Pesticide Illness and Injury Surveillance in Michigan 2024

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Executive Summary

Michigan has been conducting surveillance for acute work-related pesticide illnesses and injuries since 2001. In 2006, data on non-occupational cases were added. The Public Health Code grants Michigan the authority to track work-related conditions (PA 368 of 1978, Part 56, as amended) and chemical poisoning (R325.71-R325.75). This is the twentieth report on pesticide-related illnesses and injuries in Michigan (2001-3, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015-16, 2017-18, 2019, 2020, 2021, 2022, 2023). These 20 reports include 24 years of data.

From 2001 through 2024 there were 1,663 confirmed cases of occupational pesticide-related illnesses or injuries. Fifty-eight of those confirmed cases were reported in 2024. The number of reported cases peaked in 2008. Disinfectants were the cause of nearly half (46%) of the confirmed occupational cases from 2001-2024 and were the cause of 43% of confirmed occupational cases in 2024. Many of these cases would not have occurred if disinfectant containers were properly labeled, not mixed, and used only in situations where their use was recommended.

In 2024, where activity of the exposed person was known, 29% of confirmed occupational cases were exposed to pesticides inadvertently while doing their regular work that did not involve applying pesticides. The three most common contributing factors for confirmed occupational cases were spills or splashes, mixing incompatible products, and blow-back onto applicator during application, accounting for 27%, 13%, and 11% of cases, respectively. When occupation was known, the most common occupations were pest control operators and custodians or janitors, comprising 21% and 16% of the confirmed cases in 2024, respectively.

From 2006 through 2024, there were 3,111 confirmed cases of non-occupational pesticide-related illnesses or injuries. Fifty-one of those confirmed cases were reported in 2024.

In 2024, disinfectants accounted for 46% of confirmed non-occupational cases while insecticides accounted for 28%.

In 2024, 73% of confirmed non-occupational cases occurred when the person involved was applying the pesticide themselves. ‘Bystander’ exposure was also important, with 25% of cases involving being exposed inadvertently while doing activities not involved in the application of a pesticide.

Background

Pesticide poisoning is a potential public health threat due to widespread pesticide use. According to the U.S. Environmental Protection Agency (EPA), more than 1.1 billion pounds of conventional (non-disinfectant) pesticides were used in the United States in 2012, the last year of published data (Atwood and Paisley-Jones, 2017).

Pesticides are a category of chemicals that are used to kill or control insects, weeds, fungi, rodents, and microbes. There are over 16,000 different pesticides registered for sale in Michigan.

The term pesticide includes insecticides, herbicides, fungicides, rodenticides, disinfectants, and various other substances used to control pests and microorganisms.

Evidence has linked pesticides with a variety of acute health effects such as conjunctivitis, dyspnea, headache, nausea, seizures, skin irritation, and upper respiratory tract irritation (Roberts and Reigart, 2013). The effects of chronic or long-term exposures include cancers, immune function impairments, neurological disorders, reproductive disorders, respiratory disorders, and skin disorders (Schenker et al., 2007).

Acting on concerns about acute occupational pesticide-related illness, NIOSH began collecting standardized information about acute occupational pesticide exposure from selected states in 1998 (Centers for Disease Control and Prevention (CDC), 2024) under the Sentinel Event Notification System for Occupational Risk (SENSOR) program. An analysis of 2007-2011 data provided by the SENSOR states demonstrated that the surveillance system was a useful tool to assess acute pesticide-related illness and to identify associated risk factors (Calvert et al., 2016).

Agriculture is a major industry in Michigan with 45,581 farms, 82,548 farm producers and 68,950 hired workers. Hired workers include full time and migrant workers (US Department of Agriculture, 2022). There are 16,016 different pesticide products registered for sale and use in Michigan (MDARD, 2025). There are 6,403 privately certified agricultural pesticide applicators (number overlaps with farm operators/workers above), another 15,322 commercially certified applicators, 3,072 registered applicators and 1,861 businesses licensed to apply pesticides in Michigan (MDARD, 2024; MDARD 2025).

Recognizing the extent of pesticide use in Michigan, in 2001 Michigan joined other NIOSH-funded states to institute an occupational pesticide illness and injury surveillance program. In 2006, non-occupational pesticide exposures were added to the surveillance program. The surveillance data are used to:

- Identify groups at risk for pesticide-related illnesses;
- Identify clusters/outbreaks of pesticide-related illnesses;
- Detect trends;
- Identify high-risk active ingredients;
- Identify illnesses that occur even when the pesticide is used correctly; and
- Identify and refer cases to regulatory agencies for interventions.

Methods

Pesticide poisoning is reportable under the Public Health Code (Part 56 of Act 368 of 1978 as amended and R 325.71-5). These two parts of the public health code require health care providers (including Michigan's Poison Center and Michigan's emergency medical service response database), health care facilities, and employers to report to the state information about individuals (including names) with known or suspected pesticide poisoning. From 2001-2006 Michigan only conducted occupational pesticide illness and injury surveillance. Beginning in 2006, non-occupational cases were included in the surveillance system. At that time, the poison center began reporting cases in which the reason for exposure was coded "Unintentional – Environmental". To fully capture all environmental exposures, beginning in 2012 reporting included the exposure reasons of "Unintentional – General", "Unintentional – Misuse", and "Unintentional – Unknown". Due to limited resources, from 2014 onward, non-occupational cases were only included in the surveillance system if care from a medical provider was obtained.

In addition to information from reports submitted under the Public Health Code, the surveillance system collects information on individuals with pesticide exposures who have been reported to the Pesticide and Plant Pest Management Division of the Michigan Department of Agriculture and Rural Development (MDARD). MDARD receives complaints about pesticide misuse and health effects and is mandated to conduct investigations to address potential violations of pesticide laws. Other data sources include coworkers and worker advocates.

The pesticide poisoning surveillance system is a case-based system. A person who has been exposed to a known pesticide and develops two or more signs or symptoms after that exposure, that could be related to the exposure based on known toxicology, is considered a confirmed case. See Appendix I for more details of the case definition. An event is the incident where the case was exposed. More than one person may be exposed at an event. Data are collected according to standardized variable definitions in a database developed for NIOSH's SENSOR-Pesticide program.

Individuals exposed in reported occupational cases are interviewed to determine the circumstances of the reported exposure, the symptoms they experienced, the name of the pesticide, the name of the workplace where the exposure occurred, and other details about the incident. When possible, medical records are obtained to confirm and clarify the conditions reported. Individuals exposed in non-occupational cases are not interviewed, due to resource constraints.

Reported cases are then classified based on criteria related to (1) documentation of exposure, (2) documentation of adverse health effects, and (3) evidence supporting a causal relationship between pesticide exposure and health effects. All cases are classified as either definite, probable, possible, suspicious, unlikely, insufficient information, exposed but asymptomatic, or

unrelated (Appendix I). Cases classified as definite, probable, possible, or suspicious (DPPS) are considered confirmed and included in all data analyses.

Confirmed cases are evaluated regarding the severity of the health effect: low; moderate; high; or death. The severity index is based on the signs and symptoms experienced, whether medical care was sought, if a hospital stay was involved, and whether time was lost from work or daily activities (CDC, 2001). See Appendix I for more details on the severity categories.

Occupation and industry were coded using the 2002 Census Industry Codes and the 2002 Census Occupation Codes. Industry was then grouped into the NIOSH industry sectors (CDC, 2023).

Practices where workers or the public may be at risk were identified. When appropriate, referrals were made to either the Michigan Occupational Safety and Health Administration (MIOSHA) (LEO) or MDARD, which have regulatory responsibility for worker health and/or pesticide use.

MIOSHA enforces state and federal workplace standards on exposure limits, education, and personal protective equipment (PPE) and performs training in safety and health in construction and general industry. MDARD enforces state and federal legal requirements for the sale and use of pesticides, including label violations and instances of human exposure and the federal EPA's Worker Protection Standard, which includes requirements to protect agricultural workers from adverse health effects of pesticides.

In addition, NIOSH was provided information about high priority events, both occupational and non-occupational. The criteria for defining high priority events were:

a. events that result in a hospitalization or death;
b. events that involve four or more ill individuals;
c. events that occur despite use according to the pesticide label; or
d. events that indicate the presence of a recurrent problem at a particular workplace.

NIOSH referred cases to the EPA as needed, identified clusters across states, and identified the need for national level interventions.

Finally, if appropriate, Michigan surveillance staff provided educational consultations to reported individuals and/or their employers about reducing hazards related to pesticide exposures.

Results

Section I. All Reports

From 2001 through 2024, 4,774 individuals with reported pesticide exposure and related illnesses and/or injuries met the criteria for confirmed cases. Approximately one-third of those cases were work-related (Table 1).

Table 1: Pesticide Illness and Injury Case Confirmation by Work-Relatedness, Michigan 2001-2024

Status	Occupational	Non-Occupational	Total
Definite Case	257	247	504
Probable Case	321	601	922
Possible Case	1057	2196	3253
Suspicious Case	28	67	95
Total	**1663**	**3111**	**4774**

Males and females of all ages were exposed to pesticides in confirmed cases (Table 2).

Table 2: Confirmed Pesticide Illness and Injury Cases by Age Group & Gender, Michigan 2001-2024 and 2024 Separately

	Cumulative			2024		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	12	18	1	0	0	0
01-02 (Toddlers)	54	80	0	0	1	0
03-05 (Preschool)	40	61	0	1	0	0
06-11 (Child)	97	66	0	1	2	0
12-17 (Youth)	91	100	1	1	1	0
18-64 (Adult)	1841	1698	0	44	43	0
65+ (Senior)	190	194	0	6	8	0
Unknown age	112	75	43	1	1	0
Total	**2437**	**2292**	**45**	**54**	**56**	**0**

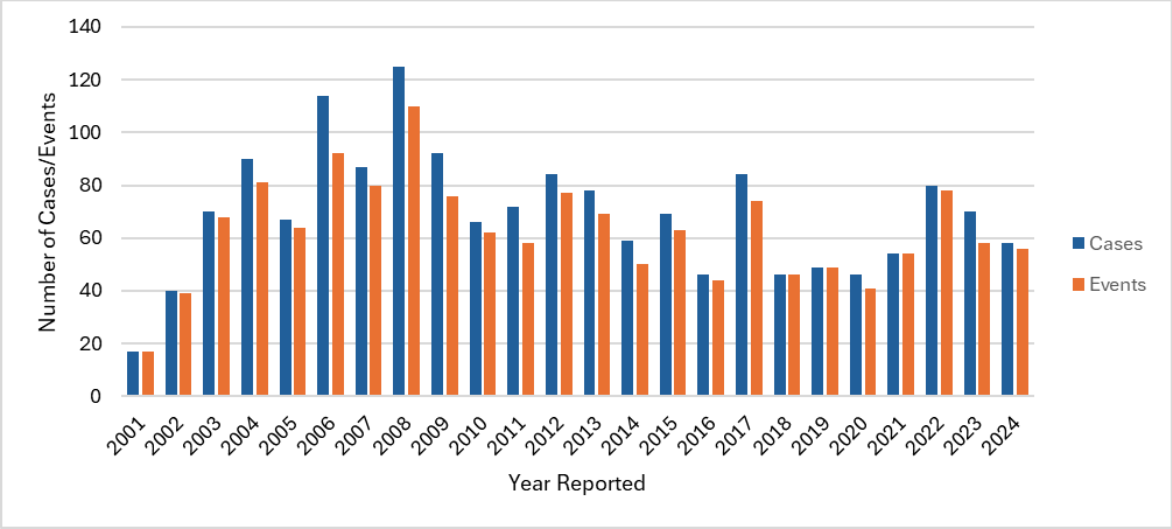
A female in her 50s was disinfecting the bathroom at a senior living facility where she worked when she used both bleach and a toilet bowl cleaner. She developed shortness of breath, a cough, and a burning sensation in her chest. She called EMS who transported her to the emergency department where she was diagnosed with chemical pneumonitis.

A female in her 40s was pulling up moldy flooring at her house and disinfecting the floor with bleach. She poured too much bleach into the mop bucket and was exposed to the fumes. She developed difficulty breathing, a cough, wheezing, a headache, and nausea. She called EMS who transported her to the emergency department.

Section II. Occupational Pesticide Illnesses and Injuries

This section describes 1,663 confirmed occupational cases. In 2024, there were 58 cases from 56 events (Figure 1).

Figure 1: Confirmed Occupational Pesticide Illness and Injury Cases and Events by Year, Michigan



People

Occupational pesticide cases occur in people of a wide variety of ages. In 2024, men (60.3%) were more likely to be confirmed occupational cases than women (39.7%) (Table 3).

Table 3: Confirmed Occupational Pesticide Illness and Injury Cases by Age Group & Gender, Michigan 2001-2024 & 2024 Separately

	Cumulative			2024		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
00-09	0	0	0	0	0	0
10-19	52	81	0	1	2	0
20-29	212	284	0	7	11	0
30-39	150	185	0	5	10	0
40-49	130	162	0	2	5	0
50-59	122	110	0	6	4	0
60-69	32	34	0	1	1	0
70-79	2	9	0	0	1	0
80+	0	0	0	0	0	0
Unknown	42	43	13	1	1	0
Total	**742**	**908**	**13**	**23**	**35**	**0**

In 2024, race was known for 53.4% of cases. When race was known, 80.6% were white and 12.9% were black. In 2024, ethnicity was known in 46.6% of the cases. When known, 74.1% were non-Hispanic while 25.9% were Hispanic (Table 4).

Table 4: Confirmed Occupational Pesticide Illness and Injury Cases by Race and Ethnicity, Michigan 2001-2024 and 2024 Separately

	Cumulative			2024		
Race	Hispanic	Not Hispanic	Unknown	Hispanic	Not Hispanic	Unknown
Indigenous American	0	8	0	0	0	0
Asian/Pacific Islander	0	3	4	0	0	0
Black	0	77	42	0	2	2
Middle Eastern	0	0	0	0	0	0
White	32	593	138	3	18	4
Mixed	3	25	2	0	0	0
Other	6	0	4	0	0	2
Unknown	66	0	660	4	0	23
Total	**107**	**706**	**850**	**7**	**20**	**31**

Confirmed cases were identified in a wide variety of occupations. In 2024, the most common occupations were pest control operators with nine cases and cleaners/housekeepers/janitors with seven cases. (Table 5). Farming and management/professional related occupations each had five cases. These four categories accounted for 60.5% of cases where the occupation was known.

Table 5: Confirmed Occupational Pesticide Illness and Injury Cases by Occupation, Michigan 2001-2024 and 2024 Separately

	Cumulative		2024	
Occupation	Count	Percent	Count	Percent
Cleaners/Housekeepers/Janitors	194	11.7%	7	12.1%
Farming	107	6.4%	5	8.6%
Sales and Office	106	6.4%	4	6.9%
Production and Transportation	99	6.0%	1	1.7%
Management, Professional, and Related	96	5.8%	5	8.6%
Healthcare	86	5.2%	3	5.2%
Food Preparation and Service	84	5.1%	4	6.9%
Pest Control Operators	80	4.8%	9	15.5%
Groundskeepers/Lawn Service	73	4.4%	2	3.4%
Construction	36	2.2%	0	0.0%
Protective Services	35	2.1%	0	0.0%
Personal Care and Service	34	2.0%	1	1.7%
Installation, Maintenance, and Repair	19	1.1%	2	3.4%
Military	2	0.1%	0	0.0%
Unknown	612	36.8%	15	25.9%
Total	**1663**	**100.0%**	**58**	**100.0%**

Confirmed cases were identified in a wide variety of industries. 'Services' includes 'accommodation and food services' as well as 'building services' and was the most common sector in 2024, followed by agriculture (Table 6).

Table 6: Confirmed Occupational Pesticide Illness and Injury Cases by Industry Sector, Michigan 2001-2024 and 2024 Separately

	Cumulative		2024	
Industry Sector	**Count**	**Percent**	**Count**	**Percent**
Services (excluding Public Safety)	616	37.0%	18	31.0%
Healthcare & Social Assistance	236	14.2%	7	12.1%
Agriculture, Forestry, Fishing	182	10.9%	8	13.8%
Wholesale & Retail Trade	125	7.5%	4	6.9%
Manufacturing	100	6.0%	7	12.1%
Construction	53	3.2%	0	0.0%
Transportation, Warehousing, Utilities	50	3.0%	2	3.4%
Public Safety	33	2.0%	0	0.0%
Unknown	268	16.1%	12	20.7%
Total	**1663**	**100.0%**	**58**	**100.0%**

Most (67.2%) cases in 2024 were of low severity, 31.0% were moderate severity, and 1.7% were high severity.

A male in his 40s and a male in his 30s were working as electricians installing solar panels when a tractor spraying an herbicide drove by and sprayed them. They both developed sore throats and irritated and watery eyes. The first male also developed redness of his skin and a headache. The second male developed a rash and irritation to his skin, a cough, chest pain, muscle weakness. The first male sought medical assistance in the emergency department the day of the exposure. When his symptoms did not subside two days later, the second male sought medical assistance in the emergency department where they consulted with the poison center.

Events

In 2024, when the person's activity at the time of exposure was known, most (55.2%) cases occurred when the person was involved with pesticide application, such as mixing or applying a pesticide, transport or disposal of a pesticide, or some combination of these activities. Conducting routine work not involved with the application was the second most common activity at exposure (29.3%).

A male in his 50s who works as a self-employed farmer was spraying his fields with a fungicide and insecticide. The products either got in his eyes from the spray or he had some on his hands and rubbed his eyes. He developed painful and watery eyes. He sought medical assistance in the emergency department, where they consulted the poison center and diagnosed him with chemical conjunctivitis of both eyes.

Identification of factors contributing to the exposure assists with the development of prevention strategies. Up to five contributing factors were coded for each case. In 2024, spill/splash of liquid or dust (26.2%) and mixing incompatible products (12.3%) were the most common contributing factors for occupational pesticide cases (Table 7).

Table 7: Contributing Factors in Confirmed Occupational Pesticide Illness and Injury Cases, Michigan 2001-2024 & 2024 Separately

	Cumulative		2024	
Contributing Factor	**Cumulative**	**Percent**	**2024**	**Percent**
Spill/Splash of liquid or dust (not equipment failure)	445	21.2%	17	26.2%
Mixing incompatible products	234	11.1%	8	12.3%
Label violations not specified	135	6.4%	0	0.0%
No label violation identified but person still exposed/ill	134	6.4%	6	9.2%
Required eye protection not worn or inadequate	118	5.6%	2	3.1%
Excessive application	116	5.5%	4	6.2%
Application equipment failure	112	5.3%	2	3.1%
Decontamination not adequate or timely	106	5.0%	0	0.0%
Drift contributory factors	90	4.3%	2	3.1%
People were in the treated area during application	65	3.1%	4	6.2%
Required gloves not worn or inadequate	54	2.6%	2	3.1%
Notification/posting lacking or ineffective	51	2.4%	2	3.1%
Applicator not properly trained or supervised	45	2.1%	0	0.0%
Structure inadequately ventilated before re-entry	32	1.5%	0	0.0%
Within reach of child or other improper storage	31	1.5%	1	1.5%
Early re-entry	30	1.4%	0	0.0%
Required respirator not worn or inadequate	26	1.2%	0	0.0%
Other required PPE not worn or inadequate	16	0.8%	3	4.6%
Blow-back onto applicator during application	7	0.3%	7	10.8%
Intentional harm	2	0.1%	0	0.0%
Other	84	4.0%	5	7.7%
Unknown	173	8.2%	0	0.0%
Total	**2106**	**100.0%**	**65**	**100.0%**

In 2024, the most common pesticide exposure resulting in a case was to disinfectants (42.6%), followed by insecticides (23.5%) (Table 8). In Table 8, some products contain more than one type of pesticide and some cases involved more than one product, so the number of types listed is greater than the number of cases.

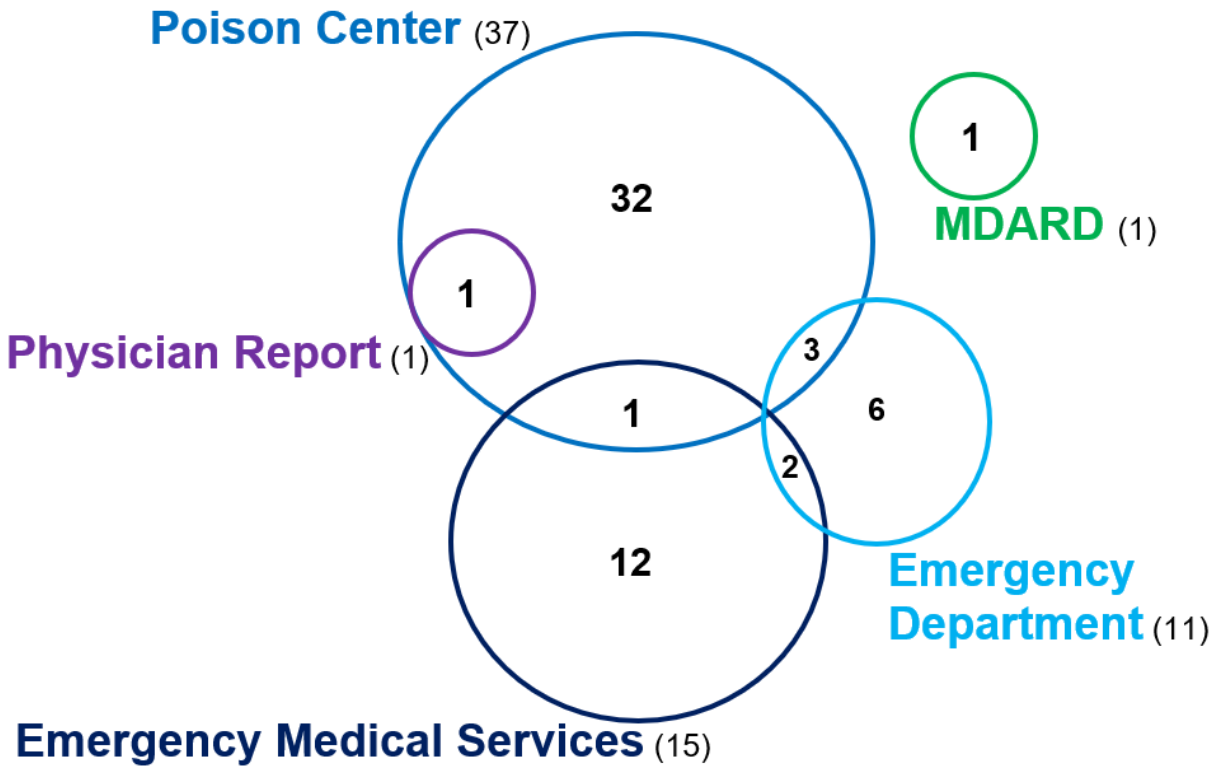
Table 8: Confirmed Occupational Pesticide Illness and Injury Cases by Pesticide Type, Michigan 2001- 2024 and 2024 Separately

	Cumulative		2024	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	846	45.9%	29	42.6%
Insecticide	440	23.9%	16	23.5%
Herbicide	218	11.8%	8	11.8%
Fungicide	61	3.3%	3	4.4%
Insecticide & Other	40	2.2%	1	1.5%
Multiple types	29	1.6%	0	0.0%
Other	92	5.0%	2	2.9%
Unknown	117	6.3%	9	13.2%
Total	**1843**	**100.0%**	**68**	**100.0%**

Reporting Sources

The most common reporting source for pesticide illness and injury cases in 2024 was the poison center (56.9%) followed by emergency medical services (23.1%) (Figure 2).

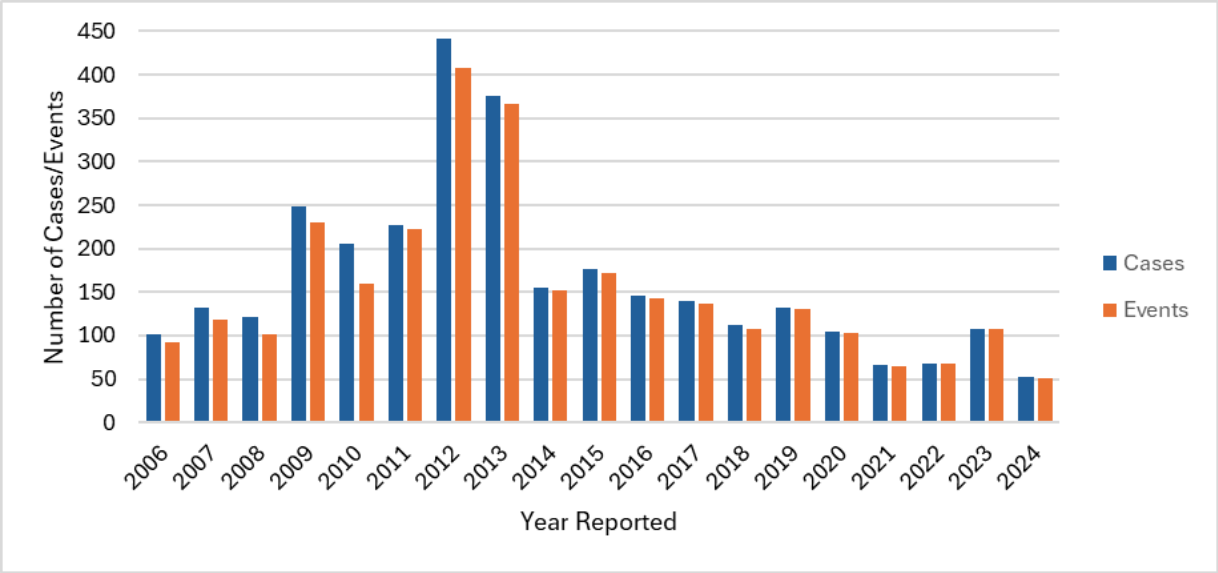
Figure 2. Original Reporting Source for Occupational Pesticide Illness and Injury Cases, Michigan 2024



Section III. Non-occupational Pesticide Illnesses and Injuries

To provide a more complete characterization of the impact of pesticide use in Michigan, the pesticide surveillance program began collecting information about non-occupational exposures in 2006. The same case definition and report sources were used for occupational and non-occupational cases. In 2012, three additional non-occupational exposure categories from the poison center were added, but in 2014, because of limited resources, data entry was limited to cases who visited a health care provider, excluding non-occupational cases whose only medical contact was to call the poison center and non-occupational cases whose only medical contact was EMS personnel without an ambulance transfer to a medical center. There were 52 confirmed cases from 51 events entered into the database in 2024 (Figure 3). There were another 93 adults and 18 children (< 6 years of age) with confirmed non-occupational cases who had called the poison center or EMS with two or more symptoms and the pesticide was known but had not seen a provider and are therefore not included in this report. Suicide attempts using pesticides are also excluded from this report. There is no follow-up to collect additional information from non-occupational cases, so some cases may have been missed because we did not know there was more than one sign or symptom or because we did not identify the pesticide or because we did not know the person saw a medical provider after calling the poison center or EMS (all three required for non-occupational case confirmation).

Figure 3: Confirmed Non-occupational Pesticide Illness and Injury Cases and Events by Year, Michigan



A female in her 40s was disinfecting her bathroom at home when she accidentally mixed an acid-based toilet bowl cleaner with bleach in the toilet. She developed a cough, shortness of breath, wheezing, tachycardia, and tachypnea. She sought medical assistance in the emergency department.

A pregnant female in her 30s remained in the home for about 10 minutes after an insecticide fogger was released. She developed shortness of breath, a cough, and a sore throat. She sought medical assistance in the emergency department, where they consulted with the poison center.

People

Non-occupational pesticide cases occurred among people of all ages. In 2024, females (59.6%) were more likely than males (40.4%) to be exposed as a non-occupational pesticide case (Table 9). In 2024, race was known for 65.4% of cases. When race was known, 55.9% were white and 44.1% were black. Data regarding ethnicity were missing for 63.5% of non-occupational cases in 2024, and when known 94.7% of cases involved non-Hispanic individuals.

Table 9: Confirmed Non-occupational Pesticide Illness and Injury Cases by Age Group & Gender, Michigan 2006-2024 & 2024 Separately

	Cumulative			2024		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	12	18	1	0	0	0
01-02 (Toddlers)	54	80	0	0	1	0
03-05 (Preschool)	40	61	0	1	0	0
06-11 (Child)	97	66	0	1	2	0
12-17 (Youth)	79	78	1	0	1	0
18-64 (Adult)	1163	878	0	24	11	0
65+ (Senior)	180	171	0	5	6	0
Unknown age	70	32	30	0	0	0
Total	**1695**	**1384**	**32**	**31**	**21**	**0**

Most (n=34; 65.4%) non-occupational cases in 2024 were of moderate severity, 16 cases (30.8%) were low severity, and 2 cases (3.8%) were of high severity.

A 3-year-old girl ran back inside an area being treated by an insecticide fogger. She developed wheezing and a cough. Her mother brought her to the emergency department for medical assistance where they consulted the poison center. She was prescribed a bronchodilator.

Events

In 2024, most cases (75.0%) occurred when a person was involved with a pesticide application, such as mixing or applying a pesticide, transport or disposal of a pesticide, or some combination of these activities. The other 25.0% happened to bystanders.

A female in her 40s accidentally drank bleach that was put in a water bottle by her daughter. She developed burning in her throat, vomiting, nausea, and an upset stomach. She called EMS, who transported her to the emergency department.

Identification of factors contributing to the exposure assists with the development of prevention strategies. Up to five contributing factors were coded for each case. In 2024, mixing incompatible products was the most common contributing factor for non-occupational

pesticide cases, followed by products being within reach of a child or other improper storage (e.g., storing chemicals in containers that resemble drinking containers) (Table 10).

Table 10: Contributing Factors in Confirmed Non-occupational Pesticide Illness and Injury Cases, Michigan 2006-2024 & 2024 Separately

	Cumulative		2024	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Mixing incompatible products	536	15.2%	13	22.4%
Label violations not otherwise specified	443	12.6%	0	0.0%
Spill/Splash of liquid or dust (not equipment failure)	343	9.7%	6	10.3%
Excessive application	321	9.1%	7	12.1%
Within reach of child or other improper storage	268	7.6%	10	17.2%
No label violation identified but person still exposed/ill	266	7.5%	5	8.6%
People were in the treated area during application	181	5.1%	6	10.3%
Structure inadequately ventilated before re-entry	115	3.3%	2	3.4%
Drift contributory factors	115	3.3%	0	0.0%
Decontamination not adequate or timely	108	3.1%	0	0.0%
Early re-entry	97	2.8%	0	0.0%
Notification/posting lacking or ineffective	60	1.7%	0	0.0%
Application equipment failure	52	1.5%	0	0.0%
Required gloves not worn or inadequate	20	0.6%	1	1.7%
Required eye protection not worn or inadequate	18	0.5%	0	0.0%
Applicator not properly trained or supervised	10	0.3%	0	0.0%
Other required PPE not worn or inadequate	9	0.3%	0	0.0%
Blow-back onto applicator during application	4	0.1%	4	6.9%
Intentional harm	3	0.1%	0	0.0%
Required respirator not worn or inadequate	2	0.1%	0	0.0%
Illegal pesticide used/Illegal dumping	2	0.1%	0	0.0%
Other	103	2.9%	4	6.9%
Unknown	449	12.7%	0	0.0%
Total	**3525**	**100.0%**	**58**	**100.0%**

In 2024, the most common pesticide case was to disinfectants and insecticides (46.2% and 27.7%, respectively) (Table 9). In Table 9, some products contain more than one type of pesticide, and some cases involved more than one product, so the number of types listed is greater than the number of cases.

A female in her 30s was disinfecting her bathroom at home when she mixed bleach with another unknown disinfectant. The unknown disinfectant was stored in a spray bottle without a label. She inhaled the fumes of the mixture and developed difficulty breathing, a cough, a burning sensation in her throat and chest, vomiting, and began feeling lightheaded. She called EMS who transported her to the emergency department.

A male in his 20s set off an insecticide fogger in his garage and stayed in the affected area for approximately ten minutes. He developed dyspnea and chest pain and sought medical assistance from the emergency department, where they consulted with the poison center.

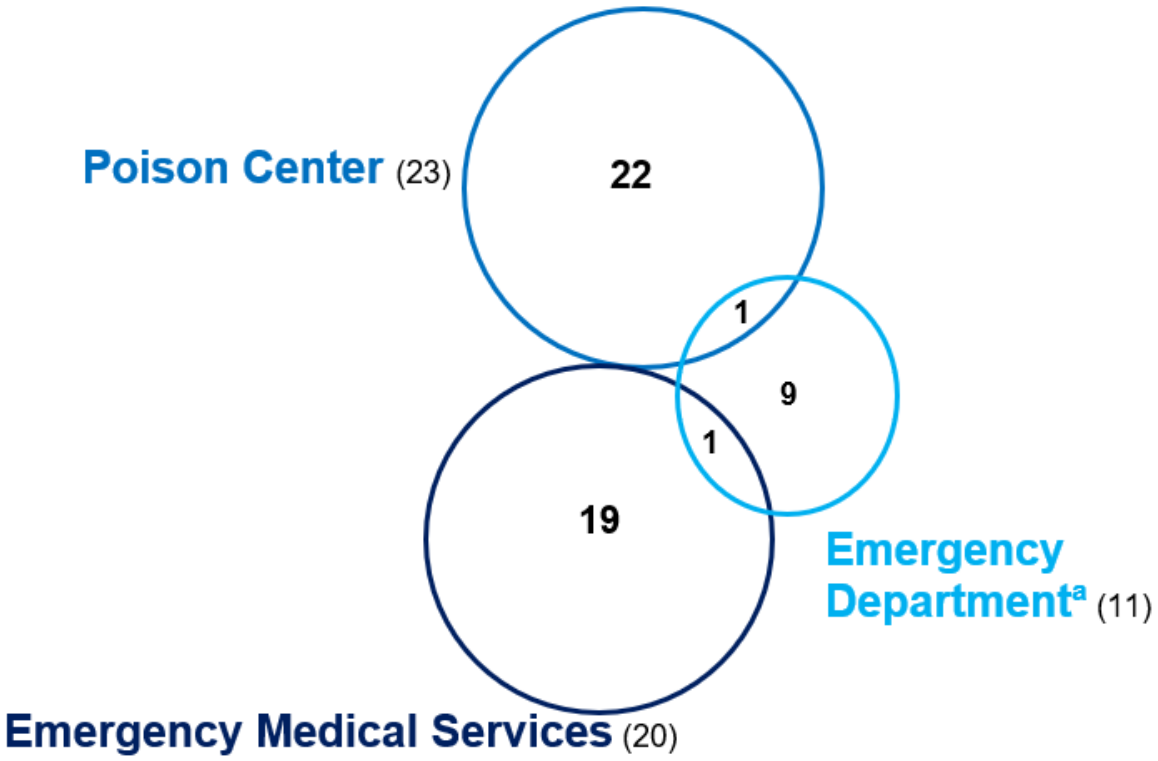
Table 9: Confirmed Non-occupational Pesticide Illness and Injury Cases by Pesticide Type, Michigan 2006-2024 & 2024 Separately

	Cumulative		2024	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	1286	37.7%	30	46.2%
Insecticide	1131	33.2%	18	27.7%
Insect Repellent	218	6.4%	0	0.0%
Herbicide	217	6.4%	0	0.0%
Insecticide & Other	181	5.3%	4	6.2%
Rodenticide	35	1.0%	0	0.0%
Fungicide	30	0.9%	0	0.0%
Multiple	42	1.2%	1	1.5%
Other	81	2.4%	0	0.0%
Unknown	187	5.5%	12	18.5%
Total	**3408**	**100.0%**	**65**	**100.0%**

Reporting Sources

The most common reporting source for non-occupational pesticide illness and injury cases in 2024 was the poison center (42.6%) followed by emergency medical services (37.0%) (Figure 4).

Figure 4. Original Reporting Source for Non-occupational Pesticide Illness and Injury Cases, Michigan 2024



[a]One individual who sought medical care in the emergency department was admitted for an inpatient stay.

Outreach, Education, and Prevention Activities

The Occupational Pesticide Illness and Injury Program used a variety of avenues to provide information about the program and pesticide safety to stakeholders and the general public. In 2024:

- Virtually attended the 2024 SENSOR-Pesticides National Meeting in Austin, Texas.
    - Presented State of Michigan update and examined the importance of receiving data from emergency medical services

- The pesticide surveillance program coordinator provided case narratives to MDARD, who shared these narratives with stake holders who have an interest in pesticides.

- The MDHHS Pesticide Information webpage provided links to all previous annual reports, a pesticide education booklet, "What You Need to Know about Pesticides and Your Health", several fact sheets, and over 150 other sites with information about pesticides and their safe use.

- Pesticide poisoning data from 2003-2023 can be found on the interactive MDHHS web site (https://www.michigan.gov/mdhhs/safety-injury-prev/environmental-health/topics/mitracking)

- Published a press release with corresponding social media posts for National Poison Prevention Week: "MSU expert offers safety advice during National Poison Prevention Week" (https://msutoday.msu.edu/news/2024/msu-safety-national-poison-prevention).

- Published an article in conjunction with Michigan State University Extension titled, "A simple Worker Protection Standard-compliant respiratory program for agricultural employers" (https://www.canr.msu.edu/news/a-simple-worker-protection-standard-compliant-respirator-program-for-agricultural-employers).

- One case was reported to both MIOSHA and NIOSH from cases reported in 2024.

    A female in her 30s was working as a respiratory therapist in a hospital when she was exposed to the fumes of a disinfectant that was being used to clean up a sewage spill in the bathroom. She developed difficulty breathing, a cough, and tachypnea. She was admitted to the hospital for seven nights. This case was referred to MIOSHA and NIOSH. No citations were given as a result of the inspection by MIOSHA, but it was determined the product was used incorrectly and suggestions were given to prevent future incidents.

- No cases were referred to MDARD from cases reported in 2024.

Discussion

Surveillance Data

There were 58 confirmed occupational cases reported in 2024. This is consistent with the range from previous years of surveillance (17-125), and the average (69). The number of confirmed occupational cases peaked in 2008.

There were 52 confirmed non-occupational cases in 2024. This is the lowest number of confirmed cases since non-occupational surveillance began in 2006 and lower than the average number of cases for those years (164). There was an increase in non-occupational cases in 2012 and 2013 because the coding of cases we reviewed from the poison center exposure reasons was expanded to capture all non-occupational cases. The number went down again in 2014 because, due to the limited resources of the pesticide surveillance program, only non-occupational cases who sought additional medical care beyond the poison center were entered into the database and included in this report.

The number and proportion of confirmed cases related to disinfectant exposures remained high and continued to be an area of ongoing concern. In 2024, 42.6% of occupational cases and 46.2% of non-occupational cases were exposed to a disinfectant. It is likely that some of these cases would not have occurred if the disinfectants had been used only in situations where their use was recommended (Rosenman et al., 2020). The calls to the Michigan Poison Center about adverse health effects from disinfectants have increased since the onset of the COVID-19 pandemic (Rosenman et al., 2021). Ongoing education is needed to provide guidance about how to use disinfectants safely when their use is recommended.

When looking at factors contributing to pesticide cases in 2024, spill/splash of liquid or dust was the most common factor for confirmed occupational cases (26.2%), followed by mixing incompatible products (12.3%) and blow-back onto applicator during application (10.8%). The most common factors contributing to non-occupational cases were mixing incompatible products (22.4%), followed by the product being improperly stored or within reach of a child (17.2%) and excessive application (12.1%). Better education, storage and reading product labels might help to reduce the number of cases.

Many confirmed cases in 2024 were “bystanders”, that is, engaged in work or living activities not related to the pesticide application (29.3% of occupational cases and 25.0% of non-occupational cases when activity was known). Better education on safe pesticide application and reading product labels is needed to prevent inadvertent exposures, as well as the exposures to applicators.

Interventions

Pesticide surveillance staff continued to work with other state and federal agencies. Pesticide program surveillance staff also worked to improve pesticide education for individuals,

employers, health care providers, and other stakeholder groups through the distribution of fact sheets and presentations.

Challenges to Surveillance

Pesticide poisoning is a complex condition for surveillance. The potential for pesticides to harm people depends in part on the dose (length of exposure and chemical concentration) and the route of entry into the body. Pesticides have a range of toxicity, from low toxicity (no signal word required by EPA) through slightly toxic (EPA signal word: Caution), moderately toxic (EPA signal word: Warning) and most toxic (EPA signal word: Danger). Pesticide products are often mixtures including one or more active ingredients, as well as other "inert" ingredients that have no effect on the target pest but may have adverse human health effects. Depending on the chemicals involved, pesticides can have short- and long-term adverse health effects on different organ systems, including the skin, gastrointestinal, respiratory, nervous, and reproductive systems.

The problem of identifying pesticide-related illness for public health surveillance begins with difficulties in recognition and diagnosis, because the signs and symptoms of pesticide toxicity can be the same as those that occur with common conditions such as allergies, acute conjunctivitis, or acute gastrointestinal illness. Health care providers receive limited education in the recognition and diagnosis of the toxic effects of pesticides and the role of pesticides may not be considered when evaluating patients with signs/symptoms that can be caused by common medical conditions. Besides problems in recognition by health care providers, patients may not seek medical care (Calvert, 2004). Migrant workers face additional barriers such as language difficulties, lack of access to care, and fear of job loss or deportation if they are not legal residents (Pardo et al., 2017). Finally, even when diagnosed, pesticide-related illnesses and injuries may not be reported due reluctance on the part of workers and their health care providers to involve state agencies, the busy work schedules of providers or lack of knowledge of the public health code reporting requirements (Calvert et al., 2009).

Continued outreach is needed to educate health care providers on the importance of recognizing and reporting pesticide illnesses and injuries. In 2024, 55.2% of confirmed occupational cases and 42.3% of the non-occupational cases were reported solely by the State's poison center. Additionally, 20.7% of confirmed occupational cases and 36.5% of the non-occupational cases were reported exclusively by the State's emergency medical service response database.

Like data from other occupational injury and illness surveillance systems (Azaroff et al., 2002), the Michigan occupational pesticide surveillance data are probably a significant undercount of the true number of work-related pesticide poisoning cases in Michigan. A 2004 study done in the State of Washington found that the primary barrier for migrant farm workers in seeking health care was economic. Workers could not afford to take time off to seek medical care and were afraid that if they did, they might lose their jobs. That study also found that only 20-30% of pesticide-related illnesses among farm workers who filed a workers' compensation claim were given a diagnosis code that indicated pesticide poisoning (Washington Department of

Health, 2004). Michigan's workers' compensation data identify poisonings as a group but are not specific enough to capture pesticide exposures.

This surveillance system continues to face challenges due to the time lag between the occurrence and the reporting of the incident from hospital and MDARD reports. This presents difficulties in following up with reported cases because of worker mobility, especially among seasonal farm workers. The poison center reports are received promptly from Michigan's Poison Center, but do not always contain enough information to allow contact with the exposed individual. Lack of information for follow-up often results in a case classification of "insufficient information" and an inability to refer cases to regulatory agencies in a timely manner.

Notwithstanding these limitations, the Michigan pesticide surveillance system is receiving and investigating reports of occupational pesticide illness and injury, including follow-up prevention activities. We are heartened by the downward trend in this decade and will continue to conduct surveillance to monitor this trend.

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Additional Resources

MDHHS Division of Environmental Health pesticide information: www.michigan.gov/mdhhs/safety-injury-prev/environmental-health/topics/pesticides

NIOSH occupational pesticide poisoning surveillance system: https://www.cdc.gov/niosh/surveillance/pesticide/

Pesticide-Related Illness and Injury Surveillance: A How-To Guide for State-Based Programs DHHS (NIOSH) publication number 2006-102. October 2005: www.cdc.gov/niosh/docs/2006-102/

MDARD Pesticide and Plant Pest Management Division (for information on licensing and registration for pesticide application businesses, credentials for certified technicians, and laws and regulations for pesticide application): https://www.michigan.gov/mdard/plant-pest

Michigan State University's Pesticide Education Program: https://www.canr.msu.edu/psep/

Information on pesticide products registered for use in Michigan: https://www.npirs.org/state/

EPA Pesticide Product Label System: https://ordspub.epa.gov/ords/pesticides/f?p=PPLS:1

Extoxnet Pesticide Information Profiles: https://extoxnet.orst.edu/pips/ghindex.html

Information on the federal Worker Protection Standard (worker exposure to pesticides in agriculture): https://www.epa.gov/pesticide-worker-safety

Recognition and Management of Pesticide Poisonings, Sixth Edition: https://www.epa.gov/sites/default/files/2015-01/documents/rmpp_6thed_final_lowresopt.pdf

To report occupational pesticide exposures in Michigan: www.oem.msu.edu/index.php/work-related-injuries/report-occupational-exposure

Appendix I

Case Definition for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System

Clinical Description
This surveillance case definition refers to any acute adverse health effect resulting from exposure to a pesticide product (defined under the Federal Insecticide Fungicide and Rodenticide Act [FIFRA]1) including health effects due to an unpleasant odor, injury from explosion of a product, inhalation of smoke from a burning product, and allergic reaction. Because public health agencies seek to limit all adverse effects from regulated pesticides, notification is needed even when the responsible ingredient is not the active ingredient.

A case is characterized by an acute onset of symptoms that are dependent on the formulation of the pesticide product and involve one or more of the following:

- Systemic signs or symptoms (including respiratory, gastrointestinal, allergic and neurological signs/symptoms)
- Dermatologic lesions
- Ocular lesions

This case definition and classification system is designed to be flexible permitting classification of pesticide-related illnesses from all classes of pesticides. Consensus case definitions for specific classes of chemicals may be developed in the future.

A case will be classified as occupational if exposure occurs while at work (this includes working for compensation; working in a family business, including a family farm; working for pay at home; and, working as a volunteer Emergency Medical Technician (EMT), firefighter, or law enforcement officer). All other cases will be classified as non-occupational. All cases involving suicide or attempted suicide will be classified as non-occupational.

A case is reportable to the national surveillance system when there is (see the Classification Criteria section for a more detailed description of these criteria):

- Documentation of new adverse health effects that are temporally-related to a documented pesticide exposure; AND
- Consistent evidence of a causal relationship between pesticide and the health effects based on known toxicology of the pesticide from commonly available toxicology texts, government publication, information supplied by the manufacturer, or two or more case series or positive epidemiologic investigations, OR
- Insufficient toxicologic information available to determine whether a causal relationship exists between the pesticide exposure and the health effects

Laboratory criteria for diagnosis
If available, the following laboratory data can confirm exposure to a pesticide:

- Biological tests for the presence of, or toxic response to, the pesticide and/or its metabolite (in blood, urine, etc.);
    - Measurement of the pesticide and/or its metabolite(s) in the biological specimen
    - Measurement of a biochemical response to the pesticide in a biological specimen (e.g., cholinesterase levels)
- Environmental tests for the pesticide (e.g., foliage residue, analysis of suspect liquid);
- Pesticide detection on clothing or equipment used by the case subject.

Classification Criteria

Reports received and investigated by state programs are scored on the three criteria provided below (criteria A, B and C). Scores are either 1, 2, 3, or 4, and are assigned based on all available evidence. The classification matrix follows the criteria section (Table 1). The matrix provides the case classification categories and the criteria scores needed to place the case into a specific category. Definite, probable, possible and suspicious cases (see the classification matrix) are reportable to the national surveillance system. Additional classification categories are provided for states that choose to track reports that do not fit the criteria for national reporting. Appendix II of "Pesticide-Related Illness and Injury Surveillance: A How-To Guide for State-Based Programs" lists the characteristic signs and symptoms for several pesticide active ingredients and classes of pesticides.

A) *Documentation of Pesticide Exposure*

1) Laboratory, clinical or environmental evidence corroborate exposure (at least one of the following must be satisfied to receive a score of A1):
    a) analytical results from foliage residue, clothing residue, air, soil, water or biologic samples;
    b) observation of residue and/or contamination (including damage to plant material from herbicides) by a trained professional [Note: a trained professional may be a plant pathologist, agricultural inspector, agricultural extension agent, industrial hygienist or any other licensed or academically trained specialist with expertise in plant pathology and/or environmental effects of pesticides. A licensed pesticide applicator not directly involved with the application may also be considered a trained professional.];
    c) biologic evidence of exposure (e.g., response to administration of an antidote such as 2-PAM, Vitamin K1, Vitamin E oil preparation, or repeated doses of atropine);
    d) documentation by a licensed health care professional of a characteristic eye injury or dermatologic effects at the site of direct exposure to a pesticide product known to produce such effects (these findings must be sufficient to satisfy criteria B.1 under documentation of adverse health effect);
    e) clinical description by a licensed health care professional of two or more postexposure health effects (at least one of which is a sign) characteristic for the pesticide as provided in Appendix II.

2) Evidence of exposure based solely upon written or verbal report (at least one of the following must be satisfied to receive a score of A2"):
   a) report by case;
   b) report by witness;
   c) written records of application;
   d) observation of residue and/or contamination (including damage to plant material from herbicides) by other than a trained professional;
   e) other evidence suggesting that an exposure occurred.

3) Strong evidence that no pesticide exposure occurred.

4) Insufficient data.

B) <u>Documentation of Adverse Health Effect</u>

1) Two or more new post-exposure abnormal signs and/or test/laboratory findings reported by a licensed health care professional.

2) At least one of the following must be satisfied to receive a score of B2:
   a) Two or more new post-exposure abnormal symptoms were reported. When new post-exposure signs and test/laboratory findings are insufficient to satisfy a B1 score, they can be used in lieu of symptoms toward satisfying a B2 score.
   b) Any new illness or exacerbation of pre-existing illness diagnosed by a licensed physician, but information on signs, symptoms and/or test findings are not available or insufficient for a B1 or B2a score.

3) No new post-exposure abnormal signs, symptoms, or test/laboratory findings were reported.

4) Insufficient data (includes having only one new post-exposure abnormal sign, symptom, or test/laboratory finding).

C) <u>Evidence Supporting a Causal Relationship Between Pesticide Exposure and Health Effects</u>

1) Where the findings documented under the Health Effects criteria (criteria B) are:
   a) characteristic for the pesticide as provided in Appendix II, and the temporal relationship between exposure and health effects is plausible (the pesticide refers to the one classified under criteria A), and/or;
   b) consistent with an exposure-health effect relationship based upon the known toxicology (i.e., exposure dose, symptoms and temporal relationship) of the putative agent (i.e., the agent classified under criteria A) from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case series or positive epidemiologic studies published in the peer-reviewed literature;

2) Evidence of exposure-health effect relationship is not present. This may be because the exposure dose was insufficient to produce the observed health effects. Alternatively, a temporal relationship does not exist (i.e., health effects preceded the exposure or occurred too long after exposure). Finally, it may be because the constellation of health effects is not consistent based upon the known toxicology of the putative agent from information in 25 commonly available toxicology texts, government publications, information supplied by the manufacturer, or the peer-reviewed literature;

3) Definite evidence of non-pesticide causal agent;

4) Insufficient toxicologic information is available to determine causal relationship between exposure and health effects. (This includes circumstances where minimal human health effects data is available, or where there are less than two published case series or positive epidemiologic studies linking health effects to the particular pesticide product/ingredient or class of pesticides.)

Case Classification Matrix:

Classification Categories[1]											
Classification Criteria	Definite Case	Probable Case		Possible Case	Suspicious Case	Unlikely Case	Insufficient Information		Asymptomatic[2]	Unrelated[3]	
A. Exposure	1	1	2	2	1 or 2	1 or 2	4	-	-	3	
B. Health Effects	1	2	1	2	1 or 2	1 or 2	-	4	3	-	
C. Causal Relationship	1	1	1	1	4	2	-	-	-	-	3

[1] Only reports meeting case classifications of Definite, Probable, Possible and Suspicious are reportable to the National Public Health Surveillance system. Additional classification categories are provided for states that choose to track the reports that do not fit the national reporting criteria.

[2] The matrix does not indicate whether asymptomatic individuals were exposed to pesticides although some states may choose to track the level of evidence of exposure for asymptomatic individuals.

[3] Unrelated = Illness determined to be caused by a condition other than pesticide exposure, as indicated by a >3' in the evidence of >Exposure= or >Causal Relationship= classification criteria.

Severity Index for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System

A brief description of each of the four severity categories is as follows:

S-1 Death
This category describes a human fatality resulting from exposure to one or more pesticides.

S-2 High severity illness or injury
The illness or injury is severe enough to be considered life threatening and typically requires treatment. This level of effect commonly involves hospitalization to prevent death. Signs and symptoms include, but are not limited to, coma, cardiac arrest, renal failure and/or respiratory depression. The individual sustains substantial loss of time (> 5 days) from regular work (this can include assignment to limited/light work duties) or normal activities (if not employed). This level of severity might include the need for continued health care following the exposure event, prolonged time off of work, and limitations or modification of work or normal activities. The individual may sustain permanent functional impairment.

S-3 Moderate severity illness or injury
This category includes cases of less severe illness or injury often involving systemic manifestations. Generally, treatment was provided. The individual is able to return to normal functioning without any residual disability. Usually, less time is lost from work or normal activities (= 3-5 days), compared to those with severe illness or injury. No residual impairment is present (although effects may be persistent).

S-4 Low severity illness or injury
This is the category of lowest severity. It is often manifested by skin, eye or upper respiratory irritation. It may also include fever, headache, fatigue or dizziness. Typically, the illness or injury resolves without treatment. There is minimal lost time (<3 days) from work or normal activities.

Appendix II

Case Narratives, 2023 Confirmed Occupational Cases Closed in 2024 after Investigation

Below are descriptions of two confirmed occupational cases reported in 2023. These two exposures are included in this report to share results of MDARD investigations, which concluded in 2024. The narratives are organized by pesticide type and occupation. They include a description of the signs and symptoms that resulted from the exposure and medical care received. Where known, age range, gender, industry, and occupation are included.

Multiple Pesticides

Agriculture

MI05963 - A male in his 20s was working as a flower room manager at a cannabis production facility when he inhaled a single product used as a fungicide, bactericide, and algaecide. The product was diluted and used in a humidifier while he was in the room. He developed a cough, shortness of breath, and chest pain. He called poison control. This case was referred to MDARD, but MDARD determined there were no violations during the inspection because the particular type of treatment is not considered a plant production activity that requires adherence to the Agricultural Worker Protection Standard (WPS).

Construction

MI05982, MI05983, MI05984, MI05985, MI05986, MI05987, MI05988, MI06033 – Eight male workers ages, one in their 60's, three in their 20's, two in their 30's and two in their 50'swere placing solar panels in a field at work when they were exposed to an insecticide (Tombstone by Loveland Products) and a fungicide (Miravis Neo) that drifted on them from an aerial application being sprayed on the crops in the neighboring field. One worker developed dizziness, nausea, a cough, red eyes, numbness to the mouth, and a headache. Four workers developed shortness of breath, chest tightness, dizziness, and nausea; one of whom also developed a cough, and one also developed a cough and itching on his skin. One worker developed a cough, shortness of breath, and a headache. One worker developed an itchy rash on his skin and a headache, and another developed a headache, muscle weakness, dizziness, a cough, and skin irritation. The workplace health and safety supervisor called poison control. All of the workers sought medical attention in the emergency department the day of the exposure. One worker reported there may have been 25-30 exposed workers. One worker called EMS from the field he was working in seven days after the exposure due to continued difficulty breathing and coughing at work. Four of the workers sought medical attention from an occupational medicine physician. This case was referred to MDARD and NIOSH. A citation was issued by MDARD that the applicator used the product in a manner that was not consistent with its label.

Case Narratives, 2024 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2024. The narratives are organized by pesticide type and occupation. They include a description of the signs and symptoms that resulted from the exposure and medical care received. Where known, age range, gender, industry, and occupation are included.

Insecticides/Insect Repellents/Insect Growth Regulators

Pest Control

MI06120 – A male in his 30s was self-employed working in pesticide control and crop management when he was cleaning out the bed of his truck. Powder from an insecticide spilled onto his arm. He developed pain in his arm as well as throat irritation, chest tightness, and dizziness. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06122 – A male in his 30s was working as a pesticide applicator for a pest control company. Over the course of a week, the backpack sprayer he was using to apply an insecticide leaked down his back. He developed a rash and blisters to his back and legs as well as nausea, dizziness, and fatigue. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06104 – A male in his 30s was working as a service professional for a pest control company when the wind blew the mist of an insecticide back at him. He developed nausea, vomiting, a headache, and dizziness. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06109 – A male in his 30s was working as a pesticide applicator for a pest control service when the backpack sprayer he was using to apply an insecticide leaked on his skin and misted back in his face. He developed a headache, dizziness, and tingling to his hands and arms. He sought medical advice from the poison center and then sought medical assistance in the emergency department at the advice of the poison center.

MI06117 – A male in his 30s was working for a mosquito prevention company when he rubbed his eyes after applying an insecticide that had unknowingly gotten on his hands. He experienced a pain and tearing in his eyes. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06121 – A male in his 40s was working as a pesticide applicator for a pest control company when he was spraying an insecticide. The wind caused the insecticide to mist back at him and he developed chest tightness and skin irritation to his face, arms, and lower legs as well as redness and irritation around and in his eyes. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06125 – A male of unknown age was spraying an insecticide while working for a pest control company. He developed redness and a painful burning sensation to his face. His wife sought medical advice from the poison center.

MI06137 – A female in her 30s was working for a pest control service when she was spraying an insecticide for mosquito prevention and the spray blew back into her face and eyes. She developed redness and irritation to her eyes and the skin around her eyes. She sought medical assistance in the emergency department where they consulted with the poison center.

Agriculture

MI06107 – A male in his 20s was at work cleaning out tanks for helicopter spraying when he was sprayed in the face with an insecticide. He developed a burning sensation and redness on his face and swelling of his eyelids. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06188 – A male in his 20s was working at a dairy farm carrying a container of an insecticide when it splashed into his eyes. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06135 – A male farmer in his 20s was using a needle to draw up a topical insecticide intended for livestock deer. He accidentally injected some of the chemical into his hand. He developed nausea, vomiting, and swelling to his hand. His coworker sought medical advice from the poison center and then he sought medical assistance in the emergency department where they consulted with the poison center.

Services

MI06126 – A female in her 50s was at work when she put an insecticide dust in water to clean a house. She developed irritation to her eyes, a cough, abdominal pain, nausea, and vomiting. When her symptoms had not subsided by the next morning, she sought medical advice from the poison center.

MI06171 – A female in her 20s set off an insecticide fogger while working at a fast-food restaurant. She developed shortness of breath and chest tightness. She sought medical assistance in the emergency department where they consulted with the poison center.

Manufacturing

MI06110 – A female in her 30s was working as a production lead for a pharmaceutical manufacturing company where she was cleaning a manufacturing tank with an insecticide foaming solution when the part of her leg that was not covered by her bib brushed up against the foam on the ladder of the tank. She developed a rash, redness, and irritation to her leg. She sought medical assistance in the emergency department where they consulted with the poison center, and she followed up with the company's occupational doctor the next day.

Miscellaneous/unknown
MI06134 – A male in his 50s was applying an insecticide as part of his job duties when it got into his face and eyes. He developed irritation and swelling around his eyes and itching and discharge in his eyes as well as abdominal pain, nausea, and vomiting. When his symptoms had not subsided four days later, he sought medical assistance in the emergency department where they consulted with the poison center.

Herbicides
Landscaping
MI06106 – A male in his 30s was working as a landscaper for a township parks and recreation department. He was unloading a backpack sprayer from a truck when the sprayer went off and sprayed him with an herbicide. He developed irritation and swelling to his face and ear and pain in his eyes. He sought medical assistance in the emergency department where they consulted with the poison center.

MI06172 – A male in his 30s was working as a lawn technician for a lawn care company when he was using a backpack sprayer to spray an herbicide on a residential lawn. He inhaled the herbicide, and it made contact with his skin. He developed a painful rash on his skin, nausea, a sore throat, and sores in his mouth. He was exposed several times over the course of six months. When his symptoms did not subside after several days after one exposure, he sought medical assistance in the emergency department.

Pest Control
MI06108 – A male in his 20s was working as a pesticide applicator for a lake management service when he dropped a bucket of herbicide causing the herbicide to splash into his eye. He developed tearing, redness, and irritation to his eye as well as pain and swelling to his face. He sought medical assistance at an urgent care where they consulted with the poison center. He also sought medical assistance from an ophthalmologist.

Service
MI06101 & MI06136 – A male in his 40s and a male in his 30s were working as electricians installing solar panels when a tractor spraying an herbicide drove by and sprayed them. They both developed sore throats and irritated and watery eyes. The first male also developed redness of his skin and a headache. The second male developed a rash and irritation to his skin, a cough, chest pain, muscle weakness. The first male sought medical assistance in the emergency department the day of the exposure. When his symptoms did not subside two days later, the second male sought medical assistance in the emergency department where they consulted with the poison center.

Miscellaneous/unknown
MI06116 – A female in her 50s had a dermal exposure to an herbicide at her job. She developed nausea, vomiting, diarrhea, abdominal pain, and an itching sensation on her skin. When her symptoms had not subsided two days later, she sought medical advice from the poison center.

MI06132 – A male in his 20s was spraying an herbicide as part of his job. The spray leaked and soaked through his shoe causing a burn, blistering, and redness to his foot. He sought medical advice from the poison center.

Disinfectants

Agriculture

MI06186 – A male in his 30s was working at a cannabis growing facility when he was using a peroxide-based disinfectant to disinfect trim trays. The pump of the disinfectant malfunctioned spraying him in the face. He developed a cough as well as pain, tearing, and an itching sensation in his eyes. He sought medical assistance in the emergency department where he was prescribed steroid eye drops.

Cleaner/housekeeper/janitor/custodian

MI06079 – A female in her 50s was working as a housekeeper at a hospital when she was filling a bottle from a wall dispenser of a disinfectant and was exposed to the fumes of the disinfectant. She developed a burning sensation in her eyes and throat, a headache, and a cough. Ten days after this exposure she was exposed again in this same way and developed the same symptoms causing her to seek medical assistance in the hospital where she worked.

MI06113 – A male in his 50s was using a disinfectant while working as a maintenance worker at a hospital when the disinfectant splashed on his forearm. He developed redness, burns, and blisters on the exposed area. He sought medical assistance in the hospital where he worked, and they called the poison center for advice.

MI06080 – A 19-year-old male was working as a janitor for a commercial restaurant cleaning company when a spray disinfectant splashed back in his eye. His eye and surrounding skin became red and painful. He sought medical assistance in the emergency department where they diagnosed him with a corneal burn.

Healthcare

MI06112 – A female in her 40s was working as a home healthcare aide when she mixed an ammonia-based cleaning agent with bleach. She inhaled the fumes and developed shortness of breath and wheezing. She sought medical advice from the poison center.

MI06078 – A female in her 30s was working as a respiratory therapist in a hospital when she was exposed to the fumes of a disinfectant that was being used to clean up a sewage spill in the bathroom. She developed difficulty breathing, a cough, and tachypnea. She was admitted to the hospital for seven nights. This case was referred to MIOSHA and NIOSH. No citations were given as a result of the inspection by MIOSHA, but it was determined the product was used incorrectly and suggestions were given to prevent future incidents.

MI06118 – A female hospital worker in her 20s was disinfecting with bleach when it splashed in her eye. She developed redness and pain in her eye. She sought medical advice from the poison center and then sought medical assistance in the hospital where she worked.

Child/Elderly Care
MI06075 – An 18-year-old male was working as a teaching assistant at a daycare facility when he was disinfecting with bleach at the end of the day. He developed shortness of breath, wheezing, and tachycardia. He called EMS who transported him to the emergency department.

MI06076 – A female in her 50s was disinfecting the bathroom at a senior living facility where she worked when she used both bleach and a toilet bowl cleaner. She developed shortness of breath, a cough, and a burning sensation in her chest. She called EMS who transported her to the emergency department where she was diagnosed with chemical pneumonitis.

MI06124 – A female in her 20s was working in a group home. Her job included disinfecting the house with bleach. She inhaled the fumes and developed shortness of breath and wheezing. She called EMS who administered a bronchodilator. She then began to feel better and refused transportation to the emergency department.

MI06191 – A male in his 40s was working at a high school when he went into the bathroom and inhaled fumes from bleach that had been poured down a clogged drain. He developed a cough, shortness of breath, a burning sensation in his throat and chest, watery eyes, and vomiting. He called EMS who transported him to the emergency department.

Manufacturing
MI06103 – A female in her 20s was working as a quality manager for a cherry packing company when an ammonia pipe began leaking. She inhaled the fumes and developed a cough, trouble breathing, a sore throat, and painful and watering eyes. She sought medical assistance in the emergency department where they consulted with the poison center.

MI06129 & MI06130 – A male in his 30s and a male in his 20s were working at a food processing company when they were splashed with bleach. One developed burns and redness to his face and arm and the other to his back. They called EMS who transported them to the emergency department.

MI06173 – A female in her 30s was working as a janitorial supervisor at an automotive factory when a coworker added bleach to a bottle containing ammonia. She inhaled the fumes as she poured the contents of the bottle down the drain. She developed nausea, vomiting, a headache, a cough, difficulty breathing, a sore throat, and watery eyes. She called EMS who transported her to the emergency department.

MI06177 – A male in his 50s was working at a furniture manufacturer when a coworker mixed bleach with an acid-based disinfectant. He inhaled the fumes and developed shortness of breath, a cough, wheezing, chest tightness, and began feeling lightheaded. He sought medical assistance in the emergency department.

MI06200 – A female in her 20s was working as a trainee at a cheese manufacturing company when her trainer was disconnecting a line containing a disinfectant. There was pressure buildup in the line and when it was disconnected, the disinfectant sprayed her. She developed irritation on her skin, shortness of breath, and chest tightness. She sought medical assistance at an employee health clinic where they consulted with the poison center.

Retail

MI06115 – A male in his 20s was unloading a trailer while working for a department store when a box fell and broke open causing bleach to splash into his face and eyes. His developed redness, irritation, and tearing in his eyes and redness and swelling to his cheek and eye lids. He called EMS who transported him to the emergency department.

MI06119 – A female in her 60s was disinfecting with undiluted bleach while working at a produce market. She inhaled the fumes and developed shortness of breath, wheezing, and irritation in her throat. She called EMS who transported her to the emergency department.

MI06174 – A female in her 60s was working at a supermarket. Her job included using bleach to disinfect surfaces. She inhaled the fumes and became dizzy and vomited. She called EMS for medical assistance.

Services

MI06102 – A male maintenance worker in his 40s was exposed to a mixture of bleach and an acid-based disinfectant while cleaning the bathroom at his workplace. He developed shortness of breath and a cough. He sought medical advice from the poison center.

MI06131 – A female of unknown age was walking back to her vehicle after making a delivery for work when she walked by someone spraying a disinfectant and it misted into her face. She developed irritation to her face and throat. She sought medical advice from the poison center.

MI06090 – A 17-year-old female was working at a fast-food restaurant when she drank from a cup containing a disinfectant that she mistook for her drinking cup. She developed nausea and abdominal pain and sought medical assistance in the emergency department where they consulted with the poison center.

MI06100 – A female in her 50s was working as a bartender. Her job included disinfecting the bathroom with a peroxide-based disinfectant and bleach. She inhaled the fumes and developed a cough, trouble breathing, a burning sensation in her lungs, dizziness, and tearing of her eyes. She called EMS who transported her to the emergency department.

MI06105 – A male restaurant worker in his 70s was disinfecting a drain with bleach when he inhaled the fumes. He developed shortness of breath and a headache. He called EMS, but refused transportation to the hospital after EMS personnel assessed him.

MI06123 – A male in his 20s was working as a busser in a restaurant when he poured both bleach and an acid-based product down a drain in an attempt to unclog it. He inhaled the fumes and developed shortness of breath and wheezing. He sought medical assistance at an urgent care who then called EMS to transfer him to the emergency department.

MI06127 – A female in her 20s was working at a bed and breakfast. Her job included using disinfectants. She inhaled the fumes of a disinfectant and developed irritation to her throat, a cough, difficult breathing, a headache, and dizziness. When her symptoms did not subside by the next morning, her boss sought medical advice from the poison center.

MI06133 – A female in her 50s was working as a mail driver when she was exposed to a package that was leaking powdered bleach. The powder was picked up by the personal fan on her dashboard and blew the powder onto her face. She developed itching, burning, and redness to her face, arms, and neck. She called EMS who rinsed her face and arms with water.

Miscellaneous/Unknown

MI06170 – A female in her 20s was working in a kitchen where she used a disinfectant. The disinfectant came into contact with her hand and face. Her skin developed painful burns. She sought medical advice from the poison center.

MI06175 – A male in his 20s was using disinfectants at work when he mixed bleach with another disinfectant. He developed difficulty breathing, a sore throat, and chest tightness. When his symptoms did not subside after going outside for fresh air, he sought medical assistance in the emergency department.

Fungicide

Agriculture

MI06111 – A female in her 20s was working as a trimmer in a cannabis production facility when someone sprayed a fungicide outside the room in which she was working. She was exposed to the fumes and developed a cough, shortness of breath, and wheezing. When her symptoms did not subside two days later, she sought medical assistance in the emergency department where they consulted with the poison center.

Retail

MI06176 – A male in his 30s was working at a retail store for agricultural products when a light fixture exploded and started a pallet of fungicide on fire. He inhaled the smoke fumes and developed difficulty breathing, a cough, and irritation in his lungs and throat. He called EMS who transported him to the emergency department where they consulted with the poison center.

Multiple Pesticides

Agriculture

MI06099 – A male in his 50s was spraying an insecticide and fungicide on his farm when the spray misted back into his face. He developed a burning sensation and rash on his face as well as irritation to his throat. When his symptoms had not subsided nine hours later, he sought medical assistance in the emergency department where they consulted with the poison center.

MI06144 – A male in his 50s who works as a self-employed farmer was spraying his fields with a fungicide and insecticide. The products either got in his eyes from the spray or he had some on his hands and rubbed his eyes. He developed painful and watery eyes. He sought medical assistance in the emergency department, where they consulted the poison center and diagnosed him with chemical conjunctivitis of both eyes.

MI06091 – A female in her 40s was working in her commercial floral greenhouse when the neighboring rye farm field was being sprayed with an herbicide and an insecticide. She smelled a strong odor and developed a cough and irritation in her nose and throat. She sought medical advice from the poison center and Michigan Department of Agriculture and Rural Development to file a complaint. There were no violations identified as a result of the MDARD investigation.

MI06114 – A male in his 20s was working at a cannabis production facility when he was exposed to the aerosolized mist of a product used as a fungicide, bactericide, and algaecide. He developed nausea, dizziness, lightheadedness, and shortness of breath. He sought medical assistance in the emergency department where they consulted with the poison center.