep/broadcast	447	43,806	0.59
			1201	Nontarpaulin/shallow/broadcast or bed	321	30,871	0.41
8	S10N34W	SANTA BARBARA	1259	Chemigation (drip system)/TIF tarpaulin	1,145	125,382	0.83
			1242	Tarpaulin/shallow/broadcast (w/ TIF)	167	25,298	0.17
9	M02S08E	SAN JOAQUIN	1226	Nontarpaulin/24 inches deep/strip	91	29,887	0.86
			1224	Nontarpaulin/24 inches deep/broadcast	15	5,027	0.14
10	M26N03W	TEHAMA	1224	Nontarpaulin/24 inches deep/broadcast	419	138,251	0.99
			1230	Nontarpaulin/tree-hole	4	1,211	0.01

Table A2-3. Detailed breakdown of field fumigation method by crop within each top township during 2024. Every reported combination of crop and field fumigation method (FFM) is listed.

Rank	Township	County	Crop	FFM	Acreage Treated	1,3-D Applied (lbs)
1	M14S18E	FRESNO	ALMOND	1226	198	65,517
			ALMOND	1224	65	21,383
2	M07S12E	MERCED	PEACH	1226	9	2,913
			SWEET POTATO	1224	1,431	166,157
			SWEET POTATO	1226	16	1,900
			SWEET POTATO	1225	19	1,880
			SWEET POTATO	1242	5	552
3	M26S25E	KERN	ALMOND	1226	424	138,341
			N-OUTDR CONTAINER/FLD GRWN PLANTS	1242	72	23,238
4	M03S11E	STANISLAUS	ALMOND	1226	327	107,890
			WALNUT	1226	21	7,028
5	M24S25E	TULARE	GRAPES	1224	272	89,163
6	M12S02E	MONTEREY	BRUSSELS SPROUTS	1201	140	6,927
			RASPBERRY (ALL OR UNSPEC)	1242	20	1,655
			STRAWBERRY (ALL OR UNSPEC)	1242	1,616	133,296
			STRAWBERRY (ALL OR UNSPEC)	1259	577	64,048
7	S16S16E	IMPERIAL	CARROTS	1206	447	43,806
			CARROTS	1201	321	30,871
8	S10N34W	SANTA BARBARA	BLACKBERRY	1242	1	83
			LETTUCE	1259	0	1
			N-OUTDR GRWN CUT FLWRS OR GREENS	1242	60	9,827
			STRAWBERRY (ALL OR UNSPEC)	1259	1,145	125,381
			STRAWBERRY (ALL OR UNSPEC)	1242	107	15,388
9	M02S08E	SAN JOAQUIN	ALMOND	1226	91	29,887
			ALMOND	1224	5	1,712

			WHEAT	1224	10	3,315
10	M26N03W	TEHAMA	SOIL APPLICATION	1224	273	90,066
			WALNUT	1224	146	48,185
			WALNUT	1230	4	1,211

APPENDIX 3