Every Breath You Take

Airborne Pesticides in the San Joaquin Valley

Environmental Working Group™

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Acknowledgements

Thanks to: the Fresno Campaign Against the Misuse of Pesticides and the Comité Para El Bienestar de Earlimart for their partnership in this project and their ongoing commitment to pesticide reform and public health in the Central Valley; Pesticide Watch, especially former Fresno organizer Justin Ruben, who recruited volunteer samplers; Gregg Small and Melanie Undem of Pesticide Watch for their support of the project; Wil Sumner of Sumner Analytical Services for sampling protocols and analysis; Dr. Sharon Seidel for oversight of risk assessment calculations; and Richard Wiles of EWG for analytical oversight and editorial suggestions.

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This report was made possible by grants from Patagonia, Inc. and the Richard and Rhoda Goldman Fund. Opinions expressed are those of the authors, who are responsible for any errors of fact or misinterpretation.

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Environmental Working Group

EWG is a nonprofit environmental research organization with offices in Washington, DC, Oakland, CA and Seattle, WA. EWG uses information technology to conduct research and inform the public on a range of environmental health issues, especially those affecting children.

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Independent scientific monitoring by the Environmental Working Group found dangerously high concentrations of a partially banned pesticide in the air San Joaquin Valley residents breathe. One-third of ambient air monitoring samples detected the pesticide chlorpyrifos, which the federal government has recently banned for home use as unsafe for children but remains the most widely used agricultural insecticide in California.

At several sites, a pesticide banned for home use as unsafe for children was found at levels that could easily expose infants to doses much higher than are safe to breathe.

• No one would want their children playing where our pumps were running. In several locations, chlorpyrifos was detected at levels that could easily expose infants to much higher doses than the federal government says are safe to breathe.

• EWG air monitoring also detected two other pesticides classified by the federal and state governments as hazardous air pollutants – chemicals the U.S. EPA says are likely to cause increased death rates or serious illness.

• Pesticide use in Fresno, Kern and Tulare counties puts more than 15 million pounds of toxic chemicals into the air each year – an amount equal to about one-third of the air pollution from most other area industrial sources combined. This amount includes not only pesticide drift, but post-application emissions of other toxic ingredients in pesticide products.

• In those counties more than 22,000 children – a population known to be more susceptible to the effects of toxic chemicals that cause damage to the brain, the nervous system and to development – attend school near sites of heavy use of toxic pesticides.

• Our detections were not the result of unusually high pesticide use on the day of sampling. In 1998 there were more than 18,400 applications of pesticides within three miles of our test sites, and applications were made on 227 different days that year. In 1996, state air quality scientists detected chlorpyrifos in 74 percent of samples near orange groves in Tulare County.

• The more than 1 million San Joaquin Valley residents who live, work and go to school in close proximity to heavy use of toxic pesticides should not have to worry if the amount of poison allowed in their air is considered "safe." They should have the right not to be exposed to poison at all.

• Agriculture is California's largest industry, and pesticide drift is air pollution as surely as the emissions from a chemical plant. The state should regulate it as strictly as other forms of industrial air pollution. Vigorous enforcement of laws against pesticide drift must apply not only to large-scale drift incidents, but everyday drift from routine use of chemical pesticides.

Every Breath You Take

Independent scientific monitoring by the Environmental Working Group found dangerously high concentrations of a partially banned pesticide in the air San Joaquin Valley residents breathe. One-third of 15 ambient air monitoring samples taken in Fresno, Tulare or Kern counties in July 2000 detected the pesticide chlorpyrifos, an acute neurotoxin which the federal government recently banned for home use as unsafe for children but remains the most widely used agricultural insecticide in California. (Table 1, Figure 1.) None of our sampling stations would be a healthy place for children to play, but in several locations chlorpyrifos was detected in concentrations that could easily expose infants to levels much higher than the safe daily dose.

A typical two-year-old who played outdoors for just an hour in a Fresno neighborhood one summer day would have inhaled almost four times the safe daily dose of a pesticide that harms kids' development and learning ability.

Also detected were the pesticides carbaryl and trifluralin. Carbaryl and trifluralin are classified by the U.S. Environmental Protection Agency as hazardous air pollutants (HAPs) and by the State of California as toxic air contaminants (TACs). Chlorpyrifos is a candidate for the state TAC list. Federal law defines HAPs as chemicals that cause or contribute to air pollution "which may reasonably be anticipated" to result in increased human mortality or serious illness. State law defines TACs as airborne pollutants which "pose a present or potential hazard to human health."

Earlier this year the EPA banned chlorpyrifos for home use after finding evidence that hundreds of children are being poisoned by exposure to the chemical each year, suffering effects ranging from headaches, nausea and diarrhea to anxiety, fatigue and decreased learning and memory capacity.

In three locations along the State Highway 99 corridor – Fresno, Dinuba and Earlimart – EWG measured chlorpyrifos at an extremely high level that clearly poses acute human health risks, particularly for young children, whose developing bodies are more susceptible to the health effects of toxic chemicals, and whose intake of air (and pollutants in the air) relative to their body weight is much higher than that of adults.

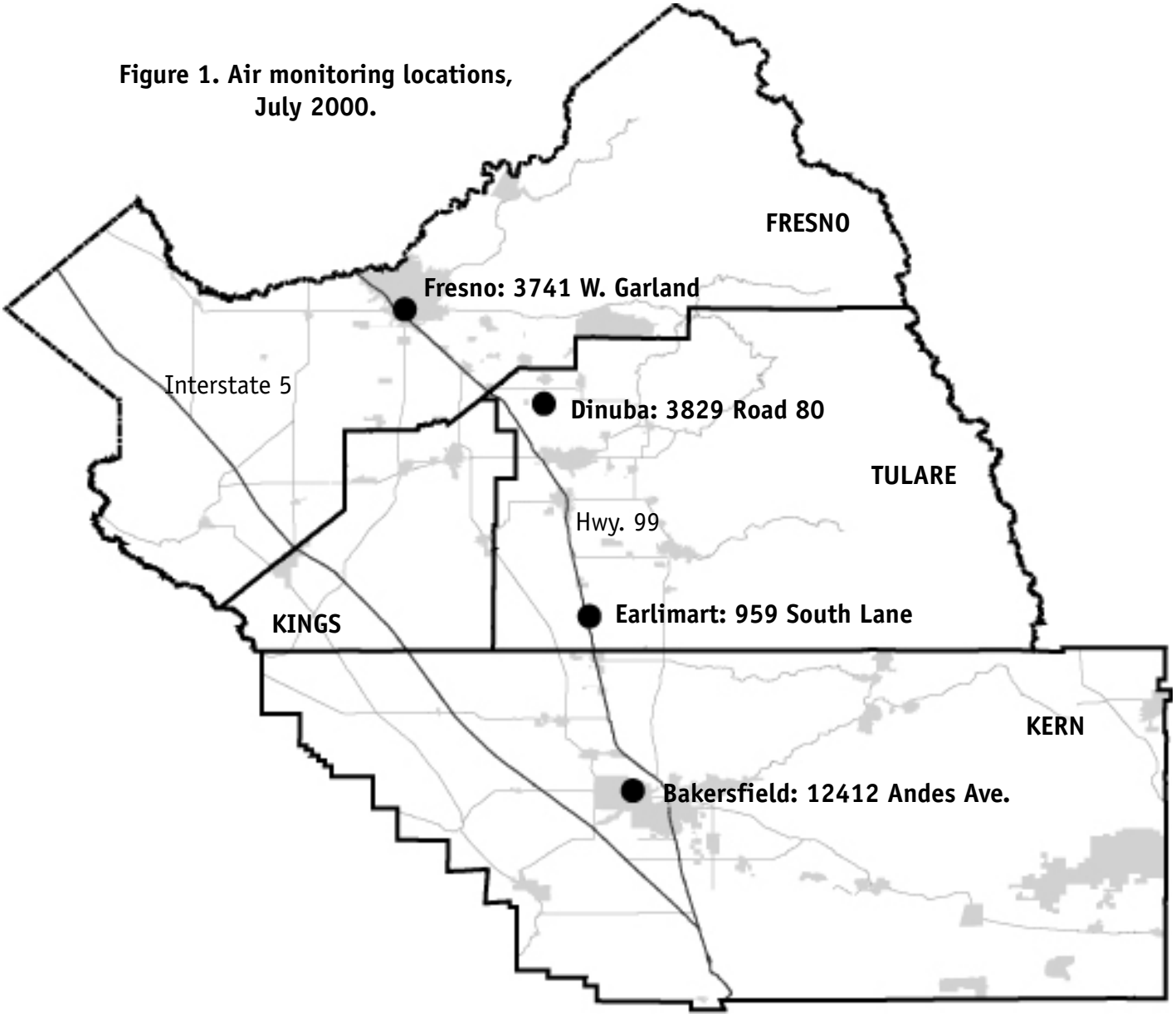
On June 12, a typical two-year-old child who played outdoors for just one hour near our sampling station in the East Yale neighborhood of Fresno would have inhaled about 3.6 times the EPA's safe daily dose of chlorpyrifos. On July 15, the same child playing near our sampling station in Earlimart would have inhaled the safe daily dose of chlorpyrifos in about three hours.

Table 1. Pesticides were detected in almost half of the 15 air samples.

Site	County	Sample Dates	Detections	Pesticides Detected
Fresno	Fresno	7/9, 12, 19, 31	50%	Carbaryl, Chlorpyrifos, Trifluralin
Dinuba	Tulare	7/3, 10, 17, 24	75%	Chlorpyrifos
Earlimart	Tulare	7/3, 10, 15	66%	Trifluralin
Bakersfield	Kern	7/3, 10, 16, 24	0	None

SOURCE: EWG air sampling, July 2000

Figure 1. Air monitoring locations, July 2000.



Although the levels of the other pesticides detected in our sampling were by comparison low, that does not necessarily mean they were safe. For almost all toxic pesticides used in California, the state Department of Pesticide Regulation (DPR) does not even attempt to establish a safe level of daily airborne exposure, to establish a level considered safe for children as compared to adults, nor to account for the cumulative effect of exposure to two or more agricultural poisons at the same time. More than 1 million residents of the San Joaquin Valley live, work and go to school in close proximity to heavy use of toxic pesticides. (Ross 1998.) For them the issue is not how much airborne poison is considered "safe," but the right not to be poisoned at all.

Pesticides Are Air Pollution

In 1999, four million to 15 million pounds of toxic chemicals drifted from pesticide application sites to nearby schools, homes and businesses in Fresno, Kern and Tulare counties.

EWG's air samples, collected by Valley residents and analyzed by an accredited private laboratory, serve to underscore the overwhelming statistical evidence that millions of pounds of pesticide pollution drift each year from farm fields and vineyards into the air Californians breathe. In the test counties alone, pesticides contribute at least 15 million pounds of toxic contaminants to the air each year. By comparison, according to the state Air Resources Board, all other industrial processes (excluding petroleum production and refining) emit an estimated 47.5 million pounds of air pollution a year in the three counties.

According to the latest available state pesticide use reports, in 1999 almost 78 million pounds of pesticides (active ingredients) were applied in Fresno, Tulare and Kern counties. (DPR 1999.) Using conservative models of pesticide drift developed by the EPA, an estimated 3.8 million to 15.5 million pounds of that total drifted from the application site onto the grounds of neighboring properties, including schools, homes and businesses. This vast amount of airborne poison clearly violates the spirit of the state Food and Agriculture Code, which says all users of pesticides must "prevent substantial drift to nontarget areas."

But pesticide drift is only part of the air pollution resulting from pesticide use. Drift estimates do not account for emissions of volatile organic compounds (VOCs, also known as reactive organic gases), the products of so-called "inert" ingredients in pesticides that evaporate into the air after the product is applied.

VOCs, which include such known human health hazards as the carcinogens benzene and tolulene, contribute to the formation of smog and are a significant factor in the San Joaquin Valley's failure to met federal clean air standards. Latest state estimates show that pesticides emit about 15.6 million pounds of VOCs in Fresno, Kern and Tulare counties — about 8 percent of the three counties' total VOC emissions — and almost half of all VOCs emitted statewide come from the San Joaquin Valley. (ARB 1999.)

Because they contribute to the formation of smog, emissions of VOCs are regulated under the U.S. Clean Air Act. To comply with the law, DPR has established a VOC emissions potential factor (EF) for every pesticide registered for use in California. This rating gives the percentage of the chemical that either is or potentially will become airborne VOCs after the pesticide is applied. The EF varies greatly according to the exact formulation of the pesticide, even for products with the same active ingredient. For example, according to DPR, chlorpyrifos used for indoor termite treatment has an emissions potential of around 25 percent while some formulations sprayed on crops have EFs of near 100 percent. For many fumigant gases - including methyl bromide, metam sodium and chloropicrin, all of which are heavily used in the San Joaquin Valley — DPR estimates the emissions potential at greater than 90 percent. Of approximately 250 currently registered pesticide products evaluated by DPR, almost one in four had emissions potential of at least 50 percent. (DPR 1998.)

Before growers are allowed to use any dangerous pesticide, they should be required to consider non- or less-toxic alternatives, to apply only the minimum amount needed, and to take precautions to protect neighbors from drift.

Recommendations

The findings of EWG's San Joaquin Valley air monitoring project have implications for local, state and national pesticide regulation.

• County agricultural commissioners, to whom DPR gives wide discretion in enforcing state pesticide regulations, should exercise increased oversight and embrace the precautionary principle in approving permits for the application of carcinogenic, neurotoxic and EPA Category I acutely toxic pesticides, especially on fields near homes, schools and workplaces. Before issuing a permit for any restricted use pesticide, ag commissioners should make sure that growers consider non-toxic alternatives, that only the minimum amount of pesticide needed is applied, and that steps are taken to prevent drift.

• San Joaquin Valley residents, and all Californians, should have the right to be informed in advance of all applications of hazardous pesticides near their homes, schools and workplaces. When large-scale applications of carcinogenic, neurotoxic or acutely toxic pesticides are scheduled, county officials should take proactive steps to notify the general public, similar to the air-quality alerts issued in cities with unhealthy levels of smog.

• Protective buffer zones should be established for the use of all carcinogenic, neurotoxic and acutely toxic pesticides.

• DPR must significantly step up its currently inadequate efforts to monitor airborne pesticide drift, particularly in counties where large amounts of pesticides are used, and continue its recent commitment to better enforcement. DPR's tougher stand of late against pesticide users responsible for large-scale drift incidents is laudable. But for most Valley residents it is "routine" drift, day-in and day-out, that poses a greater health threat.

• DPR should act promptly to clear the backlog of more than 100 pesticides, including chlorpyrifos, currently listed as candidates for designation as Toxic Air Contaminants. Once pesticides are classified as TACs, DPR must follow state law and provide the public with an extra margin of protection from exposure to those chemicals. Again, DPR's recent improved commitment to the TAC process is a good sign, but not if the TAC listing continues to mean nothing.

Production agriculture is California's largest industry, and its toxic pollution should be regulated as tightly as that of oil refineries and chemical plants.

• Authority to regulate and control emissions of pesticides listed as TACs should be transferred from DPR to the state Air Resources Board (ARB), a global leader in setting air pollution regulations to protect public health and an agency with much more expertise in monitoring and risk assessment. The ARB, which already conducts pesticide air monitoring for DPR, currently has authority over all other forms of air pollution. Californians living in areas of heavy pesticide air pollution should not be denied the same protections ARB's regulations provide from industrial sources. Agriculture is California's largest industry, and its toxic pollution should be treated no differently than that of other industrial sectors.

• The alarmingly high level of chlorpyrifos detected by our samples shows the clear inadequacy of EPA's "ban" on the pesticide. Under EPA's agreement with the manufacturer, Dow Chemical, chlorpyrifos – better known by the brand names Lorsban and Dursban – may remain on retail shelves for home use until the end of 2002. Chlorpyrifos then may continue to be used in commercial applications on most crops, exposing farm families and their neighbors to a chemical whose health effects range from headaches, nausea and diarrhea to anxiety, fatigue and decreased learning capacity. All uses of chlorpyrifos should be banned immediately.

All in a Day's Drift

On Nov. 13, 1999, nearly 180 residents of Earlimart, a small town in southern Tulare County, were evacuated from their homes after an application of metam sodium, a neurotoxic fumigant gas, drifted from a 75-acre potato field half a mile from their neighborhood. At least 46 people sought emergency medical treatment for nausea, vomiting, headaches, burning eyes and shortness of breath, and a year later, more than two dozen residents who were exposed continue to experience health problems.

The Department of Pesticide Regulation investigated and fined the applicator $150,000, in the largest settlement of a drift case in the state's history, and Tulare County banned applications of the fumigant within a mile of schools and homes. A year later, 28 Earlimart residents filed a class-action lawsuit in federal court against the pesticide applicator and two landowners. Their attorney said the state's negotiated settlement, which included money for ongoing medical treatment, "doesn't come close" to compensating the victims for a lifetime of respiratory illness and the possibility of contracting cancer. (Ramirez 2000.)

For the millions of Californians who live, work or attend school near heavy pesticide use, the daily, routine drift of toxic farm chemicals poses a greater health threat than the big drift accidents that make headlines.

In announcing the fine, DPR said the applicator "failed to take appropriate safeguards to prevent the fumes from drifting." (DPR 2000.) But according to the Tulare County Agricultural Commissioner's office, which issued the permit for use of the pesticide, the application was for the most part by the book: "The scary thing is the rules and regulations are supposed to prevent something like this," said a deputy agricultural commissioner, "and it looks like they didn't." (Maxwell 1999.)

Indeed, air monitoring and drift studies by DPR and independent scientists confirm that even when rules and regulations are followed, airborne pesticides routinely drift miles beyond the site of application. In 1995, the United States Geological Survey released a report that documented the drift of every major class of pesticides and the subsequent deposition of these chemicals in rain and fog. Most of the rain and fog samples collected in California tested positive for a number of pesticides. (Majewski 1995.) It is this "normal" drift, not the relatively infrequent and isolated accidents like Earlimart, that poses a day-in, day-out health threat to the millions of Californians who live, work or attend school near sites of heavy pesticide use.

The best estimates of the rate of drift of pesticides have been done by the EPA and its Canadian counterpart. A 1993 EPA computer modeling project found that for just 11 of the most commonly used pesticides, nationwide over 35 million pounds of active ingredients drift or evaporate off-site each year. A more recent Environment Canada study estimated total North American drift

Table 2. Pesticide use in Fresno, Kern and Tulare counties causes more than 15 million pounds of air pollution a year. (All data in millions of pounds)

County	1999 Pesticide Use	Estimated Pesticide Drift	VOCs from Pesticides	VOCs from Industrial Sources*	All Other Industrial Air Pollution*
Fresno	37.0	1.8 - 7.4	6.8	3.2	15.1
Kern	24.2	1.2 – 4.8	6.1	1.7	27.9
Tulare	16.7	0.8 – 3.3	2.7	0.8	4.5
Total	**77.9**	**3.8 – 15.5**	**15.6**	**5.7**	**47.5**

SOURCE: EWG, from DPR 1998 pesticide use data and ARB 2000 emissions estimates.
*Excluding petroleum production and refining.

of active ingredients from 10 commonly used pesticides at nearly 28 million pounds a year. The author of the EPA study estimated that an average of 5 to 20 percent of the active ingredients of a given pesticide will drift from the field. (Benjey 1993, Scholtz 1997.)

Applying these rates to the known amount of pesticide applied in Fresno, Kern and Tulare counties yields a total of 3.8 million to 15.5 million pounds of pesticide air pollution a year in the three-county region. And this may be in addition to the estimated 15.6 million pounds of air pollution generated as VOCs by pesticide application in the three counties. (Because some pesticides, including chlorpyrifos, are so volatile they are considered VOCs on their own, there is some overlap between the amount of pesticide drift and pesticide VOCs.) By comparison, according to the ARB, all other industrial processes (excluding petroleum production and refining) emit an estimated 47.5 million pounds of air pollution a year in the three counties. (Table 2.)

Pesticides drifting from Central Valley fields to lakes in Yosemite and the Sierra are believed to be the cause of dramatic population declines of rare native frog species.

Of the pesticides EWG detected, the state has conducted its own drift studies for chlorpyrifos. In 1996, the ARB detected chlorpyrifos in 74 percent of air samples taken near orange groves in Tulare County. ARB also sampled the air in urban areas well away from the groves and found chlorpyrifos in 24 percent of the samples. Private monitoring studies have found trifluralin and chlorpyrifos in Siberian fog, hundreds of miles from the nearest possible use, and carbaryl in the air more than two miles from Vermont apple orchards.

More alarming findings indicating the consequences of drift come from a recent report by a federal task force investigating the decline in the population of California frogs. Scientists from the U.S. Geological Survey and Department of Agriculture reported in December 2000 that chlorpyrifos and other pesticides drifting from Central Valley fields to Sierra Nevada lakes, including those in Yosemite National Park, are the most likely cause of dramatic population declines of several rare frog species over the last 10 to 15 years.

The scientists found chlorpyrifos and diazinon – another organophosphate pesticide just banned for home use beginning in 2003 – in 86 percent of frogs in and around Lake Tahoe. The pesticides were found in over half of frogs caught in Yosemite. By contrast, only 9 percent of frogs in the Coast Range, which lies east of the Central Valley, opposite the direction of prevailing winds, carried chlorpyrifos or diazinon in their bodies. (Kreiger 2000.)

Did EWG happen to sample on days of unusually heavy pesticide use near the four locations? Not according to DPR's pesticide use database, which shows that in 1998 more than 1.4 million pounds of pesticides were applied within a three-mile radius of the sites. The database also shows that in 1998, there were more than 18,400 applications of different pesticides within three miles of the sites, and that applications occurred within three miles on an average of 227 days that year. (Table 3.)

Table 3. Pesticide use within 3 miles of air sampling locations.

Location	Annual pesticide use in pounds	Annual applications of all pesticides	Days/year with applications
Fresno	21,886	573	145
Dinuba	624,657	12,484	336
Earlimart	568,182	4,284	283
Bakersfield	250,659	1,096	145
Total or average	**1,465,384**	**18,437**	**227**

SOURCE: EWG, from DPR 1998 pesticide use data.

Pesticide Use Near Schools

More than 22,000 children in three San Joaquin Valley counties attend school near fields where at least 10,000 pounds of toxic pesticides are applied annually.

The heavy use of toxic pesticides in the three counties is not confined to isolated rural areas where residents are less likely to be exposed. Particularly vulnerable are children who attend schools near the heavy use of toxic pesticides.

More than 22,000 children in Fresno, Kern and Tulare counties attend 39 public schools located within 1.5 miles of sites where at least 10,000 pounds of pesticides (excluding chemicals allowed in organic farming) were applied in 1998. More than 73 percent of the children who attend schools with the highest potential for exposure are non-Anglo, compared to 64.5 percent of all students in the three counties. (Table 4.)

Use near schools was heaviest in Fresno County, where about 94,000 children attend 161 schools within 1.5 miles of applications of 639,000 pounds of toxic pesticides. More than 78,000 children attend 129 Tulare County schools within 1.5 miles of 637,000 pounds of use, and almost 60,000 attend 80 Kern County schools near 577,000 pounds of toxic chemical use. (A complete list of pesticide use near schools in the three counties is available at www.ewg.org/california.)

Table 4. Schools in Fresno, Kern and Tulare counties located within 1.5 miles of at least 10,000 pounds of toxic pesticide use in 1998.

School	City	Enrollment	Non-Anglo enrollment	Lbs. of toxic pesticides used within 1.5 miles
Vineland Elementary	Bakersfield	532	94.7%	85,953
General Shafter Elem.	Bakersfield	224	58.0%	80,223
Sunset Elementary	Bakersfield	356	96.1%	55,705
Mountain View Elem.	Lamont	823	93.0%	41,660
Grand View Elementary	Dinuba	202	75.2%	33,993
Lone Star Elementary	Fresno	341	72.7%	31,962
Clay Elementary	Kingsburg	218	30.3%	26,863
Monson-Sultana Elem.	Sultana	416	77.6%	25,420
Great Western Elem.	Reedly	490	59.8%	25,268
Lamont Elementary	Lamont	664	92.8%	22,102
Myrtle Elementary	Lamont	554	92.8%	22,102
Alicante Avenue Elem.	Lamont	647	94.1%	22,102
Nueva Continuation High	Lamont	134	83.7%	21,340
Lincoln Elementary	Lindsay	765	86.7%	20,277
Lakeside Elementary	Bakersfield	475	36.8%	19,807
Outside Creek Elem.	Visalia	136	41.2%	19,067
El Monte Elementary	Orosi	958	97.3%	17,236
Woodlake Valley Middle	Woodlake	543	85.1%	17,061
Woodlake High	Woodlake	700	77.0%	16,521
Alta Sierra Intermediate	Clovis	1,695	33.1%	16,349
Conejo Middle	Selma	190	72.6%	15,354
Bravo Lake High	Woodlake	29	89.7%	14,782
Cutler Elementary	Cutler	849	97.8%	14,310
Wilson Elementary	Dinuba	672	94.0%	14,063
Firebaugh High	Firebaugh	593	80.7%	14,027
Yettem Continuation	Yettem	25	N/A	13,350
Orosi High	Orosi	836	95.2%	13,350
Lovell HIgh	Cutler	70	98.6%	13,350
Storey Elementary	Fresno	1,021	97.0%	12,956
Esperanza High	Cutler	56	80.4%	12,491
Orange Center Elem.	Fresno	379	93.1%	12,193
Ridgeview High	Bakersfield	2,252	48.1%	12,188
Bear Mountain Elem.	Arvin	875	91.9%	12,037
Norris Middle	Bakersfield	508	11.0%	11,630
Westside Elementary	Five Points	364	98.4%	11,569
Garvey Junior High	Lindsay	578	86.9%	11,125
Reyburn Intermediate	Clovis	1,173	48.0%	10,897
Navelencia Middle	Reedley	436	60.8%	10,754
Maple Elementary	Shafter	224	33.0%	10,255
TOTAL		**22,002**	**73.1%**	**861,692**

SOURCE: EWG, from DPR 1998 PUR & Dept. of Education 1998 demographic data.
For schools that were not open in 1998, current demographic data are used.

Monitoring Findings

The three detected pesticides comprise two of the three major classes of insecticides. An organophosphate and a carbamate were detected in both Fresno and Tulare counties.

Organophosphates

Chlorpyrifos is an organophosphate (OP), a class of neurotoxic insect poisons for which the observable symptoms of exposure include nausea, vomiting, blurred vision, convulsions and irregular heartbeat. Exposure to OPs can produce long term damage to the nervous system, even in the absence of observable signs of toxicity. Animal studies, as well as evidence from human poisonings, show that fetuses, infants and children are often more susceptible to OP toxicity than adults. Because organophosphates are widely used on many different food crops, they are the first group of chemicals to be regulated under the Food Quality Protection Act (FQPA), a landmark 1996 federal law that strengthened food safety standards to protect children from harmful exposure to pesticides.

The EPA found that hundreds of children are being poisoned by chlorpyrifos exposure each year, suffering effects from headaches, nausea and diarrhea to anxiety, fatigue and decreased learning capacity.

In June 2000, the U.S. EPA reached agreement with the manufacturer of chlorpyrifos, Dow Chemical Co., to end over-the-counter sales of chlorpyrifos for home use after 2002. (Dow markets chlorpyrifos for home use under the brand name Dursban; the agricultural formulation is sold as Lorsban.) The EPA found evidence that hundreds of children are being poisoned by exposure to the chemical each year, suffering effects ranging from headaches, nausea and diarrhea to anxiety, fatigue and decreased learning and memory capacity. The EPA-Dow deal permits continued agricultural use of chlorpyrifos on most California crops. It has historically been the most widely used insecticide in both California and the United States, with more than 2 million pounds applied statewide in 1999.

Carbamates

Carbaryl is a carbamate, another class of neurotoxic insecticides. Though they are more acutely toxic than organophosphates, they can be flushed from the human body more quickly, making them less lethal. Known acute health effects of carbamate exposure include headache, dizziness and nausea at low level exposure and numbness, tingling burning sensations, seizures, coma and death at high exposure.

Carbaryl, better known as Sevin, is a widely used carbamate pesticide that is used on agricultural crops, forest land, and home gardens. Carbaryl is a possible human carcinogen and suspected reproductive toxicant. About 380,000 pounds were used in California in 1999.

Dinitroanalines

Trifluralin is a dinitroanaline, which interferes with cell respiration. Little is known about the chemicals as a group, but they are suspect in cataracts, liver and kidney damage. Trifluralin is also a possible human carcinogen. In 1999, over 1.2 million pounds of trifluralin were applied in California.

Risk assessment

No one would want their child playing where our pumps were running. Although the detected levels were in most cases relatively low, a child takes in more than four times as much air per hour as EWG's sampling equipment. Currently state law requires no action on a TAC until annual concentrations exceed a "trigger level." These trigger levels correspond only to a 1-in-1 million cancer risk, and not short-term acute poisonings that may occur. Of the three pesticides observed during our monitoring, none even has a trigger level established.

In consultation with a toxicologist who has been a consultant to the ARB, EWG calculated an acute exposure risk assessment from the monitoring results. After computing the average air concentration for the 8-hour monitoring period, we compared this to a 24-hour acute inhalation reference concentration. Table 5 expresses the exposure of a 1-to-2-year-old child to the detected pesticide levels as a percentage of the EPA's "safe" daily dose. (Table 5.)

Table 5. Acute exposure risks for a 1-2 year-old child at each sampling site. (Pesticide concentrations in micrograms per cubic meter of air.)

Date	Location	Pesticide	Concentration detected in 8-hr. sample	24-hr average concentration*	EPA 'safe' 24-hr. exposure for 1-2 year old	Percent of EPA 'safe' daily dose
7/3	Dinuba	Chlorpyrifos	0.156	0.078	0.17	46%
7/3	Earlimart	Trifluralin	0.708	0.354	1,660	0%
7/10	Dinuba	Chlorpyrifos	0.069	0.035	0.17	21%
7/10	Dinuba	Trifluralin	0.008	0.004	1,660	0%
7/12	Fresno	Chlorpyrifos	14.104	7.052	0.17	4,150%
7/15	Earlimart	Chlorpyrifos	1.254	0.627	0.17	369%
7/24	Dinuba	Chlorpyrifos	0.251	0.126	0.17	74%
7/31	Fresno	Carbaryl	0.069	0.035	50.0	0%

SOURCE: EWG, from July 2000 air sampling and U.S. EPA.
*See Methodology for conversion of 8-hr. samples to 24-hr. average concentration.

To put this another way, imagine a two-year-old playing next to the sampling pump in West Fresno on July 12. If the child weighs 11 kilograms and breathes 6.8 cubic meters of air a day, he or she would have inhaled about 3.8 micrograms of chlorpyrifos in an hour – about 3.6 times the EPA's "safe" daily dose.

On July 15 in Earlimart, that same child would have reached the "safe" daily dose after 3.1 hours of exposure, and on July 24 in Dinuba, after 15.5 hours of exposure. A smaller but still significant concentration of chlorpyrifos was detected in Dinuba on July 10.

Although neither of the other pesticides was detected at levels that exceed the "safe" daily dose, that does not mean they do not pose a long-term health risk. Theoretically, these EPA-defined levels might be safe if there were no other sources of exposure to these pesticides. But we are exposed to multiple pesticides in food and water every day. And many pesticides act similarly in the human body, so that low doses of many different pesticides can be equivalent to a large dose of only one. The dose can only be deemed safe after a cumulative risk assessment, which looks at the combined effects of many different pesticides from many different sources.

Because low doses of multiple pesticides can be as dangerous as a single large dose, exposure levels can only be considered safe after looking at the combined effect of different chemicals from different sources.

Methodology

With the help of Pesticide Watch, a statewide network of grassroots groups concerned about pesticide pollution, and its Fresno affiliate, the Campaign Against Misuse of Pesticides, EWG recruited residents of the three counties to serve as volunteer air samplers. During July 2000, each volunteer proceeded by taking a 8-hour sample once per week during the month employing the same protocols used by DPR and ARB in their monitoring efforts.

The San Joaquin Valley contains a rapidly growing population in close proximity to heavy pesticide usage. Within the valley, the three counties with the highest pesticide use were selected. Each of the four testing locations was located downwind from agricultural fields with heavy pesticide use histories. (As of November 2000, DPR had released the complete 1998 pesticide use database and a summary of pesticide use data for 1999. Where 1999 data was not yet available, as in this case, we relied on the 1998 database.)

At one of the four locations, only three samples were obtained instead of four. The four samples taken in Bakersfield contained no detectable pesticide residues.

Equipment

All 15 air samples were taken using SKC programmable pumps fitted with polyurethane foam (PUF) tubes. This setup, commonly used in occupational exposure studies of workplace pollutants, involves drawing air through the tube lined with an absorbent filter. The pumps were programmed to draw one liter of air per minute for eight continuous hours.

Pesticides or other pollutants in the air were collected by the filters, which were then analyzed by an independent laboratory in Oakland. Pesticides were extracted from the filters using protocols of the National Institute of Occupational Safety and Health and the state Department of Food and Agriculture. By measuring the amount of pesticide collected in the filter against the amount of air drawn through the tube, the lab calculated the average concentration of that pesticide in the air during the monitoring period.

Though PUF tubes are state-of-the-art methodology, only 45 pesticides are detectable. PUF tubes have been verified as reliable for use on pesticides by "spike tests" – deliberately spiking the filters with a known quantity of the chemical, then testing to confirm it. PUF tubes cannot detect many pesticides or fungicides. Therefore, it is possible that our air samples contained more pesticides than the results indicate.

Lack of exact information about the specific pesticides used during the sampling period made laboratory analysis more difficult. Knowing the crop being sprayed provided some clues to lab technicians who are familiar with pesticide use practices across the state. EWG's lab employed specialists trained in pesticide identification, using techniques of analytical chemistry more advanced than the capabilities of most academic labs.

Calculations of Reference Concentrations

For this study, the target assessment has been computed based on an 11.3 kg 1-2 year-old child with a lung capacity of 6.8 m3/day in accordance with the EPA Exposure Factors Handbook. With these basic assumptions, we may calculate a reference concentration (RfC) for the 1-2 year-old child from the acute reference dose (RfC) according to:

RfC (µg/m3/day) = RfD (mg/kg/day) x 1000 (µg/mg) x BW (kg) / IR (m3/day)

In this formula, RfC is the reference concentration for inhalation exposure, RfD is the acute inhalation reference dose for a child, BW is the body weight, and IR is the inhalation rate. Using this formula, we were able to derive the RfCs used in the report.

Calculations of 24-hour Average Concentrations

Raw data from the samples were returned from the lab in micrograms of pesticide per liter of air. Since all of the samples were collected in 8-hour continuous time blocks at 1 liter per minute, we were then able to compute an 8-hour average concentration. This value was then converted to a 24-hour concentration by assuming that the residence time for the pesticides was longer than 8 hours. Conservatively, this assumption translates into a 12-hour persistence at the observed concentration. More simply, we assume that the 24-hour concentration must be at least 50 percent of the sampled value.

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