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SUMMARY

In February 2011, DPR implemented a multi-year statewide air monitoring network to measure pesticides in various agricultural communities. This pesticide 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 report is the sixth volume of this study and contains AMN results from January 1, 2016, to December 31, 2016.

DPR monitored a total of 32 pesticides and 5 pesticide breakdown products in three communities. Pesticides monitored in the AMN were selected based primarily on potential risk to human health. Higher-risk pesticides were prioritized and targeted for monitoring and were identified and prioritized based on higher use, higher volatility, and higher toxicity. DPR evaluated 226 communities in California as candidates for inclusion in the network. DPR reevaluated community data in 2013 and expanded the number of candidate communities to 1,267. DPR selected one site each in Salinas (Monterey County), Shafter (Kern County), and Ripon (San Joaquin County) for monitoring based on pesticide use, demographic data, and availability of other exposure and health data.

One 24-hour sample was collected each week at each of the three sites. Starting dates were randomly selected each week to produce variation in the sampling day. Sampling start times were left to the discretion of the field sampling personnel, but sampling always started anywhere from 7:30 a.m. to 3:30 p.m.

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 target for 1-day, 4-week, 1-year, and lifetime periods. DPR devised health screening levels based on a preliminary assessment of possible health effects, and are used as triggers for DPR to conduct a more detailed evaluation. Regulatory target concentrations 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.

Of the 5,928 analyses[1] conducted, 91.0% had no detectable concentrations. 535 (9.0%) of the analyses had detectable (trace or quantifiable) concentrations, and 307 (5.2%) of all the analyses had quantifiable concentrations. A quantifiable concentration refers to a concentration above the limit of quantitation (LOQ) for the respective pesticide.

Twelve of the 37 chemicals monitored were not detected; of the remaining 25, 14 pesticides and breakdown products were only detected at trace levels. 11 compounds were detected at quantifiable levels. Eight of the 11 pesticides (including one breakdown product) detected at quantifiable concentrations in the AMN were either:

- Fumigants (1,3-dichloropropene, carbon disulfide, methyl bromide, chloropicrin, and MITC)
- Organophosphate insecticides (chlorpyrifos and its oxygen analog, DDVP)
- Additionally: chlorothalonil, EPTC, and iprodione were also detected at quantifiable concentrations.

The chemicals with the highest number of detections were carbon disulfide (91%), chlorothalonil (44%), 1,3-dichloropropene (36%), chlorthal-dimethyl (DCPA) (28%), chlorpyrifos oxygen analog (22%), and MITC (22%).

There are no current product registrations for carbon disulfide or sodium tetrathiocarbonate (which degrades to carbon disulfide) and its detections are most likely due to combustion of fossil fuels and its release from manufacturing and processing facilities. It is a product of the anaerobic decomposition of vegetation with several natural sources including wetlands, oceans, and volcanoes. For these reasons, after 2016, DPR will no longer monitor for carbon disulfide as part of its air monitoring network.

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

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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 to stay 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 the 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 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 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

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. Past and current studies by the Air Resources Board (ARB) and DPR for the Toxic Air Contaminant program usually consist of monitoring for short time periods (e.g., a few days or weeks) for individual pesticides. These studies produce data DPR uses to estimate seasonal pesticide exposures and local concentrations. However, since long-term data were not available, DPR would extrapolate the short-term concentrations detected to estimate concentrations associated with annual and lifetime exposures. AMN results provide the needed data to more accurately 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 common 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 initial monitoring station selection process for the AMN, DPR evaluated and prioritized 226 communities in California as candidates for inclusion in the network (Segawa, 2010). The 226 communities were prioritized based on pesticide use (both local and regional), demographic data[2], and availability of other exposure and health data. DPR also considered other factors, including air sampling feasibility, weather patterns, and the potential for collaboration with other projects focused on environmental health (Segawa, 2010). Salinas (Monterey County), Shafter (Kern County), and Ripon (San Joaquin County) were selected as the sampling locations for the AMN. In 2013, DPR reevaluated community data and expanded the number of candidate communities to 1,267 (Segawa et al., 2014). Using the same methodology as in 2010, the current three communities continued to remain communities near areas of high use for many of the monitored pesticides and DPR staff recommended that monitoring should continue at the same three sampling sites.

At each of the three AMN sites, one 24-hour air sample set was collected on a weekly basis. DPR previously determined that representative sampling could be obtained from one 24-hour air sample collected each week (Vidrio et al., 2013a). The collected air samples were analyzed for 32 pesticides and 5 pesticide breakdown products. This report is the sixth volume of this study and contains AMN results from January 1, 2016, to December 31, 2016.

[2] Similar pesticide use ranking communities were prioritized based on their higher population of children, persons over 65, and number of persons living in close proximity to farms and agricultural areas with high pesticide use

Communities and Monitoring Site Locations

Ripon

Ripon, a town of 4.2 square miles in area, is located approximately 20 miles south of Stockton in San Joaquin County (Figure 1). The elevation is 69 feet, with approximately 13.8 inches of precipitation annually. Average temperatures during summer range from 60° to 94° F and 47° to 62° F during winter. Based on US Census data, the estimated population in 2010 was 14,297, of which 28.8% was below 18 years of age and 11.8% was 65 years or older. Almond orchards, grapes and field crops are the major crops surrounding the community. The monitoring site is located in an open area behind the police station on 259 N. Wilma Avenue.

Shafter

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, with approximately 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.

Salinas

Salinas is located in Monterey County approximately 15 miles northeast of Monterey and encompasses a total area of 19 square miles (Figure 1). In 2010, Salinas had a population of 150,441 of which 31.4% was below 18 years of age and 7.4% was above 65. The average rainfall is approximately 14.5 inches. Average temperatures range from 51° to 72° F in the summer and from 40° to 52° F in winter. Heavy morning fog often occurs during summer months. Salinas is surrounded mainly by strawberries, lettuce and other field crops. The monitoring site is located at the Salinas Airport in the southeastern section of the city.

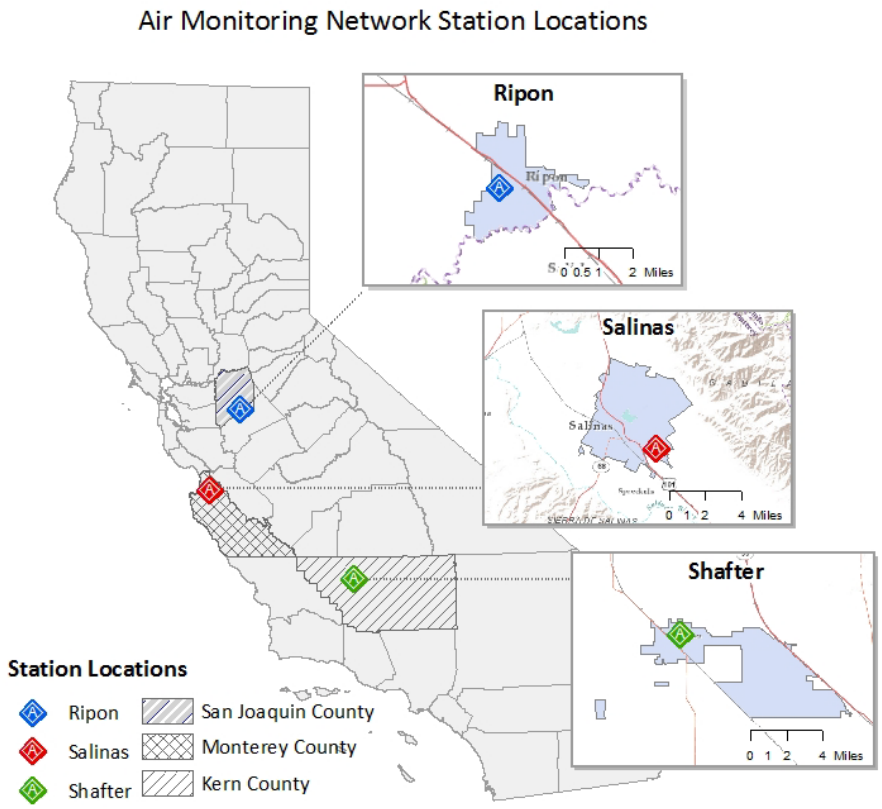

Figure 1. Map showing the locations of the three communities and monitoring sites.

Pesticides Monitored

DPR monitored a total of 37 chemicals (i.e., 32 pesticides and 5 pesticide breakdown products). Chemicals included in the AMN were selected based primarily on potential health risk. DPR gives higher-risk pesticides higher priority for monitoring. Vidrio et al. (2013a) provides a detailed description of the criteria DPR used to select pesticides.

Multi-Pesticide Residue Analysis

Multi-pesticide residue analysis using XAD-4 resin as the solid phase trapping medium was performed by the California Department of Food and Agriculture's (CDFA) Center for Analytical Chemistry laboratory using Gas Chromatography – Mass Spectrometry (GC-MS) and Liquid Chromatography – Mass Spectrometry (LC-MS) methods as described elsewhere (CDFA, 2008). 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 1 lists the 37 analytes that can be detected in the multi-pesticide residue analysis with XAD-4 resin.

Table 1. Target analytes in multi-pesticide residue analysis with XAD-4 resin.

Chemical	Product Name	Pesticide Group	Chemical Class
Acephate	Orthene	Insecticide	Organophosphate
Bensulide	Prefar	Herbicide	Organophosphate
Chlorothalonil	Bravo	Fungicide	Chloronitrile
Chlorpyrifos	Dursban	Insecticide	Organophosphate
Chlorpyrifos Oxygen Analog	-	-	Organophosphate
Chlorthal-dimethyl (DCPA)	Dacthal	Herbicide	Phthalate
Cypermethrin	Demon	Insecticide	Pyrethroid
Diazinon	Various names	Insecticide	Organophosphate
Diazinon Oxygen Analog	-	-	Organophosphate
Dicofol	Kelthan	Insecticide	Organochlorine
Dimethoate	Cygon	Insecticide	Organophosphate
Dimethoate Oxygen Analog	-	-	Organophosphate
Diuron	Karmex	Herbicide	Urea
Endosulfan	Thiodan	Insecticide	Organochlorine
Endosulfan Sulfate	-	-	Organochlorine
EPTC	Eptam	Herbicide	Carbamate
Iprodione	Rovral	Fungicide	Dicarboximide
Malathion	Various names	Insecticide	Organophosphate
Malathion Oxygen Analog	-	-	Organophosphate
Methidathion	Supracide	Insecticide	Organophosphate
Metolachlor (S-metolachlor)	Dual	Herbicide	Chloracetanilide
Named as Dichlorvos (DDVP)	Dibrom, Vapona	Insecticide	Organophosphate
Norflurazon	Solicam	Herbicide	Pyridazinone
Oryzalin	Surflan	Herbicide	Dinitroaniline
Oxydemeton-methyl	Metasystox-R	Insecticide	Organophosphate
Oxyfluorfen	Goal	Herbicide	Diphenyl ether
Permethrin	Ambush	Insecticide	Pyrethroid
Phosmet	Imidan	Insecticide	Organophosphate
Propargite	Omite	Insecticide	Organosulfite
Simazine	Princep	Herbicide	Triazine
SSS-tributylphosphorotrithioate	DEF	Defoliant	Organophosphate
Trifluralin	Treflan	Herbicide	Dinitroaniline

Volatile Organic Compound Analysis

Air canisters were analyzed for the analytes listed in Table 2 using a volatile organic compound (VOC) GC-MS method similar to the United States Environmental Protection Agency's (EPA) Method TO-15. The standard operating procedure for this analysis is described in detail elsewhere (CDFA, 2008).

MITC

Samples collected on SKC Inc® coconut charcoal sample tubes were analyzed for residues of MITC by GC-MS as described by CDFA (2004). MITC extraction from the sorbent medium involves using carbon

disulfide in ethyl acetate with subsequent analysis using a gas chromatography-nitrogen phosphorous detector (GC-NPD).

Chloropicrin

SKC Inc® XAD-4 sample tubes were analyzed for residues 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 gas chromatograph equipped with GC-ECD.

Table 2. Target analytes in volatile organic compound and individual analyte residue analysis.

Pesticide	Product Name	Pesticide Group	Chemical Class
1,3-Dichloropropene	Telone, Inline	Fumigant	Halogenated organic
Methyl Bromide	-	Fumigant	Halogenated organic
Carbon Disulfide	Enzone	Fumigant	Inorganic
MITC	Vapam, K-Pam, Dazomet	Fumigant	-
Chloropicrin	-	Fumigant	Halogenated organic

MATERIALS AND METHODS

Air Sampling Equipment and Methods

Personnel from CDFA's Center for Analytical Chemistry washed, rinsed, and packed XAD-4 sorbent material into Teflon® sample cartridges and pre-evacuated SilcoCan® canisters to a pressure of -30 inches of Hg. Chain of custody (COC) forms, sample analysis request forms, and sample labels including the study number and sample identification numbers were supplied to field sampling personnel to be attached to sampling tubes, cartridges, and canisters prior to sampling. DPR staff measures the instrument's starting flow rates and if any flow rate is measured out of the acceptable range ($^{+}/_{-}$ 10% of target flow value), sampling equipment flow rates are calibrated prior to air sample collection. As the air sampling commences at each monitoring site, the sample tracking number, date, time, staff initials, weather conditions, and air sampler flow rate were documented on the COC form (DPR, 2004). DPR (2001) provides more details on the use, operation, calibration, and maintenance of air sampling pumps. Air sampler flow rates were measured using Bios Defender 510® flow meters at the beginning and the end of the sampling period. All sample pumps were checked and initially calibrated in the laboratory.

A protective shelter, placed at each air sampling location, housed AirChek® HV30 pumps, SKC Inc® personal sample pumps, and SilcoCan® canisters. Air samples were collected via three different sampling methods (Segawa, 2010). The first method, which sampled for target analytes in the multi-pesticide residue analysis, used an AirChek® pump pulling air at a rate of 15 L/min attached to a hand-packed Teflon cartridge containing 30 mL of XAD-4 sorbent resin material. The second method, which sampled for MITC and chloropicrin, used manufactured pre-packed 200/1800 mg coconut charcoal tubes (MITC) or manufactured pre-packed 400/200 mg XAD-4 tubes (chloropicrin) with sealed glass end tips that were attached to an SKC Inc® personal sample pump set to a flow rate of 1.5 L/min for MITC or 50 mL/min for chloropicrin. The third method, which sampled for target analytes in the volatile organic compound analysis, used a vacuumed 6-L SilcoCan® canister with an attached flow controller to maintain a constant air flow rate of around 3.0 ml/min for a 24-hour period.

Once samples were collected, open tube and cartridge ends were tightly capped with appropriate end caps and the air canister's valve was tightly closed. Sample tubes and cartridges were placed in an insulated storage container containing dry ice and remained frozen until transported to DPR's West Sacramento facility where they were checked-in and placed into a freezer until delivered to the CDFA's Center for Analytical Chemistry for analysis. The SilcoCan® canisters were transported to DPR's West Sacramento facility and stored at ambient conditions. Sample handling-shipping and tracking procedures were followed as defined elsewhere (DPR, 1999; DPR, 2005).

Sampling Procedure

One 24-hour sample was collected each week at each of the three sites. The starting day varied each week with the actual dates being randomly selected. Actual sampling start times were left to the discretion of the field sampling personnel, but sampling always started anywhere from 7:30 a.m. to 3:30 p.m.

Quality Control Methods

DPR collected quality control samples in addition to regular primary samples. These quality control samples consisted of trip blanks, field spikes, and co-located duplicate samples.

A trip blank sample provides information on possible contamination of samples. For the manufactured pre-packed XAD-4 and charcoal sample tubes, the 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 taken. Trip blanks collected from each sampling site were randomly selected and collected 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 laboratory spike sent to the field and placed on an air sampler with air flowing through the sorbent tube. Shipped on dry ice to the field, it is treated just like a field sample, undergoing the same storage and shipping conditions. The field spike, in comparison with the respective field sample, gives information about any change 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. For chloropicrin- and MITC-spiked samples, spiked concentrations varied every month. VOC canister spike samples were collected at a randomly selected site every other month. Spike samples outside the control limits established from the validation data for each pesticide would trigger a reassessment of the field and laboratory procedures.

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 for each sample type once per month.

Laboratory Methods

Method calibration

The laboratory verified 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 regressing the standard concentration on the response of 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 method detection limit (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. Table 3 lists all of the quantitation and detection limits for AMN analytes.

Table 3. Quantitation and detection limits for Air Monitoring Network samples.

Pesticide	Detection limit (MDL) (ng/m^3)	Quantitation limit (LOQ) (ng/m^3)
Acephate	1.0	9.3
Bensulide	1.4	9.3
Chloropicrin	222	694 *
Chlorothalonil	13.7	23.1
Chlorpyrifos	5.0	23.1
Chlorpyrifos OA	2.9	9.3
Chlorthal-dimethyl (DCPA)	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	8.0	9.3
pp-Dicofol	2.1	23.1
Propargite	3.8	23.1
Simazine	1.2	9.3
SSS-tributyltriphosphorotrithioate (DEF)	1.8	9.3
Trifluralin	1.7	23.1
VOC Samples †		
1,3-Dichloropropene	45.4 (0.01 ppb) **	
Carbon Disulfide	31.1 (0.01 ppb) **	
Methyl Bromide	39.6 (0.01 ppb) **	

* On 6/18/2013, the quantitation limit was lowered to 694 ng/m^3.

** On 10/15/2013, the quantitation limit was lowered to 0.01 ppb.

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

‡ In previous reports the quantitation limit of malathion was mistakenly reported as 23.1 ng/m^3.

Air concentration calculations

For the sorbent tube and cartridge samples, air concentrations were 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:

$$\frac{Sample\,results\,(\mu g)\times 1000\,L/m^3}{Flow\,rate\,of\;sampler\,(L/\min)\times Run\,time\,(\min)}\ \text{x 1000 } ng/\mu g = \ ng/m^3$$

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

$$\frac{Sample\,results\,(ppbv)\ \times\ Molecular\,weight\,(g\,mol^{-1})}{24.45}\ \text{x 1000} = \ ng/m^3$$

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[3].

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)).

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 potential for high 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 such adverse effects as respiratory illnesses, damage to the nervous system, cancer, and birth defects. Vidrio et al. (2013a) summarize 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) and others compares the measured air concentrations to either health screening levels or regulatory target concentrations 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) summarize more information on DPR-determined screening levels including information on deriving screening levels for each pesticide.

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

In December 2015, DPR completed a risk assessment for inhalation exposure (DPR, 2015) to 1,3-dichloropropene (1,3-D) that updated the estimated inhalation exposure or reference concentrations that are likely to be without appreciable risk of deleterious effects. The concentrations were updated for the acute, subchronic, and chronic screening levels in addition to the cancer risk; they are different than reported screening levels in previous AMN result reports (Table 4).

Table 4. Screening levels for 1,3-dichloropropene.

Exposure scenario	Previous (ng/m^3)	Current (ng/m^3)
Acute	160,000	505,000
Subchronic	120,000	14,000
Chronic	120,000	9,000
Lifetime (70-yr)*	650	2,600

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

Once a complete assessment of possible health risks is completed, regulatory targets are established 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. 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 based on the 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, methyl bromide, MITC, and 1,3-D) have regulatory targets for one or more exposure periods. DPR has updated the regulatory target for cancer risk from lifetime exposure to 1,3-D. As described in the risk management directive (DPR, 2016a), DPR has updated the 1,3-D regulatory target from 650 ng/m^3 to 2,600 ng/m^3 , as a 70-year average concentration.

The 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 and 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 all of the HQs for the pesticides monitored.

$$HI = HQ_1\ (pesticide\ 1) + HQ_2\ (pesticide\ 2) + HQ_3\ (pesticide\ 3)_{+\ \ldots}\ \text{(and so forth)}$$

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.

The AMN collects samples for eight pesticides that have been designated as potential carcinogens by Proposition 65[4] or by U.S. EPA's B2 list. Chemicals designated as potential carcinogens by either Proposition 65 or the USEPA B2 list are: 1,3-dichloropropene, carbon disulfide, 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.), and was estimated based on the following calculation for each pesticide.

Risk of single pesticide = (cancer potency) X (exposure)

Exposure for single pesticide = (air concentration) X (respiratory rate)

Risk of single pesticide = (cancer potency) X (air concentration) X (respiratory rate)

Total risk for AMN pesticides = (risk of pesticide 1) + (risk of pesticide 2)…

It is a standard default assumption that exposure to a carcinogen takes place over a lifetime, so DPR uses a default respiratory rate for an adult of 0.28 m^3 /kg-day. The cancer potency (also called cancer slope factor) is used to estimate the risk of cancer associated with exposure to a carcinogenic substance and expressed in units of proportion (of a population) affected per mg of substance/kg body weight-day. For 1,3-dichloropropene, DPR uses a default cancer potency value of 0.014 $(mg/kg\text{-}day)^{-1}$. 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.

DPR has issued risk management directives for some pesticides that specify air concentration levels as regulatory targets, and these targets have been footnoted in the appropriate tables. DPR will use the data from this monitoring, in part, to determine the effectiveness of its mitigation measures in meeting these targets

[4] The official name of Proposition 65 is The Safe Drinking Water and Toxic Enforcement Act of 1986

AIR MONITORING RESULTS

Results for all Pesticides and Communities Combined

A total of 5,928 analyses were conducted on the air samples collected from all three sampling locations from January 1, 2016, to December 31, 2016. Of the 5,928 analyses, 9.0% (535) showed detectable concentrations, which included quantifiable and trace detections[5]. Samples with quantifiable concentrations accounted for 5.2% (307) of all analyses conducted.

Twelve of the 32 pesticides and 5 pesticide breakdown products monitored were not detected; Of the remaining 25, 14 pesticides and breakdown products were only detected at trace levels. 11 compounds were detected at quantifiable levels. Table 5 lists the number of detections for each pesticide and pesticide breakdown products included in the AMN. The chemicals with the highest number of detections were carbon disulfide (91%), chlorothalonil (44%), 1,3-dichloropropene (36%), chlorthal-dimethyl (DCPA) (28%), chlorpyrifos oxygen analog (22%), and MITC (22%).

As previously stated, 2016 is the last year in which the AMN monitored concentrations of carbon disulfide (Tuli et al., 2017). There are no current registered pesticide products that contain carbon disulfide or sodium tetrathiocarbonate (which degrades to carbon disulfide) as its active ingredient and any carbon disulfide detection is most likely due to combustion of fossil fuels as well as its use as an industrial solvent and its release from manufacturing and processing facilities. Carbon disulfide is also a product of the anaerobic decomposition of vegetation with several natural sources including wetlands, oceans, and volcanoes.

[5] Quantifiable detections refer to concentrations above the LOQ for their 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 5. Number and percentage of positive samples per chemical.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
cis-1,3-Dichloropropene	156	57	57	37%	37%
trans-1,3-Dichloropropene	156	55	55	35%	35%
Acephate	156	0	0	0%	0%
Bensulide	156	1	0	1%	0%
Carbon Disulfide	156	142	142	91%	91%
Chloropicrin	156	8	5	5%	3%
Chlorothalonil	156	69	2	44%	1%
Chlorpyrifos	156	21	3	13%	2%
Chlorpyrifos OA	156	34	1	22%	1%
Chlorthal-dimethyl (DCPA)	156	43	0	28%	0%
Cypermethrin	156	0	0	0%	0%
DDVP	156	2	1	1%	1%
Diazinon	156	2	0	1%	0%
Diazinon OA	156	3	0	2%	0%
Dimethoate	156	1	0	1%	0%
Dimethoate OA	156	1	0	1%	0%
Diuron	156	2	0	1%	0%
Endosulfan	156	0	0	0%	0%
Endosulfan Sulfate	156	0	0	0%	0%
EPTC	156	3	3	2%	2%
Iprodione	156	9	1	6%	1%
Malathion	156	4	0	3%	0%
Malathion OA	156	13	0	8%	0%
Methidathion	156	0	0	0%	0%
Methyl Bromide	156	16	16	10%	10%
Metolachlor	156	0	0	0%	0%
MITC	156	34	21	22%	13%
Norflurazon	156	0	0	0%	0%
Oryzalin	156	0	0	0%	0%
Oxydemeton methyl	156	0	0	0%	0%
Oxyfluorfen	156	2	0	1%	0%
Permethrin	156	1	0	1%	0%
Phosmet	156	0	0	0%	0%
pp-Dicofol	156	0	0	0%	0%
Propargite	156	3	0	2%	0%
Simazine	156	3	0	2%	0%
SSS-tributyltriphosphoro-trithioate (DEF)	156	0	0	0%	0%
Trifluralin	156	6	0	4%	0%
Total	**5,928**	**535**	**307**	**9%**	**5%**

* Includes both quantified and trace detections.

Tables 6 through 8 list the number of detections for each pesticide and pesticide breakdown products for each sampling location. Carbon disulfide is the pesticide with the highest number of detections in Salinas (48 detections), Shafter (48 detections), and Ripon (46 detections). All carbon disulfide detections during 2016 were quantifiable in all monitored communities. In Salinas, chlorthal-dimethyl (DCPA) had the second highest number of detections (35 detections), and all were at trace levels. In Shafter and Ripon the analyte with the second highest number of detections was chlorothalonil. There

were 32 detections of chlorothalonil in Shafter, of which 2 were quantifiable while 30 were at trace levels. In Ripon there were 34 detections of chlorothalonil, all of which were at trace levels.

Table 6. Number and percentage of positive samples per chemical in Salinas, California.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
cis-1,3-Dichloropropene	52	13	13	25%	25%
trans-1,3-Dichloropropene	52	13	13	25%	25%
Acephate	52	0	0	0%	0%
Bensulide	52	0	0	0%	0%
Carbon Disulfide	52	48	48	92%	92%
Chloropicrin	52	7	5	13%	10%
Chlorothalonil	52	3	0	6%	0%
Chlorpyrifos	52	0	0	0%	0%
Chlorpyrifos OA	52	0	0	0%	0%
Chlorthal-dimethyl (DCPA)	52	35	0	67%	0%
Cypermethrin	52	0	0	0%	0%
DDVP	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	2	0	4%	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	4	0	8%	0%
Malathion OA	52	11	0	21%	0%
Methidathion	52	0	0	0%	0%
Methyl Bromide	52	5	5	10%	10%
Metolachlor	52	0	0	0%	0%
MITC	52	2	1	4%	2%
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%
SSS-tributyltriphosphoro-trithioate (DEF)	52	0	0	0%	0%
Trifluralin	52	0	0	0%	0%
Total	**1,976**	**143**	**85**	**7%**	**4%**

* Includes both quantified and trace detections.

Table 7. Number and percentage of positive samples per chemical in Shafter, California.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
cis-1,3-Dichloropropene	52	26	26	50%	50%
trans-1,3-Dichloropropene	52	26	26	50%	50%
Acephate	52	0	0	0%	0%
Bensulide	52	0	0	0%	0%
Carbon Disulfide	52	48	48	92%	92%
Chloropicrin	52	0	0	0%	0%
Chlorothalonil	52	32	2	62%	4%
Chlorpyrifos	52	15	3	29%	6%
Chlorpyrifos OA	52	26	0	50%	0%
Chlorthal-dimethyl (DCPA)	52	8	0	15%	0%
Cypermethrin	52	0	0	0%	0%
DDVP	52	1	1	2%	2%
Diazinon	52	0	0	0%	0%
Diazinon OA	52	1	0	2%	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	3	3	6%	6%
Iprodione	52	4	1	8%	2%
Malathion	52	0	0	0%	0%
Malathion OA	52	0	0	0%	0%
Methidathion	52	0	0	0%	0%
Methyl Bromide	52	4	4	8%	8%
Metolachlor	52	0	0	0%	0%
MITC	52	22	12	42%	23%
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	3	0	6%	0%
SSS-tributyltriphosphoro-trithioate (DEF)	52	0	0	0%	0%
Trifluralin	52	0	0	0%	0%
Total	**1,976**	**219**	**126**	**11%**	**6%**

* Includes both quantified and trace detections.

Table 8. Number and percentage of positive samples per chemical in Ripon, California.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
cis-1,3-Dichloropropene	52	18	18	35%	35%
trans-1,3-Dichloropropene	52	16	16	31%	31%
Acephate	52	0	0	0%	0%
Bensulide	52	1	0	2%	0%
Carbon Disulfide	52	46	46	88%	88%
Chloropicrin	52	1	0	2%	0%
Chlorothalonil	52	34	0	65%	0%
Chlorpyrifos	52	6	0	12%	0%
Chlorpyrifos OA	52	8	1	15%	2%
Chlorthal-dimethyl (DCPA)	52	0	0	0%	0%
Cypermethrin	52	0	0	0%	0%
DDVP	52	1	0	2%	0%
Diazinon	52	2	0	4%	0%
Diazinon OA	52	2	0	4%	0%
Dimethoate	52	1	0	2%	0%
Dimethoate OA	52	1	0	2%	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	5	0	10%	0%
Malathion	52	0	0	0%	0%
Malathion OA	52	2	0	4%	0%
Methidathion	52	0	0	0%	0%
Methyl Bromide	52	7	7	13%	13%
Metolachlor	52	0	0	0%	0%
MITC	52	10	8	19%	15%
Norflurazon	52	0	0	0%	0%
Oryzalin	52	0	0	0%	0%
Oxydemeton methyl	52	0	0	0%	0%
Oxyfluorfen	52	2	0	4%	0%
Permethrin	52	1	0	2%	0%
Phosmet	52	0	0	0%	0%
pp-Dicofol	52	0	0	0%	0%
Propargite	52	3	0	6%	0%
Simazine	52	0	0	0%	0%
SSS-tributyltriphosphoro-trithioate (DEF)	52	0	0	0%	0%
Trifluralin	52	6	0	12%	0%
Total	**1,976**	**173**	**96**	**9%**	**5%**

* Includes both quantified and trace detections.

Table 9 summarizes the total number of detections of the monitored chemicals broken down by community. The percentages of detections for monitored chemicals ranged from 7.2% to 11.1% 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 (12.6%) as well as the highest percentage of quantifiable samples (6.4%). A sample set is the collective term for all samples recovered from one site in one week. A total of 156 sample sets were taken from all three communities (52 sets each from Salinas, Shafter, and Ripon), 153 (98.1%) of these sample sets contained at least one detection.

There were a large number of detections for carbon disulfide (CS_2), more than double that of the next highest monitored chemical as seen in Table 5. As such, it had an outsized effect on the number of total detections measured. Additionally, as previously stated, these CS_2 detections are believed to originate from non-pesticidal sources. Therefore, by excluding CS_2 detections from all calculations resulted in percentages of possible detections lowering to 4.9% for Salinas and 8.9% for Shafter. The total number of sets with at least one detection also fell from 153 to 130 (83.3%) when CS_2 was excluded from these calculations (Table 9).

Table 9. 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
Salinas	1,976	143	85	7.2%	4.3%	52	51	98.1%
Shafter	1,976	219	126	11.1%	6.4%	52	52	100.0%
Ripon	1,976	173	96	8.8%	4.9%	52	50	96.2%
Total	**5,928**	**535**	**307**	**9.0%**	**5.2%**	**156**	**153**	**98.1%**
Detections of monitored chemicals by location excluding carbon disulfide								
Salinas	1,924	95	37	4.9%	1.9%	52	40	76.9%
Shafter	1,924	171	78	8.9%	4.1%	52	44	84.6%
Ripon	1,924	127	50	6.6%	2.6%	52	46	88.5%
Total	**5,772**	**393**	**165**	**6.8%**	**2.9%**	**156**	**130**	**83.3%**

* Includes both quantified and trace detections.

Table 10 presents the highest 24-hour concentrations at any site for each pesticide monitored. None of the pesticides monitored exceeded their acute screening level or regulatory target. Detected concentrations of 1,3-dichloropropene were the highest relative to its screening level with a maximum 24-hour concentration of 45,322.6 ng/m^3 (9.0% of the acute screening level). Diazinon OA had the second highest 24-hour concentration, which was a trace detection calculated to be 5.7 ng/m^3 (4.4% of the acute screening level). Figures 2 through 6 present the 24-hour concentrations of all fumigants, excluding carbon disulfide, and organophosphate pesticides detected at quantifiable concentrations at any of the three sites during the 2016 calendar year.

While the results of the 24-hour samples and acute exposure are discussed in this report, estimating acute exposures is not one of the AMN objectives. 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. Application-site monitoring in the immediate vicinity of a treated field is normally used to estimate acute exposure, and these air concentrations are typically several times higher than acute exposures measured from ambient air monitoring since they are collected 100 feet or less from the application, whereas ambient samples may be collected a ¼ mile or more away. Application-site monitoring for individual pesticides is currently performed by DPR or ARB

and all monitoring reports are posted on DPR's website. It's likely that the maximum acute exposure is higher than indicated by the data presented here.

Table 10. Highest 24-hour concentration for chemicals monitored.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	% of screening level
1,3-Dichloropropene	45,322.6	505,000	8.975%
Acephate	Not Detected (0.5)	12,000	ND
Bensulide	Trace (5.4)	259,000	0.002%
Carbon Disulfide	946.3	1,550,000	0.061%
Chloropicrin	2,824.3	491,000*	0.575%
Chlorothalonil	58.5	34,000	0.172%
Chlorpyrifos	52.1	1,200	4.344%
Chlorpyrifos OA	14.9	1,200	1.238%
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
Cypermethrin	Not Detected (2.4)	113,000	ND
DDVP	49.0	11,000	0.446%
Diazinon	Trace (5.3)	130	4.038%
Diazinon OA	Trace (5.7)	130	4.385%
Dimethoate	Trace (5.8)	4,300	0.135%
Dimethoate OA	Trace (5.6)	4,300	0.130%
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Not Detected (1.6)	3,300	ND
Endosulfan Sulfate	Not Detected (2.3)	3,300	ND
EPTC	27.3	230,000	0.012%
Iprodione	17.0	939,000	0.002%
Malathion	Trace (5.8)	112,500	0.005%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	ND
Methyl Bromide	1,160.6	820,000*	0.142%
Metolachlor	Not Detected (1.4)	85,000	ND
MITC	108.9	66,000*	0.165%
Norflurazon	Not Detected (1.9)	170,000	ND
Oryzalin	Not Detected (0.7)	420,000	ND
Oxydemeton methyl	Not Detected (1.2)	39,200	ND
Oxyfluorfen	Trace (14.8)	510,000	0.003%
Permethrin	Trace (15.2)	168,000	0.009%
Phosmet	Not Detected (4.0)	77,000	ND
pp-Dicofol	Not Detected (1.1)	68,000	ND
Propargite	Trace (13.5)	14,000	0.096%
Simazine	Trace (5.3)	110,000	0.005%
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected (0.9)	8,800	ND
Trifluralin	Trace (12.4)	1,200,000	0.001%

† 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.

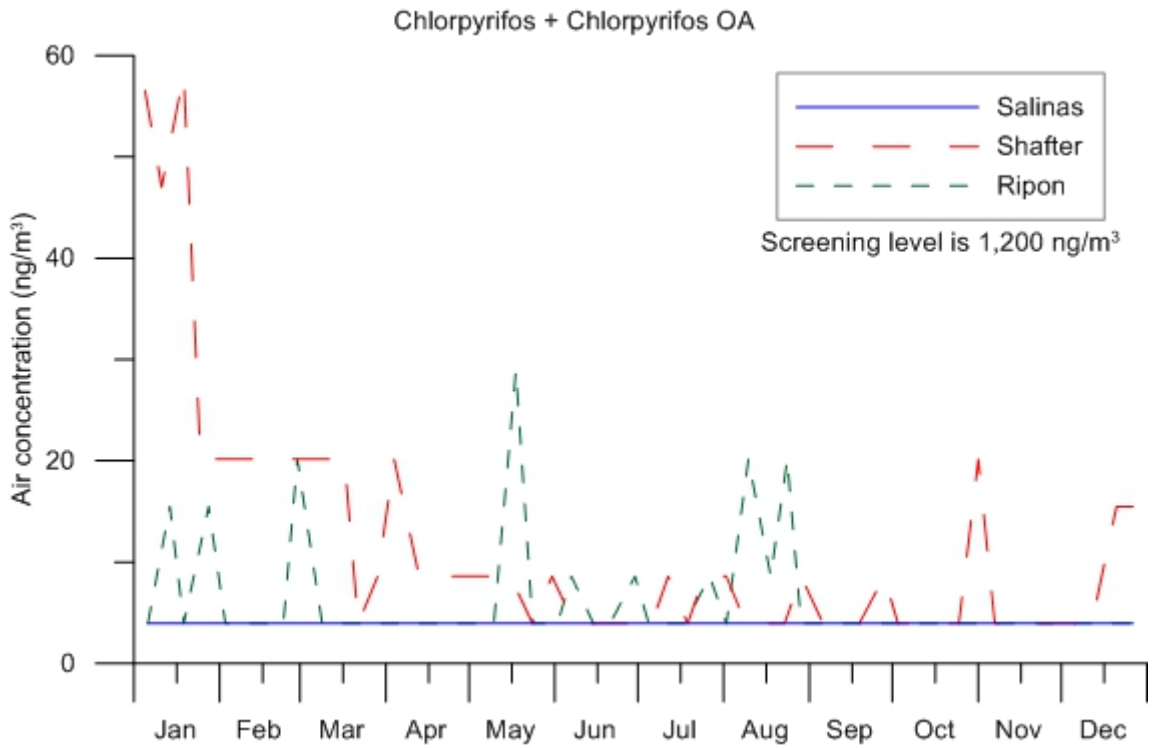

Figure 2. 24-hour (acute) chlorpyrifos + chlorpyrifos OA concentrations detected in each community.

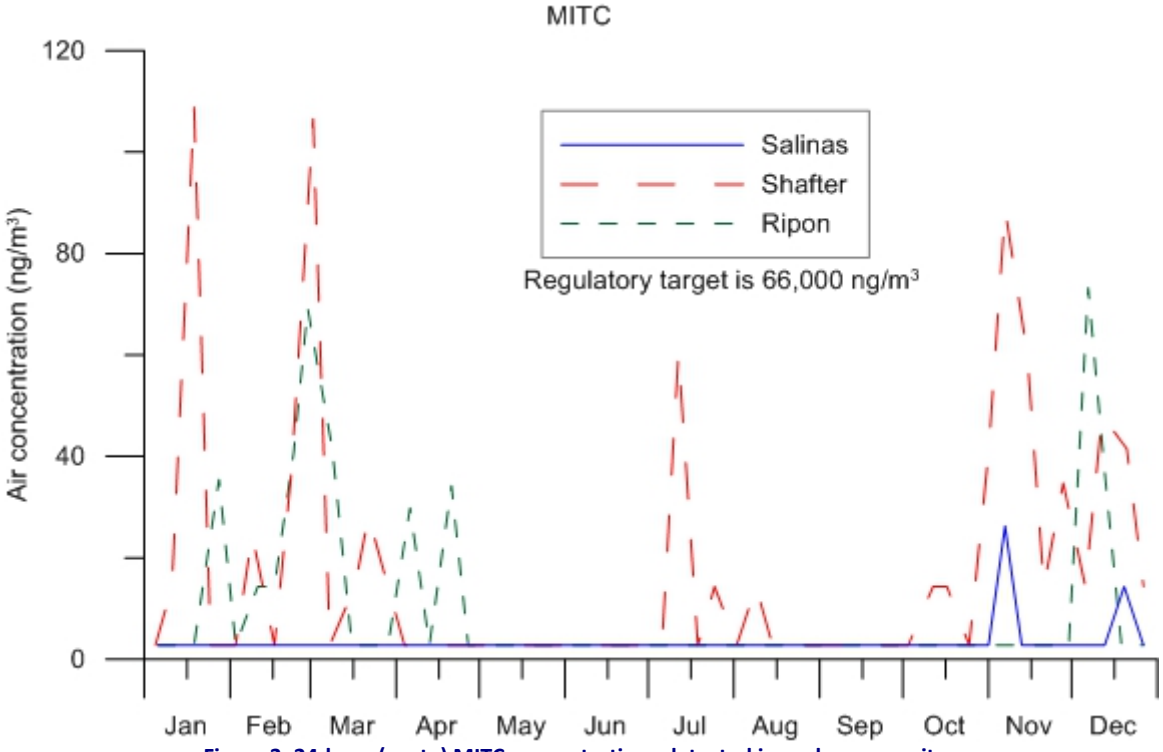

Figure 3. 24-hour (acute) MITC concentrations detected in each community.

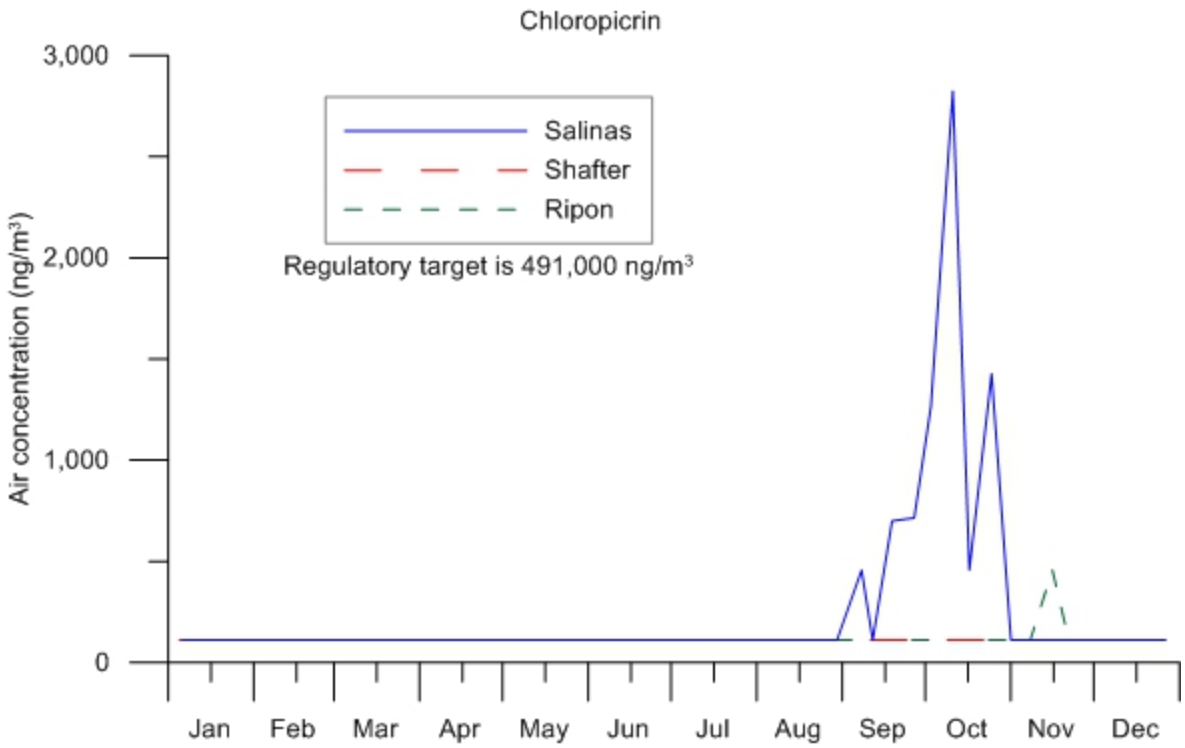

Figure 4. 24-hour (acute) chloropicrin concentrations detected in each community.

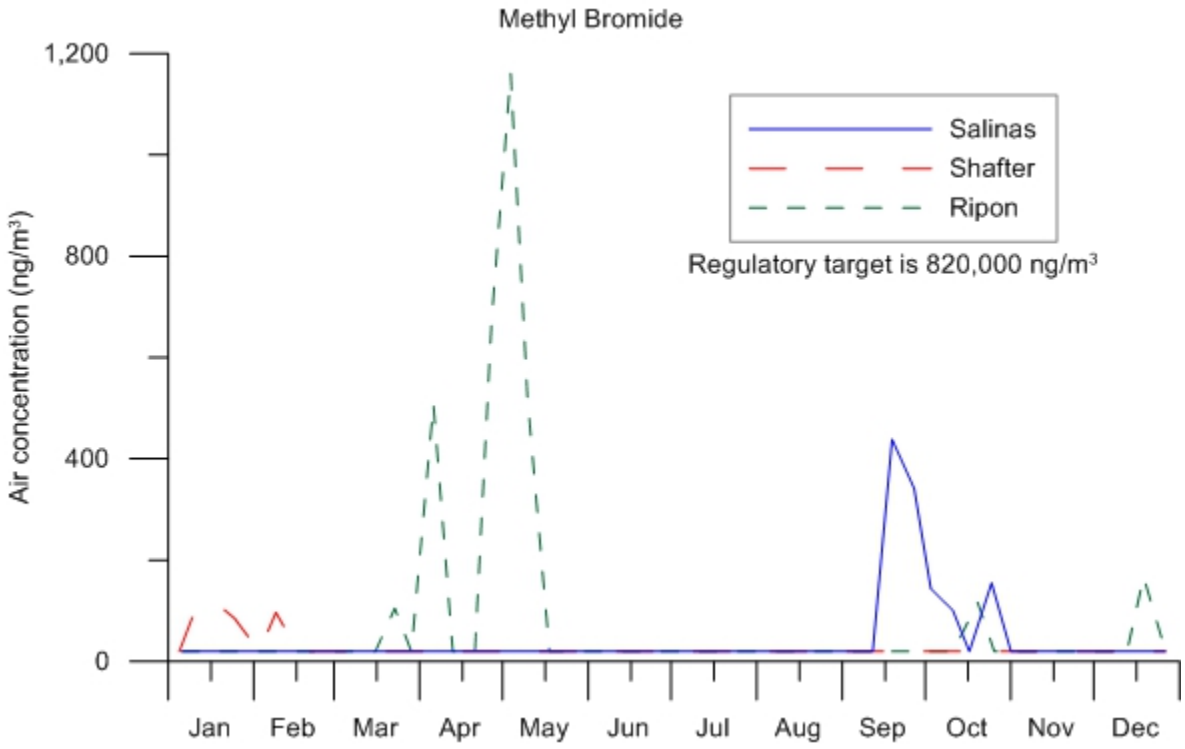

Figure 5. 24-hour (acute) methyl bromide concentrations detected in each community.

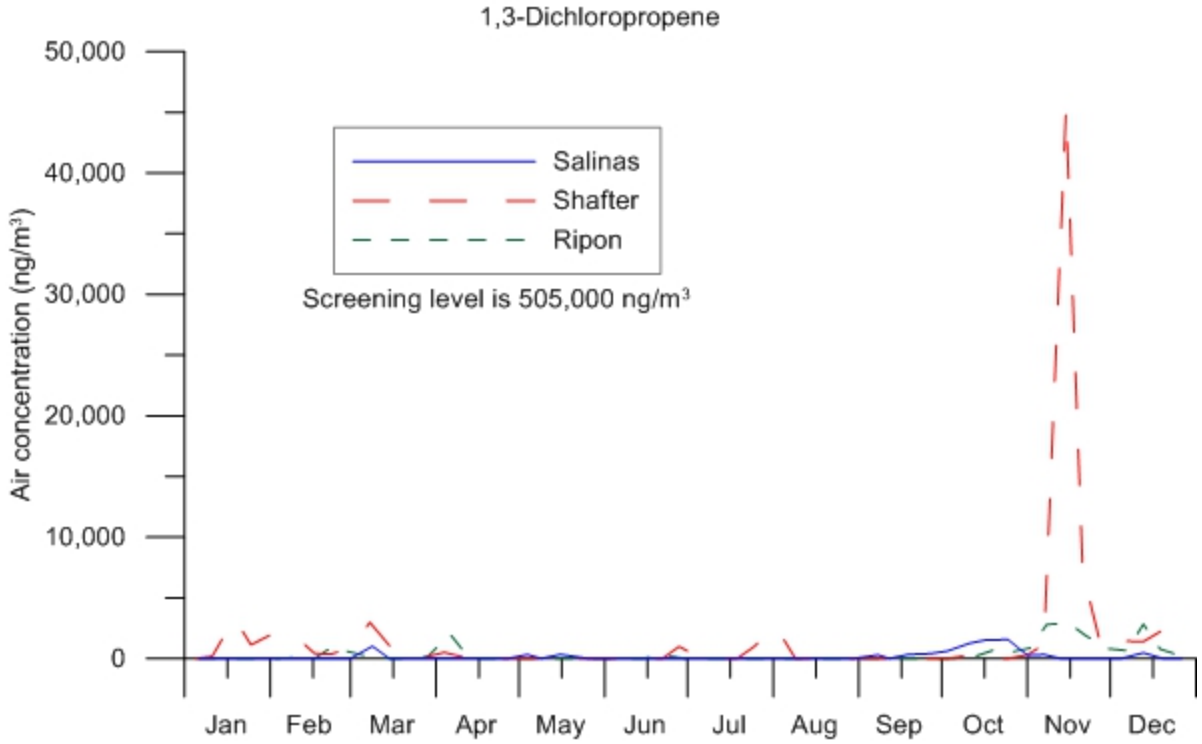

Figure 6. 24-hour (acute) 1,3-dichloropropene concentrations detected in each community.

Table 11 shows the highest rolling 4-week average concentration, the subchronic screening level, and the percentage of that subchronic screening level reached for each monitored pesticide during the 2016 calendar year. Only two of the 32 pesticides and 5 breakdown products monitored by the AMN had a rolling 4-week average concentration above 5% of their respective subchronic screening levels (chloropicrin and 1,3-dichloropropene).

The pesticide with the highest detected concentrations relative to its subchronic screening level was 1,3-dichloropropene with a maximum rolling 4-week average concentration of 13,659.2 ng/m^3, which is 97.6% of its subchronic screening level. The second highest 4-week rolling concentration detected was that of chloropicrin, which reached a maximum rolling 4-week average concentration of 1,493.4 ng/m^3 (64.9% of its subchronic screening level). Following these were chlorpyrifos with a rolling 4-week average concentrations of 39.4 ng/m^3 (4.6% of the subchronic screening level), methyl bromide at 549.0 ng/m^3 (3.1% of the subchronic regulatory target), diazinon OA at 3.4 ng/m3 (2.6% of the subchronic screening level), diazinon at 2.9 ng/m^3 (2.3% of the subchronic screening level), and MITC at 51.0 ng/m^3 (1.7% of the subchronic screening level). The rolling 4-week averages of the remaining monitored pesticides were below 1% of their respective subchronic screening levels.

Figures 7 through 11 present the rolling 4-week average concentrations of all fumigants, excluding carbon disulfide, and the organophosphate pesticides that were detected at quantifiable concentrations at any of the three sites during monitoring in the 2016 calendar year. The concentrations in Table 11 and Figures 7 through 11 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.). Figure 11 presents the highest rolling 4-week average concentrations measured for the sum of cis-1,3-dichloropropene and trans-1,3-dichloropropene for all three sampling locations. The rolling 4-week average concentrations were calculated using one-half the MDL for samples with no detectable amount, and a value halfway between the MDL and the LOQ for samples with trace (unquantifiable) concentrations.

Table 11. The highest of 4-week rolling air concentrations, subchronic screening levels, and percent of the subchronic screening level.

Pesticide	Highest 4-week rolling concentration (ng/m^3)†	Subchronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	13,659.2	14,000	97.565%
Acephate	Not Detected	8,500	ND
Bensulide	1.9	24,000	0.008%
Carbon Disulfide	914.4	800,000	0.114%
Chloropicrin	1,493.4	2,300	64.932%
Chlorothalonil	24.5	34,000	0.072%
Chlorpyrifos	39.4	850	4.633%
Chlorpyrifos OA	6.1	850	0.718%
Chlorthal-dimethyl (DCPA)	5.5	470,000	0.001%
Cypermethrin	Not Detected	81,000	ND
DDVP	13.5	2,200	0.612%
Diazinon	2.9	130	2.250%
Diazinon OA	3.4	130	2.596%
Dimethoate	2.3	3,000	0.077%
Dimethoate OA	2.1	3,000	0.070%
Diuron	3.7	17,000	0.022%
Endosulfan	Not Detected	3,300	ND
Endosulfan Sulfate	Not Detected	3,300	ND
EPTC	9.7	24,000	0.040%
Iprodione	12.1	286,000	0.004%
Malathion	4.6	80,600	0.006%
Malathion OA	5.3	80,600	0.007%
Methidathion	Not Detected	3,100	ND
Methyl Bromide	594.0	19,400*	3.062%
Metolachlor	Not Detected	15,000	ND
MITC	51.0	3,000	1.701%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	230,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	6.1	180,000	0.003%
Permethrin	6.5	90,000	0.007%
Phosmet	Not Detected	26,000	ND
pp-Dicofol	Not Detected	49,000	ND
Propargite	10.6	14,000	0.075%
Simazine	2.9	31,000	0.009%
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	8,800	ND
Trifluralin	9.5	170,000	0.006%

† 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.).

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

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

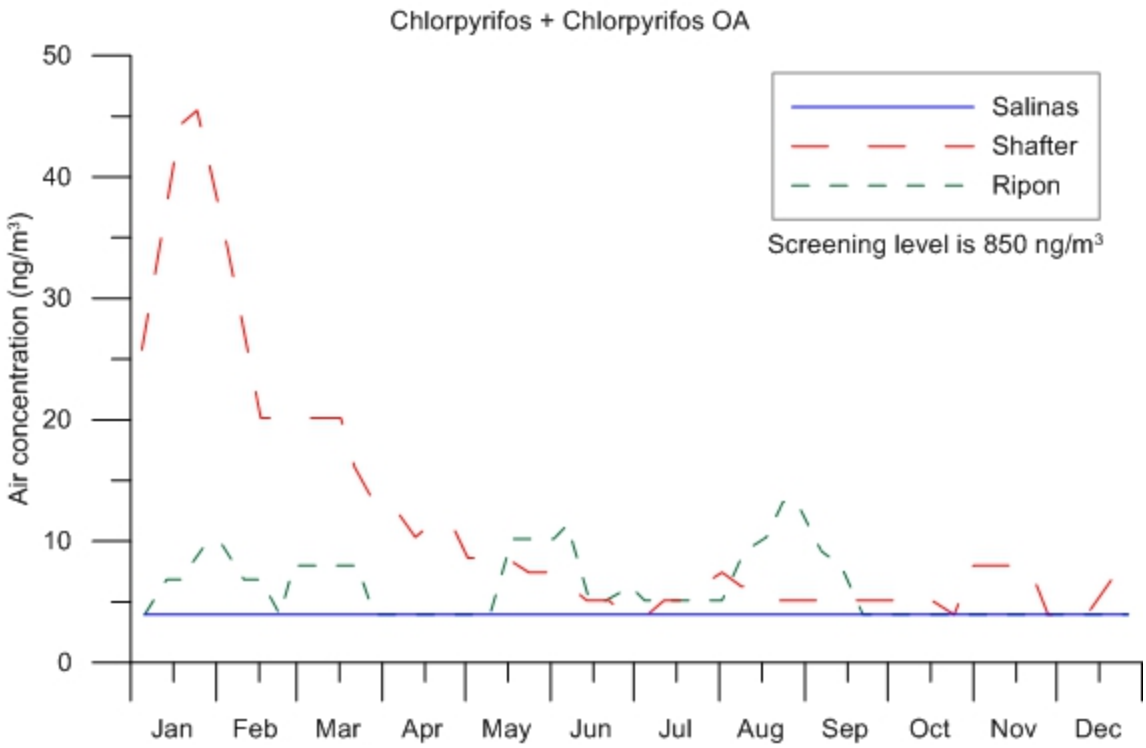

Figure 7. Rolling 4-week average (subchronic) chlorpyrifos + chlorpyrifos OA concentrations detected in each community.

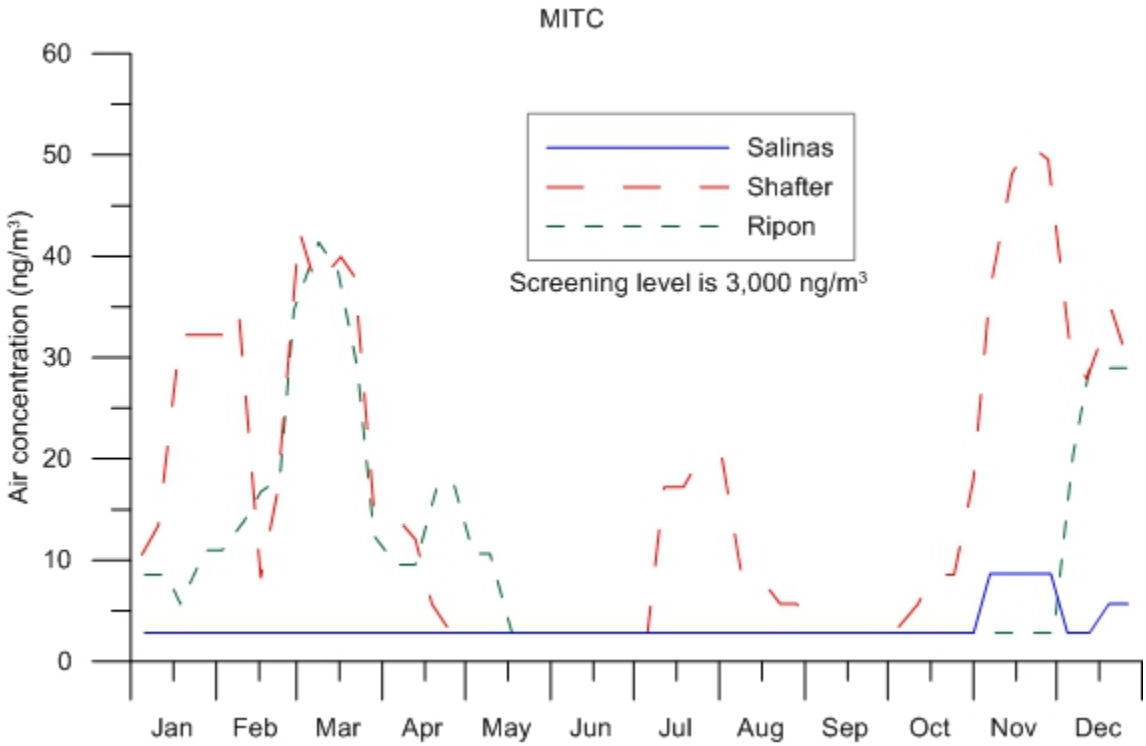

Figure 8. Rolling 4-week average (subchronic) MITC concentrations detected in each community.

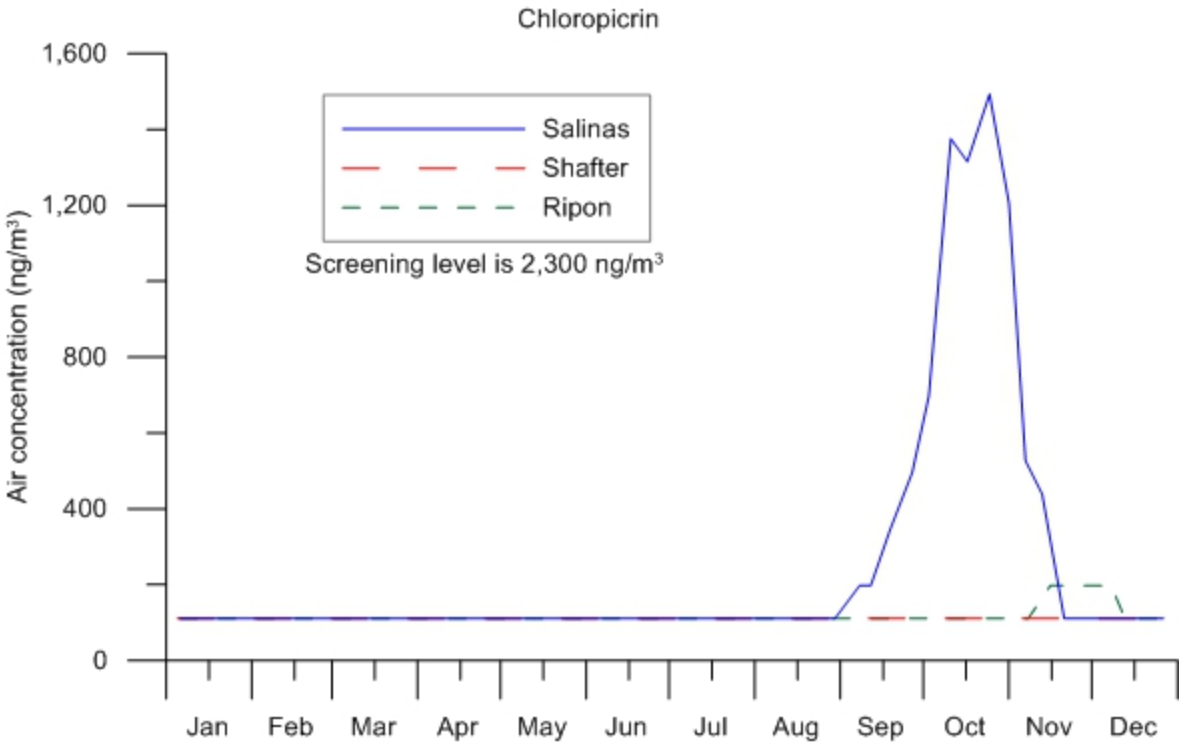

Figure 9. Rolling 4-week average (subchronic) chloropicrin concentrations detected in each community.

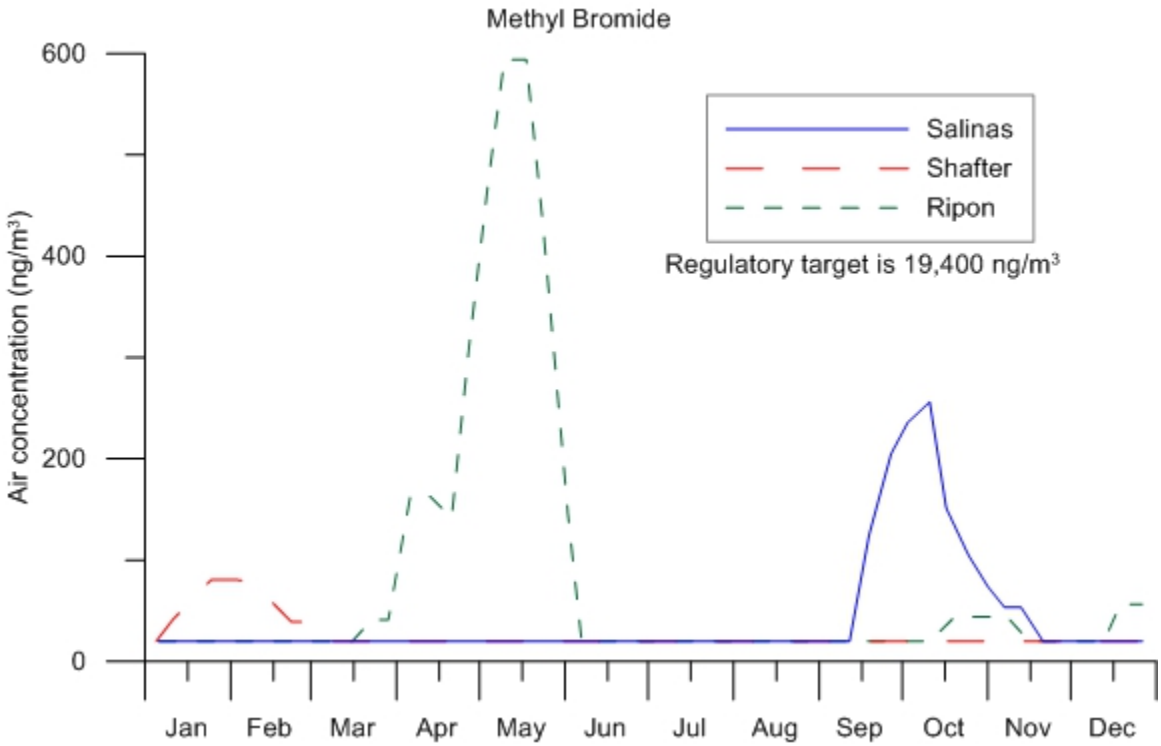

Figure 10. Rolling 4-week average (subchronic) methyl bromide concentrations detected in each community.

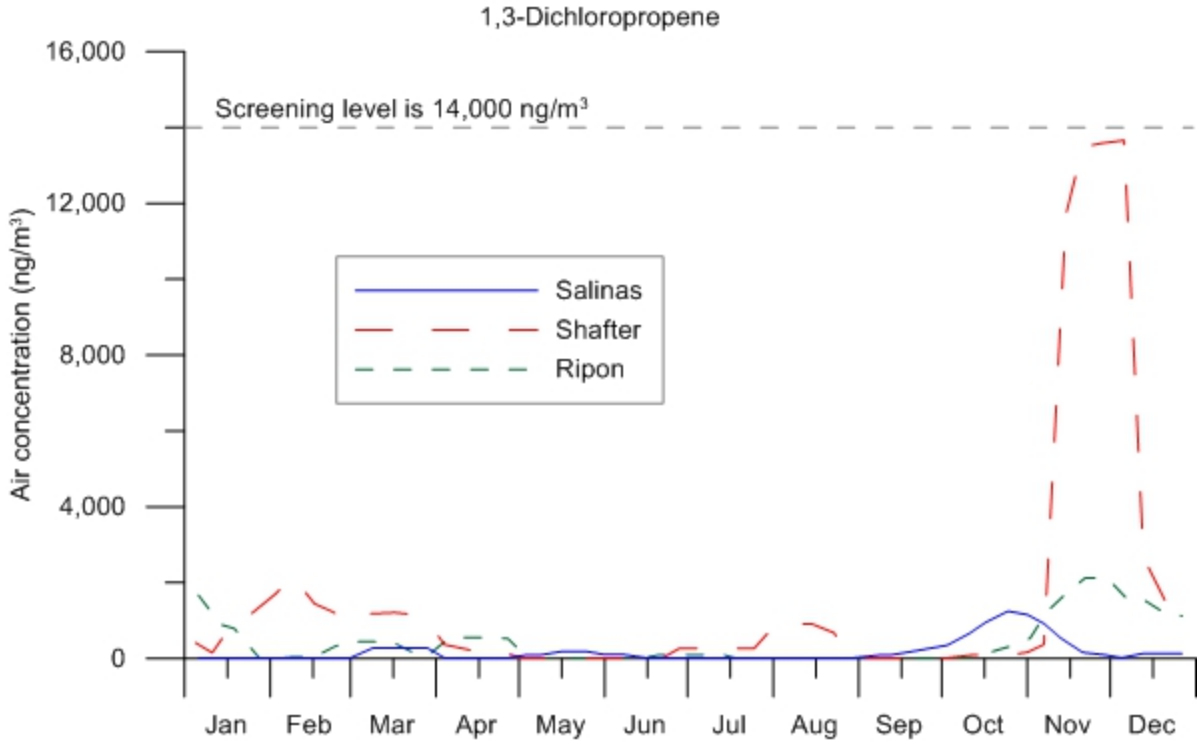

Figure 11. Rolling 4-week average (subchronic) 1,3-dichloropropene concentrations detected in each community.

Table 12 shows the 1-year average concentrations across all monitoring locations for all samples collected from January 1, 2016, to December 31, 2016. The average concentrations were calculated using one-half the MDL for samples with no detectable amount, and a value halfway between the MDL and the LOQ for samples with trace concentrations. None of the 1-year average concentrations exceeded any of the screening levels or regulatory targets for the chronic exposure period, with all monitored pesticides and breakdown products resulting in 1-year average concentrations that were 8.8% or less than their chronic screening level. The highest 1-year overall average concentration was that of chloropicrin at 158.5 ng/m^3 (8.8% of the chronic screening level). This was followed by 1,3-dichloropropene, MITC, and methyl bromide at 711.6 ng/m^3 (7.9%), 10.2 ng/m^3 (3.4%), and 48.7 ng/m^3 (1.3%), respectively. All other monitored pesticides and breakdown products were calculated to be below 1% of their individual chronic screening levels or regulatory targets.

Table 12. The 1-year average concentration for all chemicals from samples collected from January 1, 2016 through December 31, 2016.

Pesticide	Overall average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	711.6	9,000	7.907%
Acephate	Not Detected	8,500	ND
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	239.6	800,000	0.030%
Chloropicrin	158.5	1,800	8.808%
Chlorothalonil	12.2	34,000	0.036%
Chlorpyrifos	4.7	510	0.922%
Chlorpyrifos OA	2.5	510	0.494%
Chlorthal-dimethyl (DCPA)	2.1	47,000	0.005%
Cypermethrin	Not Detected	27,000	ND
DDVP	2.0	770	0.257%
Diazinon	0.7	130	0.507%
Diazinon OA	1.1	130	0.876%
Dimethoate	1.2	300	0.393%
Dimethoate OA	1.0	300	0.327%
Diuron	2.6	5,700	0.046%
Endosulfan	Not Detected	330	ND
Endosulfan Sulfate	Not Detected	330	ND
EPTC	1.1	8,500	0.013%
Iprodione	1.2	286,000	0.000%
Malathion	1.2	8,100	0.015%
Malathion OA	1.0	8,100	0.013%
Methidathion	Not Detected	2,500	ND
Methyl Bromide	48.7	3,900	1.250%
Metolachlor	Not Detected	15,000	ND
MITC	10.2	300	3.407%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	232,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	3.3	51,000	0.007%
Permethrin	3.7	90,000	0.004%
Phosmet	Not Detected	18,000	ND
pp-Dicofol	Not Detected	20,000	ND
Propargite	2.1	14,000	0.015%
Simazine	0.7	31,000	0.002%
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected	N/A - Seasonal	ND
Trifluralin	1.3	41,000	0.003%

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

Table 13 summarizes the air concentrations relative to the screening levels for the 11 pesticides and breakdown products that had quantifiable concentrations in at least one sample among all sampling locations. No pesticide exceeded its screening levels or regulatory targets for any of the exposure periods. The highest percent of screening level or regulatory target for any of the measured pesticides in all three exposure periods was that of 1,3-dichloropropene, with a rolling 4-week average concentration reaching 97.6% of the screening level.

Following 1,3-dichloropropene, chloropicrin had the second highest percent of screening level or regulatory target measured at 64.9% of the subchronic screening level and 13.7% of the chronic screening level.

Table 13. Air concentrations relative to screening levels for chemicals with quantifiable concentrations for all sampling locations.

Pesticide	% of acute screening level	% of subchronic screening level	% of chronic screening level*
1,3-Dichloropropene	9.0%	97.6%	7.9%
Carbon Disulfide	0.1%	0.1%	0.0%
Chloropicrin	0.6%	64.9%	8.8%
Chlorothalonil	0.2%	0.1%	0.0%
Chlorpyrifos	4.3%	4.6%	0.9%
Chlorpyrifos OA	1.2%	0.7%	0.5%
DDVP	0.4%	0.6%	0.3%
EPTC	0.0%	0.0%	0.0%
Iprodione	0.0%	0.0%	0.0%
Methyl Bromide	0.1%	3.1%	1.3%
MITC	0.2%	1.7%	3.4%

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

Results for Salinas

Tables 14 through 16 present the highest 24-hour, highest rolling 4-week average, and 1-year average concentrations for pesticides and breakdown products monitored in Salinas. None of the monitored pesticides or breakdown products exceeded any of their respective screening levels or regulatory targets for any exposure duration. Five pesticides or breakdown products were detected in quantifiable concentrations in Salinas, while an additional five were detected at trace levels.

The highest 1-day concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of diazinon OA at 1.1 ng/m^3 (0.8% of the acute screening level), followed by chloropicrin with a concentration of 2,824.3 ng/m^3 (0.6%), and diazinon at 0.6 ng/m^3 (0.5%). The concentrations for diazinon and diazinon OA were calculated from non-detects using a value equal to one-half of the MDL.

The highest rolling 4-week average concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of chloropicrin with a concentration of 1,493.4 ng/m^3 (64.9% of the subchronic screening level), followed by 1,3-dichloropropene at 1,245.4 ng/m^3 (8.9%), and methyl bromide at 256.2 ng/m^3 (1.3%).

The highest 1-year average concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of chloropicrin with a concentration of 246.9 ng/m^3 (13.7% of the chronic screening level), followed by 1,3-dichloropropene at 186.6 ng/m^3 (2.1%), and MITC at 3.5 ng/m^3 (1.2%). Cumulative exposure to organophosphates is discussed in a later section.

Table 14. Highest 24-hour concentration for chemicals monitored in Salinas, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	1,560.7	505,000	0.309%
Acephate	Not Detected (0.5)	12,000	ND
Bensulide	Not Detected (0.7)	259,000	ND
Carbon Disulfide	846.7	1,550,000	0.055%
Chloropicrin	2,824.3	491,000*	0.575%
Chlorothalonil	Trace (18.4)	34,000	0.054%
Chlorpyrifos	Not Detected (2.5)	1,200	ND
Chlorpyrifos OA	Not Detected (1.5)	1,200	ND
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
Cypermethrin	Not Detected (2.4)	113,000	ND
DDVP	Not Detected (1.6)	11,000	ND
Diazinon	Not Detected (0.6)	130	ND
Diazinon OA	Not Detected (1.1)	130	ND
Dimethoate	Not Detected (1.2)	4,300	ND
Dimethoate OA	Not Detected (1.0)	4,300	ND
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Not Detected (1.6)	3,300	ND
Endosulfan Sulfate	Not Detected (2.3)	3,300	ND
EPTC	Not Detected (0.9)	230,000	ND
Iprodione	Not Detected (0.6)	939,000	ND
Malathion	Trace (5.8)	112,500	0.005%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	0.023%
Methyl Bromide	438.6	820,000*	ND
Metolachlor	Not Detected (1.4)	85,000	ND
MITC	26.3	66,000*	0.040%
Norflurazon	Not Detected (1.9)	170,000	ND
Oryzalin	Not Detected (0.7)	420,000	ND
Oxydemeton methyl	Not Detected (1.2)	39,200	ND
Oxyfluorfen	Not Detected (3.2)	510,000	ND
Permethrin	Not Detected (3.6)	168,000	ND
Phosmet	Not Detected (4)	77,000	ND
pp-Dicofol	Not Detected (1.1)	68,000	ND
Propargite	Not Detected (1.9)	14,000	ND
Simazine	Not Detected (0.6)	110,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected (0.9)	8,800	ND
Trifluralin	Not Detected (0.9)	1,200,000	ND

† 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.

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

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

Table 15. Highest 4-week rolling concentrations for pesticides monitored in Salinas, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3)†	Subchronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	1,245.4	14,000	8.895%
Acephate	Not Detected	8,500	ND
Bensulide	Not Detected	24,000	ND
Carbon Disulfide	914.4	800,000	0.114%
Chloropicrin	1,493.4	2,300	64.932%
Chlorothalonil	12.6	34,000	0.037%
Chlorpyrifos	Not Detected	850	ND
Chlorpyrifos OA	Not Detected	850	ND
Chlorthal-dimethyl (DCPA)	5.5	470,000	0.001%
Cypermethrin	Not Detected	81,000	ND
DDVP	Not Detected	2,200	ND
Diazinon	Not Detected	130	ND
Diazinon OA	Not Detected	130	ND
Dimethoate	Not Detected	3,000	ND
Dimethoate OA	Not Detected	3,000	ND
Diuron	3.7	17,000	0.022%
Endosulfan	Not Detected	3,300	ND
Endosulfan Sulfate	Not Detected	3,300	ND
EPTC	Not Detected	24,000	ND
Iprodione	Not Detected	286,000	ND
Malathion	4.6	80,600	0.006%
Malathion OA	5.3	80,600	0.007%
Methidathion	Not Detected	3,100	ND
Methyl Bromide	256.2	19,400*	1.320%
Metolachlor	Not Detected	15,000	ND
MITC	8.7	3,000	0.289%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	230,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	Not Detected	180,000	ND
Permethrin	Not Detected	90,000	ND
Phosmet	Not Detected	26,000	ND
pp-Dicofol	Not Detected	49,000	ND
Propargite	Not Detected	14,000	ND
Simazine	Not Detected	31,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	8,800	ND
Trifluralin	Not Detected	170,000	ND

† 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.).

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

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

Table 16. 1-year average concentrations for pesticides monitored in Salinas, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	186.6	9,000	2.073%
Acephate	Not Detected	8,500	ND
Bensulide	Not Detected	24,000	ND
Carbon Disulfide	263.2	800,000	0.033%
Chloropicrin	246.9	1,800	13.719%
Chlorothalonil	7.5	34,000	0.022%
Chlorpyrifos	Not Detected	510	ND
Chlorpyrifos OA	Not Detected	510	ND
Chlorthal-dimethyl (DCPA)	4.0	47,000	0.008%
Cypermethrin	Not Detected	27,000	ND
DDVP	Not Detected	770	ND
Diazinon	Not Detected	130	ND
Diazinon OA	Not Detected	130	ND
Dimethoate	Not Detected	300	ND
Dimethoate OA	Not Detected	300	ND
Diuron	2.7	5,700	0.048%
Endosulfan	Not Detected	330	ND
Endosulfan Sulfate	Not Detected	330	ND
EPTC	Not Detected	8,500	ND
Iprodione	Not Detected	286,000	ND
Malathion	1.5	8,100	0.018%
Malathion OA	1.6	8,100	0.020%
Methidathion	Not Detected	2,500	ND
Methyl Bromide	40.6	3,900	1.041%
Metolachlor	Not Detected	15,000	ND
MITC	3.5	300	1.158%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	232,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	Not Detected	51,000	ND
Permethrin	Not Detected	90,000	ND
Phosmet	Not Detected	18,000	ND
pp-Dicofol	Not Detected	20,000	ND
Propargite	Not Detected	14,000	ND
Simazine	Not Detected	31,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	N/A - Seasonal	--
Trifluralin	Not Detected	41,000	ND

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

Results for Shafter

Tables 17 through 19 present the highest 24-hour, highest rolling 4-week average, and 1-year average concentrations for pesticides monitored in Shafter. None of the pesticides exceeded any of their respective screening levels for any exposure duration. Nine pesticides or breakdown products were detected in quantifiable concentrations in Shafter, while four were detected at trace levels.

The highest 1-day concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of 1,3-dichloropropene with a concentration of 45,322.6 ng/m^3 (9.0% of the acute screening level), followed by diazinon OA at 5.7 ng/m^3 (4.4%), and chlorpyrifos at 52.1 ng/m^3 (4.4%).

The highest rolling 4-week average concentration in terms of percentage of screening level for any monitored pesticide was that of 1,3-dichloropropene with a concentration of 13,659.2 ng/m^3 (97.6% of the subchronic screening level), followed by chloropicrin at 111.0 ng/m^3 (4.8%), and chlorpyrifos at 39.4 ng/m^3 (4.6%).

The highest 1-year average concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of 1,3-dichloropropene with a concentration of 1,558.7 ng/m^3 (17.3% of the acute screening level), followed by chloropicrin at 111.0 ng/m^3 (6.2%), and MITC at 17.4 ng/m^3 (5.8%). Cumulative exposure to organophosphates is discussed in a later section.

Table 17. Highest 24-hour concentration for chemicals monitored in Shafter, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	45,322.6	505,000	8.975%
Acephate	Not Detected (0.5)	12,000	ND
Bensulide	Not Detected (0.7)	259,000	ND
Carbon Disulfide	946.3	1,550,000	0.061%
Chloropicrin	Not Detected (111)	491,000*	ND
Chlorothalonil	58.5	34,000	0.172%
Chlorpyrifos	52.1	1,200	4.344%
Chlorpyrifos OA	Trace (6.1)	1,200	0.508%
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
Cypermethrin	Not Detected (2.4)	113,000	ND
DDVP	49.0	11,000	0.446%
Diazinon	Not Detected (0.6)	130	ND
Diazinon OA	Trace (5.7)	130	4.385%
Dimethoate	Not Detected (1.2)	4,300	ND
Dimethoate OA	Not Detected (1.0)	4,300	ND
Diuron	Not Detected (2.6)	170,000	ND
Endosulfan	Not Detected (1.6)	3,300	ND
Endosulfan Sulfate	Not Detected (2.3)	3,300	ND
EPTC	27.3	230,000	0.012%
Iprodione	17.0	939,000	0.002%
Malathion	Not Detected (1.1)	112,500	ND
Malathion OA	Not Detected (0.7)	112,500	ND
Methidathion	Not Detected (0.7)	3,100	ND
Methyl Bromide	112.6	820,000*	0.014%
Metolachlor	Not Detected (1.4)	85,000	ND
MITC	108.9	66,000*	0.165%
Norflurazon	Not Detected (1.9)	170,000	ND
Oryzalin	Not Detected (0.7)	420,000	ND
Oxydemeton methyl	Not Detected (1.2)	39,200	ND
Oxyfluorfen	Not Detected (3.2)	510,000	ND
Permethrin	Not Detected (3.6)	168,000	ND
Phosmet	Not Detected (4)	77,000	ND
pp-Dicofol	Not Detected (1.1)	68,000	ND
Propargite	Not Detected (1.9)	14,000	ND
Simazine	Trace (5.3)	110,000	0.005%
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected (0.9)	8,800	ND
Trifluralin	Not Detected (0.9)	1,200,000	ND

† 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.

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

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

Table 18. Highest 4-week rolling concentrations for pesticides monitored in Shafter, California

Pesticide	Highest 4-week rolling concentration (ng/m^3)†	Subchronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	13,659.2	14,000	97.565%
Acephate	Not Detected	8,500	ND
Bensulide	Not Detected	24,000	ND
Carbon Disulfide	482.5	800,000	0.060%
Chloropicrin	Not Detected	2,300	ND
Chlorothalonil	24.5	34,000	0.072%
Chlorpyrifos	39.4	850	4.633%
Chlorpyrifos OA	6.1	850	0.718%
Chlorthal-dimethyl (DCPA)	5.5	470,000	0.001%
Cypermethrin	Not Detected	81,000	ND
DDVP	13.5	2,200	0.612%
Diazinon	Not Detected	130	ND
Diazinon OA	2.2	130	1.702%
Dimethoate	Not Detected	3,000	ND
Dimethoate OA	Not Detected	3,000	ND
Diuron	Not Detected	17,000	ND
Endosulfan	Not Detected	3,300	ND
Endosulfan Sulfate	Not Detected	3,300	ND
EPTC	9.7	24,000	0.040%
Iprodione	10.4	286,000	0.004%
Malathion	Not Detected	80,600	ND
Malathion OA	Not Detected	80,600	ND
Methidathion	Not Detected	3,100	ND
Methyl Bromide	80.6	19,400*	0.416%
Metolachlor	Not Detected	15,000	ND
MITC	51.0	3,000	1.701%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	230,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	Not Detected	180,000	ND
Permethrin	Not Detected	90,000	ND
Phosmet	Not Detected	26,000	ND
pp-Dicofol	Not Detected	49,000	ND
Propargite	Not Detected	14,000	ND
Simazine	2.9	31,000	0.009%
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	8,800	ND
Trifluralin	Not Detected	170,000	ND

† 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.).

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

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

Table 19. 1-year average concentrations for pesticides monitored in Shafter, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	1,558.7	9,000	17.318%
Acephate	Not Detected	8,500	ND
Bensulide	Not Detected	24,000	ND
Carbon Disulfide	227.2	800,000	0.028%
Chloropicrin	Not Detected	1,800	ND
Chlorothalonil	14.6	34,000	0.043%
Chlorpyrifos	7.8	510	1.526%
Chlorpyrifos OA	3.8	510	0.740%
Chlorthal-dimethyl (DCPA)	1.6	47,000	0.003%
Cypermethrin	Not Detected	27,000	ND
DDVP	2.5	770	0.326%
Diazinon	Not Detected	130	ND
Diazinon OA	1.1	130	0.876%
Dimethoate	Not Detected	300	ND
Dimethoate OA	Not Detected	300	ND
Diuron	Not Detected	5,700	ND
Endosulfan	Not Detected	330	ND
Endosulfan Sulfate	Not Detected	330	ND
EPTC	1.7	8,500	0.020%
Iprodione	1.5	286,000	0.001%
Malathion	Not Detected	8,100	ND
Malathion OA	Not Detected	8,100	ND
Methidathion	Not Detected	2,500	ND
Methyl Bromide	26.0	3,900	0.666%
Metolachlor	Not Detected	15,000	ND
MITC	17.4	300	5.810%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	232,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	Not Detected	51,000	ND
Permethrin	Not Detected	90,000	ND
Phosmet	Not Detected	18,000	ND
pp-Dicofol	Not Detected	20,000	ND
Propargite	Not Detected	14,000	ND
Simazine	0.9	31,000	0.003%
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	N/A - Seasonal	--
Trifluralin	Not Detected	41,000	ND

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

Results for Ripon

Tables 20 through 22 present the highest 24-hour, highest rolling 4-week average, and 1-year average concentrations for pesticides monitored in Ripon. None of the pesticides exceeded any of their respective screening levels for any exposure duration. There were five pesticides or breakdown products detected in quantifiable concentrations in Ripon, and an additional 15 were detected at trace levels.

The highest 1-day concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of diazinon OA with a concentration of 5.7 ng/m^3 (4.4% of the acute screening level, followed by diazinon at 5.3 ng/m^3 (4.0%), and chlorpyrifos OA at 14.9 ng/m^3 (1.2%). The concentrations for diazinon and its oxygen analog were calculated from trace detections as the average of the MDL and LOQ.

The highest rolling 4-week average concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of 1,3-dichloropropene with a concentration of 2,126.6 ng/m^3 (15.2% of the subchronic screening level), followed by chloropicrin at 197.8 ng/m^3 (8.6%), and methyl bromide at 594 ng/m^3 (3.1%).

The highest 1-year average concentration in terms of percentage of screening level for any monitored pesticide or breakdown product was that of chloropicrin with a concentration of 117.7 ng/m^3 (6.5% of the chronic screening level, followed by 1,3-dichloropropene at 389.6 ng/m^3 (4.3%), and MITC at 9.8 ng/m^3 (3.3%). Cumulative exposure to organophosphates is discussed in a later section.

Table 20. Highest 24-hour concentration for chemicals monitored in Ripon, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	2,917.2	505,000	0.578%
Acephate	Not Detected (0.5)	12,000	ND
Bensulide	Trace (5.4)	259,000	0.002%
Carbon Disulfide	603.9	1,550,000	0.039%
Chloropicrin	Trace (458)	491,000*	0.093%
Chlorothalonil	Trace (18.4)	34,000	0.054%
Chlorpyrifos	Trace (14.1)	1,200	1.171%
Chlorpyrifos OA	14.9	1,200	1.238%
Chlorthal-dimethyl (DCPA)	Not Detected (0.9)	23,500,000	ND
Cypermethrin	Not Detected (2.4)	113,000	ND
DDVP	Trace (13.2)	11,000	0.120%
Diazinon	Trace (5.3)	130	4.038%
Diazinon OA	Trace (5.7)	130	4.385%
Dimethoate	Trace (5.8)	4,300	0.135%
Dimethoate OA	Trace (5.6)	4,300	0.130%
Diuron	Not Detected (2.6)	170,000	ND
Endosulfan	Not Detected (1.6)	3,300	ND
Endosulfan Sulfate	Not Detected (2.3)	3,300	ND
EPTC	Not Detected (0.9)	230,000	ND
Iprodione	Trace (12.1)	939,000	0.001%
Malathion	Not Detected (1.1)	112,500	ND
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	ND
Methyl Bromide	1,160.6	820,000*	0.142%
Metolachlor	Not Detected (1.4)	85,000	ND
MITC	73.2	66,000*	0.111%
Norflurazon	Not Detected (1.9)	170,000	ND
Oryzalin	Not Detected (0.7)	420,000	ND
Oxydemeton methyl	Not Detected (1.2)	39,200	ND
Oxyfluorfen	Trace (14.8)	510,000	0.003%
Permethrin	Trace (15.2)	168,000	0.009%
Phosmet	Not Detected (4)	77,000	ND
pp-Dicofol	Not Detected (1.1)	68,000	ND
Propargite	Trace (13.5)	14,000	0.096%
Simazine	Not Detected (0.6)	110,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected (0.9)	8,800	ND
Trifluralin	Trace (12.4)	1,200,000	0.001%

† 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.

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

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

Table 21. Highest 4-week rolling concentration for pesticides monitored in Ripon, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3)†	Subchronic screening level (ng/m^3)	% of screening level ‡
1,3-Dichloropropene	2,126.6	14,000	15.190%
Acephate	Not Detected	8,500	ND
Bensulide	1.9	24,000	0.008%
Carbon Disulfide	442.8	800,000	0.055%
Chloropicrin	197.8	2,300	8.598%
Chlorothalonil	18.4	34,000	0.054%
Chlorpyrifos	8.3	850	0.974%
Chlorpyrifos OA	6.0	850	0.702%
Chlorthal-dimethyl (DCPA)	Not Detected	470,000	ND
Cypermethrin	Not Detected	81,000	ND
DDVP	4.5	2,200	0.204%
Diazinon	2.9	130	2.250%
Diazinon OA	3.4	130	2.596%
Dimethoate	2.3	3,000	0.077%
Dimethoate OA	2.1	3,000	0.070%
Diuron	Not Detected	17,000	ND
Endosulfan	Not Detected	3,300	ND
Endosulfan Sulfate	Not Detected	3,300	ND
EPTC	Not Detected	24,000	ND
Iprodione	12.1	286,000	0.004%
Malathion	Not Detected	80,600	ND
Malathion OA	3.0	80,600	0.004%
Methidathion	Not Detected	3,100	ND
Methyl Bromide	594.0	19,400*	3.062%
Metolachlor	Not Detected	15,000	ND
MITC	41.4	3,000	1.380%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	230,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	6.1	180,000	0.003%
Permethrin	6.5	90,000	0.007%
Phosmet	Not Detected	26,000	ND
pp-Dicofol	Not Detected	49,000	ND
Propargite	10.6	14,000	0.075%
Simazine	Not Detected	31,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	8,800	ND
Trifluralin	9.5	170,000	0.006%

† 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.).

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

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

Table 22. 1-year average concentrations for pesticides monitored in Ripon, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level [†]
1,3-Dichloropropene	389.6	9,000	4.329%
Acephate	Not Detected	8,500	ND
Bensulide	0.8	24,000	0.003%
Carbon Disulfide	228.6	800,000	0.029%
Chloropicrin	117.7	1,800	6.537%
Chlorothalonil	14.4	34,000	0.042%
Chlorpyrifos	3.8	510	0.752%
Chlorpyrifos OA	2.3	510	0.458%
Chlorthal-dimethyl (DCPA)	Not Detected	47,000	ND
Cypermethrin	Not Detected	27,000	ND
DDVP	1.8	770	0.237%
Diazinon	0.8	130	0.599%
Diazinon OA	1.2	130	0.945%
Dimethoate	1.2	300	0.413%
Dimethoate OA	1.0	300	0.346%
Diuron	Not Detected	5,700	ND
Endosulfan	Not Detected	330	ND
Endosulfan Sulfate	Not Detected	330	ND
EPTC	Not Detected	8,500	ND
Iprodione	1.7	286,000	0.001%
Malathion	Not Detected	8,100	ND
Malathion OA	0.8	8,100	0.010%
Methidathion	Not Detected	2,500	ND
Methyl Bromide	79.7	3,900	2.043%
Metolachlor	Not Detected	15,000	ND
MITC	9.8	300	3.252%
Norflurazon	Not Detected	26,000	ND
Oryzalin	Not Detected	232,000	ND
Oxydemeton methyl	Not Detected	610	ND
Oxyfluorfen	3.6	51,000	0.007%
Permethrin	3.8	90,000	0.004%
Phosmet	Not Detected	18,000	ND
pp-Dicofol	Not Detected	20,000	ND
Propargite	2.6	14,000	0.018%
Simazine	Not Detected	31,000	ND
SSS-tributyltriphosphoro-trithioate (DEF)	Not Detected	N/A - Seasonal	--
Trifluralin	2.2	41,000	0.005%

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

Cumulative Exposure Estimates

Cumulative exposures were only calculated for organophosphate pesticides included in the AMN because these are the only pesticides in the AMN that have a common mode of action (cholinesterase inhibition) that were detected at quantifiable concentrations. The 14 organophosphates included in the AMN are: acephate, bensulide, chlorpyrifos (and its oxygen analog), DDVP, diazinon (and its oxygen analog), dimethoate (and its oxygen analog), malathion (and its oxygen analog), oxydemeton methyl, phosmet, and DEF. While organophosphates can have additional potential health effects, they all inhibit cholinesterase, an enzyme in the nervous system. Although EPTC, an N-methyl carbamate herbicide, inhibits cholinesterase, it has a different mechanism of toxicity and toxicity profile than the organophosphate insecticides; therefore, it would not be appropriate to group it with the organophosphates in a cumulative exposure calculation. As described in the Materials and Methods section, the cumulative exposure was estimated using a hazard quotient and hazard index approach that relies on the ratio between the detected air concentration and the screening level. The organophosphate cumulative exposures were estimated for each community and exposure period.

Table 23 presents a summary of the hazard indices for organophosphates by exposure duration for each community. None of the hazard indices exceeded a value of 1.0 at any of the sampling locations, indicating that the screening levels were not exceeded for all organophosphates combined. The highest hazard index of any site or exposure duration was that of Ripon with an acute hazard index of 0.112. Shafter follows with an acute hazard index of 0.102. The hazard indexes of both subchronic and chronic exposure scenarios are highest in Shafter with values of 0.084 and 0.049, respectively. The lowest hazard index calculated is that of Salinas in the acute exposure scenario with a value of 0.017.

Table 23. Summary of organophosphate cumulative exposure.

Community	Acute hazard index†	Subchronic hazard index†	Chronic hazard index†
Salinas	0.017	0.021	0.032
Shafter	0.102	0.084	0.049
Ripon	0.112	0.071	0.040

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

Tables 24 through 32 show the hazard quotients for each organophosphate used to arrive at the hazard index in each monitored community broken down into each exposure duration. All monitored communities had a minimum of two detected organophosphates or their breakdown products. Malathion and its oxygen analog were detected in Salinas at a maximum of trace level concentration. This resulted in values of 5.8 ng/m^3 and 5.3 ng/m^3, respectively, being calculated using the average of the MDL and LOQ for those chemicals. In Shafter there were detections for chlorpyrifos, chlorpyrifos OA, DDVP, and diazinon OA. The concentrations for chlorpyrifos and DDVP were quantifiable and were 52.1 ng/m^3 and 49.0 ng/m^3, respectively. The oxygen analogs of chlorpyrifos and diazinon were detected at trace levels and were calculated at 6.1 ng/m^3 and 5.7 ng/m^3, respectively, using the average of the MDL and LOQ. In Ripon chlorpyrifos OA was detected at a quantifiable concentration of 14.9 ng/m^3. Trace detections were calculated for Ripon using the average of the MDL and LOQ for the following: bensulide (5.4 ng/m^3), chlorpyrifos (14.1 ng/m^3), DDVP (13.2 ng/m^3), diazinon (5.3 ng/m^3), diazinon OA (5.7 ng/m^3), dimethoate (5.8 ng/m^3), dimethoate OA (5.6 ng/m^3), and malathion OA (5.3 ng/m^3). For all monitored communities all non-detections were calculated as half of the MDL.

Acephate, oxydemeton methyl, phosmet, and DEF were not detected at any of the AMN communities. Chlorpyrifos and diazinon, and their respective oxygen analogs, accounted for the largest contributions toward the hazard indices of each site and exposure period. Chlorpyrifos and its oxygen analog were the

dominant contributors across all exposure durations in the community of Shafter with the sum of their contributions ranging from 46.5% to 63.5% of the organophosphate hazard indices. Among all monitored communities the summed contribution of chlorpyrifos and chlorpyrifos OA ranged from 19.4% to 63.5%. Diazinon and its oxygen analog were the dominant contributors across all exposure periods in the communities of Salinas and Ripon with the sum of their contributions ranging from 38.7% to 74.9% of the organophosphate hazard indices. Among all monitored communities the summed contribution of diazinon and diazinon OA ranged from 25.7% to 74.9%. In the case of the acute hazard index in the community of Shafter, the summed contribution of diazinon and diazinon OA closely followed that of summed chlorpyrifos and chlorpyrifos OA with values of 47.4% and 47.5%, respectively.

Table 24. Highest 24-hour concentration of organophosphates monitored in Salinas, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	Acute hazard quotient‡
Acephate	Not Detected (0.5)	12,000	0.000
Bensulide	Not Detected (0.7)	259,000	0.000
Chlorpyrifos	Not Detected (2.5)	1,200	0.002
Chlorpyrifos OA	Not Detected (1.5)	1,200	0.001
DDVP	Not Detected (1.6)	11,000	0.000
Diazinon	Not Detected (0.6)	130	0.005
Diazinon OA	Not Detected (1.1)	130	0.008
Dimethoate	Not Detected (1.2)	4,300	0.000
Dimethoate OA	Not Detected (1.0)	4,300	0.000
Malathion	Trace (5.8)	112,500	0.000
Malathion OA	Trace (5.3)	112,500	0.000
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000
Phosmet	Not Detected (4.0)	77,000	0.000
SSS-tributyl…(DEF)	Not Detected (0.9)	8,800	0.000
Hazard index			**0.017**

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

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

Table 25. Highest 4-week rolling concentration of organophosphates monitored in Salinas, California.

Pesticide	Highest 4-week rolling concentration (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	1.6	2,200	0.001
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	5.3	80,600	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	26,000	0.000
SSS-tributyl…(DEF)	0.9	8,800	0.000
Hazard index			**0.021**

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

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

Table 26. 1-year average concentration of organophosphates monitored in Salinas, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	Chronic hazard quotient†
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	2.5	510	0.005
Chlorpyrifos OA	1.5	510	0.003
DDVP	1.6	770	0.002
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.008
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.5	8,100	0.000
Malathion OA	1.6	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl…(DEF)	0.9	N/A - Seasonal	--
Hazard index			**0.032**

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

Table 27. Highest 24-hour concentration of organophosphates monitored in Shafter, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	Acute hazard quotient‡
Acephate	Not Detected (0.5)	12,000	0.000
Bensulide	Not Detected (0.7)	259,000	0.000
Chlorpyrifos	52.1	1,200	0.043
Chlorpyrifos OA	Trace (6.1)	1,200	0.005
DDVP	49.0	11,000	0.004
Diazinon	Not Detected (0.6)	130	0.005
Diazinon OA	Trace (5.7)	130	0.044
Dimethoate	Not Detected (1.2)	4,300	0.000
Dimethoate OA	Not Detected (1.0)	4,300	0.000
Malathion	Not Detected (1.1)	112,500	0.000
Malathion OA	Not Detected (0.7)	112,500	0.000
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000
Phosmet	Not Detected (4.0)	77,000	0.000
SSS-tributyl…(DEF)	Not Detected (0.9)	8,800	0.000
Hazard index			**0.102**

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

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

Table 28. Highest 4-week rolling concentration of organophosphates monitored in Shafter, California.

Pesticide	Highest 4-week rolling concentration (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	39.4	850	0.046
Chlorpyrifos OA	6.1	850	0.007
DDVP	13.5	2,200	0.006
Diazinon	0.6	130	0.005
Diazinon OA	2.2	130	0.017
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
SSS-tributyl…(DEF)	0.9	8,800	0.000
Hazard index			**0.084**

† 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.).

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

Table 29. 1-year average concentration of organophosphates monitored in Shafter, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	Chronic hazard quotient†
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	7.8	510	0.015
Chlorpyrifos OA	3.8	510	0.007
DDVP	2.5	770	0.003
Diazinon	0.6	130	0.005
Diazinon OA	1.1	130	0.009
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.1	8,100	0.000
Malathion OA	0.6	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl…(DEF)	0.9	N/A - Seasonal	--
Hazard index			**0.049**

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

Table 30. Highest 24-hour concentration of organophosphates monitored in Ripon, California.

Pesticide	Highest 24-hour concentration (ng/m^3)†	24-hour acute screening level (ng/m^3)	Acute hazard quotient‡
Acephate	Not Detected (0.5)	12,000	0.000
Bensulide	Trace (5.4)	259,000	0.000
Chlorpyrifos	Trace (14.1)	1,200	0.012
Chlorpyrifos OA	14.9	1,200	0.012
DDVP	Trace (13.2)	11,000	0.001
Diazinon	Trace (5.3)	130	0.040
Diazinon OA	Trace (5.7)	130	0.044
Dimethoate	Trace (5.8)	4,300	0.001
Dimethoate OA	Trace (5.6)	4,300	0.001
Malathion	Not Detected (1.1)	112,500	0.000
Malathion OA	Trace (5.3)	112,500	0.000
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000
Phosmet	Not Detected (4.0)	77,000	0.000
SSS-tributyl…(DEF)	Not Detected (0.9)	8,800	0.000
Hazard index			**0.112**

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

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

Table 31. Highest 4-week rolling concentration of organophosphates monitored in Ripon, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3)†	Subchronic screening level (ng/m^3)	Subchronic hazard quotient‡
Acephate	0.5	8,500	0.000
Bensulide	1.9	24,000	0.000
Chlorpyrifos	8.3	850	0.010
Chlorpyrifos OA	6.0	850	0.007
DDVP	4.5	2,200	0.002
Diazinon	2.9	130	0.023
Diazinon OA	3.4	130	0.026
Dimethoate	2.3	3,000	0.001
Dimethoate OA	2.1	3,000	0.001
Malathion	1.1	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
SSS-tributyl…(DEF)	0.9	8,800	0.000
Hazard index			**0.071**

† 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.).

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

Table 32. 1-year average concentration of organophosphates monitored in Ripon, California.

Pesticide	1-year average concentration (ng/m^3)	Chronic screening level (ng/m^3)	Chronic hazard quotient†
Acephate	0.5	8,500	0.000
Bensulide	0.8	24,000	0.000
Chlorpyrifos	3.8	510	0.008
Chlorpyrifos OA	2.3	510	0.005
DDVP	1.8	770	0.002
Diazinon	0.8	130	0.006
Diazinon OA	1.2	130	0.009
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.1	8,100	0.000
Malathion OA	0.8	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl…(DEF)	0.9	N/A - Seasonal	--
Hazard index			**0.040**

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

Cancer Risk Estimates

Two of the chemicals (1,3-dichloropropene and chlorothalonil) that were measured at quantifiable concentrations, but below their screening levels, are classified as human carcinogens by both U.S. EPA and Proposition 65. The calculated values for the concentrations and cancer risk of 1,3-dichloropropene are presented in this section. DPR is in the process of calculating a cancer potency value for chlorothalonil to be used in future cancer risk estimates for this pesticide. In 2016, DPR updated the 1,3-dichloropropene regulatory target concentration from 650 ng/m^3 to 2,600 ng/m^3, as a 70-year average concentration (DPR, 2016a).

The risk of cancer from exposure to a chemical is determined from the cancer potency of the chemical and the human exposure to the chemical. Cancer potency is expressed in the units $(mg/kg\text{-}day)^{-1}$. 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. DPR has set a cancer risk regulatory goal of 10^{-5} for 1,3-dichloropropene.

It is a standard default assumption that exposure to a carcinogen takes place over a lifetime, so the default respiratory rate for an adult is used (0.28 m^3/kg/day) over 70 years. For 1,3-dichloropropene, DPR has calculated a cancer potency of 0.014 $(mg/kg\text{-}day)^{-1}$. The risk is then calculated as (cancer potency) × (chronic air concentration) × (respiratory rate). The 6-year average risk (averaging all years of AMN operation) is shown alongside the goal for 70-year (lifetime) risk in Table 33. The individual annual risk values used to calculate the 6-year average are also shown, but these shorter timeframes are less suitable for comparison to the 70-year goal.

Table 33. Annual cancer risk estimates for 1,3-dichloropropene using standard method for each AMN sampling location (2011-2016).

Community	2011	2012	2013	2014	2015	2016	6-year Average	Goal
Salinas	3.22E-6	1.06E-6	1.51E-6	1.23E-7	7.10E-7	7.24E-7	1.22E-6	1.00E-5
Shafter	ND	1.48E-6	1.16E-5	3.41E-6	3.01E-6	5.68E-6	4.35E-6	1.00E-5
Ripon	2.57E-6	ND	3.52E-6	1.30E-6	1.63E-6	1.51E-6	1.90E-6	1.00E-5

For illustrative purposes, the estimated annual cancer risk estimate values can also be expressed relative to the 70-year goal as follows:

Community	2011	2012	2013	2014	2015	2016	6-year Average	Goal
Salinas	0.322	0.106	0.151	0.012	0.071	0.072	0.122	1.00
Shafter	ND	0.148	1.16	0.341	0.301	0.568	0.435	1.00
Ripon	0.257	ND	0.352	0.130	0.163	0.151	0.190	1.00

* Previous year's values have been updated to reflect the updated cancer potency value of 0.014.

The detected concentrations are used to extrapolate time-weighted averages which are then used to calculate the cancer risk for 1,3-dichloropropene for each monitored community for each year. Due to a large number of analyses resulting in non-detectable concentrations, the method of handling the non-detectable concentrations can have a large effect on the estimated cancer risk. Because the detection limit for 1,3-dichloropropene may have such a significant effect on the cancer risk estimates, three different estimates were calculated using 2011–2016 averages. These methods involved calculation of each instance of non-detection as equivalent to a concentration of zero (minimum), a concentration equal to half of the MDL (standard), and a concentration equal to the MDL (maximum). In addition to uncertainty in the data, the estimates assume that the chronic exposure occurs every single day for a

lifetime (70 years). However, this assumption is consistent with standard risk assessment procedures. Table 34 presents the results of these calculations for comparison as well as DPR's established goal for cancer risk. No matter the non-detected treatment method chosen, the measured cancer risk did not exceed the established cancer risk goal for any community in any of these calculations.

Table 34. Six-year average minimum, standard, and maximum cancer risk estimates for 1,3-dichloropropene for each AMN sampling location (2011-2016).

Community	Minimum (ND = 0)	Standard (ND = ½ MDL)	Maximum (ND = MDL)	Goal
Salinas	8.06E-7	1.22E-6	1.64E-6	1.00E-5
Shafter	3.93E-6	4.35E-6	4.77E-6	1.00E-5
Ripon	1.46E-6	1.90E-6	2.34E-6	1.00E-5

Alternatively, the 1,3-dichloropropene cancer risk can also be expressed relative to DPR's regulatory target concentration of 2,600 ng/m^3 (cancer potency × respiratory rate, and converting units). DPR has set a cancer risk regulatory goal of 1.00 X 10^{-5} for 1,3-dichloropropene, which is equivalent to a concentration of 2,600 ng/m^3 as a 70-year average. The 6-year average concentration is presented in Table 35 alongside the regulatory target for comparison and the annual values (standard method) used to calculate it. The values reported in Table 35 were calculated using the mean of each 24-hour concentration rather than the time-weighted averages used in the above calculations of cancer risk. This was done to maintain consistency with the reported concentrations for all other exposure timeframes given in this report. None of the concentrations in Table 35 exceeded the regulatory target for any of the monitored communities.

Table 35. Year-by-year and 6-year average air concentration (standard method) for 1,3-dichloropropene for each community.

Community	Air concentration (ng/m^3) †						2011-2016 Average concentration (ng/m^3)	Lifetime (70-year) regulatory target concentration (ng/m^3)
	2011	2012	2013	2014	2015	2016		
Salinas	695*	289*	407	33	201	187	302	2,600
Shafter	ND (227)	384*	2,589	909	800	1,559	1,078	2,600
Ripon	784*	ND (227)	883*	302	380	390	494	2,600

For illustrative purposes, average air concentrations are also shown below in units of parts per billion (ppb):

Community	Air concentration (ppb) †						2011-2016 Average concentration (ppb)	Lifetime (70-year) regulatory target concentration (ppb) ‡
	2011	2012	2013	2014	2015	2016		
Salinas	0.15	0.06	0.09	0.01	0.04	0.04	0.07	0.56
Shafter	ND (0.05)	0.08	0.57	0.20	0.18	0.34	0.24	0.56
Ripon	0.17	ND (0.05)	0.19	0.07	0.08	0.09	0.11	0.56

† Air concentrations were calculated using ND = MDL/2 for non-detections (standard method).

‡ A small difference (2.27%) in the ratio of concentrations relative to the regulatory target occurred due to use of defined values for regulatory targets for ppb versus ng/m^3 while annual concentrations were directly mathematically converted.

* Small inaccuracies were found in some the results database which have led to minor revisions to these year's concentrations compared to previous AMN reports. More information is given in the section below.

Differences in the values reported in Tables 33, 34, and 35 from those of previous years of AMN reports resulted from revisions to methods of calculation and the values used for certain variables. These changes, as well as additional notes regarding the calculation of these values are presented below:

1) Changes as result of refining the laboratory's 1,3-D analytical process:

- On June 18, 2011, a refinement to the analytical method for the quantification of 1,3-D resulted in lowering the LOQ (4,540 ng/m^3) and MDL (599 ng/m^3) to a new shared MDL/LOQ value of 454 ng/m^3.
- The high LOQ for the first six months (4,540 ng/m^3) of the AMN, led to no quantifiable detections of 1,3-D prior to June 18, 2011. Therefore, as previously described in past AMN reports, the 2011 average 1,3-D concentrations was for only six months. This remains consistent with previous reports, but merits mention.
- Upon review it was determined that previous reported calculations for the years 2011 and 2012 were made using an MDL of 599 ng/m^3 to calculate adjusted concentrations for all non-detections instead of the updated value of 454 ng/m^3. For this report, this inaccuracy was updated and the lower LOQ of 454 ng/m^3 was used to calculate adjusted concentrations for all non-detections between June 18, 2011 and October 15, 2013.
- On October 15, 2013, the analytical process went through further refinement and the LOQ was lowered tenfold to 45.4 ng/m^3. The new LOQ of 45.4 ng/m^3 was used to calculate adjusted concentrations for all non-detections between October 16, 2013 and December 31, 2016.

2) Due to the Department's 1,3-D health risk assessment completed in December 2015, an updated cancer potency value of 0.014 $(mg/kg\text{-}day)^{-1}$ was used in the calculation of the annual cancer risk estimate for all years rather than the previously established 0.055 $(mg/kg\text{-}day)^{-1}$ value used in prior AMN reports.

Uncertainty of Air Concentrations -Treatment of Non-Detections

The impact of the 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 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 were calculated using the MDL as the presumed concentration for samples with no detectable amount. Table 36 shows these alternative methods of calculation applied to the rolling 4-week averages, while Table 37 shows these applied to the 1-year average.

The percent differences in calculated rolling 4-week average concentrations between the maximum and minimum methods ranged from 0.0% to 17.8%. For the 1-year concentration the percent difference ranged from 1.2% to 159.7%. When compared to the associated screening level the difference between these methods does not result in concentrations above that screening level. The two pesticides having concentrations closest to subchronic screening levels, 1,3-dichloropropene and chloropicrin, were unaffected by the differences in method of calculation because these 4-week windows contained no non-detections. All other subchronic and chronic concentrations remained well below screening levels for each method of calculation.

Overall, the results of these alternative calculations demonstrate that DPR's standard method versus a minimum or maximum alternative method does not change the fact that the concentrations observed are greatly below the screening levels for all pesticides monitored. The exception being those of chloropicrin and 1,3-dichloropropene in which the concentrations, although closer to screening levels,

remained unaltered by the methods used. In conclusion, the standard method has been shown to provide an accurate midpoint representation of the actual environmental concentrations for the target pesticides.

Table 36. Minimum, standard, and maximum highest rolling 4-week average concentrations for pesticides or breakdown products with at least one quantifiable detection.

Pesticide	Minimum highest 4-week rolling concentration (ng/m^3)	Standard highest 4-week rolling concentration (ng/m^3)	Maximum highest 4-week rolling concentration (ng/m^3)	Percent difference between maximum and minimum
1,3-Dichloropropene	13,659	13,659	13,659	0.0%*
Carbon Disulfide	911	914	918	0.9%
Chloropicrin	1,493	1,493	1,493	0.0%*
Chlorothalonil	23	24	26	14.0%
Chlorpyrifos	39	39	39	0.0%*
Chlorpyrifos OA	6	6	7	9.2%
DDVP	12	13	15	17.8%
EPTC	9	10	10	8.8%
Iprodione	12	12	12	0.0%*
Methyl Bromide	589	594	599	1.7%
MITC	51	51	51	0.0%*

* A percentage difference of 0.0% indicates that there were zero samples with no detectable amount during the highest 4-week rolling concentration period. Therefore, using DPR's standard method versus a minimum or maximum alternative method does not affect the calculated highest 4-week rolling concentration.

Table 37. Minimum, standard, and maximum highest 1-year average concentrations for pesticides or breakdown products with at least one quantifiable detection.

Pesticide	Minimum highest 1-year average concentration (ng/m^3)	Standard highest 1-year average concentration (ng/m^3)	Maximum highest 1-year average concentration (ng/m^3)	Percent difference between maximum and minimum
1,3-Dichloropropene	697	711	726	4.0%
Carbon Disulfide	238	240	241	1.2%
Chloropicrin	53	159	264	132.8%
Chlorothalonil	8	12	16	62.7%
Chlorpyrifos	3	5	7	92.0%
Chlorpyrifos OA	1	3	4	90.0%
DDVP	0	2	4	159.7%
EPTC	0	1	2	146.8%
Iprodione	1	1	2	83.1%
Methyl Bromide	31	49	67	72.9%
MITC	8	10	12	42.9%

Comparison of 2016 to Previous Years of AMN Results

This report covers results from the sixth year of monitoring by the AMN, which has been collecting samples since 2011 (Vidrio et al., 2013a Vidrio et al., 2013b, Vidrio et al., 2014, Tuli et al., 2015, Tuli et al., 2016). Table 38 summarizes the detections of monitored pesticides from 2011 to 2016 samples. The results from all years of the AMN are presented and briefly compared in this report.

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.

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%).

5,928 analyses were performed on samples collected from January 1, 2016, to December 31, 2016, resulting in 5,393 (91%) non-detections. Of the 535 detections in 2016, 307 (5.2% of analyses) were quantifiable. Of the 32 pesticides and 5 breakdown products monitored by the AMN in 2016, 25 were detected in at least one sample; 11 of these 25 detections were quantifiable. The highest number of detections among analytes was in 2014, with 14 of 37 monitored chemicals resulting in a detectable concentration. Eleven of these 14 detections were quantifiable concentrations.

Table 38. Summary of AMN pesticide detection results during 2011-2016 sampling.

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

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

† Includes both quantified and trace detections

Tables 39, 40, and 41 show the highest 24-hour concentrations for the communities of Salinas, Shafter, and Ripon for each year of the AMN. There were no 24-hour concentrations detected in any of the three monitored communities for pesticides or breakdown products that had not been detected in higher or

similar levels in previous years of AMN monitoring. The percentage of detections (as shown in parentheses in tables 39 through 41 for all years with at least one detectable concentration) also remained consistent with expectations from those of previous years. Observed 24-hour concentrations of 1,3-dichloropropene in each community, as well as percentage of detections per year, are also more subject to yearly variations than other monitored chemicals. The percentage of carbon disulfide detections has increased each year in each community, with the exception of remaining at 88% in Ripon from 2015 to 2016. As stated previously, these detections of carbon disulfide are believed to originate from non-pesticidal sources.

Tables 42, 43, and 44 show the rolling 4-week average concentrations for the communities of Salinas, Shafter, and Ripon for each year of the AMN. The rolling 4-week average concentration of 1,3-dichloropropene in Shafter in 2016 closely approached the revised subchronic screening level as discussed earlier in this report. This peak was second to that of 2013, which would have crossed the revised screening level (14,000 ng/m^3), but not the subchronic screening level in place during that year (120,000 ng/m^3). Rolling 4-week average concentrations of methyl bromide have shown a general trend of decline, with the exception of an elevated calculated concentration in Ripon in 2015. Rolling 4-week averages of carbon disulfide have followed a general trend of increase, with the exception of an elevated concentration in Ripon in 2015.

Tables 45, 46, and 47 show the average yearly concentrations for the communities of Salinas, Shafter, and Ripon. The values for most of the monitored pesticides and breakdown products are observed to remain non-detections, trace detections, or extremely low quantifiable concentrations. Detected annual concentrations of methyl bromide follow a decreasing trend in each of the monitored communities. 1,3-dichlorpropene, carbon disulfide, and chloropicrin show more variability than other monitored chemicals in calculated annual concentrations in each of the monitored communities. Additionally, in Shafter and Ripon there is more variation in annual concentrations than observed in the majority of monitored pesticides and breakdown products.

Table 39. Highest 24-hour concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Salinas, California.

Pesticide	Highest 24-hour concentration (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	10,072 (6%)	3,430 (2%)	4,319 (16%)	440 (4 %)	3,643 (19%)	1,561 (25%)
Acephate	Trace (2%)	ND	ND	ND	ND	ND
Acrolein *	3,117 (58%)	--	--	--	--	--
Bensulide	Trace (9%)	ND	ND	ND	Trace (2%)	ND
Carbon Disulfide	ND	616 (2%)	153 (14%)	691 (44%)	3,125 (88%)	847 (92%)
Chloropicrin	3,926 (6%)	ND	6,384 (13%)	4,809	3,023 (15%)	2,824 (13%)
Chlorothalonil	ND	ND	Trace (4%)	Trace	Trace (10%)	Trace (6%)
Chlorpyrifos	Trace (23%)	Trace (23%)	Trace (2%)	Trace (2%)	ND	ND
Chlorpyrifos OA	Trace (11%)	Trace (8%)	ND	ND	ND	ND
Chlorthal-dimethyl (DCPA)	Trace (40%)	Trace (52%)	Trace (49%)	10 (63%)	Trace (65%)	Trace (67%)
DDVP	Trace (6%)	Trace (10%)	52 (13%)	Trace	Trace (17%)	ND
Diazinon	Trace (23%)	Trace (2%)	39 (2%)	ND	Trace (2%)	ND
Diazinon OA	Trace (17%)	ND	26 (2%)	ND	ND	ND
Diuron	Trace (4%)	32 (40%)	Trace (19%)	14.4 (8%)	Trace (2%)	Trace (4%)
Endosulfan	ND	ND	ND	Trace (2%)	ND	ND
EPTC	ND	ND	ND	Trace (2%)	ND	ND
Malathion	13 (9%)	Trace (13%)	Trace (15%)	Trace	10 (13%)	Trace (8%)
Malathion OA	Trace (30%)	Trace (31%)	Trace (13%)	Trace	Trace (37%)	Trace (21%)
Methidathion	Trace (9%)	ND	ND	ND	ND	ND
Methyl Bromide	6,055 (19%)	2,527 (10%)	4,425 (10%)	3,063	179 (13%)	439 (10%)
Metolachlor	Trace (11%)	ND	ND	ND	ND	ND
MITC	51 (10%)	182 (6%)	234 (15%)	72 (12%)	73 (8%)	26 (4%)
Norflurazon	Trace (4%)	ND	ND	ND	ND	ND
Oryzalin	Trace (2%)	ND	ND	ND	ND	ND
Oxyfluorfen	ND	ND	53 (2%)	ND	ND	ND
Phosmet	Trace (2%)	ND	ND	ND	ND	ND
Simazine	Trace (6%)	Trace (4%)	ND	Trace (2%)	ND	ND
Trifluralin	Trace (2%)	Trace (2%)	ND	ND	ND	ND

† 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.

Table 40. Highest 24-hour concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Shafter, California.

Pesticide	Highest 24-hour concentration (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	ND	3,643 (6%)	39,969 (26%)	9251 (37%)	9,713 (42%)	45,323 (50%)
Acephate	ND	Trace (2%)	ND	ND	ND	ND
Acrolein *	2,796 (60%)	--	--	--	--	--
Bensulide	Trace (2%)	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	897 (15%)	548 (50%)	812 (90%)	946 (92%)
Chloropicrin	ND	ND	ND	ND	ND	ND
Chlorothalonil	Trace (13%)	Trace (23%)	80 (60%)	118 (13%)	39 (75%)	58 (62%)
Chlorpyrifos	27 (53%)	131 (48%)	423 (75%)	338 (56%)	78 (61%)	52 (29%)
Chlorpyrifos OA	9 (45%)	17 (48%)	143 (55%)	110 (62%)	13 (53%)	Trace (50%)
Chlorthal-dimethyl (DCPA)	Trace (15%)	ND	Trace (8%)	ND	Trace (2%)	Trace (15%)
DDVP	Trace (2%)	ND	Trace (6%)	Trace (2%)	Trace (8%)	49 (2%)
Diazinon	60 (11%)	Trace (4%)	29 (6%)	ND	ND	ND
Diazinon OA	36 (4%)	10 (8%)	Trace (8%)	ND	ND	Trace (2%)
Diuron	Trace (6%)	Trace (12%)	Trace (2%)	Trace (10%)	Trace (10%)	ND
EPTC	187 (17%)	18 (4%)	250 (9%)	216 (12%)	29 (10%)	27 (6%)
Iprodione	Trace (2%)	Trace (4%)	Trace (4%)	Trace (6%)	Trace (8%)	17 (8%)
Malathion	ND	Trace (2%)	Trace (4%)	Trace (2%)	ND	ND
Malathion OA	Trace (6%)	11 (10%)	Trace (9%)	Trace (6%)	Trace (6%)	ND
Methyl Bromide	2,934 (9%)	2,135 (4%)	209 (4%)	963 (15%)	283 (13%)	113 (8%)
MITC	930 (40%)	347 (56%)	762 (57%)	113 (42%)	232 (35%)	109 (42%)
Norflurazon	Trace (2%)	ND	ND	ND	Trace (2%)	ND
Oryzalin	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)	62 (6%)	ND
Permethrin	Trace (2%)	ND	Trace (2%)	ND	ND	ND
Propargite	Trace (2%)	ND	Trace (11%)	ND	ND	ND
Simazine	Trace (4%)	Trace (12%)	ND	Trace (4%)	Trace (4%)	Trace (6%)
Trifluralin	Trace (9%)	Trace (6%)	Trace (4%)	Trace (4%)	Trace (8%)	ND

† 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.

Table 41. Highest 24-hour concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Ripon, California.

Pesticide	Highest 24-hour concentration (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	12,250 (4%)	ND	14,745 (17%)	3511 (19 %)	4,074 (31%)	2,917 (33%)
Acrolein *	5,959 (57%)	--	--	--	--	--
Bensulide	ND	ND	ND	ND	ND	Trace (2%)
Carbon Disulfide	ND	ND	464 (11%)	370 (49%)	2,842 (88%)	604 (88%)
Chloropicrin	ND	ND	1,279 (6%)	1,150 (4%)	Trace (2%)	Trace (2%)
Chlorothalonil	Trace (38%)	Trace (21%)	Trace (42%)	Trace (66%)	Trace (65%)	Trace (65%)
Chlorpyrifos	Trace (19%)	Trace (13%)	Trace (21%)	Trace (15%)	Trace (27%)	Trace (12%)
Chlorpyrifos OA	Trace (25%)	13 (19%)	Trace (23%)	Trace (17%)	Trace (23%)	15 (15%)
Chlorthal-dimethyl (DCPA)	Trace (6%)	ND	ND	ND	ND	ND
DDVP	ND	69 (2%)	Trace (8%)	Trace (2%)	26 (10%)	Trace (2%)
Diazinon	Trace (4%)	Trace (4%)	49 (4%)	ND	Trace (2%)	Trace (4%)
Diazinon OA	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)	Trace (6%)	Trace (4%)
Dimethoate	ND	ND	ND	ND	ND	Trace (2%)
Dimethoate OA	ND	ND	Trace (2%)	ND	ND	Trace (2%)
Diuron	ND	Trace (10%)	Trace (2%)	Trace (4%)	Trace (4%)	ND
Endosulfan	ND	Trace (2%)	Trace (2%)	Trace (4%)	Trace (6%)	ND
Iprodione	Trace (2%)	Trace (2%)	Trace (9%)	Trace (2%)	15 (10%)	Trace (10%)
Malathion	Trace (2%)	ND	Trace (2%)	ND	ND	ND
Malathion OA	Trace (13%)	Trace (10%)	Trace (13%)	Trace (8%)	Trace (12%)	Trace (4%)
Methyl Bromide	2,934 (20%)	2,667 (4%)	1,153 (9%)	2,329 (30%)	2,981 (20%)	1,161 (13%)
MITC	308 (42%)	90 (23%)	852 (19%)	203 (23%)	373 (25%)	73 (19%)
Oryzalin	ND	Trace (6%)	ND	ND	45 (6%)	ND
Oxyfluorfen	Trace (4%)	Trace (6%)	ND	Trace (2%)	Trace (6%)	Trace (4%)
Permethrin	Trace (4%)	ND	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)
Propargite	Trace (4%)	Trace (13%)	Trace (4%)	Trace (11%)	Trace (12%)	Trace (6%)
Simazine	Trace (2%)	Trace (10%)	ND	Trace (2%)	Trace (2%)	ND
Trifluralin	Trace (25%)	Trace (23%)	Trace (11%)	Trace (15%)	ND	Trace (12%)

† 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.

Table 42. Highest rolling 4-week average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Salinas, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3) ‡					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	2,743	1,082	2,611	158	1,812	1,245
Acephate	Trace	ND	ND	ND	ND	ND
Acrolein *	1,706	--	--	--	--	--
Bensulide	Trace	ND	ND	ND	Trace	ND
Carbon Disulfide	ND	271	156	319	945	914
Chloropicrin	1,809	ND	3,224	2,161	1,551	1,493
Chlorothalonil	ND	ND	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	ND	ND
Chlorpyrifos OA	Trace	Trace	ND	ND	ND	ND
Chlorthal-dimethyl (DCPA)	Trace	Trace	Trace	7	Trace	Trace
DDVP	Trace	Trace	28	Trace	Trace	ND
Diazinon	Trace	Trace	10	ND	Trace	ND
Diazinon OA	Trace	ND	7	ND	ND	ND
Diuron	Trace	20	Trace	8	Trace	Trace
Endosulfan	ND	ND	ND	Trace	ND	ND
EPTC	ND	ND	ND	Trace	ND	ND
Malathion	Trace	Trace	Trace	Trace	7	Trace
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace
Methidathion	Trace	ND	ND	ND	ND	ND
Methyl Bromide	4,124	1,098	1,871	1,262	119	256
Metolachlor	Trace	ND	ND	ND	ND	ND
MITC	15	71	89	36	23	9
Norflurazon	Trace	ND	ND	ND	ND	ND
Oryzalin	Trace	ND	ND	ND	ND	ND
Oxyfluorfen	ND	ND	16	ND	ND	ND
Simazine	Trace	Trace	ND	Trace	ND	ND
Trifluralin	Trace	ND	ND	ND	ND	ND

† 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.).

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

Table 43. Highest rolling 4-week average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Shafter, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	ND	1,135	18,022	4,077	5,138	13,659
Acephate	ND	Trace	ND	ND	ND	ND
Acrolein *	1,901	--	--	--	--	--
Bensulide	Trace	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	341	303	410	482
Chlorothalonil	Trace	Trace	38	Trace	25	24
Chlorpyrifos	15	46	113	92	60	39
Chlorpyrifos OA	7	13	44	32	9	Trace
Chlorthal-dimethyl (DCPA)	Trace	ND	Trace	ND	Trace	Trace
DDVP	Trace	ND	Trace	Trace	Trace	13
Diazinon	18	Trace	10	ND	ND	ND
Diazinon OA	11	Trace	ND	ND	ND	Trace
Diuron	Trace	Trace	Trace	Trace	Trace	ND
EPTC	76	Trace	139	86	19	10
Iprodione	Trace	Trace	Trace	Trace	Trace	10
Malathion	ND	Trace	Trace	Trace	ND	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	ND
Methyl Bromide	1,403	683	198	389	186	81
MITC	564	177	319	74	156	51
Norflurazon	Trace	ND	ND	ND	Trace	ND
Oryzalin	Trace	Trace	Trace	Trace	16	ND
Permethrin	Trace	ND	Trace	ND	ND	ND
Propargite	Trace	ND	Trace	ND	ND	ND
Simazine	Trace	Trace	ND	Trace	Trace	Trace

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

Table 44. Highest rolling 4-week average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Ripon, California.

Pesticide	Highest 4-week rolling concentration (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	4,022	ND	7,993	1,740	2,711	2,127
Acrolein *	2,773	--	--	--	--	--
Bensulide	ND	ND	ND	ND	ND	Trace
Carbon Disulfide	ND	ND	170	226	1,565	443
Chloropicrin	ND	ND	987	578	Trace	Trace
Chlorothalonil	Trace	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos OA	Trace	8	Trace	Trace	Trace	6
Chlorthal-dimethyl (DCPA)	Trace	ND	ND	ND	ND	ND
DDVP	ND	18	Trace	Trace	Trace	Trace
Diazinon	Trace	Trace	14	ND	Trace	Trace
Diazinon OA	Trace	Trace	ND	Trace	Trace	Trace
Dimethoate	ND	ND	ND	ND	ND	Trace
Dimethoate OA	ND	ND	Trace	ND	ND	Trace
Diuron	ND	Trace	Trace	Trace	Trace	ND
Endosulfan	ND	Trace	Trace	Trace	Trace	ND
Iprodione	Trace	Trace	Trace	Trace	12	Trace
Malathion	Trace	ND	Trace	ND	ND	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace
Methyl Bromide	1,659	1,119	437	867	1,640	594
MITC	144	50	272	98	150	41
Oryzalin	ND	Trace	ND	ND	Trace	ND
Oxyfluorfen	Trace	Trace	ND	Trace	Trace	Trace
Permethrin	Trace	ND	Trace	Trace	Trace	Trace
Propargite	Trace	Trace	Trace	Trace	Trace	Trace
Simazine	Trace	Trace	ND	Trace	Trace	ND
Trifluralin	ND	ND	ND	ND	ND	Trace

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

Table 45. Comparison of the 1-year average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Salinas, California.

Pesticide	Annual average concentrations (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	695	289	407	33	201	187
Acephate	Trace	ND	ND	ND	ND	ND
Acrolein *	1,706	--	--	--	--	--
Bensulide	Trace	ND	ND	ND	Trace	ND
Carbon Disulfide	ND	270	136	84	273	263
Chloropicrin	325	ND	413	291	Trace	247
Chlorothalonil	ND	ND	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	ND	ND
Chlorpyrifos OA	Trace	Trace	ND	ND	ND	ND
Chlorthal-dimethyl (DCPA)	Trace	Trace	Trace	4	Trace	Trace
DDVP	Trace	Trace	Trace	Trace	Trace	ND
Diazinon	Trace	Trace	Trace	ND	Trace	ND
Diazinon OA	Trace	ND	Trace	ND	ND	ND
Diuron	Trace	Trace	Trace	Trace	Trace	Trace
Endosulfan	ND	ND	ND	Trace	ND	ND
EPTC	ND	ND	ND	ND	Trace	ND
Malathion	Trace	Trace	Trace	Trace	Trace	Trace
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace
Methidathion	Trace	ND	ND	ND	ND	ND
Methyl Bromide	1,020	355	301	187	35	41
Metolachlor	Trace	ND	ND	ND	ND	ND
MITC	6	Trace	Trace	Trace	Trace	3
Norflurazon	Trace	ND	ND	ND	ND	ND
Oryzalin	Trace	ND	ND	ND	ND	ND
Oxyfluorfen	ND	ND	Trace	ND	ND	ND
Simazine	Trace	Trace	ND	Trace	ND	ND
Trifluralin	Trace	ND	ND	ND	ND	ND

† 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.

Table 46. Comparison of the 1-year average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Shafter, California.

Pesticide	Annual average concentrations (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	ND	384	2,589	909	800	1,559
Acephate	ND	Trace	ND	ND	ND	ND
Acrolein *	1,901	--	--	--	--	--
Bensulide	Trace	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	149	86	217	227
Chlorothalonil	Trace	Trace	16	22	Trace	15
Chlorpyrifos	Trace	Trace	20	16	Trace	8
Chlorpyrifos OA	Trace	Trace	8	7	Trace	Trace
Chlorthal-dimethyl (DCPA)	Trace	ND	Trace	ND	Trace	Trace
DDVP	Trace	ND	Trace	Trace	Trace	3
Diazinon	Trace	Trace	Trace	ND	ND	ND
Diazinon OA	Trace	Trace	ND	ND	ND	Trace
Diuron	Trace	Trace	Trace	Trace	Trace	ND
EPTC	Trace	Trace	Trace	Trace	Trace	2
Iprodione	Trace	Trace	Trace	Trace	Trace	2
Malathion	ND	Trace	Trace	Trace	ND	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	ND
Methyl Bromide	425	247	163	70	40	26
MITC	73	51	66	21	27	17
Norflurazon	Trace	ND	ND	ND	Trace	ND
Oryzalin	Trace	Trace	Trace	Trace	Trace	ND
Permethrin	Trace	ND	Trace	ND	ND	ND
Propargite	Trace	ND	Trace	ND	ND	ND
Simazine	Trace	Trace	ND	Trace	Trace	Trace

† 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.

Table 47. Comparison of the 1-year average concentrations for pesticides with at least one detectable concentration by year (2011 - 2016) in Ripon, California.

Pesticide	Annual average concentrations (ng/m^3)					
	2011	2012	2013	2014	2015	2016
1,3-Dichloropropene	784	ND	883	302	380	390
Acrolein *	2,773	--	--	--	--	--
Bensulide	ND	ND	ND	ND	ND	Trace
Carbon Disulfide	ND	ND	140	76	352	229
Chloropicrin	ND	ND	177	146	Trace	Trace
Chlorothalonil	Trace	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos OA	Trace	Trace	Trace	Trace	Trace	2
Chlorthal-dimethyl (DCPA)	Trace	ND	ND	ND	Trace	ND
DDVP	ND	Trace	Trace	Trace	Trace	Trace
Diazinon	Trace	Trace	Trace	ND	Trace	Trace
Diazinon OA	Trace	Trace	ND	Trace	Trace	Trace
Dimethoate	ND	ND	ND	ND	ND	Trace
Dimethoate OA	ND	ND	Trace	ND	ND	Trace
Diuron	ND	Trace	Trace	Trace	Trace	ND
Endosulfan	ND	Trace	Trace	Trace	Trace	ND
Iprodione	Trace	Trace	Trace	Trace	Trace	Trace
Malathion	Trace	ND	Trace	Trace	ND	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace
Methyl Bromide	656	315	194	172	171	80
MITC	34	14	37	15	23	10
Oryzalin	ND	Trace	ND	ND	Trace	ND
Oxyfluorfen	Trace	Trace	ND	Trace	Trace	Trace
Permethrin	Trace	ND	Trace	Trace	Trace	Trace
Propargite	Trace	Trace	Trace	Trace	Trace	Trace
Simazine	Trace	Trace	ND	Trace	Trace	ND
Trifluralin	ND	ND	ND	ND	ND	Trace

† 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.

Comparison to Other Monitoring

ARB, in support of DPR's Toxic Air Contaminant (TAC) monitoring program, monitors 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. Current 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, methyl bromide, permethrin, propargite, simazine and DEF which are listed in Table 48 as other studies.

Comparison of the detected concentrations in Table 48 shows that maximum 24-hour concentrations measured at all three sampling locations in 2016 were generally much lower than concentrations measured in other parts of the state by ARB and concentrations measured by DPR in Parlier. The exceptions to this were the 118 ng/m^3 concentration of chlorothalonil in 2014 and the 250 ng/m^3 concentration of EPTC in 2013, both of which were detected in by the AMN in Shafter. Additionally, permethrin was never detected above trace levels in any of the studies compared in Table 48.

Table 48. Highest 24-hour concentrations of pesticides monitored by the AMN compared to previous DPR/ARB monitoring studies in California.

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

† ND = Not Detected.

DATA VALIDATION/QUALITY ASSURANCE

Data Review

Before evaluating any data, the entire set of sample COC and laboratory quality assurance data were reviewed to determine the strength of the data for final assessment. The sample COCs were checked for any notations of flow faults or stoppage in sample collection, or any changes greater than 20% in the flow over the sampling interval. There was a single invalid sample during the 2016 calendar year for chloropicrin due to a difference between initial and final flow greater than 20% (Appendix B).

Quality Control Results

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 quality control (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 resin packed in the sorption tubes. The blank matrix materials were not fortified, but were extracted and analyzed along with the matrix spikes and field samples. Table 49 lists the averages for the QC samples that were extracted and analyzed with the air samples for the entire monitoring period. Laboratory matrix spike recovery averages ranged from 72% to 99% for all chemicals analyzed. None of the laboratory matrix spike samples were outside the control limits established from the validation data. A single laboratory blank, for bensulide, resulted in a trace detection. All remaining laboratory blanks resulted in non-detections.

Field blanks, blind spikes and duplicate samples are part of DPR's field and laboratory QC program. The blind spikes were fortified by a CDFA chemist not associated with the analysis. The blind spikes were given to DPR staff, relabeled, and then intermingled and delivered with field samples. Table 49 lists the average percent recovery results which ranged from 0% to 233%.

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. A single field blank, for chlorthal-dimethyl, resulted in a trace detection. All remaining field blanks resulted in non-detections. These results are shown in table 49.

Table 50 summarizes the results of duplicate samples. A duplicate sample is a sample that is co-located with another sample in the field. These samples serve to evaluate overall precision in sample measurement and analysis. There was only one analysis pair among 427 in which the category of the results did not match up (ND/ND, Trace/Trace, Quantifiable/Quantifiable), which was a ND/Trace pairing. The relative difference was calculated between each quantifiable pair and averaged for each sample media type. There were no quantifiable pairs for chloropicrin and any chemical on the multi-residue cartridge. A 5.5% relative difference was calculated from 2 quantifiable pairs for MITC duplicates. A 36.9% relative difference was calculated using 25 quantifiable pairs of the pesticides monitored as VOC's (methyl bromide, carbon disulfide, and both stereoisomers of 1,3-dichloropropene).

Table 49. Average results for quality control/quality assurance in samples from the 2016 AMN.

Chemical	Lab spikes (% recovery)	Field spikes (% recovery)	Lab blanks (ng/m^3)	Trip blanks (ng/m^3)
cis-1,3-Dichloropropene	97%	79%	ND	ND
trans-1,3-Dichloropropene	96%	104%	ND	ND
Acephate	88%	117%	ND	ND
Bensulide	92%	67%	ND	ND
Carbon Disulfide	97%	**	ND	ND
Chloropicrin	94%	100%	ND	ND
Chlorothalonil	75%	77%	ND	ND
Chlorpyrifos	92%	102%	ND	ND
Chlorpyrifos OA	89%	65%	ND	ND
Chlorthal-dimethyl (DCPA)	87%	111%	ND	ND
Cypermethrin	91%	81%	ND	ND
DDVP	83%	133%	ND	ND
Diazinon	94%	50%	ND	ND
Diazinon OA	93%	0%	ND	ND
Dimethoate	90%	72%	ND	ND
Dimethoate OA	94%	126%	ND	ND
Diuron	99%	98%	ND	ND
Endosulfan	88%	98%	ND	ND
Endosulfan Sulfate	90%	95%	ND	ND
EPTC	93%	47%	ND	ND
Iprodione	93%	49%	ND	ND
Malathion	92%	96%	ND	ND
Malathion OA	95%	131%	ND	ND
Methidathion	92%	97%	ND	ND
Methyl Bromide	96%	77%	ND	ND
Metolachlor	94%	99%	ND	ND
MITC	72%	64%	ND	ND
Norflurazon	95%	87%	ND	ND
Oryzalin	92%	**	ND	ND
Oxydemeton methyl	92%	46%	ND	ND
Oxyfluorfen	80%	113%	ND	ND
Permethrin	92%	40%	ND	ND
Phosmet	91%	90%	ND	ND
pp-Dicofol	87%	233%	ND	ND
Propargite	93%	77%	ND	ND
Simazine	93%	38%	ND	ND
SSS-tributyltriphosphorotrithioate (DEF)	90%	**	ND	ND
Trifluralin	89%	46%	ND	ND

† ND = Not Detected. ‡ NS = Field sample not spiked with this chemical.

* There was a single trace detection, all others were non-detects. ** There was no spike of this chemical performed.

Validation and Control Limits

The MITC and the multi-residue pesticide analysis methods were validated according to the DPR standard operating procedures (DPR, 1995). The laboratory conducted validations by spiking three to five matrix blanks at three to five different spike levels, and then analyzing them. This procedure was repeated three to five times. For the validation data, DPR created control limits by multiplying the standard deviation of the data by ± 3 times and adding it to the mean.

Table 50. Results for duplicate sample pairs in 2016.

Primary/duplicate results	Number of pairs			
	Chloropicrin samples	MITC samples	Multi-pesticide residue analysis samples	VOC samples
ND / ND	13	8	331	26
Trace / Trace	0	1	20	0
ND / Trace	0	0	1	0
ND / >LOQ	0	0	0	0
Trace / >LOQ	0	0	0	0
>LOQ / >LOQ	0	2	0	25
Relative difference	0%	5.5%	0%	36.9%

† ND = Not Detected.

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

* For pairs with both concentrations >LOQ

DISCUSSION

DPR has established regional use limits (township caps) for 1,3-dichloropropene to control cancer risk. Townships are approximately 6 x 6 mile areas designated by the Public Lands Survey System. The township cap for 1,3-dichloropropene is an annual limit, with a goal of limiting the 70-year average concentration to no more than the regulatory target concentration. DPR's regulatory target for average 70-year lifetime exposure to 1,3-dichloropropene was revised in December of 2015 from 650 ng/m^3 to 2,600 ng/m^3. None of the averages from any community monitored by the AMN for the 6-year period from 2011 through 2016 has exceeded this level. This indicates that the 1,3-dichloropropene township caps are effectively keeping air concentrations below the health protective target set by DPR.

Fumigants accounted for 5 of the 11 pesticides detected at quantifiable concentrations by the AMN in 2016. These fumigants were 1,3-dichloropropene, carbon disulfide, chloropicrin, methyl bromide, and MITC. Organophosphates and their breakdown products accounted for another 3 of these quantifiable detections. These were chlorpyrifos, its oxygen analog, and DDVP. The remaining 3 pesticides detected at quantifiable concentrations in 2016 were chlorothalonil, EPTC, and iprodione. These detections of carbon disulfide are believed to be from non-pesticidal sources.

The results from the AMN supplement data from the Toxic Air Contaminant program, and allow DPR to provide more robust estimates of subchronic and chronic exposures to individuals as well as assess cumulative exposure to multiple pesticides. A hazard index 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 0.112, indicating a low risk from cumulative exposure.

Higher concentrations of pesticides have been detected in other studies (e.g., a methyl bromide concentration of 142,000 detected in Santa Cruz County in 2001). This is likely due to greater amounts of pesticides applied in closer proximity to the monitoring sites for these studies; mitigation measures implemented since the conclusion of these studies might also explain this. The ambient air monitoring conducted by the Toxic Air Contaminant program focuses on the highest use areas and highest use periods for individual pesticides.

Generally, relative to their respective screening levels, concentrations representing subchronic exposure were higher than chronic or acute 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 AMN objectives, and ambient air monitoring usually underestimates acute exposure. The AMN's ambient air monitoring in communities is the standard method DPR uses to estimate subchronic and chronic exposures. Application-site monitoring in the immediate vicinity of a treated field is normally used to estimate acute exposure. These air concentrations are typically several times higher than acute exposures measured from ambient air monitoring since they are collected 100 feet or less from the application, whereas ambient samples may be collected from a mile or more away. It is likely that the maximum acute exposure is higher than indicated in this data.

DPR has established regional use limits (township caps) for methyl bromide to control subchronic exposure. Townships are approximately 6 x 6 mile areas designated by the Public Lands Survey System. The township cap for methyl bromide is a monthly cap, with a goal of limiting the subchronic exposure to no more than the regulatory target of 19,400 ng/m^3 (5 ppb). In 2016 the highest measured subchronic concentration of methyl bromide was 3.1% of the regulatory target. This indicates that the methyl bromide township caps are effectively keeping air concentrations below the health protective targets set by DPR.

In April 2015, DPR implemented new mitigation control measures to reduce exposure to chloropicrin. The mitigation measures included conditions such as larger buffer zones and smaller maximum application sizes and they were intended to reduce exposure by reducing overall air concentrations of chloropicrin. The observed decrease in 2016 24-hour air concentrations of chloropicrin in Ripon and Salinas, as well as a decline in the rolling 4-week concentration in Ripon may be a result of recent measures put forth by the Department.

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 2016 calendar year marked the last year of AMN monitoring in the communities of Salinas and Ripon. AMN monitoring of Shafter will continue, but will be conducted under ARB rather than DPR. Per selection criteria outlined in the Air Monitoring Network Plan for 2017, AMN monitoring began in the communities of Chualar (Monterey County) and the vicinity of Watsonville (actual site is located in Monterey County) on January 1, 2017. As of January 1, 2017, monitoring also began in Santa Maria (Santa Barbara County). This monitoring is conducted by Santa Barbara County Agricultural Commissioner staff, with aid provided by DPR. In addition to taking over monitoring of Shafter, ARB has provided a projected start date in June, 2017 to begin monitoring the communities of Cuyama (Santa Barbara County), Lindsay (Tulare County), Oxnard (Ventura County), and San Joaquin (Fresno County).

In addition to the shifting of monitored communities in 2017, the AMN will cease monitoring for carbon disulfide. This decision was reached due to an absence of current product registrations for either carbon disulfide or sodium tetrathiocarbonate (which breaks down into carbon disulfide). Additionally, carbon disulfide is a product of anaerobic decomposition of vegetation and measured concentrations have been consistent with ambient monitoring conducted by ARB under the Toxic Air Contaminants (TAC) program.

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