Pesticide Illness and Injury Surveillance in Michigan 2019

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Pesticide Illness and Injury Surveillance in Michigan: 2019

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Contents

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 do public health surveillance for work-related conditions (PA 368 of 1978, Part 56, as amended) and chemical poisoning (R325.71-R325.75). This is the fifteenth report on pesticide-related illnesses and injuries in Michigan (2001–03, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015–16, 2017–18, 2019) including 19 years of data.

From 2001 through 2019 there were 1,358 confirmed cases of occupational pesticide-related illnesses or injuries. Forty-seven of those confirmed cases were reported in 2019. The number of reported cases peaked in 2008. Disinfectants continued to be the cause of almost half of all the confirmed occupational cases (49 percent from 2001–2019) and were the cause of 56 percent of confirmed occupational cases in 2019. It is likely that some of these cases would not have occurred if personal protective equipment had been worn.

In 2019, where activity of the exposed person was known, 24 percent of confirmed occupational cases were exposed to pesticides inadvertently while doing their regular work that did not involve applying pesticides. The most common contributing factor for confirmed occupational cases was a spill or splash of liquid or dust. The most common occupations were farming, healthcare, and cleaning/housekeeping/janitorial, each comprising 13 percent of the confirmed cases in 2019.

From 2006 through 2019, there were 2,712 confirmed cases of non-occupational pesticide-related illnesses or injuries. One hundred thirty of those confirmed cases were reported in 2019.

In 2019, insecticides accounted for 26 percent of confirmed non-occupational cases while disinfectants accounted for 22 percent.

Where activity of the exposed person was known, 59 percent of confirmed non-occupational cases were involved in applying the pesticide themselves. ‘Bystander’ exposure was also important, with 41 percent exposed inadvertently while doing activities not involved in the application of pesticides.

Two events were reported to the National Institute for Occupational Safety and Health (NIOSH) and the Environmental Protection Agency (EPA). Five events were referred to the Michigan Department of Agriculture and Rural Development (MDARD) and one to the Michigan Occupational Safety and Health Administration (MIOSHA). These events are described on pages 13–14.

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 (not disinfectant) pesticides were used in the United States in 2012, the last year of published data.[1]

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

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.

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[2] 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 the second largest income producing industry in Michigan and pesticide use is widespread in this industry. Currently there are more than 16,000 different pesticides registered for sale and use in Michigan. There are more than 2,000 businesses licensed to apply pesticides and approximately 22,000 certified applicators in Michigan.

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 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.

[1] https://www.epa.gov/sites/production/files/2017-01/documents/pesticides-industry-sales-usage-2016_0.pdf
[2] http://www.cdc.gov/niosh/topics/pesticides/

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 on only non-occupational cases who saw a medical provider were included in the surveillance system.

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 reports are not followed up on, 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. The possible classifications are definite, probable, possible, suspicious, unlikely, insufficient information, exposed but asymptomatic, or unrelated (Appendix I, page 3). Cases classified as definite, probable, possible, or suspicious (DPPS) are included in all data analyses. For simplicity, we refer to them as confirmed cases.

Confirmed cases are evaluated regarding the severity of the health effect: low, moderate, high and 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.[3]

Occupation and industry were coded using the NIOSH Industry and Occupation Computerized Coding System (NIOCCS).[4] The industry and occupation were determined based on the 2002 Census Industry Codes and the 2002 Census Occupation Codes. Industry was then categorized based on NIOSH industry sectors.[5]

Practices where workers or the general public may be at risk are identified. When appropriate, referrals are made to two other state agencies with regulatory responsibility for worker health and/or pesticide use: the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Opportunity (LEO) and MDARD.

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

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

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.

With prompt reporting of these events by states involved in pesticide illness and injury surveillance, NIOSH can refer cases to the EPA as needed, identify clusters across states, and identify the need for national level interventions.

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

A farm maintenance worker in his 40s was exposed to an herbicide. The herbicide was being stored in the shop and someone mistakenly sliced open the container causing a spill on the floor, which was not cleaned up. A week later he and a coworker were letting air out of tires and that caused dust in the shop to be stirred up onto his face. He became dizzy and his face was numb and tingling. He went to an emergency department.

[3] http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf
[4] https://wwwn.cdc.gov/nioccs3/SingleCoding.aspx
[5] http://www.cdc.gov/nora/sectorapproach.html

Results

Section I. All Reports

From 2001 through 2019, 4,070 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, 2001–2019

Status	Occupational	Non-Occupational	Total
Definite Case	131	53	184
Probable Case	311	573	884
Possible Case	896	2,021	2,917
Suspicious Case	20	65	85
Total	**1,358**	**2,712**	**4,070**

A pest control operator in his 60s sprayed lawns with three insecticides. He wore goggles but no respiratory protection. Some sprayed on his arms and face, which he wiped off, and he also may have inhaled the spray. After dinner he became unresponsive, sweaty, had a stomachache, and low blood pressure. EMS was called and he was taken to an emergency department and admitted to the hospital.

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

Table 2: Confirmed Cases by Age Group and Gender

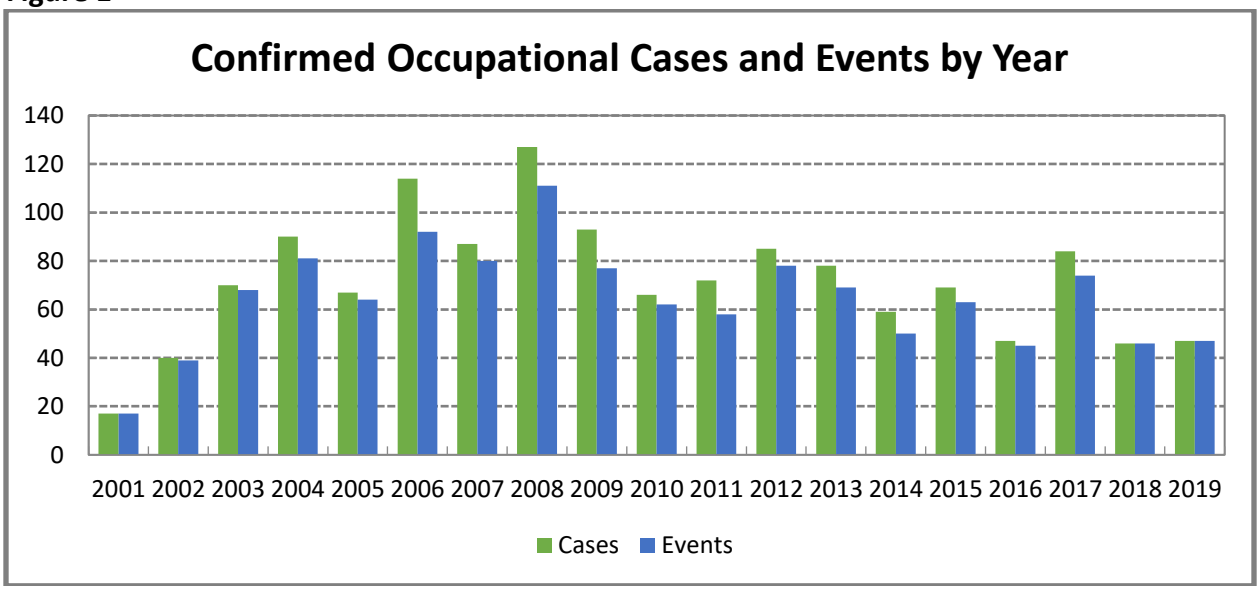
	Cumulative			2019		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	7	14	1	0	2	0
1–-2 (Toddlers)	50	66	0	4	5	0
3–5 (Preschool)	37	57	0	1	3	0
6–11 (Child)	91	64	0	6	1	0
12–-17 (Youth)	86	90	1	1	5	0
18–64 (Adult)	1547	1431	1	73	49	1
65+ (Seniors)	156	143	1	8	13	1
Unknown age	110	74	43	3	1	0
Total	**2084**	**1939**	**47**	**96**	**79**	**2**

A construction worker in his 20s was working on a municipal water line and carrying a bucket of sodium hypochlorite. He tripped and some of the disinfectant splashed in his left eye and ear. He developed eye pain, tearing, blurred vision and light sensitivity. He went to an emergency department and had five follow-up visits with an ophthalmologist. He had a corneal abrasion, edema, a dilated pupil, sloughing of the epithelium, and ear irritation.

Section II. Occupational Pesticide Illnesses and Injuries

This section describes the 1,358 confirmed occupational cases. There were 47 cases from 47 events in 2019 (Figure 1).

Figure 1



People

Occupational pesticide cases occur in people of a wide variety of ages. In 2019, women were more likely to be confirmed occupational cases than men (60 percent vs. 40 percent) (Table 3).

Table 3: Confirmed Occupational Cases by Age Group and Gender

	Cumulative 2001–19			2019		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
10-19	46	73	0	0	4	0
20-29	171	224	0	9	3	0
30-39	116	146	0	7	2	0
40-49	114	135	0	3	5	0
50-59	99	87	0	5	3	0
60-69	18	25	0	2	2	0
70-79	2	6	0	0	0	0
80+	1	0	0	0	0	0
Unknown	40	42	13	2	0	0
Total	**607**	**738**	**13**	**28**	**19**	**0**

A worker in his teens was sprayed in the eye with an insecticide. His eye became red and irritated. His coworker called poison control.

In 2019, race was unknown for 43 percent of cases; when race was known most cases (78 percent) were white, while 11 percent were black, 7 percent were mixed or other, and 4

percent were Asian. In 2019, ethnicity was unknown 49 percent of the time. When known, most (96 percent) were Not Hispanic while 4 percent were Hispanic (Table 4).

Table 4: Confirmed Occupational Cases by Race and Ethnicity

	Cumulative 2001–19			2019		
Race	**Hispanic**	**Not Hispanic**	**Unknown**	**Hispanic**	**Not Hispanic**	**Unknown**
American Indian/Alaskan	0	6	0	0	0	0
Asian/Pacific Islander	0	3	3	0	1	0
Black	0	52	32	0	2	1
White	21	483	120	0	19	2
Mixed	3	24	2	1	1	0
Other	5	0	1	0	0	0
Unknown	57	0	546	0	0	20
Total	**86**	**568**	**704**	**1**	**23**	**23**

Confirmed cases were identified in a wide variety of occupations. In 2019, the most common occupations were cleaners/housekeepers/janitors, farming, and healthcare with six cases each (Table 5). These accounted for over half (55 percent) of exposures where the occupation was known.

Table 5: Confirmed Occupational Cases by Occupation

	Cumulative 2001–19		2019	
Occupation	**Count**	**Percent**	**Count**	**Percent**
Cleaners/housekeepers/janitors	150	11.0%	6	12.8%
Sales and office	85	6.3%	0	0.0%
Production and transportation	83	6.1%	3	6.4%
Farming	82	6.0%	6	12.8%
Management, professional, and related occupations	80	5.9%	3	6.4%
Healthcare	69	5.1%	6	12.8%
Food preparation and service	64	4.7%	4	8.5%
Pest control operators	59	4.3%	3	6.4%
Groundskeepers/lawn service	54	4.0%	1	2.1%
Protective services	32	2.4%	0	0.0%
Personal care	26	1.9%	0	0.0%
Construction	23	1.7%	1	2.1%
Installation, maintenance, and repair	14	1.0%	0	0.0%
Armed forces	2	0.1%	0	0.0%
Unknown	535	39.4%	14	29.8%
Total	1358	100.0%	47	100.0%

A farmer in his 50s had a bug fly into his eye while he was driving to the field, which irritated his eye. At the field he mixed a fungicide, which got on his finger. He later rubbed his eye. His eye became painful, red, teared, and was swollen. He went to an emergency department.

Confirmed cases were identified in a wide variety of industries. 'Services' includes 'Accommodation and Food Services' as well as 'Building Services'. It was the most common sector in 2019, followed by Agriculture (Table 6).

Table 6: Confirmed Occupational Cases by Industry Sector

	Cumulative 2001–19		2019	
Industry Sector	**Count**	**Percent**	**Count**	**Percent**
Services (excluding Public Safety)	533	39.2%	15	31.9%
Healthcare & Social Assistance	192	14.1%	8	17.0%
Agriculture, Forestry, Fishing	154	11.3%	10	21.3%
Wholesale & Retail Trade	107	7.9%	2	4.3%
Manufacturing	78	5.7%	0	0.0%
Transportation, Warehousing, Utilities	40	2.9%	0	0.0%
Construction	38	2.8%	2	4.3%
Public Safety	24	1.8%	1	2.1%
Unknown	192	14.1%	9	19.1%
Total	**1,358**	**100%**	**47**	**100%**

Most (68 percent) cases in 2019 were of low severity, 30 percent were moderate severity and 2 percent were high severity.

Events

In 2019, when the person's activity at the time of exposure was known, most exposures (32 or 76 percent) occurred when a person was involved with pesticide application, such as mixing or applying a pesticide, cleaning or maintaining equipment, or some combination of these activities. Another 10 (24 percent) happened to bystanders who were doing routine work, not related to the application.

In 2019, the most common pesticide exposure was to disinfectants (56 percent), followed by insecticides (18 percent) (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.

Table 7: Pesticide Types in Confirmed Occupational Cases

	Cumulative 2001–19		2019	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	705	48.6%	28	56.0%
Insecticide	380	26.2%	9	18.0%
Herbicide	190	13.1%	5	10.0%
Other	123	8.5%	5	10.0%
Multiple	54	3.7%	3	6.0%
Total	**1452**	**100%**	**50**	**100%**

A hotel laundry worker in her 50s combined two jugs with similar looking labels. She thought both were bleach, but one was ammonia and chloramine fumes were generated. The section of the building was closed and evacuated to allow the fumes to clear. She developed a cough, sore throat, nausea, and sweating. She went to an 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 2019, spills and splashes were the most common contributing factor for occupational pesticide cases, followed by decontamination that was either inadequate or not timely (Table 8).

Table 8: Contributing Factors in Confirmed Occupational Cases

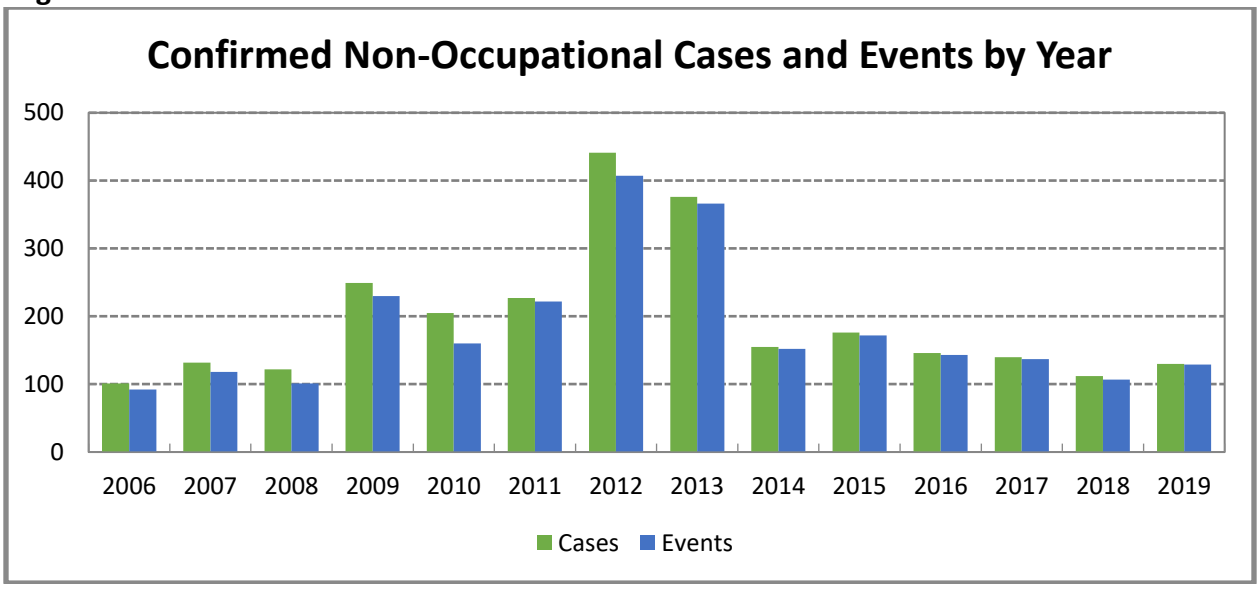
	Cumulative 2001–19		2019	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Spill/Splash of liquid or dust (not equipment failure)	390	22.1%	21	33.3%
Mixing incompatible products	178	10.1%	4	6.3%
Label violations not otherwise specified	112	6.4%	0	0.0%
Required eye protection not worn or inadequate	109	6.2%	2	3.2%
Decontamination not adequate or timely	105	6.0%	7	11.1%
No label violation identified but person still exposed / ill	105	6.0%	6	9.5%
Application equipment failure	104	5.9%	4	6.3%
Excessive application	82	4.7%	2	3.2%
Drift contributory factors	78	4.4%	1	1.6%
People were in the treated area during application	44	2.5%	1	1.6%
Required gloves not worn or inadequate	41	2.3%	1	1.6%
Notification/posting lacking or ineffective	39	2.2%	1	1.6%
Applicator not properly trained or supervised	39	2.2%	1	1.6%
Structure inadequately ventilated before re-entry	24	1.4%	1	1.6%
Early re-entry	24	1.4%	3	4.8%
Within reach of child or other improper storage	23	1.3%	0	0.0%
Required respirator not worn or inadequate	18	1.0%	0	0.0%
Other required PPE not worn or inadequate	9	0.5%	0	0.0%
Intentional harm	4	0.2%	0	0.0%
Illegal pesticide used / Illegal dumping	1	0.1%	0	0.0%
Other	60	3.4%	3	4.8%
Unknown	172	9.8%	5	7.9%
Total	**1,761**	**100%**	**63**	**100%**

An emergency medical responder in her 20s was exposed to an insecticide when she responded to a chemical exposure at a residence that was being treated for bed bugs. She developed a cough, sore throat, difficulty breathing, nausea, and vomiting. She went to an emergency department.

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 beginning 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 130 confirmed cases from 129 events entered into the database in 2019 (Figure 2). (There were another 173 confirmed non-occupational cases from 165 events who had called the poison control center but had not seen a provider and were therefore not entered in the database. 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 that there was more than one sign or symptom or because we did not identify the pesticide (both required for case confirmation).

Figure 2



To treat bed bugs, a baby's uncle mixed an organophosphate insecticide and a pyrethroid insecticide in a bottle. The baby's grandmother gave the bottle to the child not knowing what was in it. The baby started vomiting and was fussy, lethargic, sweating, and had a runny nose. The mother took the baby to an emergency department. There he continued to vomit, had a cardiac arrhythmia, shallow respirations, acidosis, bronchospasm, and coarse lung sounds. He was intubated and transferred to another hospital where he stayed four days.

People

Non-occupational pesticide cases occurred among people of all ages. In 2019, when sex was known, females were more likely than males to have a non-occupational pesticide exposure (53 percent and 47 percent, respectively) (Table 9). Race and ethnicity data were rarely available for non-occupational cases.

Table 9: Confirmed Non-occupational Cases by Age Group and Gender

	Cumulative 2006–19			2019		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	7	14	1	0	2	0
1-2 (Toddlers)	50	66	0	4	5	0
3-5 (Preschool)	37	57	0	1	3	0
6-11 (Child)	91	63	0	6	1	0
12-17 (Youth)	75	69	1	1	5	0
18-64 (Adult)	996	772	1	47	31	1
65+ (Senior)	151	128	1	8	12	1
Unknown age	70	32	30	1	1	0
Total	**1,477**	**1,201**	**34**	**68**	**60**	**2**

Most (84, or 65 percent) cases in 2019 were of low severity, 42 (32 percent) were moderate severity, 3 (2 percent) were high severity, and there was one death (one percent).

A man in his 50s turned up his heater. He started to develop difficulty breathing, coughing, nausea, vomiting, and sweating. He called 911 and was taken to an emergency department. He had poor oxygen saturation and an elevated blood pressure. It was later discovered that the house was being treated for bedbugs.

Events

In 2019, when the person's activity at the time of exposure was known, most exposures (74 or 59 percent) occurred when a person was involved with a pesticide application, such as mixing or applying a pesticide, disposing of a pesticide, or some combination of these activities. Another 52 or 41 percent happened to bystanders.

In 2019, the most common exposure for non-occupational cases was to insecticides (41 percent), followed by disinfectants (34 percent) (Table 10). Some products contain more than one type of pesticide and some exposures involve more than one product so the number of types of products is greater than the number of exposures.

A man in his 20s found a rodenticide containing zinc phosphide. The label was in Spanish; he could read that it was a rodenticide but not the details about its use. He inhaled fumes, while applying it. He developed nasal irritation, nausea, shortness of breath, chills, a dry mouth, and became lightheaded. He went to an emergency department.

Table 10: Pesticide Types in Confirmed Non-occupational Cases

	Cumulative 2006–19		2019	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	1,120	39.3%	30	22.1%
Insecticide	938	32.9%	35	25.7%
Insect Repellent	211	7.4%	8	5.9%
Herbicide	194	6.8%	9	6.6%
Rodenticide	29	1.0%	3	2.2%
Fungicide	25	0.9%	2	1.5%
Other	67	2.4%	0	0.0%
Multiple	182	6.4%	8	5.9%
Unknown	84	2.9%	41	30.1%
Total	**2,850**	**100%**	**136**	**100%**

Contributing factors provide additional information and assist with developing prevention strategies. Up to five contributing factors can be coded for each case. In 2019, the most common contributing factors were label violations not otherwise specified followed by mixing incompatible products and improper storage, including within reach of a child (Table 11).

Table 11: Contributing Factors in Confirmed Non-occupational Cases

	Cumulative 2006–19		2019	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Mixing incompatible products	449	14.6%	18	11.6%
Label violations not otherwise specified	405	13.1%	30	19.4%
Spill/Splash of liquid or dust (not equipment failure)	311	10.1%	12	7.7%
Excessive application	259	8.4%	7	4.5%
No label violation identified but person still exposed/ill	226	7.3%	11	7.1%
Within reach of child or other improper storage	221	7.2%	16	10.3%
People were in the treated area during application	127	4.1%	5	3.2%
Drift contributory factors	109	3.5%	0	0.0%
Decontamination not adequate or timely	101	3.3%	3	1.9%
Structure inadequately ventilated before re-entry	83	2.7%	7	4.5%
Early re-entry	83	2.7%	9	5.8%
Notification/posting lacking or ineffective	58	1.9%	3	1.9%
Application equipment failure	50	1.6%	2	1.3%
Required eye protection not worn or inadequate	18	0.6%	0	0.0%
Required gloves not worn or inadequate	16	0.5%	1	0.6%
Other	108	3.5%	7	4.5%
Unknown	456	14.8%	24	15.5%
Total	**3,080**	**100%**	**155**	**100%**

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 2019:

- The pesticide surveillance program coordinator represented MDHHS on the MDARD Pesticide Advisory Committee (PAC) and provided an activity report each quarter.
- 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 100 other sites with information about pesticides and their safe use. A new disinfectant safety fact sheet was added to the page.
- A press release about Poison Prevention Week was released in March by MDHHS.
- A press release about recreational water safety was released before Memorial Day weekend by MDHHS.
- Program staff participated with the Michigan Primary Care Association's Migrant Health Network. Information about pesticide safety and reporting were sent to the community health centers that care for migrant farmworkers in Michigan.
- The pesticide surveillance program coordinator participated on the pesticide coding committee of the SENSOR-Pesticides states, which worked on data quality assurance, the annual meeting, topics for papers and other ways to improve the SENSOR-Pesticides program.
- Michigan hosted the annual meeting for SENSOR-pesticide states, NIOSH, and EPA.
- Information about pesticides and the surveillance program was distributed at the Michigan Safety Conference and the Michigan Farmworker, Service Provider, and Grower conference.

NIOSH Reports
In 2019, two events met NIOSH's priority reporting criteria.

- A man in his 50s with a history of asthma and smoking stayed in a room after he set off a bug bomb. He developed a cough, bilateral arm discomfort, shortness of breath, and respiratory failure. EMS was called and he was taken to an emergency department where he died of cardiac arrest.
- A family of six was taken by ambulance from a hotel to a hospital with difficulty breathing and coughing after swimming in the hotel pool. The local health department investigated and temporarily closed the pool until the water chemistry was fixed.

No MDARD or MIOSHA Investigations were conducted on cases from 2019.

Discussion

Surveillance Data

There were 47 confirmed occupational cases in 2019. This is consistent with the range from previous years of surveillance (17-127), and the average (71). The number of confirmed occupational cases peaked in 2008.

There were 130 confirmed non-occupational cases in 2019. This is consistent with the range from previous years of surveillance (101-441) but lower than the average of those years (223). There was an increase in non-occupational case reports 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 control center were entered in 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 2019, 56 percent of occupational cases and 22 percent 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 KD et al, 2020). Because of the current COVID -19 pandemic, the use of disinfectants is expected to increase. 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 2019, spills and splashes were the most common factor for confirmed occupational cases, followed by delayed or inadequate decontamination. The most common factors contributing to non-occupational exposures were label violations not otherwise specified, followed by mixing incompatible products and improper storage, including storage within reach of a child. Better education and labeling might help to reduce the number of exposures.

Many confirmed cases in 2019 were “bystanders,” i.e., engaged in work or living activities not related to the pesticide application (24 percent of occupational cases and 41 percent of non-occupational cases). Better education on safe pesticide application is needed to prevent inadvertent exposures, as well as the exposures to applicators.

Interventions

MDHHS continued to work with other state and federal agencies. MDHHS 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 (Prado et al, 2017). Finally, even when diagnosed, pesticide-related illnesses and injuries may not be reported due to 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 2019, 81 percent of confirmed occupational cases and 73 percent 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 they might lose their jobs if they did so. That study also found that only 20-30 percent 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. 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. There has been an apparent downward trend in this decade, and we will continue to conduct surveillance to monitor this.

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Additional Resources

MDHHS Division of Environmental Health pesticide information: www.michigan.gov/mdch-toxics

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: http://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):
http://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: http://state.ceris.purdue.edu/

EPA Pesticide Product Label System:
http://oaspub.epa.gov/apex/pesticides/f?p=PPLS:1

Extoxnet Pesticide Information Profiles: http://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:
http://www2.epa.gov/pesticide-worker-safety/recognition-and-management-pesticide-poisonings

To report occupational pesticide exposures in Michigan:
https://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 should 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 the pesticide and the health effects based on the known toxicology of the pesticide from commonly available toxicology texts, government publications, 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 post-exposure 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. Documentation of Adverse Health Effect

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. Evidence Supporting a Causal Relationship Between Pesticide Exposure and Health Effects

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

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		Not a Case		
									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, 2019 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2019. 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, occupation, and more specific information about the product such as the signal word for acute toxicity assigned by the EPA are included. The signal word is assigned based on the highest hazard of all possible routes of exposure. "Caution" means the product is slightly toxic if eaten, absorbed through the skin, or can cause slight eye or skin irritation. "Warning" means the product is moderately toxic if eaten, absorbed through the skin, or can cause moderate eye or skin irritation. "Danger" means the product is highly toxic, is corrosive, or causes severe burning to the eye or skin that can result in irreversible damage.

<u>Insecticides/insect repellents/insect growth regulators</u>

Agriculture

MI05201 – A tree nursery worker in his 40s was exposed to an insecticide (signal word: Caution). He was not notified that the greenhouse where he worked was sprayed while he was on break. When the workers returned, they were not notified of the spray. The product had a restricted entry interval (REI) of 12 hours but since he had not been notified, he returned immediately after his break and drank from an open beverage container that had been in the greenhouse when it was sprayed. He developed eyelid and shoulder twitching; a numb, tingling tongue; a headache; and nausea and diarrhea. He called poison control and went to an urgent care clinic.

MI05207 – A laborer in his 40s worked for a beekeeper. Amitraz, an unregistered insecticide, got into his glove, while he soaked towels in a mixture of the insecticide and cooking oil that he used to cover the beehives. He developed a red, itchy, rash and skin peeled off his fingers. Eight months later he sought medical care at an urgent care clinic. He was not, nor was he supervised by, a certified or registered applicator.

MI05227 – A blueberry picker in her 40s picked blueberries when they were still wet with an organophosphorus insecticide (signal word: Warning). The re-entry interval was 24 hours. Her fingers became numb and she became irritable and confused. She called poison control.

MI01536 – An arborist in his 30s sprayed a mixture of insecticides on a hot day. The wind changed several times, and some sprayed on his face. He became weak, dizzy, flushed and "did not feel right". He called poison control and went to an emergency department but left after several hours without being seen.

Landscaping

MI05213 – A pest control operator in his 60s sprayed lawns with three insecticides. He wore goggles but no respiratory protection. Some sprayed on his arms and face, which he wiped off,

and he also may have inhaled the spray. He went home and after dinner became unresponsive and sweaty. He had a stomachache and low blood pressure. EMS was called and he was taken to an emergency department and admitted to the hospital.

Miscellaneous/unknown

MI05193 – A worker in his 40s sprayed an insecticide (signal word: Warning) and on his leg. He cleaned his leg a few hours later. That night he developed a headache, nausea, vomiting, and dizziness. The next day he felt weak and tired. He called poison control.

MI05262 – A worker in his teens was sprayed in the eye with an insecticide (signal word: Caution). His eye became red and irritated, and a coworker called poison control.

MI05273 – A worker in his 40s sprayed a beehive with an insecticide (signal word: Caution). Some of the spray got on his arms and in his eyes. His eyes became red, irritated and he was tearing. He called poison control.

<u>Herbicides</u>

Agriculture

MI05174 – A farm maintenance worker in his 40s was exposed to an herbicide (signal word: Caution). The herbicide was being stored in the shop and someone mistakenly sliced open the container causing a spill on the floor, which was not cleaned up. A week later he and a coworker were letting air out of tires and that caused dust in the shop to be stirred up onto his face. He became dizzy and his face was numb and tingling. He went to an emergency department.

Landscaping

MI05202 – A pesticide technician for a lawn care company in his 20s was exposed to an herbicide (signal word: Caution). A co-worker pulled a tank for a backpack sprayer out of a cabinet. The co-worker had not tightened the tank top, which fell off and herbicide splashed in the technician's face. He developed a cough and difficulty breathing and went to an emergency department.

Miscellaneous/unknown

MI05176 – An adult Home Center store worker was exposed to an herbicide when the container broke open and sprayed on her. She felt dizzy and had blurred vision. Her husband called poison control.

MI05215 – A success job coach in her 30s was working in an area of a factory that had no windows. Someone sprayed an herbicide (signal word: Danger) outside by the air intake vent. She smelled the product and developed a cough, shortness of breath, headache, nausea, and shakiness. She went to an emergency department and lost one day of work.

MI05281 – A worker in his teens sprayed an herbicide (signal word: Caution) for two months. He developed difficulty breathing, tachypnea, cough, and intermittent chest pain. He went to an emergency department

MI05291 – An emergency medical responder in her 20s was exposed to an insecticide fogger (signal word: Warning) when she responded to a chemical exposure at a residence that was being treated for bed bugs. She developed a cough, sore throat, difficulty breathing, nausea, and vomiting. She went to an emergency department.

MI05299 – A hotel housekeeper in her 30s was exposed to an insecticide fogger (signal word: Warning) when she removed the cover from a bed. The room had been treated the day before, but some product remained on the bed and got in her eye and face when she removed the cover. She developed a painful eye, itching, tearing, blurry vision, and swelling around the eye. She also had difficulty breathing. She went to an emergency department.

Disinfectants

Agriculture

MI05156 – A dairy farm employee in her 50s was sprayed with a disinfectant. She washed immediately but developed a red, painful arm and went to an emergency department.

MI05250 – A dairy farm milk bottler in her 50s was exposed twice to a disinfectant (signal word: Danger) from a tank leaking near her workstation. Both times she had difficulty breathing, a cough, burning eyes, nose, and throat, and wheezing and went to an emergency department. She had a follow-up visit with a pulmonologist. The second time she lost 10 days of work and was admitted to the hospital overnight.

MI05284 – A dairy farm worker in his teens inhaled fumes from bleach mixed with another chemical. He developed shortness of breath and chest pain and went to an emergency department.

Cleaner/housekeeper/janitor/custodian

MI05164 – A casino hotel employee in her 20s dropped a container of disinfectant (signal word: Danger), which splashed in her face and mouth. She had a burning sensation in her mouth and was short of breath. She went to an occupational health clinic.

MI05167 - A cleaning contractor in her 40s mixed ammonium hydroxide with water in a bucket. For an unknown reason, there was an increase in the water hose pressure. She grabbed for the hose and the bottle in her other hand hit her face and ammonium hydroxide splashed on her face and body. The water from the hose forced the mixture up her nose. She developed a sore throat, eye irritation, red irritated skin, diffuse itching, nausea, sinus irritation, and trouble breathing. She went to an emergency department.

MI05169 – An elementary school janitor in her 20s was exposed to a disinfectant (signal word: Danger) when it fell off a shelf and splashed in her face. She had a burning sensation on her cheek and tingling sensation on her lips. She went to an emergency department.

MI05185 – A motel cleaner in her 20s was present when a co-worker mixed two cleaning products to clean a toilet bowl. She immediately started coughing and developed shortness of breath and tachycardia. She went to an emergency department.

MI05216 – A school custodian in his 30s was exposed to disinfectant (signal word: Danger) fumes while cleaning. He developed fatigue, respiratory irritation, nausea and vomiting, and hallucinations. He called poison control. To save money, the school district had turned off the ventilation system when children were not in the building. In addition to the absence of ventilation while he cleaned, the cleaning was done with trigger pump spray bottles. After he switched to using a bucket and rags and wearing a mask (not required) when he cleaned, he felt better.

MI05289 – A hotel laundry worker in her 50s combined two jugs with similar looking labels. She thought both were bleach, but one was ammonia and chloramine fumes were generated. The section of the building was closed and evacuated to allow the fumes to clear. She developed a cough, sore throat, nausea, and sweating. She went to an emergency department

Food service/production

MI05113 – An adult restaurant worker was sprayed in the eye with a sanitizer (signal word: Danger). She rinsed her eye with water but woke up the next day with a swollen eyelid and a red eye. She called poison control.

MI05132 – A tea house assistant pastry chef in her 20s put away dishes that had air dried. One dish was not dry and some diluted sanitizer (signal word: Danger) splashed in her face, getting in her right eye. She flushed her eye for about ten minutes. It was irritated and felt dry for about a week. She called poison control, went to her primary care provider, and an ophthalmologist.

MI05209 – A deli clerk at a discount department store in her 20s reached for a vacuum cleaner that was stored near bags of chemicals on a wall. As she pulled the vacuum, it hooked onto the tube from one of the bags which contained an undiluted disinfectant (signal word: Danger). The disinfectant splashed her face, eyes, mouth, and torso. She developed red, painful eyes, blurry vision, and swollen eyelids. She went to an emergency department and then followed-up at the hospital and with an ophthalmologist. Her employer's policies resulted a several-hour delay in transporting her to the emergency department.

MI05260 – A pizza parlor worker in her 20s pushed down on the pump of a wall-mounted container to apply disinfectant (signal word: Danger) to her rag. Some splashed on her face and arm. She irrigated her eyes at work but developed eye and skin irritation and went to an emergency department where her eyes were irrigated again.

MI0536 – A coffee shop employee in her 20s poured sanitizer into a sink, inhaled the vapors and began to cough. The next morning, she had a sore throat and called poison control.

Healthcare

MI05138 – A dialysis technician in her 30s replaced a disinfectant container (signal word: Danger) and some got on her hands. She was not wearing the required gloves. She washed her hands immediately but part of the skin on her fingers turned white and had a stinging sensation. She went to an emergency department.

MI05218 – A physiotherapist clinic worker in her 30s was cleaning with a disinfectant (signal word: Danger). She started to cough and felt burning in her chest. EMS was called.

MI05219 – A hospital endoscopy department nurse in her 40s used a disinfectant (signal word: Danger) cleaning wipe on a bed and a drop splashed into her eye. She developed a red, irritated, tearing eye. She went to the emergency department.

MI05274 – A hospital housekeeper in her 50s lifted a hose off its hook to fill a mop bucket. The previous person who used the hose, had left the hose full, so when she picked up the hose undiluted disinfectant (signal word: Danger) splashed in her face and on her neck. She rinsed off, but later that evening she felt itchy and a coworker told her that her skin was red. She went to the emergency department and they told her to wash the area again and use antibacterial ointment. She showered when she went home but did not use ointment. The next morning, she woke up with painful, blistered skin. She went to the emergency department again.

MI05276 – An operating room nurse in her 30s was replacing a chemical used to clean scopes. When she opened the new container, some splashed on her skin. She had a burning sensation and it was red. She went to the emergency department.

MI05277 – A medical assistant in her 30s sprayed a disinfectant (signal word: Caution) to clean an exam room in a doctor's office. The room was not ventilated, and she immediately began coughing. That evening she had trouble swallowing and by the next morning had trouble breathing with pain on deep inspirations. She went to her employer for medical care and followed up twice as the symptoms persisted. When interviewed three months later, she still had a cough and chest pain.

MI05279 – A nurse in her 60s was threading a germicidal wipe (signal word: Caution) through the hole in the container and liquid splashed in her eyes behind her eyeglasses. She washed her eyes in the eye wash for 15 minutes. They were red and irritated, and her vision was blurry. She went to an emergency department.

Miscellaneous/unknown

MI05109 – A hardware store employee in his 20s was handling pool chlorine. The bottle was knocked over and the chlorine splashed on his hands. He rinsed within a minute or two, but they became red and irritated. EMS was called and they contacted poison control.

MI05110 – A school bus driver in his 60s was exposed to a disinfectant (signal word: Danger) after a child vomited on the bus and a maintenance worker cleaned it with undiluted product. The product should have been diluted one ounce per gallon. He was exposed to the fumes on a three-hour field trip and developed a headache, could taste it in the back of his throat, was nauseated, and dizzy. He called poison control.

MI05123 – A worker in his teens spilled some mold and mildew remover on his cheeks and the bridge of his nose at work. His cheeks became red and his eyes teared. He called poison control.

MI05131 – A worker in her 20s splashed some sterilizing solution (signal word: Danger) in her eye. She had a burning sensation which abated after she rinsed her eye in an eye wash for about fifteen minutes. She went to an emergency department and they noticed scleral injection. Eye protection was required; it is unknown if she wore any.

MI05217 – A childcare center worker in her 30s poured sanitizing tablets (signal word: Warning) from one container to another and some spilled on her hand. She developed red, itchy, skin with blisters and went to an emergency department.

MI05228 – A construction worker in his 20s working on a municipal water line was carrying a bucket of sodium hypochlorite. He tripped and some splashed in his left eye and ear. He developed eye pain, tearing, blurred vision and light sensitivity. He went to an emergency department and had five follow-up visits with an ophthalmologist. He had a corneal abrasion, edema, a dilated pupil, sloughing of the epithelium, and ear irritation.

MI05233 – A man in his 50s spent three days cleaning a rental house with a mixture of bleach, vinegar, and dishwashing detergent. He developed skin irritation and started using latex gloves. He then developed a cough, runny nose, and burning pain in his chest. He went to an emergency department.

<u>Other/Mixture</u>

MI05208 – A pond company pesticide applicator in her 50s applied a mixture of an herbicide and algaecide to a pond. The hose split and sprayed into her eyes. She developed red irritated eyes and a headache and went to an urgent care clinic. When seen in the clinic she said the pesticides were diluted and in the tank. When interviewed several months later she said she had not added the pesticides yet and it was only pond water in the tank.

MI05210 – A worker in his 50s sprayed sugar beets with a fungicide (signal word: Caution) and the hose became plugged. As he unplugged the hose, he was exposed to the fungicide which covered his clothing from the waist down. This happened at noon and he did not shower until he got home at 10 pm. The next morning, he was nauseated, had three bouts of vomiting and two bouts of diarrhea. He went to an emergency department.

MI05256 – A migrant worker in her 60 splashed a fungicide (signal word: Caution) and hydrogen peroxide 35% in her eyes. She had tissue swelling and eye pain and went to an urgent care clinic.

MI05282 – A farmer in his 50s had a bug fly into his eye while he was driving to the field, and this irritated his eye. At the field he mixed a fungicide (signal word: Caution), which got on his finger. He later rubbed his eye. His eye became painful, red, teared, and was swollen. He went to an emergency department.