

**SUMMARY OF RESULTS FROM THE CALIFORNIA PESTICIDE
ILLNESS SURVEILLANCE PROGRAM
- 2020 -**

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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 2020. 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 2020, PISP received reports for 1,319 cases, stemming from 1,027 episodes, potentially involving health effects from pesticide exposure. Due to insufficient information in the report, PISP epidemiologists were unable to determine if the health effects reported in 230 (17%) cases were associated with the pesticide exposure. Of the 1,089 (83%) cases with sufficient information, PISP epidemiologists determined that 917 (70%) of reported cases, stemming from 704 (69%) episodes, were associated with pesticide exposure. Evidence indicated that pesticide exposure did not cause or contribute to illnesses and injuries in 172 (13%) of the 1,319 cases evaluated.

PISP identified 76 episodes resulting in 158 cases as associated with agricultural use pesticides (17% of the 917 associated cases). "Agricultural" is defined as involving pesticides intended to contribute to production of an agricultural commodity, including livestock, which corresponds to the regulatory definition¹ of "production agriculture." Agricultural field workers were exposed to pesticides in 16 separate episodes in 2020, four of which were multi-person episodes. The largest number of field workers affected in a single episode was 12. These workers were exposed to insecticides and fungicides applied by an air blast sprayer used on a neighboring field.

There were 626 episodes resulting in 757 cases identified as associated with non-agricultural use of pesticides (83% of the 917 associated cases). Two (<1%) of the 917 pesticide-associated cases could not be characterized as agricultural or non-agricultural due to insufficient information.

Of the 757 cases associated with non-agricultural use pesticides, 290 (38%) were occupational, meaning the incident occurred while the affected individuals were at work. The most common settings were crop and food processing facilities, service establishments such as restaurants, hotels, or fitness centers, and hospitals or other medical facilities. Exposures to antimicrobial products accounted for 242 (83%) of all associated non-agricultural occupational cases.

Children (less than 18 years old) accounted for 121 (13%) of the 917 associated cases; of those, 106 and 15 cases involved non-agricultural and agricultural use pesticides, respectively. There were no reported cases of children exposed to agricultural use pesticides while at school.

¹ 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.

PISP further evaluated clusters of illnesses to better understand the factors leading to exposure. In the 2019 report, PISP identified clusters associated with air blast sprayers. In 2020, applications made by air blast sprayers accounted for 46 cases, stemming from 23 episodes, representing 29% and 30% of agricultural episodes and cases, respectively. Although the number of cases decreased from 2019 (172 cases), the number of episodes increased by 77% (13 episodes), confirming the need for DPR's focus on mitigation actions relative to air blast sprayers. Following DPR's evaluation of the 2019 data and release of the 2019 report in 2023, DPR formed a work group to identify factors behind the air blast exposures and potential mitigation approaches. The work group determined that focused presentation-based applicator training, particularly in areas with the highest frequency of incidents, would be most effective for mitigation. In 2024, DPR developed and distributed this training presentation to all County Agricultural Commissioners (CACs) and began presenting it at CAC sponsored applicator training sessions.

In 2020, there was an increased use of antimicrobial products to combat the COVID-19 pandemic. Although there was a decrease in the overall number of pesticide incident reports in 2020, there was a 51% increase in the number of cases involving antimicrobial products from 2019. DPR developed many new resources focused on the proper use of disinfectants and surface sanitizers.

Reported pesticide-related illnesses and injuries are investigated by the CACs 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 Pesticide² 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 pesticides³.

Data Definitions

Definitions for all terms used in this report may be found in Appendix B: Glossary (page 25).

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 began receiving PIRs from CalREDIE in 2013 but receives only a small portion of reports via this pathway.

In order to ensure that the PISP database captures 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 with 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.

² 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.

³ 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 DIR⁴ 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 DFROII's are the primary source of PISP's occupational illness reports and predominantly involve non-agricultural use pesticides. When a DFROII has been identified by PISP epidemiologists as involving a pesticide as a possible cause of injury or involving a situation in which pesticide use is likely, the DFROII is forwarded to the local CAC for investigation as described below. PISP receives pesticide-related incident reports primarily from CPCS, 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 pesticides⁵. DPR's authority to enforce pesticide laws and regulations throughout the state is largely carried out in California's 58 counties by the CACs⁶. 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."⁷

⁴ 8 CCR § 9785.

⁵ 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.

⁶ 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.

⁷ 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>.

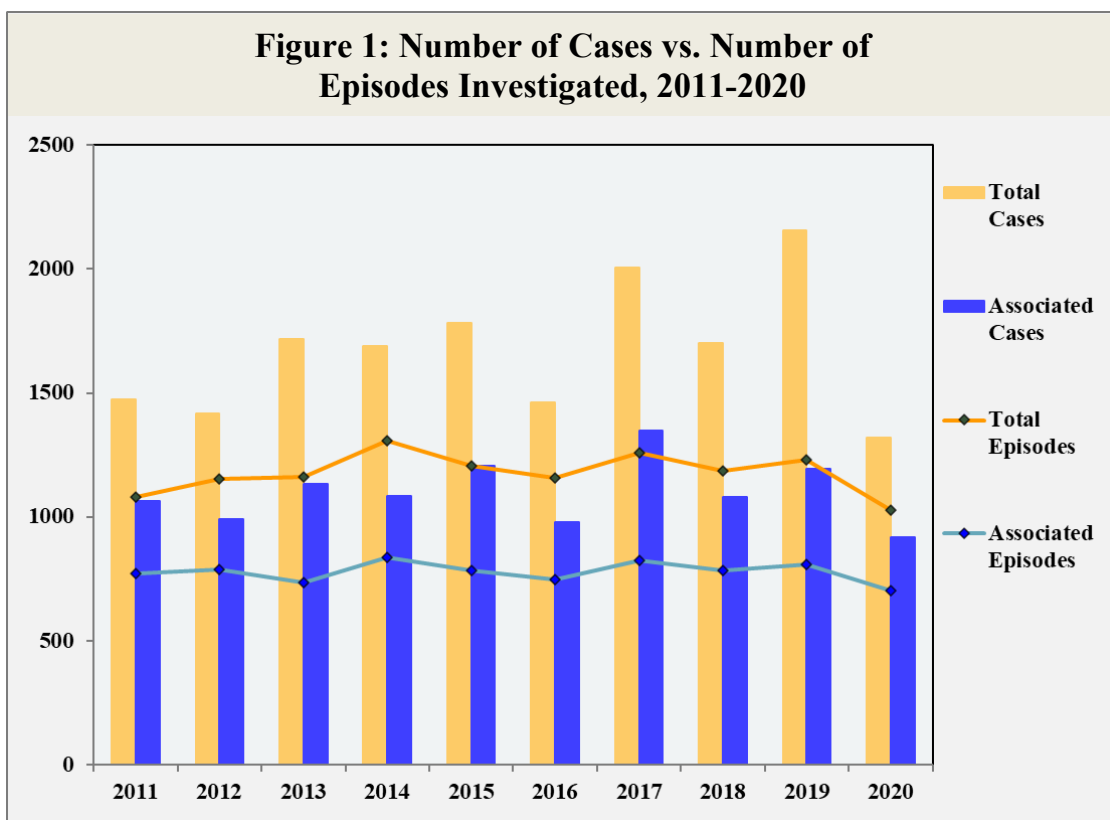
Data Limitations

PISP is a passive surveillance system that depends primarily on the reports submitted by health care 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 2020 CASES

PISP epidemiologists received reports on 1,027 episodes resulting in 1,319 cases that potentially involved health effects from pesticide exposure (Figure 1). The total number of episodes and cases decreased by 16% and 39%, respectively, in 2020 as compared to 2019. 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 25 for full glossary of terms.)

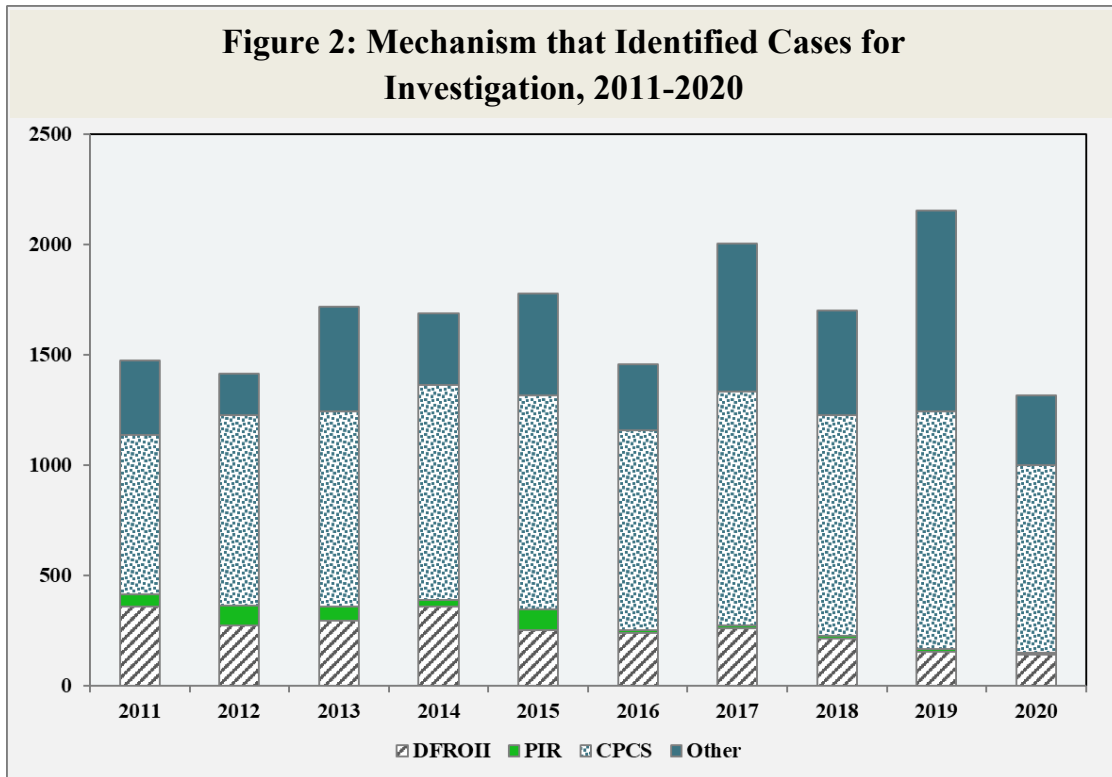


PISP receives reports of pesticide exposure and assigns case numbers to those meeting program criteria⁸ for inclusion into the PISP database. These reports are then sent out to the CACs for investigation. The CPCS remained a major source for case identification and initiating investigations (848, 64%) (Figure 2). DFROII reports contributed 144 (11%) 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.

⁸ 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 318 (24%) cases. Direct physician reporting to LHOs, as required by HSC § 105200, accounted for 9 (1%) of all identified cases, of which six were transmitted by LHO to PISP via CalREDIE and three were submitted by LHO to PISP via facsimile. Of the six CalREDIE PIRs, four were the source for initiating the investigation and two provided additional information on cases in the PISP database that were initially reported through other sources.



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 1,319 cases identified in 2020, 917 (70%), stemming from 704 episodes, were associated cases. Figure 3 shows the outcome of the cases evaluated and the level of certainty (relationship). Sufficient evidence was available to determine that of the 917 pesticide-associated cases, 127 (14%) were definitely related, 701 (76%) were probably related, and 89 (10%) were possibly related to a pesticide exposure. There was evidence indicating that pesticide exposure did not cause or contribute to the reported illness or injuries⁹ in 172 (13%) of the 1,319 cases evaluated. This grouping includes 74 asymptomatic cases, which constitute 6% of the total cases identified in 2020. There were 230 (17%) 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. In many cases, the affected individuals were unable to be contacted to determine their exposure circumstances and the association between pesticide exposure and the reported illness or injury could not be determined.

⁹ Consist of cases evaluated as Unlikely, Indirect, Unrelated or Asymptomatic.

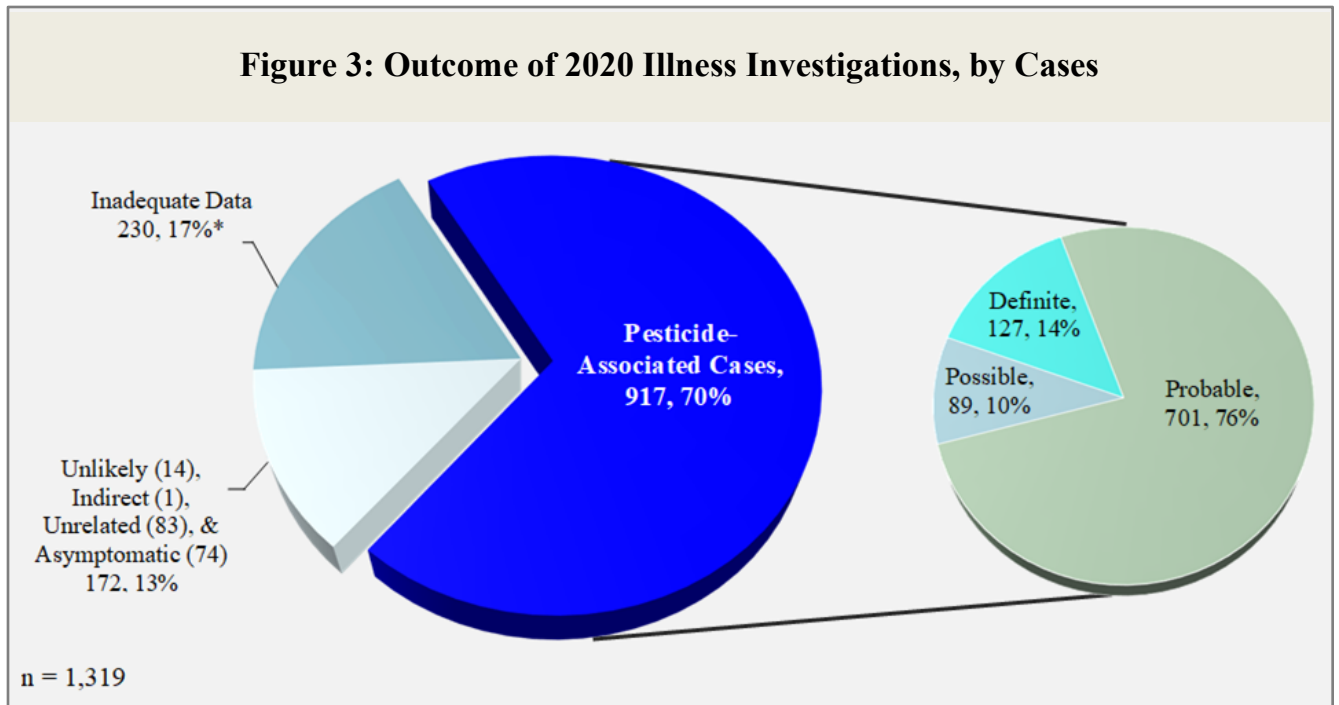
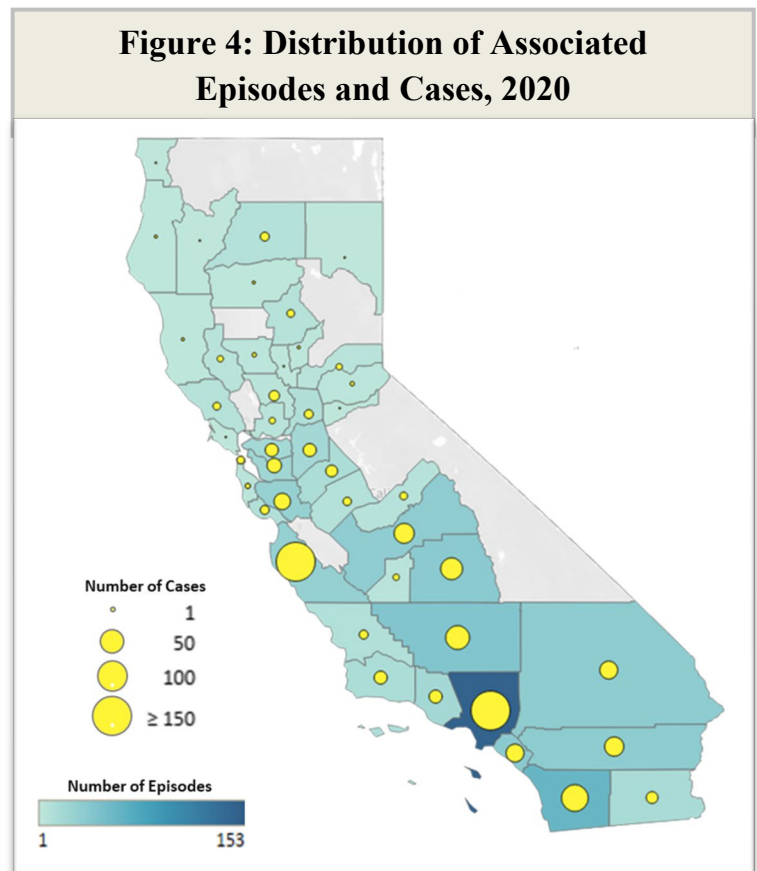


Figure 4 displays the distribution of associated episodes (704) and cases (917) across the counties statewide. Los Angeles County accounted for the largest number of associated episodes (148, 21%) and the second most number of cases (153, 17%). Although 4% (28) of associated episodes occurred in Monterey County, it accounted for the most number of cases (160, 17%), reflecting occurrences of multi-person incidents in that county. (See Table C1: 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, page 34.)

Overall, the number of associated agricultural episodes has been relatively consistent since 2011 (Figure 5). “Agricultural” is defined as involving pesticides intended to contribute to production of an agricultural commodity, including livestock, which corresponds to the

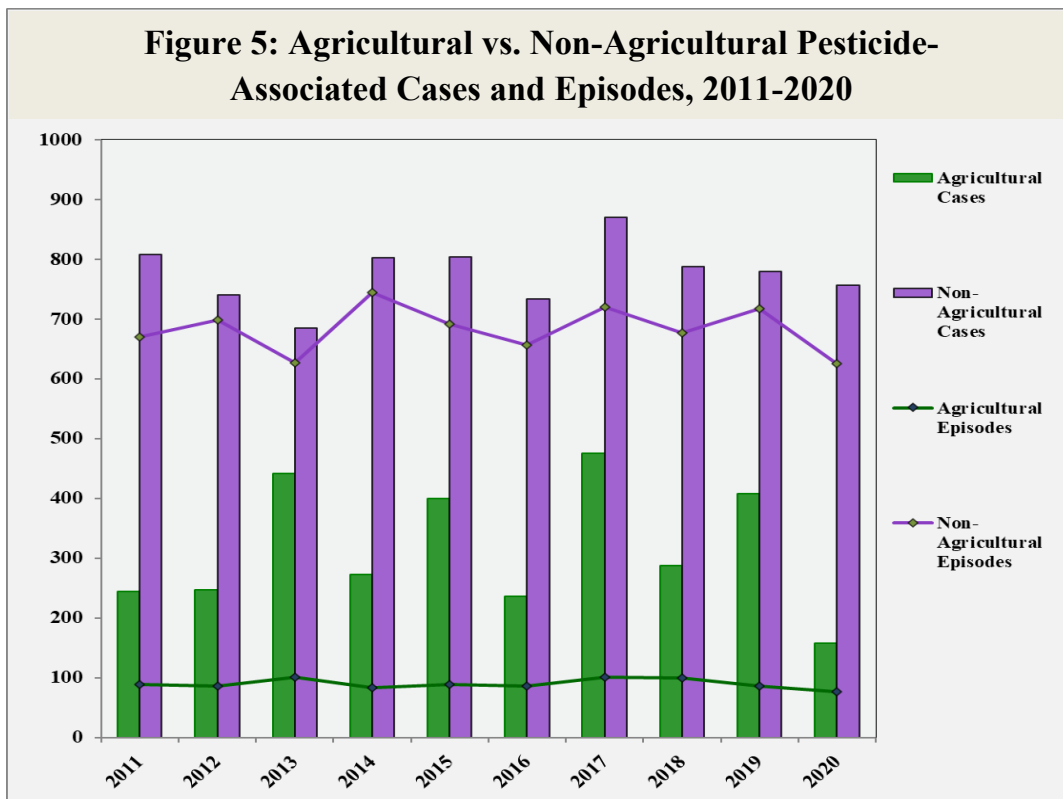


regulatory definition¹⁰ of “production agriculture.” Of the 704 associated episodes, 76 (11%) episodes resulting in 158 cases, were attributed to pesticides used for agricultural purposes. The number of cases has varied year-to-year based on the number of individuals involved in multi-person episodes. In 2020, there were 16 multi-person agricultural-related episodes involving 98 associated cases.

Most of the associated episodes occurred under non-agricultural circumstances, (626, 89%). These episodes represent 757 cases, most of them involving a single person (accounting for 97% 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 two pesticide-associated episodes, both of which were single-person events, that could not be characterized as agricultural or non-agricultural due to insufficient information. These uncharacterized events constitute less than 1% of the associated episodes and cases and are not included in Figure 5.



¹⁰ 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 373 (41%) of the 917 associated cases, with non-agricultural workers accounting for three-fourths of these cases (290, 78%). Non-occupational exposures accounted for 541 (59%) of the associated cases, involving mostly non-agricultural use pesticides (464, 86%). Three 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 2020 Illness Cases				
Occupational Status	Agricultural	Non- Agricultural	Unknown	Total
Non-Occupational	77	464	0	541
Occupational	81	290	2	373
Unknown	0	3	0	3
Total	158	757	2	917

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 704 associated episodes, resulting in 590 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, 48 (12%) were attributed to pesticides intended for agricultural purposes.

In 48 (7%) of the 704 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 180 (26%) episodes. There were 113 (16%) episodes involving 100 individuals that had health effects attributed to pesticide exposure despite apparent compliance with all applicable label instructions and safety regulations. Of the 113 episodes, 81 (72%) and 14 (12%) were attributed to pesticides used for non-agricultural and agricultural purposes, respectively, and the agricultural status could not be determined in two episodes.

NON-AGRICULTURAL PESTICIDE ILLNESSES

Of the 757 cases involving pesticides not used for agricultural commodities, exposures from direct forms of contact contributed to 299 (39%) 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 291 (38%) of the 757 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 226 (30%) cases of the non-agricultural use cases. Individuals who were exposed to pesticides through multiple routes of exposures followed closely with 210 (28%) of the cases. Table 2 shows the number of non-agricultural cases according to exposure mechanisms.

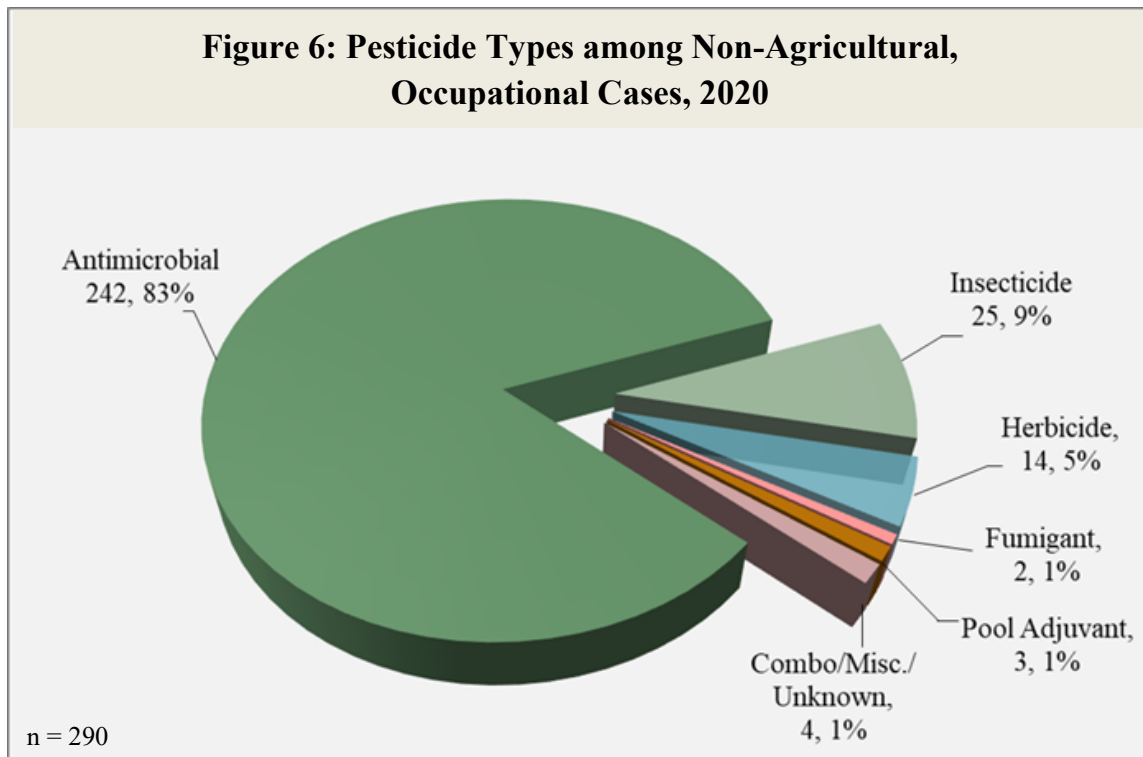
Table 2: Mechanisms of Exposure in Non-Agricultural Associated Cases, 2020				
Type of Exposure	Cases		Route of Exposure	Cases
Direct Contact	299		Dermal	60
Off-site Movement	291		Injection	1
Multiple Types of Exposures	8		Ingestion	114
			Inhalation	226
Other	35		Multiple Routes of Exposure	210
Residue	66		Ocular	109
Unknown	58		Unknown	37
Total	757		Total	757

Occupational, Non-Agricultural Exposures

For cases involving non-agricultural, occupational exposures, 290 were evaluated as associated with pesticide use. Workers exposed while handling pesticides accounted for 39% of these cases [Applicators (90, 31%), Mixer/Loaders (23, 8%)]. Forty-one (14%) of the 290 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 sitting at a desk). Antimicrobials and disinfectants were implicated in 242 (83%) of the occupational cases. Because of the COVID-19 pandemic, there was a widespread use of disinfectants and antimicrobials.¹¹ Insecticides were the second most commonly used pesticide class, accounting for 25 (9%) of occupational cases (Figure 6).

¹¹ The “Guidance for Cleaning and Disinfecting Public Spaces, Workplaces, Businesses, Schools, and Homes can be viewed or downloaded from EPA’s web site at https://www.epa.gov/sites/default/files/2020-04/documents/316485-c_reopeningamerica_guidance_4.19_6pm.pdf.

Of the antimicrobial cases (242), crop and food processing facilities were the most represented incident setting (106, 44%). Followed by exposures at service establishments, such as restaurants, hotels, or fitness centers (29, 12%), and hospitals or other medical facilities (22, 9%). Workers applying or mixing/loading antimicrobials accounted for 41% (99) of the cases. Three-fourths of the workers handling antimicrobials reported eye or skin symptoms, either alone or in combination with other illness types (75, 76%). Twenty-two workers (22%) reported having at least one disability days due to their injury. Twenty-eight workers (28%) were not wearing the label-required personal protective equipment at time of exposure, and 15 (15%) workers mixed incompatible chemicals or used the product above the label rate. An additional four (4%) workers did not wear the label-required personal protective equipment as well as used the product that was 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 regulations, provided they instead comply with corresponding Title 8 CCR regulations. The CAC does not have statutory authority to take enforcement action against Title 8 CCR violations.

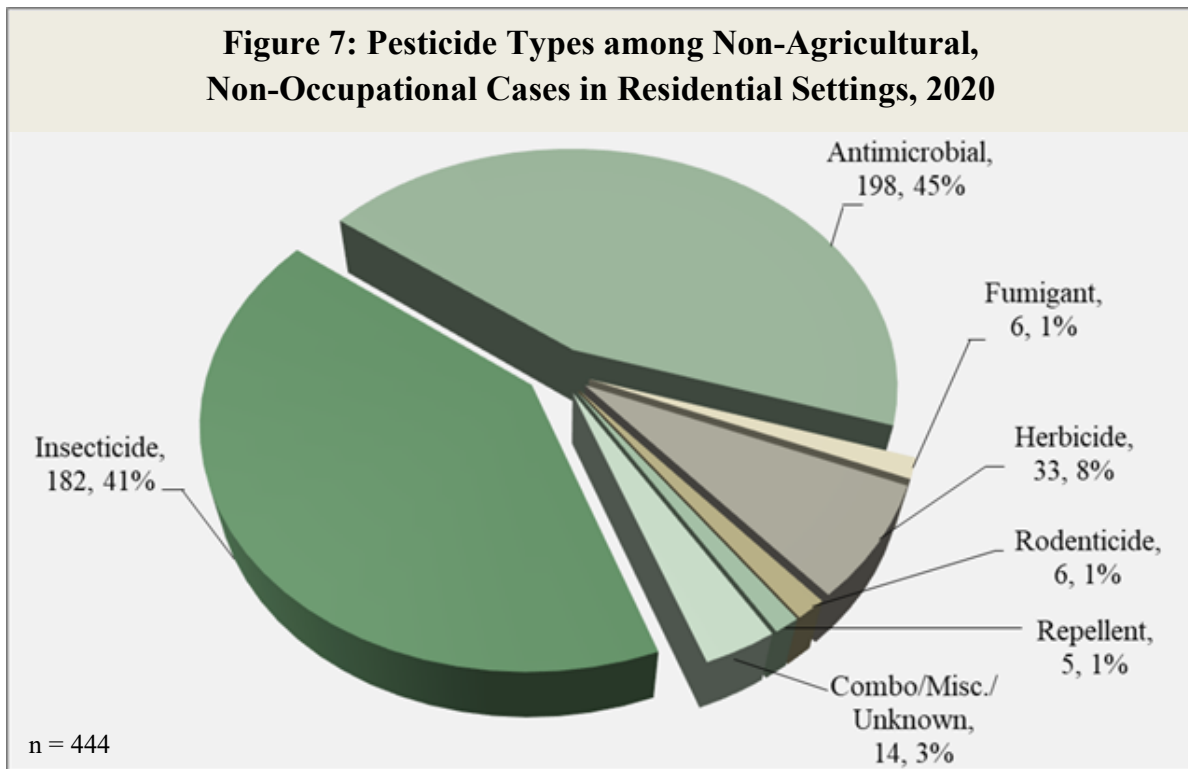


Non-Occupational, Non-Agricultural Exposures

For cases involving non-occupational, non-agricultural exposures, 464 were evaluated as associated with pesticides. Forty-five percent (209) of these individuals were exposed while handling pesticides; followed by individuals performing activities with minimal expectation for exposure (e.g., playing in the backyard) to pesticides (172, 37%). Most of these incidents occurred in residential settings (444, 96%). The remaining associated cases occurred in non-residential locations such as service or retail establishments (e.g., public pools, fitness centers, restaurants, grocery stores) (20, 4%). Unlike occupational exposures which mostly involved antimicrobials, antimicrobials (198, 45%) and insecticides (182, 41%) accounted for a similar number of non-occupational residential exposures. Of the 198 cases where antimicrobial disinfectants or sanitizers were implicated, the bathroom or toilet were the most common application sites (95, 48%).

96% of non-occupational cases occurred at home and the majority of these involved the use of antimicrobials.

Exposures to insecticidal total release foggers and aerosol cans accounted for 74 (17%) of these residential cases. The most common causes of exposure were, individuals who did not vacate the premises in a timely manner or at all, use of multiple foggers in a small area, or over spraying. The Combo/Misc./Unknown category consists of molluscicide, fungicides, multiple types of pesticides used in combination, and unknown types of pesticides (Figure 7).



Exposures via direct contact accounted for 192 (43%) of the non-agricultural, non-occupational cases in residential settings. Direct contact includes exposures to pesticides spilled or propelled by the application equipment, and by ingestion route of exposure. Exposures from off-site movement closely followed in frequency, with 144 (32%). Pesticide handlers (Applicators and Mixer/Loaders) were most commonly affected by off-site movement (e.g., a homeowner pouring 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 102 (23%) of the 444 non-agricultural, non-occupational cases in residential settings. Sixty-three (62%) 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, 2020

Activity	Direct Contact	Off-Site Movement	Residue	Multiple Exposures	Other/ Unknown	Total
Applicator	47	107	-	2	25	181
Mixer/Loader	10	10	-	1	2	21
Handler, Other or Unspecified	1	-	-	-	-	1
Routine Activity	86	24	41	-	11	162
Other Activity	37	2	4	2	4	49
Unknown	11	1	2	-	16	30
Total	192	144	47	5	56	444

AGRICULTURAL PESTICIDE ILLNESSES

Of the 917 associated cases, PISP identified 158 (17%), stemming from 76 episodes, as associated with agricultural use pesticides. Exposures from pesticide moving off-site contributed to 87 (55%) of the 158 agricultural cases. Exposures from residual pesticide and direct contact accounted for 43 (27%) and 18 (11%), respectively, of the agricultural cases. One-fifth of the cases involved exposures to insecticides (34, 22%) used for an agricultural commodity, and fumigants were involved in 37 cases (23%). Exposures to a combination of different types of pesticides, either from a tank mix or concurrent applications contributed to 41 cases (26%). 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, 2020						
Pesticide	Direct Contact	Off-Site Movement	Residue	Multiple Exposures	Other/Unknown	Total
Adjuvant	1	1	-	-	-	2
Antimicrobial	2	1	-	-	-	3
Fumigant	1	2	34	-	-	37
Fungicide	2	14	1	1	3	21
Herbicide	6	12	-	-	1	19
Insecticide	2	25	6	1	-	34
Combo/Misc.	4	32	2	1	3	42
Total	18	87	43	3	7	158

Forty-one percent of the individuals reported inhaling pesticides used for an agricultural commodity (64), and 55 individuals reported having multiple routes of exposures (35%). Applications made by air blast sprayers accounted for 46 (29%) cases, stemming from 23 episodes. In most of the applications with air blast sprayers, the applicator did not turn off the spray nozzle before turning at the end of the row. Aerial applications were involved in 9 episodes and resulted in 11 cases (7%). Other types of ground applications accounted for 36 (23%) cases, stemming from 22 episodes.

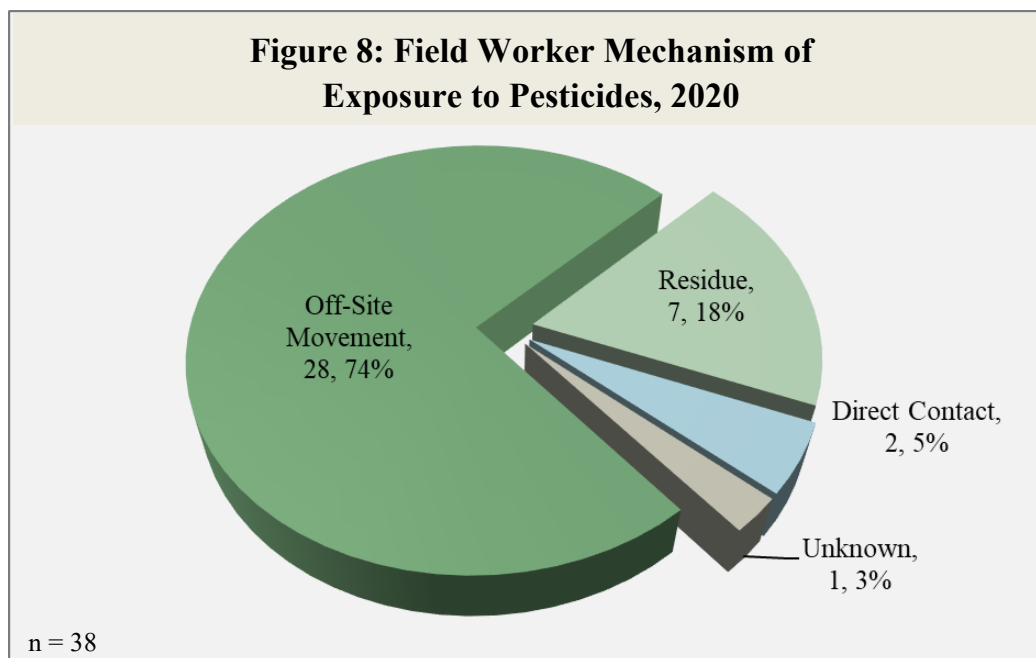
Applicators and Mixer/Loaders

Of the 158 associated cases, 20 (12%) involved applicators or mixer/loaders of agricultural pesticides, and all were single-person episodes. For these 20 cases, spills or other direct contact from pesticides not propelled by an application or mix/load equipment contributed to 10 (50%) of the cases, followed by off-site movement at four (20%) cases. The exposure mechanism remained unknown in two (10%) of the cases. Equipment failure and use inconsistent with the label contributed to nearly half (9, 45%) of the cases. Seven (35%) of the handler (Applicator and Mixer/Loader) cases had reports of lost workdays, and three (15%) of the handlers were hospitalized due to their exposure.

Field Workers

PISP data show that 38 field workers were injured by pesticide exposure in 16 separate episodes in 2020, constituting 24% of the 158 agricultural illness cases and 21% of the 76 agricultural episodes. Large multi-person episodes can dramatically alter the overall number of cases from year to year. There were four multi-person episodes involving field workers which resulted in 26 (68%) cases. The largest number of field workers injured in a single pesticide drift related episode in 2020 was 7. While eight field workers were taking a lunch break, an air blast application of insecticide, miticide, and fungicides was occurring in an almond orchard about 20 feet from their shade structure. The workers could hear a tractor

approaching and felt spray mist on their bodies. Seven of the eight workers experienced illness symptoms. Swab samples taken from cars parked nearby were positive for the pesticides applied, confirming that the pesticide moved off-site. The grower of the treated orchard was cited for failing to perform pest control in a careful and effective manner. Off-site movement of pesticide(s), as defined by PISP, was associated with 28 (74%) cases, and pesticide residue contributed to 7 (18%) of the 38 cases involving field workers (Figure 8).



REPORTED ILLNESSES AMONG CHILDREN

There were 121 associated cases of pesticide exposure involving children (less than 18 years old). Two (<1%) children were hospitalized due to their pesticide exposure. In both incidents, a parent had transferred an antimicrobial into a drinking bottle and the children accidentally drank from the bottles. The two most common types of exposures were direct contact (77, 64%), and residue (18, 15%) (Table 5). Ingestion and inhalation of pesticide(s) were the most reported route of exposure, 46 (38%) and 27 (22%), respectively. The two pesticide types most often ingested were antimicrobials and insecticides, 33 (72%) and 11 (24%), respectively. Thirty (65%) of the 46 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 (29, 97%).

Fifteen children were exposed to agricultural use pesticides in seven separate incidents. None of the children were admitted to the hospital. In the first incident, three children were exposed when they smelled an odor while an herbicide application

In 2020, there were no reports of children exposed to agricultural use pesticides while at school.

was occurring in a broccoli field about 100 feet from their home. In the second incident, two children were exposed when their vehicle was drifted on by an air blast sprayer applying insecticide to an almond orchard. Two additional incidents involved air blast sprayers exposing two children at their residences. Drip soil fumigations were used in two incidents exposing seven children. Lastly, a 14-year-old girl was exposed to fungicide when there was a fire at a nearby agricultural site and smoke drifted into her yard.

There was one report of a pesticide exposure that occurred at a school. A teenager ingested a small amount of roach gel in self-harm while at school.

**Table 5: Pesticide Types and Mode of Exposure
for Children < 18-years old, 2020**

Pesticide Type	Agricultural			Non-Agricultural				Total
	Off-Site Movement	Residue	Other*/Unknown	Direct Contact	Off-site Movement	Residue	Other*/Unknown	
Antimicrobial	-	-	-	55	9	1	4	69
Fumigant	-	7	-	1	-	-	-	8
Fungicide	1	-	1	-	-	-	-	2
Herbicide	3	-	-	-	-	-	-	3
Insecticide	2	-	-	17	4	10	1	34
Repellent	-	-	-	2	-	-	-	2
Misc./Combo	1	-	-	-	-	-	-	1
Unknown Pesticide	-	-	-	2	-	-	-	2
Total	7	7	1	77	13	11	5	121

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

MORBIDITY AND MORTALITY

Of the 917 cases evaluated as associated with pesticide exposure, 32 people (3%) were hospitalized and 139 (15%) reported time lost from work or normal activity (e.g., going to school) (Table 6). Nineteen (29%) of the 32 people hospitalized had ingested pesticide. Of those nineteen people, 11 (58%) acknowledged self-harm, of which three were fatal. An additional fatality occurred when a man entered his home while it was undergoing a structural fumigation.

Table 6: Summary of Pesticide-Associated Hospitalization and Disability, 2020			
Relationship	Cases	Number Hospitalized¹	Number with Lost Work Time²
Definite/Probable	828	26	127
Possible	89	6	12
Total	917	32	139

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.

UPDATE ON AIR BLAST SPRAYERS

PISP further evaluated clusters of illnesses to better understand the factors leading to exposure. In the 2019 report, PISP identified clusters associated with air blast sprayers. In 2020, applications made by air blast sprayers accounted for 46 cases, stemming from 23 episodes, representing 29% and 30% of agricultural episodes and cases, respectively. Although the number of cases decreased from 2019 (172 cases), the number of episodes increased by 77% (13 episodes), confirming the need for DPR's focus on mitigation actions relative to air blast sprayers. Following DPR's evaluation of the 2019 data and release of the 2019 report in 2023, DPR formed a work group to identify factors behind the air blast exposures and potential mitigation approaches. The work group determined that focused presentation-based applicator training, particularly in areas with the highest frequency of incidents, would be most effective for mitigation. In 2024, DPR developed and distributed this training presentation to all CACs and began presenting it at CAC sponsored applicator training sessions.

ANTIMICROBIAL USE PRE- AND DURING COVID-19 PANDEMIC

In response to the COVID-19 pandemic, the use of disinfectants has become a pivotal strategy in combating the spread of the virus, both in public spaces and households. Disinfectants are formulated to effectively eliminate a wide range of pathogens, including viruses. Common disinfectants contain active ingredients such as sodium hypochlorite, quaternary ammonium compounds, and hydrogen peroxide, and are available in various formulations. Given their claim to kill germs and viruses, disinfectants are a type of antimicrobial and considered a pesticide¹².

The primary mode of transmission for coronavirus is through airborne particles and droplets that carry the virus¹³. These droplets can land on frequently touched surfaces and remain viable for varying lengths of time depending on environmental conditions. As the public sought ways to mitigate virus spread, there was an increase in the use of disinfectants. The increased use of disinfectants also highlighted the concern of the potential health effects due to product misuse. In 2020, DPR developed many new resources focused on the proper use of disinfectants and surface sanitizers.

From January 2020 to March 2020, there was a notable rise in calls to poison control centers reporting exposures to cleaners and disinfectants¹⁴. Although there was a decrease in the overall number of pesticide incident reports in 2020, there was a 51% increase in the number of cases involving antimicrobials from 2019. Both the number (242) and proportion (83%) of cases involving non-agricultural use of antimicrobials in the occupational setting were higher in 2020 compared to 2019 (210, 62%). Even though the number of antimicrobial use related cases in non-occupational settings (464) decreased from 2019 (567), there was a 16% increase in the proportion of cases in 2020 (Table 7).

Table 7. Non-Agricultural Antimicrobial Use by Occupational Status, 2019-2020						
Year	Occupational			Non-Occupational		
	Number of Antimicrobial Cases	Total Cases	% of Total Cases	Number of Antimicrobial Cases	Total Cases	% of Total Cases
2019	131	210	62%	167	567	29%
2020	242	290	83%	208	464	45%

¹² The “Antimicrobials Topic Fact Sheet” can be viewed or downloaded from the NPIC’s website at <http://npic.orst.edu/factsheets/antimicrobials.html>.

¹³ The information “About COVID-19” can be viewed or downloaded from the CDC’s web site at <https://www.cdc.gov/coronavirus/2019-ncov/your-health/about-covid-19.html>.

¹⁴ Ghai A, Sabour E, Salonga R, Ho R, Apollonio DE. Exposures to Bleach, Peroxide, Disinfectants, Antimalarials, and Ivermectin Reported to the California Poison Control System Before and During the COVID-19 Pandemic, 2015-2021. Public Health Rep. 2024 Jan-Feb;139(1):112-119. doi: 10.1177/00333549231201679. Epub 2023 Nov 7. PMID: 37933467; PMCID: PMC10905766.

The number of antimicrobial use incidents involving contributory violations increased 29% from 2019. PISP defines contributory violations as regulatory or label violations that contribute to illness (e.g., early reentry, failure to use required equipment, and other misuse). The most common types of other misuse violations are mixing incompatible chemicals, improper storage of chemicals in food or beverage containers, products used above label rate or inconsistent with the label, and products within reach of a child. In 2020, the number of incidents where incompatible chemicals were mixed and/or used above label rate increased by 64% from 2019. For instance, a woman attempted to disinfect her home due to COVID-19 using diluted sodium hypochlorite from a bucket for surface wiping. When the disinfectant ran out, she added a different type of cleaner to the bucket. The incompatible mixture created vapors that she inhaled.

Twenty-one percent (97) of the exposures involved bystanders, individuals not handling antimicrobials at the time of exposure. Improper storage, such as storing antimicrobials in food or beverage containers, was implicated in nearly half of the cases (40, 41%), an increase of 82% from 2019 (22, 27%). In one incident, a man transferred sodium hypochlorite into a water bottle to disinfect laundry at the laundromat. He forgot to remove the bottle from the car and later his 3-year-old son drank from the bottle. The child was hospitalized for one day.

In 2020, there were 29 occupational cases that occurred at service establishments, similar to numbers in 2019 (35). However, the proportion of cases decreased by 17% in 2020, possibly due to the statewide stay-at-home order which closed all nonessential businesses and restaurant dining. Similarly, applicators and mixer/loaders accounted for 41% of occupational cases, marking a 28% decrease from 2019. In 2020, ocular exposures accounted for 35 (35%) of the 99 cases involving occupational applicators and mixer/loaders, while 16 (46%) of those cases included a failure to wear required equipment violation.

Despite the rise in calls to poison control centers regarding exposures to disinfectants and cleaners at the onset of the COVID-19 pandemic, the number of pesticide incident reports received by PISP decreased by 21% from the previous year. This decrease may be attributed to the unprecedented challenges faced by health care systems, where care for COVID-19 patients took precedence and illnesses related to antimicrobial exposures were managed at home with assistance from poison control centers. Additionally, it is suspected that individuals were afraid to seek medical care at hospitals due to concerns of COVID-19 exposure. Pesticide illness is a reportable condition in California. Continued surveillance and monitoring of antimicrobial-related illnesses are crucial to identifying trends and informing public health interventions aimed at mitigating potential health effects due to product misuse.

FURTHER INFORMATION

Tabular summaries presenting different aspects of 2020 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 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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

APPENDIX C: ADDITIONAL DATA TABLES**Table C1: Summary of Illness/Injury Incidents Reported in California Related to Pesticide Exposure, Summarized Statewide and by County of Occurrence
2020****Statewide**

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Off-Site	Residue	Other/Unknown	Agricultural	Non-Agricultural
TOTALS								
Definite		127	76	40	3	8	11	116
Probable		701	223	314	89	75	126	573
Possible		89	19	24	17	29	21	68
TOTAL	704	917	318	378	109	112	158	757

County of Occurrence¹

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
ALAMEDA								
Definite		4	3	0	0	1	0	4
Probable		15	8	6	0	1	0	15
Possible		3	0	2	0	1	0	3
TOTAL	20	22	11	8	0	3	0	22
AMADOR								
Definite		1	0	1	0	0	0	1
TOTAL	1	1	0	1	0	0	0	1
BUTTE								
Definite		1	0	1	0	0	0	1
Probable		5	1	4	0	0	1	4
Possible		1	1	0	0	0	1	0
TOTAL	7	7	2	5	0	0	2	5
COLUSA								
Definite		1	1	0	0	0	0	1
Probable		2	0	2	0	0	2	0
TOTAL	3	3	1	2	0	0	2	1

¹ If a county is not listed, there were no reported illnesses or associated episodes/cases for that county for the year.

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
CONTRA COSTA								
Definite		4	3	0	0	1	0	4
Probable		11	4	3	2	2	0	11
Possible		3	1	0	1	1	0	3
TOTAL	17	18	8	3	3	4	0	18
DEL NORTE								
Probable		1	1	0	0	0	0	1
TOTAL	1	1	1	0	0	0	0	1
EL DORADO								
Probable		2	1	1	0	0	0	2
Possible		1	0	0	0	1	0	1
TOTAL	3	3	1	1	0	1	0	3
FRESNO								
Definite		3	3	0	0	0	0	3
Probable		30	10	16	2	2	10	20
Possible		8	3	5	0	0	6	2
TOTAL	32	41	16	21	2	2	16	25
HUMBOLDT								
Probable		2	0	1	0	1	0	2
TOTAL	2	2	0	1	0	1	0	2
IMPERIAL								
Definite		1	0	0	0	1	1	0
Probable		13	4	4	2	3	2	11
Possible		1	0	1	0	0	1	0
TOTAL	15	15	4	5	2	4	4	11
KERN								
Definite		7	3	3	1	0	4	3
Probable		45	9	25	5	6	20	25
Possible		5	2	0	2	1	3	2
TOTAL	41	57	14	28	8	7	27	30
KINGS								
Definite		2	1	1	0	0	0	2
Probable		2	0	1	0	1	1	1

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
Possible		1	1	0	0	0	0	1
TOTAL	5	5	2	2	0	1	1	4
LAKE								
Probable		3	1	1	1	0	0	3
Possible		2	1	0	0	1	0	2
TOTAL	5	5	2	1	1	1	0	5
LASSEN								
Probable		1	1	0	0	0	0	1
TOTAL	1	1	1	0	0	0	0	1
LOS ANGELES								
Definite		23	15	6	0	2	0	23
Probable		114	50	41	6	17	0	114
Possible		16	3	5	2	6	0	16
TOTAL	148	153	68	52	8	25	0	153
MADERA								
Probable		5	3	2	0	0	1	4
Possible		1	0	0	0	1	1	0
TOTAL	6	6	3	2	0	1	2	4
MARIN								
Probable		1	1	0	0	0	0	1
TOTAL	1	1	1	0	0	0	0	1
MENDOCINO								
Definite		1	1	0	0	0	0	1
Possible		1	0	0	0	1	0	1
TOTAL	2	2	1	0	0	1	0	2
MERCED								
Probable		7	4	2	0	1	2	5
Possible		1	0	1	0	0	0	1
TOTAL	8	8	4	3	0	1	2	6
MONTEREY								
Definite		22	3	18	0	1	3	19
Probable		133	7	90	34	2	45	88
Possible		5	2	1	1	1	2	3

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
TOTAL	28	160	12	109	35	4	50	110
ORANGE								
Definite		5	4	1	0	0	0	5
Probable		28	17	8	2	1	0	28
Possible		2	1	1	0	0	0	2
TOTAL	35	35	22	10	2	1	0	35
PLACER								
Definite		1	1	0	0	0	0	1
Probable		4	1	2	0	1	0	4
TOTAL	5	5	2	2	0	1	0	5
RIVERSIDE								
Definite		5	5	0	0	0	0	5
Probable		25	16	4	2	3	0	25
Possible		8	0	1	4	3	0	8
TOTAL	33	38	21	5	6	6	0	38
SACRAMENTO								
Definite		1	1	0	0	0	0	1
Probable		9	7	1	0	1	0	9
TOTAL	10	10	8	1	0	1	0	10
SAN BERNARDINO								
Definite		7	6	0	1	0	0	7
Probable		22	15	4	1	2	0	22
Possible		4	1	1	1	1	0	4
TOTAL	33	33	22	5	3	3	0	33
SAN DIEGO								
Definite		5	4	1	0	0	0	5
Probable		58	19	21	13	5	0	58
Possible		8	1	1	2	4	0	8
TOTAL	59	71	24	23	15	9	0	71
SAN FRANCISCO								
Probable		5	2	3	0	0	0	5
Possible		2	1	0	0	1	0	2
TOTAL	7	7	3	3	0	1	0	7

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
SAN JOAQUIN								
Definite		2	0	0	1	1	0	2
Probable		14	5	5	1	3	2	12
Possible		3	0	0	0	3	2	1
TOTAL	18	19	5	5	2	7	4	15
SAN LUIS OBISPO								
Definite		2	2	0	0	0	0	2
Probable		7	2	2	1	2	2	5
TOTAL	9	9	4	2	1	2	2	7
SAN MATEO								
Definite		1	1	0	0	0	0	1
Probable		2	1	1	0	0	0	2
Possible		1	0	1	0	0	0	1
TOTAL	4	4	2	2	0	0	0	4
SANTA BARBARA								
Definite		1	1	0	0	0	0	1
Probable		16	0	8	4	4	9	7
Possible		1	0	1	0	0	1	0
TOTAL	13	18	1	9	4	4	10	8
SANTA CLARA								
Definite		7	4	3	0	0	0	7
Probable		19	5	8	1	5	0	19
Possible		2	1	0	1	0	0	2
TOTAL	27	28	10	11	2	5	0	28
SANTA CRUZ								
Definite		2	2	0	0	0	0	2
Probable		7	3	3	1	0	0	6
TOTAL	9	9	5	3	1	0	0	8
SHASTA								
Probable		9	1	0	3	5	0	9
TOTAL	8	9	1	0	3	5	0	9
SOLANO								
Definite		1	1	0	0	0	0	1

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
Probable		3	2	0	0	1	0	3
Possible		1	0	1	0	0	1	0
TOTAL	5	5	3	1	0	1	1	4
SONOMA								
Definite		1	0	1	0	0	0	1
Probable		5	1	3	0	1	0	5
Possible		1	0	0	1	0	0	1
TOTAL	7	7	1	4	1	1	0	7
STANISLAUS								
Definite		4	2	2	0	0	0	4
Probable		11	4	6	0	1	4	7
TOTAL	13	15	6	8	0	1	4	11
SUTTER								
Probable		1	0	1	0	0	1	0
TOTAL	1	1	0	1	0	0	1	0
TEHAMA								
Probable		2	2	0	0	0	1	1
TOTAL	2	2	2	0	0	0	1	1
TRINITY								
Possible		1	0	0	0	1	0	1
TOTAL	1	1	0	0	0	1	0	1
TULARE								
Definite		8	5	2	0	1	3	5
Probable		37	9	24	2	2	21	15
Possible		3	0	1	1	1	1	2
TOTAL	35	48	14	27	3	4	25	22
VENTURA								
Definite		4	4	0	0	0	0	4
Probable		11	6	4	1	0	1	10
Possible		3	0	1	1	1	2	1
TOTAL	18	18	10	5	2	1	3	15
YOLO								
Probable		12	0	7	4	1	0	12

Relationship	TOTAL EPISODES	TOTAL CASES	Type of Exposure				Intended Use	
			Direct Contact	Drift	Residue	Other/Unknown	Agricultural	Non-Agricultural
TOTAL	4	12	0	7	4	1	0	12
YUBA								
Probable		2	0	0	1	1	1	1
TOTAL	2	2	0	0	1	1	1	1

**Table C2: Cases Reported in California with Documented Pesticide Exposure,
Summarized by the Type of Illness and the Type of Pesticides
2020**

Type of Illness	Antimicrobials		Cholinesterase Inhibitors ¹		Fumigants ¹		Other Pesticides ²		Total ³
	Occupational	Non-Occupational	Occupational	Non-Occupational	Occupational	Non-Occupational	Occupational	Non-Occupational	
Systemic									
Systemic Only	8	46	9	10	3	5	16	84	181
Systemic with Respiratory Effects	19	41	1	8	1	0	17	43	130
Systemic with Topical Effects	4	3	2	1	0	2	13	14	39
Systemic with Respiratory and Topical Effects	75	12	1	1	1	1	13	13	118
Respiratory									
Respiratory Only	22	60	2	0	1	0	3	39	128
Respiratory with Topical Effects	37	15	0	1	2	8	4	13	80
Topical									
Eye Only	56	25	0	3	0	22	13	31	151
Skin Only	29	6	1	0	0	0	9	21	66
Eye and Skin	4	4	1	0	0	0	5	7	21

Type of Illness	Antimicrobials		Cholinesterase Inhibitors ¹		Fumigants ¹		Other Pesticides ²		Total ³
	Occupational	Non-Occupational	Occupational	Non-Occupational	Occupational	Non-Occupational	Occupational	Non-Occupational	
Asymptomatic									
Asymptomatic	14	1	0	4	0	5	49	1	74
TOTAL⁴	269	213	17	28	8	43	142	268	991

¹ Illness types involving fumigants that are cholinesterase inhibitors and vice versa are accounted for in each respective column.

² Any pesticide that is not an antimicrobial, cholinesterase-inhibiting pesticide, or fumigant.

³ Illness type involving a cholinesterase inhibitor that is a fumigant or vice versa is counted as one case in the total.

⁴ Totals include six additional cases for which the activity could not be determined as occupational or non-occupational, or specific illness type was not reported.

**Table C3: Hospitalization and Disability Associated with Illnesses/Injuries
Definitely or Probably Related to Pesticide Exposure in California,
Summarized by Occupational Status and Activity
2020**

Occupational

Activity	Total Cases	Hospitalization			Disability		
		No. Cases	%	Unknown	No. Cases	%	Unknown
Applicator	91	4	4.4	0	19	20.9	20
Emergency Response	3	0	0	0	0	0	0
Field Worker	34	0	0	0	11	32.4	5
Handler (Other or Unspecified)	13	0	0	0	2	15.4	2
Mechanical	5	0	0	0	1	20.0	1
Mixer/Loader	28	0	0	0	6	21.4	4
Other	15	0	0	0	6	40.0	5
Packaging/Processing	104	1	1.0	3	44	42.3	34
Routine	37	0	0	0	7	18.9	9
Transport/Storage/Disposal	6	0	0	0	2	33.3	1
Unknown	7	0	0	0	0	0	7
Total Occupational	343	5	1.5	0	98	28.6	88

Non-Occupational

Activity	Total Cases	Hospitalization			Disability		
		No. Cases	%	Unknown	No. Cases	%	Unknown
Applicator	171	4	2.3	0	9	5.3	58
Mixer/Loader	23	2	8.7	0	2	8.7	8
Other	45	7	15.6	3	8	17.8	28
Routine	221	8	3.6	0	10	4.5	69
Unknown	23	0	0	0	0	0	18
<i>Total Non-Occupational</i>	483	21	4.3	3	29	7.3	181
TOTAL CASES*	828	26	3.1	6	127	15.3	271

* Totals include two additional cases for which the activity could not be determined as occupational or non-occupational. The disability status of the two cases is unknown and none were hospitalized.

**Table C4: Hospitalization and Disability Associated with Illnesses/Injuries
Possibly Related to Pesticide Exposure in California,
Summarized by Occupational Status and Activity
2020**

Occupational

Activity	Total Cases	Hospitalization			Disability		
		No. Cases	%	Unknown	No. Cases	%	Unknown
Applicator	13	0	0	0	4	30.8	4
Field Worker	4	0	0	0	2	50.0	0
Handler (Other or Unspecified)	1	0	0	0	0	0	0
Mixer/Loader	1	0	0	0	0	0	1
Other	1	0	0	0	0	0	0
Packaging/Processing	1	0	0	0	0	0	1
Routine	9	0	0	0	0	0	7
Total Occupational	30	0	0	0	6	20.0	13

Non-Occupational

Activity	Total Cases	Hospitalization			Disability		
		No. Cases	%	Unknown	No. Cases	%	Unknown
Applicator	14	1	7.1	0	1	7.1	7
Handler (Other or Unspecified)	1	0	0	0	0	0	1
Other	9	4	44.4	0	4	44.4	4
Routine	27	0	0	0	0	0	19
Unknown	7	0	0	0	0	0	7
Total Non-Occupational	58	5	8.6	0	5	10.3	38
TOTAL CASES*	89	6	6.7	0	12	13.5	51

* Totals include one additional case for which the activity could not be determined as occupational or non-occupational. This individual was hospitalized for one day and one disability day.

Table C5: Illnesses and Injuries Reported in California Associated with Pesticide Exposure, Summarized by the Type of Activity and Type of Exposure 2020

Occupational

Type of Activity	Type of Exposure							Total
	Off-site Movement	Residue	Direct Spray/Squirt	Spill/Other Direct	Multiple	Other	Unknown	
Applicator	31	0	14	37	4	1	17	104
Emergency Response	0	3	0	0	0	0	0	3
Field Worker	28	7	1	1	0	0	1	38
Handler (Other or Unspecified)	1	0	3	8	0	2	0	14
Mechanical	2	0	1	1	0	1	0	5
Mixer/Loader	8	0	4	16	0	1	0	29
Other	0	2	2	7	0	4	1	16
Packaging/Processing	104	0	1	0	0	0	0	105
Routine	15	16	5	3	1	4	2	46
Transport/Storage/Disposal	0	0	0	3	0	3	0	6
Unknown	0	0	1	3	0	0	3	7
Total Occupational Cases	189	28	32	79	5	16	24	373

Non-Occupational

Type of Activity	Type of Exposure							
	Off-site Movement	Residue	Direct Spray/ Squirt	Spill/ Other Direct	Multiple	Other	Unknown	Total
Applicator	108	0	21	28	2	11	15	185
Handler (Other or Unspecified)	0	0	0	1	0	0	0	1
Mixer/Loader	11	0	1	10	1	0	0	23
Other	3	4	2	39	2	3	1	54
Routine	66	75	15	78	1	9	4	248
Unknown	1	2	4	7	0	0	16	30
<i>Total Non-Occupational Cases</i>	189	81	43	163	6	23	36	541
TOTAL CASES*	378	109	75	243	11	39	62	917

* Totals include three additional cases for which the activity could not be determined as occupational or non-occupational.

**Table C6: Illnesses and Injuries Reported in California Associated with Pesticide Exposure, Summarized by Pesticide(s) and Type of Illness
2020**

Pesticide	Systemic/ Respiratory		Topical		Total	
	Definite/ Probable	Possible	Definite/ Probable	Possible	Definite/ Probable	Possible
Organophosphates						
Acephate	6	0	1	0	7	0
Bensulide	6	0	1	0	7	0
DDVP	2	3	0	0	2	3
Disulfoton	0	0	0	1	0	1
Ethephon	0	0	0	0	0	1
Malathion	2	0	0	0	2	0
Naled	1	0	0	0	1	0
N-Methyl Carbamates						
Carbofuran	2	0	0	0	2	0
Methomyl	1	0	0	0	1	0
Propoxur	0	0	1	0	1	0
Pyrethrins and Pyrethroids						
Beta-Cyfluthrin	0	0	1	0	1	0
Bifenthrin	3	0	1	0	4	0
Cyfluthrin	0	1	0	0	0	1
Cypermethrin	12	0	3	0	18	0
Deltamethrin	2	1	2	0	4	2
Esfenvalerate	1	1	0	0	1	1
Gamma-Cyhalothrin	1	1	1	0	3	1
Lambda-Cyhalothrin	1	1	2	0	5	1
Other Pesticides						
Adjuvant	0	0	1	0	1	0
Alkyl Amino Propane	0	0	1	0	1	0
Aluminum Phosphide	4	0	0	0	4	0
Ammonia	1	0	0	0	1	0
Borax	0	0	1	0	1	0

Pesticide	Systemic/ Respiratory		Topical		Total	
	Definite/ Probable	Possible	Definite/ Probable	Possible	Definite/ Probable	Possible
Boric Acid	3	0	2	0	5	0
Calcium Hypochlorite	2	0	1	0	5	0
Chlorinated-Cyanuric Acid	2	1	2	0	8	1
Chlorine	0	0	0	0	1	0
Chloropicrin	0	0	8	0	11	0
Citric Acid	0	0	0	0	0	1
Citronella	0	0	0	0	2	0
Copper Ethanolamine Complex	0	0	0	1	0	1
Copper Naphthenate	1	0	0	0	1	0
Deet	2	0	2	0	4	0
Device	0	0	1	0	1	0
Diflubenzuron	0	0	1	0	1	0
Diquat	1	0	0	0	1	0
Etofenprox	0	1	0	0	0	1
Fipronil	0	1	0	0	0	1
Glycolic Acid	3	0	0	0	3	0
Glyphosate	9	1	3	1	13	2
Hydrogen Chloride	1	0	2	0	3	0
Hydrogen Peroxide	1	1	4	2	5	3
Hypochlorous Acid	0	0	2	0	2	0
Indoxacarb	1	0	0	0	1	0
Mancozeb	0	2	0	0	0	2
Metaldehyde	0	1	0	0	0	1
Metam-potassium	1	0	0	0	1	0
Metolachlor	0	1	0	0	0	1
Naphthalene	1	0	0	0	1	0
Oxyfluorfen	0	0	0	0	0	1
Ozone	1	0	0	0	1	0
Paraquat	1	0	0	0	1	0
Pine Oil	0	0	1	0	1	0
Potassium Hydroxide	0	0	1	0	1	0

Pesticide	Systemic/ Respiratory		Topical		Total	
	Definite/ Probable	Possible	Definite/ Probable	Possible	Definite/ Probable	Possible
Quaternary Ammonia	21	1	40	1	65	3
Sodium Hypochlorite	51	2	40	1	117	3
Spinetoram	0	0	0	0	1	0
Sulfur	4	0	3	0	8	1
Sulfuryl Fluoride	2	1	0	0	2	1
Thiamethoxam	1	0	0	0	1	0
Thymol	1	0	0	1	2	1
Triclopyr	1	0	0	0	1	0
Zinc Phosphide	0	1	0	0	0	1
Combinations of Antimicrobials	29	0	14	2	72	2
Combinations of Fumigants	2	0	14	0	24	0
Combinations of Fungicides	4	3	1	1	6	5
Combinations of Herbicides	15	1	7	1	24	2
Combinations of Insecticides Including ChE Inhibitor(s)	9	1	0	0	11	1
Combinations of Insecticides Without ChE Inhibitor(s)	48	9	23	3	89	12
Miscellaneous Combinations	107	5	11	2	180	8
Unknown Antimicrobials	7	0	6	0	20	3
Unknown Fumigants	1	0	0	0	1	0
Unknown Herbicides	6	0	4	2	11	2
Unknown Insecticides	22	10	7	2	43	16
Unknown Pesticides	9	2	1	0	10	2
TOTAL	415	53	217	21	828	89

Table C7: Summary of Cases Reported in California Associated with Pesticide Exposure, Summarized by Occupational Status and by Location of the Incident 2020

Incident Setting	Occupational Exposures		Non-Occupational Exposures		Total	
	Definite/ Probable	Possible	Definite/ Probable	Possible	Definite/ Probable	Possible
Farm	43	10	0	0	43	10
Nursery	2	0	0	0	2	0
Forest	1	0	0	0	1	0
Livestock Production Facility	3	0	0	0	3	0
Crop/Livestock Processing Facility	109	1	0	0	109	1
Food Processing Facility	9	0	0	0	9	0
Animal Premise (Veterinary Hospital, Kennels, not Livestock)	4	0	0	0	4	0
Residential	22	0	459	53	482	53
Residential Institution	4	0	2	0	6	0
School	16	4	1	0	17	4
Prison	8	1	2	0	10	1
Hospital/Medical	20	2	0	0	20	2
Pesticide Manufacturing Facility	1	0	0	0	1	0
Industrial or Other Manufacturing Facility	6	1	0	0	6	1
Office/Business	15	2	0	0	15	2
Retail Establishment	15	1	2	0	17	1
Service Establishment	32	4	7	0	39	5
Wholesale Establishment	3	1	0	0	3	1
Road/Rail Or Utility Right Of Way	5	0	10	2	15	2
Park	4	0	0	0	4	0
Other	6	1	0	0	6	1
Unknown	15	2	0	3	16	5
TOTAL*	343	30	483	58	828	89

* Totals include three additional cases for which the activity could not be determined as occupational or non-occupational

**Table C8: Summary of Cases Reported in California as Associated with Pesticide Exposure, Summarized by Gender, Age Distribution, Type of Pesticide, and Type of Use
2020**

Agricultural Use Pesticide Exposure Incidents

Age Group	Pesticides other than Antimicrobial Pesticides			Antimicrobial Pesticides			Total
	Male	Female	Unknown	Male	Female	Unknown	
≤ 6	0	1	0	0	0	0	1
7–12	3	3	0	0	0	0	6
13–17	2	4	0	0	0	0	6
18–24	5	6	0	1	1	0	13
25–34	16	10	0	1	1	0	28
35–44	11	15	0	0	4	0	30
45–54	13	7	0	0	3	0	23
55–64	8	7	0	0	2	0	17
> 65	1	2	0	0	0	0	3
Minor, Unknown Age	2	0	0	0	0	0	2
Adult, Unknown Age	13	14	0	0	0	0	27
Unknown	2	0	0	0	0	0	2
Total Ag Cases	76	69	0	2	11	0	158

Non-Agricultural Use Pesticide Exposure Incidents

Age Group	Pesticides other than Antimicrobial Pesticides			Antimicrobial Pesticides			Total
	Male	Female	Unknown	Male	Female	Unknown	
≤ 6	17	6	0	31	13	0	67
7–12	1	1	0	3	4	0	9
13–17	4	6	0	8	10	0	28
18–24	10	7	0	22	20	0	59
25–34	25	17	0	28	48	0	118
35–44	31	18	0	25	46	0	120
45–54	26	12	0	23	47	0	108
55–64	36	17	0	15	44	0	112
> 65	25	17	0	12	13	0	67
Minor, Unknown Age	0	0	2	0	0	0	2
Adult, Unknown Age	6	17	0	14	30	0	67
Total Non-Ag Cases	181	118	2	181	275	0	757
TOTAL CASES*	259	187	2	183	286	0	917

* Totals include two additional cases that could not be determined to be agricultural or non-agricultural use situations.

**Table C9: Agricultural Drift Cases Reported in California as Associated with Pesticide Exposure, Summarized by the Activity of the Exposed Person and by the Type of Application Equipment Used
2020**

Type of Application Equipment Used	Type of Activity		
	Field Worker	Routine	Total
Fixed Wing Aircraft	5	1	6
Helicopter	2	0	2
Ground, Other or Unspecified	0	1	1
Ground Boom, Other or Unspecified	0	1	1
Ground, Boom Below/Behind	9	1	10
Over-the-vine Boom	1	0	1
Air Blast Sprayers	13	19	32
Power Dusters	1	5	6
Shank Injection with Tarps	1	0	1
Pressurized Hose-line Sprayer	2	0	2
TOTAL	34	28	62

**Table C10: Agricultural Drift Cases Reported in California Associated with Pesticide Exposure, Summarized by Application Sites
2020**

Application Site	Number of Episodes	Number of Cases
BERRIES		
Strawberries	3	6
CUCURBITS		
Melons (Other or Unspecified)	1	1
FORAGE CROP		
Alfalfa	2	2
FRUITING VEGETABLE		
Tomatoes	1	1
GRAIN		
Corn	2	2
Rice	1	1
GRAPES		
Grapes	4	8
LEAFY/STEM VEGETABLE		
Broccoli	1	7
Cauliflower	1	1
Lettuce	1	1
NON-CROP		
Animal Burrows (Vertebrate and Insect Pests)	1	1
Soil	1	1
Uncultivated Agricultural Areas (Other or Unspecified)	1	2
NUT TREES		
Almonds	8	20
Walnuts	5	17
ORNAMENTAL		
Ornamental Plants (Other or Unspecified)	1	1
OTHER VEGETABLE		
Vegetables (Other or Unspecified)	1	1
ROOT CROP VEGETABLE		
Potatoes	1	10

Application Site	Number of Episodes	Number of Cases
STONE FRUIT		
Plums	1	1
Prunes	1	1
SUGAR CROP		
Sugar Beets	1	1
UNKNOWN		
Unknown	1	1
TOTAL	40	87

**Table C11: Illnesses and Injuries Reported in California
Associated with Pesticide Exposure, Summarized by Type of Equipment,
Type of Handler Activity, and Occupational Status
2020**

Occupational

Type of Equipment	Type of Handler Activity			
	Mixer/ Loader	Applicator	Mechanical	Total
Ground, Other or Unspecified	0	3	0	3
Ground Boom, Other or Unspecified	0	1	0	1
Airblast Sprayers	0	2	1	4
Hand, Other or Unspecified	0	12	0	12
Pressurized Hose-line Sprayers	0	5	0	6
Hand Pump Sprayer	0	4	0	4
Back Pack Sprayer	0	5	0	6
Unpressurized Hand-held Spray Equipment	1	17	0	19
Aerosol Can	0	2	0	2
Aerosol/fog Generating Equipment	0	1	0	1
Automatic Equipment, Other or Unspecified	4	3	1	9
Automatic Equipment, Chlorinators	1	1	3	6
Manual Application Methods, Other or Unspecified	2	1	0	3
Immersion Equipment	0	4	0	5
Implements without Handles	0	14	0	14
Manual Placement	16	10	0	27
Other	0	1	0	1
Unknown	4	18	0	24
Not Applicable	1	0	0	5
Total Occupational Cases	29	104	5	152

Non-Occupational

Type of Equipment	Type of Handler Activity			
	Mixer/ Loader	Applicator	Mechanical	Total
Hand, Other or Unspecified	0	23	0	23
Hand Pump Sprayer	1	5	0	6
Back Pack Sprayer	0	2	0	2
Unpressurized Hand-held Spray Equipment	2	22	0	24
Aerosol Can	0	22	0	22
Foggers	0	19	0	19
Automatic Equipment, Other or Unspecified	0	1	0	1
Manual Application Methods, Other or Unspecified	1	17	0	18
Immersion Equipment	1	0	0	1
Implements with Handles	0	2	0	2
Implements without Handles	0	8	0	8
Manual Placement	11	24	0	35
Other	0	4	0	4
Unknown	3	33	0	37
Not Applicable	4	3	0	7
Total Non-Occupational Cases	23	185	0	209
TOTAL CASES*	52	290	5	362

* Totals include sixteen additional cases for which the activity could not be determined as occupational or non-occupational.

Table C12: Illnesses and Injuries Reported in California Associated with Pesticide Exposure, Summarized by Type of Exposure and Type of Illness 2020

Type of Exposure	Systemic/ Respiratory		Topical		TOTAL	
	Definite/ Probable	Possible	Definite/ Probable	Possible	Definite/ Probable	Possible
Direct Spray/Squirt	18	1	50	1	73	2
Multiple Exposures	8	0	1	0	10	1
Off-Site Movement	204	13	23	3	354	24
Other	11	4	9	4	31	8
Residue	42	12	31	3	92	17
Spill/Other Direct	121	13	87	4	226	17
Unknown	11	10	16	6	42	20
TOTAL	415	53	217	21	828	89

**Table C13: Pesticide-Associated Illnesses and Injuries Reported in California Schools
by Exposure Category, Pesticide Type, and Illness Symptoms
2020**

Exposure	Agricultural				Non-Agricultural				Total
	Antimicrobials	Cholinesterase Inhibitors	Fumigants	Other Pesticides*	Antimicrobials	Cholinesterase Inhibitors	Fumigants	Other Pesticides*	
Off-Site Movement	0	0	0	0	4	0	0	0	4
Residue	0	0	0	0	1	7	0	1	9
Direct Spray/Squirt	0	0	0	0	1	0	0	0	1
Spill/Other Direct	0	0	0	0	3	0	0	1	4
Multiple Exposures	0	0	0	0	2	0	0	0	2
Unknown	0	0	0	0	1	0	0	0	1
TOTAL	0	0	0	0	12	7	0	2	21

* Any pesticide that is not an antimicrobial, cholinesterase-inhibiting pesticide, or fumigant.