SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE ILLNESS SURVEILLANCE PROGRAM
- 2014 -

HS-1900

California Environmental Protection Agency
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December 14, 2016

California Department of Pesticide Regulation

Worker Health and Safety Branch

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Acknowledgements

The Pesticide Illness Surveillance Program wishes to acknowledge those who have contributed to this report:

California County Agricultural Commissioners
Department of Pesticide Regulation Regional Enforcement Offices
California Poison Control System
California Department of Public Health, Occupational Health Branch

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Executive Summary

This report provides a summary of illnesses identified in 2014 by the Pesticide Illness Surveillance Program (PISP) of the California Department of Pesticide Regulation (DPR). DPR identified 1,685 cases potentially involving health effects from pesticide exposure. DPR epidemiologists determined that 1,073 (64%) of the 1,685 identified cases were at least possibly associated with pesticide exposure, a 5% decrease from the 1,128 associated cases in 2013. Evidence indicated that pesticide exposure did not cause or contribute to ill health in 330 (19%) of the 1,685 cases evaluated. Insufficient information prevented evaluation of 282 (17%) cases.

Despite a decrease in the number of associated cases in 2014, the number of associated episodes, defined as an event in which a single source possibly, probably, or definitely exposed one or more people (cases) to pesticides, increased 14%, from 733 in 2013 to 835 in 2014.

PISP identified 265 (25%) of the 1,073 cases as associated with agricultural use of pesticides. This reflects a 39% decrease from the previous year in which there were 435 cases in 2013. There were 798 (74%) cases associated with non-agricultural pesticide use, an increase of 16% from 2013 (685). Ten of the 1,073 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information.

In 2014, 268 (34%) of the 798 cases associated with non-agricultural use of pesticides were occupational, defined as those that occurred while the affected people were at work. Of the 268 associated occupational, non-agricultural use cases, 203 (76%) involved antimicrobial products.

Children (less than 18 years old) account for 146 (18%) of the 798 non-agricultural cases, and 6 (2%) of the 265 agricultural pesticide related cases. None of the 152 cases involved children exposed to pesticides while at school.

PISP data reflects that 148 agricultural field workers were injured by pesticide exposure in 25 separate episodes in 2014. The largest number of field workers injured in a single episode was 40. In 2013, the largest number of field workers injured in a single episode was 48. The total number of field worker episodes decreased by 29% from 35 episodes in 2013.

Background, Sources, and Purpose of Illness Surveillance

DPR administers the California pesticide-safety regulatory program, widely regarded as the most stringent in the nation[1]. This program includes a thorough data review of all pesticides before registration in California, often with specific data requirements not required by other states, as well as illness

[1] United States General Accounting Office. (1993). Report to the Chairman, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate. *Pesticides on Farms, Limited Capability Exists to Monitor Occupational Illnesses and Injuries*. Report Number PEMD-94-6.

reporting requirements and mandatory pesticide use reporting. In addition, DPR oversees a unique enforcement system involving the assistance of California Agricultural Commissioners (CACs) operating in every county in the state. CACs ensure compliance with all federal and state laws and regulations, and, in the case of restricted material pesticides, issue time and location specific permits that can place additional restrictions on use[2] [3].

Mandatory reporting of pesticide[4] illnesses has been part of the program since 1971. Illness reports are collected, evaluated, and analyzed by program staff. PISP is the oldest and largest program of its kind in the nation; its epidemiologists provide data to regulators, advocates, industry, and others.

Under the California Health and Safety Code section 105200, physicians are required to report any suspected case of pesticide-related illness or injury to the local health officer within 24 hours of examining the patient. The law requires local health officers (LHO) to inform the County Agricultural Commissioner (CAC) and to complete a pesticide illness report (PIR), and send it to the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Industrial Relations (DIR), and the DPR-PISP. LHOs and healthcare providers are also able to fulfill their reporting requirements via the California Reportable Disease Information Exchange (CalREDIE), an online medical provider portal. PISP began receiving PIRs from CalREDIE in 2013. Unfortunately, since it is duplicative of existing reporting systems for pesticide related illnesses and has low participation by LHOs, not many pesticide incidents are reported through CalREDIE. It is our hope that with continued outreach and training, LHOs will become more familiar with the system and its use will increase.

DPR strives to ensure that PISP captures the majority of pesticide illness incidents. DPR epidemiologists review copies of the Doctor's First Report of Occupational Illness and Injury (DFROII) submitted to the California Department of Public Health Occupational Health Branch (CDPH-OHB) to identify occupational pesticide illness cases that may not have been reported to the local health officer. These are documents associated with workers' compensation claims that physicians are required to forward to the Department of Industrial Relations (DIR) and are subsequently shared with the CDPH-OHB. These DFROIIs are the primary source of PISP's occupational illness reports and predominantly involve non-agricultural and, to a lesser extent, agricultural use of pesticides. PISP epidemiologists select for investigation any DFROII that mentions a pesticide as a possible cause of injury, or involves a situation in which pesticide use is likely.

Another significant source of pesticide illness reports is the California Poison Control System (CPCS). When a medical professional contacts CPCS about an illness or injury that may be related to a pesticide, CPCS offers to submit a pesticide incident report to DPR on behalf of the medical provider. Through this

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[2] http://phys.org/news/2015-01-california-unveils-strict-pesticide.html
[3] http://phys.org/news/2016-10-california-tightening-popular-pesticide.html
[4] Pursuant to California Code of Regulations, Section 6000, "pesticide" is used to describe any substance which is intended to prevent, destroy, repel, or mitigate any pest. Pests may be insects, fungi, weeds, rodents, nematodes, algae, viruses, or bacteria that may infest or be detrimental to vegetation, man, animals, or households, or any agricultural or non-agricultural environment. 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, water modifiers, and wetting and dispersing agents.

contract with CPCS, PISP continues to identify hundreds of symptomatic exposures, mostly non-occupational, that may otherwise be unreported. CPCS began assisting with pesticide illness reporting in 1999, but budgetary constraints prevented complete CPCS participation from 2003-2006.

The California Department of Pesticide Regulation (DPR) is vested with primary authority through the U.S. Environmental Protection Agency (U.S. EPA) to enforce federal and state laws pertaining to the proper and safe use of pesticides. DPR's authority to enforce pesticide laws and regulations in the field is largely carried out in California's 58 counties by County Agricultural Commissioners (CACs) and their staffs (approximately 400 inspector/biologists). The CAC staff investigate suspected pesticide illnesses that occur in their jurisdictions, whether or not they involve agriculture. DPR provides training and technical support for investigators. CACs are trained on how, when, and what type of samples to collect to document unintended exposure or contamination of persons and/or the environment, when possible. DPR contracts with the California Department of Food and Agriculture Center of Analytical Chemistry to analyze these samples. When investigations are complete, CACs send their reports to DPR describing their findings. These reports describe the circumstances that may have led to pesticide exposure and the consequences to all those known to have been exposed. In their role as enforcement agents, CACs also determine whether pesticide users complied with safety requirements. PISP epidemiologists evaluate medical reports and all information the CACs gather in the investigative process. They abstract and encode basic descriptors of the event, then undertake a complex synthesis of all available evidence to assess the likelihood that pesticide exposure caused the illness. Standards for the determination of pesticide exposure are described in the PISP program brochure, "Preventing Pesticide Illness," which can be viewed or downloaded from DPR's web site at http://www.cdpr.ca.gov/docs/whs/pisp/brochure.pdf.

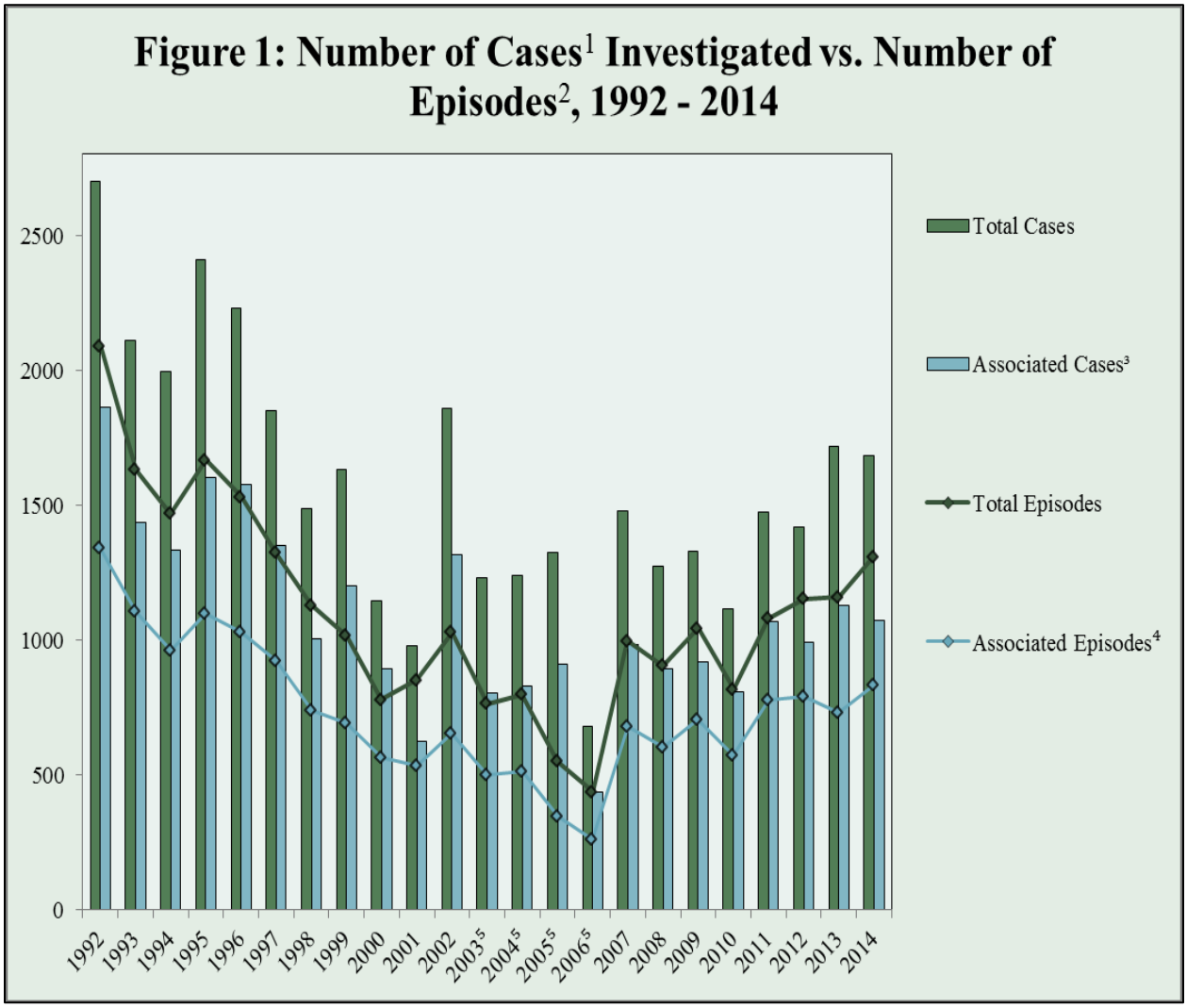
PISP is a passive surveillance system that depends primarily on the reports submitted by medical providers to identify cases of pesticide-related illnesses and injuries. Thus, there may be limitations in the quality, quantity, and timeliness of the information received. Measuring the population at risk is critically important in analysis, yet determining the size of the population at risk of a pesticide exposure is difficult. However, when combined with other reporting mechanisms, the information PISP receives can provide a more accurate representation of pesticide-related illnesses and injuries occurring throughout the state.

The purpose of this report is to provide a descriptive summary of the number and types of exposures occurring in a given year, and does not draw any conclusions or make recommendations. DPR scientists may, however, conduct subsequent investigations or studies of these cases for several reasons. For instance, DPR may consider these reports when it is conducting a risk evaluation or mitigation for a specific pesticide. Similarly, DPR epidemiologists regularly look to the PISP database to evaluate the effectiveness of the Department's pesticide safety regulatory programs and to assess the need for changes. Trends in the illness data may be brought to the attention of DPR management for future action and can result in the implementation of additional restrictions on pesticide use through California-specific permit conditions administered by the CACs or by changing statewide regulations. (E.g., see the discussion of fenpyroximate mentioned on page 22 of this report). Finally, if an illness episode results from illegal practices, in addition to an enforcement action, state and county staff may take appropriate action to educate pesticide users and promote appropriate pesticide use.

In an effort to improve the quality of the investigations received, DPR provides training sessions on investigation procedures approximately every two years or upon the request of the CACs to train new CAC staff. In 2014, DPR provided eight training sessions on Intermediate Level Investigative Techniques Training to CACs throughout the state from October through November 2014. Topics included authority and jurisdiction, types of investigations, developing an investigative plan, evidence collection and putting the report together.

2014 Numeric Results

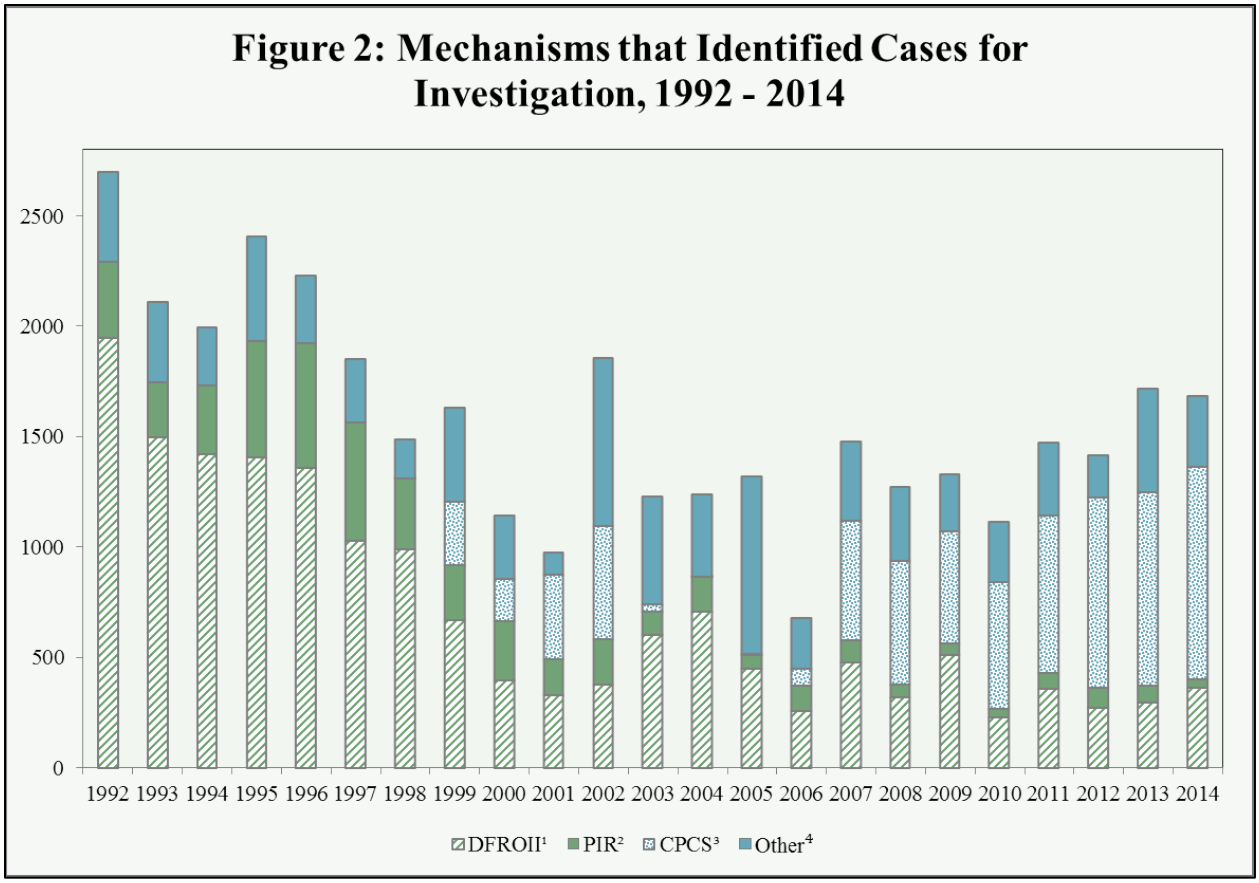
In 2014, PISP epidemiologists identified 1,685 cases that potentially involved health effects from pesticide exposure. This represents a 2% decrease from 1,718 cases identified in 2013, and a 19% increase from 1,418 cases identified in 2012. However, the total number of episodes, defined as an event in which a single source exposed one or more people (cases) to pesticides, increased by 13% from 1,160 in 2013 to 1,308 in 2014 (Figure 1).



1. A *case* is the Pesticide Illness Surveillance Program representation of a person whose health problems may relate to pesticide exposure.
2. An *episode* is an event in which a single source appears to have exposed one or more people (cases) to pesticides.
3. *Associated cases* are those evaluated as definitely, probably, or possibly related to pesticide exposure. A definite relationship indicates a high degree of correlation between the pattern of exposure and resulting symptomatology. The relationship requires both physical evidence of exposure and medical evidence of consequent ill health to support the conclusions. A probable relationship indicates a relatively high degree of correlation between the pattern of exposure and resulting symptomatology. Either medical or physical evidence is inconclusive or unavailable. A possible relationship indicates that health effects correspond generally to the reported exposure, but evidence is not available to support a relationship.
4. *Associated episodes* are those in which at least one case was evaluated as associated.
5. Budgetary constraints prevented complete California Poison Control System participation in providing case information from 2003-2006.

Figure 2 demonstrates the variation in number of cases identified by the different sources of investigation-initiating documents. The proportions of initiating documents received from the different sources in 2014 are similar to those of recent years.

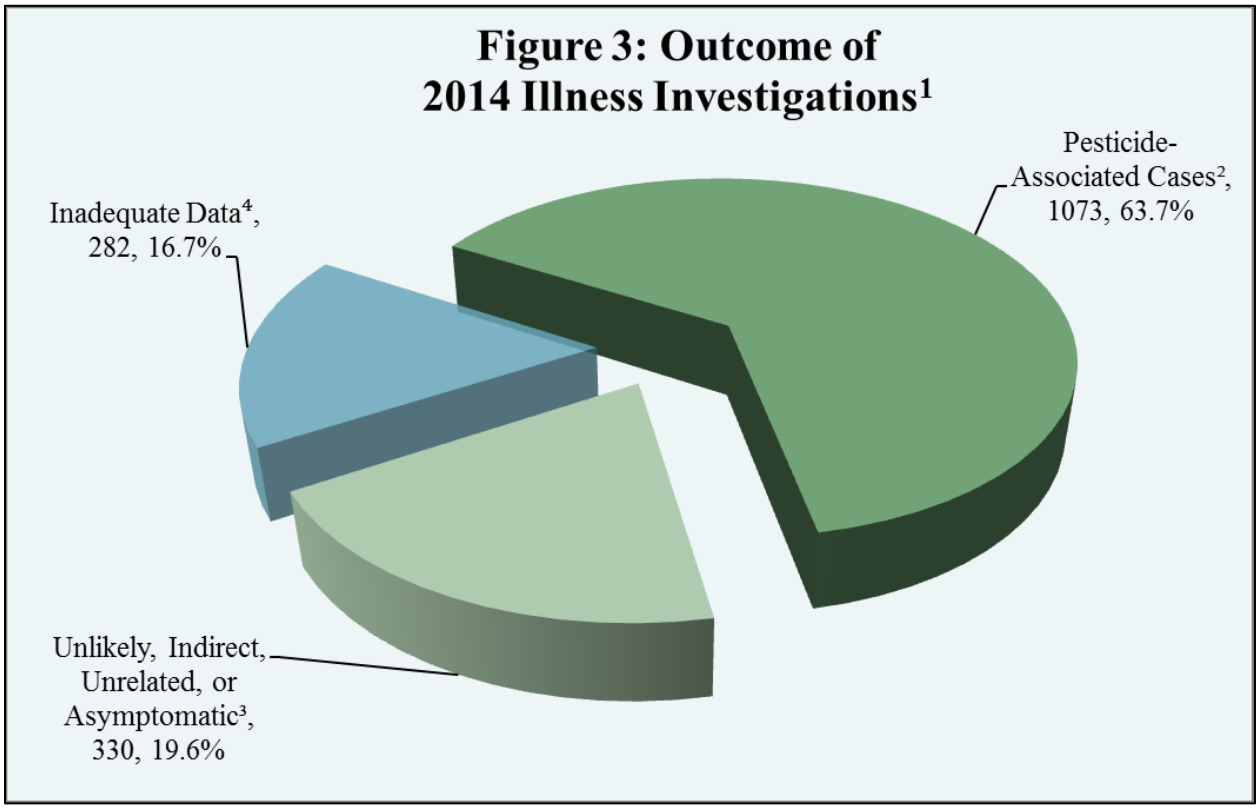
The California Poison Control System (CPCS) remained a major source of case identification in 2014. Both the number of cases reported and the proportion of total cases received from CPCS increased from 2013, by 10% and 6%, respectively. DFROII reports contributed 362 (22%) illness cases, an increase from 296 (17%) in 2013, which, similar to CPCS, represents an increase in both the number of cases reported and in the proportion of total cases received. Other reporting sources, such as county complaints, news media, as well as additional cases identified during the course of an investigation, led to 319 (19%) cases in 2014, a decrease of 32% from 2013 (471). In 2013, 27% of cases came from other reporting sources. Direct physician reporting to local health officers accounted for 41 (2%) of all identified cases. Of those 41 cases, CalREDIE PIRs initiated 5 (<1%) of the investigations. CalREDIE PIRs provided additional case information on 69 cases in the PISP database that had been initially reported through other sources.



1. *DFROII* – Doctor's First Report of Occupational Illnesses and Injury (Workers' Compensation document).
2. *PIR* – Pesticide Illness Report (physician reporting to local health officers in compliance with Health and Safety Code Section 105200).
3. *CPCS* – California Poison Control System (facilitated physician reporting). CPCS began assisting with pesticide illness reporting in 1999. Budgetary constraints prevented complete CPCS participation from 2003-2006.
4. *Other* – All other methods of case identification, including citizen complaints, contacts by emergency responders, and news reports.

PISP defines the term "associated" as cases evaluated as definitely, probably, or possibly related to pesticide exposure. PISP epidemiologists determined that 1,073 (64%) of the 1,685 cases identified in 2014 were associated cases. This is a decrease of 5% from 2013 to 2014. In 2013, 1,128 cases were associated with pesticide exposure. Despite the decrease in the number of cases in 2013, the number of associated episodes, defined as an event in which a single source possibly, probably, or definitely exposed one or more people (cases) to pesticides, actually increased 14%, from 733 in 2013 to 835 in 2014 (Figure 1).

Evidence indicated that pesticide exposure did not cause or contribute to ill health in 330 (19.6%) of the 1,685 cases evaluated. This grouping includes 111 asymptomatic cases, which constitute 6.6% of the total cases identified in 2014. Insufficient information prevented evaluation of 282 cases (16.7%) (Figure 3).

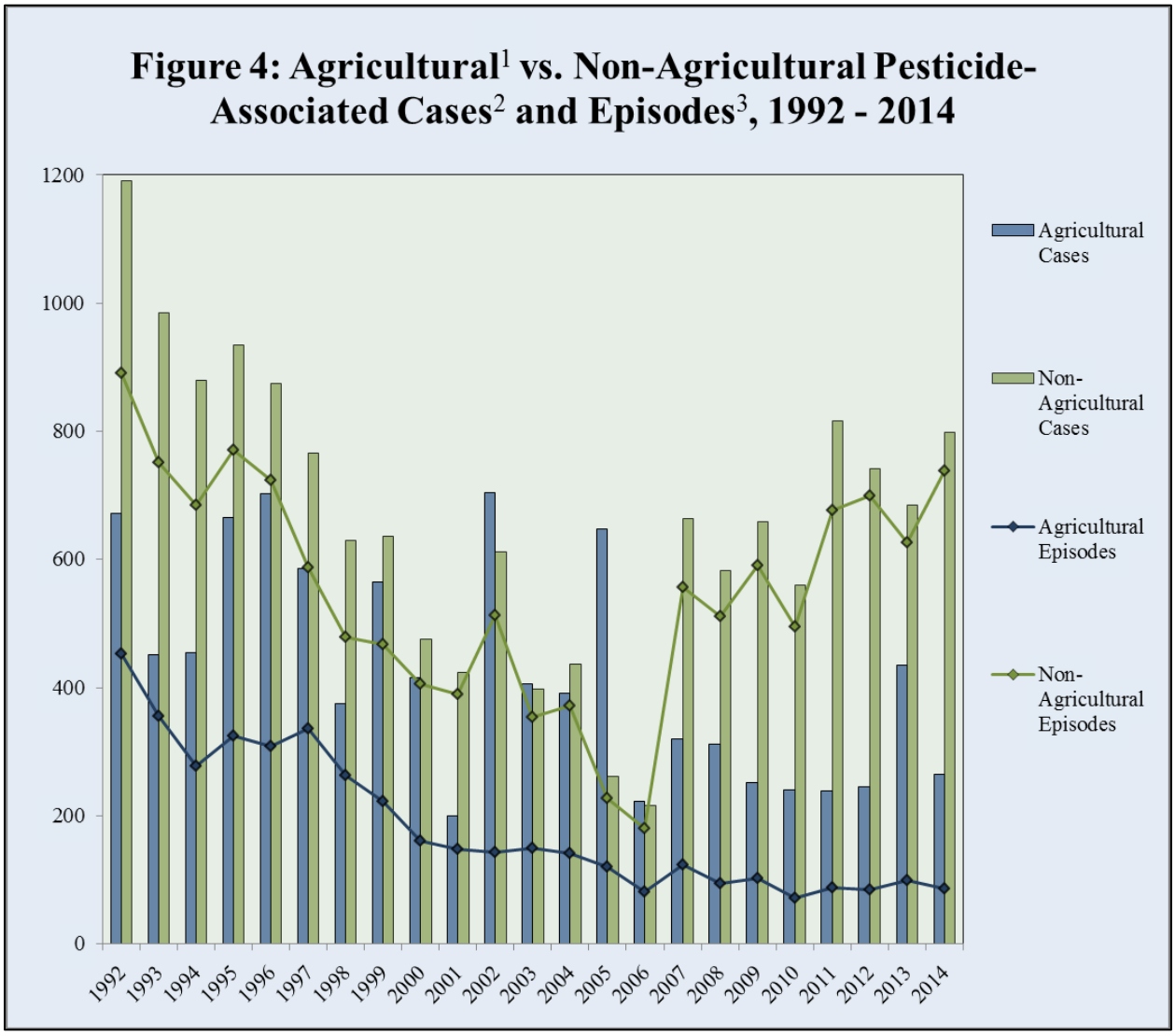


1. Total cases = 1,685
2. *Associated Cases* refers to cases involving pesticides classified as definitely, probably, or possibly related to human health effects.
3. *Unlikely/Indirect/Unrelated/Asymptomatic* refers to cases in which the weight of the evidence was against pesticide causation. Unlikely cases are those in which a correlation cannot be ruled out absolutely, but medical and/or physical evidence suggest a cause other than pesticide exposure. In indirect cases, pesticide exposure is not responsible, but pesticide regulations or product label requirements contributed to the illness (e.g., heat stress while wearing chemical resistant clothing). In unrelated cases, there is conclusive evidence of a cause other than pesticide exposure. Asympomatic cases are those in which the exposed people did not develop symptoms.
4. *Inadequate* means that there was not enough data reported to determine if pesticides contributed to ill health.

Of the 1,073 associated cases, 265 (25%) were attributed to pesticides used for agricultural purposes, a decrease of 39% from 2013 (Figure 4). Although the number of these cases decreased from 2013, the number of cases attributed to agricultural use pesticides increased 7% from 245 in 2012 and 11% from 239 in 2011. The total number of associated agricultural episodes decreased by a smaller percentage (13%) as compared to 2013, which indicates fewer large, multiple person episodes occurred in 2014. Overall, the number of associated agricultural episodes has been showing modest fluctuations since 2008. “Agricultural” is defined as involving pesticides intended to contribute to production of an agricultural commodity, including livestock. This corresponds to the regulatory definition of “production agriculture.” Use or intended use in non-production agriculture is designated as “non-agricultural.”

Of the 1,073 associated cases, 798 (75%) occurred under circumstances considered non-agricultural, an increase of 16% from 2013 and 8% from 2012. The total number of associated non-agricultural episodes also show a similar increase. Overall, the number of associated non-agricultural cases and episodes indicate an upward trend since 2007. Structural, sanitation, or home garden situations, as well as pesticide manufacture, transport, storage, and disposal, are considered "non-agricultural."

Ten of the 1,073 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information. These uncharacterized cases constitute less than 1% of the associated cases.



1. *Agricultural* cases are those that implicate exposure to pesticides intended to contribute to the production of agricultural commodities. *Non-agricultural* cases include all those in which the pesticide was not intended to contribute to production of agricultural commodities.
2. Several pesticide-associated *cases* could not be characterized as agricultural or non-agricultural due to unclear circumstances. These cases occurred in 1995 (1), 2005 (1), 2009

(12), 2010 (9), 2011 (14), 2012 (6), 2013 (8), and 2014 (10). These cases are not included in Figure 4.

3. Several pesticide-associated *episodes* could not be characterized as agricultural or non-agricultural due to unclear circumstances. These episodes occurred in 1995 (1), 2005 (1), 2009 (12), 2010 (9), 2011 (14), 2012 (6), 2013 (7), and 2014 (10). These episodes are not included in Figure 4.
4. Budgetary constraints prevented complete California Poison Control System participation in providing case information from 2003-2006.

Table 1 shows the number of cases evaluated at each level of relationship and its relation to agriculture. Sufficient evidence was available to determine that of the 1,073 pesticide-associated cases, 117 (11%) were definitely related, 603 (56%) were probably related, and 353 (33%) were possibly related to a pesticide exposure (Table 1).

Table 1: Relationship Evaluation of 2014 Illness Investigations

	Relation to Agriculture			
Relationship	Agricultural[1]	Non-Agricultural[2]	Unknown or Not Applicable[3]	**Total**
Definite[4]	24	92	1	117
Probable[5]	179	422	2	603
Possible[6]	62	284	7	353
Pesticide-Associated Subtotal	**265**	**798**	**10**	**1,073**
Unlikely[7]	16	26	0	42
Indirect[8]	1	9	0	10
Asymptomatic[9]	107	4	0	111
Unrelated[10]	0	0	167	167
Not Applicable[11]	33	239	10	282
Overall Total	**422**	**1076**	**187**	**1,685**

1. *Agricultural* cases are those that implicate exposure to pesticides intended to contribute to the production of agricultural commodities.
2. *Non-agricultural* cases include all those in which the pesticide was not intended to contribute to production of agricultural commodities.
3. Agricultural designation is not applicable to cases unrelated to pesticide exposure.
4. A *definite* relationship indicates a high degree of correlation between the pattern of exposure and resulting symptomatology. The relationship requires both physical evidence of exposure and medical evidence of consequent ill health to support the conclusions.
5. A *probable* relationship indicates a relatively high degree of correlation between the pattern of exposure and resulting symptomatology. Either medical or physical evidence is inconclusive or unavailable.

6. A *possible* relationship indicates that health effects correspond generally to the reported exposure, but evidence is not available to support a relationship.
7. An *unlikely* relationship indicates that a correlation cannot be ruled out absolutely. Medical and/or physical evidence suggest a cause other than pesticide exposure.
8. An *indirect* relationship indicates that pesticide exposure is not responsible for symptomatology, but pesticide regulations or product label requirements contributed in some way, (e.g., heat stress while wearing chemical resistant clothing).
9. An *asymptomatic* relationship indicates that exposure occurred, but did not result in illness/injury.
10. An *unrelated* relationship indicates definite evidence of causes other than pesticide exposure, including exposure to chemicals other than pesticides.
11. *Not applicable* indicates that relationship cannot be established because the necessary information is not available to the evaluator.

In 2014, occupational exposures, defined as those that occurred while the affected people were at work, account for 524 (49%) of the 1,073 associated cases. Non-occupational exposures account for 542 (51%) associated cases. Seven associated cases could not be characterized as occupational or non-occupational; 1 of these 7 cases also could not be characterized as agricultural or non-agricultural due to insufficient information (Table 1b).

Table 1b: Occupational Status Evaluation of 2014 Associated Cases

	Relation to Agriculture			
Occupational Status	Agricultural[1]	Non-Agricultural[2]	Unknown or Not Applicable[3]	**Total**
Non-Occupational[4]	18	524	0	542
Occupational[5]	247	268	9	524
Unknown or Not Applicable[3]	0	6	1	7
Total	**265**	**798**	**10**	**1,073**

1. *Agricultural* cases are those that implicate exposure to pesticides intended to contribute to the production of agricultural commodities.
2. *Non-agricultural* cases include all those in which the pesticide was not intended to contribute to production of agricultural commodities.
3. Agricultural or occupational designation could not be characterized due to insufficient information.
4. The individual was not on the job at the time of the incident. This category includes individuals on the way to or from work (before the start or after the end of their workday).
5. The individual was on the job at the time of the incident. This includes both paid employees and volunteers working in similar capacity to paid employees.

Enforcement actions are often still under consideration when PISP receives and evaluates illness investigative reports, so violations noted by PISP may not correlate with DPR Enforcement Branch violations. Based on the information available at the time of evaluation, PISP epidemiologists concluded

that 630 (59%) of the 1,073 associated cases contained evidence to indicate a violation of safety requirements that contributed to the exposure. Harm might have been avoided if all the people involved had adhered strictly to safety procedures required by regulations and/or pesticide labels. Of the 630 cases with these contributory violations, 201 (32%) were attributed to pesticides intended for agricultural purposes. PISP epidemiologists identified 48 (4%) cases of non-compliance with regulations that did not contribute to the pesticide exposure (e.g., paperwork violations). It could not be determined whether violations contributed to 170 (16%) cases, and 225 (21%) cases had health effects attributed to pesticide exposure despite apparent compliance with all applicable label instructions and safety regulations. Of these 225 cases with no noted violations, 33 (15%) were attributed to pesticides used for agricultural purposes. Further evaluation of such cases is ongoing to determine if additional safety requirements are appropriate.

Non-Agricultural Pesticide Illnesses

The number of associated non-agricultural pesticide use cases and episodes increased in 2014, by 16% and 17% respectively. Exposures from drift contributed to 173 (22%) of the 798 non-agricultural cases. PISP defines drift as spray, mist, fumes, or odor carried from the target site by air during a pesticide application or the mixing/loading of pesticides. Drift as an exposure mechanism does not necessarily correspond to drift as a violation. Definitions of drift may vary among agencies. Exposures from spill or other direct forms of contact closely followed, with 165 (21%) of the cases. These affected individuals came in contact via a mechanism in which the pesticide was not propelled by the application equipment. Table 2 shows the number of non-agricultural cases and their exposure mechanisms.

Table 2: Mechanism of Exposure in Non-Agricultural Associated Cases, 2014

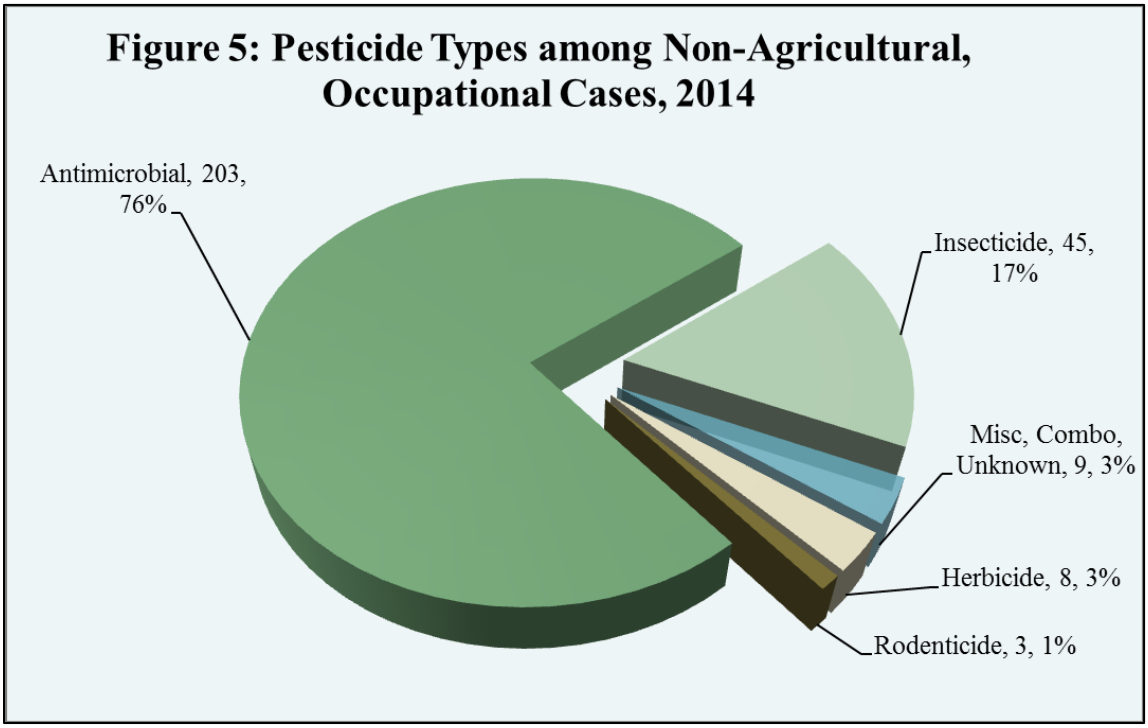
Exposure Mechanism	Count
Drift[1]	173
Residue[2]	94
Direct Spray/Squirt[3]	82
Spill/Other Direct[4]	165
Ingestion[5]	141
Other[6]	49
Multiple Exposures[7]	3
Unknown[8]	91
Overall Total	**798**

1. *Drift* refers to cases associated with exposure to spray, mist, fumes, or odor carried from the target application site by air. Drift as an exposure mechanism does not necessarily correspond to drift as a violation.

2. *Residue* refers to cases associated with exposure to pesticide that remains in the environment for a period of time following an application or drift.
3. *Direct Spray/Squirt* indicates that application equipment propelled pesticide onto the person.
4. *Spill/Other Direct* refers to contact made where the material is not propelled by application equipment.
5. *Ingestion* refers to intentional or unintentional oral ingestion and includes ingestion of residue.
6. *Other* indicates another known route of exposure that is not included in any other exposure category.
7. *Multiple Exposures* indicates that contact with pesticide occurred through two or more distinct mechanisms.
8. *Unknown* indicates the route of exposure could not be identified.

Occupational Exposures

In 2014, 268 cases involving non-agricultural, occupational exposures were evaluated as associated with pesticide use, an 18% increase from 228 in 2013. The majority of the workers (126, 47%) were exposed while applying pesticides; 23 (9%) were exposed while mixing/loading. Thirty-eight (14%) workers were exposed to pesticides although they did not handle pesticide products and their normal work activity has minimal expectation for exposure to pesticides (e.g., office workers). Products involved in the 268 cases of occupational exposures included antimicrobial disinfectants and sanitizers (203, 76%), insecticides (45, 17%), herbicides (8, 3%), and rodenticides (3, 1%). Combination of pesticide products (2), fumigants (2), fungicides (2), pool adjuvants (2), and unknown pesticide product (1) were grouped in the Misc, Combo, Unknown category, each product type accounts for less than 1% of non-agricultural, occupational cases (Figure 5). The most represented incident locations were service establishments (70, 26%), such as restaurants, hotels or fitness centers, followed by hospitals or other medical facilities (48, 18%), and schools (26, 10%). Representative case studies of employees exposed to pesticides are described below.



Case Summary - Occupational Antimicrobial Exposure

In Riverside County, a restaurant manager was cleaning an ice machine in the kitchen area to comply with a violation from a recent inspection by the Department of Environmental Health. After discarding all of the ice, the manager began to clean and sanitize the inside of the machine with a bleach and water solution.

As he was rinsing the machine, he noticed the floor drain under the machine was running slow and began to back up. He then went to the hardware store around the corner from the restaurant to purchase a clog remover. After pouring the liquid in the drain, he resumed cleaning the ice machine.

An hour later, a group of firefighters from the local station came in for lunch and noticed a chemical odor. Initially, the manager informed them only of the bleach solution he used to clean and sanitize the ice machine. When asked if other products were used, he then told them of the clog remover. The firefighters told the manager a chemical reaction was occurring and began to evacuate the restaurant. Two employees developed throat irritation and coughing. They were taken to the emergency room for evaluation and medically cleared the same day.

Although the restaurant has an automatic sanitizer dispensed at the sink, the manager purchased a bottle of bleach to sanitize the ice machine from the store next door. He did not read the label for either the bleach or the clog remover prior to use. The manager was provided with DPR's flyer "Using Disinfectants, Sanitizers, Medical Sterilants, and Other Antimicrobials in the Workplace."

Case Summary - Occupational Insecticide Exposure

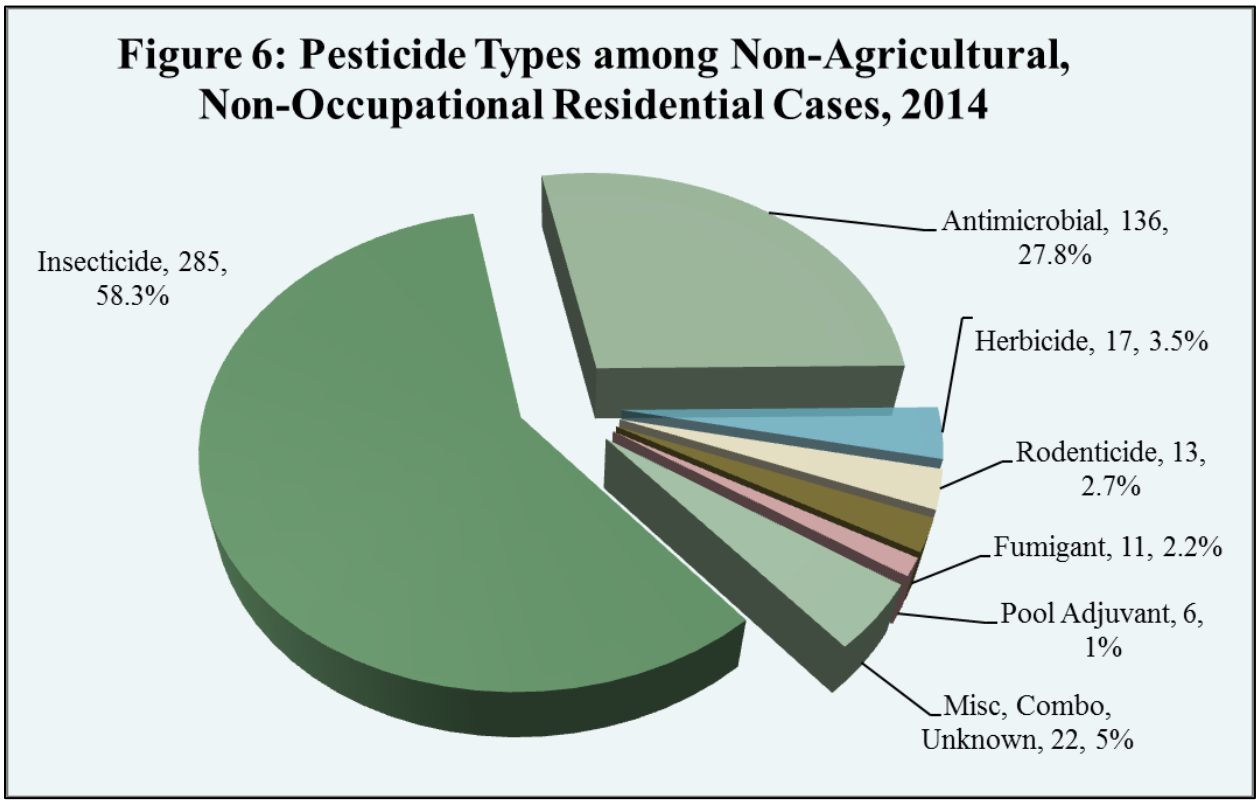
In Shasta County, during a raid of an illegal marijuana grove in the Lassen National Forest, five law enforcement agents were tasked with removing the marijuana plants. The crew used pruning shears to cut the plants and dragged the cuttings to a central location. A California Department of Fish and Wildlife warden questioned the grower about the pinkish white substance observed on the plants during the eradication effort. The grower stated that the substance was a pesticide applied to the marijuana to kill squirrels and rabbits that were eating the plants.

The agents did not report any symptoms while removing the plants. However, all began to feel ill that evening or the next day. They reported symptoms such as nausea, dizziness, headache, aluminum taste, blurry vision, cough, shortness of breath, watery eyes, runny nose, and unusually sore and stiff hands. They initially attributed their symptoms to the arduous task of eradicating the marijuana plants in the heat. After learning of their similar symptoms, they all sought care a week later. Upon interview for the investigation, nearly two weeks after the incident, a few of the men continued to feel ill.

A container of unregistered insecticide from Mexico was recovered at the site. Samples of the pinkish white substance on the plants were collected during the raid. Laboratory analysis of the samples was positive for carbofuran, the active ingredient of the unregistered pesticide.

Non-Occupational Exposures

In 2014, 524 cases involving non-occupational, non-agricultural exposures were evaluated as associated with pesticide use, a 16% increase from 452 in 2013. Most of the individuals (222, 42%) were exposed while performing routine activity with minimal expectation for exposure to pesticide (Routine Indoor and Routine Outdoor); 199 (38%) were exposed while applying or mixing/loading the pesticide. The majority of the incidents occurred in residential settings (490, 93%). The remaining associated cases occurred in non-residential locations such as Service (13, 2%) or Retail Establishments (6, 1%) (e.g., public pools, fitness centers, restaurants). Over half of the products involved in residential exposures were insecticides (285, 58%). Antimicrobial disinfectants and sanitizers (136, 29%) was the second most implicated product. Other products involved were, herbicides (17, 3%), rodenticides (13, 3%), and fumigants (11, 2%), as well as combination of and unknown pesticide products (22, 5%) (Figure 6).



Ingestion of pesticide accounted for 128 (26%) of the 490 non-agricultural, non-occupational residential cases. Eighty (63%) of these individuals were unaware that the product being ingested was a pesticide, which suggests improper storage may have made the pesticide accessible and contributed to their exposure. Drift exposures accounted for 109 (22%) of the non-agricultural, non-residential cases. Exposures via direct contact closely followed, with 104 (21%) cases. Direct contact includes exposures to pesticides propelled or squirted by the application equipment. Applicators and, to some extent, bystanders were mostly affected by drift and direct exposures, which suggests improper handling of pesticides may have contributed to their exposure (Table 3).

Table 3: Exposure and Activity of Non-Agricultural, Non-Occupational Cases in Residential Setting, 2014						
Activity	**Direct Contact[1]**	**Drift[2]**	**Residue[3]**	**Ingestion[4]**	**Other[5]/ Unknown[11]**	**Total**
Applicator[6]	58	84	5	4	31	182
Mixer/Loader[7]	4	5	0	0	0	9
Routine Actvity[8]	26	19	38	80	43	206
Transport/Storage/ Disposal[9]	1	0	0	0	0	1
Other[10]	12	1	10	39	9	71
Unknown[11]	3		0	5	13	21
Total	**104**	**109**	**53**	**128**	**96**	**490**

1. *Direct Contact* is a combination of 2 different exposure types: *Direct Spray/Squirt* indicates that the application equipment propelled pesticide onto the person; and, *Spill/Other Direct* refers to contact made where the material is not propelled by application equipment.
2. *Drift* refers to cases associated with exposure to spray, mist, fumes, or odor carried from the target application site by air. Drift as an exposure mechanism does not necessarily correspond to drift as a violation.
3. *Residue* refers to cases associated with exposure to pesticide that remains in the environment for a period of time following an application or drift.
4. *Ingestion* refers to intentional or unintentional oral ingestion and includes ingestion of residue.
5. *Other* is a combination of 2 different exposure types: *Other* indicates another known route of exposure that is not included in any other exposure category; and *Multiple Exposures* indicates that contact with pesticide occurred through two or more distinct mechanisms.
6. *Applicator* refers to individuals who applies pesticides by any method, including to their skin, or conducts activities considered ancillary to the application.
7. *Mixer/Loader* refers to individuals who mixes and/or loads pesticides.
8. *Routine Activity* refers to individuals who conducts activities in either an indoor or outdoor environment with minimal expectation for exposures to pesticides.
9. *Transport/Storage/Disposal* refers to individuals who transports pesticides between packaging and preparation for use.
10. *Other* refers to an individual performing an activity that is not adequately described by any specifically defined activity category.
11. *Unknown* refers to a case where the individual's activity or exposure type is not known.

Child Exposures

In 2014, 146 of the 796 non-agricultural cases evaluated as definitely, probably, or possibly related to pesticide exposure involved children (less than 18 years old). This excludes 20 cases of unknown ages. Of the 146 associated cases, 62 (43%) had been exposed via ingestion of the pesticide. Forty-seven (76%) of those children who ingested pesticide were less than six years of age. Products ingested by children under six years old include antimicrobial disinfectants and sanitizers (22, 47%), insecticides (18, 38%),

rodenticides (2, 4%), as well as miscellaneous or unknown pesticide products (5, 11%). Evidence suggests that in 42 (89%) of the 47 ingestions by children under six years of age, improper storage of the pesticide may have made it accessible to the child and contributed to the exposure. Exposures from direct spray and squirt account for 14% (21) of non-agricultural child exposure cases, followed closely by drift (14%, 20). Twelve children (8%) were exposed from pesticide residue and 7 (5%) were exposed from spill or direct forms of contact. Nine (6%) children became ill from "Other" or multiple modes of exposure. There was not enough information to characterize the mode of exposure for 15 (10%) children. Five of the 146 cases involved hospitalization, none of which resulted from self-harm attempts.

Of the 265 cases associated with agricultural pesticide use, six involved children. This excludes 123 cases of unknown ages. None of the 6 children were admitted to the hospital. Four (67%) of the 6 children came in contact with the pesticide via drift and 2 (33%) were exposed from pesticide residue.

None of the 152 children were exposed at school. These findings are similar to the number of child exposures in 2013.

Fatality Due to Improper Storage

A teenager found white powder inside an unlabeled prescription-type bottle in his parent's garage. A few months later, he brought the bottle to school where some students subsequently concluded that the white powder was cocaine. After school, he met a group of friends intending to snort the powder. Eventually, his friends dispersed without trying the powder and he gave the bottle to one of his friends.

Later that day, the friend and two other teenage boys decided to snort the powder in the backyard, away from family members. After snorting the powder, they immediately experienced convulsions, stomach and chest aches, stiff arms and legs, and muscle twitching. One of the boys turned blue and foamed around the mouth. He was in critical condition and pronounced brain dead a few days later. At the time of interview four to five days after the incident, the second teenager, whose house they were visiting, was still hospitalized for possible kidney damage. He was conscious and said his muscles still hurt. The third teenager was treated and medically cleared after a few hours in the hospital.

The parents of the teenager who found the bottle told investigators that they were unaware of any chemicals being stored in their garage, and some of the items had been in the garage when they moved in 14 years ago. No other suspicious substances or any other similar containers were found after a thorough search by the investigating police officer.

Laboratory analysis confirmed that the white substance was strychnine, a restricted use pesticide.

Agricultural Pesticide Illnesses

Applicators and Mixer/Loaders

In 2014, 37 (14%) of the 265 associated cases involved applicators or mixer/loaders of agricultural pesticides. Of these 37 cases, drift and spills or other direct exposures each contributed to 10 (27%). The exposure mechanism remained unknown in 7 (19%) of the cases. "Other" methods of exposure and

residue contributed to 5 (14%) and 3 (8%) of cases, respectively. Exposure via direct spray and ingestion each contributed to 1 (3%) of the 37 cases. PISP data reflects that equipment failure contributed to 3 (8%) of the cases which led to pesticide exposure via spill/ other direct. Sixteen of the handler (applicator or mixer/loader) cases resulted in lost work days. Two of the workers in these cases were hospitalized for a 24-hour period or more. One of the cases in which an applicator lost work days is highlighted below.

Case Summary - Pesticide Handler Exposure

In Monterey County, a worker became ill when he mixed, loaded and applied chlorpyrifos to a vineyard. The mixture was applied using a ground boom-sprayer being towed by an enclosed cab tractor. Near the end of his shift, he started to feel dizzy, lightheaded, nauseous and developed diarrhea. He noticed that he was able to smell the pesticide through his respirator. The worker continued to mix and load another batch of chlorpyrifos before telling a co-worker he was feeling ill. When he notified his supervisor of his symptoms, he was taken to the emergency room and was put on medical leave for 3 days.

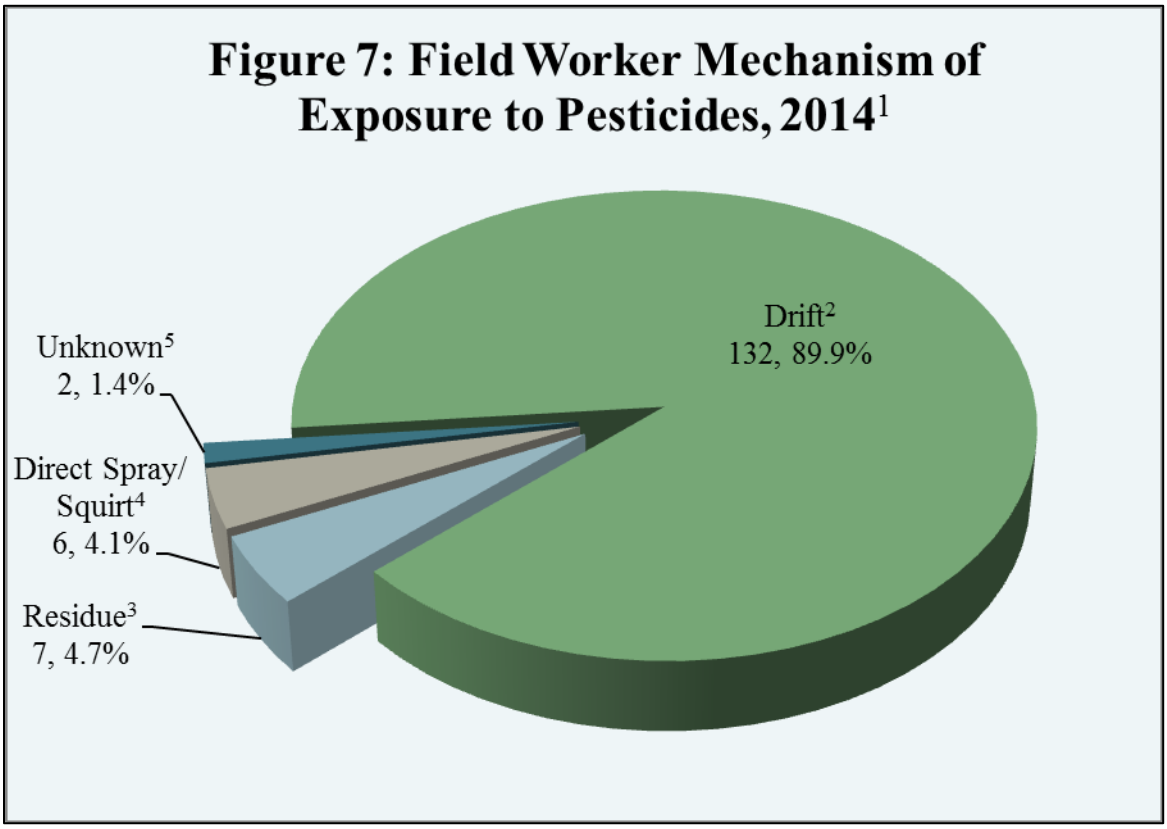
Though the employer provided a half-face respirator, they did not provide specific instructions on cartridge replacement frequency. Employees were told to replace the disposable cartridge periodically (around 40 hours) of use or as soon as pesticide can be smelled through the respirator. The worker stated he had not replaced the respiratory cartridge for eight days. He was also not wearing the label required chemical-resistant apron when mixing chlorpyrifos. Employer records showed the worker handled cholinesterase-inhibiting pesticides for 5 days in a 30-day period and he was not required to be monitored under the Medical Supervision Program.

The employer was cited for not properly training employees on respirator cartridge replacement. Since this incident, the employer has reevaluated their written respiratory protection program to include procedures on routinely replacing respirator cartridges. Employees are now trained to replace cartridges at the end of each workday when handling pesticides that require the use of a respirator.

Field Workers

PISP data reflects that 148 field workers were injured by pesticide exposure in 25 separate episodes in 2014, which constitutes 55% of the 265 agricultural illness cases and 29% of the 86 agricultural episodes. Despite a decrease from 2013, in which 266 field workers were injured in 35 separate episodes, the number of cases and episodes are comparable to that in 2012. Larger episodes may not happen in every calendar year, but when they do, they can dramatically alter the overall number of cases from year to year.

In 2014, the largest number of field workers injured in a single episode was 40, a decrease from 48 workers in 2013. The total number of multi-person field worker episodes decreased 63% from 16 multi-person episodes in 2013 to 6 in 2014, and 33% from 9 episodes in 2012. Pesticide drift, as defined by PISP, was associated with 132 (90%) of the 148 field worker cases in 15 separate episodes. Among field workers, pesticide residue contributed to 7 (5%) illnesses in 6 episodes. In two additional multi-person episodes, all 6 (4%) individuals were exposed by spill or other direct contact. There were two (1%) single-person episodes in which the exposure mechanism could not be determined (Figure 7). Two field worker episodes are summarized below.



1. Total pesticide-associated field worker cases = 266
2. *Drift* refers to field worker cases associated with exposure to spray, mist, fumes, or odor carried from the target application site by air. Drift as an exposure mechanism does not necessarily correspond to drift as a violation.
3. *Residue* refers to field worker cases associated with exposure to pesticide that remains in the environment for a period of time following an application or drift.
4. *Direct Spray/Squirt* indicates that application equipment propelled pesticide onto the worker.
5. *Unknown* indicates the route of exposure could not be identified.

Case Summaries – Field Worker Drift Exposures

In San Luis Obispo County, a field was fumigated with chloropicrin and 1,3-dichloropropene. The following day, workers at a nearby produce cooling facility noted an odor. Thirteen of 25 workers developed symptoms. Three of those with symptoms were taken for medical attention.

Upon learning of the odor complaints of the workers, the cooling facility's management began an investigation of their immediate surroundings. The facility stores a number of chemicals including a fumigant used on produce. However, photoionization detectors (PID) did not register readings inside the cooling plant's own fumigation chamber. On the other hand, a CAC staff observing the methyl bromide fumigation at the cooling facility thought that her PID was malfunctioning because it detected readings while she was inside her truck, 100 feet away from the chamber.

Workers on the western side of the cooling facility or inside the facility's air conditioned rooms experienced symptoms. By the time the farm manager was told that the cooling facility workers were ill, the sprinkler system had already activated to apply a water seal to the field.

Five days later, a second fumigation took place at another block of the same field. The next day, workers from the cooling facility noted an odor. Four workers and one CAC staff experienced symptoms but did not seek medical attention.

Although the weather conditions were suitable for fumigation, the tarps on the fumigated field were not all identical. Not all of the tarps used were Totally Impermeable Films (TIF), which was a violation of the Restricted Materials Permit condition for the fumigation. As a result, the grower and the pest control business that made the applications were issued violation notices for not accurately identifying and documenting the tarps used during the two field fumigations.

Since this episode, the CAC modified permit conditions requiring growers within a quarter mile of the cooling facility to notify the facility of proposed fumigation 48 hours prior to the fumigation. In addition, the growers are also required to notify the CAC of reports or illnesses coming from sites adjacent to the fumigated fields.

In Santa Cruz County, a crew inside and around berry hoop houses was drifted on by a helicopter application of a fungicide and insecticide to a nearby celery field. Forty of the 67 crew members reported symptoms such as nausea, vomiting, headache, burning eyes and throat, blurry vision, shortness of breath, upset stomach, rash, dry mouth, and mouth or lip numbness. Five workers were evaluated by the paramedics on site, while 4 were taken for medical attention. None of the workers were hospitalized.

Twenty five workers did not have symptoms, and two were not interviewed. Of those without symptoms, 14 reported an odor described as "sulfur," "stove cleaner," "house cleaner," "dead fish," "bleach," "poison," "bad," and "slight."

The helicopter was making turns over the hoop houses, and flying low generating gusts which caused dust to enter the hoop houses and shook the plastic covering. Some workers noted a yellow, red or orange dust being applied.

CAC staff collected swab and foliage samples from the celery field to the hoop houses. Results from the samples followed the drift pattern from the application site to the harvest site, and confirmed the presence of copper, the fungicide's active ingredient.

Although the pilot visually checked the area and could see about 10 feet into the hoop houses and his coworker drove by the berry field 30 minutes to an hour before flight to check for presence of field workers, he did not have his employees check to see exactly where the field workers were before he continued and finished the application. The pilot-owner was found not to have exercised the necessary precautions to determine the probability of harm to the field workers (CCR § 6600 and 6614, FAC § 12972 and 12973).

Shortly after the completion of the investigation, the pilot-owner was involved in an unrelated plane accident. He passed away from injuries resulting from the crash before a Notice of Proposed Action could be served, and the agricultural pest control business is no longer in operation.

Morbidity and Mortality

Of the 1,073 cases evaluated as associated with pesticide exposure, 42 people (4%) were hospitalized and 142 (13%) reported time lost from work or normal activity (e.g., going to school) (Table 4). Twenty six (62%) of the 42 people hospitalized had ingested pesticide. Of the 26 people, 17 (65%) acknowledged self-harm attempts.

Table 4: Summary of Pesticide-Associated[1] Hospitalization and Disability, 2014

Relationship	Total Cases	Number Hospitalized[4]	Lost Work Time[5]
Definite/Probable[2]	720	33	103
Possible[3]	353	9	39
Total Cases	**1073**	**42**	**142**

1. *Pesticide-associated* cases are those in which pesticide exposure was evaluated as definite, probable, or possible contributor to ill health.
2. A *definite* relationship indicates a high degree of correlation between the pattern of exposure and resulting symptomology. The relationship requires both physical evidence of exposure and medical evidence of consequent ill health to support the conclusions. A *probable* relationship indicates a relatively high degree of correlation between the pattern of exposure and resulting symptomology. Either medical or physical evidence is inconclusive or unavailable.
3. A *possible* relationship indicates that health effects correspond generally to the reported exposure, but evidence is not available to support a relationship.
4. Number of associated cases who were admitted and were hospitalized at least one full day (24-hour period).
5. Number of associated cases who missed at least one full day of work or normal activity such as school.

A total of six fatalities were evaluated as definitely, probably, or possibly associated with pesticide exposure. Three of the six cases were related to deliberate self-harm. One case was an 18-year old male who mixed products registered as pesticides, such as fungicides and disinfectants, to produce a lethal gas, a method known as detergent suicide. The other two self-harm cases involved ingestion of restricted use pesticides. Both cases were investigated, however, the source of the products could not be identified in either cases.

In the first of three unintentional fatalities, as reported above, three teenagers decided to snort white powder contained in an unmarked bottle found at a friend's garage. (See Fatality Due to Improper Storage

under Child Exposures for complete case summary.) One of the boys died after two days in the hospital. The other two boys recovered from the exposure. The boys thought the powder was cocaine. Chemical analysis confirmed the substance was strychnine.

The other two unintentional fatalities involved separate incidents of illegal entry into homes that were being fumigated with sulfuryl fluoride. In both cases, the deceased were found when the fumigator arrived to begin the aeration process. In one case, a man was found inside the home and in the other case, a man was found on the patio under the fumigation tarp. The houses had secondary locks installed and advisory signs posted on the tarp.

PISP Program Updates

Legislative Update – AB 1963

Assembly Bill 1963 (Nava, Chapter 369, Statutes of 2010), which added Section 105206 to the California Health and Safety Code, requires clinical laboratories to provide DPR the results of all cholinesterase tests performed on employees who regularly handle pesticides pursuant to Title 3 of the California Code of Regulation Section 6728 (3 CCR § 6728). The bill was established to evaluate the Medical Supervision Program (California Food and Agriculture Code Section 12981), and requires agricultural employers to contract with physicians to monitor their employees who regularly handle cholinesterase-inhibiting, toxicity category I or II pesticides. Physicians order baseline and periodic blood testing for these employees to measure the level of cholinesterase enzyme activity.

Health and Safety Code (HSC) Section 105206 requires clinical laboratories to provide the test results and the reason medical providers order cholinesterase tests (pursuant to 3 CCR § 6728) to DPR. Information on the patient, physician, employer and laboratory should also be provided.

Since January 2011, PISP regularly receives cholinesterase test results from CDPH-approved laboratories. However, these cholinesterase test results often do not include the reason it was ordered, as well as other information that will help determine whether or not the worker being tested is under the medical supervision program. In 2014, DPR received over 21,000 cholinesterase test results from the laboratories.

To supplement information not received through the cholinesterase test results reporting and to better evaluate the Medical Supervision Program, in 2014, PISP developed a questionnaire and mailed it to physicians who ordered cholinesterase tests from 2011-2013. To determine the growers' knowledge of and compliance with the requirements of 3 CCR § 6728, PISP staff, in collaboration with DPR's Enforcement Branch, conducted a focused growers' headquarters inspection on selected growers who reported the highest organophosphate and carbamate use from 2011-2013, based on the Pesticide Use Report. Complete results from both the medical supervisor survey and the focused growers' headquarters inspection are included in the report on the effectiveness of the Medical Supervision Program and the usefulness of laboratory-based reporting of cholinesterase testing for pesticide illness and surveillance. The report was a collaborative effort between DPR and OEHHA, in consultation with CDPH, and submitted to the state legislature on December 31, 2015. A copy of the complete report can be viewed or

downloaded from DPR's website
at http://www.cdpr.ca.gov/docs/legbills/reports/reg/cholinesterase/report.pdf.

Fenpyroximate Reformulation Update

Fenpyroximate was involved in 6 episodes from 2001-2010. A total of 55 associated cases were attributed to these episodes. Two of the six episodes involved more than 20 workers, and an odor was noted in five of the episodes.

Of the 55 associated cases, 18 workers experienced systemic symptoms such as headache, nausea, vomiting, and dizziness. Eleven reported eye symptoms, four experienced respiratory issues, and two had skin symptoms. Twenty of these 55 workers had 2 or more of either eye, respiratory, or systemic symptoms.

Fenpyroximate is a pale, yellow liquid with a bitter or aromatic odor, and is a skin and eye irritant. It was first registered in California in 2002. An additional insecticide/miticide product containing fenpyroximate was registered in 2004, primarily for use on fruit and nut crops. This product is an emulsifiable concentrate with a Signal Word "Warning." It contains an inert ingredient belonging to the petroleum chemical family and has a solvent odor. This product was implicated in all of the 55 associated cases.

An exposure summary written by DPR staff, and reviewed by the manufacturer's regulatory affairs division resulted in the reformulation of fenpyroximate to a "low-odor" product. The product was reformulated with inert ingredients of a considerably mild odor. The reformulated product was registered on October 16, 2013 and introduced in the marketplace in 2014.

Rodenticide Regulatory Change

Rodenticides fall into 3 categories: acute toxicant (bromethalin, cholecalciferol, strychnine, and zinc phosphide), first generation anticoagulant rodenticides (chlorophacinone, diphacinone, and warfarin), and second generation anticoagulant rodenticides (brodifacoum, bromadiolone, difenacoum, and difethialone).

In May 2008, the United States Environmental Protection Agency (U.S. EPA) proposed regulatory restrictions on rodenticide use by residential consumers to reduce the number of unintentional exposures to children. The restrictions would generally require rodenticide products aimed at residential consumers to be sold in solid formulations inside bait stations. The restrictions would also prohibit the sale of second generation anticoagulant rodenticides in stores oriented towards residential consumers. Most registrants complied with these restrictions. In November 2013, U.S. EPA moved to cancel the six non-compliant products. In July 2011, the California Department of Fish and Wildlife requested DPR to designate the second generation anticoagulant rodenticides as California restricted materials. Analysis by DPR of wildlife incident and mortality data between 1995 and 2011 revealed that exposure and toxicity to non-target wildlife from second generation anticoagulants was a statewide problem. In July 2014, DPR designated all four second generation anticoagulant rodenticides as restricted materials [3 CCR § 6400(e)]. This designation effectively banned the sale and use of these products by residential consumers.

In 2014, there were eight illnesses associated with exposures to rodenticides of which seven were due to intentional self-harm ingestions. Cases involving self-harm ingestions are typically not investigated due to the sensitivity of the case so the only information available is contained in the Pesticide Illness Report submitted by CPCS. Of the eight cases, two involved second generation anticoagulant rodenticides; three involved an unknown anticoagulant rodenticide where blood tests showed considerably elevated INRs (international normalized ratio); and three involved unidentified rodenticides without evidence of elevated INRs.

There were 145 alleged rodenticide exposures submitted by CPCS that did not meet the case criteria[5] for investigation. Children under six years old accounted for 105 (72%) of these cases. All but two children were asymptomatic and their INR levels within normal limits. Physicians found the symptoms of the two children to be inconsistent with rodenticide exposure.

The added restrictions by the U.S. EPA and DPR over the past decade on rodenticides in general and the specific restrictions on second generation anticoagulant rodenticides should help reduce the number of rodenticide exposures in the coming years.

Further Information

Tabular summaries presenting different aspects of 2014 pesticide illness data are available online at http://www.cdpr.ca.gov/docs/whs/pisp.htm or by contacting the WHS Branch at (916) 445-4222. Additionally, the public can retrieve reports of pesticide illness and generate reports according to their own specifications using the California Pesticide Illness Query program (CalPIQ). CalPIQ is available at http://apps.cdpr.ca.gov/calpiq and can retrieve cases evaluated as definitely, probably, or possibly related to pesticides from 1992 through the most recent year published.

Appendix I: Acronyms

CAC	County Agricultural Commissioner
CalREDIE	California Reportable Disease Information Exchange
CCR	California Code of Regulations
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
INR	International Normalized Ratio
OEHHA	Office of Environmental Health Hazard Assessment

[5] Criteria for case inclusion in the PISP database: 1) a pesticide is suspected to be involved, 2) evidence of signs or symptoms of illness, and 3) indication of medical consultation. Exceptions to criteria are fatalities and large scale episodes resulting with 5 or more people with symptoms.

OHB	Occupational Health Branch (of CDPH)
PIR	Pesticide Illness Report
PISP	Pesticide Illness Surveillance Program
U.S. EPA	United States Environmental Protection Agency
WHS	Worker Health and Safety Branch