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AIR MONITORING NETWORK RESULTS FOR 2011

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SUMMARY

In February 2011, DPR implemented a multi-year statewide air monitoring network for measuring pesticides in various agricultural communities. This new pesticide Air Monitoring Network (AMN) is the first long-term 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 contains AMN results from February 1, 2011 to December 31, 2011. The 2011 AMN results are intended as the first set of data to estimate multi-year concentrations. Additional data will help refine concentration estimates.

DPR monitored a total of 34 pesticides and 5 pesticide breakdown products in three communities. Pesticides monitored in the AMN were selected based primarily on potential health risk. Higher-risk pesticides were prioritized and targeted for monitoring. Higher-risk pesticides were identified based on higher use, higher volatility, and higher toxicity. DPR evaluated 226 communities in California as candidates for inclusion in the network. DPR selected one site each in Salinas (Monterey County), Shafter (Kern County), and Ripon (San Joaquin County) for the AMN based on pesticide use, demographic data, and availability of other exposure and health data.

The first AMN samples were collected in February 2011. 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. Sampling start times were left to the discretion of the field sampling personnel, but they always started anywhere from 9:00 a.m. to 2:00 pm. No state or federal agency has established health standards for pesticides in air. Therefore, DPR developed health screening levels for the monitored pesticides to place the results in a health-based context. The health screening level is the calculated air concentration based on a chemical's toxicity that is used to evaluate the possible health effects of exposure to the chemical. Although screening levels are not regulatory standards, they can be used to evaluate air monitoring results and determine if a more detailed assessment is warranted.

Of the 34 pesticides and 5 pesticide breakdown products monitored by DPR, 29 were detected in at least one sample. Almost all concentrations were low relative to the screening levels, with the exception of the results for acrolein resulting from non-pesticidal sources. Overall, 92.5 % of the 5,676 analyses (number of samples times the number of chemicals analyzed) resulted in no detectable concentrations. Only 7.5% of the analyses had detectable (trace or quantifiable) concentrations, and 3% of the analyses had quantifiable concentrations. None of the pesticides (except acrolein) exceeded their screening levels for exposure periods of one year or less, indicating low health risk to the people in these communities. Seven of the nine pesticides (plus two breakdown products) detected at quantifiable concentrations in the AMN were either fumigants (1,3-dichloropropene, chloropicrin, methyl bromide, MITC) or organophosphate insecticides (chlorpyrifos, diazinon, malathion). DPR will continue to track these pesticides.

Previous monitoring, computer modeling, and comprehensive risk assessments for the fumigants by DPR and U.S. EPA indicated unacceptably high air exposures in some cases. Therefore, U.S. EPA, DPR, and county agricultural commissioners require buffer zones, application method restrictions, use limits, and other measures to reduce acute exposure to fumigants. These monitoring results indicate that those measures appear to be effective. While chlorpyrifos and diazinon did not exceed the screening levels, either individually or combined, they have approached or exceeded the screening levels in previous monitoring studies. DPR is working in conjunction with U.S. EPA on a comprehensive risk assessment for chlorpyrifos and is also in the process of assessing the risk for diazinon to help determine if mitigation measures are needed to reduce exposures.

DPR has set a regional use limit (monthly township cap) for methyl bromide 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 one-quarter of DPR's regulatory target, indicating that the methyl bromide township caps are keeping air concentrations below the health protective targets set by DPR.

1,3-dichloropropene (1,3-D) is the only chemical detected that is considered a probable human carcinogen. Although only 4 percent of the samples contained measurable concentrations of 1,3-D, initial estimates of the cancer risk for 1,3-D may indicate a risk level that is greater than the range of what is considered negligible, and greater than DPR's regulatory goal. The risk estimate has uncertainties, including higher detection limits for the first six months of the study, value given to samples with no detectable concentrations, etc. Additional data with lower detection limits will refine the estimation of the cancer risk.

The AMN communities are located in regions of historically high use for many pesticides, but they may not be in the regions of highest use for a particular pesticide. DPR will compare the detected concentrations with pesticide use patterns as well as weather conditions once the pesticide use reports for 2011 have been compiled and verified. This evaluation will be included in Volume 2.

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

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 Cal/EPA

Cal/EPA: California Environmental Protection Agency. The Department of Pesticide Regulation is one of five boards and departments within Cal/EPA.

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

Duplicate sample: Same as a primary sample, but it is obtained on 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 primary sample and undergoes the same air flow and run time conditions. The field spiked sample, 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. Although not a regulatory standard, screening levels can be used in the process of evaluating the air monitoring results. A measured air concentration that is below the screening level for a given pesticide generally would not undergo further evaluation but should not automatically be considered “safe” and could undergo further evaluation. 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.

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, chronic). That is,

$$HI = HQ_1 + HQ_2 + HQ_3 + \dots$$

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.

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

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 assumes 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. Staff from MLD audited the Air Monitoring Network at the petition of the California Department of Pesticide Regulation.

Monitored chemical: Refers to a chemical that was sampled for in the air and analyzed for to determine its possible air concentrations. 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.

QA: Quality assurance team

QAS: Quality Assurance Section of ARB

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.

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.

SOP: Standard operating procedure. It is a document describing 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. On February 2011, as part of DPR's mandate for "continuous evaluation" of currently registered pesticides, DPR implemented a multi-year statewide air monitoring network for measuring pesticides in various agricultural communities. This new pesticide Air Monitoring Network (AMN) is the first long-term air monitoring study conducted by DPR. Past and current studies by the Air Resources Board (ARB) and DPR for the toxic air contaminant program usually consist of monitoring for a few weeks for individual pesticides. This produced data that was used to estimate seasonal pesticide exposures and local concentrations. However, since long-term data was not previously available, to estimate concentrations associated with annual and lifetime exposures, DPR would extrapolate the short-term concentrations detected. AMN results will 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:

1) Identify common pesticides in air and determine seasonal, annual, and multiple-year concentrations.
2) Compare concentrations to subchronic and chronic health screening levels.
3) Track trends in air concentrations over time.
4) Estimate cumulative exposure to multiple pesticides with common modes of action.
5) Attempt to correlate concentrations with use and weather patterns.

Air sample collection frequency and which pesticides to monitor was determined based on previous short-term studies conducted by DPR, especially the 2006 pilot 12-month air monitoring study in Parlier California, which was performed in part to evaluate methods and approaches that can be used for the future air monitoring studies (Wofford et al., 2009). Based in part on what was learned from the Parlier study, it was determined that representative sampling could be obtained from one 24-hour air sample each week from each community selected. The air samples collected were analyzed for 34 pesticides and 5 pesticide breakdown products.

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. 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.

This report contains AMN results from all three sites starting from February 1, 2011 to December 31, 2011.

Site Locations (Figure 1)

Ripon

Ripon is a small city (4.2 square miles in area) located approximately 20 miles south of Stockton in San Joaquin County. The elevation is 69 feet, with approximately 13.8 inches of precipitation annually. Average temperatures during summer range from 60º to 94º 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 N. Wilma Ave near the western side of the middle of the city.

Shafter

Shafter is a small city (18 square miles in area) located approximately located 18 miles west-northwest of Bakersfield in Kern County. 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, and alfalfa some field crops. 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 north-east of Monterey and encompasses a total area of 19 square miles. 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 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 south-eastern section of the City.

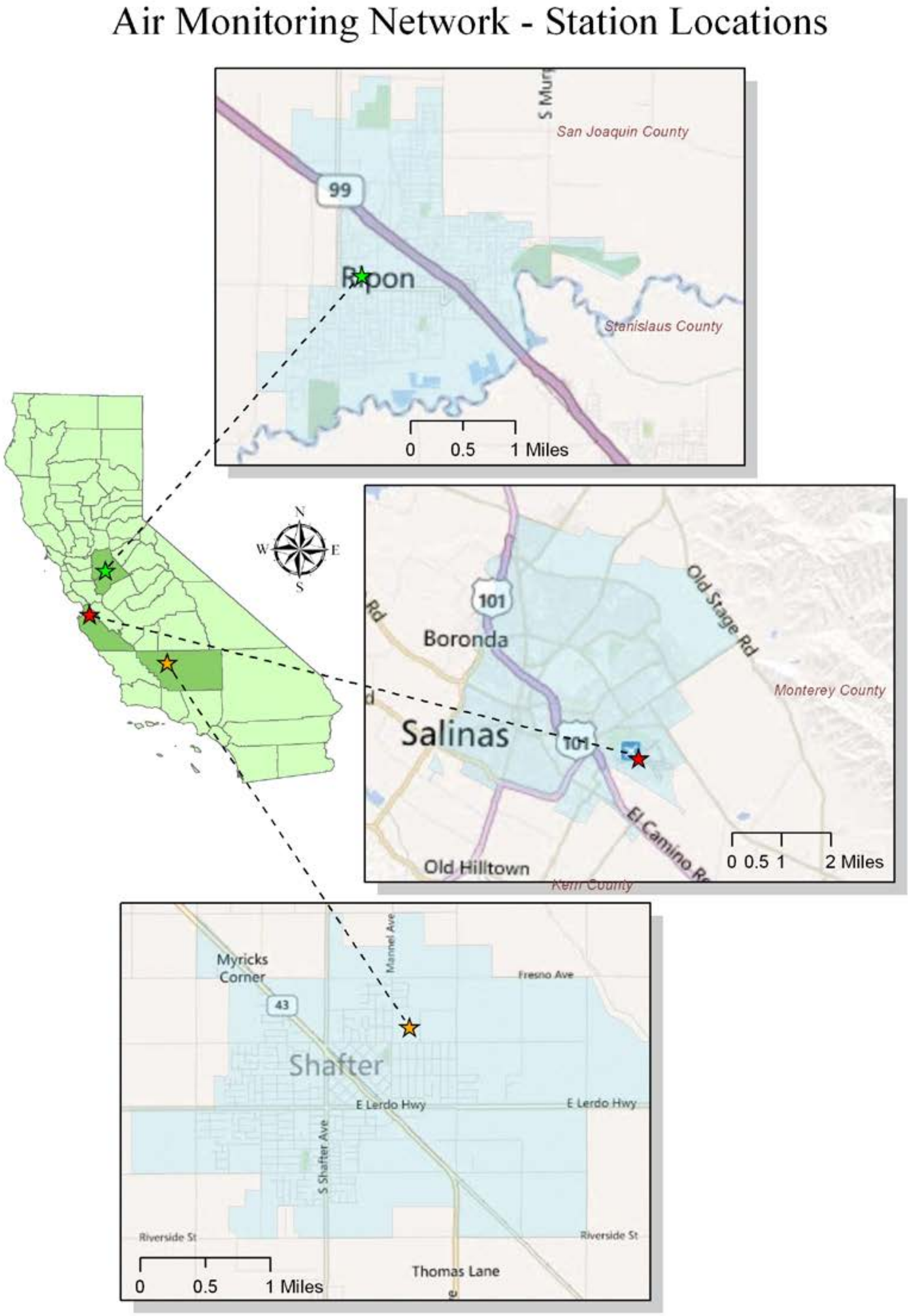


Figure 1. Map of the three sampling station locations.

Pesticides Monitored

DPR monitored a total of 34 pesticides and 5 pesticide breakdown products. Pesticides included in AMN monitoring were selected based primarily on potential health risk. Higher-risk pesticides have higher priority for monitoring. Pesticides were selected based on the following criteria:

1) Pounds of use by area/region (indicator of exposure)
2) Volatility (indicator of exposure)
3) DPR risk assessment priority (indicator of toxicity)
4) Feasibility of including in multi-residue monitoring method

Most of the pesticides monitored in this study were also included in the 2006 Parlier pilot study and thus sample method development and collection techniques were already developed and used by DPR staff (Wofford et al., 2009). The method to measure multiple chemicals in a single sample was developed by the University of California Davis (UCD) Trace Analytical Laboratory for a study that DPR conducted in Lompoc in 2000 (DPR, 2003a). The method involved analysis for 22 pesticides and 5 breakdown products. The California Department of Food and Agriculture (CDFA), Center for Analytical Chemistry Laboratory, modified the method to analyze for the pesticides selected as chemicals of concern in Parlier.

Multi-Pesticide Residue Analysis

Multi-pesticide residue analysis using XAD-4 resin as the solid phase trapping medium were performed by CDFA laboratory using GC-MS and LC-MS methods as described in method EMON-SM-05-002 (CDFA, 2008). Analysis includes 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 target analytes in multi-pesticide residue analysis with XAD-4 resin.

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

Pesticide	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	-		
Chlorthal-dimethyl	Dacthal	Herbicide	Phthalate
Cypermethrin	Demon	Insecticide	Pyrethroid
Diazinon	Various names	Insecticide	Organophosphate
Diazinon Oxygen Analog	-		
Dicofol	Kelthan	Insecticide	Organochlorine
Dimethoate	Cygon	Insecticide	Organophosphate
Dimethoate Oxygen Analog	-		
Diuron	Karmex	Herbicide	Urea
Endosulfan	Thiodan	Insecticide	Organochlorine
Endosulfan Sulfate	-		
EPTC	Eptam	Herbicide	Carbamate
Iprodione	Rovral	Fungicide	Dicarboximide
Malathion	Various names	Insecticide	Organophosphate
Malathion Oxygen Analog	-		
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) using GC-MS in a method similar to U.S. EPA's Method TO-15. The SOP describing the details of the procedure is EMON-SM-05-002 (CDFA, 2008).

MITC

Samples collected on SKC Inc® coconut charcoal sample tubes were analyzed for residues of MITC by GC-MS as described in analytical method EMON-SM41.9 (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 in CDFA Method: EM16.0 (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
Acrolein	Magnacide	Algaecide	Aldehyde
Methyl Bromide		Fumigant	Halogenated organic
carbon disulfide	Enzone	Fumigant	Inorganic
Methyl iodide	Midas	Fumigant	Halogenated organic
MITC*	Vapam, K-Pam, Dazomet	Fumigant	
Chloropicrin*		Fumigant	Halogenated organic

*are collected on individual sample tubes until CDFA is able to include in canister method.

MATERIALS AND METHODS

This section describes more in detail the types of samples DPR collected, sample measurement, sampling materials used, and methods of sampling and analysis.

Air Sampling Equipment and Methods

A protective shelter was placed at each air sampling location. The shelter housed Airchek HV30 pumps (SKC Inc® catalog #228-030), SKC Inc® personal sample pumps, and SilcoCan® canisters (Restek cat. no. 24142-65). To obtain accurate and valid air samples, the location of the sampling inlets met the following siting criteria: a minimum of 3 ft horizontal and vertical distance from its supporting structure, at least 65 ft from trees, a distance from obstacles at least twice the obstacle height, and unobstructed air flow for 270°.

Air samples were collected via three different sampling methods: modified Parlier method for semi-volatile pesticides (hereafter referred to as multi-pesticide), individual chemical method (MITC and chloropicrin), and volatile organic compound method (Segawa, 2010). For multi-pesticide monitoring, an AirChek® pump pulling air at a rate of 15 L/min was attached to a hand-packed Teflon® cartridge containing 30 mL of XAD-4 sorbent resin material. For MITC monitoring, a manufactured pre-packed 200/1800 mg coconut charcoal tube with sealed glass end tips (SKC Inc., #226-16-02) was attached to a SKC Inc® personal sample pump set to a flow rate of 1.5 L/min. Similarly, for chloropicrin monitoring, a manufactured pre-packed 400/200 mg XAD-4 tube with sealed glass end tips (SKC Inc., #226-175) was attached to a SKC Inc® personal sample pump set to a flow rate of 50 mL/min. Lastly, for VOC monitoring, a vacuumed 6-liter SilcoCan® canister (Restek cat. no. 24142-65) with an attached flow controller (Veriflo® SC423XL) to maintain a constant air flow for a 24-hour period was utilized. The samples were sent to a chemical laboratory for extraction and analysis.

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 mmHg. 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 as presented in SOP ADMN006.01 (DPR, 2004). All pumps used for air sampling were previously calibrated to their respective flow rate by DPR personnel. The use, operation, calibration and maintenance of air sampling pumps are described in DPR's SOP EQAI001.00 (DPR, 2001). Air sampler flow rates were measured using a DryCal ® flow meter at the beginning and the end of sampling period. All sample pumps were checked and initially calibrated in the laboratory.

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 the West Sacramento facility where they were checked-in and placed into a freezer until delivered to the CDFA laboratory for analysis. SilcoCan® canister were transported and stored at ambient conditions. Sample handling-shipping and tracking procedures were followed as defined in DPR's SOP QAQC004.1 and SOP QAQC003.02 (DPR, 1999; DPR, 2005).

Methods for Collecting Weather Data

Salinas

Meteorological data consisting of wind speed and direction, air temperature, barometric pressure, relative humidity, and solar radiation were collected from the California Irrigation Management Information System (CIMIS) Salinas South station #89 and from the National Oceanic and Atmospheric Administration (NOAA) Automated Surface Observing System (ASOS) weather station #KSNS located in the Salinas Municipal Airport.

Shafter

Meteorological data consisting of wind speed and direction, air temperature, barometric pressure, relative humidity, and solar radiation were collected from the CIMIS Shafter #5 station located 2.2 miles north of the AMN sampling station.

Ripon

Meteorological data consisting of wind speed and direction, air temperature, barometric pressure, relative humidity, and solar radiation were collected from the CIMIS Manteca #70 station located 9.7 miles northwest of the AMN sampling station.

Methods for Collecting Pesticide Use Data

Under California law, all agricultural pesticide use must be reported. DPR maintains a database of all reported agricultural pesticide applications in California. The pesticide use report (PUR) database contains information on all production agricultural pesticide use and some nonagricultural use in California. The database includes information on the pesticide product used, the application date, the application amount, and application location to a square-mile section. A DPR report (DPR, 2000) gives a complete description of the PUR database. Pesticide use reports are not yet available for 2011. These data will be included in Volume 2.

Sampling Procedure

The first AMN samples were collected on the week of February 1, 2011 in both Salinas and Ripon, while samples from Shafter were first taken on February 9, 2011. 24-hour samples were collected every week at each of the 3 sites. The starting day varied each week with the actual dates being randomly selected. Due to budget restrictions, initial sampling dates were restricted to weekdays; weekend days were added starting December 11, 2011. Actual sampling start times were left to the discretion of the field sampling personnel, but they always started anywhere from 9:00 a.m. to 2:00 pm.

Quality Control Methods

Besides collecting field samples during monitoring, DPR collected additional quality control samples consisting of trip blank samples, field spikes and co-located duplicate samples.

A trip blank sample provides information on possible contamination of samples. For the manufactured pre-packed XAD-4 and charcoal sample tubes, the ends were broken open, capped and placed on dry ice with the field samples. The multi-pesticide XAD tubes were opened in the field, capped, and placed on dry ice to be stored and shipped with the field samples. Due to method development issues, 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 field and laboratory procedures.

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, including 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 with the exception of VOC samples. VOC field spikes were not collected since the CDFA laboratory does not currently have the proper equipment to create field spikes using canisters. The multi-pesticide XAD cartridge was spiked with two different analytes every month. While chloropicrin and MITC spiked samples varied the spiked concentrations every month. Spike samples outside the control limits established from the validation data for each pesticide would trigger a reassessment of the field and laboratory procedures.

A duplicate sample is a sample that is co-located with a field sample. These samples evaluate overall precision in sample measurement and analysis. DPR collected one duplicate sample for each sample type once per month of sampling.

At the request of DPR, the California Air Resources Board (ARB) conducted a technical system audit (TSA) of the AMN in 2011. The TSA ensures that the data collected by the AMN staff meets the data quality objectives of the program. Additionally, the TSA included flow check audits of all the pesticide samplers in the network, providing an additional assessment of the overall quality of the program. Staff from ARBs Quality Assurance Section (QAS) of the Monitoring and Laboratory Division conducted the TSA. ARB staff provided a questionnaire to be completed by CDPR and CDFA staff and conducted interviews of management and staff from both agencies. The questionnaire and interviews covered various aspects of the pesticide air monitoring program including network design, field operations, laboratory operations, data handling procedures, and quality assurance. (For audit results see Appendix A.)

Laboratory Methods

The CDFA's Center for Analytical Chemistry analyzed all AMN samples collected by DPR.

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 SOP 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 method detection limit 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.

CDFA initially had a detection limit of 1.00 ppb for VOC analysis, however, at the petition of DPR, they were able to improve their sampling method and lower the MDL tenfold to 0.10 ppb. VOC samples analyzed before June 14 2012 (date when new MDL went into effect) were analyzed using the higher detection limit of 1.00 ppb.

The limit of quantitation (LOQ) is the level at which concentrations may be reliably measured and is set at a certain factor above the method detection limit. The level of interference determines the magnitude of this factor; the more interference, the higher the factor. Table 3 lists all of quantitation limits for Air Monitoring Network samples.

Table 3. Quantitation limits for Air Monitoring Network samples.

Pesticide	Detection limit (ng/m^3)	Quantitation limit (MDL) (ng/m^3)
Acephate	1.0	9.2
Bensulide	1.4	9.3
Chloropicrin	222	2,778
Chlorothalonil	13.7	23.1
Chlorpyrifos	5.0	23.1
Chlorpyrifos OA	2.9	9.3
Cypermethrin	4.7	23.1
Dacthal	9.3	9.3
DDVP	3.2	23.1
Diazinon	1.2	9.3
Diazinon OA	2.1	9.3
Dicofol	2.2	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	9.3
Iprodione	1.1	9.6
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	3.7	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*		
Acrolein	--	229 (0.1 ppb)
Carbon Disulfide	--	311 (0.1 ppb)
1,3-Dichloropropene	--	454 (0.1 ppb)
Methyl Bromide	--	396 (0.1 ppb)
Methyl Iodide	--	580 (0.1 ppb)

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

*Had higher quantitation limit of 1.0 ppb from February - June.

Calculations of air concentrations

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 (ug/sample). The concentrations are converted from ug/sample to nanograms (ng) per cubic meter (m^3) of sample air using the following calculations:

$$\frac{sample\,results\,(ug) \times 1000\,L/m^3}{flow\,rate\,of\,sampler\,(L/\min) \times run\,time\,(\min)} \text{ x 1000 ng/ug = ng/m}^3$$

The VOC concentrations were reported as ppb and converted to ng/m3 using the following calculations:

$$\frac{sample\,results\,(ppb) \times molecular\,weight}{24.45} \text{ x 1000 = ng/m}^3$$

The calculation above assumes 1 atmosphere of pressure at 25 °C

When calculating average concentrations from multiple samples, samples with no detectable amount were assumed to contain one-half the MDL, and samples with trace amounts were assumed to contain the value halfway between the MDL and the LOQ.

Health Evaluation Methods

Pesticides can cause a variety of health effects at high concentrations. The pesticides included in the AMN were selected in part because risk assessments indicate the potential for high exposure or they are high priority for risk assessment due to toxicity and/or exposure concerns. The AMN pesticides can cause a variety of adverse effects, including respiratory illnesses, damage to the nervous system, cancer, and birth defects. The potential health effects of each pesticide are summarized in Appendix C.

No state or federal agency has established health standards for pesticides in air. Therefore, DPR developed health screening levels for the monitored pesticides to place the results in a health-based context. Health screening levels are calculated air concentrations based on a chemical's toxicity that is used to evaluate the possible health effects of exposure to the chemical. Although screening levels are not regulatory standards, they can be used to evaluate air monitoring results. A measured air concentration below the screening level for a given pesticide would not be considered a significant health concern and would not generally undergo further evaluation, but also should not automatically be considered “safe” and could undergo further evaluation. A measured concentration that is above the screening level would not necessarily indicate a significant health concern, but would indicate the need for a further, more refined evaluation. Significant exceedances of the screening levels could be of health concern and would indicate the need to explore the imposition of mitigation measures. More information on DPR determined screening levels including information on deriving screening levels for each individual pesticide can be found on Appendix C.

The cumulative exposure and risk were estimated using a hazard quotient and hazard index approach for pesticides that have a common mode of action. 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,

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

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.

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

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 samples for nine pesticides that may cause cancer, as designated by the Proposition 65, the Safe Drinking Water and Toxic Enforcement Act of 1986, or the Environmental Protection Agency's (EPA) B2 list. Proposition 65 protects California citizens and the State's drinking water sources from chemicals known to cause cancer, birth defects or other reproductive harm, and to inform citizens about exposures to such chemicals while EPA's B2 list "probable human carcinogen" chemicals. Chemicals on the Proposition 65 list for cancer are: carbon disulfide, oxydemeton methyl, and propargite while chemicals on EPA's B2 list are: 1,3-dichloropropene, chlorothalonil, DDVP, diuron, iprodione, 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 for 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. 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 goals, and these goals have been footnoted in the appropriate tables. The data from this monitoring will be used in part to determine the effectiveness of its mitigation measures in meeting these goals.

AIR MONITORING RESULTS

Results for All Pesticides and Communities Combined

DPR collected 143 sets of samples, with each set consisting of four samples analyzed for 34 pesticides and 5 breakdown products. Of the 143 sets of samples, 133 (93%) contained at least one detectable chemical. A total of 5,676 analyses were conducted on the air samples collected from all three sampling locations from February 1, 2011 to December 31, 2011. Of the 5,676 analyses, 425 (7.5%) showed detectable concentrations, which included quantifiable and trace detections. Samples with quantifiable concentrations accounted for 3.0% of all analyses conducted. Quantifiable detections refer to concentrations above the LOQ for their respective pesticide. Ten of the 34 pesticides and 5 pesticide breakdown products monitored by DPR were not detected. Table 4 lists the number of detections for each pesticide and pesticide breakdown products included in the AMN. The chemical with the highest number of detections was acrolein, due to its non-pesticidal sources, with 82 (58%) detections followed by chlorpyrifos with 45 (32%) detections. Acrolein is mainly produced as a byproduct of automobile emissions and other combustion sources not related to pesticidal uses (ATSDR, 2007). (Note: ARB has reclassified their air monitoring results for acrolein as "unverified" due to concerns about analytical standards used to calibrate the analytical instruments.)

Table 4. Percentage of positive samples per chemical.

Pesticide	Number of possible detections	Total number of detections[a]	Number of quantified detections	Detections as percent of possible detections	Quantifiable detections as percent of possible detections
EPTC	142	8	5	6%	4%
DDVP	142	4	0	3%	0%
Trifluralin	142	17	0	12%	0%
Chlorothalonil	142	24	0	17%	0%
Dacthal	142	29	0	20%	0%
Chlorpyrifos	142	45	2	32%	1%
Dicofol	142	0	0	0%	0%
Malathion	142	5	2	4%	1%
Endosulfan	142	0	0	0%	0%
Endosulfan Sulfate	142	0	0	0%	0%
Oxyfluorfen	142	2	0	1%	0%
Propargite	142	3	0	2%	0%
Iprodione	142	2	0	1%	0%
Permethrin	142	3	0	2%	0%
Cypermethrin	142	0	0	0%	0%
Acephate	142	1	0	1%	0%
Bensulide[b]	142	5	0	4%	0%
Chlorpyrifos OA[b]	142	38	1	27%	1%
SSS-tributyltriphosphorotrithioate (DEF)	142	0	0	0%	0%
Diazinon[b]	142	18	1	13%	1%
Diazinon OA	142	11	1	8%	1%
Dimethoate	142	0	0	0%	0%
Dimethoate OA	142	0	0	0%	0%
Diuron	142	5	0	4%	0%
Malathion OA	142	23	0	16%	0%
Methidathion[b]	142	4	0	3%	0%
Metolachlor[b]	142	5	0	4%	0%
Norflurazon	142	3	0	2%	0%
Oryzalin	142	2	0	1%	0%
Oxydemeton methyl	142	0	0	0%	0%
Phosmet	142	1	0	1%	0%
Simazine	142	6	0	4%	0%
MITC	143	44	44	31%	31%
Chloropicrin	143	3	3	2%	2%
Methyl Bromide	141	22	22	16%	16%
Acrolein	141	82	82	58%	58%
Methyl Iodide	141	0	0	0%	0%
Carbon Disulfide	141	0	0	0%	0%
cis-1,3-Dichloropropene	141	5	5	4%	4%
t-1,3-Dichloropropene	141	5	5	4%	4%
Total	**5676**	**425**	**173**	**7.5%**	**3.0%**

[a] Includes both quantifiable and trace detections

[b] Some detections for bensulide, chlorpyrifos OA, diazinon, methidathion, and metolachlor may be false positives, see ata Validation/Quality Assurance section for details.

Tables 5-8 list the number of detections for each pesticide and pesticide breakdown products per sampling location. Acrolein was the chemical with the most number of detections in all three sampling locations. Dacthal (19), chlorpyrifos (25), and MITC (20) were the chemicals with the most detections in Salinas, Shafter, and Ripon, respectively.

Table 5. Percentage of positive samples per chemical detected in Salinas, California.

Pesticide	Number of possible detections	Total number of detections[a]	Number of quantified detections	Detections as percent of possible detections	Quantifiable detections as percent of possible detections
EPTC	47	0	0	0%	0%
DDVP	47	3	0	6%	0%
Trifluralin	47	1	0	2%	0%
Chlorothalonil	47	0	0	0%	0%
Dacthal	47	19	0	40%	0%
Chlorpyrifos	47	11	0	23%	0%
pp-Dicofol	47	0	0	0%	0%
Malathion	47	4	2	9%	4%
Endosulfan	47	0	0	0%	0%
Endosulfan Sulfate	47	0	0	0%	0%
Oxyfluorfen	47	0	0	0%	0%
Propargite	47	0	0	0%	0%
Iprodione	47	0	0	0%	0%
Permethrin	47	0	0	0%	0%
Cypermethrin	47	0	0	0%	0%
Acephate	47	1	0	2%	0%
Bensulide	47	4	0	9%	0%
Chlorpyridos OA	47	5	0	11%	0%
SSS-tributyltriphosphorotrithioate (DEF)	47	0	0	0%	0%
Diazinon	47	11	0	23%	0%
Diazinon OA	47	8	0	17%	0%
Dimethoate	47	0	0	0%	0%
Dimethoate OA	47	0	0	0%	0%
Diuron	47	2	0	4%	0%
Malathion OA	47	14	0	30%	0%
Methidathion	47	4	0	9%	0%
Metolachlor	47	5	0	11%	0%
Norflurazon	47	2	0	4%	0%
Oryzalin	47	1	0	2%	0%
Oxydemeton methyl	47	0	0	0%	0%
Phosmet	47	1	0	2%	0%
Simazine	47	3	0	6%	0%
MITC	48	5	5	10%	10%
Chloropicrin	48	3	3	6%	6%
Methyl Bromide	48	9	9	19%	19%
Acrolein	48	28	28	58%	58%
Methyl Iodide	48	0	0	0%	0%
Carbon Disulfide	48	0	0	0%	0%
cis-1,3-Dichloropropene	48	3	3	6%	6%
t-1,3-Dichloropropene	48	3	3	6%	6%
Total	**1888**	**150**	**53**	**8%**	**3%**

***Includes both quantified and trace detections**

Table 6. Percentage of positive samples per chemical detected in Shafter, California.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
EPTC	47	8	5	17%	11%
DDVP	47	1	0	2%	0%
Trifluralin	47	4	0	9%	0%
Chlorothalonil	47	6	0	13%	0%
Dacthal	47	7	0	15%	0%
Chlorpyrifos	47	25	2	53%	4%
pp-Dicofol	47	0	0	0%	0%
Malathion	47	0	0	0%	0%
Endosulfan	47	0	0	0%	0%
Endosulfan Sulfate	47	0	0	0%	0%
Oxyfluorfen	47	0	0	0%	0%
Propargite	47	1	0	2%	0%
Iprodione	47	1	0	2%	0%
Permethrin	47	1	0	2%	0%
Cypermethrin	47	0	0	0%	0%
Acephate	47	0	0	0%	0%
Bensulide	47	1	0	2%	0%
Chlorpyridos OA	47	21	1	45%	2%
SSS-tributyltriphosphorotrithioate (DEF)	47	0	0	0%	0%
Diazinon	47	5	1	11%	2%
Diazinon OA	47	2	1	4%	2%
Dimethoate	47	0	0	0%	0%
Dimethoate OA	47	0	0	0%	0%
Diuron	47	3	0	6%	0%
Malathion OA	47	3	0	6%	0%
Methidathion	47	0	0	0%	0%
Metolachlor	47	0	0	0%	0%
Norflurazon	47	1	0	2%	0%
Oryzalin	47	1	0	2%	0%
Oxydemeton methyl	47	0	0	0%	0%
Phosmet	47	0	0	0%	0%
Simazine	47	2	0	4%	0%
MITC	47	19	19	40%	40%
Chloropicrin	47	0	0	0%	0%
Methyl Bromide	47	4	4	9%	9%
Acrolein	47	28	28	60%	60%
Methyl Iodide	47	0	0	0%	0%
Carbon Disulfide	47	0	0	0%	0%
cis-1,3-Dichloropropene	47	0	0	0%	0%
t-1,3-Dichloropropene	47	0	0	0%	0%
Total	**1880**	**144**	**61**	**8%**	**3%**

***Includes both quantified and trace detections**

Table 7. Percentage of positive samples per chemical detected in Ripon, California.

Pesticide	Number of possible detections	Total number of detections*	Number of quantified detections	Percent of possible detections	Percent of quantifiable detections
EPTC	48	0	0	0%	0%
DDVP	48	0	0	0%	0%
Trifluralin	48	12	0	25%	0%
Chlorothalonil	48	18	0	38%	0%
Dacthal	48	3	0	6%	0%
Chlorpyrifos	48	9	0	19%	0%
pp-Dicofol	48	0	0	0%	0%
Malathion	48	1	0	2%	0%
Endosulfan	48	0	0	0%	0%
Endosulfan Sulfate	48	0	0	0%	0%
Oxyfluorfen	48	2	0	4%	0%
Propargite	48	2	0	4%	0%
Iprodione	48	1	0	2%	0%
Permethrin	48	2	0	4%	0%
Cypermethrin	48	0	0	0%	0%
Acephate	48	0	0	0%	0%
Bensulide	48	0	0	0%	0%
Chlorpyridos OA	48	12	0	25%	0%
SSS-tributyltriphosphorotrithioate (DEF)	48	0	0	0%	0%
Diazinon	48	2	0	4%	0%
Diazinon OA	48	1	0	2%	0%
Dimethoate	48	0	0	0%	0%
Dimethoate OA	48	0	0	0%	0%
Diuron	48	0	0	0%	0%
Malathion OA	48	6	0	13%	0%
Methidathion	48	0	0	0%	0%
Metolachlor	48	0	0	0%	0%
Norflurazon	48	0	0	0%	0%
Oryzalin	48	0	0	0%	0%
Oxydemeton methyl	48	0	0	0%	0%
Phosmet	48	0	0	0%	0%
Simazine	48	1	0	2%	0%
MITC	48	20	20	42%	42%
Chloropicrin	48	0	0	0%	0%
Methyl Bromide	46	9	9	20%	20%
Acrolein	46	26	26	57%	57%
Methyl Iodide	46	0	0	0%	0%
Carbon Disulfide	46	0	0	0%	0%
cis-1,3-Dichloropropene	46	2	2	4%	4%
t-1,3-Dichloropropene	46	2	2	4%	4%
Total	**1908**	**131**	**59**	**7%**	**3%**

***Includes both quantified and trace detections**

Table 8 lists the total number of detections of the monitored chemicals segregated by the sampling location. All three sites show similar detection percentages for the monitored chemicals ranging from 6.9% to 7.9% of all collected samples. These detections included both quantifiable (above LOQ) and trace detections (above MDL but below LOQ). While Salinas provided the highest percentage of samples with detections at 7.9%, it also contained the lowest percent of quantifiable samples at 2.8%.

Table 8. Detections of monitored chemicals by location.

Location	**Number of possible detections**	**Total number of detections[a]**	**Number of quantified detections**	**Detections as percent of possible detections**	**Quantifiable detections as percent detections**
Salinas	1888	150	53	7.9%	2.8%
Shafter	1880	144	61	7.7%	3.2%
Ripon	1908	131	59	6.9%	3.1%
Total	**5676**	**425**	**173**	**7.5%**	**3.0%**

[a]Includes both quantifiable and trace detections

Table 9 presents the highest 1-day concentration at any site for each pesticide monitored. Except for acrolein, none of the pesticides monitored exceeded their screening level. Acrolein exceeded its screening level due to its non-pesticidal use. Diazinon (plus diazinon OA) was the next highest pesticide relative to its screening level with a maximum concentration of 95.6 ng/m^3 or 74% of its acute screening level, followed by 1,3-dichloropropene with a concentration of 12,250 ng/m^3 or 8% of its acute screening. Figures 2a-c and 3 illustrate the highest one-day concentrations detections in all three sampling sites for selected pesticides due to pesticidal use.

Table 9. Highest one-day concentration for chemicals monitored. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 1-day concentration (ng/m^3)	1-day acute screening level (ng/m^3)	% of screening level
Acephate	Trace (4.1)	12,000	0.034
Acrolein	5,960	350	1702.857
Bensulide	Trace (4.0)	259,000	0.002
Carbon Disulfide	Not Detected (156)	1,550,000	0.010
Chloropicrin	3,930	491,000*	0.800
Chlorothalonil	Trace (18.4)	34,000	0.054
Chlorpyrifos	27.4	1,200	2.283
Chlorpyrifos OA	9.2	1,200	0.766
Cypermethrin	Not Detected (2.3)	113,000	0.002
Dacthal	Trace (6.9)	23,500	0.029
DDVP	Trace (9.9)	11,000	0.090
Diazinon	59.6	130	45.846
Diazinon OA	36.0	130	27.692
1,3-Dichloropropene	12,250	160,000	7.660
Dicofol	Not Detected (1.1)	68,000	0.002
Dimethoate	Not Detected (1.2)	4,300	0.028
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	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	187	230,000	0.081
Iprodione	Trace (11.0)	939,000	0.001
Malathion	12.5	112,500	0.011
Malathion OA	Trace (4.0)	112,500	0.004
Methidathion	Trace (3.9)	3,100	0.126
Methyl Bromide	6,060	820,000*	0.739
Methyl Iodide	Not Detected (169)	185,770	0.091
Metolachlor	Trace (3.3)	85,000	0.004
MITC	930	66,000*	1.409
Norflurazon	Trace (2.8)	170,000	0.002
Oryzalin	Trace (10.9)	420,000	0.003
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003
Oxyfluorfen	Trace (8.4)	510,000	0.002
Permethrin	Trace (7.9)	168,000	0.005
Phosmet	Trace (8.6)	77,000	0.011
Propargite	Trace (9.7)	14,000	0.069
Simazine	Trace (4.1)	110,000	0.004
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (10.7)	1,200,000	0.001

* DPR regulatory target level for 1-day or shorter exposure.

Figure 2a. Highest one-day (acute) concentrations detected in all three sampling locations.

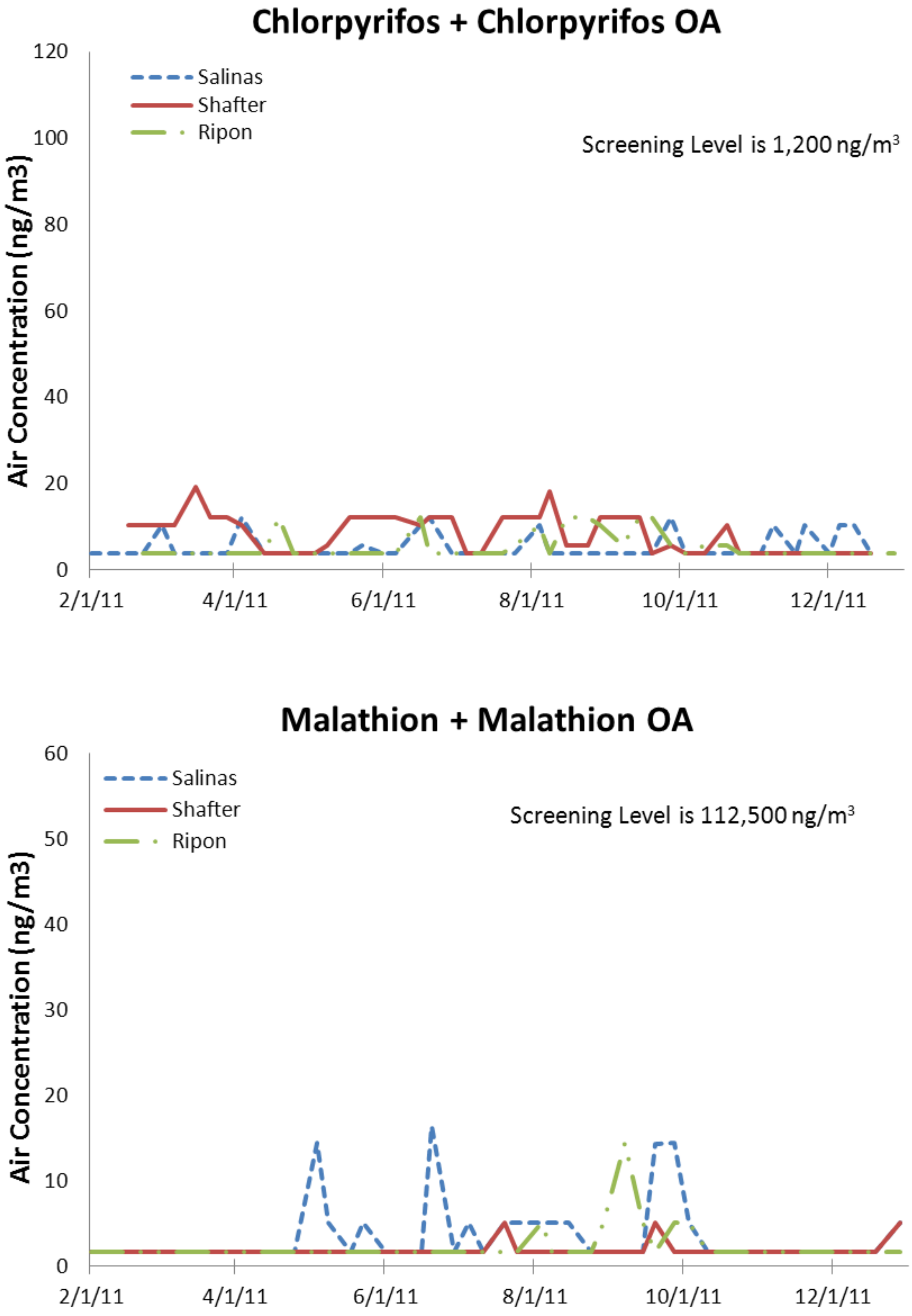
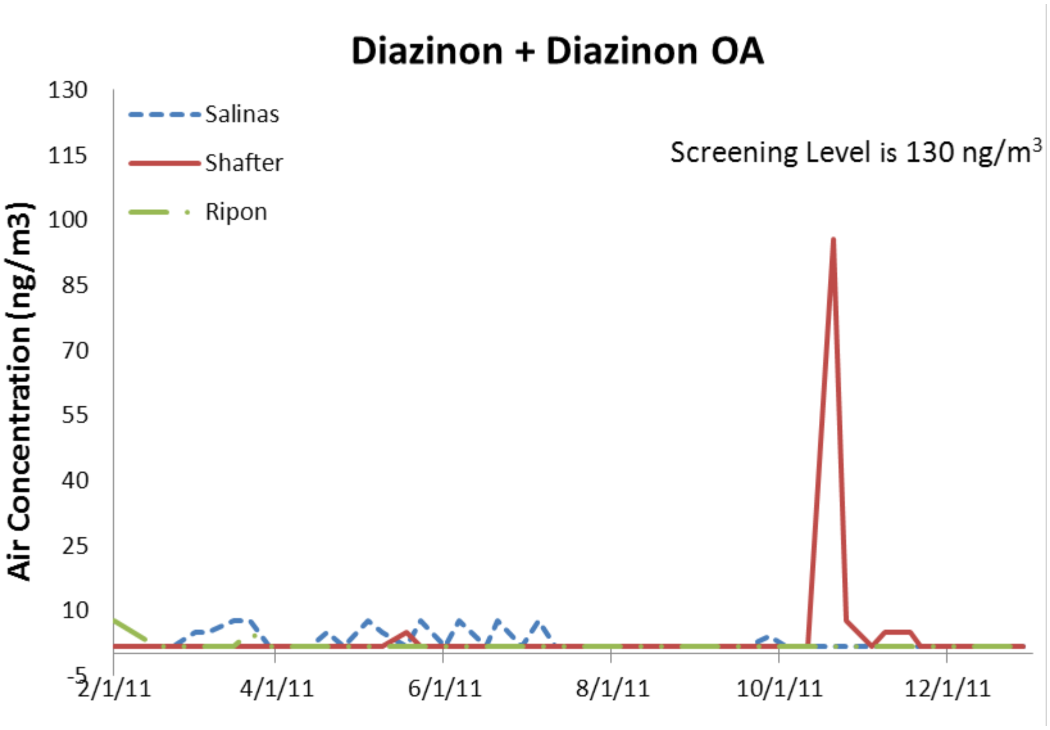


Figure 2b. Highest one-day (acute) concentrations detected in all three sampling locations (continued).



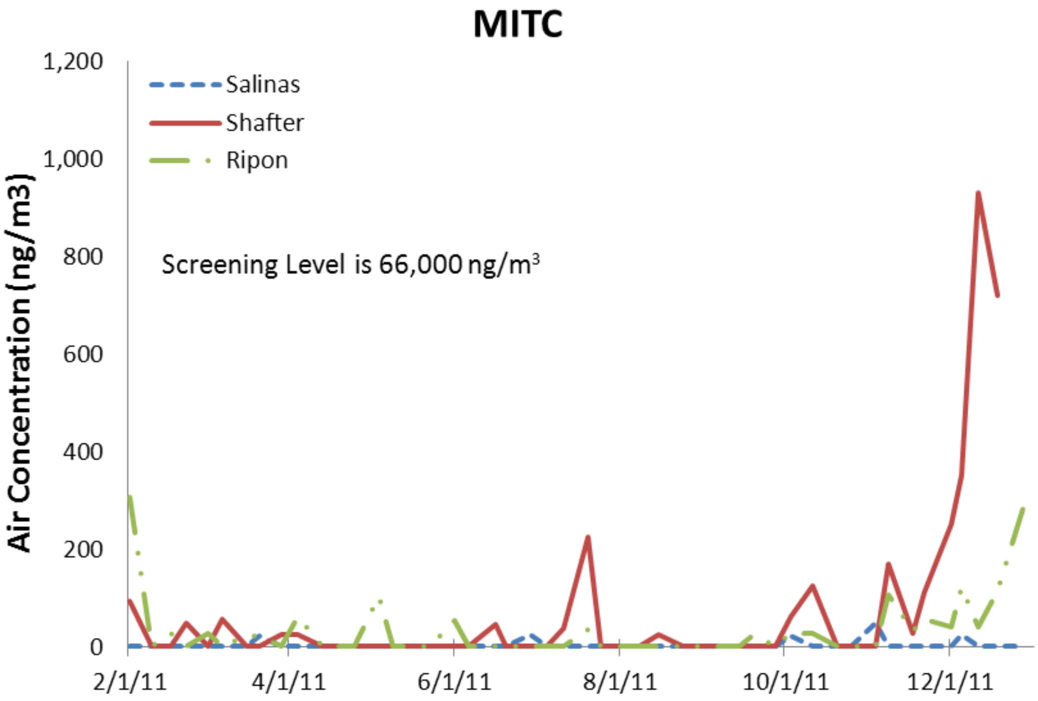
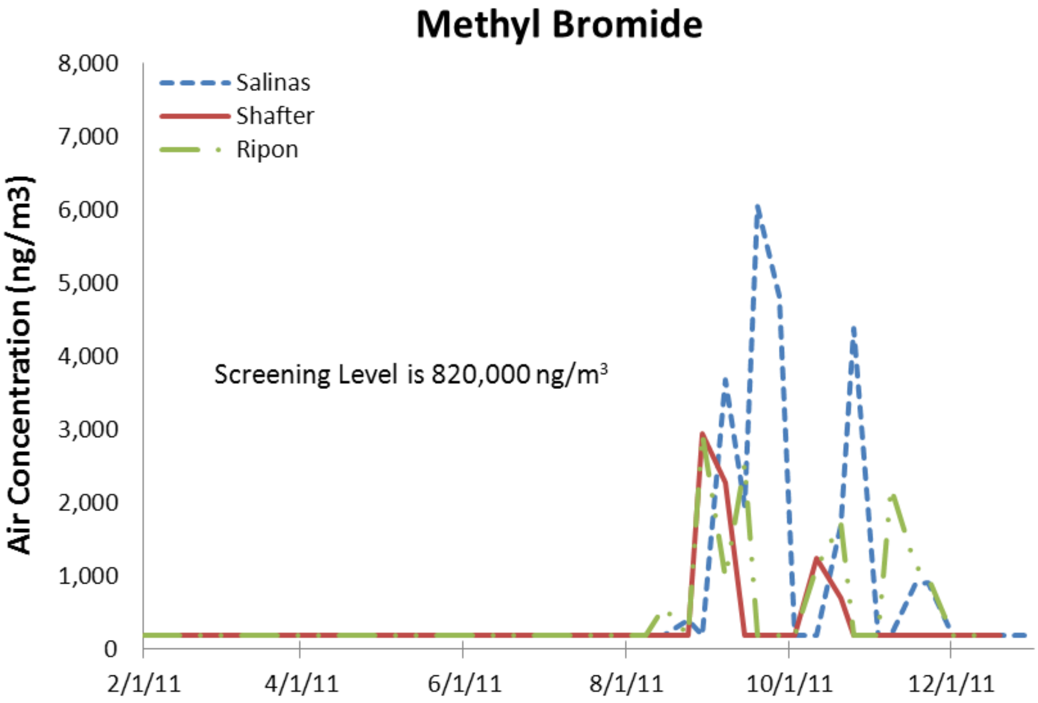


Figure 2c. Highest one-day (acute) concentrations detected in all three sampling locations (continued).



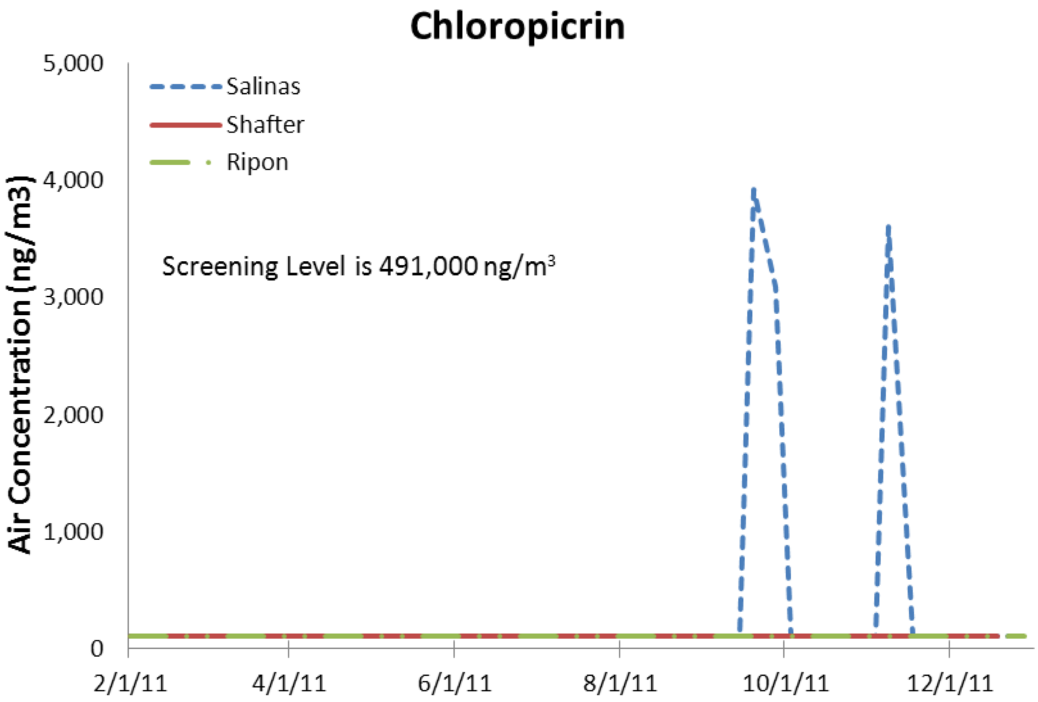


Figure 3. Highest one-day (acute) concentrations detected for the aggregate of cis- and trans-1,3-dichloropropene in all three sampling locations.

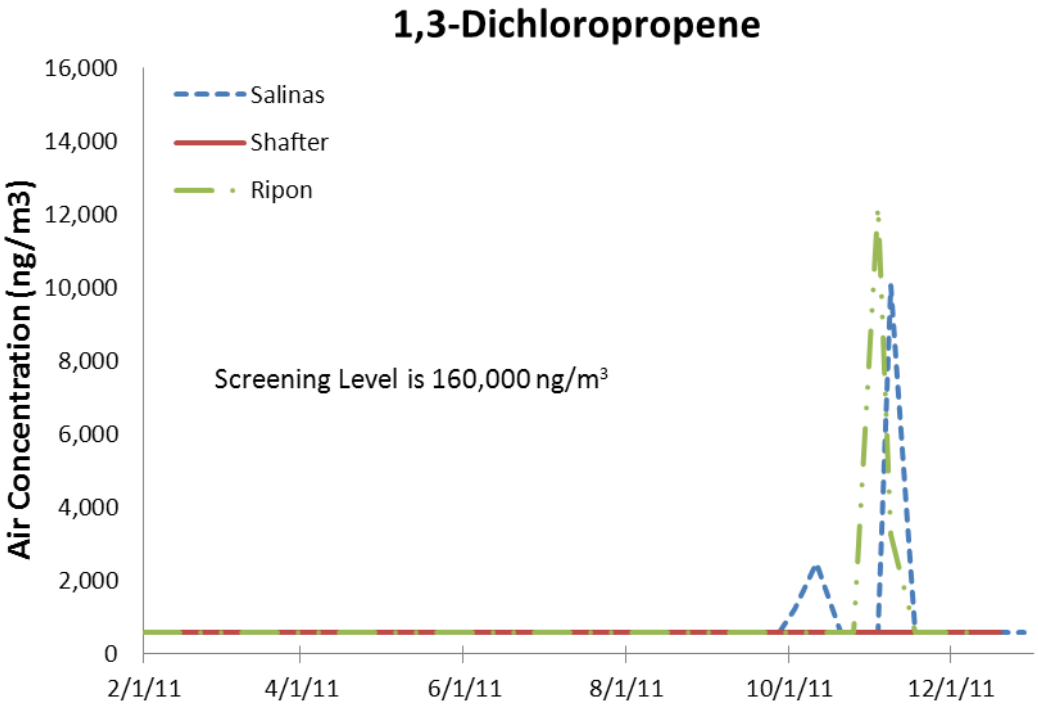


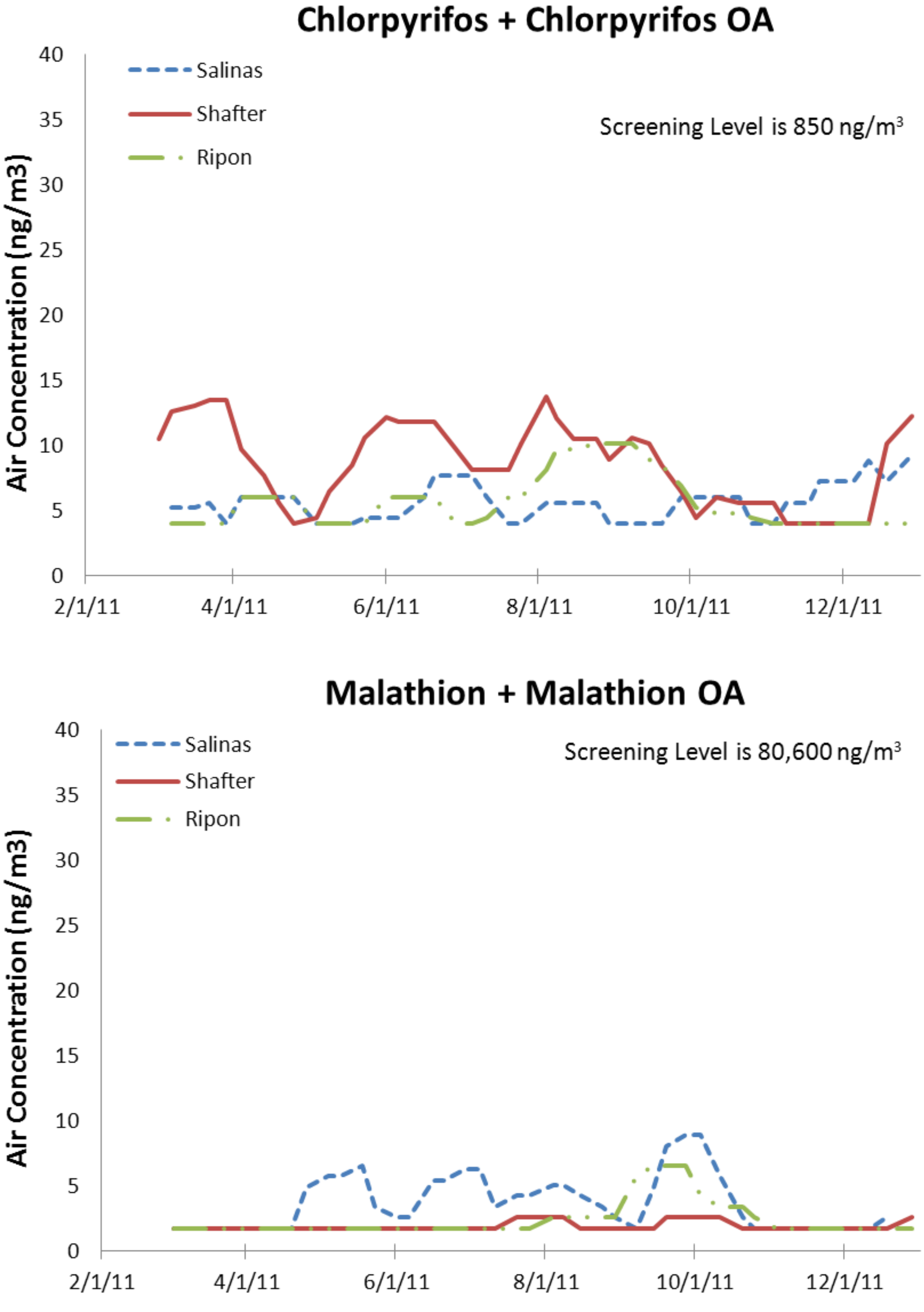
Table 10 shows the highest 4-week average concentrations. As with acute exposures, acrolein was the only pesticide to exceed its screening level, but due to non-pesticidal uses. The pesticide with the next highest subchronic exposure was chloropicrin, with a maximum 4-week concentration of 1,810 ng/m^3 or 79% of its screening level. Diazinon (plus diazinon OA) and methyl bromide were the next highest, both with maximum 4-week concentrations equivalent to 21% of their screening levels. Methyl bromide also had the highest absolute 4-week concentration of 4,124 ng/m^3. Figures 4a-c present the highest 4-week concentrations measured in any sample for each of the pesticides with a quantifiable detection that was from pesticidal use, compared with the subchronic screening level for the pesticide. Figure 5 presents the rolling 4-week concentrations measured for the sum of cis-1,3-dichloropropene and trans-1,3- dichloropropene from all three sampling locations. The 4-week 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 10. The highest of rolling 4-week air concentrations, subchronic screening levels, and % of the subchronic screening level. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 4-wk rolling concentration (ng/m^3)	Subchronic screening level (ng/m^3)	% of screening level
Acephate	Trace (1.4)	8,500	0.017
Acrolein	2,770	350	792.344
Bensulide	Trace (2.3)	24,000	0.010
Carbon Disulfide	Not Detected (155.5)	800,000	0.019
Chloropicrin	1,810	2,300	78.641
Chlorothalonil	Trace (18.4)	34,000	0.054
Chlorpyrifos	10.8	850	1.265
Chlorpyrifos OA	4.7	850	0.552
Cypermethrin	Not Detected (2.3)	81,000	0.003
Dacthal	Trace (6.9)	470	1.457
DDVP	Trace (3.7)	2,200	0.168
Diazinon	17.1	130	13.140
Diazinon OA	10.4	130	8.025
1,3-Dichloropropene	4,020	120,000	3.352
Dicofol	Not Detected (1.1)	49,000	0.002
Dimethoate	Not Detected (1.2)	3,000	0.039
Dimethoate OA	Not Detected (1.0)	3,000	0.032
Diuron	Trace (6.1)	17,000	0.036
Endosulfan	Not Detected (1.6)	3,300	0.049
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	75.0	24,000	0.313
Iprodione	Trace (3.2)	286,000	0.001
Malathion	5.7	80,600	0.007
Malathion OA	Trace (4.0)	80,600	0.005
Methidathion	Trace (2.3)	3,100	0.075
Methyl Bromide	4,120	19,400*	21.258
Methyl Iodide	Not Detected (168.5)	261,240	0.065
Metolachlor	Trace (2.3)	15,000	0.0002
MITC	564	3,000	0.1878
Norflurazon	Trace 2.3	26,000	0.0001
Oryzalin	Trace 3.2	230,000	0.0000
Oxydemeton methyl	Not Detected (1.2)	610	0.0019
Oxyfluorfen	Trace (5.3)	180,000	0.0000
Permethrin	Trace (4.7)	90,000	0.0001
Phosmet	Trace (5.1)	26,000	0.0002
Propargite	Trace (5.8)	14,000	0.0004
Simazine	Trace (2.3)	31,000	0.0001
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.0001
Trifluralin	Trace (8.2)	170,000	0.0001

* DPR regulatory target level for 4-week exposure.

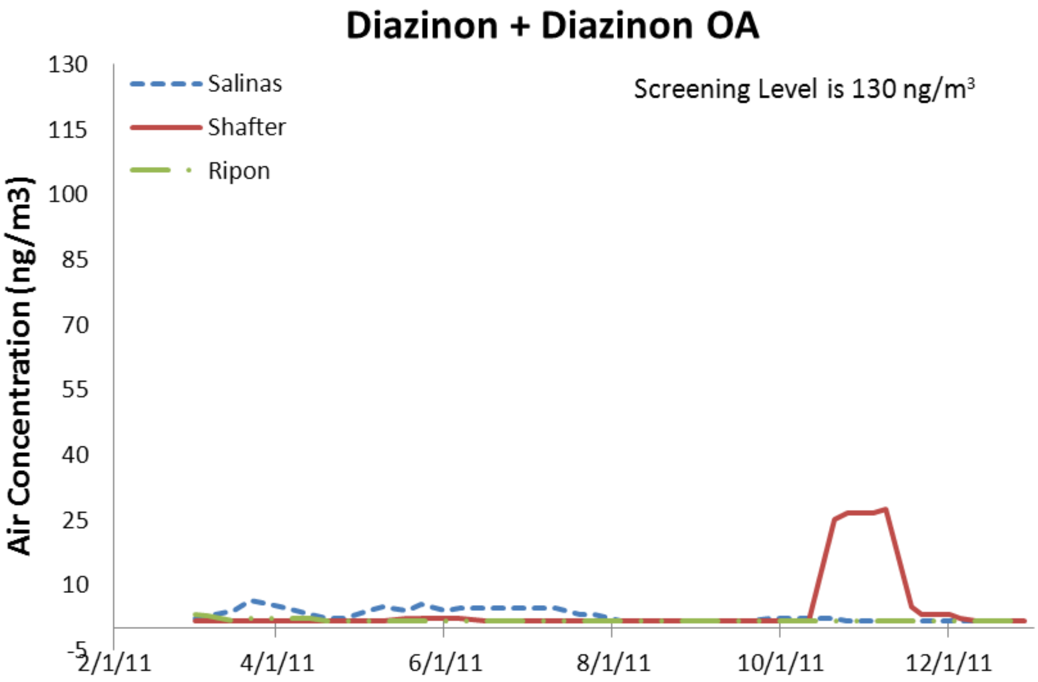
Figure 4a. Rolling 4-week average (subchronic) concentrations detected for the three monitoring locations. Concentrations are presented as rolling or moving averages (i.e., average of weeks 1,2,3, and 4; average of weeks 2,3,4, and 5, etc.).



Screening Level is 850 ng/m^3

Screening Level is 80,600 ng/m^3

Figure 4b. Rolling 4-week average (subchronic) concentrations detected for the three monitoring locations. 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.) (continued).



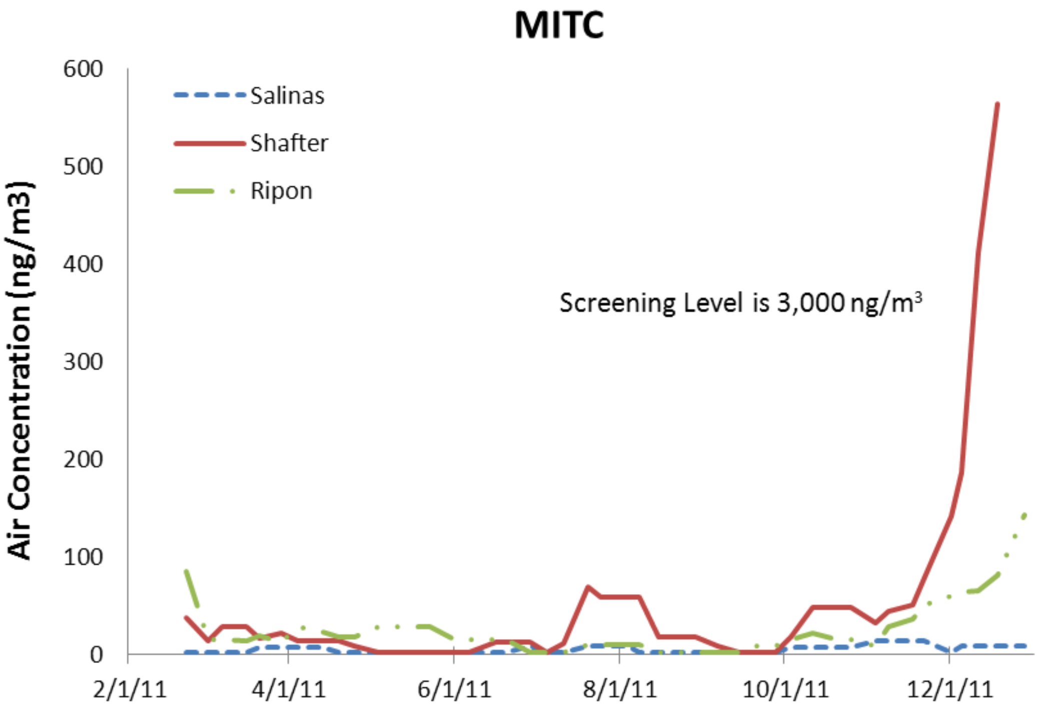
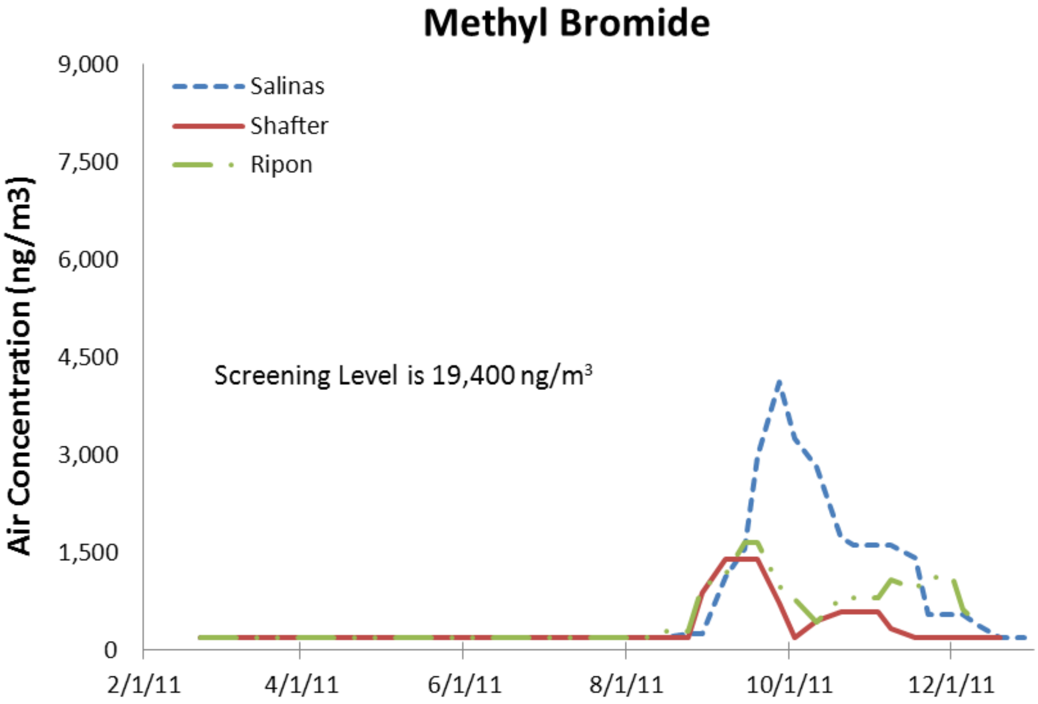


Figure 4c. Rolling 4-week average (subchronic) concentrations detected for the three monitoring locations. Concentrations are presented as rolling or moving averages (i.e., average of weeks 1,2,3, and 4; average of weeks 2,3,4, and 5, etc.) (continued).



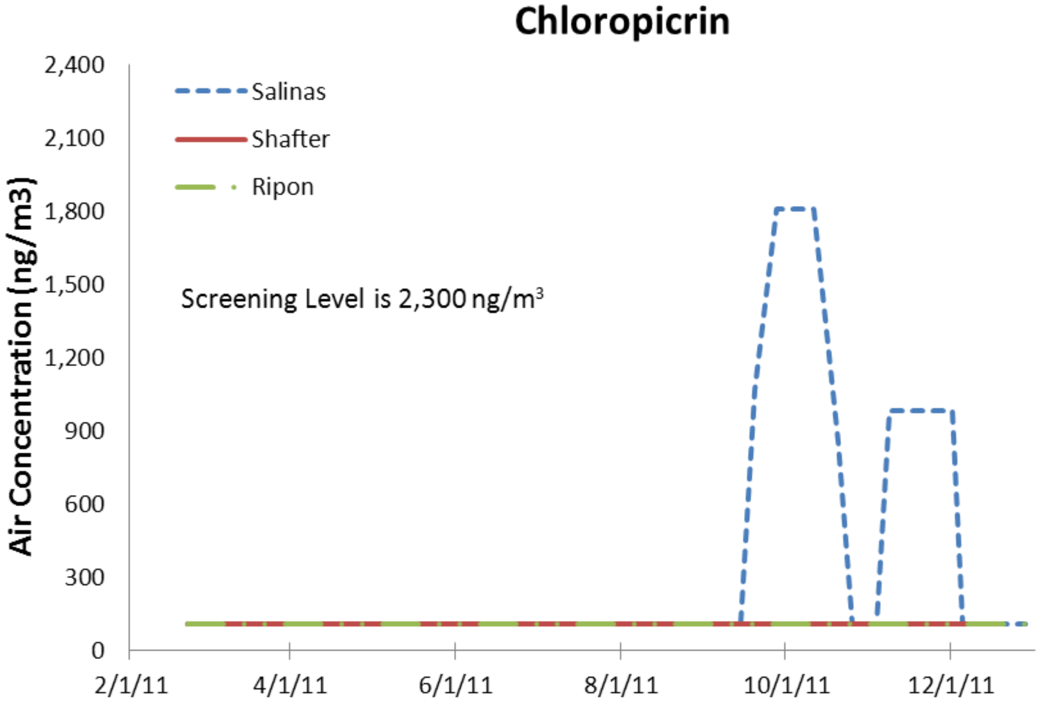


Figure 5. Rolling 4-week average (subchronic) concentrations detected for the aggregate of cis- and trans-1,3-dichloropropene in all three sampling locations.

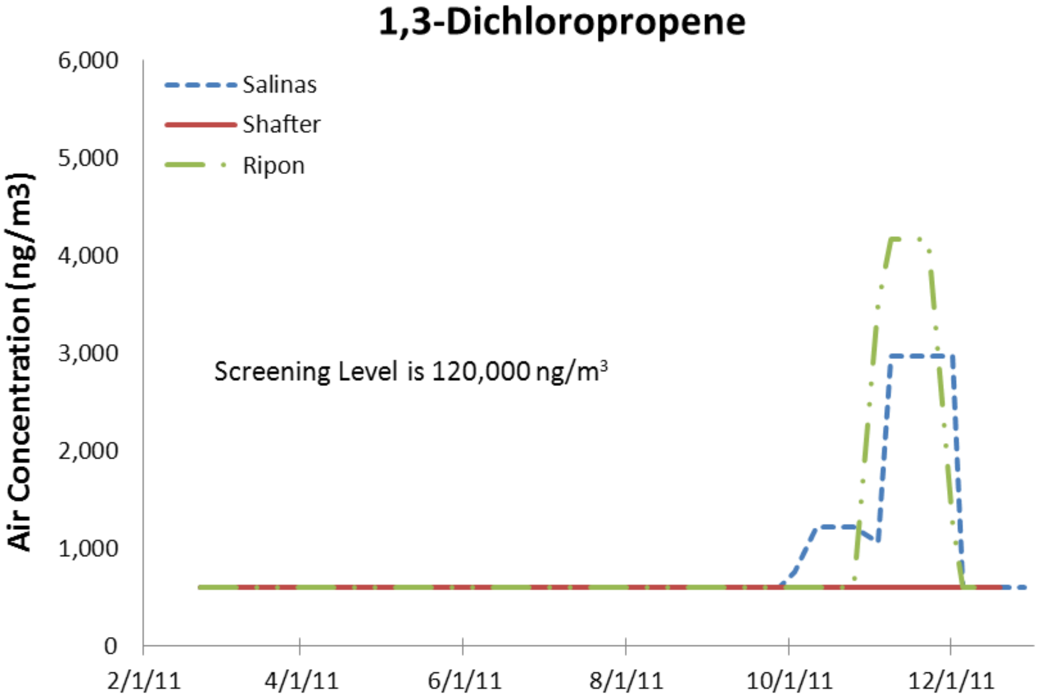


Table 11 shows the overall average concentrations for all samples collected from February 1, 2011 to December 31, 2011. Average concentrations were calculated using one-half the MDL for samples with no detectable amount, and a value halfway between the MDL and the LOQ for samples with trace (unquantifiable) concentrations. With the exception of acrolein, due to its non-pesticidal uses, no pesticide average concentrations exceeded the screening levels for the chronic exposure period. The pesticides with the next highest chronic exposures were methyl bromide, with an overall concentration of 695 ng/m^3 or 17% of its chronic screening level, and MITC with an overall concentration of 37.4 ng/m^3 or 12% of its screening level. The highest overall average concentration measured for pesticide was 695 ng/m^3 for methyl bromide. The second highest was 630 ng/m^3 for 1,3-dichloropropene.

Table 11. The average concentration for all chemicals from samples collected from February 1, 2011 through December 31, 2011. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Overall average concentration (ng/m^3)	Chronic screening level (ng/m^3)	% of screening level
Acephate	Trace (0.5)	8,500	0.006
Acrolein	1190*	350	339.618
Bensulide	Trace (0.8)	24,000	0.003
Carbon Disulfide	Not Detected (156)*	800,000	0.019
Chloropicrin	183	1,800	10.161
Chlorothalonil	Trace (8.8)	34,000	0.026
Chlorpyrifos	4.8	510	0.934
Chlorpyrifos OA	2.0	510	0.385
Cypermethrin	Not Detected (2.3)	27,000	0.009
Dacthal	Trace (5.1)	47	10.934
DDVP	Trace (1.9)	770	0.241
Diazinon	1.4	130	1.087
Diazinon OA	1.5	130	1.129
1,3-Dichloropropene	630*	120,000	0.525
Dicofol	Not Detected (1.1)	20,000	0.005
Dimethoate	Not Detected (1.2)	300	0.385
Dimethoate OA	Not Detected (1.0)	300	0.323
Diuron	Trace (2.7)	5,700	0.048
Endosulfan	Not Detected (1.6)	330	0.491
Endosulfan Sulfate	Not Detected (2.3)	330	0.702
EPTC	3.3	8,500	0.039
Iprodione	Trace (0.7)	286,000	0.000
Malathion	1.4	8,100	0.018
Malathion OA	Trace (1.2)	8,100	0.015
Methidathion	Trace (0.8)	2,500	0.032
Methyl Bromide	695*	3,900	17.820
Methyl Iodide	Not Detected (169)*	87,080	0.194
Metolachlor	Trace (1.4)	15,000	0.010
MITC	37.4	300	12.464
Norflurazon	Trace (1.9)	26,000	0.007
Oryzalin	Trace (0.8)	232,000	0.000
Oxydemeton methyl	Not Detected (1.2)	610	0.189
Oxyfluorfen	Trace (3.3)	51,000	0.006
Permethrin	Trace (3.7)	90,000	0.004
Phosmet	Trace (4.0)	18,000	0.022
Propargite	Trace (2.1)	14,000	0.015
Simazine	Trace (0.7)	31,000	0.002
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	
Trifluralin	Trace (2.0)	41,000	0.005

*Average concentration for a 6-month period.

Table 12 summarizes the magnitude of the air concentrations relative to the screening levels for the eight pesticides (plus two breakdown products) that had quantifiable concentrations in at least one sample, excluding acrolein. None of the pesticides exceeded its screening level for any of the exposure periods. Seven of the nine pesticides were either fumigants or organophosphate insecticides. EPTC was the exception as a thiocarbamate herbicide. Diazinon (plus its OA) had the highest acute risk, with a maximum 1-day concentration that was 74% of its acute screening level. Chloropicrin had the highest subchronic risk, with a maximum 4-week concentration that was 79% of its subchronic screening level. MITC had the highest chronic risk, with an 11-month concentration that was 12% of its screening level (chronic risk for 1,3-dichlorpropene and methyl bromide are based on 6-month concentrations). For all three exposure periods combined, diazinon (plus its OA) and chloropicrin had the highest overall risks.

Table 12. Overall air concentrations relative to the screening levels for chemicals with quantifiable concentrations, excluding acrolein. A concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	% of acute screening level	% of subchronic screening level	% of chronic screening level
Diazinon + OA	73.538	21.165	2.216
Chloropicrin	0.800	78.641	10.161
Methyl Bromide	0.739	21.258	17.820*
Chlorpyrifos + OA	1.592	1.817	1.319
MITC	1.409	0.188	12.464
1,3-Dichloropropene	7.625	3.352	0.525*
EPTC	0.081	0.313	0.039
Malathion	0.011	0.007	0.018

* Based on 6-month air concentrations.

Results for Salinas

Tables 13-15 show the highest 1-day, 4-week, and overall average concentrations for pesticides monitored in Salinas, respectively. None of the pesticides exceeded the screening levels, except acrolein due to non-pesticidal uses. Six pesticides were detected at quantifiable concentrations in Salinas: acrolein, chloropicrin, 1,3-dichloropropene, malathion, methyl bromide, and MITC. Seventeen additional pesticides (or breakdown products) were detected at trace levels. Sixteen pesticides (or breakdown products) were not detected. Except for acrolein, fumigants had higher air concentrations than other pesticides in Salinas, relative to the screening levels. 1,3-dichloropropene had the highest 1-day concentration relative to its screening level (6.3% of its screening level, 10,072 ng/m^3). Chloropicrin had the highest 4-week average concentration relative to its screening level (79% of its screening level, 1,809 ng/m^3). Methyl bromide had the highest overall concentration relative to its screening level (26%, 1,020 ng/m^3). Cumulative exposure to organophosphate is discussed in a later section.

Table 13. Highest 1-day concentrations for pesticides monitored in Salinas, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 1-day concentration (ng/m3)	1-day acute screening level (ng/m3)	% of screening level
Acephate	Trace (4.1)	12,000	0.034
Acrolein	3,117	350	890.571
Bensulide	Trace (4.0)	259,000	0.002
Carbon Disulfide	Not Detected (156)	1,550,000	0.010
Chloropicrin	3,926	491,000	0.800
Chlorothalonil	Not Detected (6.9)	34,000	0.020
Chlorpyrifos	Trace (9.0)	1,200	0.750
Chlorpyrifos OA	Trace (3.2)	1,200	0.267
Cypermethrin	Not Detected (2.3)	113,000	0.002
Dacthal	Trace (6.9)	23,500	0.029
DDVP	Trace (9.9)	11,000	0.090
Diazinon	Trace (4.1)	130	3.154
Diazinon OA	Trace (3.6)	130	2.769
1,3-Dichloropropene	10,072	160,000	6.295
pp-Dicofol	Not Detected (1.1)	68,000	0.002
Dimethoate	Not Detected (1.2)	4,300	0.028
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	0.048
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	12.5	112,500	0.011
Malathion OA	Trace (4.0)	112,500	0.004
Methidathion	Trace (3.9)	3,100	0.126
Methyl Bromide	6,055	820,000	0.738
Methyl Iodide	Not Detected (169)	185,770	0.091
Metolachlor	Trace (3.3)	85,000	0.004
MITC	50.5	66,000	0.077
Norflurazon	Trace (2.8)	170,000	0.002
Oryzalin	Trace (10.9)	420,000	0.003
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	Trace (8.6)	77,000	0.011
Propargite	Not Detected (1.9)	14,000	0.014
Simazine	Trace (4.1)	110,000	0.004
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (10.7)	1,200,000	0.001

Table 14. Highest 4-week rolling concentrations for pesticides monitored in Salinas, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	**Highest 4-wk rolling concentration (ng/m3)**	**Subchronic screening level (ng/m3)**	**% of screening level**
Acephate	Trace (1.4)	8,500	0.016
Acrolein	1706.3	350	487.514
Bensulide	Trace (2.3)	24,000	0.010
Carbon Disulfide	Not Detected (155.5)	800,000	0.019
Chloropicrin	1808.7	2,300	78.639
Chlorothalonil	Not Detected (6.9)	34,000	0.020
Chlorpyrifos	Trace (7.4)	850	0.871
Chlorpyrifos OA	Trace (1.9)	850	0.224
Cypermethrin	Not Detected (2.3)	81,000	0.003
Dacthal	Trace (6.9)	470	1.468
DDVP	Trace (3.7)	2,200	0.168
Diazinon	Trace (4.1)	130	3.154
Diazinon OA	Trace (2.3)	130	1.769
1,3-Dichloropropene	2742.5	120,000	2.285
pp-Dicofol	Not Detected (1.1)	49,000	0.002
Dimethoate	Not Detected (1.2)	3,000	0.040
Dimethoate OA	Not Detected (1.0)	3,000	0.033
Diuron	Trace (4.9)	17,000	0.029
Endosulfan	Not Detected (1.6)	3,300	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	Not Detected (0.8)	24,000	0.003
Iprodione	Not Detected (0.5)	286,000	0.000
Malathion	5.7	80,600	0.007
Malathion OA	Trace (4.0)	80,600	0.005
Methidathion	Trace (2.3)	3,100	0.074
Methyl Bromide	4124.0	19,400	21.258
Methyl Iodide	Not Detected (168.5)	261,240	0.065
Metolachlor	Trace (2.3)	15,000	0.015
MITC	14.7	3,000	0.490
Norflurazon	Trace (2.3)	26,000	0.009
Oryzalin	Trace (3.2)	230,000	0.001
Oxydemeton methyl	Not Detected (1.2)	610	0.197
Oxyfluorfen	Not Detected (3.2)	180,000	0.002
Permethrin	Not Detected (3.6)	90,000	0.004
Phosmet	Trace (5.1)	26,000	0.020
Propargite	Not Detected (1.9	14,000	0.014
Simazine	Trace (2.3)	31,000	0.007
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (3.3)	170,000	0.002

Table 15. Overall average concentrations for pesticides monitored in Salinas, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Overall average concentration (ng/m3)	Chronic Screening Level (ng/m3)	% of screening level
Acephate	Trace (0.6)	8,500	0.007
Acrolein	1,077*	350	307.714
Bensulide	Trace (1.0)	24,000	0.004
Carbon Disulfide	Not Detected (156)*	800,000	0.019
Chloropicrin	325	1,800	18.067
Chlorothalonil	Not Detected (6.9)	34,000	0.020
Chlorpyrifos	Trace (4.0)	510	0.793
Chlorpyrifos OA	Trace (1.6)	510	0.322
Cypermethrin	Not Detected (2.3)	27,000	0.009
Dacthal	Trace (5.6)	47	11.849
DDVP	Trace (2.2)	770	0.279
Diazinon	Trace (1.4)	130	1.074
Diazinon OA	Trace (1.5)	130	1.136
1,3-Dichloropropene	760*	120,000	0.633
pp-Dicofol	Not Detected (1.1)	20,000	0.005
Dimethoate	Not Detected (1.2)	300	0.385
Dimethoate OA	Not Detected (1.0)	300	0.323
Diuron	Trace (2.8)	5,700	0.049
Endosulfan	Not Detected (1.6)	330	0.491
Endosulfan Sulfate	Not Detected (2.3)	330	0.702
EPTC	Not Detected (0.8)	8,500	0.010
Iprodione	Not Detected (0.5)	286,000	0.000
Malathion	1.9	8,100	0.024
Malathion OA	Trace (1.6)	8,100	0.020
Methidathion	Trace (1.0)	2,500	0.040
Methyl Bromide	1,020*	3,900	26.146
Methyl Iodide	Not Detected (169)*	87,080	0.194
Metolachlor	Trace (1.6)	15,000	0.010
MITC	5.6	300	1.865
Norflurazon	Trace (1.9)	26,000	0.007
Oryzalin	Trace (0.9)	232,000	0.000
Oxydemeton methyl	Not Detected (1.2)	610	0.189
Oxyfluorfen	Not Detected (3.2)	51,000	0.006
Permethrin	Not Detected (3.6)	90,000	0.004
Phosmet	Trace (4.1)	18,000	0.023
Propargite	Not Detected (1.9)	14,000	0.014
Simazine	Trace (0.8)	31,000	0.003
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	
Trifluralin	Trace (1.0)	41,000	0.003

*Average concentration for a 6-month period.

Results for Shafter

Tables 16-18 show the highest 1-day, 4-week, and overall average concentrations for pesticides monitored in Shafter, respectively. None of the pesticides exceeded the screening levels, except acrolein due to non-pesticidal uses. Eight pesticides (or breakdown products) were detected at quantifiable concentrations in Salinas: acrolein, chlorpyrifos, chlorpyrifos OA, diazinon, diazinon OA, EPTC, methyl bromide, and MITC. Twelve additional pesticides (or breakdown products) were detected at trace levels. Eighteen pesticides (or breakdown products) were not detected. Except for acrolein, diazinon and fumigants had higher air concentrations than other pesticides in Shafter, relative to the screening levels. Diazinon (plus its OA) had the highest 1-day and 4-week concentrations relative to its screening level, 74% and 21% of its screening level, respectively. MITC had the highest overall concentration relative to its screening level (24%, 73 ng/m^3). Cumulative exposure to organophosphaste is discussed in a later section.

Table 16. Highest 1-day concentrations for pesticides monitored in Shafter, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 1-day concentration (ng/m3)	1-day acute screening level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	12,000	0.004
Acrolein	2,796	350	798.893
Bensulide	Trace (4.0)	259,000	0.002
Carbon Disulfide	Not Detected (156)	1,550,000	0.010
Chloropicrin	Not Detected (111)	491,000	0.023
Chlorothalonil	Trace (18.4)	34,000	0.054
Chlorpyrifos	27.4	1,200	2.279
Chlorpyridos OA	9.2	1,200	0.767
Cypermethrin	Not Detected (2.3)	113,000	0.002
Dacthal	Trace (6.9)	23,500	0.029
DDVP	Trace (9.9)	11,000	0.090
Diazinon	59.6	130	45.853
Diazinon OA	36.0	130	27.723
1,3-Dichloropropene	Not Detected (300)	160,000	0.188
pp-Dicofol	Not Detected (1.1)	68,000	0.002
Dimethoate	Not Detected (1.2)	4,300	0.028
Dimethoate OA	Not Detected (1.0)	4,300	0.023
Diuron	Trace (7.2)	170,000	0.000
Endosulfan	Not Detected (1.6)	3,300	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	187	230,000	0.081
Iprodione	Trace (11.0)	939,000	0.001
Malathion	Not Detected (1.1)	112,500	0.001
Malathion OA	Trace (4.0)	112,500	0.004
Methidathion	Not Detected (0.7)	3,100	0.023
Methyl Bromide	2,934	820,000	0.358
Methyl Iodide	Not Detected (169)	185,770	0.091
Metolachlor	Not Detected (1.4)	85,000	0.002
MITC	930	66,000	1.410
Norflurazon	Trace (2.8)	170,000	0.002
Oryzalin	Trace (10.9)	420,000	0.003
Oxydemeton methyl	Not Detected (1.2)	39,200	0.003
Oxyfluorfen	Not Detected (3.2)	510,000	0.001
Permethrin	Trace (7.9)	168,000	0.005
Phosmet	Not Detected (4.0)	77,000	0.005
Propargite	Trace (9.7)	14,000	0.069
Simazine	Trace (4.1)	110,000	0.004
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (10.7)	1,200,000	0.001

Table 17. Highest 4-week rolling concentrations for pesticides monitored in Shafter, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 4-wk rolling concentration (ng/m3)	Subchronic screening level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	8,500	0.006
Acrolein	1900.6	350	543.029
Bensulide	Trace (1.5)	24,000	0.006
Carbon Disulfide	Not Detected (155.5)	800,000	0.019
Chloropicrin	Not Detected (111.0)	2,300	4.826
Chlorothalonil	Trace (12.6)	34,000	0.037
Chlorpyrifos	10.8	850	1.271
Chlorpyrifos OA	4.7	850	0.553
Cypermethrin	Not Detected (2.3)	81,000	0.003
Dacthal	Trace (6.9)	470	1.468
DDVP	Trace (3.7)	2,200	0.168
Diazinon	17.1	130	13.154
Diazinon OA	10.4	130	8.000
1,3-Dichloropropene	Not Detected (299.5)	120,000	0.250
pp-Dicofol	Not Detected (1.1)	49,000	0.002
Dimethoate	Not Detected (1.2)	3,000	0.040
Dimethoate OA	Not Detected (1.0)	3,000	0.033
Diuron	Trace (6.1)	17,000	0.036
Endosulfan	Not Detected (1.6)	3,300	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	75.0	24,000	0.313
Iprodione	Trace (3.2)	286,000	0.001
Malathion	Not Detected (1.1)	80,600	0.001
Malathion OA	Trace (1.5)	80,600	0.002
Methidathion	Not Detected (0.7)	3,100	0.023
Methyl Bromide	1403.2	19,400	7.233
Methyl Iodide	Not Detected (168.5)	261,240	0.065
Metolachlor	Not Detected (1.4)	15,000	0.009
MITC	563.5	3,000	18.783
Norflurazon	Trace (2.1)	26,000	0.008
Oryzalin	Trace (3.2)	230,000	0.001
Oxydemeton methyl	Not Detected (1.2)	610	0.197
Oxyfluorfen	Not Detected (3.2)	180,000	0.002
Permethrin	Trace (4.7)	90,000	0.005
Phosmet	Not Detected (4.0)	26,000	0.015
Propargite	Trace (3.8)	14,000	0.027
Simazine	Trace (2.3)	31,000	0.007
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (5.8)	170,000	0.003

Table 18. Overall average concentrations for pesticides monitored in Shafter, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Overall average concentration (ng/m3)	Chronic Screening Level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	8,500	0.006
Acrolein	1,233*	350	352.244
Bensulide	Trace (0.8)	24,000	0.003
Carbon Disulfide	Not Detected (156)*	800,000	0.019
Chloropicrin	Not Detected (111)	1,800	6.167
Chlorothalonil	Trace (8.3)	34,000	0.024
Chlorpyrifos	6.5	510	1.278
Chlorpyrifos OA	2.4	510	0.463
Cypermethrin	Not Detected (2.3)	27,000	0.009
Dacthal	Trace (5.0)	47	10.681
DDVP	Trace (1.8)	770	0.233
Diazinon	2.1	130	1.641
Diazinon OA	1.8	130	1.415
1,3-Dichloropropene	Not Detected (300)*	120,000	0.250
pp-Dicofol	Not Detected (1.1)	20,000	0.005
Dimethoate	Not Detected (1.2)	300	0.385
Dimethoate OA	Not Detected (1.0)	300	0.323
Diuron	Trace (2.9)	5,700	0.050
Endosulfan	Not Detected (1.6)	330	0.491
Endosulfan Sulfate	Not Detected (2.3)	330	0.702
EPTC	8.3	8,500	0.098
Iprodione	Trace (0.8)	286,000	0.000
Malathion	Not Detected (1.1)	8,100	0.013
Malathion OA	Trace (0.9)	8,100	0.011
Methidathion	Not Detected (0.7)	2,500	0.029
Methyl Bromide	425*	3,900	10.906
Methyl Iodide	Not Detected (169)*	87,080	0.194
Metolachlor	Not Detected (1.4)	15,000	0.009
MITC	72.9	300	24.314
Norflurazon	Trace (1.9)	26,000	0.007
Oryzalin	Trace (0.9)	232,000	0.000
Oxydemeton methyl	Not Detected (1.2)	610	0.189
Oxyfluorfen	Not Detected (3.2)	51,000	0.006
Permethrin	Trace (3.7)	90,000	0.004
Phosmet	Not Detected (4.0)	18,000	0.022
Propargite	Trace (2.1)	14,000	0.015
Simazine	Trace (0.7)	31,000	0.002
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	
Trifluralin	Trace (1.7)	41,000	0.004

*Average concentration for a 6-month period.

Results for Ripon

Tables 19-21 show the highest 1-day, 4-week, and overall average concentrations for pesticides monitored in Ripon, respectively. None of the pesticides exceeded the screening levels, except acrolein due to non-pesticidal uses. Four pesticides were detected at quantifiable concentrations in Salinas: acrolein, 1,3-dichloropropene, methyl bromide, and MITC. Fifteen additional pesticides (or breakdown products) were detected at trace levels. Twenty pesticides (or breakdown products) were not detected. Except for acrolein, fumigants were the only pesticides detected at quantifiable concentrations and had higher air concentrations than other pesticides in Ripon, relative to the screening levels. 1,3-dichloropropene had the highest 1-day concentration relative to its screening level (7,7% of its screening level, 12,250 ng/m^3). Methyl bromide had the highest 4-week average concentration relative to its screening level (8.5% of its screening level, 1,660 ng/m^3). Methyl bromide also had the highest overall concentration relative to its screening level (17%, 656 ng/m^3). Cumulative exposure to organophosphate is discussed in a later section.

Table 19. Highest 1-day concentrations for pesticides monitored in Ripon, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 1-day concentration (ng/m3)	1-day acute screening level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	12,000	0.004
Acrolein	5,959	350	1702.558
Bensulide	Not Detected (0.7)	259,000	0.000
Carbon Disulfide	Not Detected (156)	1,550,000	0.010
Chloropicrin	Not Detected (111)	491,000	0.023
Chlorothalonil	Trace (18.4)	34,000	0.054
Chlorpyrifos	Trace (9.0)	1,200	0.750
Chlorpyridos OA	Trace (3.2)	1,200	0.267
Cypermethrin	Not Detected (2.3)	113,000	0.002
Dacthal	Trace (6.9)	23,500	0.029
DDVP	Not Detected (1.6)	11,000	0.015
Diazinon	Trace (4.1)	130	3.154
Diazinon OA	Trace (3.6)	130	2.769
1,3-Dichloropropene	12,250	160,000	7.656
pp-Dicofol	Not Detected (1.1)	68,000	0.002
Dimethoate	Not Detected (1.2)	4,300	0.028
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	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	Not Detected (0.8)	230,000	0.000
Iprodione	Trace (11.0)	939,000	0.001
Malathion	Trace (10.5)	112,500	0.009
Malathion OA	Trace (4.0)	112,500	0.004
Methidathion	Not Detected (0.7)	3,100	0.023
Methyl Bromide	2,934	820,000	0.358
Methyl Iodide	Not Detected (169)	185,770	0.091
Metolachlor	Not Detected (1.4)	85,000	0.002
MITC	308	66,000	0.467
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	Trace (8.4)	510,000	0.002
Permethrin	Trace (7.9)	168,000	0.005
Phosmet	Not Detected (4.0)	77,000	0.005
Propargite	Trace (9.7)	14,000	0.069
Simazine	Trace (4.1)	110,000	0.004
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (10.7)	1,200,000	0.001

Table 20. Highest 4-week rolling concentrations for pesticides monitored in Ripon, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Highest 4-wk rolling concentration (ng/m3)	Subchronic screening level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	8,500	0.006
Acrolein	2773.2	350	792.343
Bensulide	Not Detected (0.7)	24,000	0.003
Carbon Disulfide	Not Detected (155.5)	800,000	0.019
Chloropicrin	Not Detected (111.0)	2,300	4.826
Chlorothalonil	Trace (18.4)	34,000	0.054
Chlorpyrifos	Trace (7.4)	850	0.871
Chlorpyrifos OA	Trace (3.2)	850	0.376
Cypermethrin	Not Detected (2.3)	81,000	0.003
Dacthal	Trace (5.8)	470	1.234
DDVP	Not Detected (1.6)	2,200	0.073
Diazinon	Trace (1.5)	130	1.154
Diazinon OA	Trace (1.7)	130	1.308
1,3-Dichloropropene	4021.9	120,000	3.352
pp-Dicofol	Not Detected (1.1)	49,000	0.002
Dimethoate	Not Detected (1.2)	3,000	0.040
Dimethoate OA	Not Detected (1.0)	3,000	0.033
Diuron	Trace (2.6)	17,000	0.015
Endosulfan	Not Detected (1.6)	3,300	0.048
Endosulfan Sulfate	Not Detected (2.3)	3,300	0.070
EPTC	Not Detected (0.8)	24,000	0.003
Iprodione	Trace (3.2)	286,000	0.001
Malathion	Trace (3.4)	80,600	0.004
Malathion OA	Trace (3.2)	80,600	0.004
Methidathion	Not Detected (0.7)	3,100	0.023
Methyl Bromide	1659.3	19,400	8.553
Methyl Iodide	Not Detected (168.5)	261,240	0.065
Metolachlor	Not Detected (1.4)	15,000	0.009
MITC	143.6	3,000	4.787
Norflurazon	Not Detected (1.9)	26,000	0.007
Oryzalin	Not Detected (0.7)	230,000	0.000
Oxydemeton methyl	Not Detected (1.2	610	0.197
Oxyfluorfen	Trace (5.3)	180,000	0.003
Permethrin	Trace (4.7)	90,000	0.005
Phosmet	Not Detected (4.0)	26,000	0.015
Propargite	Trace (5.8)	14,000	0.041
Simazine	Trace (1.5)	31,000	0.005
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.010
Trifluralin	Trace (8.2)	170,000	0.005

Table 21. Overall average concentrations for pesticides monitored in Ripon, California. 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 concentration greater than 100% of the screening level suggests the need for further evaluation.

Pesticide	Overall average concentration (ng/m3)	Chronic Screening Level (ng/m3)	% of screening level
Acephate	Not Detected (0.5)	8,500	0.006
Acrolein	1,237*	350	353.272
Bensulide	Not Detected (0.7)	24,000	0.003
Carbon Disulfide	Not Detected (1556)*	800,000	0.019
Chloropicrin	Not Detected (111.0)	1,800	6.167
Chlorothalonil	Trace (11.2)	34,000	0.033
Chlorpyrifos	Trace (3.7)	510	0.734
Chlorpyridos OA	Trace (1.9)	510	0.371
Cypermethrin	Not Detected (2.3)	27,000	0.009
Dacthal	Trace (4.8)	47	10.286
DDVP	Not Detected (1.6)	770	0.210
Diazinon	Trace (0.7)	130	0.558
Diazinon OA	Trace (1.1)	130	0.841
1,3-Dichloropropene	851*	120,000	0.709
pp-Dicofol	Not Detected (1.1)	20,000	0.005
Dimethoate	Not Detected (1.2)	300	0.385
Dimethoate OA	Not Detected (1.0)	300	0.323
Diuron	Trace (2.6)	5,700	0.045
Endosulfan	Not Detected (1.6)	330	0.491
Endosulfan Sulfate	Not Detected (2.3)	330	0.702
EPTC	Not Detected (0.8)	8,500	0.010
Iprodione	Trace (0.7)	286,000	0.000
Malathion	Trace (1.3)	8,100	0.016
Malathion OA	Trace (1.1)	8,100	0.013
Methidathion	Not Detected (0.7)	2,500	0.029
Methyl Bromide	656*	3,900	16.827
Methyl Iodide	Not Detected (169)*	87,080	0.194
Metolachlor	Not Detected (1.4)	15,000	0.009
MITC	34.4	300	11.461
Norflurazon	Not Detected (1.9)	26,000	0.007
Oryzalin	Not Detected (0.7)	232,000	0.000
Oxydemeton methyl	Not Detected (1.2)	610	0.189
Oxyfluorfen	Trace (3.4)	51,000	0.007
Permethrin	Trace (3.8)	90,000	0.004
Phosmet	Not Detected (4.0)	18,000	0.022
Propargite	Trace (2.2)	14,000	0.016
Simazine	Trace (0.7)	31,000	0.002
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	
Trifluralin	Trace (3.3)	41,000	0.008

*Average concentration for a 6-month period.

Cumulative Exposure Estimates

Cumulative exposures were only calculated for organophosphate pesticides. These were the only pesticides that have a common mode of action and were detected at quantifiable concentrations. While organophosphates can have additional potential health effects, they all inhibit cholinesterase, an enzyme in the nervous system. 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 detected air concentration and the screening level. The organophosphate cumulative exposures were estimated for each community and exposure period.

As shown in Table 22, none of the hazard indices exceeded one, indicating that the screening levels were not exceeded for all organophosphates combined. Shafter had a higher hazard index than Salinas and Ripon for all exposure periods. The acute hazard indices were higher for all three communities, in comparison to the subchronic and chronic hazard indices.

Table 22. Summary of organophosphate cumulative exposure. A hazard index greater than one suggests the need for further evaluation.

Community	Acute hazard index	Subchronic hazard index	Chronic hazard index
Salinas	0.071	0.065	0.043
Shafter	0.768	0.161	0.058
Ripon	0.070	0.039	0.035

As shown in Tables 23 - 31, Salinas only had quantifiable concentrations of malathion and Ripon had no quantifiable concentrations of any of the organophosphates. All three communities had trace levels for several organophosphates. The exposure estimates particularly for Salinas and Ripon are uncertain due to the high number of trace and no detectable samples. Eleven of the 14 organophosphates or OAs were detected in at least one sample; dimethoate, dimethoate OA, and oxydemeton-methyl were not detected. Diazinon and chlorpyrifos (plus their OAs) accounted for most of the organophosphate cumulative exposure for all exposure periods. These two pesticides accounted for 72.2% – 99.8% of the organophosphate cumulative exposure, depending on the community and exposure period.

Table 23. Highest one-day concentration of organophosphates monitored in Salinas, California. 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.

Pesticide	Highest 1-day concentration (ng/m^3)	24-Hour acute screening level (ng/m^3)	Acute hazard quotient
Acephate	Trace (4.1)	12,000	0.000345
Bensulide	Trace (4.0)	259,000	0.000015
Chlorpyrifos	Trace (9.0)	1,200	0.007521
Chlorpyrifos OA	Trace (3.2)	1,200	0.002658
DDVP	Trace (9.9)	11,000	0.000903
Diazinon	Trace (4.1)	130	0.031308
Diazinon OA	Trace (3.6)	130	0.027769
Dimethoate	Not Detected (1.2)	4,300	0.000269
Dimethoate OA	Not Detected (1.0)	4,300	0.000226
Malathion	12.5	112,500	0.000111
Malathion OA	Trace (4.0)	112,500	0.000036
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000029
Phosmet	Trace (8.6)	77,000	0.000112
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000102
Hazard Index			**0.071404**

Table 24. Highest 4-week rolling concentration of organophosphates monitored in Salinas, California. 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.

Pesticide	Highest 4-wk rolling concentration (ng/m3)	Subchronic Screening Level (ng/m3)	Subchronic Hazard quotient
Acephate	Trace (1.4)	8,500	0.000167
Bensulide	Trace (2.3)	24,000	0.000097
Chlorpyrifos	Trace (7.4)	850	0.008706
Chlorpyrifos OA	Trace (1.9)	850	0.002226
DDVP	Trace (3.7)	2,200	0.001681
Diazinon	Trace (4.1)	130	0.031308
Diazinon OA	Trace (2.3)	130	0.017885
Dimethoate	Not Detected (1.2)	3,000	0.000385
Dimethoate OA	Not Detected (1.0)	3,000	0.000323
Malathion	5.7	80,600	0.000071
Malathion OA	Trace (4.0)	80,600	0.000050
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Trace (5.1)	18,000	0.000286
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000102
Hazard Index			**0.065325**

Table 25. Overall average concentration of organophosphates monitored in Salinas, California. 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.

Pesticide	Overall average concentration (ng/m3)	Chronic screening level (ng/m3)	Chronic Hazard quotient
Acephate	Trace (0.6)	8,500	0.000069
Bensulide	Trace (1.0)	24,000	0.000041
Chlorpyrifos	Trace (4.0)	510	0.007934
Chlorpyrifos OA	Trace (1.6)	510	0.003224
DDVP	Trace (2.2)	27,000	0.000080
Diazinon	Trace (1.4)	130	0.010745
Diazinon OA	Trace (1.5)	130	0.011365
Dimethoate	Not Detected (1.2)	300	0.003850
Dimethoate OA	Not Detected (1.0)	300	0.003233
Malathion	1.9	8,100	0.000238
Malathion OA	Trace (1.6)	8,100	0.000203
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Trace (4.1)	18,000	0.000227
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	NA
Hazard Index			**0.043101**

Table 26. Highest one-day concentration of organophosphates monitored in Shafter, California. 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.

Pesticide	Highest 1-day concentration (ng/m^3)	24-Hour acute Screening Level (ng/m^3)	Acute Hazard quotient
Acephate	Not Detected (0.5)	12,000	0.000043
Bensulide	Trace (4.0)	259,000	0.000015
Chlorpyrifos	27.4	1,200	0.022794
Chlorpyrifos OA	9.2	1,200	0.007670
DDVP	Trace (9.9)	11,000	0.000903
Diazinon	59.6	130	0.458531
Diazinon OA	36.0	130	0.277235
Dimethoate	Not Detected (1.2)	4,300	0.000269
Dimethoate OA	Not Detected (1.0)	4,300	0.000226
Malathion	Not Detected (1.1)	112,500	0.000010
Malathion OA	Trace (4.0)	112,500	0.000036
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000029
Phosmet	Not Detected (4.0)	77,000	0.000052
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000100
Hazard Index			**0.767911**

Table 27. Highest 4-week rolling concentration of organophosphates monitored in Shafter, California. 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.

Pesticide	Highest 4-wk rolling concentration (ng/m3)	Subchronic Screening Level (ng/m3)	Subchronic Hazard quotient
Acephate	Not Detected (0.5)	8,500	0.000060
Bensulide	Trace (1.5)	24,000	0.000063
Chlorpyrifos	10.8	850	0.012654
Chlorpyrifos OA	4.7	850	0.005522
DDVP	Trace (3.7)	2,200	0.001681
Diazinon	17.1	130	0.131402
Diazinon OA	10.4	3,000	0.003478
Dimethoate	Not Detected (1.2)	3,000	0.000385
Dimethoate OA	Not Detected (1.0)	300	0.003233
Malathion	Not Detected (1.1)	80,600	0.000014
Malathion OA	Trace (1.5)	80,600	0.000018
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Not Detected (4.0)	18,000	0.000221
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000100
Hazard Index			**0.160724**

*A hazard quotient greater than 1 suggests the need for further evaluation.

Table 28. Overall average concentration of organophosphates monitored in Shafter, California. 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.

Pesticide	Overall average concentration (ng/m3)	Chronic screening level (ng/m3)	Chronic Hazard quotient
Acephate	Not Detected (0.5)	8,500	0.000060
Bensulide	Trace (0.8)	24,000	0.000032
Chlorpyrifos	6.5	510	0.012784
Chlorpyrifos OA	2.4	510	0.004629
DDVP	Trace (1.8)	27,000	0.000067
Diazinon	2.1	130	0.016407
Diazinon OA	1.8	130	0.014149
Dimethoate	Not Detected (1.2)	300	0.003850
Dimethoate OA	Not Detected (1.0)	300	0.003233
Malathion	Not Detected (1.1)	8,100	0.000135
Malathion OA	Trace (0.9)	8,100	0.000107
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Not Detected (4.0)	18,000	0.000221
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	NA
Hazard Index			**0.057567**

Table 29. Highest one-day concentration of organophosphates monitored in Ripon, California. 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.

Pesticide	Highest 1-day concentration (ng/m^3)	24-Hour acute Screening Level (ng/m^3)	Acute Hazard quotient
Acephate	Not Detected (0.5)	12,000	0.000043
Bensulide	Not Detected (0.7)	259,000	0.000003
Chlorpyrifos	Trace (9.0)	1,200	0.007521
Chlorpyrifos OA	Trace (3.2)	1,200	0.002658
DDVP	Not Detected (1.6)	11,000	0.000147
Diazinon	Trace (4.1)	130	0.031308
Diazinon OA	Trace (3.6)	130	0.027769
Dimethoate	Not Detected (1.2)	4,300	0.000269
Dimethoate OA	Not Detected (1.0)	4,300	0.000226
Malathion	Trace (10.5)	112,500	0.000093
Malathion OA	Trace (4.0)	112,500	0.000036
Oxydemeton methyl	Not Detected (1.2)	39,200	0.000029
Phosmet	Not Detected (4.0)	77,000	0.000052
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000100
Hazard Index			**0.070252**

Table 30. Highest 4-week rolling concentration of organophosphates monitored in Ripon, California. 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.

Pesticide	Highest 4-wk rolling concentration (ng/m3)	Subchronic Screening Level (ng/m3)	Subchronic Hazard quotient
Acephate	Not Detected (0.5)	8,500	0.000060
Bensulide	Not Detected (0.7)	24,000	0.000029
Chlorpyrifos	Trace (7.4)	850	0.008706
Chlorpyrifos OA	Trace (3.2)	850	0.003753
DDVP	Not Detected (1.6)	2,200	0.000736
Diazinon	Trace (1.5)	130	0.011173
Diazinon OA	Trace (1.6)	130	0.011954
Dimethoate	Not Detected (1.2)	3,000	0.000385
Dimethoate OA	Not Detected (1.0)	3,000	0.000323
Malathion	Trace (3.4)	80,600	0.000043
Malathion OA	Trace (3.2)	80,600	0.000039
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Not Detected (4.0)	18,000	0.000221
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	8,800	0.000100
Hazard Index			**0.039416**

Table 31. Overall average concentration of organophosphates monitored in Ripon, California. 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.

Pesticide	Overall average concentration (ng/m3)	Chronic screening level (ng/m3)	Chronic Hazard quotient
Acephate	Not Detected (0.5)	8,500	0.000060
Bensulide	Not Detected (0.7)	24,000	0.000029
Chlorpyrifos	Trace (3.7)	510	0.007341
Chlorpyrifos OA	Trace (1.9)	510	0.003711
DDVP	Not Detected (1.6)	27,000	0.000060
Diazinon	Trace (0.7)	130	0.005580
Diazinon OA	Trace (1.1)	130	0.008412
Dimethoate	Not Detected (1.2)	300	0.003850
Dimethoate OA	Not Detected (1.0)	300	0.003233
Malathion	Trace (1.3)	8,100	0.000159
Malathion OA	Trace (1.1)	8,100	0.000132
Oxydemeton methyl	Not Detected (1.2)	610	0.001893
Phosmet	Not Detected (4.0)	18,000	0.000221
SSS-tributyltriphosphorotrithioate (DEF)	Not Detected (0.9)	NA - Seasonal	NA
Hazard Index			**0.034681**

Cancer Risk Estimates

Only one of the chemicals measured at a quantifiable concentration is considered a human carcinogen. 1,3-D is classified as a probable human carcinogen by U.S.EPA and is listed as a carcinogen under 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-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 and adult is used (0.28 m^3/kg/day) over 70 years. DPR has calculated a cancer potency of 0.055 (mg/kg-day)$^{-1}$. The risk is then calculated as (cancer potency) X (chronic air concentration) X (respiratory rate).

The yearly 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. Additionally, there is approximately six months of data available with the lower detection limit. Additional data with lower method limits (MDL) will increase confidence in the risk estimate. 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-D were calculated by treating samples with no detectable concentrations as having concentrations of 0 (Minimum), 1/2MDL (Standard), or MDL(Maximum):

	Minimum (ND = 0*MDL)	Standard (ND = 1/2 MDL)	Maximum (ND = MDL)
Salinas	9.70E-06	1.37E-05	1.77E-05
Ripon	6.95E-06	1.13E-05	1.56E-05
Shafter		No quantifiable detections	

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-D. When calculated with concentrations of 1/2 MDL or the MDL the risk is greater than DPR's regulatory goal, and merits further evaluation. Therefore, it is evident that additional data and refined detection limits are necessary to determine a better estimate of risk.

Uncertainty of Air Concentrations - Treatment of ND and Trace Samples

To determine the impact of DPR's practice of substituting a value of one-half of the Method Detection Limit (MDL) for samples with no detectable amount and substituting the midpoint between the MDL and the Limit of Quantitation (LOQ) for trace samples, various highest 4-week rolling average concentrations and overall 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 32 shows various highest 4-week rolling average concentrations and overall 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 Method Detection Limit (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 Limit of Quantitation (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.

Difference between maximum and minimum values for 4-week rolling averages varied from 0% to 7% depending on the pesticide in question, while the difference in the overall average concentrations contained more variance for some pesticides (i.e., 1,3-dichloropropene) while virtually no change for others (i.e., acrolein). 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 and thus the standard method provides more of an accurate midpoint representation of the actual environmental concentrations for the target pesticides.

Table 32. Minimum, standard, and maximum highest 4-week rolling average concentrations and overall average concentrations for pesticides with at least one quantifiable detection.

Pesticide	Minimum Highest 4-wk rolling concentration (ng/m^3)	Standard Highest 4-wk rolling concentration (ng/m^3)	Maximum Highest 4-wk rolling concentration (ng/m^3)		Minimum overall average concentration (ng/m^3)	Standard overall average concentration (ng/m^3)	Maximum overall average (ng/m^3)
1,3-Dicholopropene	3,870	4,020	4,170		350	630	920
Acrolein	2,770	2,770	2,770		1,190	1,190	1,190
Chloropicrin	1,750	1,810	1,860		70	183	290
Chlorpyrifos	8.1	11	23		1.8	4.8	11
Chlorpyrifos OA	4.5	4.7	9.3		0.8	2.0	4.6
Diazinon	16	17	20		0.6	1.4	2.5
Diazinon OA	9.5	10	12		0.4	1.5	2.8
EPTC	70	75	80		2.3	3.3	4.4
Malathion	3.1	5.7	9.4		0.2	1.4	2.8
Methyl Bromide	4,120	4,120	4,120		550	695	840
MITC	564	564	564		36	37	39

DATA VALIDATION/QUALITY ASSURANCE

Data Review

Before any statistical or other evaluation of the data, the entire set of sample chains of custody and laboratory quality assurance data were reviewed to determine the strength of the data for final assessment. The sample chains of custody 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. A total of three air samples were invalid. Two VOC air samples taken from the Ripon sampling location were invalid due to an ending pressure outside of the accepted criteria. The invalid VOC air samples were from February 3, 2011 and December 1, 2011. A multi-pesticide air sample collected from the Salinas location on February 9, 2011 was invalid due to an ending flow rate outside of the accepted criteria. All three invalid samples were not replaced and were not included in any of the average calculations.

Audit Results

Sampler Flow Audits

The Quality Assurance Section (QAS) of the ARB performed a sampler flow rate audit on March 2011, at the three sampling locations. All samplers were operating within the QAS ± 10 percent control limit. ARB auditors found the pesticide sampling and analysis programs to be both well organized and maintained. Furthermore, it was recommended that flow checks be conducted on an annual basis and system audits be conducted every three years to ensure that the quality systems and practices remain in place, and changes and improvements to the program are verified by an independent source. (See Appendix A for the results).

Laboratory Audits

The Quality Assurance (QA) team evaluated the CDFA Center for Analytical Chemistry laboratory (CDFA), the ARB's Organic Laboratory Section, and ARB's Inorganic Laboratory Section in April 2011. The QA team found that all the laboratories were following accepted and agreed-upon procedures for analysis and quality assurance, including sample handling, instrument calibration, method validation, and documentation. The QA team recommended that analytical standards used by CDFA for quantitation of sample results should have current certification dates and be verified against a second source where possible. They also recommended that development and implementation of a procedure for the preparation of blind spikes for the VOC analysis and the development of specific procedure/policy for handling the duplicate analyses be created by CDFA personnel. The QA team had several other comments and recommendations (see Appendix A).

Quality Control Results

Laboratory matrix spikes and matrix blanks were included with every set of samples extracted and analyzed at the lab 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 33 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 80 percent to 100 percent for all chemicals analyzed. None of the laboratory matrix spike samples were outside the control limits established from the validation data.

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 co-located with another sample in the field. These samples serve to evaluate overall precision in sample measurement and analysis. Duplicate samples (Table 34) with quantifiable concentrations had a maximum relative difference of 6.6 percent for the XAD multiple pesticide samples, 164 percent for the MITC samples, 0 percent for chloropicrin samples, and 0 percent for VOC samples, indicating proper field and laboratory procedures. One pair of MITC duplicate samples both contained MITC concentrations above the LOQ; however, one sample had a concentration of 25.7 ng/m^3 while the duplicate sample had a concentration of 253.0 ng/m^3, a difference of tenfold. This high discrepancy is the only duplicate pair in which both samples had detections above the LOQ, skewed the maximum relative difference calculation and thus is why a value of 163% existed for these type of duplicates.

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. The average percent recovery results of the blind spikes ranged from 42.6 to 94.3 percent. 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. Two of the trip blanks contained trace concentrations of malathion OA, the breakdown product of malathion. As discussed in the next section, these detections may be due a laboratory instrument problem rather than field contamination as the other 201 trip blank analyses produced no detections, including the parent compound. Field matrix spikes and field blanks for VOC sampling were not taken due to a lack of method availability. CDFA laboratory is currently working on a suitable method to take blanks from and spike VOC canisters.

Table 33. Average results for quality control/quality assurance samples.

Chemical	**Lab spikes (% recovery)**	**Field spikes (% recovery)**	**Lab blanks (ng/m^3)**	**Trip blanks (ng/m^3)**
Acephate	92.0	80.2	ND	ND
Acrolein	99.3	NS	ND	ND
Bensulide	94.4	77.3	ND	ND
Carbon Disulfide	96.7	NS	ND	ND
Chloropicrin	95.3	72.8	ND	ND
Chlorothalonil	91.1	66.7	ND	ND
Chlorpyrifos	92.4	71.0	ND	ND
Chlorpyrifos OA	95.3	67.0	ND	ND
Cypermethrin	91.3	NS	ND	ND
Dacthal	93.3	80.9	ND	ND
DDVP	87.6	82.3	ND	ND
Diazinon	94.7	NS	ND	ND
Diazinon OA	95.1	NS	ND	ND
cis-1,3-Dichloropropene	100.0	NS	ND	ND
t-1,3-Dichloropropene	99.3	NS	ND	ND
Dicofol	96.8	NS	ND	ND
Dimethoate	93.7	NS	ND	ND
Dimethoate OA	95.8	NS	ND	ND
Diuron	91.5	NS	ND	ND
Endosulfan	93.5	NS	ND	ND
Endosulfan Sulfate	96.3	NS	ND	ND
EPTC	86.2	NS	ND	ND
Iprodione	90.4	83.0	ND	ND
Malathion	95.0	NS	ND	ND
Malathion OA	91.4	NS	ND	ND*
Methidathion	95.6	81.6	ND	ND
Methyl Bromide	97.5	NS	ND	ND
Methyl Iodide	96.7	NS	ND	ND
Metolachlor	95.5	NS	ND	ND
MITC	80.9	53.9	ND	ND
Norflurazon	96.3	NS	ND	ND
Oryzalin	95.7	42.6	ND	ND
Oxydemeton methyl	96.3	71.1	ND	ND
Oxyfluorfen	94.4	NS	ND	ND
Permethrin	90.0	NS	ND	ND
Phosmet	94.9	94.3	ND	ND
Propargite	93.7	NS	ND	ND
Simazine	96.3	NS	ND	ND
SSS-tributyltriphosphorotrithioate (DEF)	96.8	85.5	ND	ND
Trifluralin	91.2	NS	ND	ND

ND = None detected; NS = Field sample not spiked with the chemical.
*Two of the trip blanks had Malathion OA trace detections.

Table 34. Results for duplicate sample pairs.

	Number of matches			
Primary/duplicate results	**Multiple chemical samples**	**MITC**	**Chloropicrin**	**VOC samples**
ND[a]/ND	213	5	7	6
Trace[b]/trace	6	0	0	0
ND/trace	4	0	0	0
ND/>LOQ	0	0	0	0
trace/>LOQ	0	0	0	0
>LOQ/>LOQ	1	1	0	0
Relative Difference[c]	6.6%	164%	0%	0%

[a] ND = None detected.

[b] trace = Pesticide detection confirmed, but less than the quantitation limit.

[c] For pairs with both concentrations >LOQ.

False Positive Samples

The CDFA laboratory reported some detections that are inconsistent with agricultural practices for S,S,S-tributylphosphorotrithioate (tribufos, active ingredient in DEF and Folex). S,S,S-tributylphosphorotrithioate was detected at trace levels in five samples between May 9 and July 5 at the Salinas site. S,S,S-tributylphosphorotrithioate is used solely for cotton defoliation, but no cotton is grown in the Salinas area and cotton defoliation applications occur in the fall. After further evaluation, CDFA determined that these detections were false positives due to "carryover" in the liquid chromatograph/mass spectrometer used to analyze the samples. The five samples are now designated as having no detectable S,S,S-tributylphosphorotrithioate. The carryover occurred when a field sample was analyzed immediately following a spiked quality control sample or the highest concentration reference standard, and some of the spike or standard bleeding into the next sample in the sequence. Additional analytes may have carryover, including bensulide, chlorpyrifos OA, diazinon, methidathion, and metolachlor.

CDFA believes that the carryover is limited and has taken steps to prevent future false positives. With the exception of the S,S,S-tributylphosphorotrithioate, CDFA believes that all other reported detections are valid. However, some quality control results are unusual, including two detections of malathion OA in field blanks, and discrepancies between several duplicate samples. The carryover will be examined more closely once pesticide use data are available to see if the results are consistent with pesticide applications. The carryover has only resulted in false positives at trace levels. DPR staff suspects that there may be more false positives at trace levels that are currently considered valid. While this may affect the number of pesticide detections, it has a negligible and health-conservative effect on the exposure estimates. Appendix B contains a series of memoranda that gives more details on the carryover.

Validation and Control Limits

The MITC and the multi-pesticide analysis method in sorption tubes were validated according to the DPR SOP QAQC001.00 (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 ± 3 times and adding it to the mean.

Trapping Efficiency

To determine the effectiveness of XAD-4 resin trapping and retention of the analytes while air is drawn through the cartridges, a trapping efficiency test was conducted according to SOP FSAI003.00 (DPR, 2003b). Six cartridges were spiked with 10 μg, six more with 5 μg and six with 2 μg of eight analytes, and were placed on pumps for 24 hours at a rate of 15 L/min. After laboratory analysis, mean recoveries of the repetitions were calculated to determine the XAD-4 resin trapping efficiency for each analyte. The trapping efficiency was good for most analytes with percent recovery ranging from 75% to 123%. One cartridge out of the 18 used in the trapping efficiency test returned low recoveries for all spiked analytes with values ranging from 49% to 66%. Since the other two collocated cartridges spiked with the same amount gave acceptable recovery levels, the low recovery values for this cartridge were attributed to a lower ending flow rate as it had the greatest negative change in flow pressure with a value of -7% compared to the starting flow value of 15 L/min.

Comparison to other monitoring

DPR, ARB, and the Pesticide Action Network North America (PANNA) have monitored ambient air for pesticides in different parts of California.

DPR conducted a two-phase study in Lompoc (Santa Barbara County). Phase One, a 1998 pilot project, was designed to develop and test a method to analyze multiple pesticides from a single air sample. In Phase Two, in 2002, DPR measured ambient air concentrations of 15 pesticides. In 2006, DPR conducted a 12-month air monitoring study in Parlier California where they measure ambient air concentrations of 22 pesticides and 5 breakdown products. A summary of the highest 24-hour air concentrations of 16 common pesticides from all three previous DPR studies and the three sampling locations from the Air Monitoring Network are listed on Table 35.

Table 35. Summary of the highest 24-hour concentrations measured in Lompoc in Phase One and Phase Two, Parlier, Salinas, Shafter, and Ripon.

Highest 24-hour concentration (ng/m^3)						
Chemical	**Lompoc**	**Lompoc**	**Parlier**	**Salinas**	**Shafter**	**Ripon**
Chlorothalonil	Trace (24)	Trace (17)	Trace (17)	ND	Trace (13)	Trace (38)
Chlorpyrifos	83 (97)	15 (34)	150 (64)	Trace (23)	27 (53)	Trace (19)
Chlorpyrifos OA	8.5 (3.4)	Trace (11)	28 (22)	Trace (11)	9.2 (45)	Trace (25)
Diazinon	18 (2.5)	Trace (7.5)	172 (32)	Trace (23)	60 (11)	Trace (4.2)
Diazinon OA	5.3 (0.8)	Trace (2.5)	71 (19)	Trace (17)	36 (4.3)	Trace (2.1)
Dicofol	NS	Trace (5.7)	ND	ND	ND	ND
Dimethoate	ND	Trace (1.9)	ND	ND	ND	ND
Dimethoate OA	ND	Trace (7.5)	ND	ND	ND	ND
EPTC	NS	6.5 (5.0)	ND	ND	187 (17)	ND
Malathion	NS	7.6 (23)	21 (1)	13 (8.5)	ND	Trace (2.1)
Malathion OA	NS	2.2 (20)	16 (5)	Trace (30)	Trace (6.4)	Trace (13)
Methyl bromide	NS	ND	2,524 (66)	6,055 (19)	2,934 (8.5)	2,934 (20)
MITC	NS	920 (58)	5,010 (84)	51 (10)	930 (40)	308 (42)
Permethrin	Trace (0.8)	Trace (4.4)	Trace (1)	ND	Trace (2.1)	Trace (4.2)
Simazine	NS	ND	Trace (7)	Trace (6.4)	Trace (4.3)	Trace (2.1)
Trifluralin	NS	Trace (24)	Trace (24)	Trace (2.1)	Trace (8.5)	Trace (25)

*Values in parentheses refer to the percentage of samples with detections.
*NS = Not Sampled.
*ND = Not Detected.

Chlorpyrifos concentrations measured in Salinas and Ripon were lower than those concentrations measured in Lompoc, Parlier, and Shafter. Chlorpyrifos OA, chlorothalonil, dicofol, dimethoate, dimethoate OA, permethrin, simazine, and trifluralin concentrations measured in all three AMN sites were very similar to those previously measured in Lompoc and Parlier. Diazinon, diazinon OA, MITC, and Malathion concentrations were lower than those measured in Parlier but higher than the concentrations measured in Lompoc. EPTC concentrations were much higher in Shafter than in any of the other five sampling locations. Concentrations of methyl bromide measured in all three AMN sampling locations were higher than both Lompoc and Parlier, with Salinas having a methyl bromide concentration that was about twice as high as those measured in Parlier, Shafter, or Ripon.

The ARB, in support of DPR's toxic air contaminant monitoring program, monitors ambient air for a variety of pesticides. The 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 in the Parlier study and AMN: 1,3-dichloropropene, chlorpyrifos, chlorothalonil, diazinon, endosulfan, EPTC, malathion, MITC, methyl bromide, permethrin, propargite, simazine and S,S,S-tributyl phosphorotrithioate. See Table 35 for detailed results of the individual pesticides monitored.

Pesticide Action Network North America (PANNA) monitored for chlorpyrifos and its oxon analog in Lindsay (Tulare County) as part of its Drift Catcher program (Mills and Kegley, 2006). The program collected 104 24-hour samples between July 13 and August 2, 2004, and 108 samples between June 13 and July 22, 2005. In 2004, 76 percent of the samples were above the quantitation limit of 30 ng/sample (equivalent to 6 ng/m^3 for a 24-hour sample). The highest concentration measured was 1,340 ng/m^3 for a 24-hour period (Table 36).

Concentrations measured at all three AMN locations were much lower than concentrations measured in other parts of the state by ARB or PANNA. Methyl bromide and EPTC were the only chemicals that had a higher maximum 24-hour concentration in an AMN sampling location than those measured in Parlier (Table 36).

Table 36. Highest 24-hour concentrations of the pesticides monitored in Salinas, Shafter, and Ripon compared to previous DPR/ARB and PANNA monitoring studies in California.

	Other Studies			**Parlier**	**Salinas**	**Shafter**	**Ripon**
Chemical	**Year**	**County**	**Maximum 24-hr concentration (ng/m^3)**	**Maximum 24-hr concentration (ng/m^3)**	**Maximum 24-hr concentration (ng/m^3)**	**Maximum 24-hr concentration (ng/m^3)**	**Maximum 24-hr concentration (ng/m^3)**
1,3-Dichloropropene	2000	Kern	135,000	23,080	10,072	ND	12,249
Chlorothalonil	2002	Fresno	14	Trace	ND	Trace	Trace
Chlorpyrifos	2004	Tulare	1,340	150	Trace	27	Trace
Chlorpyrifos OA	1996	Tulare	230	28	Trace	9.2	Trace
Diazinon	1997	Fresno	290	172	Trace	60	Trace
Endosulfan	1996	Fresno	166	ND	ND	ND	ND
EPTC	1996	Imperial	240	ND	ND	187	ND
Malathion	1998	Imperial	90	21	13	ND	Trace
Malathion OA	1998	Imperial	28	16	Trace	Trace	Trace
Methyl bromide	2001	Santa Cruz	142,000	2,468	6,055	2,934	2,934
MITC	1993	Kern	18,000	5,010	51	930	308
Permethrin	1997	Monterey	Trace	Trace	ND	Trace	Trace
Propargite	1999	Fresno	1300	Trace	ND	Trace	Trace
Simazine	1998	Fresno	18	Trace	Trace	Trace	Trace
S,S,S-tributyl… (DEF)	1987	Fresno	330	ND	ND	ND	ND

*ND = Not Detected.

DISCUSSION

Of the 34 pesticide and 5 breakdown products included in the AMN, 29 were detected in at least one sample. However, almost all air concentrations were low relative to the screening levels, except for acrolein due to non-pesticidal sources. None of the pesticides (except acrolein) exceeded their screening levels for any of the exposure periods, indicating low health risk to the people in these communities. Seven of the nine pesticides (plus two breakdown products) detected at quantifiable concentrations in the AMN were either fumigants (1,3-dichloropropene, chloropicrin, methyl bromide, MITC) or organophosphate insecticides (chlorpyrifos, diazinon, malathion).

The primary need for the AMN is to supplement data from the toxic air contaminant program, particularly to estimate subchronic and chronic exposure to individual as well as 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. 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.

While underestimated on an absolute basis, the relative risk from acute exposure to chlorpyrifos and diazinon was higher than the fumigants. This was likely due to the regulatory restrictions to mitigate fumigant acute exposure. Previous monitoring, computer modeling, and comprehensive risk assessments for the fumigants by DPR and U.S. EPA indicated unacceptably high air exposures in some cases. Therefore, U.S. EPA, DPR, and county agricultural commissioners require buffer zones, application method restrictions, use limits, and other measures to reduce acute exposure to fumigants. While chlorpyrifos and diazinon did not exceed the screening levels, either individually or combined, they have approached or exceeded the screening levels in previous monitoring studies. Working in conjunction with U.S. EPA, DPR is conducting comprehensive risk assessments for chlorpyrifos and diazinon to determine if mitigation measures are needed to reduce exposures.

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 one-quarter of DPR's regulatory target, indicating that the methyl bromide township caps are keeping air concentrations below the health protective targets set by DPR. At DPR's request, ARB conducted additional ambient monitoring for methyl bromide in other communties during 2011. Those concentrations were also less than DPR's regulatory target (Vidrio, et al. 2012).

Only 1,3-D was measured at a quantifiable concentration and is considered a probable human carcinogen. Most of the samples collected had no detectable concentrations of 1,3-D, but depending on the method of estimating chronic exposure the estimated risk may exceed DPR's regulatory goal for cancer risk. Many uncertainties are embedded in the estimation, including higher detection limits for the first six months of the study. Additional data with lower detection limits will refine the estimation of the cancer risk.

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. DPR will compare the detected concentrations with pesticide use patterns as well as weather conditions once the pesticide use reports for 2011 have been compiled and verified. This evaluation will be included in Volume 2.

The potential carryover in the liquid chromatograph/mass spectrometer will also be examined more closely once pesticide use data are available to see if the detected air concentrations are consistent with pesticide applications. The carryover has only resulted in false positives at trace levels, and there may be more false positives that are currently considered valid. While this may affect the number of pesticide detections, it has a negligible and health-conservative effect on the exposure estimates.

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