SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE ILLNESS SURVEILLANCE PROGRAM
- 2016 -

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EXECUTIVE SUMMARY

This report provides a summary of pesticide-related illnesses and injuries identified in 2016 by the Pesticide Illness Surveillance Program (PISP) of the California Department of Pesticide Regulation. PISP identified 1,460 cases, stemming from 1,156 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 978 (67%) of those identified cases, stemming from 750 (65%) episodes, were at least possibly associated with pesticide exposure. Evidence indicated that pesticide exposure did not cause or contribute to ill health in 197 (14%) of the 1,460 cases evaluated. Insufficient information prevented evaluation of 285 (20%) cases, the proportion of which has been steadily increasing since 2011.

PISP identified 86 episodes resulting in 236 cases as associated with agricultural use pesticides (24% of the 978 cases). Agricultural field workers were injured by pesticide exposure in 17 separate episodes in 2016. The largest number of field workers injured in a single episode was 34.

There were 734 cases, stemming from 656 episodes, associated with non-agricultural use pesticide (75% of the 978 cases). Eight (<1%) of the 978 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information.

Of the 734 cases associated with non-agricultural use of pesticides, 259 (35%) were occupational, meaning the incident occurred while the affected individuals were at work. Antimicrobial products were implicated in 168 of these cases (65% of the 259 cases).

Children (less than 18 years old) accounted for 146 (15%) of the 978 associated cases; 139 cases involved non-agricultural use pesticides and seven 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.

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. PISP receives only a small portion of their 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 requirement. 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). 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 and, to a lesser extent, agricultural use of 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.

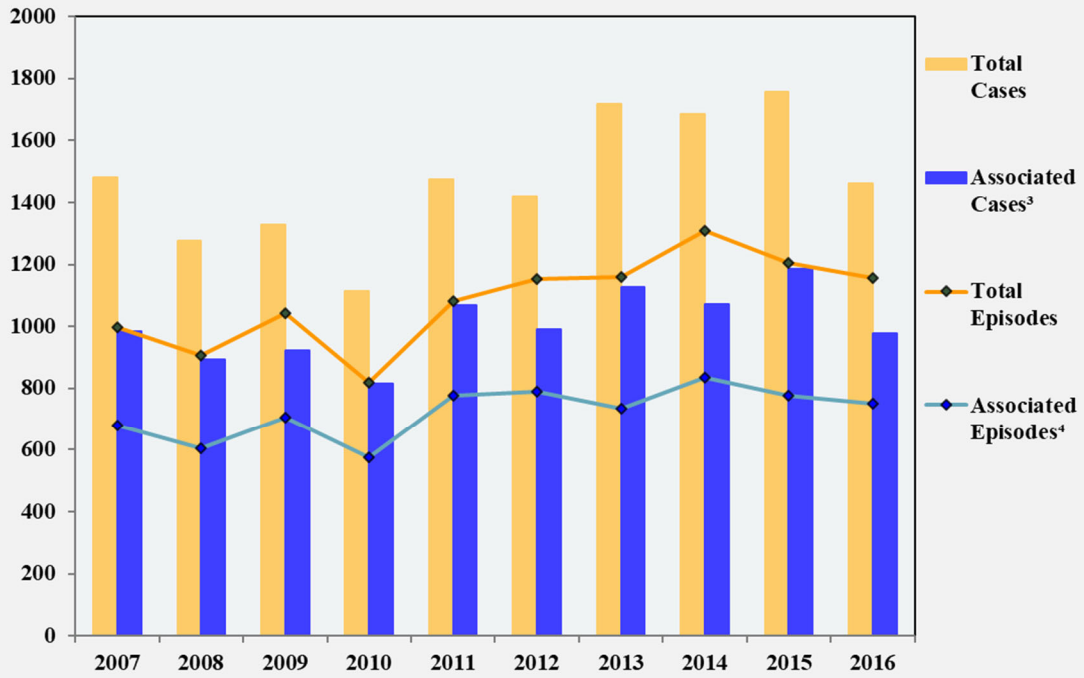
This report provides a descriptive summary of the number and types of exposures occurring in a given year, but does not draw conclusions or make recommendations.

[‡] 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 2016 CASES

PISP epidemiologists identified 1,156 episodes resulting in 1,460 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 over the last ten years.

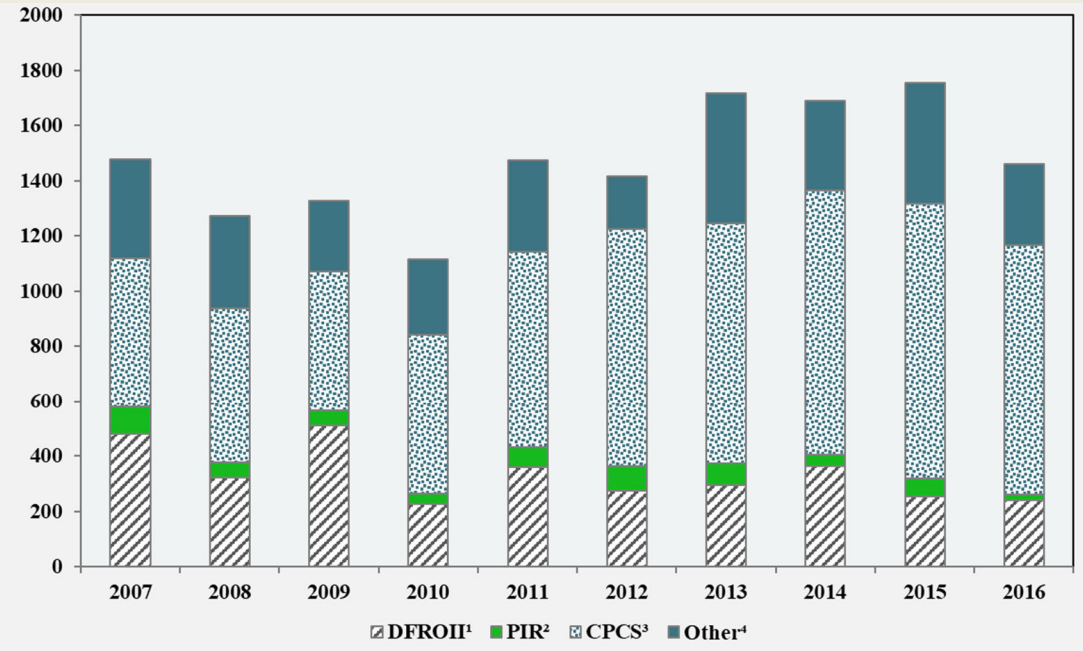
Figure 1: Number of Cases vs. Number of Episodes Investigated, 2007 - 2016



Incident reports of pesticide exposures received by PISP meeting program criteria for inclusion into the PISP database, are assigned case numbers and sent out to the CACs for investigation. The CPCS remained a major source of case identification and initiating investigations (905, 62%) (Figure 2). DFROII reports contributed 240 (16%) 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 293 (20%) cases. Direct physician reporting to LHOs, as required by HSC § 105200, accounted for 22 (2%) of all identified cases, of which 18 were transmitted by LHO to PISP via CalREDIE and 4 were submitted by LHO via facsimile. Of those 18 CalREDIE PIRs, eight were the source for initiating the investigations and ten provided additional information on cases in the PISP database that were initially reported through other sources.

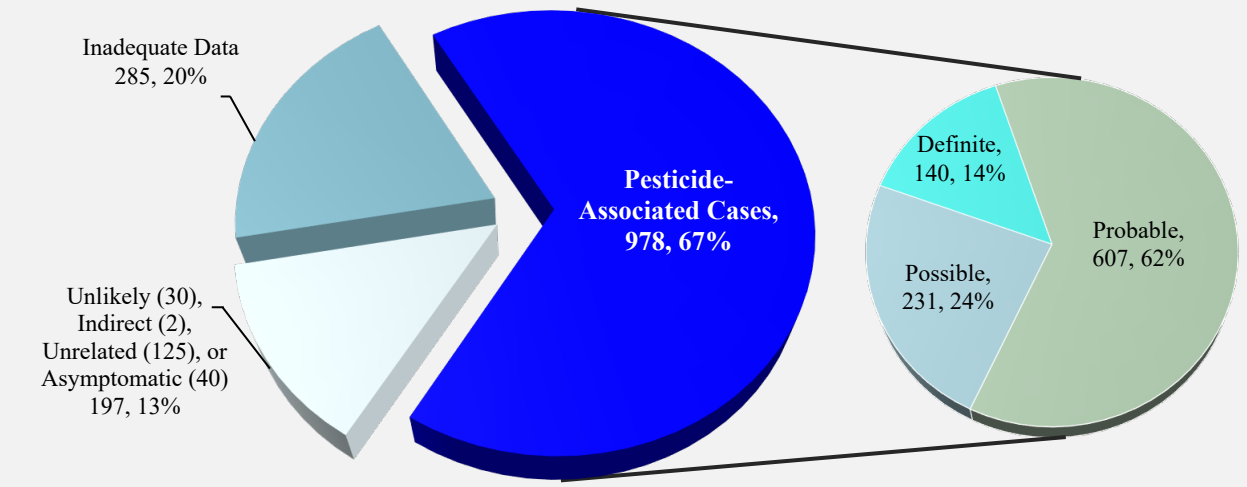
The California Poison Control System remained a major source of case identification and initiating investigations.

Figure 2: Mechanism that Identified Cases for Investigation, 2007 - 2016



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 26 for full glossary of terms). PISP epidemiologists determined that 978 (67%) of the 1,460 cases identified in 2016 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 978 pesticide-associated cases, 140 (14%) were definitely related, 607 (62%) were probably related, and 231 (24%) were possibly related to a pesticide exposure. There was evidence indicating that pesticide exposure did not cause or contribute to ill health in 197 (14%) of the 1,460 cases evaluated. This grouping includes 40 asymptomatic cases, which constitute 3% of the total cases identified in 2016. Insufficient information prevented evaluation of 285 cases (20%).

Figure 3: Outcome of 2016 Illness Investigations

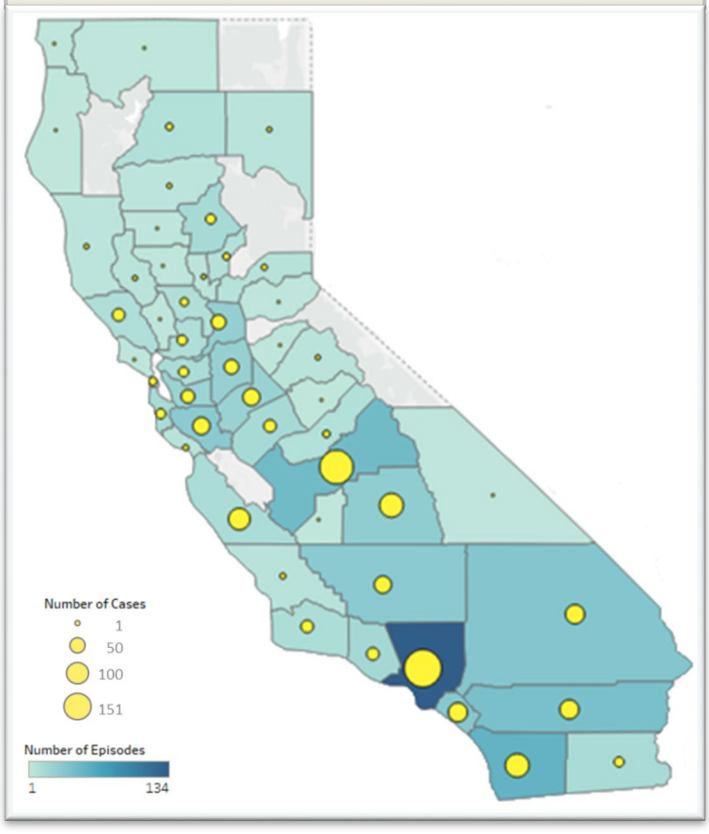


n = 1,460

Figure 4 displays the distribution of associated episodes and cases across the counties statewide. Los Angeles County accounted for the most number of associated episodes and cases, 18% (134) and 15% (151), respectively. Fresno County contributed 6% (46) episodes, and accounted for 13% (123) of total associated cases, suggesting occurrence of multi-person incidents in this county. 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.

The number of associated agricultural episodes has been relatively consistent since 2007 (Figure 5). "Agricultural" is defined as involving pesticides intended to contribute to production of an agricultural commodity, including livestock, which corresponds to the regulatory

Figure 4: Distribution of Associated Episodes and Cases



definition[§] of "production agriculture." Of the 978 associated cases, 236 (24%) cases were attributed to pesticides used for agricultural purposes. The number of cases can vary year to year based on the number individuals involved in multi-person episodes.

Of the remaining 742 associated cases, 734 (75%) occurred under non-agricultural circumstances. These cases represent 656 episodes, 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, as well as pesticide manufacture, transport, storage, and disposal.

The eight remaining 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 and are not included in Figure 5.

Figure 5: Agricultural vs. Non-Agricultural Pesticide-Associated Cases and Episodes, 2007 - 2016

[§] 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 479 (49%) of the 978 associated cases, with non-agricultural workers accounting for slightly more than half of these cases (54%). Non-occupational exposures accounted for 494 (51%) of the associated cases, involving mostly non-agricultural use pesticides (96%). Five associated cases could not be characterized as occupational or non-occupational due to insufficient information (Table 1).

Non-occupational exposures accounted for half of the associated cases.

Table 1: Agricultural and Occupational Status Evaluation of 2016 Illness Cases

Occupational Status	Agricultural	Non-Agricultural	Unknown or Not Applicable	Total
Non-Occupational	22	472	0	494
Occupational	213	259	7	479
Unknown or Not Applicable	1	3	1	5
Total	**236**	**734**	**8**	**978**

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 396 of 750 (53%) associated episodes, resulting in 515 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 396 episodes with these contributory violations, 43 (11%) were attributed to pesticides intended for agricultural purposes.

PISP epidemiologists identified 29 (4%) 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 198 (26%) episodes. There were 127 (17%) episodes involving 157 individuals that had health effects attributed to pesticide exposure despite apparent compliance with all applicable label instructions and safety regulations. Of these 127 episodes, 22 (17%) 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

Of the 734 cases involving non-agricultural use pesticides, exposures from direct forms of contact contributed to 232 (32%). The affected individuals came in contact when the pesticide was spilled or directly propelled by the application equipment. Exposures from drift accounted for 148 (20%) of the 734 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 Table 2 shows the number of non-agricultural cases according to exposure mechanisms.

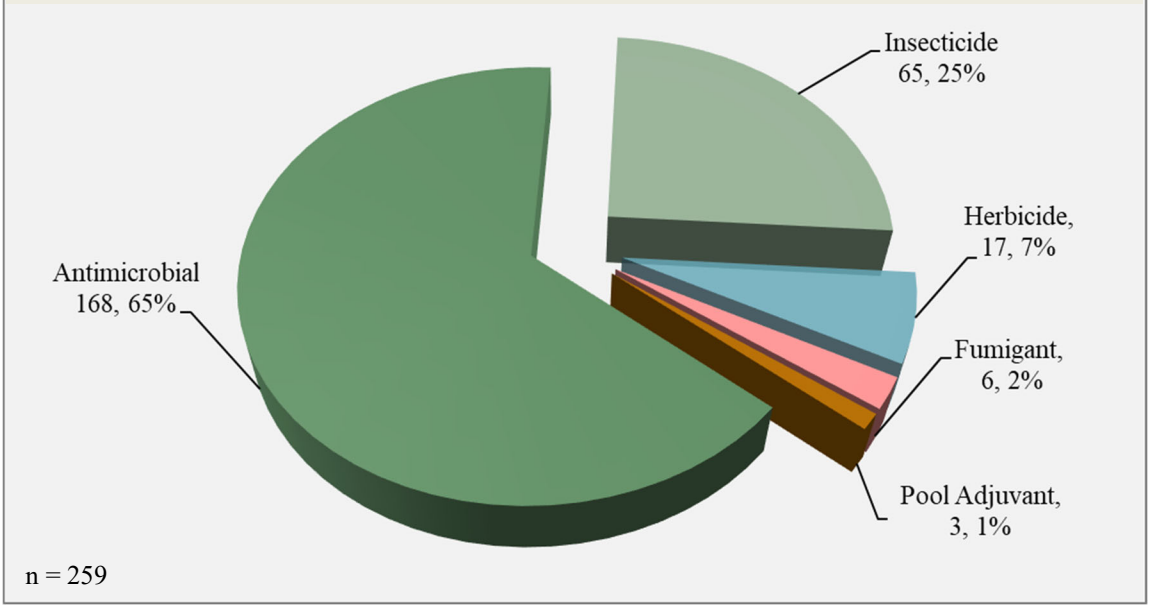
Table 2: Mechanism of Exposure in Non-Agricultural Associated Cases, 2016

Exposure Mechanism	Cases
Direct Contact	232
Drift	148
Ingestion	99
Multiple Exposures	20
Other	44
Residue	101
Unknown	90
Total	**734**

Occupational Exposures

For cases involving non-agricultural, occupational exposures, 259 were evaluated as associated with pesticide use. The majority of the workers were exposed while handling pesticides [Applicators (100, 39%) and Mixer/Loaders (29, 11%)]. Seventy-one (27%) 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 65% (168) of the occupational cases. Insecticides were the second most common pesticide class, accounting for 25% (65) of occupational cases (Figure 6). The most represented incident locations were service establishments (82, 32%), such as restaurants, hotels or fitness centers, followed by hospitals or other medical facilities (35, 14%) and crop/livestock processing (26, 10%).

Figure 6: Pesticide Types among Non-Agricultural, Occupational Cases, 2016

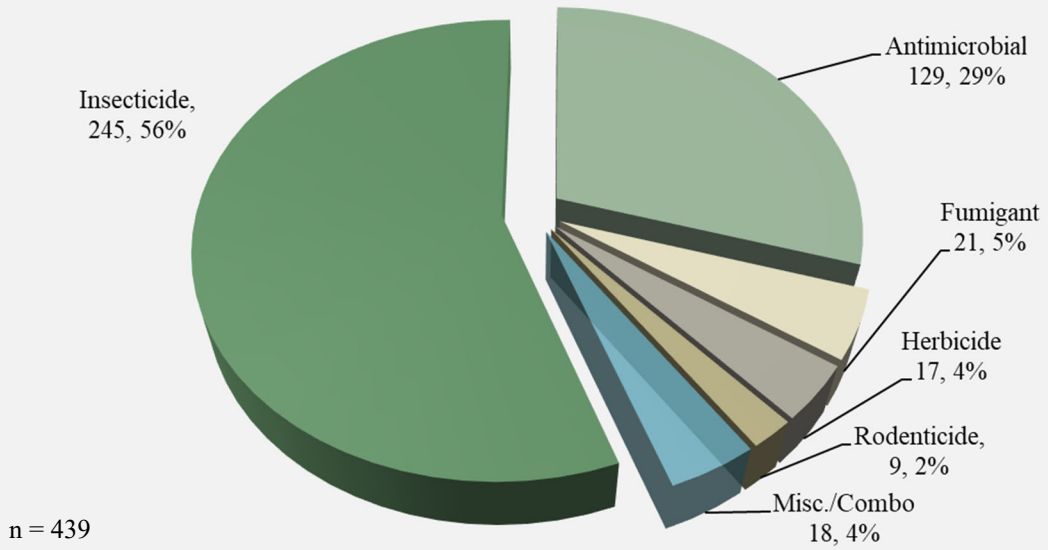


Non-Occupational Exposures

For cases involving non-occupational, non-agricultural exposures, 472 were evaluated as associated with pesticides. Most of the individuals (225, 48%) were exposed while performing activities with minimal expectation for exposure to pesticides; followed by individuals who were exposed while handling pesticides (160, 34%). The majority of the incidents occurred in residential settings (439, 93%). The remaining associated cases occurred in non-residential locations such as service establishments (11, 2%) (e.g., public pools, fitness centers, restaurants) or schools (8, 2%). Contrary to occupational exposures, over half of the products involved in non-occupational residential exposures were insecticides (245, 56%). Antimicrobial disinfectants and sanitizers (129, 29%) were the second most implicated product. The Misc./Combo category consists of pool adjuvants (e.g., muriatic acid), fungicides, and multiple types of pesticides used in combination (Figure 7).

93% 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, 2016



Ingestion of pesticides accounted for 80 (18%) of the 439 non-agricultural, non-occupational cases in residential settings. Sixty-nine (86%) of these cases involved the accidental ingestion of pesticides, primarily due to improper storage (e.g., pesticide was stored in a water bottle or placed in areas easily accessible to children). These types of exposures have been steadily increasing in the last few years. Exposures via direct contact accounted for 103 (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 95 (22%) cases. Pesticide handlers (Applicators and Mixer/Loaders) were mostly affected by drift (Table 3).

Table 3: Exposure and Activity of Non-Agricultural, Non-Occupational Cases in Residential Settings, 2016

Activity	Direct Contact	Drift	Residue	Ingestion	Other*/ Unknown	Total
Applicator	40	73	1	2	29	**145**
Mixer/Loader	5	6	0	1	1	**13**
Routine Activity	35	14	61	52	35	**197**
Transport/Storage/ Disposal	1	0	0	0	1	**2**
Other Activity	13	2	4	22	10	**51**
Unknown	9	0	0	3	19	**31**
Total	**103**	**95**	**66**	**80**	**95**	**439**

* *Other* is a combination of 2 different exposure types: *Other Exposure* and *Multiple Exposures*.

AGRICULTURAL PESTICIDE ILLNESSES

In 2016, the number of associated agricultural use pesticide episodes (86) was relatively unchanged from 2015 (87). However, the number of associated agricultural cases decreased by 41% (236) from 2015 (397), as there were more single-person episodes (Applicators and Mixer/Loaders) and less multi-person (Field Workers) incidents in 2016. Exposures from pesticide drift contributed to 127 (54%) of the 236 agricultural cases, and mostly involved fungicides (69, 29%) and insecticides (67, 28%). Exposures from pesticide residue followed with 56 (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, 2016

Pesticide	Direct Contact	Drift	Residue	Ingestion	Other*/ Unknown	Total
Antimicrobial	6	4	1	0	1	**12**
Fumigant	2	32	11	0	1	**46**
Fungicide	1	24	43	0	1	**69**
Herbicide	7	1	0	0	4	**12**
Insecticide	11	48	0	0	8	**67**
Combo & Unknown	5	18	1	1	5	**30**
Total	**32**	**127**	**56**	**1**	**20**	**236**

* *Other* is a combination of 2 different exposure types: *Other Exposure* and *Multiple Exposure*s.

Applicators and Mixer/Loaders

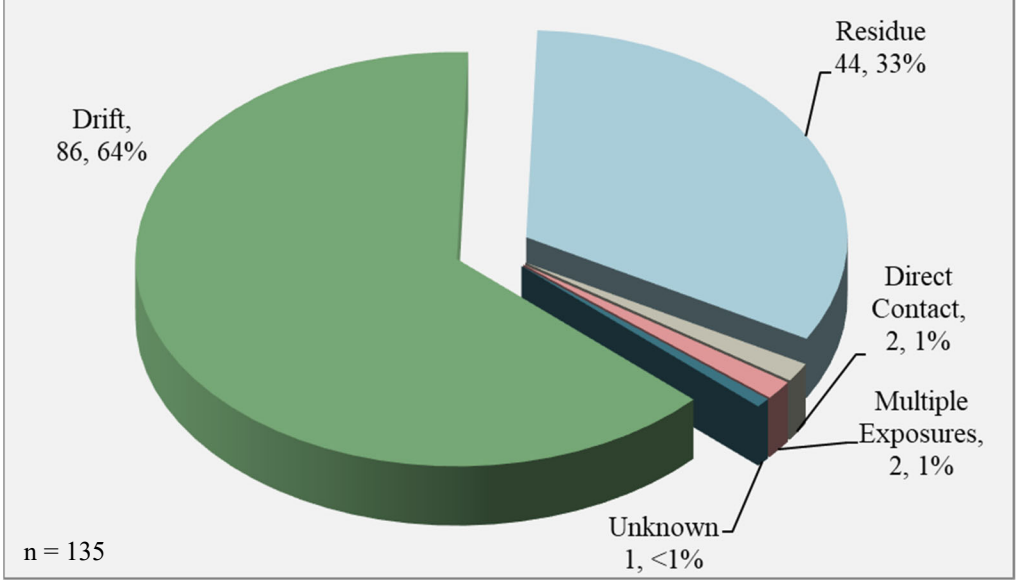
Of the 236 associated cases, 48 (20%) involved applicators or mixer/loaders of agricultural pesticides, and nearly all were single-person episodes. This represents an increase in both the number and proportion of cases from previous year (36, 9%). For these 48 cases, spills or other direct contact from pesticides not propelled by an application or mix/load equipment contributed to 17 (35%) of the cases. Exposure via drift contributed to 10 (21%) of the cases, followed closely by direct spray at 9 (19%). “Other” methods of exposure contributed to 2 cases (4%). The exposure mechanism remained unknown in 10 (21%) of the cases. Equipment failure contributed to seven (15%) of the cases which led to pesticide exposure via direct contact. Fourteen (29%) of the handler (Applicator and Mixer/Loader) cases had reports of lost work days, of which one applicator was hospitalized for three days.

Field Workers

PISP data reflects 135 field workers were injured by pesticide exposure in 17 separate episodes in 2016, which constitutes 57% of the 236 agricultural illness cases and 20% of the 86 agricultural episodes. The number of cases involving field workers decreased by 35% in 2016 as compared to 2015 (206). Similarly,

the total number of episodes decreased by 29% from 2015 (24). 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. The largest number of field workers injured in a single episode in 2016 was 34. Pesticide drift, as defined by PISP, was associated with 86 (64%) of the 135 cases involving field workers. Pesticide residue contributed to 44 (33%) illnesses, and two (2%) were exposed by drift and residue (Multiple Exposures) (Figure 8).

Figure 8: Field Worker Mechanism of Exposure to Pesticides, 2016



REPORTED ILLNESSES AMONG CHILDREN

There were 146 associated cases of pesticide exposure involving children (less than 18 years old), a decrease of 35% from 2015 (225). However, this number is consistent with prior years (152 cases in 2014 and 131 cases in 2013). Thirty-six (25%) children had direct contact with a pesticide, and an additional 36 children ingested a pesticide. Twenty-eight (19%) were exposed from residual pesticide, and 14 (10%) were exposed via drift (Table 5). The two pesticide types most often ingested were antimicrobials and insecticides, 17 (47%) and 14 (39%), respectively. Twenty-nine (81%) of the 36 children who ingested pesticide were less than six years of age. In nearly all of the ingestions by children under six years of age, improper storage of the pesticide contributed to the exposure (27, 93%). Six (4%) children were hospitalized due to their pesticide exposure, none of which were due to self-harm attempts.

Seven children were exposed to agricultural use pesticides in three separate multi-person episodes. None of the children were admitted to the hospital. Three of the seven children came in contact with the pesticide via drift from two separate episodes. In both episodes, the families reported an odor from a nearby application. The remaining four children were part of a twelve-person episode comprised of

residents complaining of symptoms three days after the completion of a pre-plant chloropicrin application. There were no reports of children exposed to agricultural use pesticides while at school.

In 2016, there were no reports of children exposed to agricultural use pesticides while at school.

Changes to the Healthy Schools Act, that took effect January 1, 2015, established a requirement for schools and pest control businesses to report their pesticide use at schools to DPR. In 2016, DPR received the specific details of 92,970 school site pesticide applications[**]. There were seven school children exposed from four separate episodes, two of which were from pesticide applications made at the school site. In one episode, three of the students became ill after an herbicide application was made around fields/landscaped areas, buildings, sidewalks and park lots of the school (see case summary Pesticide Exposure at School on page 24). In the second episode, a Structural Pest Control Operator (SPCO) set off an insecticidal fogger in a musical instrument storeroom and sprayed the carpets in a large open room. He did not aerate these areas afterwards. A few days later, one student developed rashes after entering a musical instrument storeroom and playing in one of the rooms. A handful of students and staff noticed an odd smell at the school after the application. The remaining two episodes involving school children did not result from a school site pesticide application. One student became ill after being exposed to malathion vapors when a resident poured malathion from a water bottle into a sewer drain and disposed of the bottle into a trash bin near the school. The second episode involved two developmentally delayed children who were accidentally given sanitizing solution through their feeding tube instead of water by the school nurse, who had picked up an unmarked bottle containing the solution that was left on a counter by an aide.

Table 5: Pesticide Types and Mode of Exposure for Children < 18-years old, 2016

	Agricultural		Non-Agricultural					
Pesticide Type	**Drift**	**Residue**	**Direct Contact**	**Drift**	**Residue**	**Ingestion**	**Other*/ Unknown**	**Total**
Antimicrobial	0	0	16	7	0	17	10	**50**
Fumigant	0	4	0	0	5	0	2	**11**
Fungicide	2	0	0	0	0	0	0	**2**
Herbicide	0	0	0	2	1	2	0	**5**
Insecticide	1	0	19	2	18	14	20	**74**
Rodenticide	0	0	0	0	0	2	0	**2**
Misc./Combo	0	0	1	0	0	1	0	**2**
Total	**3**	**4**	**36**	**11**	**24**	**36**	**32**	**146**

* *Other* is a combination of 2 different exposure types: *Other Exposure* and *Multiple Exposures*.

[**] Based on the 2016 California School and Child Care Pesticide Use Report Summary. A pesticide application is one product applied at one school site on one date.
https://apps.cdpr.ca.gov/schoolipm/school_ipm_law/2016_pur_summary.pdf

MORBIDITY AND MORTALITY

Of the 978 cases evaluated as associated with pesticide exposure, 26 people (3%) were hospitalized and 112 (12%) reported time lost from work or normal activity (e.g., going to school) (Table 6). Twelve (46%) of the 26 people hospitalized had ingested pesticide. Of those 12 people, 5 (42%) acknowledged self-harm attempts.

Table 6: Summary of Pesticide-Associated Hospitalization and Disability, 2016

Relationship	Cases	Number Hospitalized[1]	Number with Lost Work Time[2]
Definite/Probable	747	19	91
Possible	231	7	21
Total	**978**	**26**	**112**

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.

There were three fatalities evaluated as definitely associated with pesticide exposure and all involved transients entering properties under structural fumigation. The first case involved a 25-year-old male who broke into an apartment complex that was under fumigation. The neighbors heard him yelling for help and called the police. Police officers helped extract him from the building and an ambulance took him to the hospital. He told officers that he had smoked methamphetamines the night before and had broken into the complex looking for a place to sleep. He slept inside for approximately 3 hours. While at the hospital, he went into cardiac arrest and died.

The second case involved a 45-year-old armed homicide suspect who tried to evade the police by hiding in an apartment complex under fumigation. When SPCOs returned to aerate the property, the complex was surrounded by special weapons and tactics (SWAT) officers. The SPCOs informed the hazardous materials (HAZMAT) representative of the ongoing hazard from the fumigation. HAZMAT and SWAT entered the structure wearing self-contained breathing apparatus (SCBAs), but could not find the suspect, so the SPCOs sealed the tarps and proceeded with the aeration procedure. The following day, a licensee with the structural pest control business (SPCB) certified the property safe for re-entry and did not notice anything unusual. Five days later, a complex resident noted a decaying odor in the garage. While investigating the source of the odor, the resident found a decaying body hunched in the corner behind a couch.

The third case involved a 24-year-old male who broke into an apartment complex 18 hours after fumigation began. Shortly after, he came out of the building with difficulty breathing and asked the security guard to take him for care. The police arrived before the emergency responders, and they briefly took the man into custody for suspected burglary before sending him to the hospital via ambulance, where

he later died. The SPCB owner stated that a warning agent (chloropicrin) was not applied because a 24/7 security firm was hired to guard the tented structure. A company may apply for a waiver on the use of chloropicrin (as required by the label) in certain unique or sensitive fumigation situations. The application must be submitted to the local CAC and DPR. There was no request submitted to either departments. The SPCB owner claimed to not having been aware of the need for a waiver to not use chloropicrin as a warning agent. The SPCB was in violation of Food and Agricultural Code (FAC) § 12973 for using the product in conflict with the label.

ILLEGAL PESTICIDES IN CALIFORNIA

The Federal Insecticide, Fungicide, and Rodenticide Act requires all pesticides sold or distributed in the United States (including imported pesticides) to be registered by U.S. EPA. In addition, these products undergo further evaluation and must be registered with DPR before the pesticides 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 or the environment. When people use illegal pesticides that are not registered for use in California, they unknowingly put themselves and others at risk. Illegal pesticides are brought into the state from other countries, purchased from flea markets or sold illegally in stores. In 2016, there were seven cases, stemming from six separate episodes, where illegal pesticides were involved. Three of the episodes involved individuals committing self-harm by ingesting pesticides from Mexico. The most severe case of self-harm involved a 61-year old man who was admitted to the hospital for ingesting 240-ml of an insecticide containing cypermethrin. He had vomiting, throat irritation, and mild ulceration of his larynx. He was intubated and hospitalized for 11 days.

The remaining three episodes involved pesticide treatments to property, two of which occurred at private residences. A woman treated her home with a roach powder from Mexico containing acephate that she purchased from a flea market. Her visiting 11-month old grandchild dropped her hard candy in some residual powder, and shortly after fell ill and was taken for care. The other case involved a resident who used an unregistered product from Mexico in an unventilated space. She remained inside all day. When her family returned home, they noticed an odor and took her for care when she complained of feeling ill. The remaining episode involved two apartment complex workers who were instructed to treat units in the complex as well as other residential facilities with an illegal pesticide from Nigeria. Both workers were repeatedly exposed to the illegal pesticide several times a month, and were not provided with adequate personal protective equipment (PPE). The product contained dichlorvos, an organophosphate labeled for agricultural use only. Both workers reported ongoing symptoms and received medical care. Swab samples taken from the units at the apartment complex and residential facilities months later were positive for legal and the illegal pesticides.

COLLABORATION WITH OTHER AGENCIES

Sanitizer Safety Awareness – Restaurant Outreach Project

In 2015, PISP epidemiologists performed an analysis of 2008-2010 pesticide-related illnesses and injuries data for the top urbanized areas of California. (Alameda, Los Angeles, Orange, San Francisco, and Santa Clara). This analysis identified a total of 296 occupational illnesses as associated with non-agricultural use pesticide exposure. Retail and Service Establishments (which include restaurants, grocery stores, fitness centers, hotels and other establishments engaged in providing service to individuals) were most represented, with 82 cases (28%). Of these incidents, 73 (89%) involved antimicrobials. Further, the majority of the illness and injuries could have been prevented had the employees handling the antimicrobials worn the required PPE.

Figure 9: Example of the sanitizer safety awareness outreach poster.

Based on this analysis, PISP epidemiologists developed a sanitizer awareness outreach project in an effort to reduce the number of pesticide-related illness and injuries in this industry. In 2016, outreach materials emphasizing the safe use of sanitizers and the importance of wearing label- required PPE were created. With the assistance of the California Conference of Directors of Environmental Health and the local environmental health departments (EHD), these materials were distributed to restaurants/retail food facilities throughout the state. The EHDs are responsible for the enforcement of state and local health codes at all retail food facilities. The printed posters are available in English, Chinese, Korean, and Spanish. These posters, as well as additional posters in other languages, are available on DPR's website (https://www.cdpr.ca.gov/docs/whs/sanitizersafety/) (Figure 9).

FURTHER INFORMATION

Tabular summaries presenting different aspects of 2016 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 portal, 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

A hotel uses a registered sanitizer to clean countertops and floors. The product comes in one-gallon containers. For ease of transport, a housekeeper poured some of the solution from the original container into an empty water bottle. A few hours into her shift, she accidentally ingested the sanitizing solution. She had several blood-tinged vomitus about 10-15 minutes after ingestion. Despite the vomiting, she continued to work the remainder of her shift, after which another employee took her for care. In the emergency department, she also complained of abdominal pain, headache, and throat pain.

The hotel department manager stated the employees are trained on reading the label and the Safety Data Sheets, as well as on how to properly use the product. However, the employee stated she did not receive training on the product and the hotel did not have copies of training records. During the investigation, the hotel was found to provide only disposable gloves for the employees. The label requires the use of rubber gloves, goggles or face shield, and protective clothing when using the product.

The department manager was aware the housekeepers were pouring the product into water bottles, but did not make any attempts to stop it or provide proper equipment until the incident. After this incident, the hotel purchased smaller bottles and spray bottles that are labeled with the name of the product and signal word on a sticker. The manager also stated she will discuss with management about providing better gloves and eye protection for their employees. The use of a water bottle to store the sanitizer is a violation of 3 CCR § 6680 (Prohibited Containers for Pesticides). Additional violations of 3 CCR § 6724 (Handler Training) and 3 CCR § 6738 (Personal Protective Equipment Care) were also identified.

Occupational Insecticide Bystander Exposure

A tea and herb distributing company routinely treats products shipped from other countries with insecticides to kill live insects prior to packing. A treatment was scheduled with a SPCB for a Saturday afternoon as there would be no employees in the warehouse. An SPCB field representative put on a full face respirator and entered the quarantine room to begin the application. After using a fog generator to apply pyrethrins in the quarantine room, he closed the door and continued the fog application in the warehouse. He did not post a notice or warning sign on the building because “it was a Saturday and there were no employees.”

A few hours later, firefighters responded to a fire alarm at the warehouse. When they arrived, there was a visible smoke emitting from the back of the building. After forcing open the main door, the crew entered the building and searched the warehouse to determine the source of the smoke. The warehouse was full of smoke and the firefighters described the odor had a potpourri/sweet smell, but they did not see a fire. The firefighters opened up a rolled door of one of the rooms and it was also filled with smoke but was heavier than in the rest of the warehouse. After searching the warehouse, the firefighters determined there was no fire and that the pesticidal fog was the source of the smoke. Though the firefighters wore their PPE, they had not donned their SCBAs. All seven firefighters reported symptoms of coughing and throat irritation.

With the exception of two firefighters, their symptoms resolved within a day or two after exposure. One of the firefighters told the investigator six weeks after the incident that his coughing had not yet subsided.

A manager for the distributing company arrived at the warehouse the same time as the firefighters but did not immediately inform them of the insecticide application. He informed the firefighters of the application after they had entered the warehouse and quarantine room. The Fire Captain stated they would have approached the situation differently had they known about the application. The manager was issued a notice of violation of 3 CCR § 6618(b)(2) for failing to notify the firefighters that a pesticide application/fumigation was in progress when he arrived at the scene. After this incident, the SPCB began posting a "Caution Pesticide Application" sign outside of doors of the buildings after a scheduled pesticide treatment and also began notifying their local fire department.

Case Summary of a Resident Exposed to a Pesticide:

Non-Occupational Insecticide Exposure

A landlord used paradichlorobenzene (moth balls) to neutralize the skunk odor that was under a rental house. The tenant developed headaches, nausea and lethargy, and asked the landlord to remove the moth balls. She also has a preexisting condition that made her susceptible to moth ball vapors. The landlord stated she did not smell anything when she came to the house multiple times. A week later, she told the investigator her handyman removed all of the mothballs that was left underneath the house, a "bag's worth." When the investigator visited the house the next day, he noticed a moth ball odor inside the house and saw 2 moth balls under the house.

According to the label, the product kills clothes moths, carpet beetles and their eggs and larvae in clean, airtight containers. The landlord was issued a notice of violation for using the product in a way that was in conflict with the pesticide label (FAC § 12973).

Case Summaries of Agricultural Handlers Exposed to a Pesticide:

Pesticide Mixer/Loader Exposure

A worker at a crop processing facility was making a sanitizing solution wash for fresh fruits and vegetables. When she was pouring the undiluted sanitizer, containing hydrogen peroxide and peroxyacetic acid, into a measurement jar to ensure proper concentration, some of the solution splashed into her eye. Though she was wearing safety glasses, the solution splashed underneath her glasses and into her eye. She immediately flushed her eye with water and was taken for care by her supervisor. On medical exam, a corneal ulceration was observed and she was referred to an ophthalmologist. She returned to work two days later.

The product label states to wear goggles and face shields when handling, thus, wearing only safety glasses is a violation of FAC § 12973. After the incident, she started wearing goggles and face shield as eyewear

protection. The office manager stated he will inform the supervisors and other employees about the proper protective equipment required when handling the product and enforce its use.

Pesticide Applicator Exposure

A trained, but unlicensed, pesticide handler was asked to spray an herbicide mixture containing diquat, glyphosate, oryzalin, and an adjuvant to kill weeds outside greenhouses using a pressurized hose-line sprayer. He drove the spray rig to the greenhouse, uncoiled the hose, and placed the spray wand on the ground. When he lifted the wand off the ground after the hose was pressurized, the hose detached at the base of the wand and approximately two liters of the herbicide spilled onto his torso and inner thigh before he was able to turn off the tractor. He immediately developed nausea and dizziness. His co-workers splashed about a half-gallon of water on him. He called his supervisor to inform him of the incident and symptoms. His supervisor told him to go the main office, 15 miles away. Before going to the main office, he drove to a closer satellite office to shower and change into a clean pair of coveralls. When he arrived at the main office, the manager told him to shower again, go home, and to call if symptoms persist or worsen so he can be taken for care. He showered two more times at home.

His supervisor called him at home an hour and half later and told him to call if symptoms persist or go to the hospital. An hour later, he drove himself to the hospital because the "pain was intolerable." He had to call his supervisor for the names of the insecticides since it was already premixed and he was not told beforehand. The nausea and dizziness resolved the following day, however, he still had a burning sensation on his skin three months after the incident. He did not miss any days of work.

The investigator inspected the application equipment, and determined the incident was an accident and not due to lack of equipment maintenance. The employer was cited for not taking the applicator immediately for care when he was exposed to the herbicides and reported symptoms, and for not informing him of the identity of the herbicides prior to handling them, a violation of 3 CCR § 6726(c) and 3 CCR § 6702(b)(2), respectively.

Case Summaries of Field Worker Exposures exposed to an Agricultural Use Pesticide:

Field Worker Drift Exposures

Two crews consisting of 30 field workers entered two different fields to harvest broccoli in the early morning. One crew worked for a farm labor contractor and the other for a grower. The first crew to arrive reported symptoms within a half hour of working. The second crew, arriving a half hour later, immediately reported symptoms upon entering the field. Members of both crews noticed an odor and a total of 27 workers experienced symptoms, most commonly eye and nose irritation. Workers described the odor as a rotting smell, strong onion and pepper-like. The workers were removed from their respective fields when their symptoms persisted and moved to another location to harvest.

Earlier that morning, approximately 0.2 to 0.3 miles away, an empty field was undergoing a shank fumigation with metam-potassium. The water seal had not been applied until after workers from the second crew arrived. Weather data obtained indicated the wind was blowing 2 to 3 mph from the southeast towards the workers at the time the workers' symptoms began. In an interview with the

application crew, the applicators reported they did not see the field workers at any time during the fumigation.

Of the 27 field workers reporting symptoms, one was taken for care. The worker was driven to a nearby hospital by her husband. The remaining workers from the two crews declined medical care, so their employers had the workers sign waivers for refusal of medical treatment. However, signing the waivers did not exempt the employers from the requirement to take their employee for care after reporting of possible pesticide-related symptoms [3 CCR § 6766(c)], so both employers were cited.

Other violations were noted during the investigation. According to the fumigant label, applications must be followed immediately with a water seal. The water seal was not applied to the field until 3 hours after the application commenced, a violation of FAC § 12973. Also, there was a potential exposure to non-handlers who were in the application block during the fumigation, which the label also prohibits. Two irrigators followed behind the above fumigation by about 40-50 feet to connect the irrigation lines before the water was turned on.

Field Worker Residue Exposures

Two crews consisting of 34 field workers arrived in the early morning and began pulling leaves in a vineyard. Shortly after starting their workday, the workers developed symptoms and informed their crew foreman. Several of the workers stated that there was a strong odor present in the field. All of the field workers experienced symptoms such as burning and watery eyes, runny nose, throat irritation, headache, nausea, and dizziness. A few workers also vomited. The crew foremen did not remove the workers from the field, but gave them eye drops and encouraged them to flush their eyes with water. For most of the workers, the symptoms resolved that day and a few workers continued to experience symptoms for an additional day. Only one worker was taken to the clinic for a medical evaluation. The farm labor contractor's safety manager went to the field to assess the situation and noted a strong sulfur odor but did not experience any symptoms.

The vineyard was treated with 10 pounds of dusting sulfur per acre three days prior, and the restricted entry interval had expired four hours before the field workers entered the 50-acre vineyard, in compliance with the label and 3 CCR § 6772. Gradient leaf sampling showed sulfur levels about ten times higher on the east and west sides of the field compared to the center of the field. The two affected crews were working on the west side of the field. A third crew that was working in the center of the field did not experience any symptoms.

The farm labor contractor provided medical waiver forms for the field workers who felt symptoms but were not immediately taken for medical care. Medical waiver forms do not meet the emergency medical care requirement, thus the farm labor contractor was in violation of 3 CCR § 6766(c). After the incident, the farm labor contractor purchased safety glasses as requested by the field workers.

Case Summaries of Children Exposed to a Pesticide:

Child Insecticide Exposure

A family member sprayed and saturated a 13-year-old girl's hair and scalp with insecticide as a treatment for head lice. A hair cap was then put over the girl's head and she was sent to bed. The girl woke up early the next morning complaining of eye irritation, redness on neck area and scalp pain. She washed her neck and face, then removed the hair cap and rinsed her hair when the pain and discomfort continued. The family member took the girl to the hospital for care when her symptoms persisted with the same intensity. On interview a month later with a family member, though the child was still very upset about the circumstances of her exposure, all of her symptoms had resolved.

Pesticide Exposure at School

School district facilities and maintenance employees applied an herbicide, containing caprylic and capric acid, on the grounds of an elementary school while it was in session. Students and teachers complained of smelling a strong odor and noticed a blue marker color in the areas that were sprayed. A teacher reported that the odor persisted for a week. Eight students and teachers reported symptoms such as headache, nausea, sore throat, skin and eye irritation, and shortness of breath. A few students went home early that day.

The day before the application, the applicators notified the school and claimed to have posted three notification signs with the date of application, material to be used and areas to be sprayed. The notification was sent to the school principal and secretary, but the staff reported to not have been informed. One teacher stated she did not recall seeing any signs, while another teacher saw a sign posted after the application.

On the day of application, the herbicide was sprayed in the morning for an hour and 45 minutes, but was suspended for 35 minutes during the morning recess. The application was made with backpack sprayers to fence lines, around buildings, parking lots, around school fields and in landscaped areas. The teachers and parents reported seeing blue dye from the herbicide marker on some of the children's pants and shoes. A teacher took photos of areas of the school grounds stained blue.

The school district was cited for multiple violations: usage of the pesticide in conflict of the label; failure to include on notification signs a warning, in English and Spanish, that individuals are not to enter the treated area; and, failure to evaluate the reasonable possibility of contamination to individuals not involved in the application [FAC § 12973, FAC § 12978 and 3 CCR § 6614 (a)].

APPENDIX B: ACRONYMS

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
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
PPE	Personal Protective Equipment
SCBA	Self-Contained Breathing Apparatus
SPCB	Structural Pest Control Business
SPCO	Structural Pest Control Operator
SWAT	Special Weapons and Tactics
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: Count of number of cases 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: Count of number of cases 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 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.