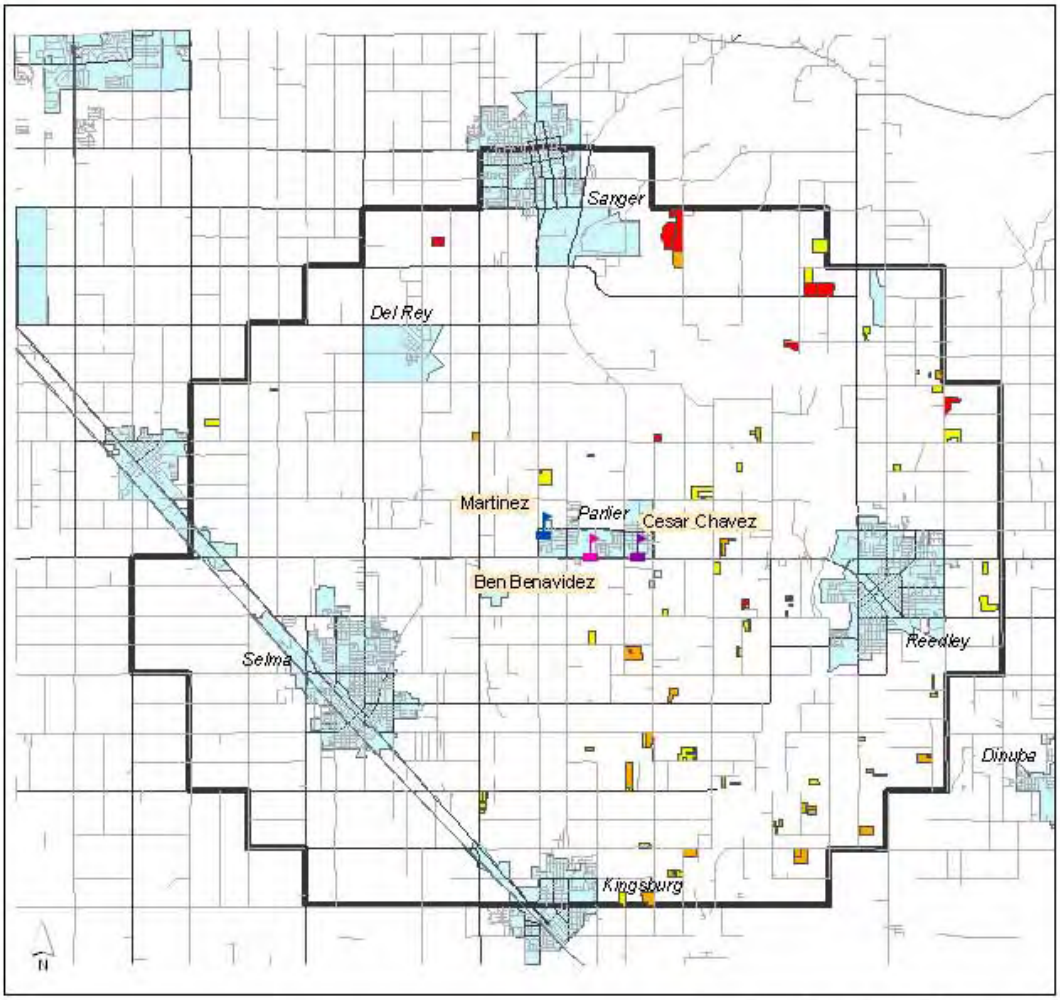
APPENDIX K

Response to Comments

APPENDIX I

Maps of Individual Pesticide Applications for Detected Pesticides

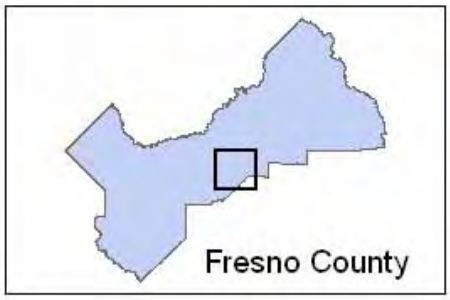
1,3-Dichloropropene Applications 01/01/06 - 12/31/06



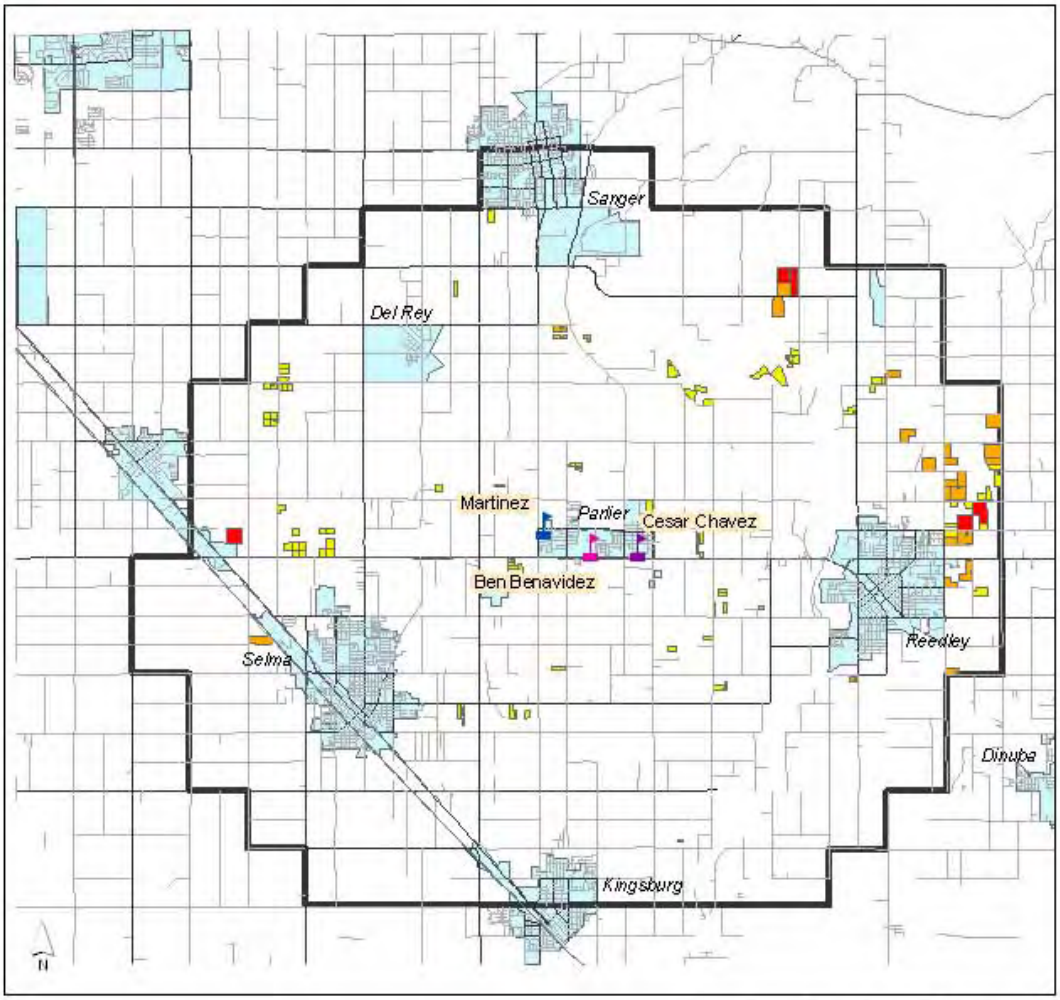
0 1 2 3 4 Miles

Total Lbs of AI

- 18 - 456
- 457 - 1327
- 1328 - 7217
- Study Area



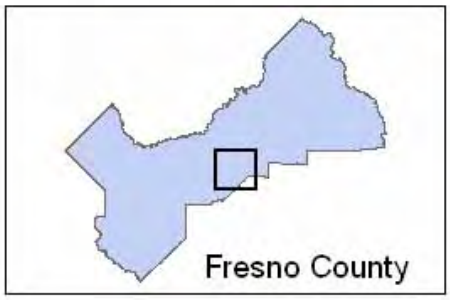
Chlorothalonil Applications 01/01/06 - 12/31/06



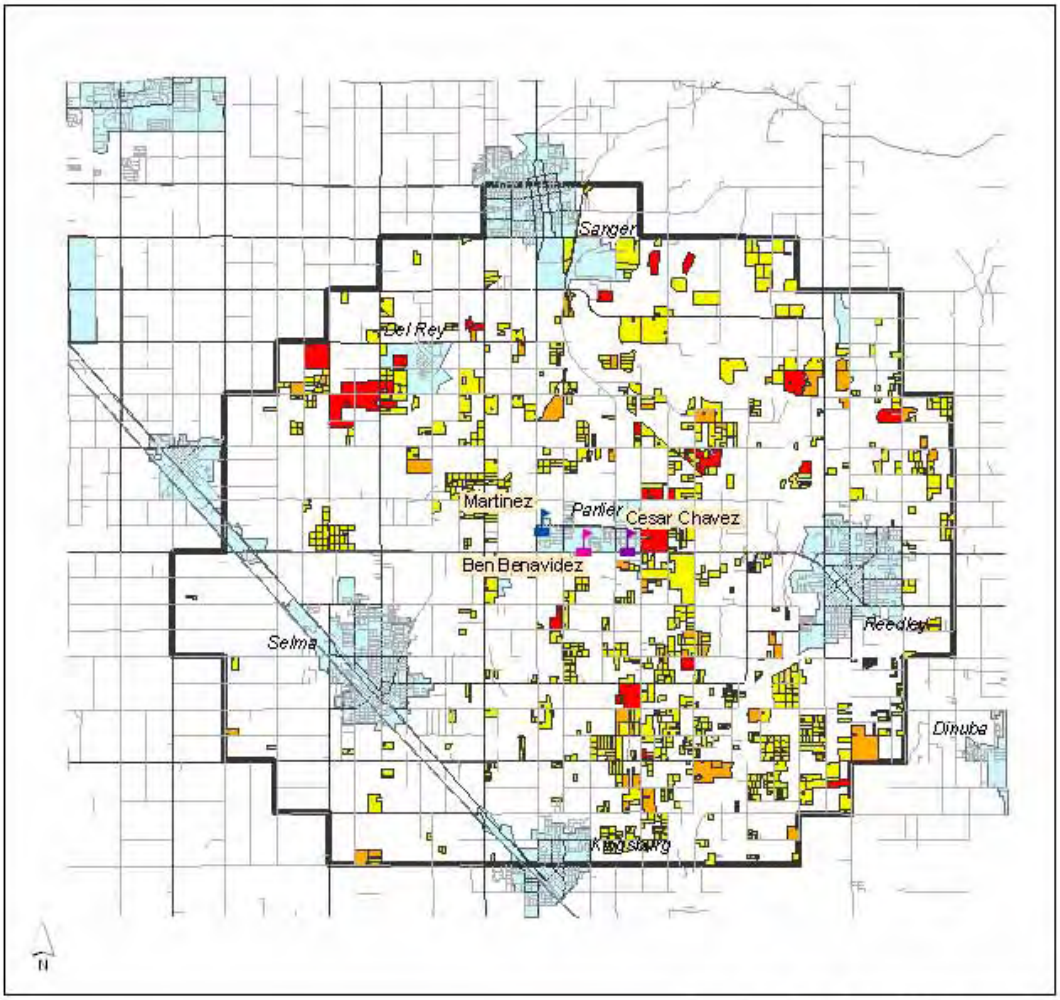
0 1 2 3 4 Miles

Total Lbs AI

- 0 - 40
- 41 - 120
- 121 - 241
- Study Area



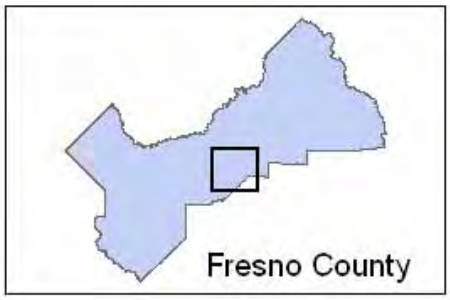
Chlorpyrifos Applications 01/01/06 - 12/31/06



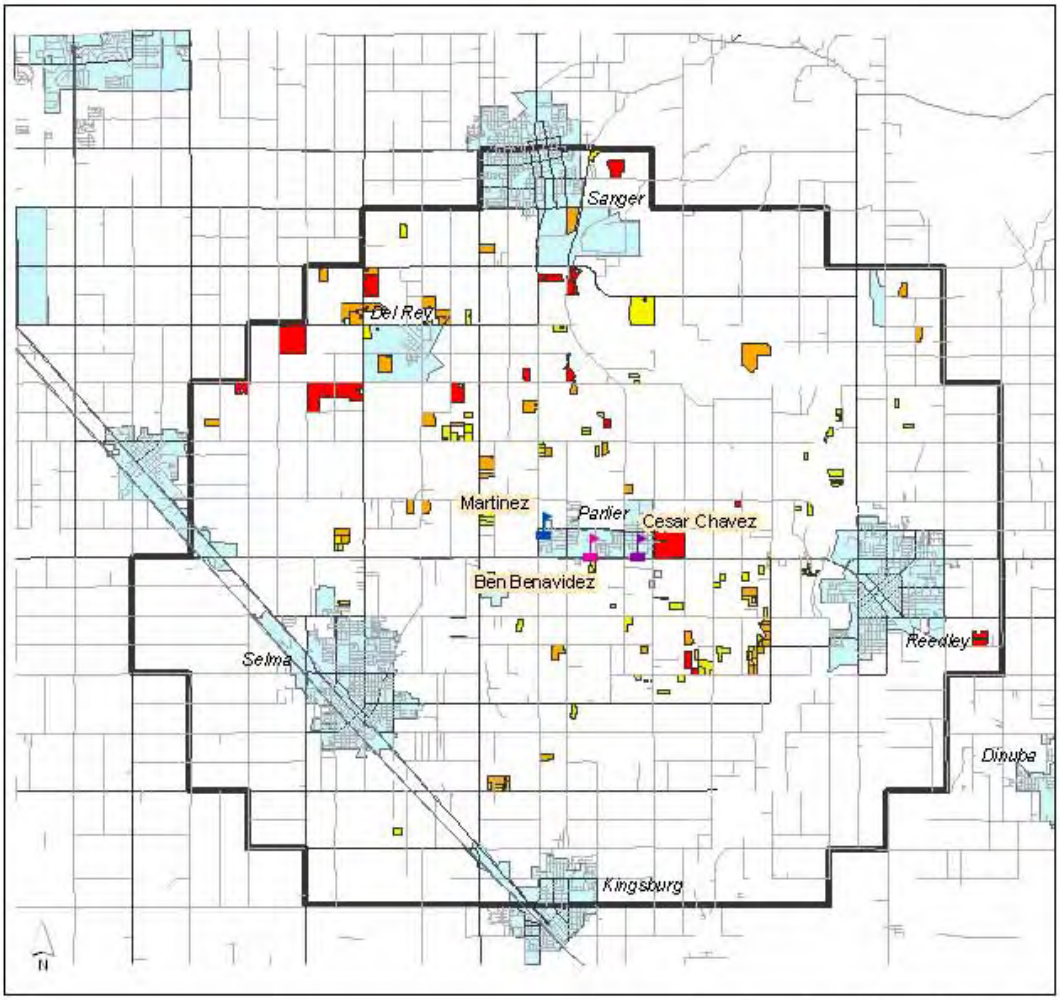
0 1 2 3 4 Miles

Total Lbs AI

- 0 - 21
- 22 - 58
- 59 - 154
- Study Area



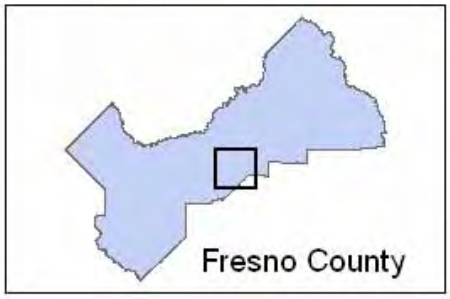
Diazinon Applications 01/01/06 - 12/31/06



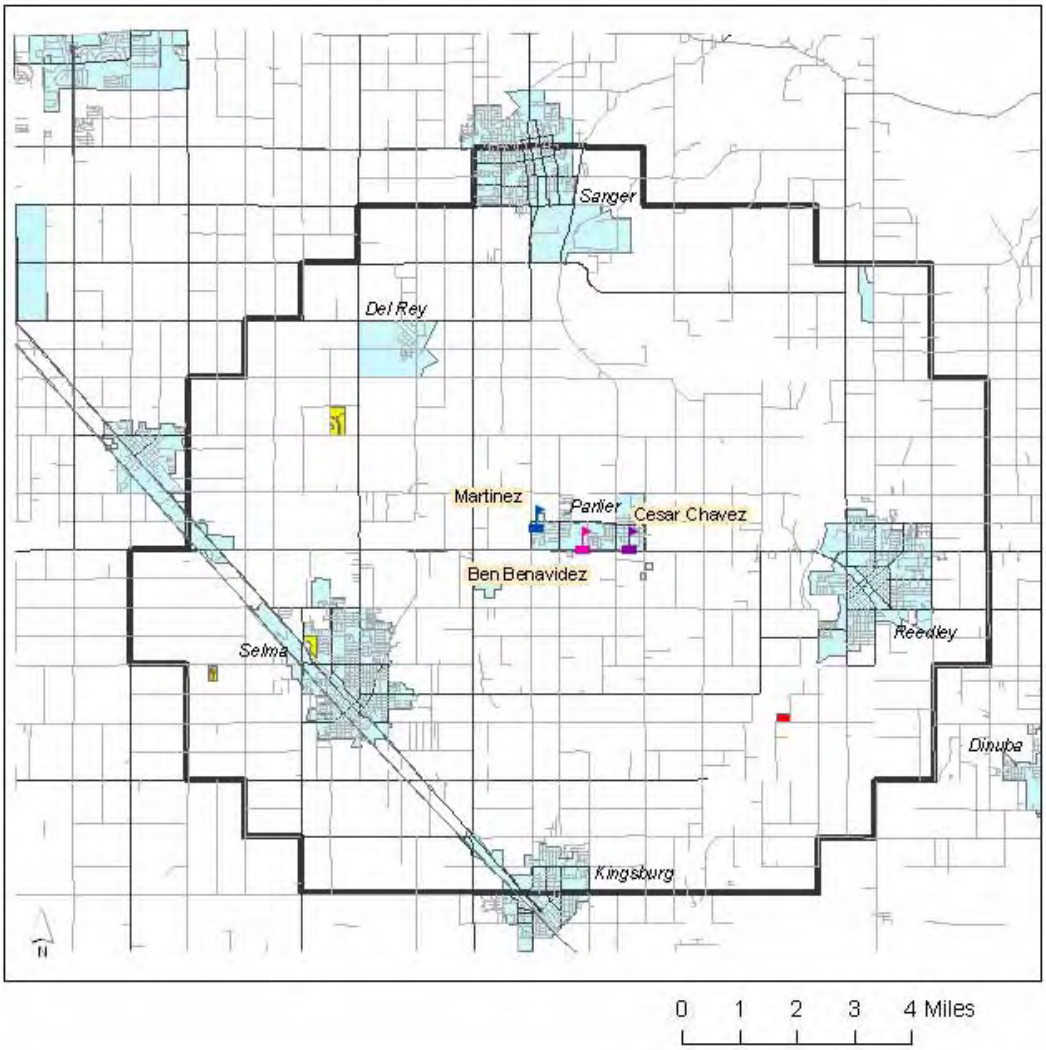
0 1 2 3 4 Miles

Total Lbs AI

- 0 - 18
- 19 - 48
- 49 - 160
- Study Area

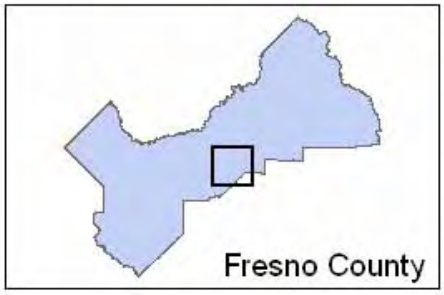


Metam-Sodium Applications 01/01/06 - 12/31/06

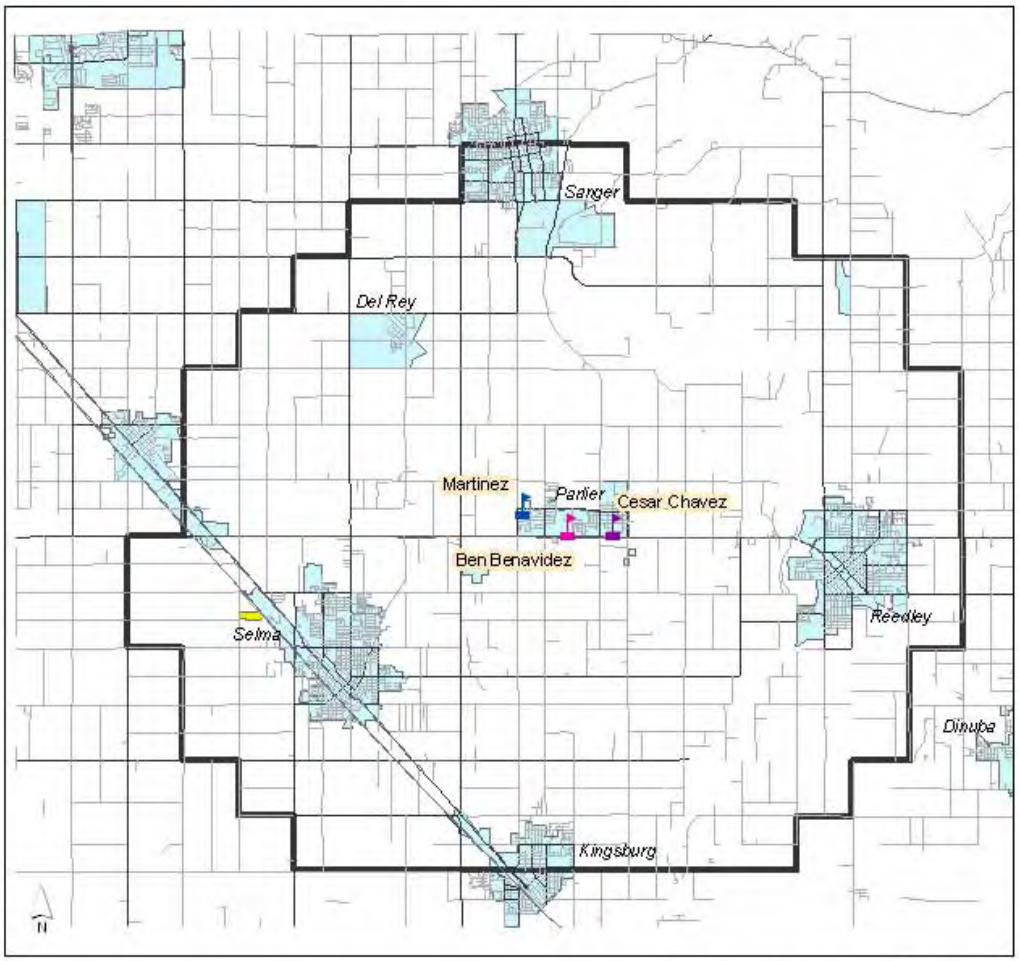


Total Lbs AI

- 191 - 952
- 953 - 1926
- 1927 - 3810
- Study Area



Potassium n-methyldithiocarbamate Applications
01/01/06 - 12/31/06

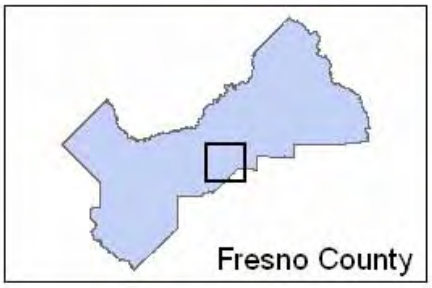


0 1 2 3 4 Miles

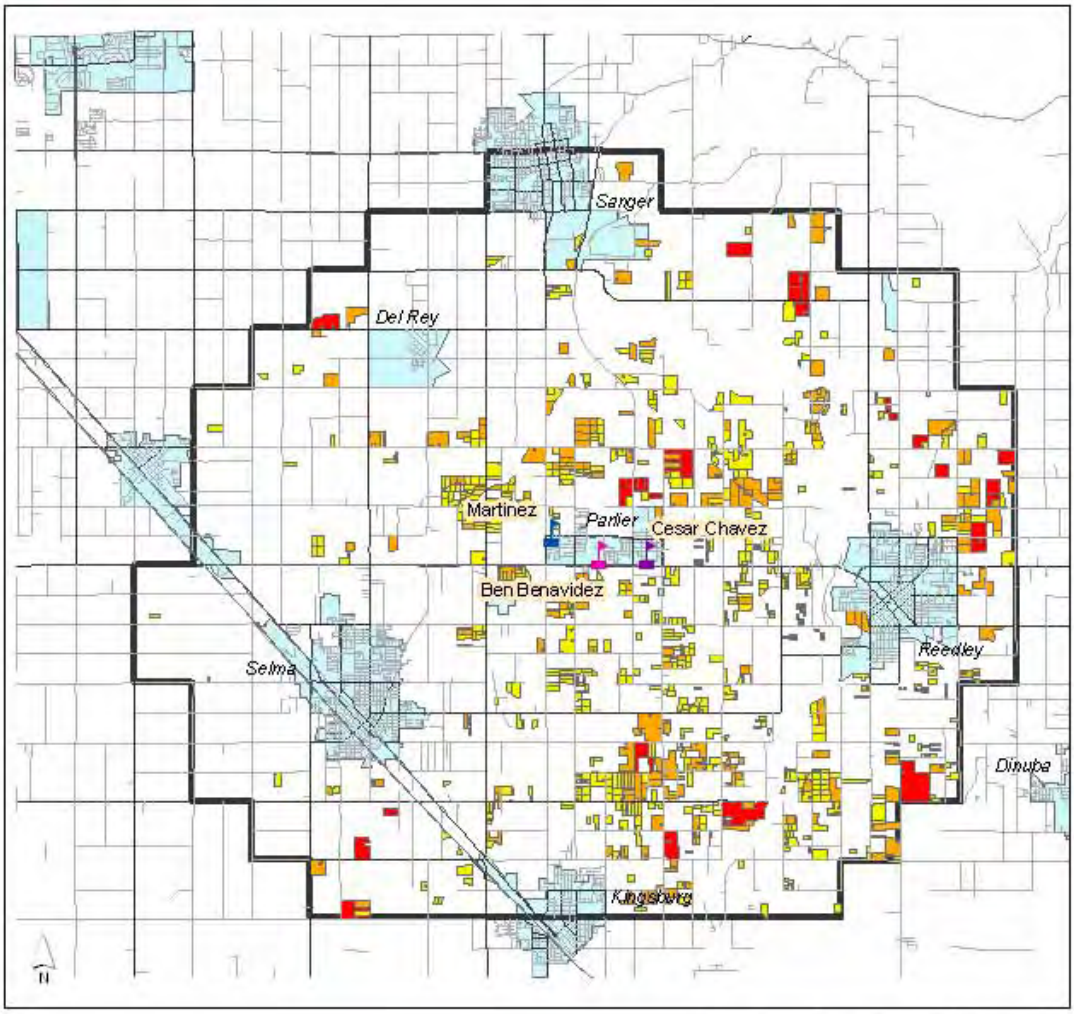
Total Lbs AI

150

Study Area



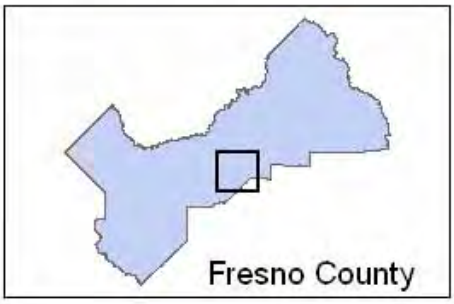
Phosmet Applications 01/01/06 - 12/31/06



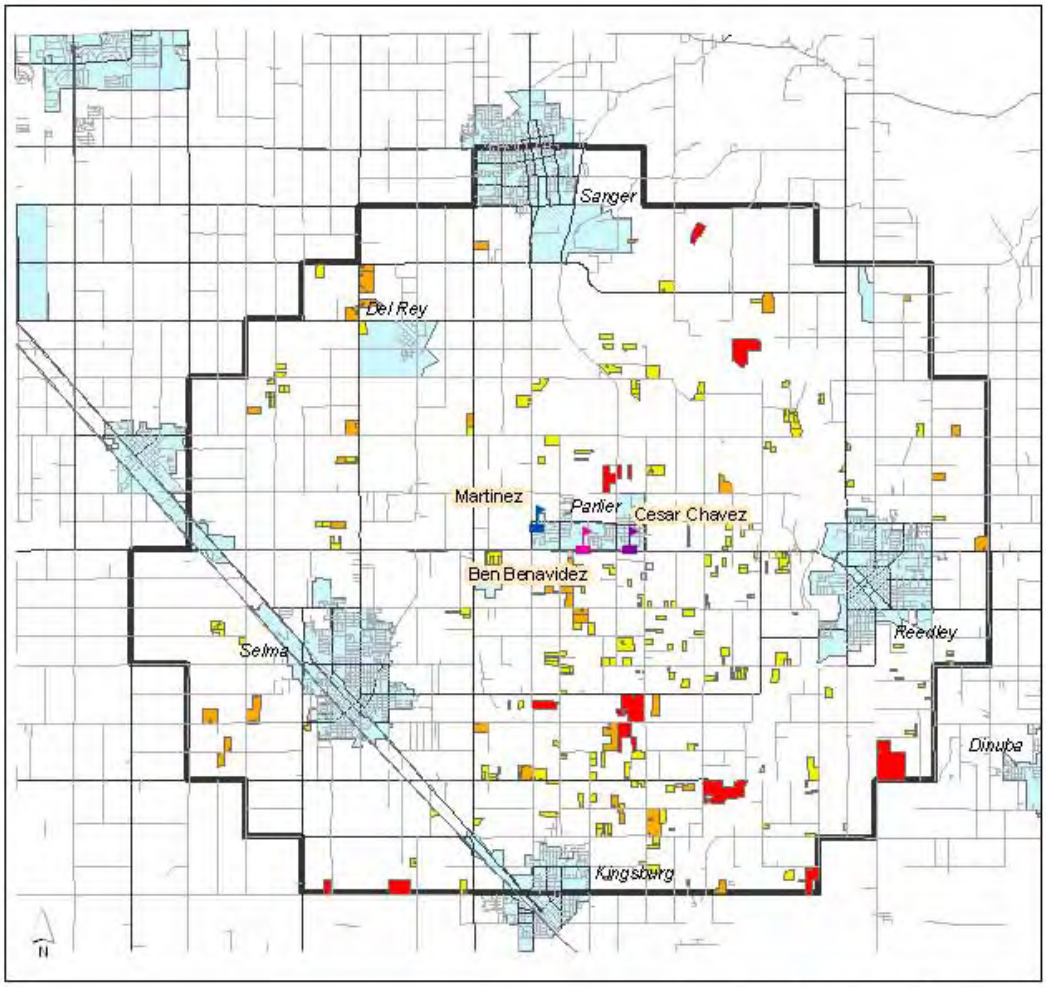
0 1 2 3 4 Miles

Total Lbs AI

- 1 - 43
- 44 - 140
- 141 - 426
- Study Area



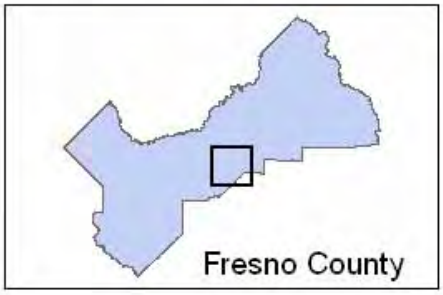
Propargite Applications 01/01/06 - 12/31/06



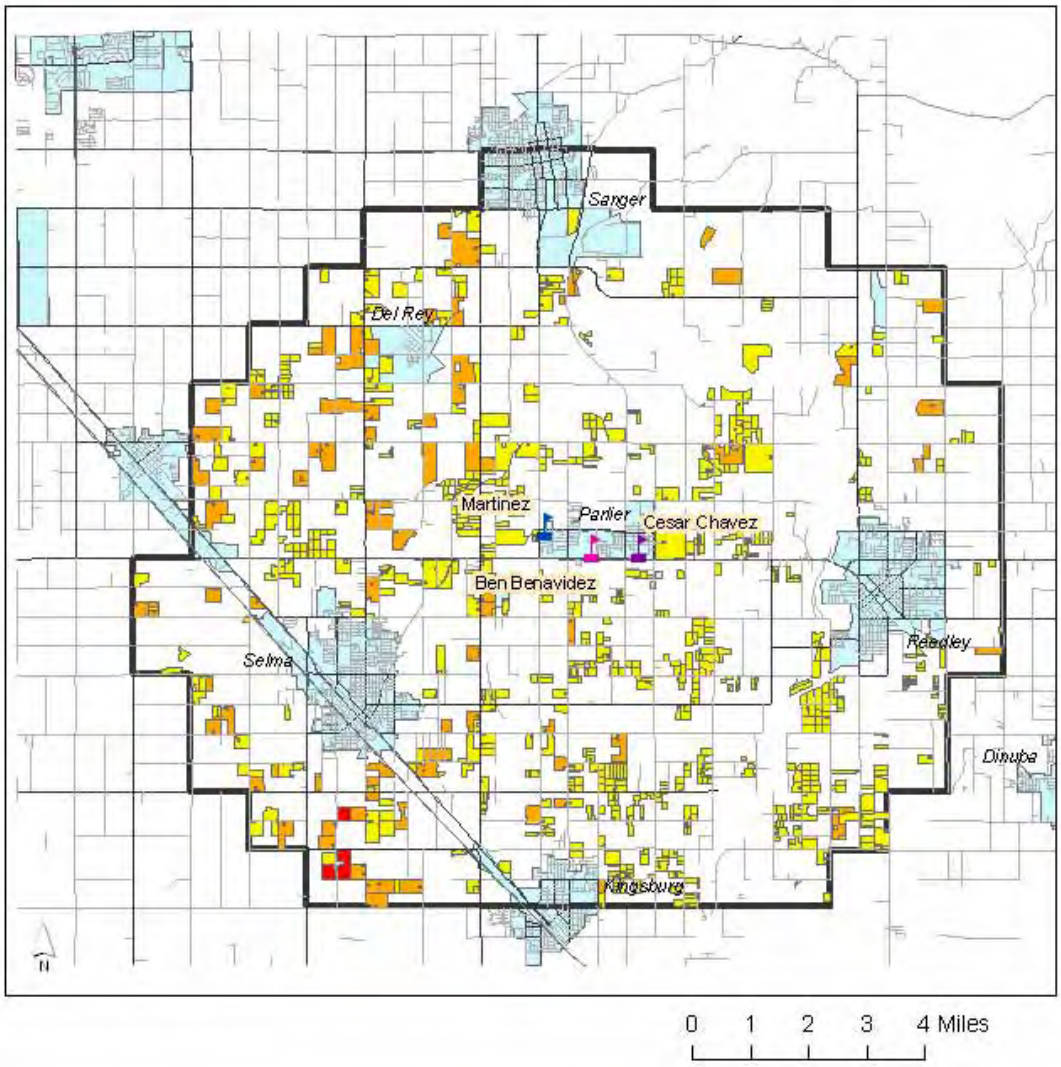
0 1 2 3 4 Miles

Total Lbs AI

- 1 - 32
- 33 - 88
- 96 - 207
- Study Area

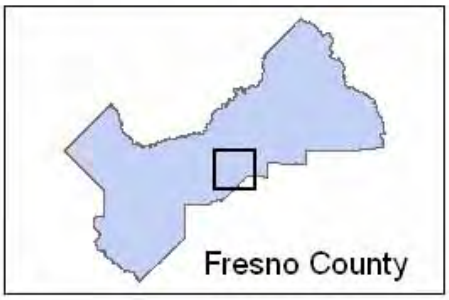


Simazine Applications 01/01/06 - 12/31/06

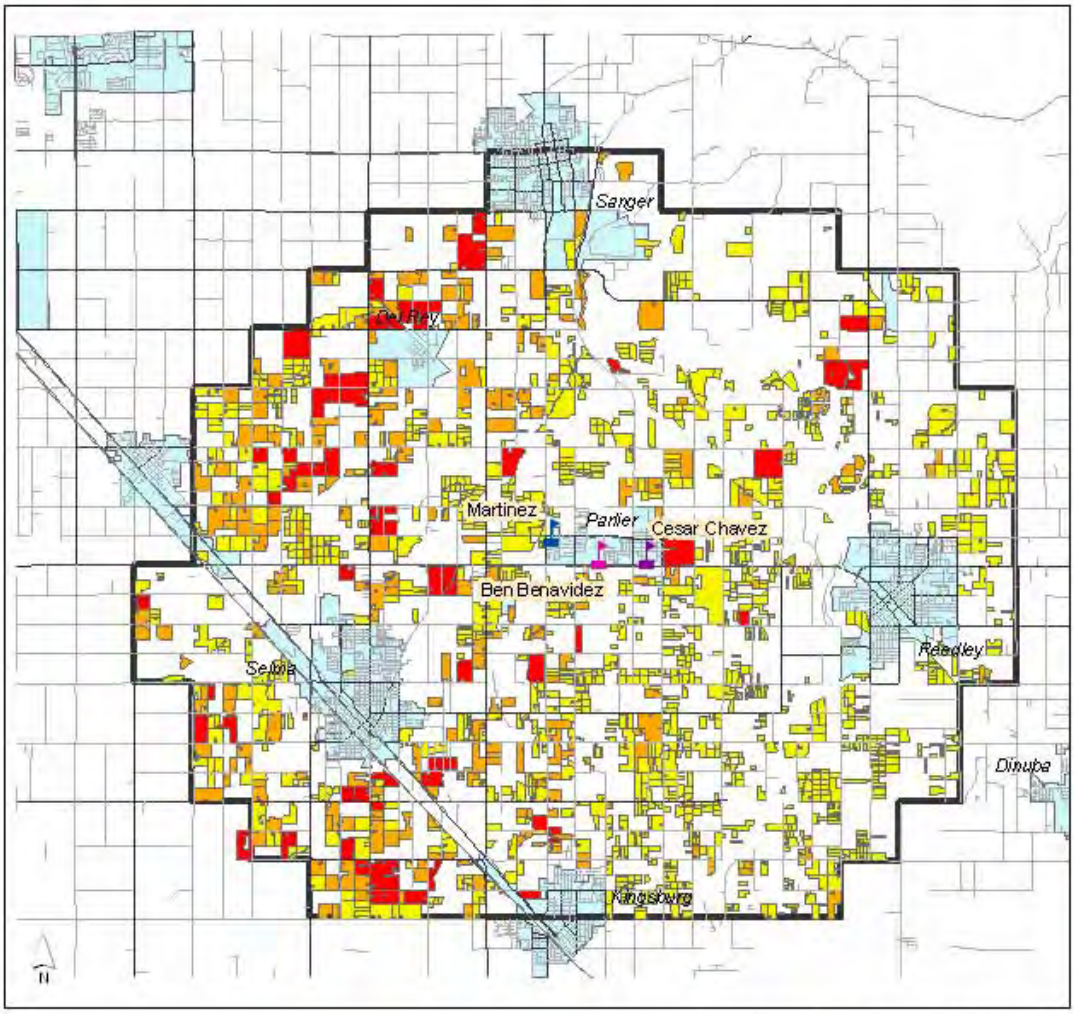


Total Lbs AI

- 0 - 30
- 31 - 153
- 154 - 450
- Study Area



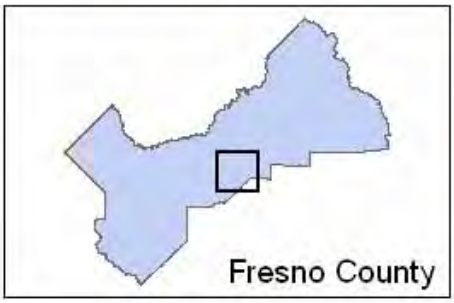
Sulfur Applications 01/01/06 - 12/31/06



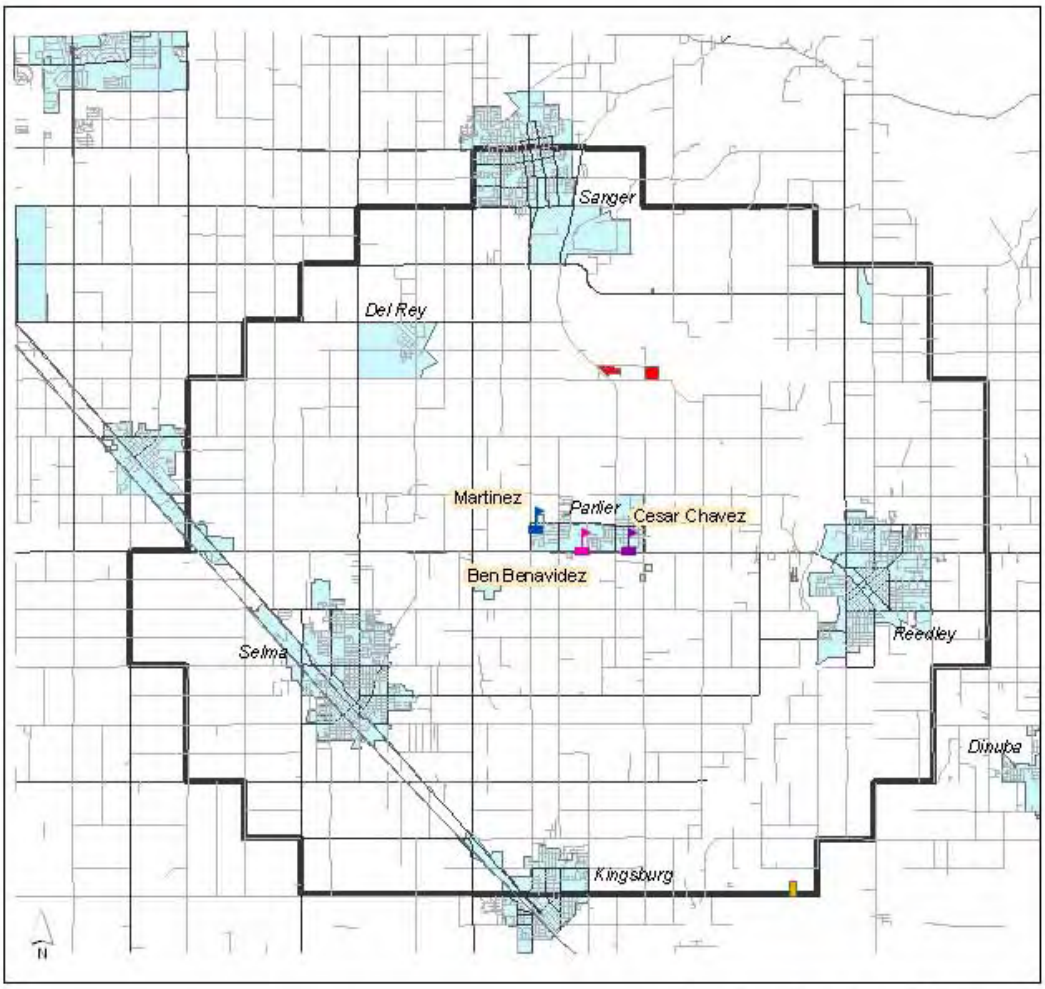
0 1 2 3 4 Miles

Total Lbs AI

- 2 - 776
- 777 - 2790
- 2791 - 12206
- Study Area



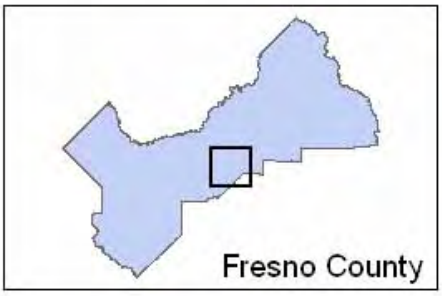
Trifluralin Applications 01/01/06 - 12/31/06



0 1 2 3 4 Miles

Total Lbs AI

- 0 - 2
- 3 - 12
- 13 - 28
- Study Area



October 16, 2009

TO: Pam Wofford, DPR

FROM: Anne Katten, CRLA Foundation akatten@crlaf.org

RE: Comments on Draft Report of the Parlier Pilot Study

Thank you for the opportunity to comment on this draft report which overall is quite comprehensive and well written.

Groundwater monitoring results analysis
The report should include an explanation of why samples were only tested for currently registered pesticides which are known groundwater contaminants and not other banned pesticides and other chemicals which are known groundwater contaminants, such as DBCP, EDB, nitrates, arsenic and radium or pesticides with significant use levels in the area that are designated as having the potential to pollute groundwater under T3CCR6800. In order to provide a more complete picture of potential exposure to chemicals through drinking water, the report should also include a summary of results of the local agency's testing of the Parlier wells, which should be supplied annually to all homeowners with their water bills and any other water monitoring data available from the DPH Office of Drinking Water or an explanation of why this information can not be integrated into the report.

Formaldehyde
The potential non-pesticidal sources of formaldehyde described in the report are plausible but use of formaldehyde in dairy or poultry operations should also be considered. It is my understanding that only part of the pesticide use in animal handling operations is reportable.

Ozone exceedances
The report should also mention that the 8 hr ozone standard came close to being exceeded in November.

Peak Exposures
Table 14 should also give the date of peak air concentration of each pesticide.

Combined levels of OPs and their oxons
The calculations used to tabulate combined exposure to each organophosphate and its oxon should be given in the report. Were the parent pesticide screening levels also used for their oxons? It is my understanding that oxons are often more toxic.

Cummulative Exposure Analysis – Grouping for Hazard Quotients
A Hazard Quotient should also be calculated for pesticides and other chemicals including priority air pollutants which are respiratory irritants and/or pesticides and other chemicals

suspected of aggravating or causing asthma or other respiratory disease and possibly for nervous system effects or other endpoints.

In order to expand the cumulative exposure assessment I would also recommend getting input for Amy Kyle and other UC Berkeley researchers working on the Cummulative Impacts and Precautionary Approaches project.

Dust samples

The report should explain how the recovery problems with the glass filters affected the ability to detect pesticide dust in air samples from the Kearney station.

Statistical Analysis

The figures showing distribution of monitoring results and reported use of selected pesticides in the report are helpful but the report should explain the problems encountered in conducting a statistical analysis and the challenges presented by a data set including a high number of samples with no detections.

Cancer risk estimates presentation and characterization

It would be clearer and more transparent to present cancer risk calculation results for 1,3 D and formaldehyde as “levels that may pose a significant cancer risk” rather than “above the level considered negligible”. The actual calculations and an explanation of how they compare to levels that DPR and other government agencies have characterized as significant levels of risk should be presented early in the report rather than for the first time on pg. 51. It should be explained that while DPR uses 1 in 100,000 as a threshold for significant cancer risk some other agencies consider exposures to cancer risk above levels of 1 in 1 million as significant from a public health standpoint.

Discussion comparing to other monitoring results

The Tables in the discussion of how the Parlier study results compare to results of other monitoring studies in California are very useful and informative. The section should be expanded to explain that in addition to levels of concern of chlorpyrifos, diazinon and 1,3 D were found in the Parlier study, the concern is heightened by the fact that much higher levels have been measured in previous air monitoring conducted in other agricultural areas of California where these pesticides are used more heavily. The implications for cancer risk from exposure to 1, 3 D appear quite serious.

Precautionary Approach

I have not had time yet to review the 2007 DPR report referenced in this section. I appreciate the focus on efforts to reduce pesticide use and air emissions but other measures such as buffer zones and neighbor notification about scheduled applications should also be discussed.

Future Monitoring

The report should explain what DPR has learned from this monitoring project about how to conduct long-term monitoring projects and the report should explain the problems

encountered in conducting a statistical analysis and the challenges presented by a data set including a high number of samples with no detections.

CALIFORNIA
SPECIALTY CROPS COUNCIL

October 15, 2009

Mr. Randy Segawa
Environmental Program Manager
Air and Ground Water Programs
Department of Pesticide Regulation
PO Box 4015
Sacramento, CA 95812-4015

Dear Mr. Segawa:

On behalf of the California Specialty Crops Council (CSCC) and the California Tree Fruit Agreement (CTFA), as official members of the Technical Advisory Group (TAG) of the Environmental Justice Pilot Project (Pilot Project), we are providing these comments on the draft final report provided to us in September 2009. Both CSCC and CTFA have concerns regarding the wording of the Executive Summary to the draft report.

The CSCC is a grower supported organization formed in 2000 as a collaborative effort to address technical aspects of pest management and environmental stewardship and the CTFA is a marketing order program which represents 900 peach, plum and nectarine growers.

Together, the CSCC and CTFA membership consists of tree fruit, vine, root, and berry crops; our base spans approximately 800,000 acres and represents several billion dollars of farm income. Pest management is a critical component of this production system and the continued availability of effective pesticides plays an important role in site preparation and crop protection for our commodities. Our farmers are entrusted to provide safe work environments which extend to the surrounding rural communities, including workers and their children.

Since 2005 we have attended TAG meetings and several of the conference calls as the monitoring project was developed. We have also participated in several of the Local Advisory Group (LAG) meetings which engaged the rural community of Parlier in the Pilot Project. Our involvement in these activities was with the understanding that the goals of the study were to determine whether pesticides were present in the ambient air and if so, are the levels present of concern to human health, particularly to children. Since the Pilot Project was conducted in the virtual epicenter of agricultural production in the San Joaquin Valley, we consider the findings of this program to be extremely important, not only to the Parlier area, but also to other agricultural regions of the state as they assess air quality and human health.

Data presented in the interim report showed that during the entire monitoring period, only one pesticide was found to be present at a level above the established health-protective screening level and this occurrence was on only one of 156 monitoring days. All of the other pesticide detections were well below the established screening levels. We are extremely concerned that the Executive Summary of the draft final report does not present findings of the study in the overall context of the extensive amount of data collected, nor does it put the data in proper perspective with regard to potential health risks. It is our assessment, that a scientific interpretation of the data in the draft report continues to support Director Warmerdam's statement, in her October 2007 letter to the Local Advisory Group, that there are no significant health risks to the community. The Executive Summary, however, does not make this clear. In its current form, the summary focuses on the number of detections and does not take this information to the next level, that is, to correlate the actual results to the health screening criteria established as official components of this study.

Without this point of reference, the final report simply does not meet the third and final goal of the Pilot Project, which was to answer the following question: *"Are the amounts of pesticides found in air of concern to human health, particularly for children?"*

We are asking for your diligence in conveying a clear message to the Parlier community with respect to the positive results of this study; the levels of pesticides detected, during a year-long monitoring period, are well below the health-protective screening levels established by DPR. As you are aware, there are many interested parties awaiting the final report of the Pilot Project. An ambiguous message from DPR leadership will create unnecessary uncertainty and anxiety in the community.

Safe farming and protection of our communities and environment is a core value of the Specialty Crops Council and the Tree Fruit Agreement. Many CSCC and CTFA members have participated in extensive research and outreach programs such as the DPR Pest Management Alliance (PMA) program. We appreciate this successful program, developed by your agency, which has clearly encouraged the adoption of "reduced risk" pest management techniques; the benefits of your own program have been demonstrated by reductions in pesticide use as reported in the annual pesticide use reports (PUR).

While we firmly believe that this study demonstrates the overall safety of current pest management practices, there is always room for continuous improvement. To this end, we plan to use the vast body of information collected in the Pilot Project to continue to refine our agricultural pest management practices and enhance our community stewardship programs.

Thank you once again for the opportunity to serve on the Technical Advisory Group and to provide our comments as you prepare a final report of the Pilot Project. The CSCC and CTFA are impressed with the commitment of the Department to undertake the monumental task of conducting this project; we recognize the expertise required to objectively summarize and interpret this large body of technical information.

We understand the responsibility of the Department to focus on the health of children in the Pilot Project and sincerely hope that the information generated during this program will help establish a clearer picture of community health and environmental safety associated with farming and pest management practices in this important agricultural region.

Please do not hesitate to contact us if you have any further questions.

Respectfully submitted,

Member, Technical Advisory Group
Lori Berger, Ph.D., Executive Director
California Specialty Crops Council
4500 S. Laspina Suite 214
Tulare, CA 93274
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lori@specialtycrops.org

Member, Technical Advisory Group
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(559) 638-8260
E-mail: gvansickle@caltreefruit.com

October 15, 2009

Randy Segawa
Environmental Program Manager
California Department of Pesticide Regulation
1001 I Street
Sacramento, CA 95812

Dear Mr. Segawa:

As members of the California Department of Pesticide Regulation's Local Advisory Group to the Parlier Environmental Justice Pilot Project, we are very concerned about some of the content of the draft final report sent to us on September 17, 2009.

What is most concerning is that unlike the preliminary DPR report, issued in 2007, the draft report seems to leave out information with respect to the potential health effects of the air monitoring detections which could help put the numbers in proper perspective. Instead the report focuses largely on detections, which are not necessarily an indication of health concerns for residents. The report leaves the distinct impression that Parlier residents are at risk and will most likely lead to a level of concern that is unwarranted. This would not be case if the final report were based upon the actual results as measured by the health screening criteria.

In a letter from DPR Director Mary-Ann Warmerdam dated October 29 2007; she stated that air monitoring data from the Parlier Project "do not show any significant health risks that warrant immediate action." Unfortunately, this same assurance is not included in the draft final report from this project. In fact, the information about health screen levels is not addressed to any significant level in the executive summary of the report. This is very interesting considering Director Warmerdam went to great lengths in her letter of October 2007 to explain the importance of risk assessment to the evaluation process.

In this same October 29, 2007 letter from Director Warmerdam, it was noted that a final report from DPR on this project would likely not be available until early 2009. That situation has indeed come to pass, which is understandable given the workload of this agency.

Because our families live, work and go to school in this community, we share concerns of other residents when it comes to the health issues. Upon learning in 2007 that a final report would likely be delayed until 2009, a group of concerned farmers and farm organizations took a proactive step to verify that, as stated by Director Warmerdam in her October 2007 letter, the findings from air monitoring data do not pose a health risk for residents of Parlier.

An independent party was brought in to conduct a review of pesticides detected through DPR monitoring in and around Parlier during a period of one year. The independent study was conducted by Dr. Rick Reiss, Director of the Center for Exposure Assessment and Dose Reconstruction at Exponent Inc. which is located in Alexandria, VA. Major findings from this analysis are listed below and the complete report by Dr. Reiss is included in this packet.

Major Findings from Exponent Review of Parlier Air Monitoring Data:

- The review concludes there are no significant health concerns for residents breathing pesticides in the air. These findings are in line with DPR reporting as of October 2007.

- The pesticide concentrations measured by DPR in Parlier were very low.

- The compounds measured in this study included 30 pesticides, 25 volatile organic compounds (VOCs) and 29 metals.

- There were 468 occasions for the measurement of each pesticide. For the majority of pesticide samples collected by DPR throughout this year-long project, there was either no pesticide present or the amount was so low that it could not be detected.

- For all but one of the pesticides found during the monitoring period, the levels detected are well below the health screening levels established by DPR.

- The one pesticide – diazinon -- which did exceed the screening level did so on one day during the entire year-long monitoring period. Because of the conservative nature of the screening levels used, this single detection is not considered to be of any health concern. As of October 2007, DPR concurs with this assessment.

- There were two VOCs that exceeded health screening levels however, it was concluded that the source of these two compounds – acrolein and formaldehyde – was motor vehicle emissions.

- One metal – chlorine – slightly exceeded the level considered safe. However, there was no pesticide use of chlorine in Parlier during the monitoring period.

As members of the Local Advisory Group, which spent considerable time and effort on this project, we believe the current draft report issued by DPR to be totally unacceptable and we strongly urge the Department to provide more information in its final report to put the potential health risks posed by the levels of pesticides detected in this study in proper context, as DPR reported in 2007 and as confirmed by the findings of Exponent, Inc.

As previously stated, if issued as written, the new draft final report will cause unnecessary alarm for the residents of Parlier. We do not believe that this report as currently summarized accurately reflects the results of the study. The fact is, neither independent analysis nor DPR reporting indicate residents should be concerned. The data shows that the vast majority of the time, pesticides monitored in the area are not in excess of health screening levels set by the agency itself.

One additional item being left out of this draft report is information about significant actions of local farmers to reduce the use of harsh pesticides and to incorporate more environmentally-friendly farming practices. Many of the farmers who produce crops in and around Parlier are

leaders in implementing Integrated Pest Management practices and are working to transition to reduced risk pesticides and safer farming practices.

Thank you very much for your time. We appreciate the opportunity to participate in this important project and to make these comments.

Sincerely,

Harold McClarty Rick Milton Vernon Peterson

Exponent®

Health Sciences

Evaluation of Parlier Air Monitoring Environmental Justice Project

Exponent®

Evaluation of Parlier Air Monitoring Environmental Justice Project

Prepared for

Alliance for Food and Farming
PO Box 2747
Watsonville, CA 95077

Prepared by

Rick Reiss, Sc.D. and Jennifer Roberts, Dr.PH.
Exponent
1800 Diagonal Road, Suite 300
Alexandria, VA 22314

June 5, 2009

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About Exponent

With over 90 scientific and engineering disciplines, Exponent's staff of approximately 800, located in 19 offices throughout the nation and four international offices, combines unparalleled technical expertise with the ability, when necessary, to focus this knowledge in extremely short time frames. Our multidisciplinary team of scientists, physicians, engineers, and regulatory consultants will perform both in-depth scientific research and analysis, or very rapid-response evaluations, to provide our clients with the critical information that both day-to-day and strategic decisions can require. Exponent is certified to ISO 9001.

The principal investigator for this project was Dr. Rick Reiss. He is the Director of the Center for Exposure Assessment and Dose Reconstruction at Exponent. Dr. Reiss is an experienced environmental health scientist with expertise in risk assessment, exposure assessment, environmental chemistry and fate, mathematical modeling, and applied statistics. He provides consulting services related to scientific issues associated with numerous environmental statutes, and has expertise in both air quality and chemical risk assessment. He has conducted risk assessments, data analyses, probabilistic exposure modeling and environmental exposure modeling for environmental agents, such as pesticides, industrial chemicals, consumer product chemicals, and asbestos. He has conducted risk assessments for new and existing products.

Dr. Reiss is very active in the application and development of quantitative methods in risk assessment. He is the developer of the Probabilistic Exposure and Risk assessment model for FUMigants (PERFUM), which is an air dispersion model designed to evaluate bystander inhalation exposure following fumigant applications. PERFUM was favorably evaluated by a multidisciplinary expert panel assembled by Environmental Protection Agency (EPA), and is being used by EPA to evaluate the registration of new fumigant active ingredients and the re-registration of existing fumigant products. Generally, he has used a variety of mathematical models in conducting occupational and ecological risk assessments for pesticides and industrial chemicals; and performed statistical analyses, including dose-response modeling to evaluate chemical toxicity.

Dr. Reiss is actively involved in several scientific societies and he is the President-Elect of the Society for Risk Analysis, the leading scientific society devoted to the field of risk assessment. Dr. Reiss was the Managing Editor of *Risk Analysis: An International Journal*, the leading scholarly journal for risk analysis, from 2001 through mid–2008. He was the winner of the 2001 Chauncey Starr award from the Society for Risk Analysis. This award recognizes a risk analyst less than 40 years of age that has made major contributions to the field of risk analysis. Dr. Reiss was also a councilor in the Society for Risk Analysis (term 2005–2008).

Acronyms and Abbreviations

ACL	Acute screening levels
ATSDR	Agency for Toxic Substances and Disease Registry
ATM	Atmosphere
BEN	Benavidez School
CDF	Cumulative distribution function
CHA	Chavez School
Cal/EPA	California Environmental Protection Agency
DPR	Department of Pesticide Regulation
EJ	Environmental Justice
HAPS	Hazardous air pollutants
HQ	Hazard quotients
LOAEL	Lowest-observed-adverse-effect level
LOQ	Limit of quantitation value
LV	Lowest quantified data point
ng/m^3	Nanograms per cubic meters
MAR	Martinez School
MRL	Minimal Risk Level
NOAEL	No-observed-adverse-effect level
PDF	Portable Document Format
PPB	Parts per billion
REL	Reference exposure levels
RL	Reporting level
SATP	Standard Ambient Temperature and Pressure
VOC	Volatile organic compounds

Executive Summary

The California Department of Pesticide Regulation (CDPR) conducted air monitoring of pesticides in Parlier, California as part of its environmental justice initiative. The Alliance for Food and Farming requested that Exponent prepare a review of the data that were collected and provide a perspective on the potential health risks of pesticides in the atmosphere of Parlier.

Parlier is a small farming community in Fresno, California. It is surrounded in all directions by agricultural. DPR established three monitoring stations in the town at different schools. These stations operated for three days each week in 2006. The pesticide concentrations in Parlier were very low. Only a few chemicals that are clearly from pesticide sources were detected with more than 5% frequency and included chlorpyrifos (10% detection rate), diazinon (9%), oxygen analog of diazinon (9%), MITC (30%), 1,3-dichloropropene (42% for both *cis* and *trans* isomers), and methyl bromide (78%). There were 16 pesticides that were not detected at all, and another six that were detected at only trace levels.

A risk assessment was also conducted by comparing the detected concentrations to acute and chronic benchmarks representing conservative estimates of the concentrations where potential health effects could occur. The benchmarks are mostly based on toxicology data and typically include safety factors to account for the extrapolation from animals to humans and to account for variability across human populations. The benchmarks are generally regarded as conservative (i.e., they tend to err on the side of overestimating risk). Figure 1 provides a comparison of the maximum daily concentration for the detected pesticides and the acute benchmark concentrations, and Figure 2 provides a comparison of the average concentration and the chronic benchmark concentration. The figures are on a logarithmic scale and show that, in most cases, the concentrations are more than an order of magnitude lower than the screening levels, indicating a large margin of safety. There was only one measurement on one day that had a level above the acute benchmark. This measurement was for diazinon. However, DPR has indicated that the acute benchmark for diazinon is very conservative (i.e., tends to overestimate the potential risk); thus, this single detection was not considered to be of any

health concern, which DPR concurs. For chlorpyrifos, MITC, 1,3-dichloropropene, malathion, phosmet and methyl bromide, none of the DPR health screening levels were exceeded.

The overall conclusion of this study is that the data collected in Parlier show that there are no acute or chronic health concerns for residents breathing pesticides in the air.

Figure 1. Comparison of maximum detected pesticide concentrations with acute screening levels

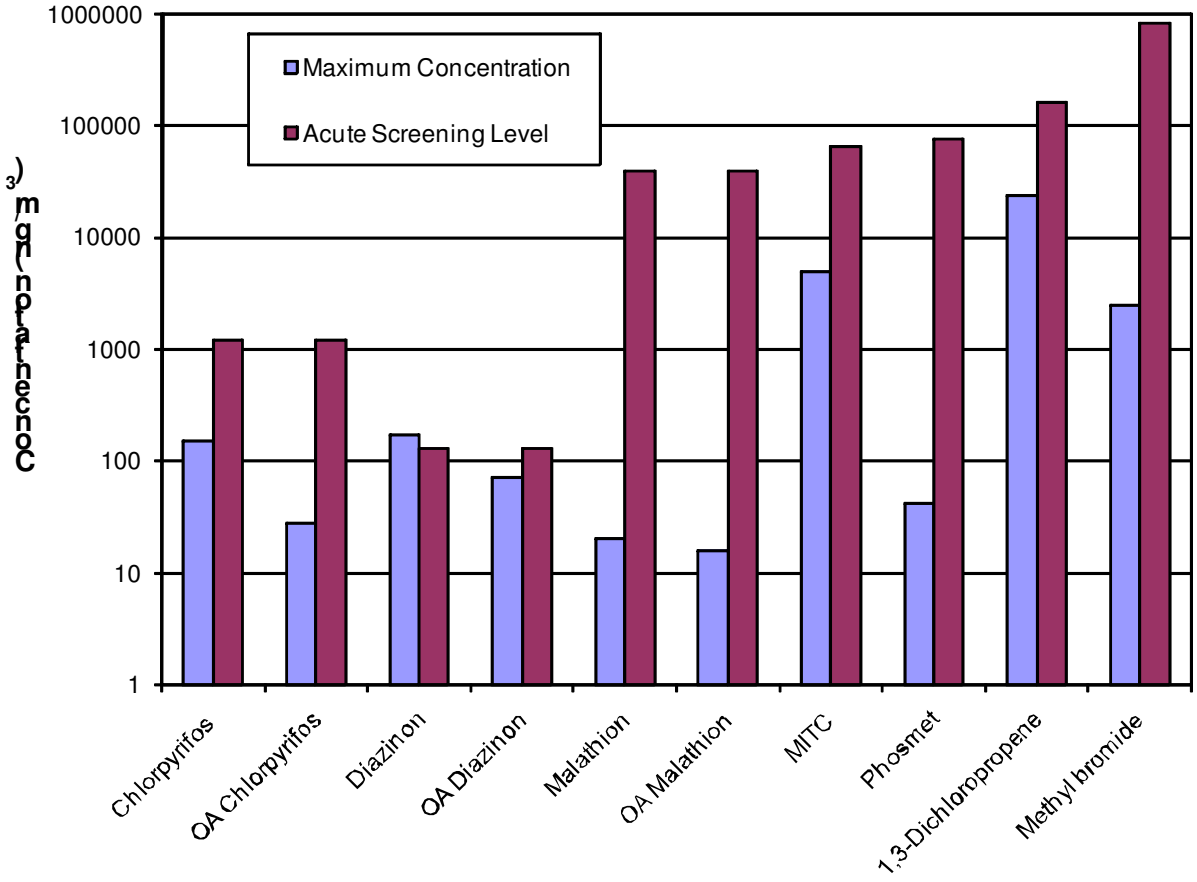
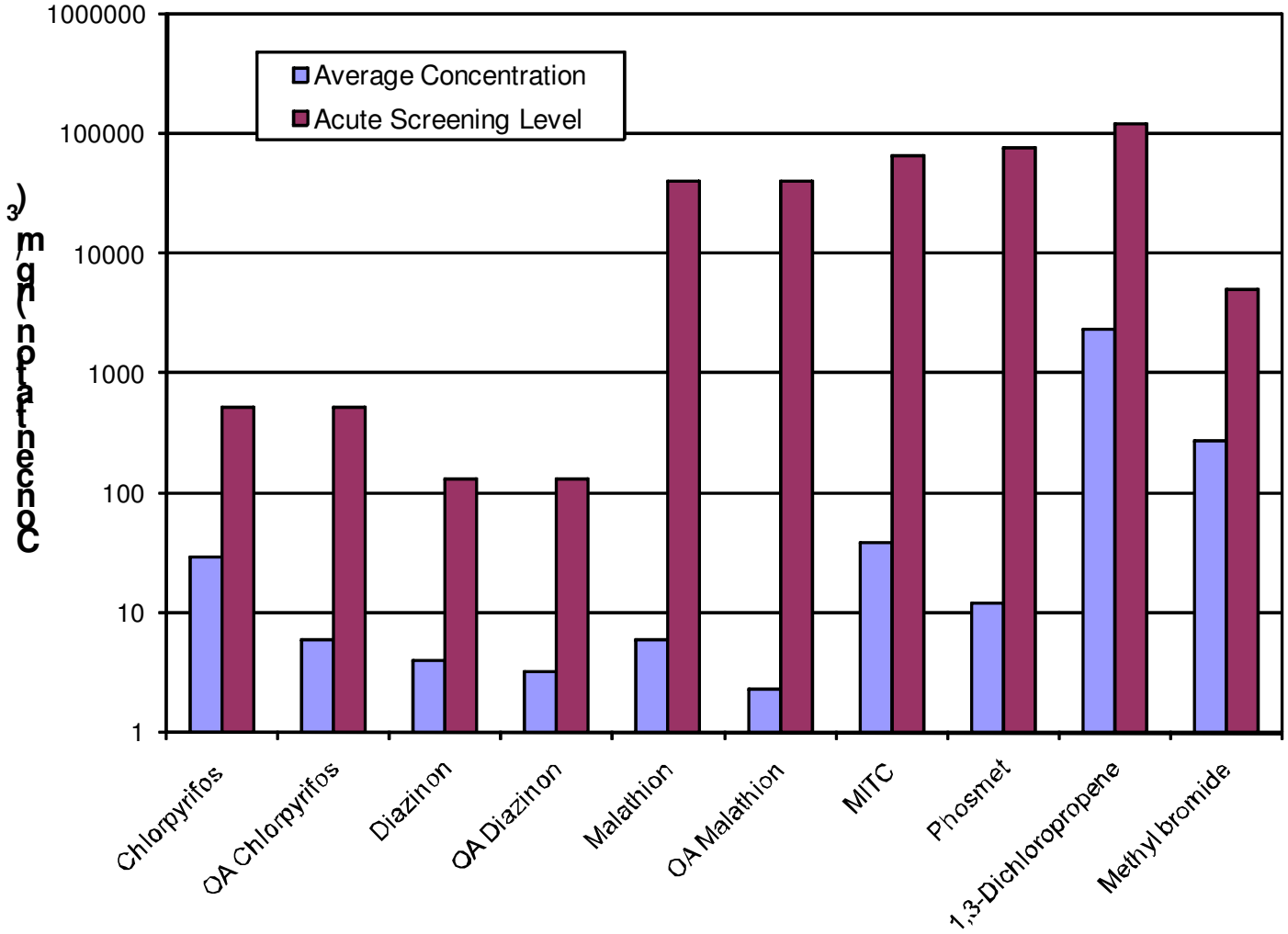


Figure 2. Comparison of average pesticide concentrations with chronic screening levels



Introduction

As part of the California Environmental Protection Agency (Cal/EPA) Environmental Justice (EJ) Action Plan, the Department of Pesticide Regulation (DPR) performed an analysis of ambient air in Parlier, California in 2006. DPR evaluated 83 communities in Fresno, Kern, Kings, Madera, Merced, Stanislaus and Tulare counties and ranked them based on EJ criteria such as income, race, and number of children in families. DPR selected Parlier, a small community in Fresno County, California, to conduct its EJ project. Figure 3 shows the location of Parlier on a map of California. Parlier is in inland California approximately 20 miles southeast of Fresno and approximately 30 miles northwest of Visalia. The Alliance for Food and Farming requested that Exponent prepare a review of the data that were collected and provide a perspective on the potential health risks of pesticides in the atmosphere of Parlier.

Parlier is a small city of only about 1.6 square miles. Within about a 5-miles radius of Parlier, DPR found that the most commonly grown crops were grapes (21,220 acres), nectarines (10,136 acres), and peaches (9,152 acres) (Cal/EPA-DPR, 2007a). Three organophosphate pesticides were applied at more than 3000 lbs of active ingredient (ai) in 2006, including chlorpyrifos, phosmet, and diazinon. Also, the fumigants metam sodium, methyl bromide, 1,3-dichloropropene and chloropicrin were also applied in significant levels in Parlier in 2006. This study included measurements for 1,3-dichloropropene, methylisothiocyanate (MITC, the breakdown product of metam sodium) and methyl bromide, but not for chloropicrin.

Air monitoring was conducted throughout 2006 with the purpose of answering three questions:

1) Are residents exposed to pesticides in the air?
2) Which pesticides are residents exposed and to what levels?
3) Are the amounts of pesticides found in the air of concern to human health, particularly for children?

DPR monitored pesticide concentrations at the Martinez School (MAR), Chavez School (CHA) and Benavidez School (BEN) in Parlier for 52 weeks. Figure 4 shows the locations of the

schools on a map of Parlier. Figure 5 shows the town of Parlier on a larger map that includes the surrounding areas. This map clearly shows that Parlier is surrounded by agriculture in all directions.

Continuous 24-hour samples were collected at each location for three days in a row each week (the specific days each week were randomly chosen and varied from week to week). Samples were collected for pesticides and breakdown products in addition to metals, and volatile organic compounds (VOCs). The VOCs and metals were monitored by the California Air Resources Board (ARB) at the Benavidez school and in nearby Fresno. DPR assembled pesticide usage data within five miles of Parlier. In addition to pesticide active ingredients, the primary breakdown products of several pesticides were monitored. These breakdown products are referred to as oxygen analogs (OA) of the parent compound.

Finally, DPR compared the monitored concentrations of pesticides, VOCs, and metals to health screening values for acute and chronic exposures. The health screening values represent levels that are considered safe and account for potential uncertainties. These values are determined from either animal toxicology assays or human epidemiologic data. The comparison of the monitored concentrations with the health screening values represents a conservative health risk assessment.

Our role was to provide a critical review of DPR's measurement data and risk assessment to determine whether the study was scientifically sound and to more broadly assess the pesticide risk to Parlier residents from ambient air exposures. The review included three steps:

1) A quality assurance review of the dataset and a tabulation of summary statistics
2) A review of the human health risk assessment
3) An identification of uncertainties in the risk analysis

Given the interests of the Alliance, the focus of our analysis is on the pesticide data. However, we also discuss the non-pesticide compounds that were measured.

Methodology

Data Presentation

DPR provided Exponent with a Microsoft Excel file containing VOC and metal sampling data. Additional DPR pesticide, VOC and metal sampling data were found on the Cal/EPA website in a Portable Document Format (pdf) format that was then converted into a Microsoft Excel format for analysis (http://www.cdpr.ca.gov/docs/envjust/pilot_proj/interim/appendix.pdf; http://www.cdpr.ca.gov/docs/envjust/pilot_proj/addendum_report2.pdf).

The compounds measured included 30 pesticides, 25 VOCs, and 29 metals including total chromium and hexavalent chromium. Among the 30 pesticide measurements were the oxygen analogs of four commonly applied pesticides, including malathion, chlorpyrifos, diazinon, and dimethoate. The oxygen analogs could form *in-situ* on the plant after application and then volatilize, but are more likely formed in the atmosphere through an oxidation reaction with hydroxyl radicals. For example, malathion oxidizes to malaoxon in the atmosphere (Finlayson-Pitts and Pitts, 2000).

Treatment of Non-Detect Data

The majority of the DPR pesticides samples were found to be non-detects or trace samples. This means that there was either no pesticide present or the amount was so low that it could not be detected by the analytical method. The presence of so high a level of censoring (i.e., non-detects), while certainly indicative of infrequent exposure, makes data analysis challenging. In particular, the estimation of mean concentrations is problematic when so many samples are below the detection limit. The estimation of mean concentrations is important for risk assessment, particularly for assessing the potential for chronic effects of long-term exposure.

The current environmental guidance documents have recommended three different methods for computing descriptive statistics of data with non-detects. These have included substituting one-

half or another fraction of the reporting level (RL), the delta-lognormal method or the Cohen's method (Helsel, 2005). These techniques have been found to introduce bias or higher variability into the estimates of mean concentrations. For most of the data in this study with censored values, the Kaplan-Meier method was employed because it is a nonparametric method that does not require the specification of an assumed distribution. With the Kaplan-Meier method, the percentiles or cumulative distribution function (CDF) were estimated, allowing a generally reliable estimate of the mean concentration. However, for the pesticides measured by DPR, the censoring was too great to get reliable results with the Kaplan-Meier method. Therefore, one-half the RL was assumed for non-detects.

Human Health Risk Assessment

A human health risk assessment was conducted based on the measurements made by DPR and ARB. The risk assessment includes a comparison of the concentrations that were measured with toxicity benchmarks. The toxicity benchmarks represent levels of exposure that are considered acceptable by the state of California. These benchmarks are derived with conservative methods. In other words, the benchmarks are developed with a bias towards overestimating risk as opposed to underestimating risk when uncertainties are confronted.

The benchmarks were developed from either animal toxicology experiments or human epidemiological studies, depending on the chemical. What follows is a general discussion of how these benchmarks are derived; however, there are many details that cannot be discussed in this limited space. For animal toxicology data, the dosage in the experiment that was found to be without significant effects is used as the point-of-departure and is called the no observed effect level. Typically, a 10-fold uncertainty factor is added to the no observed effect level to account for the extrapolation of animal data to human data and an additional 10-fold uncertainty factor is added to account for potential variability in the human population, including sensitive subpopulations including children. For epidemiological data, only the 10-fold factor for human variability is necessary.

Both acute and chronic acute screening levels were used in the assessment. The acute screening levels (ACL) were used to estimate the risks of high, short-term exposures using concentrations averaged over 1-day (Cal/EPA-DPR, 2007b, 2007c, 2007d). The chronic reference exposure levels (RELs) were used to assess longer-term exposures of 1-year or more (Cal/EPA-DPR, 2005). DPR may also conduct an analysis of subchronic exposures (about 3-4 week averages), but the subchronic benchmarks are not currently available.

To quantify potential risks, hazard quotients (*HQ*) were calculated. The *HQ* is defined as the ratio of the exposure concentration to the toxicity benchmark. The formulas for the acute and chronic *HQ* are simply:

$$HQ_{acute} = \frac{Daily\ Average\ Exposure}{Acute\ Screening\ Level} \tag{1}$$

$$HQ_{chronic} = \frac{Annual\ Average\ Exposure}{Chronic\ REL}$$

HQ values between 0 and 1.0 are considered acceptable. If the *HQ* is greater than 1, the air concentration exceeds the acceptable level. However, an *HQ* above 1 does not necessarily indicate that there are health effects given the conservative nature of the screening level development. It simply means that a greater effort should be made to investigate the potential risk.

Analysis of Pesticide Data

This section presents an analysis of the pesticide concentration data and provides a comparison of these levels to the health benchmarks in order to assess potential health risks.

Summary Statistics

Table 1 summarizes the DPR pesticide measurements at all of the sites, including the mean, standard deviation, concentration range, and percent of the data with detections[1]. Table 2 provides this same summary but for each of the three sites separately. There were 468 measurements for each pesticide. Table 3 provides a list of pesticides that were detected at only trace levels (i.e., detected but the level was too small report a specific quantity) or not detected at all.

The Kaplan-Meier method requires that the reporting limit (RL) be specified. Depending on the pesticide, the RL was assumed as either the limit of quantitation value (LOQ) provided by Cal/EPA or the lowest quantified data point, unless the two values were negligibly close. The mean concentrations in Tables 1 and 2 were calculated using the Kaplan Meier method.

By far, the most frequently detected pesticide was methylisothiocyanate (MITC), which is the breakdown product (in soil) of the fumigant metam sodium[2]. The mean concentration was 38.0 ng/m^3 and the peak concentration was 5012 ng/m^3. Soil fumigants are volatile chemicals that are designed to be in the gas phase in soil to allow rapid dispersion. Few, if any, field pesticides have vapor pressures in the range of the commonly applied fumigants. Therefore, it is not surprising that a fumigant is the most widely detected pesticide in air.

For non-fumigants, the most frequently detected pesticides were chlorpyrifos (10% detection), diazinon (9%), and the oxygen analog breakdown product of diazinon (9%). The mean

[1] Other pesticides measured by ARB, instead of DPR, are discussed below.

concentrations were 29.2, 4.0, and 3.2 ng/m^3 for chlorpyrifos, diazinon and diazinon OA, respectively. Also, phosmet and the oxygen analog of malathion were detected in about 1% of the measurements. Malathion and the oxygen analog breakdown product of chlorpyrifos were detected at less than 1 percent.

Table 2 shows a breakdown of the detections at the different schools. There were no significant differences in the concentrations at the different schools. This is not surprising given the small size of the town, the relative closeness of the monitors (within a few miles of one another), and because Parlier is surrounded by agriculture in all directions. There was no prominent wind direction according to the meteorological measurements made by ARB.

Most pesticides were either never detected or detected only at trace levels (i.e., below the limit of quantification). Table 3 summarizes the six pesticides found only at trace levels and the 16 pesticides that were not detected at all.

Seiber et al. (1993) also made measurements of chlorpyrifos and diazinon concentrations in Parlier in 1993. The measurements were made in the winter of 1989 at the UC Kearney Agricultural Research and Extension Center, which was in close proximity to orchards in Parlier. The mean chlorpyrifos concentration was 64.9 ng/m^3 (range 17.9-171.9 ng/m^3) and the mean diazinon concentration was 76.8 ng/m^3 (7.6-306.5 ng/m^3). The oxygen analogs were also detected, but at lower concentrations. The peak concentrations measured in this study were relatively similar (150 ng/m^3 for chlorpyrifos and 172 ng/m^3 for diazinon). Given that the Seiber et al. measurements were made during an application period, the peak concentrations are probably the best comparison. This suggests little change since the 1990s.

Risk Assessment

HQs were estimated for acute, subchronic, and chronic exposures to the DPR pesticides based on both average daily air concentration (chronic), peak monthly average concentration

[2] Another fumigant, methyl bromide, was measured by ARB. The methyl bromide levels are discussed with the

(subchronic) and the maximum daily air concentration (acute). The results are summarized in Table 4. For the acute assessment, the most appropriate comparison is with an air concentration at the upper-end of the distribution. For example, a typical risk assessment procedure is to use the 95th percentile value. However, in this case, the maximum value was used (which is sometimes well above the 95th percentile value) given the intermittent nature of pesticide concentrations as the result of the infrequency of applications for some pesticides such as MITC.

DPR calculated the *HQs* for both the parent and oxygen analogs using the same acute screening levels that were derived from data on the parent compound (see uncertainty discussion in Section 4 related to this issue). In addition to those calculations, we also calculated *HQs* by combining the parent and oxygen analog concentrations.

With one exception, the acute *HQ*s were all below 1.0. However, the *HQ* for diazinon was 1.3 for the parent compound only and 1.9 for the parent compound and oxygen analog combined. All of the subchronic and chronic *HQs* were less than 1.0.

In its December 12, 2006 letter to the residents of Parlier, DPR discounted the diazinon result stating that:

> "Please note that the screening level for diazinon is very health-protective. U.S. EPA recommended (in its diazinon registration eligibility document) that the results of a 21-day animal inhalation study be used to assess human exposures for all time periods (that, for short-term, medium-term, and long-term exposures), since that was the only available inhalation study. Therefore, a multi-day study was being used to set target exposure levels for a single day. Typically, allowable exposures for one day are higher than the acceptable exposure over a longer period.
>
> So, considering the very protective diazinon screening level, our scientists do not believe this single diazinon sample represents an immediate health concern."

ARB results below.

In other words, in addition to the already conservative procedures used to estimate risk, the acute screening level for diazinon was based on a 21-day exposure, while the hazard quotient was calculated using a 1-day average exposure. It is expected that animals can tolerate a higher exposure for one day compared to 21 days.

All of the pesticides listed in Table 4, except MITC, are organophosphates. Organophosphates exert their toxicity by a common mechanism of action, specifically the inhibition of the acetylcholinesterase enzyme. Given the common mechanism of action, the U.S. EPA has conducted a cumulative risk assessment for organophosphates, which attempts to estimate the combined effect of multiple organophosphates. Analogous to the EPA effort, Figure 6 provides the combined *HQs* for the organophosphate pesticides on each day (the maximum value across the schools is provided). The results of this analysis do not change the analysis of the individual pesticides in a meaningful way. The maximum *HQ* was 1.9 on July 18th, which is solely due to diazinon and its oxygen analog. There was no other day that had an *HQ* greater than unity.

Usage Statistics

DPR reported the usage of pesticides within a 5-mile radius of Parlier in 2006 (Cal/EPA-DPR, 2007b). Several pesticides were used at over 10,000 lbs, including 1,3-dichloropropene (302,075 lbs), chlorpyrifos (31,420 lbs), copper, sum of various forms (109,750 lbs), metam sodium (36,480 lbs), methyl bromide (12,481 lbs) oryzalin (12,970 lbs), phosmet (31,862 lbs), simazine (13,120 lbs), and sulfur (801,340 lbs).

The usage statistics roughly correspond to the prevalence of detections when the volatility is considered. The three fumigants, 1,3-dichloroproprene, methyl bromide, and MITC (breakdown product of metam sodium), were all detected with high prevalence and were applied in significant quantities. Given that these chemicals are very volatile, it is not surprising that they were frequently detected. On the other hand, some pesticides that were applied at significant levels such as phosmet, and simazine were not detected or only rarely detected due to their low volatility.

The usage of copper and sulfur were significant. However, given that metals are not volatile, the only pathway for pesticide applications to result in exposure within the town would be from drift from soil erosion. However, emissions of metals from other point sources with buoyant stacks can more readily transport over large distances.

VOCs and Metals

This section presents an analysis of the VOC and metal concentration data and provides a comparison of these levels to the health benchmarks in order to assess potential health risks.

Summary Statistics

The VOC measurements are summarized in Table 5. There were 71 samples for most compounds in Parlier (a few VOCs had fewer, likely due to measurement problems) and 34 samples for most VOCs in Fresno.

Acetone had the highest mean concentration at the both the Parlier (mean=6.2 ppb) and Fresno sites (mean=6.0 ppb). The concentrations of acetaldehyde and formaldehyde were also among the highest, with means of 1.7 and 2.6 ppb, respectively in Parlier, and 1.6 and 3.4 ppb, respectively in Fresno. The following VOCs were detected in 100% of the measurements at both sites: acetaldehyde, acetone, benzene, carbon disulfide, formaldehyde, and methyl chloroform. These VOCs are typically not associated with pesticide sources. The sources of many of these VOCs are discussed more thoroughly in the next section.

Two of the VOCs that were measured are primarily used as fumigants. Methyl bromide is used as both a soil and structural/commodity fumigant. Dichloropropene is also used a soil fumigant (under the product name Telone). Telone is a mixture of the *cis* and *trans* isomers of dichloropropene. The mean concentration of methyl bromide in Parlier was 0.069 ppb with a 78% detection rate and a peak concentration of 0.65 ppb. In Fresno, the mean concentration was somewhat lower at 0.042 ppb with a 74% detection rate and a peak concentration of 0.11 ppb. For dichloropropene, both the *cis* and *trans* isomers were measured. For the *cis* isomer, the mean concentration in Parlier was 0.27 ppb with a detection rate of 42% and a peak concentration of 2.5 ppb. In Fresno, the mean concentration was lower at 0.096 ppb with a detection rate of 24% and a peak concentration of 0.74 ppb. For the *trans* isomer, the mean concentration in Parlier was 0.24 ppb with a detection rate of 42% and a peak concentration of

2.7 ppb. In Fresno, the mean concentration was lower at 0.086 ppb with a detection rate of 21% and a peak concentration of 0.58 ppb. The high agreement in the detection rates for the *cis* and *trans* isomers is not surprising given the common source.

The mean concentrations at the two sites were also compared statistically using the Wilcoxon Rank Sum test. The Wilcoxon test is non-parametric and ideal for datasets with a high number of non-detects. The following VOCs had statistically higher mean concentrations in Fresno: 1,3-butadiene, acetonitrile, benzene, chloroform, ethyl benzene, meta/para-xylene, methylene chloride, ortho-xylene, perchloroethylene, styrene, and toluene. A number of these VOCs, particularly 1,3-butadiene and benzene, are associated with vehicle emissions and the higher concentrations in Fresno may be due to greater vehicle traffic. At Parlier, the concentrations were statistically higher for carbon disulfide, cis-1,3-dichlorpropene, and trans-1,3-dichloropropene. This may be because the small town of Parlier is in closer proximity to fumigant applications compared to the larger city of Fresno.

Table 6 summarizes the metal founds at the Parlier site on Tuolumne street. The only metals with significant use as pesticides are copper and sulfur. Among the 29 metals measured at the Parlier site, silicon was found to have the highest mean air concentration (4475 ng/m^3) followed by iron (1774 ng/m^3) and aluminum (1587 ng/m^3). All metals were found in at least 5% of the measurements. The following metals were detected in 100% of the measurements: aluminum, barium, calcium, chlorine, copper, iron, manganese, phosphorus, potassium, silicon, sulfur, titanium, and zinc.

Additionally, hexavalent chromium was measured at both the Parlier and Fresno sites and summarized in Table 7, but in only four samples. The mean concentration in Parlier was 0.063 ng/m^3. The mean concentration in Fresno was 0.065 ng/m^3. Hexavalent chromium was measured in 50% of the Parlier samples and 25% of the Fresno samples.

Human Health Risk Assessment

In order to estimate the *HQs* for VOCs, the concentration of each VOC had to be converted from ppb to ng/m^3 by using the molecular weight of each compound and the molar volume of

24.45 L/mol at SATP (Standard Ambient Temperature and Pressure = 25 degrees Celsius and 1 atm/101.3 kPa). The values in ng/m^3 are summarized in Tables 8 and 9 with the acute *HQs* (Table 8) and the chronic *HQs* (Table 9). The acute *HQs* were calculated using both the mean and maximum concentrations. The chronic *HQs* were calculated using only the mean concentration. It would be inappropriate to compare a 1-day peak concentration with a chronic REL. Also, reference levels were not available for a number of VOCs; therefore, *HQs* could not be calculated for these VOCs.

The acute *HQs* for all of the VOCs were well below 1.0 with the exception of acrolein. The acrolein *HQs* using the mean and maximum air concentration values ranged from 7.0 to 24.1 in Parlier and 6.8 to 26.5 in Fresno (Table 8). DPR did not report any use of acrolein as a pesticide in 2006 within five miles of Parlier. Therefore, the concentrations that exist in Parlier are due to other sources, including motor vehicle emissions (see more detailed discussion in the next section).

For chronic risk, the *HQs* for acrolein and formaldehyde exceed the benchmarks (Table 9). However, the *HQs* for formaldehyde only marginally exceed the benchmark with an *HQ* of 1.1 in Parlier and 1.4 in Fresno. DPR did not report any formaldehyde pesticide use in Parlier in 2006. As discussed in Section 4, there are significant emissions of formaldehyde from motor vehicles. For acrolein, the *HQs* were 22.2 in Parlier and 21.4 in Fresno.

It is important to note that Parlier is not unusual in regard to risks associated with acrolein. The U.S. EPA has conducted a nationwide risk assessment for air toxic compounds and estimated concentrations and risks in every U.S. census tract. The assessment estimated that about 220 million Americans live in areas where the acrolein concentrations are above EPA's chronic exposure benchmark[3].

The acute *HQs* for metals are summarized in Table 10 and the chronic *HQs* are summarized in Table 11. There are acute screening levels available for only five of the metals, and chronic screening levels for only six of the metals.

[3] http://www.epa.gov/ttn/atw/nata1999/risksum.html

None of the acute *HQs* were greater than unity. For chronic exposure, the chlorine *HQ* was marginally greater than unity at 1.2. There were no reported uses of chlorine as a pesticide in Parlier.

DPR reports the use of copper and sulfur as pesticides in Parlier. There was an acute screening level for copper and the *HQs* were 0.00042 (based on the mean concentration) and 0.0055 (based on the maximum concentration). A chronic screening level was not available for copper and neither an acute nor chronic screening level was available for sulfur.

Discussion of Results

This section focuses on two areas of uncertainties. First, it considers each of the chemicals where some measure of concern was indicated based on the measured concentrations and analyzes its uses for pesticides and other purposes. In addition, toxicity benchmarks from other sources are discussed and compared to the DPR values. Secondly, the potential underestimation of toxicity of the oxygen analogs is discussed.

Diazinon

Diazinon is an organophosphate pesticide used to control pest insects in soil, and on fruit and vegetable field crops. It is also used to control flies, fleas and cockroaches in household products. The sale of home and garden products containing diazinon was phased out in December 2004 as part of an agreement between EPA and diazinon registrants. However, although sales ceased in the U.S. in 2004, individuals may still be exposed if the products were purchased prior to 2004 and stored. Agricultural uses, which are most relevant to Parlier, are still registered.

The Agency for Toxic Substances and Disease Registry (ATSDR) has derived an intermediate-duration inhalation Minimal Risk Level (MRL) of 0.01 mg/m^3 for diazinon (ATSDR, 2006). An MRL is an estimate of daily human exposure to a hazardous substance that is likely to be without an appreciable risk of adverse non-cancerous health effects. This ATSDR MRL is based on a NOAEL (no-observed-adverse-effect level) of 1.57 mg/m^3 for inhibition of erythrocyte acetylcholinesterase (RBC AChE) in rabbits.

The ATSDR intermediate-duration inhalation MRL of 0.01 mg/m^3 for diazinon is equivalent to 10,000 ng/m^3. Given the fact that the Cal/EPA ASL is 130 ng/m^3 and although the ASL is an acute reference value as opposed to an intermediate-duration value, this value would certainly not pose a question of being considered too stringent.

Acrolein

Acrolein is a very reactive aldehyde that has a sweet and pungent odor, and can be found in small amounts endogenously because it is formed naturally in the human body. Yet, it is primarily used as an intermediate in chemical manufacturing and as a biocide, which is added to irrigation canals and the water supply systems of some industrial plants to control underwater plant and algae growth (ATSDR, 2007). Acrolein has also been used in some livestock feed, as a warning agent in methyl chloride refrigerant and as a component of chemical weapons (ATSDR, 2007).

Acrolein is byproduct formed through the burning of tobacco, wood, plastics, gasoline and diesel fuel, paraffin wax and the heating of animal and vegetable fats at high temperatures. The individuals with the highest exposure to acrolein include smokers, those who inhale environmental tobacco smoke second-hand, and those who reside or work in close proximity to sources of wood and plastic smoke, firefighting communities and areas of dense automotive traffic.

EPA has derived a reference concentration (RfC) for acrolein of $2x10^{-5}$ mg/m^3 (20 ng/m^3), which was based on a LOAEL (lowest-observed-adverse-effect-level) of 0.9 mg/m^3 for nasal lesions in rats exposed to acrolein for 6 hours/day, 5 days/week for 13 weeks (ATSDR, 2007). RfCs are developed by U.S. EPA and are considered a safe exposure level for a chronic duration. ATSDR derived two MRLs. The acute and intermediate duration inhalation MRLs for acrolein were 0.003 ppm (6879 ng/m^3) and 0.00004 ppm (92 ng/m^3), respectively (ATSDR, 2007). In comparison to the U.S. EPA RfC and the ATSDR MRLs, the California reference values are not exceptionally stringent or conservative.

The elevation in the acrolein *HQs* is due to non-pesticide sources, as no pesticide use of acrolein was reported near Parlier in 2006. The U.S. EPA Office of Air and Radiation maintains an AirData website that presents annual summaries of air pollution data from two EPA databases: (1) Air Quality System; and (2) National Emission Inventory (EPA, 2007). The highest source of acrolein in Fresno County was nonroad emissions such as diesel engines and commercial

marine vehicles, followed by onroad emissions such as cars and buses. Although this data is from 1999, it can be assumed that the source breakdown of emissions for acrolein has not changed significantly. Thus, the use of acrolein as a pesticide does not appear to be a significant contributing factor, if at all, to the elevated air concentration levels in Parlier.

Formaldehyde

Formaldehyde is a flammable gas at room temperature. Formaldehyde is naturally produced in very small quantities in the human body as part of metabolic processes (ATSDR, 1999). The major sources of formaldehyde are automobile exhaust and combustion processes (ATSDR, 1999).

Currently, EPA has not derived an RfC for formaldehyde. ATSDR has derived an acute, intermediate and chronic duration MRL of 0.04, 0.03, 0.008 ppm for formaldehyde. Respectively, these values are equivalent to 49,109, 36,832 and 9,822 ng/m^3. In comparison to this chronic ATSDR MRL of 9,822 ng/m^3, the formaldehyde Cal/EPA REL of 3,000 ng/m^3 is more conservative by nearly a factor of three.

Formaldehyde emissions in California mostly are due to vehicle emissions and other non-agricultural sources. Thus, the use of formaldehyde as a pesticide does not appear to be a significant factor to the air concentration levels in Parlier.

Chlorine

Chlorine is a gas with an irritating odor that has been used in the production of many commercial products such as refrigerants, silicone rubber, plastics, solvents, disinfectants and pesticides. Chlorine is stored and transported as a liquid under pressure and is releases into the environment have been the result of accidents or form emissions at facilities where it is produced or used. The background exposure to chlorine of the general population is not expected to represent a health concern.

ATSDR has derived an acute, intermediate and chronic duration MRL of 0.07, 0.002, 0.00005 ppm for chlorine. Respectively, these values are equivalent to 101,451, 2,899 and 72.5 ng/m^3. The chlorine Cal/EPA REL of 200 ng/m^3 is less stringent by a factor of more than two in comparison to the chlorine chronic ATSDR MRL of 72.5 ng/m^3.

Chlorine was not used as a pesticide in Parlier in 2006.

Toxicity of Oxygen Analogs

DPR has assumed that the oxygen analogs of organophosphates have toxicity equivalent to the parent compound. However, the U.S. EPA has concluded the oxygen analogs are frequently more toxic. For example, EPA assumed that malaoxon was 61-fold more toxic than malathion for chronic exposures (EPA, 2006).

For this assessment, the diazinon oxygen analog was the most frequently detected and diazinon has the highest toxicity of the pesticides. However, EPA did not estimate a factor comparing the oxon to parent toxicity for diazinon like it did for malathion. Therefore, the effect of potentially increased toxicity for the oxygen analog of diazinon cannot be quantitatively evaluated. For the other oxygen analogs, the concentrations were too low to be considered hazardous even if higher toxicity is assumed for the oxygen analog.

Conclusions

Pesticide, VOC, and metal air concentrations were collected in Parlier in 2006 as part of an environmental justice project. The focus of this review was on pesticide usage, but the non-pesticide uses were also discussed.

The pesticide concentrations in Parlier were very low. Only a few chemicals that are clearly from pesticide sources were detected with more than 5% frequency and included chlorpyrifos (10% detection rate), diazinon (9%), oxygen analog of diazinon (9%), MITC (30%), 1,3-dichloropropene (42% for both *cis* and *trans* isomers), and methyl bromide (78%). Some other VOC and metals were detected in all samples, including acetaldehyde, acetone, benzene, carbon disulfide, methyl chloroform, aluminum, barium, calcium, chlorine, copper, iron, manganese, potassium, phosphorous, silicon, and zinc.

A risk assessment was conducted by comparing the detected concentrations to acute and chronic benchmarks. For pesticides, there was only one measurement on one day that had a level above the acute benchmark. This measurement was for diazinon. However, DPR has indicated that the acute benchmark for diazinon is very conservative (i.e., tends to overestimate the potential risk); thus, this single detection was not considered to be of health concern. Chronic RELs were not available for the pesticides evaluated by DPR, so a chronic risk assessment was not conducted.

There were two VOCs that exceeded the benchmark levels for acute and chronic exposures and some of these VOCs are used as pesticides. Concentrations of acrolein exceeded the acute benchmark, and concentrations of acrolein and formaldehyde exceeded the chronic benchmarks. While acrolein and formaldehyde have some registered uses of pesticides, there were no applications of acrolein or formaldehyde within five miles of Parlier in 2006. It was concluded that the principal source for these compounds was motor vehicle emissions.

For metals, the chronic benchmark for chlorine was marginally exceeded. However, there was no pesticide use of chlorine in Parlier in 2006.

The overall conclusion of this study is that the data collected in Parlier show that there are no acute or chronic health concerns for residents breathing pesticides in the air.

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Figure 3. Map of California showing Parlier

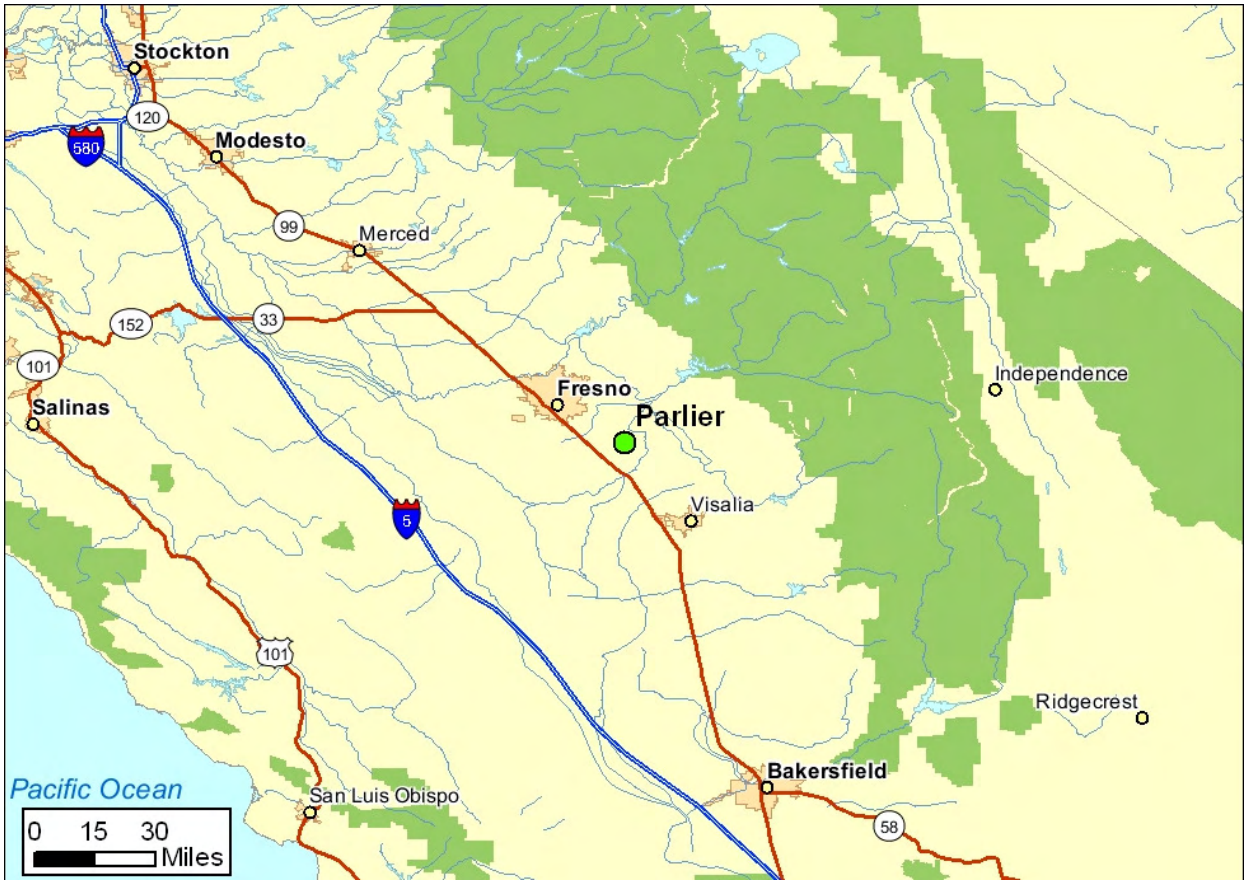

Figure 4. Map of Parlier showing monitoring locations

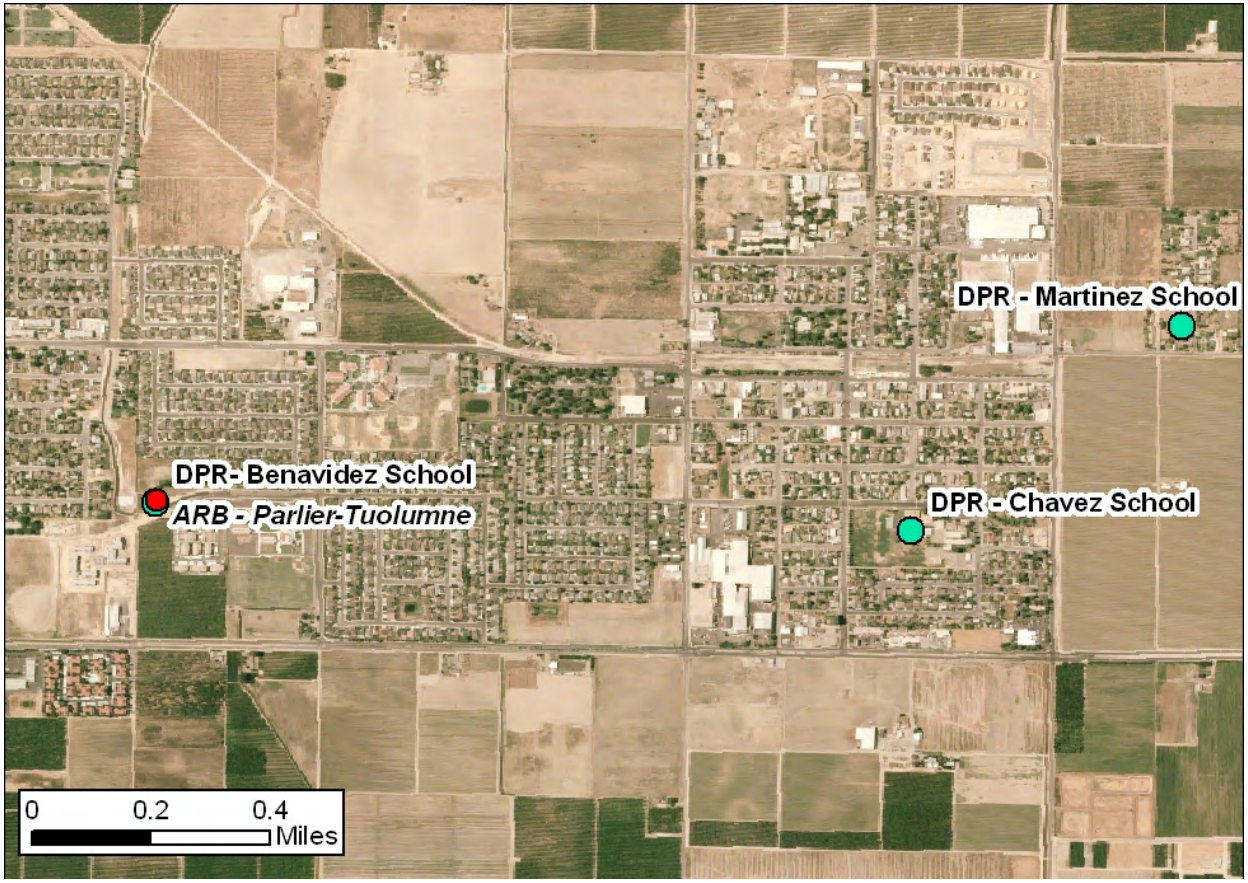

Figure 5. Map of Parlier showing surrounding area

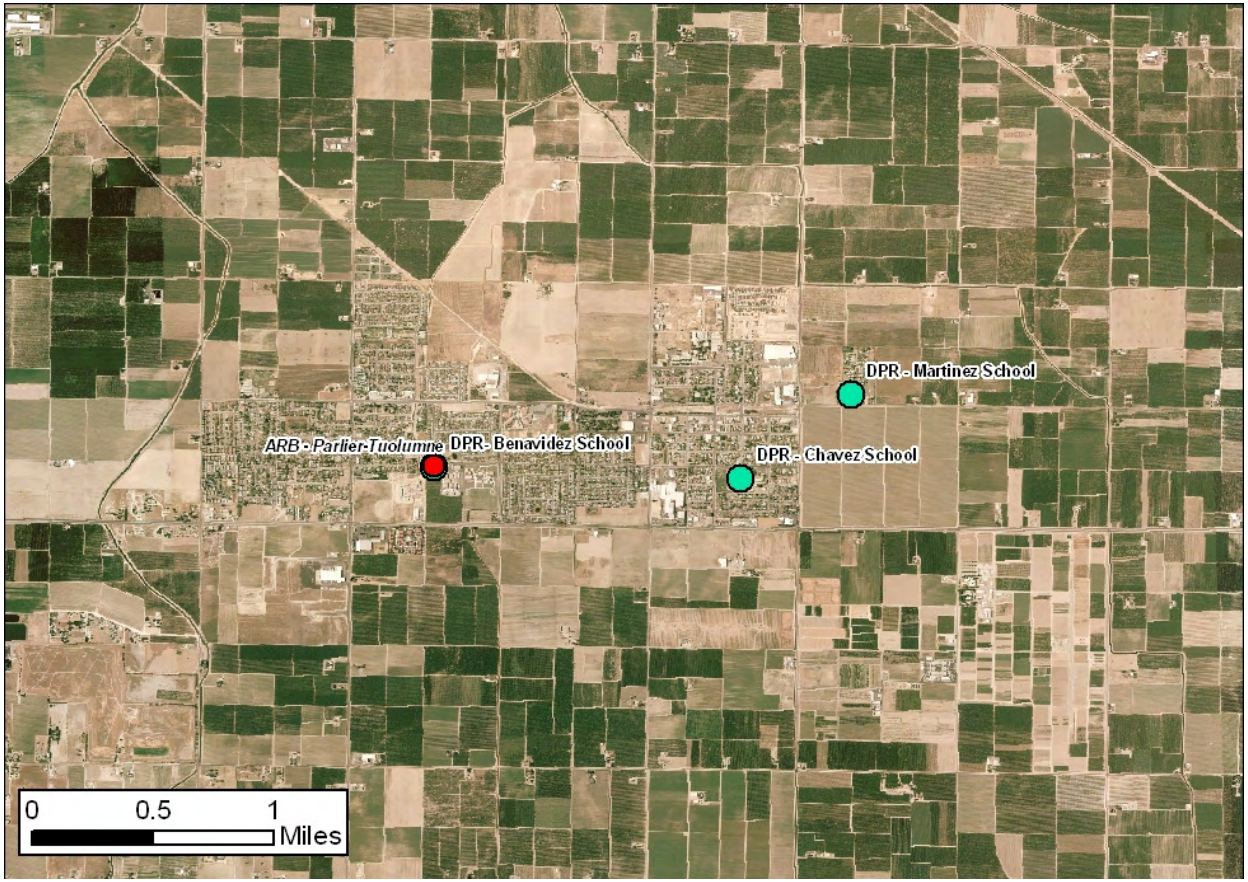

Figure 6. Time-series of maximum daily cumulative hazard index

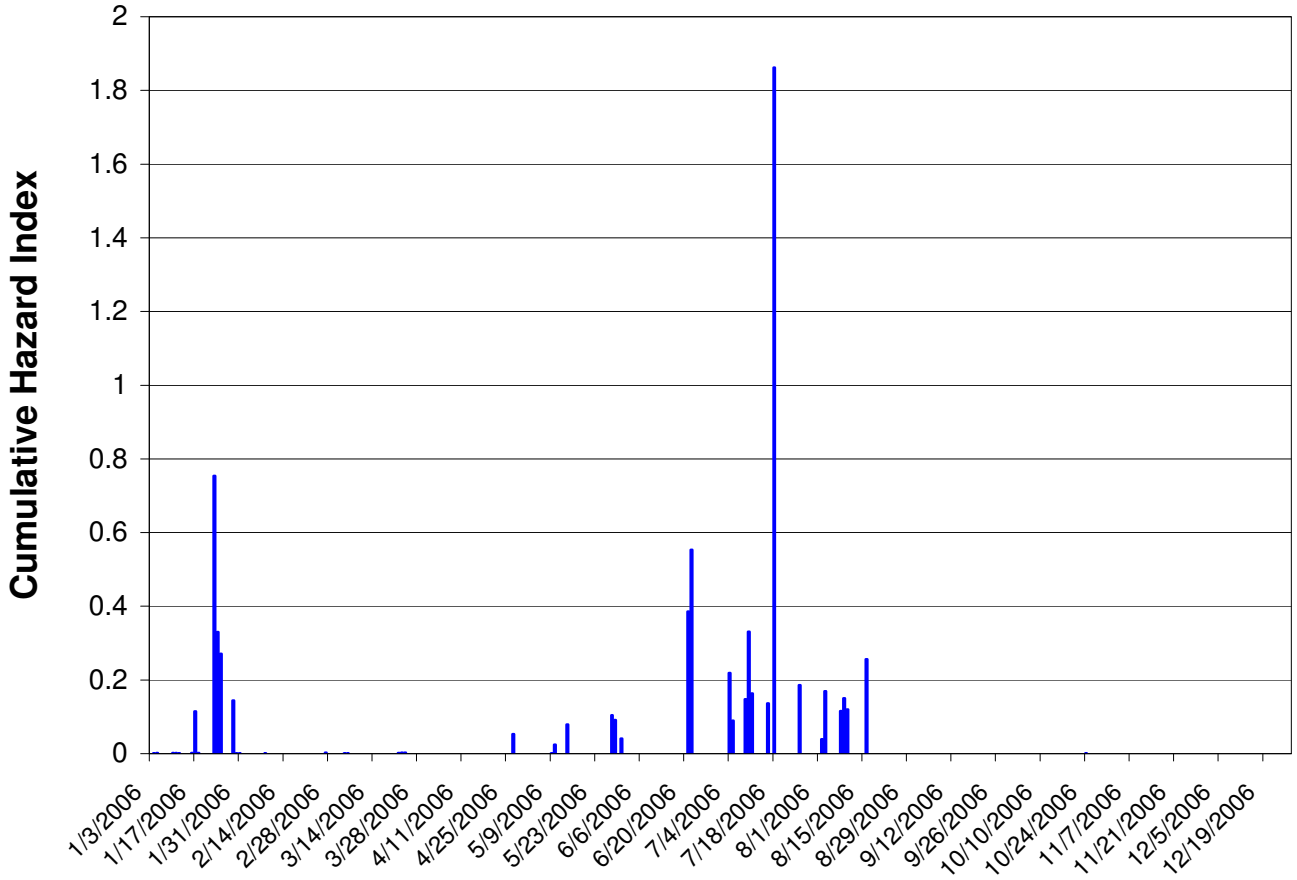

Table 1. Summary statistics for detected DPR pesticides

Pesticide	Mean (ng/m^3)	Range of Concentrations (ng/m^3)	Detection Rate
Chlorpyrifos	29.2	ND - 150.0	10%
OA Chlorpyrifos	5.9	ND - 27.6	0.4%
Diazinon	4.0	ND - 171.5	9%
OA Diazinon	3.2	ND - 70.5	9%
Malathion	5.9	ND - 20.6	0.6%
OA Malathion	2.3	ND - 15.9	1%
MITC	38.0	ND - 5012	30%
Phosmet	11.8	ND - 42.6	1%

OA=oxygen analog

Table 2. Summary statistics for detected DPR pesticides by site

Pesticide	Site	Mean (ng/m^3)	Range of Concentrations (ng/m^3)	Detection Rate
Chlorpyrifos	BEN	29.5	ND - 150.0	12%
	CHA	30.1	ND – 135.6	11%
	MAR	28.2	ND – 116.7	8%
OA Chlorpyrifos	BEN	5.9	ND - 25.2	0.6%
	CHA	n/a	ND	0%
	MAR	5.9	ND - 27.6	0.6%
Diazinon	BEN	4.5	ND - 97.9	9%
	CHA	4.2	ND - 171.5	10%
	MAR	3.3	ND - 42.6	7%
OA Diazinon	BEN	3.2	ND - 34.8	9%
	CHA	3.4	ND - 70.5	11%
	MAR	2.9	ND - 26.4	7%
Malathion	BEN	n/a	ND	0%
	CHA	n/a	ND	0%
	MAR	6.1	ND - 20.6	0.6%
OA Malathion	BEN	2.3	ND – 5.1	0.6%
	CHA	n/a	ND	0%
	MAR	2.4	ND – 15.9	1.9%
MITC	BEN	60.8	ND – 5012	32%
	CHA	24.7	ND - 374	28%
	MAR	28.5	ND - 549	29%
Phosmet	BEN	11.8	ND – 30.3	1%
	CHA	11.7	ND – 42.6	0.6%
	MAR	11.7	ND – 27.4	0.6%

Table 3. Summary of pesticides with only trace detection or not detected

Pesticide	Detection
Chlorothalonil	Trace
Dichlorovos	Trace
Permethrin	Trace
Progargite	Trace
Simazine	Trace
Trifluralin	Trace
Azinphos-methyl	Not detected
Cypermethrin	Not detected
Dicofol	Not detected
Dimethoate oxygen analog	Not detected
Diuron	Not detected
Endosulfan	Not detected
Endosulfan sulfate	Not detected
EPTC	Not detected
Metolachlor	Not detected
Molinate	Not detected
Norflurazon	Not detected
Oryzalin	Not detected
Oxyfluorfen	Not detected
Propanil	Not detected
Tribufos	Not detected
Thiobencarb	Not detected

Table 4. Acute human health hazard quotients for pesticides

Chemical	Concentration (ng/m^3)			California Screening Level (ng/m^3)			Hazard Quotient		
	Mean	Seasonal	Maximum	Acute	Subchronic	Chronic	Acute	Subchronic	Chronic
Chlorpyrifos	29.2	75.3	150	1200	850	510	0.13	0.09	0.06
OA Chlorpyrifos	5.9	24.0	27.6	1200	850	510	0.02	0.03	0.01
Chlorpyrifos (combined parent + OA)	35.1	99.3	178	1200	850	510	0.15	0.12	0.07
Diazinon	4.0	12.5	172	130	130	130	1.3	0.10	0.03
OA Diazinon	3.2	9.1	70.5	130	130	130	0.54	0.07	0.02
Diazinon (combined parent + OA)	7.2	21.6	242	130	130	130	1.9	0.17	0.06
Malathion	5.9	6.6	20.6	40,000	29,000	29,000	0.0005	0.0002	0.0002
OA Malathion	2.3	2.8	15.9	40,000	29,000	29,000	0.0004	0.0001	0.0001
Malathion (combined parent + OA)	8.2	9.4	36.5	40,000	29,000	29,000	0.0009	0.0003	0.0003
MITC	38.0	158.3	5012	66,000	3,000	300	0.08	0.05	0.13
Phosmet	11.8	13.1	42.6	77,000	26,000	26,000	0.0006	0.0005	0.0005

Table 5. Summary statistics for VOCs (all concentrations in ppb)

Parameter	Mean	Standard Deviation	Min	Max	Sample Size	Detection Rate	Mean	Standard Deviation	Min	Max	Sample Size	Detection Rate
	Parlier-Tuolumne Street						Fresno-1st Street					
1,3-Butadiene	0.065	0.043	(0.04)	0.23	71	45%	0.11*	0.087	(0.04)	0.3	34	68%
Acetaldehyde	1.7	1.05	0.2	5.9	65	100%	1.6	0.86	0.3	4.0	31	100%
Acetone	6.2	3.5	1.6	20	71	100%	6.0	3.1	1.7	15	34	100%
Acetonitrile	0.35	0.58	(0.3)	4.8	71	62%	0.49	0.64	(0.3)	3.8	34	65%
Acrolein	0.58	0.33	(0.3)	2.0	71	89%	0.56	0.34	(0.3)	2.2	34	85%
Acrylonitrile	0.42	0.26	(0.3)	1.2	71	78%	0.27	0.20	(0.3)	0.88	33	36%
Benzene	0.28	0.18	0.07	1.0	71	100%	0.46*	0.36	0.05	1.4	34	100%
Carbon Disulfide	0.66*	0.22	0.16	1.0	33	100%	0.32	0.15	0.19	0.68	15	100%
Chloroform	0.016	0.007	(0.02)	0.03	71	62%	0.025*	0.012	(0.02)	0.05	34	74%
cis-1,3-Dichloropropene	0.27*	0.51	(0.1)	2.5	71	42%	0.096	0.15	(0.1)	0.74	34	24%
Ethyl Benzene	0.10	0.021	(0.2)	0.28	71	18%	0.15*	0.11	(0.2)	0.47	34	32%
Formaldehyde	2.6	1.6	0.3	7.7	65	100%	3.4	1.9	0.6	8.8	31	100%
meta/para-Xylene	0.26	0.20	(0.2)	1	71	59%	0.52*	0.46	(0.2)	1.7	34	76%
Methyl Bromide	0.069	0.092	(0.03)	0.65	71	78%	0.042	0.025	(0.03)	0.11	34	74%
Methyl Chloroform	0.018	0.004	0.01	0.02	71	100%	0.019	0.002	0.01	0.02	34	100%
Methyl Ethyl Ketone	0.078	0.085	(0.1)	0.60	65	35%	0.097	0.10	(0.1)	0.5	31	39%
Methylene Chloride	0.073	0.061	(0.1)	0.41	71	35%	0.14*	0.071	(0.1)	0.34	34	85%

Parameter	Mean	Standard Deviation	Min	Max	Sample Size	Detection Rate	Mean	Standard Deviation	Min	Max	Sample Size	Detection Rate
	Parlier-Tuolumne Street						**Fresno-1st Street**					
ortho-Dichlorobenzene	n/a	n/a	(0.3)	(0.3)	71	0.0%	n/a	n/a	(0.3)	(0.3)	34	0%
ortho-Xylene	0.093	0.069	(0.1)	0.36	71	45%	0.18*	0.159	(0.1)	0.62	34	71%
para-Dichlorobenzene	n/a	n/a	(0.3)	(0.3)	71	0.0%	n/a	n/a	(0.3)	(0.3)	34	0%
Perchloroethylene	0.009	0.008	(0.01)	0.05	71	54%	0.020*	0.012	(0.01)	0.05	34	85%
Styrene	0.050	0.000	(0.1)	0.05	71	18%	0.069*	0.044	(0.1)	0.26	34	29%
Toluene	0.57	0.38	(0.2)	1.7	71	92%	1.0*	0.77	(0.2)	3.2	34	97%
trans-1,3-Dichloropropene	0.24*	0.44	(0.1)	2.7	71	42%	0.086	0.12	(0.1)	0.58	34	21%
Trichloroethylene	0.010	0.001	(0.02)	0.02	71	20%	0.010	0.0	(0.02)	0.01	34	9%

Key: Measurements below the detection limit are in parentheses

* Statistically significant, asterisk next to the higher value.

Table 6. Summary statistics for metals at Parlier-Tuolumne Street (all values in ng/m^3)

Parameter	Mean	Standard Deviation	Min	Max	Detection Rate
Aluminum	1587	1361	25	6600	100%
Antimony	4.8	4.54	(5)	27	34%
Arsenic	1.4	1.04	(1)	5	66%
Barium	49.1	53.1	7	390	100%
Bromine	6.6	4.0	(1)	28	98%
Calcium	1026	803	41	3800	100%
Chlorine	238	237	24	1000	100%
Chromium	4.2	3.6	(1)	22	86%
Cobalt	0.77	1.6	(1)	13	5%
Copper	41.5	79.1	3	550	100%
Iron	1774	1568	65	8300	100%
Lead	5.91	3.0	(1)	15	95%
Manganese	43.2	37.0	2	170	100%
Mercury	0.53	0.20	(1)	2	5%
Molybdenum	2.05	6.60	(2)	52	5%
Nickel	0.55	0.21	(1)	2	8%
Phosphorus	121	176	5	1200	100%
Potassium	1012	902	39	5000	100%
Rubidium	5.30	4.6	(1)	23	77%
Selenium	1.61	0.93	(1)	5	55%
Silicon	4475	3810	110	19000	100%
Strontium	17.3	16.2	(1)	94	98%
Sulfur	720	385	110	1800	100%
Tin	2.97	1.9	(4)	9	27%
Titanium	172	154	4	790	100%
Vanadium	2.9	2.2	(1)	10	66%
Yttrium	1.1	0.38	(1)	3	31%
Zinc	43.5	30.6	4	200	100%

Key: Measurements below the detection limit are in parentheses

Table 7. Summary statistics for hexavalent chromium (all values in ng/m^3)

Parameter	Parlier-Tuolumne Street	Fresno-1st Street
Mean	0.063	0.065
Standard Deviation	0.0043	0.0087
Min	(0.06)	(0.06)
Max	0.07	0.08
Range	(0.06) - 0.07	(0.06) - 0.08
Sample Size	4	4
% Below Detection Limit	50	25

Key: Measurements below the detection limit are in parentheses

Table 8. Acute human health hazard quotients for volatile organic compounds (VOCs)

Parameter	Mean (ng/m^3)	Max (ng/m^3)	California Acute Screening Level (ng/m^3)	Hazard Quotient (Mean)	Hazard Quotient (Max)	Mean (ng/m^3)	Max (ng/m^3)	California Acute Screening Level (ng/m^3)	Hazard Quotient (Mean)	Hazard Quotient (Max)
	Parlier-Tuolumne Street					**Fresno-1st Street**				
1,3-Butadiene	142	509	---	---	---	243	663	---	---	---
Acetaldehyde	3062	10,625	---	---	---	2881	7204	---	---	---
Acetone	14,722	47,490	---	---	---	14,247	35,617	---	---	---
Acetonitrile	587	8056	---	---	---	822	6378	---	---	---
Acrolein	1329	4584	190	7.0	24.1	1284	5042	190	6.8	26.5
Acrylonitrile	912	2605	---	---	---	586	1910	---	---	---
Benzene	894	3193	13,000,000	$6.9x10^{-5}$	$2.5x10^{-4}$	1469	4471	13,000,000	$1.1x10^{-4}$	$3.4x10^{-4}$
Carbon Disulfide	2053	3111	1,550,000	0.0013	0.0020	996	2116	1,550,000	$6.4x10^{-4}$	$1.4x10^{-3}$
Chloroform	78.1	146.4	1,500,000	$5.2x10^{-5}$	$9.8x10^{-5}$	122	244	1,500,000	$8.1x10^{-5}$	$1.6x10^{-4}$
cis-1,3-Dichloropropene + trans-1,3-dichloropropene	2314	23,608	160,000	0.014	0.15	826	5992	160,000	0.005	0.038
Ethyl Benzene	434	1215	---	---	---	651	2040	---	---	---
Formaldehyde	3192	9453	19,000	0.17	0.50	4174	10,804	19,000	0.220	0.569
meta/para-Xylene	1128	4340	900,000	0.0013	0.0048	2257	7378	900,000	$2.5x10^{-3}$	$8.2x10^{-3}$
Methyl Bromide	268	2523	820,000	$3.3x10^{-4}$	0.0031	163	427	820,000	$2.0x10^{-4}$	$5.2x10^{-4}$
Methyl Chloroform	98.2	109	---	---	---	104	109	---	---	---
Methyl Ethyl Ketone	230	1769	130,000,000	$1.8x10^{-6}$	$1.4x10^{-5}$	286	1474	130,000,000	$2.2x10^{-6}$	$1.1x10^{-5}$
Methylene Chloride	254	1424	140,000,000	$1.8x10^{-6}$	$1.0x10^{-5}$	486	1181	140,000,000	$3.5x10^{-6}$	$8.4x10^{-6}$

Parameter	Mean (ng/m^3)	Max (ng/m^3)	California Acute Screening Level (ng/m^3)	Hazard Quotient (Mean)	Hazard Quotient (Max)	Mean (ng/m^3)	Max (ng/m^3)	California Acute Screening Level (ng/m^3)	Hazard Quotient (Mean)	Hazard Quotient (Max)
ortho-Dichlorobenzene	n/a	n/a	---	---	---	n/a	n/a	---	---	---
ortho-Xylene	404	1563	900,000	0.00045	0.0017	781	2691	900,000	$8.7x10^{-4}$	$3.0x10^{-3}$
para-Dichlorobenzene	n/a	n/a	---	---	---	n/a	n/a	---	---	---
Perchloroethylene	61.0	339	200,000,000	$3.1x10^{-7}$	$1.7x10^{-6}$	136	339	200,000,000	$6.8x10^{-7}$	$1.7x10^{-6}$
Styrene	213	213	210,000,000	$1.0x10^{-6}$	$1.0x10^{-6}$	294	1107	210,000,000	$1.4x10^{-6}$	$5.3x10^{-6}$
Toluene	2147	6404	370,000,000	$5.8x10^{-6}$	$1.7x10^{-5}$	3767	12,054	370,000,000	$1.0x10^{-5}$	$3.3x10^{-5}$
Trichloroethylene	53.7	107	---	---	---	53.7	53.7	---	---	---

Table 9. Chronic human health hazard quotients for VOCs in Parlier and Fresno

Parameter	Mean (ng/m^3)	California Chronic Inhalation Reference Exposure Level (ng/m^3)	Hazard Quotient	Mean (ng/m^3)	California Chronic Inhalation Reference Exposure Level (ng/m^3)	Hazard Quotient (Mean)
	Parlier-Tuolumne Street			**Fresno-1st Street**		
1,3-Butadiene	142	20,000	0.0071	243	20,000	0.012
Acetaldehyde	3062	9,000	0.34	2881	9,000	0.32
Acetone	14,722	---	---	14,247	---	---
Acetonitrile	587	---	---	822	---	---
Acrolein	1329	60	22.2	1284	60	21.4
Acrylonitrile	912	5,000	0.18	586	5,000	0.12
Benzene	894	60,000	0.015	1469	60,000	0.024
Carbon Disulfide	2053	800,000	0.0026	996	800,000	0.0012
Chloroform	78.1	300,000	2.6×10^{-4}	122	300,000	4.1×10^{-4}
cis-1,3-Dichloropropene + trans-1,3-dichloropropene	2314	120,000	0.019	826	120,000	0.0069
Ethyl Benzene	434	2,000,000	2.2×10^{-4}	651	2,000,000	3.3×10^{-4}
Formaldehyde	3192	3,000	1.1	4174	3,000	1.4
meta/para-Xylene	1128	700,000	0.0016	2257	700,000	0.0032
Methyl Bromide	268	5,000	0.054	163	5,000	0.033
Methyl Chloroform	98.2	1,000,000	9.8×10^{-5}	104	1,000,000	1.0×10^{-4}
Methyl Ethyl Ketone	230	---	---	286	---	---
Methylene Chloride	254	400,000	6.4×10^{-4}	486	400,000	0.0012

Parameter	Mean (ng/m^3)	California Chronic Inhalation Reference Exposure Level (ng/m^3)	Hazard Quotient	Mean (ng/m^3)	California Chronic Inhalation Reference Exposure Level (ng/m^3)	Hazard Quotient (Mean)
ortho-Dichlorobenzene	n/a	---	---	n/a	---	---
ortho-Xylene	404	700,000	5.8×10^{-4}	781	700,000	0.0011
para-Dichlorobenzene	n/a	800,000	---	n/a	800,000	---
Perchloroethylene	61.0	35,000	0.0017	136	35,000	0.0039
Styrene	213	900,000	2.4×10^{-4}	294	900,000	3.2×10^{-4}
Toluene	2147	300,000	0.0072	3767	300,000	0.013
Trichloroethylene	53.7	600,000	9.0×10^{-5}	53.7	600,000	0

Table 10. Acute human health hazard quotients for metals in Parlier

Parameter	Mean (ng/m^3)	Max (ng/m^3)	California Acute Screening Level (ng/m^3)	Hazard Quotient (Mean)	Hazard Quotient (Max)
Aluminum	1587	6600	---	---	---
Antimony	4.8	27	---	---	---
Arsenic	1.4	5	190	0.0074	0.026
Barium	49.1	390	---	---	---
Bromine	6.6	28	---	---	---
Calcium	1026	3800	---	---	
Chlorine	238	1000	210,000	0.0011	0.0048
Chromium	4.2	22	---	---	---
Cobalt	0.77	13	---	---	
Copper	42	550	100,000	4.2×10^{-4}	0.0055
Iron	1774	8300	---	---	---
Lead	5.9	15	---	---	---
Manganese	43	170	---	---	---
Mercury	0.53	2	1,800	2.9×10^{-4}	0.0011
Molybdenum	2	52	---	---	---
Nickel	0.55	2	6,000	9.2×10^{-5}	0.000333
Phosphorus	121	1200	---	---	---
Potassium	1012	5000	---	---	---
Rubidium	5	23	---	---	---
Selenium	1.6	5	---	---	---
Silicon	4475	19000	---	---	---
Strontium	17	94	---	---	---
Sulfur	720	1800	---	---	---
Tin	3	9	---	---	---
Titanium	172	790	---	---	---
Vanadium	2.9	10	---	---	---
Yttrium	1.1	3	---	---	---
Zinc	44	200	---	---	---

Table 11. Chronic human health hazard quotients for metals

Parameter	Mean (ng/m^3)	California Chronic Inhalation Reference Exposure Level (ng/m^3)	Hazard Quotient
Aluminum	1587	---	---
Antimony	4.8	---	---
Arsenic	1.4	30	0.047
Barium	49.1	---	---
Bromine	6.6	---	---
Calcium	1026	---	---
Chlorine	238	200	1.2
Chromium	4.2	---	---
Cobalt	0.77	---	---
Copper	41.5	---	---
Iron	1774	---	---
Lead	5.91	---	---
Manganese	43.2	200	0.22
Mercury	0.53	90	0.0059
Molybdenum	2.05	---	---
Nickel	0.55	50	0.011
Phosphorus	121	---	---
Potassium	1012	---	---
Rubidium	5.3	---	---
Selenium	1.61	20,000	8.1×10^{-4}
Silicon	4475	---	---
Strontium	17.3	---	---
Sulfur	720	---	---
Tin	2.97	---	---
Titanium	172	---	---
Vanadium	2.9	---	---
Yttrium	1.1	---	---
Zinc	43.5	---	---

Responses to Comments on the Draft Parlier Report

Responses to Comments of Anne Katten, CRLA Foundation

Groundwater monitoring results analysis: Text has been added to the report.

Formaldehyde: There are no known commercial poultry or dairy operations within 5 miles of Parlier.

Ozone exceedances: Text has been added to the report.

Peak exposures: It would be misleading to add the date to Table 14 since the VOC data is monitored only 1 in 6 days. The date of exposure is not relevant to the analysis for the VOC exposure.

Combined levels of OPs and their oxons: The air concentration of each organophosphate and its oxon are listed separately. While the oxons are often more toxic than the parent OP, these differences are not yet dependably quantified. As a result, the assumption is made that the oxon and the parent are equally toxic and the screening level for the parent is applied to the oxon. In the calculations, the concentrations of the parent and the oxon were added together for comparison to the screening level.

Cumulative exposure analysis – grouping for hazard quotients: Dr. Amy Kyle and her associates are not doing cumulative impact assessments or developing guidance for these assessments. Her tasks, under OEHHA contract, include researching tools and methods for cumulative assessments as well as policies adopted by other agencies. UC is also conducting case studies of past Cal/EPA projects to determine, in part, how they would benefit from cumulative impacts analysis guidance. Once this is done, it will be OEHHA's task to develop a framework for analysis of cumulative impacts and, in the future, the actual guidance for the BDOs to do these analyses. This has not yet been done. Also, it should be noted that Dr. Kyle does have a copy of the Parlier draft report as it is one of the case studies that her group is doing.

Dust samples: Text has been added to the report.

Statistical analysis:
The commenter is correct. There are many problems with conducting a statistical analysis of a data set that includes a high number of samples with no detections. DPR is looking into statistical methods that can take into account the non-detects and will address the issue in a separate memo.

Cancer risk estimates presentation and characterization, Discussion comparing to other monitoring results: The terms "negligible risk" and "significant risk" are both scientifically correct. Describing a risk level as being above a level of risk generally considered to be negligible is just as correct and transparent as describing the level as a level of risk generally considered significant.

It is not correct that DPR uses 1 in 100,000 as the threshold for significant risk in contrast to other agencies that use 1 in 1 million. Rarely do regulatory agencies utilize a single cancer risk level as an inflexible “bright line” or absolute threshold with higher risk levels considered indicative of significant risk and lower risk levels considered indicative of negligible risk. One exception is the 1 in 100,000 level of significant risk used by the State for the implementation of the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). The agencies (at both the federal and State level) usually consider a range of risk values, with risk levels above this range considered clearly significant, risk levels below this range considered clearly negligible. DPR’s presentation of the risk values for 1, 3-D and formaldehyde are consistent with this approach. The current wording assigns the appropriate level of concern and urgency to the estimated cancer risk of 1, 3-D. Further, as noted in the conclusions of the report, DPR believes the 1, 3-D results indicate a need for further evaluation. Therefore, the results will be considered along with the Department’s air modeling results as part of its continuing evaluation of management plans and permitted uses and procedures for 1,3-D. Additionally, DPR has reopened the risk assessment of 1,3-D and is evaluating current uses in various regions in the state.

Precautionary Approach:

Potential mitigation efforts are outside of the scope of this study.

Future Monitoring:

See answer above to Statistical Analysis.

Responses to Comments of Lori Berger and Gary Van Sickle

Page 1, Paragraph 4: The reiteration of some of the goals of the project is correct. In addition, another goal was to determine if some of the findings require further evaluation. The screening levels were developed as a tool to aid in meeting these goals. The screening level is not and was not intended to be a health standard. As was noted, in the report, measured air levels above the screening level do not necessarily indicate a health concern, nor do levels below a screening level indicate a lack of concern. A single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation.

Page 2, Paragraph 1: The commenters are correct in noting that only one pesticide (diazinon) was found to be above the screening level. However, as noted in the report, if the FQPA safety factor was applied to chlorpyrifos and its oxon, six samples would be above the screening level. In addition, since chlorpyrifos and diazinon are both organophosphates, their combined effects should be considered.

The commenters state that all "other pesticide detections were *well* (emphasis added) below the established screening levels." Actually, some of the chlorpyrifos and diazinon levels were within an order of magnitude of the screening levels. Again, as noted above and in the report (and the protocol), a single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation. In addition, while carcinogenic effects were not used in establishing screening levels, they were used to evaluate measured air levels of pesticides with carcinogenic effects. The report's findings for 1, 3-dichloropropene did prompt some concern for long term exposures and indicated the need for further evaluation.

Director Warmerdam's actual statement was "The data do not show significant health risks that warrant immediate action." This is different from "there are no significant health risks to the community," which the commenters cite. Director Warmerdam went on in the next sentence to say: "As promised, however, we are taking a closer look at findings that were above or close to our health-protective screening levels." This is consistent with the data in the report and the statements in the executive summary. Having said this, the Department revised the executive summary to ensure that it accurately reflects all the data presented in the report and that the findings are placed in context.

Page 2, Paragraph 2: Given the information presented above, we believe that the final report clearly meets the goal of answering the question: "*Are the amounts of pesticides found in air of concern to human health, particularly children.*"

Page 2, Paragraph 3: With the dataset from Parlier monitoring, we have minimal concern at this time with the exception of diazinon, chlorpyrifos, and 1,3-D which we will look into further. However, new data or new methods may be developed in the future that may require DPR to revisit our conclusions regarding the Parlier data. No credible scientific document can make claims of no risk, zero risk, absolute safety, etc. While it would simplify the discussion, such claims would not be scientifically honest.

Responses to Comments from Harold McClarty, Rick Melton, and Vernon Peterson

Page 1, Paragraph 2: Contrary to the last sentence, the report is a presentation of data and is based on the actual measurements. Any scientific report is subject to misinterpretation or misrepresentation by independent parties: some asserting that the data clearly indicates immediate health risks and others asserting that the same data clearly indicates zero risk. While this cannot be prevented, the Department has sought to at least assure that everyone is working from the same database by presenting all the data. Regarding the health screening levels, it should be remembered that the levels were developed as a tool to aid in the evaluation of the measurements. The screening level is not and was not intended to be a health standard. As was noted, in the report, measured air levels above the screening level do not necessarily indicate a health concern, nor do levels below a screening level indicate a lack of concern. A single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation.

With the dataset from Parlier monitoring, we have minimal concern at this time with the exception of diazinon, chlorpyrifos, and 1,3-dichloropropene which we will look into further. However, new data or new methods may be developed in the future that may require DPR to revisit our conclusions regarding the Parlier data. No credible scientific document can make claims of no risk, zero risk, absolute safety, etc. While it would simplify the discussion, such claims would not be scientifically honest.

Page 1, Paragraphs 3 and 5: Paragraph 3 correctly quotes Director Warmerdam as stating in a 2007 letter that "The data do not show significant health risks that warrant immediate action." However, the commenters appear to misinterpret this statement as indicating there are no significant health risks to the community. As an example, in paragraph 5, the commenters contend that the Director's statement was that the "findings from the air monitoring data do not pose a health risk for the residents of Parlier." At no time did the Director state or imply that there were no or zero health risks. In fact, the Director went on in the next sentence of the 2007 letter to say: "As promised, however, we are taking a closer look at findings that were above or close to our health-protective screening levels." Clearly, this does not indicate no concern or zero health risks. This is consistent with the data in the report and the statements in the executive summary. Having said this, the Department revised the executive summary to ensure that it accurately reflects all the data presented in the report and that the findings are placed in context.

Page 1, Paragraph 6: A significant proportion of the Exponent study contracted by the commenters was a restatement of what was said and done in the DPR report. Several errors were made in the restatement, the most important of which will be addressed in the responses to the Exponent document.

Page 2, Paragraph 1, Findings:

Bullet 1: The finding incorrectly notes that DPR report found "no significant health concerns for residents breathing pesticides in air." As has already been stated, neither the DPR report nor the DPR Director has made such an absolute finding or statement.

Bullet 2: The finding states that "The pesticide concentrations measured by DPR in Parlier were very low." This statement does not accurately represent the DPR findings. While such a clear-cut finding would simplify the discussion and evaluation, it would not be scientifically honest. Most, but not all, pesticide concentrations were low.

Bullet 3: Actually, DPR's monitoring included 31 pesticides, of which 5 were breakdown products. The ARB monitored 23 VOCs (2 of the chemicals were monitored for separate isomers), 6 of which have pesticidal uses; 29 metals/elements, including hexavalent chromium, 3 of which have pesticidal uses.

Bullet 5: The findings are correct in noting that only one pesticide (diazinon) was found to be above the screening level; however, it is incorrect in stating that other pesticide detections were *well* (emphasis added) below the established screening levels. As noted in the DPR report, if the FQPA safety factor was applied to chlorpyrifos and its oxon, six samples would be above the screening level. In addition, since chlorpyrifos and diazinon are both organophosphates, their combined effects should be considered. Further, some of the chlorpyrifos and diazinon levels were within an order of magnitude of the screening levels. Again, as noted above and in the report (and the protocol), a single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation. In addition, while carcinogenic effects were not used in establishing screening levels, they were used to evaluate measured air levels of pesticides with carcinogenic effects. The report's findings for 1, 3-dichloropropene did result in some concern for long term exposures and indicated the need for further evaluation. While the necessary data were readily available, the Exponent report did not address carcinogenic effects.

Bullet 6: This finding perpetuates the misinterpretation of the conclusions of DPR in the October 2007 letter from Director Warmerdam.

Page 2, Paragraph 8 and 9: DPR presented all the data that it collected, so it is difficult to understand what additional data should be presented. The report is a presentation of data and is based on the actual measurements. Any scientific report is subject to different interpretation, misinterpretation, or misrepresentation by independent parties: some asserting that the data clearly indicates immediate health risks and others asserting that

the same data clearly indicates zero risk. While this cannot be prevented, the Department has sought to assure, at a minimum, that everyone is working from the same database by presenting all data. With the dataset from Parlier monitoring, DPR has minimal concern at this time, with the exception of diazinon, chlorpyrifos, and 1, 3-dichloropropene which we will look into further. However, new data or new methods may be developed in the future that may require DPR to revisit our conclusions regarding the Parlier data. No credible scientific document can make claims of no risk, zero risk, absolute safety, etc. While it would simplify the discussion, such claims would not be scientifically honest. Having said this, the Department reexamined the executive summary to ensure that it accurately reflects all the data presented in the report and that the findings are placed in the proper perspective.

Exponent Evaluation

A significant proportion of the Exponent report was a restatement of what was said and done in the DPR report. However, several errors were made in the restatement, only the most important of which will be addressed here.

Page viii, Paragraph 3, last sentence: Contrary to the Exponent report's statement in reference to the diazinon measurements, "thus, this single detection was not considered to be of *any* (emphasis added) health concern, which DPR concurs," DPR reached no such absolute assertion and does not agree with the Exponent report's conclusion. Some of the diazinon levels were within an order of magnitude of the screening level. As noted in the DPR report (and the protocol), a single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation.

In an October 2007 letter, Director Warmerdam states that "The data do not show significant health risks that warrant immediate action." However, this statement appears to be misunderstood as indicating there are no health risks or concerns. At no time has DPR stated or implied there were *no* or health risks or concerns. In fact, the Director went on in the next sentence of the 2007 letter to say: "As promised, however, we are taking a closer look at findings that were above or close to our health-protective screening levels." Clearly, this does not indicate zero concern or zero risk.

Page ix, Paragraph 1: The Exponent report correctly notes that for 1, 3-dichloropropene, none of the DPR screening levels were exceeded. However, the Exponent report does not mention that the DPR report did note concern with and the need for further evaluation of the carcinogenic effects of 1, 3-dichloropropene. As noted in other responses, while carcinogenic effects were not used in establishing screening levels, they were used to evaluate measured air levels of pesticides with carcinogenic effects. The Exponent report did not address carcinogenic effects.

Page ix, Paragraph 2: The Exponent report states that "The overall conclusion of this study is that the data collected in Parlier show that there are *no* (emphasis added) acute or chronic health concerns for residents breathing pesticides in air." This statement is incorrect and such a finding was never reached by DPR nor stated by DPR. This error has been addressed in a response above.

Page 3, Data Presentation: The report states "The compounds measured included 30 pesticides, 25 VOCs, and 29 metals including total chromium and hexavalent chromium. Among the 30 pesticide measurements were the oxygen analogs of four commonly applied pesticides, including malathion, chlorpyrifos, diazinon, and dimethoate." DPR monitoring included 31 pesticides, of which 5 were breakdown products. The ARB monitored 23 VOCs (2 of the chemicals were monitored for separate isomers), 6 of which

have pesticidal uses; 29 metals/elements, including hexavalent chromium, 3 of which have pesticidal uses.

Page 3, Treatment of Non-Detect Data: The report states, "The majority of the DPR pesticides samples were found to be non-detects or trace samples. This means that there was either no pesticide present or the amount was so low that it could not be detected by the analytical method." This is incorrect. The DPR report states that samples with concentrations above the minimum detection limit but below the limit of quantitation (contains an amount but the concentration cannot be measured reliably) are considered to contain a *trace* amount. The samples therefore do contain an amount of the chemical analyzed but the exact amount is not high enough to confidently measure. The Exponent report considers trace samples to be the same as a sample with no detectable amount. Therefore, when the report lists the percentage of detections for several pesticides (see Table 1 or Executive Summary or Summary Statistics) it does not take into consideration trace detections and are much lower than percentages reported in the DPR report.

The Exponent report used a different method of estimating average concentrations, which gave different values to the non-detected samples (non-detected samples appear to include the trace samples) than the method used by DPR. The method used by Exponent is valid and accepted. The method used by DPR is also accepted and a conventional one that was outlined in the protocol for the study. The study averages reported in the Exponent report were generally higher than those in the DPR report.

Page 4, Paragraph 2: The characterization of the DPR "toxicity benchmarks" (presumably the screening levels) is incorrect. The screening level is not and was not intended to be a health standard. As was noted, in the report, measured air levels above the screening level do not necessarily indicate a health concern, nor do levels below a screening level indicate a lack of concern. A single air concentration above a screening level may not indicate a health concern, but can indicate the need for further evaluation. Likewise, measured air concentrations for a chemical may all be below a screening level, but if the residues are found in a large proportion of samples, there may also be reason for further evaluation.

Page 5, Paragraph 1: DPR also used subchronic screening levels and evaluated subchronic exposures.

Page 8, Paragraph 4: DPR did not discount the diazinon result. DPR placed the measurement in the proper perspective, supporting the need for further evaluation but not the need for *immediate* action.

Page 11, Summary Statistics (Analysis of ARB Data): The Exponent report did an extensive analysis of the ARB results for concentrations measured in Parlier versus concentrations found in Fresno. The analysis shows that there is not much difference in concentrations measured in Parlier than those measured in Fresno for most of the chemicals monitored. It rightly points out that Parlier's air concentrations of VOCs are not unusual for a Central Valley community.

The report states the results of analysis of ARB's monitoring of both methyl bromide and 1,3-dichloropropene measured in Parlier and Fresno. Results presented by DPR combine the results for both the *cis* and *trans* isomers of 1,3-dichloropropene and are therefore different. Unfortunately, the analysis of the ARB data is incorrect due to a confusing data set from ARB. The data sets state that measurements below the detection limit (non-detects) are expressed as the negative of the detection limit. A closer look at the data reveals that some of the non-detects are also expressed as one-half the detection limit (or as a positive number). Therefore, the percentage of detections reported for ARB's data are lower in the DPR report. The general results of the analysis of comparison of Parlier to Fresno would still be accurate.

Page 18, Toxicity of Oxygen Analogs: The Exponent report is correct in noting that the oxygen analogs (oxons) of organophosphates are often more toxic than the parent compounds and that there is not an available (and vetted) quantitative factor relating the toxicity of diazinon and its oxon. As a result, DPR made and transparently described the assumption that the oxon and the parent are equally toxic and the screening level for the parent is applied to the oxon. In the calculations, the concentrations of the parent and the oxon were added together for comparison to the screening level. If, in fact, the diazinon oxon is more toxic than diazinon, the toxicological significance of the exposures to diazinon and its oxon in the air would be increased. This would further support DPR's concerns and its conclusion that there should be further evaluation. This would also hold for the findings of chlorpyrifos and its oxon.