

**SUMMARY OF RESULTS FROM THE  
CALIFORNIA PESTICIDE ILLNESS  
SURVEILLANCE PROGRAM  
- 2007 -**

**HS-1876**

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Department of Pesticide Regulation  
Worker Health and Safety Branch  
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Executive Summary:

This report describes illnesses identified by the Pesticide Illness Surveillance Program (PISP) of the California Department of Pesticide Regulation (DPR) during 2007. With this release, DPR announces the availability of an Internet query program that allows people to supplement the information in this report by retrieving data to their own specifications. The California Pesticide Illness Query (CalPIQ) is available at <http://apps.cdpr.ca.gov/calpiq>, and can supply either individual case descriptions or data summaries.

DPR assigned 1,479 cases for investigation in 2007, which returns the program to a level typical of recent years after a dip in 2006 partially attributable to absence of reports from the California Poison Control System (CPCS) during most of the year. CPCS had previously offered this service through a federally supported pilot program that lapsed at the end of 2002. CPCS assistance resumed in October 2006, under a new contract funded by DPR. Of the 1,479 cases investigated in 2007, 538 were reported through CPCS. Scientists concluded that pesticide exposure had been at least a possible contributing factor to 982 (66%) of the 1,479 cases investigated. Agriculture was the source of pesticide exposure in 318 of the 982 cases.

DPR expanded pesticide safety outreach efforts in 2007. The DPR outreach program disseminated pesticide safety information at health and service oriented events attended by thousands of low-income Spanish speakers, and has publicized safety principles in interviews on Spanish-language radio and television. To help direct pesticide-related complaints to County Agricultural Commissioners more quickly, DPR continues to maintain a statewide toll free phone number (1-87-PestLine). DPR scientists also remain active in the Border 2012 project, helping to coordinate border-area focus groups and plan for international cooperation in illness surveillance.

A list of acronyms is provided as an appendix to this report.

## **Background on the Reporting System**

The California pesticide safety program, which the Department of Pesticide Regulation (DPR) administers, is widely regarded as the most stringent in the nation. Mandatory reporting of pesticide<sup>1</sup> illnesses has been part of this comprehensive program since 1971. Reports are collected, evaluated, and analyzed by the Pesticide Illness Surveillance Program (PISP). PISP is the oldest and largest program of its kind in the nation, and provides data to regulators, advocates, industry, and individual citizens.

The U.S. Environmental Protection Agency (U.S. EPA) and the National Institute for Occupational Safety and Health (NIOSH) have encouraged other states to develop programs similar to PISP. Through the NIOSH Sentinel Event Notification System for Occupational Risk (SENSOR), federal grants partially support programs in the states of Iowa, Michigan, New York, Texas, and Washington. SENSOR also provides technical assistance to the states of Arizona, Florida, Louisiana, New Mexico, North Carolina, and Oregon. In addition, it supports pesticide-related work by the Occupational Health Branch of the California Department of Public Health (CDPH), which coordinates with DPR's Worker Health & Safety (WHS) Branch. U.S. EPA continues to rely heavily on California data for evidence of pesticide adverse effects because of the large size and long historical perspective of the database.

DPR scientists participate in the national working group on pesticide illness surveillance that NIOSH convened to develop standards for information collection. In 1998, DPR expanded the PISP database and incorporated several features from the NIOSH standards. These upgrades have been applied to all data collected from 1992 through the present. Data earlier than 1992 have not been revised to incorporate the 1998 database upgrades, and will be presented only when historical perspective is important.

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<sup>1</sup> "Pesticide" is used to describe many substances that control pests. Pests may be insects, fungi, weeds, rodents, nematodes, algae, viruses, or bacteria -- almost any living organisms that cause damage or economic loss, or transmit or produce disease. Therefore, pesticides include herbicides, fungicides, insecticides, rodenticides, and disinfectants, as well as insect growth regulators. In California, adjuvants are also subject to the regulations that control pesticides. Adjuvants are substances added to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, and wetting and dispersing agents.

Excessive exposure to pesticides may cause illness by various mechanisms, and the surveillance program attempts to monitor all of them. Every pesticide active ingredient has a mechanism of action by which it controls its target pests. Pesticide products may have other potentially harmful properties in addition to the qualities intended to control pests. PISP collects information on any adverse effects from any component of pesticide products, including the active ingredients, inert ingredients, impurities, and breakdown products. DPR has a mission to mitigate any pesticide exposure that compromises health or safety. This responsibility applies to health effects from products that act as irritants or as allergens, through their smells or by causing fires or explosions, as well as to classical toxic effects.

### **Sources of Illness Information**

Under a statute enacted in 1971 and amended in 1977 (now codified as Health and Safety Code section 105200), California physicians are required to report any suspected case of pesticide-related illness or injury (whether it occurred on a farm, in a home, or in any other situation) by telephone to the local health officer within 24 hours of examining the patient. Each California county has a health officer with broad responsibility for safeguarding public health, and a few cities have chosen to have their own health officers. These officials may investigate pesticide incidents to whatever extent they find useful. The law only requires them to inform the county agricultural commissioner (CAC), to complete a pesticide illness report (PIR), and to send copies of the PIR to the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Industrial Relations (DIR), and DPR.

DPR strives to ensure that the PISP captures the majority of significant illness incidents and records them in its database. To identify pesticide cases that may go unreported by doctors, DPR has negotiated a memorandum of understanding with DIR and the CDPH, under which scientists review copies of the Doctor's First Report of Occupational Illness and Injury (DFROII), documents that the California Labor Code requires workers' compensation claims payers to forward to DIR. Scientists select for investigation any DFROII that mentions a pesticide, or pesticides in general, as a possible cause of injury. Reports that mention unspecified chemicals

are also investigated if the setting is one in which pesticide use is likely. From 1983 through 1998, DFROII review identified the majority of the cases investigated.

From 1999 through 2002, the California Poison Control System (CPCS) facilitated pesticide illness reporting. Funds from U.S. EPA supported development of an enhanced system of poison control facilitation, which operated from mid-2001 through November 2002. Cooperation with CPCS identified hundreds of symptomatic exposures that otherwise would have escaped detection, but the 2002 state budget crisis prevented continuation of the contract after federal funding ended. Improved financial status allowed DPR to renew its contract with CPCS in 2006. Poison control facilitation of illness reporting resumed in October 2006. DPR also continues to cooperate with OEHHA in efforts to provide the public and the health care community with information on pesticide safety and public health surveillance.

The agricultural commissioners of the counties where exposures occurred investigate all identified incidents, whether or not they involve agriculture. They attempt to locate and interview all the people with knowledge of the pesticide exposure event, and also review relevant records. Their investigations identify how exposure occurred, characterize the subsequent illnesses, and determine whether pesticide users complied fully with safety requirements. DPR provides instructions, training and technical support for investigations. These instructions include directions for when and how to collect samples of foliage, clothing, or surface residues to document environmental exposures. As part of the technical support, DPR contracts with a California Department of Food and Agriculture laboratory to analyze the samples.

The CACs prepare reports describing the circumstances in which pesticide exposure may have occurred and any other relevant aspects of the case. When appropriate, they request authorization from the affected people to include relevant portions of their medical records with the report. Medical record authorizations comply with the federal Health Insurance Portability and Accountability Act (HIPAA) and include commitments to maintain confidentiality in accordance with the California Information Practices Act. When investigations identify affected people not previously reported by other mechanisms, those people are identified in the investigation report and recorded in the PISP database. DPR scientists evaluate the physicians' reports and all the

information the CACs have gathered. They then classify incidents according to the circumstances of pesticide exposure.

DPR evaluators undertake a complex evaluation of medical records and investigation reports to assess the likelihood that pesticide exposure caused the incident. Standards for the determination are described in the PISP program brochure, “Preventing Pesticide Illness,” which can be viewed or downloaded from the DPR Web site at <http://www.cdpr.ca.gov/docs/whs/pisp/brochure.pdf>.

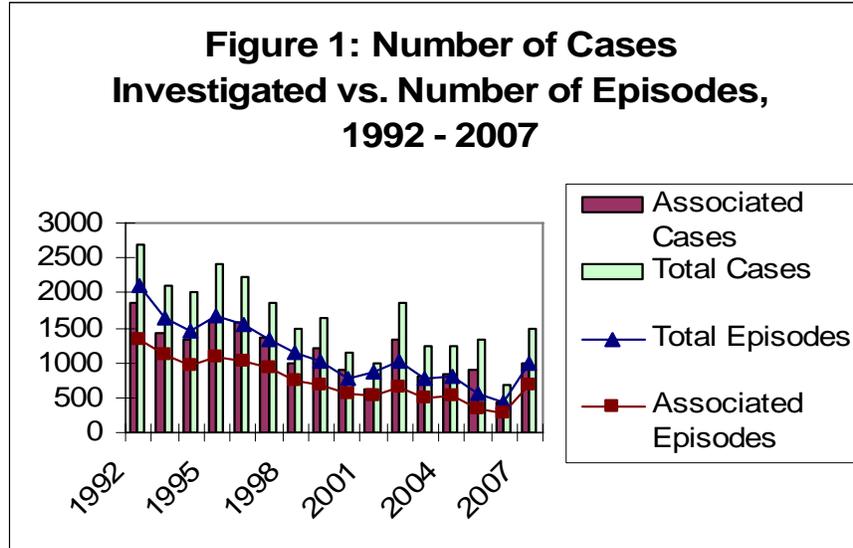
### **Purpose of Pesticide Illness Surveillance**

DPR maintains its surveillance of human health effects of pesticide exposure in order to evaluate the circumstances of pesticide exposures that result in illness. DPR scientists regularly consult the PISP database to evaluate the effectiveness of the DPR pesticide safety regulatory programs and assess any need for changes. In high-risk situations, DPR may implement additional California restrictions on pesticide use. For example, taking illness data into consideration, DPR may adjust the restricted entry interval following pesticide application, specify buffer zones or other application conditions, or require pesticide handlers to use protective equipment that meets certain standards. In some instances, changes to pesticide labels provide the most appropriate mitigation measures. Since the U.S. EPA has exclusive authority to require label changes, DPR cooperates with U.S. EPA to develop appropriate instructions for users throughout the country. If an illness incident results from illegal practices, state and county enforcement staff take appropriate action to deter future incidents.

During 2007, WHS finalized a review of PISP data on illnesses attributed to exposure to agricultural pesticides that release methyl isothiocyanate (Akanda, 2007) and incorporated illness data into a finalized exposure assessment for methidathion (Beauvais, 2007). WHS also investigated a report of cholinesterase inhibition among employees of an agricultural pest control business (Fong, 2007), and identified several potential sources of exposure. The most heavily contaminated source proved to be the symptomatic employee’s own leather boots, which may have acted as a reservoir for the organophosphate insecticide chlorpyrifos.

### 2007 Numeric Results – Totals

In 2007, DPR and CACs investigated 1479 cases (see Figure 1). This is more than double the 681 investigated in 2006, and a return to levels typical of recent years.



A case is the Pesticide Illness Surveillance Program representation of a person whose health problems may relate to pesticide exposure.

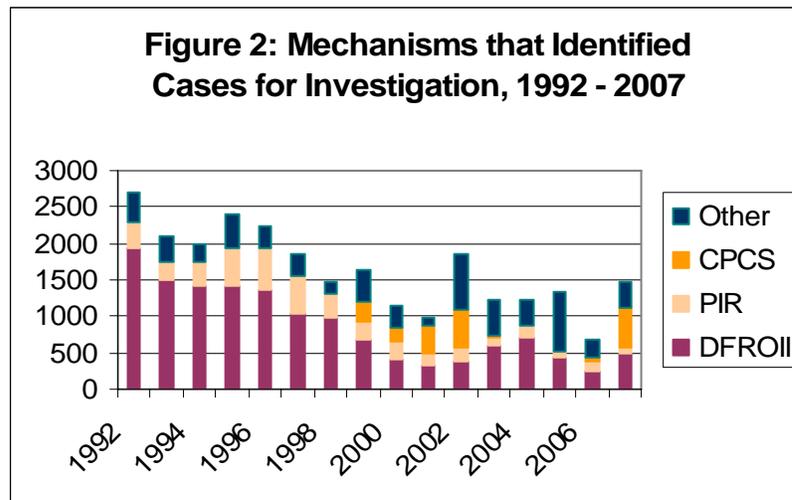
An episode is an event in which a single source appears to have exposed one or more people (cases) to pesticides.

Associated cases are those evaluated as definitely, probably, or possibly related to pesticide exposure. A definite relationship indicates that both physical and medical evidence document exposure and consequent health effects. A probable relationship indicates that limited or circumstantial evidence supports a relationship to pesticide exposure. A possible relationship indicates that evidence neither supports nor contradicts a relationship.

Associated episodes are those in which at least one case was evaluated as associated.

Renewed participation by CPCS, which assisted in the transmission of 538 case reports, provided the majority of the increase in case identification. There were also several significant exposure episodes, described in later segments of this report.

Although the 2007 case count returned to pre-2006 levels, DPR will continue to pursue authorization for access to electronic workers' compensation data. Access to these data would significantly improve the reliability and consistency of information about occupational exposures. DPR also expanded outreach efforts to provide safety information to farm workers and other groups potentially isolated by poverty and/or lack of English fluency.



DFROII – Doctor’s First Report of Occupational Illnesses and Injury (Workers’ Compensation document).

PIR – Pesticide Illness Report (physician reporting in compliance with Health and Safety Code Section 105200).

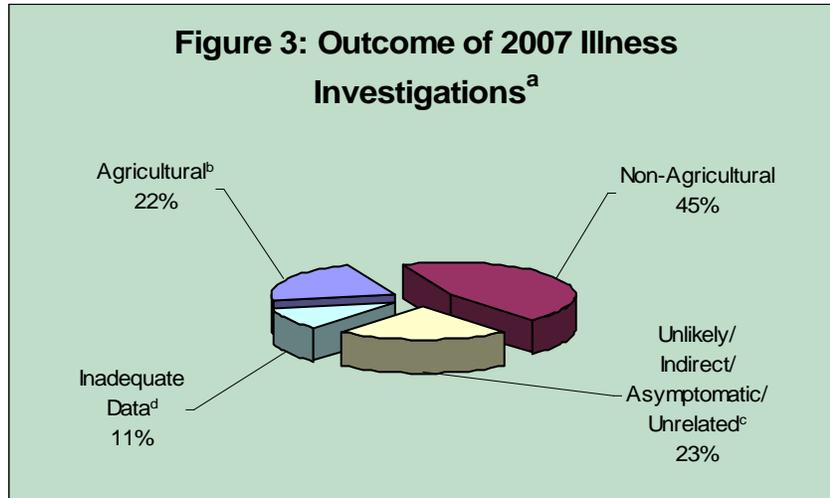
CPCS – California Poison Control System (facilitated physician reporting).

Other – All other methods of case identification, including citizen complaints, contacts by emergency responders, and news reports.

Figure 2 shows that PISP continues to receive a substantial number of reports outside of the standard PIR and DFROII-based pathways. Such episodes may come to the CACs’ attention via emergency response contacts, news reports, or direct citizen complaints. Large drift episodes gave rise to exceptional numbers in this category in 2002 and 2005. In these episodes, relatively few people received medical care; so doctors could report only the minority of cases. When CACs investigated the episodes, they located many additional affected people and informed DPR of their findings.

DPR found that pesticide exposure had been at least a possible contributing factor to 982 (66%) of the 1479 cases investigated. PISP uses the term “pesticide-associated” to refer to cases evaluated as possibly, probably, or definitely related to pesticide exposure. Pesticide-associated cases included 318 (22% of the 1479 investigated) attributed to pesticides used for agricultural purposes (i.e., intended to contribute to production of an agricultural commodity, including livestock). The other 664 associated cases (45% of the 1479 investigated) occurred in non-agricultural circumstances such as structural, sanitation, or home garden use, in the manufacturing process, or during storage. In 337 (23%) of the 1479 cases assigned for

investigation, the weight of evidence was against a pesticide contribution to ill health, including the cases of 77 individuals (5%) who denied experiencing health effects. Lack of information prevented evaluation of 160 cases (11%) (Figure 3).



<sup>a</sup> Total cases investigated = 1479.

<sup>b</sup> *Agricultural* and *Nonagricultural* refer to the intended use of the pesticides definitely, probably, or possibly related to human health effects.

<sup>c</sup> *Unlikely/Indirect/Unrelated/Asymptomatic* refers to cases in which the weight of the evidence was against pesticide causation. This occurs when exposed people did not develop symptoms, or if symptoms were not caused or were unlikely to have been caused by pesticide exposure.

<sup>d</sup> *Inadequate* means that there was not enough data available or reported to determine if pesticides contributed to ill health.

Evidence established a definite relationship to pesticide exposure for 89 (9%) of the 982 pesticide-associated cases. Another 576 (59%) were classified as probable, with 317 (32%) entered as possible (Table 1). Tabular summaries presenting different aspects of the data are available through the DPR Web site at <http://www.cdpr.ca.gov/docs/whs/2007pisp.htm>, or by contacting the WHS Branch.

**Table 1: Relationship Evaluation of 2007 Illness Investigations**

Relationship	Agricultural <sup>a</sup>	Non-Agricultural	Relation to Agriculture Unknown or Not Applicable	Total
Definite <sup>b</sup>	10	79	0	89
Probable <sup>c</sup>	195	381	0	576
Possible <sup>d</sup>	113	204	0	317
<b>Pesticide-Associated Subtotal</b>	<b>318</b>	<b>664</b>	<b>0</b>	<b>982</b>
Unlikely <sup>e</sup>	23	75	5	103
Indirect <sup>f</sup>	0	3	0	3
Asymptomatic <sup>g</sup>	71	6	0	77
Unrelated <sup>h</sup>	0	0	154	154
Not Applicable <sup>i</sup>	12	132	16	160
<b>Overall Total</b>	<b>424</b>	<b>880</b>	<b>175</b>	<b>1479</b>

- <sup>a</sup> Agricultural cases are those that implicate exposure to pesticides intended to contribute to the production of agricultural commodities.
- <sup>b</sup> High degree of correlation between pattern of exposure and resulting symptomatology. Requires both physical evidence of exposure and medical evidence of consequent ill health to support the conclusions.
- <sup>c</sup> Relatively high degree of correlation exists between the pattern of exposure and the resulting symptomatology. Either medical or physical evidence is inconclusive or unavailable.
- <sup>d</sup> Some degree of correlation evident. Medical and physical evidence are inconclusive or unavailable.
- <sup>e</sup> A correlation cannot be ruled out absolutely. Medical and/or physical evidence suggest a cause other than pesticide exposure.
- <sup>f</sup> Pesticide exposure is not responsible for symptomatology, but pesticide regulations or product label contributed in some way, (e.g., heat stress while wearing chemical resistant clothing).
- <sup>g</sup> Exposure occurred, but did not result in illness/injury.
- <sup>h</sup> Definite evidence of cause other than pesticide exposure, including exposures to chemicals other than pesticides.
- <sup>i</sup> Relationship cannot be established because the necessary information is either unavailable or not provided.

Internet users now have the additional option of using the new query program, CalPIQ, to develop reports to their own specifications. CalPIQ is available at <http://apps.cdpr.ca.gov/calpiq> and can retrieve any cases evaluated as definitely, probably, or possibly related to pesticides from 1992 through the most recent year completed. Users can specify which cases to retrieve based on county of occurrence, year of identification, whether or not agriculture was the source

of pesticide exposure, the identity of the implicated pesticide(s), the type of location where exposure occurred (e.g. farm, school), the site for which the pesticide application was intended (e.g. grapes, food handling equipment), the manner of exposure (e.g. drift, direct spray), and/or activity of the affected people (e.g. applicator, field worker). Users can direct CalPIQ to retrieve either descriptions of each individual case or the total number of cases that match the selected criteria (summary report). If the summary report option is selected, users may request subtotals by activity, county, type of exposure, type of location, and/or year of identification.

Occupational exposures (those that occurred while the affected people were at work) accounted for 640 (65%) of the 982 pesticide-associated cases from 2007. Occupational exposures typically predominate among the cases PISP collects, reflecting the importance of DFROIIs (workers' compensation documents) for identifying cases. Three pesticide-associated cases could not be identified as occupational or non-occupational.

Enforcement actions often are still under consideration when DPR receives the illness investigative reports, and identification of violations is difficult. Based on the information available at the time of evaluation, WHS scientists concluded that 407 (41%) of the 982 pesticide-associated cases might have been avoided if pesticide users had adhered strictly to safety procedures already required by regulations and pesticide labels. In 107 cases (11%), violations were identified but were judged not to have contributed to pesticide exposure, and scientists remained uncertain whether violations contributed to 57 cases (6%). In 411 (42%) of the pesticide-associated cases, health effects were attributed to pesticide exposure in spite of apparent compliance with all applicable label instructions and safety regulations. Exposure in spite of compliance was more common for pesticide handlers than for bystanders, for exposures to residue than for spray or drift exposures, and for non-agricultural exposure situations than for exposure to agricultural-use pesticides. Further evaluation of these cases is needed to determine if additional safety requirements are appropriate.

The fraction of cases with violations is comparable to the 45% identified in 2004 and 2006, although a 2005 drift episode affected 324 people and raised the percentage of cases with violations to 68%. In 2007, contributory violations were identified in 155 (49%) of the 318 cases

associated with agricultural uses of pesticides, and 252 (38%) of the 664 non-agricultural pesticide-associated cases.

### **Agricultural Field Worker Incidents**

In 2007, 126 cases of field worker illness or injury were evaluated as definitely, probably or possibly related to pesticide exposure (Figure 4). Fifty-eight of them (46%) involved exposure to pesticide residue in 33 separate episodes, and 66 (52%) involved exposure in eight drift episodes. One field worker became ill after drinking potentially contaminated water. A greenhouse worker's exposure could not be characterized with confidence.

Twenty-five of the 58 residue exposures were evaluated as probably related to reported health effects. The other 33 field worker residue exposures were evaluated as possibly related.

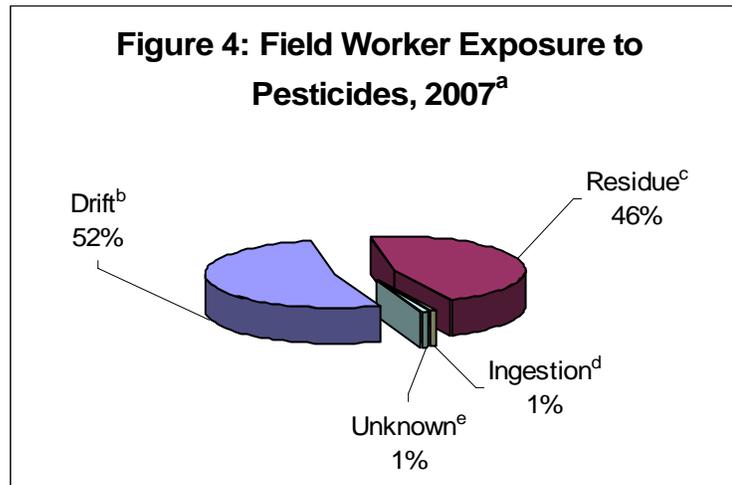
WHS helped to investigate a Tulare County reentry violation episode (Hernandez and Kabir, 2007): Two harvesting crews (total of 33 workers) entered an orange grove about 90 minutes after the end of a chlorpyrifos application. The workers smelled a strong pesticide odor and noticed that the leaves were wet. One by one, they stopped working; and all left the orchard within an hour and a half. Interviews with 28 of the workers were documented. Of the 28, 12 denied experiencing any health effects from their exposure. The other 16 reported symptoms, primarily headaches and dizziness, which resolved within a day.

The day after the application, WHS scientists took leaf samples, which demonstrated chlorpyrifos deposition on the orange leaves in amounts consistent with application records. Samples from a neighboring pistachio orchard showed only about one percent of the chlorpyrifos level found on the orange leaves.

Investigators determined that the required signs had not been posted at the orange grove, and the grower had not informed workers of the application. One of the labor contractors had not trained his workers appropriately, did not provide adequate decontamination facilities, and did not take

sick workers for medical care. The Tulare County Agricultural Commissioner fined the grower \$3,000 and the labor contractor \$9,970 for these violations of regulations.

Of the other 42 field workers exposed to residue, 28, including three irrigators who violated reentry intervals, were exposed in incidents that involved no other people. The remaining 14 field workers were involved in four episodes that each exposed two to six field workers to pesticide residue. No violations were identified in these four episodes.



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- <sup>a</sup> Total field worker cases associated with pesticide exposure = 126.
  - <sup>b</sup> Drift refers to field worker cases associated with exposure to drift from a pesticide application.
  - <sup>c</sup> Residue refers to field worker cases associated with exposure to residue of previously applied pesticides.
  - <sup>d</sup> Ingestion refers to pesticides exposure through consumption either of pesticide products or of contaminated food or beverage.
  - <sup>e</sup> Unknown means scientists could not determine how exposure occurred.

Drift exposure probably caused or contributed to symptoms experienced by 51 field workers, and was a possible factor in 15 field worker cases. The largest field worker drift episode occurred in Tulare County on a Saturday, when an almond grower made an airblast application of chlorpyrifos to his trees while, across a narrow road, 70 workers pulled grape leaves and turned cane.

The grape workers smelled the pesticide, and several of them reported feeling mist, although light wind blew from the vineyard towards the almond grove. The grape grower took 11 workers

for medical care, and eventually 28 of the crew members consulted doctors. In interviews, 26 grape workers reported experiencing symptoms that day or the next.

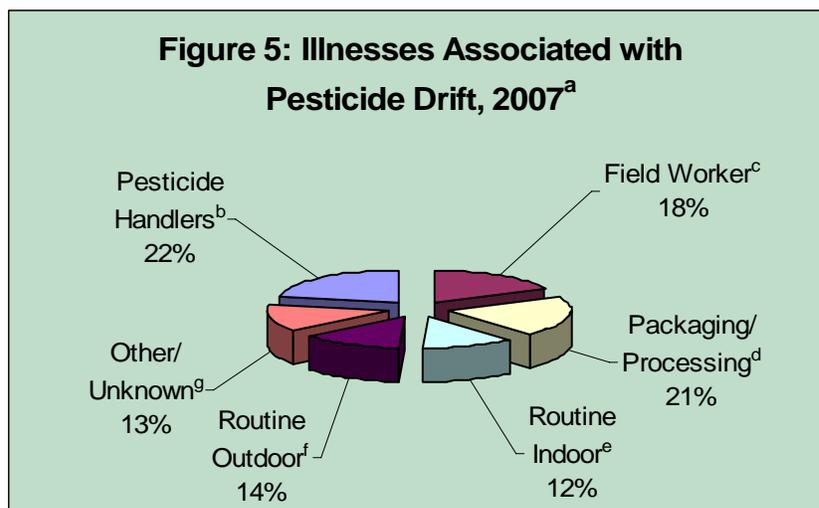
The agricultural commissioner took leaf samples on the day of exposure, and twelve exposed people donated clothing to test for pesticide. Lab tests detected chlorpyrifos in all the leaf samples and all but one of the clothing samples. WHS took samples for dislodgeable residue the following Monday, two days after the event (Hernandez 2007). No detectable amount of chlorpyrifos was found on those samples. The agricultural commissioner fined the almond grower \$33,640 for proceeding with the application with workers nearby, for drifting pesticide onto the workers, and for shortcomings in his safety program for his own workers.

Large drift episodes also exposed field workers in Monterey and San Joaquin Counties. In Monterey, 19 of 34 strawberry harvesters reported symptoms upon smelling the odor from applications to adjacent fields. Eighteen of the reports were evaluated as probably related to the exposure; one was evaluated as unlikely to be related. In San Joaquin County, 14 of 18 tomato workers developed symptoms when an aerial application of propargite to corn drifted onto them. Samples demonstrated the propargite drift, and the agricultural commissioner proposed to fine the applicator \$5,000. Four other drift episodes each affected one field worker, and one episode affected four.

### **Drift Exposure**

The PISP defines drift exposure as exposure to pesticide “spray, mist, fumes, or odor carried from the target site by air.” This definition differs from the definition used for enforcement of regulations in that the PISP definition includes the offsite movement of pesticides after they have been deposited at the target site, so long as the application remains in progress. Since fumigations remain in progress until ventilation is complete, this includes exposures to fumigants that escape confinement. It also includes exposures of pesticide users in which air movement carried the pesticide and caused exposure.

In 2007, DPR recorded a total of 370 individuals who reported symptoms evaluated as definitely, probably, or possibly related to exposure to drift (Figure 5) in 160 separate episodes, including the eight episodes that affected 66 field workers. Agricultural pesticide use was found responsible for 22% of the episodes and 49% of the affected people (35 episodes, 180 cases).



<sup>a</sup> Total drift cases for 2007 = 370.

<sup>b</sup> Handlers include people mixing, loading and applying pesticides, repairing pesticide equipment and flagging for aerial application.

<sup>c</sup> Field Workers are people working in agricultural fields at the time of drift exposure.

<sup>d</sup> Packaging/Processing includes people involved in processing harvested crops.

<sup>e</sup> Routine Indoor includes people in offices and businesses, residential structures, etc. (occupational and non-occupational) who were not handling pesticides.

<sup>f</sup> Routine Outdoor includes people outdoors (occupational and non-occupational) with little expectation of contacting pesticides (e.g., gardeners not handling pesticides, residents).

<sup>g</sup> Other/Unknown – Any other type of activity or unknown activity.

Non-agricultural use accounted for 125 episodes in which 190 people experienced effects evaluated as definitely, probably, or possibly related to airborne pesticide exposure.

The largest drift episode affected 39 workers at a Yolo County tomato cannery. Plant material heavily coated a chlorine-sensing probe in the flume water, so the probe sensed a lack of chlorine. The automated system had increased the chlorine level to 15 times normal by the time the problem was identified. Chlorine drifted through the work area, causing respiratory and eye irritation, with additional symptoms reported in some cases. On that day, supervisors had neglected a protocol that required them to check and clean the sensor. This violated a regulatory requirement that employers inspect pesticide equipment every day before use, and correct any

safety defects. For this violation, the cannery paid a fine of \$3,000. Cannery management responded to the lapse by augmenting the protocol to require the probe to be checked and cleaned every 4 hours, and chlorine measurements to be taken and recorded every hour. They also announced plans to install chlorine gas sensors above the flume water.

The next largest drift episode occurred in Monterey County, where vapor escaped from a field fumigated with a mixture of 41.5% chloropicrin and 57% methyl bromide. The application had gone smoothly and had been monitored by a CAC employee who noted no deficiencies. When nearby residents reported eye and respiratory irritation, CAC staff canvassed the affected neighborhood and identified 31 people probably or possibly affected, including two of the investigators. The investigation identified no cause for the problem beyond the fact of performing a fumigation near a residential area.

Overall, drift exposure was evaluated as definitely, probably, or possibly related to health effects reported by 66 field workers, 76 workers processing harvested produce, 46 people engaged in routine indoor activities when exposed, 51 people engaged in routine outdoor activities, 37 people involved in activities not adequately described by any of the defined categories, and 12 people whose activities were not known. Additionally, 82 pesticide handlers were definitely, probably, or possibly affected by airborne exposure to the pesticides they handled. Such exposures are recorded as drift. The affected handlers included five agricultural applicators and 77 non-agricultural pesticide handlers (12 mixer/loaders, 63 applicators, and two people who worked on contaminated equipment).

### **Light Brown Apple Moth**

In an effort to eradicate the Light Brown Apple Moth (LBAM), the California Department of Food and Agriculture made aerial applications of moth mating disruption pheromones in Monterey and Santa Cruz Counties during September, October, and November 2007.

Applications occurred on the Monterey Peninsula September 9 - 13 and October 24 - 26, 2007, in the north Santa Cruz area of Santa Cruz County on November 8 and 9, 2007, in the North Salinas/Boronda area of Monterey County on November 9 and 11, 2007, and in the

Prunedale/Royal Oaks area of Monterey County on November 9, 11, and 12, 2007. Hundreds of people registered complaints of health effects attributed to exposure to the pheromone, and medical care providers submitted illness reports for 46.

County agricultural commissioners investigated those 46 cases and submitted reports for evaluation by DPR scientists. In all investigation evaluations, PISP scientists must consider evidence of exposure, evidence of health effects, and any available toxicologic and epidemiologic information on the potential for the given exposure to elicit health effects of the sorts reported.

In cases attributed to the LBAM eradication effort, scientists considered that all people present in the treated areas during the applications incurred very small but real exposures. As in all case abstraction, symptomatology was transcribed verbatim. Respiratory effects were prominent, reported in 38 of the 46 cases. Three cases could not be evaluated because they reported symptoms that did not correspond to spray dates, and investigators could neither confirm nor correct the dates. One person reported pain that developed a month after a short visit to the spray area; this was evaluated as unrelated to exposure.

A collaborative review of toxicity studies on the LBAM pheromone products by scientist from DPR, OEHHA, and CDPH concluded that there is a very low likelihood of health problems from touching, breathing or ingesting any of the pheromone products (CDPH/DPR/OEHHA 2008). DPR scientists' attempt to develop epidemiologic evidence, described below, also failed to provide sufficient evidence to support attribution of symptoms to exposure in the other 42 cases.

Since toxicology results provided little support and no epidemiologic study was available, PISP scientists took the unusual step of attempting to develop epidemiologic evidence of an effect from spray exposure. A report published by the Centers for Disease Control and Prevention (CDC 2008) provided a model for using emergency room reports to identify an increase in health problems. CDC investigators analyzed data from San Diego County for the month of October 2007, when smoke from wildfires polluted the air October 21 – 26. Although some 300,000 people had evacuated, the CDC researchers demonstrated a marked increase, relative to the

period before the fires, in emergency room visits for respiratory conditions during the time the fires burned.

DPR scientists attempted a similar analysis for LBAM health problems: The Office of Statewide Health Planning and Development supplied counts of emergency room contacts at Monterey hospitals for the months of September, October, and November 2007 and for November consultations at Santa Cruz hospitals (OSHPD 2008). Cases were included if they were coded as asthma, other respiratory conditions, or any effect of pesticide exposure. To preserve the patients' anonymity, the data were aggregated into time periods of no less than a week. For each month, cases were reported for the period before spraying, the week spraying occurred, and the remainder of the month.

Scientists could not identify any increase in consultations during the spray periods. On the contrary, at each hospital in or near spray zones, respiratory complaints decreased slightly during the week that the area was sprayed. The few diagnoses of pesticide exposure related only to consultations that occurred before the spraying. So we have no epidemiologic basis for attributing ill health to spray exposure. This does not prove that no one suffered health effects from exposure to the LBAM spray. It remains possible that a few people have exceptional sensitivity to the product used.

### **Morbidity and Mortality**

Among the 665 cases evaluated as definitely or probably related to pesticide exposure, 23 people were admitted to hospitals and 85 lost time from work. Of the 317 possible cases, six reported hospitalization and 40 lost work time. Thirteen of the hospitalized people apparently ingested pesticide intentionally, and one injected himself with pesticide. One child was hospitalized after drinking an insecticide from a bottle his father had collected for recycling. Among the other 14 hospitalizations, seven followed exposures to antimicrobial pesticides, five involved insecticides, and two involved fumigants. CPCS assisted in the transmission of reports on 26 of the 29 hospitalized cases.

DPR and CACs investigated four deaths in 2007. All four resulted from intentional pesticide ingestion, and all were reported via CPCS.

### **Significance of CPCS Participation**

CPCS report facilitation greatly strengthens illness surveillance: CPCS transmits reports more rapidly than other intermediaries, and CPCS identifies qualitatively different exposures from those the program identifies by other means. Table 2 summarizes these characteristics.

**Table 2: Characteristics of Report Sources, 2007<sup>a</sup>**

	CPCS <sup>b</sup>	Other PIRs <sup>c</sup>	DFROILs <sup>d</sup>
Median days in transit <sup>e</sup>	2	11	77
Average days in transit	3	23	97
Minimum days in transit	0	1	12
Maximum days in transit	29	206	1517
Non-occupational exposures	319	44	0
Exposures of children age < 10	93	1	1
Hospitalizations	34	1	2
Intentional exposures	36	1	0

<sup>a</sup> Includes all case reports investigated, whether or not evaluated as associated with pesticide exposure.

<sup>b</sup> Cases reported via the California Poison Control System (CPCS)

<sup>c</sup> Cases for which physicians submitted Pesticide Illness Reports independently of CPCS

<sup>d</sup> Cases identified through review of Doctor's First Reports of Occupational Illness or Injury

<sup>e</sup> Days in transit represents the number of days elapsed between exposure and arrival of a report at DPR.

This shows that DPR relies almost entirely on CPCS for information about exposures of children and non-occupational exposures, which account for the majority of hospitalizations and deaths from pesticide exposure. Additionally, prompt notification enables more informative investigations.

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**Appendix I: Acronyms**

CAC	County Agricultural Commissioner
CDC	Centers for Disease Control and Prevention
CDPH	California Department of Public Health
CPCS	California Poison Control System
DFROII	Doctor's First Reports of Occupational Illness and Injury
DIR	Department of Industrial Relations
DPR	California Department of Pesticide Regulation
HIPAA	Health Insurance Portability and Accountability Act
LBAM	Light Brown Apple Moth
NIOSH	National Institute for Occupational Safety and Health
OEHHA	Office of Environmental Health Hazard Assessment
PIR	Pesticide Illness Report
PISP	Pesticide Illness Surveillance Program
SENSOR	Sentinel Event Notification System for Occupational Risk
U.S. EPA	United States Environmental Protection Agency
WHS	Worker Health & Safety Branch