AIR MONITORING NETWORK RESULTS FOR 2017

Volume 7

November 2018

By

Kenneth D. King, Environmental Scientist
Minh Pham, Air Program Supervisor
Edgar Vidrio, Environmental Program Manager I
Pam Wofford, Environmental Program Manager II

Air Program
Environmental Monitoring Branch
Department of Pesticide Regulation
1001 I Street, P.O. Box 4015
Sacramento, CA 95812-4015

Report AIR 18-03

EXECUTIVE SUMMARY

In February 2011, DPR implemented a multi-year statewide air monitoring network to measure pesticides in various agricultural communities. This Air Monitoring Network (AMN) is the first multi-year air monitoring study conducted by DPR. The goals of the AMN are to provide data that assists in assessing potential health risks, developing measures to mitigate risks, and measuring the effectiveness of regulatory requirements. This annual report is the seventh volume of this study and contains AMN results from January 1, 2017 to December 31, 2017.

In 2017, DPR monitored a total of 31 pesticides and 5 pesticide breakdown products in four communities. Pesticides monitored in the AMN were selected based primarily on potential risk to human health. Higher-risk pesticides were prioritized and selected for inclusion in the AMN based on higher use, higher volatility, and higher toxicity. The AMN originally provided monitoring for three communities, but with the passing of the Budget Act of 2016, it was expanded to include a total of eight sites for a two-year period. Four sites were operational in 2017 while the other four were added to the AMN in 2018. The four operational AMN monitoring sites were in the communities of Shafter (Kern County), Santa Maria (Santa Barbara County), Watsonville (Monterey County), and Chualar (Monterey County).

One 24-hour sample was collected each week at each of the four sites. Starting dates were randomly selected each week to produce variation in the sampling day while sampling start times were left to the discretion of field sampling personnel.

Of the 7,396 analyses[1] conducted, 92.9% (6,868) had no detectable concentrations. Five hundred twenty-eight (7.1%) of the analyses had a detectable (trace or quantifiable) concentrations, while 122 (1.6%) of all analyses had quantifiable concentrations. A quantifiable concentration refers to a concentration above the limit of quantitation for the respective pesticide.

Nine of the 36 pesticides and breakdown products monitored were not detected; of the remaining pesticides, 17 pesticides and breakdown products were only detected at trace levels. Ten compounds were detected at quantifiable levels. These included 1,3-dichloropropene, chloropicrin, chlorothalonil, chlorpyrifos and its oxygen analog, chlorthal-dimethyl, DDVP, EPTC, malathion, and methyl isothiocyanate (MITC). The chemicals with the highest number of detections from all four sites were chlorthal-dimethyl (39%), MITC (34%), and chlorothalonil (27%).

No state or federal agency has established health standards for pesticides in air. Therefore, DPR estimates the potential for adverse health effects by comparing the air concentrations to its health screening levels or regulatory targets for 1-day, 28- or 90-day depending on the pesticide, 1-year, and lifetime exposure periods. DPR devised health screening levels based on a preliminary assessment of possible health effects; they are used as triggers for DPR to conduct a more detailed evaluation. Regulatory targets are established after a complete assessment of possible health risks and supersede the screening levels. DPR puts measures in place based on the regulatory target to limit exposures so that adverse effects can be avoided. Exceeding a regulatory target does not necessarily mean an adverse health effect occurs, but it does indicate that the restrictions on the pesticide use may need to be modified. For 2017, no monitored pesticide exceeded any screening level or regulatory targets at any of the AMN sampling locations.

[1] Number of analyses = Number of samples multiplied by number of chemicals analyzed in each sample.

ACKNOWLEDGEMENTS

We would like to thank DPR's Air Program sampling crew—Clarice Ando, Colin Brown, Amy Budahn, Christopher Collins, Kelsey Craig, Jazmin Gonzalez, Kelly Heal, Fabio Sartori, Atac Tuli, and DPR's West Sacramento crew for sampling, sample handling and equipment assistance: Sue Peoples, Minda Dimaano, Roger Sava, and Jesse Ybarra. We also would like to thank Jazmin Gonzalez for creating a portion of the graphics used in this report. We would like to thank Justin Kroes and Angel Fong for help with the completion of this report. We extend our appreciation for additional support from Kevin Richardson and Alfredo DaSilva of DPR's Groundwater Program for sampling assistance. We would like to thank Alma Cangelosi, Rocio Lara, Connor Shanahan, and Adriana Rosales of the Santa Barbara County Agricultural Commissioner's Office for their help operating the Santa Maria sampling location.

We would like to thank all of the members of the Pesticide Registration and Evaluation Committee—Ann Prichard, Lynn Baker, Lori Lim, David Ting, Crystal Reul-Chen, Brian Larimore, Jodi Pontureri, Dawit Tadesse, Valerie Hanley, Kevi Mace, Michael Horak, Matt Hengel, Stella McMillin, Amalia Neidhardt, Jeff Fowles, Tom Ineichen, Patti TenBrook, Ruben Arroyo, and James Seiber—for their scientific input.

We also would like to thank the California Department of Food and Agriculture's Center for Analytical Chemistry laboratory personnel for their hard work. We also would like to thank the Air Resources Board's monitoring and laboratory staff for their valuable assistance with this study. Special thanks to the Agricultural Commissioners of Kern, Santa Barbara, and Monterey counties for their cooperation as well as the staff of Ohlone Elementary School, Shafter High School, and American Water in Chualar.

TABLE OF CONTENTS

INTRODUCTION

Background

The Department of Pesticide Regulation (DPR) is the public agency responsible for protecting California and its residents from adverse health effects caused by the use of pesticides. In February 2011, as part of DPR's mandate for "continuous evaluation" of currently registered pesticides, DPR implemented its first multi-year statewide Air Monitoring Network (AMN) for measuring pesticides in various agricultural communities. The AMN data is used to estimate subchronic and chronic pesticide exposures. The goals of the AMN are to provide data that assists in assessing potential health risks, developing measures to mitigate risks, and measuring the effectiveness of regulatory requirements.

The AMN includes these scientific objectives:

- Identify pesticides in air and determine seasonal, annual, and multiple-year concentrations.
- Compare concentrations to subchronic and chronic health screening levels.
- Track trends in air concentrations over time.
- Estimate cumulative exposure to multiple pesticides with common physiological modes of action in humans (e.g., cholinesterase inhibitors).
- Attempt to correlate concentrations with use and weather patterns.

As part of the community selection process for the AMN, DPR evaluated a total of 1,267 communities and ranked them based on pesticide use (both local and regional), demographic data[2], and availability of other exposure and health data. DPR ranked all 1,267 communities and a total of eight communities were selected for the AMN. In 2017, four sampling sites were operational while four others were added to the AMN in 2018. The four operational sites in 2017 are Chualar (Monterey County), Santa Maria (Santa Barbara County), Shafter (Kern County), and Watsonville (Monterey County).

At each sampling site location, one 24-hour (h) air sample set was collected on a weekly basis. The air samples were analyzed for 31 pesticides and 5 pesticide breakdown products. This report is the seventh volume of this study and contains AMN results from January 1, 2017, to December 31, 2017.

Changes to the Air Monitoring Network in 2017

The Budget Act of 2016 increased DPR's funding toward the Air Program, enabling DPR to expand the AMN from three original sampling sites to a total of eight sites for a period of two years (Vidrio, et al., 2017). DPR is responsible for operation of three AMN sites while the California Air Resources Board (ARB) is responsible for operating five sampling sites. This expansion formally began on January 1, 2017 and included or enabled the changes detailed below:

Number of Communities Monitored

The Budget Act of 2016 provided funding to expand the AMN to a total of eight communities. Four communities were selected based on nearby use of the fumigants 1,3-dichloropropene (1,3-D),

[2] Communities with similar pesticide-use ranking were prioritized based on the number of children, number of persons over 65, and number of persons living in close proximity to farms and agricultural areas with high pesticide use.

chloropicrin, methyl isothiocyanate (MITC), and MITC-generators, while the other four communities were selected based on the use of selected organophosphates (Vidrio et al., 2017). Complete details on community selection can be found elsewhere (Vidrio et al., 2017). Table 1 lists the eight communities selected for monitoring were:

Table 1. List of communities in 2017 AMN monitoring plan.

Community	County
Chualar	Monterey County
Cuyama	Santa Barbara County
Lindsay	Tulare County
Oxnard	Ventura County
San Joaquin	Fresno County
Santa Maria	Santa Barbara County
Shafter	Kern County
Watsonville[3]	Monterey County[4]

Complications in the ability to procure the necessary air sampling equipment impacted ARB and they were unable to begin sampling at any of their five assigned sites in 2017. The sampling site at Shafter, which has been an AMN sampling site location operated by DPR since 2011, will be transferred to ARB during the two year AMN expansion period. To avoid a gap in monitoring data for Shafter, DPR continued to operate this sampling location until ARB took over operations in March 2018.

Equipment Upgrades

The increased funding allowed for DPR and ARB to purchase upgraded sampling equipment custom built for pesticide ambient air monitoring. A key advantage of the new system is greater accuracy and precision in sample collection. This is explained in greater depth in the Materials and Methods section.

Communities and Monitoring Site Locations

Chualar

Chualar is a census-designated place (0.6 square miles in area) located approximately 10 miles south-southeast of Salinas in Monterey County (Figure 1). The elevation is 115 feet; it receives on average about 16 inches of precipitation annually. Average temperatures range from 53 to 72° F in the summer and 41 to 63° F in the winter. In 2010, the population was 1,190 of which 36.1% was below 18 years of age and 5.0% was above 65 years of age. The major crops in the immediate area around Chualar are strawberries, lettuce, and tomatoes. The monitoring site is located at a privately-owned water well situated on the eastern side of the community.

[3] The Oxnard sampling site, which since 2010 has been part of DPR's toxic air contaminant (TAC) program and will transition to an AMN site operated by ARB.

[4] While Watsonville is in Santa Cruz County, the actual monitoring site is located just across the county line (as marked by the Pajaro River) in Monterey County.

Santa Maria

Santa Maria is located in Santa Barbara County, and is 23.42 square miles in area (Figure 1). The average elevation is 217 feet; it receives an average of about 14 inches of precipitation annually. Average temperatures range from 47° to 73° F in the summer and 39° to 64° F in winter. Santa Maria is the most populous city in Santa Barbara County, with a population in 2010 of 99,553 of which 31.45% was below 18 years of age and 9.43% was above 65 years of age. The major crops in the immediate area around Santa Maria are strawberries, wine grapes, and broccoli. The monitoring site is located at an ARB community monitoring location adjacent to Santa Maria High School near the center of town. Monitoring at this site is conducted through a contract with the Santa Barbara County Agricultural Commissioner's (SB CAC) office. SB CAC staff follow strict Standard Operation Procedures established by DPR for this study and treat the collected samples in the same manner as DPR staff. DPR staff provides training and support for SB CAC for monitoring at this sampling location.

Shafter

The Shafter sampling site was retained as a monitoring site from the initial 2011-2016 AMN monitoring period. Shafter is a small city (18 square miles in area) located approximately 18 miles west-northwest of Bakersfield in Kern County (Figure 1). The elevation is 351 feet; it receives an average of about 7 inches of precipitation annually. Average temperatures range from 59° to 99° F in the summer and 35° to 64° F in winter. In 2010, the population was 16,988 of which 36.0% was below 18 years of age and 6.6% was above 65 years of age. The major crops in the immediate area around Shafter are almonds, grapes, carrots, and alfalfa. The monitoring site is situated at a city well location adjacent to Shafter High School in the northeastern edge of the city.

Watsonville

Watsonville is a small city (7 square miles in area) located on the southern edge of Santa Cruz County (Figure 1). The elevation is 29 feet; it receive on average about 22 inches of precipitation annually. Average temperatures range from 50° to 72° F in the summer to 38° to 63° F in winter. In 2010 the population was 51,199 of which 31.5% was below 18 years of age and 8.3% was above 65 years of age. The major crops in the immediate area around Watsonville are strawberries, apples, and lettuce. The monitoring site is located approximately 2 miles south of Watsonville in the Pajaro Valley area at Ohlone Elementary School. This puts the monitoring site itself across the county line, in the northern portion of Monterey County.

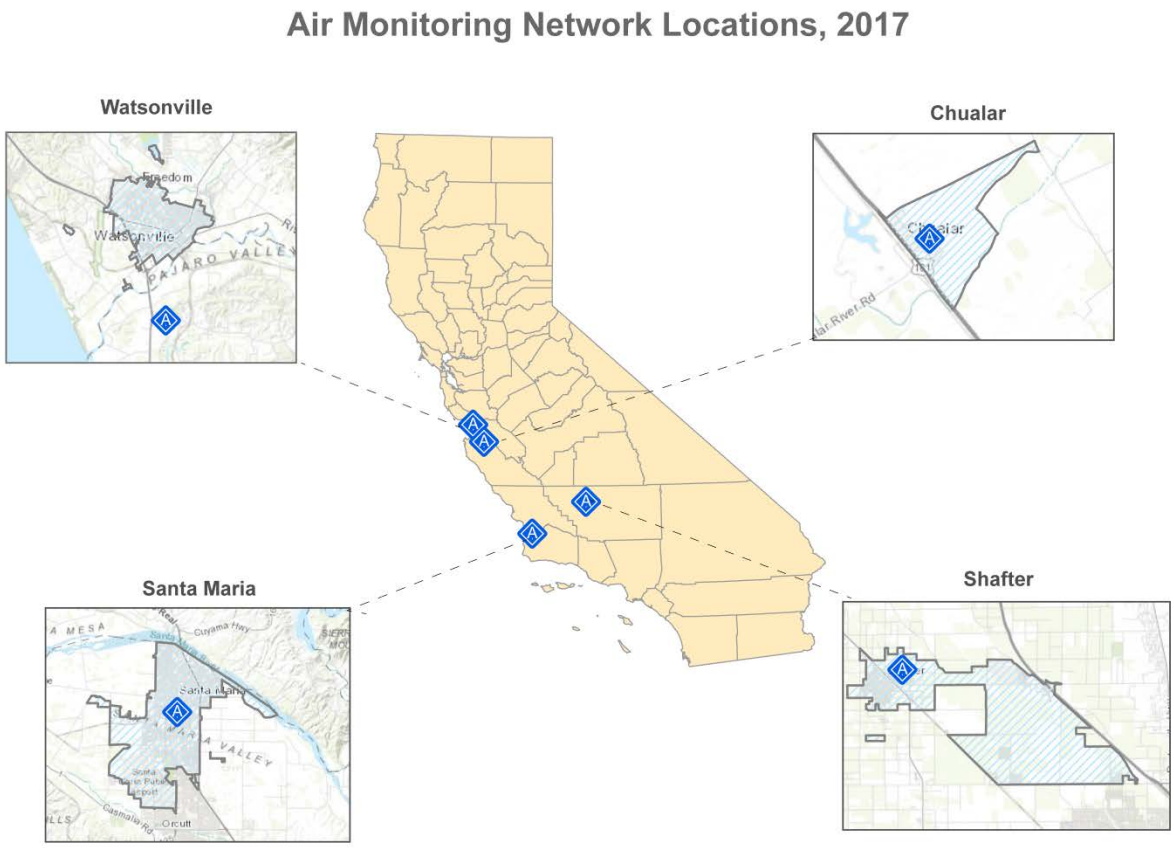

Figure 1. Map showing the locations of the communities with active AMN sites in 2017.

Pesticides Monitored

As part of the AMN, DPR monitored for 31 pesticides and 5 breakdown products. Chemicals included in the AMN were selected based primarily on potential health risk (Vidrio et al., 2013a). A total of four analytical methods were used to analyze the collected air samples as part of the AMN: (1) multi-pesticide residue analysis; (2) volatile organic compounds (VOC) analysis; (3) MITC analysis; and (4) chloropicrin analysis.

Multi-Pesticide Residue Analysis

Prior to sampling, personnel from the California Department of Food and Agriculture's (CDFA) Center for Analytical Chemistry laboratory (CDFA CAC laboratory) washed, rinsed, and packed 30 mL of XAD-4 sorbent material into a custom built Teflon® cartridge to be used for the collection of 32 analytes via multi-pesticide residue analysis.

Multi-pesticide residue analysis using XAD-4 resin was performed by laboratory staff using gas chromatography – mass spectrometry (GC-MS) and liquid chromatography – mass spectrometry (LC-MS)

methods as described elsewhere (CDFA, 2018a). This analysis can detect a variety of fungicides, insecticides, herbicides, and defoliants. The breakdown products of chlorpyrifos, diazinon, dimethoate, endosulfan and malathion were also included in the multi-pesticide residue analysis method. Table 2 lists the 32 analytes included in the multi-pesticide residue analysis.

Table 2. Target analytes in multi-pesticide residue analysis with XAD-4 resin.

Pesticide Group	Chemical Class	Chemical
Defoliant	Organophosphate	DEF (SSS-tributyl phosphorotrithioate)
Fungicide	Chloronitrile	Chlorothalonil
	Dicarboximide	Iprodione
Herbicide	Carbamate	EPTC
	Chloracetanilide	Metolachlor
	Dinitroaniline	Oryzalin
		Trifluralin
	Diphenyl ether	Oxyfluorfen
	Organophosphate	Bensulide
	Phthalate	Chlorthal-dimethyl (DCPA, Dacthal)
	Pyridazinone	Norflurazon
	Triazine	Simazine
	Urea	Diuron
Insecticide	Organochlorine	Dicofol
		Endosulfan
	Organophosphate	Acephate
		Chlorpyrifos
		Diazinon
		Dimethoate
		Malathion
		Methidathion
		DDVP
		Oxydemeton-methyl
		Phosmet
	Organosulfite	Propargite
	Pyrethroid	Cypermethrin
		Permethrin
Degradate	Organochlorine	Endosulfan Sulfate
	Organophosphate	Chlorpyrifos Oxygen Analog
		Diazinon Oxygen Analog
		Dimethoate Oxygen Analog
		Malathion Oxygen Analog

Volatile Organic Compound Analysis

Collected air canisters were analyzed for the presence of two analytes (Table 3) using a volatile organic compound (VOC) GC-MS method similar to the United States Environmental Protection Agency's (US EPA) Method TO-15. The standard operating procedure for this analysis is described in detail elsewhere (CDFA,

2010). Canister samples collected at the sampling sites of Watsonville, Santa Maria, and Chualar were analyzed by ARB's Organic Laboratory Section laboratory (ARB OLS laboratory), while canister samples collected at the Shafter site continued to be analyzed by CDFA's CAC laboratory until ARB takes over the operation of this sampling location at which point the analytical responsibilities transfer to ARB's OLS laboratory. Analysis of 1,3-D, includes results for both *cis*- and *trans*- isomers, which are then consolidated and reported as a total 1,3-D concentration for use in this report.

MITC

Samples collected on Anasorb coconut charcoal sorbent tubes were by CDFA's CAC laboratory analyzed for the presence of MITC by GC-MS as described by CDFA (2018b). MITC extraction from the sorbent medium involves using carbon disulfide in ethyl acetate. The proportion of carbon disulfide used was recently increased to 1.0% (CDFA, 2018b). This is followed by analysis using a gas chromatography-nitrogen phosphorous detector (GC-NPD) (Table 3).

Chloropicrin

Samples collected on XAD-4 sorbent tubes were analyzed by CDFA's CAC laboratory for the presence of chloropicrin by gas chromatography-electron capture detector (GC-ECD) as described by CDFA (1999). Each tube was desorbed in hexane and analyzed by a GC equipped with an ECD (Table 3).

Table 3. Target analytes in volatile organic compound and individual analyte residue analysis.

Pesticide	Pesticide Group	Chemical Class
VOC Analysis		
1,3-dichloropropene	Fumigant	Halogenated organic
Methyl Bromide	Fumigant	Halogenated organic
Individual Analyte Analysis		
MITC	Fumigant	-
Chloropicrin	Fumigant	Halogenated organic

MATERIALS AND METHODS

Air Sampling Equipment and Methods

There were a total of four methods used for the collection of air samples as part of the AMN. Each of these methods required specific equipment as described below.

Multi-Pesticide Residue Sampling

Original AMN Equipment:

For the entirety of 2017 in Shafter and January in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn through the XAD-4 media with an SKC® AirChek HV30 air pump, calibrated at a flow rate of 15 L/min (± 10%) for a continuous 24-h period. The cartridge was connected to the pump using a combination of threaded ABS plastic fittings, nitrile o-rings, and approximately 8 feet of Tygon® tubing which were all downstream of the sample media. The Teflon® tube containing the sample media was kept sealed prior to sampling at which time the inlet of the cartridge itself was open to the ambient air. Bios Defender 530® or DC-Lite® flow meters were used to obtain flow rates at the start and finish of the sampling period.

New Equipment:

Starting in February in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn through the XAD-4 media using channel 1 of a custom-built 3-channel pesticide sampling version of a Speciation Air Sampling System (SASS) manufactured by Met One Instruments, hereafter referred to as Met One® pesticide sampler. Channel 1 provided a sustained flow of 15.0 L/min ± 5%. The average of flow measurements collected at 5-minute intervals was used to directly calculate the volume sampled which was reported by the instrument. This allowed for more certainty than that of the previous method of calculation which used the mean from only two data points (measurements at the start and finish of sample collection). The Met One® pesticide sampler includes a solar shield of a sufficient size to shield the multi-pesticide cartridges from direct sunlight exposure during the sampling period.

Volatile Organic Compounds

Original AMN Equipment:

For the entirety of 2017 in Shafter and January in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn into a 6-L SilcoCan canister (cat. # 24142) pre-evacuated to a pressure of -30” Hg for VOC analysis. A Restek flow controller (cat. # 24160) was attached to the canister inlet to achieve a flow rate of 3.0 mL/min (± 10%) for a continuous 24-h sampling period. The air sampling inlet of the flow controller was placed at a sampling height of 3-10 meters, depending on the sampling site location, with a sufficient amount of 1/16” internal diameter PTFE (Teflon®) tubing to reach the canister. Bios Defender 530® or DC-Lite® flow meters were used to check the flow rate at the start and finish of the sampling period.

New Equipment:

Starting in February in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn through 1/16” internal diameter PTFE (Teflon®) tubing into a Xonteck model 901 ambient air sampler into a 6-L SilcoCan canister. The flow rate using this method was 7.5 mL/min (± 10%) and was sustained for a 24-h period. The sampler itself included an automatically initiated 60 second purge period to clear the sampling lines immediately prior to sample collection.

MITC

Original AMN Equipment:

For the entirety of 2017 in Shafter and January in Santa Maria, Watsonville, and Chualar: as part of sample collection, Anasorb sorbent sample tubes containing activated charcoal as the sampling media (cat. # 226-16-02) were used for the collection of MITC. These tubes measured 10mm in diameter by 160mm in length and contained 1,800 mg of sorbent in the primary sample region. Ambient air was drawn through the media by an SKC® XR series pump (PCXR8 or PCXR4) at a flow rate of 1.5 L/min (± 10%) for a continuous 24 h sampling period. The glass tube containing the sample media was connected to the pump with approximately 8 feet of Tygon® tubing, downstream of the sample media. The glass tips sealing the sampling media were broken open immediately prior to sampling. Bios Defender 530® or DC-Lite® flow meters were used to obtain flow rates at the start and finish of the sampling period.

New Equipment:

Starting in February in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn through the SKC® Anasorb® CSC sorbent sample tubes containing activated coconut charcoal media using channel 2 of the Met One pesticide sampler. Channel 2 provided a sustained flow of 1.5 L/min ± 5%. The average of flow measurements collected at 5-minute intervals was used to directly calculate the volume sampled which was reported by the sampler. This allowed for more certainty than that of the previous method of calculation, which used the mean from only two data points (measurements at the start and end of sample collection). The glass sorption tubes containing the sampling media and any collected analyte were shielded from sunlight by the sampler's radiation shield.

Chloropicrin

Original AMN Equipment:

For the entirety of 2017 in Shafter and January in Santa Maria, Watsonville, and Chualar: as part of sample collection, SKC® XAD-4 sorbent sample tubes (cat. # 226-175) were used for the collection of the analyte chloropicrin. These tubes measured 8mm in diameter and 150 mm in length, and contained 400 mg of sorbent material in the primary sample region. Ambient air was drawn through the media by an SKC® XR series pump (PCXR8 or PCXR4) at a flow rate of 50 mL/min (± 10%) for a continuous 24-h sampling period. The glass tube containing the sample media was connected to an adjustable low-flow single tube holder (SKC cat. # 224-26-01) which was in turn connected to the pump with approximately 8 feet of Tygon® tubing, all of which were downstream of the sample media. The glass tips sealing the sampling media were broken to allow airflow immediately prior to sampling and the inlet was open directly to the ambient air. Bios Defender 530® or DC-Lite® flow meters were used to obtain flow rates at the start and finish of the sampling period.

New Equipment:

Starting in February in Santa Maria, Watsonville, and Chualar: as part of sample collection, ambient air was drawn through the SKC® XAD-4 sorbent sample tubes using channel 3 of the Met One pesticide sampler. Channel 3 provided a sustained flow of 50 mL/min ± 5%. The average of flow measurements collected at 5-minute intervals was used to directly calculate the volume sampled which was reported by the machine. This allowed for more certainty than from the previous method of calculation which used the mean from only two data points (measurements at the start and finish of sample collection). The glass sorption tubes containing the sampling media and any collected analyte were shielded from sunlight by the sampler's radiation shield.

Field Sampling Procedure

One 24-h sample was collected each week at each of the four sites. The starting day varied each week with the actual dates being randomly selected as much as possible. Actual sampling start times were left to the discretion of the field sampling personnel.

Chain of custody (COC) forms, sample analysis request forms, and sample labels including the study number and unique sample identification numbers were supplied to field sampling personnel to be attached to sample tubes, cartridges, and canister tags prior to sampling.

Each of the four sample types detailed above were set up and started at the same time, except for the occasional make-up sample needed to replace an invalid sample. These make-up samples were typically run on the day following an invalidation event. Reasons why samples might be deemed invalid include, but are not limited to, the following: sampling period out of range, ending flow or pressure out of acceptable range, power interruptions, glass tube breakage during removal (i.e., damaged sampling media), and inoperative sampling equipment. The starting flow rates were measured prior to air sample collection and if any were determined to be out of the acceptable range (± 5% for the new equipment, ± 10% for the old equipment) that sampling equipment was recalibrated to within an acceptable tolerance. As the air sampling commenced at each monitoring site, the sample tracking number, date, time, staff initials, weather conditions, and air sampler flow rate were documented on a COC form.

Quality Control Methods

In addition to the primary samples, DPR collected quality control (QC) samples including trip blanks, field spikes, and co-located duplicate samples at a rate of 10% of primary samples. The QC results section located at the end of this report summarizes the results of these QC procedures.

A trip blank sample provides information on possible contamination of field collected samples. For the manufactured pre-packed XAD-4 and charcoal sample tubes, trip blank sample ends were broken open, capped and placed on dry ice with the field samples. The multi-pesticide residue XAD cartridges were opened in the field, capped, and placed on dry ice to be stored and shipped with the field samples. No air canister trip blanks were collected. Trip blanks were collected from the monitoring station in Watsonville (designated DPR's QC sampling site) at least once every month of sampling. Trip blank samples containing detectable amounts of any of the pesticides would indicate a problem with contamination during transport or during laboratory extraction.

A field spike is a sample with a known amount of chemical spiked onto the sample media, which is placed next to a primary sample that undergoes the same air flow and run time conditions. The field spike is stored under dry ice (-78.5° C) during transport for sorbent tubes and cartridges, and at ambient temperature for canisters. It is treated like a field sample, undergoing the same storage and shipping conditions. The field spiked sample, when compared to the primary sample, provides some information about any changes in the ability to recover the analyte during air sampling. DPR collected one field spike sample per month for each sample type. The multi-pesticide residue XAD cartridge was spiked with two different analytes every month at various concentrations. For chloropicrin- and MITC-spiked samples, concentrations varied every month. VOC canister spike samples were collected once per month at the monitoring station in Watsonville.

An acceptable range of spike recoveries for the AMN was established by analyzing blank-matrix spike samples at five replicate analyses at five different spike levels. The mean percent recovery and standard

deviation (SD) were determined based on these 25 data points. The control limits are then established at the mean percent recovery ± 3 SDs. Spike samples outside the control limits established for each pesticide do not necessarily indicate that the obtained results are deemed invalid or unusable, however, it would indicate the need for a further and more refined assessment of the field and laboratory procedures to determine the root issue. Depending on the results of this assessment, changes to field and laboratory procedures may be necessary. A detailed evaluation was necessary for a portion of 2017 MITC and methyl bromide (MeBr) analytical results as explained in the QC Results section at the end of this report.

Additionally, to look for sample analyte breakthrough in the sampling media, a method trapping efficiency was conducted for AMN sample collection media with the exception of air canisters (DPR, 1995). Two-stage air samples were collected and analyzed to determine the proportion of the spike trapped in the bottom stage to assess for possible sample breakthrough.

A duplicate sample is a sample that is co-located with a regular field sample. These samples evaluate overall precision in sample measurement and analysis. DPR collected one duplicate sample per month.

The site at Watsonville was designated as DPR's QC site for the DPR-operated portion of the AMN. A second set of sampling equipment dedicated to the collection of QC samples was installed at this location

To test for unacceptable collection variations between the original and the new AMN sampling equipment, duplicate sample sets were collected for a two-week period in early February using the original equipment adjacent to the new sampling equipment. Results of this co-located sampling scheme are discussed in the QC Results section.

Laboratory Methods

Analytical Laboratories

Analyses for all samples collected on sorbent tubes were analyzed by CDFA's CAC laboratory. In February 2017, the analysis of VOC (1,3-D and MeBr) samples collected at the monitoring sites in Santa Maria, Watsonville, and Chualar were analyzed by ARB's OLS laboratory. VOC samples collected in Shafter continued to be analyzed by the CDFA's CAC laboratory.

In the context of the AMN, the only appreciable difference between the two laboratories used for VOC samples is in the method detection limits (MDL) for 1,3-D and MeBr. Tables 4 and 5 detail these analytical limits.

Method Calibration

The laboratory established method calibration by analyzing a series of standard samples (samples containing known amounts of analyte dissolved in a solvent). The linear range of calibration was determined by analyzing standards of increasing concentration. Within the linear range, the calibration was determined by conducting a regression analysis of standard concentrations measured by the instrument (peak height or peak area of the chromatogram) using at least five concentrations. The minimum acceptable correlation coefficient of the calibration was given in the standard operating procedure for each method, but in general was at least 0.95.

Method Detection Limits and Limits of Quantitation

The MDL is the lowest concentration of a pesticide (analyte) that a chemical method can reliably detect. The laboratory determined the MDL for each analyte by analyzing a standard at a concentration with a signal to noise ratio of 2.5 to 5. This standard is analyzed at least 7 times, and the MDL is determined by calculating the 99 % confidence interval of the mean.

The limit of quantitation (LOQ) is the level at which concentrations may be reliably measured and is set at a certain factor above the MDL. The level of interference determines the magnitude of this factor; the more interference, the higher the factor. Tables 4 and 5 lists all the quantitation and detection limits for AMN analytes.

Table 4. Quantitation and detection limits for Air Monitoring Network samples analyzed by the CDFA laboratory.

Pesticide	Detection limit (MDL) (ng/m^3)	Quantitation limit (LOQ) (ng/m^3)
Acephate	1	9.3
Bensulide	1.4	9.3
Chloropicrin	222	694
Chlorothalonil	13.7	23.1
Chlorpyrifos	5	23.1
Chlorpyrifos OA	2.9	9.3
Chlorthal-dimethyl	1.7	9.3
Cypermethrin	4.7	23.1
DDVP	3.2	23.1
Diazinon	1.2	9.3
Diazinon OA	2.1	9.3
Dimethoate	2.3	9.3
Dimethoate OA	1.9	9.3
Diuron	5.1	9.3
Endosulfan sulfate	4.6	23.1
Endosulfan	3.2	23.1
EPTC	1.7	23.1
Iprodione	1.1	23.1
Malathion	2.2	9.3
Malathion OA	1.3	9.3
Methidathion	1.4	9.3
Metolachlor	2.7	9.3
MITC	5.6	23.1
Norflurazon	3.8	9.3
Oryzalin	1.4	23.1
Oxydemeton methyl	2.3	9.3
Oxyfluorfen	6.4	23.1
Permethrin	7.2	23.1
Phosmet	8	9.3
pp-Dicofol	2.1	23.1
Propargite	3.8	23.1
Simazine	1.2	9.3
DEF	1.8	9.3
Trifluralin	1.7	23.1
VOC Samples †		
1,3-dichloropropene	45.4 (0.01 ppb)	
Methyl bromide	39.6 (0.01 ppb)	

† For VOC samples the detection limit is equal to the quantitation limit.

Table 5. Quantitation and detection limits for Air Monitoring Network samples analyzed by the ARB laboratory.

Pesticide	Reporting Limit (ng/m^3) †
1,3-dichloropropene	454 (0.1 ppb)
Methyl bromide	396 (0.1 ppb)

† Analytical results provided by ARB use a reporting limit in which the MDL and LOQ are identical.

Air Concentration Calculations

For the sorbent tube and cartridge samples, air concentrations are calculated as an amount of pesticide captured from a volume of air moving through the sampling media. Analytical results are presented in micrograms per sample (µg/sample). The concentrations are converted from µg/sample to nanograms per cubic meter (ng/m^3) of sample air using the following calculation:

$$\frac{Sample\ results\ (ug) x\ 1000\ L/m^3}{Flow\ rate\ (\frac{L}{\min}) x\ run\ time\ (\min)} \text{ x 1000 } ng/\mu g = ng/m^3$$

The VOC concentrations were reported as parts per billion by volume (ppb) and converted to ng/m^3 using the following calculations:

$$\frac{Sample\ results\ (ppb) x\ Molecular\ weight\ (g/mol)}{24.45} \text{ x 1000 = } ng/m^3$$

The calculation above assumes 1 atmosphere of pressure at 25°C and 24.45 is obtained from multiplication of the Universal Gas Constant (R) (82.06 atm.cm^3/(mol·K)) and temperature in degrees Kelvin (298 K) with appropriate unit conversions based on the ideal gas law[5].

Per standard DPR practice, when calculating average concentrations from multiple samples, samples with no detectable amounts were assumed to contain one-half the MDL (ND=0.5*MDL), and samples with trace amounts were assumed to contain the value halfway between the MDL and the LOQ (Trace= 0.5*(MDL+LOQ)).

Calculation of Subchronic Rolling Averages

90-day Rolling Averages

In 2016, DPR eliminated the practice of using a 4-week rolling average concentration to represent a subchronic time period for 1,3-D and chloropicrin for comparisons to subchronic screening levels and regulatory targets. This determination was based on an evaluation conducted by DPR's Human Health Assessment Branch that looked at seasonal reference concentrations for these two chemicals. Evaluation results are explained in greater detail elsewhere (DPR, 2016b)

[5] Ideal gas law: pV = nRT
where p = pressure, V = volume, n = number of moles, R = universal gas constant, and T = temperature

Health Evaluation Methods

Pesticides can cause a variety of health effects when present at concentrations above health-protective levels. The pesticides included in the AMN were selected in part because (1) risk assessments indicate the high potential for exposure, or (2) they are high priority for risk assessment due to toxicity and/or exposure concerns. Some of the pesticides in the AMN can cause adverse effects such as respiratory illnesses, damage to the nervous system, cancer, and birth defects. Vidrio et al. (2013a) summarizes the potential health effects of each pesticide. No state or federal agency has established health standards for pesticides in air. Therefore, DPR in consultation with the Office of Environmental Health Hazard Assessment (OEHHA) developed health screening levels or regulatory targets to place the results in a health-based context.

Health screening levels are based on a preliminary assessment of possible health effects, and are used as triggers for DPR to conduct a more detailed evaluation. A measured air concentration below the screening level for a given pesticide would not be considered a significant health concern and the pesticide would not undergo further evaluation at this time. A measured concentration above the screening level would not necessarily indicate a significant health concern, but would indicate the need for a further, more refined evaluation. Vidrio et al. (2013a) summarizes more information on DPR-determined screening levels including information on deriving screening levels for each pesticide.

DPR puts measures in place based on the regulatory target to limit exposures so that adverse effects can be avoided. Exceeding a regulatory target does not necessarily mean an adverse health effect occurs, but it does indicate that the restrictions on the pesticide use may need to be modified. DPR normally establishes a regulatory target after completing a formal risk assessment of a chemical's toxicity and potential exposures. DPR management determines a regulatory target using its risk assessment, as well as risk assessments from other agencies, pesticide use patterns, potential effects on use of alternative pesticides, and other factors. A regulatory target is based on a more comprehensive evaluation than a health screening level. Therefore, a regulatory target supersedes a health screening level (i.e., a specific pesticide and exposure duration will have either a regulatory target or a health screening level, but not both). Four of the pesticides monitored in the AMN (chloropicrin, MeBr, MITC, and 1,3-D) have regulatory targets for one or more exposure periods.

Cumulative Exposures

Cumulative exposure and risk were estimated using a hazard quotient and hazard index approach for pesticides that have a common mode of action (such as cholinesterase inhibitors). The potential risk of the measured concentrations of a pesticide in air was evaluated by comparing the air concentration measured over a specified time (e.g., 24 hours, 4 weeks, 1 year) with the screening level derived for a similar exposure (i.e., acute, subchronic, chronic). The ratio of measured air concentration of a pesticide to a reference concentration or screening level for that pesticide is called the hazard quotient (HQ). In this case,

$$\text{Hazard Quotient} = \frac{\text{Air Concentration Detected } (ng / m^3)}{\text{Screening Level } (ng / m^3)}$$

If the HQ is greater than 1, then the air concentration exceeds the screening level. Such a results would indicate the need for further and more refined evaluation. Similarly, the risk from multiple pesticides (cumulative risk) is evaluated using the hazard index (HI) approach, which sums of the HQs for the pesticides monitored.

HI = HQ1 (pesticide 1) + HQ2 (pesticide 2) + HQ3 (pesticide 3) + … (and so forth)

An HI greater than 1 indicates that the cumulative toxicity of the multiple pesticides should be further evaluated and that potential health impacts may have been missed by only considering the pesticides individually.

Cancer Risk Estimates

The AMN monitors for seven pesticides that have been designated as potential carcinogens by Proposition 65 or by U.S. EPA's B2 list. These chemicals are: 1,3-D, chlorothalonil, DDVP, diuron, iprodione, oxydemeton methyl, and propargite.

Cancer risk is expressed as a probability for the occurrence of cancer (e.g., 1 in 1,000,000 or 10^{-6}, 1 in 100,000 or 10^{-5}, etc.). Risk in the range of 10^{-5} to 10^{-6} or less is generally considered to be at the limit of what is considered to be negligible. Cancer risk is estimated based on the following calculation:

*Cancer Risk = CPFH * LAC * nBR*

where:

Cancer Risk = probability of an additional case of cancer over a 70-year period.
CPFH = estimated cancer potency factor in humans (mg/kg/day)-1.
LAC = mean lifetime (70-year) air concentration (mg m-3).
nBR = normalized breathing rate of a human adult (m3 kg-1 day-1).

DPR assumes nBR to be 0.28 m^3 kg^{-1} day^{-1} (DPR 2015). Based on the available monitoring data, LAC is taken as the mean annual concentration of the pesticide for all available monitoring years. DPR has estimated the following CPF_H values for three of the seven AMN-monitored pesticides:

- For 1,3-D: CPF_H= 0.014 $(mg/kg\text{-}day)^{-1}$ (DPR 2015).
- For chlorothalonil: CPF_H= 0.016 $(mg/kg\text{-}day)^{-1}$ (DPR 2018).
- For DDVP: CPF_H= 0.35 $(mg/kg\text{-}day)^{-1}$ (DPR 1996).

AIR MONITORING NETWORK RESULTS

Results for all Pesticides and Communities Combined

Pesticide Detections

A total of 7,396 analyses were conducted on the air samples collected from the four AMN sites operating from January 1, 2017 to December 31, 2017. Of the 7,396 analyses, 7% (528) showed detectable concentrations, which included both quantifiable and trace detections[6]. Samples with quantifiable detections accounted for 2% (122) of all analyses conducted.

Nine of the 36 pesticides and breakdown products were not detected; of the remaining 27, 17 were only detected at trace levels. Ten pesticides or breakdown products were detected at quantifiable levels. Table 6 lists the number of detections by type for each pesticide and pesticide breakdown product at all sites included in the AMN. The chemicals with the highest number of detections were chlorthal-dimethyl (39%), MITC (34%), and chlorothalonil (27%).

[6] Quantifiable detections refer to concentrations above the LOQ for the respective pesticide.
Trace detections are measured concentrations between the LOQ and the MDL.
Non-detections refer to all samples with measured concentrations below the MDL.

Table 6. Number and percentage of positive samples per chemical for all AMN sites.

Chemical	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
1,3-dichloropropene	195	43	43	22%	22%
Acephate	206	1	0	0%	0%
Bensulide	206	2	0	1%	0%
Chloropicrin	207	30	13	14%	6%
Chlorothalonil	206	56	4	27%	2%
Chlorpyrifos	206	26	3	13%	1%
Chlorpyrifos OA	206	30	4	15%	2%
Cypermethrin	206	0	0	0%	0%
Chlorthal-dimethyl	206	81	18	39%	9%
DDVP	206	17	1	8%	0%
DEF	206	0	0	0%	0%
Diazinon	206	2	0	1%	0%
Diazinon OA	206	1	0	0%	0%
Dimethoate	206	0	0	0%	0%
Dimethoate OA	206	0	0	0%	0%
Diuron	206	5	0	2%	0%
Endosulfan	206	1	0	0%	0%
Endosulfan Sulfate	206	0	0	0%	0%
EPTC	206	5	1	2%	0%
Iprodione	206	3	0	1%	0%
Malathion	206	50	6	24%	3%
Malathion OA	206	51	0	25%	0%
Methidathion	206	0	0	0%	0%
Methyl bromide	195	0	0	0%	0%
Metolachlor	206	6	0	3%	0%
MITC	207	71	29	34%	14%
Norflurazon	206	4	0	2%	0%
Oryzalin	206	7	0	3%	0%
Oxydemeton methyl	206	0	0	0%	0%
Oxyfluorfen	206	3	0	1%	0%
Permethrin	206	1	0	0%	0%
Phosmet	206	0	0	0%	0%
pp-Dicofol	206	1	0	0%	0%
Propargite	206	1	0	0%	0%
Simazine	206	5	0	2%	0%
Trifluralin	206	25	0	12%	0%
Total	**7,396**	**528**	**122**	**7%**	**2%**

* Includes both quantified and trace detections

Table 7 summarizes the total number of detections of the monitored chemicals by community. The percentages of detections for monitored chemicals ranged from 3.6% to 10.2% of all collected samples. These detections include quantifiable detections (above the LOQ) and trace detections (above the MDL but below the LOQ). Shafter had the highest percentage of samples with detections (10.2%) as well as the highest percentage of quantifiable samples (3.0%).

A sample set is the collective term for all samples recovered from one site in one week. A total of 207 sample sets were taken from all four communities (52 sets each from Shafter, Santa Maria, and Chualar; 51 sets from Watsonville); 174 (84.1%) of these sample sets contained at least one detection (Table 7).

One complete sample set was lost due to a power outage resulting from a storm at Watsonville; DPR was unable to take a make-up sample. Additionally, certain weeks produced incomplete sample sets due to individual sample invalidations for a variety of reasons as described in the Field Sampling Procedure section of this report.

Table 7. Detections of monitored chemicals by location.

Community	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of Quantifiable Detections	Number of sampling sets	Number of sets with at least one detection	Percent of sample sets with at least one detection
Shafter	1,872	191	56	10.2%	3.0%	52	52	100%
Santa Maria	1,858	156	26	8.4%	1.4%	52	52	100%
Watsonville	1,832	66	17	3.6%	0.9%	51	42	82.4%
Chualar	1,834	115	23	6.3%	1.3%	52	28	53.8%
Total	**7,396**	**528**	**122**	**7.1%**	**1.6%**	**207**	**174**	**84.1%**

* Includes both quantified and trace detections.

Pesticide Concentrations

Highest 24-Hour Concentrations among All Sites

While the results of the 24-h samples and acute exposures are discussed in this report, estimating acute exposures is not one of the AMN objectives since the AMN best measures subchronic and chronic exposures. The AMN's ambient air monitoring in communities is the standard method DPR uses to estimate subchronic and chronic exposures because samples may be collected at distances of more than a quarter of a mile away. Application-site monitoring in the immediate vicinity (100 feet or less) of a treated field is normally used to estimate acute exposures, and these air concentrations are typically several times higher than 24 h concentrations measured from ambient air. Application-site monitoring for individual pesticides is currently performed by DPR or ARB and all monitoring reports are posted on DPR's website.

Table 8 lists the highest 24 h concentrations at any site for each pesticide monitored in the AMN. None of the pesticides or breakdown products exceeded their respective screening levels or regulatory targets during 2017 monitoring. Of all monitored pesticides, the highest detected 24 h concentration of chlorpyrifos was closest to its screening level (11.5%), followed by chlorpyrifos OA (4.9%). All other compounds were less than 1% of their acute screening level or regulatory target during monitoring in 2017 (Table 8). Table 9 lists the 24-hour, 28- or 90-day rolling average, and annual average concentrations at any site for quantifiable pesticides detected at any sampling location. Table 10 lists the highest 24-hour concentrations for each monitoring location.

Table 8. Highest 24-h air concentrations, acute screening levels, and percent of the acute screening level for chemicals monitored.

Chemical	Highest 24-h concentration (ng/m^3)	24-h acute screening level (ng/m^3)	% of screening level
1,3-dichloropropene	3,394	505,000	0.7%
Acephate	Trace (5.2)	12,000	
Bensulide	Trace (5.4)	259,000	
Chloropicrin	3,221	491,000[1]	0.7%
Chlorothalonil	55.3	34,000	0.2%
Chlorpyrifos	138	1,200	11.5%
Chlorpyrifos OA	59	1,200	4.9%
Cypermethrin	ND (2.4)	113,000	
Chlorthal-dimethyl	22	23,500,000	0.0%
DDVP	65	11,000	0.6%
DEF	ND (0.9)	8,800	
Diazinon	Trace (5.3)	130	
Diazinon OA	Trace (5.7)	130	
Dimethoate	ND (1.2)	4,300	
Dimethoate OA	ND (1.0)	4,300	
Diuron	Trace (7.2)	170,000	
Endosulfan	Trace (13)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	12	230,000	0.0%
Iprodione	Trace (12)	939,000	
Malathion	15	112,500	0.0%
Malathion OA	Trace (5.3)	112,500	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	820,000*	
Metolachlor	Trace (6.0)	85,000	
MITC	457	66,000[1]	0.7%
Norflurazon	Trace (6.6)	170,000	
Oryzalin	Trace (12)	420,000	
Oxydemeton methyl	ND (1.2)	39,200	
Oxyfluorfen	Trace (15)	510,000	
Permethrin	Trace (15)	168,000	
Phosmet	ND (4.0)	77,000	
pp-Dicofol	Trace (13)	68,000	
Propargite	Trace (14)	14,000	
Simazine	Trace (5.3)	110,000	
Trifluralin	Trace (12)	1,200,000	

† Number in parentheses is one-half of the MDL for samples with no detectable amount, and a value halfway between the MDL and LOQ for trace samples.

* This value is a regulatory target rather than a screening level.

[1] This value is an 8-h time weighted average (TWA) used to compare against the 24-h measured concentration.

Table 9. Highest measured air concentrations and percent of the screening level for pesticides detected at quantifiable concentrations at any sampling location.

Pesticide	Highest 24h Conc. (ng/m³)	% of Screening Level	Highest 28d or 90d Conc. (ng/m³)	% of Screening Level	2017 Average Conc. (ng/m3)	% of Screening Level
1,3-dichloropropene	3,394	0.7%	4,812*	34.4%	377	4.2%
Chloropicrin	3,221	0.7%	974 *	42.4%	234	13.0%
Chlorothalonil	55.3	0.2%	37.6	0.1%	10.4	0.0%
Chlorpyrifos	138	11.5%	51.3	6.0%	4.7	0.9%
Chlorpyrifos OA	59.0	4.9%	19.3	2.3%	2.5	0.5%
Chlorthal dimethyl	22.3	0.0%	15.8	0.0%	3.4	0.0%
DDVP	64.7	0.6%	17.4	0.8%	2.8	0.4%
EPTC	12.4	0.0%	9.1	0.0%	1.1	0.0%
Malathion	15.3	0.0%	11.9	0.0%	2.4	0.0%
MITC	457	0.7%	236	7.9%	21.8	7.3%

* These concentrations represent the highest 90-day rolling average.

Table 10. Highest 24-h concentration for pesticides detected at quantifiable concentrations by sampling location.

Sampling Location	1,3-dichloropropene	Chloropicrin	Chlorothalonil	Chlorpyrifos	Chlorpyrifos OA	Chlorthal dimethyl	DDVP	EPTC	Malathion	MITC
Shafter	3,394	ND	55.3	138	59.0	Trace	64.7	12.4	14.9	382
Santa Maria	2,450	3,095	Trace	ND	ND	Trace	Trace	ND	15.3	457
Watsonville	1,860	3,221	Trace	Trace	ND	Trace	Trace	ND	Trace	55.5
Chualar	1,996	805	Trace	ND	ND	22.3	Trace	ND	Trace	92.1

Highest Rolling 4-Week Average Concentrations among All Sites

Table 11 lists the highest observed rolling 4-week or 90-day average concentrations among all sites. Among all sites monitored, none of the pesticides exceeded any of their subchronic screening levels, with chloropicrin (42.4%), 1,3-D (34.4%), and MITC (7.9%) having the highest percentages of their screening levels. Table 12 lists the highest 4-week or 90-day rolling average concentration for quantifiable pesticides detected by sampling location.

Table 11. Highest rolling 4-week average air concentrations, subchronic screening levels, and percent of the subchronic screening level for chemicals monitored.

Chemical	Highest 4-week rolling concentration (ng/m^3) †	Subchronic screening level (ng/m^3)	% of screening level
1,3-dichloropropene	4,812 **	14,000	34.4%
Acephate	Trace (1.7)	8,500	
Bensulide	Trace (1.9)	24,000	
Chloropicrin	974 **	2,300	42.4%
Chlorothalonil	38	34,000	0.1%
Chlorpyrifos	51	850	6.0%
Chlorpyrifos OA	19	850	2.3%
Cypermethrin	ND (2.4)	81,000	
Chlorthal-dimethyl	16	470,000	0.0%
DDVP	17	2,200	0.8%
DEF	ND (0.9)	8,800	
Diazinon	Trace (2.9)	130	
Diazinon OA	Trace (2.2)	130	
Dimethoate	ND (1.2)	3,000	
Dimethoate OA	ND (1.0)	3,000	
Diuron	Trace (4.9)	17,000	
Endosulfan	Trace (4.5)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	9.1	24,000	0.0%
Iprodione	Trace (6.3)	286,000	
Malathion	12	80,600	0.0%
Malathion OA	Trace (5.3)	80,600	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	19,400 *	
Metolachlor	Trace (4.8)	15,000	
MITC	236	3,000	7.9%
Norflurazon	Trace (4.2)	26,000	
Oryzalin	Trace (6.5)	230,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	Trace (12)	180,000	
Permethrin	Trace (6.5)	90,000	
Phosmet	ND (4.0)	26,000	
pp-Dicofol	Trace (3.9)	49,000	
Propargite	Trace (4.8)	14,000	
Simazine	Trace (2.9)	31,000	
Trifluralin	Trace (12)	170,000	

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

* This value is a regulatory target rather than a screening level.

**These concentrations represent the highest 90-day rolling average.

Table 12. Highest 28-day or 90-day rolling average concentration for pesticides detected at quantifiable concentrations by sampling location.

Sampling Location	1,3-dichloropropene *	Chloropicrin *	Chlorothalonil	Chlorpyrifos	Chlorpyrifos OA	Chlorthal dimethyl	DDVP	EPTC	Malathion	MITC
Shafter	4,812	ND	37.6	51.3	19.3	Trace	17.4	9.1	4.5	236
Santa Maria	1,152	849	Trace	ND	ND	Trace	Trace	ND	11.9	140
Watsonville	904	974	Trace	Trace	ND	Trace	Trace	ND	Trace	18.9
Chualar	398	322	Trace	ND	ND	15.7	Trace	ND	Trace	30.9

* These concentrations represent the highest 90-day rolling average.

One Year Average Concentrations among All Sites

Table 13 presents the annual overall average concentrations for each analyte alongside its respective chronic screening levels. The highest annual overall average concentration relative to its chronic screening level was that of chloropicrin (13.0%), followed by MITC (7.3%), then 1,3-D (4.2%). Table 14 lists the annual average concentration for quantifiable pesticides detected at any monitoring location.

Table 13. Annual average air concentrations, chronic screening levels, and percent of the chronic screening level for chemicals monitored across all AMN sites.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level
1,3-dichloropropene	377	9,000	4.2%
Acephate	Trace (0.5)	8,500	
Bensulide	Trace (0.7)	24,000	
Chloropicrin	234	1,800	13.0%
Chlorothalonil	10	34,000	0.0%
Chlorpyrifos	4.7	510	0.9%
Chlorpyrifos OA	2.5	510	0.5%
Cypermethrin	ND (2.4)	27,000	
Chlorthal-dimethyl	3.4	47,000	0.0%
DDVP	2.8	770	0.4%
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	Trace (0.6)	130	
Diazinon OA	Trace (1.1)	130	
Dimethoate	ND (1.2)	300	
Dimethoate OA	ND (0.9)	300	
Diuron	Trace (2.7)	5,700	
Endosulfan	Trace (1.7)	330	
Endosulfan Sulfate	ND (2.3)	330	
EPTC	1.1	8,500	0.0%
Iprodione	Trace (0.7)	286,000	
Malathion	2.4	8,100	0.0%
Malathion OA	Trace (1.8)	8,100	
Methidathion	ND (0.7)	2,500	
Methyl bromide	ND (45)	3,900	
Metolachlor	Trace (1.5)	15,000	
MITC	22	300	7.3%
Norflurazon	Trace (2.0)	26,000	
Oryzalin	Trace (1.1)	232,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	Trace (3.4)	51,000	
Permethrin	Trace (3.7)	90,000	
Phosmet	ND (4.0)	18,000	
pp-Dicofol	Trace (1.1)	20,000	
Propargite	Trace (2.0)	14,000	
Simazine	Trace (0.7)	31,000	
Trifluralin	Trace (2.3)	41,000	

Table 14. Annual average concentration for pesticides detected at quantifiable concentrations by sampling location.

Sampling Location	1,3-dichloropropene	Chloropicrin	Chlorothalonil	Chlorpyrifos	Chlorpyrifos OA	Chlorthal dimethyl	DDVP	EPTC	Malathion	MITC
Shafter	486	ND	16.4	11.1	5.7	Trace	2.8	1.9	1.5	50.7
Santa Maria	366	317	Trace	ND	ND	Trace	Trace	ND	4.5	23.1
Watsonville	397	345	Trace	Trace	ND	Trace	Trace	ND	Trace	5.6
Chualar	252	164	Trace	ND	ND	8.4	Trace	ND	Trace	7.2

Results for all Pesticides for Individual Communities

Table 15 summarizes the highest percentage of screening levels (acute, subchronic, and chronic) for chemicals detected in quantifiable concentrations only. No pesticide exceeded any screening level or regulatory targets at any of the four AMN sampling locations. The two highest concentrations relative to their respective screening level were the subchronic concentrations for chloropicrin (42.4%) and 1,3-D (34.4%).

Table 15. Air concentration relative to screening levels for chemicals with quantifiable concentrations across all sampling locations.

Chemical	% of acute screening level *	% of subchronic screening level *	% of chronic screening level *
1,3-dichloropropene	0.7%	34.4%	4.2%
Chloropicrin	0.7% **	42.4%	13.0%
Chlorothalonil	0.2%	0.1%	0.0%
Chlorpyrifos	11.5%	6.0%	0.9%
Chlorpyrifos OA	4.9%	2.3%	0.5%
Chlorthal-dimethyl	0.0%	0.0%	0.0%
DDVP	0.6%	0.8%	0.4%
EPTC	0.0%	0.0%	0.0%
Malathion	0.0%	0.0%	0.0%
MITC	0.7% **	7.9%	7.3%

* A concentration greater than 100% of the screening level suggests the need for further evaluation.

** This value is calculated from a regulatory target rather than a screening level.

Shafter, California

Pesticide Detections

Table 16 lists the number and percentage of analyses resulting in detections at the Shafter sampling site. The highest percentage of detections were for chlorothalonil (69%, n = 36), MITC (62%, n = 32), and chlorpyrifos OA (58%, n = 30). Chlorpyrifos and 1,3-D followed, each with 48% (n = 25). 1,3-D (48%, n = 25) had the highest percentage of quantifiable detections. The next highest percentage of quantifiable detections was that of MITC (33%, n = 17), followed by chlorothalonil and chlorpyrifos OA, both at 8% (n = 4).

Table 16. Number and percentage of positive samples per chemical in Shafter, California.

Chemical	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
1,3-dichloropropene	52	25	25	48%	48%
Acephate	52	1	0	2%	0%
Bensulide	52	0	0	0%	0%
Chloropicrin	52	0	0	0%	0%
Chlorothalonil	52	36	4	69%	8%
Chlorpyrifos	52	25	3	48%	6%
Chlorpyrifos OA	52	30	4	58%	8%
Cypermethrin	52	0	0	0%	0%
Chlorthal-dimethyl	52	5	0	10%	0%
DDVP	52	1	1	2%	2%
DEF	52	0	0	0%	0%
Diazinon	52	2	0	4%	0%
Diazinon OA	52	1	0	2%	0%
Dimethoate	52	0	0	0%	0%
Dimethoate OA	52	0	0	0%	0%
Diuron	52	2	0	4%	0%
Endosulfan	52	0	0	0%	0%
Endosulfan Sulfate	52	0	0	0%	0%
EPTC	52	5	1	10%	2%
Iprodione	52	3	0	6%	0%
Malathion	52	3	1	6%	2%
Malathion OA	52	2	0	4%	0%
Methidathion	52	0	0	0%	0%
MeBr	52	0	0	0%	0%
Metolachlor	52	5	0	10%	0%
MITC	52	32	17	62%	33%
Norflurazon	52	1	0	2%	0%
Oryzalin	52	4	0	8%	0%
Oxydemeton methyl	52	0	0	0%	0%
Oxyfluorfen	52	3	0	6%	0%
Permethrin	52	0	0	0%	0%
Phosmet	52	0	0	0%	0%
pp-Dicofol	52	0	0	0%	0%
Propargite	52	1	0	2%	0%
Simazine	52	3	0	6%	0%
Trifluralin	52	1	0	2%	0%
Total	**1,872**	**191**	**56**	**10%**	**3%**

* Includes both quantified and trace detections

Pesticide Concentrations

Shafter, Acute

Table 17 shows the highest 24 h concentrations observed in Shafter. The highest concentration relative to its screening level was that of chlorpyrifos at 11.5% followed by chlorpyrifos OA, at 4.9%. All other compounds were less than 1% of their acute screening level or regulatory target in Shafter during monitoring in 2017.

Shafter, Subchronic

Table 18 lists the highest observed subchronic concentrations for each monitored chemical at the AMN site in Shafter. The highest concentration relative to its screening level was that of 1,3-D at 34.4% of the subchronic screening level. This was followed by MITC at 7.9%, then chlorpyrifos at 6.0%.

Figures 2-3 show the acute and subchronic concentrations for 1,3-D, MITC, and the summed detected concentrations for chlorpyrifos and chlorpyrifos OA.

Shafter, Chronic

Table 19 lists the annual average concentrations for each monitored chemical at the AMN site in Shafter. The highest of these relative to its chronic screening level was that of MITC (16.9%), followed by 1,3-D (5.4%). The only other chemicals to exceed 1% of their respective screening levels were chlorpyrifos (2.2%) and chlorpyrifos OA (1.1%).

As noted in the Laboratory Methods section, the MDL for 1,3-D and MeBr analyzed by ARB's OLS laboratory is 10-fold higher than that of samples analyzed by CDFA's CAC laboratory. Because all Shafter samples were analyzed by the CDFA's CAC laboratory, the annual average value was below that of the other three AMN sites as the MDL is used to assign a value to samples not detected (ND = ½ MDL) and the majority of the 1,3-D samples collected were non-detects.

Table 17. Highest 24-h air concentrations, acute screening levels, and percent of the acute screening level for chemicals monitored in Shafter, California.

Chemical	Highest 24-h concentration (ng/m^3)	24-h acute screening level (ng/m^3)	% of screening level
1,3-dichloropropene	3,394	505,000	0.7%
Acephate	Trace (5.2)	12,000	
Bensulide	ND (0.7)	259,000	
Chloropicrin	ND (111)	491,000[1]	
Chlorothalonil	55	34,000	0.2%
Chlorpyrifos	138	1,200	11.5%
Chlorpyrifos OA	59	1,200	4.9%
Cypermethrin	ND (2.4)	113,000	
Chlorthal-dimethyl	Trace (5.5)	23,500,000	
DDVP	65	11,000	0.6%
DEF	ND (0.9)	8,800	
Diazinon	Trace (5.3)	130	
Diazinon OA	Trace (5.7)	130	
Dimethoate	ND (1.2)	4,300	
Dimethoate OA	ND (1.0)	4,300	
Diuron	Trace (7.2)	170,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	12	230,000	0.0%
Iprodione	Trace (12)	939,000	
Malathion	15	112,500	0.0%
Malathion OA	Trace (5.3)	112,500	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (20)	820,000*	
Metolachlor	Trace (6.0)	85,000	
MITC	382	66,000[1]	0.6%
Norflurazon	Trace (6.6)	170,000	
Oryzalin	Trace (12)	420,000	
Oxydemeton methyl	ND (1.2)	39,200	
Oxyfluorfen	Trace (15)	510,000	
Permethrin	ND (3.6)	168,000	
Phosmet	ND (4.0)	77,000	
pp-Dicofol	ND (1.1)	68,000	
Propargite	Trace (14)	14,000	
Simazine	Trace (5.3)	110,000	
Trifluralin	Trace (12)	1,200,000	

† Number in parentheses is one-half of the MDL for samples with no detectable amount, and a value halfway between the MDL and LOQ for trace samples.

* This value is a regulatory target rather than a screening level.

[1] This value is an 8-h time weighted average (TWA) used to compare against the 24-h measured concentration.

Table 18. Highest 4-week rolling average air concentrations, subchronic screening levels, and percent of the subchronic screening level for chemicals monitored in Shafter, California.

Chemical	Highest 4-week rolling concentration (ng/m^3) †	Subchronic screening level (ng/m^3)	% of screening level
1,3-dichloropropene	4,812 **	14,000	34.4%
Acephate	Trace (1.7)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	ND (111) **	2,300	
Chlorothalonil	38	34,000	0.1%
Chlorpyrifos	51	850	6.0%
Chlorpyrifos OA	19	850	2.3%
Cypermethrin	ND (2.4)	81,000	
Chlorthal-dimethyl	Trace (3.2)	470,000	
DDVP	17	2,200	0.8%
DEF	ND (0.9)	8,800	
Diazinon	Trace (2.9)	130	
Diazinon OA	Trace (2.2)	130	
Dimethoate	ND (1.2)	3,000	
Dimethoate OA	ND (1.0)	3,000	
Diuron	Trace (3.7)	17,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	9.1	24,000	0.0%
Iprodione	Trace (6.3)	286,000	
Malathion	4.5	80,600	0.0%
Malathion OA	Trace (3.0)	80,600	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (20)	19,400 *	
Metolachlor	Trace (4.8)	15,000	
MITC	236	3,000	7.9%
Norflurazon	Trace (3.1)	26,000	
Oryzalin	Trace (6.5)	230,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	Trace (12)	180,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	26,000	
pp-Dicofol	ND (1.1)	49,000	
Propargite	Trace (4.8)	14,000	
Simazine	Trace (2.9)	31,000	
Trifluralin	Trace (3.7)	170,000	

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

* This value is a regulatory target rather than a screening level.

**These concentrations represent the highest 90-day rolling average.

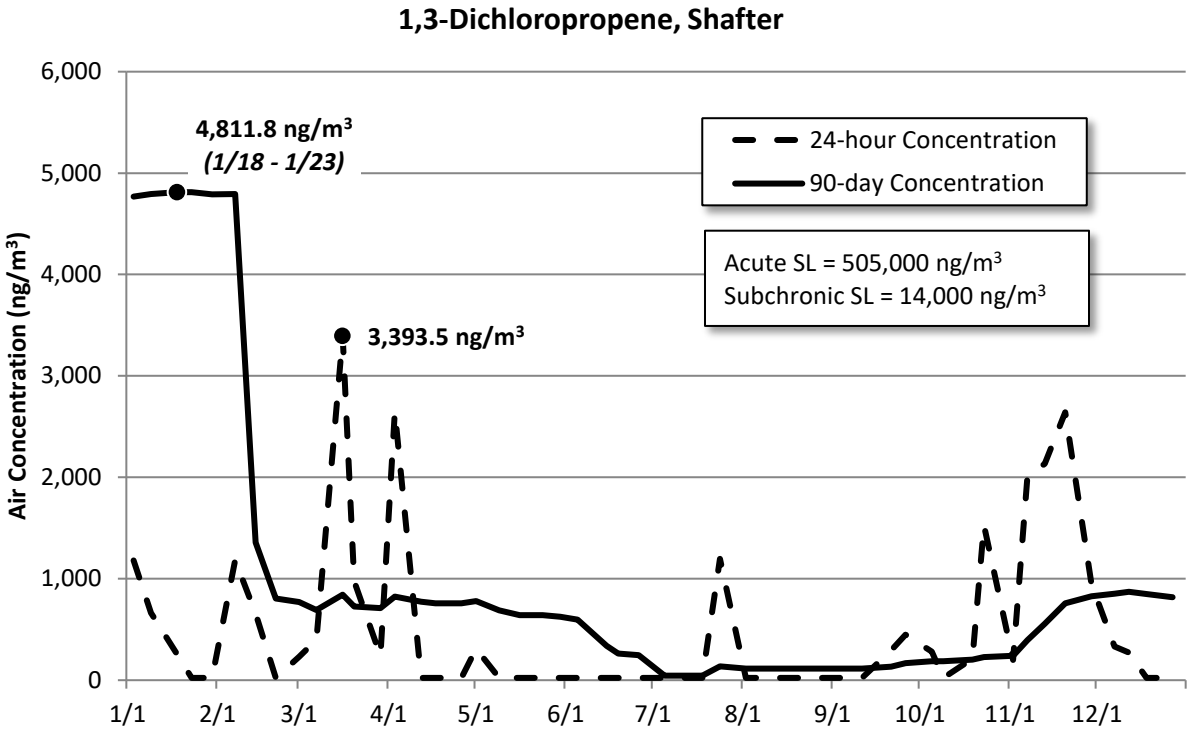

Figure 2. 24-hour and 90-day rolling average concentrations of 1,3-dichloropropene in Shafter.

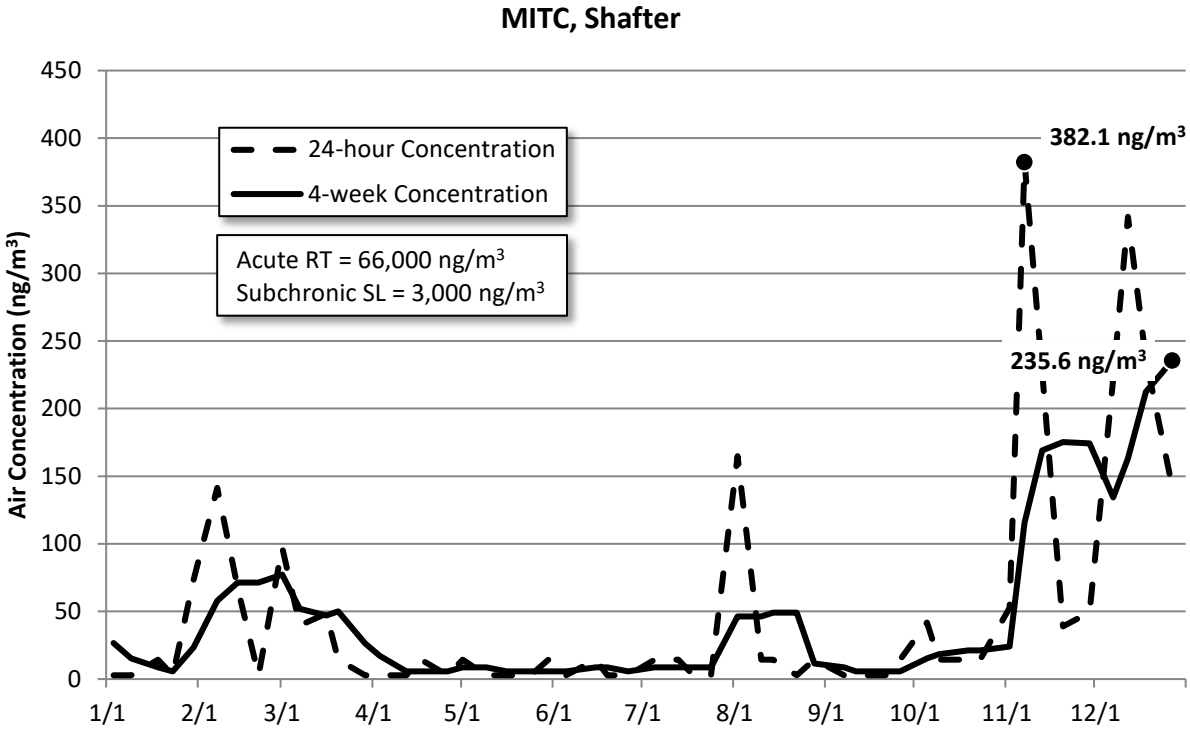

Figure 3. 24-hour and 4-week rolling average concentrations of MITC in Shafter.

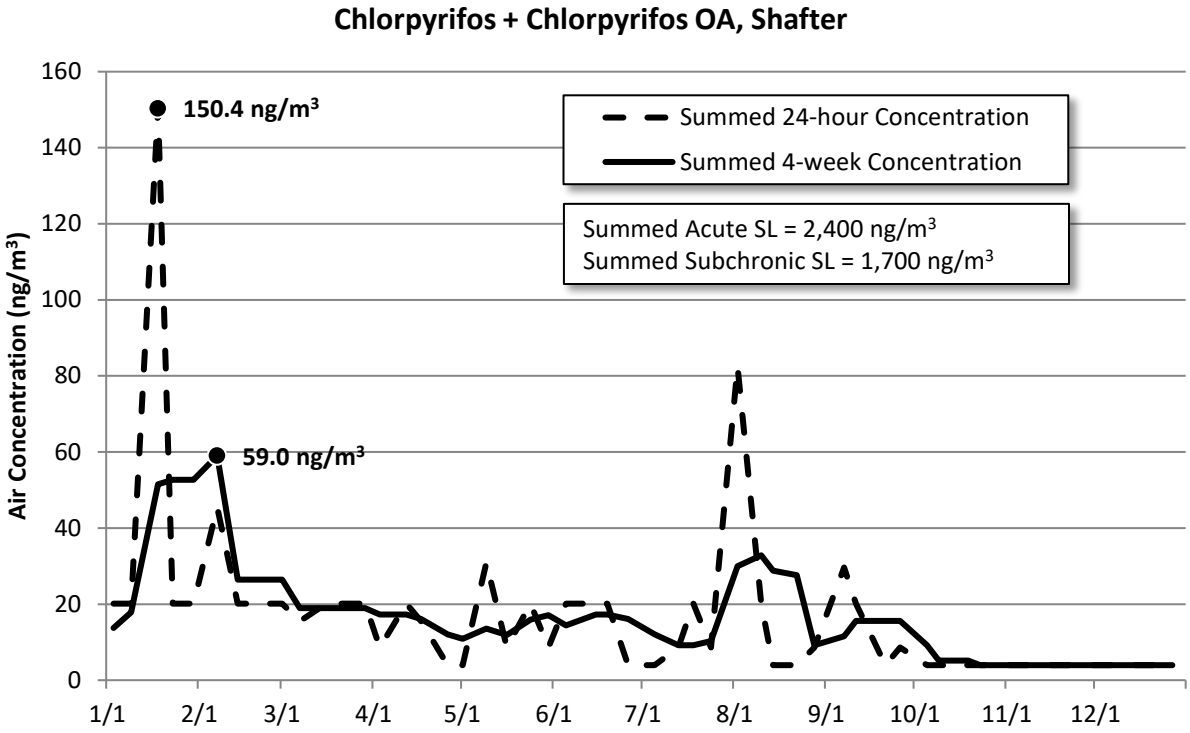

Figure 4. Summed 24-hour and 4-week rolling average concentrations of chlorpyrifos and chlorpyrifos OA in Shafter.

Table 19. Annual average air concentrations, chronic screening levels, and percent of the chronic screening level for chemicals monitored in Shafter, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level
1,3-dichloropropene	486	9,000	5.4%
Acephate	Trace (0.6)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	ND (111)	1,800	
Chlorothalonil	16	34,000	0.0%
Chlorpyrifos	11	510	2.2%
Chlorpyrifos OA	5.7	510	1.1%
Cypermethrin	ND (2.4)	27,000	
Chlorthal-dimethyl	Trace (1.3)	47,000	
DDVP	2.8	770	0.4%
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	Trace (0.8)	130	
Diazinon OA	Trace (1.1)	130	
Dimethoate	ND (1.2)	300	
Dimethoate OA	ND (1.0)	300	
Diuron	Trace (2.7)	5,700	
Endosulfan	ND (1.6)	330	
Endosulfan Sulfate	ND (2.3)	330	
EPTC	1.9	8,500	0.0%
Iprodione	Trace (1.2)	286,000	
Malathion	1.5	8,100	0.0%
Malathion OA	Trace (0.8)	8,100	
Methidathion	ND (0.7)	2,500	
Methyl bromide	ND (20)	3,900	
Metolachlor	Trace (1.8)	15,000	
MITC	51	300	16.9%
Norflurazon	Trace (2.0)	26,000	
Oryzalin	Trace (1.6)	232,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	Trace (3.9)	51,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	18,000	
pp-Dicofol	ND (1.1)	20,000	
Propargite	Trace (2.1)	14,000	
Simazine	Trace (0.9)	31,000	
Trifluralin	Trace (1.1)	41,000	

Santa Maria, California

Pesticide Detections

Table 20 lists the number and percentages of detections of monitored pesticides at the Santa Maria sampling site. Malathion OA was the pesticide most often detected at this sampling site (69%, n = 36), none of these detections were quantifiable. Malathion followed with 60% (n = 31) of analyses resulting in a detection, 5 of which were quantifiable. The third highest percentage of total detections was that of chlorthal-dimethyl (40%, n = 21), none of which were quantifiable. A total of four pesticides were measured at quantifiable concentrations at this site, of which three were fumigants: MITC, 1,3-D, and chloropicrin. The fourth was malathion. Of these, MITC had the highest percentage of quantifiable detections (19%, n = 10), followed by 1,3-D (13%, n = 6), chloropicrin (10%, n = 5), and malathion (10%, n = 5).

There were a total of seven invalid samples from analysis of VOCs (1,3-D and MeBr) originating in Santa Maria. These resulted from three analysis errors, one collection error, one sample received by the laboratory at low pressure, one sample that leaked during transit, and one from a laboratory instrument issue during analysis.

Table 20. Number and percentage of positive samples per chemical in Santa Maria, California.

Chemical	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
1,3-dichloropropene	45	6	6	13%	13%
Acephate	52	0	0	0%	0%
Bensulide	52	0	0	0%	0%
Chloropicrin	52	11	5	21%	10%
Chlorothalonil	52	5	0	10%	0%
Chlorpyrifos	52	0	0	0%	0%
Chlorpyrifos OA	52	0	0	0%	0%
Cypermethrin	52	0	0	0%	0%
Chlorthal-dimethyl	52	21	0	40%	0%
DDVP	52	12	0	23%	0%
DEF	52	0	0	0%	0%
Diazinon	52	0	0	0%	0%
Diazinon OA	52	0	0	0%	0%
Dimethoate	52	0	0	0%	0%
Dimethoate OA	52	0	0	0%	0%
Diuron	52	0	0	0%	0%
Endosulfan	52	0	0	0%	0%
Endosulfan Sulfate	52	0	0	0%	0%
EPTC	52	0	0	0%	0%
Iprodione	52	0	0	0%	0%
Malathion	52	31	5	60%	10%
Malathion OA	52	36	0	69%	0%
Methidathion	52	0	0	0%	0%
Methyl bromide	45	0	0	0%	0%
Metolachlor	52	0	0	0%	0%
MITC	52	17	10	33%	19%
Norflurazon	52	0	0	0%	0%
Oryzalin	52	0	0	0%	0%
Oxydemeton methyl	52	0	0	0%	0%
Oxyfluorfen	52	0	0	0%	0%
Permethrin	52	0	0	0%	0%
Phosmet	52	0	0	0%	0%
pp-Dicofol	52	0	0	0%	0%
Propargite	52	0	0	0%	0%
Simazine	52	0	0	0%	0%
Trifluralin	52	17	0	33%	0%
Total	**1,858**	**156**	**26**	**8%**	**1%**

* Includes both quantified and trace detections

Pesticide Concentrations

Santa Maria, Acute

No 24-h concentrations were observed at or above 1% of the acute screening level or regulatory target in Santa Maria during monitoring in 2017 (Table 21).

Santa Maria, Subchronic

Table 22 lists the highest observed subchronic concentrations for each monitored chemical at the AMN site in Santa Maria. The highest relative to its screening level was chloropicrin (36.9%), followed by 1,3-dichloropropene (8.3%), then MITC (4.7%). No other analytes exceeded 1% of their screening levels at Santa Maria.

Figures 5-7 plot the acute and subchronic concentrations for 1,3-D, chloropicrin, and MITC.

Santa Maria, Chronic

Table 23 lists the annual average concentrations for each monitored chemical at the AMN site in Santa Maria. The highest concentration relative to its chronic screening level was that of chloropicrin (17.6%), followed by MITC (7.7%), then 1,3-D (4.1%).

Table 21. Highest 24-h air concentrations, acute screening levels, and percent of the acute screening level for chemicals monitored in Santa Maria, California.

Chemical	Highest 24-h concentration (ng/m^3)	24-h acute screening level (ng/m^3)	% of screening level
1,3-dchloropropene	2,450	505,000	0.5%
Acephate	ND (0.5)	12,000	
Bensulide	ND (0.7)	259,000	
Chloropicrin	3,095	491,000[1]	0.6%
Chlorothalonil	Trace (18)	34,000	
Chlorpyrifos	ND (2.5)	1,200	
Chlorpyrifos OA	ND (1.5)	1,200	
Cypermethrin	ND (2.4)	113,000	
Chlorthal-dimethyl	Trace (5.5)	23,500,000	
DDVP	Trace (13)	11,000	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	4,300	
Dimethoate OA	ND (1.0)	4,300	
Diuron	ND (2.6)	170,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	230,000	
Iprodione	ND (0.6)	939,000	
Malathion	15	112,500	0.0%
Malathion OA	Trace (5.3)	112,500	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	820,000*	
Metolachlor	ND (1.4)	85,000	
MITC	457	66,000[1]	0.7%
Norflurazon	ND (1.9)	170,000	
Oryzalin	ND (0.7)	420,000	
Oxydemeton methyl	ND (1.2)	39,200	
Oxyfluorfen	ND (3.2)	510,000	
Permethrin	ND (3.6)	168,000	
Phosmet	ND (4.0)	77,000	
pp-Dicofol	ND (1.1)	68,000	
Propargite	ND (1.9)	14,000	
Simazine	ND (0.6)	110,000	
Trifluralin	Trace (12)	1,200,000	

† Number in parentheses is one-half of the MDL for samples with no detectable amount, and a value halfway between the MDL and LOQ for trace samples.

* This value is a regulatory target rather than a screening level.

[1] This value is an 8-h time weighted average (TWA) used to compare against the 24-h measured concentration.

Table 22. Highest rolling 4-week average air concentrations, subchronic screening levels, and percent of the subchronic screening level for chemicals monitored in Santa Maria, California.

Chemical	Highest 4-week rolling concentration (ng/m^3) †	Subchronic screening level (ng/m^3)	% of screening level
1,3-dichloropropene	1,152 **	14,000	8.3%
Acephate	ND (0.5)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	849 **	2,300	36.9%
Chlorothalonil	Trace (13)	34,000	
Chlorpyrifos	ND (2.5)	850	
Chlorpyrifos OA	ND (1.5)	850	
Cypermethrin	ND (2.4)	81,000	
Chlorthal-dimethyl	Trace (5.5)	470,000	
DDVP	Trace (10)	2,200	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	3,000	
Dimethoate OA	ND (1.0)	3,000	
Diuron	ND (2.6)	17,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	24,000	
Iprodione	ND (0.6)	286,000	
Malathion	12	80,600	0.0%
Malathion OA	Trace (5.3)	80,600	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	19,400 *	
Metolachlor	ND (1.4)	15,000	
MITC	140	3,000	4.7%
Norflurazon	ND (1.9)	26,000	
Oryzalin	ND (0.7)	230,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	180,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	26,000	
pp-Dicofol	ND (1.1)	49,000	
Propargite	ND (1.9)	14,000	
Simazine	ND (0.6)	31,000	
Trifluralin	Trace (12)	170,000	

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

* This value is a regulatory target rather than a screening level.

**These concentrations represent the highest 90-day rolling average.

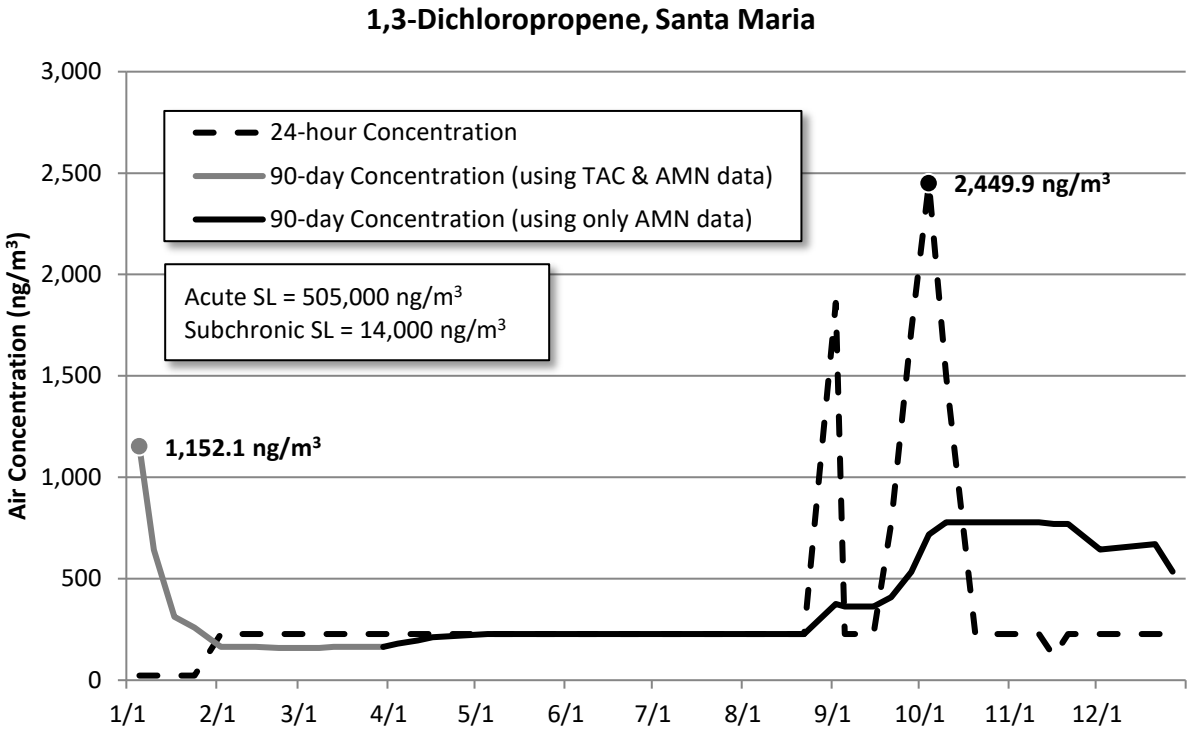

Figure 5. 24-hour and 90-day rolling average concentrations of 1,3-dichloropropene in Santa Maria.

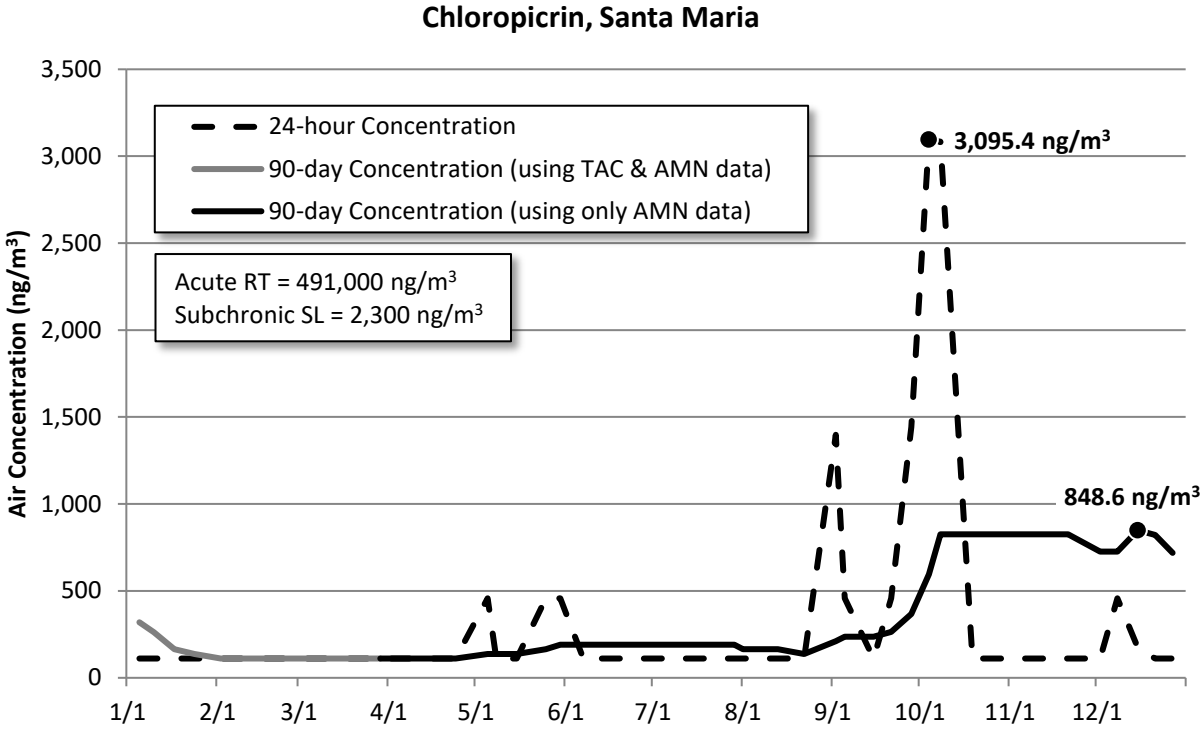

Figure 6. 24-hour and 90-day rolling average concentrations of chloropicrin in Santa Maria.

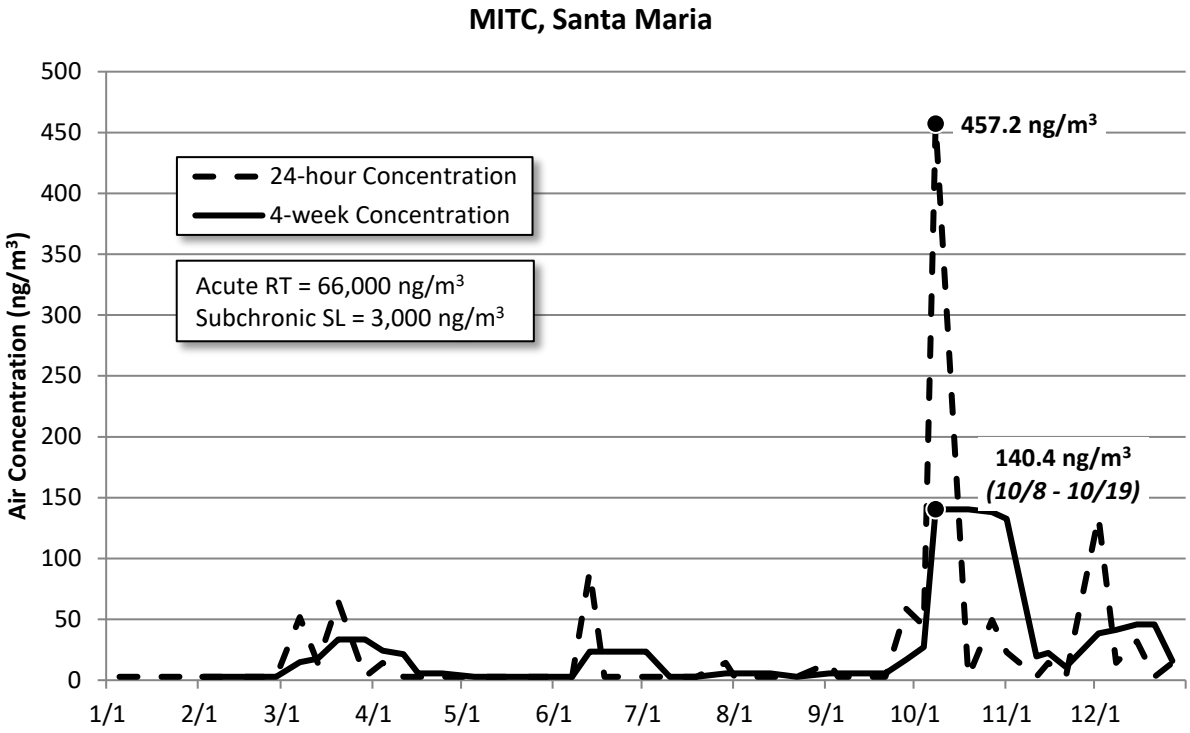

Figure 7. 24-hour and 4-week rolling average concentrations of MITC in Santa Maria

Table 23. Annual average air concentrations, chronic screening levels, and percent of the chronic screening level for chemicals monitored in Santa Maria, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level
1,3-dichloropropene	366	9,000	4.1%
Acephate	ND (0.5)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	317	1,800	17.6%
Chlorothalonil	Trace (8.0)	34,000	
Chlorpyrifos	ND (2.5)	510	
Chlorpyrifos OA	ND (1.5)	510	
Cypermethrin	ND (2.4)	27,000	
Chlorthal-dimethyl	Trace (2.7)	47,000	
DDVP	Trace (4.3)	770	
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	300	
Dimethoate OA	ND (1.0)	300	
Diuron	ND (2.6)	5,700	
Endosulfan	ND (1.6)	330	
Endosulfan Sulfate	ND (2.3)	330	
EPTC	ND (0.9)	8,500	
Iprodione	ND (0.6)	286,000	
Malathion	4.5	8,100	0.1%
Malathion OA	Trace (3.9)	8,100	
Methidathion	ND (0.7)	2,500	
Methyl bromide	ND (54)	3,900	
Metolachlor	ND (1.4)	15,000	
MITC	23	300	7.7%
Norflurazon	ND (1.9)	26,000	
Oryzalin	ND (0.7)	232,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	51,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	18,000	
pp-Dicofol	ND (1.1)	20,000	
Propargite	ND (1.9)	14,000	
Simazine	ND (0.6)	31,000	
Trifluralin	Trace (4.6)	41,000	

Watsonville, California

Pesticide Detections

Table 24 list the number and percentage of positive detections for the Watsonville sampling site. Three analytes had the highest percentage of detections for both total and quantifiable detections. Chloropicrin had the highest percentage of total detections (25%, n=13) and the second highest percentage of quantifiable detections (12%, n=6). 1,3-D had the second highest percentage of total detections (20%, n=10) and the highest percentage of quantifiable detections (20%, n=10). MITC had the third highest percentage of both total and quantifiable detections at 18% (n=9) and 2% (n=1), respectively.

Table 24. Number and percentage of positive samples per chemical in Watsonville, California.

Chemical	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
1,3-dichloropropene	49	10	10	20%	20%
Acephate	51	0	0	0%	0%
Bensulide	51	0	0	0%	0%
Chloropicrin	51	13	6	25%	12%
Chlorothalonil	51	2	0	4%	0%
Chlorpyrifos	51	1	0	2%	0%
Chlorpyrifos OA	51	0	0	0%	0%
Cypermethrin	51	0	0	0%	0%
Chlorthal-dimethyl	51	4	0	8%	0%
DDVP	51	1	0	2%	0%
DEF	51	0	0	0%	0%
Diazinon	51	0	0	0%	0%
Diazinon OA	51	0	0	0%	0%
Dimethoate	51	0	0	0%	0%
Dimethoate OA	51	0	0	0%	0%
Diuron	51	1	0	2%	0%
Endosulfan	51	1	0	2%	0%
Endosulfan Sulfate	51	0	0	0%	0%
EPTC	51	0	0	0%	0%
Iprodione	51	0	0	0%	0%
Malathion	51	7	0	14%	0%
Malathion OA	51	5	0	10%	0%
Methidathion	51	0	0	0%	0%
Methyl bromide	49	0	0	0%	0%
Metolachlor	51	1	0	2%	0%
MITC	51	9	1	18%	2%
Norflurazon	51	1	0	2%	0%
Oryzalin	51	1	0	2%	0%
Oxydemeton methyl	51	0	0	0%	0%
Oxyfluorfen	51	0	0	0%	0%
Permethrin	51	0	0	0%	0%
Phosmet	51	0	0	0%	0%
pp-Dicofol	51	1	0	2%	0%
Propargite	51	0	0	0%	0%
Simazine	51	1	0	2%	0%
Trifluralin	51	7	0	14%	0%
Total	**1,832**	**66**	**17**	**4%**	**1%**

* Includes both quantified and trace detections

Pesticide Concentrations

Watsonville, Acute

Table 25 lists the highest observed 24-h concentrations in Watsonville during AMN monitoring in 2017. No compounds exceeded 1% of their acute screening level or regulatory target at this site.

Watsonville, Subchronic

Table 26 lists the highest observed subchronic concentrations for each monitored chemical at the AMN site in Watsonville. The highest of these concentrations relative to its subchronic screening level was that of chloropicrin (42.3%) followed by 1,3-D at 6.5%. No other concentrations exceeded 1% of their respective screening level.

Figures 8 – 10 plot the acute and subchronic concentrations for 1,3-D, chloropicrin, and MITC.

Watsonville, Chronic

Table 27 lists the annual average concentrations for each monitored chemical at the AMN site in Watsonville. The highest average 1-year concentration relative to its chronic screening level was that of chloropicrin (19.3%), followed by 1,3-D (4.4%), then MITC (1.9%).

Table 25. Highest 24-h air concentrations, acute screening levels, and percent of the acute screening level for chemicals monitored in Watsonville, California.

Chemical	Highest 24-h concentration (ng/m^3)	24-h acute screening level (ng/m^3)	% of screening level
1,3-dichloropropene	1,860	505,000	0.4%
Acephate	ND (0.5)	12,000	
Bensulide	ND (0.7)	259,000	
Chloropicrin	3,221	491,000[1]	0.7%
Chlorothalonil	Trace (18)	34,000	
Chlorpyrifos	Trace (14)	1,200	
Chlorpyrifos OA	ND (1.5)	1,200	
Cypermethrin	ND (2.4)	113,000	
Chlorthal-dimethyl	Trace (5.5)	23,500,000	
DDVP	Trace (13)	11,000	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	4,300	
Dimethoate OA	ND (1.0)	4,300	
Diuron	Trace (7.2)	170,000	
Endosulfan	Trace (13)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	230,000	
Iprodione	ND (0.6)	939,000	
Malathion	Trace (5.8)	112,500	
Malathion OA	Trace (5.3)	112,500	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	820,000*	
Metolachlor	Trace (6.0)	85,000	
MITC	56	66,000[1]	0.1%
Norflurazon	Trace (6.6)	170,000	
Oryzalin	Trace (12)	420,000	
Oxydemeton methyl	ND (1.2)	39,200	
Oxyfluorfen	ND (3.2)	510,000	
Permethrin	ND (3.6)	168,000	
Phosmet	ND (4.0)	77,000	
pp-Dicofol	Trace (13)	68,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (5.3)	110,000	
Trifluralin	Trace (12)	1,200,000	

† Number in parentheses is one-half of the MDL for samples with no detectable amount, and a value halfway between the MDL and LOQ for trace samples.

* This value is a regulatory target rather than a screening level.

[1] This value is an 8-h time weighted average (TWA) used to compare against the 24-h measured concentration.

Table 26. Highest rolling 4-week average air concentrations, subchronic screening levels, and percent of the subchronic screening level for chemicals monitored in Watsonville, California.

Chemical	Highest 4-week rolling concentration (ng/m^3 †)	Subchronic screening level (ng/m^3)	% of screening level
1,3-dichloropropene	904	14,000	6.5%
Acephate	ND (0.5)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	974 **	2,300	42.3%
Chlorothalonil	Trace (9.7)	34,000	
Chlorpyrifos	Trace (5.4)	850	
Chlorpyrifos OA	ND (1.5)	850	
Cypermethrin	ND (2.4)	81,000	
Chlorthal-dimethyl	Trace (2.4)	470,000	
DDVP	Trace (4.5)	2,200	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	3,000	
Dimethoate OA	ND (1.0)	3,000	
Diuron	Trace (3.7)	17,000	
Endosulfan	Trace (4.5)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	24,000	
Iprodione	ND (0.6)	286,000	
Malathion	Trace (4.6)	80,600	
Malathion OA	Trace (3.0)	80,600	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	19,400 *	
Metolachlor	Trace (2.5)	15,000	
MITC	19	3,000	0.6%
Norflurazon	Trace (3.1)	26,000	
Oryzalin	Trace (3.6)	230,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	180,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	26,000	
pp-Dicofol	Trace (3.9)	49,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (1.8)	31,000	
Trifluralin	Trace (6.6)	170,000	

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

* This value is a regulatory target rather than a screening level.

**These concentrations represent the highest 90-day rolling average.

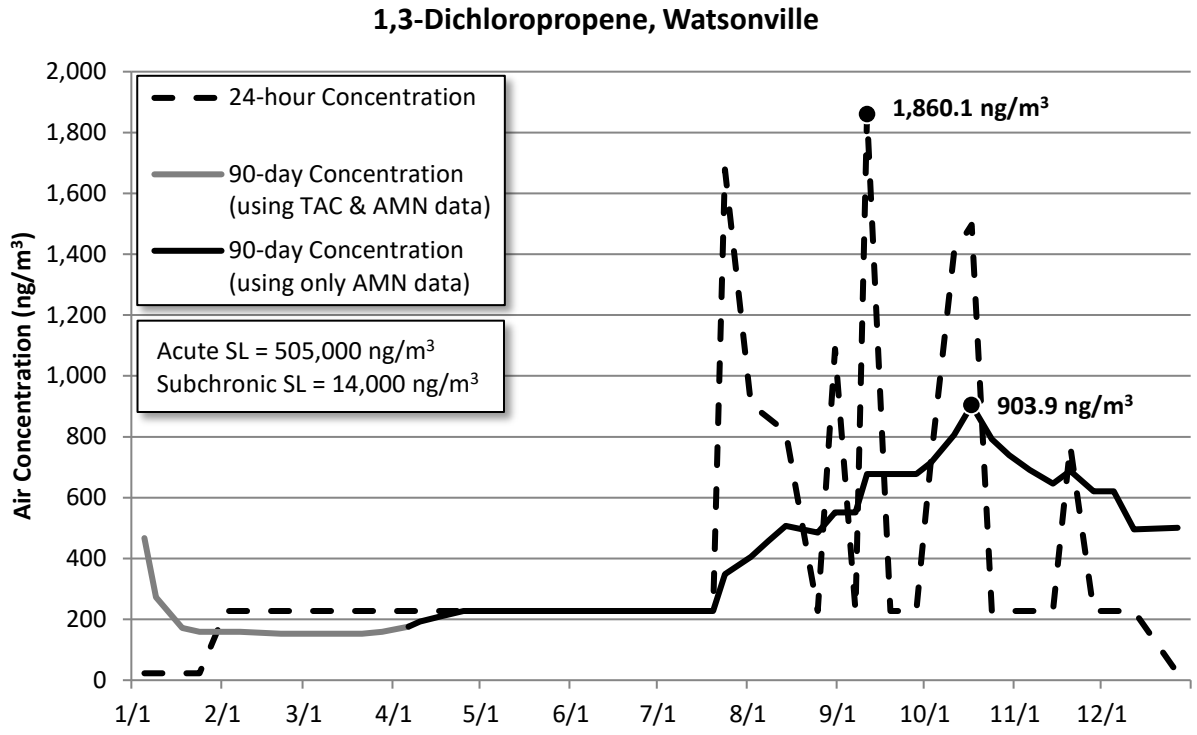

Figure 8. 24-hour and 90-day rolling average concentrations of 1,3-dichloropropene in Watsonville.

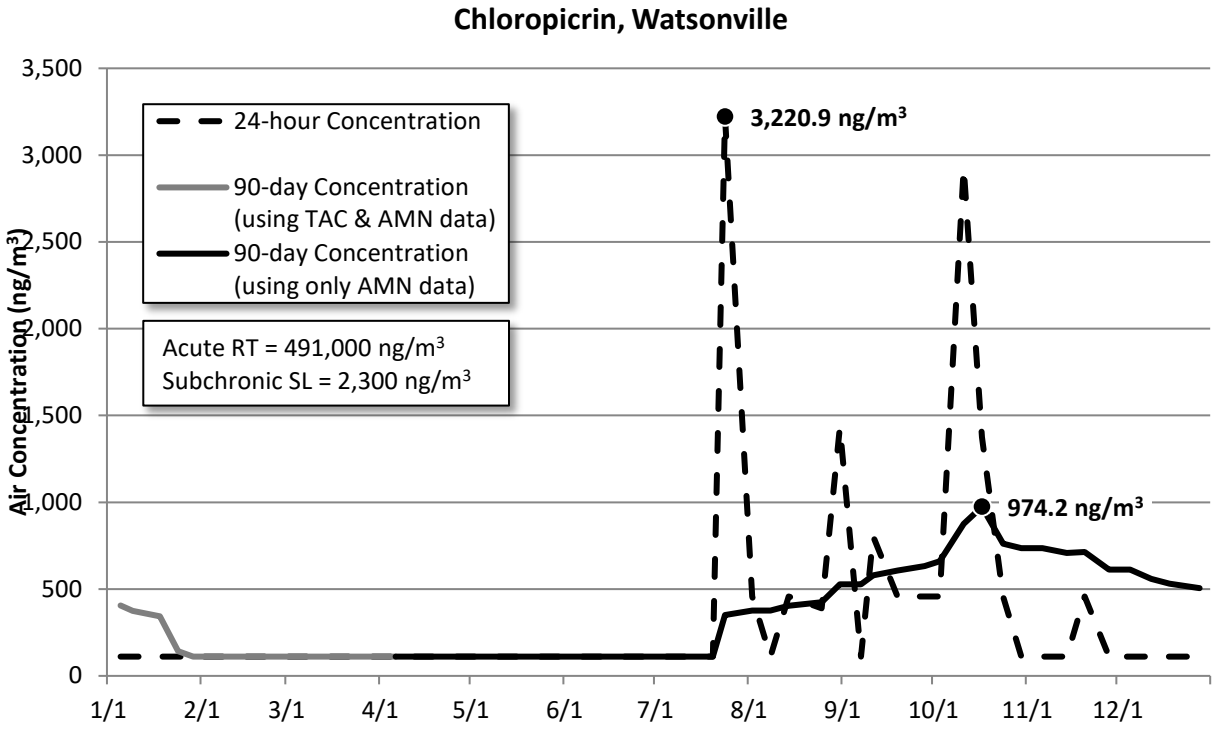

Figure 9. 24-hour and 90-day rolling average concentrations of chloropicrin Watsonville.

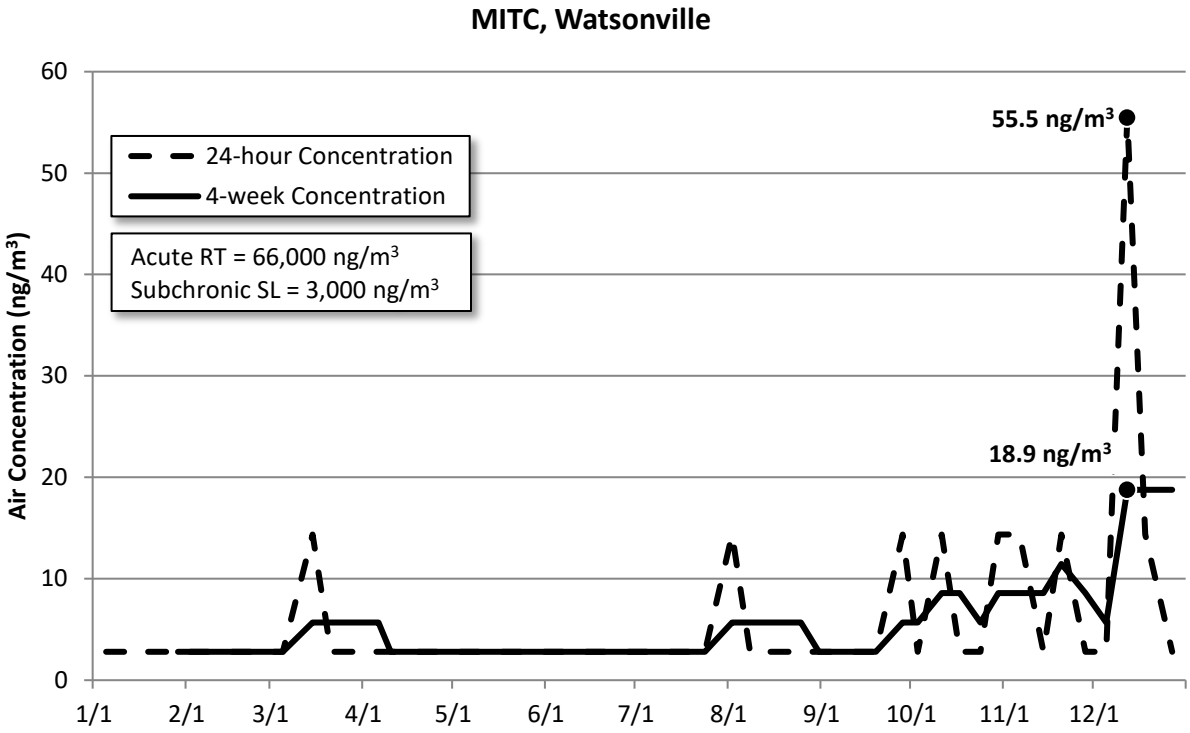

Figure 10. 24-hour and 4-week rolling average concentrations of MITC in Watsonville.

Table 27. Annual average air concentrations, chronic screening levels, and percent of the chronic screening level for chemicals monitored in Watsonville, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level
1,3-dichloropropene	397	9,000	4.4%
Acephate	ND (0.5)	8,500	
Bensulide	ND (0.7)	24,000	
Chloropicrin	347	1,800	19.3%
Chlorothalonil	Trace (7.3)	34,000	
Chlorpyrifos	Trace (2.7)	510	
Chlorpyrifos OA	ND (1.5)	510	
Cypermethrin	ND (2.4)	27,000	
Chlorthal-dimethyl	Trace (1.2)	47,000	
DDVP	Trace (1.8)	770	
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	300	
Dimethoate OA	ND (1.0)	300	
Diuron	Trace (2.6)	5,700	
Endosulfan	Trace (1.8)	330	
Endosulfan Sulfate	ND (2.3)	330	
EPTC	ND (0.9)	8,500	
Iprodione	ND (0.6)	286,000	
Malathion	Trace (1.7)	8,100	
Malathion OA	Trace (1.1)	8,100	
Methidathion	ND (0.7)	2,500	
Methyl bromide	ND (54)	3,900	
Metolachlor	Trace (1.4)	15,000	
MITC	5.6	300	1.9%
Norflurazon	Trace (2.0)	26,000	
Oryzalin	Trace (0.9)	232,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	51,000	
Permethrin	ND (3.6)	90,000	
Phosmet	ND (4.0)	18,000	
pp-Dicofol	Trace (1.3)	20,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (0.7)	31,000	
Trifluralin	Trace (2.4)	41,000	

Chualar, California

Pesticide Detections

Table 28 lists the number and percentage of positive detections for the Chualar sampling site. Chlorthal-dimethyl produced the highest percentage of both total detections (100%, n=51) and quantifiable detections (35%, n=18). Chlorothalonil and MITC both followed with 25% (n=13) of analyses resulting in any detection. The second highest percentage of quantifiable detections was shared by 1,3-D and chloropicrin at 4% (n=2).

Table 28. Number and percentage of positive samples per chemical in Chualar, California.

Chemical	Number of possible detections	Total number of detections *	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
1,3-dichloropropene	49	2	2	4%	4%
Acephate	51	0	0	0%	0%
Bensulide	51	2	0	4%	0%
Chloropicrin	52	6	2	12%	4%
Chlorothalonil	51	13	0	25%	0%
Chlorpyrifos	51	0	0	0%	0%
Chlorpyrifos OA	51	0	0	0%	0%
Cypermethrin	51	0	0	0%	0%
Chlorthal-dimethyl	51	51	18	100%	35%
DDVP	51	3	0	6%	0%
DEF	51	0	0	0%	0%
Diazinon	51	0	0	0%	0%
Diazinon OA	51	0	0	0%	0%
Dimethoate	51	0	0	0%	0%
Dimethoate OA	51	0	0	0%	0%
Diuron	51	2	0	4%	0%
Endosulfan	51	0	0	0%	0%
Endosulfan Sulfate	51	0	0	0%	0%
EPTC	51	0	0	0%	0%
Iprodione	51	0	0	0%	0%
Malathion	51	9	0	18%	0%
Malathion OA	51	8	0	16%	0%
Methidathion	51	0	0	0%	0%
Methyl bromide	49	0	0	0%	0%
Metolachlor	51	0	0	0%	0%
MITC	52	13	1	25%	2%
Norflurazon	51	2	0	4%	0%
Oryzalin	51	2	0	4%	0%
Oxydemeton methyl	51	0	0	0%	0%
Oxyfluorfen	51	0	0	0%	0%
Permethrin	51	1	0	2%	0%
Phosmet	51	0	0	0%	0%
pp-Dicofol	51	0	0	0%	0%
Propargite	51	0	0	0%	0%
Simazine	51	1	0	2%	0%
Trifluralin	51	0	0	0%	0%
Total	**1,834**	**115**	**23**	**6%**	**1%**

* Includes both quantified and trace detections

Pesticide Concentrations

Chualar, Acute

Table 29 lists the highest observed 24-h concentrations at the Chualar sampling site in 2017. No monitored chemicals exceeded 1% of their acute screening level or regulatory target at this site.

Chualar, Subchronic

Table 30 lists the highest observed subchronic concentrations for each monitored chemical at the AMN site in Chualar. The highest of these concentrations relative to its subchronic screening level was that of chloropicrin (14.0%), followed by 1,3-D (2.8%), then MITC (1.0%). No other subchronic concentrations at Chualar exceeded 1% of their screening levels.

Figures 11 – 13 plot the acute and subchronic concentrations for 1,3-D, chloropicrin, and MITC .

Chualar, Chronic

Table 31 lists the annual average concentrations for each monitored chemical at the AMN site in Chualar. The highest concentration relative to its chronic screening level was that of chloropicrin (9.1%), followed by 1,3-D (2.8%), then MITC (2.4%).

Table 29. Highest 24-h air concentrations, acute screening levels, and percent of the acute screening level for chemicals monitored in Chualar, California.

Chemical	Highest 24-h concentration (ng/m^3)	24-h acute screening level (ng/m^3)	% of screening level
1,3-dichloropropene	1,996	505,000	0.4%
Acephate	ND (0.5)	12,000	
Bensulide	Trace (5.4)	259,000	
Chloropicrin	805	491,000[1]	0.2%
Chlorothalonil	Trace (18)	34,000	
Chlorpyrifos	ND (2.5)	1,200	
Chlorpyrifos OA	ND (1.5)	1,200	
Cypermethrin	ND (2.4)	113,000	
Chlorthal-dimethyl	22	23,500,000	0.0%
DDVP	Trace (13)	11,000	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	4,300	
Dimethoate OA	ND (1.0)	4,300	
Diuron	Trace (7.2)	170,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	230,000	
Iprodione	ND (0.6)	939,000	
Malathion	Trace (5.8)	112,500	
Malathion OA	Trace (5.3)	112,500	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	820,000*	
Metolachlor	ND (1.4)	85,000	
MITC	92	66,000[1]	0.1%
Norflurazon	Trace (6.6)	170,000	
Oryzalin	Trace (12)	420,000	
Oxydemeton methyl	ND (1.2)	39,200	
Oxyfluorfen	ND (3.2)	510,000	
Permethrin	Trace (15)	168,000	
Phosmet	ND (4.0)	77,000	
pp-Dicofol	ND (1.1)	68,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (5.3)	110,000	
Trifluralin	ND (0.9)	1,200,000	

† Number in parentheses is one-half of the MDL for samples with no detectable amount, and a value halfway between the MDL and LOQ for trace samples.

* This value is a regulatory target rather than a screening level.

[1] This value is an 8-h time weighted average (TWA) used to compare against the 24-h measured concentration.

Table 30. Highest rolling 4-week average air concentrations, subchronic screening levels, and percent of the subchronic screening level for chemicals monitored in Chualar, California.

Chemical	Highest 4-week rolling concentration (ng/m^3) †	Subchronic screening level (ng/m^3)	% of screening level
1,3-dichloropropene	398 **	14,000	2.8%
Acephate	ND (0.5)	8,500	
Bensulide	Trace (1.9)	24,000	
Chloropicrin	322 **	2,300	14.0%
Chlorothalonil	Trace (18)	34,000	
Chlorpyrifos	ND (2.5)	850	
Chlorpyrifos OA	ND (1.5)	850	
Cypermethrin	ND (2.4)	81,000	
Chlorthal-dimethyl	16	470,000	0.0%
DDVP	Trace (7.4)	2,200	
DEF	ND (0.9)	8,800	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	3,000	
Dimethoate OA	ND (1.0)	3,000	
Diuron	Trace (4.9)	17,000	
Endosulfan	ND (1.6)	3,300	
Endosulfan Sulfate	ND (2.3)	3,300	
EPTC	ND (0.9)	24,000	
Iprodione	ND (0.6)	286,000	
Malathion	Trace (4.6)	80,600	
Malathion OA	Trace (5.3)	80,600	
Methidathion	ND (0.7)	3,100	
Methyl bromide	ND (58)	19,400 *	
Metolachlor	ND (1.4)	15,000	
MITC	31	3,000	1.0%
Norflurazon	Trace (4.2)	26,000	
Oryzalin	Trace (6.5)	230,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	180,000	
Permethrin	Trace (6.5)	90,000	
Phosmet	ND (4.0)	26,000	
pp-Dicofol	ND (1.1)	49,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (1.8)	31,000	
Trifluralin	ND (0.9)	170,000	

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

* This value is a regulatory target rather than a screening level.

**These concentrations represent the highest 90-day rolling average.

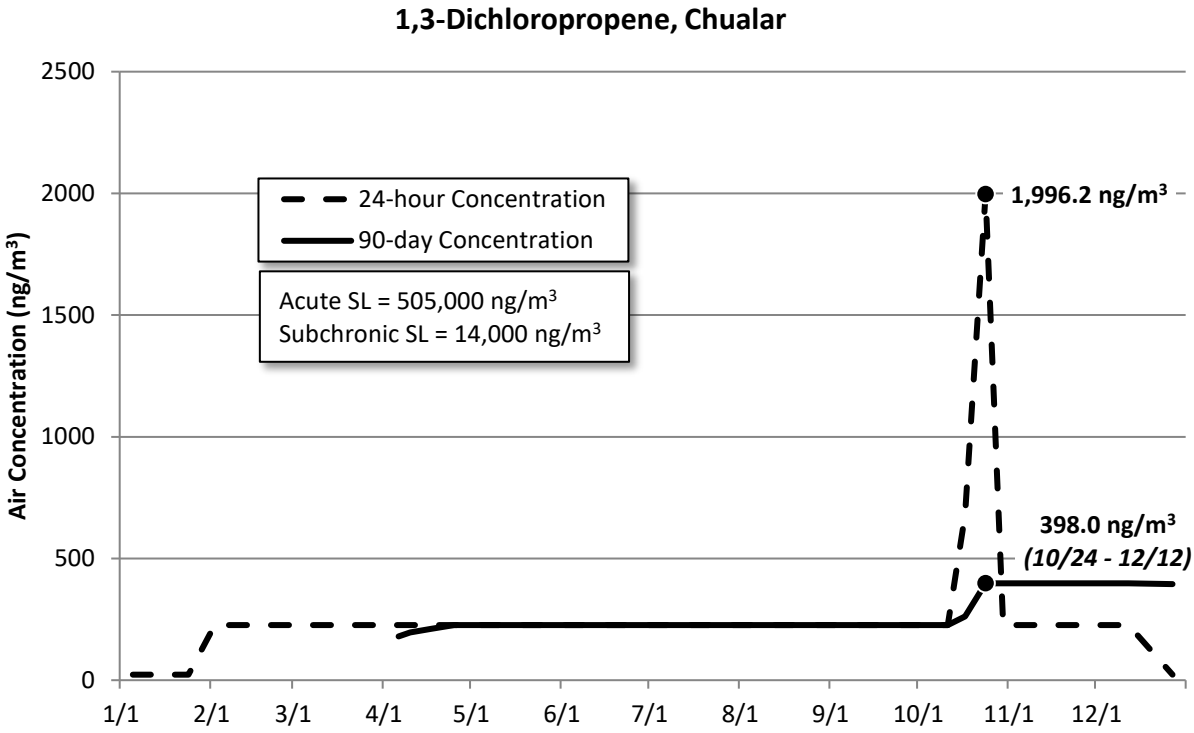

Figure 11. 24-hour and 90-day rolling average concentrations of 1,3-dichloropropene in Chualar.

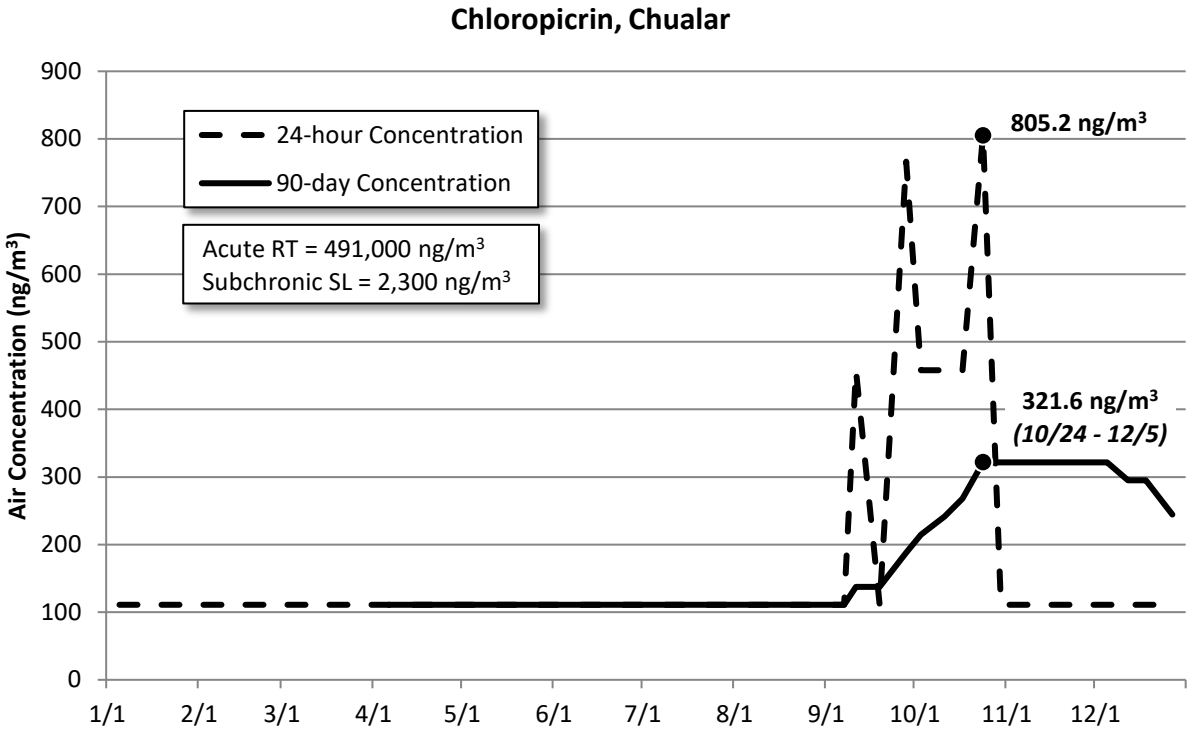

Figure 12. 24-hour and 90-day rolling average concentrations of chloropicrin in Chualar.

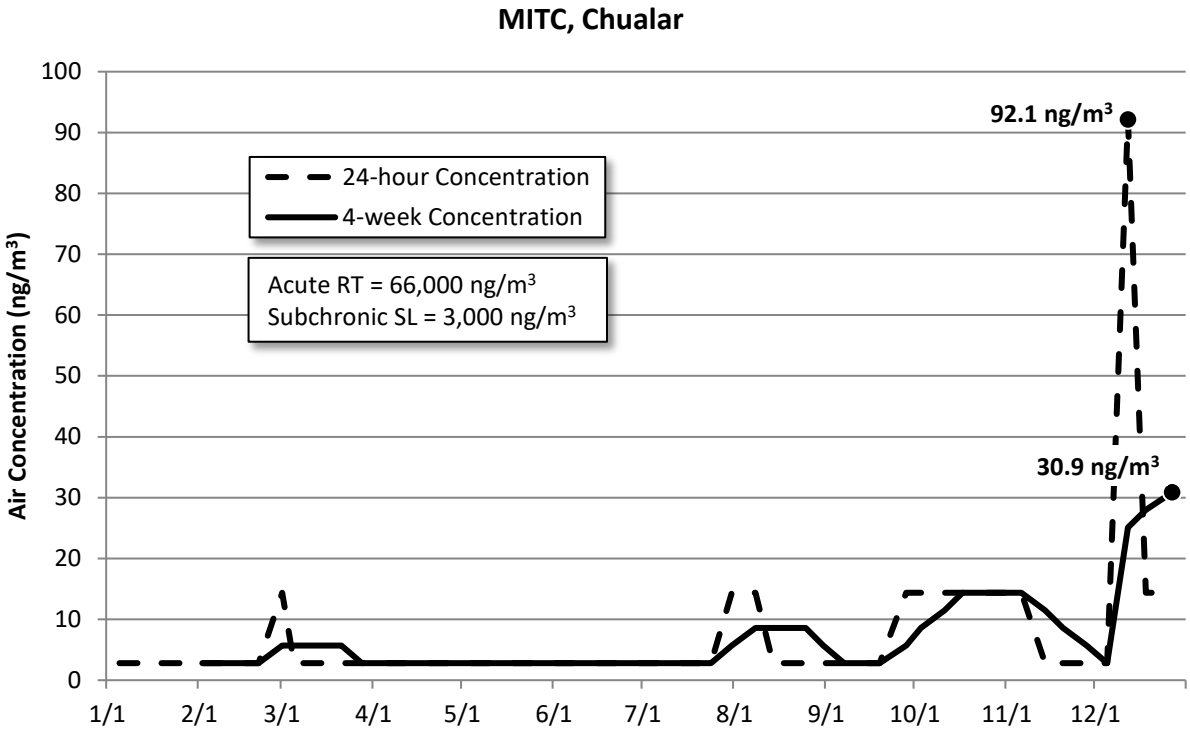

Figure 13. 24-hour and 4-week rolling average concentrations of MITC in Chualar.

Table 31. Annual average air concentrations, chronic screening levels, and percent of the chronic screening level for chemicals monitored in Chualar, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level
1,3-dichloropropene	252	9,000	2.8%
Acephate	ND (0.5)	8,500	
Bensulide	Trace (0.9)	24,000	
Chloropicrin	164	1,800	9.1%
Chlorothalonil	Trace (9.8)	34,000	
Chlorpyrifos	ND (2.5)	510	
Chlorpyrifos OA	ND (1.5)	510	
Cypermethrin	ND (2.4)	27,000	
Chlorthal-dimethyl	8.4	47,000	0.0%
DDVP	Trace (2.3)	770	
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	
Diazinon OA	ND (1.1)	130	
Dimethoate	ND (1.2)	300	
Dimethoate OA	ND (1.0)	300	
Diuron	Trace (2.7)	5,700	
Endosulfan	ND (1.6)	330	
Endosulfan Sulfate	ND (2.3)	330	
EPTC	ND (0.9)	8,500	
Iprodione	ND (0.6)	286,000	
Malathion	Trace (1.9)	8,100	
Malathion OA	Trace (1.4)	8,100	
Methidathion	ND (0.7)	2,500	
Methyl bromide	ND (54)	3,900	
Metolachlor	ND (1.4)	15,000	
MITC	7.2	300	2.4%
Norflurazon	Trace (2.1)	26,000	
Oryzalin	Trace (1.2)	232,000	
Oxydemeton methyl	ND (1.2)	610	
Oxyfluorfen	ND (3.2)	51,000	
Permethrin	Trace (3.8)	90,000	
Phosmet	ND (4.0)	18,000	
pp-Dicofol	ND (1.1)	20,000	
Propargite	ND (1.9)	14,000	
Simazine	Trace (0.7)	31,000	
Trifluralin	ND (0.9)	41,000	

Cancer Risk Estimates

Annual average concentrations and cancer risk estimates for 1,3-D, chlorothalonil, and DDVP are shown in Table 32 - 38. Although annual values used are shown throughout the tables below, it is important to note that these shorter timeframes are less suitable for comparison to a 70-year target and are shown for illustrative purposes only.

Previous air monitoring results from TAC monitoring at the current AMN sites were included where possible but have been shaded with crosshatching to indicate that this is not a perfectly seamless comparison. These sites were spatially identical within the context of the study, but differed slightly in field and laboratory procedures as detailed in the Laboratory Methods section of this report.

Table 32. Yearly average 1,3-dichloropropene concentrations for each AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average concentration (ng/m³)	**1,083**	**638**	**496**	**245**
Lifetime regulatory target (ng/m³)	**2,600**	**2,600**	**2,600**	**2,600**
2017	502	330	401	245
2016	1,559	*507*	*346*	*N/A †*
2015	800	*505*	*526*	
2014	909	*543*	*420*	
2013	2,589	*885*	*583*	
2012	384	*888*	*683*	
2011	ND (227)	*674*	*590*	
2010	*N/A †*	*962*	*N/A †*	

* Values in crosshatched cells were pulled from DPR TAC program's monitoring data, there were slight differences in collection procedure as described in the text of this section.
† Sampling was not conducted at this monitoring location during this time.

Table 33. Annual cancer risk estimates for 1,3-dichloropropene for each current AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average for all years shown	**4.25E-06**	**2.50E-06**	**1.94E-06**	**9.59E-07**
Target	**1.00E-05**	**1.00E-05**	**1.00E-05**	**1.00E-05**
2017	1.97E-06	1.29E-06	1.57E-06	9.59E-07
2016	5.68E-06	*1.99E-06*	*1.36E-06*	*N/A †*
2015	3.01E-06	*1.98E-06*	*2.06E-06*	
2014	3.41E-06	*2.13E-06*	*1.65E-06*	
2013	1.16E-05	*3.47E-06*	*2.28E-06*	
2012	1.48E-06	*3.48E-06*	*2.68E-06*	
2011	ND	*2.64E-06*	*2.31E-06*	
2010	*N/A †*	*3.77E-06*	*N/A †*	

* Values in crosshatched cells were pulled from DPR TAC program's monitoring data, there were slight differences in collection procedure as described in the text of this section.
† Sampling was not conducted at this monitoring location during this time.

Table 34. Annual cancer risk estimates for 1,3-dichloropropene expressed relative to the 70-year target.

	Shafter	Santa Maria	Watsonville	Chualar
Average for all years shown	**0.425**	**0.250**	**0.194**	**0.096**
Target	**1.00**	**1.00**	**1.00**	**1.00**
2017	0.197	0.129	0.157	0.096
2016	0.568	*0.199*	*0.136*	*N/A †*
2015	0.301	*0.198*	*0.206*	
2014	0.341	*0.213*	*0.165*	
2013	1.16	*0.347*	*0.228*	
2012	0.148	*0.348*	*0.268*	
2011	ND	*0.264*	*0.231*	
2010	*N/A †*		*N/A †*	

* Values in crosshatched cells were pulled from DPR TAC program's monitoring data, there were slight differences in collection procedure as described in the text of this section.
† Sampling was not conducted at this monitoring location during this time.

Table 35. Annual average chlorothalonil concentrations for each AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average concentration (ng/m³)	14.7	7.7	7.3	9.8
2017	16.1	7.7	7.3	9.8
2016	14.5	*N/A* †		
2015	16.2			
2014	22.1			
2013	15.8			
2012	9.4			
2011	8.3			

† Chlorothalonil was not monitored at this location.

Table 36. Annual cancer risk estimates for chlorothalonil using standard method for each current AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average for all years shown	6.59E-08	3.47E-08	3.27E-08	4.41E-08
2017	7.19E-08	3.47E-08	3.27E-08	4.41E-08
2016	6.48E-08	*N/A* †		
2015	7.24E-08			
2014	9.91E-08			
2013	7.09E-08			
2012	4.22E-08			
2011	3.73E-08			

† Chlorothalonil was not monitored at this location.

Table 37. Annual average DDVP concentrations for each AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average concentration (ng/m³)	2.1	4.2	1.8	2.2
2017	2.3	4.2	1.8	2.2
2016	2.4	*N/A* †		
2015	2.4			
2014	1.9			
2013	2.2			
2012	1.6			
2011	1.9			

† DDVP was not monitored at this location.

Table 38. Annual cancer risk estimates for DDVP using standard method for each current AMN sampling location.

	Shafter	Santa Maria	Watsonville	Chualar
Average for all years shown	2.05E-07	4.13E-07	1.72E-07	2.16E-07
2017	2.25E-07	4.13E-07	1.72E-07	2.16E-07
2016	2.46E-07	*N/A* †		
2015	2.46E-07			
2014	1.79E-07			
2013	2.21E-07			
2012	1.57E-07			
2011	1.81E-07			

† DDVP was not monitored at this location.

Cumulative Exposure Estimates for Organophosphates

Cumulative exposures were calculated for the organophosphate pesticides included in the AMN because these are the only pesticides in the AMN that have a common mode of action (cholinesterase inhibition) and were detected at quantifiable concentrations. Table 39 lists the 14 organophosphates included in AMN monitoring.

Table 39. Organophosphates included in AMN cumulative exposure estimates.

1. Acephate
2. Bensulide
3. Chlorpyrifos
4. Chlorpyrifos OA
5. DDVP
6. Diazinon
7. Diazinon OA
8. Dimethoate
9. Dimethoate OA
10. Malathion
11. Malathion OA
12. Oxydemeton methyl
13. Phosmet
14. DEF

As described in the Health Evaluation Methods section of this report the cumulative exposure was estimated using an HQ and HI approach that relies on the ratio between the detected air concentration and the screening level (or regulatory target). The organophosphate cumulative exposures were estimated for each community and exposure period.

Table 40 summarizes the highest calculated HI's for each community and time period during monitoring in 2017, while Tables 41 - 52 present this information in detail. Both the acute and subchronic HI values were calculated for each individual sample set, from which the maximum observed HI was reported. None of the HIs exceeded a value of 1.0 at any of the sampling locations during this year. This indicates that even for the combined 14 organophosphate compound, a summed screening level was not exceeded.

Table 40. Summary of organophosphate cumulative exposure.

Community	Acute hazard index *	Subchronic hazard index *	Chronic hazard index *
Shafter	0.139	0.086	0.061
Santa Maria	0.018	0.025	0.037
Watsonville	0.027	0.026	0.034
Chualar	0.018	0.024	0.034

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Organophosphate Details for Shafter

The only organophosphates detected in Shafter at quantifiable levels were chlorpyrifos, chlorpyrifos OA, DDVP, and malathion. Among these, chlorpyrifos had the largest effect on the calculated acute HI (82.7%), subchronic HI (69.8%), and chronic HI (36.1%). This was followed by chlorpyrifos OA which accounted for 7.2% of the acute HI, 10.5% of the subchronic HI, and 18.0% of the chronic HI.

Table 41. Observed 24-h concentrations on date of highest calculated acute hazard index for cumulative organophosphates at Shafter, California.

Chemical	24-h concentration at cumulative peak (ng/m^3)	24-h acute screening level (ng/m^3)	Acute hazard quotient *
Acephate	0.5	12,000	0.000
Bensulide	0.7	259,000	0.000
Chlorpyrifos	138	1,200	0.115
Chlorpyrifos OA	12	1,200	0.010
DDVP	1.6	11,000	0.000
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	4,300	0.000
Dimethoate OA	1.0	4,300	0.000
Malathion	1.1	112,500	0.000
Malathion OA	0.7	112,500	0.000
Oxydemeton methyl	1.2	39,200	0.000
Phosmet	4.0	77,000	0.000
Hazard Index			**0.139**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 42. Observed rolling 4-week average concentrations on date of highest calculated subchronic hazard index for cumulative organophosphates at Shafter, California.

Chemical	4-week concentration at cumulative peak (ng/m^3)	Subchronic screening level (ng/m^3)	Subchronic hazard quotient *
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	51	850	0.060
Chlorpyrifos OA	7.7	850	0.009
DDVP	1.6	2,200	0.001
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	1.1	80,600	0.000
Malathion OA	0.7	80,600	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	26,000	0.000
Hazard Index			**0.086**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 43. 1-year average concentration of organophosphates monitored in Shafter, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level *
Acephate	Trace (0.6)	8,500	0.000
Bensulide	ND (0.7)	24,000	0.000
Chlorpyrifos	11	510	0.022
Chlorpyrifos OA	5.7	510	0.011
DDVP	2.8	770	0.004
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	Trace (0.8)	130	0.006
Diazinon OA	Trace (1.1)	130	0.008
Dimethoate	ND (1.2)	300	0.004
Dimethoate OA	ND (1)	300	0.003
Malathion	1.5	8,100	0.000
Malathion OA	Trace (0.8)	8,100	0.000
Oxydemeton methyl	ND (1.2)	610	0.002
Phosmet	ND (4)	18,000	0.000
Hazard Index			**0.061**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Organophosphate Details for Santa Maria

The only organophosphate detected at quantifiable levels in Santa Maria was malathion. This occurred on five occasions. Calculation of the acute HI was dominated by adjusted concentrations using assumed values for four non-detections (chlorpyrifos, chlorpyrifos OA, diazinon, and diazinon OA) and one trace (DDVP) detection.

Table 44. Observed 24-h concentrations on date of highest calculated acute hazard index for cumulative organophosphates at Santa Maria, California.

Chemical	24-h concentration at cumulative peak (ng/m^3)	24-h acute screening level (ng/m^3)	Acute hazard quotient *
Acephate	0.5	12,000	0.000
Bensulide	0.7	259,000	0.000
Chlorpyrifos	2.5	1,200	0.002
Chlorpyrifos OA	1.5	1,200	0.001
DDVP	13	11,000	0.001
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	4,300	0.000
Dimethoate OA	1.0	4,300	0.000
Malathion	14	112,500	0.000
Malathion OA	5.3	112,500	0.000
Oxydemeton methyl	1.2	39,200	0.000
Phosmet	4.0	77,000	0.000
Hazard Index			**0.018**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 45. Observed rolling 4-week average concentrations on date of highest calculated subchronic hazard index for cumulative organophosphates at Santa Maria, California.

Chemical	4-week concentration at cumulative peak (ng/m^3)	Subchronic screening level (ng/m^3)	Subchronic hazard quotient *
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	2.5	850	0.003
Chlorpyrifos OA	1.5	850	0.002
DDVP	11	2,200	0.005
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	7.0	80,600	0.000
Malathion OA	5.3	80,600	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	26,000	0.000
Hazard Index			**0.025**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 46. 1-year average concentration of organophosphates monitored in Santa Maria, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level *
Acephate	ND (0.5)	8,500	0.000
Bensulide	ND (0.7)	24,000	0.000
Chlorpyrifos	ND (2.5)	510	0.005
Chlorpyrifos OA	ND (1.5)	510	0.003
DDVP	Trace (4.3)	770	0.006
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	0.005
Diazinon OA	ND (1.1)	130	0.008
Dimethoate	ND (1.2)	300	0.004
Dimethoate OA	ND (1)	300	0.003
Malathion	4.5	8,100	0.001
Malathion OA	Trace (3.9)	8,100	0.000
Oxydemeton methyl	ND (1.2)	610	0.002
Phosmet	ND (4)	18,000	0.000
Hazard Index			**0.037**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Organophosphate Details for Watsonville

No organophosphates were detected at quantifiable levels in Watsonville during AMN monitoring in 2017. The HIs for this site were calculated solely through the use of adjusted concentrations for trace detections and non-detections.

Table 47. Observed 24-h concentrations on date of highest calculated acute hazard index for cumulative organophosphates at Watsonville, California.

Chemical	24-h concentration at cumulative peak (ng/m^3)	24-h acute screening level (ng/m^3)	Acute hazard quotient *
Acephate	0.5	12,000	0.000
Bensulide	0.7	259,000	0.000
Chlorpyrifos	14	1,200	0.012
Chlorpyrifos OA	1.5	1,200	0.001
DDVP	1.6	11,000	0.000
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	4,300	0.000
Dimethoate OA	1.0	4,300	0.000
Malathion	5.8	112,500	0.000
Malathion OA	5.3	112,500	0.000
Oxydemeton methyl	1.2	39,200	0.000
Phosmet	4.0	77,000	0.000
Hazard Index			**0.027**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 48. Observed rolling 4-week average concentrations on date of highest calculated subchronic hazard index for cumulative organophosphates at Watsonville, California.

Chemical	4-week concentration at cumulative peak (ng/m^3)	Subchronic screening level (ng/m^3)	Subchronic hazard quotient *
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	5.4	850	0.006
Chlorpyrifos OA	1.5	850	0.002
DDVP	4.5	2,200	0.002
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	4.6	80,600	0.000
Malathion OA	3.0	80,600	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	26,000	0.000
Hazard Index			**0.026**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 49. 1-year average concentration of organophosphates monitored in Watsonville, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level *
Acephate	ND (0.5)	8,500	0.000
Bensulide	ND (0.7)	24,000	0.000
Chlorpyrifos	Trace (2.7)	510	0.005
Chlorpyrifos OA	ND (1.5)	510	0.003
DDVP	Trace (1.8)	770	0.002
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	0.005
Diazinon OA	ND (1.1)	130	0.008
Dimethoate	ND (1.2)	300	0.004
Dimethoate OA	ND (1.0)	300	0.003
Malathion	Trace (1.7)	8,100	0.000
Malathion OA	Trace (1.1)	8,100	0.000
Oxydemeton methyl	ND (1.2)	610	0.002
Phosmet	ND (4)	18,000	0.000
Hazard Index			**0.034**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Organophosphate Details for Chualar

No organophosphates were detected at quantifiable levels in Chualar during AMN monitoring in 2017. The HI's for this site were calculated solely through the use of adjusted concentrations for trace detections and non-detections.

Table 50. Observed 24-h concentrations on date of highest calculated acute hazard index for cumulative organophosphates at Chualar, California.

Chemical	24-h concentration at cumulative peak (ng/m^3)	24-h acute screening level (ng/m^3)	Acute hazard quotient *
Acephate	0.5	12,000	0.000
Bensulide	0.7	259,000	0.000
Chlorpyrifos	2.5	1,200	0.002
Chlorpyrifos OA	1.5	1,200	0.001
DDVP	13	11,000	0.001
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	4,300	0.000
Dimethoate OA	1.0	4,300	0.000
Malathion	5.8	112,500	0.000
Malathion OA	5.3	112,500	0.000
Oxydemeton methyl	1.2	39,200	0.000
Phosmet	4.0	77,000	0.000
Hazard Index			**0.018**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 51. Observed rolling 4-week average concentrations on date of highest calculated subchronic hazard index for cumulative organophosphates at Chualar, California.

Chemical	4-week concentration at cumulative peak (ng/m^3)	Subchronic screening level (ng/m^3)	Subchronic hazard quotient *
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	2.5	850	0.003
Chlorpyrifos OA	1.5	850	0.002
DDVP	7.4	2,200	0.003
DEF	0.9	8,800	0.000
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	4.6	80,600	0.000
Malathion OA	3.0	80,600	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	26,000	0.000
Hazard Index			**0.024**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Table 52. 1-year average concentration of organophosphates monitored in Chualar, California.

Chemical	Overall average concentration (ng/m³)	Chronic screening level (ng/m³)	% of screening level *
Acephate	ND (0.5)	8,500	0.000
Bensulide	Trace (0.9)	24,000	0.000
Chlorpyrifos	ND (2.5)	510	0.005
Chlorpyrifos OA	ND (1.5)	510	0.003
DDVP	Trace (2.3)	770	0.003
DEF	ND (0.9)	*N/A - Seasonal*	
Diazinon	ND (0.6)	130	0.005
Diazinon OA	ND (1.1)	130	0.008
Dimethoate	ND (1.2)	300	0.004
Dimethoate OA	ND (1.0)	300	0.003
Malathion	Trace (1.9)	8,100	0.000
Malathion OA	Trace (1.4)	8,100	0.000
Oxydemeton methyl	ND (1.2)	610	0.002
Phosmet	ND (4)	18,000	0.000
Hazard Index			**0.034**

* A hazard quotient or hazard index greater than one suggests the need for further evaluation

Uncertainty of Air Concentrations – Treatment of Non-Detections

The impact of the standard practice of substituting a value equal to half of the MDL for samples with no detectable concentration was assessed by performing alternative calculations of the highest rolling 4-week average concentrations and 1-year average concentrations for pesticides with at least one detectable concentration.

These alternative calculations were performed using two different methods of treating samples with non-detectable concentrations. The highest rolling 4-week or 90-day average concentrations, and 1-year average concentrations were determined by using a "minimum," a "standard," and a "maximum" method. Minimum average concentrations are calculated using a presumed concentration of zero for samples with no detectable amount. Standard average concentrations are calculated by using a value of one-half of the MDL for samples with no detectable amount. Maximum average concentrations are calculated using the MDL as the presumed concentration for samples with no detectable amount. Table 53 shows these alternative methods of calculation applied to the rolling 4-week averages, while Table 54 shows these applied to the 1-year average.

The percent differences in calculated rolling 4-week[7] average concentrations between the maximum and minimum methods ranged from 0.0% to 13.8 %. For the 1-year concentrations the percent difference ranged from 0.0% to 76.9%. The high percentage values are for pesticides with a low number of quantifiable detections (<90% NDs) and as such the treatment of these ND values can greatly affect the average concentrations. However, for pesticides with either a large number of quantifiable detections or

high concentrations (i.e., 1,3-D or MITC), the treatment of NDs has a lesser effect on the overall average value.

Table 53. Minimum, standard, and maximum highest rolling 4-week average concentrations for pesticides or breakdown products with at least one quantifiable detection.

Chemical	Minimum highest 4-week rolling average concentration	Standard highest 4-week rolling average concentration	Maximum highest 4-week rolling average concentration	Percent difference between maximum and minimum
1,3-dichloropropene†	4810	4812	4814	0.1%
Chloropicrin†	957	974	991	3.5%
Chlorothalonil	38	38	38	0.0%
Chlorpyrifos	51	51	51	0.0%
Chlorpyrifos OA	19	19	19	0.0%
Chlorthal-dimethyl	16	16	16	0.0%
DDVP	16	17	19	13.8%
EPTC	8.9	9.1	9.3	4.4%
Malathion	12	12	12	0.0%
MITC	236	236	236	0.0%

† These are rolling 90-day average concentrations.

Table 54. Minimum, standard, and maximum highest annual average concentrations for pesticides or breakdown products with at least one quantifiable detection.

Chemical	Minimum highest annual average concentration	Standard highest annual average concentration	Maximum highest annual average concentration	Percent difference between maximum and minimum
1,3-dichloropropene	473.8	485.6	556.7	16.1%
Chloropicrin	261.9	346.9	434.4	49.5%
Chlorothalonil	14.3	16.4	18.5	25.6%
Chlorpyrifos	9.8	11.1	12.4	23.4%
Chlorpyrifos OA	5	5.7	6.3	23.0%
Chlorthal-dimethyl	8.4	8.4	8.4	0.0%
DDVP	3	4.3	5.5	58.8%
EPTC	1.2	1.9	2.7	76.9%
Malathion	4.1	4.5	5	19.8%
MITC	49.7	50.7	51.8	4.1%

Comparison of 2017 to Previous Years of AMN Results

All AMN Sites

This report covers results from the seventh year of monitoring by the AMN, which has been collecting samples since 2011 (Vidrio et al., 2013; Vidrio et al., 2014; Tuli et al., 2015, Tuli et al., 2016, King et al. 2017). While there have been significant changes to the AMN as detailed in the Introduction section of this report, a few comparisons to the results from previous years are possible. Table 55 summarizes the detections of monitored pesticides from 2011 to 2017 samples.

The initial number of pesticides monitored by the AMN was 39 in 2011 (34 pesticides and 5 breakdown products). On January 1, 2012, acrolein was dropped from AMN monitoring because acrolein is mainly produced as a byproduct of automobile emissions and other combustion sources not related to pesticidal

uses (ATSDR, 2007). On March 21, 2012, DPR cancelled the sale of all products containing methyl iodide at the request of the registrant. Therefore, monitoring for methyl iodide as part of the AMN was stopped on June 20, 2012. In December 2016, carbon disulfide was removed from the list of monitored chemicals due to detections originating from non-pesticidal sources as explained in the introduction of this report.

Inspection of these results reveals that the highest number of detections as a percentage of analyses occurred in 2015 (10.3%), and that the highest percentage of quantifiable detections occurred in both 2015 and 2016 (5.2%, each). The lowest percentage of detections occurred in 2012 (5.5%), which also had the lowest percentage of quantifiable detections (1.3%).

Table 55. Summary of pesticide detection trends in the Air Monitoring Network (2011-2017).

	2011	2012	2013	2014	2015	2016	2017
Total monitored pesticides*	39	38	37	37	37	37	36
Total non-detected pesticides	10	14	13	14	11	12	9
Total detected pesticides †	29	24	24	23	26	25	27
Total quantifiable pesticides	9	11	14	11	14	11	10
Total analyses	5,676	6,002	6,033	5,966	5,892	5,928	7,396
Total non-detected analyses	5,251	5,671	5,607	5,468	5,286	5,393	6,868
Total detected analyses †	425	331	426	498	606	535	528
Total quantifiable analyses	173	81	159	225	306	307	122
Percent of non-detected analyses	92.5%	94.5%	92.9%	91.7%	89.7%	91.0%	92.9%
Percent of detected analyses	7.5%	5.5%	7.1%	8.3%	10.3%	9.0%	7.1%
Percent of quantifiable analyses	3.0%	1.3%	2.6%	3.8%	5.2%	5.2%	1.6%

* Includes all pesticides that were monitored as part of the AMN for that year

† Includes both quantified and trace detections

Historic Air Concentrations in Shafter

Table 56 shows the highest 24-h concentrations for any chemical with at least one quantifiable detection at Shafter for all years of the AMN. Tables 56 - 58 are limited to Shafter which is the only AMN site continuing from previous years. Monitoring data from 2017 did show some slightly higher concentrations for certain chemicals than previously detected in Shafter. For example, DDVP was detected at a 24 h concentration of 65 ng/m^3, over a previous high of 49 ng/m^3. Malathion was detected for the first time in 2017 in Shafter at a concentration above trace level (14.9 ng/m^3). Neither DDVP nor malathion exceeded 1% of its acute screening level during any year of AMN monitoring. 2017 also marked the first year of detections at trace levels for metolachlor and oxyfluorfen in Shafter; neither had previously been detected at that site.

Table 57 shows the highest 4-week rolling average concentrations for Shafter for each year of the AMN for any chemical with at least one quantifiable detection during all years of monitoring. Historic rolling 4-week rolling concentrations for 1,3-D have been recalculated to 90-day rolling averages to facilitate

comparison among years. This was not necessary for chloropicrin, which has never been detected by the AMN in Shafter.

Table 58 shows the average annual concentrations for Shafter for each year of the AMN. The annual average concentration of malathion in 2017 exceeded that of previous years, at 2 ng/m^3, but did not exceed 1% of the chronic screening level. DDVP and EPTC both matched the previous highest annual concentration, seen in 2016 for both chemicals.

Table 56. Highest 24-hour concentrations for pesticides with at least one detectable concentration by year (2011 - 2017) in Shafter, California.

Pesticide	Highest 24-h concentration (ng/m^3)						
	2011	2012	2013	2014	2015	2016	2017
1,3-dichloropropene	ND	3,643 (6%)	39,969 (26%)	9,251 (37%)	9,713 (42%)	45,323 (50%)	3,394 (48%)
Acephate	ND	Trace (2%)	ND	ND	ND	ND	Trace (2%)
Acrolein †	2,796 (60%)	--	--	--	--	--	--
Bensulide	Trace (2%)	ND	ND	ND	ND	ND	ND
Carbon Disulfide ‡	ND	ND	897 (15%)	548 (50%)	812 (90%)	946 (92%)	--
Chlorothalonil	Trace (13%)	Trace (23%)	80 (60%)	118 (13%)	39 (75%)	58 (62%)	55 (69%)
Chlorpyrifos	27 (53%)	131 (48%)	423 (75%)	338 (56%)	78 (61%)	52 (29%)	138 (48%)
Chlorpyrifos OA	9 (45%)	17 (48%)	143 (55%)	110 (62%)	13 (53%)	Trace (50%)	59 (58%)
Chlorthal-dimethyl	Trace (15%)	ND	Trace (8%)	ND	Trace (2%)	Trace (15%)	Trace (10%)
DDVP	Trace (2%)	ND	Trace (6%)	Trace (2%)	Trace (8%)	49 (2%)	65 (2%)
Diazinon	60 (11%)	Trace (4%)	29 (6%)	ND	ND	ND	Trace (4%)
Diazinon OA	36 (4%)	10 (8%)	Trace (8%)	ND	ND	Trace (2%)	Trace (2%)
Diuron	Trace (6%)	Trace (12%)	Trace (2%)	Trace (10%)	Trace (10%)	ND	Trace (4%)
EPTC	187 (17%)	18 (4%)	250 (9%)	216 (12%)	29 (10%)	27 (6%)	12 (10%)
Iprodione	Trace (2%)	Trace (4%)	Trace (4%)	Trace (6%)	Trace (8%)	17 (8%)	Trace (6%)
Malathion	ND	Trace (2%)	Trace (4%)	Trace (2%)	ND	ND	15 (6%)
Malathion OA	Trace (6%)	11 (10%)	Trace (9%)	Trace (6%)	Trace (6%)	ND	Trace (4%)
Methyl bromide	2,934 (9%)	2,135 (4%)	209 (4%)	963 (15%)	283 (13%)	113 (8%)	ND
Metolachlor	ND	ND	ND	ND	ND	ND	Trace (10%)
MITC	930 (40%)	347 (56%)	762 (57%)	113 (42%)	232 (35%)	109 (42%)	382 (62%)
Norflurazon	Trace (2%)	ND	ND	ND	Trace (2%)	ND	Trace (2%)
Oryzalin	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)	62 (6%)	ND	Trace (8%)
Oxyfluorfen	ND	ND	ND	ND	ND	ND	Trace (6%)
Permethrin	Trace (2%)	ND	Trace (2%)	ND	ND	ND	ND
Propargite	Trace (2%)	ND	Trace (11%)	ND	ND	ND	Trace (2%)
Simazine	Trace (4%)	Trace (12%)	ND	Trace (4%)	Trace (4%)	Trace (6%)	Trace (6%)
Trifluralin	Trace (9%)	Trace (6%)	Trace (4%)	Trace (4%)	Trace (8%)	ND	Trace (2%)

* Values in parentheses refer to the percentage of samples with detections

** ND = Not Detected.

† Acrolein, which was previously included on the AMN as a monitored pesticide was dropped from AMN monitoring starting on January 1, 2012.

‡ Carbon disulfide, which was previously included on the AMN as a monitored pesticide was dropped from AMN monitoring starting on January 1, 2017.

Table 57. Highest rolling 4-week average concentrations for pesticides with at least one detectable concentration by year (2011 - 2017) in Shafter, California.

Pesticide	Highest 4-week rolling concentration (ng/m³)						
	2011	2012	2013	2014	2015	2016	2017
1,3-dichloropropene (13-wk)	ND	594	9,190	10,119	2,176	4,678	4,812
Acephate	ND	Trace	ND	ND	ND	ND	Trace
Bensulide	Trace	ND	ND	ND	ND	ND	ND
Chlorothalonil	Trace	Trace	38	Trace	25	24	38
Chlorpyrifos	15	46	113	92	60	39	51
Chlorpyrifos OA	7	13	44	32	9	Trace	19
Chlorthal-dimethyl	Trace	ND	Trace	ND	Trace	Trace	Trace
DDVP	Trace	ND	Trace	Trace	Trace	13	17
Diazinon	18	Trace	10	ND	ND	ND	Trace
Diazinon OA	11	Trace	ND	ND	ND	Trace	Trace
Diuron	Trace	Trace	Trace	Trace	Trace	ND	Trace
EPTC	76	Trace	139	86	19	10	9
Iprodione	Trace	Trace	Trace	Trace	Trace	10	Trace
Malathion	ND	Trace	Trace	Trace	ND	ND	5
Malathion OA	Trace	Trace	Trace	Trace	Trace	ND	Trace
Methyl bromide	1,403	683	198	389	186	81	ND
Metolachlor	ND	ND	ND	ND	ND	ND	Trace
MITC	564	177	319	74	156	51	236
Norflurazon	Trace	ND	ND	ND	Trace	ND	Trace
Oryzalin	Trace	Trace	Trace	Trace	16	ND	Trace
Oxyfluorfen	ND	ND	ND	ND	ND	ND	Trace
Permethrin	Trace	ND	Trace	ND	ND	ND	ND
Propargite	Trace	ND	Trace	ND	ND	ND	Trace
Simazine	Trace	Trace	ND	Trace	Trace	Trace	Trace
Trifluralin	ND	ND	ND	ND	ND	ND	Trace

* Values in parentheses refer to the percentage of samples with detections.

** ND = Not Detected.

*** Concentrations are presented as rolling or moving averages (i.e., average of weeks 1, 2, 3, and 4; average of weeks 2, 3, 4, and 5; etc.).

Table 58. Comparison of the 1-year average concentrations for pesticides with at least one detectable concentration by year (2011 - 2017) in Shafter, California.

Pesticide	Annual average concentration (ng/m³)						
	2011	2012	2013	2014	2015	2016	2017
1,3-dichloropropene	ND†	453	2,589	909	800	1,559	486
Acephate	ND	Trace	ND	ND	ND	ND	Trace
Bensulide	Trace	ND	ND	ND	ND	ND	ND
Chlorothalonil	Trace	Trace	16	22	Trace	15	16
Chlorpyrifos	Trace	Trace	20	16	Trace	8	11
Chlorpyrifos OA	Trace	Trace	8	7	Trace	Trace	6
Chlorthal-dimethyl	Trace	ND	Trace	ND	Trace	Trace	Trace
DDVP	Trace	ND	Trace	Trace	Trace	3	3
Diazinon	Trace	Trace	Trace	ND	ND	ND	Trace
Diazinon OA	Trace	Trace	ND	ND	ND	Trace	Trace
Diuron	Trace	Trace	Trace	Trace	Trace	ND	Trace
EPTC	Trace	Trace	Trace	Trace	Trace	2	2
Iprodione	Trace	Trace	Trace	Trace	Trace	2	Trace
Malathion	ND	Trace	Trace	Trace	ND	ND	2
Malathion OA	Trace	Trace	Trace	Trace	Trace	ND	Trace
Methyl bromide	425	247	163	70	40	26	ND
Metolachlor	ND	ND	ND	ND	ND	ND	Trace
MITC	73	51	66	21	27	17	51
Norflurazon	Trace	ND	ND	ND	Trace	ND	Trace
Oryzalin	Trace	Trace	Trace	Trace	Trace	ND	Trace
Oxyfluorfen	ND	ND	ND	ND	ND	ND	Trace
Permethrin	Trace	ND	Trace	ND	ND	ND	ND
Propargite	Trace	ND	Trace	ND	ND	ND	Trace
Simazine	Trace	Trace	ND	Trace	Trace	Trace	Trace
Trifluralin	ND	ND	ND	ND	ND	ND	Trace

* Values in parentheses refer to the percentage of samples with detections.

** ND = Not Detected.

Comparison to Other Monitoring

As part of DPR's TAC monitoring program, both DPR and ARB monitor ambient air for a variety of pesticides, specifically in counties with the highest reported use for that particular pesticide and during the season of its highest reported use. Previous TAC monitoring performed by ARB include results for 15 of the pesticides monitored in the AMN: 1,3-D, chlorpyrifos, chlorpyrifos OA, chlorothalonil, diazinon, endosulfan, EPTC, malathion, malathion OA, MITC, MeBr, permethrin, propargite, simazine, and DEF which are listed on Table 59 as "Other Studies".

Comparison of the detected concentrations in Table 59 shows that the maximum 24-h concentrations measured at all four sampling locations in 2017 were generally much lower than concentrations measured in other parts of the state by ARB and concentrations measured by DPR in Parlier. The 24-h concentrations in 2017 were also generally lower than those detected by the AMN in 2011-2016. The quantifiable concentrations that were exceptions to this were chlorothalonil which exceeded the previous highest concentration seen in Fresno in 2002, and chlorpyrifos OA which exceeded the concentration seen in Parlier in 2006.

Table 59. Highest 24-h concentrations of pesticides monitored by the AMN compared to previous DPR and ARB monitoring studies in California.

Chemical	Other Studies‡		Parlier (2006)	Highest AMN (2011-2016)		Highest AMN (2017)	
	County (Year)	Concentration (ng/m³)	Concentration (ng/m³)	Site (Year)	Concentration (ng/m³)	Site	Concentration (ng/m³)
1,3-dichloropropene	Kern (2000)	135,000	23,080	Shafter (2016)	45,323	Shafter	3394
Chlorothalonil	Fresno (2002)	14	Trace	Shafter (2014)	118	Shafter	55
Chlorpyrifos	Tulare (1996)	815	150	Shafter (2013)	423	Shafter	138
Chlorpyrifos OA	Tulare (1996)	230	28	Shafter (2013)	143	Shafter	59
Diazinon	Fresno (1997)	290	172	Shafter (2011)	60	Shafter	Trace
Endosulfan	Fresno (1996)	140	ND	*multiple*	Trace	Watsonville	Trace
EPTC	Imperial (1996)	240	ND	Shafter (2013)	250	Shafter	12
Malathion	Imperial (1998)	90	21	Salinas (2011)	13	Shafter	15
Malathion OA	Imperial (1998)	28	16	Shafter (2012)	11	*multiple*	Trace
Methyl bromide	Santa Cruz (2001)	142,000	2,468	Salinas (2011)	6,055	*all sites*	ND
MITC	Kern (1993)	18,000	5,010	Shafter (2011)	930	Santa Maria	457
Permethrin	Monterey (1997)	Trace	Trace	*multiple*	Trace	Chualar	Trace
Propargite	Fresno (1999)	1300	Trace	*multiple*	Trace	Shafter	Trace
Simazine	Fresno (1998)	18	Trace	*multiple*	Trace	*multiple*	Trace
DEF	Fresno (1987)	340	ND	*all sites*	ND	*all sites*	ND

† ND = Not Detected.

‡ These are the results of studies conducted by ARB included in the references section of this document.

DATA VALIDATION/QUALITY ASSURANCE

Method Validation

An acceptable range of spike recoveries was established by analyzing laboratory spike samples in five replicate analyses at five different spike levels. The mean percent recovery and standard deviation were determined based on these 25 data points. The control limits were established as the mean percent recovery ± 3 SDs. In addition, a method trapping efficiency was determined by collecting 2-stage air samples that were analyzed to determine the proportion of the spike trapped in the bottom stage to assess for possible sample breakthrough.

General Continuing Quality Control

Samples were stored at the DPR facility in West Sacramento under the care of the laboratory liaison until scheduled delivery to the CDFA's CAC laboratory. Storage stability was evaluated for the longest anticipated holding period with at least four sampling intervals and two replicate samples at each sampling interval. All analytes have storage stability data for a minimum of 28 days. Each extraction set consisted of 5 to 20 actual samples and QC samples which include a reagent blank, a matrix blank, and a matrix spiked sample. Any subsequent matrix spiked samples outside the control limits required the set of samples associated with that spike to be reanalyzed.

Comparison of Equipment

During the transition from the original AMN sampling equipment to the new equipment (between January and February 2017), DPR conducted co-located sampling for a period of two weeks in an attempt to identify any differences that might occur in the detected concentrations. Ultimately, no quantifiable concentrations were detected during this period. Three pairs of samples were generated for chloropicrin, all of which were non-detections. Four pairs of samples were generated for MITC, although again all of these resulted in non-detections. VOC analysis produced matching non-detections across three paired canisters, for both 1,3-D and MeBr. Four pairs of samples were generated for the multi-pesticide residue analysis. Two trace detections of chlorthal-dimethyl were shown in paired samples, while there was one trace detection paired with a non-detection. The results of this are detailed in Table 60.

Table 60. Comparison of co-located pairs of previously used and new equipment.

Primary/duplicate results	Number of pairs			
	Chloropicrin samples	MITC samples	Multi-pesticide residue analysis samples	VOC samples
ND † / ND	3	4	125	12
Trace ‡ / Trace	0	0	2	0
ND / Trace	0	0	1	0
ND / >LOQ	0	0	0	0
Trace / >LOQ	0	0	0	0
>LOQ / > LOQ	0	0	0	0
Relative difference *	0%	0%	0%	0%

† ND = Not Detected.

‡ Trace = Pesticide detection confirmed, but less than the quantitation limit.

* For pairs with both concentrations >LOQ.

During monitoring for 1,3-D in 2017, DPR conducted further comparison between the new equipment and the previous method using the flow controllers (Brown and Gonzalez, 2018). Sixteen pairs were generated, of which four were paired non-detections, and one was a detection paired with a non-detection (Brown and Gonzalez, 2018). The eleven paired detections had a mean difference of 56.9 ng/m^3 and a SD of 298 ng/m^3 (Brown and Gonzalez, 2018). These were compared with a two-tailed t-test and resulted in a p-value of 0.54, indicating no evidence of a significant difference between the methods (Brown and Gonzalez, 2018).

Quality Control Results

Quality Control Sample Issues Encountered in 2017

MeBr

Recovery of MeBr from laboratory spikes was within the tolerance set by ARB OLS laboratory as none of the laboratory matrix blank samples showed any MeBr concentrations. However, the percent recovery for the MeBr field spiked samples was outside acceptable control limits set by ARB OLS laboratory (Table 63). The MeBr field spiked samples from 2017 had an average recovery of only 8.6% (n = 21). Low field spike recoveries can indicate possible issues with: spiking procedure, laboratory extraction, storage instability, sample transport, and field handling. Therefore, DPR requested ARB OLS laboratory to conduct an extensive investigation into the cause of the low spike recoveries and provide DPR with a report. Preliminary analysis indicates issues with spiking procedure and the analytical instrument's water management system affected the field spike samples and not necessarily the collected field samples. The ARB OLS laboratory will provide a more complete evaluation results in a later report.

MITC

Recovery of MITC from laboratory matrix spikes was within tolerance set by the CDFA CAC laboratory. However, the percent recovery for the field MITC spike samples was outside acceptable control limits set by the CDFA CAC laboratory (Table 61). As shown in Table 61, MITC spiked samples had an average spike

recovery percent of 60% (n=8). Therefore, DPR requested that CDFA CAC laboratory conduct an extensive investigation into the cause of these low spike recoveries.

The CDFA CAC laboratory issued a memorandum to DPR on May 9, 2018 discussing ongoing laboratory spikes recovery improvements due to modifications to the solvent extraction procedure (CDFA 2018c). This modification in the extraction technique resulted in an overall extraction efficiency from approximately 75% to close to 90% for laboratory spikes.

On June 14, 2018, CDFA CAC laboratory issued a memorandum to DPR presenting results of a laboratory study that looked into possible reasons for the low MITC field spike recoveries (CDFA 2018c). For the laboratory study, five sets of two sorbent tubes were spiked with identical amounts of MITC standard; one tube was kept frozen while the other tube was taken to the field and set up in an air sampler for 24-h with ambient air running through the sorbent material. Both MITC spike samples were analyzed by the lab and compared to one another. Results show that field spikes had recoveries between 2% and 12% lower than spike samples kept frozen. These results indicate a modest loss of spiked MITC from time of preparation to analysis

On July 3, 2018, CDFA CAC laboratory issued a memorandum to DPR addressing possible reasons for the low MITC field spike recoveries, including an inherent inefficiency of ambient analytes to absorb onto a spiked matrix during sampling (CDFA 2018c). During the preparation of field spike samples, an MITC solution prepared in a 1% carbon disulfide in ethyl acetate solvent is spiked onto the sorption tube. Hot or humid air may move and spread the volatile solution throughout the sorption tube, causing the trapped MITC to pass-through and out of the sorbent media without binding, leading to lower recoveries. Memorandum concludes that field spikes may not be a good indicator of actual recovery efficiency of ambient air samples.

CDFA CAC Laboratory

Laboratory matrix spikes and matrix blanks were included with every set of samples extracted and analyzed at the laboratory and are part of the laboratory QC program. The matrix spikes are conducted to assess accuracy and precision; the blanks are to check for contamination at the laboratory or contamination of the media packed in the sorption tubes or cartridges. The blank matrix materials were not fortified, but were extracted and analyzed along with the matrix spikes and field samples. Table 61 lists the average for the QC samples that were extracted and analyzed with the air samples for the entire monitoring period. Average laboratory matrix spike recoveries ranged from 72% to 96% for all chemicals analyzed. Aside from MITC, as mentioned above, none of the laboratory matrix spike samples were outside the control limits established from the validation data.

Field blanks, blind field spikes, and duplicate samples are part of DPR's field and laboratory QC program. The field spikes were fortified by a CDFA chemist not associated with the analysis. The field spikes were given to DPR staff, relabeled, and then intermingled and delivered with field samples to the laboratory for analysis. Table 61 lists the average percent recovery results which ranged from 14.8% to 161%.

The trip blanks were blank matrix samples that were transported to and from the field locations, but were not placed on air pumps. These samples were a control to check for contamination during transportation. All field blanks resulted in non-detections. These results are shown in Table 61.

Table 62 summarizes the results of duplicate samples. A duplicate sample is a sample that is collocated with another sample in the field. These samples serve to evaluate the overall precision in sample

measurement and analysis. Consistent with previous reports, there were a large number of non-detection pairs among co-located samples.

Table 61. Average results for quality control/quality assurance in samples from the 2017 AMN.

Chemical	Lab spikes (% recovery)	Field spikes (% recovery)	Lab blanks (ng/m³)	Field blanks (ng/m³)
Chloropicrin	91%	108% (n=7)	ND	ND
MITC	72%	60% (n=8)*	ND	ND
EPTC	89%	62% (n=2)	ND	ND
DDVP	91%	124% (n=2)	ND	ND
Trifluralin	94%	142% (n=1)	ND	ND
Chlorothalonil	93%	NS †	ND	ND
Chlorthal-dimethyl	93%	NS †	ND	ND
Chlorpyrifos	93%	NS †	ND	ND
pp-Dicofol	96%	119% (n=1)	ND	ND
Malathion	95%	128% (n=1)	ND	ND
Endosulfan	92%	NS †	ND	ND
Endosulfan Sulfate	93%	NS †	ND	ND
Oxyfluorfen	95%	62% (n=1)	ND	ND
Propargite	92%	NS †	ND	ND
Iprodione	92%	107% (n=2)	ND	ND
Permethrin	92%	100% (n=1)	ND	ND
Cypermethrin	91%	114% (n=1)	ND	ND
Acephate	92%	135% (n=1)	ND	ND
Bensulide	84%	74% (n=1)	ND	ND
Chlorpyrifos OA	90%	NS †	ND	ND
DEF	84%	NS †	ND	ND
Diazinon	89%	67% (n=1)	ND	ND
Diuron	92%	100% (n=1)	ND	ND
Methidation	88%	NS †	ND	ND
Norflurazon	95%	NS †	ND	ND
Oryzalin	91%	87% (n=1)	ND	ND
Oxydemeton methyl	93%	NS †	ND	ND
Phosmet	87%	117% (n=1)	ND	ND
Diazinon OA	94%	80% (n=1)	ND	ND
Dimethoate	95%	**	ND	ND
Dimethoate OA	94%	14.8% (n=1)	ND	ND
Malathion OA	92%	161% (n=1)	ND	ND
Metolachlor	90%	NS †	ND	ND
Simazine	92%	97% (n=2)	ND	ND
VOC's (as analyzed by CDFA laboratory)				
cis-1,3-dichloropropene	97%	NS †	ND	NB ‡
trans-1,3-dichloropropene	95%	NS †	ND	NB ‡
Methyl bromide	97%	NS †	ND	NB ‡

* The collection of MITC field spikes included one invalid sample, one trace detection, and one non-detection.

** There was one field spike of dimethoate, which resulted in a trace detection.

NS † indicates that there was no field spike analyzed for this chemical.

NB ‡ indicates that there was no trip blank analyzed for this chemical.

Table 62. Results for duplicate sample pairs in 2017.

Primary/duplicate results	Number of pairs			
	Chloropicrin samples	MITC samples	Multi-pesticide residue analysis samples	VOC samples
ND † / ND	2	1	120	3
Trace ‡ / Trace	0	1	2	0
ND / Trace	0	0	6	0
ND / >LOQ	0	0	0	0
Trace / >LOQ	0	0	0	0
>LOQ / > LOQ	1	0	0	0
Relative difference *	0%	0%	0%	0%

† ND = Not Detected.

‡ Trace = Pesticide detection confirmed, but less than the quantitation limit.

* For pairs with both concentrations >LOQ.

ARB OLS Laboratory

The results of the analysis of field spikes are detailed in Table 63. As stated above, the MeBr recoveries were below the level considered acceptable, with an average of 9% of spike analyte being recovered during analysis. Both *cis*- and *trans*-1,3-D field spikes produced acceptable average percent recoveries (130% and 124% respectively).

One co-located sample collected in Ohlone was invalid due to the canister arriving at the laboratory with low pressure. The second was identical to its paired primary, with non-detections for all three analytes (MeBr and both stereoisomers of 1,3-D). As such, an absolute percent difference among these could not be calculated.

Table 63. Average results for canister spikes analyzed by ARB reported as percent recovery.

Chemical	Field spikes (% recovery)
VOC's (as analyzed by ARB laboratory)	
cis-1,3-dichloropropene	130% (n=11) *
trans-1,3-dichloropropene	124% (n=11) *
Methyl bromide	9% (n=11) **

* One sample was invalid for both stereoisomers of 1,3-D.

** Three samples were invalid for MeBr.

DISCUSSION

Fumigants accounted for three of the ten pesticides detected at quantifiable concentrations by the AMN in 2017. These fumigants were 1,3-D, chloropicrin, and MITC. All currently active AMN sites had at least one quantifiable detection of each of these fumigants, the exception being Shafter which had no detections of any kind for chloropicrin. Organophosphates and their breakdown products accounted for another four of these quantifiable detections. These were chlorpyrifos, chlorpyrifos OA, DDVP, and malathion. The remaining three pesticides detected at quantifiable concentrations in 2017 were chlorothalonil, chlorthal-dimethyl, and EPTC.

An HI was calculated for organophosphates which are the only pesticides that have a common mode of action (cholinesterase inhibition) and were detected at quantifiable concentrations. The highest hazard index for any site at any exposure period was 0.139, indicating a low risk from cumulative exposure.

Generally, relative to their respective screening levels, concentrations representing subchronic exposure were higher than acute or chronic exposures. Acute exposures were generally slightly higher than chronic exposures relative to their respective screening levels. While acute exposure is discussed in this report, the AMN best measures subchronic and chronic exposures. Estimation of acute exposures is not one of the objectives of the AMN, and ambient air monitoring typically underestimates acute exposure. Application site monitoring in the immediate vicinity of a treated field is normally used to estimate acute exposure, while the AMN's ambient air monitoring in communities is the standard method DPR uses to estimate subchronic and chronic exposures. Application site monitoring typically produces observations of concentrations several times higher than acute exposures from ambient air monitoring.

The Budget Act of 2016 provided additional funds for DPR and ARB to increase the AMN from three sites to eight sites for two years. The 2017 calendar year marked the first year that the sites operated by DPR were operational. These sites were Shafter (Kern Co.), Watsonville (Monterey Co.), and Chualar (Monterey Co.). Monitoring at Santa Maria (Santa Barbara Co.) is conducted by Santa Barbara County Agricultural Commissioner staff, with logistical support from DPR. As of the writing of this report on June 1, 2017, ARB has been able to take over monitoring for Shafter, as well as bring AMN sites in Cuyama (Santa Barbara Co.), Lindsay (Tulare Co.), and San Joaquin (Fresno Co.) online. Oxnard (Ventura Co.) continues to provide monitoring for the TAC and will be rolled into the AMN in the near future.

REFERENCES

ARB, 1988. ARB Monitoring of DEF. Memorandum to Jack Parnell, dated December 30, 1988. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/DEF-88.pdf

ARB, 1994. Ambient Air Monitoring for MITC in Kern County during Summer 1993. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/mitckern.pdf

ARB, 1998a. Final Report for the 1996 Chlorpyrifos Monitoring in Tulare County. Memorandum to Douglas Okumura, dated April 13, 1998. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/chlrpfs.pdf

ARB, 1998b. Final Report for the 1997 Diazinon Monitoring in Fresno County. Memorandum to Douglas Okumura, dated April 23, 1998. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/diaamb.pdf

ARB, 1998c. Final Report for the 1997 Permethrin Air Monitoring. Memorandum to Douglas Okkumura, dated November 17, 1998. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/permethr.pdf

ARB, 1998d. Final Report for the Endosulfan Monitoring in Fresno and San Joaquin Counties. Memorandum to Douglas Okumura, dated May 4, 1998. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/endosulf.pdf

ARB, 1998e. Final Report for the EPTC Monitoring in Merced and Imperial Counties. Memorandum to Doug Okumura, dated June 15, 1998. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/eptcmeim.pdf

ARB, 1999a. Final Report for the 1998 Malathion Air Monitoring. Memorandum to Douglas Okumura, dated February 9, 1999. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/mala99fe.pdf

ARB, 1999b. Final Report for the 1998 Simazine Air Monitoring. Memorandum to John Sanders, dated November 22, 1999. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/simazine.pdf

ARB, 2000. Final Report for the 2000 MeBr and 1,3-Dichloropropene Air monitoring in Kern County. Memorandum to John Sanders, dated December 27, 2000. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/mthdic13.pdf

ARB, 2001. Final Report for the 1999 Propargite and Bifenthrin Air Monitoring. Memorandum to John Sanders, dated August 8, 2001. California Air Resources Board. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/prop_bif.pdf

ARB, 2002. Final Report for the 2001 MeBr and 1,3-Dichloropropene Air Monitoring in Monterey and Santa Cruz Counties. Memorandum to John Sanders, dated March 29, 2002. California Air

Resources Board. Sacramento, CA.
http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/mbr_13d.pdf

ARB, 2003. Final Report for the 2002 Ambient Air Monitoring for Chlorothalonil in Fresno County. Memorandum to John Sanders, dated November 6, 2003. California Air Resources Board. Sacramento, CA http://www.cdpr.ca.gov/docs/emon/pubs/tac/tacpdfs/chlorothal02.pdf

ATSDR, 2007. Toxicological profile for Acrolein. Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, GA. http://www.atsdr.cdc.gov/toxprofiles/tp124-c6.pdf

Brown, C. and Gonzalez, J. (2018). Monitoring of 1,3-dichloropropene in Merced and Fresno counties, 2016-2017 annual report. Department of Pesticide Regulation. Sacramento, CA.

CDFA, 1999. Determination of chloropicrin desorbed from XAD-4 resin tubes. California Department of Food and Agriculture. Sacramento, CA.
http://www.cdpr.ca.gov/docs/specproj/lompoc/99append/append_m.pdf

CDFA, 2004. Determination of MITC in air by GC/NPD or GC/TSD. California Department of Food and Agriculture. Sacramento, CA.
http://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/bio_282.pdf

CDFA, 2010. Determination of Acrolein, Iodomethane, Carbon Disulfide, cis-1,3-Dichloropropene, trans-1,3-Dichloropropene, MIBK and Bromomethane in air samples collected in summa canisters. EMON-SM-019. California Department of Food and Agriculture. Sacramento, CA.
https://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/emon-sm-05-019.pdf

CDFA, 2008a. Determination of Selected Pesticides Collected on XAD-4 Resin by High Performance Liquid Chromatography Ion Trap Mass Spectrometry and Gas Chromatography Mass Spectrometry. California Department of Food and Agriculture. Sacramento, CA.
http://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/imeth_309.pdf

CDFA, 2018b. Determination of MITC in Air by GC-MS. California Department of Food and Agriculture. Sacramento, CA. https://www.cdpr.ca.gov/docs/emon/pubs/anl_methds/emon-sm-05-041_rev2.pdf

CDFA, 2018c. California Department of Food and Agriculture's Center for Analytical Chemistry Memoranda Addressing MITC Field Spike Recoveries, PDF Sacramento, CA.
https://www.cdpr.ca.gov/docs/emon/airinit/cdfa_memoranda_mitc_field_spike.pdf

DPR, 1995. Standard Operating Procedure: Chemistry Laboratory Quality Control. Department of Pesticide Regulation. Sacramento, CA.
http://www.cdpr.ca.gov/docs/emon/pubs/sops/qaqc001.pdf

DPR, 1996. Risk Characterization Document: Dichlorvos (DDV). Department of Pesticide Regulation. Sacramento, CA. https://www.cdpr.ca.gov/docs/risk/rcd/ddvp.pdf

DPR, 1999. Standard Operating Procedure: Transporting, Packaging and Shipping Samples from the Field to the Warehouse or Laboratory. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/sops/qaqc0401.pdf

DPR, 2001. Standard Operating Procedure: Instructions for Calibration and Use of SKC Inc. Personal Sample Pumps. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/sops/eqai001.pdf

DPR, 2004. Standard Operating Procedure: Creating and Filling out a Chain of Custody Record. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/sops/admn00601.pdf

DPR, 2005. Standard Operating Procedure: Sample Tracking Procedures. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/pubs/sops/QAQC003.02.pdf

DPR, 2015. 1,3-Dichloropropene, Risk characterization document-Inhalation exposure to workers, occupational and residential bystanders and the general public. Human Health Assessment Branch. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/risk/rcd/dichloro_123115.pdf

DPR, 2016a. Risk Management Directive and Mitigation Guidance for Cancer Risk From 1,3-Dichloropropene (1,3D). Memorandum to Marylou Verder-Carlos and George Farnsworth dated October 6, 2016. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/whs/pdf/1,3-d_directive_mitigation.pdf

DPR, 2016b. Calculation of Intermediate-Term Residential Exposures Using Measured Air Concentrations from the Ambient Air Monitoring Network. Memorandum to Shelley DuTeaux dated August 9, 2016. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/hha/memos/intermediate_term_exposure_calculations.pdf

DPR, 2018. Cancer Potency Estimate for Chlorothalonil. Memorandum to Pam Wofford, dated April 3, 2018. Department of Pesticide Regulation. Sacramento, CA.

King, K.D., Vidrio, E., Wofford, P., Segawa, R. 2017. Air Monitoring Network Results for 2016: Volume 6. Report Air 17-01. Department of Pesticide Regulation. Sacramento, CA.

Segawa, R. 2010. Pesticide Air Monitoring Network Monitoring Plan. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/air_network_plan_final.pdf

Segawa, R., P. Wofford, R. Neal, and E. Vidrio. 2014. Recommended Air Monitoring Network Plan for 2014. Memorandum to David Duncan, dated January 30, 2014. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_plan2014.pdf

Tuli, A., E. Vidrio, P. Wofford, and R. Segawa. 2015. Air Monitoring Network Results for 2014: Volume 4. Report Air 15-02. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_2014_report_final.pdf

Tuli, A., E. Vidrio, P. Wofford, and R. Segawa. 2017. Air Monitoring Network Results for 2015: Volume 5. Report Air 16-01. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_2015_report_final.pdf

Vidrio, E., P. Wofford, and R. Segawa. 2012. Methyl Bromide Air Monitoring Results for 2011. Memorandum to Christopher Reardon, dated July 17, 2012. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/methylbromide_2011.pdf

Vidrio, E., P. Wofford, R. Segawa and J. Shreider. 2013a. Air Monitoring Network Results for 2011: Volume 1. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_vol1_final.pdf

Vidrio, E., P. Wofford, R. Segawa and J. Shreider. 2013b. Air Monitoring Network Results for 2012: Volume 2. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_2012_final_report_1013.pdf

Vidrio, E., P. Wofford, R. Segawa and J. Shreider. 2014. Air Monitoring Network Results for 2013: Volume 3. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/amn_2013_report_final.pdf

Vidrio, E., R. Neal, R. Segawa, P. Wofford. 2017. Department of Pesticide Regulation Air Monitoring Network Plan. Department of Pesticide Regulation. Sacramento, CA. http://www.cdpr.ca.gov/docs/emon/airinit/air_monitoring_plan_2017.pdf

GLOSSARY

Acute exposure: Short-term exposure. Acute toxicity can be defined as the toxicity manifested within a relatively short time interval. Acute exposure can be as short as a few minutes or as long as a few days, but is generally not longer than one day. In animal toxicity studies, exposure is usually for 24 hours or less.

Analyte: The individual pesticide active ingredient or breakdown product that is subject to analysis.

ARB: California Air Resources Board, part of CalEPA.

CalEPA: California Environmental Protection Agency. The Department of Pesticide Regulation is one of six boards, departments, and offices within CalEPA.

Chronic exposure: Long-term exposure. Chronic exposure is generally for a significant portion of an animal or human lifetime. Exposure may be through repeated single doses or may be continuous.

Co-located sampler: A second sampler located within 1 meter of the primary sampler.

Concentration: The amount of a chemical (by weight) in a given volume of air. Concentrations in air can be expressed in units of volume or weight. In this report, pesticide concentrations are expressed as nanograms per cubic meter (ng/m^3).

Detected: Pertains to a chemical that is found in a sample above the method detection limit (see MDL).

Detection limit: see MDL (method detection limit)

DPR: California Department of Pesticide Regulation, part of CalEPA

Duplicate sample: Same as a primary sample, but it is obtained from a co-located sampler as a replicate.

Exposure: Contact with a chemical. Common routes of exposure are dermal (skin), oral (by mouth) and inhalation (breathing).

Field spiked sample: A sample with a known amount of chemical spiked onto the sample media, which is placed next to a primary sample that undergoes the same air flow and run time conditions. The field spiked sample, when compared to the primary sample, provides some information about any change in the ability to recover the analyte during air sampling.

FQPA: U.S. Food Quality Protection Act

Health screening level: The calculated air concentration based on a chemical's toxicity that is used to evaluate the possible health effects of exposure to the chemical. Screening levels can be useful in the process of evaluating the air monitoring results although they are not regulatory standards. A measured air concentration that is below the screening level for a given pesticide generally would not undergo further evaluation, unless additional data presents the necessity to do so. A measured concentration that is above the screening level would not necessarily indicate a health concern but would indicate the need for a further and more refined evaluation. Different screening levels are determined for different

exposure periods, i.e., acute, subchronic, and chronic. DPR develops a health screening level when a regulatory target has not been established. Also see definition of regulatory target.

HI: Hazard index. The HI is the sum of all hazard quotients (HQs). It is used to estimate the potential health risk for non-cancer effects from exposure to several chemicals for a given time period (acute, subchronic, or chronic). That is,

$$HI = HQ1 + HQ2 + HQ3 + \ldots$$

HQ: Hazard quotient. The HQ is the ratio of an exposure level for a chemical (measured air concentration of a pesticide) to a reference concentration for the chemical (screening level or regulatory target for that pesticide) over the same time period. An HQ less than 1 is generally considered to be health protective.

LOQ: Limit of quantitation. Similar to method detection limit (MDL), the LOQ is the smallest amount of the chemical that can be reliably measured. Samples with concentrations above the minimum detection limit but below the LOQ can be identified as containing a trace amount but the concentration cannot be measured reliably. When calculating average concentrations or other statistics, DPR assumes that samples with a trace concentration have a concentration at the midpoint between the MDL and the LOQ. As with the MDL, the LOQ is a characteristic of both the method and the chemical. Different methods can have different LOQs for the same chemical. The same method can have different LOQs for different chemicals.

Matrix: The substance in the sampling tubes, such as XAD resin or charcoal that traps and removes organic compounds from the atmosphere during sampling

MDL: Method detection limit. The MDL is the smallest amount of the chemical that can be identified (although not necessarily quantified) in a sample with the method employed. If nothing is detected, the sample may contain none of the chemical or may have a concentration less than the MDL. In either instance, the sample is designated as containing no detectable amount. When calculating average concentrations or other statistics, DPR makes a conservative assumption that samples with no detectable amount have a concentration of one-half the MDL. The MDL is a characteristic of both the method and the chemical. That is, different methods can have different MDLs for the same chemical. Similarly, one method can have different MDLs for different chemicals. (See also LOQ, limit of quantitation)

MLD: Monitoring and Laboratory Division. The MLD is the monitoring and laboratory division of the California Air Resources Board.

Monitored chemical: Refers to a chemical that was sampled for in air and analyzed to determine its possible concentration. Air sampling apparatus can consist of pumps and sampling tubes or vacuum canisters. Pumps draw air over sampling tubes containing absorptive media which trap chemicals from the air. The media is then chemically analyzed in the laboratory to determine if the monitored chemical was in the air. Vacuum canisters are air-tight metal containers which utilize a starting vacuum to draw air inside during the monitoring period. The air in the canisters is then subjected to chemical analysis in the laboratory to determine if the monitored chemical was in the collected air. In this study, air sampling periods were 24 hours long.

ND: None detected. This is the concentration below the method detection limit (MDL).

OA: Oxygen analog, also known as oxon. This is the breakdown product from certain organophosphate pesticides. Oxygen analogs usually are more toxic than the parent compound.

OEHHA: California Office of Environmental Health Hazard Assessment, part of CalEPA.

Primary sample: Sample collected in the field to measure pesticide air concentrations.

PUR: Pesticide use report. All agricultural pesticide use in California is required to be reported to the County Agricultural Commissioners. DPR collects these pesticide use reports; it evaluates and annually publishes the data.

QAS: Quality Assurance Section of ARB.

QC: Quality control

RCD: Risk characterization document. DPR's human health risk assessment for a pesticide is presented in the RCD. The RCD explains the results of the risk assessment and assembles, critiques, and interprets all pertinent scientific data on a chemical's toxicology, human experience, and exposure.

RED: Reregistration eligibility document. As part of its reregistration process, U.S. EPA reevaluates and relicenses existing pesticides originally registered prior to current scientific and regulatory standards. U.S. EPA's human health risk assessment for a pesticide is presented as part of its RED.

Regulatory target: Regulatory targets are concentrations that DPR's legal requirements are designed keep air concentrations below. DPR puts measures in place based on the regulatory target to limit exposures so that adverse effects can be avoided. Exceeding a regulatory target concentration does not necessarily mean an adverse health effect occurs, but it does indicate that the restrictions on the pesticide use may need to be modified. DPR normally establishes a regulatory target after completing a comprehensive risk assessment of a chemical's toxicity and potential exposures. DPR determines a regulatory target based on its risk assessment, as well as risk assessments from other agencies, pesticide use patterns, potential effects on use of alternative pesticides, and other factors. A regulatory target is based on a more comprehensive evaluation than that of a health screening level. Therefore, a regulatory target supersedes a health screening level (i.e., a specific pesticide at a specific exposure duration will have either a regulatory target or a health screening level, but not both).

Risk: Risk is the probability that a toxic effect (adverse health effect) will result from a given exposure to a chemical. It is a function of both the inherent toxicity of the chemical as well as the exposure to the chemical.

Screening level: see Health screening level

SOP: Standard operating procedure. This document describes the materials and methods used for various monitoring tasks.

Sorbent cartridge: A Teflon® cartridge filled with a measured amount of trapping media and then sealed. The tube is attached to an air pump and ambient air is drawn through the trapping media in the tube.

Subchronic exposure: A medium time interval of exposure to a chemical. Subchronic exposure is longer than acute exposure, but shorter than chronic exposure. Subchronic exposure may be through repeated single doses or may be continuous. See acute exposure, chronic exposure.

Trace: see LOQ (limit of quantitation)

Trip blank sample: A clean sample cartridge capped and stored on dry ice with the rest of the samples collected from the monitoring site. The purpose is to determine if handling conditions in the field, sample transporting, or storage procedures may have contaminated the samples.

U.S. EPA: U.S. Environmental Protection Agency

VOC: Volatile organic compound