Pesticide Illness and Injury Surveillance in Michigan 2022

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Pesticide Illness and Injury Surveillance in Michigan: 2022

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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 eighteenth 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). These 18 reports include 22 years of data.

From 2001 through 2022 there were 1,535 confirmed cases of occupational pesticide-related illnesses or injuries. Eighty of those confirmed cases were reported in 2022. The number of reported cases peaked in 2008. Disinfectants continued to be the cause of about half of the confirmed occupational cases (47% from 2001-2022) and were the cause of 50% of confirmed occupational cases in 2022. 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 2022, where activity of the exposed person was known, 38% of confirmed occupational cases were exposed to pesticides inadvertently while doing their regular work that did not involve applying pesticides. The two most common contributing factors for confirmed occupational cases were spills or splashes and mixing incompatible products. When occupation was known, the most common occupations were cleaning/housekeeping/janitorial and farming, comprising 20% and 15% of the confirmed cases in 2022, respectively.

From 2006 through 2022, there were 2,951 confirmed cases of non-occupational pesticide-related illnesses or injuries. Sixty-seven of those confirmed cases were reported in 2022.

In 2022, disinfectants accounted for 39% of confirmed non-occupational cases while insecticides accounted for 24%.

The activity of the exposed person was known for all confirmed non-occupational cases in 2022. Seventy-six percent of confirmed non-occupational cases occurred when the person involved was applying the pesticide themselves. ‘Bystander’ exposure was also important, with 15% 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, containing over 600 different active ingredients.

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

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), 2017) under the Sentinel Event Notification System for Occupational Risk (SENSOR) program. An analysis of 1998-99 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., 2004).

Agriculture is a major industry in Michigan with 52,194 farms, 80,000 farm operators and 77,000 hired workers. Hired workers include full time and migrant workers (US Department of Agriculture, 2017). There are 14,537 different pesticide products registered for sale and use in Michigan (MDARD, 2021). There are 6,731 privately certified agricultural pesticide applicators (number overlaps with farm operators/workers above), another 15,156 commercially certified applicators, 1,125 registered applicators and 2,050 businesses licensed to apply pesticides in Michigan (MDARD 2021; MDARD, 2022).

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. In 2006, non-occupational pesticide exposures were added to the surveillance system. 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 Control Center), 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, poison control 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.

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. 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).

Occupation and industry were coded using the NIOSH Industry and Occupation Computerized Coding System (NIOCCS) (NIOSH, 2012), which uses the 2002 Census Industry Codes and the 2002 Census Occupation Codes. Industry was then grouped into the NIOSH industry sectors (CDC, 2013).

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 2022, 4,486 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: Case Confirmation by Work-Relatedness, 2001-2022

Status	Occupational	Non-Occupational	Total
Definite Case	186	127	313
Probable Case	319	590	909
Possible Case	1005	2167	3172
Suspicious Case	25	67	92
Total	**1535**	**2951**	**4486**

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

Table 2: Confirmed Cases by Age Group & Gender, 2001-2022 and 2022 separately

	Cumulative			2022		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	9	15	1	0	0	0
01-02 (Toddlers)	52	72	0	1	2	0
03-05 (Preschool)	37	62	0	0	2	0
06-11 (Child)	95	63	0	0	0	0
12-17 (Youth)	87	95	1	0	2	0
18-64 (Adult)	1729	1587	0	61	59	0
65+ (Senior)	178	176	0	9	11	0
Unknown age	110	74	43	0	0	0
Total	**2297**	**2144**	**45**	**71**	**76**	**0**

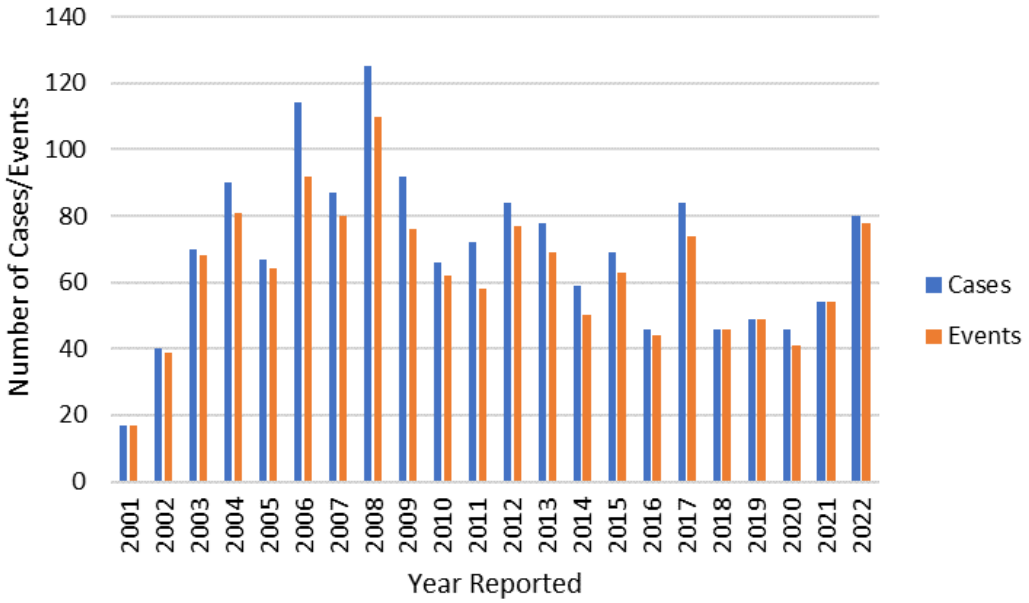
A male in his 20s was working as a pest control technician for a pest control company. As he was spraying for insects in the yard of a residential home, the insecticide blew back into his face and dripped into his eyes with his sweat. He developed eye irritation. He sought medical attention at his primary care physician who consulted with poison control.

A male in his 50s was cleaning his basement when he poured an acid followed by bleach into a drain. He developed shortness of breath, a cough, chest tightness, burning in his upper airway, wheezing, and nausea. He sought medical attention in the emergency department.

Section II. Occupational Pesticide Illnesses and Injuries

This section describes 1,535 confirmed occupational cases. In 2022, there were 80 cases from 78 events (Figure 1).

Figure 1: Confirmed Occupational Cases and Events by Year



People

Occupational pesticide cases occur in people of a wide variety of ages. In 2022, men (55.0%) were more likely to be confirmed occupational cases than women (45.0%) (Table 3).

Table 3: Confirmed Occupational Cases by Age Group & Gender, 2001-2022 & 2022 Separately

	Cumulative			2022		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
00-09	0	0	0	0	0	0
10-19	50	76	0	0	3	0
20-29	196	257	0	13	17	0
30-39	135	166	0	9	12	0
40-49	125	151	0	8	4	0
50-59	113	103	0	2	6	0
60-69	29	30	0	4	1	0
70-79	2	7	0	0	1	0
80+	0	0	0	0	0	0
Unknown	40	42	13	0	0	0
Total	**690**	**832**	**13**	**36**	**44**	**0**

In 2022, race was known for 60.0% of cases. When race was known, most cases (72.9%) were white and 22.9% were black. In 2022, ethnicity was known in 53.8% of the cases. When known, most (93.0%) were not Hispanic while 7.0% were Hispanic (Table 4).

Table 4: Confirmed Occupational Cases by Race and Ethnicity, 2001-2022 and 2022 Separately

	Cumulative			2022		
Race	**Hispanic**	**Not Hispanic**	**Unknown**	**Hispanic**	**Not Hispanic**	**Unknown**
Indigenous American	0	7	0	0	1	0
Asian/Pacific Islander	0	3	3	0	0	0
Black	0	68	36	0	8	3
White	27	546	128	1	30	4
Mixed	3	25	2	0	1	0
Other	6	0	1	0	0	0
Unknown	61	0	619	2	0	30
Total	**97**	**649**	**789**	**3**	**40**	**37**

Confirmed cases were identified in a wide variety of occupations. In 2022, the most common occupations were cleaners/housekeepers/janitors and farming with eleven and eight cases, respectively (Table 5). Sales and office and food preparation and service both had six cases. These four categories accounted for just over half (57.4%) of cases where the occupation was known.

Table 5: Confirmed Occupational Cases by Occupation, 2001-2022 and 2022 Separately

	Cumulative		2022	
Occupation	**Count**	**Percent**	**Count**	**Percent**
Cleaners/Housekeepers/Janitors	182	11.9%	11	13.8%
Farming	96	6.3%	8	10.0%
Sales and Office	96	6.3%	6	7.5%
Production and Transportation	94	6.1%	5	6.3%
Management, Professional, and Related	85	5.5%	4	5.0%
Healthcare	79	5.1%	4	5.0%
Food Preparation and Service	74	4.8%	6	7.5%
Pest Control Operators	67	4.4%	5	6.3%
Groundskeepers/Lawn Service	66	4.3%	1	1.3%
Protective Services	32	2.1%	0	0.0%
Personal Care and Service	31	2.0%	2	2.5%
Construction	30	2.0%	2	2.5%
Installation, Maintenance, and Repair	15	1.0%	0	0.0%
Military	2	0.1%	0	0.0%
Unknown	586	38.2%	26	32.5%
Total	**1535**	**100.0%**	**80**	**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 2022, followed by healthcare & social assistance (Table 6).

Table 6: Confirmed Occupational Cases by Industry Sector, 2001-2022 and 2022 Separately

	Cumulative		2022	
Industry Sector	**Count**	**Percent**	**Count**	**Percent**
Agriculture, Forestry, Fishing	166	10.8%	7	8.8%
Construction	45	2.9%	3	3.8%
Healthcare & Social Assistance	217	14.1%	10	12.5%
Manufacturing	88	5.7%	5	6.3%
Public Safety	28	1.8%	1	1.3%
Services (excluding Public Safety)	577	37.6%	23	28.8%
Transportation, Warehousing, Utilities	45	2.9%	2	2.5%
Wholesale & Retail Trade	118	7.7%	8	10.0%
Unknown	251	16.4%	21	26.3%
Total	**1535**	**100.0%**	**80**	**100.0%**

Most (53.8%) cases in 2022 were of low severity, 46.3% were moderate severity, and none were high severity.

A female in her 30s was working for a home health care service when she was cleaning a client's home with bleach. She began experiencing shortness of breath, a cough, and wheezing. She went to urgent care for medical attention. The day after the exposure, she was still experiencing symptoms, so she went to the emergency department for further medical attention where they diagnosed her with chemical pneumonitis.

Events

In 2022, when the person's activity at the time of exposure was known, most exposures (59.7%) occurred when a 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. Another 29 exposures (37.7%) happened to bystanders who were doing routine work, not related to the application.

In 2022, the most common pesticide exposure was to disinfectants (49.5%), followed by insecticides (14.3%) (Table 7). Some products contain more than one type of pesticide and some exposures involved more than one product, so the number of types listed is greater than the number of exposures.

A male in his 30s was working as a field technician for an extension unit of a university. He was in a potato field and exposed for about an hour to the mist of an herbicide that another worker was applying. He developed a headache, dry mouth, and dry and itchy eyes. He sought medical advice from poison control.

Table 7: Confirmed Occupational Cases by Pesticide Type, 2001- 2022 and 2022 Separately

	Cumulative		2022	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	785	47.1%	45	49.5%
Insecticide	391	23.4%	13	14.3%
Herbicide	201	12.1%	4	4.4%
Fungicide	54	3.2%	0	0.0%
Multiple types	64	3.8%	3	3.3%
Other	88	5.3%	2	2.2%
Unknown	85	5.1%	24	26.4%
Total	**1668**	**100.0%**	**91**	**100.0%**

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 2022, spill/splash of liquid or dust and mixing incompatible products were the most common contributing factors for occupational pesticide cases (Table 8).

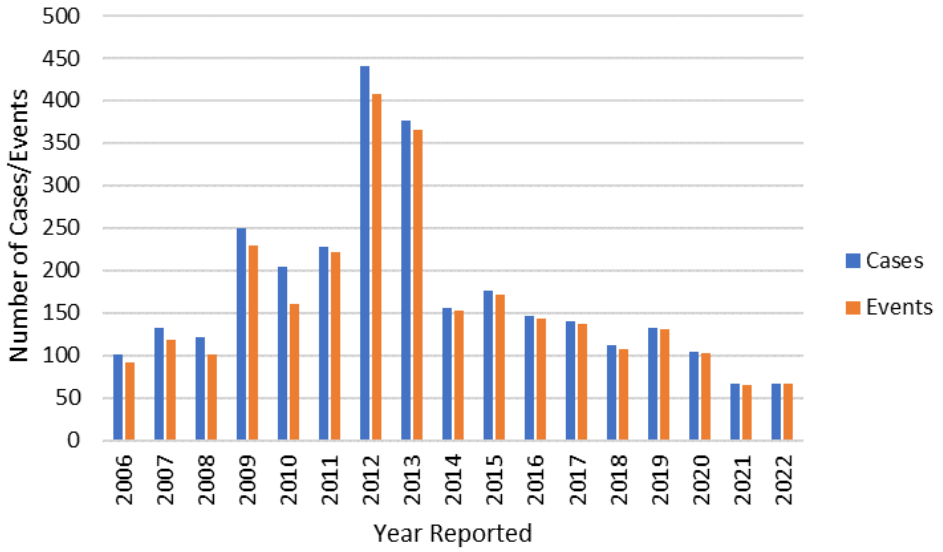
Table 8: Contributing Factors in Confirmed Occupational Cases, 2001-2022 & 2022 Separately

	Cumulative		2022	
Contributing Factor	**Cumulative**	**Percent**	**2022**	**Percent**
Spill / Splash of liquid or dust (not equipment failure)	417	21.2%	16	18.4%
Mixing incompatible products	215	10.9%	16	18.4%
Label violations not specified	134	6.8%	4	4.6%
No label violation identified but person still exposed / ill	118	6.0%	2	2.3%
Required eye protection not worn or inadequate	114	5.8%	2	2.3%
Application equipment failure	108	5.5%	2	2.3%
Excessive application	108	5.5%	10	11.5%
Decontamination not adequate or timely	106	5.4%	0	0.0%
Drift contributory factors	85	4.3%	3	3.4%
People were in the treated area during application	52	2.6%	5	5.7%
Required gloves not worn or inadequate	49	2.5%	2	2.3%
Notification / posting lacking or ineffective	45	2.3%	3	3.4%
Applicator not properly trained or supervised	43	2.2%	1	1.1%
Structure inadequately ventilated before re-entry	31	1.6%	2	2.3%
Within reach of child or other improper storage	29	1.5%	3	3.4%
Early re-entry	27	1.4%	0	0.0%
Required respirator not worn or inadequate	24	1.2%	1	1.1%
Other required PPE not worn or inadequate	13	0.7%	1	1.1%
Intentional harm	2	0.1%	1	1.1%
Illegal pesticide used / Illegal dumping	1	0.1%	0	0.0%
Other	73	3.7%	12	13.8%
Unknown	173	8.8%	1	1.1%
Total	**1967**	**100.0%**	**87**	**100.0%**

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 poison control 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 control center. There were 67 confirmed cases from 67 events entered into the database in 2022 (Figure 2). There were another 109 adults and 9 children (< 6 years of age) with confirmed non-occupational cases who had called the poison control center with two or more symptoms and the pesticide was known but had not seen a provider. 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 (both required for non-occupational case confirmation).

Figure 2: Confirmed Non-occupational Cases and Events by Year



A female in her 20s mixed an ammonia-based disinfectant with bleach to disinfect her bathroom at home. She developed dyspnea, wheezing, chest tightness, and tachycardia. She sought medical attention in the emergency department where she was diagnosed with chemical pneumonitis and prescribed a bronchodilator.

A female in her 50s was attempting to unclog a drain at home with a sodium hydroxide-based disinfectant. She then used a bleach to clean the sink and the two disinfectants reacted. She developed shortness of breath, wheezing, hypertension, and tachycardia. She brought herself to the emergency department for medical attention. She was treated and transported my EMS to another hospital for further care where she was admitted and stayed for six days.

People

Non-occupational pesticide cases occurred among people of all ages. In 2022, females (52.2%) were slightly more likely than males (47.8%) to have a non-occupational pesticide exposure (Table 9). Race and ethnicity data were rarely available for non-occupational cases.

Table 9: Confirmed Non-occupational Cases by Age Group & Gender, 2006-2022 & 2022 Separately

	Cumulative			2022		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	9	15	1	0	0	0
01-02 (Toddlers)	52	72	0	1	2	0
03-05 (Preschool)	37	62	0	0	2	0
06-11 (Child)	95	63	0	0	0	0
12-17 (Youth)	76	73	1	0	2	0
18-64 (Adult)	1098	838	0	27	17	0
65+ (Senior)	170	157	0	7	9	0
Unknown age	70	32	30	0	0	0
Total	**1607**	**1312**	**32**	**35**	**32**	**0**

Most (64.2%) non-occupational cases in 2022 were of moderate severity and 24 (35.8%) were low severity.

A 3-year-old boy was exposed to rodenticide pellets. It is unknown if the exposure was dermal or ingestion. He later developed eye fluttering, drooling, and fatigue. He was brought to the emergency department where they consulted with poison control.

Events

In 2022, most exposures (83.6%) 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. Another 14.9% happened to bystanders and 1.5% happened during application of a pesticide to a person (themselves or another).

A female in her 70s was adjusting the nozzle of an herbicide container while doing yard work at home when it sprayed into her face. She developed a rash, swelling, and pain to the exposed areas and hypertension. Two days after the exposure, symptoms were worsening, so she presented to the emergency department for medical attention where they consulted with poison control.

In 2022, the most common pesticide exposure was to insecticides and disinfectants (24.1% and 39.2%, respectively) (Table 10). Some products contain more than one type of pesticide and some exposures involved more than one product, so the number of types listed is greater than the number of exposures.

Table 10: Confirmed Non-occupational Cases by Pesticide Type, 2006-2022 & 2022 Separately

	Cumulative		2022	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	1179	37.8%	31	39.2%
Insecticide	997	32.0%	19	24.1%
Insect Repellent	217	7.0%	1	1.3%
Herbicide	212	6.8%	7	8.9%
Rodenticide	34	1.1%	3	3.8%
Fungicide	29	0.9%	1	1.3%
Multiple	213	6.8%	4	5.1%
Other	77	2.5%	0	0.0%
Unknown	159	5.1%	13	16.5%
Total	**3041**	**100.0%**	**75**	**100.0%**

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 2022, mixing incompatible products was the most common contributing factor for non-occupational pesticide cases, followed by product being improperly stored or within reach of a child and people were in the treated area during application (Table 11).

Table 11: Contributing Factors in Confirmed Non-occupational Cases, 2006-2022 & 2022

	Cumulative		2022	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Mixing incompatible products	494	14.7%	16	21.6%
Label violations not otherwise specified	441	13.2%	3	4.1%
Spill / Splash of liquid or dust (not equipment failure)	326	9.7%	7	9.5%
Excessive application	292	8.7%	8	10.8%
No label violation identified but person still exposed / ill	250	7.5%	4	5.4%
Within reach of child or other improper storage	241	7.2%	10	13.5%
People were in the treated area during application	165	4.9%	9	12.2%
Drift contributory factors	114	3.4%	2	2.7%
Structure inadequately ventilated before re-entry	106	3.2%	4	5.4%
Decontamination not adequate or timely	104	3.1%	1	1.4%
Early re-entry	96	2.9%	0	0.0%
Notification / posting lacking or ineffective	60	1.8%	0	0.0%
Application equipment failure	52	1.6%	1	1.4%
Required gloves not worn or inadequate	19	0.6%	2	2.7%
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%	1	1.4%
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	100	3.0%	5	6.8%
Not applicable	1	0.0%	0	0.0%
Total	**3353**	**100.0%**	**74**	**100.0%**

Outreach, Education, and Prevention Activities

Publications, Presentations, and Other Outreach 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 2022:

- Attended the 2022 SENSOR-Pesticides National Meeting in Washington, DC.

- The pesticide surveillance program coordinator provided case narratives to the MDARD Pesticide Advisory Committee (PAC) each quarter. Dr. Rosenman is a member of the PAC.

- 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.

- A press release about Poison Prevention Week was released in March by MSU. https://msutoday.msu.edu/news/2022/national-poison-prevention-week

- A press release about recreational water safety was released before Memorial Day by MDHHS.

- No exposures were reported to NIOSH from cases reported in 2022.

- One case was already being investigated by MIOSHA at time of intended reporting:

  A male in his 50s was exposed to a disinfectant while working as a nurse at a hospital. He developed a headache, cough, shortness of breath, and vomiting. He sought medical treatment in the emergency department of the hospital where he worked and was prescribed an oral steroid. The emergency department consulted with poison control. A few days later, he had hypertension, tachycardia, and extreme fatigue and was diagnosed with chemical pneumonitis.

- Two exposures were referred to MDARD from cases reported in 2022:

  A male in his 20s was working at a dairy farm when he went to investigate a problem with a hose and was sprayed in the face at high pressure with a disinfectant. He developed redness, a burning sensation, blisters and pain to his face, chest, and hands as well as swelling of his eyes and lips. He sought medical attention at the emergency department who consulted with poison control. This case was referred to MDARD; however, MDARD chose not to investigate.

A male in his 50s was working as a bus driver for a grade school. For two years, he had used an aerosol gun several times a day in his school bus to vaporize a disinfectant containing acetic acid. He was not trained to use the chemical or equipment. He developed wheezing, a cough, shortness of breath, chest tightness, and swelling in his legs. He sought medical attention several times in the emergency department and from his pulmonologist over the course of two years. This case was referred to MDARD for investigation. The investigation is ongoing.

- A MDARD investigation for one reported exposure in 2021, which was still ongoing when the 2021 annual report was released, has now been completed:

  An auto manufacturer contracted with a cleaning company to provide cleaning and disinfection. The cleaning company used the disinfectant in a fogger, which was not an allowable usage on the disinfectant label, and fogged areas where workers who were positive for COVID-19 had worked. The cleaning company ceased using the disinfectant in a fogger after MIOSHA conducted their inspection. The active ingredients of the disinfectant used were Didecyl dimethyl ammonium chloride (10.14%) and n-Alkyl (C14 50%, C12 40%, C16 10%) dimethyl benzyl ammonium chloride (6.76%).

  MIOSHA did not issue any citations pertaining to the fogger/respirator use as it was outside of their scope and referred the case to MDARD. MDARD sent the employer a warning letter for not using a pesticide in a manner consistent with its label (R285.637.4(a)). The label states that for spray applications to use a course droplet size. The atomizer used would have produced an extremely fine droplet size, which would've been easier to inhale.

Discussion

Surveillance Data

There were 80 confirmed occupational cases reported in 2022. This is consistent with the range from previous years of surveillance (17-125), and the average (70). The number of confirmed occupational cases peaked in 2008.

There were 67 confirmed non-occupational cases in 2022. This is lower than the range from previous years of surveillance (101-441) and lower than the average number of cases for those years (134). There was an increase in non-occupational cases in 2012 and 2013 because the coding of cases we reviewed from the poison control 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 control center were entered into the database.

The number and proportion of confirmed cases related to disinfectant exposures remained high and continued to be an area of ongoing concern. In 2022, 49.5% of occupational cases and 39.2% 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). In the wake of the COVID-19 pandemic, the use of disinfectants is widespread. The calls to the Michigan poison control 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 exposures in 2022, spill/splash of liquid or dust and mixing incompatible products were the most common factors for confirmed occupational cases (18.4% each), followed by excessive application (11.5%). The most common factors contributing to non-occupational exposures were mixing incompatible products (21.6%), followed by the product being improperly stored or within reach of a child (13.5%) and people being in the treated area during application (12.2%). Better education, storage and labeling might help to reduce the number of exposures.

Many confirmed cases in 2022 were “bystanders”, i.e., engaged in work or living activities not related to the pesticide application (37.7% of occupational cases and 14.9% of non-occupational cases when activity was known). Better education on safe pesticide application 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 2022, 50.0% of confirmed occupational cases and 52.2% of the non-occupational cases were reported by the State's poison control center.

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. PCC reports are received promptly from Michigan's poison control 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: www.cdc.gov/niosh/topics/pesticides/

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): www.michigan.gov/mdard/0,4610,7-125-1572_2875-8324--,00.html

Michigan State University's Pesticide Education Program: www.pested.msu.edu

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

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

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

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

Recognition and Management of Pesticide Poisonings, Sixth Edition: www2.epa.gov/pesticide-worker-safety/recognition-and-management-pesticide-poisonings

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 2 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 2.

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 2, 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.

Appendix II

Case Narratives, 2022 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2022. 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

Agriculture

MI05732 & MI05733– A female in her 40s and a male in his 20s were working in a greenhouse when they were exposed for about an hour to a mixture of two different insecticides that were being used to spray flowers. The female developed throat swelling and lost her voice. She called poison control and was advised to go to the emergency department. The male developed a cough and sought medical treatment in the emergency department.

MI05761 – A self-employed male farmer in his 30s dropped a jug of insecticides. Later, he went to pour from the jug not realizing the seal was broken and the insecticide spilled on his glove. He then touched his face and skin and developed a burning sensation. His wife contacted poison control for medical advice.

MI05793 – A male in his 30s was working on his family farm when an insecticide got on his hands and then he touched his face. His eyes became itchy, and he developed irritation on the skin around his eyes. He sought medical advice from poison control.

MI05800 – A male in his 20s was working for a cannabis farming company when he was mixing fertilizers. The liquid splashed up into his eye. He developed eye discomfort and sought medical care in the emergency department the next day where he was diagnosed with chemical conjunctivitis.

MI05819 – A male in his 20s was working on his family farm preparing to spray a field with a combination of herbicide and insecticide when the pump on the sprayer malfunctioned and sprayed him in the face. He developed a burning sensation in his eyes, hypertension, and nausea and he vomited. He called EMS who transported him to the emergency department.

Healthcare

MI05779 – A 29-week pregnant female in her 20s was working at a medical facility when she was exposed to fumes from an insecticide that was sprayed in the hallway. She developed coughing, throat irritation, vomiting, dizziness, a headache, abdominal cramping, and elevated blood pressure. She sought medical attention at an emergency department where they consulted with poison control.

Pest Control
MI05746 – A male in his 40s was working for a pest control company when an insecticide spilled in the cab of his truck. The insecticide got on his pants when he opened the door, and his face began tingling and burning. He sought advice from poison control.

MI05767 – A male in his 20s was sprayed in the face with an insecticide while doing pest control at work. He developed redness, irritation, and burns to his face. His mother called poison control for medical advice.

MI05777 – A male in his 20s was working as a pest control technician for a pest control company. As he was spraying for insects in the yard of a residential home, the insecticide blew back into his face and dripped into his eyes with his sweat. He developed eye irritation. He sought medical attention at his primary care physician who consulted with poison control.

MI05785 – A male pesticide applicator in his 20s was spraying an overhang with an insecticide when mist of the insecticide landed on him and in his mouth. He developed a headache, lightheadedness, and nausea. Two days after the exposure he vomited and sought medical advice from poison control.

MI05879 – A male in his 20s was working for a pesticide company where he drove a van with insecticides and rodenticides inside the cab to residential application sites. He began to develop difficulty breathing, a cough, and gastrointestinal issues that worsened over the course of a week. He sought medical attention from his primary care provider and sought further medical advice from poison control at the suggestion of his primary care provider.

Retail
MI05744 – A male in his 20s was stocking shelves at a grocery store when a can of insecticide sprayed into his eye. He was wearing glasses so much of the direct spray missed his eye. He developed pain in his eye and sought advice from poison control.

Services
MI05786 – A male in his 30s was working as an EMT when he was responding to a call for a woman that was not feeling well. When he arrived on scene there was a smell of an insecticide in the air that the woman had sprayed. He developed a cough, shortness of breath, a headache, irritation in his eyes, vomiting, and a sore throat. He sought medical care from the emergency department where they consulted with poison control.

MI05835 – A male in his 20s was working as an animal cremator. He sprayed himself with an insecticide for fleas and ticks every day for two weeks. He developed a headache, chest pain, and confusion and became lightheaded. He sought medical advice from poison control who advised him to go to the emergency department.

MI05836 – A female in her 30s was working at a recycling facility when a coworker sprayed an insecticide to fumigate for fleas. She developed shortness of breath, chest tightness, nausea,

fatigue, dizziness, and a headache. The day after the exposure, she sought medical care in the emergency department where they consulted with poison control.

MI05883 – A male in his 30s was working at an auto repair shop when he sprayed an insecticide and then touched his face. His lips and the skin around his right eye became swollen. He sought medical care in the emergency department.

Miscellaneous/unknown

MI05717 – A male in his 30s used an insecticide at work. His workplace and occupation are unknown. He developed a headache and dizziness and sought medical advice from poison control.

MI05762 – A male in his late teens was using an insecticide fogger at work when he developed a burning sensation to his exposed skin. He consulted poison control for medical advice.

MI05763 – A female in her 60s was spraying an insecticide outside and under a tent while at work. The mist blew back at her, and she developed tightness in her chest. She called poison control for medical advice.

MI05780 – A male in his 20s was working on the side of the road spraying an insecticide on a hornet's nest on a guardrail when the insecticide blew back into his face. It got in his mouth and face, and he developed a tingling sensation on his face. He sought medical advice from poison control.

MI05781 – A male in his 30s is self-employed and renovates houses. Over the past four months he set off many bug bombs in a house he was renovating. Two days after moving into the house he developed a headache, dizziness, confusion, and a metallic taste in his mouth. He can still smell the insecticide in the home. He sought medical advice from poison control.

MI05787 – A male in his 20s was spraying an insecticide at work when the insecticide got on his face. He developed a burning sensation, red spots on his face, and nausea. He sought advice from poison control.

Herbicides

Agriculture

MI05758 – A male in his 30s was working as a field technician for an extension unit of a university. He was in a potato field and exposed for about an hour to the mist of an herbicide that another worker was applying. He developed a headache, dry mouth, and dry and itchy eyes. He sought medical advice from poison control.

MI05775 – A male in his late teens was spraying an herbicide on his family farm when the herbicide got in his eyes. He developed redness, excessive tearing, and an itchy sensation in his eyes. The next day he visited his family doctor who consulted with poison control.

MI05892 & MI05893 – A male in his 70s owns and operates a composting company neighboring a farm field. The neighboring farmer sprayed the soil of the field with two different herbicides when the composting owner was 60 ft away on his tractor. The composting owner felt mist from the spray on his skin and began feeling dizzy and confused. A male of an unknown age who works at the composting company was outside during the application. He developed nausea and vomiting and sought medical care from his primary care physician. The owner of the composting company contacted MDARD for an investigation but did not receive medical attention.

Landscaping

MI05784 – A male in his 30s was working as a landscaper when he was mowing grass that was sprayed with an herbicide. He developed a rash on his chin and forearm. He sought medical advice from poison control.

MI05806 – A male in his 30s was working as a landscaper for a commercial landscaping company when he was applying an herbicide to a lawn. The herbicide splashed into his eye and his eye became irritated and he lost vision in the eye. He sought medical treatment at an occupational medicine clinic who referred him to the emergency department.

Miscellaneous/unknown

MI05757 – A male in his 20s was at work when an herbicide was sprayed on his head. He developed dizziness and a headache. He sought medical advice from poison control.

MI05766 – A male in his 60s touched his eye after handling an herbicide at work. His eye developed redness and he was unable to see clearly. The day after the exposure, he sought medical care at an urgent care facility who consulted with poison control.

MI05894 & MI05895 – Two males in their 60s were working for an electric company conducting pre-design work for a solar panel project when the farmer of the field applied two herbicides to the field. The boom was lifted over the electric company workers as it was spraying. Both workers developed a headache and tingling sensation on their lips but did not receive medical attention. The health and safety director of the electric company contacted MDARD for an investigation.

<u>Disinfectants</u>

Agriculture

MI05727 – A male in his 20s was working at a dairy farm when he went to investigate a problem with a hose and was sprayed in the face at high pressure with a disinfectant chemical. He developed redness, a burning sensation, blisters and pain to his face, chest, and hands as well as swelling of his eyes and lips. He sought medical attention at the emergency department who consulted with poison control.

MI05751 – A male in his 20s was working as a cannabis technician in a cannabis grow facility when a co-worker dumped an undiluted disinfectant down the sink, which splashed on the

technician's leg. He developed a painful burning sensation and blisters and sought medical attention in the emergency department four days after the exposure.

Cleaner/housekeeper/janitor/custodian

MI05705 – A female in her 60s was working for a commercial cleaning company when she was exposed to a disinfectant used in a fogger. The fogger was used in areas where workers who were found positive for COVID-19 may have been. Her first exposure was in April 2020. She was exposed daily and a year and a half later she developed fatigue, a cough, shortness of breath, and chest tightness. She sought medical attention in the emergency department. She continues to be on sick leave. This case was referred to MDARD. MDARD sent the employer a warning letter for not using a pesticide in a manner consistent with its label (R285.637.4(a)). The label states that for spray applications to use a course droplet size. The atomizer used would have produced an extremely fine droplet size, which would've been easier to inhale. This was a 2021 case with an ongoing investigation when the 2021 annual report was published.

MI05737 – A female in her 60s works as a custodian for a commercial cleaning company where she cleans a bank. She was cleaning with aerosol disinfectants and developed a bad taste in her mouth and diarrhea. She contacted poison control for advice and sought medical attention at an urgent care.

MI05818 – A male in his 50s was working for the state as a custodian when a contracted cleaning company released a COVID-19 disinfectant fogger while he was still in the office. It took him approximately five minutes to get out of the office. Early the next morning he began coughing and having shortness of breath and constant sweating. He sought medical attention in the occupational clinic where they called EMS to transport him to the hospital.

MI05838 – A female in her 30s was working for her friend who cleans homes when she was cleaning a bathroom. She sprayed bleach on the toilet and before she wiped it, she applied an ammonia-based toilet bowl disinfectant in the toilet. She developed a cough, shortness of breath, chest pain, wheezing, hypoxia, and tachypnea. She sought medical attention at urgent care and was then transported to the emergency department via EMS.

MI05858 – A female in her 60s was working as a cleaner in residential homes when she accidentally drank from a bottle containing a disinfectant. She developed throat irritation and called poison control for advice.

MI05866 – A male in his 60s was using bleach to disinfect the bathrooms at the community center where he worked when he became dizzy, sweaty, and fainted. He called EMS who transported him to the emergency department.

MI05872 – A male in his 40s was working as a custodian when he sprayed a table with disinfectant and the spray splashed back into his eye. He developed pain, redness, and excessive tearing in his eye. He sought medical attention from the emergency department where they consulted with poison control.

MI05874 – A female in her 20s was working as a custodian for an injection molding company when she inhaled fumes from toilet bowl cleaner. She developed a tight and burning sensation in her nose and throat, shortness of breath, and nausea. She called poison control for advice and left work. Her shortness of breath got worse on her way home from work, and she called EMS who transported her to the emergency department.

Construction

MI05792 – A 19-year-old male was working for a roofing company when a disinfectant was spilled on his neck, eyes, and right ear. He developed a burning sensation on his exposed skin. He was evaluated by EMS but refused transportation and further care.

Healthcare

MI05724 – A female in her 20s was working as a housekeeper at a hospital using a disinfectant to clean. The disinfectant penetrated her glove and contacted the palm of her hand. Her palm turned white and began itching. She sought medical attention in the hospital's occupational health unit.

MI05726 – A female in her 20s was working as a housekeeper in a hospital when she was mopping the floor of an operating room with a disinfectant. She developed redness, a rash, and itching on her arms and neck. She sought medical attention in the hospital where she works.

MI05731 – A male in his 50s was exposed to disinfectant fumes while working as a nurse at a hospital. He developed a headache, cough, shortness of breath, and vomiting. He sought medical treatment in the emergency department of the hospital where he works and was prescribed an oral steroid. The emergency department consulted with poison control. A few days later, he developed hypertension, tachycardia, and extreme fatigue and was diagnosed with chemical pneumonitis.

MI05754 – A female in her 60s was working in housekeeping at a hospital when she developed wheezing, a cough, and shortness of breath. She had been exposed to multiple disinfectants over several years starting in 1995. She sought medical care from a pulmonologist and was prescribed a bronchodilator and diagnosed with asthma in 2021.

MI05756 – A male in his 30s was working as a pharmacy technician at a hospital when his glove tore, and he was exposed to a disinfectant on his hands. His fingers developed a burning sensation and turned white. He sought medical attention in the emergency department of the hospital where he works. The emergency department consulted with poison control.

MI05834 – A female in her 20s was working as a certified nursing assistant at a senior living facility when she was disinfecting a bathtub. The disinfectant splashed into her eye. She developed eye irritation and sought medical advice from poison control.

MI05855 & MI05856 – Two females in their 20s were working at a hospital when the ceiling started leaking and eventually caved in. They believe the leaking water was sewer water. The cleaning crew came in and began using bleach to clean the water. Both women developed shortness of breath, fatigue, a headache, and light-headedness, and one woman also developed nausea. They went to the emergency department of the hospital where they worked to seek medical attention.

MI05859 – A female in her 30s was working as a technician in a dialysis unit when she was cleaning with bleach. She got blood on her hands and cleaned the blood off her hands with hydrogen peroxide. She developed a burning sensation in both of her hands. Her co-worker called poison control for advice.

MI05882 – A female in her 30s was working for a home health care service when she was cleaning a client's home with bleach. She began experiencing shortness of breath, a cough, and wheezing. She went to urgent care for medical attention. The day after the exposure, she was still experiencing symptoms, so she went to the emergency department for further medical attention where they diagnosed her with chemical pneumonitis.

Office and sales

MI05735 – A male in his 20s was working at a car dealership where he cleaned mold with bleach that was diluted 1:1. He developed trouble breathing, a cough, throat irritation, and chest pain. The next morning, he sought medical attention in the emergency department where he was diagnosed with acute chemical pneumonitis. He was prescribed an oral steroid and an antibiotic.

MI05736 – A female in her 30s was working in an office when an office cleaner mixed bleach with an ammonium product to clean the floors. She was exposed to this mixture for about an hour. She developed chest tightness, throat irritation, a headache, a cough, and her lips and tongue began tingling. She sought advice from poison control.

MI05750 – A female in her 30s was working as an office manager when she was disinfecting surfaces with three separate disinfectants. She did not mix the chemicals but used them consecutively for seven hours. She believes the bleach was not properly diluted. She developed a burning sensation in her eyes, a cough, a runny nose, trouble breathing, and throat irritation. She called poison control who advised she seek medical attention in the emergency department. By the time she arrived at the emergency department she developed confusion, shortness of breath, a headache, and vomited. She was prescribed a bronchodilator.

Manufacturing

MI05765 – A female in her 20s, who worked at a food manufacturer, was rinsing a disinfectant out of a bucket when the disinfectant splashed into her eyes. She developed a burning sensation in her eyes, swelling in her eyelids, excessive tearing, and foggy vision. She sought medical care at an urgent care facility two days after the exposure and in the emergency

department four days after the exposure. She was found to be hypertensive in the emergency department.

MI05840 – A male in his 30s who works for a boat manufacturer was attempting to disinfect a garbage can at work. He mixed bleach and an ammonia-based disinfectant in the garbage can. He developed shortness of breath, a cough, wheezing, hypoxia, and began sweating. He sought medical care at the emergency department where they consulted with poison control.

Retail

MI05753 – A female in her 50s was working for a convenience store when she was carrying a box full of bottles of bleach. She dropped the box and bleach splashed into her eye. She developed a painful burning sensation in her eye. She sought medical care in the emergency department where she was diagnosed with a chemical burn of her right conjunctiva.

MI05809 – A female in her 40s was working at a drug store when a coworker sprayed an aerosol disinfectant into the air. She developed shortness of breath and wheezing and called EMS who transported her to the emergency department.

MI05813 – A female in her 40s was working as a checkout clerk at a grocery store when she touched bleach, which triggered an allergic reaction. She developed redness in her face and nausea and began feeling shaky and weak. She self-administered her EPI pen and called EMS. She refused transport from EMS but said she would follow up at the emergency department of a local hospital.

MI05815 – A male in his 40s was in the employee break room of a grocery store where he worked when his coworker was disinfecting with bleach. He has a known sensitivity to bleach and developed difficulty breathing and a cough. He called EMS who transported him to the emergency department.

MI05817 – A male in his 20s was stocking bleach onto shelves at a retail supermarket when he started to smell the bleach. He began having chest pain and feeling nauseous and dizzy. He called EMS who transported him to the emergency department.

MI05881 – A female in her 20s was working at a restaurant when she was washing dishes with an ammonia-based detergent for several hours. She was not wearing gloves and started to develop redness and a burning sensation on both of her hands. She sought medical attention in the emergency department where they consulted with poison control.

Services

MI05722 – A male in his 50s was working as a professor at a college when he was exposed to bleach fumes. He is allergic to bleach, but there were no posted signs of bleach allergy in the building. A co-worker with no knowledge of the bleach allergy used bleach to clean up after a dissection laboratory. He began sweating and developed hand tingling, hives, and skin redness.

He is known to have an anaphylactic allergy to bleach. He sought advice from his allergist and medical treatment in the emergency department.

MI05725 – A female in her 40s was working as a teacher when she sat on the school toilet that had recently been disinfected. Her legs began to burn and develop redness. She sought medical attention at an occupational health clinic where they consulted with poison control.

MI05734 – A female in her late teens was working at a fast-food restaurant when she was exposed for approximately five hours to a mixture of sanitizer, detergent, degreaser, and peroxide. She developed a cough, difficulty breathing, a rash on both arms, vomiting, congestion, a headache, and a fever. Three days after the exposure she sought medical treatment in the emergency department where she was diagnosed with chemical pneumonitis.

MI05741 – A male in his late teens, who was working as a dishwasher was exposed to a sink and surface sanitizer that got on his skin due to an equipment failure. He developed a rash, redness, and irritation in the area where he was exposed. He sought medical treatment the next day in the emergency department where they consulted with poison control.

MI05743 – A male in his 50s was cleaning out a well with a mixture of muriatic acid and bleach while working as a plumber for a well drilling contractor. The mixture exploded and he developed facial swelling as well as burns, redness, and a rash on his face, chest, and abdomen. He sought medical attention in the emergency department.

MI05745 – A male in his 40s was working at a car wash where periodically throughout the day he got bleach in his eye. He developed cloudy vision and redness in his eyes. He sought advice from poison control.

MI05764 – A female in her 20s who works as a manager at a restaurant poured a sanitizer into another bottle not knowing there was a different sanitizer in the bottle and the mixture exploded. She inhaled fumes of the mixture and developed shortness of breath, a cough, and wheezing. She sought medical care in the emergency department where they consulted with poison control.

MI05799 – A male in his 30s was working as a city employee when he was treating the city pool with chlorine tablets. He was exposed to the dusts from the bag of tablets and developed shortness of breath and coughing. He sought medical care from emergency medical services who transferred him to the emergency department for further care.

MI05804 – An 18-year-old male was working in a restaurant when he was disinfecting a cutting board with bleach. The bleach splashed in his eye and his eye became irritated. He sought medical treatment in the emergency department.

MI05805 – A female in her 20s was using several different chemicals to disinfectant dorm rooms at a university for seasonal work. She did not mix the disinfectants but did use the same sponge for disinfecting. She developed dizziness, light-headedness, and vomiting. The next day,

she vomited again and developed chills and a non-productive cough and called an ambulance for transport to the emergency department.

MI05808 – A male in his 20s was working for a shipping and delivery company when he dropped a box containing a dog kennel disinfectant. The box broke and the disinfectant sprayed out into his face. He developed difficulty breathing, a sensation of his throat closing, dermal irritation, and a swollen eye. He sought medical attention in the emergency department where they consulted with poison control for advice.

MI05810 – A male in his 30s was working as a cook at a fast-food restaurant when he mixed bleached and ammonia products to disinfect surfaces at work. He developed shortness of breath, nausea, diarrhea, and abdominal pain. He called EMS when the symptoms persisted for a few days, and they transported him to the emergency department.

MI05811 – A male in his 30s was working at a hotel when he mixed bleach and an ammonia-based product to disinfect the bathrooms. He developed shortness of breath, throat irritation, and coughing and called EMS who transported him to the emergency department.

MI05812 – A female in her 30s was working at a restaurant when she mixed bleach and an acid-based disinfectant to clean the grill. She developed coughing, a burning sensation in her chest, and difficulty breathing. She called EMS who transported her to the emergency department.

MI05814 – A female in her 40s was working for county social services when the custodian was disinfecting her office with bleach and two acid-based disinfectant products. She developed a headache, shortness of breath, and a burning sensation in her throat. She called EMS who transported her to the emergency department.

MI05820 – A female in her 30s was working in an adult foster care home when she was refilling her disinfectant chemicals and bleach spilled on the floor. She began coughing and developed a burning feeling in her chest. She called EMS for medical attention, but her symptoms began to subside as EMS arrived and she refused transport to the emergency department.

MI05825 – A female in her 40s was working as a caregiver for her disabled child when she was cleaning the bathroom with bleach. She developed shortness of breath, coughing, wheezing, chest tightness, and tachycardia. She called EMS who transported her to the emergency department.

MI05857 – A female in her 60s was working as a cafeteria worker for an elementary school when she mixed dishwashing detergent with bleach to disinfect lunch tables. She was unaware the bucket she used to mix had hydrated lime in it. She began wiping lunch tables when she developed a headache, shortness of breath, and nose and throat irritation. She sought medical attention in the emergency department where they consulted with poison control.

MI05870 – A female in her 40s was working as a cafeteria worker in an elementary school when she mixed bleach and ethanol to clean mold in the freezer. She developed difficulty breathing and chest pain and called EMS for medical attention. She began feeling better when EMS arrived and refused transport to the emergency department. A couple days later she was seen at workplace health for continued shortness of breath.

MI05878 – A male in his 20s was working as a dishwasher at a restaurant when he was disinfecting an ice chest with bleach and then ammonia using one product after the other. He developed shortness of breath, chest pain, a cough, a sore throat, body aches, a headache, confusion, tachycardia, and hypertension. He sought medical attention in the emergency department.

MI05885 – A male in his 50s was working as a bus driver for a grade school when he used an aerosol gun to vaporize a chemical containing acetic acid several times a day for two years. He was not trained to use the chemical or equipment. He developed wheezing, a cough, shortness of breath, chest tightness, and swelling in his legs. He sought medical attention several times in the emergency department and from his pulmonologist over the course of two years. This case was referred to MDARD for investigation.

Miscellaneous/unknown

MI05728 – A male in his 20s accidentally ingested bleach from an unlabeled water bottle at work. He developed a burning sensation in his throat, vomiting, and diarrhea. His girlfriend called poison control the next day for advice.

MI05738 – A female in her 30s was cleaning at work with two different disinfectants. It is unknown if the disinfectants were mixed or used separately. She was exposed to the fumes while cleaning for 5 hours and developed shortness of breath, a burning sensation in her eyes, vomiting, confusion, and body chills. She called poison control and sought medical attention in the emergency department at the advice of poison control.

MI05742 – A male in his 30s was cleaning equipment at work with a spray solution of soap and bleach when the mixture splashed in his eye. He developed blurred vision and his eye developed redness, pain, discharge, and swelling. He sought medical attention in the emergency department.

MI05807 – A female in her 30s was at her job when a co-worker used a non-diluted bleach to disinfect the floors. She developed shortness of breath, a cough, a headache, and light-headedness. She sought medical treatment in the emergency department.

MI05816 – A female in her 50s was using bleach while working at a school. She developed shortness of breath and called EMS. Her breathing improved when EMS arrived, and she refused transportation to the emergency department.

MI05852 – A female in her 20s was at work when she dropped towels into a bucket filled with a disinfectant used to sanitize soda fountain machines and the disinfectant splashed up into her eye. She developed pain, inflammation, redness, and tearing in her eye. Her vision in the exposed eye was also blurred. Hours after the exposure, her symptoms had not subsided, so she sought medical attention in the emergency department where they consulted with poison control.

MI05869 – A male in his 30s was at work when a coworker mixed bleach with an acid-based disinfectant in a bucket of mop water. He used the mixture to mop and poured out the bucket. He began experiencing shortness of breath and chest pain. He sought medical advice from poison control.

MI05871 – A male in his 20s was mopping the floors at work with a disinfectant when the chemical splashed back into his eye. He began experiencing pain in his eye and blurry vision. He sought medical attention in the emergency department.

MI05884 – A female in her 30s was using bleach to wash dishes while at work when she developed shortness of breath, chest pain, wheezing, dizziness, swelling in her hands, and tingling in her face. Her co-workers called EMS who transported her to the emergency department for medical care.

Fungicide

Agriculture

MI05719 – A female in her 60s was working outside at her cut flower business when a cherry farm field adjacent to her business was sprayed with multiple fungicides. She felt the mist on her skin and in her eye but had no symptoms. She filed a complaint with MDARD.

MI05760 – A female in her 40s was working at a cannabis growing facility when she was exposed to the fumes of a broad-spectrum fungicide, bactericide, and algaecide. She walked into the grow room as the chemical was being sprayed. She developed shortness of breath, dizziness, and shaking. She sought medical advice from poison control.

Services

MI05759 – A male in his 30s was working as a laborer for a crawlspace remediation company when he was exposed to a mold stain remover while working in a crawlspace. His mask did not have the appropriate filter for the chemical being used. He developed a productive cough, shortness of breath, a burning sensation in his throat, and nauseousness. He sought medical attention in the emergency department the next day where he was diagnosed with chemical pneumonitis and prescribed a bronchodilator.

Unknown Pesticide

Cleaner/housekeeper/janitor/custodian

MI05721 – A male in his 50s was working for a floor and window cleaning company when he was exposed to an unknown pesticide believed to be in the carpet that he was cleaning. He

developed a burning sensation in his eyes and nose, a chemical taste in his mouth, chest pain, shortness of breath, and he vomited. He sought medical attention in the emergency department.