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Department of Pesticide Regulation
Pesticide Air Monitoring Network
Proposed Monitoring Plan

by
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Overview

The Department of Pesticide Regulation (DPR) is establishing a network to sample ambient air for multiple pesticides in several communities. Sampling will be done on a regular schedule over five or more years. DPR will use the data gathered to evaluate health risk and, as necessary, improve protective measures against pesticide exposure. The project is expected to begin in 2010. DPR is soliciting comments on its proposed monitoring plan, including objectives, pesticides, and communities included in the monitoring network. DPR will describe additional details, particularly on sampling, laboratory, and data analysis methods, in a subsequent monitoring protocol.

Proposed project objectives

The objectives define the scope of the project. DPR proposes the following scientific objectives:

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

Proposed sampling plan

DPR proposes to monitor one location in each community selected, collecting one or two 24-hour samples each week. This sampling plan is based on an evaluation of results from a one-year study in Parlier that included air monitoring at three locations, three days each week. The Parlier data indicated that monitoring a single location once a week will provide adequate data to estimate long-term concentrations. DPR will describe additional details, particularly on sampling, laboratory, and data analysis methods in a subsequent monitoring protocol.

Monitoring in the selected communities is contingent on finding suitable monitoring locations that meet U.S. Environmental Protection Agency (U.S. EPA) siting criteria, are secure from tampering, provide electricity, and grant permission.

Proposed pesticides for monitoring

DPR proposes to monitor for 25 to 34 pesticides and several breakdown products, selected based on the following criteria:

1) Use (indicator of exposure)
2) Volatility (indicator of exposure)

3) DPR risk assessment priority (indicator of toxicity)
4) Feasibility of including in multi-residue monitoring method

Almost all of the pesticides can be monitored by collecting and analyzing two samples, one for semi-volatile (nonfumigant) pesticides by modifying the Parlier study method, and one for volatile (mostly fumigant) pesticides using a volatile organic compound (VOC) method. Based on the four criteria above, DPR proposes to monitor for:

Pesticides included in the method used for Parlier project

1) Chlorothalonil (Bravo)
2) Chlorpyrifos (Lorsban) and oxygen analog breakdown product
3) Cypermethrin
4) Diazinon and oxygen analog breakdown product
5) Dicofol (Kelthane)
6) Dimethoate (Cygon) and oxygen analog breakdown product
7) Diuron (Karmex)
8) Endosulfan (Thiodan)
9) EPTC (Eptam)
10) Malathion and oxygen analog breakdown product
11) Naled as dichlorvos (DDVP) breakdown product
12) Norflurazon (Solicam)
13) Oryzalin (Surflan)
14) Oxyfluorfen (Goal)
15) Permethrin
16) Phosmet (Imidan)
17) Propargite (Omite)
18) S,S,S-tributyl phosphorotrithioate (DEF)
19) Simazine (Princep)
20) S-metolachlor (Dual)
21) Trifluralin (Treflan)

Pesticides included in the VOC method

22) 1,3-dichloropropene (Telone, Inline)
23) Acrolein (Magnacide)
24) Methyl bromide
25) Sodium tetrathiocarbonate (Enzone) as carbon disulfide breakdown product

DPR will attempt to modify the method used for the Parlier project to include the following pesticides, if they have high use within 5 miles of a community selected for monitoring:

26) Acephate (Orthene)
27) Bensulide (Prefar)
28) Iprodione (Rovral)
29) Methidathion (Supracide)
30) Oxydemeton-methyl (Metasystox-R)

If the monitoring network includes fewer communities, or if sampling frequency is decreased, DPR may take additional samples and analyze for one or more of the following pesticides:

31) Chloropicrin

32) Dazomet as methyl isothiocyanate (MITC) breakdown product (Basamid)
33) Metam-sodium as MITC (Vapam, Sectagon)
34) Potassium N-methyl dithiocarbamate (metam-potassium) as MITC (K-Pam)

Proposed communities

DPR likely has sufficient resources to monitor two to five communities in the state. The number of communities monitored depends on the number of samples collected each week, and if chloropicrin and/or MITC are included in the monitoring. DPR proposes to select communities based on the following criteria:

1) Use of the 34 proposed pesticides
    a. Use within the community (community zone)
    b. Use between the community boundary and 1 mile of the community (local zone)
    c. Use within 1 to 5 miles of the community (regional zone)
2) Demographic criteria
    a. Population density of people under age 18
    b. Population density of people older than 65
    c. Population density of people older than 5, with disabilities
    d. Population density of people employed in farming, fishing, or forestry
3) Other desirable community characteristics, such as an existing air monitoring station or complementary studies
4) Geographic distribution

DPR proposes to select communities with higher use of the 34 proposed pesticides within the zones listed above because they will likely have higher air concentrations. The demographic groups noted above represent subpopulations DPR considers in its risk assessments. DPR proposes to use community demographic characteristics and the other two factors listed above to help select a single community for monitoring when a group of communities within a geographic area have similar pesticide use.

Based on the criteria above, DPR proposes to select a total of two to five communities for the air monitoring network from those listed below:

- Linden or Ripon (San Joaquin Valley, San Joaquin County)
- Shafter or Wasco (San Joaquin Valley, Kern County)
- Greenfield, Salinas, or Castroville (North Central Coast, Monterey County)
- Camarillo or Oxnard (Ventura County)
- Huron or Mendota (San Joaquin Valley, Fresno County)
- Reedley or Parlier (San Joaquin Valley, Fresno County)

Introduction

Under California law, DPR is required to "eliminate from use" any pesticides that "endangers the agricultural or nonagricultural environment…." To perform this function, the law requires DPR to conduct "continuous evaluation" of currently registered pesticides. Several DPR programs evaluate use practices to detect possible problems and to determine if further regulatory action is necessary. For example, DPR conducts field studies to monitor exposure to workers, and to measure how pesticides move and break down in air, soil and water. DPR uses monitoring data (including the kind of data envisioned from the air network) to evaluate exposure and resulting risk to health (risk assessment), develop measures to reduce risk (risk management), and determine the effectiveness of use restrictions.

DPR, the Air Resources Board (ARB), university researchers, and others currently conduct short-term air monitoring studies of pesticides. For example, DPR and the ARB coordinate monitoring for pesticides under California's Toxic Air Contaminant Act. In this program, two types of samples are collected. Air is monitored next to applications of specific pesticides for several days (application-site monitoring) to estimate acute exposures. Samples are also collected for several weeks in communities near high-use regions and during high-use periods (ambient monitoring) to estimate seasonal exposures. DPR extrapolates the short-term concentrations detected during several days or weeks of monitoring to estimate concentrations associated with annual and lifetime exposures. Additionally, both the application-site and ambient monitoring usually sample for single pesticides.

While similar to current ambient monitoring, the proposed air monitoring network will supplement the toxic air contaminant monitoring by providing data for long-term exposures over several years to multiple pesticides. The project is expected to begin in 2010. DPR conducted similar multiple-pesticide monitoring projects in Lompoc (Santa Barbara County) and Parlier (Fresno County). However, their duration was shorter (Lompoc 10 weeks; Parlier 12 months). DPR designed the Parlier project in part to evaluate methods and approaches that it might use for a future air monitoring network.

This plan is a revised version of a plan first proposed in April 2009. The revisions are based on comments received during public meetings with DPR's Pesticide Registration and Evaluation Committee on April 17, May 15, July 16, and August 20, 2009; a public meeting with DPR's Pest Management Advisory Committee on May 14, 2009; and meetings with agricultural commissioners of the affected counties. Comments that did not result in changes to the plan are noted in the appropriate sections below.

Project Objectives

The objectives define the scope of the project and are consistent with DPR's overall goals discussed above. The intent in developing the objectives is to make them simple, measurable, realistic, and timely. DPR proposes the following scientific objectives:

1) Identify common pesticides in air and determine seasonal, annual, and multiple-year concentrations
2) Compare concentrations to subchronic and chronic health screening levels
3) Track trends in air concentrations over time

4) Estimate cumulative exposure to multiple pesticides with common modes of action
5) Attempt to correlate concentrations with use and weather patterns

In general, DPR uses monitoring data for risk assessment, risk management, and to determine the effectiveness of regulatory requirements. DPR will likely use the data from the air monitoring network for all three goals. The air network data will enable DPR to make more accurate estimates of long-term exposure and resulting risk, since it will no longer be necessary to extrapolate from short-term monitoring data. DPR currently assesses exposure and risk for individual pesticides. The air network data will provide the opportunity to assess cumulative exposure to multiple pesticides. DPR will assess cumulative exposure for pesticides that cause toxic effects by a common mode of action (e.g., cholinesterase inhibition).

Since risk assessments normally take several years to complete, DPR will initially evaluate detected air concentrations using “health screening levels” to place the results in a health-based context. Although not regulatory standards, these screening levels can be used in the process of evaluating the air monitoring results. A measured air concentration that is below the screening level for a given pesticide would not be considered to represent a significant health concern and would not generally undergo further evaluation, but also should not automatically be considered “safe” and could undergo further evaluation. By the same token, a measured level that is above the screening level would not necessarily indicate a significant health concern, but would indicate the need for a further and more refined evaluation. Significant exceedances of the screening levels could be of health concern and may result in mitigation measures.

Risk management is the evaluation and selection of mitigation options. Risk managers use risk assessment as an important tool to determine the acceptability of a level of exposure and then reduce exposures to that level. Unlike risk assessment, risk management is not based solely on scientific considerations, since it also involves social, economic, and legal considerations to make regulatory and policy decisions. DPR considers these factors in analyzing the possible regulatory responses to potential health hazards. The process is necessarily subjective in that it requires value judgments on the acceptability of risks and the reasonableness of control measures. If DPR considers the risk unacceptable from either individual or multiple pesticides, the air network data will provide information to develop mitigation measures. For pesticides with unacceptable risks, it is likely that DPR will use the air network data in conjunction with the other application-site and ambient monitoring data to develop mitigation measures such as application method restrictions and/or use limitations to reduce long-term exposures.

If and when DPR implements voluntary or regulatory restrictions, the air network will provide evidence of the effectiveness of the restrictions. For example, use limitations (township caps) for 1,3-dichloropropene and methyl bromide are based on achieving certain target concentrations. The air network will provide data to determine if the target concentrations are met. Similarly, the air monitoring network will provide data to determine trends over time within the monitored communities. If DPR can relate pesticide use levels to detected concentrations, the effect of application method changes or other restrictions on air concentrations can be estimated.

Several additional suggested objectives are beyond the proposed scope and DPR resources or capabilities. As described above, DPR will use screening levels and risk assessment to evaluate the detected air concentrations. DPR will also attempt to relate detected air concentrations with use and weather patterns for each community, but comparing communities is not an objective.

DPR assesses and mitigates risk of pesticides, not communities. Therefore, monitoring an urban community, or other type of control or background site, may be valuable but not essential for this project. This would require monitoring fewer high agricultural use communities due to resource constraints. Moreover, selecting an appropriate comparison community is problematic. As described in later sections, DPR proposes to select pesticides and communities for monitoring that have high reported use. Pesticide use reports mainly reflect agricultural applications; home use of pesticides is not reported. DPR cannot determine which pesticides have high use in which urban communities, making the selection of the pesticides and communities to monitor problematic. In addition, many home use pesticides would have lower priority for monitoring due to lower toxicity.

While the air monitoring network is a follow-up to an environmental justice pilot project in Parlier, it will not focus on environmental justice issues. This is a project to obtain scientific information and therefore does not address several environmental justice goals such as community capacity building, and monitoring may or may not occur in communities with environmental justice characteristics. However, DPR will include applicable environmental justice elements, such as considering certain demographic factors in selecting communities, coordination with other agencies, and public participation in the project development and planning phase.

DPR or other agencies and researchers may find the air network data useful for purposes other than the stated objectives. For example, DPR plans to collect a series of 24-hour samples to evaluate seasonal and long-term exposures. However, single 24-hour samples also indicate acute exposures. DPR normally uses the higher concentrations associated with application-site monitoring to evaluate acute exposures, rather than the lower concentrations associated with ambient monitoring. However, DPR may compare the 24-hour concentrations to acute screening levels. Another example is estimating cumulative impacts from pesticides or other pollutants with different modes of action. This type of evaluation is currently beyond DPR's capabilities, but the Office of Environmental Health Hazard Assessment (OEHHA) is researching this issue. DPR is coordinating and consulting with OEHHA on the air monitoring network and methods to assess cumulative exposure, so a more comprehensive cumulative exposure evaluation may be feasible in the future. Also beyond DPR's current capabilities is attempting to relate the detected concentrations with disease rates (epidemiology evaluation). Other researchers may attempt this, particularly if a health study is conducted in a community selected for monitoring.

Proposed Sampling Plan

DPR proposes to monitor one location in each community selected, collecting one or two 24-hour samples each week. In 2006, DPR conducted a year-long ambient air monitoring study in Parlier (http://www.cdpr.ca.gov/docs/envjust/pilot_proj/index.htm). This plan is based on an evaluation of results from a one-year study in Parlier that included air monitoring at three locations, three days each week. The Parlier data indicated that monitoring a single location once a week will provide adequate data to estimate long-term concentrations (Appendix 1). DPR analyzed the number of positive samples for the three most frequently detected pesticides: chlorpyrifos, diazinon, and methyl isothiocyanate (MITC). The air concentrations were not normally distributed, so standard statistical techniques could not be used. However, the Parlier data showed little difference between the three Parlier monitoring locations in the frequency of

detection. Similarly, there was little difference in frequency of detections between odd and even weeks, and days of the week. Based on this analysis, it is likely that sampling at one location in each community, one or two days each week, will provide adequate data to characterize seasonal and long-term exposure. Collecting one sample per week will provide minimal data to estimate seasonal exposures; two samples per week will provide more robust data. However, DPR must balance the number of samples collected with the number of pesticides and communities monitored.

Monitoring sites must meet the following minimum criteria:

- The location of sample collection meets all U.S. EPA ambient air siting criteria
    - 2 to 15 meters above ground
    - At least 1 meter horizontal and vertical distance from supporting structure
    - Should be at least 20 meters from trees
    - Distance from obstacles should be at least twice the obstacle height
    - Unobstructed air flow for 270°
- Accessible to sampling personnel during time of sampling
- Accessible to electrical outlets
- Secure from equipment loss or tampering
- Permission of site operator/owner

Preferred monitoring sites also meet the following criteria:

- School, day care center, or other "sensitive site"
- Located on the edge of the community and/or adjacent to agricultural fields

DPR will describe additional details, particularly on sampling, laboratory, and data analysis methods, in a subsequent monitoring protocol.

Proposed Pesticides for Monitoring

DPR proposes to monitor for most of the same pesticides as the Parlier project in 2006, based primarily on potential health risk. Higher-risk pesticides will have higher priority for monitoring. Proposed pesticides were selected based on the following criteria:

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

** NOTE: Risk assessments have been completed on several of the target pesticides. However, each was at some point assigned a priority for risk assessment based on a number of factors, including health concern. The risk assessment priority ranking assigned to the pesticide was therefore incorporated as a factor in selecting pesticides to be targeted in this project.*

Several people suggested other criteria to select pesticides that DPR did not add, including octanol-water coefficient as an indicator of persistence, acreage treated, and method of application. DPR evaluated data for several dozen proposed pesticides and found no correlation between octanol-water coefficient and terrestrial field dissipation rate. Moreover, some pesticides that are persistent would be rated higher even though they are low risk, such as copper,

sulfur, and oils. DPR believes that mass (pounds) of use is a better indicator of exposure than acreage treated. For example, exposure to fumigants is high in part due to the high mass applied and high application rates, but the acreage treated is relatively small compared to other pesticides. DPR believes that the limited information received on the method of application is not a good indicator of exposure. Most use reports only indicate air, ground, or other. Some ground application methods, such as air blast sprayers may cause as high or higher exposure than aerial applications.

DPR selected candidates for monitoring from the 100 pesticides with the most pounds reported from 2005 through 2007 in each of the five candidate areas: North Central Coast air basin, Sacramento Valley air basin, Salton Sea air basin, San Joaquin Valley air basin, and Ventura County. [NOTE: See the following section for the reasons these areas were selected.] DPR excluded inorganic pesticides (e.g., copper and sulfur), oils, and antimicrobial pesticides because of their low volatility, low risk assessment priority, and difficulty in monitoring. The remaining pesticides were each assigned ratings for use, volatility, and risk assessment priority. Pesticides were rated 0 to 4 in use for each of the five areas, with 0 for a pesticide not within the top 100 in use for the area and 4 representing high use in the area. Pesticides were each rated 1 to 4 in volatility (vapor pressure), with 1 representing unknown volatility and 4 representing high volatility. Pesticides were also rated 1 to 4 based on the risk assessment priority assigned by DPR and OEHHA scientists, with 1 representing no priority established and 4 representing high priority. An overall score was determined for each pesticide by adding individual rating. Therefore, each pesticide was assigned a total rating of 2 to 12 for each of the five geographic areas. Table 1 shows the 82 pesticides rated 6 or higher in any of the areas. [See the key following Table 1 for the exact rating criteria for each category.]

DPR proposes to collect and analyze at least two different air samples. The California Department of Food and Agriculture's (CDFA's) Center for Analytical Chemistry will develop and validate the pesticide residue method(s) and analyze the samples collected by DPR. CDFA developed a method to analyze for 29 pesticides and breakdown products in a single sample for the Parlier project and will modify this method for the air network. In Parlier, ARB analyzed additional pesticides that are volatile organic compounds (VOCs). However, DPR recently funded the purchase of instruments and materials that will enable the CDFA laboratory to analyze samples for VOCs, including the fumigants methyl bromide and 1,3-dichloropropene. DPR and CDFA should be able to include these compounds in the air network without ARB assistance.

Based on the ratings in Table 1 and the feasibility of including the compounds in the two monitoring methods, DPR proposes to include the following 25 pesticides in the monitoring network:

Pesticides included in the method used for Parlier project

1) Chlorothalonil (Bravo)
2) Chlorpyrifos (Lorsban) and oxygen analog breakdown product
3) Cypermethrin
4) Diazinon and oxygen analog breakdown product
5) Dicofol (Kelthane)
6) Dimethoate (Cygon) and oxygen analog breakdown product
7) Diuron (Karmex)

8) Endosulfan (Thiodan)
9) EPTC (Eptam)
10) Malathion and oxygen analog breakdown product
11) Naled as dichlorvos (DDVP) breakdown product
12) Norflurazon (Solicam)
13) Oryzalin (Surflan)
14) Oxyfluorfen (Goal)
15) Permethrin
16) Phosmet (Imidan)
17) Propargite (Omite)
18) S,S,S-tributyl phosphorotrithioate (DEF)
19) Simazine (Princep)
20) S-metolachlor (Dual)
21) Trifluralin (Treflan)

Pesticides included in the VOC method

22) 1,3-dichloropropene (Telone, Inline)
23) Acrolein (Magnacide)
24) Methyl bromide
25) Sodium tetrathiocarbonate (Enzone) as carbon disulfide breakdown product

DPR may also monitor for as many as 9 additional pesticides, 5 by adding them to the Parlier method and 4 that would require single-chemical analysis.

DPR will attempt modify the method used for the Parlier project to include the following pesticides, if they have high use within 5 miles of a community selected for monitoring:

26) Acephate (Orthene)
27) Bensulide (Prefar)
28) Iprodione (Rovral)
29) Methidathion (Supracide)
30) Oxydemeton-methyl (Metasystox-R)

The following pesticides likely can only be monitored by collecting additional single-chemical samples. DPR may include one or more of the following pesticides, if fewer communities are monitored and/or fewer samples are collected:

31) Chloropicrin
32) Dazomet as methyl isothiocyanate breakdown product (MITC, Basamid)
33) Metam-sodium as MITC (Vapam, Sectagon)
34) Potassium N-methyl dithiocarbamate (metam-potassium) as MITC (K-Pam)

DPR proposes to <u>not</u> monitor for the following pesticides that were included in the Parlier project:

Azinphos-methyl (registration [sale] ends in 2012)
Formaldehyde (difficult to include in CDFA's VOC method)
Molinate (registration [sale] ends in 2009)
Propanil (low use in selected areas)
Thiobencarb (low use in selected areas)

DPR proposes to not monitor the remaining pesticides shown in Table 1. This includes 21 pesticides rated 10 or higher in at least one candidate area. Eleven of the 21 pesticides cannot be included in either of the two monitoring methods. Ten of the 21 pesticides have relatively low use in the three selected areas for monitoring. The following pesticides specifically suggested by commenters are also not proposed for monitoring:

Aminopyralid (not highly rated due to low use, low volatility)
Chlorthal-dimethyl (cannot be included in proposed methods)
Clopyralid (not highly rated due to low use, low volatility)
Mancozeb (cannot be included in proposed methods)
Maneb (cannot be included in proposed methods)

DPR will reconsider the pesticides for monitoring after selecting communities and reassessing pesticide use in those areas.

Proposed Communities for Monitoring

DPR likely has sufficient resources to monitor two to five communities in the state. DPR proposes to select communities based on objective data, using criteria that can be quantified, validated, and verified. This provides a transparent and fair selection process. DPR is unable to fully evaluate all communities in all areas suggested for monitoring in a timely manner due to the large number of communities that would require compilation of pesticide use, demographic, and other data. DPR proposes to select the monitored communities from among one to three areas based on the following two-tiered process.

Tier 1 – Selection of Candidate Areas

DPR evaluated the pesticide use in five areas (Figure 1):

- North Central Coast air basin (all of Monterey, San Benito, and Santa Cruz counties)
- Sacramento Valley air basin (all of Butte, Colusa, Glenn, Sacramento, Sutter, Tehama, Yolo, Yuba counties)
- Salton Sea air basin (all of Imperial County, and Coachella Valley portion of Riverside County)
- San Joaquin Valley air basin (all of Fresno, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare counties, and valley portion of Kern County)
- Ventura County ozone nonattainment area (all of Ventura County)

DPR selected these five areas for several reasons. 1) These areas were suggested by one or more commenters, including members of DPR's Pesticide Registration and Evaluation Committee or Pest Management Advisory Committee. 2) These areas have high pesticide use. They include all of the top 10 counties and 17 of the top 20 counties for reported pesticide from 2005 through 2007. The 22 counties included in these five areas account for 86 percent of the reported statewide pesticide use from 2005 through 2007 [Table 2]. 3) All or parts of four areas do not meet one or more federal air quality standards [all except North Central Coast].

Neither of the remaining areas suggested (Napa, San Diego) are among the top 20 counties for reported pesticide use during 2005-2007.

DPR compiled and compared the use of the candidate pesticides for each of the five areas (Tables 3a and 3b). San Joaquin Valley is likely the top area for monitoring because it has more than twice the use density (pounds per square mile) of the original Parlier-method pesticides than the other areas. San Joaquin Valley also has the highest use density for 17 of the 30 pesticides included in the original Parlier and VOC methods. The remaining four areas have the highest use density for 3 or 4 of the 30 Parlier and VOC pesticides. Ventura has the highest use density for VOC method pesticides, including the fumigants methyl bromide and 1,3-dichloropropene, but has the lowest pesticide use density for semi-volatile (Parlier method) pesticides. North Central Coast has relatively high use density for fumigants as well as several semi-volatile pesticides. Most of the additional high-rated candidate pesticides (e.g., chloropicrin and MITC) also have highest use in North Central Coast, San Joaquin Valley or Ventura.

DPR evaluated two key weather parameters that influence air concentrations: consistency of wind direction and wind speed. Generally, consistent wind directions and lower wind speeds lead to higher downwind air concentrations from pesticide applications. DPR compiled and evaluated several years of weather data from 37 stations within the five areas. Ventura County had the lowest wind speeds and most consistent wind direction. The Salton Sea air basin had the highest wind speeds and least consistent wind directions. However, the differences between areas in terms of low wind speeds and consistency of wind direction was minor and yield inconclusive results for assessing likely impact on long-term air pesticide concentrations (Figures 2 and 3; Appendix 2).

DPR received a comment to consider including pesticide drift illnesses as a factor in selecting areas. However, reported drift illnesses are primarily due to acute exposure, while the objective of the air monitoring network is to measure seasonal and long-term exposure. Drift incidents are usually a result of misuse and does not appear to be good indicator for selecting areas to evaluate seasonal and longer-term exposures. DPR did not consider drift illnesses in selecting the areas, but North Central Coast and Ventura had the highest number of drift illnesses from 2005 through 2007 (Table 4).

Based on the use of the proposed pesticides, DPR proposes to select communities in the North Central Coast air basin, and/or San Joaquin Valley, and/or Ventura County for the air monitoring network.

Tier 2 – Candidate Communities Within the Selected Areas

DPR proposes to evaluate 226 communities in the following areas and select a total of 2 to 5 for monitoring:

- North Central Coast air basin (48 communities)
- San Joaquin Valley (161 communities)
- Ventura County (17 communities)

DPR proposes to evaluate and rate each of the communities using the following criteria:

1) Use of 34 proposed pesticides listed above
    b. Use within the community (community zone)
    c. Use between the community boundary and 1 mile of the community (local zone)
    d. Use within 1 to 5 miles of the community (regional zone)

2) Demographic criteria
    a. Population density of people under age 18
    b. Population density of people older than 65
    c. Population density of people older than 5, with disabilities
    d. Population density of people employed in farming, fishing, or forestry (indicator of farmworkers)

The distances for pesticide use zones are a subjective selection, although the pesticides most frequently detected in the Parlier project typically did correspond with applications within five miles. The demographic factors are based on subpopulations considered in DPR's risk assessments, such as children and farmworkers.

The pesticide ratings developed for this analysis are based on the average use reported to DPR from 2006 through 2008. Demographic ratings are based on 2000 U.S. Census data. New data from "The 2008 American Community Survey" - a nationwide survey designed to provide data on selected communities to show how they are changing – was evaluated for use in this selection procedure. However, it was deemed unsuitable because it only contains demographic data for approximately 10 percent of the communities within California.

Pesticide Use Data – Use information was obtained from DPR's pesticide use report database for 2006, 2007 and 2008. The total amount per year of each pesticide applied to each square-mile section was averaged over the three years. A geographic information system (GIS) analysis calculated the amount of each pesticide applied to one-mile-square geographic sections. These were classified under three types of zones: those all or partially within the community boundary (the "community zone," or CZ); between the community boundary and 1 mile of the community boundary (the "local zone," LZ); and within 1 to 5 miles of the community boundary (the "regional zone," RZ). The amount of pesticides applied within each of these three "zones" was divided by the square mileage of each zone, and then expressed as amount of pesticide active ingredient per square mile.

The pesticide use category has 102 subcategories (34 pesticides x 3 use zones). For each subcategory, the 48 North Central Coast communities, the 161 San Joaquin Valley communities, and the 17 Ventura County communities are combined (226 total communities) and ranked, with the community with the highest use density ranked 226 and the lowest community ranked 1. With such a large number of variables there is a wide range of data completeness. While there may have been reported use of a certain pesticide within a geographic area, there may be no use within the community, local or regional zones (Table 5).

DPR proposes to assign a rating of 1 to 4 for each subcategory (i.e., each pesticide and zone combination), with 4 representing the highest priority for monitoring. For each of the 102 pesticide use subcategories, the 226 communities are divided into four groups (quartiles). The top quartile (approximately 56 communities) with the highest values are rated four, the second highest quartile are rated three, and so forth. For each pesticide, the rankings and quartile rating for the three use zones (community, local, and regional zones) are averaged to determine an overall ranking and rating for each pesticide.

Demographic Factors – The range of population densities for each demographic factor is shown in Table 6. Similar to the pesticide use category, the demographic category has four

subcategories. For each subcategory, the 226 communities are ranked, with the community with the highest value ranked 226 and the lowest community ranked 1. For each of the four demographic factors, the 226 communities are divided into four groups (quartiles). The top quartile (approximately 56 communities) with the highest values are rated 4, the second highest quartile are rated 3, and so forth. The quartile rating for the four demographic subcategories are averaged to determine an overall demographic rating.

Additional considerations for community selection

Some communities in proximity to each other have similar ratings, particularly for pesticide use due to similar cropping patterns. To evaluate a variety of pesticide exposures, DPR proposes to select communities that represent different pesticide use patterns. If two or more highly rated communities have similar cropping patterns and pesticide use, DPR proposes to select only one of the communities.

DPR proposes to select communities for monitoring primarily based on their pesticide use ratings. These are likely the communities with the highest exposure. Where two or more communities with high pesticide ratings are within a few miles of each other, DPR may select the community with the higher demographic rating for monitoring, depending on other factors (for example, suitable monitoring locations).

OEHHA or others may find the data from this project useful for a cumulative impacts evaluation or other research. Therefore, DPR may favor communities where complementary work is being conducted (e.g., monitoring station for criteria air pollutants or community health study). However, this is not an overriding factor in selecting communities for pesticide monitoring.

Proposed communities

Pesticide and demographic data for all 226 communities are shown in Appendix 3. Tables 7 to 9 summarize the highest rated communities for various groups of pesticides. Communities with the highest average ratings for all 34 proposed pesticides combined are summarized in Table 7. Communities with the highest average ratings for fumigants (Table 8) and organophosphates (Table 9) are shown because historical monitoring indicates that these pesticides can have high exposure and resulting risk. Table 10 summarizes the communities with the highest average demographic ratings. Table 11 lists the communities with other desirable characteristics such as a criteria air pollutant monitoring station or a community health study.

Based on the information in Tables 7 to 11, DPR proposes to select a total of two to five communities for the air monitoring network from those listed below (Figure 4):

- Linden or Ripon (San Joaquin Valley, San Joaquin County)
- Shafter or Wasco (San Joaquin Valley, Kern County)
- Greenfield, Salinas, or Castroville (North Central Coast, Monterey County)
- Camarillo or Oxnard (Ventura County)
- Huron or Mendota (San Joaquin Valley, Fresno County)
- Reedley or Parlier (San Joaquin Valley, Fresno County)

DPR proposes selecting from these 13 communities based primarily on pesticide use ratings, then deciding among closely ranked communities using demographic factors and other characteristics. The communities listed are the top two within each geographic group in overall pesticide use ratings (Table 7), with the following exceptions:

- In Monterey County, Salinas is preferred over Soledad due to the monitoring station for criteria air pollutants, a health study in Salinas, higher use ratings for organophosphate pesticides, and more desirable demographic characteristics.
- Castroville is included in the Monterey County group because use densities for several pesticides (chloropicrin, malathion, methidathion, methyl bromide) are several times higher than the other proposed communities (Figures 5 to 10).
- Patterson and Westley are not included because of their proximity to Linden and Ripon. Patterson and Westley are approximately 20 miles southwest of Ripon, likely too far to be included in that group but likely too close to consider monitoring as a separate location. Linden and Ripon are preferred over Patterson and Westley due to higher pesticide ratings.
- Huron and Mendota are preferred over Cantua Creek because of the air monitoring station in Huron, a health study in Mendota, and more desirable demographic characteristics. In addition, there are few if any suitable monitoring locations in Cantua Creek.

Several other communities with high use of certain pesticides were considered, but not included (Figure 11):

- Gonzales (Monterey County), Chualar (Monterey County), and East Orosi (Tulare County) had among the highest nonfumigant use densities due to a few pesticides but lower ratings for other pesticides.
- Similarly, Mettler (Kern County), Pajaro (Monterey County), and El Rio (Ventura County) had the highest fumigant use densities but lower ratings for the other pesticides.
- Several Merced County communities (Delhi and others) had the second highest fumigant ratings (Table 6). The use densities for most fumigants were comparable to the other proposed communities. The Merced County group was rated higher primarily due to relatively high use of sodium tetrathiocarbonate. Most other communities do not rate highly for this fumigant.

In selecting the communities, DPR also proposes to consider which specific pesticides have high use near each community. As shown in Figures 5 to 10, some of the proposed geographic groups have high use for many of the same pesticides (e.g., Parlier and Shafter) while other geographic groups have high use for different pesticides (e.g., Parlier and Huron). DPR may favor communities that have high use for different pesticides. Table 12 lists the rankings of each pesticide for the 13 proposed communities. It shows that Huron had the highest use of 9 pesticides and Castroville the highest use of 8 pesticides. The remaining proposed communities had the highest use of 3 or fewer pesticides.

Options and Key Decisions

Given limited resources, DPR must balance three components in developing the air monitoring network: the number of samples collected from each community, the number of pesticides

monitored, and the number of communities monitored. The tradeoffs associated with these components can be summarized by the following questions:

- Should DPR collect one or two 24-hour samples each week in each community? Two samples per week will provide more robust data to estimate seasonal exposure.

- Should DPR maximize the number of pesticides monitored by including chloropicrin and/or MITC, in addition to those already proposed? To do so would require reducing the number of samples collected and the number of communities monitored. If yes, DPR may only collect one sample per week in each community, in two or three communities.

- Should DPR maximize the number of communities monitored (4 or 5) and minimize the number of samples collected and number of pesticides monitored? If yes, DPR may only collect one sample per week in each community and cannot monitor chloropicrin and MITC.

There are other key issues to consider. First, the proposed rating system favors communities with relatively high use of many pesticides. Communities with extremely high use for a few pesticides are not as highly rated. It is uncertain if high use of many pesticides has greater overall risk than extremely high use of a few pesticides. DPR proposes this rating system because the project is designed to supplement the toxic air contaminant monitoring that already measures pesticide concentrations in areas of the highest use of individual pesticides.

Second, is the relative weighting of the various community factors. DPR proposes to select communities for monitoring based primarily on pesticide use. DPR proposes to use demographic ratings and other factors to assist in selecting a single community within a geographic group that has high pesticide use ratings. Different communities would be proposed if the demographic ratings or other factors were to be weighted more heavily.

Third, is selecting the appropriate combination of communities. DPR proposes to select a set of communities that represents a variety of pesticide use and cropping patterns. This may mean selecting a lower rated community over a higher rated community. In addition, DPR may favor Parlier over higher rated communities due to the previous year-long monitoring. Continuing monitoring in Parlier will leverage the previous monitoring data, particularly in determining time trends and relating concentrations to use and weather patterns. DPR will also consider resources when selecting the communities, particularly related to Oxnard or Camarillo. These two communities cannot be sampled within a single day by DPR monitoring staff located in Sacramento or Fresno. Travel expenditures, contract, or other additional resources would be needed to monitor Oxnard or Camarillo. The number of samples, number of pesticides, or number of communities may need to be reduced to include Oxnard or Camarillo.

Table 1. Pesticide candidates for the air monitoring network (top 100 pesticides reported in each of five areas for 2005-2007, excluding oils, inorganics, and antimicrobials). Each pesticide is rated 1 - 4 in each of three categories: volatility, risk assessment priority, and use. Higher rating indicates higher monitoring priority, with 12 as the highest total rating. Top 82 pesticides (rated 6 or higher) are shown in table. Total rating may differ by area due to differences in area use. Yellow highlight indicates pesticide included in Parlier or VOC monitoring method. Blue highlight indicates considering monitoring as a single pesticide method. Pink highlight indicates DPR will attempt to add pesticide to Parlier method, if high use area selected.

			Total Rating						
Pesticide	**Volatility Rating**	**Risk Assessment Rating**	**North Central Coast**	**Sacramento Valley**	**Salton Sea**	**San Joaquin Valley**	**Ventura**	**Max**	**Highest Use Area**
Chloropicrin	4	4	12	12	12	12	12	12	
Methyl bromide	4	4	12	12	12	12	12	12	Ventura
1,3-dichloropropene	4	4	12	12	12	12	12	12	Ventura
Metam-sodium (MITC)	4	4	12	12	12	12	12	12	
Metam-potassium (MITC)	4	4	12	12	8	12	12	12	
Sodium tetrathiocarbonate	4	4	11	8	12	12	11	12	San Joaquin Valley
Propylene oxide	4	4	8	12	8	10	8	12	
Sulfuryl fluoride	4	3	11	10	7	9	11	11	
Chlorpyrifos	3	4	11	11	11	11	11	11	San Joaquin Valley
Diazinon	3	4	11	9	10	9	9	11	North Central Coast
Chlorothalonil	3	4	10	10	10	10	11	11	Ventura
Propargite	3	4	7	11	7	11	7	11	San Joaquin Valley
Malathion	3	4	11	9	11	9	11	11	North Central Coast
Acrolein	4	4	8	9	8	11	8	11	San Joaquin Valley
Oxydemeton-methyl	3	4	11	7	7	7	7	11	
2,4-D, dimethylamine salt	3	4	7	11	10	10	7	11	
EPTC	3	4	7	7	11	8	7	11	Salton Sea
Paraquat dichloride	2	4	10	10	10	10	8	10	
Maneb	2	4	10	10	10	9	9	10	
Captan	2	4	10	9	6	8	10	10	
Propanil	2	4	6	10	6	6	6	10	Sacramento Valley
Trifluralin	3	3	6	9	10	10	6	10	Salton Sea
Phosmet	3	3	6	9	6	10	6	10	San Joaquin Valley
Ziram	2	4	6	10	6	10	6	10	
Diuron	3	3	8	9	8	10	8	10	San Joaquin Valley
Mancozeb	2	4	9	9	9	9	10	10	
Bensulide	3	3	10	6	10	6	9	10	
Dicloran	3	3	9	6	6	6	10	10	

			Total Rating						
Pesticide	**Volatility Rating**	**Risk Assessment Rating**	**North Central Coast**	**Sacramento Valley**	**Salton Sea**	**San Joaquin Valley**	**Ventura**	**Max**	**Highest Use Area**
Aldicarb	3	4	7	7	9	10	7	10	
Chlorthal-dimethyl	3	3	10	6	10	6	9	10	
Methomyl	3	3	10	7	10	8	8	10	
Thiram	3	3	8	6	7	6	10	10	
Dimethoate	3	4	10	9	10	10	7	10	San Joaquin Valley
Propyzamide	3	4	10	7	10	7	8	10	
Acephate	3	4	10	7	10	7	9	10	
Thiobencarb	3	3	6	10	6	6	6	10	Sacramento Valley
Iprodione	3	4	10	8	9	9	7	10	
Naled	3	4	10	8	7	9	7	10	San Joaquin Valley
Methidathion	3	4	10	8	7	8	7	10	
Molinate	3	4	7	10	7	7	7	10	Sacramento Valley
Aluminum phosphide	4	4	9	9	8	9	10	10	
Atrazine	3	4	7	7	10	7	7	10	
Dazomet (MITC))	4	4	8	8	10	8	10	10	
Linuron	3	4	7	7	10	7	8	10	
4-(2,4-DB), dimethylamine salt	3	4	7	8	10	7	7	10	
Pendimethalin	3	2	5	8	8	9	5	9	
Oryzalin	3	3	8	9	6	9	6	9	San Joaquin Valley
Oxyfluorfen	3	3	9	9	8	9	6	9	San Joaquin Valley
Simazine	3	3	8	8	6	9	8	9	San Joaquin Valley
Hydrogen cyanamide	4	1	5	5	9	7	5	9	
Oxamyl	3	2	7	5	5	7	9	9	
Cypermethrin	3	3	9	7	8	6	6	9	North Central Coast
Formaldehyde	4	3	7	8	7	9	7	9	San Joaquin Valley
Metaldehyde	4	2	8	6	6	6	9	9	
Permethrin	3	3	9	7	9	8	9	9	San Joaquin Valley
Dicofol	3	4	7	7	7	9	7	9	San Joaquin Valley
Carbaryl	3	4	9	9	7	9	9	9	
Cyprodinil	3	3	7	7	6	7	9	9	
Diquat dibromide	2	4	7	7	9	6	7	9	
Endosulfan	3	4	7	7	9	7	7	9	Salton Sea
2,4-DB acid	3	4	7	7	9	7	7	9	
Glyphosate, isopropylamine salt	2	2	8	8	8	8	8	8	
Fosetyl-al	2	2	8	4	6	4	6	8	
Ethephon	3	2	5	6	7	8	5	8	

			Total Rating						
Pesticide	**Volatility Rating**	**Risk Assessment Rating**	**North Central Coast**	**Sacramento Valley**	**Salton Sea**	**San Joaquin Valley**	**Ventura**	**Max**	**Highest Use Area**
Imidacloprid	2	3	8	5	8	5	8	8	
S-metolachlor	3	2	5	8	5	8	5	8	San Joaquin Valley
MCPA, dimethylamine salt	3	3	6	8	6	8	6	8	
Prometryn	3	2	7	5	5	6	8	8	
Isopropyl alcohol	4	1	8	5	6	7	5	8	
Spinosad	2	3	7	5	8	5	7	8	
S,S,S-tributyl phosphorotrithioate	3	4	7	7	7	8	7	8	San Joaquin Valley
Glyphosate, potassium salt	2	1	7	7	7	7	7	7	
Glyphosate	2	2	6	5	4	7	4	7	
Fenhexamid	2	2	6	4	4	4	7	7	
Methoxyfenozide	2	3	7	5	7	7	7	7	
Piperonyl butoxide	2	2	4	6	4	4	7	7	
Norflurazon	3	3	6	6	6	7	6	7	San Joaquin Valley
Borax	1	3	4	4	7	4	4	7	
Propamocarb hydrochloride	2	1	6	3	3	3	3	6	
Boscalid	2	1	6	4	4	5	6	6	
Glyphosate, monoammonium salt	2	2	4	4	4	4	6	6	
Oleic acid	2	1	3	3	6	3	3	6	

Key to Pesticide Candidate Ratings

Use (DPR Pesticide Use Report Database)

4 = approx top 25 pesticides of pounds reported in area, 2005-2007 average
3 = approx 2nd 25 pesticides of pounds reported in area, 2005-2007 average
2 = approx 3rd 25 pesticides of pounds reported in area, 2005-2007 averge
1 = approx 4th 25 pesticides of pounds reported in area, 2005-2007 average
0 = not among top 100 pesticides used in area, 2005-2007

Volatility (DPR Pesticide Chemistry Database)

4 = >10-2 mm Hg (high)
3 = 10-6 - 10-3 mm Hg (medium)
2 = <10-6 mm Hg (low)
1 = volatility unknown

DPR Risk Assessment Priority (SB950 report)

4 = high priority
3 = medium priority
2 = low priority
1 = no priority assigned

Table 2. Reported pesticide use by county, 2005-2007. Counties with an area identified are included in one of the five candidate areas for the air monitoring network.

County	Area	2005-2007 average (lbs)	Rank
Fresno	San Joaquin Valley	30,004,078	1
Kern	San Joaquin Valley	28,231,745	2
Tulare	San Joaquin Valley	16,615,982	3
San Joaquin	San Joaquin Valley	10,410,585	4
Madera	San Joaquin Valley	9,979,675	5
Monterey	North Central Coast	8,505,686	6
Merced	San Joaquin Valley	7,173,859	7
Ventura	Ventura	6,476,493	8
Kings	San Joaquin Valley	6,067,134	9
Stanislaus	San Joaquin Valley	5,817,403	10
Imperial	Salton Sea	5,342,814	11
Santa Barbara		4,301,460	12
Sacramento	Sacramento Valley	3,483,331	13
Butte	Sacramento Valley	3,226,091	14
Sutter	Sacramento Valley	3,092,629	15
Sonoma		2,866,769	16
Los Angeles		2,823,577	17
Riverside	Salton Sea	2,825,473	18
Yolo	Sacramento Valley	2,646,438	19
Glenn	Sacramento Valley	2,331,833	20
Colusa	Sacramento Valley	2,024,572	21
San Luis Obispo		2,136,360	22
Napa		1,831,760	23
Santa Cruz	North Central Coast	1,752,055	24
San Diego		1,719,357	25
Mendocino		1,418,136	26
Orange		1,298,107	27
Yuba	Sacramento Valley	1,331,087	28
Santa Clara		1,090,570	29
Siskiyou		1,035,967	30
Solano		873,015	31
Tehama	Sacramento Valley	923,949	32
Contra Costa		795,901	33
San Benito	North Central Coast	726,996	34
Lake		618,193	35
San Bernardino		493,742	36
Del Norte		334,895	37
Shasta		308,480	38
Placer		313,916	39
Alameda		299,196	40
San Mateo		277,220	41
Modoc		267,803	42

County	Area	2005-2007 average (lbs)	Rank
El Dorado		145,489	43
Amador		112,692	44
Lassen		93,209	45
Humboldt		62,151	46
Marin		54,570	47
Nevada		62,761	48
Calaveras		44,630	49
San Francisco		34,178	50
Tuolumne		28,723	51
Trinity		10,841	52
Plumas		12,100	53
Inyo		8,459	54
Mariposa		7,744	55
Sierra		5,786	56
Mono		2,681	57
Alpine		431	58
STATEWIDE TOTAL		184,780,778	
CANDIDATE COUNTIES TOTAL		158,989,908	

Table 3a. 2005-2007 area use summary of the 30 pesticides included in the original Parlier and VOC methods.

	North Central Coast	**Sacramento Valley**	**Salton Sea**	**San Joaquin Valley**	**Ventura**
2005-2007 use density of all VOC method pesticides (lbs/mi^2)	2,280.4	189.8	297.4	1,083.8	3,562.1
2005-2007 use density of all Parlier method pesticides (lbs/mi^2)	116.6	121.3	82.6	304.7	75.3
Number of Parlier and VOC pesticides with highest use	3	4	3	17	3

Table 3b. 2005-2007 area use summary of additional candidate pesticides. Underline indicates highest use area.

Candidate Pesticide (max total rating from Table 1)	**2005-2007 Pesticide Use Density (lbs/mi^2)**				
	North Central Coast	**Sacramento Valley**	**Salton Sea**	**San Joaquin Valley**	**Ventura**
Chloropicrin (12)	1,418.3	31.5	61.0	57.3	2,192.8
MITC-generating pesticides (12)	286.1	36.6	752.2	1,253.0	523.2
Oxydemeton-methyl (11)	15.7				
Bensulide (10)	17.3	20.1			
Acephate (10)	10.2		1.6		3.2
Iprodione (10)	7.6	0.5	0.9	8.0	
Methidathion (10)	4.4	0.6		2.8	

Table 4. Number of pesticide drift illnesses reported in the candidate areas, 2005-2007. Data from DPR's pesticide illness surveillance program.

Area	**2005-2007 Reported Illnesses (number/mi^2)**	**2005-2007 Reported Episodes (number/mi^2)**
North Central Coast	0.0835	0.00388
Sacramento Valley	0.0058	0.00139
Salton Sea	0.0036	0.00211
San Joaquin Valley	0.0147	0.00258
Ventura	0.0260	0.00489

Table 5. Number of communities within an area that had reported use of a pesticide within the community zone, local zone (1 mile), and regional zone (5 miles) zone.

	Geographic Area								
	Ventura 17 Communities			**North Central Coast 48 Communities**			**San Joaquin Valley 161 Communities**		
Pesticide	***CZ***	***LZ***	***RZ***	***CZ***	***LZ***	***RZ***	***CZ***	***LZ***	***RZ***
1,3-dichloropropene	8	12	12	7	11	16	75	101	130
Acephate	11	11	12	10	14	16	49	90	133
Acrolein	0	0	0	0	0	0	0	0	0
Bensulide	7	9	12	9	10	12	7	15	51
Chloropicrin	10	14	16	8	9	15	49	76	117
Chlorothalonil	13	14	17	8	12	16	81	105	136
Chlorpyrifos	13	16	16	11	15	16	134	144	148
Cypermethrin	7	9	15	6	10	13	13	31	74
Dazomet (MITC)	2	4	7	0	2	6	0	3	5
Diazinon	8	10	15	11	13	17	68	100	134
Dicofol	2	4	8	1	5	9	59	82	127
Dimethoate	7	9	12	9	11	14	97	120	142
Diuron	10	12	16	2	5	11	117	139	149
Endosulfan	4	6	7	2	3	7	27	54	96
EPTC	0	1	4	3	4	7	30	62	105
Iprodione	9	13	16	8	13	16	112	130	144
Malathion	9	11	14	7	10	15	89	120	142
Metam-sodium (MITC)	7	9	12	3	4	9	33	55	100
Methidathion	0	0	4	3	3	7	53	85	127
Methyl bromide	8	10	12	6	8	15	59	82	116
Naled	4	6	11	6	10	13	43	67	117
Norflurazon	4	6	11	0	1	2	74	108	139
Oryzalin	6	7	15	1	6	13	117	133	144
Oxydemeton-methyl	7	9	12	10	11	17	6	18	47
Oxyfluorfen	12	13	16	9	13	16	136	144	150
Permethrin	12	13	16	10	12	17	89	116	141
Phosmet	1	2	8	2	4	6	81	112	140
Potassium N-methyl dithiocarbamate (MITC)	2	3	6	5	9	14	32	48	82
Propargite	0	0	4	0	1	2	109	127	141
S,S,S-tributyl phosphorotrithioate	0	0	0	0	0	0	9	18	46
Simazine	11	14	16	3	5	7	107	120	137
S-metolachlor	4	7	12	6	6	8	65	88	130
Sodium tetrathiocarbonate	2	8	15	0	0	2	7	14	46
Trifluralin	6	8	12	3	6	11	100	126	144

Table 6. Range of population densities for the demographic factors.

Community Demographic Factors	**Min**	**Max**
Population density of people <18 yrs old (persons/mi^2):		
Ventura County	179	2290
North Central Coast	48	2842
San Joaquin Valley	4	3514
Population density of people > 65 yrs old (persons/mi^2):		
Ventura County	39	689
North Central Coast	20	1156
San Joaquin Valley	2	923
Population density of people > 5 yrs old with disabilities (persons/mi^2):		
Ventura County	63	1298
North Central Coast	27	1738
San Joaquin Valley	0	1906
Civilian population employed in farming (persons/mi^2):		
Ventura County	0	280
North Central Coast	0	1127
San Joaquin Valley	0	1641

Table 7. Communities with the highest average ratings for 2006-2008 use of all 34 candidate pesticides combined. Communities within a few miles of each other are grouped together. Communities highly rated for demographics (4.00 or 3.75 rating) are shown in italics. Communities that have other desirable characteristics, such as criteria air pollutant monitoring station are underlined.

Community(ies)	Area (County)	Pesticide Rating
Linden, Ripon, Salida, Escalon, Manteca, Del Rio, Riverdale Park, Lathrop, Modesto, *Stockton*, Hickman	San Joaquin Valley (San Joaquin, Stanislaus)	3.23-2.71
Shafter, Wasco, Arvin, Rosedale, Mettler	San Joaquin Valley (Kern)	3.01-2.77
Greenfield, Soledad, *Salinas*, *Gonzales*, King City, *Castroville*	North Central Coast (Monterey)	2.96-2.62
Patterson, Westley	San Joaquin Valley (Stanislaus)	2.93
Camarillo, *Oxnard*	Ventura (Ventura)	2.89-2.86
Cantua Creek, *Huron*, *Mendota*	San Joaquin Valley (Fresno)	2.85-2.71
Reedley, *Parlier*	San Joaquin Valley (Fresno)	2.77-2.62
Poplar	San Joaquin Valley (Tulare)	2.71

Table 8. Communities with the highest average ratings for 2006-2008 fumigant use (1,3-dichloropropene, chloropicrin, methyl bromide, MITC pesticides, and sodium tetrathiocarbonate). The ratings are similar if chloropicrin and/or MITC pesticides are excluded. Communities within a few miles of each other are grouped together. Communities highly rated for demographics (4.00 or 3.75 rating) are shown in italics. Communities that have other desirable characteristics, such as criteria air pollutant monitoring station are underlined.

Community(ies)	Area (County)	Pesticide Rating
Camarillo, *Oxnard*, El Rio, Ventura, Thousand Oaks, Santa Paula, Port Hueneme	Ventura (Ventura)	3.78-2.84
Delhi, Livingston, Hilmar, Winton, Turlock, Atwater	San Joaquin Valley (Merced)	3.64-2.84
Salida, Ripon, Manteca, Escalon, Del Rio, Riverdale Park, West Modesto	San Joaquin Valley (San Joaquin, Stanislaus)	3.23-2.84
Salinas, Prunedale, Elkhorn	North Central Coast (Monterey)	3.04-2.89
Delano, Wasco, Shafter	San Joaquin Valley (Kern)	3.04-2.87
Kingsburg	San Joaquin Valley (Fresno)	2.89
Patterson	San Joaquin Valley (Stanislaus)	2.84

Table 9. Communities with the highest average ratings for 2006-2008 organophosphate use. Communities within a few miles of each other are grouped together. Communities highly rated for demographics (4.00 or 3.75 rating) are shown in italics. Communities that have other desirable characteristics, such as criteria air pollutant monitoring station are underlined

Community(ies)	Area (County)	Pesticide Rating
Salinas, Boronda, *Castroville*, Prunedale, Moss Landing, *Watsonville*, San Juan Bautista, Chualar, and others	North Central Coast (Monterey, San Benito)	3.36-3.21
Mendota, Cantua Creek, Firebaugh	San Joaquin Valley (Fresno)	3.30-2.94
Linden, Ripon, Salida	San Joaquin Valley (San Joaquin, Stanislaus)	3.21-2.91
Shafter	San Joaquin Valley (Kern)	3.09
Oxnard, Camarillo	Ventura (Ventura)	3.03-2.97
Reedley	San Joaquin Valley (Fresno)	2.97

Table 10. Communities with the highest average ratings for all demographic factors combined. Demographic factors include density (number of persons per square mile) of people less than 18, people greater than 65, people with disabilities, and people employed in farming, fishing, and forestry.

Community(ies)	Area	Demographic Rating
Castroville, Freedom, Gonzales, Greenfield, Salinas, Watsonville	North Central Coast	4.00
August, Bret Harte, Dinuba, Kerman, Lindsay, Newman, Parlier, Reedley, Sanger, Selma, Shackelford, South Woodbridge	San Joaquin Valley	4.00
Oxnard, Santa Paula	Ventura	4.00
Hollister, Pajaro	North Central Coast	3.75
Atwater, Bystrom, Cutler, Exeter, Farmersville, Garden Acres, Huron, Kettleman City, Lodi, Madera, McFarland, Mendota, Orange Cove, Richgrove, Riverbank, Stockton, Turlock	San Joaquin Valley	3.75
Casa Conejo, Fillmore, Port Hueneme	Ventura	3.75

Table 11. Communities with other desirable characteristics. These include monitoring station for criteria air pollutants, ongoing health study, or previous monitoring.

Area	Community	Desirable Characteristic(s)
North Central Coast	Carmel Valley	Air monitoring station
North Central Coast	Davenport	Air monitoring station
North Central Coast	King City	Air monitoring station
North Central Coast	Hollister	Air monitoring station
North Central Coast	Salinas	Health study; air monitoring station
North Central Coast	Santa Cruz	Air monitoring station
North Central Coast	Scotts Valley	Air monitoring station
North Central Coast	Watsonville	Air monitoring station
San Joaquin Valley	Arvin	Air monitoring station
San Joaquin Valley	Bakersfield	Air monitoring station
San Joaquin Valley	Clovis	Air monitoring station
San Joaquin Valley	Corcoran	Air monitoring station
San Joaquin Valley	Edison	Air monitoring station
San Joaquin Valley	Fresno	Air monitoring station
San Joaquin Valley	Hanford	Air monitoring station
San Joaquin Valley	Huron	Air monitoring station
San Joaquin Valley	Lebec	Air monitoring station
San Joaquin Valley	Madera	Air monitoring station
San Joaquin Valley	Mendota	Health study
San Joaquin Valley	Merced	Air monitoring station
San Joaquin Valley	Modesto	Air monitoring station
San Joaquin Valley	Oildale	Air monitoring station
San Joaquin Valley	Parlier	Air monitoring station; 2006 pesticide monitoring
San Joaquin Valley	Shafter	Air monitoring station
San Joaquin Valley	Stockton	Air monitoring station
San Joaquin Valley	Tracy	Air monitoring station
San Joaquin Valley	Turlock	Air monitoring station
San Joaquin Valley	Visalia	Air monitoring station
Ventura	El Rio	Air monitoring station
Ventura	Ojai	Air monitoring station
Ventura	Simi Valley	Air monitoring station
Ventura	Thousand Oaks	Air monitoring station
Ventura	Ventura	Air monitoring station

Table 12. 2006-2008 pesticide use rankings for proposed communities. Highest possible rank is 226. Rank of 1 indicates no use.

Pesticide	Linden	Ripon	Shafter	Wasco	Greenfield	Salinas	Castroville	Camarillo	Oxnard	Huron	Mendota	Reedley	Parlier	Highest Ranked Community
1,3-Dichloropropene	137	200	186	190	83	188	150	203	215	29	30	210	202	Oxnard
Acephate	53	141	171	178	216	221	223	193	200	127	207	112	67	Castroville
Acrolein	1	1	1	1	1	1	1	1	1	1	1	1	1	
Bensulide	104	138	1	1	222	215	219	206	205	52	59	178	116	Greenfield
Chloropicrin	167	182	92	125	109	216	220	210	218	60	1	116	142	Castroville
Chlorothalonil	179	199	171	129	163	134	182	207	209	224	120	179	149	Huron
Chlorpyrifos	176	167	216	205	194	126	132	141	134	195	162	179	205	Shafter
Cypermethrin	161	100	1	1	217	203	217	220	215	224	42	1	1	Huron
Dazomet	1	1	1	1	1	1	1	224	225	1	1	1	1	Oxnard
Diazinon	166	183	209	160	217	220	220	153	139	211	118	179	196	Salinas/Castroville
Dicofol	213	141	160	188	197	139	1	85	128	75	212	105	47	Linden
Dimethoate	162	126	163	156	212	198	200	107	125	224	172	139	80	Huron
Diuron	182	126	151	171	127	74	152	83	70	130	187	155	165	Mendota
Endosulfan	194	136	1	121	44	45	113	90	160	226	220	110	181	Huron
EPTC	40	121	217	146	200	170	1	95	1	1	143	1	1	Shafter
Iprodione	196	193	218	211	214	214	203	91	109	221	68	198	201	Huron
Malathion	189	167	93	101	193	218	221	196	201	86	160	154	186	Castroville
Metam sodium	185	36	217	208	117	194	49	214	216	218	205	173	59	Huron
Methidathion	205	214	218	183	1	188	226	34	36	56	181	212	112	Castroville
Methyl bromide	171	191	178	204	124	215	222	210	217	103	1	115	91	Castroville
Naled	208	168	168	49	199	215	220	187	189	224	211	67	23	Huron
Norflurazon	177	191	146	190	1	1	1	64	27	66	1	166	193	Parlier
Oryzalin	156	200	164	189	136	1	1	82	77	77	41	207	194	Reedley
Oxydemeton-methyl	188	48	1	119	219	221	221	195	197	64	139	1	1	Salinas/Castroville
Oxyfluorfen	209	204	214	211	179	91	218	72	86	183	176	187	185	Castroville
Permethrin	132	205	208	187	214	215	205	192	199	213	62	108	86	Salinas
Phosmet	190	141	226	216	1	1	1	23	104	32	79	215	221	Shafter
Potassium N-methyl dithiocarbamate	156	146	136	1	203	41	51	195	186	76	208	99	185	Mendota
Propargite	225	189	138	175	1	1	1	27	28	197	162	157	185	Linden
S,S,S-tributyltriphosphoro (DEF)	1	1	209	67	1	1	1	1	1	71	222	61	1	Mendota
Simazine	187	155	135	120	183	1	1	115	86	166	20	182	197	Parlier
S-metolachlor	205	162	177	176	208	121	31	135	136	226	207	23	25	Huron
Sodium tetrathiocarbonate	1	144	73	66	72	1	1	136	64	1	1	1	1	Ripon
Trifluralin	168	164	179	179	106	100	53	113	107	220	217	103	125	Huron