Pesticide Illness and Injury Surveillance in Michigan 2017–18

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Pesticide Illness and Injury Surveillance in Michigan: 2017–18

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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 fourteenth 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) including 18 years of data.

From 2001 through 2018 there were 1,311 confirmed cases of occupational pesticide-related illnesses or injuries. Eighty-four of those confirmed cases were reported in 2017, and 46 were reported in 2018. The number of reported cases peaked in 2008. Disinfectants continued to be the cause of almost half of all the confirmed occupational cases (48 percent from 2001–2018) and were the cause of 47 percent of confirmed occupational cases in 2017–18. 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.

Where activity of the exposed person was known, 47 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 occupation was cleaning/ housekeeping/janitorial, comprising 15 percent of the confirmed cases in 2017–18. In addition, 11 percent were pest control operators, and 10 percent were healthcare workers.

From 2006 through 2018, there were 2,581 confirmed cases of non-occupational pesticide-related illnesses or injuries. One hundred forty of those confirmed cases were reported in 2017 and 111 were reported in 2018.

In 2017–18, disinfectants accounted for 34 percent of confirmed non-occupational cases.

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 normal activities not involved in the application of pesticides.

One event was reported to the National Institute for Occupational Safety and Health (NIOSH) and the Environmental Protection Agency (EPA). Two 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 page 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]

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[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 included in 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 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.

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 firefighter in his 20s crawled over potatoes to get to a ventilation system in a barn that was on fire. He had a mask on, but it fell off while he was crawling. He was exposed to smoke and the plant growth inhibitors that were used to treat the potatoes. It took him about 35–40 seconds to get his mask back on. He immediately started coughing, left the barn, and was given oxygen. His lungs felt like they were burning, he was lightheaded, nauseous, and vomited once. He was taken by ambulance 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 2018, 3,892 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, 2001–18

Status	Occupational	Non-Occupational	Unknown	Total
Definite Case	127	51	0	178
Probable Case	302	537	1	840
Possible Case	862	1,926	1	2,789
Suspicious Case	20	65	0	85
Total	**1,311**	**2,579**	**2**	**3,892**

Men and women of all ages were exposed to pesticides (Table 2).

Table 2: Confirmed Cases by Age Group and Gender

	Cumulative 2001—18			2017–18		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
00-<1 (Infants)	7	12	1	1	0	0
01-02 (Toddlers)	46	61	0	12	11	0
03-05 (Preschool)	36	54	0	4	7	0
06-11 (Child)	84	63	0	6	2	0
12-17 (Youth)	85	85	1	13	6	0
18-64 (Adult)	1474	1382	0	130	144	0
65+ (Senior)	148	130	0	17	17	0
Unknown age	107	73	43	5	0	6
Total	1987	1860	45	188	187	6

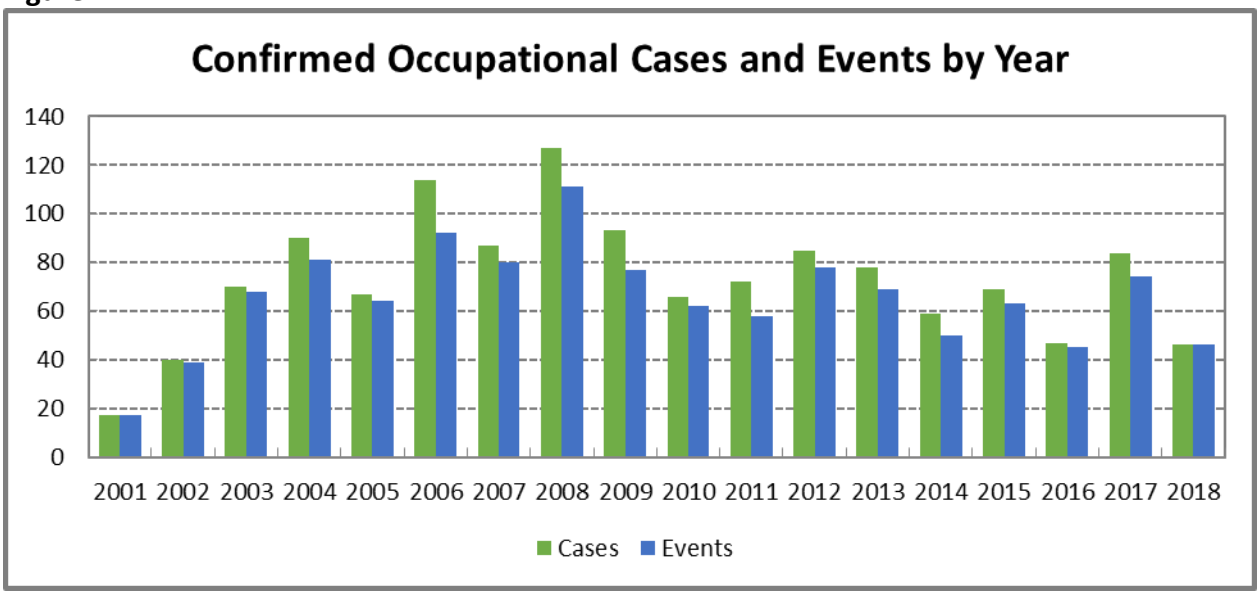
A fertilizer technician for a landscaping company in his 60s sprayed several lawns with an herbicide. He diluted it correctly and used a riding sprayer that he calibrated regularly. He wore the required PPE (Personal Protective Equipment) but became ill anyway. He had stomach pain, nausea, vomiting, and pinpoint pupils. He went to an urgent care clinic and was sent to an emergency department. He followed up with an ophthalmologist and lost seven days of work.

A barista in her teens was squirting sanitizer into the steam wand. The wand was in a bucket half full of water. The sanitizer bounced off the water, hit a towel, and then splashed onto her eye, arm, and thigh. She developed a corneal abrasion and skin burns. She went to an urgent care clinic and an ophthalmologist.

Section II. Occupational Pesticide Illnesses and Injuries

This section describes the 1,311 confirmed occupational cases. There were 84 cases from 74 events in 2017 and 46 cases from 46 events in 2018 (Figure 1).

Figure 1



People

Occupational pesticide cases occur in people of a wide variety of ages. In 2017–2018 women were less likely to be confirmed occupational cases than men (44 percent vs. 56 percent in 2017 and 41 percent vs 59 percent in 2018) (Table 3). Most (65 percent) cases in 2017–18 were of low severity, 32 percent were moderate severity and 3 percent were high severity.

Table 3: Confirmed Occupational Cases by Age Group and Gender

	Cumulative 2001–18			2017–18		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
10-19	46	69	0	4	9	0
20-29	162	221	0	14	19	0
30-39	109	144	0	10	17	0
40-49	111	130	0	6	13	0
50-59	94	84	0	16	12	0
60-69	16	23	0	5	3	0
70-79	2	6	0	0	1	0
80+	1	0	0	0	0	0
Unknown	38	42	13	1	0	0
Total	**579**	**719**	**13**	**56**	**74**	**0**

In 2017–18 race was unknown for 35 percent of cases; when race was known, most cases (82 percent) were white, while 13 percent were black, and 5 percent were mixed or other. In 2017–

18 ethnicity was unknown 43 percent of the time. When known, most (92 percent) were Not Hispanic while 6 percent were Hispanic (Table 4).

Table 4: Confirmed Occupational Cases by Race and Ethnicity

	Cumulative 2001–18			2017–18		
Race	**Hispanic**	**Not Hispanic**	**Unknown**	**Hispanic**	**Not Hispanic**	**Unknown**
American Indian/Alaskan	0	6	0	0	0	0
Asian/Pacific Islander	0	2	3	0	0	0
Black	0	50	31	0	9	2
White	21	464	118	1	56	12
Mixed	2	23	2	0	3	0
Other	5	0	1	1	0	0
Unknown	57	0	526	4	0	42
Total	**85**	**545**	**681**	**6**	**68**	**56**

Confirmed cases were identified in a wide variety of occupations. In 2017–18, the most common occupation was cleaners/housekeepers/janitors (Table 5). This category was 15 percent of all occupational cases and 19 percent of cases where the occupation was known. Pest control operators include structural applicators and mosquito sprayers. There were 27 people exposed in the farming, pest control, and lawn care occupations. This was 21 percent of all workers and 25 percent where the occupation was known.

Table 5: Confirmed Occupational Cases by Occupation

	Cumulative 2001–18		2017–18	
Occupation	**Count**	**Percent**	**Count**	**Percent**
Cleaners/housekeepers/janitors	144	11.0%	20	15.4%
Sales and office	85	6.5%	9	6.9%
Production and transportation	80	6.1%	10	7.7%
Management, professional, and related	77	5.9%	8	6.2%
Farming	76	5.8%	11	8.5%
Healthcare	63	4.8%	13	10.0%
Food preparation and service	60	4.6%	10	7.7%
Pest control operators	56	4.3%	14	10.8%
Groundskeepers/lawn service	53	4.0%	2	1.5%
Protective services	32	2.4%	2	1.5%
Personal care	26	2.0%	0	0.0%
Construction	22	1.7%	4	3.1%
Installation, maintenance, and repair	14	1.1%	4	3.1%
Armed forces	2	0.2%	0	0.0%
Unknown	521	39.7%	23	17.7%
Total	**1311**	**100%**	**130**	**100%**

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 2017–18 (Table 6).

Table 6: Confirmed Occupational Cases by Industry Sector

	Cumulative 2001–18		2017–18	
Industry Sector	**Count**	**Percent**	**Count**	**Percent**
Services (excluding Public Safety)	518	39.5%	44	33.8%
Healthcare & Social Assistance	184	14.0%	23	17.7%
Agriculture, Forestry, Fishing	144	11.0%	14	10.8%
Wholesale & Retail Trade	105	8.0%	12	9.2%
Manufacturing	78	5.9%	5	3.8%
Transportation, Warehousing, Utilities	40	3.1%	5	3.8%
Construction	36	2.7%	5	3.8%
Public Safety	23	1.8%	2	1.5%
Unknown	183	14.0%	20	15.4%
Total	**1311**	**100%**	**130**	**100%**

Events

In 2017–18, when the person's activity at the time of exposure was known, most exposures (78 or 62 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 47 (38 percent) happened to bystanders who were doing routine work, not related to the application.

In 2017–18, the most common pesticide exposure was to disinfectants (47 percent), followed by insecticides (24 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: Confirmed Occupational Cases by Pesticide Type

	Cumulative 2001–18		2017–18	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	677	48.3%	71	46.7%
Insecticide	371	26.5%	37	24.3%
Herbicide	185	13.2%	16	10.5%
Other	118	8.4%	26	17.1%
Multiple	51	3.6%	2	1.3%
Total	**1402**	**100%**	**152**	**100%**

A hospital housekeeper in her 50s was splashed in the eye with a disinfectant when she emptied a bucket and tripped. She developed a red, irritated eye and a corneal burn. She went to an emergency department.

A sprayer for a mosquito squad in his 30s had skin irritation, nausea, and a headache on the days he sprayed, but felt fine on weekends. He wore the required PPE and showered after work each day. He called poison control and 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 2017–18, 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

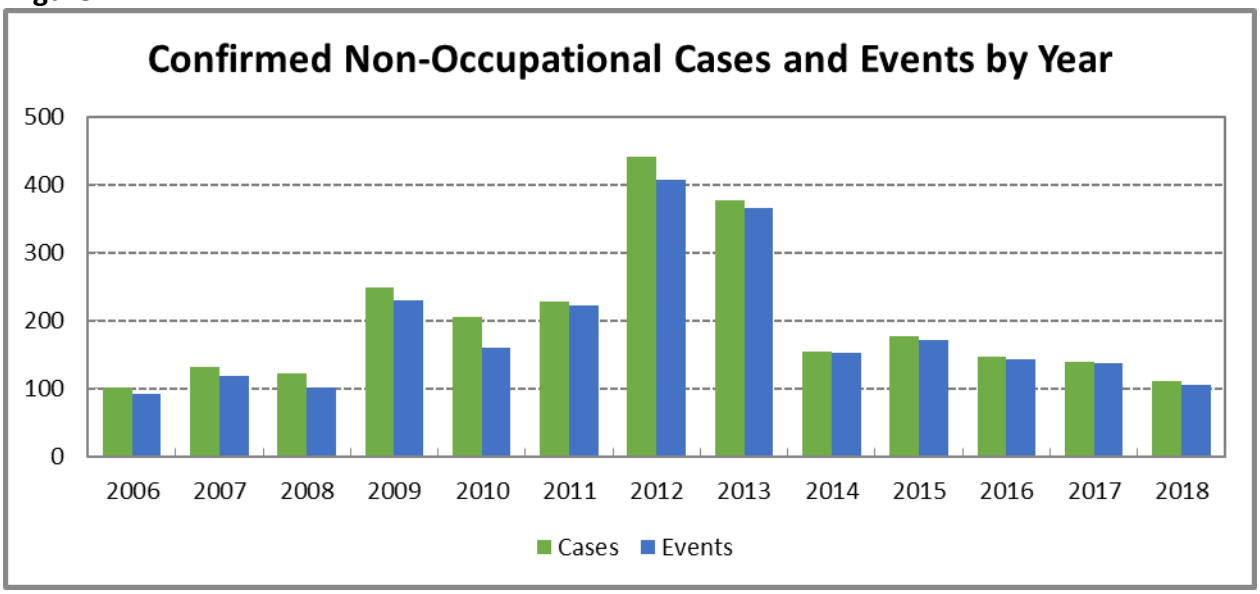
	Cumulative 2001–18		2017–18	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Spill/Splash of liquid or dust (not equipment failure)	369	21.7%	28	16.8%
Mixing incompatible products	174	10.2%	15	9.0%
Label violations not otherwise specified	112	6.6%	9	5.4%
Application equipment failure	107	6.3%	10	6.0%
Required eye protection not worn or inadequate	100	5.9%	10	6.0%
Decontamination not adequate or timely	99	5.8%	21	12.6%
No label violation identified but person still exposed / ill	98	5.8%	10	6.0%
Drift contributory factors	80	4.7%	16	9.6%
Excessive application	77	4.5%	2	1.2%
People were in the treated area during application	43	2.5%	2	1.2%
Applicator not properly trained or supervised	40	2.4%	7	4.2%
Notification/posting lacking or ineffective	38	2.2%	2	1.2%
Required gloves not worn or inadequate	38	2.2%	4	2.4%
Structure inadequately ventilated before re-entry	23	1.4%	2	1.2%
Within reach of child or other improper storage	23	1.4%	2	1.2%
Early re-entry	21	1.2%	2	1.2%
Required respirator not worn or inadequate	18	1.1%	5	3.0%
Other required PPE not worn or inadequate	9	0.5%	1	0.6%
Intentional harm	4	0.2%	0	0.0%
Illegal pesticide used / Illegal dumping	1	0.1%	0	0.0%
Other	57	3.4%	6	3.6%
Unknown	167	9.8%	13	7.8%
Total	**1698**	**100%**	**167**	**100%**

A phlebotomist at a blood bank in her 20s was cleaning blood bags with a disinfectant. She was wearing gloves, but some splashed above the glove on her forearm. It started to hurt on her way home. When she arrived home she washed her arm. She developed a bleeding wound and called poison control the next day.

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 251 confirmed cases from 243 events entered into the database in 2017–18, and there were a total of 1,408 cases from 1,141 events for 2006–2018 (Figure 2). (There were another 337 confirmed non-occupational cases from 325 events in 2017–18 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



A male in his 50s lived in a rented room. He set off a total release fogger and remained in the room for about 40 minutes although the label directions were to leave the room. He then called his ex-girlfriend to get him due to his severe coughing and bilateral arm discomfort. When she arrived, he walked outside and bent over, coughing violently, and spitting up large amounts of sputum. She took him to her house but did not think anything of the coughing because he has had similar coughing fits in the past. They went in her house and he sat down. She went outside for about 15 minutes. When she went back inside, he was slumped over in the chair and purple. She called 911 and started CPR. He was taken to an emergency department where he was pronounced dead from cardiac arrest. He was also diagnosed with respiratory arrest.

People

Non-occupational pesticide cases occurred among people of all ages. In 2017–18, when sex was known, women were more likely than men to have a non-occupational pesticide exposure (54 percent and 46 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 2006–18			2017–18		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
<1 (Infants)	7	12	1	1	0	0
1-2 (Toddlers)	46	61	0	12	11	0
3-5 (Preschool)	36	54	0	4	7	0
6-11 (Child)	84	62	0	6	2	0
12-17 (Youth)	74	64	1	13	5	0
18-64 (Adult)	949	741	0	76	74	0
65+ (Senior)	143	116	0	16	14	0
Unknown age	69	31	30	4	0	6
Total	**1,408**	**1,141**	**32**	**132**	**113**	**6**

Most (168 or 67 percent) cases in 2017–18 were of low severity, 77 (31 percent) were moderate severity, and there were six (2 percent) high severity cases.

A four-year-old child inhaled pool chlorinating tablets and started to vomit, cough, and have difficulty breathing. His family called poison control and took him to an emergency department. He was admitted to the hospital for four days.

Events

In 2017–18, when the person's activity at the time of exposure was known, most exposures (144 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 100 or 41 percent happened to bystanders.

A man in his 30s sprayed an insecticide outside and the wind blew some back in his face. He became nauseous, vomited, was dizzy, coughed, and had tachycardia. He went to an emergency department.

In 2017–18, 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.

Table 10: Confirmed Non-occupational Cases by Pesticide Type

	Cumulative 2006–18		2017–18	
Pesticide Type	**Count**	**Percent**	**Count**	**Percent**
Disinfectant	1090	40.2%	92	33.9%
Insecticide	901	33.2%	112	41.3%
Insect Repellent	203	7.5%	13	4.8%
Herbicide	185	6.8%	15	5.5%
Rodenticide	26	1.0%	1	0.4%
Fungicide	23	0.8%	1	0.4%
Other	67	2.5%	9	3.3%
Multiple	174	6.4%	23	8.5%
Unknown	44	1.6%	5	1.8%
Total	**2713**	**100%**	**271**	**100%**

Contributing factors provide additional information about the cases and assist with developing prevention strategies. Up to five contributing factors can be coded for each case. In 2017–18, the most common contributing factors were spills and splashes followed by improper storage (Table 11).

Table 11: Contributing Factors in Confirmed Non-occupational Cases

	Cumulative 2006–18		2017–18	
Contributing Factor	**Count**	**Percent**	**Count**	**Percent**
Mixing incompatible products	431	14.7%	21	7.6%
Label violations not otherwise specified	375	12.8%	20	7.2%
Spill/Splash of liquid or dust (not equipment failure)	299	10.2%	33	11.9%
Excessive application	251	8.6%	15	5.4%
No label violation identified but person still exposed/ill	215	7.4%	26	9.4%
Within reach of child or other improper storage	205	7.0%	31	11.2%
People were in the treated area during application	122	4.2%	20	7.2%
Drift contributory factors	109	3.7%	6	2.2%
Decontamination not adequate or timely	98	3.4%	7	2.5%
Structure inadequately ventilated before re-entry	76	2.6%	3	1.1%
Early re-entry	74	2.5%	6	2.2%
Notification/posting lacking or ineffective	55	1.9%	6	2.2%
Application equipment failure	48	1.6%	12	4.3%
Required eye protection not worn or inadequate	18	0.6%	1	0.4%
Required gloves not worn or inadequate	15	0.5%	2	0.7%
Other	101	3.5%	19	6.8%
Unknown	432	14.8%	50	18.0%
Total	**2924**	**100%**	**278**	**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 2017 and 2018:

- 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 each March by MDHHS.

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

- Program staff participated with the Michigan Primary Care Association's Migrant Health Network. Extensive outreach was implemented in 2017. Letters and emails with information about pesticide safety and reporting were sent to the community health centers that care for migrant farmworkers in Michigan and each network received a follow-up phone call.

- This migrant outreach initiative and results were presented at the Midwest Migrant Stream meeting in September 2017.

- Program staff presented information about the Pesticide Related Illness and Injury Surveillance Project to a meeting of about 50 Migrant outreach workers, coordinated by the Michigan Interagency Migrant Services Committee (IMSC).

- 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.

- The program coordinator attended the annual NIOSH-sponsored meetings of pesticide surveillance states.

- Information about pesticides and the surveillance program was distributed at the Michigan Safety Conference and the Michigan Farmworker, Service Provider, and Grower conference.

- The pesticide surveillance program coordinator was as a peer reviewer for a paper published in the Journal of Agromedicine.

NIOSH Reports

In 2017–18, one event met NIOSH's priority reporting criteria.

- A male in his 50s lived in a rented room. He set off a total release fogger and remained in the room for about 40 minutes. He then called his ex-girlfriend to get him due to his severe coughing and bilateral arm discomfort. When she arrived, he walked outside and bent over, coughing violently, and spitting up large amounts of sputum. She took him to her house but did not think anything of the coughing because he has had similar coughing fits in the past. They went in her house and he sat down. She went outside for about 15 minutes. When she went back inside, he was slumped over in the chair and purple. She called 911 and started CPR. He was taken to an emergency department where he was pronounced dead of a cardiac arrest. He was also diagnosed with respiratory arrest.

MDARD Referrals

In 2017–18, two events were referred to MDARD for investigation.

- Two people were installing windmills in a field; a heavy equipment operator in his 30s and a foreman in his 40s. They were sprayed with two insecticides by an aerial applicator. The equipment operator developed elevated blood pressure, numbness in his mouth and throat, tunnel vision, and a headache that lasted for five days. He went to an emergency department. The foreman developed dizziness, a headache, difficulty breathing, a sore throat, and numb lips. He also went to an emergency department. MDARD investigated and found the following violations: the applicator applied the pesticides in a way that contacted persons; the pesticides were not used in accordance with worker protective standards; the applicator did not record the EPA registration numbers; the pesticides were applied to an off-target field; there was no agreement with the customer or agent; the applicator did not provide risk-benefit information; and the applicator did not provide re-entry information.

- A trucker in his 40s who slept in the truck on long hauls took the truck to a towing/storage company, as instructed by his employer, to have it treated for bedbugs. The towing/storage company set off four foggers on each of two days (total of eight foggers) and did not air out the truck. After he picked up the truck, an additional fogger that had been left in the truck went off. He had to drive about 10 minutes after that to pull off at a rest stop. He developed a headache, nausea, coughing, and difficulty breathing and was taken to a hospital by ambulance. He continued to have respiratory symptoms and headaches several months later when interviewed. MDARD investigated and found the following violations: the towing/storage company was not licensed to apply pesticides; the applicator was not certified; trucks are not listed as an allowable application site for the pesticide; the truck was not ventilated; the applicator failed to minimize human exposure; and the paperwork for an application was not complete.

MIOSHA Referral

In 2017–18, one event was referred to MIOSHA for investigation.

- A cashier at a fast food restaurant in her 30s, who was short, reached over a sink to put a block of a disinfectant into a container. She said that there was no stool available, and it would have been fine if there had been a stool. But as she pushed the top of the container down it chipped off a corner of the block and the chip flew into her eye. She rinsed her eye at work, but her eye continued to tear and be painful. She went to an emergency department. Goggles or a face shield were required but were not worn. This case was investigated by MIOSHA. No violations were found.

Discussion

Surveillance Data

There were 84 confirmed occupational cases in 2017 and 46 in 2018. This is consistent with the range from previous years of surveillance (17-127), and the average (74). The number of confirmed occupational cases peaked in 2008.

There were 140 confirmed non-occupational cases in 2017 and 111 in 2018. This is consistent with the range from previous years of surveillance (101-441) but lower than the average of those years (212). 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 2017–18, 47 percent of occupational cases and 34 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. Evidence-based recommendations/regulations still need to be followed regarding the use of cleaning products, including those containing disinfectants. Ongoing education is needed to provide guidance about how to clean, when disinfectants are recommended, and how to use them properly.

When looking at factors contributing to pesticide exposures in 2017–18, 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 spills and splashes, followed by improper storage, including within reach of a child. Better education and labeling might help to reduce the number of exposures.

Many confirmed cases in 2017–18 were “bystanders,” i.e., engaged in work or living activities not related to the pesticide application (47 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 the EPA) through slightly toxic (EPA signal word: Caution), moderately toxic (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 2017–18, 89 percent of confirmed occupational cases and 79 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 are 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, 2017–18 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2017 and 2018. 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

MI04791 – A worker in her 60s helped spray an insecticide on a farm. She developed abdominal pain, nausea, vomiting, and fatigue. She went to an emergency department.

MI05041 – A farmworker in her teens applied a fly cream (signal word: Caution) to a calf without wearing long sleeves. Some got on her arms, which became itchy and painful. She called poison control.

MI05056 – A farmworker his teens was spraying an insecticide (signal word: Warning) under the supervision of a certified pesticide handler. Some spilled on his skin when he poured it into an agitator. He developed red, irritated skin and called poison control.

Landscaping

MI04664 – A landscaper in his 40s used an organophosphate insecticide. He developed nausea, vomiting, pain, sweating, chills, thirst, headache, confusion, and dizziness. He went to an emergency department and was admitted to the hospital.

MI04877 – A pest control operator for a lawn service company in his 60s sprayed a mixture of insecticides (both with signal word: Caution) for five months. He developed a headache, nausea and vomiting that lasted for about three weeks. He went to an emergency department and his primary care provider.

Structural pest control

MI04818 – An independent contractor for a home remodeler in his 30s sprayed an insecticide (signal word: Caution) for bedbugs in a house. He got some on his skin while spraying overhead and developed a burning, itchy rash. He called poison control.

MI04828 – A laborer in his 30s helped treat an apartment complex for cockroaches with a mixture of insecticides. He developed a cough, tearing and swollen eyes, and vomited. His coworker called poison control.

MI04929 – A pest control operator in his 50s used several insecticides, one of which was an organophosphate. He developed frequent falling and confusion. He went to a hospital and was admitted for fifteen days. He was diagnosed with Guillain-Barre, which, rather than insecticides, may have accounted for his symptoms.

MI03333 – A pest control operator in his 30s was releasing pressure on a sprayer filled with insecticide (signal word: Warning) when the valve exploded. The insecticide went into his eyes, nose, and mouth. He developed nausea, vomiting, abdominal pain, a burning sensation in his chest, cough, and numbness down his arms. He went to an emergency department and was admitted overnight.

MI05047 – A pesticide applicator in his 30s was applying an insecticide (signal word: Caution). The bottle broke in his pocket and the insecticide dripped down his side and leg. His skin became painful and itchy and he called poison control.

Mosquito control

MI04735 – A field technician for a mosquito control company in his 20s was exposed to insecticides (signal word: Caution) for about three weeks while wearing a particulate rather than a chemical mask. He developed shortness of breath, nausea, dizziness and a headache. He called poison control and went to the emergency department three times. He lost seven days of work.

MI04834 – A field technician for a mosquito control company in his teens was exposed to insecticides (signal word: Caution) for about three weeks while wearing a particulate rather than a chemical mask. He developed shortness of breath, a bloody nose, and a cough. He was a co-worker of the individuals in case MI04735.

MI04783 – A pesticide applicator in his teens sprayed a mixture of insecticides for mosquitos. Some blew back in his face and eyes. He developed red, puffy, and itchy eyes, tearing, and blurred vision. He went to an emergency department.

MI05053 – A sprayer for a mosquito squad in his 30s had skin irritation, nausea, and a headache on the days he sprayed, but felt fine on weekends. He wore the required PPE and showered after work each day. He called poison control and went to an emergency department. He quit his job after three weeks.

Miscellaneous/unknown

MI04583 – A surgical center worker in his 50s was cleaning mouse feces from an enclosed area where a new dishwasher was being installed. The area had been sprayed the previous day with

an unknown organophosphate. He fainted, vomited, was incontinent, had diarrhea, was sweating, tearing, and his heart rate was low. He was taken by ambulance to an emergency department.

MI04601 – A stocker at a home center in his 20s was exposed to an insecticide (signal word: Caution) when a pallet of product fell. When he mopped up the spill some got on him and he inhaled fumes. He developed a headache, nausea, and dizziness. He went to an urgent care clinic.

MI04782 – A foreman in his 40s was installing windmills in a farm field. He was sprayed by an aerial applicator with two insecticides as he left a port-a-john. He became dizzy, had a headache, trouble breathing, a sore throat, and his lips were numb. He went to an emergency department. MDARD cited the applicator for multiple violations.

MI04786 – A heavy equipment operator in his 30s was installing windmills in a field when he was sprayed by an aerial applicator. He developed high blood pressure, numbness in his mouth and throat, tunnel vision, and a headache that lasted for five days. He went to an emergency department. MDARD cited the applicator for multiple violations. He was a co-worker of case MI04782.

MI04797 – An employee at a federal screening checkpoint in his 40s was exposed to an insecticide. He became nauseated and dizzy, and his chest felt heavy. He later developed a headache and increased salivation. He called poison control.

MI04804 – A roofer in his 20s sprayed a yellow jacket nest with an insecticide (signal word: Caution) and some blew back at him. He became lightheaded and had difficulty breathing. He called poison control.

MI04830 – A long term care nurse in her 30s was exposed to an insecticide being sprayed outside that was brought into the facility through the ventilation system. She developed a runny nose, cough, tingling lips and tongue, and dizziness. She called poison control.

MI04842 – A fast food worker in his teens was reaching for something on a shelf and an insect repellent container (no signal word) next to the item he was reaching for fell. The insect repellent splashed in one eye. His eye became painful, red and was tearing. He rinsed his eye at work and then went to an emergency department

MI04876 – A training supervisor at a vocational services agency in her 60s entered her office the day after the building had been treated for bed bugs with an insecticide (signal word: Caution). She became dizzy and unsteady, started slurring her words, and developed a headache. She went to an emergency department.

MI 4888 – A vet tech for a humane society in her teens was opening flea control medicine for dogs (signal word: Warning) and it exploded onto her face. A splatter went into her mouth,

most went into her right eye and a little into her left eye. She immediately rinsed her eyes in an eye wash for ten minutes. She developed red, irritated eyes and her vision was blurry in her right eye. She went to an emergency department.

MI 4908 – A food server at a restaurant in her 50s was sprayed on her arm and the back of her head with an insecticide (signal word: Caution) by her manager who was aiming at a bee during an outdoor wedding reception. Her head and hands were soaked. She washed her hands in the bathroom and dabbed her head with paper towels. Two days later she took a hot shower in the morning and became lightheaded, had blurred vision and a headache. The headache lasted 4-5 days, the dizziness 2-3 days, and two months later when interviewed she felt that her short-term memory had become worse since the exposure. She called poison control.

MI04910 – A sales agent for an insurance company in her 50s was out in the field when her supervisor set off a total release insecticide fogger (signal word: Warning) in the office. Her supervisor did not know how soon she would return and did not post information about the fogger application in the office. When she returned the mist was still in the air and she started choking. She developed a cough, sore throat, and difficulty breathing. She called poison control.

MI04939 – A trucker in his 40s who slept in the truck on long hauls took the truck to a towing/storage company, as instructed by his employer, to have it treated for bedbugs. The towing/storage company set off four foggers (signal word: Warning) on each of two days (total of eight foggers) and did not air out the truck. An additional fogger that had been left behind went off after he picked up the truck. He had to drive about 10 minutes after the fogger went off to pull off at a rest stop. He developed headaches, nausea, coughing, and difficulty breathing and was taken to a hospital by ambulance. He continued to have respiratory symptoms and headaches several months later when interviewed. MDARD cited the towing/storage company for several violations.

MI04964 – A hotel housekeeper in her 50s was spraying an insecticide (signal word: Caution) for bedbugs and got some in her eye. Her eye was initially painful and itchy, and her vision was blurry. She went to an emergency department.

MI05049 – A worker in his 50s sprayed 55 rooms at a camp with an insecticide (signal word: Caution) for bed bugs. He developed difficulty breathing, a cough, headache, and nausea. He went to a medical clinic and called poison control.

MI05065 – A hospital electrician in his 50s sprayed bees in an outside light fixture with an insecticide (signal word: Caution). The wind picked up and blew the insecticide back in his face and on his shirt. He was wearing safety glasses. He developed eye irritation, dizziness, nausea, and a headache that kept him up all night. He went to the emergency department the following day.

MI05067 – A condominium maintenance worker in his 50s was spraying moths on a roof with an insecticide (signal word: Danger). He became thirsty and went to the store for water. He was

later found passed out in the store parking lot by his co-workers. He was lightheaded, had altered mental status, nausea, trouble breathing, and kidney failure. He was taken to the emergency department and was admitted to the hospital overnight.

MI05076 – A city department of transportation mechanic in his 50s inhaled an insecticide (signal word: Caution) after the bus terminal where he worked was treated for fleas. There was no notification to workers. He developed a burning sensation in his chest and shortness of breath and went to an urgent care clinic.

MI05087 – A road commission worker in his 50s walked into a bathroom that was being treated with an insecticide fogger. He developed a cough and respiratory irritation. He went to a medical clinic.

Herbicides

Agriculture

MI04570 – A tree farm worker in his 20s was exposed to an herbicide (signal word: Caution). He developed a cough, abdominal pain, diarrhea, nausea, and vomited. He went to an emergency department.

MI04779 – A farmer in his 60s used his bare hands to move soybeans that had been treated with an herbicide (signal word: Caution). His hands became numb and tingly, and he was queasy and pale. He called poison control.

MI04843 – A farmer in his 70s inhaled an herbicide (signal word: Caution) as he turned around at the end of his field when spraying. He developed nausea, difficulty breathing, a sore throat, tachycardia, and was shaky. He went to an urgent care clinic, an emergency department, and was admitted to the hospital.

MI05039 – A farmer in her 50s was in the field near where her husband was spraying an herbicide (signal word: Caution) on a windy day. She felt the application on her skin but then mowed the lawn before showering. She developed skin irritation, nausea, vomiting, diarrhea, and eyes, nose, and throat irritation. She went to an emergency department.

MI05050 – A farmworker in his 50s spread 80-pound bags of an herbicide (signal word: Caution) over crops. He did not use a mask or any other PPE. A long sleeve shirt, long pants, gloves, shoes, and socks were required. He developed irritated skin and eyes, a headache, and difficulty breathing. He went to an emergency department.

MI05059 – A greenhouse grower in his 40s was spraying a plant growth regulator (signal word: Caution) when the hose blew, sending the chemical through his Tyvek suit. He washed immediately but developed a burning sensation and redness. He went to an emergency department.

MI05068 – A nursery shipping foreman in his 20s was spraying rows of flowers with an herbicide (signal word: Caution). After diluting the herbicide there was a little left and his boss told him to add it to the backpack sprayer tank, so the solution was more concentrated than usual. Some leaked on his legs and socks. He developed a red, painful, itchy rash with blisters and went to an urgent care clinic.

Landscaping

MI04632 – A lawn care service worker in her 20s was working outside and was exposed to a recently sprayed herbicide (signal word: Caution) for about 30 minutes. She developed a sore throat, cough, and shortness of breath and went to an emergency department. There is no re-entry restriction on the herbicide label.

MI04702 – A pond company employee in his 40s got an herbicide (signal word: Danger) in his eye. It was red, tearing, and painful and he had blurred vision. He went to an emergency department and was diagnosed with a corneal abrasion.

MI04942 – A worker in his 40s was sprayed in his eyes with an herbicide (signal word: Danger), a surfactant, and antifreeze while winterizing a vehicle at a landscaping company. He developed red, itching, painful, eyes, and blurry vision. He went to an emergency department.

MI04958 – A pest control applicator for a right-of-way vegetation control company in his 30s sprayed glyphosate into trees. Some dripped down on his arms and he developed a red, painful rash with blisters. He went to an emergency department.

MI05060 – A fertilizer technician for a landscaping company in his 60s sprayed several lawns with an herbicide (signal word: Danger). He diluted it correctly and used a riding sprayer that he calibrated regularly. He wore the required PPE (Personal Protective Equipment) but became ill anyway. He had stomach pain, nausea, vomiting, and pinpoint pupils. He went to an urgent care clinic and was sent to an emergency department. He followed up with an ophthalmologist and lost seven days of work.

Miscellaneous/unknown

MI04805 – A service technician/shop worker for a fire apparatus distributer in his 20s was spraying an herbicide (signal word: Warning) around an apartment complex his boss owned. He had a problem with the sprayer, set it down, and then the pressure line disconnected. He was sprayed in the face and upper body. He was not wearing required eye protection. His eyes became red and irritated and he called poison control.

MI04829 – An applicator in his 30s got splashed in the face with an herbicide (signal word: Danger). He developed difficulty breathing, with pain on deep breathes, wheezing, and sweating. He went to an emergency department.

MI04869 – A home center store clerk in her 40s was cleaning up broken bottles and was exposed to an herbicide (signal word: Caution). Despite wearing a respirator, she developed a

tingling sensation around her lips and tongue; watery eyes; burning nose, throat, and chest; and a headache. She went to an urgent care clinic.

MI05048 – A wastewater treatment supervisor in his 20s sprayed two herbicides in a wastewater pond. It was windy and some of the spray got on his skin and in his eyes. He was on a boat and unable to wash off right away. He developed red, irritated, and tearing eyes, and red, swollen and painful skin on his face, a headache, rapid breathing, sweating, and nasal congestion. He went to an urgent care clinic and was sent from there to an emergency department.

MI05095 – A firefighter in his 20s crawled over potatoes to get to a ventilation system in a barn that was on fire. His respirator fell off while he was crawling. He was exposed to smoke and two plant growth inhibitors, chlorparopham, and dimethylnaphthalene, which had been applied to the potatoes. It took the firefighter about 35–40 seconds to get his mask back on. He immediately started coughing, left the barn, and was given oxygen. His lungs felt like they were burning, he was lightheaded, nauseated, and vomited once. He was taken by ambulance to an emergency department.

Disinfectants

Agriculture

MI04568 – A dairy farmworker in her 20s was pumping a disinfectant used to clean walls and equipment from a barrel to a bucket and the hose came off and some of the undiluted chemical splashed on her thigh. She developed a second degree burn and went to an urgent care clinic.

MI05079 – A farmworker in his 30s was cleaning milk buckets on a dairy farm when some disinfectant splashed in his eye. He developed eye pain and blurry vision and went to an emergency department.

MI05088 – A dairy farm employee in his teens mixed bleach with an acid cleaner. He inhaled fumes from the mixture (chlorine) and developed shortness of breath and a cough. He went to an emergency department.

Cleaner/housekeeper/janitor/custodian

MI04569 – A school maintenance worker in his 20s was exposed to a disinfectant placed in a plug-in aerosolizer. He thinks the usual chemical was replaced with a different disinfectant. He became lightheaded, vomited, and developed a cough, difficulty breathing, and a headache. He went to an emergency department and lost three days of work.

MI04576 – A janitor in his 20s used several disinfectants without gloves. He developed irritated, cracked skin on his fingers and called poison control.

MI04577 – A hospital custodian in his 40s cleaned restrooms with a disinfectant (signal word: Danger). He developed shortness of breath, a cough, and a sore throat. He went to the emergency department and an allergist. He lost two days of work.

MI04581 – A hospital environmental aide in her 50s developed shortness of breath, asthma exacerbation, headaches, coughing, and nasal congestion when the hospital switched to a new disinfectant (signal word: Danger). She went to her primary care provider and an employee health clinic. She was able to switch back to using the previous disinfectant.

Mi04582 – A house cleaner in her 50s had a disinfectant (signal word: Caution) in a water bottle and mistakenly took a sip out of it. She developed throat irritation, dizziness, dry heaves and an altered taste in her mouth. She called poison control.

MI04584 – A hospital housekeeper in her 50s was cleaning with a disinfectant (signal word: Danger), which gave off a strong odor. She developed nasal and dermal irritation and chest tightness. Two days later, she went to her doctor because she still had symptoms. Two days after that, she called poison control because of a lingering smell in her nose.

MI04585 – A uniform company laundry facility worker in his 20s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. He developed nausea, a burning sensation in his chest, and felt jittery. He went to an emergency department.

MI04586 – A uniform company laundry facility worker in her 40s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed nausea and a headache. She went to an emergency department.

MI04587 – A sorter for a uniform company laundry facility in her 50s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed lung and throat irritation, dizziness, asthma exacerbation. She used her inhaler and went to an emergency department.

MI04588 – A uniform company laundry facility employee in her 40s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed chest discomfort, a headache, nausea and a burning sensation in her nasal passage. She went to an emergency department.

MI04589 – A uniform company laundry facility employee was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed nausea and went to an emergency department.

MI04592 – A uniform company laundry facility employee in his 20s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the

washing machine. He developed a sore throat, nausea, and high blood pressure. He went to an emergency department.

MI04593 – A uniform company laundry facility production worker in her 50s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed nausea, a sore throat, altered taste, and a headache. She went to an emergency department.

MI04597 – A uniform company laundry facility employee in his 20s was one of ten employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. He developed shortness of breath, burning sensation in his chest, nausea, headache, and high blood pressure. He went to an emergency department.

MI04598 – A pregnant uniform company laundry facility employee in her 20s was one of 10 employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed a burning sensation in her chest and nausea. She went to an emergency department.

MI04599 – A uniform company laundry facility employee in her 30s was one of 10 employees exposed to disinfectants when something broke in the line and too much solution went into the washing machine. She developed a headache, muscle pain, throat irritation and burning eyes. She went to an emergency department.

MI04604 – A hospital environmental aide in her 30s cleaned patient rooms after discharge with a disinfectant (signal word: Danger). She developed sinus problems, nose bleeds, headaches, and difficulty breathing. She went to an occupational health clinic and an allergist.

MI04605 – A hospital environmental aide in her 60s walked by an area where a disinfectant (signal word: Danger) had been used. She developed palpitations, shortness of breath and asthma exacerbation. She went to the emergency department and the employee health clinic.

MI04606 – A hospital environmental aide in his 40s was cleaning patient rooms with a disinfectant (signal word: Danger). He developed eye irritation, tearing, sore throat, runny nose, and wheezing. He went to the employee health clinic.

MI04607 – A hospital environmental aide in his 30s was cleaning patient rooms with a disinfectant (signal word: Danger). He developed a sore and swollen throat, tearing, eye irritation, diaphoresis, and nausea. He went to the emergency department and the employee health clinic.

MI04817 – A cage washer for a university laboratory animal unit in his 20s had disinfectant (signal word: Danger) splash up under his safety glasses when he was pouring it out of a bucket. His eye became red and irritated and he felt like there was a foreign body in his eye. He went to an occupational health clinic.

MI04856 – A janitor in his 50s was spraying bleachers in a school gym with a disinfectant (signal word: Danger) diluted in a power washer. Some misted back on his face. He was wearing safety glasses even though PPE was not required. He developed a cough, difficulty breathing, eye irritation, and a sore throat. He went to an emergency department.

MI04858 – A factory custodian in her 20s cleaned a bathroom with a disinfectant (signal word: Danger). She developed a cough and sore throat. The cough lasted through the night. She called poison control.

MI05046 – A hospital housekeeper in her 60s got a disinfectant (signal word: Danger) in her eye. It became red and irritated. She went to the emergency department and then an ophthalmologist.

MI05074 – A hospital housekeeper in her 50s was splashed in the eye with a disinfectant (signal word: Danger) when she emptied a bucket and tripped. She developed a red, irritated eye and a corneal burn. She went to the emergency department.

MI05091 – A hospital environmental services worker in her teens was cleaning and when she moved a bucket it hit the side of a cart. The disinfectant (signal word: Danger) splashed into her right eye. She irrigated at an eyewash station for five minutes and went to the emergency department. Her eyes were irritated, red, and felt dry. Eye protection was not worn, but not required.

Food service/production

MI04567 – A forklift operator in his 50s lifted apples into a disinfectant tank. After the company changed the machinery used to spray one of the disinfectants, he started developing headaches; itchy, burning skin; shortness of breath; nausea; and loss of appetite. No PPE was provided but goggles were required. He was afraid he would be fired if he contacted MIOSHA or went to an occupational health clinic. He planned to start bringing in his own PPE. He went to a Veteran's Administration clinic and called poison control.

MI04572 – A dishwasher in his 30s, who had been washing dishes in a three-part sink, using a disinfectant (signal word: Caution) for a few months, developed dry itchy hands, a sinus headache and eye irritation. He called poison control.

MI04575 – A restaurant server in her 50s had disinfectant splash in her eye. She rinsed her eye for 10 minutes but it was still burning and red, so she went to an emergency department. They flushed it with two liters of lactated ringers, but the pH remained high. She was referred to an ophthalmologist.

MI04579 – A restaurant worker in her 30s got dishwashing disinfectant (signal word: Danger) on her hands and lips. Her hands were red and painful. She went to an emergency department.

MI04931 – A fast food worker in her 30s opened a bag of sanitizer (signal word: Caution) and inhaled the powder. She developed a sore throat, and a sour taste. She went to an emergency department.

MI04970 – A temp agency employee at a blueberry factory in her 40s was exposed to chlorine dioxide. She was washing tubs and used a product that was diluted by another worker. Another worker added too much chlorine dioxide to the solution. The temp agency employee developed a cough, shortness of breath, sore throat, skin irritation, eye irritation, nausea, and a headache. She went to an emergency department.

MI04976 – A restaurant worker in his teens mixed a de-limer (acid) with bleach and inhaled the fumes (chlorine). He developed a cough and shortness of breath. His mother called poison control.

MI05010 – A fast food worker in her 20s was washing dishes and went to add sanitizer when the hose from the container came off. She tried to reattach the hose and the sanitizer leaked down her arm. She developed a red, painful, itchy, rash and went to an urgent care clinic.

MI05044 – A food processing plant maintenance technician in his 40s was exposed to a disinfectant (signal word: Danger) after a fire alarm went off. A coworker was fogging a room and some of the fog drifted into the electrical room and set off the alarm. He went looking for the source of the fire and made sure everyone was out of the building. He opened the door to the electrical room to let the fog dissipate. He developed a cough, lung irritation, sore throat, dizziness, and had a scleral hemorrhage in his right eye. He went to an emergency department.

MI05051 – A fast food worker in his 20s spilled floor sanitizer (signal word: Danger) on himself. His skin became red, painful, and itchy. He went to an emergency department.

MI05062 – A cashier at a fast food restaurant in her 30s, who was short, reached over a sink to put a block of a disinfectant (signal word: Danger) into a container. She said that there was no stool available, and it would have been fine if there was a stool. But as she pushed the top of the container down it chipped off a corner of the block and the chip flew into her eye. She rinsed her eye at work, but it continued to tear and was painful, so she went to an emergency department and had her eye thoroughly rinsed. Goggles or a face shield were required but were not worn. MIOSHA was notified of this case.

MI05105 – A barista in her teens was squirting sanitizer into the steam wand. The wand was in a bucket half full of water. The sanitizer bounced off the water, hit a towel, and splashed into her eye, on her arm, and thigh. She developed a corneal abrasion and skin burns. She went to an urgent care clinic and an ophthalmologist.

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 swollen eyelids and a red eye. She called poison control.

Healthcare

MI04563 – A worker in an endoscopy laboratory in her 30s got disinfectant (signal word: Danger) on her hand. She rinsed it right away, but it became mottled in color and painful. Gloves were required; it is unknown if she was wearing gloves. She went to the emergency department.

MI04565 – A nurse in her 60s was opening a box of disinfectant. One of the gallon jugs was leaking, and some got on her thumb. Her thumb became irritated and turned white. She went to the emergency department.

MI04602 – A hospital dietetic technician in her 50s walked by a room being cleaned with a disinfectant (signal word: Danger). She developed a cough, shortness of breath, gagging, lacrimation and throat irritation. She left the area and recovered. She did not seek medical care.

MI04803 – A certified nursing assistant in her 20s at a nursing home got sprayed in her eyes and face with a disinfectant (signal word: Danger) used for mopping. The spray hose clicked off but knocked back to on when she turned the water off. She was not wearing required eye protection. She flushed her eyes immediately but developed red, burning eyes and a headache. She went to an urgent care clinic and lost two days of work.

MI04875 – A phlebotomist at a blood bank in her 20s was cleaning blood bags with a disinfectant (signal word: Caution). She was wearing gloves, but some splashed above the glove on her forearm. It started to hurt on her way home. When she arrived home, she washed her arm. She developed a bleeding wound and the next day called poison control.

MI04912 - A dietary aid in her 20s at a long-term care facility was washing dishes. The dishwashing machine was adding too much bleach. She developed difficulty breathing, a cough, and a burning sensation in her lungs. She went to an emergency department.

MI04946 – An endoscopy technician in his 40s was present when a bottle of a sterilant (signal word: Danger) fell to the floor. He inhaled the fumes and got some on his fingers. He developed a sore throat, became dizzy, and he had white spots on his fingers. He went to an occupational health clinic.

MI04972 – A patient care technician at a dialysis center in her 20s was sterilizing a machine. Some of the sterilant poured out of a part of the machine that it was not supposed to and spilled on her hand. It became red and painful. She went to an emergency department.

MI04989 – A hospital worker in her 20s spilled some disinfectant on herself while cleaning endoscopes. She was wearing a gown at the time and did not realize she had spilled some on her arm until it started to itch. She developed a quarter-sized white area on her arm and went to an occupational health clinic.

MI05075 – A student nurse in her 20s was changing a resident's briefs and pulled up a spare trash bag from the trash can. The bag was wet with sanitizer used on the toilet next to the spare trash can. Liquid in the bottom of the can splashed in her face and she developed a nosebleed, and face and eye irritation. She went to an emergency department.

Pool-related

MI04785 – A supercenter discount store cashier in her 60s inhaled some pool shock as she scanned the bag. She developed a sore throat, runny nose, and difficulty breathing. She still had difficulty breathing ten days later so she went to an emergency department.

MI04812 – A home center store sales associate in his 20s handled a defective box of a pool chemical. Powder went into his face and he developed a cough, nausea, and vomiting. He went to an emergency department

MI05078 – A teacher in a high school in her 20s was teaching in a room across the hall from the pool. The pool was over treated, and the smell of chlorine spread. The school was evacuated, and HazMat was called. She became lightheaded, had a headache, was nauseated and developed high blood pressure. She went to an emergency department.

Miscellaneous/unknown

MI04573 – A chemist at a lubricant manufacturing plant in her 30s was exposed to a disinfectant (signal word: Danger) on her arm while cleaning a coolant tank. She did not realize that she got it on her arm until it became red. Two weeks later, the area became dry and leathery. The following day it was red, itchy, and weeping. She called poison control.

MI04574 – A grocery store stocker in his 30s spilled some disinfectant (signal word: Danger) on his arm while cleaning vegetables. He washed it off but developed a red, painful, area and went to an emergency department.

MI04885 – A worker in her 30s worked with a disinfectant (signal word: Danger) for three hours. She was not wearing any protective equipment although gloves, goggles, and protective clothing were required, a mask or other respiratory protection was not required. She did not shower until the following morning. She developed respiratory irritation, a cough, chest pain, felt hot, and vomited. She called poison control.

MI04886 – A paper mill worker in his 40s got some disinfectant in his eye. He developed a red, irritated eye and had a corneal burn. He went to an emergency department.

MI04906 – A drug store pharmacist in his 50s was exposed to chloramine gas when a plumber poured ammonia down a drain that already had bleach in it. He developed eye irritation, felt lightheaded, and vomited four times. He called poison control.

MI04916 – A tire store technician in his 30s drank from a water bottle that had a disinfectant (signal word: Caution) in it and that had been left near his water bottle. He took three to four swallows and developed nausea, stomach pain, a sore throat, and his back felt like it was on fire. He called poison control and went to an emergency department.

MI04928 – A worker in his 30s had disinfectant (signal word: Danger) splash on his arm. It became red and irritated. He called poison control and went to an emergency department.

MI04938 – A shift engineer in his 40s put acid drain cleaner down a pipe. It leaked out and he tried to clean the leak up with a mixture of ammonia and bleach. He developed shortness of breath, a cough, tachypnea and burning eyes. He called poison control and went to an emergency department.

MI04971 – A worker in her 30s drank a cup of coffee from a carafe that may have had some sanitizer (signal word: Danger) left in it. She developed nausea, dizziness, and a dry, tingling throat. She went to an emergency department.

MI04973 – A worker in her 50s got disinfectant (signal word: Danger) in her eye. It became irritated and she had blurry vision. She went to an emergency department.

MI05002 – A worker in her 50s was exposed to a disinfectant (signal word: Caution) that a co-worker was spraying to the vents to cover up the cigarette smoke odor coming from outside the back door. She developed a cough, eye irritation and a headache. She called poison control.

MI05011 – A chemical manufacturing company delivery driver in his 40s delivered sodium hypochlorite to a manufacturing facility and dumped it into an open pit. He began to see fumes and was told that there could be cyanide in the pit. He became lightheaded, was nauseated, confused, had changes in his depth perception, and shortness of breath. He went to an emergency department.

MI05057 – A truck driver for a grocery wholesaler in his 30s was exposed to a mixture of sodium hypochlorite and water softener salt from broken bags loaded in the truck. When the truck driver opened the back of the truck at his first stop, he was enveloped in fumes. He and a coworker cleaned it up with no PPE and continued driving the route. He developed a cough, burning sensation in his lungs, eyes, nose, and throat irritation, nausea, and felt disoriented. He went to an emergency department. The co-worker was also exposed, but only had one symptom, eye irritation, and therefore did not meet the NIOSH criteria for a confirmed case.

MI05084 – A worker for a sheriff's department in her 40s sat on a toilet bowl that had been treated with a disinfectant (signal word: Caution). Her skin became red and painful. She called poison control.

MI05096 – A teenage worker had sanitizer splash in his eye. He developed a red, irritated eye. He called poison control.

MI05101 – An adult worker swallowed some disinfectant (signal word: Danger) after it splashed in her face. She developed nausea, a headache, and dizziness. She went to an emergency department.

MI05104 – A woman in her 20s got splashed in her eye with a disinfectant mop cleaner (signal word: Danger) that is typically sold to commercial establishments. It could not be confirmed this occurred at work. She developed eye irritation and tearing and called poison control.

MI05109 – A worker in a hardware store in his 20s was handling pool chlorine which splashed on his hands after he knocked the bottle over. He rinsed within a minute or two but developed red, irritated skin. He called poison control.

MI05110 – A school bus driver in his 60s drove a football team on a field trip. The bus had just been cleaned with an undiluted disinfectant (signal word: Danger) due to a child vomiting. The driver inhaled the fumes for three hours and got some on his hands. He became dizzy, nauseated, had a headache, and had a bad taste in the back of his throat. He called poison control.

<u>Other/Mixture</u>

MI04580 – A pesticide applicator for a tree service company in her 40s was spraying with a mixture of an insecticide and a fungicide (both with signal word: Caution). Some of the vapors came back on her face and neck, which became red, and she had a burning sensation. She went to an urgent care clinic.

MI04798 – A farmworker in his teens got some algicide (signal word: Danger) in his eye. It became red and irritated. He went to an emergency department.

MI04799 – A lifeguard at a country club in her 20s sprayed an algaecide (signal word: Danger) on a pool filter and some splashed back into her left eye. She went to an emergency department and was diagnosed with a corneal abrasion.

MI04814 – A worker in his 20s was spraying a mixture of fungicides and the next day he woke up with eye pain. He went to an emergency department.

MI04832 – A farm manager in his 20s was fixing a plugged valve on a sprayer and got some insecticide and fungicide on his arm. He developed a numb tongue, numbness to his hands and lightheadedness. He went to an emergency department.

MI04844 – A private farm pesticide applicator in his 20s used a backpack sprayer to apply a fungicide (signal word: Danger) to tomatoes. He wore prescription glasses but not goggles. The label requires protective eye gear. He developed a burning, itchy eye and swollen lid. He called poison control and went to an urgent care clinic.

MI05038 – A construction worker in his teens was tearing down ceilings. A few particles of rat poison dropped in his drink. He spit most of it out but later vomited and developed a headache that lasted for days. He called poison control.

MI05052 – A postal worker in her 50s was sorting mail when she noticed an empty bottle of fungicide (signal word: Caution) and some wet mail. She called maintenance to clean it up but continued to work in the same area for another hour and a half. Her lips and tongue were numb and tingling, she had a funny taste in her mouth, and she developed stomach pain and a feeling of fullness in her stomach, with loss of appetite for a day. She went to an occupational health center and called poison control.

MI05070 – A worker in his 50s sprayed a mixture of pesticides (insecticide and fungicide) in his eye. He developed a red, irritated eye, tearing, and irritated skin. He went to an emergency department and called poison control.