Pesticide Illness and Injury Surveillance in Michigan 2012

April 2014

Division of Environmental Health
Michigan Department of Community Health

Pesticide Illness and Injury Surveillance in Michigan: 2012

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Acknowledgements
The Occupational Pesticide Illness and Injury Surveillance Program wishes to acknowledge those who have contributed to the development and implementation of the surveillance program and this report:

Michigan Department of Agriculture and Rural Development
Brian Rowe, BS

National Institute for Occupational Safety and Health
Geoffrey Calvert, MD, MPH

Children's Hospital of Michigan Poison Control Center
Susan Smolinske, PharmD

This publication was supported by a sub-award to MDCH from MSU of grant number 2U60OH008466 from the U.S. Centers for Disease Control and Prevention – National Institute for Occupational Safety and Health (CDC-NIOSH). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC-NIOSH.

Contents

Summary

The Michigan Department of Community Health (MDCH) has been conducting surveillance for acute work-related pesticide illnesses and injuries since 2001. MDCH began collecting data on non-occupational cases in 2006. 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 tenth annual report on pesticide-related illnesses and injuries in Michigan (MDCH, 2001-3, 2004, 2005, 2006, 2007, 2008, 2009, 2010, and 2011).

From 2001 through 2012, 1,335 reports of occupational exposures and pesticide illness or injury were received and 926 (69.4%) were confirmed as cases according to the surveillance case definition. Eighty-four of those confirmed cases were reported in 2012.

Michigan's Poison Control Center (PCC) remained the main data source, contributing 79.8% of confirmed occupational cases in 2012. Disinfectants continued to be the cause for over half of the confirmed occupational cases. A number of these cases would not have occurred if disinfectants were only used in situations where their use was necessary.

Where activity of the exposed person was known, 23.8% 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. The most common occupation was Building and Grounds Cleaning and Maintenance, comprising 28.6% of the confirmed cases in 2012. Of those, two-thirds were cleaners, housekeepers or maintenance workers and one-third were pest control operators.

From 2006 through 2012, 5,481 reports of non-occupational exposures and pesticide illness or injury were received and 1,481 (27.0%) were confirmed as cases according to the surveillance case definition. Four hundred forty of those confirmed cases were reported in 2012. Michigan's PCC is also the main data source for non-occupational exposures, reporting 82.7% of the confirmed non-occupational cases in 2012. There was about a four-fold increase in the number of reported non-occupational pesticide exposures because several new categories of non-occupational exposures were added to the poison control reporting algorithm. This resulted in an almost two-fold increase in confirmed cases. This represents a change in reporting, not necessarily an increase in exposures.

In 2012, disinfectants accounted for 54.0% and insecticides for 23.8% of confirmed non-occupational cases. Again many of these cases would not have occurred if disinfectants were only used in situations where their use was necessary.

Where activity of the exposed person was known, 51.1% of confirmed non-occupational cases were applying the pesticide themselves. 'Bystander' exposure was also important, with 27.7% exposed inadvertently while doing normal activities, not involved in the application of pesticides.

Three cases in 2012 were investigated by the Michigan Department of Agriculture and Rural Development (MDARD) for possible pesticide use violations, one occupational and two non-occupational. Fifteen events met the criteria for priority reporting to the National Institute for Occupational Safety and Health (NIOSH), seven occupational and eight non-occupational. These events are described on pages 28-31.

Background

Pesticide poisoning is a potential public health threat due to widespread pesticide use. According to the U.S. Environmental Protection Agency (EPA), over 1.1 billion pounds of pesticides were used in the United States in 2007, the last year of published data.[1]

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

Pesticides are a category of chemicals that are used to kill or control insects, weeds, fungi, rodents, and microbes. There are over 16,000 different pesticides registered for sale in Michigan, containing over 600 different active ingredients.

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

Acting on concerns about acute occupational pesticide-related illness, NIOSH began collecting standardized information about acute occupational pesticide exposure from selected states in 1998[2] under the Sentinel Event Notification System for Occupational Risk (SENSOR) program. An analysis of 1998-99 data provided by the SENSOR states demonstrated that the surveillance system was a useful tool to assess acute pesticide-related illness and to identify associated risk factors (Calvert, et al 2004).

Agriculture is the second largest income producing industry in Michigan and pesticide use is widespread in Michigan. Currently there are over 16,000 different pesticides registered for sale and use in Michigan. Businesses are required to obtain a license from the MDARD if they hold themselves out to the public as being in the business of applying pesticides for hire. There are 2,255 businesses licensed to apply pesticides in Michigan. Pesticide applicators are certified by the MDARD as either private or commercial. Private certification includes applicators involved in the production of an agricultural commodity (farmers). All other certified applicators are considered commercial. These include such categories as forestry, wood preservation, ornamental and turf pest control, seed treatment, aquatic, swimming pool, right-of-way, structural pest control, general pest management, mosquito control, aerial, fumigation and several others. In 2012, there were a total of 22,039 certified pesticide applicators. Table 1 shows the number of licensed businesses and certified applicators since 2003.

Table 1. Pesticide Licensing and Certification, 2003-2012

Type	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Private Certification	9,576	9,200	8,793	8,352	8,122	7,848	7,722	7,580	7, 490	7, 377
Commercial Cert.	13,387	13,588	13,485	13,743	14,123	14,118	14,210	14,199	14,458	14,396
Registered Tech.	NA	NA	NA	NA	NA	NA	NA	382	312	266
Total Applicators	22,963	22,788	22,278	22,095	22,245	21,966	21,932	22,161	22,260	22,039
Licensed Businesses	1,755	NA	1,900	1,962	1,923	2,025	2,147	2,095	2,212	2,255

[1] http://www.epa.gov/opp00001/pestsales/07pestsales/market_estimates2007.pdf
[2] http://www.cdc.gov/niosh/topics/pesticides/

Recognizing the extent of pesticide use in Michigan, in 2001 MDCH joined other NIOSH-funded states to institute an occupational pesticide illness and injury surveillance program. In 2006 MDCH added surveillance of non-occupational pesticide exposures. The intent of this surveillance is to identify the occurrence of adverse health effects and then intervene to prevent similar events from occurring in the future. MDCH recognizes the need for data on pesticide exposures and adverse health effects in Michigan.

The goals of the pesticide surveillance system are to characterize the pesticide-poisoning problem in Michigan and to prevent others from experiencing adverse health effects from pesticide exposures, with an emphasis on occupational exposure hazards. 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;
- Identify and refer cases to regulatory agencies for interventions;
- Provide information for planning and evaluating intervention programs.

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 information about individuals (including names) with known or suspected pesticide poisoning to the state. Originally (since 2001) poison control was required to report cases where the exposure reason was categorized as "Unintentional – Occupational". Beginning in 2006, poison control was required to report non-occupational cases where the reason for exposure was coded "Unintentional – Environmental." To fully capture environmental exposures, beginning in 2012 they began reporting cases with an exposure reason of "Unintentional – General", "Unintentional – Misuse" or "Unintentional – Unknown".

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 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 Michigan's Hazardous Substances Emergency Event Surveillance (HSEES)[3] program; Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) adverse effects reports; coworkers; and worker advocates.

The MDCH pesticide poisoning surveillance system is a case-based system. A reported individual must meet the case definition established by NIOSH and the participating states[4] to be included as a confirmed case. Data are collected according to standardized variable definitions in a database developed for states that are conducting pesticide surveillance.

Reported occupational cases are interviewed to determine the circumstances of the reported pesticide 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.[5] 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.[6]

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[3] http://www.michigan.gov/mdch/0,1607,7-132-2945_5105-110654--,00.html
[4] http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_revAPR2005.pdf page 1
[5] ibid, pages 2-3
[6] http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf

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 Licensing and Regulatory Affairs (LARA) and MDARD.

MIOSHA enforces 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 or employer.

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

Results

Section I. All Reports

There were 6,819 reports of acute pesticide poisonings from 2001 – 2012. These represent 6,071 separate events. In 2012 there were 2,756 people, from 2,546 events reported. In 2012 we added several categories of exposure reason from poison center reports which increased the number of non-occupational reports. Figure 1 shows the number of reported people and events by year. Figure 2 demonstrates that the increase in reports in 2012 was due to the changes in non-occupational reporting.

Figure 1

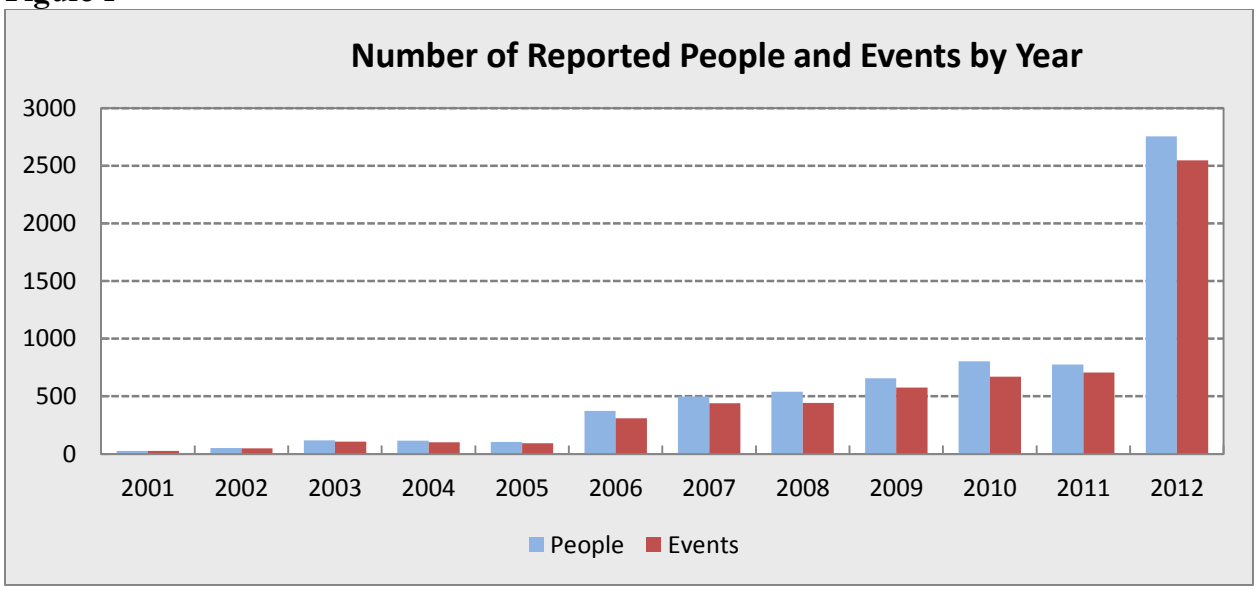
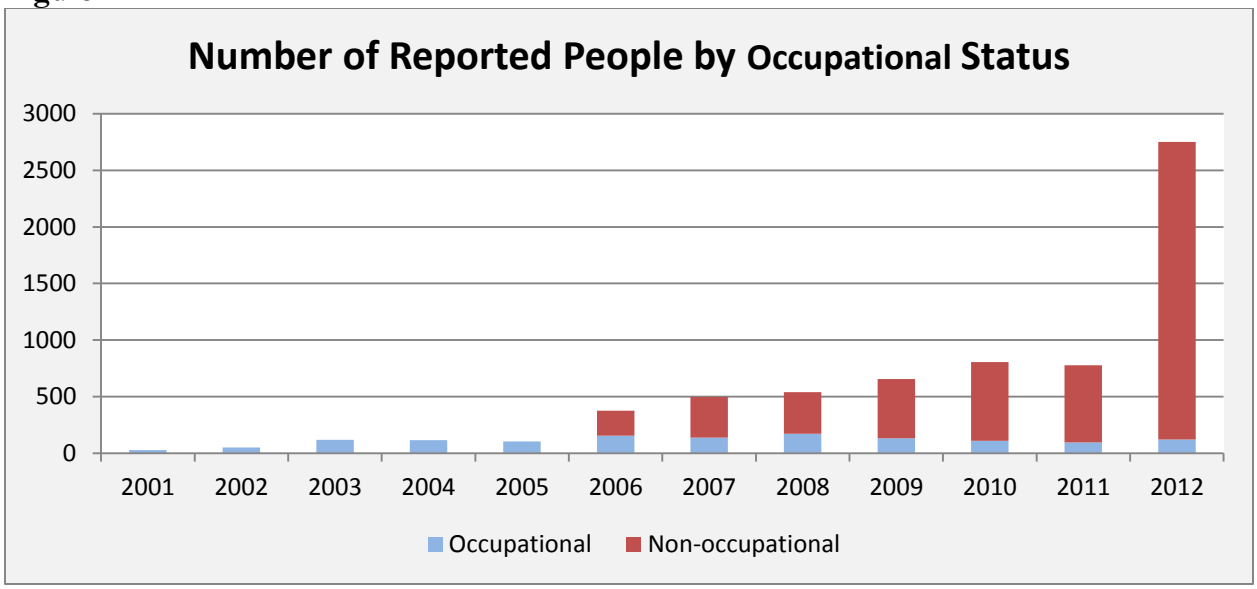


Figure 2



Of the 6,821 reports from 2001 through 2012, 2407 (35.3%) met the criteria for confirmed cases. See Table 2.

Table 2 : Case Confirmation by Work-Relatedness, 2001-2012 and 2012 Occupational Separately

Status	Occupational 2001-2012	Non-Occupational 2006-2012	Unknown 2001-2012	Total 2001-2012	Occupational 2012
Definite Case	103	23	0	126	6
Probable Case	223	219	0	442	24
Possible Case	588	1176	0	1764	54
Suspicious Case	12	63	0	75	0
Subtotal	*926*	*1481*	*0*	*2407*	*84*
Unlikely Case	6	7	0	13	1
Insufficient Information	349	2256	2	2607	24
Exposed/Asymptomatic	34	1620	0	1654	6
Unrelated	22	118	0	140	5
Subtotal	*411*	*4001*	*2*	*4414*	*36*
Total	**1337**	**5482**	**2**	**6821**	**120**

The remainder of this report only includes people with a case status of Definite, Probable, Possible, or Suspicious (DPPS); i.e., the confirmed cases.

Age is not always known. When known, persons of all ages may be exposed to pesticides. Table 3 shows the age groups for all confirmed cases.

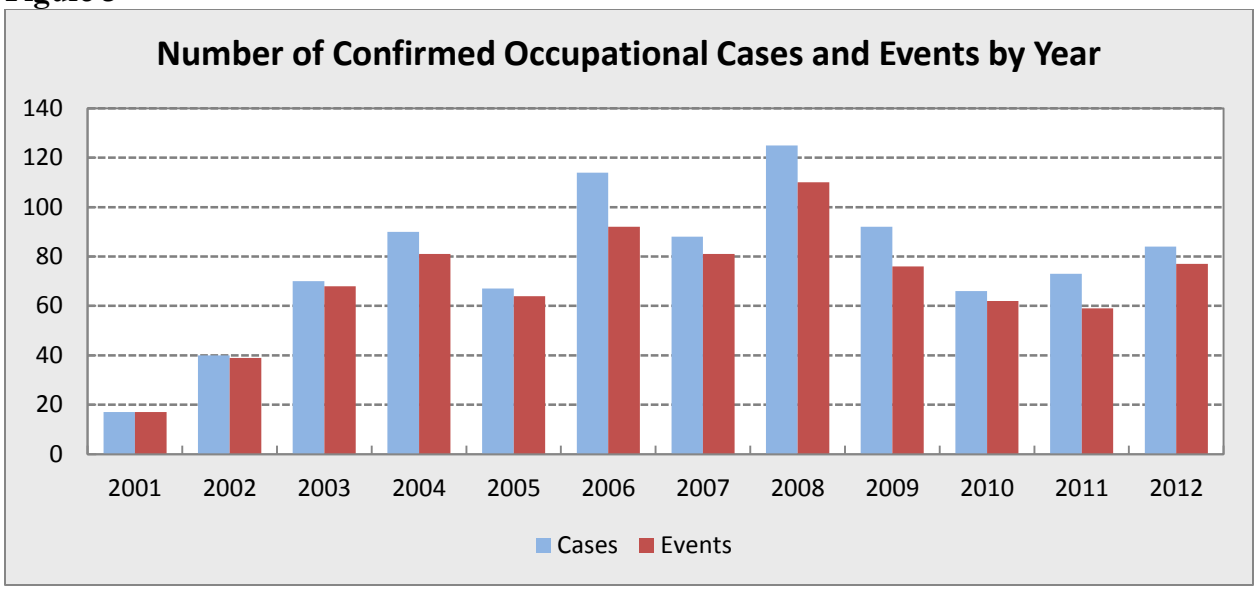
Table 3: Confirmed Cases by Age Group & Gender, 2001-2012 and 2012 separately

	Cumulative			2012		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
Unknown age	87	62	35	10	7	12
00-<1:Infants	3	8	1	0	3	0
01-02:Toddlers	19	21	0	3	8	0
03-05:PreSchool	24	26	0	9	16	0
06-11:Child	56	42	1	8	11	1
12-17:Youth	56	63	1	13	14	0
18-64:Adult	917	838	0	200	173	0
65+:Senior	82	65	0	22	14	0
Total	**1244**	**1125**	**38**	**265**	**246**	**13**

Section II. Occupational Pesticide Illnesses and Injuries

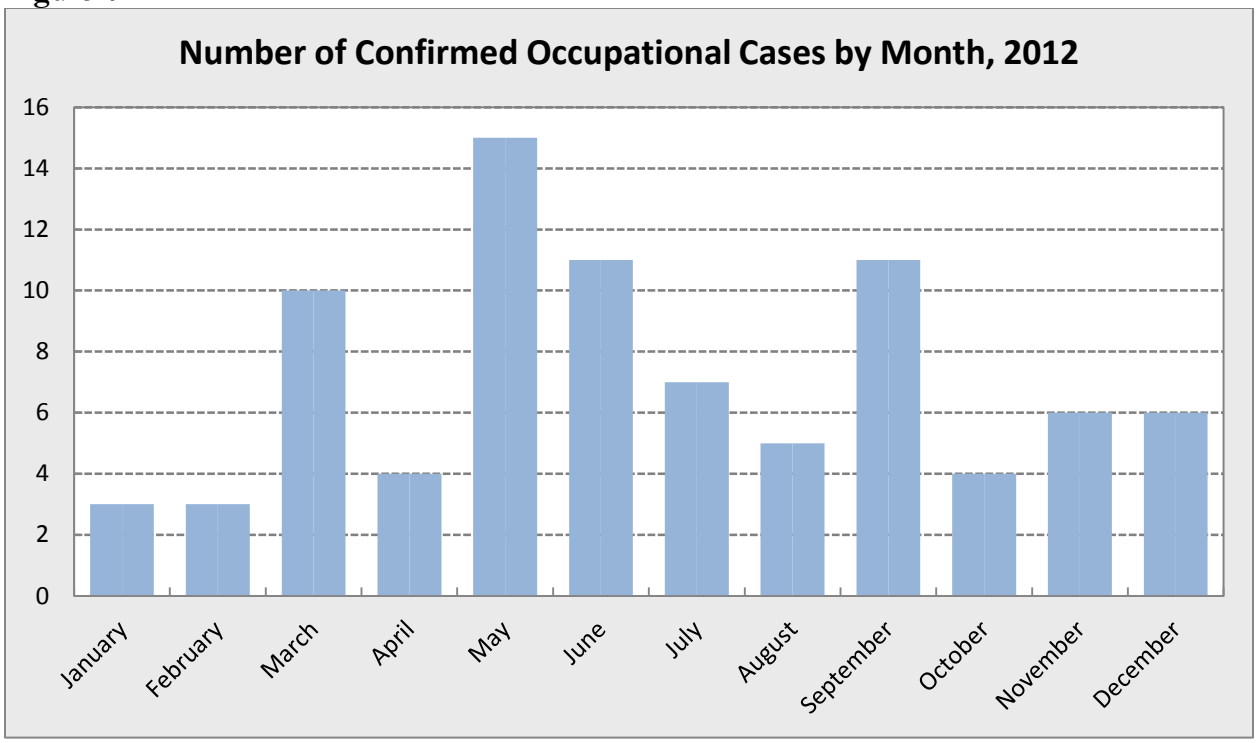
This section describes confirmed occupational cases. Figure 2 shows the number of cases and events. There were 84 cases from 77 events in 2012.

Figure 3



The chart below shows all confirmed occupational cases reported in 2012 by month of exposure.

Figure 4



Cases come from a variety of reporting sources. The Poison Control Center (PCC) remains the major source of reports. In 2012, 67 (79.8%) of the 84 occupational cases were first reported by PCC. Some exposures were reported by multiple sources; the table below shows the first source.

Table 4 : First Report Source, Confirmed Occupational Cases 2001-2012 and 2012 Separately

Report Source	Cumulative	Percent	2012	Percent
Poison control center	735	79.4%	67	79.8%
Other health care provider	68	7.3%	3	3.6%
State Health Department - HSEES	51	5.5%	1	1.2%
Report/referral from governmental agency	18	1.9%	6	7.1%
Department of Agriculture and Rural Development (MDARD)	13	1.4%	0	0.0%
News report/obituary	11	1.2%	7	8.3%
Employer	6	0.6%	0	0.0%
Physician report	6	0.6%	0	0.0%
Co-worker report	6	0.6%	0	0.0%
Friend or relative report	5	0.5%	0	0.0%
Other	7	0.8%	0	0.0%
Total	**926**	**100.0%**	**84**	**100.0%**

Demographics

Pesticide exposures occur to people of all ages. In2012, men were more likely to have had an occupational exposure to pesticides than women (57% vs. 43%), and when race and ethnicity were known, most cases were white, non-Hispanic (93.5%).

Table 5: Confirmed Occupational Cases by Age Group and Gender, 2001-2012 and 2012 Separately

	Cumulative			2012		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
10-19	38	51	0	1	3	0
20-29	102	143	0	11	15	0
30-39	75	102	0	7	8	0
40-49	89	89	0	8	10	0
50-59	62	63	0	6	6	0
60-69	8	14	0	1	3	0
70+	3	5	0	0	0	0
Unknown	32	39	11	2	3	0
Total	**409**	**506**	**11**	**36**	**48**	**0**

A county park cleaner in his 60s was filling a spray bottle with a quaternary ammonium chloride disinfectant from a larger container. Disinfectant leaked on the outside of the bottle and the bottle slipped from his hands and fell onto the floor. Disinfectant splashed into his eyes. He washed his eyes in the sink at work and then in the shower at home, but his eyes continued to burn and he had trouble seeing. He went to an emergency department and was diagnosed with corneal abrasion.

Table 6 : Confirmed Occupational Cases by Race and Ethnicity, 2001-2012 and 2012 Separately

	Cumulative			2012		
Race	**Hispanic**	**Not Hispanic**	**Unknown**	**Hispanic**	**Not Hispanic**	**Unknown**
American Indian/Alaskan	0	6	0	0	0	0
Asian/Pacific Islander	0	3	1	0	1	0
Black	0	29	23	0	2	4
White	12	319	84	2	24	10
Mixed	1	18	1	0	2	0
Unknown	38	0	390	0	0	39
Total	**51**	**375**	**500**	**2**	**29**	**53**

The table below shows the industry involved in occupational cases, based on NIOSH industry sectors.[7] 'Services' includes 'Services to Buildings and Dwellings' such as structural pest control or landscaping as well as 'Accommodation and Food Services' such as hotels and restaurants, where disinfectants are commonly used, and was the most common sector in 2012 (32.1%).

Table 7: Confirmed Occupational Cases by NIOSH Industry Sectors, 2001-2012 and 2012 Separately

Industry Sector	**Cumulative**	**Percent**	**2012**	**Percent**
Agriculture, Forestry, Fishing	99	10.7%	6	7.1%
Construction	19	2.1%	2	2.4%
Healthcare & Social Assistance	131	14.1%	17	20.2%
Manufacturing	44	4.8%	10	11.9%
Public Safety	18	1.9%	1	1.2%
Services (excluding Public Safety)	360	38.9%	27	32.1%
Transportation, Warehousing, Utilities	28	3.0%	1	1.2%
Wholesale & Retail Trade	85	9.2%	6	7.1%
Unknown	142	15.3%	14	16.7%
Total	**926**	**100.0%**	**84**	**100.0%**

A landlord in his 60s set off 10-12 bug bombs in one of his rental properties, a duplex. He used one per room and also one in the stairway. He inhaled fumes while setting the alarm on his way out and developed difficulty breathing, a cough, and a headache. He called poison control.

[7] http://www.cdc.gov/niosh/nora/sector.html

Table 8 shows the occupation of the exposed worker based on the 2002 Census Occupation Codes. In 2012, the most common occupation was 'Building and Grounds Cleaning and Maintenance' (28.6%). This included sixteen cleaning personnel and eight pest control operators.

Table 8: Confirmed Occupational Cases by Census Occupation, 2001-2012 and 2012 Separately

Occupation	Cumulative	Percent	2012	Percent
Building and Grounds Cleaning and Maintenance	153	16.5%	24	28.6%
Sales and Related	43	4.6%	2	2.4%
Farming, Forestry, and Fishing	42	4.5%	6	7.1%
Food Preparation and Serving Related	38	4.1%	6	7.1%
Management	26	2.8%	2	2.4%
Transportation and Material Moving	24	2.6%	3	3.6%
Healthcare Support	21	2.3%	5	6.0%
Production	21	2.3%	2	2.4%
Healthcare Practitioners and Technical	20	2.2%	3	3.6%
Office and Administrative Support	17	1.8%	2	2.4%
Personal Care and Service	16	1.7%	2	2.4%
Protective Service	16	1.7%	2	2.4%
Education, Training, and Library	11	1.2%	0	0.0%
Construction and Extraction	10	1.1%	2	2.4%
Architecture and Engineering	9	1.0%	2	2.4%
Installation, Repair, and Maintenance	6	0.6%	0	0.0%
Other	6	0.6%	2	2.4%
Unknown	447	48.3%	19	22.6%
Total	**926**	**100%**	**84**	**100%**

A meat packer in her 20s was thirsty and took a drink from a hose she thought contained only water, but it contained a quaternary ammonium chloride disinfectant. She only took one sip of the diluted disinfectant and developed a burning throat and vomited. Her workplace called poison control and sent her to an emergency department.

Exposures

Type of exposure describes how the exposure occurred. "Drift exposures" occur when an individual is exposed by the movement of pesticides away from the application site. "Targeted" indicates that the individual was exposed when a pesticide was released at the target site. "Indoor air" indicates that the individual was exposed to contaminated indoor air. "Surface" indicates that the individual was exposed via contact with pesticide residues on a treated surface or by entry into an outdoor treated area. "Leak/spill" indicates the individual was exposed to a leak or spill of pesticide material from any cause. People were most commonly exposed while applying the pesticide or due to a leak or spill. Some individuals had more than one type of exposure.

Figure 5

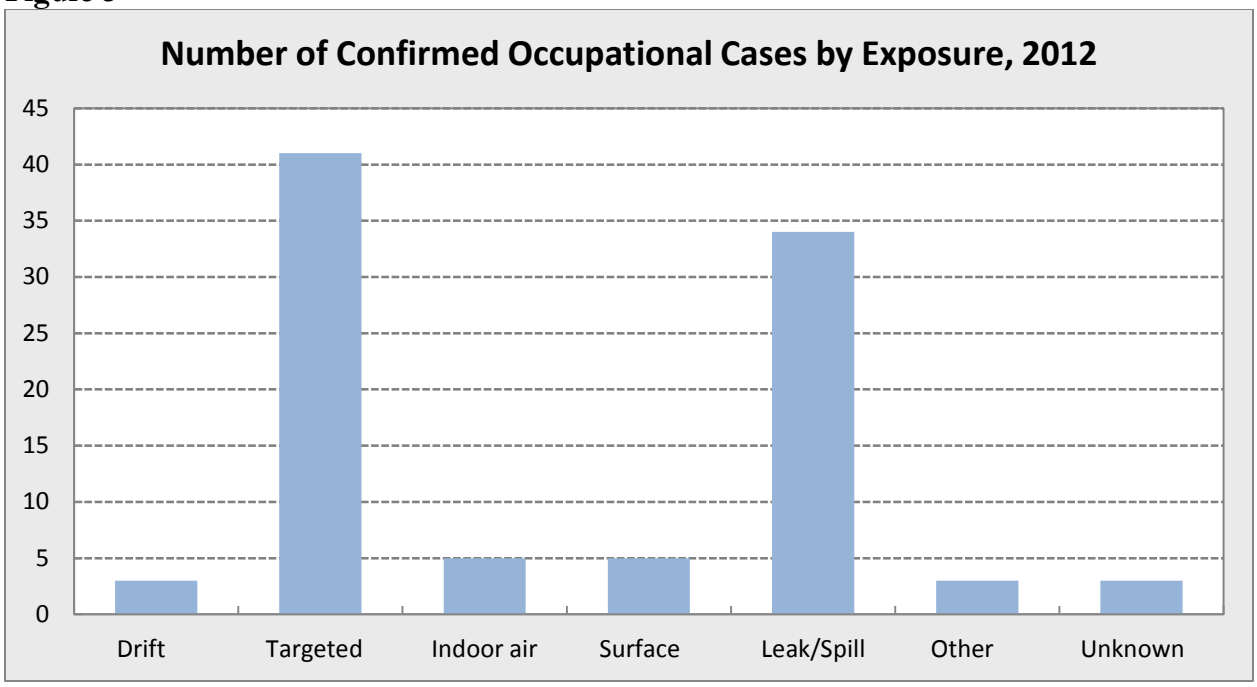


Table 9 shows the type of pesticide the person was exposed to. In 2012, the most common exposure was to disinfectants (62.4%), followed by insecticides (18.8%). Some products contain more than one type of pesticide and some exposures involve more than one product so the number of types listed is greater than the number of exposures.

Table 9: Confirmed Occupational Cases by Pesticide Type, 2001- 2012 and 2012 Separately

Pesticide Type	Cumulative	Percent	2012	Percent
Insecticide	275	25.1%	19	18.8%
Herbicide	151	13.8%	8	7.9%
Fungicide	24	2.2%	1	1.0%
Fumigant	9	0.8%	0	0.0%
Rodenticide	14	1.3%	0	0.0%
Disinfectant	556	50.7%	63	62.4%
Insect Repellent	7	0.6%	0	0.0%
Insecticide and Fungicide	5	0.5%	0	0.0%
Insecticide and Other	21	1.9%	6	5.9%
Herbicide and Fungicide	5	0.5%	1	1.0%
Other	13	1.2%	3	3.0%
Multiple	7	0.6%	0	0.0%
Unknown	10	0.9%	0	0.0%
Total	**1097**	**100.0%**	**101**	**100.0%**

Pesticide exposures occur in a wide range of locations. For example, a landscaper involved in an accident and an emergency responder may both be exposed to a pesticide spilled on a road. Table 10 shows the actual location where occupational exposures in Michigan have taken place.

Table 10: Confirmed Occupational Cases by Exposure Location, 2001-2012 and 2012 Separately

Location	Cumulative	Percent	2012	Percent
Service establishment	124	13.4%	13	15.7%
Farm	86	9.3%	6	7.2%
Retail Establishment	79	8.6%	4	4.8%
Hospital	72	7.8%	8	9.6%
Single family home	68	7.4%	3	3.6%
Office/business	56	6.1%	7	8.4%
School	48	5.2%	0	0.0%
Multi-unit housing	29	3.1%	4	4.8%
Residential Institution	25	2.7%	3	3.6%
Food processing/manufacturing Facility	25	2.7%	10	12.0%
Pet care and veterinary services	15	1.6%	0	0.0%
Industrial facility	14	1.5%	3	3.6%
Other manufacturing/industrial	14	1.5%	2	2.4%
Golf course	11	1.2%	1	1.2%
Park	9	1.0%	1	1.2%
Greenhouse	8	0.9%	0	0.0%
Mobile home	8	0.9%	0	0.0%
Post-harvest crop prep facility	7	0.8%	0	0.0%
Road/rail	7	0.8%	1	1.2%
Nursery	6	0.7%	0	0.0%
Day care facility	6	0.7%	0	0.0%
Farm product warehouse/storage	6	0.7%	0	0.0%
Prison	5	0.5%	0	0.0%
Right-of-way (road, rail, utility)	5	0.5%	1	1.2%
Other	44	4.8%	3	3.6%
More than one site	14	1.5%	1	1.2%
Unknown	135	14.6%	13	15.7%
Total	**926**	**100.4%**	**84**	**101.2%**

An assistant greens keeper at a golf course in his 40s applied a pyrethroid insecticide to tee boxes. He spilled some on his shoes, which were wet. He woke up vomiting at two AM, he had a headache, and his right foot was numb. He called poison control.

Workers were exposed through applications to a wide variety of targets, as shown in table 11. 'Other', which includes targets such as sinks, dishwashers, trays containing surgical instruments, utility poles, and furniture, was the most frequent (32.1%). When there is no targeted pest, for example when a product is knocked off a shelf, the target is coded as not applicable.

Table 11: Confirmed Occupational Cases by Target, 2001-2012 and 2012 Separately

Application Target	Cumulative	Percent	2012	Percent
Landscape/ornamentals	75	8.1%	1	1.2%
Forest trees/land	3	0.3%	0	0.0%
Veterinary - livestock	3	0.3%	0	0.0%
Veterinary - domestic animals	3	0.3%	0	0.0%
Building structure	13	1.4%	0	0.0%
Building surface	173	18.7%	8	9.5%
Building space treatment	1	0.1%	0	0.0%
Undesired plant	20	2.2%	4	4.8%
Aquatic - pond/stream/lake/canal	8	0.9%	0	0.0%
Aquatic - pool/spa/hot tub/Jacuzzi	31	3.3%	3	3.6%
Soil	1	0.1%	0	0.0%
Wood product	3	0.3%	0	0.0%
Fruit crops	28	3.0%	1	1.2%
Vegetable crops	10	1.1%	1	1.2%
Grain/grass/fiber crops	10	1.1%	1	1.2%
Miscellaneous field crops	2	0.2%	0	0.0%
Oil crops	1	0.1%	0	0.0%
Application to seeds	1	0.1%	1	1.2%
Humans - skin/hair/clothing	5	0.5%	1	1.2%
Bait for rodent/bird/predator	10	1.1%	0	0.0%
Community-wide application	1	0.1%	0	0.0%
Other	208	22.5%	27	32.1%
Not applicable	74	8.0%	5	6.0%
Unknown	242	26.1%	31	36.9%
Total	**926**	**100.0%**	**84**	**100.0%**

A fork lift driver in his 40s was unloading a truck. One of the containers of herbicide and fungicide in an upper pallet had been sliced open by a forklift when loaded. The forklift was pulling that pallet and caught the plastic shrink-wrap from a lower pallet. It pulled until the plastic snapped, splashing about ½ gal of leaked product in his face and eyes. Eye protection was not required but he was wearing safety glasses. His eyes became red and very painful; he had blurry vision for three days; and he could taste the herbicide. He rinsed his eyes in an eyewash and was then taken to an emergency department. He later saw an ophthalmologist.

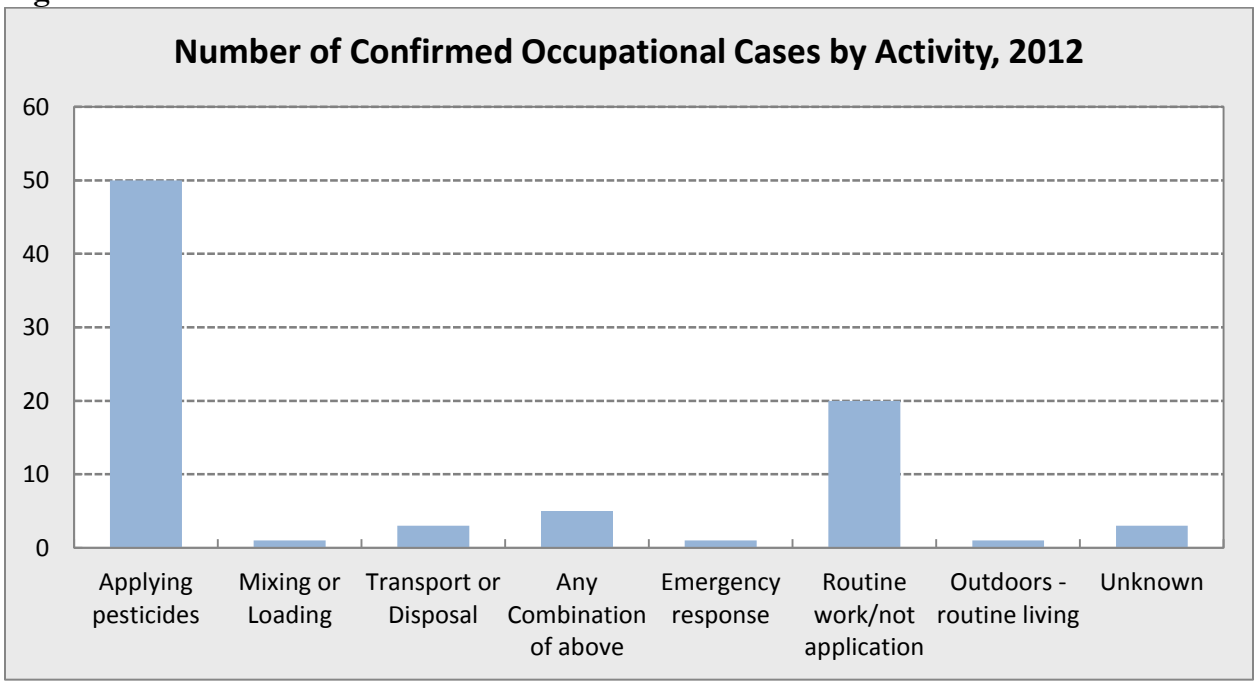
Type of equipment used to apply pesticides was known for half of the confirmed occupational cases in 2012. The most common type was 'other' (22.6%), which includes mops, buckets and pool shock tabs.

Table 12: Confirmed Occupational Cases by Equipment, 2001-2012 and 2012 Separately

Application Equipment	Cumulative	Percent	2012	Percent
Trigger pump/compressed air	60	6.5%	3	3.6%
Pressurized can	57	6.2%	5	6.0%
Ground sprayer, not classified elsewhere	31	3.3%	2	2.4%
Sprayer, backpack	25	2.7%	2	2.4%
Manual placement	22	2.4%	2	2.4%
Spray line, hand held	19	2.1%	0	0.0%
Total Release Fogger	19	2.1%	3	3.6%
Aerosol generator/fogger	8	0.9%	0	0.0%
Handheld granular/dust applicator	6	0.6%	1	1.2%
Other	216	23.3%	19	22.6%
More than one type of equipment	6	0.6%	3	3.6%
Not applicable	62	6.7%	1	1.2%
Unknown	395	42.7%	43	51.2%
Total	**926**	**100.0%**	**84**	**100.0%**

Activity at time of exposure was determined for 80 (96.4%) of the cases.

Figure 6



A farm hand in his 20s sprayed trees in a blueberry field with an herbicide. He went on a break. He spilled some of the herbicide on a chair but didn't leave the field to wash his hands. He was wearing gloves but they had holes in them. He ate his snack and noticed a bitter taste. He developed throat irritation, stomach pain, nausea, and vomited once. He 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 2012, spills and splashes were the most common contributing factor (23.9%) for occupational pesticide cases.

Table 13: Contributing Factors in Confirmed Occupational Cases, 2001-2012 and 2012 Separately

Contributing Factor	Cumulative	Percent	2012	Percent
Spill/Splash of liquid or dust (not equipment failure)	274	23.1%	26	23.9%
Mixing incompatible products	113	9.5%	12	11.0%
Label violations not otherwise specified	80	6.7%	8	7.3%
Application equipment failure	71	6.0%	8	7.3%
No label violation identified but person still exposed/ill	71	6.0%	7	6.4%
Required eye protection not worn or inadequate	68	5.7%	8	7.3%
Decontamination not adequate or timely	66	5.6%	8	7.3%
Drift contributory factors	59	5.0%	1	0.9%
Excessive application	47	3.9%	5	4.6%
People were in the treated area during application	31	2.6%	5	4.6%
Applicator not properly trained or supervised	31	2.6%	0	0.0%
Required gloves not worn or inadequate	25	2.1%	3	2.8%
Notification/posting lacking or ineffective	24	2.0%	3	2.8%
Within reach of child or other improper storage	18	1.5%	0	0.0%
Structure inadequately ventilated before re-entry	17	1.4%	2	1.8%
Early re-entry	14	1.2%	3	2.8%
Required respirator not worn or inadequate	11	0.9%	1	0.9%
Other required PPE not worn or inadequate	8	0.7%	3	2.8%
Illegal pesticide used/illegal dumping	1	0.1%	0	0.0%
Other	34	2.9%	1	0.9%
Unknown	128	10.7%	6	5.5%
Total	**1191**	**100.0%**	**110**	**100.0%**

Health Effects

Most (78.3%) cases in 2012 were of low severity.

Table 14: Severity of Confirmed Occupational Cases, 2001-2012 and 2012 Separately

Severity	Cumulative	Percent	2012	Percent
Fatal	2	0.2%	0	0.0%
High	12	1.3%	2	2.4%
Moderate	174	18.8%	16	19.0%
Low	738	79.7%	66	78.6%
Total	**926**	**100.0%**	**84**	**100.0%**

Table 15 shows all the places cases received medical care. Many cases received care from multiple sources, for example being referred to an emergency department or urgent care center by the poison control center, thus the total is greater than the number of cases. Most hospital admissions were seen in the emergency department first. Sometimes doctors call the poison control center for advice in treating a patient.

Table 15: Treatment of Confirmed Occupational Cases, 2001-2012 and 2012 Separately

Care Received	Cumulative	Percent	2012	Percent
Advice of Poison Control Center	770	50.7%	69	46.3%
Emergency Department	470	31.0%	44	29.5%
Physician Office Visit/Urgent Care	126	8.3%	19	12.8%
Employee Health/Occupational Health Center	46	3.0%	2	1.3%
On site by EMT	42	2.8%	11	7.4%
Hospital Admission	31	2.0%	2	1.3%
Other	17	1.1%	1	0.7%
No Medical Care Sought	15	1.0%	0	0.0%
Unknown	1	0.1%	1	0.7%
Total	**1518**	**100.0%**	**149**	**100.0%**

A worker in his 50s mixed bleach and a quaternary ammonium chloride disinfectant when cleaning a bathroom. He developed a cough and difficulty breathing. He went to an urgent care center and was taken by ambulance from there to an emergency department.

Section III. Non-occupational Pesticide Illnesses and Injuries

This section examines non-occupational cases. To provide a more complete characterization of the impact of pesticide use in Michigan, the MDCH pesticide surveillance program began collecting information about non-occupational exposures in 2006. Suicide attempts using pesticides are excluded from this report. The same case definition and report sources are used for occupational and non-occupational cases, but as mentioned in Section I, three additional non-occupational exposure categories from poison control were added in 2012. There is no follow-up for additional information with non-occupational cases. There were 440 confirmed cases from 406 events in 2012.

Figure 7

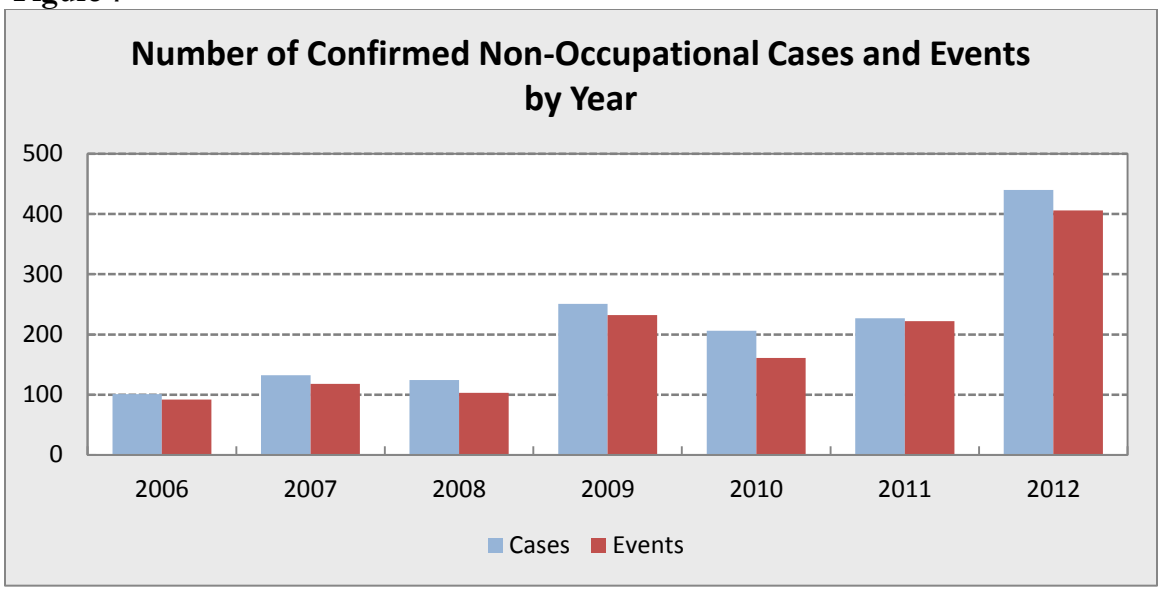


Figure 8 shows all confirmed non-occupational cases reported in 2012 by month of exposure.

Figure 8

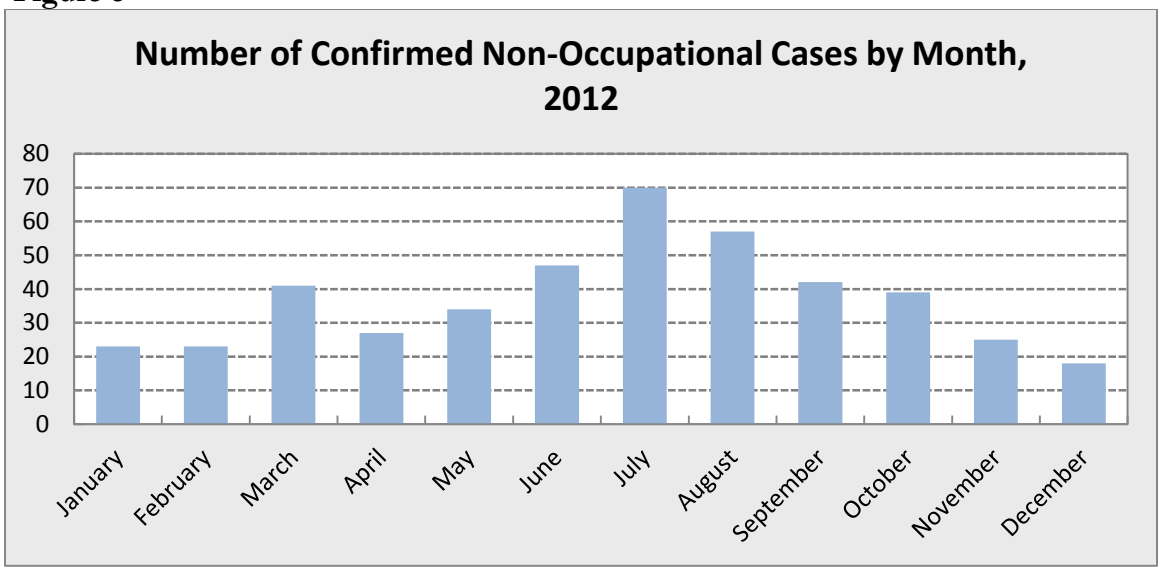


Table 16 shows the first report source for non-occupational cases. Poison Control remains the primary source of non-occupational cases, as well as occupational cases. Some cases are reported by multiple sources; the first source is listed here.

Table 16 : First Report Source, Confirmed Non-occupational Cases 2006-2012 and 2012 Separately

Report Source	Cumulative	Percent	2012	Percent
Poison control center	1060	71.6%	364	82.7%
Other health care provider	220	14.9%	63	14.3%
State Health Department - HSEES	113	7.6%	0	0.0%
Department of Agriculture and Rural Development (MDARD)	32	2.2%	0	0.0%
Report/referral from governmental agency	31	2.1%	7	1.6%
Obituary/news report	11	0.7%	6	1.4%
Other	14	0.9%	0	0.0%
Total	**1481**	**100.0%**	**440**	**100.0%**

Demographics

Table 17 shows confirmed non-occupational cases by age and gender. Race and ethnicity information is rarely available for non-occupational cases.

Table 17: Confirmed Non-occupational Cases by Age Group and Gender, 2006-2012 and 2012 Separately

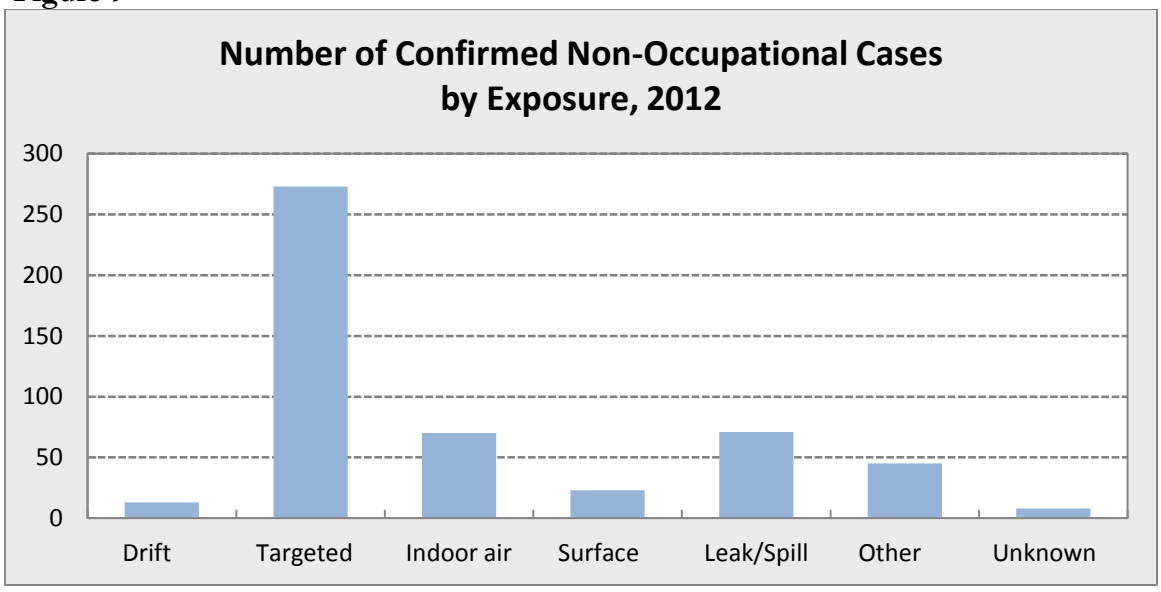
	Cumulative			2012		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
Unknown age	55	23	24	8	4	12
00-<1:Infants	3	8	1	0	3	0
01-02:Toddlers	19	21	0	3	8	0
03-05:PreSchool	24	26	0	9	16	0
06-11:Child	56	41	1	8	11	1
12-17:Youth	42	42	1	12	14	0
18-64:Adult	558	401	0	167	130	0
65+:Senior	78	57	0	22	12	0
Total	**835**	**619**	**27**	**229**	**198**	**13**

A child had insect repellent on his hands. He rubbed his eyes and they became red, irritated, and swollen. He was taken to an emergency department.

Exposures

Figure 9 shows the type of exposure for confirmed non-occupational cases in 2012. The most common type of exposure was targeted, followed by indoor air. Some individuals had more than one type of exposure.

Figure 9



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. In 2012, the most common exposure for non-occupational cases was to disinfectants (54.0%), followed by insecticides (23.8%).

Table 18: Confirmed Non-occupational Cases by Pesticide Type, 2006-2012 and 2012 Separately

Pesticide Type	Cumulative	Percent	2012	Percent
Insecticide	529	29.7%	128	23.8%
Herbicide	123	6.9%	22	4.1%
Fungicide	20	1.1%	3	0.6%
Rodenticide	14	0.8%	1	0.2%
Disinfectant	826	46.4%	290	54.0%
Insect Repellent	122	6.9%	36	6.7%
Insecticide and Fungicide	8	0.4%	3	0.6%
Insecticide and Other	71	4.0%	27	5.0%
Other	40	2.2%	22	4.1%
Multiple (not specified)	15	0.8%	1	0.2%
Unknown	13	0.7%	4	0.7%
Total	**1781**	**100.0%**	**537**	**100.0%**

Individuals are exposed through applications in a wide variety of locations and to a wide variety of targets, as shown in table 19 and 20 below.

Table 19: Location of Exposure for Confirmed Non-occupational Cases, 2006-2012 and 2012 Separately

Location	Cumulative	Percent	2012	Percent
Single Family Home	719	48.5%	133	30.2%
Private Residence, type not specified	434	29.3%	225	51.1%
Multi-unit housing	61	4.1%	21	4.8%
Service Establishment	39	2.6%	12	2.7%
Park	36	2.4%	2	0.5%
School	34	2.3%	1	0.2%
Mobile home	18	1.2%	4	0.9%
Farm	10	0.7%	1	0.2%
Private vehicle	8	0.5%	1	0.2%
Residential Institution	4	0.3%	0	0.0%
Retail Establishment	4	0.3%	2	0.5%
Prison	2	0.1%	1	0.2%
Greenhouse	1	0.1%	0	0.0%
Day care facility	1	0.1%	0	0.0%
Office/Business	1	0.1%	1	0.2%
Road/Rail	1	0.1%	0	0.0%
Golf Course	1	0.1%	0	0.0%
Other	13	0.9%	1	0.2%
Unknown	94	6.3%	35	8.0%
Total	**1481**	**100.0%**	**440**	**100.0%**

Table 20: Application Target for Confirmed Non-occupational Cases, 2006-2012 and 2012 Separately

Application Target	Cumulative	Percent	2012	Percent
Landscape/ornamentals	100	6.8%	17	3.9%
Veterinary - livestock	1	0.1%	0	0.0%
Veterinary - domestic animals	17	1.1%	10	2.3%
Building structure	22	1.5%	3	0.7%
Building surface	336	22.7%	70	15.9%
Undesired plant	3	0.2%	0	0.0%
Aquatic - pond, stream, lake, canal	19	1.3%	0	0.0%
Pool, spa, hot tub, jacuzzi	163	11.0%	66	15.0%
Fruit crops	8	0.5%	0	0.0%
Flavoring/spice crops	1	0.1%	0	0.0%
Vegetable crops	7	0.5%	0	0.0%
Cereal grain crops	5	0.3%	1	0.2%
Miscellaneous field crops	5	0.3%	0	0.0%
Human - skin/hair and clothing	48	3.2%	23	5.2%
Bait for rodent, bird, or predator	7	0.5%	0	0.0%
Community-wide application	8	0.5%	1	0.2%
Other	189	12.8%	61	13.9%
Not applicable	84	5.7%	22	5.0%
Unknown	458	30.9%	166	37.7%
Total	**1481**	**100.0%**	**440**	**100.0%**

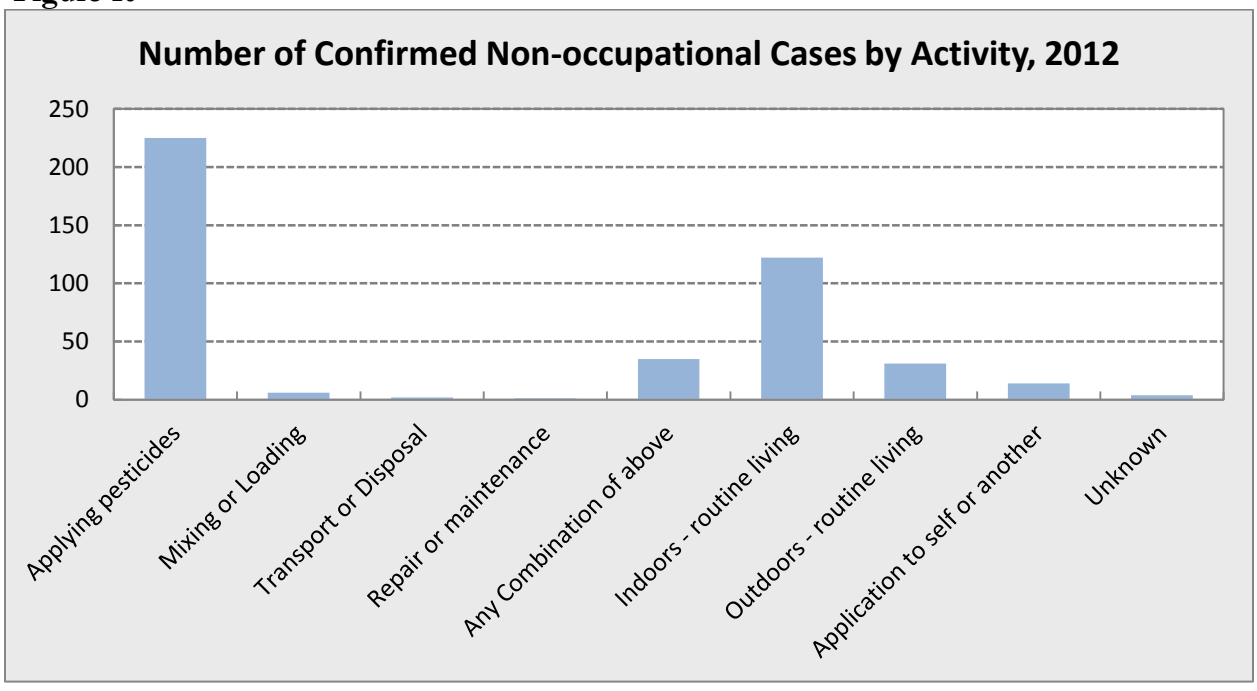
Type of equipment used in the pesticide application was known for 51.6% of the non-occupational cases in 2012. The most common types were manual placement (19.8%) such as pool tabs or ant or rodent bait. Aerosol cans (9.8%) and total release foggers (bug bombs) (6.4%) were also common.

Table 21: Equipment Used in Confirmed Non-Occupational Cases, 2006-2012 and 2012 Separately

Application Equipment	Cumulative	Percent	2012	Percent
Manual Placement	165	11.1%	87	19.8%
Pressurized can	149	10.1%	43	9.8%
Total Release Fogger	136	9.2%	28	6.4%
Trigger pump/compressed air	95	6.4%	28	6.4%
Spray line, hand held	13	0.9%	2	0.5%
Ground sprayer, NEC	11	0.7%	1	0.2%
Aerial application equipment	9	0.6%	1	0.2%
Aerosol generator/fogger	6	0.4%	0	0.0%
Handheld granular/dust applicator	4	0.3%	1	0.2%
Air Blast Sprayer	2	0.1%	0	0.0%
Sprayer, backpack	1	0.1%	0	0.0%
Other	137	9.3%	27	6.1%
More than one type of equip.	12	0.8%	5	1.1%
Not applicable	19	1.3%	4	0.9%
Unknown	722	48.8%	213	48.4%
Total	**1481**	**100.0%**	**440**	**100.0%**

The activity at time of exposure was determined for 436 (99.1%) of the confirmed cases in 2012. More than half (51.1%) were applying pesticides when they were exposed. (Figure 10)

Figure 10



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.

Table 22: Contributing Factors in Confirmed Non-occupational Cases, 2006-2012 and 2012 Separately

Contributing Factor	Cumulative	Percent	2012	Percent
Label violations not otherwise specified	243	14.4%	98	19.7%
Mixing incompatible products	241	14.3%	86	17.3%
Excessive application	170	10.1%	38	7.6%
Spill/Splash of liquid or dust (not equipment failure)	154	9.1%	72	14.5%
No label violation identified but person still exposed/ill	135	8.0%	17	3.4%
Within reach of child or other improper storage	94	5.6%	39	7.8%
Drift contributory factors	86	5.1%	12	2.4%
People were in the treated area during application	65	3.8%	13	2.6%
Structure inadequately ventilated before re-entry	60	3.5%	30	6.0%
Decontamination not adequate or timely	45	2.7%	11	2.2%
Early re-entry	36	2.1%	11	2.2%
Notification/posting lacking or ineffective	33	2.0%	11	2.2%
Application equipment failure	26	1.5%	10	2.0%
Required gloves not worn or inadequate	8	0.5%	2	0.4%
Required eye protection not worn or inadequate	7	0.4%	4	0.8%
Applicator not properly trained or supervised	6	0.4%	1	0.2%
Other	44	2.6%	2	0.4%
Unknown	238	14.1%	41	8.2%
Total	**1691**	**100.0%**	**498**	**100.0%**

A man in his 40s set off a total release fogger in his truck. He went back into the truck for a few minutes after the fogger was released. He developed a cough and runny nose and called poison control.

A homeowner in his 50s was outside during an aerial application of a fungicide to a neighboring wheat field. The application drifted on him and he developed eye irritation, lung irritation, salivation, polyuria, nausea, vomiting, skin irritation, headache, dilated pupils, and burping. He showered and went to an emergency department.

Health Effects

Table 23 shows the severity of non-occupational cases, using the NIOSH standardized criteria for determining severity index. Most (78.4%) of the confirmed non-occupational cases in 2012 were of low severity.

Table 23: Severity of Confirmed Non-occupational Cases, 2006-2012 and 2012 Separately

Severity	Cumulative	Percent	2012	Percent
High	33	2.2%	8	1.8%
Moderate	221	14.9%	87	19.8%
Low	1227	82.8%	345	78.4%
Total	**1481**	**100.0%**	**440**	**100.0%**

Table 24 shows all the places cases received medical care. Many cases received care from multiple sources, for example being referred to an emergency department or urgent care center by the poison control center, thus the totals in Table 24 are greater than the total number of cases. Most hospital admissions were seen in the emergency department first. Sometimes doctors call the poison control center for advice in treating a patient.

Table 24: Treatment of Confirmed Non-Occupational Cases, 2006-2012 and 2012 Separately

Care Received	Cumulative	Percent	2012	Percent
Advice of Poison Control Center	1153	56.4%	369	60.1%
Emergency Department	546	26.7%	157	25.6%
Physician Office Visit/Urgent Care	132	6.5%	43	7.0%
On site by EMT	78	3.8%	26	4.2%
Hospital Admission	68	3.3%	17	2.8%
Other	35	1.7%	0	0.0%
No Medical Care Sought	30	1.5%	2	0.3%
Unknown	4	0.2%	0	0.0%
Total	**2046**	**100.0%**	**614**	**100.0%**

A homeowner in his 30s mixed calcium hypochlorite with an algaecide and the mixture exploded in his face. He developed 1st and 2nd degree burns to his face and chest, a cough, dyspnea, decreased oxygen, pleuritic pain, wheeze, rapid breathing, fluid in his lung , right lung collapse, fever, hypertension, rapid heartbeat, renal insufficiency (he had a history of kidney transplant), and eye irritation. He was ventilated and diagnosed with severe lung injury and chemical pneumonitis from chemical inhalation with Acute Respiratory Distress Syndrome (ARDS). He developed a fever due to bacterial infections. He was taken by ambulance to an emergency department and admitted to a hospital for 31 days, then discharged to a nursing home.

Outreach, Education, and Prevention Activities

Publications, Presentations, and Other Outreach Activities
Staff members of 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 2012:

- A staff member of the surveillance program represented MDCH on the MDARD Pesticide Advisory Committee (PAC) and provided an activity report each quarter.

- The MDCH Pesticide Information webpage provided links to all previous annual reports, our pesticide education booklet, "What You Need to Know about Pesticides and Your Health", several fact sheets, and links to over 100 other sites with information about pesticides and their safe use.

- Safety information was sent to cases and employers.

- MDCH staff participated with the Michigan Primary Care Association's Migrant Health Network. Letters with information about pesticide safety and reporting were sent to the migrant health clinics in Michigan and about 550 migrant camp owners.

- MDCH staff chaired the pesticide coding committee of the SENSOR-Pesticides states, which worked on data quality assurance and made revisions to the standardized variable document.

- MDCH staff attended the annual conference of pesticide surveillance states.

- The MDCH surveillance program coauthored an article about gender differences in acute pesticide-related illnesses and injuries among farmworkers, published in the American Journal of Industrial Medicine. (Kasner et al, 2012).

- One event was reported to the CDC waterborne illness surveillance program.

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

- MDCH surveillance program staff participated in Michigan Birth Defects Steering Committee meetings.

- The NIOSH SENSOR-Pesticides Program was the recipient of the Bullard-Sherwood Research to Practice award; the MDCH pesticide program is a contributing member of the SENSOR-Pesticides program.

MDARD Referrals

Three events were referred to MDARD in 2012, one occupational and two non-occupational.

- MI02671 – A hotel housekeeper in her 20s cleaned a room, and then went into the hall. She could see fog in the hallway from a pesticide treatment, and applicators who were wearing masks. She immediately started coughing, had shortness of breath, wheezing, a headache, and felt nauseous. She went to an emergency department. This was not a confirmed case because she did not know what product was used. The exposure was referred to MDARD, but not investigated because too much time had elapsed between the exposure and the report.

- MI02910 – Six people went to a hospital, with symptoms including shortness of breath, headache, chest pain, and vomiting. One person was an Emergency Responder; the rest all lived in an apartment complex that was sprayed for bed bugs two days before with a pyrethroid insecticide. See MI03361 below for the results of the investigation.

- MI03361 – About two weeks after the previous exposure, there was a media report of a letter carrier and two apartment residents being exposed to pesticides and having difficulty breathing. These were not confirmed cases because there was only one reported symptom, but the event was referred to MDARD. The same application company was used for both this event and MI02910 above. MDARD's investigation included both events, and the following violations were found: an applicator applied pesticides without being a certified or registered applicator; the company provided false information in the investigation, claiming only one person applied the pesticides; the company did not notify the apartment management or surrounding apartment tenants about the application; the concentration used was too high; the pesticide was applied to prohibited areas; the pesticide was applied too frequently; the customer information did not include the name of the pesticide, date and time of application or precautionary warnings; the firm did not provide any written information for one of the applications; the firm did not maintain records of the applications; and the company did not provide a written explanation of the risks and benefits to the customer.

MIOSHA Referrals

No cases were referred to MIOSHA in 2012.

NIOSH Reports

In 2012 seven occupational and eight non-occupational events met NIOSH's priority reporting criteria. These reports are forwarded to EPA, the regulatory agency for pesticides registration and labeling.

These occupational cases were reported because four or more persons became ill.

- MI032743 - An adult office worker inhaled fumes after a pyrethroid insecticide (signal word: Caution) was sprayed in the office. He developed a cough, sneezing, and runny nose and called poison control. He said 8-10 of his coworkers also had respiratory symptoms (irritation).

- MI02952 – A pipe carrying chlorine ruptured in a baby food manufacturing plant. Seven employees were taken to emergency departments with symptoms including difficulty breathing, chest tightness, cough, and sore throat.

- MI02770 – Four members of the coast guard were taken to an emergency room after someone mopped the galley floor with a mixture of bleach and acid cleaner. Their symptoms included red, burning eyes, cough, headache, and chest tightness.

These occupational cases were reported because the product was used according to the label but the person became ill.

- MI03017 – A pest control operator in his 30s applied a pyrethroid insecticide (signal word: Caution). He was wearing the required respirator but no facial protection (not required). He developed redness and facial pain. He called poison control.

- MI03150 – A pest control operator for a lawn care company in her 40s used a pyrethroid insecticide (signal word: Caution). She said she never got any in her eyes and wore safety glasses, which were not required, but when she was around the fumes her eyes would burn and she would get a headache. She went to an employee health clinic.

- MI03248 – A resident aide in her 30s was cleaning a bathtub with a disinfectant (signal word: Caution) According to the label, no PPE is required. As she sprayed it she developed lightheadedness, and felt like her lungs were burning. She also developed a headache, nausea, stomach ache, chest tightness, difficulty breathing and her face was numb and tingling. An ambulance was called and she was taken to an emergency department.

This occupational case was reported because it resulted in a hospitalization.

- MI03046 – A truck driver in his 50s unloaded a tank of ammonia at a power plant. When he tried to clear out the hose after unloading, ammonia was released into the air and splattered on his skin. He developed shortness of breath, a hoarse voice, and 1st and 2nd degree burns. EMS transported him to a hospital where he was admitted for three days.

These non-occupational cases were reported because the product was used according to the label but the person became ill.

- MI02723 – A man in his 20s used an animal repellent that is exempt from EPA registration under section 25 (b) of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) as being a minimum risk pesticide. He inhaled some fumes while he was spraying and developed diarrhea and vomited.

- MI02905 - A man in his 30s used a pyrethroid insecticide (signal word: Caution) and got some on his hands and feet. He became anxious and his hands tingled. The label says to wash hands after use, but does not suggest or require gloves and does not say to avoid contact with skin.

- MI02918 – A woman in her 60s used a pyrethroid insecticide (signal word: Caution) in her house. Two days later she called poison control saying she had a headache and felt nauseous since using it. There is no indication that there was a label violation.

- MI02921 – A woman in her 60s sprayed her dog on her bedroom carpet with a flea and tick spray (signal word: Caution). She developed difficulty breathing, sinus drainage, and a cough.

The symptoms lasted about two months and she went to her doctor several times. The label does not advise avoiding use over carpet.

These non-occupational cases were reported because four or more persons became ill.

- MI02818 – Twelve women were living in a 4-story old home. There were squirrels in the home so the landlord placed mothballs in the duct work and attic. They were living with the smell for 2-3 months. They didn't realize how bad it was until they went home for Christmas and their parents complained that their clothes reeked of mothballs. One 20-year-old had nausea, vomiting, drowsiness, headache and bloody urine. All the others had headaches and general malaise.

- MI02910 – Six people went to a hospital, with symptoms including shortness of breath, headache, chest pain, and vomiting. One person was an Emergency Responder; the rest all lived in an apartment complex that was sprayed for bed bugs two days before with a pyrethroid insecticide. The event was referred to MDARD.

- MI03154 – A counseling center/clubhouse for clients was treated for fleas with an insecticide/miticide (signal word: Caution) around 5-6 pm. The next morning when workers and consumers came in, they could smell the pesticide. A social worker in her 50s with a history of asthma developed difficulty breathing, a sore throat, headache, and cough. She went to a health clinic. Another staff worker in her 50s had a rash and eye irritation. About twelve consumers developed red, irritated eyes. Poison control and the local public health department were called and about 40 people were evacuated from the building.

This non-occupational case was reported because it resulted in a hospitalization.

- MI03107 – A homeowner in his 30s mixed calcium hypochlorite with "blue algae" algaecide [trichloroisocyanuric acid (TCCA)], and the mixture exploded in his face. He developed 1st and 2nd degree burns to his face and chest, a cough, dyspnea, ronchi, , hypoxia, pleuritic pain, wheeze, tachypnea, pulmonary edema, right lung collapse, fever, hypertension, tachycardia, renal insufficiency (he had a history of kidney transplant), and eye irritation. He was ventilated and diagnosed with severe lung injury and chemical pneumonitis from chemical inhalation with ARDS (Acute Respiratory Distress Syndrome). He developed a fever due to bacterial infections. He was taken by ambulance to an emergency department and admitted to a hospital for 31 days, then discharged to a nursing home.

Discussion

Surveillance Data
There were more confirmed acute pesticide poisonings in 2012 than in 2011; 84 vs. 69 occupational cases and 440 vs. 227 non-occupational cases. The increase in non-occupational cases was due to a change in reporting requirements on the part of poison control.

Most confirmed cases were reported by poison control (79.8% of occupational and 82.7% of non-occupational cases). Most confirmed cases were considered low severity (78.6% of occupational and 78.4% of non-occupational cases). In 2012 we requested and began receiving three additional categories of non-occupational reported exposures from poison control to ensure completeness of case ascertainment. This resulted in a four-fold increase in reports and a doubling of confirmed non-occupational cases. The confirmed non-occupational cases from the new categories are similar to the ones that have been reported since 2006. Most are low severity and more than half were due to exposure to disinfectants.

The number of disinfectant cases remained high and continues to be an area of ongoing concern. Occupational disinfectant cases were more numerous in 2012 than in 2011 [63 (62.4%) vs. 45 (51.7%)]. Non-occupational disinfectant cases increased over 2011 as well [290 (54.0%) vs. 130 (46.6%)]. In spite of the absence of evidence that hand contact with "contaminated surfaces" causes infectious diseases, the widespread use of disinfectants in homes, schools, and other non-healthcare locations has been promoted. Evidence-based recommendations are needed regarding the use of cleaning agents, particularly disinfectants. Education is needed to provide guidance about how to clean and when disinfectants/pesticides are recommended, and how to use them properly.

When looking at factors contributing to the pesticide exposure, spills and splashes were the most common factor for confirmed occupational cases (23.6%), followed by mixing incompatible products (10.9 %). Label violations not otherwise specified, for example spraying into the wind was the most common contributing factor for non-occupational exposures (19.7%) followed by mixing incompatible products (17.3%). Better education and additional PPE requirements might help to reduce the number of exposures.

Almost a quarter of the confirmed occupational cases in 2012 were "bystanders", i.e., engaged in work activities not related to the pesticide application. Better education of users of pesticides on safe pesticide application is needed to prevent inadvertent workplace exposures.

Interventions
MDCH continued to refer cases to MDARD for investigation of possible safety violations. MDCH also notified NIOSH of 15 events that met the criteria for high priority reporting. These reports are forwarded to the EPA and are considered during re-registration evaluations. MDCH also worked to improve pesticide education for individuals, health care providers, and other stakeholder groups through the distribution of brochures and presentations listed in the results section.

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 practically nontoxic (no signal word

required) through slightly toxic (signal word: Caution), moderately toxic (signal word: Warning) and most toxic (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 diverse signs and symptoms experienced can resemble allergies, acute conjunctivitis, or acute gastrointestinal illness, among other conditions. In addition, health care providers receive limited education in the recognition and diagnosis of the toxic effects of pesticides and the role of pesticides may be overlooked. 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. Finally, even when diagnosed, pesticide-related illnesses and injuries may not be reported due reluctance on the part of workers and their health care providers to involve state agencies or lack of knowledge of the public health code reporting requirements. (Calvert et al, 2009).

More outreach is needed to educate health care providers on the importance of recognizing and reporting instances of occupational pesticide illnesses and injuries. Almost eighty percent of confirmed occupational cases in 2012 were reported by the State's poison control center, with relatively few reports (only 3.6%) from health care providers.

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. PCC reports are received promptly, but do not always contain sufficient information to allow contact with the exposed individual. Lack of information for follow-up often results in a case classification of "insufficient information."

Notwithstanding these limitations, the Michigan occupational pesticide surveillance system is receiving and investigating reports of occupational pesticide illness and injury, including follow-up prevention activities. In addition, the surveillance system has expanded to include non-occupational cases, more than doubling the cases evaluated.

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Additional Resources

MDCH 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):
http://www.epa.gov/pesticides/health/worker.htm

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: http://oem.msu.edu/ReportForm.aspx

Appendix

Case Narratives, 2012 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2012. The narratives are organized by pesticide type and include a description of the signs and symptoms that resulted from the exposure and medical care received. Where known, age range, gender, industry, and occupation are included. In addition, more specific information about the product such as chemical class or the signal word for acute toxicity assigned by the EPA, is provided when known. 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.

Insecticides

MI02667 – A maintenance worker for a cleaning service was working in a warehouse where his employer had mixed an insecticide (signal word: Caution) with coca cola, to kill raccoons. Some time later he grabbed some equipment that had some of this dried up mixture on it. He was not wearing gloves, and had forgotten that it was there. He did not wash his hands and later pulled a splinter out of his finger with his mouth. He had an altered taste in his mouth for 2-3 days, and felt anxious and "weird". He went to an emergency department the next day.

MI02739 – A teenage employee at a discount store got some liquid pyrethrin plus pyrethroid insecticide (signal word: Caution) on her hands as she was unpacking containers, one of which was leaking. She then wiped her nose with her hand before washing. Her nose became numb and irritated and she went to an emergency department.

MI02743 – An adult office worker inhaled fumes after a pyrethroid insecticide (signal word: Caution) was sprayed in the office. He developed a cough, sneezing, and runny nose and called poison control.

MI02891 – A teenaged pest control operator applied a pyrethroid insecticide (signal word: Caution) for mosquitos at work. A gust of wind caused it to splash around his face shield. He developed tingling, irritated skin that was sensitive to touch and eye irritation. He called poison control.

MI02910 – An EMS technician in his 50s was on a run to what he thought was carbon monoxide exposure. He heard that there was a baby in one of the apartments so he knocked on the door. When there was no answer, he left, but by the time he got outside he was coughing so much he couldn't breathe. He drank some pop, which soothed his coughing. He was transported to an emergency department along with all the tenants present in the building. The apartment building had been sprayed for bed bugs with a pyrethroid insecticide (signal word: Caution). The application company told owner to have the tenants leave for 24 hours, but the tenants said the owner did not tell them. This event was referred to MDARD and reported to NIOSH.

MI02949 – A construction foreman in his 40s drank Gatorade that had been maliciously spiked with a pyrethroid insecticide by his crew. He began burping, vomited, had a headache, and was acting 'weird'. He called poison control and went to an emergency department.

MI02984 – A structural pest control operator in his 20s had a sprayer "blow up" on him due to a malfunctioning pressure release. Some of the pyrethrin insecticide (signal word: Caution) spilled onto his left buttock and leg. He continued working and he began to feel a burning sensation. He went to an urgent care and was diagnosed with a chemical burn.

MI02985 – A crop scout in her 20s was exposed to an organophosphorous insecticide (signal word: Danger) when she entered a field that had been recently sprayed. The field was not posted, so it is unknown how recently the field had been sprayed. She could smell the insecticide and developed a headache, tachycardia, anxiety, difficulty breathing, confusion, and excessive sweating. She called poison control.

MI02987 – An assistant greens keeper at a golf course in his 40s applied a pyrethroid insecticide to tee boxes. He spilled some on his shoes, which were wet. He woke up vomiting at two AM, he had a headache, and his right foot was numb. He called poison control.

MI03014 A landlord in his 60s set off 10-12 bug bombs (signal word: Warning) in one of his rental properties, a duplex. He used one per room and also one in the stairway. He inhaled fumes while setting the burglar alarm and developed difficulty breathing, a cough, and a headache. He called poison control.

MI03017 – A pest control operator in his 30s applied a pyrethroid insecticide (signal word: Caution). He was wearing the required respirator but no facial protection (not required). He developed redness and facial pain. He called poison control.

MI03020 – A landscaper in his 30s was attacked by wasps in the shop. He grabbed a can of pyrethroid insecticide (signal word: Caution) and sprayed. The can was facing the wrong direction and he sprayed himself in the face. His eyes were red and painful and he was nauseous and vomited. He called poison control.

MI03036 – An Internet Service Provider technician in his 20s was working on the side of a radio tower where there was a bee's nest. He sprayed a pyrethroid wasp and hornet killer (signal word: Caution), and some leaked onto his hand. He ran out of that and used some of the homeowner's peppermint oil insecticide. This came out in a fine mist and the wind blew it in his face. He became dizzy, felt weird and dreamy, was slow processing speech, and had a headache. He went to an emergency department.

MI03148 – A fast food cook in his 20s was spraying wasps outside with a pyrethroid insecticide (signal word Caution) and the wind blew some spray in his face. He had a bad taste in his mouth and became sleepy. He called poison control.

MI03150 – A pest control operator for a lawn care company in her 40s used a pyrethroid insecticide (signal word: Caution). She said she never got any in her eyes and wore safety glasses (not required),

but when she was around the fumes her eyes would burn and she would get a headache. She went to an employee health clinic.

MI03153 – A self-employed man in his 50s sprayed a basement with a total release fogger containing pyrethroid insecticides (signal word: Caution). He was wearing a respirator but started coughing and realized that one filter was off the respirator. He continued to cough and developed a burning sensation in his lungs, shortness of breath, sore throat, diaphoresis, fatigue, and dizziness. He went to an emergency department.

MI03154 – A social worker in her 50s was exposed to a 'pyrethroid plus pyrethrin plus other' insecticide (signal word: Caution) when she went to work in a building that had been treated for fleas the evening before. When the workers and service consumers came in, they could smell the pesticide. She developed difficulty breathing, a sore throat, headache and cough. PCC and local public health emergency manager were called. Several others developed symptoms and the building was evacuated as a precaution. (Event 2781).

MI03155 – An employee in her 50s was exposed to a 'pyrethroid plus pyrethrin plus other' insecticide (signal word: Caution) when she went to work in a building that had been treated for fleas the evening before. When the workers and service consumers came in, they could smell the pesticide. She developed eye irritation and a rash. PCC and local public health emergency manager were called. Several others developed symptoms and the building was evacuated as a precaution. (Event 2781).

MI03168 – A fast food swing manager in her 40s was sprayed in the face with a pyrethrin insecticide (signal word: Caution) at work. One pupil became dilated, her vision was blurry and she had a headache. She went to an eye clinic.

MI03169 – A worker in his 20s set off a pyrethroid total release fogger (signal word: Caution) in an apartment he was working in. He was exposed for about one minute as he left the apartment. He developed coughing and sinus drainage and called poison control.

MI03174 – A farmer/farm worker handled soy beans treated with an insecticide (signal word: Caution) without wearing the required gloves. The next day he developed a raised rash which persisted for at least six weeks. He saw his doctor and called the manufacturer.

MI03182 – A security guard in his 30s entered a building treated with an organophosphorous insecticide (Signal word: Danger) before the end of the posted re-entry interval. He had not seen the posting at first because when he came to work it was still dark out. He set off the alarm accidentally and went in to turn off the alarm and do the interior check. He was inside for about 1 ½ hours. He became dizzy, had difficulty breathing, a headache, blurred vision, and his eyes were tearing. He called poison control.

Herbicides

MI02893 – A wrecker operator in his 40s applied a chlorophenoxy herbicide (signal word: Danger) to the parking lot of a service station. He developed contact dermatitis over a large part of his body and acute necrotizing ulcerative gingivitis. He saw a dermatologist and dentist.

MI02942 – A worker in her 30s sprayed a field with an herbicide (signal word: Caution). The wind blew some in her face. She had a little wheezing at first and the next morning woke up with 'crusty' eyes. She called poison control and saw her doctor.

MI02951 – An adult farmer applied a triamine herbicide (signal word: Caution) to his fields over a period of about two weeks. After the first day he developed a black spot on his tongue and spit up blood. Later he developed a bad taste in his mouth, bruised forearms and swollen hands. He was admitted to a hospital.

MI03009 – A farm hand in his 20s sprayed trees in blueberry field with an herbicide (signal word: Danger). He went on a break. He spilled some of the herbicide on a chair but didn't leave the field to wash his hands. He was wearing gloves but they had holes in them. He ate his snack and noticed a bitter taste. He developed throat irritation, stomach pain, nausea, and vomited once. He went to an emergency department.

MI03023 – An applicator in his 20s was applying an herbicide under power lines. He developed redness and itchiness on his arms and then his legs. A week later he still had the symptoms and went to an emergency room.

MI03175 – A worker in his 30s sprayed an herbicide (signal word: Danger) without wearing the required long sleeve shirt. The next day his arms and neck were swollen and his skin itched. He saw a doctor.

MI03189 – A worker in his 60s was outside when a coworker accidentally sprayed an herbicide (signal word: Danger) in close range. Some spray got on his face and in his right eye, resulting in throat and eye irritation. He rinsed immediately and went to an emergency department.

Disinfectants

MI02664 – A dental assistant in her 20s poured out some disinfectant. The cap was loose and some splashed on her face. A face shield was not required. Her face became red and she felt a burning sensation. A coworker called poison control and she was seen by a doctor at the clinic. Safety information was sent to the employer.

MI02668 – A wall cleaner at a restaurant in her 20s was putting bleach away on an overhead shelf. It fell. Most of the bleach went on the floor, some spilt on her scalp and face, including her eyes. Her eyes were tearing and burning, her skin was red and irritated, and she had a headache. She called poison control.

MI02669 – A hospital cleaner in her 20s had an accidental splash of quaternary ammonium chloride disinfectant (signal word: Caution) on her abdomen. She finished working, went home, and showered. She then went to the emergency department with red, irritated skin.

MI02670 – A personal assistant in an adult foster care home in his 20s mopped a bathroom floor with a quaternary ammonium chloride disinfectant (signal word: Caution). He then shut the door and cleaned the sink, tub, and tub walls with an acid disinfectant (signal word: Caution). Fumes developed, and he was exposed for about 10 minutes. He became lightheaded and disoriented. He left the bathroom, drank two glasses of water and got fresh air. His coworker called poison control.

MI02672 – A hospital housekeeper in her 50s was splashed in the eye from a cloth containing a sodium hypochlorite disinfectant (signal word: Caution). She rinsed her eye immediately. It became red and irritated. She went to the emergency department where her eye was rinsed again. Eye protection was not required.

MI02673 – A cleaner in his 40s at a food processing plant got a splash of a quaternary ammonium chloride disinfectant (signal word: Danger) in his eye. He rinsed it at work, and a coworker called poison control. It continued to burn so he went to an urgent care center and was diagnosed with a corneal burn.

MI02674 – A dishwasher in his 40s got splashed in the eye with a sanitizer when he moved a bucket of it. He flushed his eye and went to an emergency department where he was diagnosed with conjunctivitis.

MI02675 – A surgical technician in her 30s was splashed in her eye with a disinfectant (signal word: Danger). Her eye was irritated and she had blurred vision. She went to an emergency department and was diagnosed with chemical conjunctivitis.

MI02676 – A dental assistant in her 20s closed a container of disinfectant (signal word: Danger) too fast after putting instruments in it. Some disinfectant splashed in her eye. Protective eyewear was required, but she was only wearing her small prescription glasses. Her eye became red and burned. She went to an urgent care center.

MI02677 – A janitor in his 20s cleaned a bathroom using full strength bleach. He developed a cough, shortness of breath, runny nose and difficulty breathing. He called poison control.

MI02680 – A worker in her 30s was exposed to fumes from a mixture of bleach and ammonia. She developed a headache, throat irritation, and a cough with deep breathing. She called poison control.

MI02724 – A bartender in his 20s was cleaning with a quaternary ammonium chloride disinfectant (signal word: Danger), using a rag. Some splashed in his eye and it became red with a burning sensation. He also had blurred vision. He went to an emergency department.

MI02725 – A freeway rest area attendant in her 30s with a history of asthma used acid disinfectant in a toilet bowl, then bleach on the toilet seat. She developed difficulty breathing, a cough, sinus drainage, and a sore throat. She was taken by ambulance to an emergency department.

MI02726 – A hotel worker in his 20s mixed bleach and muriatic acid while cleaning/mopping the pool area. He felt nauseous, was coughing and had pain with deep breathing. He went to an urgent care center.

MI02740 – A hospital cleaner in her 20s was splashed in the eye with a disinfectant (signal word: Caution) when putting a rag into a bucket. Her eye was red and irritated and she went to the emergency department. Eye protection was not required.

MI02741 – A farm hand in his 20s got a splash of a disinfectant (signal word: Danger) in his mouth and eye. His eye was red and irritated and he went to an emergency department.

MI02770 – A Coast Guard engineer in his 20s was present when acid cleaner and bleach were mixed to clean the galley floor. He developed red, burning eyes, a cough, and diarrhea. He went to an emergency department.

MI02771 – A Coast Guard petty officer in his 30s was present when acid cleaner and bleach were mixed to clean the galley floor. He developed red, burning eyes, a cough, and a headache. He went to an emergency department.

MI02772 – A member of the Coast Guard in his 20s was present when acid cleaner and bleach were mixed to clean the galley floor. He developed red, burning eyes, a cough, and chest tightness. He went to an emergency department.

MI02773 – A Coast Guard operations officer in his 20s was present when acid cleaner and bleach were mixed to clean the galley floor. He developed red, burning eyes and a cough. He went to an emergency department.

MI02774 – A pig farmer in his 40s was disinfecting (signal word: Danger) his barn. The applicator that the product came with was not working so he used a high pressure sprayer. He did not wear required goggles or face shield. He went to sleep and woke up with eye pain, tearing, and blurred vision. He went to an emergency department.

MI02887 – A maintenance worker in his 30s at a highway rest area tried to unclog a toilet. In the morning he poured in a sulfuric acid drain cleaner. In the afternoon, it was still clogged so he added another drain opener. Later he added bleach and fumes were released from the mixture of chemicals used. He developed difficulty breathing, cough, headache, wheezing, and vomited from coughing so hard. He went to an emergency department and was diagnosed with chemical pneumonitis.

MI02945 – A worker in his 40s inhaled bleach at work. The next day he went to an emergency department with a headache, sore throat, and ear pain.

MI02947 – A firefighter in his 20s was sprayed in the eyes with a quaternary ammonium chloride disinfectant (signal word: Caution) while walking in a fire station. His eyes were red and burning and he had a headache. He irrigated his eyes at work and went to an emergency department where they were irrigated again.

MI02948 – A worker in her 40s mixed a disinfectant (signal word: Warning) powder with water, inhaled some vapor, and coughed. The next morning she awoke with a painful rash on her face. She called poison control.

MI02952 – A pipefitter in his 20s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed chest tightness, cough, and sore throat. He was treated by EMS on site and taken to an emergency department. (Event 2589).

MI02953 – A pipefitter in his 30s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed burning in his chest. He was taken to an emergency department. (Event 2589).This was not a confirmed case, as he only had one symptom.

MI02954 – A quality assurance manager in her 30s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. She developed chest tightness and a cough. She was taken to an emergency department. (Event 2589).

MI02955 – A general contractor in his 20s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed chest tightness, cough, difficulty breathing and discomfort with deep breathing. He was treated by EMS on site and taken to an emergency department. (Event 2589).

MI02965 – A worker in his 20s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed chest tightness, cough, difficulty breathing and discomfort with deep breathing. He was treated by EMS on site and taken to an emergency department. (Event 2589).

MI02966 – A steam plant operator in his 40s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed chest tightness, cough, and difficulty breathing. He was treated by EMS on site and taken to an emergency department. (Event 2589).

MI03143 – A worker in his 40s was present when chlorine leaked due to a pipe rupture in a food manufacturing plant. He developed a sore throat and a metallic taste in his mouth. He was treated by EMS on site and taken to an emergency department. (Event 2589).

MI02974 – A worker in in her 50s at an assisted living home was exposed to a mixture of "The Works" and bleach. She developed shortness of breath, a cough, and wheezing. She was taken by ambulance to an emergency department

MI02986 – A physical therapist in her 50s was helping to clean a bed using a quaternary ammonium chloride disinfectant (signal word: Caution). The nozzle was facing the wrong direction, and she accidentally sprayed herself in the eye. It became red, irritated, and was tearing. She irrigated it twice and went to an emergency department.

MI02988 – A county park cleaner in his 60s was filling a spray bottle with a quaternary ammonium chloride disinfectant (signal word: Caution) from a larger container. Disinfectant leaked on the outside of the bottle and the bottle slipped from his hands and fell onto the floor. Disinfectant splashed into his eyes. He washed his eyes in the sink at work and then in the shower at home, but his eyes continued to burn and he had trouble seeing. He went to an emergency department and was diagnosed with corneal abrasion.

MI03012 – A hospital housekeeper in her 40s was cleaning a bed with a phenolic disinfectant (signal word Danger). The rag she was using got wrapped around her arm, above her glove. She washed her arm right away, but it became red, swollen, itchy, and painful. She went to the emergency department. She now uses longer gloves.

MI03016 – A hospital housekeeper in her 30s reached for a quaternary ammonium chloride cleaner. The container had been left open and some spilled on her right arm, chest, and left side. She immediately washed off her arm, but was unable to change her clothes for about half an hour. She developed a painful itchy rash with lesions. She went to an occupational health clinic.

MI03021 – A laboratory technician in her 30s at a fruit processing plant was exposed to disinfectant fumes (signal word: Danger) that had spilled on the floor where she was testing the fluid the apples were in. She developed chest tightness, congestion, cough, headache, eyes burning and tearing, and nausea and she vomited. She went to an emergency department.

MI03022 – A worker in his 30s inhaled dust from pool chemicals when he opened the bucket. He coughed and his throat burned. His coworker called poison control.

MI03037 – A worker in her 40s at a sausage factory was cleaning with a diluted disinfectant (signal word: Danger). She was wearing goggles, but some got in her eyes. She went to an emergency department.

MI03046 – A truck driver in his 50s unloaded a tank of ammonia at a power plant. When he tried to clear out the hose after unloading, ammonia was released into the air and splattered on his skin. He developed shortness of breath, a hoarse voice, and 1st and 2nd degree burns. EMS transported him to a hospital where he was admitted for three days.

MI03144 – A fast food worker in his 20s was exposed to two spilled disinfectants. He developed a cough, fever, shortness of breath, chest tightness and vomiting. He went to his doctor and called poison control.

MI03151 – A pool sales person in his 20s picked up his shirt that had been put down on some pool chlorine tablet dust. He smelled his shirt and developed nasal irritation and a bloody nose. He called poison control.

MI03173 – A worker in his 50s used an ammonia cleaner followed by a disinfectant (signal word: Caution) to clean graffiti. He immediately felt a cool sensation in his nose, and woke up five hours later sweaty, nauseous, and shaky. The nausea and shakiness persisted and he called the manufacturer about 30 hours after his exposure.

MI03176 – A worker in her 40s dropped a container of disinfectant (signal word: Danger) and some splashed in her eye. Her eye became red and painful and she rinsed it. She went to an urgent care center and was diagnosed with scratches on her cornea.

MI03177 - Two dental office workers developed symptoms after cleaning patient rooms with a disinfectant (signal word: Caution). Each had a heavy feeling in her chest, "symptoms of severe asthma" although neither had a severe case of asthma, and bumps in the back of the throat. Albuterol alleviated the symptoms. They called the manufacturer.

MI03178 - Two dental office workers developed symptoms after cleaning patient rooms with a disinfectant (signal word: Caution). Each had a heavy feeling in her chest, "symptoms of severe asthma" although neither had a severe case of asthma, and bumps in the back of the throat. Albuterol alleviated the symptoms. They called the manufacturer.

MI03179 – A janitor in his 50s mixed a quaternary ammonium chloride disinfectant (signal word: Danger) with a cleaner containing bleach to clean a bathroom. He was in the room for about five minutes and became lightheaded and had difficulty breathing. Two days later he went to an urgent care because of a persistent cough, sinus pressure, congestion, headache, and eye irritation.

MI03180 – A casino dishwasher in her 20s got a splash of disinfectant (signal word: Danger) in her eye. Her eye was painful and she went to an emergency department.

MI03183 – A housekeeper in her 40s got a splash of disinfectant (signal word: Danger) in her eye. She rinsed at the eye wash at work, but her eye was painful and she went to an urgent care center. She had photophobia, tearing, and conjunctivitis.

MI03187 – A worker in his 50s mixed bleach and a quaternary ammonium chloride disinfectant (signal word: Danger) when cleaning a bathroom. He developed a cough and difficulty breathing. He went to an urgent care center and was taken by ambulance from there to an emergency department.

MI03190 – A hospital custodian in her 20s was squirted in both eyes with a disinfectant (signal word: Caution). She developed red, burning, tearing eyes and had blurry vision. She went to an emergency department.

MI03212 – A hair stylist in his teens got some disinfectant (signal word: Caution) in his eye. His eye became red and irritated and was tearing. He went to an emergency department.

MI03248 – A resident aide in her 30s was cleaning a bathtub with a disinfectant (signal word: Caution) According to the label, no PPE is required. As she sprayed it she developed lightheadedness, and felt like her lungs were burning. She also developed a headache, nausea, stomachache, chest tightness, difficulty breathing and her face was numb and tingling. An ambulance was called and took her to an emergency department.

MI03249 – A gas station cashier in her 20s sprayed a disinfectant (signal word: Caution) to clean a bathroom. She developed a cough, shortness of breath, sore throat, and chest pain while breathing. She went to an emergency department and was given a breathing treatment. She returned to the emergency department the next day because she was still having difficulty breathing and was wheezing.

MI03251 – A meat packer in her 20s was thirsty and took a drink from a hose she thought contained only water, but it contained a quaternary ammonium chloride disinfectant (signal word: Danger). She only took one sip of the diluted disinfectant and developed a burning throat and vomited. Her workplace called poison control and sent her to an emergency department.

MI03252 – A laborer in his 40s cleaned a basement in a house that had had a fire using a variety of cleaners and a disinfectant. He developed skin and eye irritation, weakness, diaphoresis, and difficulty breathing. He went to an emergency department and called poison control.

MI03253 – An employee in her 20s at a home health care agency was exposed to a mixture of bleach and an acid cleaner, resulting in chlorine gas. She inhaled a few whiffs and began coughing, developed difficulty breathing, had chest tightness, and wheezing. She went to an emergency department.

MI03299 – A laborer in his 30s was exposed to pool chlorine in a manufacturing plant. He developed a cough, nasal irritation, tight chest, sneezing and a rash on both arms. He called poison control.

Mixtures

MI02727 – A forklift driver in his 40s was unloading a truck. One of the containers of herbicide and fungicide (signal word: Caution) in an upper pallet had been sliced open by a forklift when loaded. The forklift was pulling that pallet and caught the plastic shrink wrap from a lower pallet. It pulled until the plastic snapped, splashing about ½ gal of leaked product in his face and eyes. Eye protection was not required but he was wearing safety glasses anyway. His eyes were red and very painful; he had blurry vision for three days; and he could taste the herbicide. He rinsed his eyes in an eyewash and was then taken to an ED. He later saw an ophthalmologist.

MI01376 – A field manager in his 20s was planting potatoes mixed with an insecticide and a fungicide when the nozzles became plugged. The pesticides sprayed back in his face and around his safety goggles. His eyes were burning and tearing and he went to an emergency department. He lost two days of work.