SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE ILLNESS SURVEILLANCE PROGRAM
- 2017 -

HS-1903

California Environmental Protection Agency
Department of Pesticide Regulation
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April 30, 2020

California Department of Pesticide Regulation

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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
Office of Environmental Health Hazard Assessment

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EXECUTIVE SUMMARY

This report provides a summary of pesticide-related illnesses and injuries identified in 2017 by the Pesticide Illness Surveillance Program (PISP) of the California Department of Pesticide Regulation. PISP identified 2,006 cases, stemming from 1,257 episodes, potentially involving health effects from pesticide exposure. A case is a representation of an individual's exposure to a pesticide(s) that may or may not result in an illness and/or injury. An episode is an event in which a particular source appears to have exposed one or more people (cases) to pesticides. PISP epidemiologists determined that 1,342 (67%) of those identified cases, stemming from 818 (65%) episodes, were at least possibly associated with pesticide exposure. Evidence indicated that pesticide exposure did not cause or contribute to ill health in 345 (17%) of the 2,006 cases evaluated. Insufficient information prevented evaluation of 319 (16%) cases.

PISP identified 98 episodes resulting in 482 cases as associated with agricultural use pesticides (36% of the 1,342 cases). Agricultural field workers were injured by pesticide exposure in 34 separate episodes in 2017. The largest number of field workers injured in a single episode was 92.

There were 714 episodes resulting in 854 cases as associated with non-agricultural use pesticides (64% of the 1,342 cases). Six (<1%) of the 1,342 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information.

Of the 854 cases associated with non-agricultural use of pesticides, 303 (35%) were occupational, meaning the incident occurred while the affected individuals were at work. Antimicrobial products were implicated in 185 of these cases (61% of the 303 cases).

Children (less than 18 years old) accounted for 176 (13%) of the 1,342 associated cases; 161 cases involved non-agricultural use pesticides and 15 cases involved agricultural use. Four students were exposed to pesticides applied at a school site. There were no reported cases of children exposed to agricultural use pesticides while at school.

BACKGROUND, SOURCES, AND PURPOSE OF ILLNESS SURVEILLANCE

The California Department of Pesticide Regulation (DPR) administers the California Pesticide* Safety Regulatory Program. This program includes a thorough review of all pesticide data submitted for registration in California, often with specific data requirements not required by other states, as well as mandatory pesticide illness and pesticide use reporting requirements. In addition, DPR oversees a unique

* Pursuant to Title 3, California Code of Regulations (3 CCR) 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 used to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, water modifiers, and wetting and dispersing agents.

enforcement system involving the assistance of the County Agricultural Commissioners (CACs) operating in every county in the state. The CACs ensure compliance with all federal and state pesticide laws and regulations, and, in the case of restricted material pesticides, issue time and location specific permits that can place additional restrictions on use[†].

Data Definitions

Definitions for all terms used in this report may be found in Appendix C: Glossary (page 27).

Data Sources

In California, reporting of pesticide illnesses is mandatory. Under California Health and Safety Code (HSC) section 105200, physicians are required to report any suspected case of pesticide-related illness or injury to the local health officer (LHO) within 24 hours of examining the patient. LHOs must then inform the local CAC and complete a pesticide illness report (PIR), and send the PIR to the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Industrial Relations (DIR), and the DPR-Pesticide Illness Surveillance Program (PISP). LHOs and medical providers are also able to fulfill their reporting requirements via the California Reportable Disease Information Exchange (CalREDIE), a statewide web-based morbidity reporting system. PISP began receiving PIRs from CalREDIE in 2013, but receives only a small portion of reports via this pathway.

In order to ensure that the PISP database captures the majority of pesticide-related illnesses and injuries, DPR maintains a contract with the California Poison Control System (CPCS) to further assist healthcare providers in fulfilling their reporting requirements. When a medical professional consults with CPCS about an illness or injury that may involve a pesticide, CPCS offers to submit a PIR on behalf of the medical provider. Through this contract, PISP has been able to identify hundreds of pesticide-related exposures, mostly non-occupational, that may otherwise have been unreported.

Doctor's First Report of Occupational Illness and Injury (DFROII) are documents associated with workers' compensation claims that physicians are required to forward to the DIR and are subsequently shared with the California Department of Public Health-Occupational Health Branch (CDPH-OHB). Although physicians are required to submit a pesticide incident report to the LHO, PISP epidemiologists review copies of these reports submitted to the CDPH-OHB to identify occupational pesticide-related illness cases that may not have been reported to the LHO. The DFROIIs are the primary source of PISP's occupational illness reports and predominantly involve non-agricultural use pesticides. When a DFROII has been identified by PISP epidemiologists as involving a pesticide as a possible cause of injury, or involving a situation in which pesticide use is likely, the DFROII is forwarded to the local CAC for investigation as described below. PISP receives pesticide-related incident reports primarily from CPCS, worker's compensation reports, and LHOs, and to a lesser extent from citizen complaints, and referrals from other agencies and news media.

[†]California Food and Agricultural Code (FAC) § 11501.5, 12977, 12982, 14004, and 15201 specifies that the CACs enforce the pesticide use enforcement program under the direction and supervision of the DPR. FAC § 2281 outlines the responsibilities of each party in joint programs. 3 CCR sections 6140 and 6141 specify that DPR or the CAC may at any reasonable time, enter and inspect, interview employees and/or sample items in order to determine compliance.

Investigations and Analysis

Through the U.S. Environmental Protection Agency (U.S. EPA), DPR is vested with primary authority to enforce federal and state laws pertaining to the proper and safe use of pesticides. DPR's authority to enforce pesticide laws and regulations throughout the state is largely carried out in California's 58 counties by the CACs. The CAC staff investigate suspected pesticide illnesses that occur in their jurisdictions, whether or not they pertain to agriculture.

When investigations are complete, the CACs send their reports describing their findings to DPR. These reports describe the circumstances that may have led to the pesticide exposure and the consequences to all those known to have been exposed. In their role as enforcement agents, the CACs also determine whether pesticide users complied with safety requirements. In an effort to maintain the quality of the investigation reports received, DPR provides training sessions on investigation procedures to train new CAC staff and to also serve as a refresher for experienced investigators. DPR also provides technical support for CAC investigators on how, when, and what type of samples to collect and to document unintended exposure or contamination of persons and/or the environment, when possible.

PISP epidemiologists evaluate medical reports and all information gathered by the CACs in the investigative process. Following analysis of all the available information and evidence, PISP epidemiologists assess the likelihood that the pesticide exposure caused or contributed to the illness or injury. Standards for the determination of pesticide exposure are described in the PISP program brochure, "Preventing Pesticide Illness."‡

Data Limitations

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. PISP may become aware of a pesticide-related illness episode, and receive illness reports or additional case information for the published year after the release of the Annual Report. Therefore, the numbers contained in this report may differ from the online database query system, California Pesticide Illness Query (CalPIQ), which is updated with the new information.

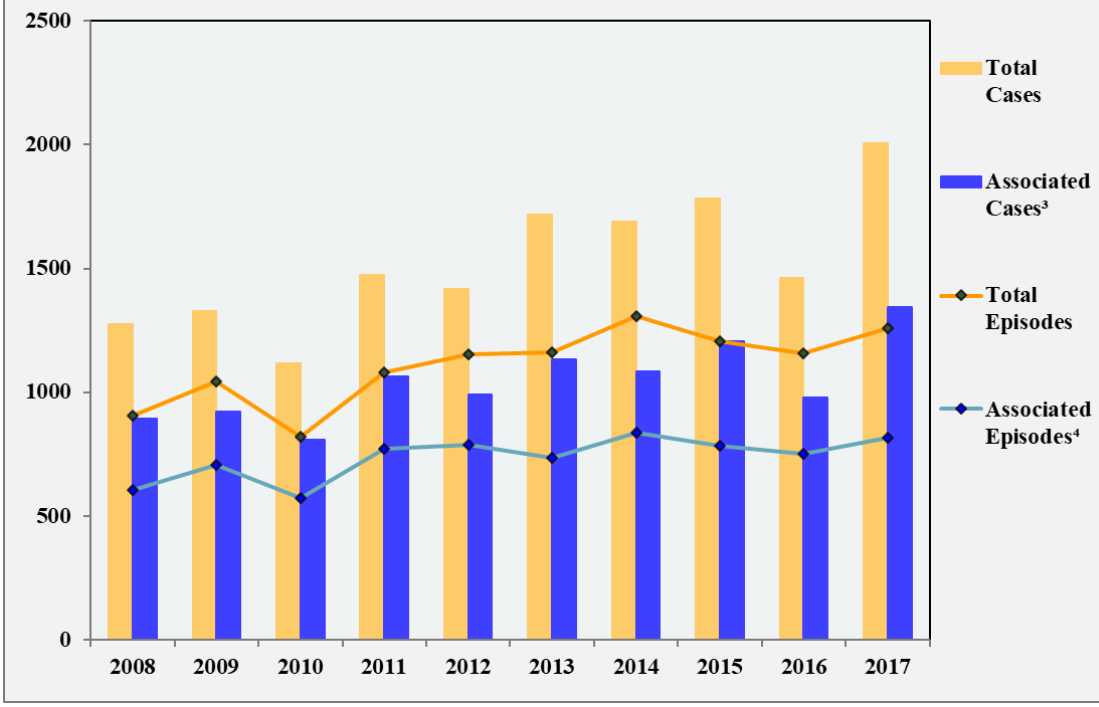
This report provides a descriptive summary of the number and types of exposures occurring in a given year, but does not draw conclusions or make recommendations.

‡ The PISP program brochure, "Preventing Pesticide Illness" can be viewed or downloaded from DPR's web site at http://www.cdpr.ca.gov/docs/whs/pisp/brochure.pdf.

OVERVIEW OF 2017 CASES

PISP epidemiologists identified 1,257 episodes resulting in 2,006 cases that potentially involved health effects from pesticide exposure (Figure 1). Overall, the data suggest that despite slight annual variations in the total number of episodes and cases, the number of associated episodes and cases have been relatively consistent since 2011.

Figure 1: Number of Cases vs. Number of Episodes Investigated, 2008 - 2017

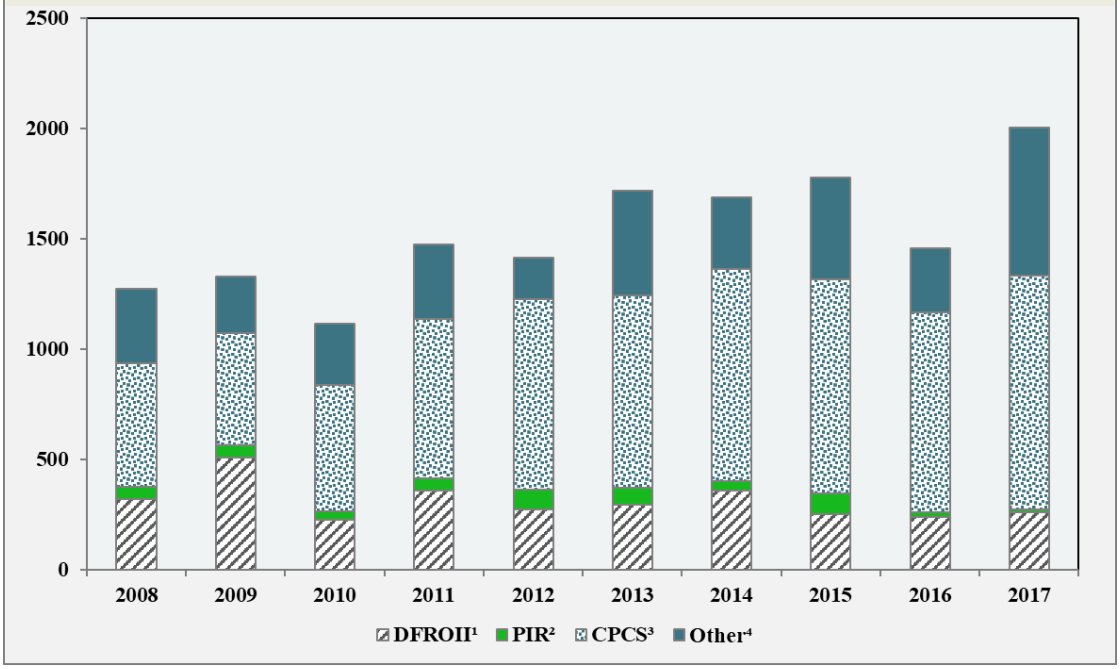


PISP receives report of pesticide exposure and assigns case numbers to those meeting program criteria for inclusion into the PISP database. These reports are then sent out to the CACs for investigation. The CPCS remained a major source of case identification and initiating investigations (1,059, 53%) (Figure 2). DFROII reports contributed 261 (13%) illness cases.

Other reporting sources, such as county complaints, news media, as well as additional cases identified during the course of an investigation, accounted for 670 (33%) cases. Direct physician reporting to LHOs, as required by HSC § 105200, accounted for 16 (<1%) of all identified cases, of which nine were transmitted by LHO to PISP via CalREDIE and seven were submitted by LHO via facsimile. Of those nine CalREDIE PIRs, five were the source for initiating the investigations and four provided additional information on cases in the PISP database that were initially reported through other sources.

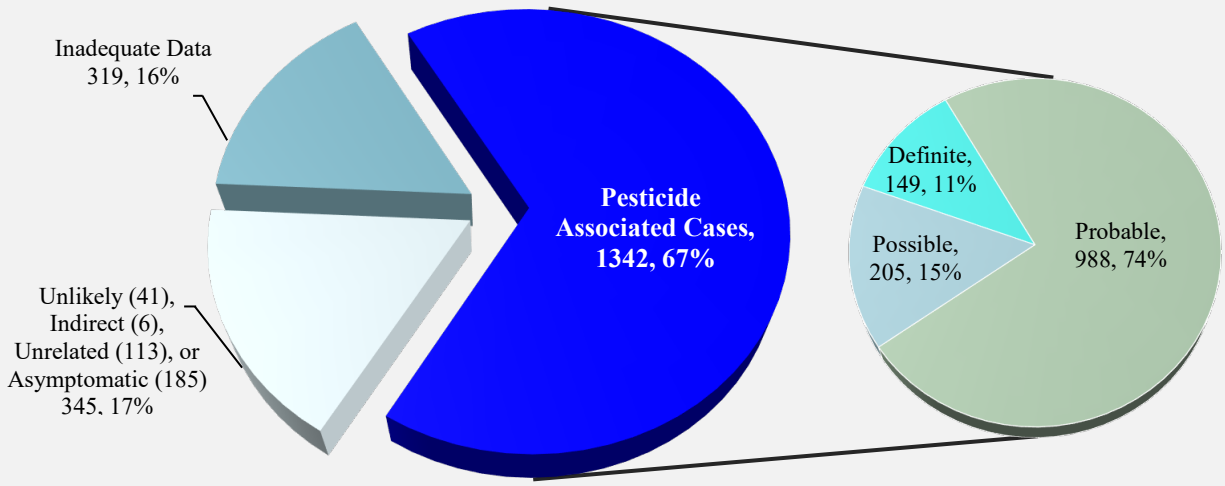
The California Poison Control System continues to be a major source of case identification and initiating investigations.

Figure 2: Mechanism that Identified Cases for Investigation, 2008 - 2017



PISP defines the term "associated" as cases where the associated illnesses or injuries were evaluated as definitely, probably, or possibly related to pesticide exposure (see Appendix C on page 27 for full glossary of terms). PISP epidemiologists determined that of the 2,006 cases identified in 2017, 1,342 (67%), stemming from 818 episodes, were associated cases. Figure 3 shows the outcome of the cases evaluated and the level of certainty (relationship). Sufficient evidence was available to determine that of the 1,342 pesticide-associated cases, 149 (11%) were definitely related, 988 (74%) were probably related, and 205 (15%) were possibly related to a pesticide exposure. There was evidence indicating that pesticide exposure did not cause or contribute to ill health in 345 (17%) of the 2,006 cases evaluated. This grouping includes 185 asymptomatic cases, which constitute 9% of the total cases identified in 2017. Insufficient information prevented evaluation of 319 (16%) cases.

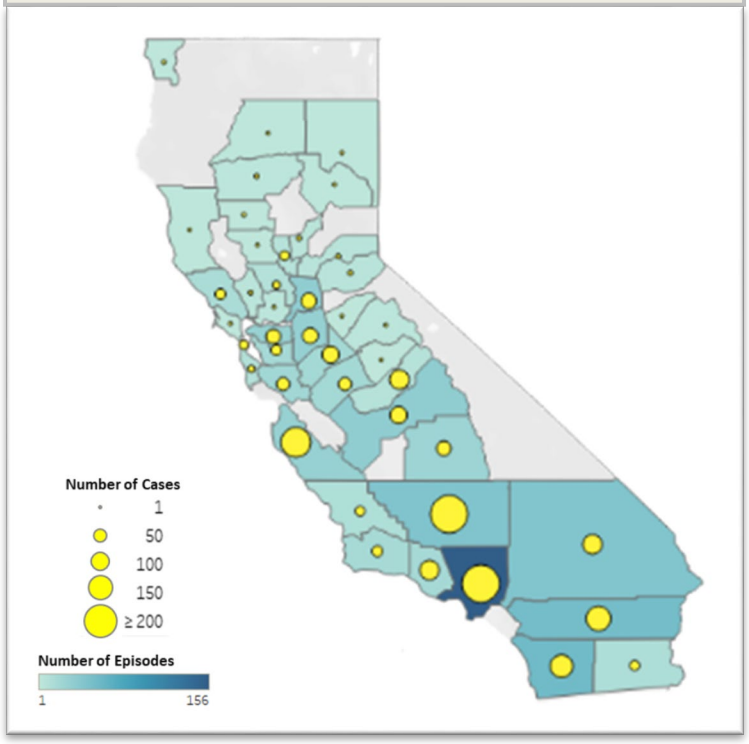
Figure 3: Outcome of 2017 Illness Investigations, by Cases



n = 2,006

Figure 4 displays the distribution of associated episodes (818) and cases (1,342) across the counties statewide. Los Angeles County accounted for the most number of associated episodes and cases, 19% (156) and 13% (180), respectively. Although 5% (43) of the episodes occurred in Kern County, it contributed to nearly the identical number of total associated cases (179, 13%) as Los Angeles County, reflecting occurrence of multi-person incidents in this county. Similar patterns are also seen in Madera, Monterey and Santa Cruz counties (See Table D1: Summary of Illness/Injury Incidents Reported in California Related to Pesticide Exposure, Summarized Statewide and by County of Occurrence, for a complete listing of associated episodes and cases by county).

Figure 4: Distribution of Associated Episodes and Cases



Overall, the number of associated agricultural episodes has been relatively consistent since 2008 (Figure 5). "Agricultural" is defined as involving pesticides intended to contribute to production of an agricultural commodity,

including livestock, which corresponds to the regulatory definition[§] of "production agriculture." Of the 818 associated episodes, 98 (12%) episodes were attributed to pesticides used for agricultural purposes. The number of cases can vary year to year based on the number of individuals involved in multi-person episodes.

Most of the associated episodes occurred under non-agricultural circumstances, (714, 87%). These episodes represent 854 cases, mostly involving a single person. Use or intended use in non-production agriculture is designated as "non-agricultural," and includes structural, sanitation, or home garden use, most industrial and institutional uses, as well as pesticide manufacture, transport, storage, and disposal.

The six remaining pesticide-associated episodes could not be characterized as agricultural or non-agricultural due to insufficient information. These uncharacterized cases constitute less than 1% of the associated cases and are not included in Figure 5.

Figure 5: Agricultural vs. Non-Agricultural Pesticide-Associated Cases and Episodes, 2008 - 2017

[§] FAC § 11408: "Agricultural use" means the use of any pesticide or method or device for the control of plant or animal pests, or any other pests, or the use of any pesticide for the regulation of plant growth or defoliation plants.

Occupational exposures, defined as those that occurred while the affected people were at work, accounted for 719 (54%) of the 1,342 associated cases, with agricultural workers accounting for more than half of these cases (413, 57%). Non-occupational exposures accounted for 619 (46%) of the associated cases, involving mostly non-agricultural use pesticides (550, 89%). Four associated cases could not be characterized as occupational or non-occupational due to insufficient information (Table 1).

Occupational exposures accounted for over half of the associated cases.

Table 1: Agricultural and Occupational Status Evaluation of 2017 Illness Cases

Occupational Status	Agricultural	Non-Agricultural	Unknown or Not Applicable	Total
Non-Occupational	69	550	0	619
Occupational	413	303	3	719
Unknown or Not Applicable	0	1	3	4
Total	**482**	**854**	**6**	**1,342**

When PISP receives and evaluates illness investigative reports, enforcement actions by CAC and DPR are often still under consideration, so violations noted by PISP may not correlate with enforcement actions taken. Based on the information available at the time of evaluation, PISP epidemiologists concluded that 431 (53%) of 818 associated episodes, resulting in 811 cases, contained evidence to indicate that a violation of safety requirements contributed to the exposure. Illness and/or injury *may* have been prevented if the people involved had adhered strictly to safety procedures required by regulations and/or pesticide labels. Of the 431 episodes with these contributory violations, 46 (11%) were attributed to pesticides intended for agricultural purposes.

PISP epidemiologists identified 32 (4%) of the 818 episodes of non-compliance with regulations that did not contribute to the pesticide exposure (e.g., paperwork violations). Due to insufficient information, PISP could not determine if non-compliances occurred in 213 (26%) episodes. There were 142 (17%) episodes involving 237 individuals that had health effects attributed to pesticide exposure despite apparent compliance with all applicable label instructions and safety regulations. Of these 142 episodes, 29 (20%) were attributed to pesticides used for agricultural purposes.

NON-AGRICULTURAL PESTICIDE ILLNESSES

Of the 854 cases involving non-agricultural use pesticides, exposures from direct forms of contact contributed to 246 (29%) cases. The affected individuals came in contact when the pesticide was spilled or directly propelled by the application equipment. Exposures from drift accounted for 191 (22%) of the 854 cases. PISP defines drift as spray, mist, vapors, 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. Illness and injuries due to ingestion of pesticide accounted for 133 (16%) of the non-agricultural use cases. Table 2 shows the number of non-agricultural cases according to exposure mechanisms.

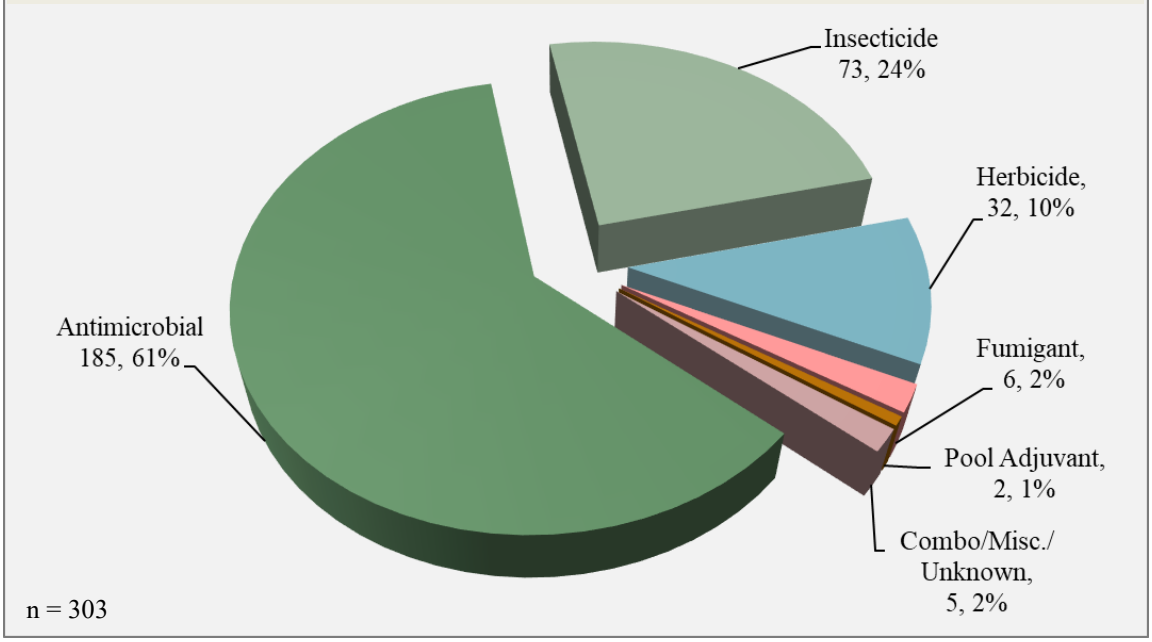
Table 2: Mechanism of Exposure in Non-Agricultural Associated Cases, 2017

Exposure Mechanism	Cases
Direct Contact	246
Drift	191
Ingestion	133
Multiple Exposures	26
Other	45
Residue	123
Unknown	90
Total	**854**

Occupational Exposures

For cases involving non-agricultural, occupational exposures, 303 were evaluated as associated with pesticide use. Workers exposed while handling pesticides accounted for over a third of these cases [Applicators (89, 29%) and Mixer/Loaders (25, 8%)]. Eighty-four (28%) of the 303 workers were exposed to pesticides as bystanders, meaning they were not handling pesticide products and their normal work activity had minimal expectation for exposure to pesticides (e.g., office workers). Antimicrobials and disinfectants were implicated in in 185 (61%) of the occupational cases. Insecticides were the second most common pesticide class, accounting for 24% (73) of occupational cases (Figure 6). The most represented incident locations were service establishments (89, 29%), such as restaurants, hotels or fitness centers, followed by crop/livestock processing (37, 12%) and hospitals or other medical facilities (35, 12%).

Figure 6: Pesticide Types among Non-Agricultural, Occupational Cases, 2017

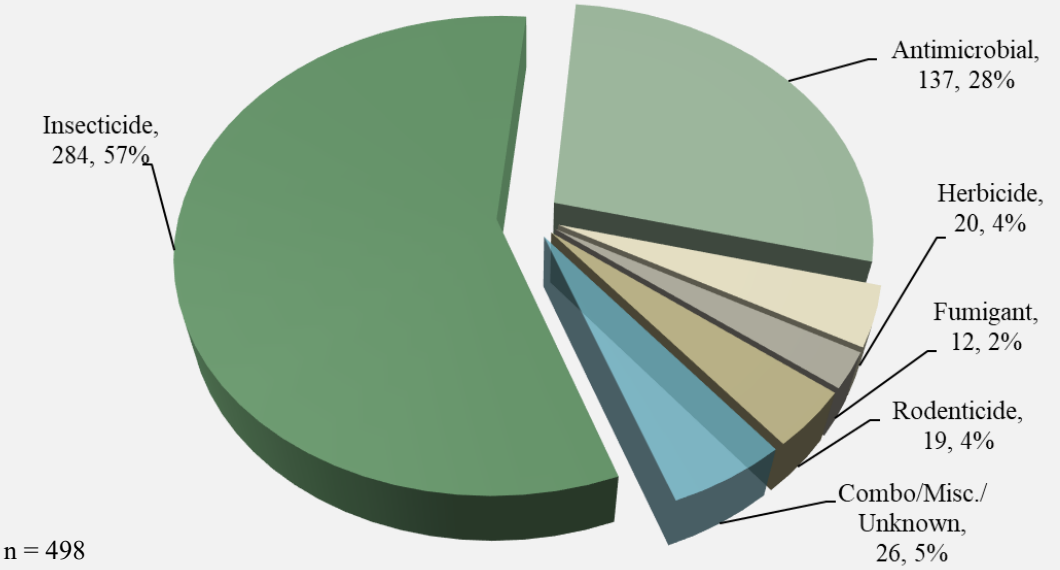


Non-Occupational Exposures

For cases involving non-occupational, non-agricultural exposures, 550 were evaluated as associated with pesticides. Most of these individuals were exposed while performing activities with minimal expectation for exposure to pesticides (245, 45%); followed by individuals who were exposed while handling pesticides (204, 37%). The majority of the incidents occurred in residential settings (498, 91%). The remaining associated cases occurred in non-residential locations such as service establishments (e.g., public pools, fitness centers, restaurants) (25, 5%) or schools (10, 2%). Contrary to occupational exposures, over half of the products involved in non-occupational residential exposures (498) were insecticides (284, 57%). Antimicrobial disinfectants and sanitizers (137, 28%) were the second most implicated products. The Combo/Misc./Unknown category consists of pool adjuvants (e.g., muriatic acid), fungicides, and multiple types of pesticides used in combination (Figure 7).

91% of non-occupational cases occurred at home and the majority of these involved the use of insecticides.

Figure 7: Pesticide Types among Non-Agricultural, Non-Occupational Cases in Residential Settings, 2017



Ingestion of pesticides accounted for 114 (23%) of the 498 non-agricultural, non-occupational cases in residential settings. Ninety-five (83%) of the ingestion cases were accidental, primarily due to improper storage (e.g., pesticide was stored in a water bottle or placed in areas easily accessible to children. Exposures via direct contact accounted for 121 (24%) of the non-agricultural, non-occupational cases in residential settings. Direct contact includes exposures to pesticides spilled or propelled by the application equipment. Drift exposures closely followed in frequency, with 110 (22%) cases. Pesticide handlers (Applicators and Mixer/Loaders) were most commonly affected by drift (Table 3).

Table 3: Exposure and Activity of Non-Agricultural, Non-Occupational Cases in Residential Settings, 2017

Activity	Direct Contact	Drift	Residue	Ingestion	Other*/ Unknown	Total
Applicator	64	77	1	4	29	**175**
Mixer/Loader	9	14	0	0	1	**24**
Routine Activity	35	13	45	83	32	**208**
Other Activity	9	6	14	22	10	**61**
Unknown	4	0	1	5	20	**30**
Total	**121**	**110**	**61**	**114**	**92**	**498**

* *Other* is a combination of two different exposure types: *Other Exposure* and *Multiple Exposures*.

AGRICULTURAL PESTICIDE ILLNESSES

Of the 1,342 associated cases, PISP identified 482 (36%), stemming from 98 episodes, as associated with agricultural use pesticides. Exposures from pesticide drift contributed to 250 (52%) of the 482 agricultural cases. One third of the cases involved exposures to multiple types of pesticides, from a tank mix or concurrent applications (167, 35%). Fumigants and mixtures of only fumigants and insecticides account for 133 (28%) cases. Exposures from pesticide residue followed with 117 (24%) of the cases. Table 4 shows the number of agricultural cases according to the type of pesticide and exposure mechanisms.

Table 4: Types of Pesticide and Mode of Exposure in Agricultural Cases, 2017

Pesticide	Direct Contact	Drift	Residue	Ingestion	Multiple Exposures	Other*/ Unknown	Total
Antimicrobial	8	3	11	0	0	1	**23**
Fumigant	6	35	54	0	0	0	**95**
Fumigant & Insecticide Combination	0	0	0	0	38	0	**38**
Fungicide	9	18	5	0	0	4	**36**
Herbicide	7	26	1	1	1	3	**39**
Insecticide	3	56	7	0	0	18	**84**
Combination of Different Types of Pesticides	0	112	39	0	2	14	**167**
Total	**33**	**250**	**117**	**1**	**41**	**40**	**482**

* *Other* is a combination of two different exposure types: *Other Exposure* and *Unknown Exposure*s.

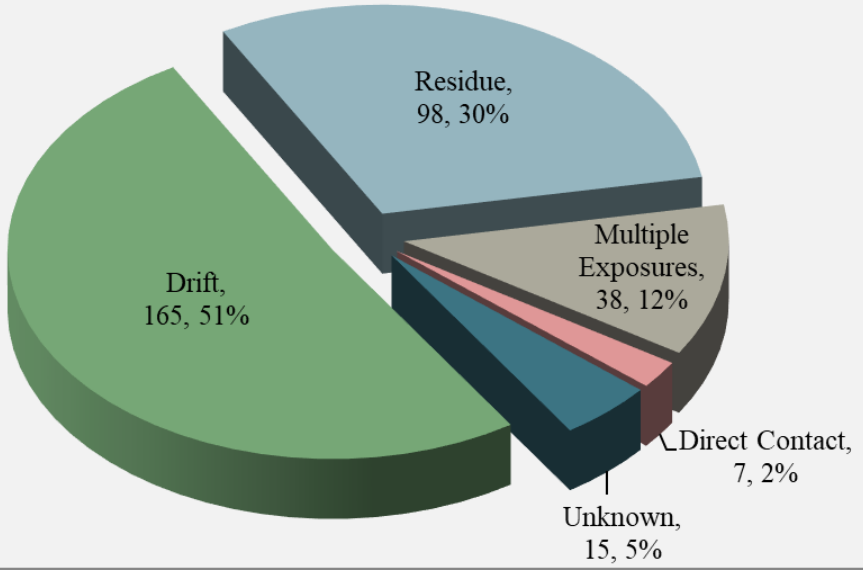
Applicators and Mixer/Loaders

Of the 482 associated cases, 40 (8%) involved applicators or mixer/loaders of agricultural pesticides, and nearly all were single-person episodes. For these 40 cases, spills or other direct contact from pesticides not propelled by an application or mix/load equipment contributed to 12 (30%) of the cases. Exposure via direct spray or squirt contributed to eight (20%) of the cases, followed closely by drift at six (15%) cases. *Other* methods of exposure contributed to two cases (5%), and *Residue* and *Multiple Exposures* each contributed one case (2%). The exposure mechanism remained unknown in ten (25%) of the cases. Equipment failure contributed to six (15%) of the cases, leading to pesticide exposure via direct contact. Ten (25%) of the handler (Applicator and Mixer/Loader) cases had reports of lost work days, but no one was hospitalized.

Field Workers

PISP data reflects 323 field workers were injured by pesticide exposure in 34 separate episodes in 2017, which constitutes 67% of the 482 agricultural illness cases and 35% of the 98 agricultural episodes. Large multi-person 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. The largest number of field workers injured in a single episode in 2017 was 92, whereas the largest number in 2016 was 34. Pesticide drift, as defined by PISP, was associated with 165 (51%) of the 323 cases involving field workers. Pesticide residue contributed to 98 (30%) illnesses, and 38 (12%) were exposed by drift and residue (Multiple Exposures) (Figure 8).

Figure 8: Field Worker Mechanism of Exposure to Pesticides, 2017



REPORTED ILLNESSES AMONG CHILDREN

There were 176 associated cases of pesticide exposure involving children (less than 18 years old). The two most common types of exposures were ingestion (58, 33%), and direct contact (48, 27%). Twenty-one (12%) children were exposed via drift, and 20 (11%) were exposed from residual pesticide (Table 5). The two pesticide types most often ingested were antimicrobials and insecticides, 17 (29%) and 26 (45%), respectively. Forty-three (74%) of the 58 children who ingested pesticides were less than six years of age. In the majority of the ingestions by children under six years of age, improper storage of the pesticide contributed to the exposure (37, 86%). Three (2%) children were hospitalized due to their pesticide exposure, none of which were due to self-harm attempts.

Fifteen children were exposed to agricultural use pesticides in eight separate incidents, of which seven were multi-person episodes. None of the children were admitted to the hospital. Four of the 15 children were working adolescents, ranging from 16 to 17 years old. The remaining 11 children were bystanders

from five separate multi-person episodes. The investigations identified contributory violations in four of the five episodes. There were no reports of children exposed to agricultural use pesticides while at school.

In 2017, there were no reports of children exposed to agricultural use pesticides while at school.

Since 2015 schools and pest control businesses are required to report their pesticide use at schools to DPR. In 2017, DPR received pesticide use reports from 7,172 schools and 1,802 child care centers across California, accounting for a total of 98,522 pesticide applications. Insecticides were the most reported pesticide type, followed by herbicides.[**] There were nine school children exposed from six separate episodes, one of which was from an insecticide application made at the school site by a pest control company. In this episode, four students and five teachers became ill after returning to their classrooms after the rooms were treated with insecticides three days prior (see case summary Pesticide Exposure at School on page 24). Of the remaining five episodes, one involved a student who brought a fogger to school and set it off. Two episodes involved insect repellents – one student accidentally sprayed himself in the eye with the repellent, and the other became ill after repellent was applied to most of his body. The final two episodes involved antimicrobials – a student poured unused sanitizing solution down the sink and inhaled the vapors. She had found the bottle of sanitizer in the bathroom that was left by the volunteer cleaning crew. In the last episode, a student was accidentally sprayed with an antimicrobial by her classmate while they were sanitizing tables.

Table 5: Pesticide Types and Mode of Exposure for Children < 18-years old, 2017

	Agricultural				Non-Agricultural					
Pesticide Type	**Direct Contact**	**Drift**	**Residue**	**Unknown**	**Direct Contact**	**Drift**	**Residue**	**Ingestion**	**Other*/ Unknown**	**Total**
Antimicrobial	1	0	0	0	24	6	2	17	10	**60**
Fumigant	0	0	2	0	0	0	0	3	1	**6**
Herbicide	0	3	0	0	1	0	0	2	1	**7**
Insecticide	0	6	0	1	21	4	16	26	16	**90**
Rodenticide	0	0	0	0	0	0	0	8	0	**8**
Pool Adjuvant	0	0	0	0	1	0	0	0	0	**1**
Misc./Combo	0	2	0	0	0	0	0	2	0	**4**
Total	**1**	**11**	**2**	**1**	**47**	**10**	**18**	**58**	**28**	**176**

* *Other* is a combination of three different exposure types: *Other Exposure*, *Multiple Exposures* and *Unknown*.

[**] https://apps.cdpr.ca.gov/schoolipm/school_ipm_law/2017_pur_summary.pdf.

MORBIDITY AND MORTALITY

Of the 1,342 cases evaluated as associated with pesticide exposure, 24 people (2%) were hospitalized and 141 (11%) reported time lost from work or normal activity (e.g., going to school) (Table 6). Fifteen (63%) of the 24 people hospitalized had ingested pesticide. Of those 15 people, ten (67%) acknowledged deliberate self-harm.

Table 6: Summary of Pesticide-Associated Hospitalization and Disability, 2017

Relationship	Cases	Number Hospitalized[1]	Number with Lost Work Time[2]
Definite/Probable	1137	21	125
Possible	205	3	16
Total	**1342**	**24**	**141**

1. Number of associated cases who were admitted and were hospitalized at least one full day (24-hour period).
2. Number of associated cases who missed at least one full day of work or normal activity such as school.

Five people were hospitalized for ten days or more due to ingestion of pesticides.

The first case involved an 89-year-old man who unknowingly ingested a pesticide that was improperly stored in a sports drink bottle. He spat the liquid out after tasting it, but shortly fell ill. By the time he was seen at the hospital, he had symptoms that included dizziness, vomiting, shakiness, pinpoint pupils, excessive secretions, shortness of breath, and pulmonary edema. He was admitted to the intensive care unit (ICU) and spent 40 days in the hospital. The specific pesticide product could not be identified as it was obtained from a friend in Mexico.

The remaining four cases were the result of deliberate self-harm. The first case involved a 27-year-old female who ingested an insecticide. She had characteristic symptoms of organophosphate toxicity and was admitted to the ICU for 13 days. The second case involved a 50-year-old male who ingested a cup of herbicide and experienced renal failure. He was hospitalized for 11 days. In the third case, a 30-year-old male also ingested an herbicide and was hospitalized for at least ten days. In the fourth case, a 76-year-old female ingested half a quart of an organophosphate insecticide and was hospitalized for at least 18 days.

Similarly, the two fatalities evaluated as definitely associated with pesticide exposure were both due to deliberate self-harm. They involved glyphosate and diquat, and aluminum phosphide pellets. In the first case, a 70-year-old male reportedly ingested two bottles of an herbicide before passing away due to respiratory failure. In the second case, a 22-year-old male ingested five aluminum phosphide pellets. He experienced renal and respiratory failure prior to passing.

ILLEGAL PESTICIDES IN CALIFORNIA

All pesticides, including antimicrobials, must first be registered by the U.S. EPA and DPR before they can be used, possessed, or offered for sale in California. This is done to ensure that, when used according to approved label directions, pesticide products should pose minimal risk to human health and the environment. Through the course of investigations, PISP has identified cases involving illegal pesticides that are brought into California from other countries, sold illegally at flea markets, in stores and online. The number of reports PISP received regarding these types of pesticides greatly increased in 2017 as compared to the previous five years (Table 7). What has remained consistent over the years is that the majority of the illegal pesticides identified in the case reports were found to originate from Mexico, and a majority of the cases involved cholinesterase (ChE)-inhibiting pesticides.

Table 7: Episodes vs. Cases According to Type of Illegal Pesticide, 2012-2017

Year	Total Episodes	Total Cases	
		ChE Inhibitors	Other Pesticides
2012	6	3	3
2013	4	3	2
2014	7	9	3
2015	5	3	2
2016	6	3	4
2017	16	13	11
TOTAL	**44**	**34**	**25**

In 2017, there were 24 cases, stemming from 16 separate episodes involving illegal pesticides. Two of the episodes involved self-harm attempts using illegal products obtained from Mexico (carbofuran and zinc phosphide).

Two of the remaining 14 episodes involved occupational exposures to carbofuran used on illegal cannabis grows. The first incident involved a game warden who was exposed to carbofuran when he crawled through an illegal cannabis garden while attempting to apprehend the growers. He experienced muscle aches, fatigue, cough, sore throat, and felt unwell. The second episode involved six workers in a forestry office who became ill after a rancher brought in a burlap bag containing carbofuran from an illegal marijuana grow and left it on the service counter. Their symptoms included headache, stomachache and dizziness. Although the burlap bag had several layers of plastic surrounding the container, the container lid had not been completely secured.

The remaining 12 non-occupational episodes, resulting in 13 cases, were mostly single person exposures and occurred at private residences. The most severe case, as previously discussed in the Morbidity and Mortality section (page 17), involved an 89-year old man who ingested an unknown pesticide that was

stored in a sports drink bottle that was obtained from a friend in Mexico. He spent 40 days in the hospital. The largest multi-person episode involved a 29 year-old woman who applied an insecticidal dust (cypermethrin) from Mexico to the floor of a bedroom to treat for bedbugs. She and her two children, ages 8 and 9, left for a period of time as instructed by the label. When they returned, she cleaned the bedroom and they all went to sleep in the room. All three woke up two hours later with symptoms of irritation and burning sensation to their faces.

FURTHER INFORMATION

Tabular summaries presenting different aspects of 2017 pesticide illness data are available online at http://www.cdpr.ca.gov/docs/whs/pisp.htm , or by contacting the Worker Health and Safety (WHS) Branch at (916) 445-4222 or email PISP at PISP@cdpr.ca.gov. Additionally, the public can retrieve reports of pesticide illness and generate reports according to their own specifications using the CalPIQ, which is available at http://apps.cdpr.ca.gov/calpiq. Through this online pesticide illness query application, users can retrieve cases evaluated as definitely, probably, or possibly related to pesticides from 1992 through the most recent year published.

APPENDIX A: CASE SUMMARIES

Case Summaries of Non-agricultural, Occupational Pesticide Exposures:

Occupational Antimicrobial Exposure

While a nurse was dialyzing a patient, a loosely-capped bottle of disinfectant that was behind the dialysis machine accidentally fell and spilled approximately 100 ml of bleach on the floor and onto the nurse's pants. The nurse immediately cleaned up the spill with towels. She put the contaminated towels in the dirty laundry basket inside the patient's room instead of directly into the disposal containers for hazardous materials. The odor of the disinfectant permeated the area, including the hallway. Another nurse brought in a fan for aeration, and the patient was moved to a different room. Although neither the patient nor the dialysis nurse developed any symptoms, 11 nurses working ten feet away from the patient's room experienced a variety of symptoms such as burning and redness of eyes, throat irritation, nausea, headache and difficulty breathing. The 11 nurses proceeded to the emergency room for immediate medical care.

Occupational Herbicide Bystander Exposure

A tree service company applied herbicides using a rugged terrain vehicle with a pull-behind spray boom to an open industrial lot. The application was completed at 6:50 am. The tank mix contained glyphosate, pendimethalin, and aminopyralid. As employees of a building adjacent to the lot began to arrive to work at 6:00 am, they noticed an odor, which they described as "rotten", "chemical", "gas like", or "pesticide". A call regarding the odor was placed to the local hazardous materials response team (HazMat) who informed the local CAC. One HazMat personnel described the wind as "gusty" and could smell a "chemical" odor. The fire department arrived at 8:00 am and evacuated 121 people from the building, then cleared it for re-entry. The building had to be re- evacuated around two hours later when the odor worsened.

The CAC interviewed 27 people who were involved in this episode. Twenty employees and one visitor at the building experienced respiratory and systemic symptoms such as coughing, headache, dizziness, vomiting, difficulty breathing, and throat irritation. Of the 21 people with symptoms, three were transported by ambulance to a hospital. They were observed and released the same day. Six employees were asymptomatic; however, five of them described smelling an odor as they arrived to work that morning.

The CAC collected two surface swab samples from the glass front door, and the window of the building. Additionally, two foliage samples were collected; one of which was from a shrub located three feet from the application site. The two swab samples were positive for pendimethalin, and the foliage sample from the shrub was positive for pendimethalin, aminopyralid, and glyphosate.

The tree service company was cited for applying pesticides when there was a reasonable possibility of damage to non-target private property, including the creation of a health hazard which prevented the normal use of the said property [3 CCR § 6614 (b)(3)].

Case Summary of a Resident Exposed to a Pesticide:

Non-Occupational Insecticide Exposure

Two residents noticed a toxic and pungent odor while inside their house, which had the door sliders and most of the windows open. Thinking it was a gas leak, they called the gas company. Upon arrival, the technician determined it was not a gas leak and identified that the source of the odor was emanating from their neighbor's yard. Both residents became ill shortly after smelling the odor, reporting symptoms of dizziness, nausea, vomiting, difficulty breathing, and chest and throat tightness. They also reported having a bad taste in their mouth. Emergency responders and the local Environmental Health Department (EHD) were also called to the house. The residents were taken to the hospital via ambulance.

The neighbor had mixed malathion with a ready-to-use insecticide containing cypermethrin and bifenthrin to control for aphids, and used the mixture to spray an Indian Laurel tree adjacent to the shared fence between the two homes. He stated that he generally does not measure the amounts. For this application, he poured the remaining couple of inches that was in a one quart malathion bottle into a half full 1.33 gallon ready-to-use insecticide container. He stated he was careful not to spray over the trees. Although he noticed the strong odor, he stated that was expected and did not experience any symptoms. He was instructed by the EHD to dilute the treated tree and area with water.

According to the malathion label, the dilution rate for treatment of aphids on outdoor ornamental plants is two teaspoons of the concentrate per one gallon of water. A letter of warning was sent to the neighbor for using the product in conflict with the pesticide label (FAC § 12973).

Case Summary of Bystanders Exposed to an Agricultural Use Pesticide:

Bystander Drift Exposure

A licensed pilot for an Agricultural Pest Control Business (Ag PCB) made an aerial application of an organophosphate insecticide and an adjuvant to approximately 1,900 acres of almonds between 7:00 pm and 11:29 pm. In the ensuing days, the local CAC received 55 complaints of an odor described as "strong" and "bad" from residents in a neighborhood located a half mile to the east of the almond orchard. The CAC's investigation determined that 64 residents were involved in this episode. Of the 64 residents, 42 experienced symptoms, most commonly headache, eye, and respiratory. Of the 42 residents who had symptoms, four went to the hospital for medical care. Sixteen residents were asymptomatic. Six residents could not be interviewed by the CAC, therefore, it could not be determined if they experienced any symptoms.

At the beginning of the application, the temperature was 83.2° F with winds at 7 mph from the west and humidity at 41%. By the end of the application, the temperature fell to 66.5° F with winds at 6 mph from west-southwest and humidity rose to 70%. These weather conditions indicated that the neighborhood was located downwind throughout the application period.

The CAC conducted a 10-point swab sampling to determine if drift had occurred in the residential neighborhood. Surface swab samples were collected from nine houses and a foliage sample was collected

from the almond orchard. A swab sample from a house a half mile east of the almond orchard was positive for the active ingredient of the insecticide.

The Ag PCB was cited for failing to prevent substantial drift to non-target areas [3 CCR § 6614(b) and FAC §12972], and for using the adjuvant in conflict with the label [FAC § 12973 and FAC §12971] as it is labeled for use with herbicides, not insecticides. The Ag PCB also failed to provide a warning to the almond grower of possible damages for making an application near a densely populated residential area [FAC § 12003(f)]. Additionally, the Pest Control Advisor was cited for failing to provide the criteria used for determining the need for the recommended treatment, and certification that alternatives and mitigating measures that would substantially lessen any significant adverse impact on the environment have been considered and, if feasible, adopted [3 CCR § 6556 (d)(e)].

Case Summaries of Agricultural Handlers Exposed to Pesticides:

Pesticide Mixer/Loader Exposure

While mixing his eighth load of pesticides containing gibberellic acid, sulfur, triflumizole, beta-cyfluthrin and spinetoram, a handler noticed burning sensations on the areas of his face that were not covered by his safety glasses and N-95 particulate respirator. He tried to call his supervisor but was unsuccessful and continued working. A co-worker told him to wash and rinse his face. He sought relief by washing his face several times throughout his shift. Once he got home, he took a long shower but noticed his pain worsened. He called his supervisor again who told him to go to the emergency room. The supervisor met the worker at the hospital. An investigation found no violations and that the worker wore all the label required personal protective equipment.

Pesticide Applicator Exposure

A worker dipped new re-plants of cherry trees in a bleach and water solution to disinfect the trees prior to storage. Some of the solution spilled on his right hand but he did not wash it off and continued working. Several hours later, he sought care when he felt as burning sensation to his hand and it was slightly red and swollen.

The investigation revealed that the employer was using an unregistered pesticide for pesticidal purposes, a violation of FAC § 12995, and was issued a Notice of Violation and a Cease and Desist Order.

Case Summaries of Field Workers Exposed to an Agricultural Use Pesticide:

Field Worker Drift Exposures

At approximately 5:00 a.m., a crew of 16 field workers began harvesting parsley. There was a slight breeze from the northwest, with wind speeds ranging from 4.4 to 5.1 mph. Two hours later, the workers noticed a chemical-like odor. Several of the workers saw a helicopter north of them making an application a few fields away. One of the workers reported seeing pesticide warning signs to the west of where they were working. The workers informed their crew foreman of the odor and were then moved east to another site where the odor was less intense.

Two of the workers experienced symptoms such as eye irritation, headache, dizziness, nausea and vomiting. Both of these workers were taken for care. Another worker reported a burning sensation in her eyes that subsided after a few minutes, however, she did not notify the foreman of her symptoms and was not taken for care.

The CAC identified an Ag PCB that had completed three separate aerial applications around the time the workers noticed the odor, and all were 3,000 feet or greater from the field where the crew was working. These applications were upwind from the crew's location. The active ingredients of the products applied were flonicamid, spinetoram, permethrin, pyraclostrobin, spirotetramat, naled, lamba-cyhalotrin and chlorantraniliprole. There were also two different adjuvants applied. No violations were found during the investigation.

Field Worker Multiple Exposures

In the early morning hours, three crews consisting of 167 workers began harvesting garlic. A few hours into their work day, workers began to smell an odor and developed symptoms. Ninety-two of the 167 workers reported symptoms such as burning and watery eyes, headache, nausea, and throat irritation. The fire department responded to the scene and set up decontamination tents and triage. A total of 14 field workers were decontaminated. Two workers were transported to the hospital. Two additional workers sought medical attention on their own in the subsequent days.

At the time of the incident, there was an aerial application of an organophosphate insecticide to an alfalfa field 0.75 mile to the southwest. A few of the workers recalled seeing or hearing a helicopter while working. Some of the garlic harvesters had already left the field before the start of this application. Clothing and foliage samples indicated that offsite movement occurred in the direction of the workers but did not reach the garlic site where the workers were located.

During the investigation, it was discovered that another application had taken place the previous day to a fallow field planned for carrots, adjacent to the garlic site. The fallow field was fumigated with metam-sodium and three water seals had been completed. On the day of the incident, off-gassing occurred and an additional water seal was performed. It was determined that the application, post-application field monitoring, and water seals had been performed in compliance with pesticide laws and regulations.

The Ag PCB performing the air application was cited for the offsite movement of the organophosphate insecticide (FAC § 12973, 3 CCR § 6614 and 3 CCR § 6600). The property operator of the carrot field, who was also the operator of the garlic field, was cited for failing to notify the fieldworkers that they were working within ¼ mile of a treated field [3 CCR § 6619 (e)(2)]. All three farm labor contractors were cited for failing to ensure their employees were taken for medical care [3 CCR § 6766(c)].

Case Summaries of Children Exposed to Pesticides:

Improper Storage and Accidental Insecticide Ingestion

A family member left a toddler playing in the front yard and went inside the house for a few minutes. When she returned, the toddler was crying and smelled of gasoline. He had found a sport drink bottle and drank out of the container. He immediately became ill and was taken to the emergency room by paramedics, where he was decontaminated. The toddler had pinpoint pupils, increased secretions, seizures and diarrhea. He was in the pediatric ICU for eight days.

The next door neighbor had just finished collecting a large amount of recyclables from the neighborhood and placed them in his front yard. The family member indicated the sports drink bottle was labeled with a specific agricultural use organophosphate insecticide. She gave the bottle to the firefighters who responded to the call. The CAC spoke to the neighbor in an attempt to identify the home from which the bottle was collected but was unsuccessful.

Swimming Pool Exposure

A hotel worker was backwashing sand filters of the pool while people were in the pool. During this process, a chlorine gas bubble formed in the water return line. When the gas bubble reached the surface of the pool, it burst and a large amount of chlorine gas escaped. Hotel guests reported the floor started rumbling, then a plume of water shot out of the pool followed by a foul sewer-like odor. The people swimming near the bubble were exposed to the gas. Thirteen children, ages 9 to 16 experienced symptoms of breathing difficulty, coughing, and eye and skin irritation. The pool was evacuated, and HazMat and paramedics were called to the scene. Ten of the 13 children were taken to various nearby hospitals, although none were admitted.

The filters are routinely backwashed twice a day, and the pool is not closed during this maintenance. The backwash process directs debris to the sewer line and clean water into the pool. There is also an automated closed system that monitors the pool chlorine levels. Due to this incident, the hotel hired a third party company to investigate the incident and inspect the pool equipment. The company speculated that this incident was caused by air that entered the filtration system when debris was removed from the filter baskets during the back flush process, causing a chlorine gas burp. Inspection by the local EHD identified a missing pressure gauge on the sand filters, a leaky pipe behind the sand filters, and flow meters that required repair.

As a result of this incident, hotel management changed their policy to perform the filter backwashing procedures only when the pool is closed and to inspect their equipment more frequently.

Pesticide Exposure at School

A Structural Pest Control Operator (SPCO) treated three classrooms for fleas and spiders at an elementary school on a Friday afternoon. When teachers and students returned to their classrooms the following Monday, three teachers and three students developed symptoms of headache, nausea, and stomachache. The three students were taken to the health office to rest, and later returned to their classrooms. A fourth student was identified the following day when she was sent home early for similar symptoms. None of the affected individuals, including this student, were known to have sought medical care.

On the day of the pesticide applications, the SPCO had conducted spot treatments of an insecticide containing esfenvalerate and an insect growth regulator inside the three classrooms (walls, floors, windows), and sprayed the outside perimeter of the building. He then ventilated the classrooms by turning on fans and opening the classroom doors for 45 minutes. Lastly, he left postings of the applications at the entry gate of the school and removed them the following Monday.

Two of the three teachers were interviewed, and both smelled an odor and said they saw no postings or warnings of pesticide treatment done prior to the weekend. The principal acknowledged that she notified the teachers of the scheduled application via email earlier that morning. A music teacher that used one of the treated classrooms said she did notice an odor; however, none of her students complained of an odor or had symptoms.

The following week, the school met with parents to inform them of the rodent and mite issue and that the three classrooms would be closed for the remainder of the school year and the students would be relocated.

Following this incident, the school began working with DPR to improve its integrated pest management program.

APPENDIX B: ACRONYMS

Ag PCB	Agricultural Pest Control Business
CAC	County Agricultural Commissioner
CalPIQ	California Pesticide Illness Query
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
EHD	Environmental Health Department
FAC	Food and Agricultural Code
HazMat	Hazardous Materials Response Team
ICU	Intensive Care Unit
LHO	Local Health Officer
OEHHA	Office of Environmental Health Hazard Assessment
OHB	Occupational Health Branch (of CDPH)
PIR	Pesticide Illness Report
PISP	Pesticide Illness Surveillance Program
SPCB	Structural Pest Control Business
SPCO	Structural Pest Control Operator
U.S. EPA	United States Environmental Protection Agency
WHS	Worker Health and Safety Branch

APPENDIX C: GLOSSARY

Agricultural: Cases or episodes that implicate exposure to pesticide(s) intended to contribute to the production of agricultural commodities, including livestock. This includes: 1) agricultural research facilities, 2) handling of raw agricultural commodities in packing houses, 3) drift from agricultural applications into non-agricultural areas, and 4) transportation and storage of pesticides on farm lands. It excludes forestry operations, although they are classified as agricultural for regulatory purposes. It also excludes manufacture, transportation, and storage of pesticides prior to arrival at the site of agricultural production.

Activity Type: Activity of the individual at the time of exposure.

Applicator: Applies pesticides by any method or conducts activities considered ancillary to the application (e.g., cleans spray nozzles in the field).

Emergency Response: Emergency response personnel (police, fire, ambulance, and HAZMAT personnel) responding to a fire, spill, accident, or any pesticide incident in the line of duty.

Field Worker: Works in an agricultural setting performing tasks such as advising, scouting, harvesting, thinning, irrigating, driving tractor (except as part of an application), field packing, conducting cultural work in a greenhouse, etc. Researchers performing similar tasks in an agricultural field are also included

Manufacturing and Formulation: Manufactures, processes, or packages pesticides. This includes "mixing" if it is done in a plant for application elsewhere.

Mechanical: Maintains (e.g., cleans, repairs, conducts maintenance) pesticide contaminated equipment used to mix, load, or apply pesticides, as well as the protective equipment used by individuals involved in such activities. This excludes the following: 1) maintenance performed by applicators on their equipment incidental to the application; and 2) maintenance performed by mixer/loaders on their equipment incidental to mixing and loading.

Mixer/Loader: Mixes and/or loads pesticides. This includes: 1) removing a pesticide from its original container; 2) transferring the pesticide to a mixing or holding tank; 3) mixing pesticides prior to application; 4) driving a nurse rig; or 5) transferring the pesticide from a mix/holding tank or nurse rig to an application tank.

Other Activity: Activity is not adequately described by any other activity category. This includes but is not limited to: 1) dog groomers not handling pesticides; 2) individuals handling pesticide treated wood; 3) two or more activities with potential for pesticide exposure.

Packaging/Processing: Handles (packs, processes, or retails) agricultural commodities from the packing house to the final market place. Field packing of agricultural commodities is classified as field worker.

Routine (Other/Unspecified): Conducts activities in an environment with minimal expectation for exposure to pesticides but is not adequately defined as indoor or outdoor. This includes individuals exposed to pesticides while inside a vehicle.

Routine Activity: Combination of three Routine activities: *Routine Indoor*, *Routine Outdoor* and *Routine (Other/Unspecified)*.

Routine Indoor: Conducts activities in an indoor environment with minimal expectation for exposure to pesticides. This includes people in offices and businesses, residential structures, etc. who are not handling pesticides.

Routine Outdoor: Conducts activities in an outdoor environment with minimal expectation for exposure to pesticides. This excludes field workers in agricultural fields. This includes gardeners who are not handling pesticides.

Transport/Storage/Disposal: Transports or stores pesticides between packaging and preparation for use. This includes shipping, warehousing, and retailing, as well as storage by the end-user prior to preparation for use. Disposal of unused pesticides (not ancillary to an application or mix/load activity) is also included in this activity. This excludes driving a nurse rig to an application site.

Application Site: Site of the pesticide application. For crops, this includes applications at the growing site and to the commodity while being packed for sale. For incidents involving drift, the intended application site is listed.

Associated Case: A case that has been evaluated as definitely, probably, or possibly related to pesticide exposure.

Associated Episode: An episode in which at least one corresponding case was evaluated as associated.

Case: Representation of an individual's exposure to a pesticide(s) that may or may not result in an illness and injury.

Disability Days: Number of days in which an individual missed at least one full day (24-hour period) of work or other normal activity, such as school.

Episode: An event in which a particular source appears to have exposed one or more people (cases) to pesticides.

Equipment: Defines the type of application equipment regardless of who performed the application.

Aerosol Can: Disposable pressurized cans designed for intermittent use. The pesticide is propelled out of the can by an inert compressed gas propellant. This excludes foggers.

Airblast Sprayer: Ground application equipment with a pump that delivers spray into an air stream created by a large fan at the back of the spray equipment.

Automatic Equipment, Chlorinator: Chlorination units that automatically inject chlorine into water for disinfection purposes. This includes chlorinators for swimming pools, packing houses, and food processing plants.

Automatic Equipment, Other or Unspecified: Equipment that automatically injects the pesticide to the target area. This includes equipment attached to milking machinery, dishwashers, ozone generators, etc. This excludes specific automatic equipment already described.

Back Pack Sprayer: Sprayer where the tank is worn on the back of the applicator. This may include compressed, motorized, liquid, or dust.

Chamber: A sealed enclosure used for fumigating or sterilizing its contents.

Electrostatic Sprayer: Ground operated equipment designed to impart an electrical charge to the pesticide particles. The electrostatic designation for ground application equipment overrides any other type of equipment it is used with.

Fogger: Disposable pressurized cans designed for the total release of the contents in a single use. The pesticide is propelled out of the can by an inert compressed gas propellant.

Ground Boom Below/Behind: Ground application equipment with a spray boom located below and behind the equipment operator with the spray nozzles pointed downward.

Ground Boom, Other or Unspecified: Ground application equipment with a spray boom. The following are excluded: 1) *Ground Boom Below/Behind*, 2) *Over-the-Vine Boom*, and 3) *Electrostatic Sprayer*.

Ground, Other or Unspecified: Ground application equipment, unknown or unspecified. This includes two or more types of ground application.

Hand Pump Sprayer: Hand-held compressed air sprayer with small volume tanks (1 to 5 gallons). This excludes *Back Pack Sprayers*.

Hand, Other or Unspecified: Hand-held types of application equipment not already specified where the equipment must propel the pesticide from a reservoir. This includes two or more types of hand-held application equipment.

Hand-Held Duster: Hand-held application equipment for granules or dust. This includes belly grinders, bellows, squeeze bulbs, etc.

Immersion Equipment: Tanks, trays, sinks, etc. used for the dipping of animals, produce, bulbs, medical equipment, dishes, pots and pans, etc.

Implements with Handles: Mops, brushes, and other implements with handles.

Implements without Handles: Cloths, towels, rags, sponges, and other implements without handles.

Manual Application Methods, Other or Unspecified: Manual type of application methods not already specified where the pesticide is not propelled by any type of equipment. This includes two or more types of manual application methods.

Manual Placement: Pesticide is manually placed directly to a target site. This includes bait stations, hand tossed pellets, and direct pouring of a pesticide onto a target surface from a container (such as pouring liquid chlorine directly into swimming pool water). This excludes the placement of fumigation pellet packs in chambers and under tarps.

Other Equipment: Any application methodology not described in any of the equipment categories. This includes two or more types of application equipment.

Over-the-Vine Boom: Ground operated equipment with the arms of the spray boom extending over the tops of grapevines.

Pressurized Hose-Line Sprayer: Hand-held spray equipment attached by a long hose to a power-pressurized tank.

Shank Injection without Tarps: Ground application equipment that uses a shank or other piece of equipment to directly apply a pesticide into the soil except when a tarp is placed over the soil, which is classified under shank injection with tarps. This also excludes surface applied pesticides that are subsequently incorporated into the soil by a cultivator.

Sprinkler Irrigation Equipment: Chemigation through sprinkler irrigation equipment (automatic equipment).

Tarp: Tarp placed over a commodity or structure and designed to restrict a fumigant to the application site.

Unpressurized Hand-Held Spray Equipment: Hand-held spray bottles (usually plastic) with built-in finger triggers. This includes battery powered continuous spray products and application syringes.

Exposure: characterization of how an individual came in contact with a pesticide(s).

Direct Contact: A combination of two different exposure types: *Direct Spray/Squirt* and *Spill/Other Direct*.

Direct Spray/Squirt: Material propelled by the application or mix/load equipment. Contact with the material can be by direct projection or ricochet. This includes exposure of mechanics working on application or mix/load equipment when the material is forced out by pressure.

Drift: Spray, mist, vapors, or odor carried from the target site by air during an application or mix/load activity. Drift as an exposure mechanism does not necessarily correspond to drift as a violation.

Ingestion: Intentional or unintentional oral ingestion. This includes ingestion of residue (on food, produce, toys, etc.).

Multiple Exposures: Contact with pesticides occurred through two or more distinct mechanisms regardless of the number of pesticides involved.

Other Exposure: Other known route of exposure that is not included in any other exposure category. This includes, but not limited to: 1) vapors, odor or other indirect contact from pesticide(s) not related to an application; 2) exposure from smoke or pyrolytic products from a fire where pesticides are burning; and 3) pesticide transfer from contaminated equipment (e.g., from contaminated hand/glove to eye).

Residue: The part of a pesticide that remains in the environment for a period of time following an application or drift. This includes odor after the completion of an application.

Spill/Other Direct: Any of the following: 1) contact where the material is not propelled by the application or mix/load equipment; 2) expected direct contact during use (e.g., washing dishes in a disinfectant solution); 3) leaks, spills, etc. not related to an application; and 4) exposure of people who are in the target area during fumigation/fogging.

Hospitalization: Number of days in which an individual was hospitalized at least one full day (24-hour period).

Illness type: Categorization of the type of symptoms experienced by the affected individual.

Asymptomatic: Exposure occurred, but did not result in illness/injury. Cholinesterase depression without symptoms falls in this category.

Respiratory: Health effects involving any part of the respiratory tree.

Systemic: Any health effects not limited to the respiratory tree, skin, and/or eyes. Cases involving multiple illness symptom types including systemic symptoms are included in the systemic category

Topical: Health effects involving only the eyes and/or skin. This excludes outward physical signs (e.g., miosis, lacrimation) related to effects on internal bodily systems. These signs are classified under 'Systemic.'

Incident Setting: Location where the incident occurred. The location may not coincide with the application site.

Animal Premise (Veterinary Hospital, Kennels, Not Livestock): Veterinary services, animal research laboratories, animal kennels, animal control facilities, dog grooming facilities, and other services provided for companion animals. This excludes livestock.

Crop/Livestock Processing Facility: Facilities involved in packing, manufacturing, or processing foods or beverages for human consumption and feed products for animals and fowl.

Farm: Areas where agricultural crops are grown. This excludes the following: 1) nurseries and greenhouses which are classified under *Nursery*; 2) livestock and poultry farms; and 3) forestry operations

Forest: Establishment engaged in the operation of timber tracts, tree farms, reforestation projects and other forest related activities.

Hospital/Medical: Establishments that provide medical, surgical, and other health services to people. This includes offices and clinics of doctors and dentists, hospitals, medical and dental laboratories, kidney dialysis centers, and other health related facilities.

Industrial or Other Manufacturing Facility: Facilities involved in the mechanical or chemical transformations of materials or substances into new products. This excludes: 1) facilities engaged in manufacture or formulation of pesticides; and 2) facilities engaged in treatment of wood to protect against pest damage.

Landscape, Lawn: Landscaped lawns. This excludes lawn areas in any other incident setting.

Landscape, Other: Landscaped ornamental shrub, tree, and other areas. This excludes landscaped areas in any other incident setting.

Livestock Production Facility: Ranches, dairies, feedlots, egg production facilities, hatcheries, and other establishments involved in keeping, grazing, or feeding livestock or poultry for the sale of them or their products. This includes veterinary services provided for livestock.

Multi-Unit Housing: Apartments and multi-plexes and other buildings on property. This includes swimming pools and landscaped areas on the property.

Nursery: Facilities (including greenhouses) growing and selling plants, bulbs, seeds, etc. This includes the production of seedlings for transplanting into agricultural fields or forests.

Office/Business: Commercial establishments including public and private business offices. This excludes retail establishments and service establishments.

Other Setting: Location of exposure occurred at a site not adequately described in any other incident setting category. This includes, but is not limited to, telephone poles, fences, water supply systems, and wastewater treatment plants.

Park: An area of public land set aside for recreation. This includes public swimming pool facilities. This excludes recreational facilities such as amusement parks, physical fitness facilities, etc. which are classified under *Service Establishment*.

Pesticide Manufacturing Facility: Facilities engaged in manufacture and/or formulation of pesticides.

Prison: Establishments for the confinement and correction of offenders as ordered by courts of law. This includes California youth authority facilities.

Residence (Other or Unspecified): Human habitation of unknown type, or of a type not adequately described as single family home, multi-unit housing, labor housing, or residential institution.

Residential Institution: Dormitories, nursing homes, homeless shelters, and similar facilities.

Residential: A combination of three residential settings: *Single Family Home*, *Multi-Unit Housing*, and *Residence (Other or Unspecified)*.

Retail Establishment: Businesses engaged in selling merchandise for the consumption of the end-user and providing services related to the products. This excludes restaurants which are classified under *Service Establishment*.

Road/Rail or Utility Right of Way: Roads, rails or utilities, and adjacent right-of-way areas. This includes aqueducts, canals, levees, manholes, landscaped median strips, and vehicles moving along roadways.

School: Establishments that provide academic or technical instruction. This includes daycare centers.

Service Establishment: Establishments primarily engaged in providing services to individuals, businesses, and government. This includes restaurants, hotels, fitness facilities, etc. This excludes medical service establishments.

Single Family Home: The house and other structures on property intended for use by a single family. This includes swimming pools and landscaped areas on the property.

Wholesale Establishment: Establishments primarily engaged in the warehousing and direct distribution of merchandise to retail establishments or other wholesale establishments. This includes warehousing operations that ship directly to the public.

Non-agricultural: Case or episode in which the pesticide(s) was not intended to contribute to the production of agricultural commodities. This includes: 1) residential pesticide uses, 2) structural pest control, 3) rights-of-way, 4) parks, 5) landscaped urban areas, and 6) manufacture, transportation and storage of pesticides except on farm lands.

Non-occupational: 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).

Occupational: 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.

Pesticide Type: Type of pesticide based on functional class.

Antimicrobials: Pesticides used to kill or inactivate microbiological organisms (e.g., bacteria, viruses).

Cholinesterase Inhibitors: Pesticides known to inhibit the function of the cholinesterase enzyme.

Fumigants: Pesticide in gas or vapor formulation that is released into the air or injected into the application site.

Relationship: Degree of correlation between pesticide exposure and resulting symptomology.

Definite: Relationship indicating a high degree of correlation between the pattern of exposure and resulting symptomatology. Requires both medical evidence (e.g., measured cholinesterase inhibition, positive allergy tests, characteristic signs observed by medical professional) and physical evidence of exposure (e.g., environmental and/or biological samples, exposure history) to support the conclusions.

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.

Possible: relationship indicates that health effects correspond generally to the reported exposure, but evidence is not available to support a relationship.

Inadequate: relationship in which there was not enough information collected to determine if the pesticide(s) contributed to ill health.

Indirect: relationship in which the pesticide(s) exposure is not responsible, but pesticide regulations or product label requirements contributed to the illness (e.g., heat stress while wearing chemical resistant clothing).

Asymptomatic: a case in which the affected individual did not develop symptom(s).

Unlikely: relationship in which a correlation cannot be ruled out absolutely, but medical and/or physical evidence suggest a cause other than pesticide exposure.

Unrelated: relationship in which there was conclusive evidence of a cause other than pesticide exposure.