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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 fifth volume of this study and contains AMN results from January 1, 2015 to December 31, 2015.

DPR monitored a total of 37 chemicals (i.e., 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. The starting day varied each week; the actual dates were randomly selected. Sampling start times were left to the discretion of the field sampling personnel, but sampling always started anywhere from 9:00 a.m. to 2:00 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 concentrations 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 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

Of the 5,892 analyses (number of samples times the number of chemicals analyzed) conducted, 89.7% had no detectable concentrations. 606 (10.3%) of the analyses had detectable (trace or quantifiable) concentrations, and 306 (5.2%) of the analyses had quantifiable concentrations. A quantifiable concentration refers to a concentration above the limit of quantitation (LOQ) for their respective pesticide. Eleven of the 37 chemicals monitored by DPR were not detected.

Of the 37 chemicals monitored, 26 were detected in at least one sample and none exceed any of their screening levels or regulatory target concentrations. Of the 26 pesticides detected, 12 were detected at trace levels, and 14 had quantifiable concentrations. Nine of the 14 pesticides (including three breakdown products) detected at quantifiable concentrations in the AMN were either fumigants (1,3-dichloropropene, carbon disulfide, methyl bromide, chloropicrin, and MITC) or organophosphate insecticides (chlorpyrifos + and its oxygen analog, DDVP, malathion). In addition, chlorothalonil, EPTC, iprodione, and oryzalin were also detected at quantifiable concentrations. The chemicals with the highest number of detections were carbon disulfide (89%), chlorothalonil (50%), 1,3-dichloropropene (31%), chlorpyrifos (29%), chlorpyrifos oxygen analog (25%), and MITC (22%). Carbon disulfide has very little use as a fumigant and its detections are 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. It also has several natural sources including wetlands, oceans, and volcanoes.

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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.

ARB: California Air Resources Board, part of CalEPA

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

$$HI = HQ_1 + HQ_2 + HQ_{3+\ldots}$$

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 for that pesticide) over the same time period. An HQ less than 1 is generally considered to be health protective.

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

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 limits 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 which 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 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.

QAS: Quality Assurance Section of ARB.

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

QC: Quality Control

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.

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. Reregistration is U.S. EPA's reevaluation and relicensing of 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 target concentrations are levels 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 and 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 *Limit of Quantitation* (LOQ)

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 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 results to more accurately estimate 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 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 (including: communities with higher populations of children, persons over 65, and number of persons living in close proximity to farms and agricultural areas with high pesticide use), 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 air network. DPR reevaluated community data in 2013 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 areas of high use for many of the monitored pesticides and DPR staff recommended that monitoring should continue at the same three sampling sites.

DPR previously determined that representative sampling could be obtained from one 24-hour air sample collected each week from each community selected (Vidrio et al., 2013a). The air samples were analyzed for 32 pesticides and 5 pesticide breakdown products. This report is the fifth volume of this study and contains AMN results from January 1, 2015 to December 31, 2015.

Communities and Monitoring Site Locations

<u>Ripon</u>

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 60º to 94º F and 47º to 62º 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 North Wilma Avenue near the western side of the middle of the city.

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 59º to 99º F in the summer and 35º to 64º 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 located near a city well 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 51º to 72º F in the summer and from 40º to 52º 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.

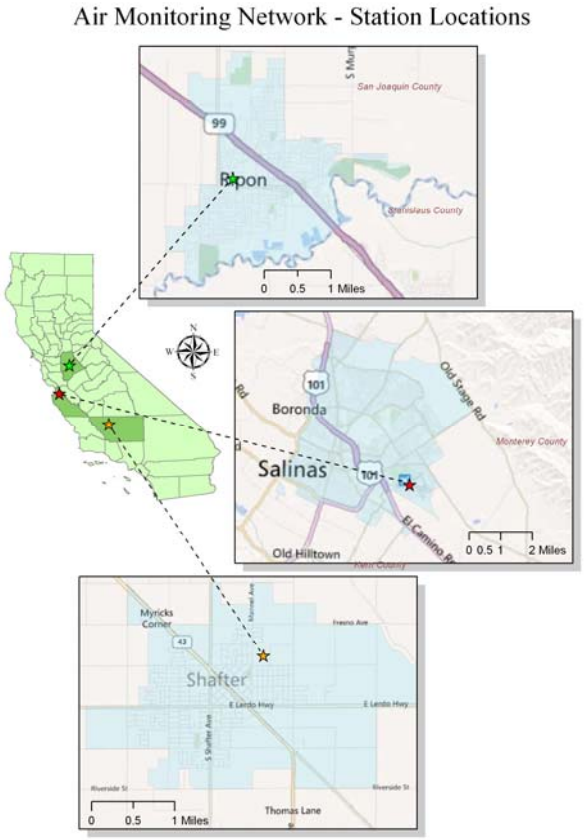

Figure 1. Map showing the location of the three communities and monitoring sites.

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. Pesticides were selected based on criteria described in Vidrio et al. (2013a).

Multi-Pesticide Residue Analysis

Multi-pesticide residue analysis using XAD-4 resin as the solid phase trapping medium were 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-residue analysis method. Table 1 lists the analytes that can be detected in 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
Naled 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 U.S. EPA's Method TO-15. DPR's 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 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 gas chromatograph equipped with GC-ECD.

Table 2. Target analytes in canister 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

*are collected on individual sample tubes.

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 forms (COC), 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. As the air sampling commenced at each monitoring site, the sample tracking number, date, time, staff initials, weather conditions, and air sampler flow rate were documented on the COC form (DPR, 2004). DPR personnel previously calibrated all pumps used for air sampling to their respective flow rate. DPR (2001) describes 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 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 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 canister residue 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 9:00 a.m. to 2:00 p.m.

Quality Control Methods

Besides collecting field samples during monitoring, DPR collected additional quality control samples consisting of trip blank samples, field spikes and collocated 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 mean 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 collocated 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 percent 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 Air Monitoring Network samples.

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
Cypermethrin	4.7	23.1
Chlorthal-dimethyl (DCPA)	1.7	9.3
DDVP	3.2	23.1
Diazinon	1.2	9.3
Diazinon OA	2.1	9.3
Dicofol	2.1	23.1
Dimethoate	2.3	9.3
Dimethoate OA	1.9	9.3
Diuron	5.1	9.3
Endosulfan	3.2	23.1
Endosulfan Sulfate	4.6	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
Propargite	3.8	23.1
Simazine	1.2	9.3
SSS-tributyltriphosphorotrithioate (DEF)	1.8	9.3
Trifluralin	1.7	23.1
VOC Samples†		
Carbon Disulfide	--	31.1 (0.01 ppb)‡
1,3-Dichloropropene (*cis* and *trans)*	--	45.4 (0.01 ppb)‡
Methyl Bromide	--	39.6 (0.01 ppb)‡

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

** Previous reports, Malathion LOQ was mistakenly reported as 23.1 ng/m^3.

†For VOC samples the detection limit is the LOQ, the level that can be reliably quantified.

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

Air concentration calculations

For the sorbent tube 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 calculations:

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

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

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

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 $atm.cm^3/(mol{\cdot}K)$) and temperature in degrees Kelvin (298 K) with appropriate unit conversions based on the ideal gas law.

When calculating average concentrations from multiple samples, samples with no detectable amount 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 a variety of adverse effects, including respiratory illnesses, damage to the nervous system, cancer, and birth defects. Vidrio et al. (2013a) summarizes the potential health effects of each pesticide. No state or federal agency has established health standards for pesticides in air. Therefore, DPR in consultation with the Office of Environmental Health Hazard Assessment (OEHHA) 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) summarizes more information on DPR-determined screening levels including information on deriving screening levels for each pesticide.

In December 2015, DPR completed a risk assessment for inhalation exposure (DPR, 2015) to 1,3-dichloropropene 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 and are different than reported screening levels in previous Air Monitoring Network 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

Once a complete assessment of possible health risks is completed, regulatory target concentrations are established and supersede the screening levels. DPR puts measures in place based on the regulatory target concentration 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 concentration after completing a formal risk assessment of a chemical's toxicity and potential exposures. DPR management determines a regulatory target concentration 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 concentration is based on a more comprehensive evaluation than a health screening level. Therefore, a regulatory target concentration 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-dichloropropene) have regulatory targets for one or more exposure periods. DPR has updated the regulatory target concentration for cancer risk from lifetime exposure to 1,3-dichloropropene. As described in the risk management directive (DPR, 2016a), DPR has 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.

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.

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

If the HI is greater than 1, this 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 (the Safe Drinking Water and Toxic Enforcement Act of 1986) or by the U.S. Environmental Protection Agency's (EPA) 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.

AIR MONITORING RESULTS

Results for all Pesticides and Communities Combined

A total of 5,892 analyses were conducted on the air samples collected from all three sampling locations from January 1, 2015 to December 31, 2015. Of the 5,892 analyses, 10.3% (606) showed detectable concentrations, which included quantifiable and trace detections. Samples with quantifiable concentrations accounted for 5.2% (306) of all analyses conducted. Quantifiable detections refer to concentrations above the LOQ for their respective pesticide.

Twelve of the 32 pesticides and 5 pesticide breakdown products monitored by DPR were only detected at trace levels. Eleven of the 32 pesticides and 5 pesticide breakdown products monitored by DPR were not detected. 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 (89%), chlorothalonil (50%), 1,3-dichlorpropene (31%), chlorpyrifos (29%), chlorpyrifos oxygen analog (OA) (25%), chlorthal-dimethyl (DCPA) (23%) and MITC (22%). Carbon disulfide has very little use as a fumigant and its detections are most likely due combustion of fossil fuels as well as its use as an industrial solvent

and its release from manufacturing and processing facilities. It also has several natural sources including wetlands, oceans, and volcanoes.

Table 5. 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	155	48	48	31%	31%
trans-1,3-Dichloropropene	155	48	48	31%	31%
Acephate	155	0	0	0%	0%
Bensulide	155	1	0	1%	0%
Carbon Disulfide	155	138	138	89%	89%
Chloropicrin	156	9	2	6%	1%
Chlorothalonil	155	77	2	50%	1%
Chlorpyrifos	155	45	6	29%	4%
Chlorpyrifos OA	155	39	3	25%	2%
Chlorthal-dimethyl (DCPA)	155	35	0	23%	0%
Cypermethrin	155	0	0	0%	0%
DDVP	155	18	1	12%	1%
Diazinon	155	2	0	1%	0%
Diazinon OA	155	3	0	2%	0%
Dimethoate	155	0	0	0%	0%
Dimethoate OA	155	0	0	5%	0%
Diuron	155	8	0	5%	0%
Endosulfan	155	3	0	2%	0%
Endosulfan Sulfate	155	0	0	0%	0%
EPTC	155	5	4	3%	3%
Iprodione	155	9	2	6%	1%
Malathion	155	7	1	5%	1%
Malathion OA	155	28	0	18%	0%
Methidathion	155	0	0	0%	0%
Methyl Bromide	155	24	24	15%	15%
Metolachlor	155	0	0	0%	0%
MITC	156	35	25	22%	16%
Norflurazon	155	1	0	1%	0%
Oryzalin	155	6	2	4%	1%
Oxydemeton methyl	155	0	0	0%	0%
Oxyfluorfen	155	3	0	2%	0%
Permethrin	155	1	0	1%	0%
Phosmet	155	0	0	0%	0%
pp-Dicofol	155	0	0	0%	0%
Propargite	155	6	0	4%	0%
Simazine	155	3	0	2%	0%
SSS-tributyltriphosphorotrithioate (DEF)	155	0	0	0%	0%
Trifluralin	155	4	0	3%	0%
Total	**5,892**	**606**	**306**	**10%**	**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 chemical with the highest number of detections in Salinas (46 detections), Shafter (47 detections), and Ripon (45 detections). DCPA (34) in Salinas and chlorothalonil (38 and 34) in Shafter and Ripon, respectively, had the second highest number of detections.

Table 6. 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	10	10	19%	19%
trans-1,3-Dichloropropene	52	10	10	19%	19%
Acephate	52	0	0	0%	0%
Bensulide	52	1	0	2%	0%
Carbon Disulfide	52	46	46	88%	88%
Chloropicrin	52	8	2	15%	4%
Chlorothalonil	52	5	0	10%	0%
Chlorpyrifos	52	0	0	0%	0%
Chlorpyrifos OA	52	0	0	0%	0%
Cypermethrin	52	0	0	0%	0%
Chlorthal-dimethyl (DCPA)	52	34	0	65%	0%
DDVP	52	9	0	17%	0%
Diazinon	52	1	0	2%	0%
Diazinon OA	52	0	0	0%	0%
Dimethoate	52	0	0	0%	0%
Dimethoate OA	52	0	0	0%	0%
Diuron	52	1	0	2%	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	7	1	13%	2%
Malathion OA	52	19	0	37%	0%
Methidathion	52	0	0	0%	0%
Methyl Bromide	52	7	7	13%	13%
Metolachlor	52	0	0	0%	0%
MITC	52	4	2	8%	4%
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-tributyltriphosphorotrithioate (DEF)	52	0	0	0%	0%
Trifluralin	52	0	0	0%	0%
Total	**1,976**	**162**	**78**	**8%**	**4%**

***Includes both quantified and trace detections**

Table 7. 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	22	22	42%	42%
trans-1,3-Dichloropropene	52	22	22	42%	42%
Acephate	51	0	0	0%	0%
Bensulide	51	0	0	0%	0%
Carbon Disulfide	52	47	47	90%	90%
Chloropicrin	52	0	0	0%	0%
Chlorothalonil	51	38	2	75%	4%
Chlorpyrifos	51	31	6	61%	12%
Chlorpyrifos OA	51	27	3	53%	6%
Cypermethrin	51	0	0	0%	0%
Chlorthal-dimethyl (DCPA)	51	1	0	2%	0%
DDVP	51	4	0	8%	0%
Diazinon	51	0	0	0%	0%
Diazinon OA	51	0	0	0%	0%
Dimethoate	51	0	0	0%	0%
Dimethoate OA	51	0	0	0%	0%
Diuron	51	5	0	10%	0%
Endosulfan	51	0	0	0%	0%
Endosulfan Sulfate	51	0	0	0%	0%
EPTC	51	5	4	10%	8%
Iprodione	51	4	0	8%	0%
Malathion	51	0	0	0%	0%
Malathion OA	51	3	0	6%	0%
Methidathion	51	0	0	0%	0%
Methyl Bromide	52	7	7	13%	13%
Metolachlor	51	0	0	0%	0%
MITC	52	18	15	35%	29%
Norflurazon	51	1	0	2%	0%
Oryzalin	51	3	1	6%	2%
Oxydemeton methyl	51	0	0	0%	0%
Oxyfluorfen	51	0	0	0%	0%
Permethrin	51	0	0	0%	0%
Phosmet	51	0	0	0%	0%
pp-Dicofol	51	0	0	0%	0%
Propargite	51	0	0	0%	0%
Simazine	51	2	0	4%	0%
SSS-tributyltriphosphorotrithioate (DEF)	51	0	0	0%	0%
Trifluralin	51	4	0	8%	0%
Total	**1,944**	**244**	**129**	**13%**	**7%**

***Includes both quantified and trace detections**

Table 8. 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	51	16	16	31%	31%
trans-1,3-Dichloropropene	51	16	16	31%	31%
Acephate	52	0	0	0%	0%
Bensulide	52	0	0	0%	0%
Carbon Disulfide	51	45	45	88%	88%
Chloropicrin	52	1	0	2%	0%
Chlorothalonil	52	34	0	65%	0%
Chlorpyrifos	52	14	0	27%	0%
Chlorpyrifos OA	52	12	0	23%	0%
Cypermethrin	52	0	0	0%	0%
Chlorthal-dimethyl (DCPA)	52	0	0	0%	0%
DDVP	52	5	0	10%	0%
Diazinon	52	1	0	2%	0%
Diazinon OA	52	3	0	6%	0%
Dimethoate	52	0	0	0%	0%
Dimethoate OA	52	0	0	0%	0%
Diuron	52	2	0	4%	0%
Endosulfan	52	3	0	6%	0%
Endosulfan Sulfate	52	0	0	0%	0%
EPTC	52	0	0	0%	0%
Iprodione	52	5	2	10%	4%
Malathion	52	0	0	0%	0%
Malathion OA	52	6	0	12%	0%
Methidathion	52	0	0	0%	0%
Methyl Bromide	51	10	10	20%	20%
Metolachlor	52	0	0	0%	0%
MITC	52	13	8	25%	15%
Norflurazon	52	0	0	0%	0%
Oryzalin	52	3	1	6%	2%
Oxydemeton methyl	52	0	0	0%	0%
Oxyfluorfen	52	3	0	6%	0%
Permethrin	52	1	0	2%	0%
Phosmet	52	0	0	0%	0%
pp-Dicofol	52	0	0	0%	0%
Propargite	52	6	0	12%	0%
Simazine	52	1	0	2%	0%
SSS-tributyltriphosphorotrithioate (DEF)	52	0	0	0%	0%
Trifluralin	52	0	0	0%	0%
Total	**1,972**	**200**	**98**	**10%**	**5%**

***Includes both quantified and trace detections**

Table 9 lists the total number of detections of the monitored chemicals segregated by the sampling location. Detection percentages for the monitored chemicals ranged from 8.2% to 12.6% of all collected samples from all three sampling sites. These detections included both quantifiable (above LOQ) and trace detections (above the MDL but below the LOQ). Shafter had the highest percentage of samples with detections (12.6%) and the highest percent of quantifiable samples (6.6%). A total of 156 sample sets were taken from all three sampling locations (52 sample sets collected from Salinas, Shafter and Ripon), 155 (99.4%) sample sets contained at least one detection.

Table 9. Detections of monitored chemicals by location.

Location	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	162	68	8.2%	3.4%		52	52	100.0%
Shafter	1,944	244	129	12.6%	6.6%		52	52	100.0%
Ripon	1,972	200	98	10.1%	5.0%		52	51	98.1%
Total	**5,892**	**606**	**295**	**10.3%**	**5.0%**		**156**	**155**	**99.4%**

***Includes both quantified and trace detections**

Table 10 presents the highest 24-hour concentration at any site for each pesticide monitored. None of the pesticides monitored exceeded their acute screening level. Detected concentrations of chlorpyrifos were the highest relative to its screening level with a maximum concentration of 77.8 ng/m^3, which is 6.5% of its acute screening level. Diazinon OA was the next highest pesticide relative to its screening level with a concentration of trace level of 5.7 ng/m^3 or 4.4% of its acute screening level. The acute screening level of 1,3-dichloropropene was updated to reflect the results of a new risk assessment in December 2015 from 160,000 to 505,000 ng/m^3 (Table 10). Figures 2 through 8 illustrate the highest 24-hour concentrations detections in all three sampling sites for selected fumigant and organophosphate pesticides due to pesticidal use.

While the results of the 24-hour samples and acute exposure are discussed in this report, the AMN best measures subchronic and chronic exposures. Estimating acute exposures is not one of the AMN objectives. 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 mile or more away. It's likely that the maximum acute exposure is higher than indicated by these data.

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	9,713.3	505,000*	1.923%
Acephate	Not Detected (0.5)	12,000	0.004%
Bensulide	Trace (5.3)	259,000	0.002%
Carbon Disulfide	3125.3	1,550,000	0.202%
Chloropicrin	3023.4	491,000**	0.616%
Chlorothalonil	38.6	34,000	0.114%
Chlorpyrifos	77.8	1,200	6.487%
Chlorpyrifos OA	13.4	1,200	1.116%
Cypermethrin	Not Detected (2.3)	113,000	0.002%
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
DDVP	25.9	11,000	0.235%
Diazinon	Trace (5.2)	130	4.023%
Diazinon OA	Trace (5.7)	130	4.377%
Dimethoate	Not Detected (1.2)	4,300	0.027%
Dimethoate OA	Not Detected (1.0)	4,300	0.023%
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Trace (13.2)	3,300	0.399%
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070%
EPTC	28.6	230,000	0.012%
Iprodione	14.7	939,000	0.002%
Malathion	10.5	112,500	0.009%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	0.023%
Methyl Bromide	2980.9	820,000**	0.364%
Metolachlor	Not Detected (1.4)	85,000	0.002%
MITC	373.0	66,000**	0.565%
Norflurazon	Trace (6.5)	170,000	0.004%
Oryzalin	62.4	420,000	0.015%
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003%
Oxyfluorfen	Trace (14.7)	510,000	0.003%
Permethrin	Trace (15.2)	168,000	0.009%
Phosmet	Not Detected (4.0)	77,000	0.005%
pp-Dicofol	Not Detected (1.1)	68,000	0.002%
Propargite	Trace (13.5)	14,000	0.096%
Simazine	Trace (5.3)	110,000	0.005%
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010%
Trifluralin	Trace (12.4)	1,200,000	0.001%

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

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

*New screening level was adopted after reevaluation on December 31, 2015.

**Regulatory target

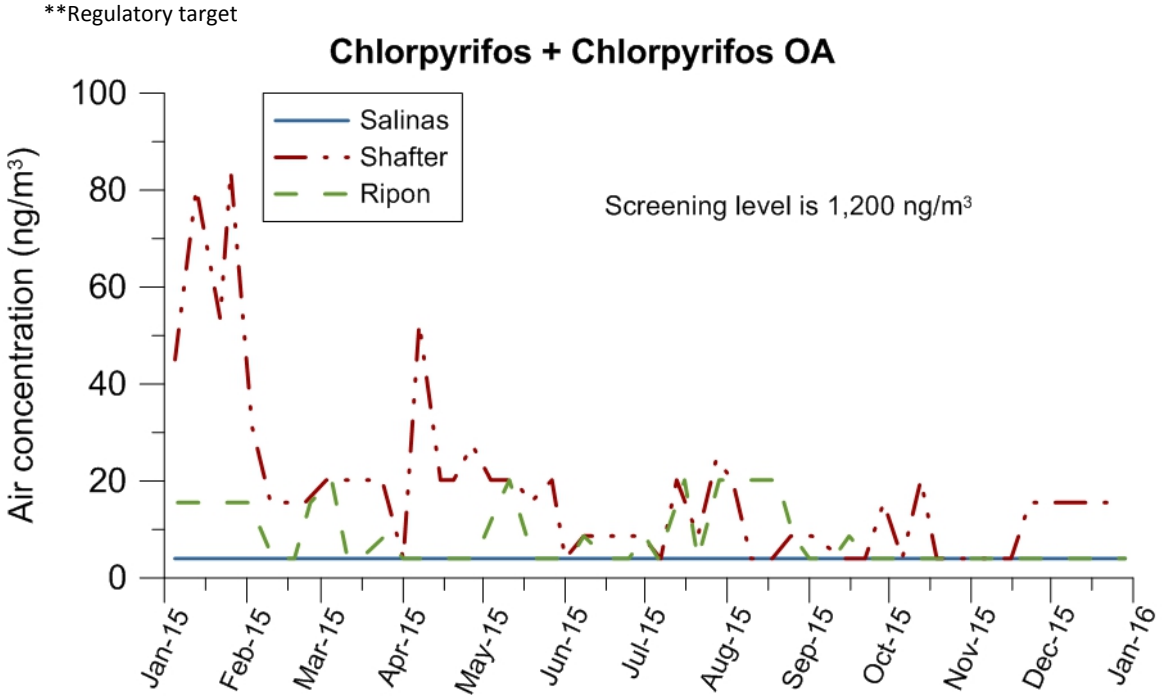

Figure 2. Highest 24-hour (acute) Chlorpyrifos + Chlorpyrifos OA concentrations detected at each of the three sampling locations.

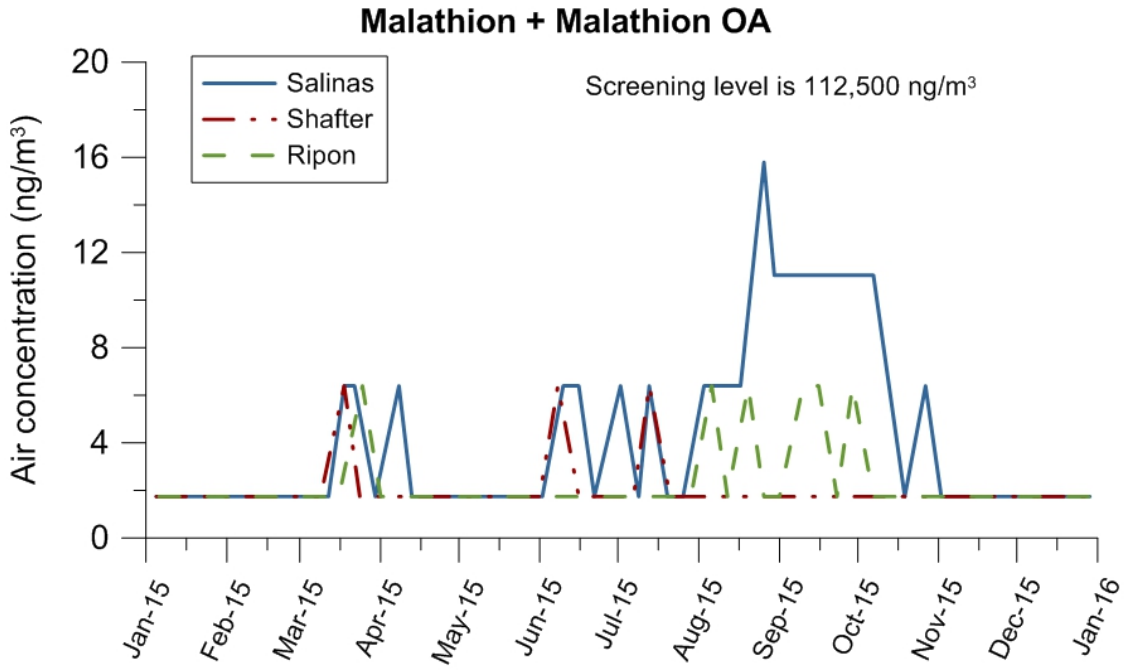

Figure 3. Highest 24-hour (acute) Malathion + Malathion OA concentrations detected at each of the three sampling locations.

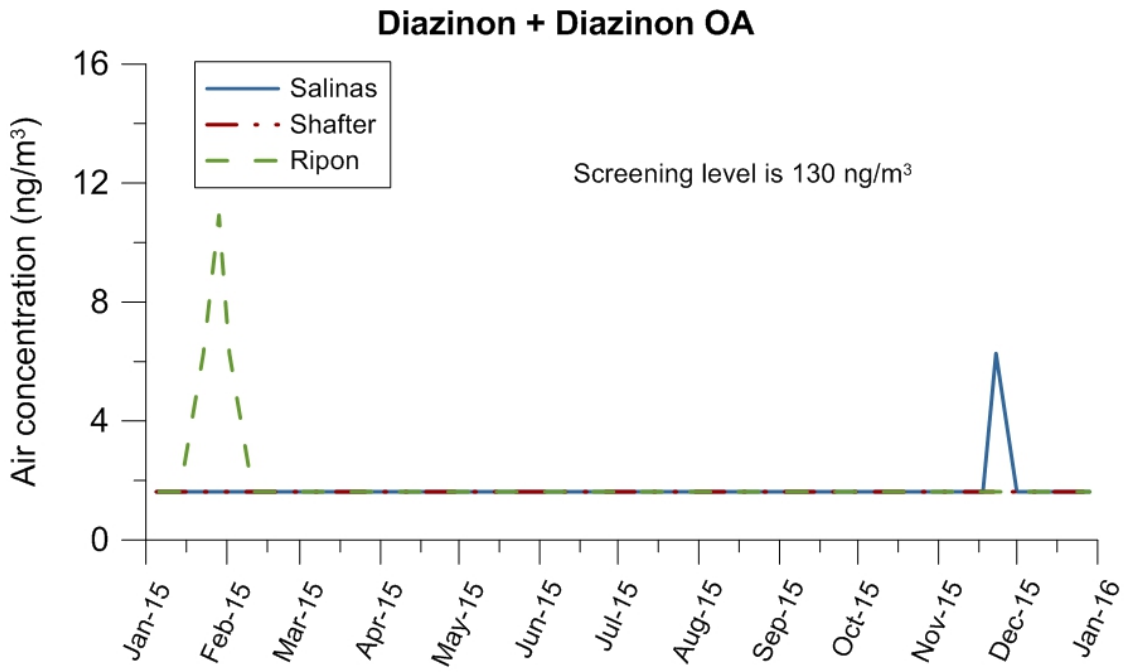

Figure 4. Highest 24-hour (acute) Diazinon + Diazinon OA concentrations detected at each of the three sampling locations.

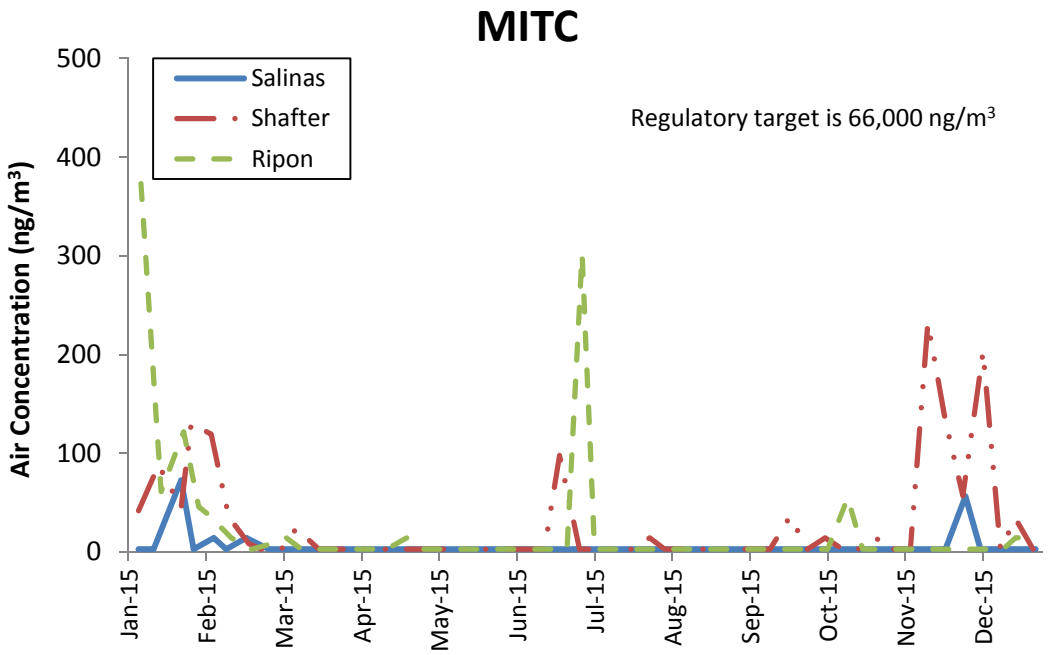

Figure 5. Highest 24-hour (acute) MITC concentrations detected at each of the three sampling locations.

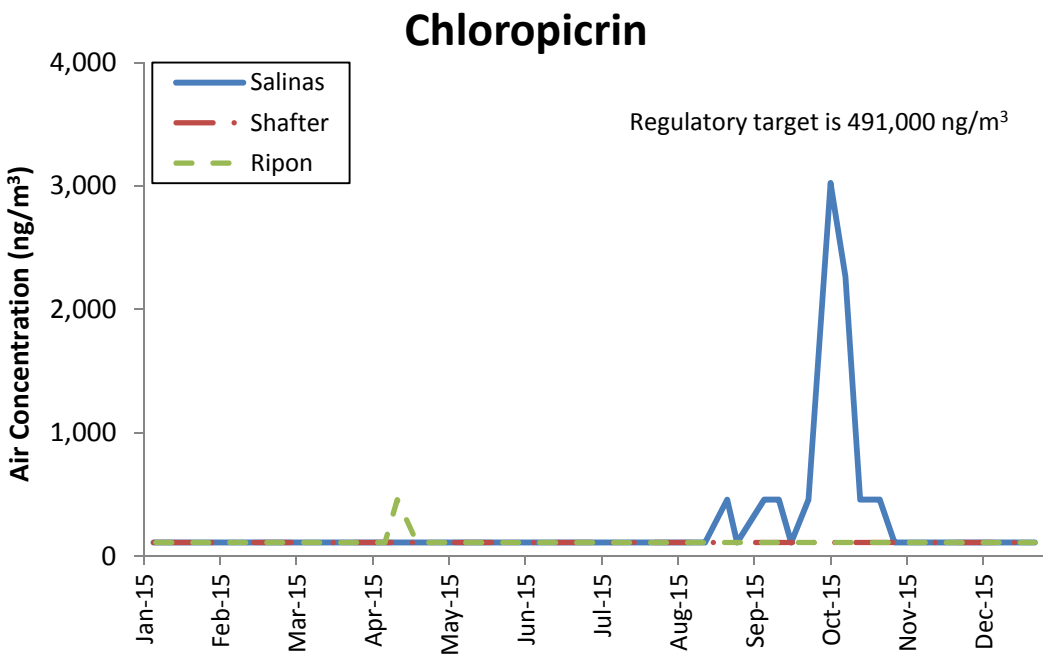

Figure 6. Highest 24-hour (acute) methyl bromide concentrations detected at each of three sampling locations.

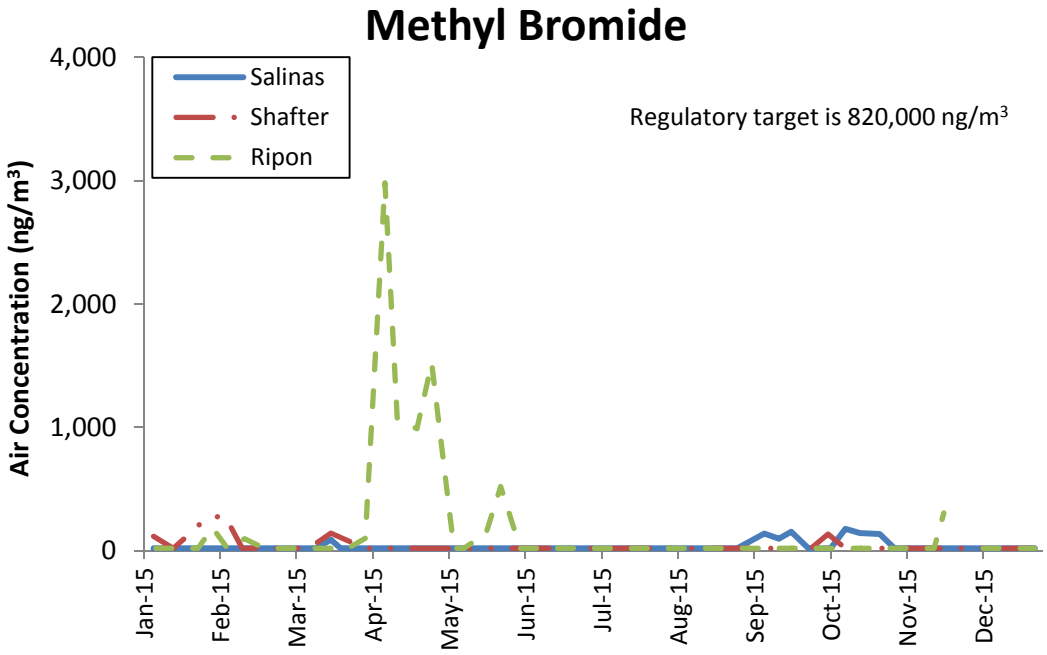

Figure 7. Highest 24-hour (acute) methyl bromide concentrations detected at each of three sampling locations.

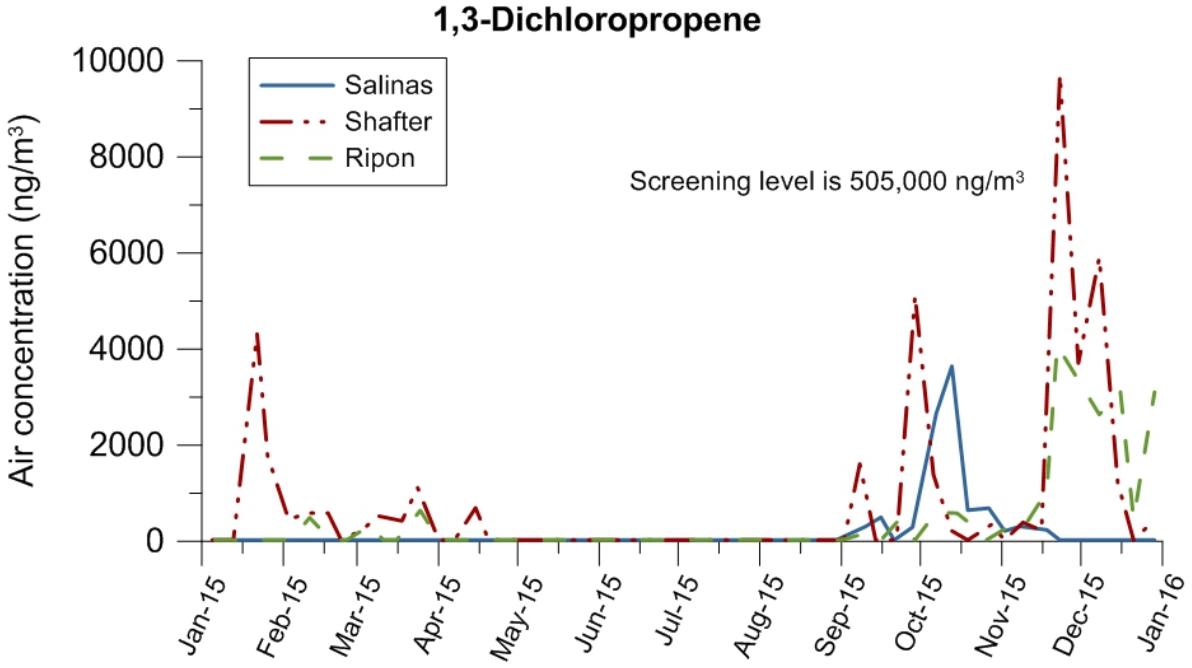

Figure 8. Highest 24-hour (acute) concentrations detected for the aggregate of *cis*- and *trans*-1,3-dichloropropene at each of three sampling locations.

Table 11 shows the highest rolling 4-week average concentrations, the subchronic screening levels, and the percent of the subchronic screening levels for each pesticide monitored. Thirty-five of the pesticides and breakdown products monitored had a highest rolling 4-week average concentration that was 8.4% or less of their subchronic screening levels. The pesticide with the highest subchronic exposure risk was chloropicrin, with a maximum rolling 4-week average concentration equivalent to 67.4% of its screening level. 1,3-Dichloropropene had the highest rolling 4-week average concentration of 5,138 ng/m^3 and it corresponded to 37% of its updated subchronic screening level of 14,000 ng/m^3 (DPR, 2015). In previous reports the subchronic screening level had been 120,000 ng/m^3. Methyl bromide and chlorpyrifos were the next highest, with maximum rolling 4-week average concentrations equivalent to 8.4% and 7.0% of their regulatory target or screening level, respectively. Figures 9 through 15 present the rolling 4-week average concentrations measured in any sample for each of the pesticides including a quantifiable detection that was from pesticidal use, compared with the subchronic screening level for the pesticide. The concentrations in figures 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 15 presents the highest rolling 4-week average concentrations measured for the sum of *cis*-1,3-dichloropropene and *trans*-1,3-dichloropropene from 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-wk rolling concentration (ng/m^3)†	Subchronic Screening Level (ng/m^3)	% of screening level‡
1,3-Dichloropropene	5,137.9	14,000*	36.699%
Acephate	0.5	8,500	0.006%
Bensulide	1.9	24,000	0.008%
Carbon Disulfide	1,565.0	800,000	0.196%
Chloropicrin	1,551.3	2,300	67.446%
Chlorothalonil	25.2	34,000	0.074%
Chlorpyrifos	59.6	850	7.014%
Chlorpyrifos OA	9.1	850	1.075%
Cypermethrin	2.3	81,000	0.003%
Chlorthal-dimethyl (DCPA)	5.5	470,000	0.001%
DDVP	10.3	2,200	0.467%
Diazinon	1.7	130	1.340%
Diazinon OA	4.5	130	3.483%
Dimethoate	1.2	3,000	0.039%
Dimethoate OA	1.0	3,000	0.032%
Diuron	6.1	17,000	0.036%
Endosulfan	10.3	3,300	0.312%
Endosulfan Sulfate	2.3	3,300	0.070%
EPTC	18.6	24,000	0.078%
Iprodione	12.1	286,000	0.004%
Malathion	6.9	80,600	0.009%
Malathion OA	5.3	80,600	0.007%
Methidathion	0.7	3,100	0.023%
Methyl Bromide	1,639.9	19,400**	8.453%
Metolachlor	1.4	15,000	0.009%
MITC	156.2	3,000	5.205%
Norflurazon	3.0	26,000	0.012%
Oryzalin	16.1	230,000	0.007%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	9.0	180,000	0.005%
Permethrin	6.5	90,000	0.007%
Phosmet	4.0	26,000	0.015%
pp-Dicofol	1.1	49,000	0.002%
Propargite	13.5	14,000	0.096%
Simazine	1.8	31,000	0.006%
SSS-tributyltriphosphorotrithioate (DEF)	0.9	8,800	0.010%
Trifluralin	6.6	170,000	0.004%

†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 percentage greater than 100% of the screening level suggests the need for further evaluation

*New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

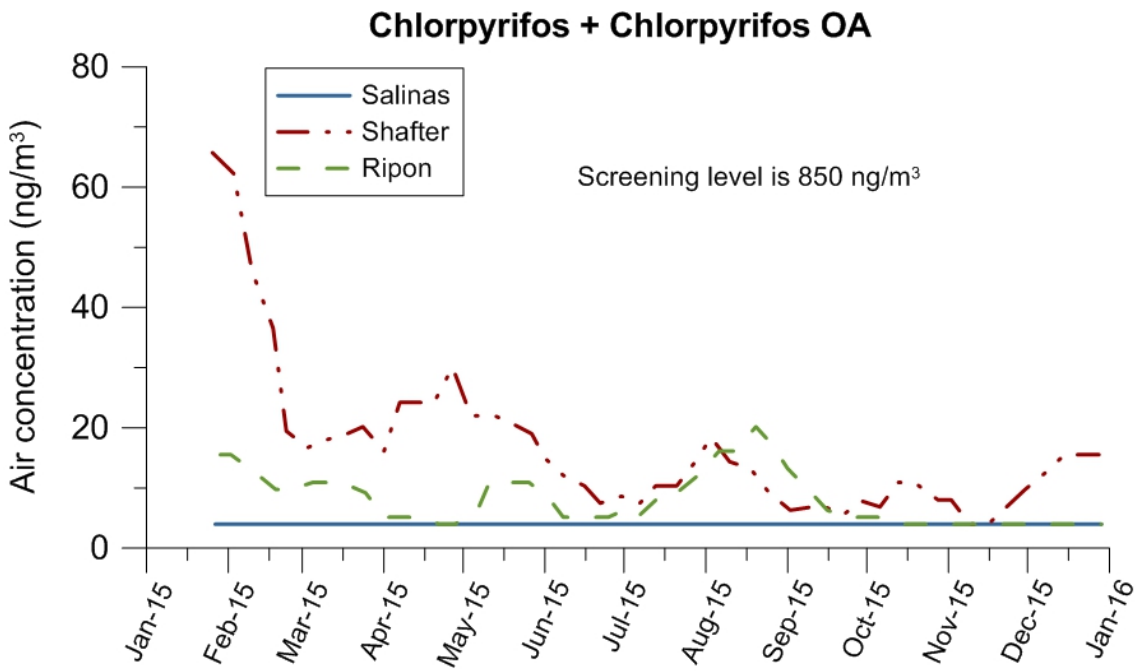

Figure 9. Rolling 4-week average (subchronic) Chlorpyrifos +Chlorpyrifos OA concentrations detected at each of the three monitoring locations.

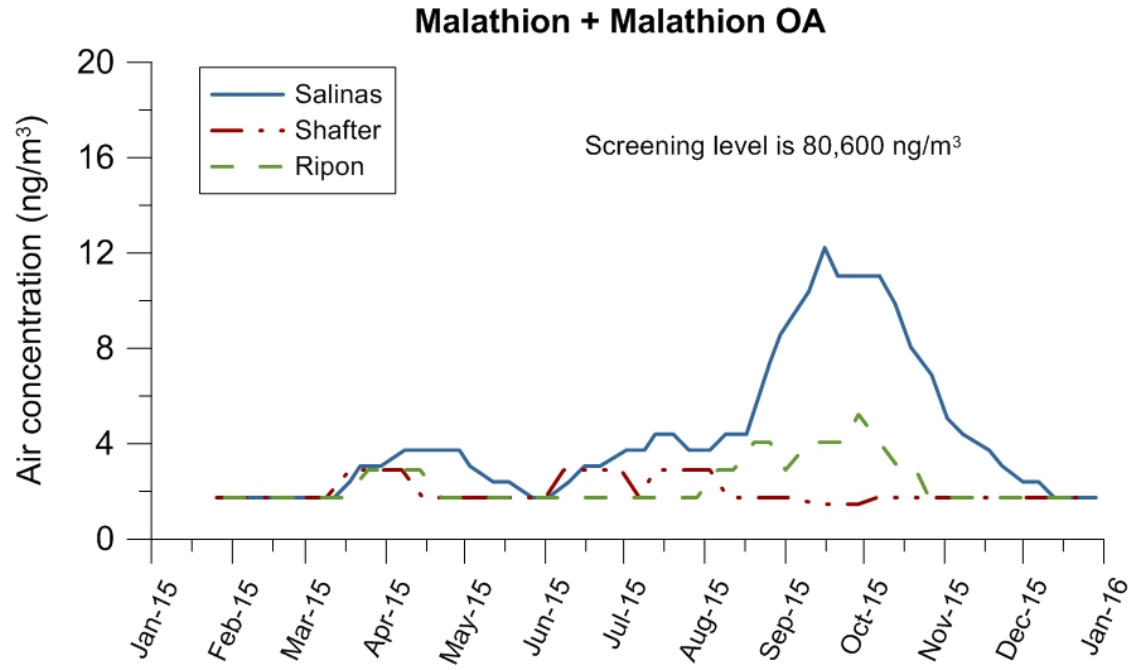

Figure 10. Rolling 4-week average (subchronic) Malathion + Malathion OA concentrations detected at each of the three monitoring locations.

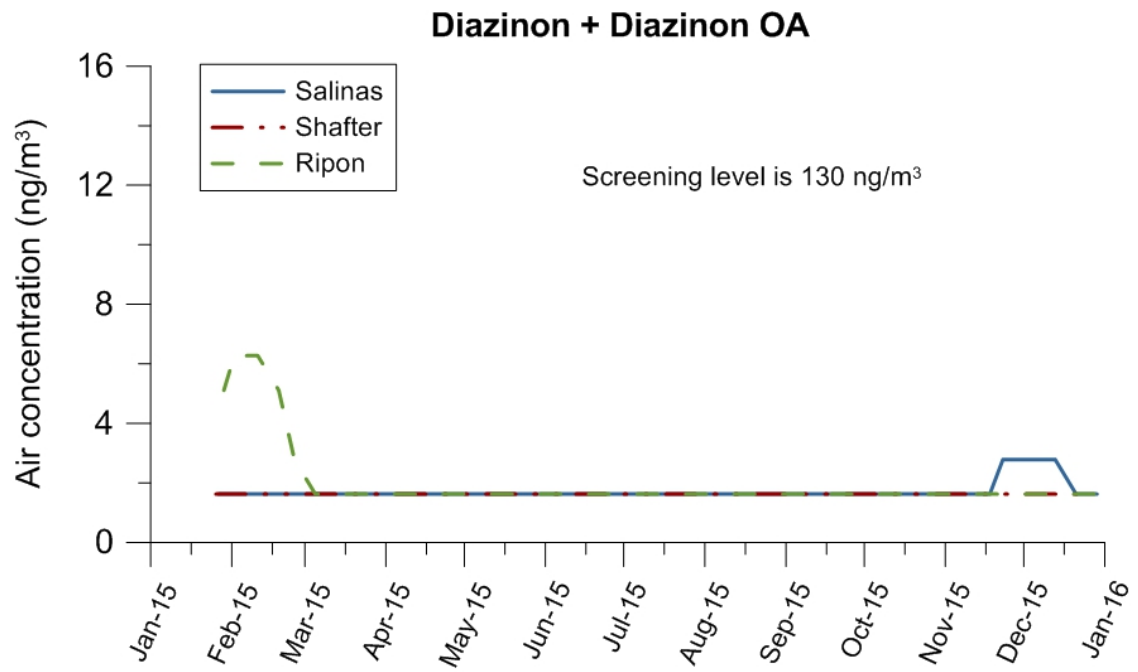

Figure11. Rolling 4-week average (subchronic) Diazinon + Diazinon OA concentrations detected at each of the three monitoring locations.

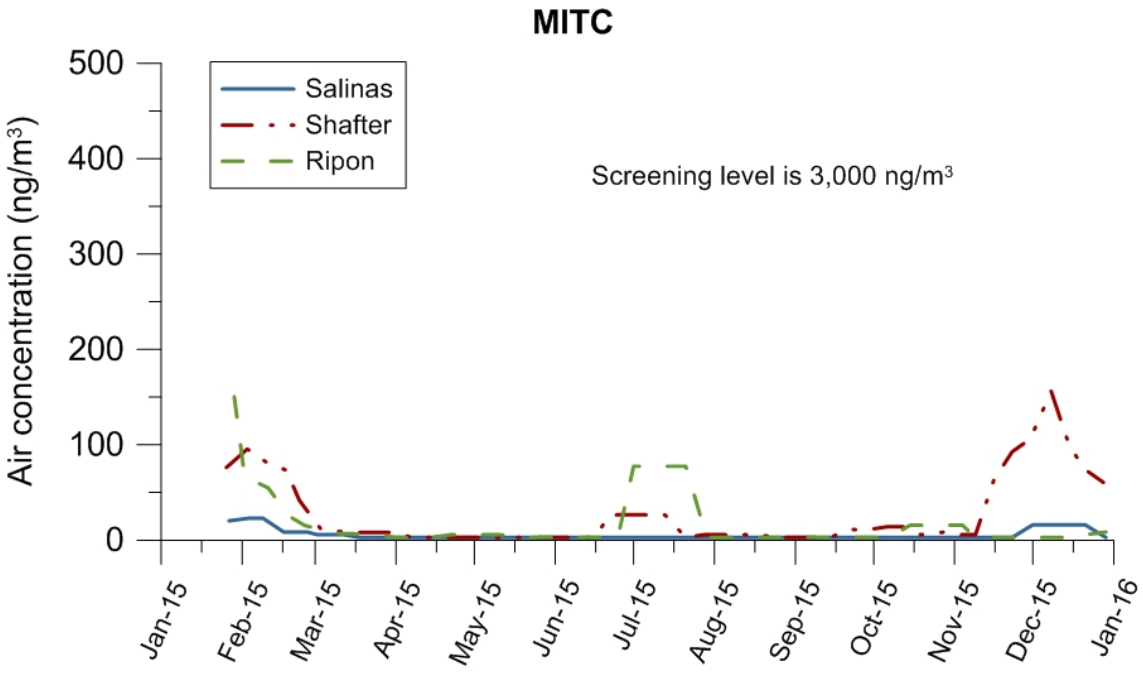

Figure 12. Rolling 4-week average (subchronic) MITC concentrations detected at each of the three monitoring locations.

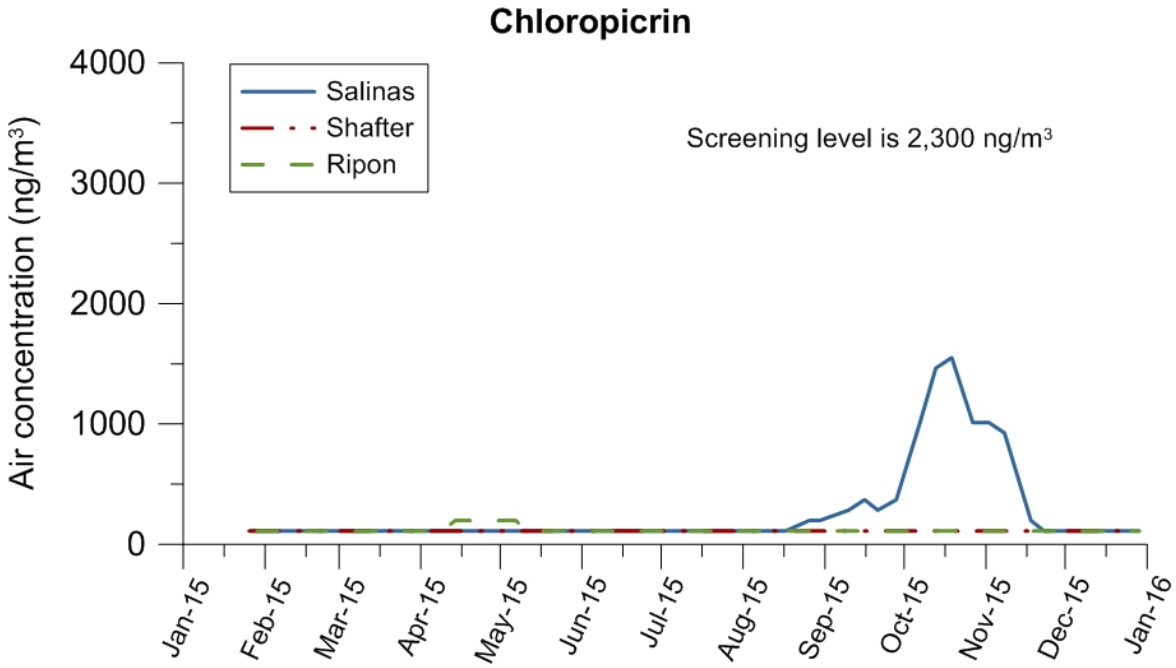

Figure 13. Rolling 4-week average (subchronic) Chloropicrin concentrations detected at each of the three monitoring locations.

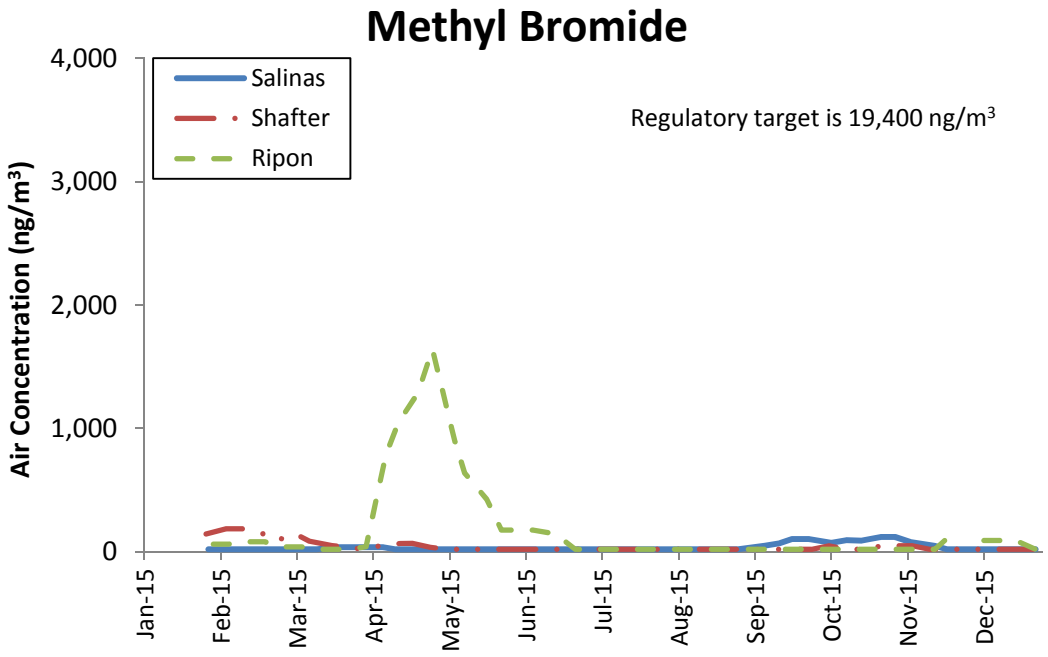

Figure 14. Rolling 4-week average (subchronic) methyl bromide concentrations detected at each of the three sampling locations.

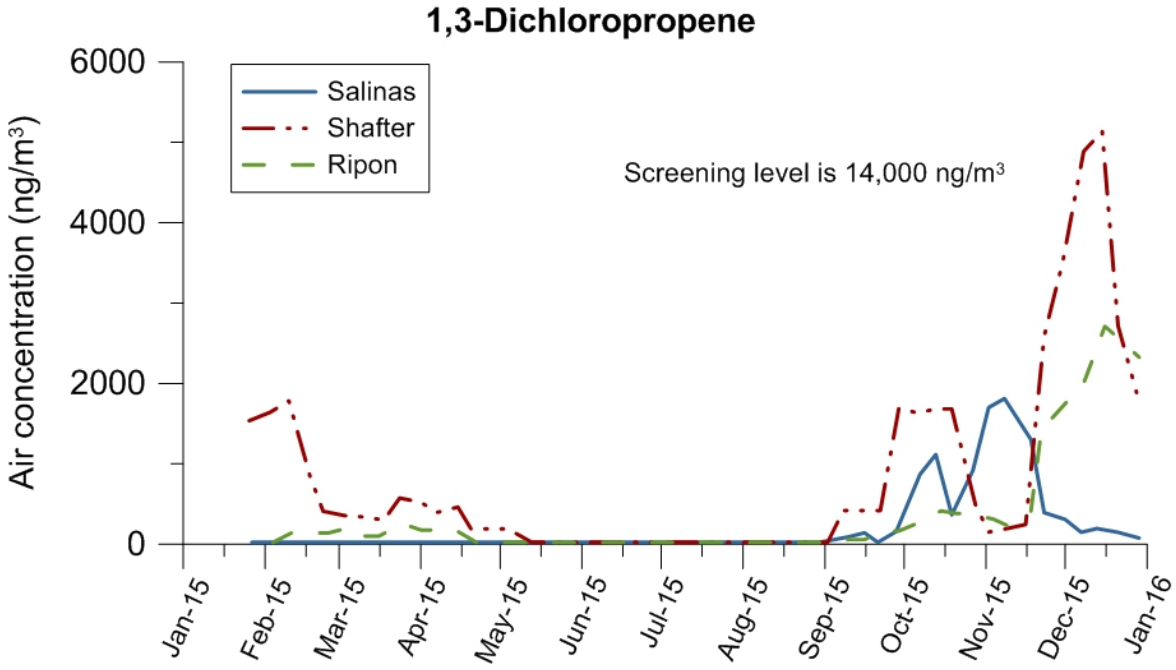

Figure 15. Rolling 4-week average (subchronic) concentrations detected for the aggregate of cis- and trans-1,3-dichloropropene at each of the three sampling locations.

Table 12 shows the 1-year average concentrations for all samples collected from January 1, 2015 to December 31, 2015. 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 (unquantifiable) concentrations. None of the pesticide 1-year average concentrations exceeded the screening levels for the chronic exposure period; all pesticides monitored had 1-year average concentrations that were 9% or less of their chronic screening level. Chloropicrin, MITC, and 1,3-dichloropropene had average concentrations with the highest percentage of their chronic screening level with 8.8%, 6.2%, and 5.1%, respectively. The highest 1-year average concentration measured for any pesticide was 460.6 ng/m^3 for 1,3-dichloropropene (5.1 % of its updated chronic screening level). The chronic screening level for 1,3-dichloropropene was updated to 120,000 ng/m^3 from to 9,000 ng/m^3 based on the 2015 inhalation risk assessment (DPR, 2015). The 1-year concentration of carbon disulfide and chloropicrin were 279.9 ng/m^3 and 159.1 ng/m^3 as the second and third highest concentrations in Table 12.

Table 13 summarizes the magnitude of the air concentrations relative to the screening levels for the 13 pesticides and breakdown products that had quantifiable concentrations in at least one sample from all sampling locations. No pesticide exceeded its screening levels for any of the exposure periods. Chlorpyrifos and 1,3-dicholoropropene had the highest acute risk, with maximum 24-hour concentrations that were 6.5% and 1.9% of their acute screening level, respectively.

Table 12. The 1-year average concentration for all chemicals from samples collected from January 1, 2015 through December 31, 2015.

Pesticide	Overall average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level†
1,3-Dichloropropene	460.6	9,000*	5.118%
Acephate	0.51	8,500	0.006%
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	279.9	800,000	0.035%
Chloropicrin	159.1	1,800	8.836%
Chlorothalonil	12.8	34,000	0.038%
Chlorpyrifos	7.3	510	1.432%
Chlorpyrifos OA	2.7	510	0.537%
Cypermethrin	2.3	27,000	0.009%
Chlorthal-dimethyl (DCPA)	1.9	47,000	0.004%
DDVP	3.0	770	0.395%
Diazinon	0.6	130	0.492%
Diazinon OA	1.1	130	0.869%
Dimethoate	1.2	300	0.385%
Dimethoate OA	1.0	300	0.323%
Diuron	2.8	5,700	0.049%
Endosulfan	1.8	330	0.559%
Endosulfan Sulfate	2.3	330	0.702%
EPTC	1.4	8,500	0.016%
Iprodione	1.2	286,000	0.000%
Malathion	1.3	8,100	0.016%
Malathion OA	1.5	8,100	0.018%
Methidathion	0.7	2,500	0.029%
Methyl Bromide	81.6	3,900	2.093%
Metolachlor	1.4	15,000	0.009%
MITC	18.6	300	6.187%
Norflurazon	1.9	26,000	0.007%
Oryzalin	1.7	232,000	0.001%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.4	51,000	0.007%
Permethrin	3.7	90,000	0.004%
Phosmet	4.0	18,000	0.022%
pp-Dicofol	1.1	20,000	0.005%
Propargite	2.3	14,000	0.017%
Simazine	0.7	31,000	0.002%
SSS-tributyltriphosphorotrithioate (DEF)	0.9	NA - Seasonal	
Trifluralin	1.1	41,000	0.003%

†A percentage greater than 100% of the screening level suggests the need for further evaluation.

*New screening level was adopted on December 31, 2015 (DPR, 2015).

Chloropicrin had the highest subchronic risk, with a highest rolling 4-week average concentration that was approximately 67.4% of its subchronic screening level. 1,3-Dicholoropropene had the second highest rolling 4-week average concentration which was approximately 36.7% of its subchronic screening level. Chloropicrin and MITC had the highest chronic risk, with 1-year average concentrations that were 8.8% and 6.2% of their chronic screening levels, respectively.

Table 13. Air concentrations relative to the 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	1.923%	36.699%	5.118%
Carbon Disulfide	0.202%	0.196%	0.035%
Chloropicrin	0.616%	67.446%	8.836%
Chlorothalonil	0.114%	0.074%	0.038%
Chlorpyrifos	6.487%	7.012%	1.432%
Chlorpyrifos OA	1.116%	1.071%	0.537%
DDVP	0.235%	0.467%	0.395%
EPTC	0.012%	0.078%	0.016%
Iprodione	0.002%	0.004%	0.000%
Malathion	0.009%	0.009%	0.016%
Methyl Bromide	0.364%	8.453%	2.093%
MITC	0.565%	5.207%	6.187%
Oryzalin	0.015%	0.007%	0.001%

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

Results for Salinas

Tables 14 through 16 give the highest 24-hour, rolling 4-week, and 1-year average concentrations for pesticides monitored in Salinas. None of the pesticides exceeded any of their screening levels. Although 1,3-dichloropropene was the pesticide with the highest measured 24-hour air concentration (3,643 ng/m^3), diazinon was the pesticide with the highest percentage of its acute screening level (4%) (Table 14). Table 15 shows that chloropicrin had the highest percentage of subchronic screening level (67.4%) with rolling 4-week average air concentration of 1,551.3 ng/m^3. Six pesticides were detected at quantifiable concentrations in Salinas: 1,3-dichloropropene, carbon disulfide, chloropicrin, malathion, methyl bromide, and MITC. Seven additional pesticides (or breakdown products) were detected at trace levels only (Table 14 and 15) and 24 pesticides (or breakdown products) were not detected at levels above their detection limit. Table 16 shows that 1,3-dichloropropene was the pesticide with the highest 24-hour and 4-week rolling concentration of 3,643 ng/m^3 (0.7% of its acute screening level) and 1,812 ng/m^3 (13% of its subchronic screening level), respectively. Chloropicrin produced the highest percentage of chronic screening level (13.8%) (Table 16). Cumulative exposure to organophosphate is discussed in a later section.

Table 14. Highest 24-hour concentrations for pesticides monitored in Salinas, California.

Pesticide	Highest 1-day concentration (ng/m^3)†	1-day acute screening level (ng/m^3)	% of screening level‡
1,3-Dichloropropene	3,643.0	505,000*	0.721%
Acephate	Not Detected (0.5)	12,000	0.004%
Bensulide	Trace (5.3)	259,000	0.002%
Carbon Disulfide	3,125.3	1,550,000	0.202%
Chloropicrin	3,023.4	491,000**	0.616%
Chlorothalonil	Trace (18.4)	34,000	0.054%
Chlorpyrifos	Not Detected (2.5)	1,200	0.210%
Chlorpyrifos OA	Not Detected (1.5)	1,200	0.122%
Cypermethrin	Not Detected (2.3)	113,000	0.002%
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
DDVP	Trace (13.2)	11,000	0.120%
Diazinon	Trace (5.2)	130	4.023%
Diazinon OA	Not Detected (1.0)	130	0.800%
Dimethoate	Not Detected (1.2)	4,300	0.027%
Dimethoate OA	Not Detected (1.0)	4,300	0.023%
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Not Detected (1.6)	3,300	0.049%
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070%
EPTC	Not Detected (0.8)	230,000	0.000%
Iprodione	Not Detected (0.5)	939,000	0.000%
Malathion	10.5	112,500	0.009%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	0.023%
Methyl Bromide	178.5	820,000**	0.022%
Metolachlor	Not Detected (1.4)	85,000	0.002%
MITC	72.8	66,000**	0.110%
Norflurazon	Not Detected (1.9)	170,000	0.001%
Oryzalin	Not Detected (0.7)	420,000	0.000%
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003%
Oxyfluorfen	Not Detected (3.2)	510,000	0.001%
Permethrin	Not Detected (3.6)	168,000	0.002%
Phosmet	Not Detected (4.0)	77,000	0.005%
pp-Dicofol	Not Detected (1.1)	68,000	0.002%
Propargite	Not Detected (1.9)	14,000	0.014%
Simazine	Not Detected (0.6)	110,000	0.001%
SSS-tributyl...(DEF)	Not Detected (0.9)	8,800	0.010%
Trifluralin	Not Detected (0.8)	1,200,000	0.000%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

Table15. Highest 4-week rolling concentrations for pesticides monitored in Salinas, California.

Pesticide	Highest 4-wk rolling concentration (ng/m^3)†	Subchronic Screening level (ng/m^3)	% of screening level‡
1,3-Dichloropropene	1,812.4	14,000*	19.362%
Acephate	0.51	8,500	0.006%
Bensulide	1.9	24,000	0.003%
Carbon Disulfide	944.7	800,000	0.196%
Chloropicrin	1,551.3	2,300	8.598%
Chlorothalonil	12.6	34,000	0.054%
Chlorpyrifos	2.5	850	1.656%
Chlorpyrifos OA	1.5	850	0.719%
Cypermethrin	2.3	81,000	0.003%
Chlorthal-dimethyl (DCPA)	5.5	470,000	0.000%
DDVP	10.3	2,200	0.467%
Diazinon	1.7	130	1.340%
Diazinon OA	1.0	130	3.483%
Dimethoate	1.2	3,000	0.039%
Dimethoate OA	1.0	3,000	0.032%
Diuron	3.7	17,000	0.022%
Endosulfan	1.6	3,300	0.312%
Endosulfan Sulfate	2.3	3,300	0.070%
EPTC	0.8	24,000	0.003%
Iprodione	0.5	286,000	0.004%
Malathion	6.9	80,600	0.001%
Malathion OA	5.3	80,600	0.005%
Methidathion	0.7	3,100	0.023%
Methyl Bromide	119.5	19,400**	8.453%
Metolachlor	1.4	15,000	0.009%
MITC	23.2	3,000	5.014%
Norflurazon	1.9	26,000	0.007%
Oryzalin	0.7	230,000	0.005%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.2	180,000	0.005%
Permethrin	3.6	90,000	0.007%
Phosmet	4.0	26,000	0.015%
pp-Dicofol	1.1	49,000	0.002%
Propargite	1.9	14,000	0.096%
Simazine	0.6	31,000	0.006%
SSS-tributyl...(DEF)	0.9	8,800	0.010%
Trifluralin	0.8	170,000	0.000%

† Concentrations are presented as rolling or moving averages (i.e., average of weeks 1,2,3, and 4; average of weeks 2,3,4, and 5, etc.). Number in parentheses is one-half the MDL for samples with no detectable amount, and a value halfway between the MDL and the LOQ for trace samples.

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

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	200.6	9,000*	4.218%
Acephate	0.5	8,500	0.006%
Bensulide	0.8	24,000	0.003%
Carbon Disulfide	272.8	800,000	0.044%
Chloropicrin	248.5	1,800	6.537%
Chlorothalonil	8.0	34,000	0.042%
Chlorpyrifos	2.5	510	1.105%
Chlorpyrifos OA	1.5	510	0.497%
Cypermethrin	2.3	27,000	0.009%
Chlorthal-dimethyl (DCPA)	3.9	47,000	0.002%
DDVP	3.6	770	0.386%
Diazinon	0.7	130	0.515%
Diazinon OA	1.0	130	1.006%
Dimethoate	1.2	300	0.385%
Dimethoate OA	1.0	300	0.323%
Diuron	2.7	5,700	0.048%
Endosulfan	1.6	330	0.693%
Endosulfan Sulfate	2.3	330	0.702%
EPTC	0.8	8,500	0.010%
Iprodione	0.5	286,000	0.001%
Malathion	1.8	8,100	0.013%
Malathion OA	2.3	8,100	0.015%
Methidathion	0.7	2,500	0.029%
Methyl Bromide	35.2	3,900	4.385%
Metolachlor	1.4	15,000	0.009%
MITC	5.6	300	7.583%
Norflurazon	1.9	26,000	0.007%
Oryzalin	0.7	232,000	0.001%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.2	51,000	0.008%
Permethrin	3.6	90,000	0.004%
Phosmet	4.0	18,000	0.022%
pp-Dicofol	1.1	20,000	0.005%
Propargite	1.9	14,000	0.023%
Simazine	0.6	31,000	0.002%
SSS-tributyl...(DEF)	0.9	NA - Seasonal	0.000%
Trifluralin	0.8	41,000	0.002%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

Results for Shafter

Tables 17 through 19 lists the highest 24-hour, highest 4-week rolling, and 1-year average concentrations for pesticides monitored in Shafter, respectively. No pesticide exceeded any of the screening levels.

Nine pesticides were detected at quantifiable concentrations: 1,3-dichloropropene, carbon disulfide, chlorothalonil, chlorpyrifos + OA, EPTC, methyl bromide, MITC, and oryzalin. Moreover, eight additional pesticides were detected at trace levels (Tables 17 and 18). Twenty pesticides (or breakdown products) were not detected. Chlorpyrifos, 1,3-dichloropropene, and chlorpyrifos OA had the highest 24-hour concentration relative to their screening levels with values of 6.5%, 1.9%, and 1.1 %, respectively (Table 17). Moreover, 1,3-dichloropropene, chlorpyrifos, MITC, and chloropicrin had the highest 4 week rolling concentrations relative to their screening level with values of 36.7%, 7.0%, 5.2%, and 4.8% of its screening level, respectively (Table 18). It can be observed from Table 19 that MITC had the highest 1-year average concentration relative to its screening level with a value of 9.1% (or 27.3 ng/m^3). Cumulative exposure to organophosphates is discussed in a later section.

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

Pesticide	Highest 1-day concentration (ng/m^3)†	1-day acute screening level (ng/m^3)	% of screening level‡
1,3-Dichloropropene	9713.3	505,000*	1.923%
Acephate	Not Detected (0.5)	12,000	0.004%
Bensulide	Not Detected (0.7)	259,000	0.000%
Carbon Disulfide	812.5	1,550,000	0.052%
Chloropicrin	Not Detected (111)	491,000**	0.023%
Chlorothalonil	38.6	34,000	0.114%
Chlorpyrifos	77.8	1,200	6.487%
Chlorpyrifos OA	13.4	1,200	1.116%
Cypermethrin	Not Detected (2.3)	113,000	0.002%
Chlorthal-dimethyl (DCPA)	Trace (5.5)	23,500,000	0.000%
DDVP	Trace (13.2)	11,000	0.120%
Diazinon	Not Detected (0.6)	130	0.446%
Diazinon OA	Not Detected (1.0)	130	0.800%
Dimethoate	Not Detected (1.2)	4,300	0.027%
Dimethoate OA	Not Detected (1.0)	4,300	0.023%
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Not Detected (1.6)	3,300	0.049%
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070%
EPTC	28.6	230,000	0.012%
Iprodione	Trace (12.1)	939,000	0.001%
Malathion	Not Detected (1.1)	112,500	0.001%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	0.023%
Methyl Bromide	283.3	820,000**	0.035%
Metolachlor	Not Detected (1.4)	85,000	0.002%
MITC	231.9	66,000**	0.351%
Norflurazon	Trace (6.5)	170,000	0.004%
Oryzalin	62.4	420,000	0.015%
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003%
Oxyfluorfen	Not Detected (3.2)	510,000	0.001%
Permethrin	Not Detected (3.6)	168,000	0.002%
Phosmet	Not Detected (4.0)	77,000	0.005%
pp-Dicofol	Not Detected (1.1)	68,000	0.002%
Propargite	Not Detected (1.9)	14,000	0.014%
Simazine	Trace (5.3)	110,000	0.005%
SSS-tributyl...(DEF)	Not Detected (0.9)	8,800	0.010%
Trifluralin	Trace (12.4)	1,200,000	0.001%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

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	5,137.9	14,000*	36.699%
Acephate	0.5	8,500	0.006%
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	410.1	800,000	0.051%
Chloropicrin	111.0	2,300	4.826%
Chlorothalonil	25.2	34,000	0.074%
Chlorpyrifos	59.6	850	7.014%
Chlorpyrifos OA	9.1	850	1.075%
Cypermethrin	2.3	81,000	0.003%
Chlorthal-dimethyl (DCPA)	2.0	470,000	0.000%
DDVP	7.4	2,200	0.336%
Diazinon	0.6	130	0.446%
Diazinon OA	1.0	130	0.800%
Dimethoate	1.2	3,000	0.039%
Dimethoate OA	1.0	3,000	0.032%
Diuron	6.1	17,000	0.036%
Endosulfan	1.6	3,300	0.049%
Endosulfan Sulfate	2.3	3,300	0.070%
EPTC	18.6	24,000	0.078%
Iprodione	9.2	286,000	0.003%
Malathion	1.1	80,600	0.001%
Malathion OA	1.8	80,600	0.002%
Methidathion	0.7	3,100	0.023%
Methyl Bromide	186.4	19,400**	0.961%
Metolachlor	1.4	15,000	0.009%
MITC	156.2	3,000	5.205%
Norflurazon	3.0	26,000	0.012%
Oryzalin	16.1	230,000	0.007%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.2	180,000	0.002%
Permethrin	3.6	90,000	0.004%
Phosmet	4.0	26,000	0.015%
pp-Dicofol	1.1	49,000	0.002%
Propargite	1.9	14,000	0.014%
Simazine	1.8	31,000	0.006%
SSS-tributyl...(DEF)	0.9	8,800	0.010%
Trifluralin	6.6	170,000	0.004%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

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	800.1	9,000*	8.890%
Acephate	0.5	8,500	0.006%
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	216.5	800,000	0.027%
Chloropicrin	111.0	1,800	6.167%
Chlorothalonil	16.0	34,000	0.047%
Chlorpyrifos	13.9	510	2.720%
Chlorpyrifos OA	4.2	510	0.833%
Cypermethrin	2.3	27,000	0.009%
Chlorthal-dimethyl (DCPA)	0.9	47,000	0.002%
DDVP	2.5	770	0.328%
Diazinon	0.6	130	0.446%
Diazinon OA	1.0	130	0.800%
Dimethoate	1.2	300	0.385%
Dimethoate OA	1.0	300	0.323%
Diuron	3.0	5,700	0.053%
Endosulfan	1.6	330	0.491%
Endosulfan Sulfate	2.3	330	0.702%
EPTC	2.6	8,500	0.030%
Iprodione	1.4	286,000	0.001%
Malathion	1.1	8,100	0.013%
Malathion OA	0.9	8,100	0.011%
Methidathion	0.7	2,500	0.029%
Methyl Bromide	40.4	3,900	1.036%
Metolachlor	1.4	15,000	0.009%
MITC	27.3	300	9.111%
Norflurazon	2.0	26,000	0.008%
Oryzalin	2.4	232,000	0.001%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.2	51,000	0.006%
Permethrin	3.6	90,000	0.004%
Phosmet	4.0	18,000	0.022%
pp-Dicofol	1.1	20,000	0.005%
Propargite	1.9	14,000	0.014%
Simazine	0.8	31,000	0.003%
SSS-tributyl...(DEF)	0.9	NA - Seasonal	0.000%
Trifluralin	1.7	41,000	0.004%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

Results for Ripon

Tables 20 through 22 show the highest 24-hour, highest 4-week rolling, and 1-year average concentrations for pesticides monitored in Ripon, respectively. None of the pesticides exceeded any of the screening levels. Eight pesticides were detected at quantifiable concentrations in Ripon: 1,3-dichloropropene, carbon disulfide, DDVP, iprodione, methyl bromide, MITC, oryzalin, and simazine. Twelve additional pesticides were detected at trace levels (Table 20). Seventeen pesticides were not detected. Diazinon OA and diazinon had the highest 24-hour concentration relative to its screening level (4.4% and 4.0 %) whereas 1,3-dicholoropropene was the pesticide with the highest 24-hour concentration of 4,074.0 ng/m^3. 1,3-dichloropropene had the highest rolling 4-week average concentration relative to its screening level (19.4% or 2,710.7 ng/m^3) (Table 21). Chloropicrin and methyl bromide followed 1,3-dichloropropene as having second and third highest percent of subchronic screening level (8.6% and 8.5 %, respectively).

Table 20. Highest 24-hour concentrations for pesticides 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	4074.0	505,000*	0.807%
Acephate	Not Detected (0.5)	12,000	0.004%
Bensulide	Not Detected (0.7)	259,000	0.000%
Carbon Disulfide	2842.0	1,550,000	0.183%
Chloropicrin	Trace (458.0)	491,000**	0.093%
Chlorothalonil	Trace (18.4)	34,000	0.054%
Chlorpyrifos	Trace (14.1)	1,200	1.173%
Chlorpyrifos OA	Trace (6.1)	1,200	0.509%
Cypermethrin	Not Detected (2.3)	113,000	0.002%
Chlorthal-dimethyl (DCPA)	Not Detected (0.8)	23,500,000	0.000%
DDVP	25.9	11,000	0.235%
Diazinon	Trace (5.2)	130	4.023%
Diazinon OA	Trace (5.7)	130	4.377%
Dimethoate	Not Detected (1.2)	4,300	0.027%
Dimethoate OA	Not Detected (1.0)	4,300	0.023%
Diuron	Trace (7.2)	170,000	0.004%
Endosulfan	Trace (13.2)	3,300	0.399%
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070%
EPTC	Not Detected (0.8)	230,000	0.000%
Iprodione	14.7	939,000	0.002%
Malathion	Not Detected (1.1)	112,500	0.001%
Malathion OA	Trace (5.3)	112,500	0.005%
Methidathion	Not Detected (0.7)	3,100	0.023%
Methyl Bromide	2980.9	820,000**	0.364%
Metolachlor	Not Detected (1.4)	85,000	0.002%
MITC	373.0	66,000**	0.565%
Norflurazon	Not Detected (1.9)	170,000	0.001%
Oryzalin	44.8	420,000	0.011%
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003%
Oxyfluorfen	Trace (14.7)	510,000	0.003%
Permethrin	Trace (15.2)	168,000	0.009%
Phosmet	Not Detected (4.0)	77,000	0.005%
pp-Dicofol	Not Detected (1.1)	68,000	0.002%
Propargite	Trace (13.5)	14,000	0.096%
Simazine	5.3	110,000	0.005%
SSS-tributyl...(DEF)	Not Detected (0.9)	8,800	0.010%
Trifluralin	Not Detected (0.8)	1,200,000	0.000%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

Table 21. Highest 4-week rolling concentrations 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	2,710.7	14,000*	19.362%
Acephate	0.5	8,500	0.006%
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	1,565.0	800,000	0.196%
Chloropicrin	197.8	2,300	8.598%
Chlorothalonil	18.4	34,000	0.054%
Chlorpyrifos	14.1	850	1.656%
Chlorpyrifos OA	6.1	850	0.719%
Cypermethrin	2.3	81,000	0.003%
Chlorthal-dimethyl (DCPA)	0.8	47,000	0.002%
DDVP	10.3	2,200	0.467%
Diazinon	1.7	130	1.340%
Diazinon OA	4.5	130	3.483%
Dimethoate	1.2	3,000	0.039%
Dimethoate OA	1.0	3,000	0.032%
Diuron	3.7	17,000	0.022%
Endosulfan	10.3	3,300	0.312%
Endosulfan Sulfate	2.3	3,300	0.070%
EPTC	0.8	24,000	0.003%
Iprodione	12.1	286,000	0.004%
Malathion	1.1	80,600	0.001%
Malathion OA	4.1	80,600	0.005%
Methidathion	0.7	3,100	0.023%
Methyl Bromide	1,639.9	19,400**	8.453%
Metolachlor	1.4	15,000	0.009%
MITC	150.4	3,000	5.014%
Norflurazon	1.9	26,000	0.007%
Oryzalin	11.7	230,000	0.005%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	9.0	180,000	0.005%
Permethrin	6.5	90,000	0.007%
Phosmet	4.0	26,000	0.015%
pp-Dicofol	1.1	49,000	0.002%
Propargite	13.5	14,000	0.096%
Simazine	1.8	31,000	0.006%
SSS-tributyl...(DEF)	0.9	8,800	0.010%
Trifluralin	0.8	170,000	0.000%

†Concentrations are presented as rolling or moving averages (i.e., average of weeks 1,2,3, and 4; average of weeks 2,3,4, and 5, etc.). Number in parentheses is one-half the MDL for samples with no detectable amount, and a value halfway between the MDL and the LOQ for trace samples.

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

* New screening level was adopted after reevaluation on December 31, 2015.

**regulatory target

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	379.6	9,000*	4.218%
Acephate	0.51	8,500	0.006%
Bensulide	0.7	24,000	0.003%
Carbon Disulfide	351.6	800,000	0.044%
Chloropicrin	117.7	1,800	6.537%
Chlorothalonil	14.4	34,000	0.042%
Chlorpyrifos	5.6	510	1.105%
Chlorpyrifos OA	2.5	510	0.497%
Cypermethrin	2.3	27,000	0.009%
Chlorthal-dimethyl (DCPA)	0.8	47,000	0.002%
DDVP	3.0	770	0.386%
Diazinon	0.7	130	0.515%
Diazinon OA	1.3	130	1.006%
Dimethoate	1.2	300	0.385%
Dimethoate OA	1.0	300	0.323%
Diuron	2.7	5,700	0.048%
Endosulfan	2.3	330	0.693%
Endosulfan Sulfate	2.3	330	0.702%
EPTC	0.8	8,500	0.010%
Iprodione	1.6	286,000	0.001%
Malathion	1.1	8,100	0.013%
Malathion OA	1.2	8,100	0.015%
Methidathion	0.7	2,500	0.029%
Methyl Bromide	171.0	3,900	4.385%
Metolachlor	1.4	15,000	0.009%
MITC	22.7	300	7.583%
Norflurazon	1.9	26,000	0.007%
Oryzalin	2.0	232,000	0.001%
Oxydemeton methyl	1.2	610	0.189%
Oxyfluorfen	3.9	51,000	0.008%
Permethrin	3.8	90,000	0.004%
Phosmet	4.0	18,000	0.022%
pp-Dicofol	1.1	20,000	0.005%
Propargite	3.2	14,000	0.023%
Simazine	0.7	31,000	0.002%
SSS-tributyl...(DEF)	0.9	NA - Seasonal	
Trifluralin	0.8	41,000	0.002%

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

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

* New screening level was adopted after reevaluation on December 31, 2015.

Cumulative Exposure Estimates

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

As shown in Table 23, 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. Table 22 indicates that Shafter had a higher hazard index than Salinas and Ripon for subchronic and chronic exposure periods. However, Ripon had a higher acute hazard index than other two stations. The acute hazard indices were higher for Ripon and Salinas in comparison to their respective subchronic and chronic hazard indices. Overall, Shafter was the only AMN station that had a higher subchronic hazard index than its acute and chronic hazard indices.

Table 23. Summary of organophosphate cumulative exposure.

Community	Acute hazard index†	Subchronic hazard index†	Chronic hazard index†
Salinas	0.054	0.034	0.035
Shafter	0.090	0.100	0.061
Ripon	0.104	0.080	0.045

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

As shown in Tables 24 through 32, all three sampling locations had at least one quantifiable concentration of an organophosphate. All three communities had trace levels for several organophosphates. Five of the 14 organophosphates or OAs was detected in at least one sample in Salinas: bensulide, DDVP, diazinon, malathion, and malathion OA. Four of the 14 organophosphates or OAs were detected in at least one sample in Shafter: chlorpyrifos, chlorpyrifos OA, DDVP, and malathion OA. Six of the 14 organophosphates or OAs were detected in at least one sample in Ripon: chlorpyrifos, chlorpyrifos OA, DDVP, diazinon, diazinon OA, and malathion OA.

Acephate, dimethoate, dimethoate OA, oxydemeton-methyl, phosmet, and DEF were not detected at any of three AMN communities at any exposure period (Tables 24 through 32). As in 2014, chlorpyrifos (plus its OA) accounted for most of the organophosphate cumulative exposure for all exposure periods in 2015. Chlorpyrifos and its oxygen analog accounted for 6.2% - 84% of the organophosphate cumulative exposure, depending on the community and exposure period.

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	Trace (5.3)	259,000	0.000
Chlorpyrifos	Not Detected (2.5)	1,200	0.002
Chlorpyrifos OA	Not Detected (1.5)	1,200	0.001
DDVP	Trace (13.2)	11,000	0.001
Diazinon	Trace (5.2)	130	0.040
Diazinon OA	Not Detected (1.0)	130	0.008
Dimethoate	Not Detected (1.2)	4,300	0.000
Dimethoate OA	Not Detected (1.0)	4,300	0.000
Malathion	10.5	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			**0.054**

† Number in parentheses is 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 quoΘent‡
Acephate	0.51	8,500	0.000
Bensulide	1.9	24,000	0.000
Chlorpyrifos	2.5	850	0.003
Chlorpyrifos OA	1.5	850	0.002
DDVP	10.3	2,200	0.005
Diazinon	1.7	130	0.013
Diazinon OA	1.0	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	6.9	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			**0.034**

† 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.). Number in parentheses is 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 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 quoϴent‡
Acephate	0.51	8,500	0.000
Bensulide	0.8	24,000	0.000
Chlorpyrifos	2.5	510	0.005
Chlorpyrifos OA	1.5	510	0.003
DDVP	3.6	770	0.005
Diazinon	0.7	130	0.005
Diazinon OA	1.0	130	0.008
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.8	8,100	0.000
Malathion OA	2.3	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl...(DEF)	0.9	NA - Seasonal	NA
Hazard Index			**0.035**

† Number in parentheses is 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 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 quoϴent‡
Acephate	Not Detected (0.5)	12,000	0.000
Bensulide	Not Detected (0.7)	259,000	0.000
Chlorpyrifos	77.8	1,200	0.065
Chlorpyrifos OA	13.4	1,200	0.011
DDVP	Trace (13.2)	11,000	0.001
Diazinon	Not Detected (0.6)	130	0.004
Diazinon OA	Not Detected (1.0)	130	0.008
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	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			**0.090**

† Number in parentheses is 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	0.51	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	59.6	850	0.070
Chlorpyrifos OA	9.1	850	0.011
DDVP	7.4	2,200	0.003
Diazinon	0.6	130	0.004
Diazinon OA	1.0	130	0.008
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	1.1	80,600	0.000
Malathion OA	1.8	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			**0.100**

† 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.). Number in parentheses is 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 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 quoϴent‡
Acephate	0.51	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	13.9	510	0.027
Chlorpyrifos OA	4.2	510	0.008
DDVP	2.5	770	0.003
Diazinon	0.6	130	0.004
Diazinon OA	1.0	130	0.008
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.1	8,100	0.000
Malathion OA	0.9	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl...(DEF)	0.9	NA - Seasonal	NA
Hazard Index			**0.061**

† Number in parentheses is 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 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 quoΘent‡
Acephate	Not Detected (0.5)	12,000	0.000
Bensulide	Not Detected (0.7)	259,000	0.000
Chlorpyrifos	Trace (14.1)	1,200	0.012
Chlorpyrifos OA	Trace (6.1)	1,200	0.005
DDVP	25.9	11,000	0.002
Diazinon	Trace (5.2)	130	0.040
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	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			**0.104**

† Number in parentheses is 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 quoΘent‡
Acephate	0.5	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	14.1	850	0.017
Chlorpyrifos OA	6.1	850	0.007
DDVP	10.3	2,200	0.005
Diazinon	1.7	130	0.013
Diazinon OA	4.5	130	0.035
Dimethoate	1.2	3,000	0.000
Dimethoate OA	1.0	3,000	0.000
Malathion	1.1	80,600	0.000
Malathion OA	4.1	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			**0.080**

† 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.). Number in parentheses is 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 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 quoΘent‡
Acephate	0.51	8,500	0.000
Bensulide	0.7	24,000	0.000
Chlorpyrifos	5.6	510	0.011
Chlorpyrifos OA	2.5	510	0.005
DDVP	3.0	770	0.004
Diazinon	0.7	130	0.005
Diazinon OA	1.3	130	0.010
Dimethoate	1.2	300	0.004
Dimethoate OA	1.0	300	0.003
Malathion	1.1	8,100	0.000
Malathion OA	1.2	8,100	0.000
Oxydemeton methyl	1.2	610	0.002
Phosmet	4.0	18,000	0.000
SSS-tributyl...(DEF)	0.9	NA - Seasonal	NA
Hazard Index			**0.045**

† Number in parentheses is 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.

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 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 of $(mg/kg\text{-}day)^{-1}$. 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). 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) X (chronic air concentration) X (respiratory rate). Alternatively, the 1,3-dichloropropene cancer risk can be expressed relative to DPR's regulatory target concentration of 2,600 ng/m^3 (cancer potency X respiratory rate, and converting units). DPR is working on calculating a cancer potency value for chlorothalonil to be used in future cancer risk estimates for this pesticide.

The concentration is calculated as an average of the monthly averages of the measured concentrations over the year of sampling. Since most of the samples resulted 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 has such a significant effect on the cancer risk estimates, three different estimates were calculated using 2011–2015 averages (Table 33). In addition to uncertainty in the data, the estimate assumes that the chronic exposure occurs every single day for a lifetime (70 years). However, this assumption is consistent with standard risk assessment procedures.

As described in the next section, the cancer risk estimates for 1,3-dichloropropene were calculated by treating samples with no detectable concentrations as having concentrations of 0 (Minimum), 1/2*MDL (Standard), or MDL (Maximum):

Table 33. Five-year average minimum, standard, and maximum cancer risk estimates for 1,3-dichloropropene for each AMN sampling location (2011-2015).

Sampling location	Minimum (ND = 0*MDL)*	Standard (ND=1/2*MDL)**	Maximum (ND = MDL)***	Goal
Salinas	8.64E-07	1.43E-06	2.04E-06	1.00E-05
Shafter	3.09E-06	3.67E-06	4.29E-06	1.00E-05
Ripon	1.49E-06	2.08E-06	2.72E-06	1.00E-05

* Cancer risk estimates were calculated using a concentration of 0 ng/m^3 for samples with no detectable concentrations.
** Cancer risk estimates were calculated using ½*MDL for samples with no detectable concentrations (standard method).
*** Cancer risk estimates were calculated using MDL for samples with no detectable concentrations.

The method of calculation determines whether the risk is considered negligible or above that. 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, this is equivalent to a concentration of 2,600 ng/m^3 as a 70-year average. Using any of the methods of calculation for no detectable samples, the air concentrations at all sites showed that for the five years, 1,3-dichloropropene was detected at an average concentration below the regulatory target concentration (Table 34).

Table 34. Year-by-year and 5-year average air concentration (standard method) for 1,3-dichloropropene for each sampling location.

Sampling location	Air concentration (ng/m^3)†					2011-2015 Average concentration (ng/m^3)‡	Lifetime (70 year) Regulatory Target concentration (ng/m^3)
	2011	2012	2013	2014	2015		
Salinas	759	360	407	33	201	287	2,600
Shafter	ND*	453	2,589	909	800	1,062	2,600
Ripon	851	ND	914	302	380	484	2,600

† Air concentrations were calculated using 1/2*MDL for samples with no detectable concentrations (standard method).
‡ 5-year average concentration.
*ND = Not Detected.

Uncertainty of Air Concentrations - Treatment of ND and Trace Samples

To determine the impact of DPR's practice of substituting a value of ½MDL for samples with no detectable amount and substituting the midpoint between the MDL and the LOQ for trace samples, various highest rolling 4-week average concentrations and 1-year average concentrations were calculated for pesticides with at least one detectable concentration using two alternative methods of treating samples with no detectable and trace concentrations. Table 35 shows various highest rolling 4-week average concentrations and 1-year average concentrations determined by using a "minimum", a "standard", and a "maximum" method. Minimum average concentrations are calculated using a value of 0 ng/m^3 for samples with no detectable amount and by using the MDL for trace samples. Standard average concentrations are calculated by using a value of one-half of the MDL for samples with no detectable amount and substituting the midpoint between the MDL and the LOQ for trace samples. Maximum

average concentrations were calculated using the MDL for samples with no detectable amount and substituting the LOQ for all trace detections.

The difference between maximum and minimum values for rolling 4-week averages varied from 0% to 8% depending on the pesticide in question, while the difference in the 1-year average concentrations contained more variance for some pesticides ranging from 1% to 132%. Overall compared to the screening level, employing the 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, with chloropicrin's subchronic screening level and 1,3-dichloropropene's cancer risk being exceptions, and thus the standard method provides more of an accurate midpoint representation of the actual environmental concentrations for the target pesticides.

Table 35. Minimum, standard, and maximum highest rolling 4-week average concentrations and 1-year 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	Minimum 1-year average concentration (ng/m^3)	Standard 1-year average concentration (ng/m^3)	Maximum 1-year average (ng/m^3)	Percent Difference between maximum and minimum
1,3-Dichloropropene	5,138	5,138	5,138	0%	445	461	476	7%
Carbon Disulfide	1,565	1,565	1,565	0%	278	280	281	1%
Chloropicrin	1,551	1,551	1,551	0%	54	159	264	132%
Chlorothalonil	25	25	25	0%	9	13	16	54%
Chlorpyrifos	60	60	60	0%	3	7	11	111%
Chlorpyrifos OA	9	9	9	0%	2	3	4	80%
DDVP	10	10	11	8%	2	3	4	94%
EPTC	19	19	19	0%	1	1	2	115%
Iprodione	12	12	12	0%	1	1	2	83%
Malathion	13	13	13	0%	1	2	3	130%
Methyl Bromide	1,640	1,640	1,640	0%	65	82	98	41%
MITC	156	156	156	0%	16	19	21	23%
Oryzalin	16	16	17	6%	1	2	2	80%

AIR MONITORING NETWORK TREND ANALYSIS

This report covers results from the fifth 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). Table 36 summarizes the detection trend of monitored pesticides from 2011 to 2015 samples. The initial number of pesticides monitored by the AMN was 39 in 2011 (34 pesticides and 5 breakdown products). On January 1, 2012, Acrolein was dropped from AMN monitoring study since 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.

Table 36. Summary of pesticide detection trend during 2011-2015 Air Monitoring Network study.

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

*Includes all pesticides that were monitored as part of the AMN for that year
†Includes both quantified and trace detections

From table 36, it can be observed that 2012 was the year with both the highest number of non-detected samples and the lowest number of quantifiable samples among all AMN sampling years. Conversely, 2015 had the highest number of both total detected samples (606) and total quantifiable samples (306) among all AMN sampling years. Percent of non-detected samples relative to their corresponding total analyses ranged from 89.7% (2015) to 94.5% (2012).

Of the 32 pesticides and 5 pesticide breakdown products monitored by DPR in 2015, 26 were detected in at least one sample. None of the pesticides exceeded their current screening level in 2015. All concentrations were low relative to their respective screening levels. A total of 5,892 analyses were conducted on the air samples collected from all three sampling locations from January 1, 2015 to December 31, 2015. Of the 5,892 analyses, 606 (10.3%) showed detectable concentrations, which included quantifiable and trace detections. Samples with quantifiable concentrations accounted for 5.2% (306) of all analyses conducted which indicated an increasing trend starting from 2012. Quantifiable detections refer to concentrations above the LOQ for their respective pesticide. Eleven of the 32 pesticides and 5 pesticide breakdown products monitored by DPR were not detected.

Table 37 shows the highest 24-hour concentrations from all three AMN sampling locations from 2011, 2012, 2013, 2014, and 2015. Concentrations measured in 2012 were relatively lower than the concentrations measured in 2011 for most pesticides monitored with the exception of chlorpyrifos, chlorpyrifos OA, and carbon disulfide both of which were not detected in 2011 but had quantifiable concentrations in 2012. Similarly, concentrations measured in 2013 were both lower and higher than concentrations measured in 2011 or 2012, depending on the pesticide monitored. Each of the previously detected pesticides (either in 2011 or 2012) were also detected in 2013 at quantifiable or at trace concentrations in at least one sampling location. Generally, the quantifiable concentrations in 2014 are lower than the ones in 2013 except methyl bromide and chlorothalonil in Shafter and carbon disulfide in Salinas. All quantifiable concentrations in 2015 were generally lower than measured concentrations previously detected anytime from 2011 - 2014. Carbon disulfide in both Salinas and Ripon, and methyl bromide concentrations in Ripon were detected in 2015 at slightly higher concentrations than previously

measured by the AMN. Additionally, in 2015, two pesticides (iprodione in Ripon and malathion in Salinas) were measured at quantifiable concentrations which hadn't been detected previously.

Table 38 shows the highest rolling 4-week average concentrations from all three AMN sampling locations from 2011 through 2015. 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.). Although, most concentrations measured in 2012 were relatively lower than the concentrations measured in 2011 for most pesticides monitored, the highest rolling 4-week average concentrations for chlorpyrifos, chlorpyrifos OA, DDVP, and diuron all were higher in 2012 compared to the highest rolling 4-week average concentrations from 2011. Compared to highest rolling 4-week average concentrations from 2011 and 2012, concentrations in 2013 provided mixed results: seven pesticides were generally higher than previously measured concentrations in 2011 or 2012 (1,3-Dichlorpropene (1,3-D), carbon disulfide, chloropicrin, chlorpyrifos, chlorpyrifos OA, DDVP, and EPTC), seven pesticides were generally lower than previously measured concentrations in 2011 or 2012 (diazinon, diazinon OA, diuron, malathion, malathion OA, methyl bromide, and MITC), and two pesticides were detected in 2013 that were previously never been measured above trace levels in either 2011 or 2012 as part of the AMN monitoring (chlorothalonil and oxyfluorfen). The rolling 4-week average concentrations in 2014 showed decreasing trend relative to 2013 results except for carbon disulfide in all sites, chlorthal-dimethyl and diuron in Salinas, and methyl bromide in Ripon. Diazinon, and dimethoate OA were two pesticides that were not detected in 2014 but had been detected in previous sampling years. With the exception of carbon disulfide, oryzalin, and iprodione, all other pesticides monitored had lower rolling 4-week average concentrations in 2015 compared to those measured in previous years at all sampling locations (Table 38).

The change in the subchronic screening level for 1,3-dichloropropene (Table 4; decreased from 120,000 ng/m^3 to 14,000 ng/m^3) resulted in an subchronic screening level exceedance in Shafter in 2013. Therefore, DPR conducted a more thorough evaluation of the risk associated with the measured concentration for the subchronic or seasonal exposure scenario (DPR, 2016b). The more detailed evaluation concluded that a 3-month average concentration is the more appropriate time period to assess seasonal exposure to 1,3-dichloropropene, rather than the default 4-week period. The default 4-week period is health-conservative, and using the more appropriate 3-month period indicates lower seasonal exposure. The highest 3-month average air concentration in Shafter for 2013 – 2015 was 10,130 ng/m^3, or 74% the subchronic screening level (DPR 2016b). A more thorough evaluation was also conducted for a previous exceedance of the subchronic screening level for chloropicrin at Salinas in 2013. The more detailed evaluation concluded that a 5-month average concentration is the more appropriate time period to assess seasonal exposure to chloropicrin (DPR, 2016b), rather than the default 4-week period. The default 4-week period is health-conservative, and using the more appropriate 5-month period indicates lower seasonal exposure. The 5-month average concentration of 807 ng/m^3 in 2013 was 35% of the subchronic screening level of 2,300 ng/m^3.

As listed in Table 39, the 1-year average concentrations from the pesticides with at least one detectable concentration in 2012 were generally lower than the average concentrations from 2011. With the exception of diuron, malathion, and malathion OA; pesticides detected in 2013 had a higher 1-year average concentration than the same pesticides in 2011 and 2012. In 2014, the 1-year average concentrations for most pesticides decreased relative to the average concentrations of the same pesticides in 2013 with exception of chlorothalonil (22 ng/m^3 in 2014 vs 16 ng/m^3 in 2013). Methyl bromide shows a decreasing 2011-2015 trend in measured concentrations in all three sampling locations. This may be due to gradual decline in agricultural use of methyl bromide by the ongoing phase-out of this pesticide.

Table 37. Highest 24-hour concentrations for pesticides with at least one detectable concentration by year (2011 – 2015) for each AMN sampling location.

Chemical	Highest 24-hour concentration (ng/m^3)														
	Salinas					Shafter					Ripon				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
1,3-Dichloropropene	10,072 (6%)†	3,430 (2%)	4,319 (16%)	440 (4 %)	3,643 (19%)	ND‡	3,643 (6%)	39,969 (26%)	9251 (37%)	9,713 (42%)	12,250 (4%)	ND	14,745 (17%)	3511 (19 %)	4,074 (31%)
Acephate	Trace (2%)	ND	ND	ND	ND	ND	Trace (2%)	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein *	3,117 (58%)	--	--	--	--	2,796 (60%)	--	--	--	--	5,959 (57%)	--	--	--	--
Bensulide	Trace (9%)	ND	ND	ND	Trace (2%)	Trace (2%)	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	616 (2%)	153 (14%)	691 (44%)	3,125 (88%)	ND	ND	897 (15%)	548 (50%)	812 (90%)	ND	ND	464 (11%)	370 (49%)	2,842 (88%)
Chloropicrin	3,926 (6%)	ND	6,384 (13%)	4,809 (2%)	3,023 (15%)	ND	ND	ND	ND	ND	ND	ND	1,279 (6%)	1,150 (4%)	Trace (2%)
Chlorothalonil	ND	ND	Trace (4%)	Trace (12%)	Trace (10%)	Trace (13%)	Trace (23%)	80 (60%)	118 (13%)	39 (75%)	Trace (38%)	Trace (21%)	Trace (42%)	Trace (66%)	Trace (65%)
Chlorpyrifos	Trace (23%)	Trace (23%)	Trace (2%)	Trace (2%)	ND	27 (53%)	131 (48%)	423 (75%)	338 (56%)	78 (61%)	Trace (19%)	Trace (13%)	Trace (21%)	Trace (15%)	Trace (27%)
Chlorpyrifos OA	Trace (11%)	Trace (8%)	ND	ND	ND	9 (45%)	17 (48%)	143 (55%)	110 (62%)	13 (53%)	Trace (25%)	13 (19%)	Trace (23%)	Trace (17%)	Trace (23%)
Chlorthal-dimethyl	Trace (40%)	Trace (52%)	Trace (49%)	10 (63 %)	Trace (65%)	Trace (15%)	ND	Trace (8%)	ND	Trace (2%)	Trace (6%)	ND	ND	ND	ND
DDVP	Trace (6%)	Trace (10%)	52 (13%)	Trace (12%)	Trace (17%)	Trace (2%)	ND	Trace (6%)	Trace (2%)	Trace (8%)	ND	69 (2%)	Trace (8%)	Trace (2%)	26 (10%)
Diazinon	Trace (23%)	Trace (2%)	39 (2%)	ND	Trace (2%)	60 (11%)	Trace (4%)	29 (6%)	ND	ND	Trace (4%)	Trace (4%)	49 (4%)	ND	Trace (2%)
Diazinon OA	Trace (17%)	ND	26 (2%)	ND	ND	36 (4%)	10 (8%)	Trace (8%)	ND	ND	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)	Trace (6%)
Dimethoate OA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace (2%)	ND	ND
Diuron	Trace (4%)	32 (40%)	Trace (19%)	14.4 (8%)	Trace (2%)	Trace (6%)	Trace (12%)	Trace (2%)	Trace (10%)	Trace (10%)	ND	Trace (10%)	Trace (2%)	Trace (4%)	Trace (4%)
Endosulfan	ND	ND	ND	Trace (2%)	ND	ND	ND	ND	ND	ND	ND	Trace (2%)	Trace (2%)	Trace (4%)	Trace (6%)
EPTC	ND	ND	ND	Trace (2%)	ND	187 (17%)	18 (4%)	250 (9%)	216 (12%)	29 (10%)	ND	ND	ND	ND	ND
Iprodione	ND	ND	ND	ND	ND	Trace (2%)	Trace (4%)	Trace (4%)	Trace (6%)	Trace (8%)	Trace (2%)	Trace (2%)	Trace (9%)	Trace (2%)	15 (10%)
Malathion	13 (9%)	Trace (13%)	Trace (15%)	Trace (12%)	13 (13%)	ND	Trace (2%)	Trace (4%)	Trace (2%)	ND	Trace (2%)	ND	Trace (2%)	ND	ND
Malathion OA	Trace (30%)	Trace (31%)	Trace (13%)	Trace (27%)	Trace (37%)	Trace (6%)	11 (10%)	Trace (9%)	Trace (6%)	Trace (6%)	Trace (13%)	Trace (10%)	Trace (13%)	Trace (8%)	Trace (12%)
Methidathion	Trace (9%)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	6,055 (19%)	2,527 (10%)	4,425 (10%)	3,063 (27%)	179 (13%)	2,934 (9%)	2,135 (4%)	209 (4%)	963 (15%)	283 (13%)	2,934 (20%)	2,667 (4%)	1,153 (9%)	2,329 (30%)	2,981 (20%)
Metolachlor	Trace (11%)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MITC	51 (10%)	182 (6%)	234 (15%)	72 (12%)	73 (8%)	930 (40%)	347 (56%)	762 (57%)	113 (42%)	232 (35%)	308 (42%)	90 (23%)	852 (19%)	203 (23%)	373 (25%)
Norflurazon	Trace (4%)	ND	ND	ND	ND	Trace (2%)	ND	ND	ND	Trace (2%)	ND	ND	ND	ND	ND
Oryzalin	Trace (2%)	ND	ND	ND	ND	Trace (2%)	Trace (2%)	Trace (2%)	Trace (2%)	62 (6%)	ND	Trace (6%)	ND	ND	45 (6%)
Oxyfluorfen	ND	ND	53 (2%)	ND	ND	ND	ND	ND	ND	ND	Trace (4%)	Trace (6%)	ND	Trace (2%)	Trace (6%)
Permethrin	ND	ND	ND	ND	ND	Trace (2%)	ND	Trace (2%)	ND	ND	Trace (4%)	ND	Trace (2%)	Trace (2%)	Trace (2%)
Phosmet	Trace (2%)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Propargite	ND	ND	ND	ND	ND	Trace (2%)	ND	Trace (11%)	ND	ND	Trace (4%)	Trace (13%)	Trace (4%)	Trace (11%)	Trace (12%)
Simazine	Trace (6%)	Trace (4%)	ND	Trace (2%)	ND	Trace (4%)	Trace (12%)	ND	Trace (4%)	Trace (4%)	Trace (2%)	Trace (10%)	ND	Trace (2%)	Trace (2%)
Trifluralin	Trace (2%)	Trace (2%)	ND	ND	ND	Trace (9%)	Trace (6%)	Trace (4%)	Trace (4%)	Trace (8%)	Trace (25%)	Trace (23%)	Trace (11%)	Trace (15%)	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 38. Highest rolling 4-week average concentrations for pesticides with at least one detectable concentration by year (2011 – 2015) for each AMN sampling location.

Chemical	Highest 4-week rolling concentration (ng/m^3)														
	Salinas					Shafter					Ripon				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
1,3-Dichloropropene	2743‡	1,082	2,611	158	1,812	ND†	1,135	18,022	4,077	5,138	4,022	ND	7,993	1,740	2,711
Acephate	Trace	ND	ND	ND	ND	ND	Trace	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein*	1,706	--	--	--	--	1,901	--	--	--	--	2,773	--	--	--	--
Bensulide	Trace	ND	ND	ND	Trace	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	271	156	319	945	ND	ND	341	303	410	ND	ND	170	226	1,565
Chloropicrin	1,809	ND	3,224	2,161	1,551	ND	ND	ND	ND	ND	ND	ND	987	578	Trace
Chlorothalonil	ND	ND	Trace	Trace	Trace	Trace	Trace	38	Trace	25	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	ND	15	46	113	92	60	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos OA	Trace	Trace	ND	ND	ND	7	13	44	32	9	Trace	8	Trace	Trace	Trace
Chlorthal-dimethyl	Trace	Trace	Trace	7	Trace	Trace	ND	Trace	ND	Trace	Trace	ND	ND	ND	ND
DDVP	Trace	Trace	28	Trace	Trace	Trace	ND	Trace	Trace	Trace	ND	18	Trace	Trace	Trace
Diazinon	Trace	Trace	10	ND	Trace	18	Trace	10	ND	ND	Trace	Trace	14	ND	Trace
Diazinon OA	Trace	ND	7	ND	ND	11	Trace	ND	ND	ND	Trace	Trace	ND	Trace	Trace
Dimethoate OA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace	ND	ND
Diuron	Trace	20	Trace	8	Trace	Trace	Trace	Trace	Trace	Trace	ND	Trace	Trace	Trace	Trace
Endosulfan	ND	ND	ND	Trace	ND	ND	ND	ND	ND	ND	ND	Trace	Trace	Trace	Trace
EPTC	ND	ND	ND	Trace	ND	76	Trace	139	86	19	ND	ND	ND	ND	ND
Iprodione	ND	ND	ND	ND	ND	Ttrace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	12.1
Malathion	Trace	Trace	Trace	Trace	6.9	ND	Trace	Trace	Trace	ND	Trace	ND	Trace	ND	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Methidathion	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	4,124	1,098	1,871	1,262	119	1,403	683	198	389	186	1,659	1,119	437	867	1,640
Metolachlor	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MITC	15	71	89	36	23	564	177	319	74	156	144	50	272	98	150
Norflurazon	Trace	ND	ND	ND	ND	Trace	ND	ND	ND	Trace	ND	ND	ND	ND	ND
Oryzalin	Trace	ND	ND	ND	ND	Trace	Trace	Trace	Trace	16	ND	Trace	ND	ND	Trace
Oxyfluorfen	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	Trace	Trace	ND	Trace	Trace
Permethrin	ND	ND	ND	ND	ND	Trace	ND	Trace	ND	ND	Trace	ND	Trace	Trace	Trace
Trifluralin	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Propargite	ND	ND	ND	ND	ND	Trace	ND	Trace	ND	ND	Trace	Trace	Trace	Trace	Trace
Simazine	Trace	Trace	ND	Trace	ND	Trace	Trace	ND	Trace	Trace	Trace	Trace	ND	Trace	Trace
Trifluralin	Trace	Trace	ND	ND	ND	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	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 39. Comparison of the 1-year average concentrations for pesticides with at least one detectable concentration by year (2011 – 2015) for each AMN sampling location.

Chemical	1-year average concentration (ng/m^3)														
	Salinas					Shafter					Ripon				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
1,3-Dichloropropene	760	360	407	33	201	ND†	453	2,589	909	800	851	ND	914	302	380
Acephate	Trace	ND	ND	ND	ND	ND	Trace	ND	ND	ND	ND	ND	ND	ND	ND
Acrolein*	1,706	--	--	--	--	1,901	--	--	--	--	2,773	--	--	--	--
Bensulide	Trace	ND	ND	ND	Trace	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	270	136	84	273	ND	ND	149	86	217	ND	ND	140	76	352
Chloropicrin	325	ND	413	291	248	ND	ND	ND	ND	ND	ND	ND	177	146	Trace
Chlorothalonil	ND	ND	Trace	Trace	Trace	Trace	Trace	16	22	16	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos	Trace	Trace	Trace	Trace	ND	9	11	20	16	14	Trace	Trace	Trace	Trace	Trace
Chlorpyrifos OA	Trace	Trace	ND	ND	ND	4	4	8	7	4	Trace	2	Trace	Trace	Trace
Chlorthal-dimethyl	Trace	Trace	Trace	4	Trace	Trace	ND	Trace	ND	Trace	Trace	ND	ND	ND	Trace
DDVP	Trace	Trace	4	Trace	Trace	Trace	ND	Trace	Trace	Trace	ND	3	Trace	Trace	3
Diazinon	Trace	Trace	1	ND	Trace	2	Trace	1	ND	ND	Trace	Trace	2	ND	Trace
Diazinon OA	Trace	ND	2	ND	ND	2	1	ND	ND	ND	Trace	Trace	ND	Trace	Trace
Dimethoate OA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	Trace	ND	ND
Diuron	Trace	5	Trace	3	Trace	Trace	Trace	Trace	Trace	Trace	ND	Trace	Trace	Trace	Trace
Endosulfan	ND	ND	ND	Trace	ND	ND	ND	ND	ND	ND	ND	Trace	Trace	Trace	Trace
EPTC	ND	ND	ND	ND	Trace	8	1	12	8	3	ND	ND	ND	ND	ND
Iprodione	ND	ND	ND	ND	ND	Ttrace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	2
Malathion	2	Trace	Trace	Trace	2	ND	Trace	Trace	Trace	ND	Trace	ND	Trace	Trace	ND
Malathion OA	Trace	Trace	Trace	Trace	Trace	Trace	1	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Methidathion	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl bromide	1,020	355	301	187	35	425	247	163	70	40	656	315	194	172	171
Metolachlor	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MITC	6	8	12	6	6	73	51	66	21	27	34	14	37	15	23
Norflurazon	Trace	ND	ND	ND	ND	Trace	ND	ND	ND	Trace	ND	ND	ND	ND	ND
Oryzalin	Trace	ND	ND	ND	ND	Trace	Trace	Trace	Trace	2	ND	Trace	ND	ND	2
Oxyfluorfen	ND	ND	4	ND	ND	ND	ND	ND	ND	ND	Trace	Trace	ND	Trace	Trace
Permethrin	ND	ND	ND	ND	ND	Trace	ND	Trace	ND	ND	Trace	ND	Trace	Trace	Trace
Trifluralin	Trace	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Propargite	ND	ND	ND	ND	ND	Trace	ND	Trace	ND	ND	Trace	Trace	Trace	Trace	Trace
Simazine	Trace	Trace	ND	Trace	ND	Trace	Trace	ND	Trace	Trace	Trace	Trace	ND	Trace	Trace
Trifluralin	Trace	Trace	ND	ND	ND	Trace	Trace	Trace	Trace	Trace	Trace	Trace	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.

Comparison to Other Monitoring

ARB, in support of DPR's Toxic Air Contaminant monitoring program, monitors ambient air for a variety of pesticides. ARB monitors air concentrations of a pesticide in counties with the highest reported use for that particular pesticide and during the season of its highest reported use. The ambient air sampling conducted under this program includes results for 15 of the pesticides monitored in the AMN: 1,3-dichloropropene, chlorpyrifos, chlorpyrifos OA, chlorothalonil, diazinon, endosulfan, EPTC, malathion, malathion OA, MITC, methyl bromide, permethrin, propargite, simazine and S,S,S-tributylphosphorotrithioate (DEF) (Table 40).

Maximum 24-hour concentrations measured at all three sampling locations in 2015 were generally much lower than concentrations measured in other parts of the state by ARB, or those measured by DPR in Parlier except chlorothalonil concentration, which was slightly higher than DPR's study in Parlier and other studies. Concentrations measured in 2015 for chlorothalonil in Shafter were higher than the 24-hour maximum concentrations measured in Parlier and other parts of the state by ARB. Methyl bromide concentration measured in Ripon was higher than concentrations measured in Parlier but lower than concentration measured in other parts of the state by ARB (Table 40).

Table 40. Highest 24-hour concentrations of the pesticides monitored in Salinas, Shafter, and Ripon from 2011 to 2015 compared to previous DPR/ARB monitoring studies in California.

Chemical	Year	County	Other Studies	Parlier	2011			2012			2013			2014			2015		
					Salinas	Shafter	Ripon	Salinas	Shafter	Ripon	Salinas	Shafter	Ripon	Salinas	Shafter	Ripon	Salinas	Shafter	Ripon
			Maximum 24-hour concentration (ng/m^3)																
1,3-Dichloropropene	2000	Kern	135,000	23,080	10,072	ND†	12,249	3,430	3,643	ND	4,319	39,969	14,745	440	9,251	3,511	3,643	9,713	4,074
Chlorothalonil	2002	Fresno	14	Trace	ND	Trace	Trace	ND	18	Trace	Trace	80	Trace	Trace	118	Trace	Trace	39	Trace
Chlorpyrifos	2004	Tulare	1,340	150	Trace	27	Trace	Trace	131	Trace	Trace	423	Trace	Trace	338	Trace	ND	78	Trace
Chlorpyrifos OA	1996	Tulare	230	28	Trace	9.2	Trace	Trace	17	13	ND	143	Trace	ND	110	Trace	ND	13	Trace
Diazinon	1997	Fresno	290	172	Trace	60	Trace	Trace	Trace	Trace	39	29	49	ND	ND	ND	Trace	13	Trace
Endosulfan	1996	Fresno	166	ND	ND	ND	ND	ND	ND	Trace	ND	ND	Trace	Trace	ND	Trace	ND	ND	Trace
EPTC	1996	Imperial	240	ND	ND	187	ND	ND	18	ND	ND	250	ND	Trace	216	ND	ND	29	ND
Malathion	1998	Imperial	90	21	13	ND	Trace	Trace	Trace	ND	Trace	Trace	Trace	Trace	Trace	ND	13	ND	ND
Malathion OA	1998	Imperial	28	16	Trace	Trace	Trace	Trace	11	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace	Trace
Methyl bromide	2001	Santa Cruz	142,000	2,468	6,055	2,934	2,934	2,527	2,135	2,667	4,425	209	1,153	3,063	963	2,329	179	283	2981
MITC	1993	Kern	18,000	5,010	51	930	308	182	347	90	234	762	852	72	113	203	73	232	373
Permethrin	1997	Monterey	Trace	Trace	ND	Trace	Trace	ND	ND	ND	ND	Trace	Trace	ND	ND	Trace	ND	ND	Trace
Propargite	1999	Fresno	1300	Trace	ND	Trace	Trace	ND	ND	Trace	ND	Trace	Trace	ND	ND	Trace	ND	ND	Trace
Simazine	1998	Fresno	18	Trace	Trace	Trace	Trace	Trace	Trace	Trace	ND	ND	ND	Trace	Trace	Trace	ND	Trace	Trace
DEF	1987	Fresno	330	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

† ND = Not Detected.

DATA VALIDATION/QUALITY ASSURANCE

Data Review

Before evaluating any data, the entire set of sample chains of custody (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 percent in the flow over the sampling interval. There were no invalid air samples in 2015 but one canister and one multi-residue sample were lost during lab analysis, no makeup samples were taken for these lost samples.

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 41 lists the averages for the quality control samples that were extracted and analyzed with the air samples for the entire monitoring period. Laboratory matrix spike recovery averages ranged from 72% to 100% for all chemicals analyzed. None of the laboratory matrix spike samples were outside the control limits established from the validation data.

The matrix 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 41 lists the average percent recovery results and they ranged from 1% to 125%. 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.

Field blanks, blind spikes and duplicate samples are part of DPR's field and laboratory QC program. A duplicate sample is a sample that is collocated with another sample in the field. These samples serve to evaluate overall precision in sample measurement and analysis. Table 42 lists duplicate samples with quantifiable concentrations which had a maximum relative difference of 8.2% for the XAD multiple pesticide samples, 5.3% for the MITC samples, 0% for chloropicrin samples, and 55.0% for VOC samples.

Table 41. Average results for quality control/quality assurance in samples from the 2014 AMN.

Chemical	Lab spikes (% recovery)	Field spikes (% recovery)	Lab blanks (ng/m^3)	Trip blanks (ng/m^3)
Acephate	96	74	ND†	ND
Bensulide	95	90	ND	ND
Carbon Disulfide	97	NS‡	ND	ND
Chloropicrin	95	81	ND	ND
Chlorothalonil	97	NS	ND	ND
Chlorpyrifos	98	75	ND	ND
Chlorpyrifos OA	95	100	ND	ND
Cypermethrin	95	74	ND	ND
Chlorthal-dimethyl (DCPA)	97	95	ND	ND
DDVP	94	79	ND	ND
Diazinon	94	47	ND	ND
Diazinon OA	96	NS	ND	ND
cis-1,3-Dichloropropene	100	71	ND	ND
trans-1,3-Dichloropropene	100	102	ND	ND
pp-Dicofol	98	125	ND	ND
Dimethoate	95	79	ND	ND
Dimethoate OA	95	94	ND	ND
Diuron	96	87	ND	ND
Endosulfan	97	87	ND	ND
Endosulfan Sulfate	98	91	ND	ND
EPTC	96	69	ND	ND
Iprodione	97	77	ND	ND
Malathion	99	72	ND	ND
Malathion OA	96	104	ND	ND
Methidathion	94	99	ND	ND
Methyl Bromide	97	30	ND	ND
Metolachlor	94	89	ND	ND
MITC	72	78	ND	ND
Norflurazon	96	58	ND	ND
Oryzalin	97	1	ND	ND
Oxydemeton methyl	93	47	ND	ND
Oxyfluorfen	99	96	ND	ND
Permethrin	95	NS	ND	ND
Phosmet	95	83	ND	ND
Propargite	95	115	ND	ND
Simazine	95	58	ND	ND
SSS-tributyl… (DEF)	94	70	ND	ND
Trifluralin	97	NS	ND	ND

†ND = Not detected.

‡NS = Field sample not spiked with the chemical.

Table 42. Results for duplicate sample pairs in 2015.

Primary/duplicate results	Number of pairs			
	Multi-pesticide residue analysis samples	MITC samples	Chloropicrin samples	VOC samples
ND†/ND	397	12	16	36
Trace‡/Trace	16	0	0	0
ND/Trace	2	0	0	0
ND/>LOQ	0	1	0	1
Trace/>LOQ	0	1	0	0
>LOQ/>LOQ	1	2	0	15
Relative Difference*	8.2%	5.3%	0%	55.0%

†ND = Not detected.

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

*For pairs with both concentrations >LOQ.

Validation and Control Limits

The MITC and the multi-pesticide pesticide analysis method 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. From the validation data, DPR created control limits by multiplying the standard deviation of the data by $\pm$ 3 times and adding it to the mean.

DISCUSSION

In previous reports, DPR's goal for 1,3-dichloropropene was not to exceed the regulatory target of 650 ng/m^3 (0.14 ppb) as an average for a 70-year lifetime exposure to address cancer risk. DPR's updated risk management directive (DPR, 2016a) has updated the regulatory target to 2,600 ng/m^3 (0.56 ppb) as a 70-year average. None of the 2011-2015 average 1,3-dichloropropene concentrations at the three sites exceeded the updated regulatory target concentration.

Nine of the fourteen pesticides detected at quantifiable concentrations in the AMN were either fumigants (1,3-dichloropropene, carbon disulfide, methyl bromide, chloropicrin, and MITC) or organophosphate insecticides (chlorpyrifos + OA, DDVP, malathion). Chlorothalonil, EPTC, iprodione, and oryzalin were also detected at quantifiable concentrations. However, carbon disulfide concentrations were more likely due to combustion of fossil fuels or its use as an industrial solvent and its release from manufacturing and processing facilities.

The AMN results 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. Organophosphates were the only pesticides that were detected at quantifiable concentrations and have a common mode of action (cholinesterase inhibition). The hazard index (combined screening level) for organophosphates was less than one for all exposure periods, indicating a low risk from cumulative exposure.

Relative to the screening levels, air concentrations representing chronic exposure were less than the acute or subchronic exposures for most pesticides. While the subchronic exposure was greater than the acute exposure for several pesticides, the AMN and other community ambient air monitoring usually underestimates acute exposure. 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. 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 mile or more away. It's likely that the maximum acute exposure is higher than indicated by these data.

DPR has established regional use limits (township caps) for methyl bromide to control subchronic exposure. Townships are 6 x 6 mile areas designated by the Public Lands Survey System. The township cap for methyl bromide is a monthly cap, with the goal of limiting the subchronic exposure to no more than the screening level of 19,400 ng/m^3 (5 ppb). All measured air concentrations were less than ten percent of DPR's regulatory target, indicating that the methyl bromide township caps are effectively keeping air concentrations below the health protective targets set by DPR.

Higher pesticide air concentrations have been detected in other studies. This is likely due to greater amounts of pesticides applied near the monitoring sites for the other studies, as well as mitigation measures implemented since some of the studies were conducted. Ambient air monitoring for the toxic air contaminant program focuses on the highest use areas and highest use periods for individual pesticides.

Additionally, to reduce exposure to chloropicrin, DPR implemented new control measures in April 2015. The mitigation measures will reduce overall air concentrations and include such conditions as smaller maximum application size and larger buffer zones for many applications.

DPR plans to continue monitoring at the same AMN sites through 2016, in part to determine the effectiveness of the actions to reduce exposure to chloropicrin and 1,3-dichloropropene. Beginning in 2017, DPR will expand the AMN, with the assistance of ARB. 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. DPR is consulting with its Pesticide Registration and Evaluation Committee and stakeholders on the appropriate sites for monitoring.

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