Monitoring of 1,3-Dichloropropene in Fresno and Merced Counties: Results for 2023

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1. Introduction

The soil fumigant 1,3-dichloropropene (1,3-D), also known as Telone®, is one of the most used fumigants in California and plays a critical role in agricultural industries by protecting crops from nematodes in the soil and soil-borne diseases. A portion of the applied chemical can disperse into the atmosphere depending on the field fumigation method used during application as well as environmental conditions. In 2017, the California Department of Pesticide Regulation (DPR) eliminated 1,3-D use in December and restricted the total allotted application amount within each township - a 6x6 square mile area - to a maximum of 136,000 adjusted pounds (a weighting method to account for emissions based on application method, month, and region) in a calendar year (DPR 2016).

In 2016, DPR evaluated the reported 1,3-D pesticide use to identify and rank communities surrounded by the highest 1,3-D use. DPR prioritized regions outside the coverage area of DPR's Air Monitoring Network and the California Air Resources Board's (CARB) Toxic Air Contaminant programs. As a result, DPR selected two communities in the Central Valley: Delhi (Merced County) and Parlier (Fresno County). This monitoring study aims to identify the presence of ambient air concentrations of 1,3-D in regions of high use, compare measured air concentrations to sub-chronic and chronic human health screening levels, and evaluate the effectiveness of the current township cap on chronic ambient concentrations. Although we evaluate short-term exposure as a part of this project for comparison purposes, DPR emphasizes that this study is designed to evaluate long-term ambient air concentrations of 1,3-D in regions of higher use. Therefore, sampling, and analytical methods used for this study are specifically designed to achieve these goals. DPR staff collected weekly 24-h air samples to monitor 1,3-D in these two communities beginning in November 2016.

This report evaluates the results of samples collected from January 1, 2023, through December 31, 2023, and is the seventh report for this multi-year study.

2. Methods

2.1 Field and Laboratory Methods

From January 1, 2023, through December 31, 2023, one 24-h ambient air sample (primary sample) was collected each week on a randomly assigned day of the week at Delhi and Parlier. Sample start times varied between 7 am to 3 pm, as they were left to the discretion of individual field staff. Samples were collected using a 6-liter SilcoCan® canister (Restek cat. no. 24142-65) pre-evacuated to a pressure of -30" Hg placed on a Xonteck 901 Model automated active sampler. If the Xonteck 901 sampler malfunctioned or was unavailable, a Veriflow SC423XL flow controller (i.e., a regulator) attached to the SilcoCan® canister was used to conduct the air sampling. Xonteck flow rates were set to 7.5 mL/min and regulator samples were targeted to 3.0 mL/min. Acceptable flow rates ranged within +/- 10% of the targeted rate (Appendix V). Approximately once a month, a collocated sample (which was placed adjacent to the primary samples) was collected. Delhi was chosen as the collocated site and was used as the quality control monitoring station. All samples were collected using the same standard air

sampling procedures (Appendix V). Samples were analyzed by the California Department of Food and Agriculture's Center for Analytical Chemistry (CDFA CAC) Laboratory using method EMON-SM-05-019 (Appendix VI). In May 2022, CDFA CAC Laboratory updated their lab method introducing new method detection limits (MDL) for each 1,3-D isomer, and Trace as a reportable result. CDFA CAC Laboratory followed DPR's standard lab quality control procedures and conducted laboratory blanks and laboratory spikes during each analytical run (CDFA 2022).

2.2 Data Analysis

DPR aggregates the laboratory results of 1,3-D isomers (*cis* and *trans*) per sample as the total 1,3-D concentration. The aggregated values are compared with current health-based screening levels and regulatory targets for each year. When calculating average concentrations, DPR applies a substitution to non-detections (NDs) and trace values. Data collected before May 2022 substituted one-half of the reporting limit (RL) for ND results. However, if either *cis* or *trans* isomers of 1,3-D were detected, then the total 1,3-D result would equal the value of that detection and no substitution would be used for the respective ND isomer. Once CDFA CAC updated the laboratory method in May 2022, a RL of 0.01 parts per billion (ppb) remains for each isomer. MDL values were updated to the following: *cis*-1,3-D is equal to 0.00815 ppb and *trans*-1,3-D is 0.00655 ppb. In this update, Trace values were introduced. A Trace detection is a value somewhere between the MDL and the RL. Therefore, Trace values are substituted using the following formula: (MDL+RL)/2.

Average concentrations of 1,3-D are calculated for acute, sub-chronic, chronic, and lifetime periods (Table 1). DPR's sampling methods are limited to a 24-h sample which is used to compare to the established 72-h acute exposure level. A rolling average of 90 days (13 consecutive weeks) is used to calculate a sub-chronic exposure. The one-year average concentration is used to determine the chronic exposure. The lifetime exposure of 1,3- D has a regulatory target of 0.56 ppb. This value is derived from submitted toxicology studies and is based on a set of assumptions for one person's cancer risk over a 70-year average of inhalation exposure (DPR 2016). In the absence of 70 years' worth of 1,3-D monitoring data, DPR uses the average concentrations from the start of this study, beginning in December 2016, to calculate lifetime exposure. To determine the risk associated for each exposure period, DPR uses a Hazard Quotient (HQ). The HQ is calculated as a ratio of the measured 1,3-D concentrations to a screening level or a regulatory target. An HQ of greater than one indicates exceedance of the screening level and requires DPR to act to further evaluate the data and assess possible mitigation measures (DPR 2011).

Table 1. Screening levels (SL) and regulatory target (RT) for 1,3-dichloropropene.

Exposure	Exposure Period	SL / RT (ppb)	Potential Health Effect
Acute	72 hours	55	Change in body weight
Sub-chronic	90 days	3	Tissue damage in nose and lung
Chronic	1 year	2	Tissue damage in nose and lung
Lifetime/Cancer Risk	70 years	0.56	Cancer

2.3 Study Limitations

This study has several limitations, including: (1) monitoring is conducted once a week for 24-h to address the study's goal of long-term ambient air of 1,3-D monitoring in a high-use region. (2) Similarly, air monitoring results are compared to acute screening levels which are based on submitted toxicology studies that reference a 72-h acute period, rather than a 24- h period. Due to current field methods, DPR is not able to collect the longer 72-h air sample. Therefore, DPR practice is to collect 24-h sampling results and compare them to established screening levels. (3) The lifetime/cancer risk requires 70 years of data. However, this study was initiated at the end of 2016, so the lifetime risk period is limited to 7 years.

3. **Air Monitoring Results**

In 2023, a total of 104 valid primary samples were collected from the two sites in Delhi and Parlier (Appendices I and II). All samples collected were valid. During the 2023 calendar year, 1,3-D was detected in 31% of air samples collected from both sites.

3.1 Delhi

Fifty-two (52 out of 52 possible samples) valid primary samples were collected at the Delhi site. Twenty-seven percent of Delhi samples were above the RL in 2023 (14 out of 52 samples). Quantifiable detections (above the RL of 0.01 ppb) ranged from 0.0141 to 0.2577 ppb (Figure 1). Thirty-five samples resulted in NDs. The remaining samples were two ND/Trace and one Trace/ND combination. No detection exceeded established targets for acute, sub-chronic, chronic, or lifetime exposures. The mean annual concentration for Delhi was 0.031 ppb and a median of 0.0075 ppb in 2023. Table 2 summarizes the maximum observed concentrations for each exposure period for Delhi. Results for acute, sub-chronic, chronic, and lifetime exposure categories were below an HQ of 1.0. The highest observed HQ in 2023 was 0.5 which corresponds to the lifetime exposure period.

Table 2. Delhi's maximum concentrations for each exposure period.

Exposure	Exposure Period	1,3-D (ppb)	SL / RT (ppb)	Hazard Quotient**
Acute	72 hours*	0.26	55	0.005
Sub-chronic	90 days	0.31	3	0.10
Chronic	1 year	0.031	2	0.02
Lifetime	70 years	0.28***	0.56	0.5

* Compared using a 24-hr sample

** Calculated as the ratio of measured concentration to screening level

*** Calculated from available data Dec. 2016-Dec. 2023

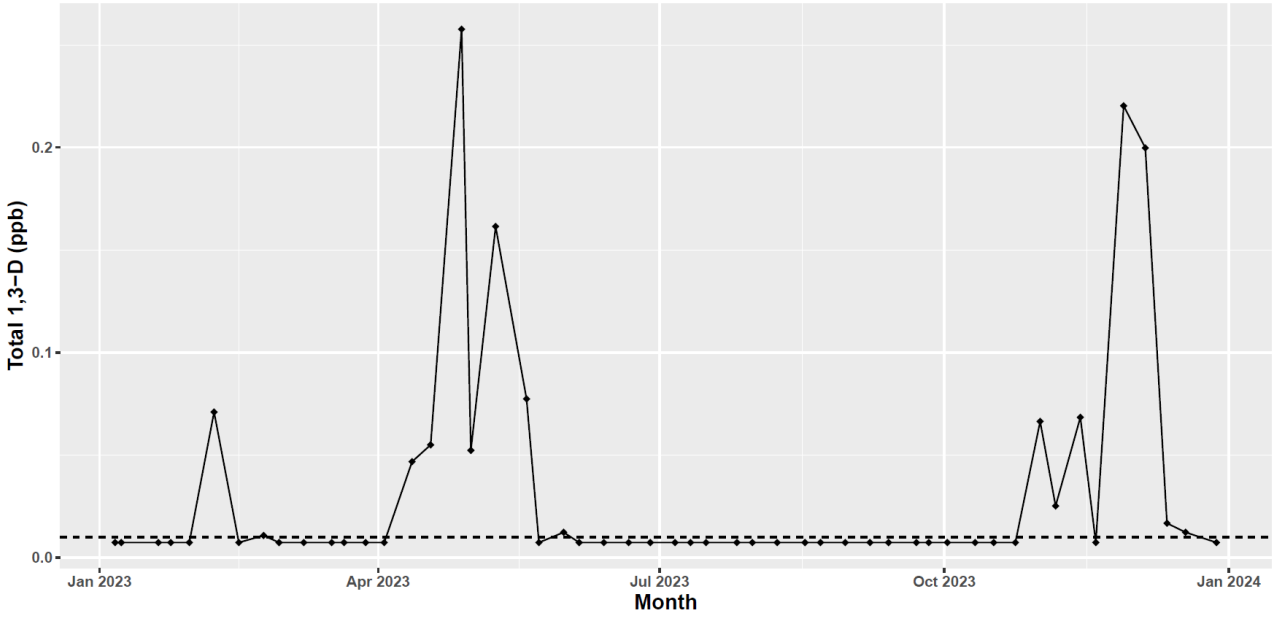

Figure 1. 2023 1,3-D air concentrations in Delhi. The dashed horizontal line is the reporting limit (RL).

3.2 Parlier

In Parlier, of the 52 possible air samples, all samples were valid. 1,3-D was detected in 36% of the air samples (18 of 52 samples). Thirty samples resulted in NDs. The remaining samples were two Trace/ND, ND/Trace, and Trace/Trace combinations. No exceedances for acute, subchronic, and chronic targets were seen in 2023. Quantifiable detections in 2023 ranged from 0.02 to 0.69 ppb (Figure 2) with the annual mean and median concentrations of 0.07 ppb and 0.0075 ppb, respectively.

Aggregating the measured air concentrations at the Parlier monitoring site from December 2016 through December 2023, staff found that an exceedance of the established regulatory target for lifetime exposure continues (Table 3). This is largely due to a single high detection of 111 ppb in October 2018 and not a direct result of concentrations from 2023 (Gonzalez, 2019). DPR implemented new 1,3-D regulations to mitigate non-occupational exposures to 1,3-D (DPR, 2023). These regulations went into effect January 1, 2024.

Table 3. Parlier's maximum concentrations for each exposure period.

Exposure	Exposure Period	1,3-D (ppb)	SL / RT (ppb)	Hazard Quotient**
Acute	72 hours*	0.69	55	0.013
Sub-chronic	90 days	2.1	3	0.70
Chronic	1 year	0.07	2	0.035
Lifetime	70 years	0.95***	0.56	1.7

* Compared using a 24-hr sample

** Calculated as the ratio of measured concentration to screening level

*** Calculated from available data Dec. 2016-Dec. 2023

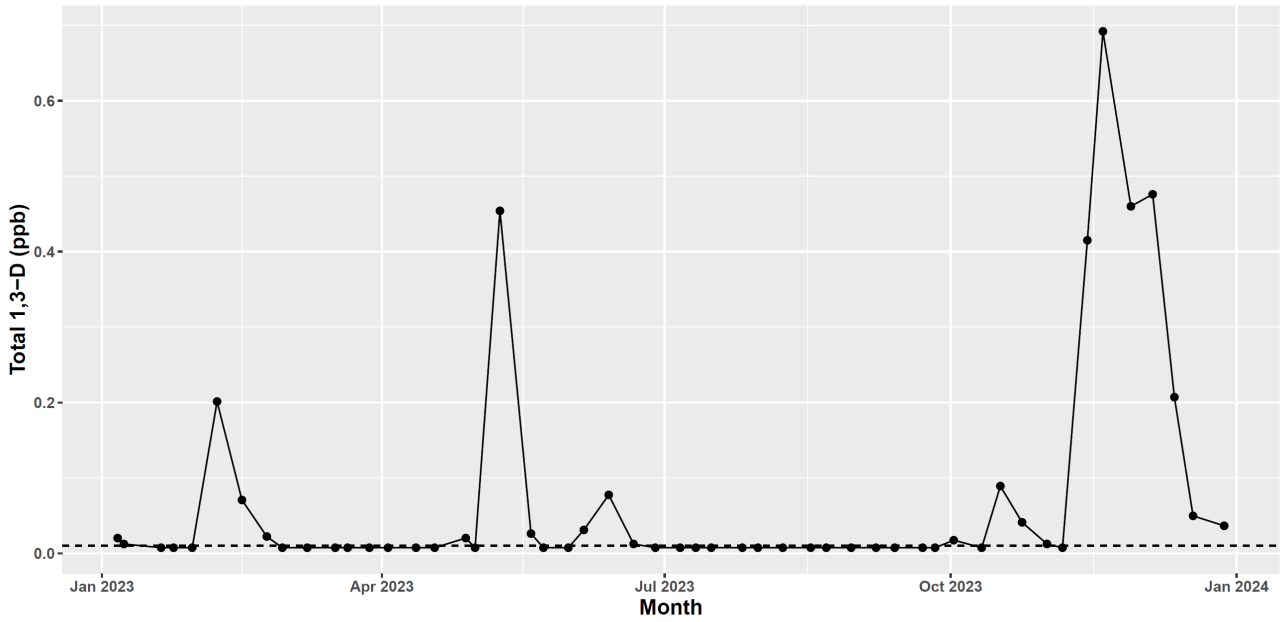

Figure 2. 2023 1,3-D air concentrations in Parlier. The dashed horizontal line is the reporting limit (RL).

4. Quality Assurance Results

4.1 Collocated Samples

During 2023, 10 collocated paired air samples were valid and collected from the Delhi site. Nine pairs of sample results reported NDs for the primary sample and the collocated sample; thus, DPR was not able to calculate a relative percent difference for these pairs. One pair (A464/A465) had measurable detections above the RL resulting in an average relative percent difference of 9%. To minimize differences in calculated relative percent difference largely due to low concentrations, the absolute relative difference was divided by the acute screening level of 55 ppb. Table 4 summarizes the results of the 10 collocated samples.

Table 4. Summary of collocated sample results and absolute relative percent difference.

Sample Date	Primary Sample	Primary Result (ppb)	Collocated Sample	Collocated Result (ppb)	|Relative % Difference|	|Relative % Difference/ Acute|
1/24/2023	A449	ND	A450	ND	N/A	N/A
3/8/2023	A456	ND	A456	ND	N/A	N/A
4/28/2023	A464	0.2577	A465	0.2355	9	1
6/21/2023	A474	ND	A475	ND	N/A	N/A
7/26/2023	A480	ND	A481	ND	N/A	N/A
8/8/2023	A483	ND	A484	ND	N/A	N/A
9/13/2023	A490	ND	A491	ND	N/A	N/A
10/11/2023	A495	ND	A496	ND	N/A	N/A

10/17/2023	A497	ND	A498	ND	N/A	N/A
11/19/2023	A503	ND	A504	ND	N/A	N/A

4.2 Laboratory Spikes and Blanks

For quality assurance purposes, the CDFA CAC Laboratory conducted 41 laboratory spikes when performing the air sample analysis. Spike recovery rates averaged 98.1% (SD = 7.8) and 98% (SD = 7.9) for the *cis*- and *trans*- isomers, respectively. In addition, 41 laboratory blanks were evaluated; no cross contamination was detected in these samples. Appendices III and IV include Individual results of laboratory spikes and laboratory blanks.

5. **Discussion**

5.1 December Air Concentrations

Current 1,3-D permit conditions do not allow the application of 1,3-D during December. Quantifiable, low-level detections of 1,3-D were present in six out of eight samples collected from Delhi and Parlier during December. In Delhi, low-level detections exhibit a decreasing trend from 0.1998 ppb to non-detectable (ND) levels. Similarly, in Parlier, there was a decrease in low-level detections from 0.476 to 0.0364 ppb. For untarped applications of 1,3-D, studies have shown that the fumigant's cumulative emission tends to stabilize roughly two weeks after application (Gao et al. 2008, Gao and Trout 2007), which may partially explain the low levels of detections seen during December even in the absence of 1,3-D applications.

5.2 Comparisons to Previous Year

All maximum concentrations for acute, sub-chronic, and chronic exposure levels decreased in Delhi and Parlier in 2023 when compared to 2022 (Figures 3 and 4, Tables 5 and 6).

In Delhi, the maximum acute (1-day) exposure decreased 91% from 2.79 to 0.26 ppb, the maximum sub-chronic (90-day) decreased 50% from 0.62 to 0.31 ppb, and the chronic (1-year) exposure decreased 89% from 0.28 to 0.03 ppb (Table 5). Likewise, the cumulative lifetime exposure decreased from 0.315 to 0.28 ppb.

In Parlier, the maximum acute (1-day) concentration decreased 94% from 10.82 ppb to 0.69 ppb, the sub-chronic (90-day) concentration decreased 12% from 2.38 to 2.1 ppb, and the maximum chronic (1-year) average exposure decreased 91% from 0.78 to 0.07 ppb (Table 6, Figure 4). Likewise, the cumulative lifetime exposure decreased from 1.1 to 0.95 ppb.

Table 5. Maximum Delhi air concentrations (ppb) by year.

Monitoring Period	2017	2018	2019	2020	2021	2022	2023
1 day	1.06	1.8	2.04	3.75	9.37	2.79	0.26
90 days	0.29	0.48	0.42	1	2.29	0.62	0.31
1 year	0.13	0.19	0.15	0.46	0.68	0.28	0.031
Lifetime	0.28						

Table 6. Maximum Parlier air concentrations (ppb) by year.

Monitoring Period	2017	2018	2019	2020	2021	2022	2023
1 day	15.96	111.29	2.07	10.61	24.93	10.82	0.69
90 days	1.83	10.53	0.78	1.62	3.3	2.38	2.1
1 year	0.62	2.94	0.27	0.51	1.55	0.78	0.07
Lifetime	0.95						

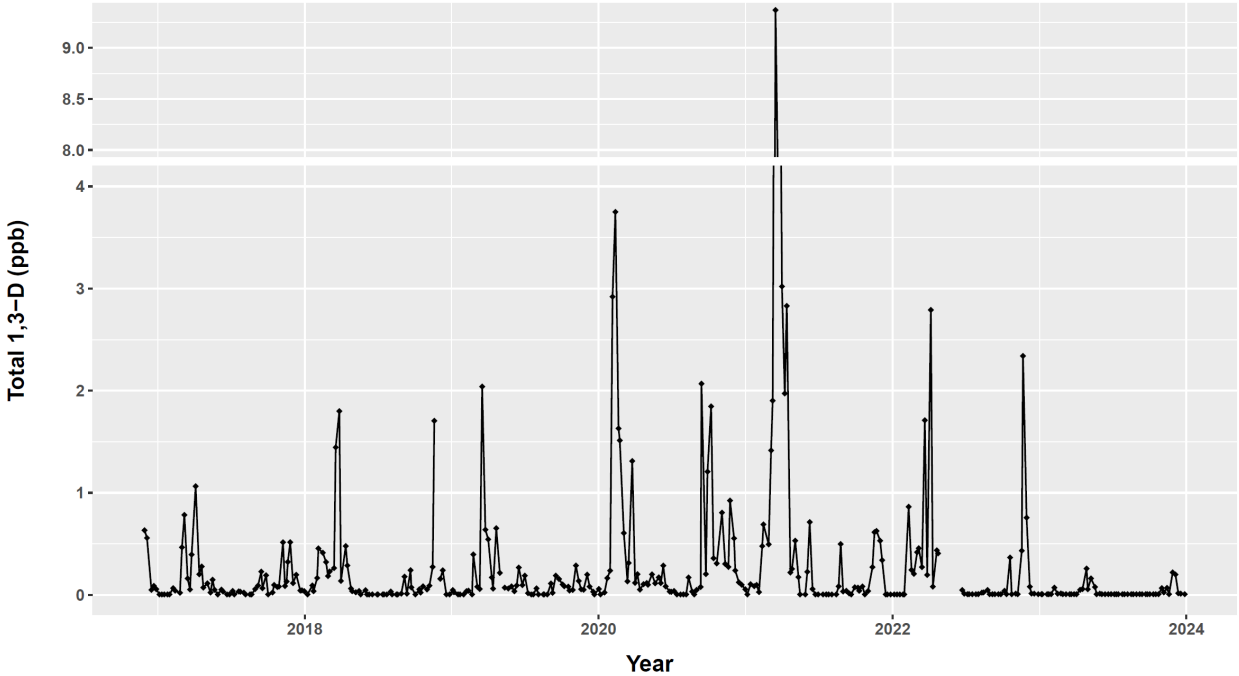

Figure 3. Delhi air concentrations since the beginning of the study from December 2016 to December 2023.

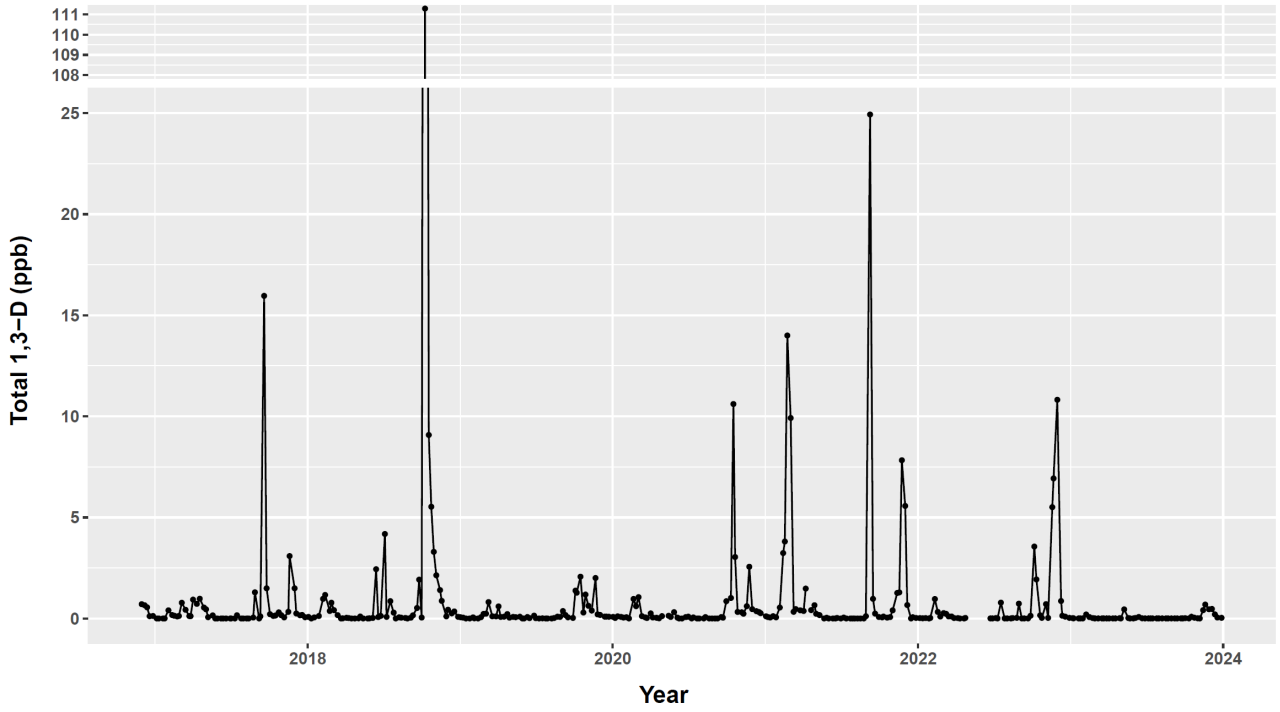

Figure 4. Parlier air concentrations since the beginning of the study from December 2016 to December 2023.

6. Conclusion

The year 2023 marked the seventh consecutive year of 1,3-D ambient monitoring in the communities of Delhi and Parlier. The ambient 1,3-D results collected from this study continue to supply meaningful information for the evaluation of acute, sub-chronic, chronic, and lifetime exposures in high-use communities. Delhi's 1,3-D concentrations seen in calendar year 2023 were below currently established thresholds of 1,3-D for acute, sub-chronic, chronic, and lifetime exposures. In Parlier, concentrations of 1,3-D were below acute, sub-chronic, and chronic exposures. Lifetime exposures were above currently established thresholds in Parlier. DPR implemented new 1,3-D regulations to mitigate non-occupational exposures to 1,3-D (DPR, 2023) which went into effect on January 1, 2024.

References

CDFA (2022). Determination of Bromomethane, cis-1,3-Dichloropropene and trans-1,3-Dichloropropene in Air Samples Collected in Summa Canisters. California Department of Food and Agriculture. Sacramento, CA.

DPR (2011). Air monitoring network study: Long-term ambient air monitoring for pesticides in multiple California communities. Department of Pesticide Regulation, California. Sacramento, CA.

DPR (2016). Risk management directive and mitigation guidance for cancer risk from 1,3-dichloropropene (1,3-D). California Department of Pesticide Regulation. Sacramento, CA.

DPR (2023). DPR 22-005 Health Risk Mitigation and Volatile Organic Compound Emission Reduction for 1,3-Dichloropropene. California Department of Pesticide Regulation. Sacramento, CA.

Gao, S., Trout, T. J., & Schneider, S. (2008). Evaluation of fumigation and surface seal methods on fumigant emissions in an orchard replant field. Journal of Environmental Quality, 37(2), 369-377.

Gao, S., & Trout, T. J. (2007). Surface seals reduce 1, 3-dichloropropene and chloropicrin emissions in field tests. Journal of Environmental Quality, 36(1), 110-119.

Gonzalez, J. (2019). Monitoring of 1,3-Dicloropropene in Merced and Fresno Counties Results for 2018. Sacramento, CA: Department of Pesticide Regulation, California Environmental Protection Agency.

Appendices

Appendix I. Raw data for Delhi. Total 1,3-D is the sum of *cis* and *trans* 1,3-d.

Sample Date	Sample ID	Total 1,3-D (ppb)	Cis 1,3-D (ppb)	Trans 1,3-D (ppb)
1/6/2023	309-A446	0.00735	ND	ND
1/8/2023	309-A447	0.00735	ND	ND
1/20/2023	309-A448	0.00735	ND	ND
1/24/2023	309-A449	0.00735	ND	ND
1/30/2023	309-A451	0.00735	ND	ND
2/7/2023	309-A452	0.071	0.044	0.027
2/15/2023	309-A453	0.01235	Trace	ND
2/23/2023	309-A454	0.014075	0.0108	ND
2/28/2023	309-A455	0.00735	ND	ND
3/8/2023	309-A456	0.00735	ND	ND
3/17/2023	309-A458	0.00735	ND	ND
3/21/2023	309-A459	0.00735	ND	ND
3/28/2023	309-A460	0.00735	ND	ND
4/3/2023	309-A461	0.00735	ND	ND
4/12/2023	309-A462	0.050075	0.0468	ND
4/18/2023	309-A463	0.058275	0.055	ND
4/28/2023	309-A464	0.2577	0.158	0.0997
5/1/2023	309-A466	0.055575	0.0523	ND
5/9/2023	309-A468	0.1615	0.0865	0.075
5/19/2023	309-A469	0.0774	0.0399	0.0375
5/23/2023	309-A470	0.00735	ND	ND
5/31/2023	309-A471	0.01235	ND	Trace
6/5/2023	309-A472	0.00735	ND	ND
6/13/2023	309-A473	0.00735	ND	ND
6/21/2023	309-A474	0.00735	ND	ND
6/28/2023	309-A476	0.00735	ND	ND
7/6/2023	309-A477	0.00735	ND	ND
7/11/2023	309-A478	0.00735	ND	ND
7/16/2023	309-A479	0.00735	ND	ND
7/26/2023	309-A480	0.00735	ND	ND
7/31/2023	309-A482	0.00735	ND	ND
8/8/2023	309-A483	0.00735	ND	ND
8/17/2023	309-A485	0.00735	ND	ND
8/22/2023	309-A486	0.00735	ND	ND

Sample Date	Sample ID	Total 1,3-D (ppb)	Cis 1,3-D (ppb)	Trans 1,3-D (ppb)
8/30/2023	309-A487	0.00735	ND	ND
9/7/2023	309-A489	0.00735	ND	ND
9/13/2023	309-A490	0.00735	ND	ND
9/22/2023	309-A492	0.00735	ND	ND
9/26/2023	309-A493	0.00735	ND	ND
10/2/2023	309-A494	0.00735	ND	ND
10/11/2023	309-A495	0.00735	ND	ND
10/17/2023	309-A497	0.00735	ND	ND
10/24/2023	309-A499	0.00735	ND	ND
11/1/2023	309-A500	0.0664	0.0446	0.0218
11/6/2023	309-A501	0.0252	0.0122	0.0130
11/14/2023	309-A502	0.0684	0.0414	0.027
11/19/2023	309-A503	0.00735	ND	ND
11/28/2023	309-A505	0.2203	0.141	0.0793
12/5/2023	309-A507	0.1998	0.0948	0.105
12/12/2023	309-A508	0.016775	ND	0.0127
12/18/2023	309-A509	0.01235	ND	Trace
12/28/2023	309-A510	0.00735	ND	ND

Appendix II. Raw data for Parlier. Total 1,3-D is the sum of cis and trans 1,3-d.

Sample Date	Sample ID	Total 1,3-D (ppb)	Cis 1,3-D (ppb)	Trans 1,3-D (ppb)
1/6/2023	309-B327	0.020175	0.0119	Trace
1/8/2023	309-B328	0.01235	Trace	ND
1/20/2023	309-B329	0.00735	ND	ND
1/24/2023	309-B330	0.00735	ND	ND
1/30/2023	309-B331	0.00735	ND	ND
2/7/2023	309-B332	0.2012	0.136	0.0652
2/15/2023	309-B333	0.0706	0.0375	0.0331
2/23/2023	309-B334	0.022175	0.0189	ND
2/28/2023	309-B335	0.00735	ND	ND
3/8/2023	309-B336	0.00735	ND	ND
3/17/2023	309-B337	0.00735	ND	ND
3/21/2023	309-B338	0.00735	ND	ND
3/28/2023	309-B339	0.00735	ND	ND
4/3/2023	309-B340	0.00735	ND	ND
4/12/2023	309-B341	0.00735	ND	ND
4/18/2023	309-B342	0.00735	ND	ND
4/28/2023	309-B343	0.020175	0.0169	ND
5/1/2023	309-B344	0.00735	ND	ND
5/9/2023	309-B345	0.454	0.259	0.195
5/19/2023	309-B346	0.0261	0.0117	0.0144
5/23/2023	309-B347	0.00735	ND	ND
5/31/2023	309-B348	0.00735	ND	ND
6/5/2023	309-B349	0.0309	0.0142	0.0167
6/13/2023	309-B350	0.0774	0.0431	0.0343
6/21/2023	309-B351	0.01235	ND	Trace
6/28/2023	309-B352	0.00735	ND	ND
7/6/2023	309-B353	0.00735	ND	ND
7/11/2023	309-B354	0.00735	ND	ND
7/16/2023	309-B355	0.00735	ND	ND
7/26/2023	309-B356	0.00735	ND	ND
7/31/2023	309-B357	0.00735	ND	ND
8/8/2023	309-B358	0.00735	ND	ND
8/17/2023	309-B359	0.00735	ND	ND
8/22/2023	309-B360	0.00735	ND	ND
8/30/2023	309-B361	0.00735	ND	ND
9/7/2023	309-B362	0.00735	ND	ND

Sample Date	Sample ID	Total 1,3-D (ppb)	Cis 1,3-D (ppb)	Trans 1,3-D (ppb)
9/13/2023	309-B363	0.00735	ND	ND
9/22/2023	309-B364	0.00735	ND	ND
9/26/2023	309-B365	0.00735	ND	ND
10/2/2023	309-B366	0.01735	Trace	Trace
10/11/2023	309-B367	0.00735	ND	ND
10/17/2023	309-B368	0.0891	0.0568	0.0323
10/24/2023	309-B369	0.041	0.0224	0.0186
11/1/2023	309-B370	0.01235	Trace	ND
11/6/2023	309-B371	0.00735	ND	ND
11/14/2023	309-B372	0.415	0.263	0.152
11/19/2023	309-B373	0.692	0.424	0.268
11/28/2023	309-B374	0.46	0.252	0.208
12/5/2023	309-B375	0.476	0.244	0.232
12/12/2023	309-B376	0.207	0.105	0.102
12/18/2023	309-B377	0.0496	0.0233	0.0263
12/28/2023	309-B378	0.0364	0.0189	0.0175

Appendix III. Laboratory and spike recovery data.

Analysis Date	Spike Amount (ppb)	Cis Result (ppb)	Cis 1,3-D Recovery (%)	Trans Result (ppb)	Trans 1,3-D Recovery (%)
1/23/2023	0.150	0.141	94	0.142	94.7
1/26/2023	0.150	0.14	93.3	0.14	93.3
2/2/2023	0.150	0.169	113	0.166	111
2/10/2023	0.150	0.128	85.3	0.127	84.7
2/13/2023	0.150	0.129	86	0.128	85.3
3/6/2023	0.150	0.151	101	0.148	98.7
3/8/2023	0.150	0.168	112	0.168	112
3/23/2023	0.150	0.148	98.7	0.148	98.7
5/5/2023	0.150	0.149	99.3	0.149	99.3
5/11/2023	0.150	0.144	96	0.143	95.3
5/15/2023	0.150	0.149	99.3	0.15	100
5/16/2023	0.150	0.146	97.3	0.146	97.3
5/18/2023	0.150	0.15	100	0.147	98
5/22/2023	0.150	0.133	88.7	0.132	88
5/25/2023	0.150	0.131	87.3	0.128	85.3
6/2/2023	0.150	0.147	98	0.145	96.7
6/9/2023	0.150	0.149	99.3	0.148	98.7
7/5/2023	0.150	0.146	97.3	0.136	90.7
7/6/2023	0.150	0.153	102	0.149	99.3
7/10/2023	0.150	0.152	101	0.147	98
8/4/2023	0.150	0.156	104	0.159	106
8/7/2023	0.150	0.156	104	0.157	105
8/10/2023	0.150	0.148	98.7	0.143	95.3
8/17/2023	0.150	0.129	86	0.131	87.3
8/25/2023	0.150	0.127	84.7	0.129	86
9/21/2023	0.150	0.144	96	0.146	97.3
9/22/2023	0.150	0.156	104	0.155	103
10/6/2023	0.150	0.160	107	0.158	105
10/24/2023	0.150	0.169	113	0.171	114
10/25/2023	0.150	0.132	88	0.129	86
10/31/2023	0.150	0.130	86.7	0.131	87.3
11/2/2023	0.150	0.131	87.3	0.130	86.7
11/13/2023	0.150	0.148	98.7	0.149	99.3
11/21/2023	0.150	0.150	100	0.150	100
11/29/2023	0.150	0.143	95.3	0.141	94
12/15/2023	0.150	0.149	99.3	0.149	99.3
12/18/2023	0.150	0.15	100	0.151	101

12/22/2023	0.150	0.161	107	0.160	107
1/18/2024	0.150	0.173	115	0.172	115
1/19/2024	0.150	0.147	98	0.149	99.3
1/26/2024	0.150	0.15	100	0.151	101

Appendix IV. Laboratory and blank recovery data.

Analysis Date	Cis Result	Trans Result
1/23/2023	ND	ND
1/26/2023	ND	ND
2/2/2023	ND	ND
2/10/2023	ND	ND
2/13/2023	ND	ND
3/6/2023	ND	ND
3/8/2023	ND	ND
3/23/2023	ND	ND
5/5/2023	ND	ND
5/11/2023	ND	ND
5/15/2023	ND	ND
5/16/2023	ND	ND
5/18/2023	ND	ND
5/22/2023	ND	ND
5/25/2023	ND	ND
6/2/2023	ND	ND
6/9/2023	ND	ND
7/5/2023	ND	ND
7/6/2023	ND	ND
7/10/2023	ND	ND
8/4/2023	ND	ND
8/7/2023	ND	ND
8/10/2023	ND	ND
8/17/2023	ND	ND
8/25/2023	ND	ND
9/21/2023	ND	ND
9/22/2023	ND	ND
10/6/2023	ND	ND
10/24/2023	ND	ND
10/25/2023	ND	ND
10/31/2023	ND	ND
11/2/2023	ND	ND
11/13/2023	ND	ND
11/21/2023	ND	ND
11/29/2023	ND	ND
12/15/2023	ND	ND
12/18/2023	ND	ND

12/22/2023	ND	ND
1/18/2024	ND	ND
1/19/2024	ND	ND
1/26/2024	ND	ND

Appendix V. Study #309: Monitoring of 1,3-dichloropropene in Merced and Fresno Counties.

(Document Attached)

Appendix VI. Determination of bromomethane, carbon disulfide, cis-1,3- dichloropropene and trans-1,3-dichloropropene in air samples collected in summa canisters, Revision 3.

(Document Attached)