California Environmental Protection Agency
Department of Pesticide Regulation

OVERVIEW

Environmental Justice Pilot Project
Pesticide Air Monitoring in Parlier

As part of the California Environmental Protection Agency's (Cal/EPA's) Environmental Justice Action Plan, the Department of Pesticide Regulation (DPR) conducted a pilot project focusing on pesticide air concentrations in a rural community in California. Rural communities may have higher concentrations of pesticides in ambient air because of their proximity to agricultural fields. The overall goal of this pilot project was to evaluate ambient air exposure to pesticides to better understand and identify opportunities to reduce environmental health risk, particularly to children. DPR evaluated 83 communities in Fresno, Kern, Kings, Madera, Merced, Stanislaus, and Tulare counties as candidates for this project, and selected the City of Parlier in Fresno County.

Parlier is a small city in the San Joaquin Valley, roughly 20 miles southeast of Fresno. During the winter and spring the predominant winds are from the southeast, while during the summer and fall the winds are mainly from the northwest. According to the 2000 U.S. Census, 11,088 people live in Parlier. About 38 percent of the population is less than 18 years old, 97 percent are Hispanic, and the median annual family income is $24,275. Parlier is a rural community surrounded by agriculture. The major crops are grapes and tree fruit. Insecticides and fungicides are the most heavily used pesticides in the area.

Pesticides and Area Monitored

This pilot project monitored ambient air concentrations of 40 pesticides and pesticide breakdown products. The method to measure multiple chemicals in a single sample was developed by the University of California Davis (UCD) Trace Analytical Laboratory for a study conducted by DPR in Lompoc in 2000. DPR monitored 31 pesticides and breakdown products. The California Air Resources Board (ARB) monitored 23 volatile organic compounds (VOC), six of which have pesticidal uses; 28 metals, 3 of which have pesticidal uses; and hexavalent chromium. In addition, the San Joaquin Valley Air Pollution Control District (SJVAPCD) monitored ozone, nitrogen oxide and particulate matter (PM2.5) air concentrations. The 40 pesticides and pesticide breakdown products are in Table 1.

Since public participation was an essential element of this environmental justice project, DPR formed a local advisory group (LAG) of community leaders, advocacy representatives and area farmers to advise the Department on a number of project elements. In addition, DPR formed a Technical Advisory Group (TAG) to provide guidance on the scientific elements of the pilot project. The TAG included staff from federal, state, and county agencies, as well as technical specialists from the local communities After consultation the LAG, DPR set up air-sampling stations at three

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elementary schools in Parlier (Figure 1): Martinez (northwest part of town), Benavidez (central), and Chavez (southeast). ARB set up a station at the Benavidez Elementary School to monitor VOCs, criteria pollutants and metals. In addition, the SJVAPCD routinely monitors for other air pollutants at the University of California, Kearney Agricultural Center, approximately one mile southeast of town.

METHODS

Air Monitoring – DPR collected samples from January through December 2006. Samples were collected for 24 hours three consecutive days a week at each of the three schools. The starting day varied each week with the criterion that one DPR sample day would correspond with ARB's scheduled 24-hour air toxics samples. Sampling usually started around 8:00 a.m.

ARB's collection and monitoring for PM2.5, VOCs, elements and metals ran from mid-January 2006 through mid-January 2007. ARB collected 24-hour VOC samples every six days at Benavidez School. The sampling frequency increased to every three days during peak high-use periods for sulfur and 1,3-dichloropropene. ARB monitored PM2.5 and weather data on a continuous basis.

SJVAPCD monitors ozone and nitrogen dioxide continuously and hydrocarbons seasonally at the Kearney Agricultural Center. The hydrocarbon samples are collected as four sequential 3-hour samples (12 consecutive hours during the day), every three days between July and September.

Quality Control Methods – The monitoring included extensive quality control measures. The method validation verified that the lowest possible detection limits and quantitation limits were achieved and ensured the detection limits were lower than the health screening levels. The quality control measures included analysis of samples containing known amounts of pesticides (spikes) to determine accuracy, samples containing no pesticides (blanks) to detect inadvertent contamination and duplicate samples to determine precision. A multi-agency group, led by the ARB, conducted several audits to ensure appropriate procedures were followed.

Methods for Collecting Weather and Pesticide Use Data – DPR collected weather and pesticide use information to help evaluate the air monitoring data. The ARB meteorological station at Benavidez Elementary School measured wind speed, wind direction, and temperature. The SJVAPCD station at the Kearney Agricultural Center measures wind speed and direction, air temperature, barometric pressure, relative humidity, and solar radiation (Figure 1). All agricultural pesticide use must be reported to the state and DPR maintains a database of these applications, including pesticide applied, date and amount applied and application location.

Additional Sampling Methods by DPR - In addition collecting air samples, DPR collected ground water samples from three municipal wells that supply drinking water to Parlier. DPR collected samples from all wells in use in 2006.

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RESULTS

Of the 40 pesticides or breakdown products for which results were available, 23 were detected in one or more of the 1,075 samples collected and analyzed by DPR and ARB. Of the 23 detected pesticides and breakdown products, 19 are assumed to be present because of their use as pesticides or in pesticide formulations. One of the 19, however, had no reported use in the Parlier area during the study period. The remaining four compounds detected have some pesticidal uses (although there were no reported applications), but their presence is typically due to non-pesticidal sources (for example, vehicle emissions).

Diazinon was the only pesticide monitored that exceeded the screening levels for the acute (one-day) period and approached it in several other instances (Table 2). The chemical with the highest concentration that likely resulted from pesticide use was 1,3-dichloropropene (23,601 ng/m^3). This level is below the acute screening level.

Acrolein and formaldehyde were frequently detected, often well above the acute screening levels (Table 2), likely due to nonpesticidal uses.

Of the pesticides monitored by DPR, MITC was detected most frequently (84 percent). Sulfur and copper were detected in 100 percent of the elemental/metal samples collected by ARB.

The PM2.5 state and federal standard was exceeded in February 2006, December 2006, and January 2007 in samples collected by ARB. Ozone concentrations measured by SJVAPCD at the Kearney Agricultural Center monitoring station exceeded the 8-hour average concentration air quality standard multiple times from May through October 2006.

In the Parlier area, weather data measured during the monitoring study show a winter period when winds tend to be higher and blow from the southeast, with a shift during April through September when the winds change to a dominant northwest direction with slower speeds. During October through December the wind speeds are slower and the wind direction is more variable but still predominantly from the northwest.

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Table 1. Percent of samples with detectable pesticide concentrations and reported use (within five miles of Parlier). Pesticides in **Bold** were monitored by DPR. Pesticides in *italics* were monitored by ARB.

Pesticide	Numbers of samples collected	Percent of samples with detection[a]
Carbon disulfide [b]	33	100
Copper [c]	64	100
Formaldehyde [b]	65	100
Sulfur [c]	64	100
Acrolein [b]	71	85
MITC	468	84
Methyl Bromide	71	66
Chlorpyrifos	468	64
Arsenic [b]	64	64
Xylene [c]	71	49
1,3-dichloropropene	71	34
Diazinon	468	32
Trifluralin	468	24
Chlorpyrifos oxygen analog	468	22
Diazinon oxygen analog	468	19
Phosmet	468	19
Chlorothalonil	468	17
Propargite	468	15
Simazine	468	7
Malathion oxygen analog	468	5
Malathion	468	1
Dichlorvos	468	1
Permethrin	468	1
Azinphos-methyl	468	0
Dicofol	468	0
Dimethoate	468	0
Dimethoate oxygen analog	468	0
Diuron	468	0
Endosulfan	468	0
Norflurazon	468	0
Oryzalin	468	0
Oxyfluorfen	468	0
Cypermethrin	468	0
Endosulfan sulfate	468	0
EPTC	468	0
Metolachlor	468	0
Molinate	468	0
Propanil	468	0
SSS-tributylphos… (DEF)	468	0
Thiobencarb	468	0

a.i. = Active ingredient

[a] Includes quantified detections and trace detections.

[b] Detections of these compounds are likely due to non-pesticidal sources only.

[c] Detections of these compounds are likely due pesticidal and non-pesticidal sources.

[d] Includes some chamber fumigations.

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Table 2. Highest one-day air concentrations, acute screening levels, and acute hazard quotients. The adjusted hazard quotient adds an uncertainty factor for some pesticides to address children's sensitivity. Pesticides with the highest risk are shown in **bold**.

Pesticide	24-hour acute screening level (ng/m^3)	Highest 1-day concentration (ng/m^3)
1,3-dichloropropene	**160,000**	**23,601**
Acrolein[a]	**190**	**4,586**
Arsenic[a]	**30**	**5**
Azinphos-methyl	101,000	ND (3.80)
Carbon disulfide[a]	1,550,000	3,114
Chlorothalonil	34,000	Trace (30-238)[c]
Chlorpyrifos	**1,200**	**150**
Chlorpyrifos OA	**1,200**	**28**
Copper[b]	100,000	550
Cypermethrin	40,000	ND (2.34)
Diazinon	**130**	**172**
Diazinon OA	**130**	**71**
Dichlorvos	11,000	Trace (24.8)
Dicofol	68,000	ND (1.07)
Dimethoate	34,000	ND (1.16)
Dimethoate OA	34,000	ND (0.97)
Diuron	170,000	ND (2.57)
Endosulfan	4,000	ND (1.62)
Endosulfan sulfate	4,000	ND (2.32)
EPTC	230,000	ND (0.84)
Formaldehyde[a]	**19,000**	**9,457**
Malathion	40,000	21
Malathion OA	40,000	16
Methyl bromide	820,000	2,524
Metolachlor	85,000	ND (1.37)
MITC	66,000	5,010
Molinate	200,000	ND (0.91)
Norflurazon	170,000	ND (1.88)
Oryzalin	420,000	ND (0.70)
Oxyfluorfen	510,000	ND (3.20)
Permethrin	168,000	Trace (26.8)
Phosmet	77,000	42
Propanil	51,000	ND (1.16)
Propargite	14,000	Trace (25.1)
Simazine	110,000	Trace (2.9-6.4)[d]
SSS-tributylphos.. (DEF)	8,800	ND (0.88)
Sulfur[b]	NA	1,800
Thiobencarb	425,000	ND (2.80)
Trifluralin	1,200,000	Trace (23.2)
Xylene[b]	900,000	5,905
TOTAL (Hazard Index)		

FQPA = Food quality protection act.
NA = Not available
[a] Detections of these compounds are likely due to non-pesticidal sources only.
[b] Detections of these compounds are likely due pesticidal and non-pesticidal sources.
[c] All "traces" were detected when reporting limit was 30 ng/m^3.
[d] Used average of reporting limits since "trace" detections occurred with both reporting limits.

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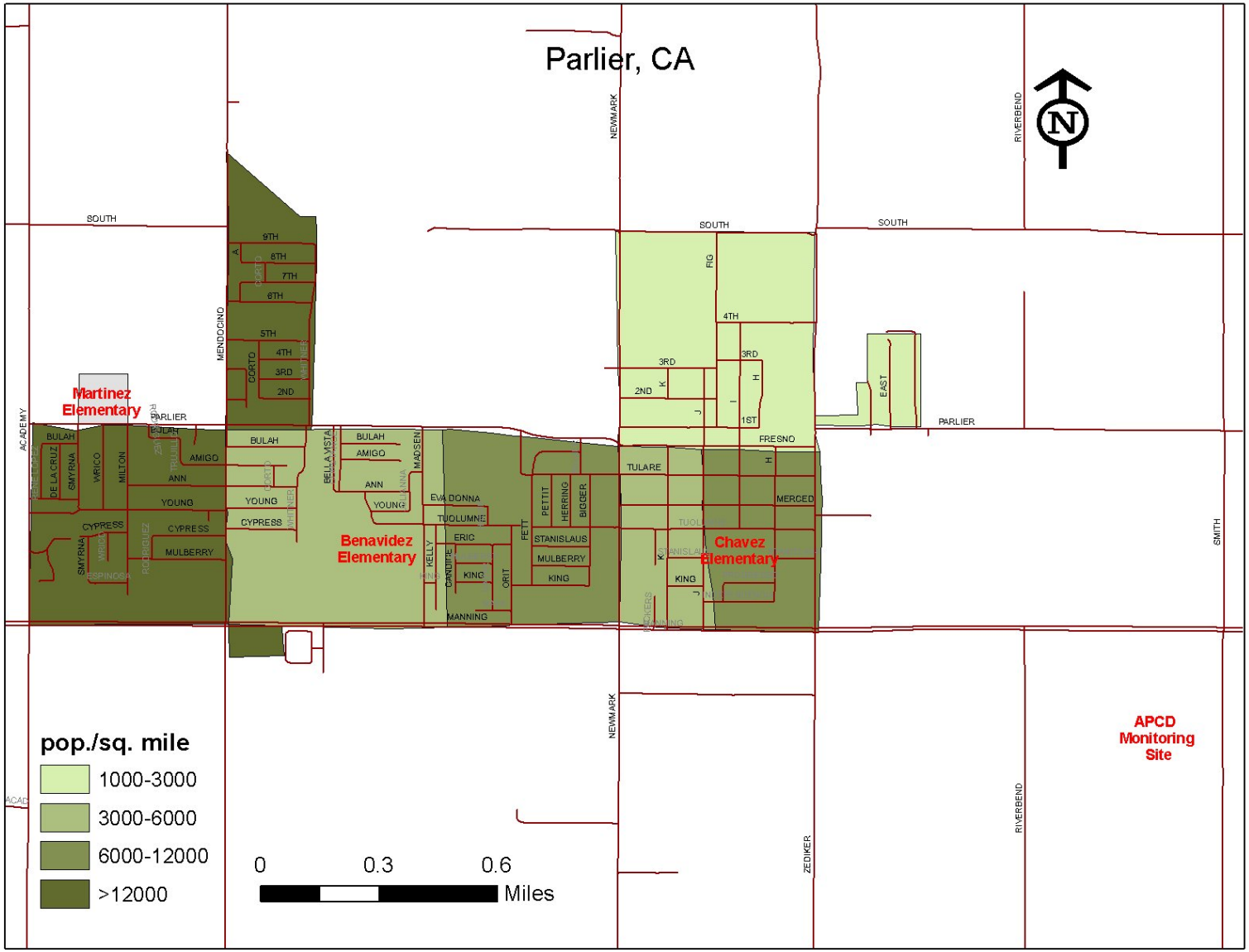
Figure 1. Sampling locations in Parlier, Ca and the San Joaquin Air Pollution Control District monitoring site (APCD).