

**SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE
ILLNESS SURVEILLANCE PROGRAM
- 2022 -**

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EXECUTIVE SUMMARY

This report provides a summary of pesticide-related illnesses and injuries reported to the California Department of Pesticide Regulation's Pesticide Illness Surveillance Program (PISP) in 2022¹. PISP identifies an individual's exposure to a pesticide(s) that may or may not result in an illness and/or injury as a 'case.' PISP identifies an event in which one or more individuals ('cases') are exposed to a pesticide(s) as an 'episode.' All reports received by PISP are evaluated to determine if the pesticide exposure was associated with the reported health effects. PISP defines the term 'associated' as cases where the reported illnesses or injuries were evaluated as definitely, probably, or possibly related to pesticide exposure.

In 2022, PISP received 1,432 reported cases, stemming from 964 episodes, potentially involving health effects from pesticide exposure. Of the reported cases, PISP epidemiologists determined that 1,041 (73%) cases, stemming from 709 (74%) episodes, were associated with pesticide exposure. Evidence indicated that pesticide exposure did not cause or contribute to the reported illnesses and injuries in 221 (15%) cases. For 170 (12%) cases, there was not enough information in the report to determine whether the illnesses and injuries were associated with pesticide exposure.

PISP identified 311 cases stemming from 62 episodes associated with agricultural use pesticides (30% of the 1,041 cases). "Agricultural" is defined as involving pesticides intended to contribute to production of an agricultural commodity, including livestock, which corresponds to the regulatory definition² of "production agriculture." Agricultural field workers were exposed to pesticides in 18 separate episodes in 2022, 11 of which were multi-person episodes. The largest number of field workers affected in a single episode was 163.

PISP identified 721 cases stemming from 638 episodes as associated with non-agricultural use of pesticides (69% of the 1,041 cases). Of the 721 cases associated with non-agricultural use pesticides, 180 (25%) were occupational, meaning the incident occurred while the affected individuals were at work. The most common settings were service establishments such as restaurants, hotels, or fitness centers, and hospitals or other medical facilities. Exposures to antimicrobial products accounted for 122 (68%) of all associated non-agricultural occupational cases.

Nine (<1%) of the 1,041 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information.

Children (less than 18 years old) accounted for 154 (15%) of the 1,041 associated cases; 149 cases involved non-agricultural use pesticides, five cases involved agricultural use pesticides, and the agricultural status of one case could not be determined. Of the five children exposed to an agricultural use pesticide, three were exposed to an herbicide application while at school. The school had also recently applied herbicide with the same active ingredient; thus, off-site movement could not be confirmed. The remaining two children were exposed while at their residence in two separate episodes.

¹ The 2022 data is available on the California Pesticide Illness Query portal at <https://apps.cdpr.ca.gov/calpiq/>.

² 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.

Reported pesticide-related illnesses and injuries are investigated by the County Agricultural Commissioners to support statewide enforcement and compliance with pesticide use laws and regulations. Reported pesticide-related illnesses and injuries and PISP evaluation inform DPR's continuous evaluation of pesticides to mitigate human health and environmental risks, including identification of potential exposure trends from pesticide use.

BACKGROUND, SOURCES, AND PURPOSE OF ILLNESS SURVEILLANCE

The California Department of Pesticide Regulation (DPR) administers the California Pesticide³ 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 enforcement system involving the assistance of the County Agricultural Commissioners (CACs) operating in every county in the state. The CACs enforce all federal and state pesticide laws and regulations at the local level and can impose additional permit conditions on the use of restricted material pesticides⁴.

Data Definitions

Definitions for all terms used in this report may be found in Appendix B: Glossary (page 26).

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, 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, physicians, and other health care 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 receives only a small portion of reports via the CalREDIE pathway.

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

³ 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 pertain to pesticides. Adjuvants are substances used to enhance the efficacy of a pesticide, and include emulsifiers, spreaders, water modifiers, and wetting and dispersing agents.

⁴ 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 § 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.

A Doctor's First Report of Occupational Illness and Injury (DFROII) is a document associated with a workers' compensation claim that a physician is required to forward to the DIR⁵ and is subsequently shared with the California Department of Public Health-Occupational Health Branch (CDPH-OHB). PISP epidemiologists also 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 amount of DFROII shared with PISP has been consistently decreasing since 2018 and the reasons for this trend remain unclear to PISP and CDPH. 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, workers' compensation reports, LHOs, and, to a lesser extent, from citizen complaints, Federal Insecticide, Fungicide, and Rodenticide Act 6(a)(2) adverse effect reports, and referrals from other agencies and news media.

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 pesticides⁶. DPR's authority to enforce pesticide laws and regulations throughout the state is largely carried out in California's 58 counties by the CACs⁷. 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."⁸

⁵ 8 CCR § 9785.

⁶ Under Federal Insecticide, Fungicide, and Rodenticide Act section 26, a State shall have primary enforcement responsibilities for pesticide use violations if EPA determines that such State has adopted and is implementing adequate pesticide use laws and regulations, enforcement procedures, and recordkeeping and reporting requirements.

⁷ California Food and Agricultural Code section 12977: The director and the commissioners of each county under the direction and supervision of the director, shall enforce the provisions of this article and the regulations adopted pursuant to it.

⁸ The PISP program brochure, "Preventing Pesticide Illness" can be viewed or downloaded from DPR's web site at <https://www.cdpr.ca.gov/wp-content/uploads/2024/12/brochure.pdf>.

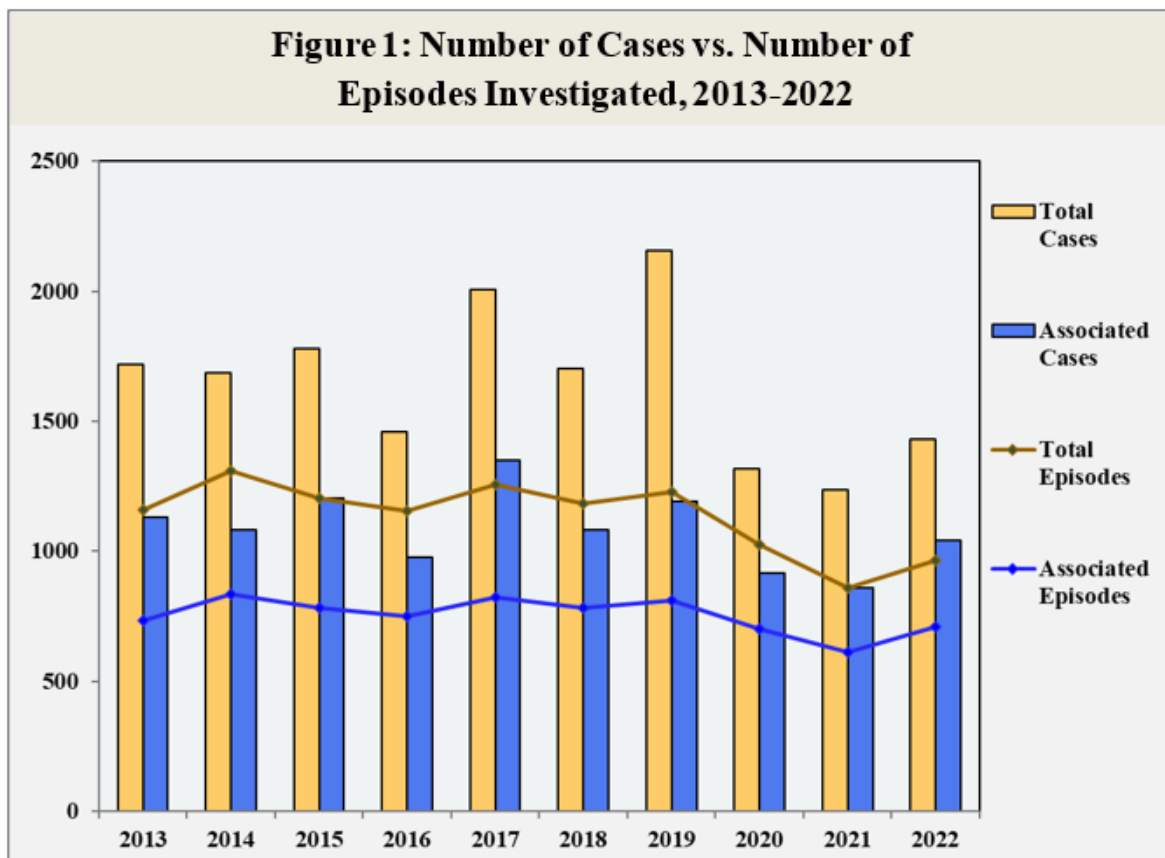
Data Limitations

PISP is a passive surveillance system that depends primarily on the reports submitted by healthcare providers to identify cases of pesticide-related illnesses and injuries. Thus, the quality, quantity, and timeliness of the information received can vary widely. 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 DPR's 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 the given year but does not draw conclusions or make recommendations.

OVERVIEW OF 2022 CASES

PISP epidemiologists received reports on 964 episodes resulting in 1,432 cases that potentially involved health effects from pesticide exposure (Figure 1). The total number of episodes and cases increased by 12% and 16%, respectively, in 2022 as compared to 2021. PISP identifies an individual's exposure to a pesticide(s) that may or may not result in an illness and/or injury as a 'case.' PISP identifies an event in which one or more individuals ('cases') are exposed to a pesticide(s) as an 'episode.' (See Appendix B on page 26 for full glossary of terms.)

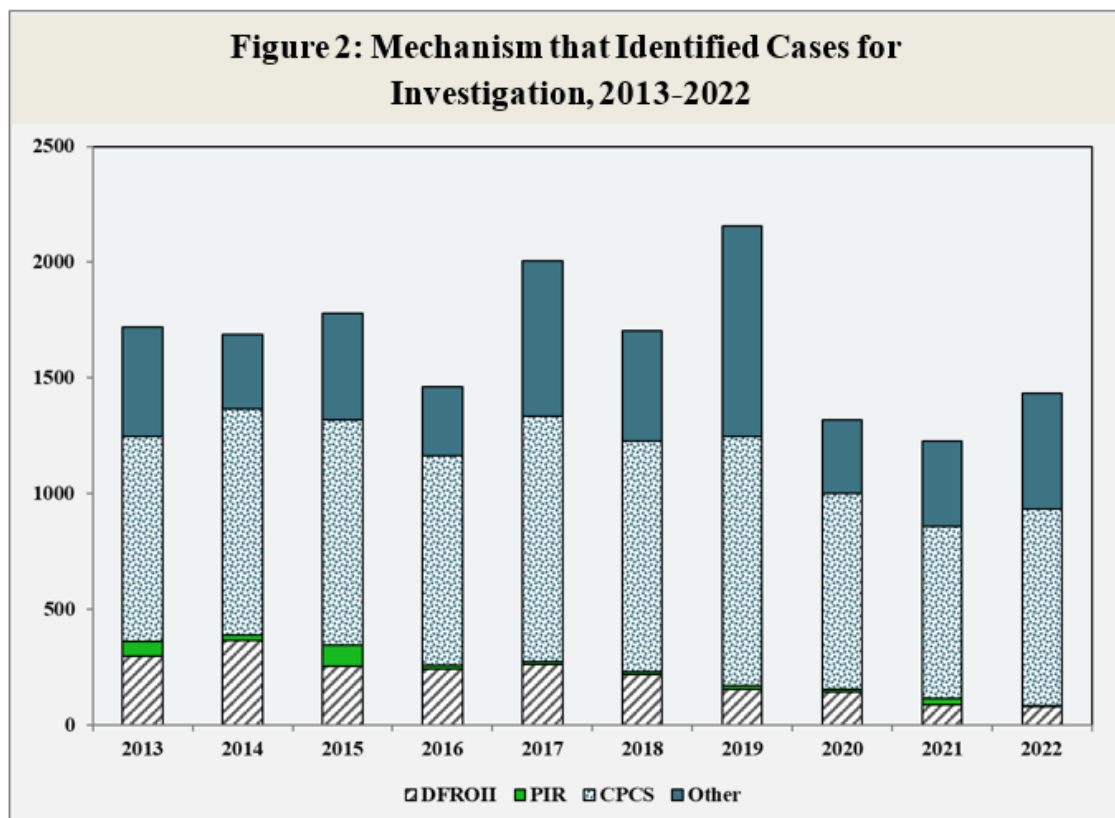


PISP receives reports of pesticide exposure and assigns case numbers to those meeting program criteria⁹ for inclusion into the PISP database. These reports are then sent out to the CACs for investigation. The CPCS remained a major source for case identification and initiating investigations (850, 59%) (Figure 2). DFROII reports contributed 79 (6%) illness cases. Other reporting sources, such as county complaints, news media, as well as additional cases identified by the CAC during the

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

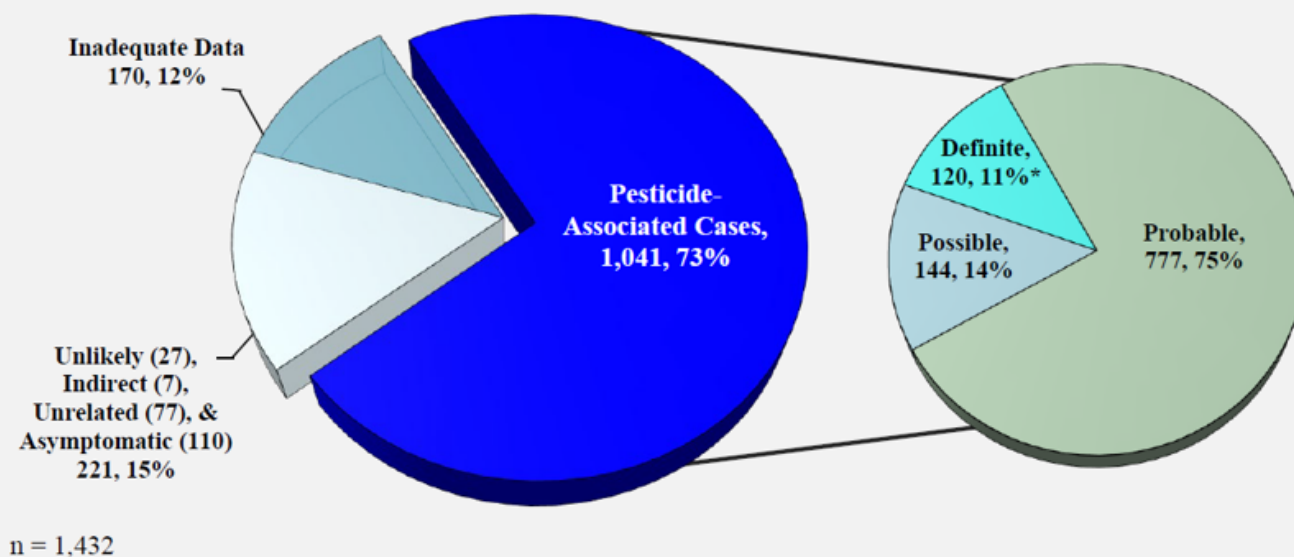
⁹ Incident reports must meet all of the following criteria for inclusion into the PISP database: a pesticide is suspected to be involved in the exposure, symptoms were reported, evaluation by a health care provider, and exposure occurred in California.

course of an investigation, accounted for 499 (35%) cases. Direct physician reporting to LHOs, as required by HSC § 105200, accounted for 4 (< 1%) of all identified cases, of which one was transmitted by LHO to PISP via CalREDIE and 3 were submitted by LHO to PISP via facsimile. There were 16 CalREDIE PIRs which provided additional information on a case in the PISP database that was initially reported through another source.



PISP defines the term “associated” as cases where the reported illnesses or injuries were evaluated as definitely, probably, or possibly related to pesticide exposure. PISP epidemiologists determined that of the 1,432 cases identified in 2022, 1,041 (73%), stemming from 709 episodes, were associated with pesticide exposure. Figure 3 shows the outcome of the cases evaluated and the level of certainty (relationship). Sufficient evidence was available to determine that of the 1,041 pesticide-associated cases, 120 (12%) were definitely related, 777 (75%) were probably related, and 144 (14%) were possibly related to a pesticide exposure. There was evidence indicating that pesticide exposure did not cause or contribute to the reported illness or injuries¹⁰ in 221 (15%) of the 1,432 cases evaluated. This grouping includes 110 asymptomatic cases, which constitute 8% of the total cases identified in 2022 and were all part of multi-person episodes. There were 170 (12%) cases in which not enough information was provided in the report to determine an association between the pesticide exposure and the resulting illness or injury.

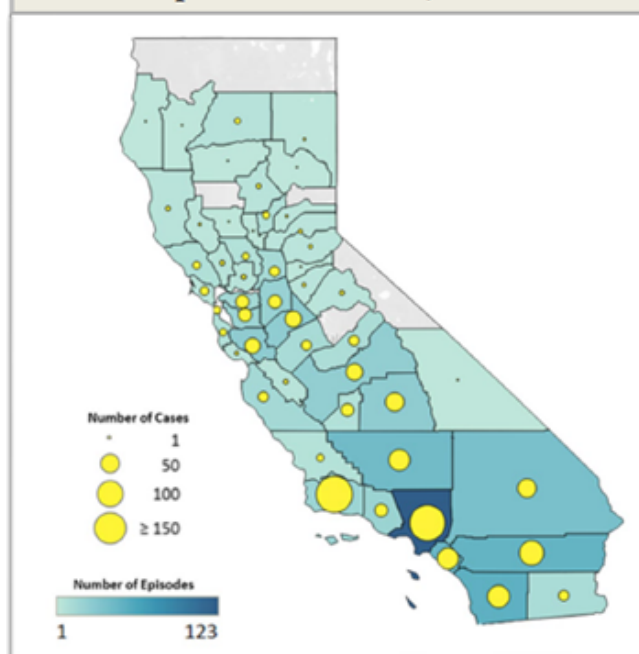
¹⁰ Consist of cases evaluated as Unlikely, Indirect, Unrelated or Asymptomatic.

Figure 3: Outcome of 2022 Illness Investigations, by Cases

* Actual percentage of *Definite Cases* is 11.5%. The graphing software rounded the percentage down to 11% for pie chart to reflect a total of 100%.

Figure 4 displays the distribution of associated episodes (709) and cases (1,041) across the counties statewide. Los Angeles County accounted for the largest number of associated episodes (123, 17%) and the second highest number of cases (143, 14%), indicating that the majority of the exposures there were single-person incidents. Although 3% (18) of associated episodes occurred in Santa Barbara County, it accounted for the largest number of cases (213, 20%), reflecting occurrences of multi-person incidents in that county. (See Table - 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 have been decreasing since 2018, averaging a decrease of 11% per year over the five-year period (Figure 5). “Agricultural” is defined as involving

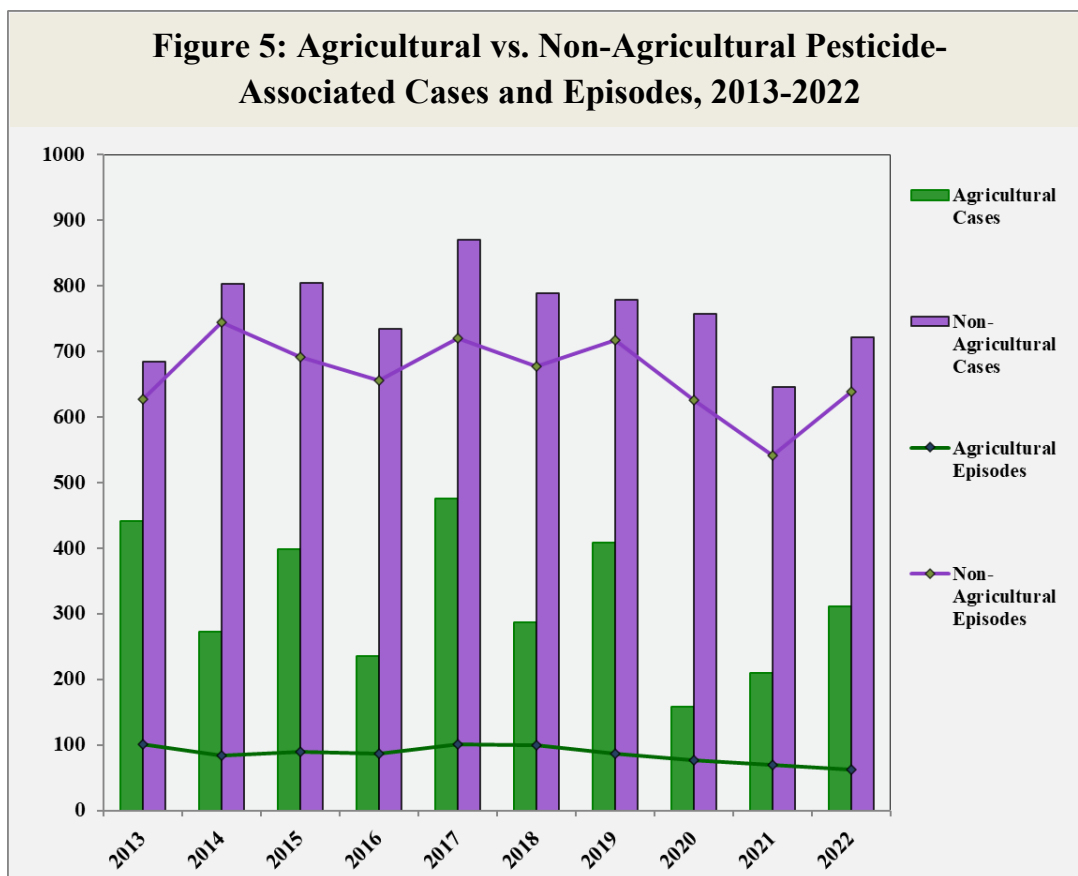
Figure 4: Distribution of Associated Episodes and Cases, 2022

pesticides intended to contribute to production of an agricultural commodity, including livestock, which corresponds to the regulatory definition¹¹ of “production agriculture.” Of the 709 associated episodes, 62 (9%) episodes resulting in 311 cases, were attributed to pesticides used for agricultural purposes. The number of cases has varied year-to-year based on the number of individuals involved in multi-person episodes. In 2022, there were 20 multi-person agricultural-related episodes involving 269 associated cases.

Most of the associated episodes involved non-agricultural use pesticides, (638, 90%). These episodes represent 721 cases, most of them involving a single person (accounting for 93% of the non-agricultural episodes). Use or intended use in non-production agriculture is designated as “non-agricultural,” and includes structural, sanitation, home garden, most industrial and institutional uses, as well as pesticide manufacturing, transport, storage, and disposal.

Majority of the cases involved non-agricultural use pesticides.

There were nine pesticide-associated episodes, all of which were single-person events, that could not be characterized as agricultural or non-agricultural due to insufficient information. These uncharacterized events constitute 1% of the associated episodes and cases and are not included in Figure 5.



¹¹ 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 individuals were at work, accounted for 471 (45%) of the 1,041 associated cases, with agricultural exposures accounting for over half of these cases (284, 60%). Non-occupational exposures accounted for 564 (54%) of the associated cases, involving mostly non-agricultural use pesticides (537, 95%). Six associated cases could not be characterized as occupational or non-occupational due to insufficient information (Table 1).

Table 1: Agricultural and Occupational Status Evaluation of 2022 Illness Cases				
Occupational Status	Agricultural	Non-Agricultural	Unknown	Total
Non-Occupational	27	537	0	564
Occupational	284	180	7	471
Unknown	0	4	2	6
Total	311	721	9	1,041

When PISP receives and evaluates illness investigative reports for a given year, which includes determining if any violations of pesticide laws and regulations have occurred, enforcement actions by CACs and DPR are often still ongoing. Thus, violations noted by PISP for the given year may not always reflect enforcement actions ultimately taken by CACs and/or DPR. Based on the information available at the time of evaluation, PISP epidemiologists concluded that 411 (58%) of 709 associated episodes, resulting in 681 cases, contained evidence to indicate that a violation of safety requirements contributed (contributory violation) to the exposure, e.g., not wearing label-required personal protective equipment. Illness and/or injury *may* have been prevented if the people involved had followed the safety procedures required by regulations and/or pesticide labels. Of the 411 episodes with these contributory violations, 43 (10%) were attributed to pesticides intended for agricultural purposes. Investigation by the CACs determined drift occurred in 19 (44%) of the 43 episodes.

In 26 (4%) of the 709 episodes, PISP epidemiologists determined that non-compliance with regulations did not contribute to the pesticide exposure (e.g., record keeping violations). Due to insufficient information, PISP could not determine if a violation occurred in 214 (30%) episodes. There were 55 (8%) episodes involving 74 individuals that had health effects attributed to pesticide exposure despite apparent compliance with all applicable label instructions and safety regulations. Of the 55 episodes, 47 (85%) and 8 (15%) were attributed to pesticides used for non-agricultural and agricultural purposes, respectively.

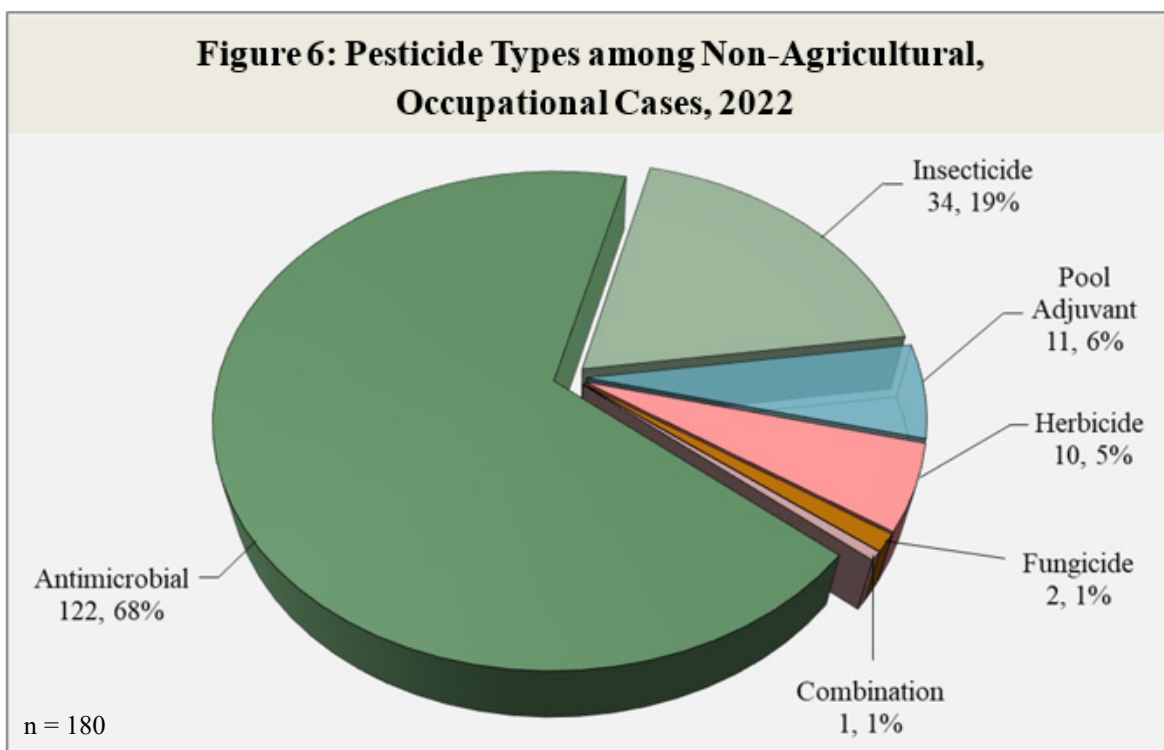
NON-AGRICULTURAL PESTICIDE ILLNESSES

Of the 721 cases involving pesticides not used for agricultural commodities, exposures from direct forms of contact contributed to 303 (42%) cases. The affected individuals came directly in contact with a pesticide when the pesticide was spilled, propelled by the application equipment or other mechanisms where the pesticide was on their person. Exposures from off-site movement accounted for 198 (27%) of the 721 cases. PISP defines off-site movement as spray, mist, vapors, or odor carried from the target site by air during a pesticide application or the mixing/loading of pesticides. Off-site movement as an exposure mechanism does not necessarily correspond to drift as a violation. Illness and injuries due to inhalation accounted for 309 (43%) cases of the non-agricultural use cases. Individuals who were exposed to pesticides through multiple routes of exposures followed with 128 (18%) of the cases. Table 2 shows the number of non-agricultural cases according to exposure mechanisms.

Table 2: Mechanisms of Exposure in Non-Agricultural Associated Cases, 2022				
Type of Exposure	Cases		Route of Exposure	Cases
Direct Contact	303		Dermal	47
Off-site Movement	198		Injection	0
Multiple Types of Exposures	11		Ingestion	115
			Inhalation	309
Other	38		Multiple Routes of Exposure	128
Residue	110		Ocular	86
Unknown	61		Unknown	36
Total	721		Total	721

Occupational, Non-Agricultural Exposures

For cases involving non-agricultural, occupational exposures, 180 were evaluated as associated with pesticide use. Workers exposed while handling pesticides accounted for 48% of these cases [Applicators (61, 34%), Mixer/Loaders (26, 14%)]. Thirty-nine (22%) of the 180 workers were exposed to pesticides as bystanders, meaning they were not handling pesticide products and their normal work activity had minimal expectation of exposure to pesticides (e.g., office workers sitting at a desk). Antimicrobials and disinfectants were implicated in 122 (68%) of the occupational cases. Insecticides were the second most commonly used pesticide class, accounting for 34 (19%) of occupational cases (Figure 6). Occupational bystanders were exposed to applications performed by structural pest control operators (SPCO) in 14 (41%) of the 34 cases. In one episode, an SPCO applied insecticide using a portable fogger in a processing facility. During the application, the fog drifted into adjacent rooms where employees of the facility were working. Employees described seeing a fog and noticing an odor. The facility was evacuated and eight workers reported symptoms. The SPCO was cited for performing a space spray application while the facility was in operation, a violation of the label instructions.

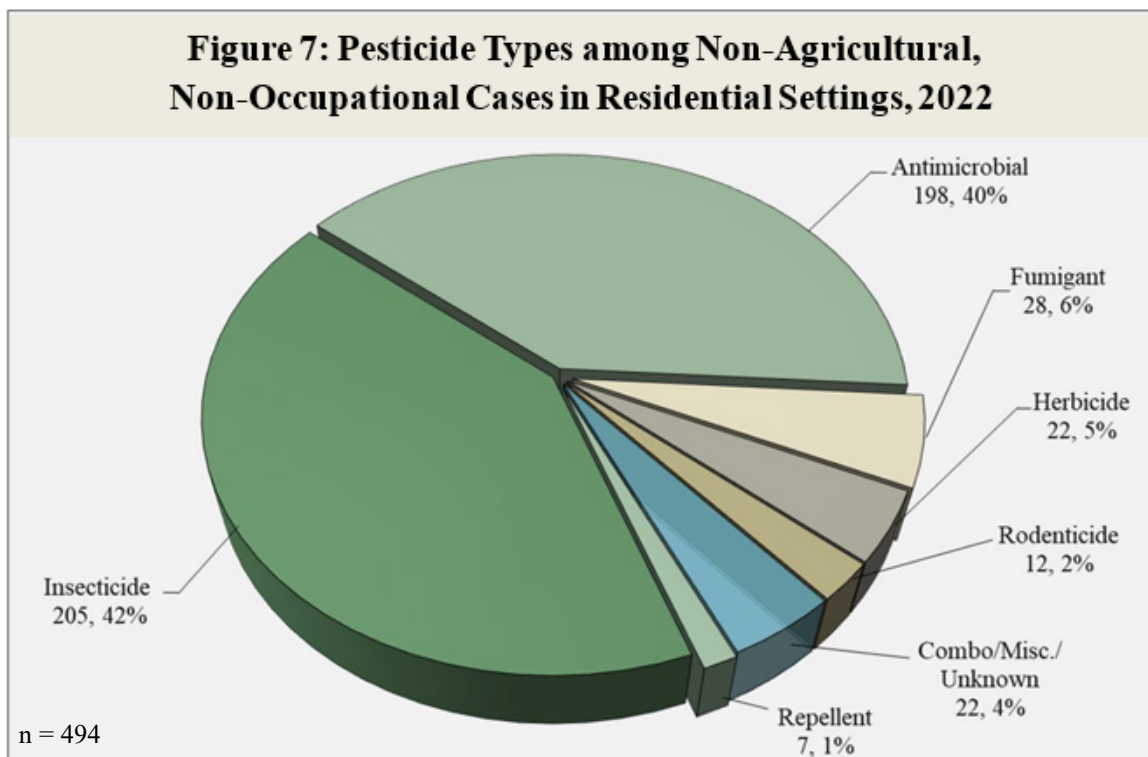


Of the antimicrobial cases (122), service establishments, such as restaurants, hotels, or fitness centers, were the most represented incident setting (32, 26%). Followed by exposures at hospitals or other medical facilities (19, 16%). Workers applying or mixing/loading antimicrobials accounted for 65% (79) of the cases. Three-fourths of the workers handling antimicrobials reported eye or skin symptoms, either alone or in combination with other illness types (56, 76%). Twenty-six of the workers (35%) reported having at least one disability day due to their injury. There was evidence to indicate a violation of safety requirements contributed to the exposure in 48 (65%) handler cases. Of these 48 cases, 13 (18%) handlers were not wearing the label-required personal protective equipment at time of exposure, and 25 (34%) handlers mixed incompatible chemicals or used the product above the label rate. An additional 10 (13%) handlers did not wear the label-required personal protective equipment as well as used the product in a manner inconsistent with the label. Most of the antimicrobials involved contained sodium hypochlorite or quaternary ammonium compounds, which can produce a toxic vapor when mixed together. Under Title 3 CCR § 6720(c), employers using antimicrobials as sanitizers or disinfectants are exempt from certain Title 3 CCR provisions, provided they instead comply with corresponding Title 8 CCR provisions. The CAC does not have statutory authority to take enforcement action against Title 8 CCR violations.

Non-Occupational, Non-Agricultural Exposures

For cases involving non-occupational, non-agricultural exposures, 537 were evaluated as associated with pesticides. Forty-seven percent (250) of these individuals were performing activities with minimal expectation of exposure (e.g., playing in the backyard) to pesticides; followed by individuals handling pesticides (207, 39%). Most of these incidents occurred in residential settings (494, 92%). The remaining associated cases occurred in non-residential locations such as service or retail establishments (e.g., fitness centers, restaurants, grocery stores) (43, 8%). Contrary to occupational exposures which mostly involved antimicrobials, a majority of non-occupational residential exposures involved insecticides (205, 42%), followed closely by antimicrobials (198, 40%). Of the 198 cases where antimicrobial disinfectants or sanitizers were implicated, the bathroom or toilet was the most common application site (94, 47%), followed by swimming pools (23, 24%). Exposures to insecticidal total release foggers and aerosol cans accounted for 66 (13%) of these residential cases. The most common causes of these exposures were individuals who did not vacate the premises in a timely manner or at all, use of multiple foggers in a small area, re-entering the premises prior to the recommended time, or over spraying. The Combo/Misc./Unknown category consists of fungicides, pool adjuvants, multiple types of pesticides used in combination, and unknown types of pesticides (Figure 7).

92% of non-occupational cases occurred at home.



Exposures via direct contact accounted for 193 (39%) of the non-agricultural, non-occupational cases in residential settings. Direct contact includes exposures to pesticides spilled or propelled by the application equipment, or by ingestion as the route of exposure. Exposures from off-site movement followed in frequency, with 142 (29%) cases. Pesticide handlers (Applicators and Mixer/Loaders) were most commonly affected by off-site movement (e.g., a homeowner poured pool chlorine into their swimming pool and inhaled the vapors carried by air away from the target site) (Table 3). Ingestion of pesticides accounted for 103 (21%) of the 494 non-agricultural, non-occupational cases in residential settings. Fifty-five (53%) 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.

Table 3: Exposure and Activity of Non-Agricultural, Non-Occupational Cases in Residential Settings, 2022

Activity	Direct Contact	Off-Site Movement	Residue	Multiple Exposures	Other/ Unknown	Total
Applicator	46	116	0	4	22	188
Mixer/Loader	3	5	0	0	0	8
Handler, Other or Unspecified	4	2	0	0	1	7
Routine Activity	106	15	77	2	23	223
Other Activity	29	3	10	1	3	46
Unknown	5	1	2	0	14	22
Total	193	142	89	7	63	494

AGRICULTURAL PESTICIDE ILLNESSES

Of the 1,041 associated cases, PISP identified 311 (30%), stemming from 62 episodes, as associated with agricultural use pesticides. Exposures from pesticides moving off-site contributed to 267 (86%) of the 311 agricultural cases. Exposures from direct contact and residual pesticide accounted for 25 (8%) and 13 (4%), respectively, of the agricultural cases. Most of the cases involved exposures to a fumigant (209, 67%), primarily stemming from two large multi-person episodes that involved applications to pre-plant strawberry fields using drip irrigation equipment which resulted in 181 cases. Exposures to a combination of different types of pesticides, either from a tank mix or concurrent applications were involved in 35 cases (11%), and insecticides were involved in 29 cases (9%). Table 4 shows the number of agricultural cases according to the types of pesticide and exposure mechanisms.

Table 4: Types of Pesticide and Mode of Exposure in Agricultural Cases, 2022					
Pesticide	Direct Contact	Off-Site Movement	Residue	Other/ Unknown	Total
Antimicrobial	0	2	0	1	3
Fumigant	9	199	0	1	209
Fungicide	0	13	0	1	14
Herbicide	6	9	1	2	18
Insecticide	2	23	3	0	29
Rodenticide	0	3	0	0	3
Combo/Misc.	8	18	9	0	35
Total	25	267	13	6	311

Eighty-one percent of the individuals reported inhaling pesticides used for an agricultural commodity (251), and 30 individuals reported having multiple routes of exposures (10%). Applications made by air blast sprayers accounted for 19 (6%) cases, stemming from 12 episodes. In most of the applications with air blast sprayers, the applicator did not turn off the spray nozzles before turning at the end of the crop row, as specified by the label. Aerial applications were involved in 5 episodes and resulted in 12 cases (4%). Other types of ground applications accounted for 38 (12%) cases, stemming from 13 episodes.

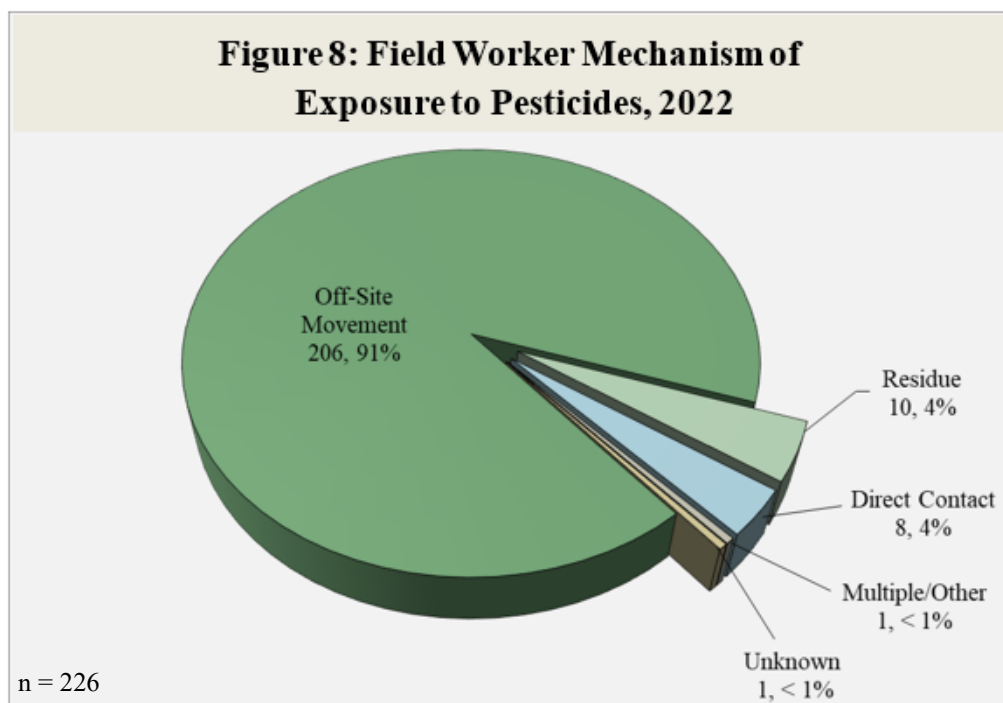
Applicators and Mixer/Loaders

Of the 311 associated cases, 21 (7%) involved applicators or mixer/loaders of agricultural use pesticides, and most were single-person episodes. For these 21 cases, spills or other direct contact from pesticides not propelled by an application or mix/load equipment contributed to 13 (62%) of the cases, followed by off-site movement at six (29%) cases. Equipment failure or use inconsistent with the label contributed to over half (12, 57%) of the cases. Eight workers (38%) were not wearing the label-required personal protective equipment at time of exposure. Five (24%) of the handler (Applicator and Mixer/Loader) cases had reports of lost workdays, and none were hospitalized due to their exposure.

Field Workers

PISP data show that 226 field workers were injured by pesticide exposure in 18 separate episodes in 2022, constituting 73% of the 311 agricultural illness cases and 29% of the 62 agricultural episodes. Large multi-person episodes can dramatically alter the overall number of cases from year to year. There were 11 multi-person episodes involving field workers which resulted in 219 (97%) cases. The largest number of field workers injured in a single pesticide drift related episode in 2022 was 163. In this episode, multiple field worker crews were working near a field that was being fumigated with chloropicrin. Within an hour, the first crew reported symptoms. There were 212 workers present and 163 reported symptoms. During the application, irrigators fixed leaks on the tarps and two applicators also

developed symptoms. The exact cause of the off-gassing could not be determined but the fumigated beds and furrows at the site consisted of soil that was cloddy which may have allowed the fumigant to escape. The AG PCB was cited for not performing pest control in a careful and effective manner. Off-site movement of pesticide(s), as defined by PISP, was associated with 206 (91%) cases, and exposure to residue contributed to 10 (4%) of the 226 cases involving field workers (Figure 8).



REPORTED ILLNESSES AMONG CHILDREN

There were 154 associated cases of pesticide exposure involving children (less than 18 years old). Three (2%) children were hospitalized due to their pesticide exposure. In one episode, two children ingested an organophosphate--that was purchased in another country--after their grandmother thought it was cough syrup. In another episode, a teenager ingested an organophosphate in a self-harm attempt. The two most common types of exposures were direct contact (93, 60%), and residue (30, 19%) (Table 5). Ingestion and multiple exposure routes were the most reported route of pesticide exposure, 48 (31%) and 41 (27%), respectively. The two pesticide types most often ingested were antimicrobials and insecticides, 27 (56%) and 16 (33%), respectively. Thirty-three (69%) of the 48 children who ingested pesticides were less than six years of age. In most of the ingestions by children under six years of age, improper storage and accessibility of the pesticide contributed to the exposure (31, 94%).

In 2022, there were three reports of children exposed to agricultural use pesticides while at school.

Five children were exposed to agricultural use pesticides in three separate episodes. In two of the episodes, the children were exposed while at their residence. In both episodes, off-site movement was

confirmed and notice of violations were issued. In the third episode, three students were exposed to the odor from a nearby herbicide application. Off-site movement could not be confirmed because the school had also recently applied an herbicide with the same active ingredient.

Table 5: Pesticide Types and Mode of Exposure for Children < 18-years old, 2022						
Pesticide Type	Agricultural	Non-Agricultural				
	Off-Site Movement	Direct Contact	Off-site Movement	Residue	Other*/ Unknown	Total
Antimicrobial	0	58	8	5	6	77
Fumigant	0	0	0	8	0	8
Herbicide	3	1	0	0	0	4
Insecticide	1	25	5	16	3	50
Repellent	0	4	0	0	1	5
Rodenticide	0	4	0	1	1	6
Combo/Misc.	1	1	1	0	1	4
Total	5	93	14	30	12	154

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

MORBIDITY AND MORTALITY

Of the 1,041 cases evaluated as associated with pesticide exposure, 23 people (2%) were hospitalized and 118 (11%) reported time lost from work or normal activity (e.g., going to school) (Table 6). Twelve (52%) of the 23 people hospitalized had ingested pesticide. Of those twelve people, 7 (58%) acknowledged self-harm, of which one was fatal. This individual ingested two glasses of herbicide.

Table 6: Summary of Pesticide-Associated Hospitalization and Disability, 2022			
Relationship	Cases	Number Hospitalized¹	Number with Lost Work Time²
Definite/Probable	897	21	108
Possible	144	2	10
Total	1,041	23	118

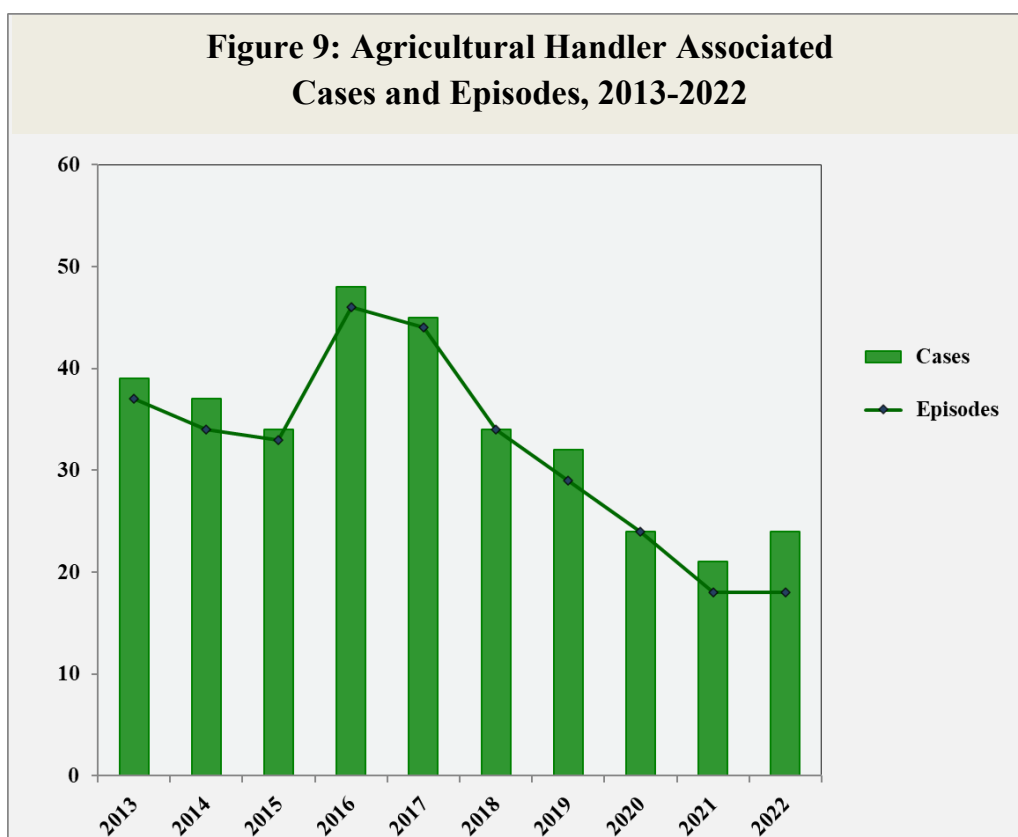
¹ Number of associated cases who were admitted and were hospitalized at least one full day (24-hour period).

² Number of associated cases who missed at least one full day of work or normal activity such as school.

PROGRAM MONITORING OF AGRICULTURAL HANDLERS

California produces over 400 different agricultural commodities with over a third of the country's vegetables and most of the country's fruits and nuts grown in California.¹² To protect these commodities from pests and diseases, pesticides such as insecticides, herbicides, fungicides, are used. Pesticide handlers are among those with the highest risk of exposure due to the nature of their work in the agricultural industry. Title 3 of the California Code of Regulations (3 CCR) defines pesticide handlers as workers who participate in applying, mixing, or loading pesticides, or workers who service, repair, or maintain pesticide-contaminated equipment (3 CCR § 6000). Handlers often work with concentrated pesticides and may be exposed through accidental spills, splashes, equipment malfunctions, or leaks. In some cases, exposure occurs because the worker improperly handled the products or failed to use the required PPE.

From 2013 to 2022, PISP identified 317 episodes (338 cases) of pesticide-related illnesses involving agricultural handlers, and most were single person episodes. Over the past decade, illness episodes involving agricultural handlers have been declining. The years 2021 and 2022 marked the fewest number of reported episodes – 18 episodes each year – for the 10-year period (Figure 9).



¹² CDFA. (2025). California's Top 10 Agricultural Commodities. *CDFA California Department of Food and Agriculture*. <https://www.cdfa.ca.gov/Statistics/>

Applicators accounted for most of the handler cases followed by mixer/loaders, 227 cases (67%) and 78 cases (23%), respectively. Direct contact with pesticides was the most common method of exposure, occurring in 156 cases (46%), followed by off-site movement of pesticides (72 cases, 21%). In one episode, a worker was instructed to spray the weeds around coffee bushes. Prior to the application, he was given verbal training on how to operate the backpack sprayer but was unaware of the product that he was applying. During the application he felt liquid on his back and a burning sensation. He informed his supervisor but was advised to continue working. He later took off his wet shirt but did not rinse it. Later, he wore the contaminated shirt which is against label instructions. The grower was cited for not ensuring that the worker had been trained as a pesticide handler.

From 2013 to 2022, contributory violations, such as not wearing the appropriate PPE or failing to follow label instructions or regulations were identified in 155 (46%) cases (Table 7). Of these cases, over half involved the failure to use the label-required PPE (85, 55%). For 47 (55%) of the 85 cases, the employer provided the required PPE and the affected worker did not wear the PPE or wore the PPE improperly (e.g., safety glasses resting on top of their head). The employer did not provide the required PPE for 30 (35%) cases, and it is not known if PPE was provided for 8 (9%) cases. In one episode an untrained applicator applied a tank mix of pesticides with an air blast sprayer. He wore safety glasses instead of the label-required goggles. As he turned the tractor, pesticide mist got under his safety glasses, and he felt a burning sensation. He rinsed his eyes and continued to apply. When he continued to apply, another mist of pesticides went into his eyes, and he rinsed his eyes again.

Table 7: Total Agricultural Handler Cases with a Contributory Violation, 2013-2022			
Year	Number of Cases	Number of Cases with a Contributory Violation	Percent of Cases with a Contributory Violation
2013	39	11	28%
2014	37	17	46%
2015	34	12	35%
2016	48	28	58%
2017	45	16	36%
2018	34	17	50%
2019	32	17	53%
2020	24	12	50%
2021	21	8	38%
2022	24	17	71%
Total	338	155	46%

Equipment failure was noted in 53 (16%) of the 338 cases, with most resulting in eye or skin symptoms (42 cases, 79%). In a quarter of the cases, the exposure occurred because of the worker's failure to wear the label-required PPE (13, 25%). In one instance, a worker used a backpack sprayer to spray weeds in an avocado grove. While spraying, the backpack leaked, and he could feel the herbicide on his back. By the end of the day, his clothes were saturated. His employer did not provide the label-required coveralls to wear during the application.

In 2022, non-compliances were identified in 17 out of the 24 reported cases of agricultural handlers, accounting for 71%. This marks the highest percentage observed in the last ten years, where the average was 46%. In these cases, the resulting illnesses could have been prevented had the worker followed label instructions or wore the label-required PPE.

To promote safe pesticide use and prevent illness, DPR requires employers to provide annual training to pesticide handlers. For handlers who possess a Qualified Applicator License or Certificate, they must accumulate a determined amount of approved continuing education (CE) hours to maintain their license or certificate.¹³ The Pesticide Safety Information Series (PSIS) leaflets developed by the Worker Health & Safety Branch (WHS) contain information about all training topics required for handler training (3 CCR § 6724). Topics included are hazard communication, first aid, medical supervision, pesticide handler safety, pesticide storage and transport, protective equipment and engineering controls, and respiratory protection. The PSIS leaflets are also available in multiple languages¹⁴. Growers with employees who handle pesticides must display the PSIS A-8, *Safety Rules for Pesticides Handlers on Farms*, at a central location (3 CCR § 6723). DPR staff also provide outreach and continuing education at community events and industry workshops. For example, WHS regularly conducts training presentations at the Pesticide Applicators Professional Association and assists the CACs with their handler training to provide CE hours. Additionally, DPR has developed outreach materials for agricultural workers.¹⁵

While the data suggests a downward trend in pesticide-related illnesses for agricultural handlers, the continued occurrence of preventable exposures highlights the need for ongoing outreach and education. This is particularly important as a majority of the incidents stem from handlers and employers failing to adhere to the label and regulations. For instance, mandate further training following incidents where handlers were not wearing the label required PPE or where employers fail to provide the appropriate PPE. Ongoing surveillance of illnesses involving handlers will enable PISP staff to identify any emerging issues for focused outreach opportunities.

¹³ Some new license holders may require fewer CE hours for their first renewal depending on when the license was issued.

¹⁴ The Pesticide Safety Information Series (PSIS) can be viewed or downloaded from DPR's web site at <https://www.cdpr.ca.gov/worker-health-and-safety/education-series/>

¹⁵ https://www.cdpr.ca.gov/wp-content/uploads/2024/08/pest_handlers_safety_tips.pdf;
https://www.cdpr.ca.gov/wp-content/uploads/2024/08/farmworker_safety_tips.pdf

FURTHER INFORMATION

Tabular summaries presenting different aspects of 2022 pesticide illness data are available online at <http://www.cdpr.ca.gov/docs/whs/pisp.htm>, or by contacting the Worker Health and Safety 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 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: 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
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
U.S. EPA	United States Environmental Protection Agency

APPENDIX B: 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 farmlands. 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.

Handler, Other or Unspecified: Assists with tasks following an application (i.e., tarp removal during a structural application or soil fumigation, and not ancillary to the application or mix/load activity).

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 marketplace. Field packing of agricultural commodities is classified as field worker.

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.

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.

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.

Aerosol/Fog Generating Equipment: Refillable application equipment designed to disperse pesticide as a small airborne droplet, either in confined spaces or outdoor areas.

Air, Other or Unspecified: Aerial application equipment, other or unspecified. This includes two or more types of aerial application equipment.

Air Blast 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.

Drip Irrigation: Chemigation through drip irrigation equipment.

Fixed Wing Aircraft: A fixed wing aircraft.

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, where the location of the boom was not specified.

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.

Helicopter: A helicopter.

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.

Power Dusters: Ground application equipment used to apply dust formulated pesticides.

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

Shank Injection with Tarps: Ground application equipment that uses a shank or other piece of equipment to directly apply a pesticide into the soil and a tarp is placed over the soil to restrict the pesticide to the application site.

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.

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.

Not Applicable: No application equipment is involved or exposure from original container without known method of application.

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.

Food Processing Facility: A commercial operation that manufactures, packages, labels or stores food for human consumption, and provides food for sale or distribution to other business entities such as food processing plants or food establishments. This includes centralized kitchens that make meals for distribution.

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, 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 definite or probable 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.

Route of Exposure: Route by which the pesticide(s) enters or comes in contact with the body.

Dermal: Exposure via direct contact with the skin

Ingestion: Intentional or unintentional oral ingestion or substance entering the oral cavity. This includes ingestion of residue (on food, produce, toys).

Inhalation: Breathing or inhaling vapors, gases, mists, fumes, odor or particulates into the respiratory tract/lungs.

Injection: Substance was injected into the body by a syringe or when a mechanical injury occurred, involving a contaminated object puncturing the skin.

Multiple: Indicates exposure occurred by two or more distinct route.

Ocular: Exposure via contact with the eyes.

Type of Exposure: Characterizes the nature of the exposure.

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.

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

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

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.