Pesticide Illness and Injury Surveillance in Michigan

2010

March 2012

Division of Environmental Health
Michigan Department of Community Health

Pesticide Illness and Injury Surveillance in Michigan: 2010

State of Michigan

Governor – Rick Snyder, BGS, MBA, JD

Michigan Department of Community Health

Director – Olga Dazzo, MBA
Public Health Administration – Jean Chabut, RN, MPH
Bureau of Epidemiology – Corinne Miller, DDS, PhD
Division of Environmental Health – David R. Wade, PhD

Authors

Abby Schwartz, MPH
Martha Stanbury, MSPH

Contributor

Kenneth Rosenman, MD
Michigan State University

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 Community Health
Thomas Largo, MPH

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), chemical poisoning (R325.71-R325.75), and laboratory cholinesterase test results (R325.61 and R325.68). This is the eighth annual report on pesticide-related illnesses and injuries in Michigan.

From 2001 through 2010, 1,120 reports of occupational exposures and pesticide illness or injury were received and 768 (68.6%) were confirmed as cases according to the surveillance case definition. Sixty-seven of those confirmed cases were reported in 2010.

Michigan's Poison Control Center (PCC) remained the main data source, contributing 86.6% of the reports of occupationally exposed individuals in 2010. Antimicrobials continued to be the cause for over half of the confirmed occupational cases. A number of these cases may not have occurred if disinfectants were only used in situations where there was an indication that their use would be effective and necessary.

Where activity of the exposed person was known, 37.1% 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.

Where occupation was known, 20.9% of the confirmed cases in 2010 involved Building and Grounds Cleaning and Maintenance. Of those, 42.9% were cleaners, housekeepers or maintenance workers and 57.1% were pest control operators.

From 2006 through 2010, 2,166 reports of non-occupational exposures and pesticide illness or injury were received and 813 (37.5%) were confirmed as cases according to the surveillance case definition. Two hundred seven of those confirmed cases were reported in 2010.

Michigan's Poison Control Center (PCC) is also an important data source for non-occupational exposures, reporting 80.7% of these individuals in 2010. In 2010, insecticides accounted for 34.8% of confirmed non-occupational cases and antimicrobials accounted 30.5% of the confirmed non-occupational cases.

Where activity of the exposed person was known, 60.3% of confirmed non-occupational cases were exposed inadvertently while doing normal activities and were not involved in the application of pesticides.

Two cases in 2010 were investigated by the Michigan Department of Agriculture and Rural Development (MDARD) for possible pesticide use violations, one occupational and one non-occupational. In addition, three occupational cases were investigated by the Michigan Occupational Safety and Health Administration (MIOSHA). Seven events met the criteria for

priority reporting to the National Institute for Occupational Safety and Health (NIOSH), four occupational and three non-occupational. These events are described on pages 28 and 29.

Background

Pesticide poisoning is a potential public health threat due to widespread pesticide use. According to the U.S. Environmental Protection Agency (EPA), 1.2 billion pounds of pesticides (excluding antimicrobials and wood preservatives) were used in the United States in 2001, the last year they collected this data.[1]

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

Evidence has linked pesticides with a variety of acute health effects such as conjunctivitis, dyspnea, headache, nausea, seizures, skin irritation, and upper respiratory tract irritation.[2] The effects of chronic or long term exposures include cancers, immune function impairments, neurological disorders, reproductive disorders, respiratory disorders, and skin disorders.[3]

Pesticides are a category of chemicals that are used to kill or control insects, weeds, fungi, rodents, and microbes. There are 15,471 different pesticides registered for sale in Michigan, containing over 600 different active ingredients.

Acting on concerns about acute occupational pesticide-related illness, NIOSH began collecting standardized information about acute occupational pesticide exposure from selected states in 1998[4] 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).

Pesticide use is widespread in Michigan. In 2010, there were 15,471 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 2,095 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). Agriculture is the second largest income-producing industry in Michigan. 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 2010, there were a total of 22,161 certified pesticide applicators. Table 1 shows the number of licensed businesses and certified applicators since 2001.

---

[1] http://www.epa.gov/opp00001/pestsales/01pestsales/market_estimates2001.pdf
[2] Recognition and Management of Pesticide Poisonings, ed. Dr. J. Routt Reigart and Dr. James R. Roberts, 5th edition. 1999. http://www.epa.gov/pesticides/safety/healthcare/handbook/handbook.htm
[3] ibid
[4] http://www.cdc.gov/niosh/topics/pesticides/

Table 1. Pesticide Licensing and Certification, 2001-2010

Type	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Private Certification	10,596	10,075	9,576	9,200	8,793	8,352	8,122	7,848	7,722	7,580
Commercial Cert.	13,045	13,089	13,387	13,588	13,485	13,743	14,123	14,118	14,210	14,199
Total Applicators	23,641	23,164	22,963	22,788	22,278	22,095	22,245	21,966	21,932	22,161
Licensed Businesses	NA	NA	1,755	NA	1,900	1,962	1,923	2,025	2,147	2,095

MDARD is the Michigan agency that regulates pesticide use and misuse. The Pesticide and Plant Pest Management Division of MDARD investigates allegations of pesticide misuse. They also perform random inspections of licensed businesses. Table 2 shows MDARD's staff levels and some of the oversight activities of those staff.

Table 2. Pesticide Inspections and Investigations, 2001-2010

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Misuse Investigations	194	165	132	153	182	231	178	180	108	152
Random Inspections	1,126	1,077	1,261	1,266	1,175	797	655	303	312	613
# of Field Staff	20	20	20	18	18	15	15	16	13	16

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 at worksites;
- Provide information for planning and evaluating intervention programs.

Methods

Occupational pesticide poisoning is reportable under the Public Health Code (Part 56 of Act 368 of 1978, as amended). This law requires health care providers (including Michigan's Poison Control Center), health care facilities, and employers to report information about individuals (including names) with suspected or confirmed work-related diseases to the state. In October 2005, laboratories started reporting acetylcholinesterase and pseudocholinesterase test results in accordance with R 325.61 and R 325.68 additions to the Michigan Public Health Code. These tests are sometimes ordered for patients exposed to organophosphate and carbamate insecticides. Regulations to require the reporting of all pesticide injuries and illnesses (including non-occupational) went into effect September 18, 2007 (R 325.71-5).

In addition to information from reports submitted under the public health code, the surveillance system also 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)[5] 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[6] 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 cases 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.[7] 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

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

care was sought, if a hospital stay was involved, and whether time was lost from work or daily activities.[8]

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.

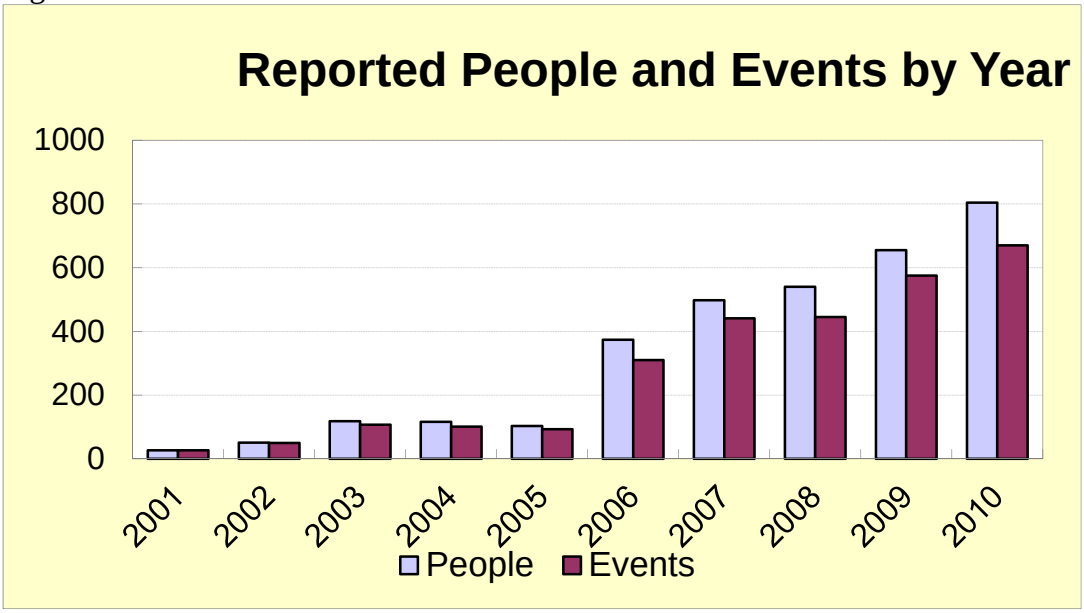
[8] http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf

Results

Section I. All Reports

There were 3,286 reports of acute pesticide poisonings from 2001 – 2010. These represent 2,819 separate events. In 2010 there were 804 people, from 670 events reported. Figure 1 shows the number of reported cases and events by year.

Figure 1



Of the 3,286 reports from 2001 through 2010, 1,581 (48.1%) met the criteria for confirmed cases. See Table 3.

Table 3 : Case Confirmation by Work-Relatedness, 2001-2010 and 2010 Occupational separately

Status	Occupational 2001-2010	Non-Occupational 2006-2010	Total	Occupational 2010
Definite Case	90	9	99	8
Probable Case	173	108	281	13
Possible Case	489	626	1115	44
Suspicious Case	16	70	86	2
Subtotal	*768*	*813*	*1581*	*67*
Unlikely Case	2	1	3	0
Insufficient Information	307	1012	1319	41
Exposed/Asymptomatic	28	327	355	1
Unrelated	15	13	28	1
Subtotal	*352*	*1353*	*1705*	*43*
	1120	**2166**	**3286**	110

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

Age is not always known. When known, persons of all ages may be exposed to pesticides. Table 4 shows the age groups for all confirmed cases.

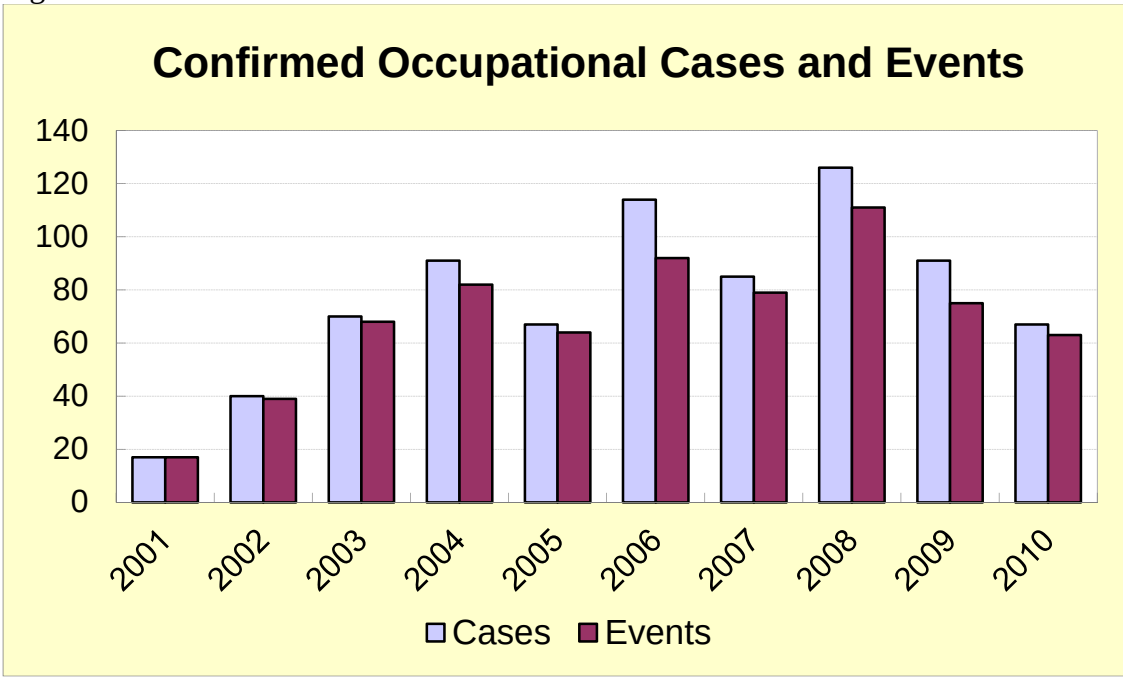
Table 4: Confirmed Cases by Age Group & Gender, 2001-2010 and 2010 separately

	Cumulative			2010		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
Unknown age	72	55	23	6	3	0
00-<1:Infants	2	2	0	1	1	0
01-02:Toddlers	15	14	0	4	2	0
03-05:PreSchool	13	5	0	4	1	0
06-11:Child	45	26	0	21	10	0
12-17:Youth	36	36	1	9	7	0
18-64:Adult	611	544	0	104	83	0
65+:Senior	42	39	0	10	8	0
Total	**836**	**721**	**24**	**159**	**115**	**0**

Section II. Occupational Pesticide Illnesses and Injuries

This section describes confirmed occupational cases. There were 67 cases from 63 events in 2010.

Figure 2



The chart below shows all confirmed occupational cases in 2010 by month of exposure.

Figure 3

Cases come from a variety of reporting sources. The Poison Control Center (PCC) remains the major source of reports. In 2010, 58 (86.6%) of the 67 occupational cases were reported by PCC. Some exposures were reported by multiple sources; the table below shows the first source.

Table 5 : First Report Source, Confirmed Occupational Cases 2001-2010 and 2010 Separately

Report Source	Cumulative	Percent	2010	Percent
Poison control center	604	78.6%	58	86.6%
Other health care provider	61	7.9%	4	6.0%
State Health Department - HSEES	50	6.5%	1	1.5%
Department of Agriculture (MDARD)	13	1.7%	1	1.5%
Report/referral from governmental agency	11	1.4%	0	0.0%
Employer	6	0.8%	2	3.0%
Physician report	5	0.7%	0	0.0%
Co-worker report	5	0.7%	0	0.0%
Friend or relative report	5	0.7%	0	0.0%
Other	8	1.0%	1	1.5%
Total	**768**	**100.0%**	**67**	**100.0%**

Demographics

Pesticide exposures occur to people of all ages. In Michigan, men are more likely to have had an occupational exposure to pesticides than women and most cases are white, non-hispanic.

Table 6: Confirmed Occupational Cases by Age Group and Gender, 2001-2010 and 2010 Separately

	Cumulative			2010		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
10-19	29	39	0	1	1	0
20-29	87	121	0	10	12	0
30-39	61	83	0	2	7	0
40-49	76	81	0	10	5	0
50-59	56	39	0	7	8	0
60-69	7	10	0	1	0	0
70+	1	3	0	0	1	0
Unknown	27	37	11	0	2	0
Total	**344**	**413**	**11**	**31**	**36**	**0**

A farmworker in his 70s was spraying herbicides in an orchard. A tree limb hit the valve on the boom sprayer and broke the regulator, so it sprayed in his eye from about 10 inches away. He was wearing sunglasses with side protectors. He washed his eye with water from his drinking bottle then drove to a hospital where his eye was irrigated again and he was diagnosed with conjunctivitis.

Table 7 : Confirmed Occupational Cases by Race and Ethnicity, 2001-2010 and 2010 Separately

	Cumulative			2010		
Race	**Hispanic**	**Not Hispanic**	**Unknown**	**Hispanic**	**Not Hispanic**	**Unknown**
American Indian/Alaskan	0	5	0	0	0	0
Asian/Pacific Islander	0	2	1	0	1	1
Black	0	26	14	0	0	0
White	10	263	67	1	31	9
Mixed	1	15	1	0	2	0
Unknown	35	0	328	2	0	20
Total	**46**	**311**	**411**	**3**	**34**	**30**

The table below shows the industry involved in occupational cases, based on NIOSH industry sectors.[9] '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 many disinfectant exposures occur.

Table 8: Confirmed Occupational Cases by NIOSH Industry Sectors, 2001-2010 and 2010 Separately

Industry Sector	**Cumulative**	**Percent**	**2010**	**Percent**
Agriculture, Forestry, Fishing	87	11.3%	6	9.0%
Construction	15	2.0%	0	0.0%
Healthcare & Social Assistance	109	14.2%	9	13.4%
Manufacturing	27	3.5%	2	3.0%
Public Safety	13	1.7%	0	0.0%
Services (exc. Public Safety)	292	38.0%	31	46.3%
Transportation, Warehousing, Utilities	21	2.7%	4	6.0%
Wholesale & Retail Trade	69	9.0%	4	6.0%
Unknown	135	17.6%	11	16.4%
Total	**768**	**100.0%**	**67**	**100.0%**

An office worker was present in a small office when a coworker sprayed a pyrethroid insecticide in the office. He developed a headache and burning eyes. The next day the office was sprayed again and he became nauseated and vomited. He called poison control.

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

Table 9 shows the occupation of the exposed worker based on the 2002 Census Occupation Codes. The most common occupation is 'Building and Grounds Cleaning and Maintenance'. In 2010 this included eight cleaners and six pest control operators.

Table 9: Confirmed Occupational Cases by Census Occupation, 2001-2010 and 2010 Separately

Occupation	Cumulative	Percent	2010	Percent
Building and Grounds Cleaning and Maintenance	110	14.3%	14	20.9%
Sales and Related	37	4.8%	4	6.0%
Farming, Forestry, and Fishing	34	4.4%	6	9.0%
Food Preparation and Serving Related	27	3.5%	6	9.0%
Management	18	2.3%	3	4.5%
Office and Administrative Support	15	2.0%	4	6.0%
Transportation and Material Moving	15	2.0%	4	6.0%
Personal Care and Service	14	1.8%	3	4.5%
Production	14	1.8%	3	4.5%
Healthcare Practitioners and Technical	13	1.7%	3	4.5%
Healthcare Support	13	1.7%	4	6.0%
Education, Training, and Library	11	1.4%	2	3.0%
Protective Service	10	1.3%	0	0.0%
Construction and Extraction	7	0.9%	0	0.0%
Installation, Repair, and Maintenance	6	0.8%	1	1.5%
Other	5	0.7%	2	3.0%
Unknown	419	54.6%	8	11.9%
Total	768	100.0%	67	100.0%

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 treatment 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. Some individuals had more than one type of exposure.

Figure 4

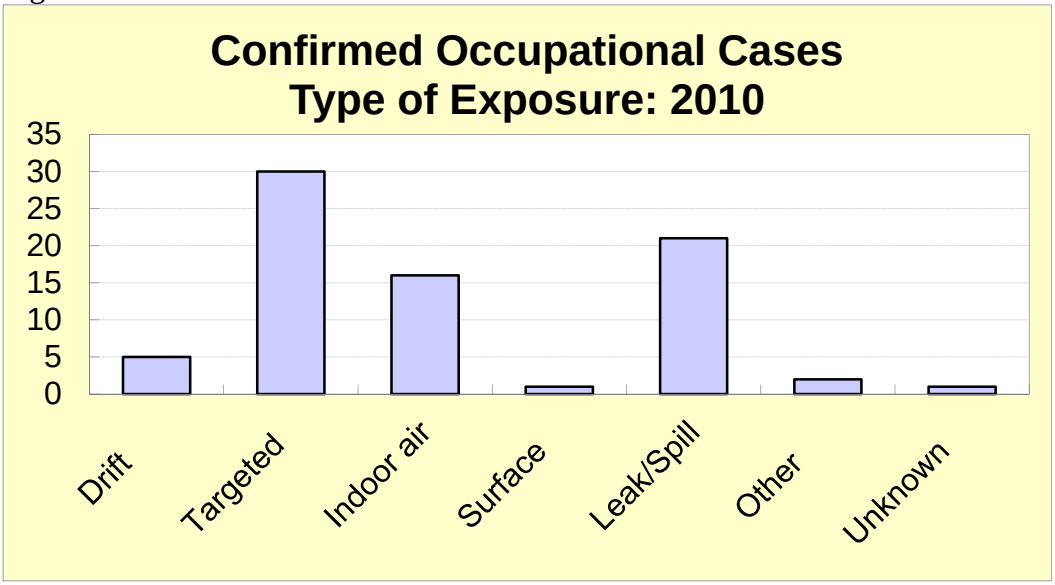


Table 10 shows the type of pesticide the person was exposed to. In 2010, the most common exposure was to antimicrobials (57.3%), followed by insecticides (17.1%) and herbicides (14.6%). Some products contain more than one type of pesticide and some exposures involve more than one product so the number of types listed is greater than the number of exposures.

Table 10: Confirmed Occupational Cases by Pesticide Type, 2001- 2010 and 2010 Separately

Pesticide Type	Cumulative	Percent	2010	Percent
Insecticide	230	25.5%	14	17.1%
Herbicide	130	14.4%	12	14.6%
Fungicide	22	2.4%	1	1.2%
Fumigant	9	1.0%	1	1.2%
Rodenticide	13	1.4%	0	0.0%
Disinfectant	442	48.9%	47	57.3%
Insect Repellent	5	0.6%	1	1.2%
Insecticide and Fungicide	5	0.6%	0	0.0%
Insecticide and Other	16	1.8%	0	0.0%
Other	11	1.2%	1	1.2%
Multiple (not specified)	10	1.1%	5	6.1%
Unknown	10	0.01107	0	0
Total	**903**	**100.00%**	**82**	**100.00%**

A school custodian accidentally mixed bleach with an acid cleaner. He poured the solution down the drain. He developed a cough, nose and throat irritation, difficulty breathing, wheezing, eye irritation, headache, diarrhea and nausea. He called poison control and went to an emergency department. MDCH sent him information about disinfectant safety and asthma and cleaning agents.

Workers were exposed through applications to a wide variety of targets, as shown in table 11.

Table 11: Application Target for Confirmed Occupational Cases, 2001-2010 and 2010 Separately

Application Target	Cumulative	Percent	2010	Percent
Landscape/ornamentals	66	8.6%	6	9.0%
Forest trees/land	3	0.4%	0	0.0%
Veterinary - livestock	3	0.4%	0	0.0%
Veterinary - domestic animals	3	0.4%	0	0.0%
Building structure	12	1.6%	0	0.0%
Building surface	107	13.9%	10	14.9%
Building space treatment	44	5.7%	6	9.0%
Undesired plant	16	2.1%	3	4.5%
Aquatic - pond, stream, lake, canal	7	0.9%	1	1.5%
Pool, Spa, Hot Tub, Jacuzzi	24	3.1%	3	4.5%
Soil	1	0.1%	0	0.0%
Wood product	3	0.4%	0	0.0%
Small fruits	19	2.5%	0	0.0%
Tree Fruits	3	0.4%	0	0.0%
Pome fruits	1	0.1%	0	0.0%
Stone fruits	2	0.3%	0	0.0%
Vegetable crops	2	0.3%	0	0.0%
Cucurbit vegetables	1	0.1%	0	0.0%
Fruiting vegetables	1	0.1%	0	0.0%
Root/tuber vegetables	3	0.4%	1	1.5%
Seed/pod vegetables	2	0.3%	0	0.0%
Grain/grass/fiber crops	1	0.1%	0	0.0%
Forage, fodder, silage, legumes	1	0.1%	0	0.0%
Cereal grain crops	8	1.0%	0	0.0%
Miscellaneous field crops	2	0.3%	0	0.0%
Oil crops	1	0.1%	0	0.0%
Application to seeds	1	0.1%	0	0.0%
Humans	1	0.1%	1	1.5%
Human - skin/hair	1	0.1%	0	0.0%
Human - skin/hair & clothing	2	0.3%	0	0.0%
Bait for rodent, bird, predator	9	1.2%	0	0.0%
Community-wide application	1	0.1%	0	0.0%
Other	162	21.1%	22	32.8%
Not applicable	59	7.7%	4	6.0%
Unknown	196	25.5%	10	14.9%
Total	**768**	**100.0%**	**67**	**100.0%**

A general laborer at a grain elevator was working in a room about 100 yards away from a room that had been fumigated. The treated room was sealed with plastic but he could smell the product and developed red, tearing, burning eyes, photophobia, a sore throat, and rhinitis. He went to an emergency department.

Pesticide exposures occur in a wide range of establishments. The table below shows where occupational exposures in Michigan have taken place.

Table 12: Location of Exposure for Confirmed Occupational Cases, 2001-2010 and 2010 Separately

Location	Cumulative	Percent	2010	Percent
Service Establishment	102	13.3%	11	16.4%
Farm	73	9.5%	7	10.4%
Retail Establishment	68	8.9%	4	6.0%
Hospital	62	8.1%	2	3.0%
Single Family Home	59	7.7%	3	4.5%
Office/Business	47	6.1%	3	4.5%
School	45	5.9%	11	16.4%
Multi-unit housing	24	3.1%	5	7.5%
Residential Institution	21	2.7%	4	6.0%
Food Process/Manufacture Facility	14	1.8%	3	4.5%
Pet Care and Veterinary Services	13	1.7%	0	0.0%
Other Manufacturing/industrial	11	1.4%	0	0.0%
Golf Course	9	1.2%	1	1.5%
Greenhouse	8	1.0%	1	1.5%
Mobile home	8	1.0%	0	0.0%
Post-Harvest Crop Prep Facility	7	0.9%	1	1.5%
Industrial Facility	7	0.9%	0	0.0%
Nursery	6	0.8%	0	0.0%
Day care facility	6	0.8%	0	0.0%
Farm Product Warehouse/Storage	6	0.8%	2	3.0%
Road/Rail	6	0.8%	0	0.0%
Park	6	0.8%	1	1.5%
Other	35	4.6%	3	4.5%
More than one site	12	1.6%	0	0.0%
Unknown	113	14.7%	5	7.5%
Total	**768**	**100.0%**	**67**	**100.0%**

A letter carrier leaned over his satchel to get the mail for the next house. The nozzle from the capsicum dog repellent hanging off the satchel got caught on the steering wheel and the product discharged onto his leg. He was unable to wash it off until he was done with his route about four to five hours later. In addition, he breathed in the fumes for the remainder of the day. He developed a red, burning area on his leg, a cough, trouble breathing, nasal congestion, a sore throat, tearing and burning eyes, and nausea.

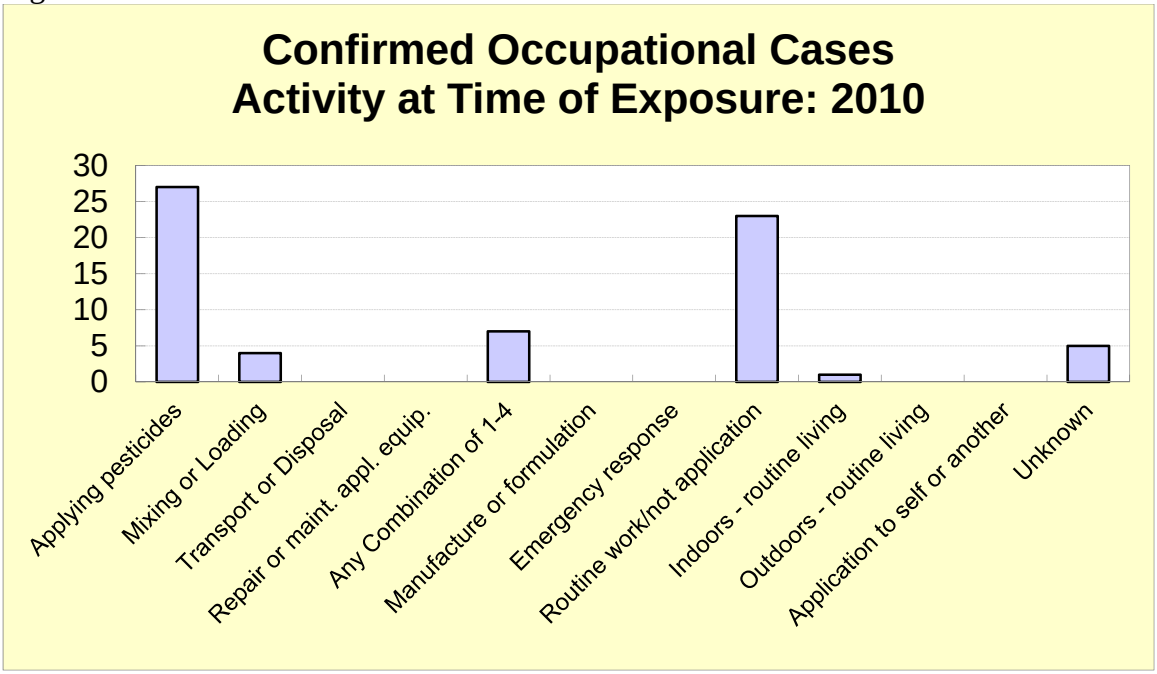
Type of equipment used to apply pesticides was known for 73.1% of the confirmed occupational cases in 2010. The most common type was 'other' which includes mops, buckets and pool shock tabs.

Table 13: Equipment Used in Confirmed Occupational Cases, 2001-2010 and 2010 Separately

Application Equipment	Cumulative	Percent	2010	Percent
Trigger pump/compressed air	52	6.8%	10	14.9%
Pressurized can	46	6.0%	5	7.5%
Ground sprayer, not elsewhere classified	26	3.4%	2	3.0%
Sprayer, backpack	21	2.7%	2	3.0%
Spray line, hand held	18	2.3%	1	1.5%
Manual Placement	18	2.3%	0	0.0%
Total Release Fogger	12	1.6%	1	1.5%
Aerosol generator/fogger	8	1.0%	0	0.0%
Handheld granular/dust applicator	5	0.7%	0	0.0%
Other	176	22.9%	25	37.3%
Not applicable	57	7.4%	3	4.5%
Unknown	329	42.8%	18	26.9%
Total	**768**	**100.0%**	**67**	**100.0%**

Activity at time of exposure was determined for 62 (92.5%) of the cases.

Figure 5



Identification of factors contributing to the exposure assists with the development of prevention strategies. Up to five contributing factors were coded for each case. Spills and splashes were the most common contributing factor for occupational pesticide cases.

Table 14: Contributing Factors in Confirmed Occupational Cases, 2001-2010 and 2010 Separately

Contributing Factor	Cumulative	Percent	2010	Percent
Spill/Splash of liquid or dust (not equipment failure)	231	23.5%	17	19.3%
Mixing incompatible products	88	8.9%	9	10.2%
Label violations not otherwise specified	64	6.5%	2	2.3%
No label violation identified but person still exposed/ill	62	6.3%	8	9.1%
Application equipment failure	60	6.1%	8	9.1%
Required eye protection not worn or inadequate	53	5.4%	5	5.7%
Drift contributory factors	50	5.1%	5	5.7%
Decontamination not adequate or timely	49	5.0%	6	6.8%
Excessive application	36	3.7%	8	9.1%
Applicator not properly trained or supervised	28	2.8%	2	2.3%
People were in the treated area during application	26	2.6%	3	3.4%
Notification/posting lacking or ineffective	20	2.0%	1	1.1%
Within reach of child or other improper storage	18	1.8%	1	1.1%
Required gloves not worn or inadequate	17	1.7%	1	1.1%
Structure inadequately ventilated before re-entry	14	1.4%	2	2.3%
Required respirator not worn or inadequate	10	1.0%	1	1.1%
Early re-entry	9	0.9%	0	0.0%
Other required PPE not worn or inadequate	4	0.4%	0	0.0%
Other	29	2.9%	3	3.4%
Unknown	116	11.8%	6	6.8%
Total	**984**	**100.0%**	**88**	**100.0%**

A certified pesticide applicator for a tree company turned up the pressure on the equipment used to reach the top of tall trees. When he pulled the trigger there was an equipment malfunction and the dithiocarbamate fungicide sprayed in his face. The high pressure knocked his face shield off and he got some in his eyes, mouth and on his face. He developed chest pressure, burning eyes and face, a bad taste in his mouth and blurred vision. He went to an emergency department.

Health Effects
Most (79.1%) cases in 2010 were of low severity.

Table 15: Severity of Confirmed Occupational Cases, 2001-2010 and 2010 Separately

Severity	Cumulative	Percent	2010	Percent
Fatal	2	0.3%	0	0.0%
High	9	1.2%	2	3.0%
Moderate	135	17.6%	12	17.9%
Low	622	81.0%	53	79.1%
Total	**768**	**100.0%**	**67**	**100.0%**

The table below shows where the case first received medical care and whether they were hospitalized. (Additional medical care may have been sought. For example, a case may have been referred by poison control to an urgent care center, but that is not shown in the table.) 'Other' includes emergency medical services such as an ambulance.

Table 16: Confirmed Occupational Cases by First Care and Hospitalization, 2010

First Care	Not Hospitalized	Hospitalized	Total
Emergency Room	19	2	21
Advice of Poison Control Center	37	0	37
No Medical Care Sought	1	0	1
Other	5	0	5
Employee/Occupational Health Center	3	0	3
Total	**65**	**2**	**67**

An employee sprayed a pyrethroid insecticide around the grounds. The next day he developed a cough, stuffy nose, throat irritation, shortness of breath, and fever. He went to an emergency department and was hospitalized for four days.

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 there is no follow-up for additional information with non-occupational cases. There were 207 confirmed cases from 162 events in 2010.

Figure 6

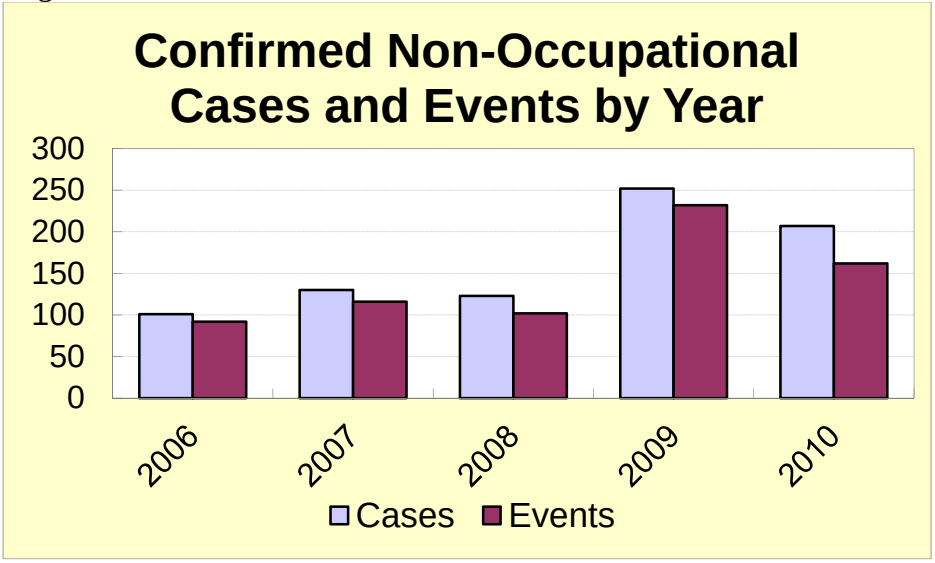
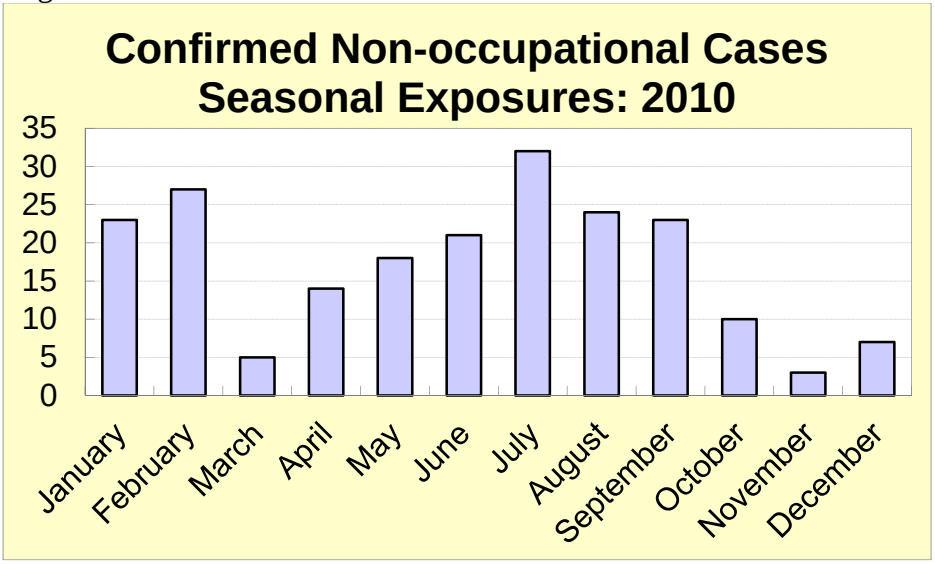


Figure 7 shows all confirmed non-occupational cases reported in 2010 by month of exposure.

Figure 7



The table below 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 19 : First Report Source, Confirmed Non-occupational Cases 2006-2010 and 2010 Separately

Report Source	Cumulative	Percent	2010	Percent
Poison control center	532	65.4%	167	80.7%
State Health Department - HSEES	113	13.9%	0	0.0%
Other health care provider	96	11.8%	10	4.8%
Department of Agriculture (MDARD)	30	3.7%	3	1.4%
Report/referral from governmental agency	24	3.0%	14	6.8%
Obituary/news report	5	0.6%	0	0.0%
Other	13	1.6%	13	6.3%
Total	**813**	**100.0%**	**207**	**100.0%**

A man used 25-30 cans of a pyrethroid insecticide over the course of three weeks. He developed nausea, lethargy, coughing, and wheezing. He saw his physician who called the manufacturer. A FIFRA adverse effect report was generated and forwarded to MDCH by the US EPA.

Demographics

The table below shows non-occupational cases by age and gender. In Michigan, women are more likely to havea non-occupational exposure than men.

Table 18: Confirmed Non-occupational Cases by Age Group and Gender, 2006-2010 and 2010 Separately

	Cumulative			2010		
Age Groups	**Female**	**Male**	**Unknown**	**Female**	**Male**	**Unknown**
Unknown age	45	18	12	6	1	0
00-<1:Infants	2	2	0	1	1	0
01-02:Toddlers	15	14	0	4	2	0
03-05:PreSchool	13	5	0	4	1	0
06-11:Child	45	26	0	21	10	0
12-17:Youth	26	21	1	9	7	0
18-64:Adult	307	189	0	73	50	0
65+:Senior	39	33	0	10	7	0
Total	**492**	**308**	**13**	**128**	**79**	**0**

A mother set off foggers and left the home for the required four hours. About ten minutes after returning her seven-week-old baby began coughing, crying and would not take a bottle.

The next table shows the race and ethnicity of non-occupational cases. Race and ethnicity information is rarely available for non-occupational cases.

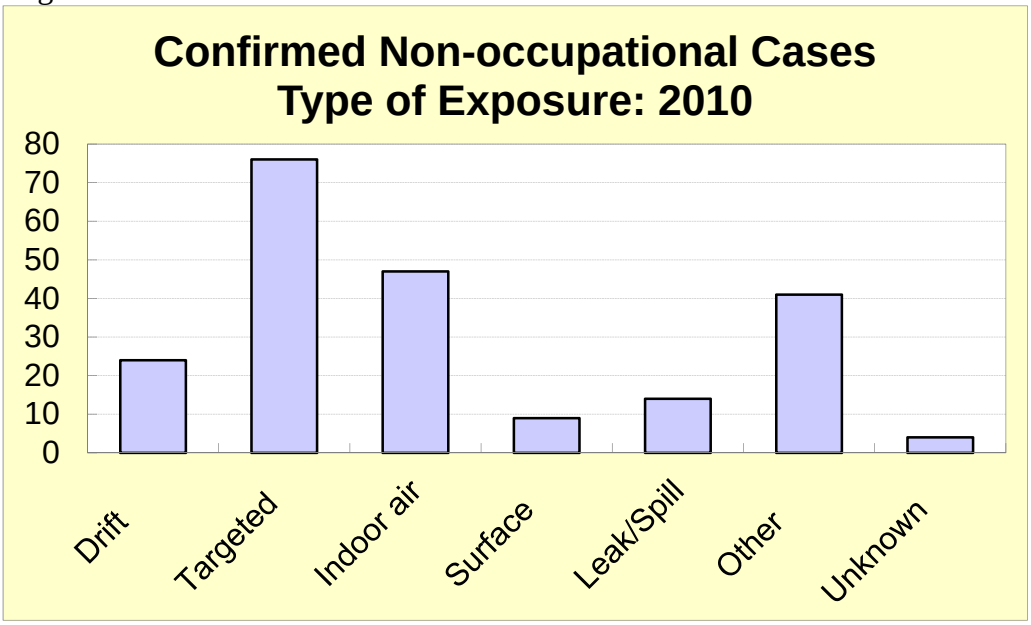
Table 19: Confirmed Non-occupational Cases by Race and Ethnicity, 2006-2010 and 2010 Separately

Race	Cumulative Hispanic	Cumulative Not Hispanic	Cumulative Unknown	2010 Hispanic	2010 Not Hispanic	2010 Unknown
American Indian/Alaskan	0	0	2	0	0	0
Black	0	0	13	0	0	3
White	0	6	63	0	3	6
Unknown	1	0	728	0	0	195
Total	**1**	**6**	**806**	**0**	**3**	**204**

Exposures

The chart below shows the type of exposure for confirmed non-occupational cases in 2010. The most common type of exposure was targeted, followed by indoor air. Some individuals had more than one type of exposure.

Figure 8



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 2010, the most common exposure for non-occupational cases was to insecticides (34.8%), followed by disinfectants (30.5%) and herbicides (16.3%).

Table 20: Confirmed Non-occupational Cases by Pesticide Type, 2006-2010 and 2010 Separately

Pesticide Type	Cumulative	Percent	2010	Percent
Insecticide	301	31.2%	81	34.8%
Herbicide	88	9.1%	38	16.3%
Fungicide	16	1.7%	2	0.9%
Rodenticide	11	1.1%	2	0.9%
Disinfectant	407	42.2%	71	30.5%
Insect Repellent	72	7.5%	18	7.7%
Insecticide and Fungicide	5	0.5%	0	0.0%
Insecticide and Other	29	3.0%	15	6.4%
Other	15	1.6%	5	2.1%
Multiple (not specified)	14	1.5%	1	0.4%
Unknown	6	0.6%	0	0.0%
Total	**964**	**100.0%**	**233**	**100.0%**

Individuals are exposed through applications to a wide variety of targets and in a wide variety of locations, as shown in table 21 and 22 below.

Table 21: Application Target for Confirmed Non-occupational Cases, 2006-2010 and 2010 Separately

Application Target	Cumulative	Percent	2010	Percent
Landscape/ornamentals	71	8.7%	25	12.1%
Veterinary - domestic animals	5	0.6%	0	0.0%
Building structure	14	1.7%	2	1.0%
Building surface	59	7.3%	7	3.4%
Building space treatment	151	18.6%	43	20.8%
Undesired plant	3	0.4%	0	0.0%
Aquatic - pond, stream, lake, canal	18	2.2%	14	6.8%
Pool, Spa, Hot Tub, Jacuzzi	74	9.1%	23	11.1%
Pome fruits	3	0.4%	0	0.0%
Stone fruits	3	0.4%	0	0.0%
Flavoring/spice crops	1	0.1%	0	0.0%
Fruiting vegetables	1	0.1%	0	0.0%
Root/tuber vegetables	3	0.4%	1	0.5%
Seed/pod vegetables	3	0.4%	0	0.0%
Cereal grain crops	3	0.4%	0	0.0%
Misc. field crops	4	0.5%	0	0.0%
Human - skin/hair	8	1.0%	4	1.9%
Human - clothing	1	0.1%	1	0.5%
Human - skin/hair & clothing	13	1.6%	4	1.9%
Bait for rodent, bird, predator	6	0.7%	1	0.5%
Community-wide application	7	0.9%	0	0.0%
Other	91	11.2%	20	9.7%
Not applicable	49	6.0%	11	5.3%
Unknown	222	27.3%	51	24.6%
Total	**813**	**100.0%**	**207**	**100.0%**

Table 22: Location of Exposure for Confirmed Non-occupational Cases, 2006-2010 and 2010 Separately

Location	Cumulative	Percent	2010	Percent
Single Family Home	477	58.7%	75	36.2%
Private Residence, type not specified	128	15.7%	63	30.4%
Park	33	4.1%	18	8.7%
School	30	3.7%	13	6.3%
Multi-unit housing	29	3.6%	12	5.8%
Service Establishment	24	3.0%	5	2.4%
Mobile home	13	1.6%	0	0.0%
Farm	9	1.1%	2	1.0%
Private vehicle	5	0.6%	1	0.5%
Residential Institution	4	0.5%	1	0.5%
Retail Establishment	2	0.2%	0	0.0%
Prison	1	0.1%	0	0.0%
Road/Rail	1	0.1%	1	0.5%
Golf Course	1	0.1%	0	0.0%
Other	10	1.2%	8	3.9%
Unknown	46	5.7%	8	3.9%
Total	**813**	**100.0%**	**207**	**100.0%**

A woman cleaned her toilet with bleach and an acid toilet bowl cleaner. She developed a headache, dizziness, nausea, cough, shortness of breath, and wheezing. She went to an emergency department where she was given a breathing treatment and oxygen. She had decreased air movement and was diagnosed with chemical pneumonitis.

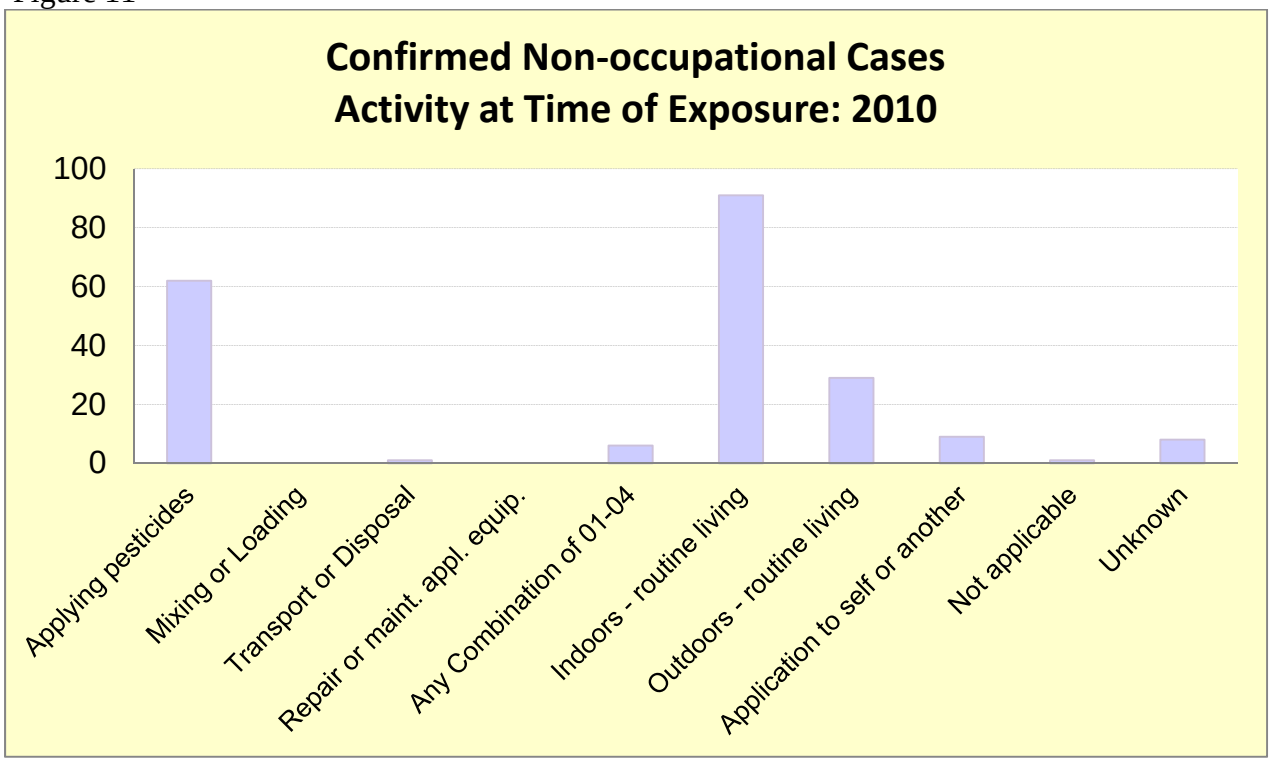
Type of equipment used in the pesticide application was known for 56.0% of the non-occupational cases in 2010. The most common types were pressurized can and trigger pump/compressed air.

Table 23: Equipment Used in Confirmed Non-Occupational Cases, 2006-2010 and 2010 Separately

Application Equipment	Cumulative	Percent	2010	Percent
Pressurized can	91	11.2%	31	15.0%
Total Release Fogger	62	7.6%	25	12.1%
Manual Placement	57	7.0%	13	6.3%
Trigger pump/compressed air	53	6.5%	31	15.0%
Ground sprayer, not elsewhere classified	8	1.0%	1	0.5%
Aerial application equipment	7	0.9%	0	0.0%
Spray line, hand held	7	0.9%	0	0.0%
Aerosol generator/fogger	6	0.7%	0	0.0%
Handheld granular/dust applicator	2	0.2%	0	0.0%
More than one type of equipment	2	0.2%	2	1.0%
Air Blast Sprayer	2	0.2%	0	0.0%
High pressure fumigator	1	0.1%	0	0.0%
Other	94	11.6%	9	4.3%
Not applicable	12	1.5%	4	1.9%
Unknown	409	50.3%	91	44.0%
Total	**813**	**100.0%**	**207**	**100.0%**

The activity at time of exposure was determined for 199 (96.1%) of the confirmed cases.

Figure 11



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 24: Contributing Factors in Confirmed Non-occupational Cases, 2006-2010 and 2010 Separately

Contributing Factor	Cumulative	Percent	2010	Percent
Mixing incompatible products	111	11.9%	13	5.3%
Excessive application	106	11.4%	34	13.8%
Label violations not otherwise specified	102	11.0%	33	13.4%
No label violation identified but person still exposed/ill	89	9.6%	38	15.4%
Spill/Splash of liquid or dust (not equipment failure)	72	7.7%	11	4.5%
Drift contributory factors	66	7.1%	14	5.7%
People were in the treated area during application	42	4.5%	14	5.7%
Within reach of child or other improper storage	41	4.4%	4	1.6%
Structure inadequately ventilated before re-entry	26	2.8%	3	1.2%
Decontamination not adequate or timely	21	2.3%	6	2.4%
Notification/posting lacking or ineffective	19	2.0%	16	6.5%
Early re-entry	18	1.9%	14	5.7%
Application equipment failure	13	1.4%	3	1.2%
Applicator not properly trained or supervised	5	0.5%	0	0.0%
Other	39	4.2%	7	2.8%
Unknown	160	17.2%	37	15.0%
Total	**931**	**100.0%**	**247**	**100.0%**

Health Effects

Table 25 shows the severity of non-occupational cases, using the NIOSH standardized criteria for determining severity index. Most (87.9%) of confirmed non-occupational cases were of low severity. Table 26 shows where the case first received medical care and whether they were hospitalized.

Table 25: Severity of Confirmed Non-occupational Cases, 2006-2010 and 2010 Separately

Severity	Cumulative	Percent	2010	Percent
High	17	2.1%	3	1.4%
Moderate	82	10.1%	23	11.1%
Low	714	87.8%	181	87.4%
Total	**813**	**100.00%**	**207**	**100.00%**

A woman complained about rodents in her home. Her landlord used a pyrethrin and pyrethroid fogger in the basement (an off-label use), and did not tell her. She developed a headache and sore throat and then found the fogger in the crawl space. She called poison control.

Table 26: Confirmed Non-occupational Cases by First Care and Hospitalization, 2010

First Care	Not Hospitalized	Hospitalized	Total
Physician Office Visit/Urgent	17	1	18
Emergency Room	37	3	40
Advice of Poison Control Center	119	1	120
No Medical Care Sought	3	0	3
Other	23	2	25
Unknown	1	0	1
Total	**200**	**7**	**207**

A woman was dusting ant hills with a pyrethroid insecticide and inhaled some when the wind blew in her direction. She also raked and burned leaves in the area with the insecticide. She developed a headache, dizziness, right arm numbness and weakness, an unsteady gait, twitching and dystonic movements in her extremities. She went to an emergency department and was admitted for four days. She recovered completely.

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 2010:

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

- MDCH staff presented information about the surveillance program and descriptions of individual incidents about how exposures occurred at an in-service for MSU Extension and MDARD staff.

- The 2009 Pesticide annual report was completed, distributed to stakeholders, and made available on the Division of Environmental Health's website.

- The MDCH Pesticide webpage provided links to over 100 other sites with information about pesticides and their safe use. This site received 653 hits in 2010. In addition, MDCH's educational booklet, "What You Need to Know about Pesticides and Your Health" received 1,344 hits. Previous annual reports received a total of 2,144 hits.

- 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.

- 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 surveillance program staff participated in Michigan's Bed Bug Working group. Staff wrote a side bar to an article on bed bugs for Epi Insight, a newsletter for state and local Epidemiologists in Michigan. Staff assisted in writing a grant to the US EPA for bed bug outreach and education that was awarded.

- Data on a case was reported to the CDC waterborne illness surveillance program.

- Program materials and pesticide information was made available at tables at the Michigan Safety Conference and the Michigan Growers and Farmworkers conference.

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

MDARD Referrals
Two events were investigated by MDARD in 2010. One was a non-occupational event, where a family rented a new apartment. The mother began to have symptoms of burning eyes, nose, and throat, very dry eyes, lungs burning, headache, coughing, and shortness of breath, soon after they moved in. The father began to develop eye and nose irritation, respiratory irritation and a metallic taste in his mouth. The daughter also developed eye and nose irritation and exacerbation of her asthma. The apartment complex had been treated for bed bugs before they moved in. MDARD investigated and issued a Notice of Intent to the pesticide application company based on several violations. The customer information did not contain the name of the active ingredient and did not list the precautionary warning from the labels. The application records did not contain the concentration of the pesticide applied or rate of application.

The second event also involved treatment for bed bugs. A Family Services Coordinator was doing an interview in a home. The apartment had been sprayed two days before with four insecticides (three pyrethroid, one pyrethroid plus other, all with signal word: Caution) for bed bugs. The interviewee said the windows had not been opened to ventilate the home after the spraying. After about 50 minutes in the apartment the Family Services Coordinator began coughing, had burning of her lungs and then developed a headache that lasted about a day. She also felt weak, nauseous, and had a sore throat. She did not seek medical care but did lose one day of work as she rested in bed. MDARD investigated but did not find any violations.

MIOSHA Referrals
Three events were investigated by the Michigan Occupational Safety and Health Administration (MIOSHA) in 2010. A restaurant server closed the dishwasher door and a tube with bleach product came loose. Some splashed in her eye, which started to burn. It became red, swollen, teary, and sensitive to light. She went to an urgent care center and was diagnosed with a chemical burn. Violations were issued for lack of PPE assessment and PPE not being provided; no first aid for flushing eyes and body; and no MSDS for each chemical.

A prevention maintenance worker for a high school was filling crocks containing pool chemicals. The crocks were close to each other (about a foot apart), but were well labeled. He started pouring chlorine into the crock containing a 1:5 solution of muriatic acid, realized immediately that he'd combined incompatible chemicals and stopped pouring. He developed shortness of breath, lightheadedness, a burning sensation in his nose and chest discomfort. He went to an emergency department. The fire department was called to check the air and ventilated the area. No students were present. Violations were issued for lack of eye wash, lack of a written PPE assessment certification and PPE training, and PPE use not being required; lack of development, implementation, and maintenance of a written hazard communication program and lack of MSDS.

A worker in a tanning salon was cleaning beds with a quaternary ammonium disinfectant. The day was hot and she was very busy, so when she developed shortness of breath, chest tightness, and dizziness, she thought it was related to the heat and running around. She still had symptoms the next morning, so she went to an emergency department. She was diagnosed with bronchospasm and told to take two days off from work. She had not worn required PPE and no MSDS was available. Violations were issued for lack of development, implementation, and

maintenance of a written hazard communication program; lack of a written PPE assessment certification and PPE training; and lack of an eyewash.

NIOSH Reports
Seven events were reported to NIOSH as high priority events, two because they resulted in hospitalization, two because they involved four or more ill individuals, and three because they occurred even though the product was used according to the pesticide label.

One was a non-occupational case where a woman opened a container of pool chemicals and inhaled some of the chlorine dust. She developed shortness of breath, stridor, wheezing, burns in her throat, and bradycardia. She was admitted to a hospital for a week.

Another case involving hospitalization was a farmer who went to spray a small field of potatoes with a thiocarbamate herbicide. It should have taken about ten minutes, but he had problems with the equipment. He was in the field for about two hours as he worked on fixing the sprayer. In addition to the increased time in the field, the wind picked up during that time, so when he did complete the spray he got wet. He went home, ate dinner and later developed difficulty breathing and felt like his lungs were filling up with fluid. He went to an emergency department and was hospitalized for a week. He lost an additional week of work. He was diagnosed with respiratory failure, pulmonary edema, and myocardial infarction.

One event in which more than four persons became ill involved two families who were at a waterpark for two days. On the afternoon of the second day all twelve suddenly developed symptoms including burning eyes, itching skin, rash, cough, and vomiting.

Eight campers canoed out to an island and went swimming. After about 30 minutes, they saw a sign that said the lake had been treated that day with an herbicide containing triclopyr. They all developed an itchy rash which was treated by the camp nurse.

A home day care provider was informed by a parent that a child she took care of had head lice. She sprayed her furniture with a pyrethroid containing insecticide that evening and left the house in accordance with label instructions. She returned to sleep and the next morning she had diarrhea and dizziness. She called poison control.

A school custodian was using a Kyvac (spray-and-vac) machine to clean bathrooms at school. She sprayed a diluted quaternary ammonium disinfectant on the walls with a tube from the machine. Some splashed back in her face. She was wearing prescription eyeglasses; after dilution, protective eyewear is not required. She developed eye irritation and saw something on her eye. She went to a clinic and was diagnosed with a corneal abrasion.

A pork farm employee sprayed a pyrethroid insecticide for several hours on the ceiling and other areas inaccessible to pigs in a pig barn. Mist caused his eyes and skin to burn. The skin on his arms, face and neck was red and painful. He showered at work after spraying, but the burning continued to intensify. He showered again at home and again at an emergency department. He was only able to get relief after applying vitamin E oil.

Discussion

Surveillance Data
There were fewer confirmed cases in 2010 compared to 2009; 67 occupational cases vs. 91 and 207 non-occupational cases vs. 252.

The number of disinfectant cases remained high, comprising 57.3% of confirmed occupational cases and 30.5% of confirmed non-occupational cases. This is a decrease from 2009 (47 vs. 65 occupational and 71 vs. 161 non-occupational), but remains an area of ongoing concern. Despite the absence of proof about hand contact with "contaminated surfaces" causing 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 (19.3%). Better education and additional PPE requirements might help to reduce the number of exposures.

Most confirmed occupational cases (86.6%) were reported by poison control, and most (87.4%) were considered low severity.

More than a third of the confirmed occupational cases in 2010 were engaged in activities not related to 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 and MIOSHA for investigation of possible safety violations. 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. In particular MDCH contributed to a day-long training for MSU Extension and MDARD regional staff members, providing information they can use to educate applicators. Education must remain a priority for both certified and non-certified pesticide applicators, since both groups may be exposed or expose others.

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 pesticide-related illnesses 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. Another problem is that 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 because of concerns about job security, lack of knowledge of the public health code reporting requirements, or lack of time to report (Calvert et al, 2001). Additional education to promote recognition of pesticide poisoning and compliance with the reporting requirement is needed.

More outreach is needed to educate health care providers on the importance of recognizing and reporting instances of occupational pesticide illnesses and injuries. Over eight-five percent of confirmed occupational cases in 2010 were reported by the State's poison control center, with relatively few reports (only 6.0%) from health care providers.

Like data from other occupational injury and illness surveillance systems,[10] 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. (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 and follow-up on laboratory reports of cholinesterase test results, more than doubling the cases evaluated.

[10] Azaroff LS, Levenstein C, Wegman D. Occupational injury and illness surveillance: Conceptual filters explain underreporting. Am J Public Health 2002. 92:1421-1429

References

Alarcon WA, Calvert GM, Blondell JM, Mehler LN, Sievert J, Propeck M, Tibbetts DS, Becker A, Lackovic M, Soileau SB, Das R, Beckman J, Male DP, Thomsen CL, Stanbury M. Acute illnesses associated with pesticide exposures at schools. JAMA 2005; 294: 455-565

Calvert GM. Health effects from pesticide exposure. Am Fam Physician 2004; 69:1613-4,1616.

Calvert GM, Karnik J, Mehler L, Beckman J, Morrissey B, Sievert J, Barrett R, Lackovic M, Mabee L, Schwartz A, Mitchell Y, Moraga-McHaley S. Acute pesticide poisoning among agricultural workers in the United States, 1998-2005. Am J Ind Med 2008; 51:883–898

Calvert GM, Petersen AM, Sievert J, Ball C, Mehler LN, Das R, Harter LC, Romoli C, Becker A, Ball C, Male D, Schwartz A, Lackovic M. Acute pesticide poisoning in the US retail industry, 1998-2004. Public Health Rep 2007; 122:232-244.

Calvert GM, Plate DK, Das R, Rosales R, Shafey O, Thomsen C, Male D, Beckman J, Arvizu E, Lackovic M. Acute occupational pesticide-related illness in the US, 1998-1999: surveillance findings from the SENSOR-pesticides program. Am J Ind Med 2004; 45:14-23.

Calvert GM, Sanderson WT, Barnett M, Blondell JM, Mehler LN, Sanderson WT. Surveillance of pesticide-related illness and injury in humans. In: Krieger R, editor. *Handbook of Pesticide Toxicology*. 2nd ed. San Diego: Academic Press; 2001. p. 633.

Jacobson J, Wheeler K, Hoffman R, Mitchell Y, Beckman J, Mehler L, Mulay P, Schwartz A, Langley R, Diebolt-Brown B, Prado JB, Newman N, Calvert GM, Hudson N. Acute Illnesses Associated With Insecticides Used to Control Bed Bugs — Seven States, 2003–2010 MMWR September 23, 2011 / Vol. 60 / (37); 1269-1274

Lee SJ, Mulay P, Diebolt-Brown B, Lackovic M, Mehler L, Beckman J, Waltz J, Prado J, Mitchell Y, Higgins S, Schwartz A, Calvert GM. Acute illnesses associated with exposure to fipronil – surveillance data from 11 states in the United States, 2001–2007. Clinical Toxicology 2010; 48:737–744

Lee SJ, Mehler L, Beckman J, Diebolt-Brown B, Prado J, Lackovic M, Waltz J, Mulay P, Schwartz A, Mitchell Y, Moraga-McHaley S, Gergely R, Calvert GM. Acute Pesticide Illnesses Associated with Off-Target Pesticide Drift from Agricultural Applications — 11 States, 1998–2006. Environ Health Perspect 119:1162–1169 (2011).

Mehler L, Schwartz A, Diebolt-Brown B, Badakhsh R, Calvert GM, Lee SJ. Acute Antimicrobial Pesticide-Related Illnesses Among Workers in Health-Care Facilities - California, Louisiana, Michigan, and Texas, 2002—2007. MMWR. 2010; 59:551-556 *and* JAMA. 2010; 304(2):152-154.

Mehler L, Beckman J, Badakhsh R, MPH, Diebolt-Brown B, Schwartz A, Higgins S, Gergely R, Calvert GM, Hudson N. Acute Illness and Injury from Swimming Pool Disinfectants and Other Chemicals --- United States, 2002—2008 MMWR
October 7, 2011 / 60(39); 1343-1347

Michigan Department of Community Health, Division of Environmental Health. Pesticide Illness and Injury Surveillance in Michigan: 2009. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Pesticide Illness and Injury Surveillance in Michigan: 2008. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Pesticide Illness and Injury Surveillance in Michigan: 2007. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Pesticide Illness and Injury Surveillance in Michigan: 2006. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Occupational Pesticide Illness and Injury Surveillance in Michigan: 2005. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Occupational Pesticide Illness and Injury Surveillance in Michigan: 2004. www.michigan.gov/mdch-toxics

Michigan Department of Community Health, Division of Environmental Health. Occupational Pesticide Illness and Injury Surveillance in Michigan: 2001-2003. www.michigan.gov/mdch-toxics

Washington Department of Health. Improving Data Quality in Pesticide Illness Surveillance – 2004. June 17, 2004.
http://www.doh.wa.gov/ehp/oehas/publications_pdf/improvingdataqualitypesticideillnessssurveillance-2004.pdf

Wheeler K, Kass D, Hoffman RS, Lackovic M, Mitchell Y, Barrett R, Morrissey B, Mehler L, Diebolt-Brown B, Waltz J, Schwartz A, Calvert GM, Luckhaupt SE, Illnesses and injuries related to total release foggers – eight states, 2001–2006. MMWR 2008; Vol. 57 / No. 41:1125-1126 *and* JAMA. 2008; 300(22):2600-2602.

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=104:1:1586485117486165

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, Fifth Edition:
http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.pdf

To report occupational pesticide exposures in Michigan: http://oem.msu.edu/

Appendix

Case Narratives, 2010 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2010. 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

MI02139 – An adult office worker was present in a small office when a coworker sprayed a pyrethroid insecticide (signal word: Caution) in the office. He developed a headache and burning eyes. The next day the office was sprayed again and he was nauseous and vomited. He called poison control.

MI02147 – A graduate student in her 20s went into her lab and smelled and saw smoke. She stayed about 5 minutes to see if she could find the source, then left and called public safety. They responded (cases MI01746 and MI01836, reported in 2009). The source of the smoke was an organophosphorous insecticide (signal word: Danger) that was seeping into the building from an attached greenhouse that was being fogged. She developed a headache, dizziness, and shortness of breath. Five days later she went to an emergency department.

MI02153 – A home day care provider in her 20s was informed by a parent that a child had lice. She sprayed her furniture with a pyrethroid containing insecticide (signal word: Caution) in the evening and left the house. She returned and slept there and the next morning she had diarrhea and dizziness. She called poison control. The case was reported to NIOSH because she became ill even though the product was used according to the label.

MI02159 – A nurse in her 40s was exposed to a carbamate insecticide in a client's home where the carpet had been sprayed for fleas. She developed shortness of breath, a burning, scratchy throat, and burning eyes. She went to an emergency department.

MI02208 – A pest control applicator for a lawn care company was spraying for five hours with an insecticide that was new to him, (signal word: Caution). He inhaled and swallowed droplets of the chemical and it also came into contact with his skin, causing a burning sensation. He developed an upset stomach, nausea, and skin irritation. He went to an urgent care center. Per the label, no face or respiratory protective equipment was required.

MI02209 –An employee in his 20s sprayed a pyrethroid insecticide around the grounds. The next day he developed a cough, stuffy nose, throat irritation, shortness of breath, and fever. The following day he went to an emergency department. A chest ex-ray showed basal infiltrates, atelectasis and scarring. He was hospitalized for four days.

MI02351 – An office clerk at a dollar store in her 40s was exposed to a pyrethroid insecticide through monthly applications throughout the store. Within 10-15 minutes of the application she usually developed a headache. After the most recent application, her headache continued intermittently and she had onset of a nose bleed six days after the application. She called poison control and went to a health clinic.

MI02352 – A pregnant telemarketer in her 20s was exposed to a pyrethroid insecticide (signal word: Caution) when she went to work in the morning after the workplace had been sprayed for bed bugs. She developed a headache, difficulty breathing, eye irritation, and a rash. She called her doctor and poison control, and lost three days of work to be sure the building was safe for her to enter.

MI02357 – A warehouse worker in his 50s was exposed to a pyrethrin insecticide (signal word: Caution) when he began working in a treated building. He developed altered taste, nausea, headache, a runny nose, and muscle spasms. EMS was called and he was taken to an emergency department. (See MI02358.) The incident was referred to MDARD and NIOSH.

MI02358 – A warehouse worker in his 50s was exposed to a pyrethrin insecticide (signal word: Caution) when he began working in a treated building. He developed shortness of breath, altered taste, headache, a runny nose, and tachycardia. EMS was called and he was taken to an emergency department. (See MI02357.) The incident was referred to MDARD and NIOSH.

MI02308 – A Family Services Coordinator in her 50s was doing an interview in a home. The apartment had been sprayed two days before with four insecticides (three pyrethroid, one pyrethroid plus other, all with signal word: Caution) for bed bugs. The interviewee said the windows had not been opened to ventilate the home after the spraying. After about 50 minutes in the apartment the Family Services Coordinator began coughing, her lungs started burning and she developed a headache that lasted about a day. She also felt weak, nauseous, and had a sore throat. She did not seek medical care but did lose one day of work as she rested in bed. The case was referred to MDARD; no violations were found.

MI02309 – A pork farm employee in his 20s was spraying a pyrethroid insecticide (signal word: Caution) for several hours on the ceiling and other areas inaccessible to pigs in a pig barn. Mist caused his eyes and skin to burn. The skin on his arms, face and neck was red and painful. He showered at work after spraying, but the burning continued to intensify. He showered again at home and again at an emergency department. He only was able to get relief after applying vitamin E oil. This was classified as a possible case of low severity. This case was reported to NIOSH and EPA as an exposure that caused an illness even though the pesticide was used according to the label.

MI02331 – A high school employee in his 30s used a pyrethroid insecticide (signal word: Caution) and it sprayed back in his mouth. He developed nausea, vomiting, sweating, dizziness, coughing and headache. He called poison control and went to an emergency department.

Insect Repellent
MI02215 – A maintenance worker for an apartment complex in his 30s was working outside. A coworker sprayed a DEET containing insect repellent (no signal word). Some blew into his mouth. He had a cough, some throat irritation, and a bad taste in his mouth. He called poison control.

Herbicides
MI00583 – An adult store stocker was exposed to an herbicide (signal word: Warning). He developed red, irritated hands and called poison control.

MI02067 – A farmer in his 50s went to spray a small field of potatoes with a thiocarbamate herbicide (signal word: Warning). It should have taken about ten minutes, but he had problems with the equipment. He was in the field for about two hours as he worked on fixing the sprayer. In addition to the increased time in the field, the wind picked up during that time, so when he did complete the spray he got wet. He went home, ate dinner and later developed difficulty breathing and it felt like his lungs were filling up with fluid. He went to an emergency department and was hospitalized for a week. He lost an additional week of work. He was diagnosed with respiratory failure, pulmonary edema, and myocardial infarction. This case was reported to NIOSH because it resulted in a hospitalization.

MI02211 – An adult pesticide applicator was applying a mixture of two herbicides using a backpack sprayer which leaked down his back and leg. He was exposed for about two hours. He developed a burning sensation of his skin, and it was red with a rash and welts. His friend called poison control and he went to an urgent care.

MI02263 – A farmworker in his 70s was spraying herbicides in an orchard. A tree limb hit the valve on the boom sprayer and broke the regulator, so it sprayed in his eye from about 10 inches away. He was wearing sunglasses with side protectors. He washed his eye with water from his drinking bottle then drove to a hospital seven miles away where his eye was irrigated again and he was diagnosed with conjunctivitis. He was not registered or certified to apply pesticides without supervision. The farmer, who was a registered applicator, was not present.

MI02276 – A man in his 20s got a glyphosate herbicide (signal word: Warning) in his eyes while working on his father's farm. It burned and he rinsed it out and then went to an emergency department where he was diagnosed with chemical conjunctivitis.

MI02301 – A foreman for a landscaping company in his 20s was spraying an herbicide on weeds in cement cracks. He may have inhaled some and may have gotten some on his hands. He rinsed his hands, but not well and then ate a sandwich for lunch. He thinks he may have contaminated his bread. He was not certified or registered as a pesticide applicator, and had no training or supervision. The label was not available, nor was the material safety data sheet. He first

developed a headache, then nausea, vomiting and diarrhea. His eyes were red and irritated. He called poison control. All symptoms were resolved the next day.

Fungicides
MI02148 – A certified pesticide applicator for a tree company in his 40s turned up the pressure on the equipment to reach the top of tall trees. When he pulled the trigger there was an equipment malfunction and the dithiocarbamate fungicide sprayed in his face. The high pressure knocked his face shield off and he got some in his eyes, mouth and on his face. He developed chest pressure, burning eyes and face, a bad taste in his mouth and blurred vision. He went to an emergency department.

Fumigant
MI02305 – A general laborer at a grain elevator in his 20s was working in a room about 100 yards away from a room that had been fumigated with an inorganic fumigant (signal word: Danger). The treated room was sealed with plastic but he could smell the product and developed red, tearing, burning eyes, photophobia, a sore throat, and rhinitis. He went to an emergency department.

Disinfectants
MI01984 – A janitor in his 30s mixed bleach, dish soap, and bathroom cleaners to clean a rental bathroom. The resultant fumes caused him to cough and wheeze. He called poison control.

MI01985 – An office worker in his 20s was exposed to chlorine gas when his supervisor mixed an acid drain opener and bleach in a urinal. He developed a cough, difficulty breathing, and pain in his lungs. He called poison control.

MI01986 – A kitchen manager in his 40s dropped a container of bleach and some splashed up in his eye. It became red, and was burning and tearing. He went to an outpatient clinic and was diagnosed with a chemical burn and corneal abrasion.

MI01987 – A restaurant server in her 40s closed the dishwasher door and a tube with bleach product came loose. Some splashed in her eye, which started to burn. It became red, swollen, teary, and sensitive to light. She went to an urgent care center and was diagnosed with a chemical burn. MDCH referred this case to MIOSHA. Violations were issued for lack of PPE assessment and PPE not being provided; no first aid for flushing eyes and body; and no MSDS for each chemical.

MI01988 – A prevention maintenance worker for a high school was filling crocks containing pool chemicals. The crocks were close to each other (about a foot apart), but were well labeled. He started pouring chlorine into the crock containing a 1:5 solution of muriatic acid, realized immediately that he'd combined incompatible chemicals and stopped pouring. He developed shortness of breath, lightheadedness, a burning nose and chest discomfort. He went to an emergency department. The fire department was called to check the air and ventilated the area. No students were present. Violations were issued for lack of eye wash, lack of a written PPE assessment certification and PPE training, and PPE use not being required; lack of development,

implementation, and maintenance of a written hazard communication program and lack of MSDS.

MI02003 – A fruit packer in her 20s was cleaning vegetables with a chlorine product. Her eyes were burning, she was coughing and sneezing, and was nauseous. She called poison control and began to wear a face mask.

MI02004 – A gas station/convenience store manager in his 30s was sanitizing food service parts. He put them in a bucket, and pumped in a quaternary ammonium disinfectant (signal word: Danger) from a concentrate container. Some hit a curved piece and splashed up in his eye. He was not wearing required eye PPE. He forgot about the eye wash and used Visine to rinse out his eye, which made it feel worse. It was painful, swollen and tearing. He called poison control and went to an urgent care where they rinsed his eye and found corneal abrasion. He was referred to an eye specialist. He now always wears required eye goggles.

MI02008 – A fast food worker in his 20s splashed bleach in his eye. It became red and painful. A coworker called poison control. This was classified as a possible case of low severity.

MI02009 – A teenaged worker in a tanning salon was cleaning beds with a quaternary ammonium disinfectant (signal word: Danger). That day was very busy and she cleaned more beds than usual, running back and forth to get them done. It was also hot, so when she developed shortness of breath, chest tightness, and dizziness, she thought it was related to the heat and running around. But she still had the symptoms when she woke up the next morning, so she went to an emergency room. She was diagnosed with bronchospasm and told to take two days off from work, although she was only scheduled for one day. She had not worn required PPE and no MSDS sheet was available to her, so the case was referred to MIOSHA. Violations were issued for lack of development, implementation, and maintenance of a written hazard communication program; lack of a written PPE assessment certification and PPE training; and lack of an eyewash.

MI02010 – A casino housekeeper in her 40s was washing down the front of some slot machines. She put a quaternary ammonium disinfectant (signal word: Danger) in her bucket. She did not rinse her bucket out before doing that, and there may have been some residual of another cleaner in the bucket. She was not wearing the required gloves and splashed some on her forearms. She developed a red, burning rash up to her shoulders. She saw the company nurse and then went to an urgent care. She was given information to contact OSHA regarding storing chemicals in mislabeled containers, a concern she mentioned during the interview.

MI02038 – A wastewater treatment operator at food processing facility in his 50s was topping off a 5,000 gal tank. Unknown to him, an out-pipe was broken. When he opened the valve, pressure caused some of the sodium hypochlorite solution to shoot out through the broken pipe. It went behind his safety glasses into his left eye. He rinsed his eye at work, but developed a red, tearing, and painful eye. He went to an emergency department where the eye was rinsed again. He was diagnosed with corneal abrasion.

MI02075 – A maintenance cleaner in her 50s was transporting some quaternary ammonium chloride disinfectant (signal word: Danger) to another building. Instead of taking the large container, she put some in a water bottle. While in the car she reached for her water bottle, and in the dark picked the wrong one. She swallowed some cleaner, most was spit out. She had a red, burning throat. She called poison control and went to an emergency department. She never transfers chemicals into another container now, and when transporting them puts them in the back of the car.

MI02108 – A school custodian in her 50s got bleach splashed into her eye when adding it into a bucket of water. She rinsed her eye immediately. She had pain and difficulty opening her eye completely.

MI02109 – A house cleaner in her 20s cleaned with mix of bleach and “The Works”. She developed a cough and pain on deep inspiration.

MI02122 – A worker in her 20s stepped in some liquid pool chlorine. She rinsed her feet, but they became red and painful.

MI02140 – A restaurant server in her 20s mixed an acid cleaner and bleach in a mop bucket and cleaned the floor. She developed chest pressure, difficulty breathing, a cough and hoarse voice from the resulting chlorine gas. She called poison control and went to an emergency department.

MI02154 – A Head Start bus driver in her 40s was exposed to a disinfectant (signal word: Warning) that was used to clean the buses and items in the school. She developed a swollen and tingling mouth, headache, and vocal cord dysfunction. She went to an urgent care, her physician, and a specialist. She was unable to work for about six months and lost her job.

MI02155 – A school Noon Hour Supervisor in her 40s was busy, and had not yet cleaned the table she was supposed to clean. Her coordinator came to do it and while spraying a diluted quaternary ammonium chloride disinfectant (signal word: Danger) back and forth, sprayed the supervisor in the eye. They cleaned her eye with a wet paper towel. The next morning she woke up with a red, swollen, tearing eye. She went to an occupational health clinic and missed two days of work. This case was referred to MIOSHA, but they decided not to investigate.

MI02163 – A night manager at a restaurant in his 20s was washing the floor with steel wool and got a splash of dilute bleach solution in his right eye. It stung, and he flushed it and removed his contact lenses. The next day it was red and crusty, and oozed throughout the day. He called poison control.

MI02205 – A worker in his 20s drank coffee from a pot that had been cleaned with bleach. About ten minutes later he began vomiting, tasting bleach when vomiting. He vomited eight or nine times and was not able to keep food down. He contacted poison control.

MI02220 – A group home worker in her 20s mixed toilet bowl cleaner and bleach. She inhaled the resultant chlorine fumes for about two minutes. She developed a cough, shortness of breath, diaphoresis, and chest discomfort. She was taken by an ambulance to an emergency department.

MI02221 – A school custodian in her 50s was using a Kyvac machine to clean bathrooms at school. She sprayed a diluted quaternary ammonium disinfectant (signal word: Danger) on the walls with a tube from the machine. Some splashed back in her face. She was wearing prescription eyeglasses; after dilution, protective eyewear is not required. She developed eye irritation and saw something on her eye. She went to a clinic and was diagnosed with a corneal abrasion. This was reported to NIOSH because the custodian became injured even though she was using the product according to the label.

MI02231 – An employee in a food processing facility was present when a coworker dumped four gallons of sodium hypochlorite disinfectant (signal word: Danger) on the floor. He developed fatigue, nausea, shortness of breath, and a headache. He called poison control. When interviewed three months later he said he still became nauseous when he smelled bleach.

MI02237 – A dairy farmer in his 50s splashed sodium hypochlorite sanitizer (signal word: Danger) in his eye while cleaning the milking machines. Eye protection was required, but he was only wearing prescription glasses. His eye became painful and his vision was blurry. He flushed his eye for twenty minutes and called poison control.

MI02266 – A winery worker in his 40s was exposed to a disinfectant used to sterilize wine vats when the machinery that dispensed it began to leak. He developed burning eyes, a cough, nasal congestion, scratchy throat and loss of appetite. He went to an emergency department and lost two days of work. The winery no longer uses this product.

MI02288 – An amusement park worker added chlorine to a pool and inhaled fumes. He coughed and vomited and called poison control.

MI02326 – A worker in her 20s at an adult foster care facility was exposed to chlorine fumes after she mixed bleach and an acid cleaner when cleaning a resident's bathroom. She developed a cough and shortness of breath. She used her inhaler, but it did not help. Her coworker (MI02327) went into the room to air it out and rinse the toilet. The coworker called poison control.

MI02327 – A caregiver in her 30s at an adult foster care facility was exposed to chlorine fumes after her co-worker (see MI02326) mixed bleach and an acid cleaner when cleaning a resident's bathroom. This caregiver went into the room to air it out and rinse the toilet. She was exposed for two to three minutes and developed difficulty breathing, a cough, sore throat, headache, and weakness. She called poison control.

MI02330 – A restaurant delivery driver in his 30s was in a store room, getting plastic wear for the next day. Another worker had been cleaning the store room and spilled bleach into a vent. When the air came on the delivery driver inhaled bleach fumes and became dizzy and nauseated. In addition his lungs felt like they were burning. He called poison control and coworkers ventilated the room.

MI02342 – An operating room nurse in her 50s was cleaning instruments with Cidex. The product began to boil in a malfunctioning machine and vapors were released into her face and

eyes. She developed a cough and irritated, tearing eyes. She went to the employee health center where her eyes were flushed. She continued to cough and went to the emergency department. Her breath sounds were diminished bilaterally.

MI02347 – A farm laborer in his 30s was cleaning the piglet birthing room with a disinfectant (signal word: Danger). The connector to the high pressure line overhead failed and it splashed in his face, eyes, nose and mouth. He irrigated for 20 minutes with water and showered before going to an emergency department. His eyes and face were red and burning, his eyes were tearing, he had blurred vision, he had a metallic taste in his mouth, his nose was irritated, and some skin was abraded off his fingertips. He was diagnosed with bilateral corneal abrasion and lost two days of work.

MI02348 – A nurse in her 50s was cleaning reverse osmosis machines at work. While moving between machines she accidentally moved a waste water line and got splashed in her eye with a disinfectant (signal word: Danger). She was wearing prescription glasses and a face shield. She irrigated her eyes, but the pain persisted so she called poison control and went to the emergency department, where she was diagnosed with a corneal abrasion. The incident was referred to MIOSHA, but they did not take action since she was wearing PPE and they had no applicable standards.

MI02350 – A cook in her 50s added 1/3 of a gallon of bleach to a dishwashing machine to clean stained coffee cups. She ran the cups through three times to get them cleaned and inhaled the steam each time she opened the dishwasher to check. She initially had a cough and burning sensation in her throat. The next day she had difficulty breathing, her chest hurt, and she felt feverish, delirious, and nauseated. It took about ten days for her to feel completely normal again. She called poison control but did not seek additional medical attention because she did not have insurance.

MI02353 – A school custodian in his 50s accidentally mixed bleach with an acid cleaner. He poured the solution down the drain. He developed a cough, nose and throat irritation, difficulty breathing, wheezing, eye irritation, headache, diarrhea and nausea. He called poison control and went to an emergency department, where he was diagnosed with pneumonia. MDCH sent him information about disinfectant safety and asthma and cleaning agents.

MI02354 – A grocery store clerk in her 40s got some quaternary ammonium chloride disinfectant (signal word: Danger) on her arm. She developed a red, painful rash and called poison control.

MI02362 – A direct care worker in her 30s at an adult foster care home was cleaning a toilet with a disinfectant (signal word: Danger). While she was spraying it the heat came on, and the heat vent was right next to the toilet. Mist was sprayed back in her face. She was wearing prescription glasses but a couple of drops of disinfectant got in one of her eyes. Goggles or a face shield were required. She had a burning sensation in the eye and it was bloodshot for a few days. She called poison control. She advocated for some changes at work. Information about how to use cleaners is now posted and a new eyewash station has been installed.

MI02363 – A restaurant employee in her 20s got some disinfectant splashed in her eye. It was red and painful and she went to an emergency department.

MI02367 – A hotel general manager in his 30s added bromine tabs to a hot tub filter and some of the water splashed up in his eye. The next day he noticed it was red and tearing. He called poison control. The redness went away about two days later.

Other
MI02325 – A letter carrier in his 30s leaned over his satchel to get the mail for the next house. The nozzle from the capsicum dog repellent (signal word: Danger) hanging off the satchel got caught on the steering wheel and the product discharged onto his leg. He was unable to wash it off until he was done with his route about four to five hours later. In addition, he breathed in the fumes for the remainder of the day. He developed a red, burning area on his leg, a cough, trouble breathing, nasal congestion, a sore throat, tearing and burning eyes, and nausea.

Mixtures
MI02228 – A certified pesticide applicator in his 20s was treating a lake on a golf course. He pumped lake water into container containing a mixture of concentrated algaecides and herbicides and then pumped the diluted solution into the lake. The hose out of the container sprang a leak, and the solution squirted into his eye. The hose did not appear damaged prior to use, and is changed fairly regularly. Eye protection was required, but not worn. He had his partner in the boat take him to the center of lake where no chemicals were to wash his eye; then on shore used water from his water bottle to continue washing eye. He called poison control and went to an emergency department where he was diagnosed with conjunctivitis. He now wears all required PPE.

MI02320 – A greenhouse supervisor in her 40s was spraying an herbicide and fungicide with both ends of the greenhouse open, but felt she sprayed too much without enough ventilation. She inhaled fumes and developed nausea, a sore throat, trouble breathing and a headache. She lost her sense of taste for about a day and a half. She called poison control. She was not certified or registered, and not supervised by a certified applicator.