SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE ILLNESS SURVEILLANCE PROGRAM - 2000 -

HS-1831

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Pesticide Illness Surveillance Program – 2000

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. It includes requirements for thorough data review of all pesticides[1] before registration for use in California, safety training of all pesticide handlers and field workers, and ongoing monitoring of people and the environment to detect potential for pesticide exposure. Mandatory reporting of pesticide 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.

DPR maintains its surveillance of human health effects of pesticide exposure in order to evaluate the circumstances of pesticide exposures that result in illness. 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 Cal/EPA 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.

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

DPR strives to ensure that the Pesticide Illness Surveillance Program (PISP) captures the majority of illness incidents. For example, since doctors do not always properly report pesticide cases, DPR's Worker Health and Safety Branch (WH&S) also reviews Doctors' First Reports of Occupational Illness and Injury (DFROII), 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 setting is one in which pesticide use is likely. In typical years, DFROII review identifies two-thirds to three-quarters of the incidents investigated.

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, WH&S scientists managed two pilot projects where CPCS specialists would offer to report pesticide-related illnesses for physicians. Although the results of these projects were encouraging, funding was unavailable in 2000. CPCS specialists, however, continued to educate callers about the reporting requirement. The Regional Poison Control Center at the University of California, Davis, Medical Center, which serves the northeast quadrant of California, was particularly active in continuing to encourage reporting in 2000. A summary of the 2000 reporting results from CPCS can be found at the end of this document.

The agricultural commissioner of the county where the incident occurred investigates each incident. 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.

WH&S scientists evaluate the physicians' reports and all the information the CACs have gathered. They then classify incidents according to the circumstances of pesticide exposure. 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 www.cdpr.ca.gov or by request.

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 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.

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 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, 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.

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. NIOSH now partially supports programs in the states of Florida, New York, Oregon, and Texas which make use of the standards defined by the working group. This NIOSH

program also supports pesticide-related work by the Occupational Health Branch of the California Department of Health Services, which coordinates closely with the WH&S Branch.

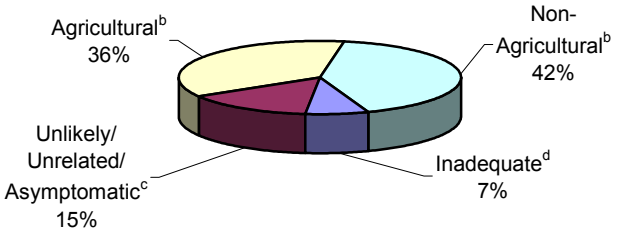
Changes to the Data Collection Program

The PISP continues to collect data using the revised and enhanced computer program that debuted in 1998. The new program provided the opportunity to increase the amount of data collected and to organize it more logically. Annual summaries for 1998 and 1999 describe specifics of the revision. Cases from 1996 and 1997 have now been re-evaluated and coded to bring them up to the 1998 standards. In 2000, DPR increased the amount of detail collected on the types of application equipment used. DPR revised the summary tables available with this report to make use of some of the enhancements. Analysis is in progress to develop a system to make surveillance data available to the public via the DPR Internet Web site.

2000 Numeric Results -- Totals

During 2000, DPR received reports of 1,144 people whose health may have been affected by pesticide exposure. After investigation, WH&S scientists found that pesticide exposure had been at least a possible contributing factor to 893 (78%) of the 1,144 cases (Figure 1). Of those 893 cases, 417 (47%) involved use of pesticides for agricultural purposes and 476 (53%) occurred in other settings. Evidence established a definite relationship to pesticide exposure for 159 of the cases. Another 478 were classified as probable, with 256 entered as possible. Of the 1,144 cases investigated, 251 either had insufficient data available to evaluate the case (82 cases) or evidence established an unlikely or unrelated relationship to pesticide exposure (169 cases). Tabular summaries presenting different aspects of the data are available through DPR's Web site at www.cdpr.ca.gov, or by contacting the WH&S Branch.

Figure 1: Outcome of 2000 Pesticide Illness Investigations[a]



[a] Total cases investigated = 1144.
[b] *Agricultural* and *Non-Agricultural* refers to the intended use of the pesticide.
[c] *Unlikely/Unrelated/Asymptomatic* refers to cases determined as unlikely related or unrelated to pesticide exposure or the exposed person did not develop symptoms.
[d] *Inadequate* means that there was not enough data available or reported to determine if pesticides were involved in the case.

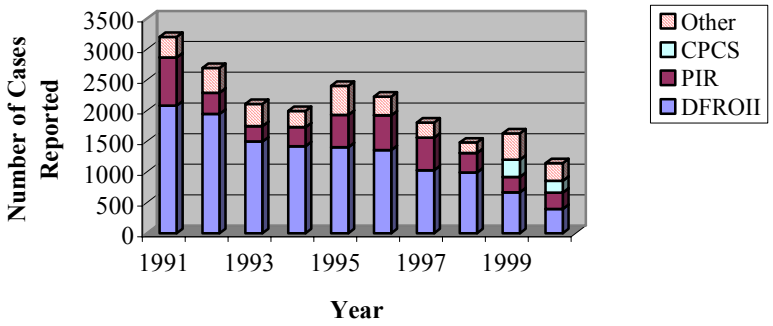
The 1,144 total cases investigated in 2000 represent a decrease of 485 (30%) relative to 1999, when 1,629 cases were investigated. There was a decrease of 308 (26%) pesticide-related cases in 2000 (893 cases) relative to 1999 (1,201 cases). Occupational exposures (those that occurred while the affected people were at work and eligible for workers' compensation) accounted for 656 (73%) of the 893 pesticide-related cases identified during 2000.

Enforcement actions often are still under consideration when WH&S Branch receives the investigative reports. Based on the information available, WH&S scientists were able to recognize that actions already prohibited by pesticide safety regulations had contributed to 382 (43%) of the 893 cases evaluated as definitely, probably, or possibly related to pesticide exposure. This indicates that safety could be further improved through increased compliance efforts.

A distinct downward trend over the past decade is apparent for all pesticide categories, all areas of the state, all activities, and both agricultural and other use scenarios. This trend is limited, however, to occupational exposures, and corresponds to a drop in retrievals of doctor's reports (DFROIIs) forwarded to the Department of Industrial Relations by workers' compensation

claims payers (Figure 2). The decrease in DFROIIs has been partially compensated by reporting through poison control centers and, for agricultural exposures only, by an increase in the number of cases identified independently of formal notification systems. The decrease in the number of DFROIIs may reflect changes in insurer procedures as they convert to electronic transmission of employers' reports. If this were the case, all programs that depend on DFROIIs would see comparable drops. The Department of Health Services uses DFROIIs to monitor occupational asthma and carpal tunnel syndrome, but the number of DFROIIs for those conditions has remained consistent. DPR plans to investigate the cause of the decrease in DFROII reports.

Figure 2: Number of Cases Reported by Method of Reporting, 1991-2000

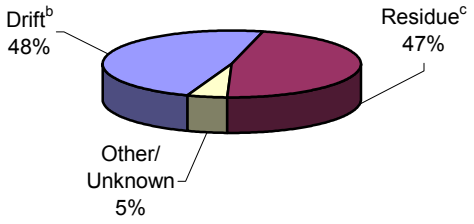


DFROII – Doctor's First Report of Occupational Illness and Injury (Workers' Compensation report).
PIR – Pesticide Illness Report (physician reporting).
CPCS – California Poison Control System (mediated physician reporting).
Other – All other methods of reporting.

Agricultural Field Worker Incidents

In 2000, 161 cases involving field worker illness and injury were evaluated as probably or possibly related to pesticide exposure; pesticide exposure could not be proved definitely responsible for any field worker illness or injury. (Definitions of definite, probable and possible can be found in the "Preventing Pesticide Illness" which is available at http://www.cdpr.ca.gov/docs/dprdocs/pisp/brochure.pdf). Exposure to residue was implicated for 75 (47%) of the field workers. Another 78 field workers (48%) were exposed to drift. The other eight (5%) encountered other or unknown exposures (Figure 3).

Figure 3: Field Worker Exposure to Pesticides, 2000[a]



[a] Total field worker cases associated with pesticide exposure = 161.
[b] Drift refers to field worker cases associated with exposure to drift from a pesticide application.
[c] Residue refers to field worker cases associated with exposure to residue on the crops.

Of the total 161 cases of field workers exposed to pesticides by any mechanism, DPR classified 89 as possible and 72 as probable. Exposures to residue gave rise to 52 of the cases classified as possible and 23 of those classified as probable. Reentry during the restricted entry interval contributed to 43 (57%) of the 75 cases of field workers exposed to residue. Other violations contributed to four (5%) of the 75, including two that also involved reentry violations.

WH&S assisted in investigating two episodes in which field workers were exposed to pesticides, both in Tulare County, one involving drift and one involving residue. In the residue episode, 17 orange harvesters began working in the orchard during the restricted entry interval. All 17 developed headaches and were treated and released at a local medical clinic. Foliage samples taken the following day detected the pesticide at levels that did not raise health concerns (Spencer, 2001a).

An application of chlorpyrifos and propargite to almonds drifted into a vineyard where 24 women were working; all 24 developed symptoms that included nausea, vomiting, dizziness and weakness. Environmental samples confirmed the occurrence of drift and determined residue levels low enough to permit safe resumption of work. Microgram quantities of pesticides were detected in two of four articles of clothing analyzed (Spencer, 2001b). Pesticide metabolites were

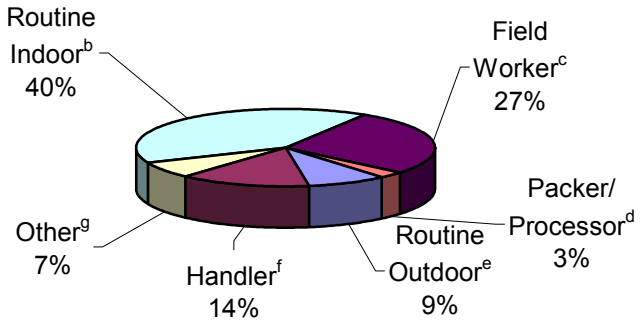
detected in the workers' urine at levels comparable to those found in a sample of the general population (Hill, 1996).

Drift Exposure

As in 1998 and 1999, drift exposures accounted for the largest number of pesticide exposures in 2000. A total of 287 individuals reported symptoms definitely, probably or possibly related to exposure to drift (Figure 4); this involved 121 separate episodes of drift. This includes 116 people exposed in the course of routine indoor activities (e.g., office worker, store clerk, etc) and 25 exposed during routine outdoor activities, in addition to 78 field workers, and 40 pesticide handlers (mixers, loaders, and/or applicators). Eight people were drifted upon while packing or processing harvested crops, by contrast to the 81 people exposed to drift in that situation during 1999. Drift from agricultural applications was responsible for 180 of the 287 drift exposures, including all 78 field workers, all eight of the packers, 64 of the 116 people exposed during routine indoor activities, and 15 of the 25 drifted on during routine outdoor, but only six of the of the pesticide handlers.

The largest drift episode of the year affected three correctional officers and 55 inmates at a Kings County prison, all of whom noticed the odor of an application around poultry houses operated by the facility. DPR learned of this episode too late to take environmental samples, and the one garment available for analysis showed no residue. Insufficient evidence was available to demonstrate the occurrence of drift.

Figure 4: Illnesses Associated with Exposure to Pesticide Drift by Activity, 2000[a]



[a] Total drift cases for 2000 = 287.
[b] Routine Indoor includes people in offices and businesses, residential structures, etc. (occupational and non-occupational) who were not handling pesticides.
[c] Field Worker are people working in agricultural fields at the time of drift exposure.
[d] Packer/Processor includes people involved in processing harvested crops.
[e] Routine Outdoor includes people outdoors (occupational and non-occupational) with little expectation of contacting pesticides (e.g., gardeners not handling pesticides, residents).
[f] Handler includes people mixing, loading and applying pesticides, repairing pesticide equipment and flagging for aerial application.
[g] Other/Unknown – Any other type of activity or unknown activity.

The most significant drift episode occurred in Ventura County, where an application to lemon trees drifted across a street onto school grounds while young children were arriving for class. A concerned resident alerted the Ventura County Agricultural Commissioner to this event, and an investigator arrived in time to witness the improper application and order the operation stopped. Environmental samples also confirmed pesticide drift. A total of 32 people (24 children, six parents, and two teachers) reported symptoms that included headache, nausea, upset stomach, stomach cramps, diarrhea, and irritated eyes. WH&S scientists identified only three of these people who were exposed directly to pesticide drift, and another seven were exposed to residue of the drifted pesticide. In most cases, WH&S scientists did not have information on individual exposures.

The Ventura County District Attorney brought charges against the grower. The action was still pending as of February 2002. Separately, a judge issued a restraining order restricting pesticide applications in the orchards adjacent to the school. Under the restraining order, the grower may not apply pesticide to those areas earlier than 6 p.m. on a school day, and he must give notice to school officials 72 hours in advance of pesticide applications to those areas. To avoid similar problems at other locations, the Ventura County Agricultural Commissioner imposed similar restrictions on all agricultural chlorpyrifos applications adjacent to school property.

Morbidity and Mortality

Among the 637 cases evaluated after investigation as definitely or probably related to pesticide exposure, 33 people were admitted to hospitals and 144 lost time from work. Of the 256 possible cases, three reported hospitalization and 51 lost work time.

DPR investigated nine deaths that occurred during the year 2000. Five of them were suicides by pesticide ingestion. Two agricultural workers died of strokes, which were not related to pesticide exposure. The other two fatalities occurred when aerial applicators crashed. In one of these, mechanical problems with the aircraft were documented. The other, however, could not be evaluated because the pilot had applied methomyl on the day before the fatal accident and dimethoate two days before, but his remains were not tested to determine whether pesticide exposure may have contributed to the accident.

DPR also learned of 21 non-fatal suicide attempts using pesticides, and assisted in the treatment of one by analyzing the patient's vomitus to identify the pesticide he had ingested. DPR also learned of a case of child abuse in which a man forced his eight-year-old son to swallow pesticide. The child was hospitalized and treated successfully for toxicity. No other information is available, as the police investigation was still in progress when the pesticide illness investigation was submitted.

Examples of the Importance of Compliance with Safety Procedures

Severe intoxications typically result from careless and often illegal use of pesticides. As in past years, several young children were injured by inappropriately stored pesticides. A two-year-old girl took a swallow of chlorpyrifos that her grandmother had diluted into a drinking bottle. Another two-year-old girl tasted a sanitizer her father brought home from work at a dairy. These two children were treated and released.

Two young boys were less fortunate, although both ultimately recovered. A four-year-old boy drank from a water bottle in which a neighbor had diluted a combination product containing acephate organophosphate insecticide as well as triforine (a fungicide) and fenbutatin-oxide (a miticide). He became seriously ill and was admitted to a hospital for treatment of organophosphate toxicity. A two-year-old boy became critically ill when he drank diazinon concentrate from a juice container left unattended on a table at his home. He was on a ventilator for a day and in the hospital for four days, but recovered with treatment. Child protective services were consulted before his discharge.

Regulations prohibit storing pesticides in any container that does not identify the contents appropriately. Using a food container to store pesticides is also prohibited and compounds the danger.

Analysis of Information on Pesticide Toxicity from Sources Outside PISP

The U.S. EPA funded a project to collect and analyze data from death certificates, hospital inpatient records, and poison control contact logs. This work demonstrated that pesticide poisoning is an uncommon cause of death or hospitalization in California. Changes in pesticide use patterns, particularly substitution of anticoagulant rodent baits for products containing arsenic or strychnine, have contributed to a ten-fold drop in the rate of accidental death from pesticides over the past 30 years. Death during childhood has decreased even more dramatically (Mehler, 2001a).

We found that most hospitalizations and poison control consultations about pesticide exposure concerned domestic exposures (Mehler, 2001b). An estimated 27% of hospitalizations and 9% of poison control consultations concerned suicide attempts, most commonly by people in their 20s and 30s. The largest age group for unintentional exposures was children less than five years old, who constituted an estimated 29% of hospital admissions and 34% of poison control consultations for unintentional pesticide exposures.

The PISP, by contrast, recorded primarily occupational exposures (87%). It recorded exposure to agricultural-use pesticides in 39% of its cases, compared to 5% among hospital records and 13% in poison control logs. Less than 1% of PISP records concerned either suicide attempts or children less than five years old.

File linkage indicated that the PISP learns of all episodes in which groups of people are exposed to pesticides, and that reports reach the surveillance program for roughly half of all exposures to agricultural-use pesticides (Mehler, 2001b). This represents relatively good reporting for surveillance in these categories (Teutsch 1994). The major gap in surveillance coverage is for residential exposures, including suicide attempts and exposures of children.

Results of Cooperation with Poison Control

As discussed earlier in this report, DPR constantly works to improve reporting of pesticide illnesses. In 1999, U.S. EPA funding allowed DPR to contract with the California Poison Control System (CPCS) to assist physicians in reporting pesticide cases. Federal funding was unavailable in 2000, but concerned poison control personnel continued to inform health care workers of their responsibilities under the law, to distribute reporting forms, and even to submit reports. DPR assigned 190 cases for investigation in 2000 based on information that CPCS had helped to provide. Investigation revealed at least a possible relation to pesticide exposure in 154 of the 190 cases.

These 154 cases include 100 (42%) of the 237 cases associated with non-occupational exposures, 24 (67%) of 36 hospitalizations, 39 (76%) of 51 cases in which people ingested pesticide, and 14

(47%) of the 30 cases involving children younger than 10 years old. Cases in which CPCS assisted also included all six of the cases reported on the day of exposure, 32 of the 39 reported the day after exposure, and 122 of the 185 reported within a week of exposure. The average time from exposure to notification was 15 days for cases that CPCS helped to report. For all other cases, the average time from exposure to notification was 78 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 county agricultural commissioners take advantage of the opportunity to collect environmental samples and to interview the people involved. Availability of federal funds allowed DPR to resume formal cooperation with CPCS in 2001.

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