SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE ILLNESS SURVEILLANCE PROGRAM - 2001 -

HS-1843

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Pesticide Illness Surveillance Program – 2001

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[1] illnesses has been part of this comprehensive program since 1971. The U.S. General Accounting Office (GAO, 1993) noted that "California had by far the most effective and well-established monitoring system in place" and that the U.S. Environmental Protection Agency (U.S. EPA) "relies heavily on the pesticide illness data collected by the California monitoring system . . . and has tried to encourage selected states to develop monitoring systems modeled after the California system." Several other states have initiated surveillance programs for pesticide illness. As yet, most of them have collected only limited numbers of case reports, and the U.S. EPA still relies heavily on California data.

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 pharmacologic effect by which it controls its target pests. Pesticide products may have other potentially harmful properties in addition to the qualities designed to control pests. The Pesticide Illness Surveillance Program (PISP) collects information on adverse effects from any component of pesticide products including the active ingredients, inert ingredients, impurities, and breakdown products. Whether pesticide products act as irritants or as allergens, through their smell or by causing fires or explosions, DPR's mission is to mitigate exposures that compromise health.

DPR maintains its surveillance of human health effects of pesticide exposure in order to evaluate the circumstances of pesticide exposures that result in illness. The PISP database provides the means to identify high-risk situations warranting DPR action including the implementation of additional California restrictions on pesticide use. Taking illness data into consideration, DPR may adjust the restricted entry interval following pesticide application, specify buffer zones or

[1] "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, disinfectants, as well as insect growth regulators. In California, adjuvants are also subject to the regulations that control pesticides.

other application conditions, or require pesticide handlers to use protective equipment that meets certain standards. A recent illness episode identified unintentional misuse of the pyrethroid insecticide cyhalothrin, in response to which DPR developed a protective regime to allow workers to enter the contaminated field and minimize exposure. Reviews of illness investigations concerning mixer/loader/applicators (Fong, 2001), field posting requirements (Spencer, 2001), and hazard communication/notification requirements (McCarthy, 2002) have contributed to development of proposals for modification of regulations. In some instances, changes to pesticide labels provide the most appropriate mitigation measures, and DPR cooperates with the 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.

Sources of Illness Cases

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 by telephone to the local health officer within 24 hours of examining the patient. The health officer informs the county agricultural commissioner (CAC) and also completes a pesticide illness report (PIR), copies of which are distributed to the California Environmental Protection Agency Office of Environmental Health Hazard Assessment, to the Department of Industrial Relations (DIR), and to DPR. Scientists regularly consult the data collected to evaluate the effectiveness of DPR's pesticide safety regulatory programs and assess the need for changes.

DPR strives to ensure that the PISP captures the majority of illness incidents and records them in its database. For example, since doctors do not always properly report pesticide cases, DPR also reviews Doctor’s First Reports of Occupational Illness and Injury (DFROIIs), which California's Labor Code requires workers' compensation claims payers to forward to DIR. Staff members select for investigation any DFROII that mentions a pesticide, or pesticides in general, as a possible cause of injury. Reports that mention unspecified chemicals also are investigated if the

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Adjuvants are substances added to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, and wetting and dispersing agents.

setting is one in which pesticide use is likely. Until recently, DFROII review identified two-thirds to three-quarters of the incidents investigated. In 2001, review of DFROIIs was interrupted while DPR negotiated a new memorandum of understanding with DIR and the California Department of Health Services (see Numeric Results, below).

Over the past several years, DPR has worked with the California Poison Control System (CPCS) to assist in identifying potential pesticide illnesses. Prior to 2000, DPR scientists managed two pilot projects where CPCS specialists would offer to report pesticide-related illnesses for physicians. Funds from U.S. EPA supported development of an enhanced system of poison control facilitation, which operated from mid-2001 through November 2002. A summary of the 2001 reporting results from CPCS can be found at the end of this document.

During 2001, DPR scientists completed a comprehensive review of data sources on medical consultations following exposure to pesticides (Mehler, 2001). This review determined that the PISP is highly successful in identifying episodes that affect groups of people, and reasonably successful in identifying exposures related to agriculture or employment. Many residential and intentional exposures, however, continue to escape surveillance. Cooperation with CPCS showed great promise for filling this gap, but the State's fiscal crisis necessitated suspension of the contract. When resources become available, DPR will pursue funding for a continuing contractual relationship with CPCS.

The agricultural commissioner of the county where the incident occurred investigates each incident. They primarily investigate incidents to determine if violations occurred. Secondarily, the CAC determines the causes of exposure and characterizes the illness. DPR provides instructions, training, and technical support for conducting 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 maintains specialized laboratories 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. When investigations identify additional affected people

(not previously reported by other mechanisms), they 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 took a close look at the quality of investigations of agricultural episodes in a special project supported by U.S. EPA and completed in 2001 (Edmiston, 2001). Reviewers evaluated the information in investigations of 376 case reports derived from 210 episodes of exposure to pesticides used agriculturally. They concluded that investigators generally collected adequate information on the immediate circumstances and on aspects related to regulatory compliance, but too often neglected to explore background factors that contributed to development of hazardous situations. DPR scientists developed training to address the shortcomings identified and presented the training to agricultural investigators throughout the State.

Evaluators undertake a complex task of determining the likelihood that a pesticide exposure caused the incident. Standards for the determination are described in the PISP program brochure, "Preventing Pesticide Illness," which is available through the DPR Web site at http://www.cdpr.ca.gov/docs/dprdocs/pisp/brochure.pdf.

DPR scientists participate in the working group convened by the National Institute for Occupational Safety and Health (NIOSH) to develop standards for collection of information on pesticide illnesses. They provide the group with documentation of the data elements and standards the PISP uses. The 1998 PISP database upgrade incorporated several features from the NIOSH standards. NIOSH now partially supports programs in the states of Massachusetts, Michigan, New Mexico, New York, Oregon, Texas, and Washington, which make use of the standards defined by the working group. This NIOSH program also provides technical assistance to the states of Arizona, Florida, and Louisiana, and supports pesticide-related work by the Occupational Health Branch of the California Department of Health Services, which coordinates with the DPR's Worker Health & Safety Branch (WH&S).

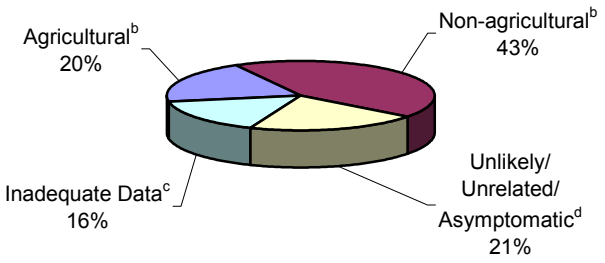
2001 Numeric Results -- Totals

For calendar year 2001, DPR assigned 979 investigations of case reports that suggested health effects from pesticide exposure. This represents a decrease of 165 (14 percent) relative to 2000, when 1,144 cases were investigated, and follows annual declines of 30 percent and 26 percent in the preceding years. Only 329 of the 979 cases were identified by retrieval of DFROIIs, including 98 located after a revised memorandum of understanding was signed in March 2002 (see Background on the Reporting System, above). Through July 2002, DPR assigned 2001 identification numbers to reports that would have been retrieved during 2001 if document review had not been interrupted. Because agricultural commissioners received these reports long after the events, investigations were difficult and often unproductive. This increases the number of cases that could not be evaluated, and leaves open the likelihood that evaluations will be revised if commissioners supply additional information in the future. This report describes the information available as of January 6, 2003.

Based on the information available, DPR found that pesticide exposure had been at least a possible contributing factor to 616 (63 percent) of the cases assigned for investigation (Figure 1). Lack of information prevented evaluation of 159 (16 percent) of the cases, reflecting the difficulties agricultural commissioners encountered in trying to investigate cases identified months after the fact. From 1988 through 2000, the percentage of unclassifiable cases ranged from 4.4 to 9.4.

Of the 616 cases recognized as definitely, probably, or possibly related to pesticide exposure, 192 (31 percent) involved use of pesticides for agricultural purposes and 424 (69 percent) occurred in other settings. Evidence established a definite relationship to pesticide exposure for 131 of the 616 cases. Another 299 were classified as probable, with 186 entered as possible. Evidence established an unlikely or unrelated relationship to pesticide exposure for 204 of the 979 cases assigned for investigation. Tabular summaries presenting different aspects of the data are available through DPR's Web site at http://www.cdpr.ca.gov/docs/dprdocs/pisp/2001pisp.htm, or by contacting the WH&S Branch.

Figure 1: Outcome of 2001 Pesticide Illness Investigations[a]

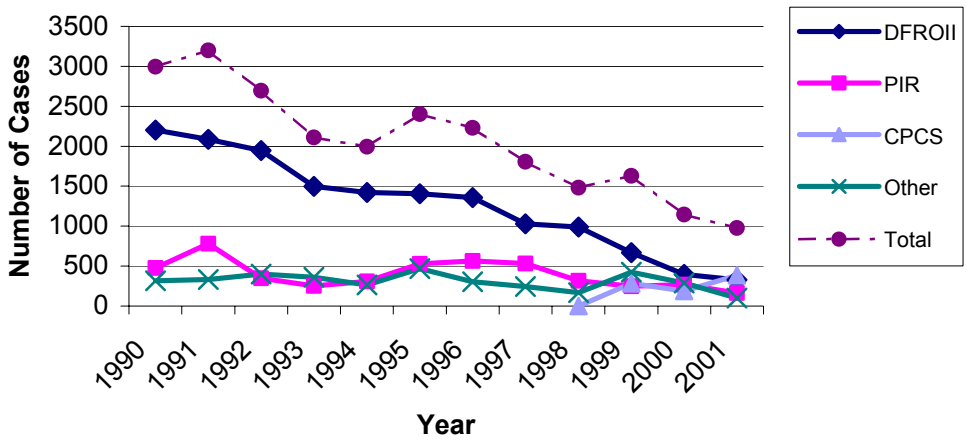


[a] Total cases investigated = 979.
[b] *Agricultural* and *Non-agricultural* refers to the intended use of the pesticide.
[c] *Inadequate* means that there was not enough data available or reported to determine if pesticides were involved in the case.
[d] *Unlikely/Unrelated/Asymptomatic* refers to cases determined as unlikely related or unrelated to pesticide exposure or the exposed person did not develop symptoms.

Enforcement actions often are still under consideration when DPR receives the investigative reports. Based on the information available, DPR scientists were able to recognize that actions already prohibited by pesticide safety regulations had contributed to 261 (42 percent) of the 616 cases evaluated as definitely, probably, or possibly related to pesticide exposure. This indicates that safety could be further improved through increased compliance efforts.

Occupational exposures (those that occurred while the affected people were at work, not necessarily related to their assignments) accounted for 408 (66 percent) of the 616 pesticide-related cases from 2001. From 1982 through 2000, occupational exposures accounted for 88 percent of the cases classified as definitely, probably, or possibly related to pesticide exposure. The relatively low percentage for 2001 reflects the shifts that have occurred in case identification sources. The past decade's downward trend in DFROII retrieval (Figure 2) has continued. The decrease in DFROIIs has been partially compensated by reporting through poison control centers, which provided notification of more 2001 cases than any other source. The majority of cases reported through poison control concerned non-occupational exposures.

Figure 2. Number of Cases Reported by Method of Reporting, 1990-2001



DFROII – Doctor's First Report of Occupational Illnesses and Injury (Workers' Compensation report).
PIR – Pesticide Illness Report (physician reporting).
CPCS – California Poison Control System (facilitated physician reporting).
Other – All other methods of case identification.

DPR scientists hypothesized that the decrease in pesticide cases identified by DFROIIs may reflect changes in insurer procedures. During the period of decline in DFROII retrieval, insurers accommodated a legislative mandate to convert from postal to electronic transmission of employers' reports. Regulations still require insurers to forward physical copies of DFROIIs, but DPR was concerned that transmission may have been compromised by changes in procedures for related reports.

To investigate this possibility, DPR scientists reviewed all of the DFROIIs selected for investigation during 1990, 1995, and 2000, and collected the names of the insurers responsible for forwarding them. DPR could not detect any important change in the sources of DFROIIs during this period. The California State Compensation Insurance Fund was the largest source in all three years, providing from 22 percent to 30 percent of the case reports investigated. The number that did not identify their source ranged from 7 percent to 14 percent. No other source accounted for more than 7 percent of the cases in any year. The top ten insurers all provided cases in all three years. The total number of insurers represented decreased in later years, but by

a smaller percentage than the drop in case identification. Nothing suggested insurer failure to forward reports as required.

Another analysis suggested that some but not the entire decline did result from worsening DFROII retrieval. Throughout the period, some physicians continued to comply with the statutory requirement to report pesticide illnesses. These reports were received on an identifiable form, the PIR. If these consultations concerned occupational exposures evaluated under workers' compensation, they should also have given rise to DFROIIs, which we might retrieve through standard DFROII review. The fraction of occupational PIR cases for which DPR subsequently locate DFROIIs provides a measure of the overall effectiveness of the DFROII route of case identification.

DPR scientists extracted from the database all occupational cases reported by PIR and grouped them by episode so that statistics would not be distorted by a small number of events that involved large numbers of people. For each year from 1988 through 2000, DPR determined the fraction of those episodes for which DFROIIs were subsequently retrieved. From 1988 through 1995, DPR retrieved DFROIIs for sixty percent of the occupational episodes identified by PIRs. Since not all occupational injuries are processed through the workers' compensation system, this suggests a very high rate of DFROII retrieval for those that were. The percentage fell to fifty in 1997. In 1998, 1999, and 2000, DPR found DFROIIs for less than forty percent of the episodes reported by PIRs. If the sixty percent that DPR found from 1988 through 1995 represents complete or near complete success in finding the DFROIIs doctors sent to insurers, by 1998 the success rate had fallen to two-thirds or less.

The observed decrease in DFROII retrieval effectiveness does not fully account for the decrease in case identification. The analysis described above suggests that DPR's ability to locate DFROIIs has decreased by a third to a half, beginning around 1996. The total number of DFROIIs, however, has dropped to about one-fifth the number found prior to 1990.

Cases reported by PIRs may not be typical of all pesticide cases that occur. It is possible that DPR has greater difficulty recognizing DFROIIs concerning pesticide cases that were not

reported by PIR. DPR can propose one scenario that would have such an effect, although it cannot be tested: In recent years, DPR scientists who select DFROIIs for investigation report a sense that they find less detail in DFROIIs to guide their decision. It may be that doctors who reported via PIRs also include the critical information in the DFROIIs they submit. Doctors who did not report by PIRs may provide only generic information in DFROIIs, causing DPR to overlook those cases.

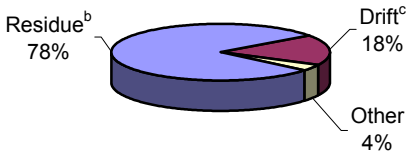
Alternatively, DPR may retrieve fewer DFROIIs because doctors file fewer. This possibility is supported by the observation that the number of episodes identified by PIRs has declined to about half the 1990 level. If the true number of pesticide-related DFROIIs dropped (like the PIRs) by half and DPR's ability to find them also decreased by half, the overall drop in DFROIIs would be very close to what DPR observed. Filing of DFROIIs could decrease either because fewer occupational pesticide illnesses occur, or because fewer victims seek treatment than a decade ago.

Agricultural Field Worker Incidents

In 2001, only 57 cases involving field worker illness and injury were evaluated as definitely, probably, or possibly related to pesticide exposure. Nine field worker cases could not be evaluated because of lack of information, and 11 were evaluated as unrelated or unlikely to be related to pesticide exposure.

Exposure to residue was implicated for 45 (79 percent) of the field workers. Another 10 field workers (18 percent) were exposed to drift. Two field workers were exposed by other mechanisms: one field worker smelled pesticide (metam-sodium) that leaked from a vandalized tractor in an equipment yard adjacent to his work site, and a disinfectant spilled into a worker's eyes when his tractor overturned on the way to a field.

Figure 3. Field Worker Exposure to Pesticides, 2001[a]



[a] Total field worker cases associated with pesticide exposure = 57.
[b] Residue refers to field worker cases associated with exposure to residue on the crops.
[c] Drift refers to field worker cases associated with exposure to drift from a pesticide application.

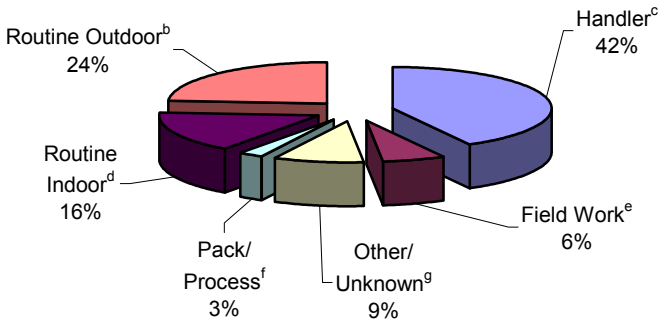
Of the 57 total pesticide-related cases of field workers exposed to pesticides by any mechanism, DPR evaluated 43 as possible and 13 as probable. Only one field worker case, the spill in an overturned tractor, could be definitely attributed to pesticide exposure. Exposures to residue gave rise to 38 of the cases evaluated as possible and seven of those evaluated as probable. Known violations of existing safety requirements contributed to 10 (22 percent) of the 45 cases involving exposure to field residue. Reentry during the restricted entry interval contributed to eight of the cases, including seven of the nine cases with other contributory violations. The largest field worker episode affected six workers; no more than three field workers were involved in any other single episode.

Drift Exposure

The PISP defines drift exposure as exposure to pesticide "spray, mist, fumes, or odor carried from the target site by air." In 2001, DPR recorded a total of 155 individuals who reported symptoms definitely, probably, or possibly related to exposure to drift (Figure 4) in 112 separate episodes. This includes 25 people exposed in the course of routine indoor activities (e.g., office worker, store clerk, etc.) and 37 exposed during routine outdoor activities, in addition to 10 field workers and 65 pesticide handlers (including two people who did maintenance work on pesticide equipment as well as mixers, loaders, and/or applicators). Four people were drifted upon while packing or processing harvested crops. Drift from agricultural applications was responsible for 73 (47.1 percent) of the 155 drift exposures, including all 10 field workers, three of the four

packers, 11 of the 25 people exposed during routine indoor activities, and 27 of the 37 drifted on during routine outdoor activities, as well as 14 of the of the 65 pesticide handlers.

Figure 4. Illnesses Associated with Exposure to Pesticide Drift by Activity, 2001[a]



[a] Total drift cases for 2001 = 155.
[b] Routine Outdoor includes people outdoors (occupational and non-occupational) with little expectation of contacting pesticides (e.g., gardeners not handling pesticides, residents).
[c] Handler includes people mixing, loading and applying pesticides, repairing pesticide equipment and flagging for aerial application.
[d] Routine Indoor includes people in offices and businesses, residential structures, etc. (occupational and non-occupational) who were not handling pesticides.
[e] Field Worker are people working in agricultural fields at the time of drift exposure.
[f] Packer/Processor includes people involved in processing harvested crops.
[g] Other/Unknown – Any other type of activity or unknown activity.

The largest 2001 drift episode affected 16 students at a Tulare County continuation school adjacent to an orange grove. Most of the affected students were exposed when, as part of a fitness test, they ran along the road that separates the school from the orchard. Several of them observed that the applicator continued spraying during turns at the ends of rows. Analysis of environmental and clothing samples demonstrated drift. The Tulare CAC fined the grower $4,000.

Morbidity and Mortality

Among the 430 cases evaluated as definitely or probably related to pesticide exposure, 27 people were admitted to hospitals and 78 lost time from work. Of the 186 possible cases, two reported hospitalization and 25 lost work time.

DPR investigated only one death that occurred in 2001, and found it was unrelated to pesticide exposure. A man died of an infection acquired a month after he was drenched with herbicide at work.

DPR learned of 40 non-fatal suicide attempts using products identified as pesticides, all but two of which were reported through poison control centers. Because DPR instructs investigators not to risk aggravating such sensitive situations by contacting the individuals involved, 13 of the 40 could not be evaluated for lack of basic information. In another eight suicide attempts, of which six involved anticoagulant rodenticides, pesticide ingestion produced no effects on health.

Examples of the Importance of Compliance with Safety Procedures

Severe intoxications typically result from careless and often illegal use of pesticides. Continuing the dismal series of young children whose lives were endangered by adults' carelessness, in 2001 a three-year-old girl was hospitalized for six days after drinking the organophosphate insecticide product 'Asuntol', which is not registered for use in the United States. The child's family refused to speak to investigators, so they could not find out how she was able to get into it, but did learn she made a full recovery.

Excessive pesticide use at home caused injuries to the users and others. One man became convinced he suffered from a severe mite infestation (which an entomologist could not detect). He treated his property with massive quantities of various products and, without authorization, sprayed pesticides on his neighbors' property also. Several neighbors complained about his irresponsible and illegal behavior. One of them, a nurse with no prior history of respiratory disease, appears to have developed a chronic respiratory condition from her exposure. In a separate incident, a man was hospitalized for two days after repeatedly over-treating his small apartment with various insecticides.

Pesticide labels all provide explicit instructions for use. Using pesticides in excess of the specified application rate, besides being a violation of state and federal laws, greatly increases hazards to health without comparable improvement in efficacy.

Results of Cooperation with Poison Control

As discussed earlier in this report, DPR constantly works to improve reporting of pesticide illnesses. Cooperation with CPCS has shown particular promise for identifying pesticide illnesses that would be otherwise missed and providing the information more promptly than any other mechanism. In 2001, renewed U.S. EPA funding allowed DPR to negotiate a new contract with CPCS to assist physicians in reporting pesticide cases. Under the new contract, CPCS implemented software enhancements to notify specialists early in case management that the substance involved might be subject to the pesticide reporting requirement and to reduce the amount of manual work required to report each case. Equally importantly, the new contract included assignment of a staff professional to act as liaison to DPR.

Reporting under the new contract began July 1, 2001. In the following six months, DPR assigned 383 cases for investigation based on information that CPCS had helped to provide. This made CPCS, participating just half of the year, the largest single source of case identification for 2001. Investigation revealed at least a possible relation to pesticide exposure in 237 of the 383 cases.

These 237 cases include 148 (71 percent) of the 208 cases associated with non-occupational exposures, 23 (79 percent) of 29 hospitalizations, 42 (98 percent) of 43 cases in which people ingested pesticide, and 27 (82 percent) of the 33 cases involving children 10 years old or younger.

Cases in which CPCS assisted also included all 35 cases reported on the day of exposure, 131 (89 percent) of the 148 reported the day after exposure, and 311 (89 percent) of the 348 reported within a week of exposure. The average time from exposure to notification was eight days for cases that CPCS helped to report. For all other cases (excluding the DFROIIs delayed by

renegotiation of the memorandum of understanding), the average time from exposure to notification was 66 days. Median time to notification was two days for reports facilitated by poison control; for PIRs without poison control assistance, it was 15 days. For DFROIIs (excluding those delayed by renegotiation of the memorandum of understanding), the median time from exposure to case identification was 37 days.

These figures demonstrate the importance of poison control intervention to identify non-occupational and pediatric pesticide exposures. This cooperation has been valuable to DPR surveillance, which otherwise has limited ability to detect health problems caused by home-use pesticides. Prompt notification enhances the value of investigation, as CACs take advantage of the opportunity to collect environmental samples and to interview the people involved.

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