Parlier Air Monitoring Report

Executive Summary

This report culminates an unprecedented air monitoring project conducted by the Department of Pesticide Regulation (DPR). The project built on the knowledge and experience DPR had gained in more than two decades of conducting dozens of air monitoring studies. However, what came to be known as the Parlier project marked several firsts:

- It was the first time DPR or any other government agency in the U.S. did pesticide air monitoring for 12 months in a single community.
- It was the first project to monitor so many pesticides (40 in all, including pesticide breakdown products). It was also the first project to include community air monitoring conducted jointly by DPR and the Air Resources Board (ARB) for both pesticides and non-pesticide air pollutants like ozone.
- It represented the first time a local advisory group played a key role in helping DPR frame goals, select monitoring sites, and decide other aspects of the project. It was the first time DPR had an open house and community fair before a project began to introduce the project to a city where DPR would be doing a study.
- And it was the first time DPR released its preliminary results and evaluations before monitoring was complete, posting them in a series of interim reports on the Department's Web site and discussing them with the local advisors.

Analysis of hundreds of monitoring samples taken over a full year added substantially to our knowledge of pesticides in air – and not just in Parlier. Parlier, a small rural community in Fresno County, is similar to many Central Valley towns, surrounded by agriculture and the associated use of pesticides. Data from this project can be extrapolated to predict pesticide air concentrations in the many other communities that share similar pesticide use, cropping patterns, geographic and other factors.

The San Joaquin Valley was targeted for this project because, despite significant progress, the Valley continues to be severely impacted by adverse air quality. The region's topography and weather provide ideal conditions for trapping air pollution for long periods, producing harmful pollutants such as ozone and particulate matter. The region also is home to major freeways with heavy traffic moving goods and people from one end of the state to the other. Recent years have also seen the Valley's population grow at a rate 65 percent above the state's average.

Ozone and particulate matter are the two pollutants responsible for most of the Valley's air quality problems and associated health risks. Not surprisingly, however, pesticides also are found in ambient air in communities surrounded by agriculture. In Parlier, DPR monitoring detected many pesticides, the majority at levels well below those expected to cause health effects. None were unique to Parlier, but were consistent with what would be expected in other areas of the San Joaquin Valley. No findings warranted immediate regulatory action. Nonetheless, some detections did trigger regulatory concern and further evaluation. DPR is expediting its risk assessments on two chemically related insecticides (diazinon and chlorpyrifos), which were found often and, in one sample, above the health screening level. Detections of the fumigant 1,3-dichloropropene prompted further evaluation as lifetime exposure at the levels detected may pose a potential cancer risk. This prompted DPR to reopen its risk assessment and to examine the adequacy of existing limits on use designed to keep concentrations below levels of health concern.

Air monitoring results in brief:

- *DPR and the ARB monitored over 12 months at Parlier schools.* (See Figure 2, page 10, for map of sampling locations.) *DPR took samples three days a week, the ARB at least once every six days. The San Joaquin Valley Air Pollution Control District conducted its regular air monitoring one mile from Parlier.*
- *Among chemicals monitored, the greatest potential health risk in Parlier was not from substances used as pesticides but from two pollutants found commonly throughout California: acrolein and formaldehyde. Their concentrations were similar to those found in ambient air elsewhere in the state. The most likely source is motor vehicle and industrial emissions.*
- *Of the 35 pesticides the two agencies monitored (plus 5 pesticide breakdown products), 16 were detected (plus 3 breakdown products.) Measured amounts varied, depending on the pesticide. For the most part, levels were comparable to those found in single-pesticide monitoring previously done by DPR and ARB in other agricultural communities.*
- *Another four chemicals were detected that are sometimes used as pesticides. However, there was no reported pesticide use of these compounds in the Parlier area. Levels were comparable to those found statewide and their presence in Parlier – like elsewhere in the state – is most likely the result of auto or industrial emissions.*
- *The pesticide detected most often was MITC, found in 84 percent of the samples. Although levels were well below screening levels, pesticide use records show little use in the surrounding areas, suggesting that the residues may have been from fumigant applications outside the five-mile study boundary area.*
- *The insecticides chlorpyrifos and diazinon were among the pesticides found most often. Amounts found were below health screening levels, with one exception. Detections of these chemically related pesticides posed the highest non-cancer risk among pesticides detected, prompting DPR to focus added resources on ongoing risk assessments for these compounds.*

- *Detections of 1,3-dichloropropene warranted further evaluation. This fumigant is a carcinogen and lifetime exposure at the levels detected may be of health concern.*
- *Of the 15 pesticides monitored but not detected, 10 had no or low use and the remaining 5 had moderate to high use.*
- *A detailed discussion of the air monitoring results, including tables and figures, begins on page 21 of the report. A detailed discussion on the health evaluation of measured air concentrations begins on page 47.*

Why DPR Did This Study

In 2004, the California Environmental Protection Agency (Cal/EPA) released its Environmental Justice Action Plan. *(The Action Plan is posted on Cal/EPA Web site, www.calepa.ca.gov.)* Under the plan, Cal/EPA charged its six boards, departments and offices (BDOs) with developing and conducting pilot projects that "focus on environmental risk factors (including emissions/discharge, exposure, and health risk) that impact children's health." Because rural, agricultural communities may have higher concentrations of pesticides in ambient air compared with their urban counterparts, Cal/EPA asked DPR to postpone its air monitoring network project and instead conduct focused air monitoring for one year in a Central Valley farming community.

The Parlier project was designed to provide more systematic air monitoring for a suite of pesticides over several months, with the resulting data serving as a more robust foundation for assessing exposure, particularly for children.

For these EJ projects, each BDO was asked to collect environmental data beyond their typical regulatory scope. For example, the Parlier project collected not only pesticide data but also data on criteria air pollutants (such as ozone and particulate matter) as a result of DPR collaboration with the ARB and the San Joaquin Valley Air Pollution Control District. *(For the results of the ARB and District air monitoring, see page 36 of the report.)*

With their environmental justice (EJ) orientation, the Action Plan projects also emphasized public participation. A key element was inclusion of local advisory groups (LAGs) to provide recommendations and input on how each project should be carried out. The BDOs were also strongly encouraged to use the Internet to widen opportunities for public participation.

Each EJ project included elements to support Cal/EPA efforts to develop definitions of and guidance for cumulative impacts assessment and precautionary approaches. (Note: Those elements are only tangentially addressed in this report, which focuses on the collection, analysis, and scientific evaluation of air monitoring data.)

The Parlier study also met DPR's mandate for "continuous evaluation." Under California law, DPR is required to "eliminate from use" any pesticide 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 measures are 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.

To develop effective measures to reduce potentially unsafe pesticide levels in air, regulators must first find out what those levels are and how they relate to possible health effects. Past air monitoring by DPR and ARB provided limited data to estimate human exposure as these earlier studies focused on short-term monitoring for a single chemical in each study. *(For information on other air studies, see Appendix 14.)* To generate better data on long-term exposures, in the early part of this decade DPR began planning a network to sample ambient air for multiple pesticides in several communities over several years. The data would help DPR scientists evaluate exposure and resulting risk to health (risk assessment), develop measures to reduce risk (risk management), and determine the effectiveness of existing use restrictions.

Objectives, Scope and Methodology

The Parlier project differed from previous air monitoring projects in that before work began, DPR sought extensive public comment on project priorities and in selecting a community for monitoring. DPR evaluated 83 Central Valley communities on several demographic factors (for example, number of children and nonwhite population), and for the relative use of pesticides the project was to monitor. DPR also considered air sampling feasibility, weather patterns, monitoring stations for other air pollutants,

Project objectives added by the Parlier Local Advisory Group

In the draft project protocol, DPR scientists proposed three project objectives, the focus of this report: to find out if residents were exposed to pesticides in air and, if so, which pesticides, what amounts, and did those levels pose a health threat. At its first meeting June 9, 2005, the Parlier Local Advisory Group (LAG) added these four objectives:

Inform the community of the project. DPR sponsored a community forum in Parlier in January 2006 to tell residents about the air monitoring pilot project. To encourage greater attendance, DPR invited representatives of more than two dozen local and regional government agencies to staff booths focused on jobs, education, public safety, and community health. The event was held on a Saturday to make it easier for working people to attend, and more than 300 people did so.

DPR also held eight public meetings with the LAG from 2005 through 2007. Agendas and minutes were translated into Spanish, as were report summaries issued on monitoring results. Agendas, minutes and project reports were posted on DPR's Web site. DPR staff also made presentations at Parlier monitored schools, discussing the study and other monitoring the Department conducts.

Reduce pesticide risk. As part of its Parlier project, DPR scientists conducted a pest management assessment in the area to help develop, evaluate and promote lower-risk alternatives for Parlier's major crops–grapes, stone fruit and citrus. The assessment is posted on DPR's Web site. Among other things, DPR is using the information to help develop new pest management initiatives. DPR has also funded the use is innovative application equipment that reduces pesticide use and has funded research on alternatives to highly toxic

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availability of data on pesticides in groundwater, and the potential for collaboration with organizations planning complementary or related studies. *(See Appendix B of the report for more information on development of the project protocol.)*

After three rounds of public comment (including an October 2004 workshop in Fresno), DPR completed its draft project protocol in early 2005, subject to further revisions from technical and community advisory groups to be formed when the project began.

In the draft protocol, DPR outlined its project objectives: to find out if residents were exposed to pesticides in air and, if so, which pesticides, what amounts, and did those levels pose a health threat. This report focuses on these scientific issues. The project's local advisory group later added four objectives. *See sidebar below for how DPR met those goals.*

As the project location, DPR chose Parlier because it ranked high in EJ and other factors and in collaborative opportunities. Parlier, about one-square-mile in area, is about 20 miles southeast of Fresno. Of the 11,088 people living in Parlier in the year 2000, about 38 percent were younger than 18 years old and 97 percent were Hispanic. Like scores of other Central Valley farm towns, Parlier is surrounded by agriculture. Major crops in the area are grapes and tree fruit. More than 200 chemicals are used for agricultural production in the study area, that is, within five

Project objectives added by the Parlier Local Advisory Group *(continued)*

pesticides. The idea is to help participating pest managers improve their operations while reducing human and environmental exposure to pesticides. Pest management initiatives carried out by DPR include projects in walnuts, wine grapes, almonds, stone fruit, citrus, and the containerized nursery industry, and for IPM in schools.

Conduct follow-up actions *(for example regulatory actions or education)*. The Parlier air monitoring data prompted DPR to expedite risk assessments on chlorpyrifos and diazinon, and to reopen its risk assessment on the fumigant, 1,3-dichloropropene. DPR is also reexamining permitted uses and restrictions on this fumigant.

Put risk in perspective, *that is, to the extent feasible, put pesticide risk in perspective compared with other pollutants*. The insecticides chlorpyrifos and diazinon accounted for most of the relative non-cancer health risk of pesticides detected. However, the air concentrations of acrolein and formaldehyde were often well above screening levels, posing a health risk higher than any of the pesticides detected in Parlier.

DPR is collaborating with Cal/EPA's Office of Environmental Health Hazard Assessment to consider various approaches for evaluating cumulative health impacts of environmental chemicals. When this guidance is developed, the Parlier and other monitoring data can be reevaluated. It is expected that acrolein and formaldehyde would dominate any consideration of non-cancer chronic risk from multiple chemical exposures in Parlier. These two compounds are sometimes used as pesticides but their presence in Parlier is from vehicle and industrial emissions. Concentrations were similar to those found in ambient air throughout the San Joaquin Valley and elsewhere in the state.

miles of Parlier, with more than two million pounds used yearly. Insecticides and fungicides are the most heavily used pesticides in the area. *(See map of study area boundaries, Figure 1, page 9 of the report.)*

DPR formed a technical advisory group (TAG) to provide informal peer review on technical and scientific elements of the project. It included representatives from government agencies, universities, and commodity groups. The TAG evaluated the monitoring plan to ensure that appropriate pesticides were included, that the monitoring sites represented locations of relatively high exposure in Parlier, and that the number and frequency of sampling were enough to determine exposures. They also reviewed the health screening levels and methods used to estimate risk from individual as well as multiple contaminants. The TAG held seven meetings between June 2005 and May 2007. In 2009, members reviewed and commented on a draft of this report. *(Minutes of the TAG meetings are posted on DPR's Web site, www.cdpr.ca.gov.)*

To ensure public participation, DPR also set up a local advisory group (LAG). DPR invited applications for LAG membership from the Parlier community and regional environmental justice (EJ) organizations. In May 2005, DPR named 18 people to the group, including EJ and farmworker representatives, members of local government, and Parlier-area farmers and business owners.

The LAG met eight times between 2005 and 2007. (Members also reviewed and commented on a draft of this report). Although not a decision-making group, the LAG had significant impact on how DPR conducted the project. The LAG helped DPR select pesticides to monitor, sampling sites, and monitoring frequency. The LAG approved delaying the start of monitoring until January 2006 so DPR could spread the costs of the project over two fiscal years, allowing monitoring to be done more often and at more sites. *(Agendas and minutes of the LAG meetings minutes are posted on DPR's Web site, www.cdpr.ca.gov.)*

In consultation with the LAG, three Parlier elementary schools were chosen as sampling locations, with samples taken three days a week. The ARB monitored at a single Parlier school, at least once every six days. *(See map of sampling locations, Figure 2, page 20.)*

DPR initially proposed to monitor from 21 to 27 pesticides, selected based on statewide use, volatility, and DPR risk assessment priority. Other considerations included their extent of use in the area, whether the compounds could be included in a multi-pesticide method, and resources for sample collection and analysis. In addition, DPR proposed to the LAG that either chloropicrin or MITC be monitored because neither could be detected on the multi-pesticide screen; the LAG chose MITC.

When the ARB became a full partner in the project and agreed to monitor for a full range of criteria air pollutants, this expanded the number of pesticides that could be monitored. Metals used as pesticides (copper and sulfur) were added to the project, and ARB's volatile organic compound monitoring picked up the fumigants methyl bromide and 1,3-dichloropropene.

As a result, the project sampled for 35 pesticides, plus 5 pesticide breakdown products. *(See Table 1, page 4, for a list of pesticides monitored, and Table 3, page 6, for their chemical class, intended use, and trade names.)* Twenty of the 35 pesticides that DPR and the ARB monitored were among the top 100 used within five miles of Parlier in 2003. The remaining pesticides were included in the multi-pesticide monitoring method because they could be added without extra cost. Many have high use in other areas of the state where DPR will use the method in its planned air monitoring network.

DPR took samples at three schools on 156 days over the 12-month project, collecting a total of 468 samples that were analyzed for 33 pesticides and breakdown products. Another 468 taken on the same days and sites were analyzed for the fumigant pesticide MITC. *(Tables 12 and 13, page 34, show the pesticide detections by location, and the number of detections of each pesticide at each DPR monitoring site.)*

Working from one Parlier school, the ARB analyzed 71 samples for VOCs and 64 samples for metals and elements. The SJVAPCD collected continuous samples for the criteria pollutants, nitrogen dioxide, and ozone at its monitoring station just southeast of Parlier.

In addition, DPR conducted limited groundwater monitoring in Parlier for currently registered pesticides which are known groundwater contaminants. *(See page 42 for more information.)*

DPR toxicologists evaluated the data on a continuing basis, as air monitoring samples were analyzed throughout 2006. To do this, scientists relied on "health screening levels" developed by DPR in collaboration with technical experts from other agencies. Screening levels were set for each pesticide, and for various lengths of exposure – short-term or acute exposure; intermediate-term (subchronic) exposure; and chronic exposures of a year or more. (Screening levels were not developed for carcinogens. DPR toxicologists evaluated community exposure to potential carcinogens after monitoring was complete.)

Health-protective screening levels were necessary because there are no federal or state standards for pesticides in air, that is, no enforceable health-based limits on pesticide emissions allowed in air. The screening levels were designed to point out potential concerns for non-cancer health effects. Although they are not regulatory standards, these screening levels are useful for preliminary evaluations of air monitoring data. Detections below the screening level for a given pesticide would not be considered to represent a significant health concern and generally would not undergo further evaluation, but neither should such detections automatically be considered "safe." They could still undergo further evaluation. Detections above the screening level would not necessarily signal a significant health concern but would point out the need for a more refined evaluation. Detections that were significantly greater than the screening levels could be of health concern; such detections would suggest the need to explore use restrictions or other risk reduction measures. *(See page 17 for discussion of how health evaluation methods were developed. Further discussion of health screening level development is in Appendix F; Table 6, page 20, lists the screening levels for each pesticide monitored.)*

After monitoring was complete, DPR scientists conducted an in-depth assessment of the data to determine the exposure and health risk from both individual as well as multiple pesticides. Potential risks from short-, intermediate-, and long-term exposures (including potential cancer risk) were calculated. *(An in-depth discussion of the results of the health evaluation of measured air concentrations begins on page 47.)*

DPR also compared the data with its air monitoring results from other areas, and analyzed correlations with pesticide use and weather monitoring data. *(Comparisons with air monitoring from other areas is in Appendix H. Table 11, page 32, presents the percent of samples with detectable pesticide concentrations and their reported use in the study area. A discussion of pesticide use in the area, including use of monitored pesticides, begins on page 58. Weather data is discussed beginning on page 43.)*

Conclusions

In mid-2005, in a presentation to a Cal/EPA advisory committee on environmental justice, DPR scientists outlined four deliverables the Department expected from the Parlier project:

- More robust exposure assessment data.
- Indicators for future air monitoring projects.
- Indicators for areas for future investigation.
- Data that can be used to develop risk reduction measures that may be needed.

The Department is pleased to report that the project achieved these scientific goals, along with those set by the advisory committee, and other objectives that were not imagined at the time. *(Further discussion on conclusions begins on page 77 of the report.)* Through this project, DPR gained valuable knowledge about, and experience in, conducting ambient air monitoring in a community.

Several years before the Parlier project, DPR began planning for a network of monitoring stations that would sample for pesticides residues over several years. The Parlier project now provides a foundation and springboard for this network, which DPR plans to set up in 2010. DPR's work in Parlier served to test and perfect sampling protocols, develop health screening levels, improve and expand laboratory analytical methodology, and fine-tune approaches to data analysis.

The Department also added to its knowledge of and experience in conducting projects that depend on input and assistance from the community. As resources permit, DPR plans to use this knowledge and experience to create an ambient air monitoring network to monitor several types of communities to determine what pesticide exposures, if any, occur in different situations.

Department of Pesticide Regulation
1001 I Street, P.O. Box 4015, Sacramento, CA 95812
www.cdpr.ca.gov
916.445.4300