Pesticide Illness and Injury Surveillance in Michigan

2007

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Division of Environmental Health
Michigan Department of Community Health

Jennifer M. Granholm, Governor
Janet Olszewski, Director

Pesticide Illness and Injury Surveillance in Michigan: 2007

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Summary

The Michigan Department of Community Health (MDCH) has been conducting surveillance for acute work-related pesticide illnesses and injuries since 2001, and 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), for chemical poisoning (R325.71-R325.75), and for laboratory cholinesterase test results (R325.61 and R325.68). This is the fourth annual report on work-related pesticide illnesses and injuries in Michigan. It also includes data on cholinesterase and non-occupational surveillance.

From 2001 through 2007, 696 reports of occupational exposures and pesticide illness or injury were received and 488 (70.1%) were confirmed as cases according to the surveillance case definition. In 2007, there were 132 reported occupational cases; 87 (65.9%) were confirmed.

Michigan's Poison Control Centers (PCC) remain the main data source, reporting 108 (81.8%) occupationally exposed individuals. Antimicrobials continue to be a major exposure source. In 2007, antimicrobials accounted for over 40% of the confirmed occupational cases, including the only death.

Seven (9.1%) of the confirmed cases in 2007 involved agricultural workers. Twelve (15.6%) worked in food service and another 12 in Administrative and Support and Waste Management and Remediation Services, which includes applicators and landscapers. Eleven (14.3%) worked in retail and nine (11.7%) in health care. Where activity of the exposed person was known, 31 (37.8%) were exposed to pesticides inadvertently while doing their regular work that did not involve applying pesticides.

Five cases in 2007 were referred to the Michigan Department of Agriculture (MDA) for investigation of possible pesticide use violations. One event met the criteria for priority reporting to the National Institute for Occupational Safety and Health (NIOSH). Four events were referred for inclusion by Michigan's work-related asthma surveillance program and one to the MDCH Hazardous Substance Emergency Event Surveillance (HSEES) program. These events are described on pages 17 and 18.

Two hundred sixty non-occupationally exposed pesticide cases were identified, of which 144 (55.4%) met the definition of a confirmed case. One hundred fifty-eight reports (60.8%) were identified from poison control data. There was insufficient data to confirm many of these cases because MDCH did not have the resources to follow-up with reported individuals.

Section I: Occupational Pesticide Illness and Injury Surveillance

Background

Acting on concerns about acute occupational pesticide-related illness, NIOSH began collecting standardized information about acute occupational pesticide exposure from selected states in 1998[1] 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 2007, there were 15,501 different pesticides registered for sale and use in Michigan. There are approximately 16,000 different pesticide products currently used in the United States, and each of them contains one or more of approximately 600 approved pesticide active ingredients. According to the U.S. Environmental Protection Agency (EPA), 1.23 billion pounds of pesticides (excluding antimicrobials and wood preservatives) are used annually[2] in the United States.

Businesses are required to obtain a license from the MDA if they hold themselves out to the public as being in the business of applying pesticides for hire. There are almost 2,000 businesses licensed to apply pesticides in Michigan. Pesticide applicators are certified by the MDA 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 2007, there were a total of 22,245 certified pesticide applicators and 1,923 licensed businesses. Table 1 shows the number of licensed businesses and certified applicators since 2001.

Table 1

Pesticide Licensing and Certification, 2001-2007							
Type	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Private Certification	10,596	10,075	9,576	9,200	8,793	8,352	8,122
Commercial Certification	13,045	13,089	13,387	13,588	13,485	13,743	14,123
Total Certifications	23,641	23,164	22,963	22,788	22,278	22,095	22,245
Licensed Businesses *	NA	NA	1,755	NA	1,900	1,962	1,923

* The number of licensed businesses in 2001, 2002, and 2004 is not available.

MDA is the agency that regulates pesticide use, and misuse. The Pesticide and Plant Pest Management Division of MDA investigates all allegations of pesticide misuse. They also perform random inspections of licensed businesses. Table 2 shows MDA's staff levels and some of the oversight activities of those staff. Due to budgetary constraints, the number of staff has decreased over time.

[1] http://www.cdc.gov/niosh/topics/pesticides/
[2] http://www.epa.gov/oppbead1/pestsales/01pestsales/usage2001.htm

Table 2

Pesticide Inspections and Investigations, 2001-2007							
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Misuse Investigations	194	165	132	153	182	231	178
Inspections	1,126	1,077	1,261	1,266	1,175	797	655
# of Field Staff	20	20	20	18	18	15	15

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. The intent of this surveillance was 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 work-related pesticide exposures and adverse health effects in Michigan.

The goals of the pesticide surveillance system are to characterize the occupational pesticide-poisoning problem in Michigan and to prevent others from experiencing adverse health effects from occupational pesticide exposures. 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 two Poison Control Centers), 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 went into effect September 18, 2007 (R 325.71-5).

Pesticides are a category of chemicals that are used to kill or control insects, weeds, fungi, rodents, and microbes. There are over 600 different approved active ingredients that are sold in about 16,000 products used in the United States (Calvert, 2004).

In addition to information from reports submitted under the public health code, the surveillance system also collects information on individuals with occupational exposure to pesticides who have been reported to the Pesticide and Plant Pest Management Division of MDA. MDA 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 work-related 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 cases are interviewed to determine the circumstances of the reported pesticide exposure, the signs and 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.

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 are considered confirmed cases.

[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] http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_revAPR2005.pdf pages 2-3

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 work time was lost.[6]

Work sites or work practices where other workers may be at risk are identified. When appropriate, referrals are made to two other state agencies with regulatory responsibility for worker health and pesticide use: the MDA and the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Growth (DLEG). MDA enforces state and federal legal requirements for the sale and use of pesticides, including training and licensing pesticide applicators. MDA also enforces the federal EPA's Worker Protection Standard, which includes requirements to protect agricultural workers from adverse health effects of pesticides. MIOSHA enforces workplace standards on exposure limits, education, and Personal Protective Equipment (PPE) and performs training in safety and health.

In addition, NIOSH is provided information about high priority events. 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 their employers about reducing hazards related to pesticide exposures.

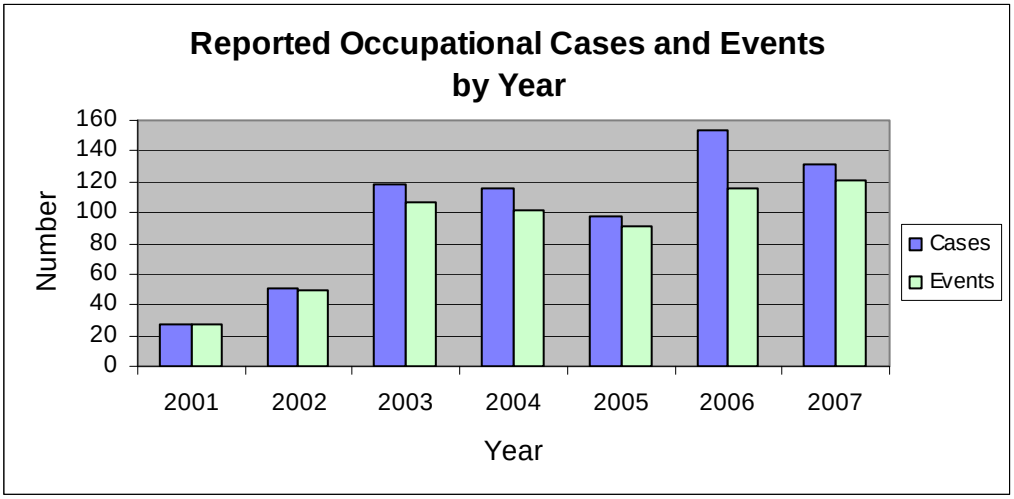
[6] http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf

Results

Reports

There were 696 reports of acute occupational pesticide poisonings from 2001 – 2007. These represent 613 separate events, 121 of which were reported in 2007. Figure 1 shows that since some events have multiple cases, the number of cases varies more than the number of events.

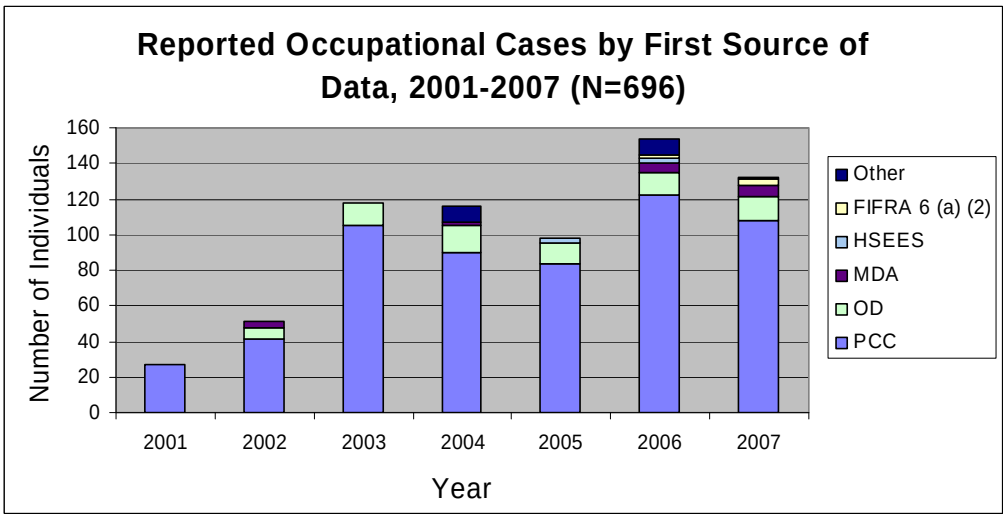
Figure 1



Data Source

The distribution of the sources of the case reports is shown in Figure 2. The Poison Control Centers (PCC) remain the major source of reports. In 2007, 108 (81.8%) of the 132 reported cases were reported by the PCCs. Thirteen (9.8%) cases were from occupational disease (OD) reports from a health care provider and seven (5.3%) cases were reported by the MDA. Figure 2 indicates by year the initial source of the cases received. Some cases were reported by multiple sources.

Figure 2



The average time between the event and the report to the State varied by reporting source. Half of all occupational reports in 2007 from PCC were reported the day of the event. Table 3 shows the average number of days between the occurrence of the event and its report to the surveillance system, the median number of days, the number of incidents reported on the day of occurrence, and the percent reported the same day.

Table 3

Lag Time by Data Source, 2007 Reported Occupational Cases (N=132)				
Source	**Average # of Days**	**Median # of Days**	**# Cases Reported Same Day**	**% Cases Reported Same Day**
PCC	17.0	0.5	54	50.0%
OD	332	310	0	0.0%
MDA	316	121	0	0.0%
FIFRA 6 (a) (2)	370	418	0	0.0%
Other	78	78	0	0.0%

Classification

Of the 696 occupational cases reported from 2001 through 2007, 489 (69.3%) met the criteria to be considered confirmed cases. In 2007, 87 (62.6%) cases were considered confirmed cases. See Table 4.

Table 4

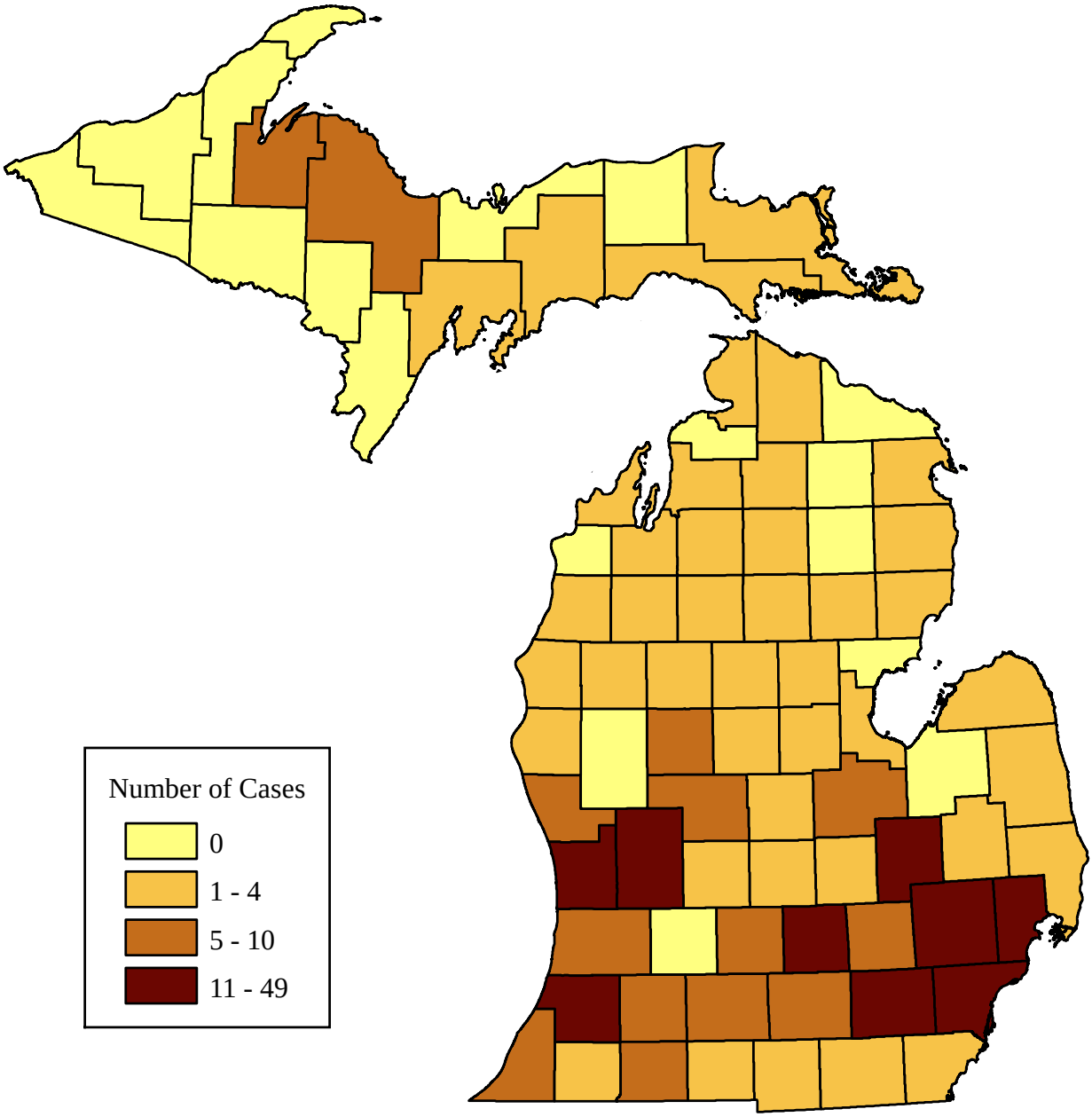
Reported Occupational Cases by Classification, 2007 and 2001-2007				
	2007		**2001-2007**	
Classification	**Number**	**Percent**	**Number**	**Percent**
Confirmed cases				
Definite	9	6.8	74	10.6
Probable	18	13.6	106	15.2
Possible	46	34.8	278	39.9
Suspicious	14	10.6	30	4.3
Total confirmed	*87*	*65.9*	*488*	*70.1*
Not confirmed				
Unlikely	0	0.0	2	0.3
Insufficient Information	43	32.6	174	25.0
Exposed, Asymptomatic	1	0.8	25	3.6
Unrelated	1	0.8	7	1.0
Total not confirmed	*45*	*34.1*	*208*	*29.9*
Total	132	100.0	696	100.0

Location in State

In 2007, there were no confirmed occupational cases in 60.2% of Michigan's counties (50 of 83 counties). For 6 (6.9%) confirmed cases in 2007, county of exposure was unknown. Wayne County had 13 confirmed cases, Oakland 12, and Macomb County had 7 confirmed cases in 2007. Since the numbers per county are low, Figure 3 shows the distribution of all confirmed occupational cases for the years 2001-2007 to preserve anonymity. During that time period, the county of exposure was unknown for 80 (16.4%) confirmed cases.

Figure 3

Confirmed Occupational Pesticide Poisoning Cases
by County of Exposure, 2001-2007
(N = 408*)



* County of exposure was unknown for 80 of the 488 confirmed cases.

The summary information that follows includes data on the 87 confirmed occupational cases reported in 2007. These represent 80 separate events. The appendix contains a brief narrative of each confirmed occupational case from 2007. See the previous annual reports for brief narratives of confirmed cases from previous years.

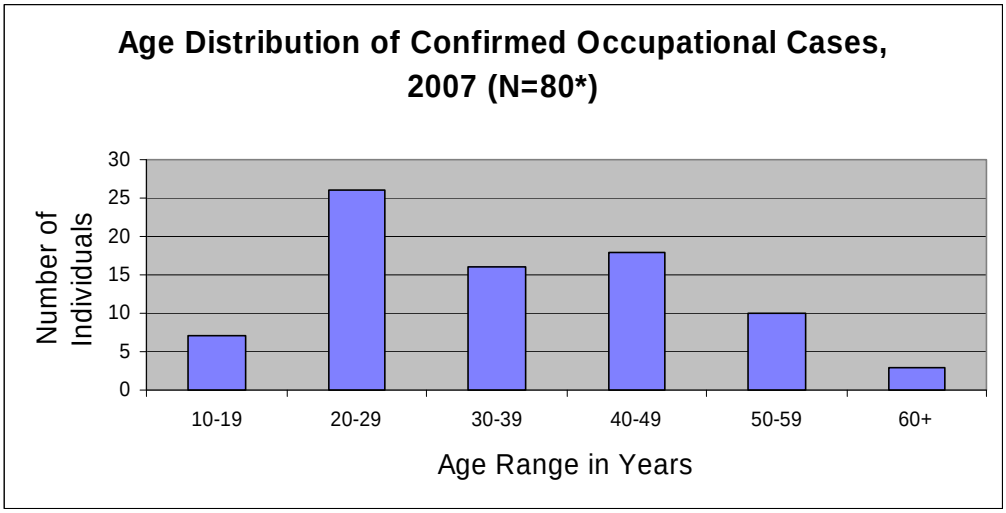
Demographics

Gender
Of the 87 persons with confirmed work-related pesticide illnesses or injuries, 47 (54.0%) were men and 40 (46.0%) were women.

Race and Ethnicity
For 55 (36.8%) individuals, race was unknown. Where race was known, 41 (74.5%) were white. Ethnicity was unknown for 37 (42.5%) cases. Where it was known, 6 (12.0%) were Hispanic.

Age
The age distribution of the individuals where the age was known is shown in Figure 4. The median age was 34, with a range of 17 to 79. Most (52.5%) of the exposed individuals were young adults, 20 – 39 years old.

Figure 4



* Age was unknown for seven of the 87 confirmed occupational cases.

Industry[7]
The type of industry where individuals were employed provides information on where to target interventions. Industry of employment was known for 77 (88.5%) of the 87 confirmed cases.

[7] Categorized based on 2002 North American Industry Classification System (NAICS) codes http://www.census.gov/epcd/naics02/naicod02.htm

As table 5 shows, the industry categories with the most persons exposed to a pesticide in 2007 were Administrative and Support and Waste Management and Remediation Services and Accommodation and Food Services with 12 workers each, followed by 11 workers in Retail Trade. Six of the workers in Administrative and Support and Waste Management and Remediation Services were involved in lawn care or landscaping. In previous years, the 1990 Census Industry Codes were used so the data are not comparable.

Table 5

Industry of Confirmed Cases, 2007 (N=77*)

Type of Industry	Number	Percent
Accommodation and Food Services	12	15.6
Administrative and Support and Waste Management and Remediation Services	12	15.6
Retail Trade	11	14.3
Health Care and Social Assistance	9	11.7
Agriculture, Forestry, Fishing, and Hunting	7	9.1
Other	20	26.0
Total	77	100.0

* Industry was unknown for 10 of the 87 confirmed occupational cases.

Occupation[8]

The occupation of the workers who become ill provides additional information that may help to direct interventions and activities. Occupation was known for 71 (81.6%) of the 87 confirmed cases and is shown in Table 6.

The most common occupation was “Building and Grounds Cleaning and Maintenance”. This included 12 cleaners/housekeepers/maintenance personnel, eight structural pesticide applicators, and six grounds keepers/lawn care workers. Pesticide application may be part of the grounds keepers/lawn care workers job duties. In previous years, the 1990 Census Occupation Codes were used so the data are not comparable.

Table 6

Occupation of 2007 Confirmed Cases (N=71*)

Occupation	Number	Percent
Building and Grounds Cleaning and Maintenance	26	36.6
Food Preparation and Serving Related	9	12.7
Protective Service	7	9.9
Management	6	8.5
Sales and Related	5	7.0
Other	18	25.4
Total	71	100.0

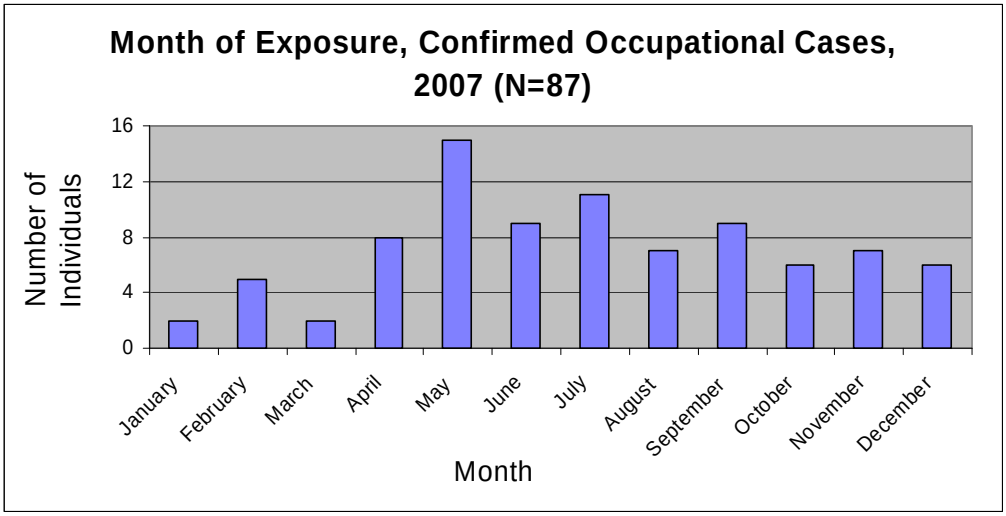
* Occupation was unknown for 16 of the 87 confirmed occupational cases.

[8] Categorized based on 2002 US Bureau of Census Occupation Codes
http://www.census.gov/hhes/www/ioindex/ioindex02/view02.html

Exposures

Month of Exposure
Figure 5 shows that confirmed cases were more likely to be exposed in the spring and summer months.

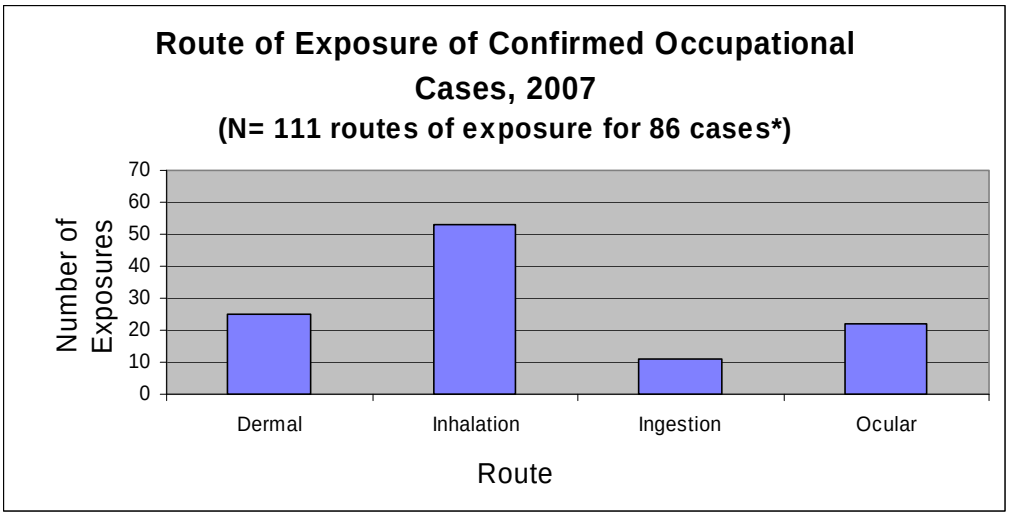
Figure 5



Route of Exposure
Route of exposure indicates how the pesticide entered the body. Figure 6 shows that 86 individuals identified one or more routes of exposure for a total of 111 routes, including 53 inhalation exposures, 25 dermal exposures and 22 ocular exposures. Sixteen individuals were exposed through two different routes. Three had three routes of exposure and one had four routes.

A 23-year-old pregnant cashier at a fast food restaurant turned a corner as her manager was walking in the other direction spraying an insecticide. She inhaled some and some mist fell on her face and clothes. She developed nausea, vomiting, and stomach cramps; shortness of breath, wheezing and pain on deep breathing; headache; sweating; and her face was flushed. She remained at work for about an hour and then went to an emergency department.

Figure 6

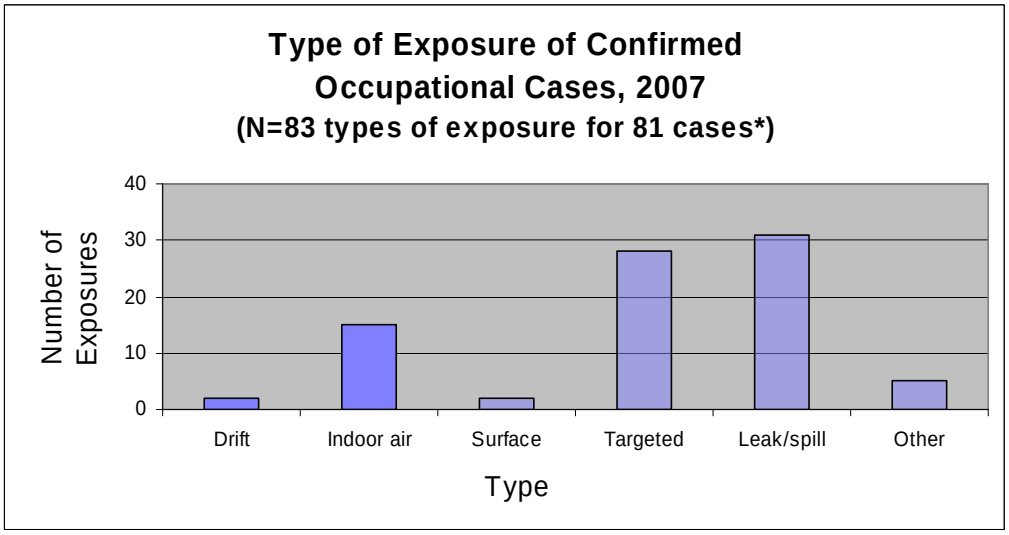


*Route of exposure was unknown for one confirmed case; 20 had multiple routes of exposure.

Type of Exposure

Figure 7 shows how workers who became ill were exposed to pesticides. Exposure from an unintentional leak or spill accounted for 31 exposures. Exposure during a targeted application accounted for an additional 28 exposures. For six cases, the type of exposure was unknown. Two workers experienced two types of exposure.

Figure 7



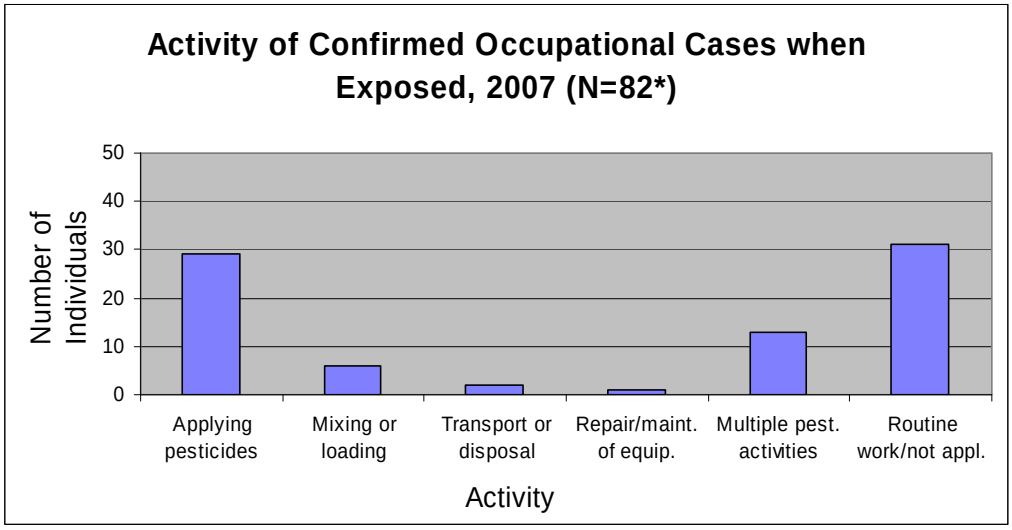
*Type of exposure was unknown for six confirmed cases; two cases had more than one type of exposure.

Activity at Time of Exposure

Activity at time of exposure was determined for 82 (94.3%) of the confirmed cases. Of those, Figure 8 shows that 31 (37.8%) were doing work activities that did not involve pesticide applications and thus had "bystander" exposure. Twenty-nine (35.4%) individuals who became ill were applying pesticides when they were exposed.

A truck driver drove on a road at night where a mosquito control agency was spraying an insecticide. He developed nausea and vomiting, eye irritation, headache, dizziness, and confusion. He contacted poison control and went to an emergency department.

Figure 8



* Activity was unknown for five of the 87 confirmed occupational cases.

Medical Care

Table 7 shows where confirmed cases first sought medical care. Thirty-nine (45.3%) of the cases first sought medical advice from an emergency department; in many instances medical personnel consulted with poison control which then reported the case to MDCH.

Table 7

First Source of Medical Care of Confirmed Occupational Cases, 2007 (N=86*)

First Care	Number	Percent
Emergency room/urgent care	39	45.3
Advice from poison control	34	39.5
Ambulance	6	7.0
Physician office visit	6	7.0
Occupational health clinic	1	1.2
Total	86	100.0

* First care sought was unknown for one of the 87 confirmed occupational cases.

Product Used

Among confirmed cases, the most common exposure was to antimicrobials (42.5%), followed by insecticides (37.9%). See Table 8

Table 8

Product Type of Confirmed Occupational Cases, 2007 (N=87)		
Product Type	**Number**	**Percent**
Antimicrobial	37	42.5
Insecticide	33	37.9
Herbicide	8	9.2
Rodenticide	3	3.4
Fungicide	3	3.4
Fumigant	1	1.1
Mixture	2	2.3
Total	87	100.0

Severity

Table 9 shows the severity of the case by the type of product used. Most cases (82.8%) are low severity, with no high severity cases. However, there was one confirmed death reported in 2007.

A woman in her 50s worked in a nursing home laundry. One day, bleach was left out overnight. When the dryer was turned on the fumes from the bleach became more noticeable. She was exposed to the fumes for about 10-15 minutes. She had a history of asthma and developed of shortness of breath and asked someone to get her inhaler. She lost consciousness and EMS was called. They evacuated the laundry room and took her to a hospital where she was intubated and admitted. She never regained consciousness and died five days later.

Table 9

Severity by Product Type of Confirmed Occupational Cases, 2007 (N=87)								
Product Type	**Low**		**Moderate**		**High**		**Death**	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Antimicrobial	30	41.7	6	42.9	0	0.0	1	100.0
Insecticide	30	41.7	3	21.4	0	0.0	0	0.0
Herbicide	4	5.6	4	28.6	0	0.0	0	0.0
Rodenticide	3	4.2	0	0.0	0	0.0	0	0.0
Fungicide	3	4.2	0	0.0	0	0.0	0	0.0
Fumigant	1	1.4	0	0.0	0	0.0	0	0.0
Mixture	1	1.4	1	7.1	0	0.0	0	0.0
Total	72	100.0	14	100.0	0	100.0	1	100

Antimicrobials

Antimicrobials accounted for over 40% of the 2007 confirmed occupational cases, including the one death.

Antimicrobial pesticides are substances or mixtures of substances used to destroy or suppress the growth of microorganisms such as bacteria, viruses, or fungi on inanimate objects and surfaces.[9] Antimicrobials are registered by the EPA, just as other pesticides are. Antimicrobials include:

- sterilizers, which destroy microbes including fungi, viruses, bacteria, and their spores;
- disinfectants, which destroy or inactivate fungi and bacteria, but not necessarily their spores; and
- sanitizers, which reduce microorganisms from inanimate objects to levels considered safe.

Type of Antimicrobial

Where the type of antimicrobial used was known, the most commonly reported type was disinfectant (64.0%). See Table 10.

Table 10

Antimicrobial Type of Confirmed Cases, 2007
(N=25*)

Type	Number	Percent
Sterilizer	1	4.0
Disinfectant	16	64.0
Sanitizer	8	32.0
Total	25	100.0

* Type of antimicrobial was unknown for 12 cases of the 37 confirmed cases.

Confirmed cases from 2007 with antimicrobial pesticide exposures were compared to cases with exposures to other pesticides:

Gender

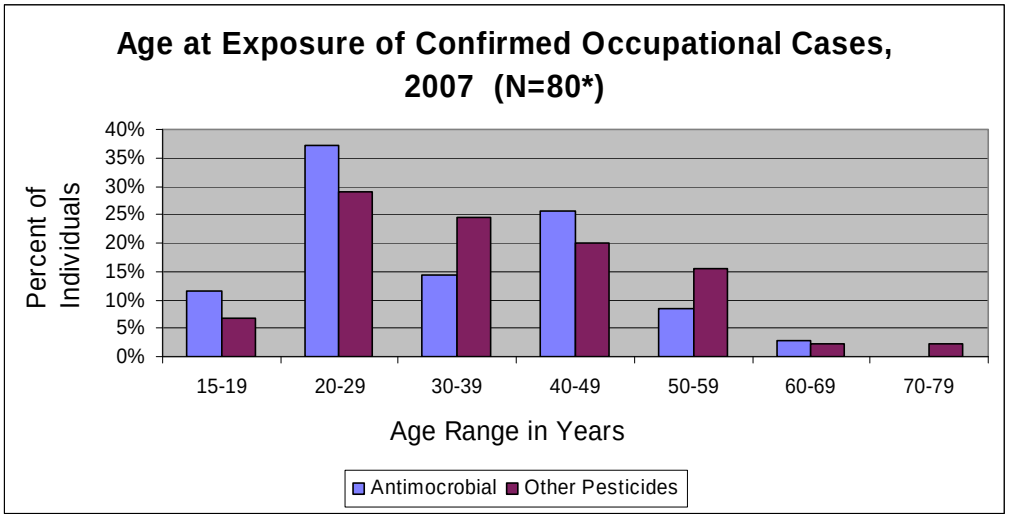
Women were more likely to be exposed to antimicrobial pesticides, with 67.6% of antimicrobial exposures, whereas only 30.0% of the non-antimicrobial exposures were women.

Age

Figure 9 shows that workers exposed to antimicrobials tended to be younger (average age 33.5) than those exposed to other pesticides (average age 37.8).

[9] http://www.epa.gov/oppad001/ad_info.htm "What Are Antimicrobial Pesticides?"

Figure 9

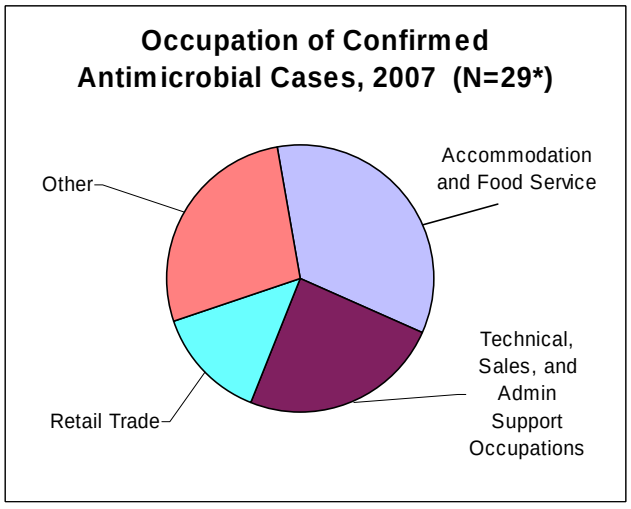


* Age was unknown for seven of the 87 confirmed cases.

Occupation

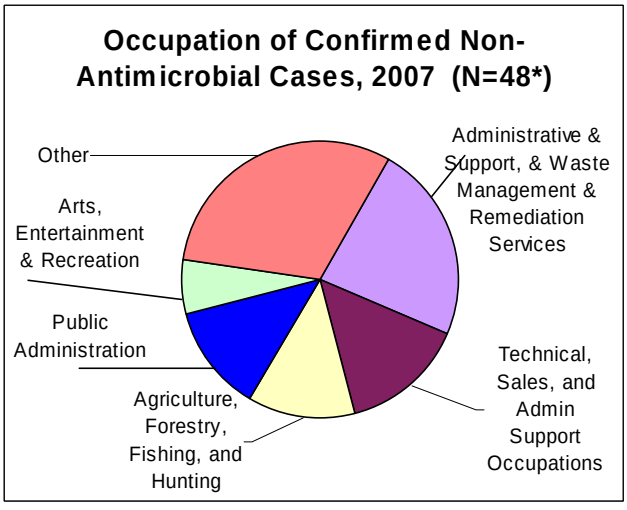
In over one third of the antimicrobial cases, the exposed person was working in Accommodation and Food Service. Among other pesticide cases, the largest group was in Administrative and Support and Waste Management and Remediation Services. See Figures 10 and 11.

Figure 10



* Occupation was unknown for eight antimicrobial cases

Figure 11



* Occupation was unknown for two non-antimicrobial cases

Outreach, Education, and Prevention Activities

Publications and Presentations
Staff members of Occupational Pesticide Illness and Injury Program sought many avenues to provide information about the program and pesticide safety to stakeholders and the general public. In 2007:

- A staff member of the surveillance program represented MDCH on the MDA Pesticide Advisory Committee (PAC) and provided an activity report each quarter. An additional analysis of cases involving children was prepared for one of the PAC members. An analysis of quaternary ammonium chloride cases was prepared for another PAC member.

- The 2006 Pesticide annual report was completed, distributed to stakeholders, and made available on the Division of Environmental Health's website.

- An update of the project, with results, was presented at the annual meeting with MDCH and Michigan's Poison Control Centers.

- Information about the program, pesticide safety, and occupational disease reporting requirements was provided to migrant health clinics in May 2007.

- The MDCH surveillance program contributed to a NIOSH article about cases occurring in agriculture. The article was published in 2008 in the American Journal of Industrial Medicine.

- MDCH surveillance program staff facilitated a discussion on subpoenas and FOIA requests at the annual winter meeting of SENSOR-pesticide surveillance states.

- MDCH surveillance program staff presented information about the program to the Michigan Birth Defects Steering Committee.

- MDCH surveillance program staff worked on updating a bill analysis of for proposed bill banning lindane use in Michigan.

- MDCH surveillance program staff sent information about our program and other resources to the Michigan Migrant Legal Assistance Project.

- MDCH surveillance program staff sent information about our program to the Michigan Primary Care Association (MPCA). Staff also attended MPCA meeting of the migrant and seasonal farm worker workgroup.

- MDCH contributed to an article on acute pesticide poisoning in retail, published in Public Health Reports in 2007.

MDA Reports
Five cases were reported to MDA in 2007. The first, MI00981, was a groundskeeper at a theme park who applied an herbicide and an algaecide to a lake from a boat. She was told to wear gloves, but not long pants. MDA found that the employer did not maintain records of pesticide applications, the applicator was not certified, the applicator did not wear proper personal protective equipment (PPE) as required by the label, and that required posting after pesticide application did not occur.

Another case, MI01052, involved an administrative assistant working in an aluminum can recycling office that was frequently sprayed for roach control. The case was reported to MDA, which investigated and found information missing from the pesticide application firm's application records and written customer information as well as irregularities related to the firm's name and contracts. MDA issued the application firm a warning letter, requiring a written response indicating what changes have been made to bring the firm into compliance. This case was also referred to Michigan's work-related asthma surveillance[10] program.

In a third case, MI01101, a worker was reported to MDCH as having sprayed a fungicide into a hole in a utility pole. It traveled through a hollow area and out another of the drilled holes, directly into his mouth. This case was reported to MDA because the worker was not a certified or registered applicator. Upon investigation, MDA was told that a coworker, who was certified, was the person who made the application.

For the remaining two cases, MI01015 and MI01196, MDA investigations have not been completed. More information about all of these cases can be found in the appendix.

NIOSH Reports
One event was reported to NIOSH as a high priority event. This event involved five individuals working in a nursing home laundry who were exposed to bleach fumes. See the appendix, cases MI00890-94 for more details. One of the exposed individuals had a history of asthma. She developed shortness of breath, lost consciousness, and was taken to a hospital where she died five days later. This case was also referred to the Michigan work-related asthma surveillance program and the Michigan Fatality Assessment and Control Evaluation (MIFACE)[11] program.

Asthma Surveillance Referrals
In addition to MI00890 and MI01052, two other cases were referred to Michigan's work-related asthma surveillance program. One, MI00877, involved a veterinary technician who inhaled a sterilant while mixing it. She developed shortness of breath and went to an emergency department where she was diagnosed with reactive airway disease. The other case involved a person with a history of asthma who was at work when a janitor sprayed an unknown pesticide. This was not a confirmed case, because the pesticide was not identified.

[10] A collaborative program of MIOSHA, MDCH, and Michigan State University (MSU), and funded by NIOSH to prevent work-related asthma through the reporting of index patients. http://www.oem.msu.edu/asthma.asp
[11] A collaborative program of MIOSHA and MSU funded by NIOSH to investigate work-related fatalities in Michigan. http://www.oem.msu.edu/miface.asp

HSEES Referral
One case, MI01208, was referred to HSEES, because it involved a mixture of acid cleaner and sodium hypochlorite, resulting in the release of chlorine gas.

Other Prevention
One person who was exposed to a metam-sodium fumigant (see MI01194 in the appendix and sidebar below) was concerned about possible long-term effects of the exposure. An MDCH toxicologist researched the chemical and provided him with the information.

A truck driver for a potato farm was transporting Vapam, a fumigant containing metam-sodium (a dithiocarbamate with signal word Danger), on a bumpy road. He pulled over to check his directions and noticed that a pipe had shaken loose and the fumigant was leaking out. He tried to hook it back together and got splashed with the Vapam. His skin was burning, red and itchy. He could smell it and had a bad taste in his mouth. His supervisor took him to an emergency department and he had three to four showers there before his skin stopped burning. He was given silvadene for the skin burn. Approximately 300 gallons of a mix of 50% Vapam and 50% water were spilled on the road. The fire department responded, as well as MDA. Twenty local people were evacuated for three hours as a precaution. A hazmat company was called in to clean up the spill.

Discussion

Surveillance Data
There were fewer reported occupational cases in 2007, compared to 2006 (132 vs. 154), and fewer confirmed occupational cases (87 vs. 113).

More than a third of the confirmed cases in 2007 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.

The number of exposures to antimicrobials remains high. Workers exposed to antimicrobials were predominantly female. Antimicrobial exposure cases had a higher percentage of moderate severity cases, as well as the one death, although the numbers were small. Antimicrobial exposures remain an area of ongoing concern.

The surveillance system was expanded to include non-occupational pesticide injuries and illnesses in 2006. Section III summarizes data on the 260 non-occupational cases reported in 2007.

Interventions
MDCH has continued to refer cases to MDA for investigation of possible safety violations. MDCH also worked to improve pesticide education for individuals and groups through the activities listed above. Education must remain a priority for both certified and non-certified pesticide applicators, since both groups may be exposed or expose other workers.

Challenges to Surveillance
Pesticide poisoning is a complex condition for surveillance because it encompasses many kinds of illnesses and injuries from skin rash to nerve toxicity. These are a result of exposure to numerous products with 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). 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. 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. It is also related to the specific chemicals in each product. Pesticide products are often mixtures including one or more active ingredients, as well as other ingredients that may also be toxic. 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 an acute upper respiratory illness, acute conjunctivitis, or acute gastrointestinal illness, among other conditions. In these cases, patients may not seek medical care, or may not be correctly diagnosed if an occupational and environmental history that asks about pesticide exposure is not taken (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 to the 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. While the emergency department was the first source of care for 39 (45.3%) of confirmed occupational cases in 2007, the hospital submitted an occupational disease report for only 14 (35.9%) of those cases. The remaining cases were brought to the program's attention by the PCC, but if the health care providers in the hospital do not call the PCC for advice, the case is unlikely to be identified by the surveillance system.

Like data from other occupational disease and illness surveillance systems,[12] 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 some challenges due to the time lag between the occurrence and the reporting of the incident for OD and MDA 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 from 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.

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

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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/

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

EPA Pesticide Product Label System: http://oaspub.epa.gov/pestlabl/ppls.home

Information on pesticide products registered for use in Michigan: http://state.ceris.purdue.edu/

Information on licensing and registration for pesticide application businesses, credentials for certified technicians, and laws and regulations for pesticide application: www.michigan.gov/mda/0,1607,7-125-1569_16988---,00.html

Information on the federal Worker Protection Standard (worker exposure to pesticides in agriculture): www.epa.gov/pesticides/health/worker.htm. In Michigan, call the Pesticide and Plant Pest Management Division, MDA, at (517) 373-1087.

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

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

Section II: Laboratory Cholinesterase Test Surveillance

Background

Cholinesterase is an enzyme necessary for proper nerve impulse transmission. If the amount of this enzyme is reduced below a critical level, nerve impulses to the muscles can no longer be controlled, resulting in serious consequences and even death. Two classes of pesticides, organophosphates and carbamates, act as cholinesterase inhibitors; that is, they reduce the amount of cholinesterase available for the body's use. Depression of cholinesterase activity can be measured by several related blood tests. There is considerable variation in values between laboratories and among unexposed individuals, thus comparative measures from each person's unexposed baseline to their own subsequent results are the best measures of cholinesterase inhibition temporally related to pesticide exposure. It should be noted that suspected pesticide exposure is not the only reason cholinesterase tests are ordered. Most notably, they may be ordered prior to anesthesia with succinylcholine (a paralyzing agent that is eliminated by these enzymes) to prevent exposure to persons with a genetic deficiency of these enzymes, or after a bad reaction to anesthesia.

MDCH began using laboratory cholinesterase test reporting as another data source for the work-related pesticide illness and injury surveillance system, beginning in late 2005. This section presents the first set of results from the MDCH laboratory surveillance system for cholinesterase-inhibiting pesticide exposure/illness.

Methods

In September 2005, MDCH rules for clinical laboratory reporting of cholinesterase test results went into effect. By 2007, most laboratories were reporting electronically. Laboratory test results are managed in an excel data file that included identifying and demographic information about the tested individual, the test results, and the laboratory reference ranges for those results. It should be noted that each laboratory has its own test procedures and reference ranges. Further, some laboratories run up to six types of cholinesterase test results per specimen (e.g. acetylcholinesterase, pseudocholinesterase). Individuals with single test results below the laboratory reference range, or with tests from specimens taken on two or more occasions where there was a change from baseline of more than 20%, are flagged for follow-up to determine the reason for the test. If the test was for suspected pesticide exposure, the follow-up includes collection of information about the type of pesticide, the source of exposure, the employer, and any associated symptoms or diagnosed illness.

Results of laboratory tests from the beginning of data collection in late 2005 through April 2008 are presented.

Results

From October 1, 2005 through April 30, 2008 laboratories reported 2, 278 test results on 811 individuals. Eighty-one (10%) of these individuals met criteria for follow-up, including 60 (74.1%) with a low test result and 21 (25.9%) with a 20% change from the first reported test. Table 11 shows the reason for the cholinesterase test. Thirty seven (45.7%) of the 81 individuals were tested because of potential work-related pesticide exposure.

Table 11

Laboratory Cholinesterase Tests for Follow-up
October 2005 - April 2008 (N=81)

Reason for Test	Number	Percent
Occupational	37	45.7
Non-Occupational		
Surgery	*24*	
Suicide attempt with pesticide	*1*	
Other	*1*	
Total non-occupational	26	32.1
Unknown *(including 10 non- Michigan residents)*	18	22.2
Total	81	100.0

Follow-up of the work-related cases identified six employers among the 37 work-related cases. Twenty two of the 37 individuals were identified by a low test result, 13 had at least one test result with a 20% increase from the first test reported, and two had at least one test result with a greater than 20% decrease from the first test. Five individuals were interviewed; none reported symptoms. The others were determined to be part of employer routine monitoring programs, including pre-employment screening, by contacting a person handling the testing for the employer. We discussed the employer's screening program with each of these people, during the course of which they indicated that none of the workers in their screening program reported symptoms related to pesticide exposure.

In addition, another seven employers were identified from laboratory reports as providing cholinesterase monitoring because of potential pesticide exposure, even though none of the test results among their employees met the MDCH thresholds for follow-up. Table 12 lists the business types of all the identified employers.

Table 12

Types Of Businesses Conducting Routine Employee Cholinesterase Monitoring
October 2005 - April 2008 (N=11)

Architectural/Engineering Service	Hazmat responder
Chemical manufacturer/wholesaler (2)	Pesticide applicator
County mosquito control commission	Tree service company
Food manufacturer	University (2)
Government Fish and Wildlife Service	

Discussion

Over a 2 ½ year period 81 individuals were identified with potential pesticide exposure, 37 of which were tested because of potential work exposure. Although none of the work-related cases had pesticide-related symptoms, their test results led to the identification of employers who are testing employees because of the use of cholinesterase-inhibiting pesticides at work. The Michigan Department of Agriculture has agreed to consider employer follow-up based on data from this system. We will continue to track reports and collect medical and exposure information from individuals who meet criteria for follow-up. Symptomatic individuals will be included in the pesticide illness/injury surveillance system.

While the cholinesterase laboratory reporting system presents a number of challenges to data management and interpretation, we believe that it provides a useful addition to our pesticide illness and injury surveillance system. It has the potential to identify exposures at an early stage prior to symptoms to review work practices and thus prevent exposure, symptoms, and disease.

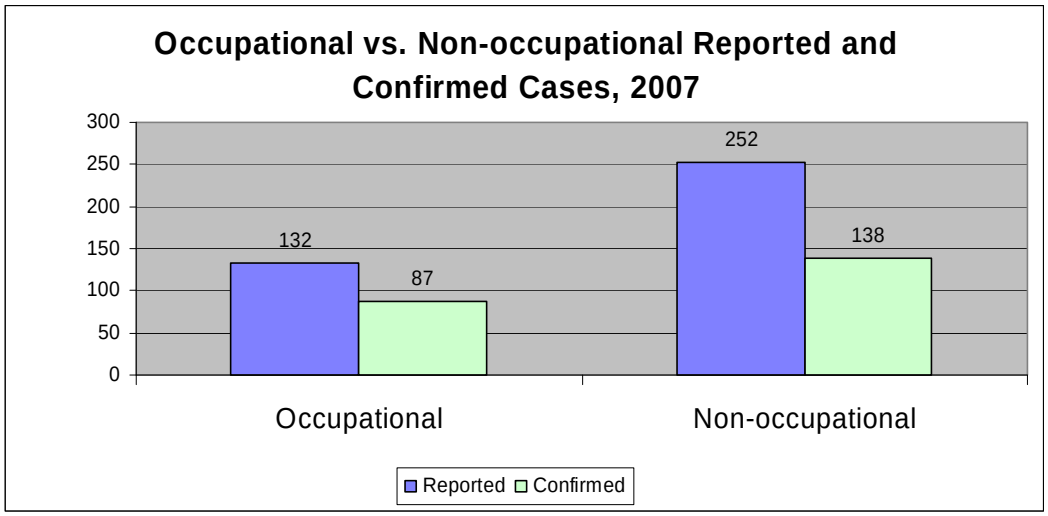
Section III: Non-occupational Exposures

To better characterize the impact of pesticide use in Michigan, the MDCH pesticide surveillance program began collecting information about non-occupational exposures in 2006. Suicide attempts are excluded. The occupational case definition and data sources were used for these cases as well.

Reports

In 2007, there were 252 reported non-occupational cases, up from 221 in 2006. One hundred thirty-eight of these reported cases met the NIOSH criteria (other than work-relatedness) to be considered confirmed cases compared to 101 in 2006. Due to limited resources, no case follow-up was done, resulting in a lower percentage of confirmed cases than for occupational cases. See Figure 12.

Figure 12

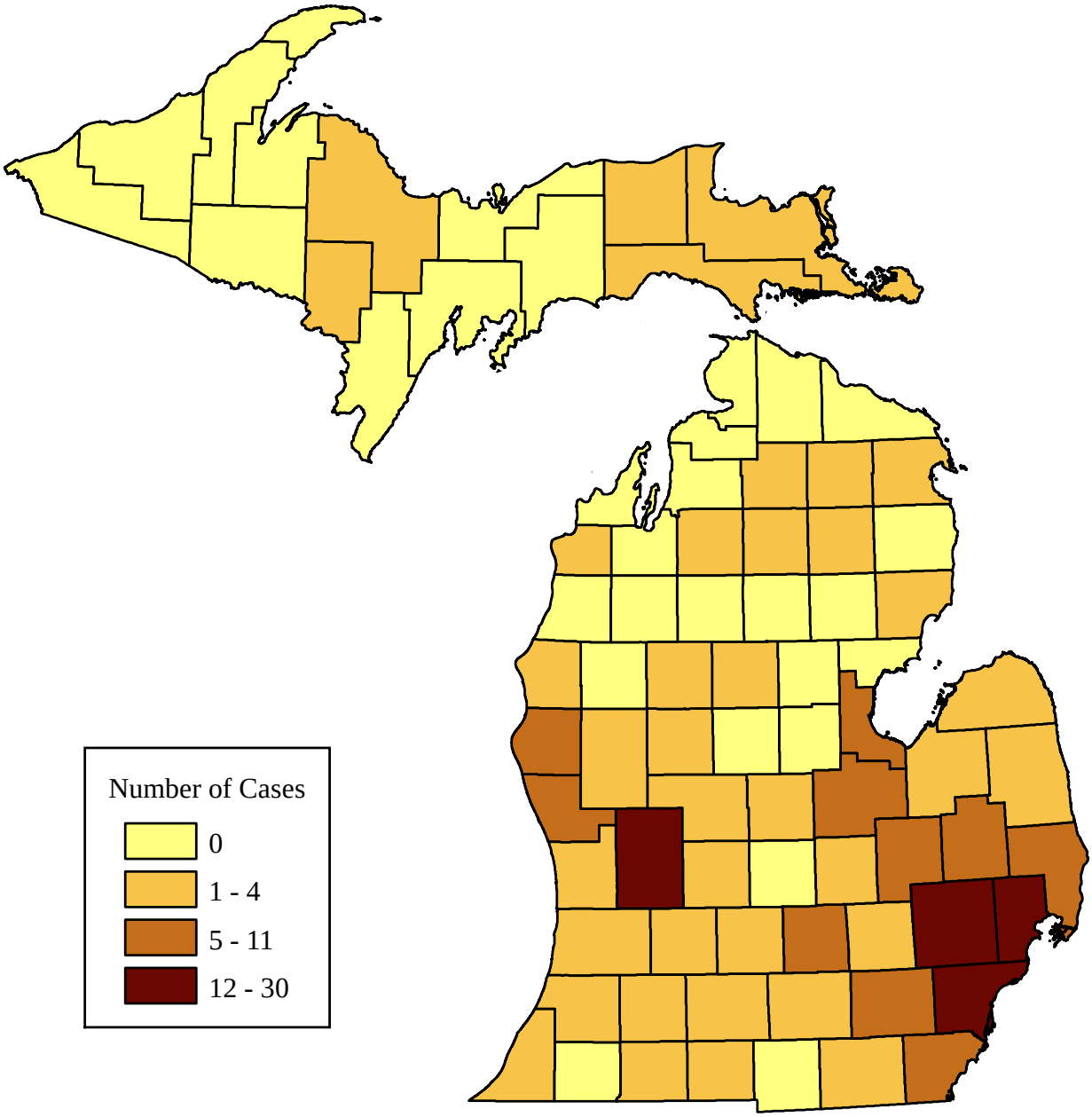


Location in State

In 2007, there were no confirmed non-occupational cases in 49 of Michigan's 83 counties (59.0%). For 20 (14.5%) confirmed cases, county of exposure was unknown. There were 19 confirmed cases exposed in Wayne County, 14 in Kent, and 11 in Macomb in 2007. Figure 14 shows the distribution of confirmed non-occupational cases in 2006 and 2007.

Figure 13

Confirmed Non-occupational Pesticide Poisoning Cases
by County of Exposure, 2006-2007
(N = 217*)



* County of exposure was unknown for 24 of the 241 confirmed cases.

Classification

Of the 252 non-occupational cases reported in 2007, about half (138 or 54.8%) met the criteria to be considered confirmed cases. The remaining cases all had insufficient information to be confirmed. (Table 12.)

Table 12

Reported Cases by Classification, Occupational vs. Non-occupational, 2007

	Occupational		Non-occupational	
Classification	**Number**	**Percent**	**Number**	**Percent**
Confirmed cases				
Definite	9	6.8	3	1.2
Probable	18	13.6	10	4.0
Possible	46	34.8	94	37.3
Suspicious	14	10.6	31	12.3
Total confirmed	*87*	*65.9*	*138*	*54.8*
Not confirmed				
Unlikely	0	0.0	0	0.0
Insufficient Information	43	32.6	114	45.2
Exposed, Asymptomatic	1	0.8	0	0.0
Unrelated	1	0.8	0	0.0
Total not confirmed	*45*	*34.1*	*114*	*45.2*
Total	132	100.0	252	100.0

Demographics

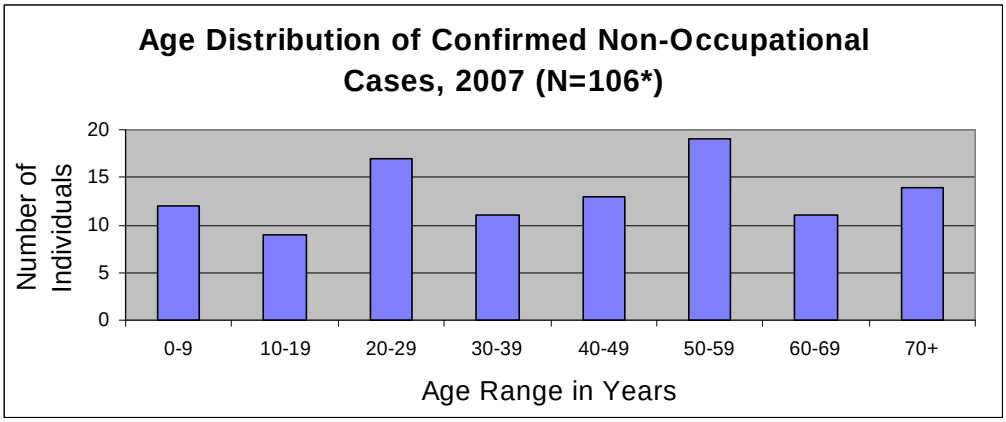
Gender

Of the 138 persons with confirmed illnesses or injuries, 56 (40.6%) were men and 70 (50.7%) were women. Gender was unknown for 12 cases.

Age

The age distribution of individuals where the age was known is shown in figure 14. The median age was 41.7, with a range of 1 to 88.

Figure 14

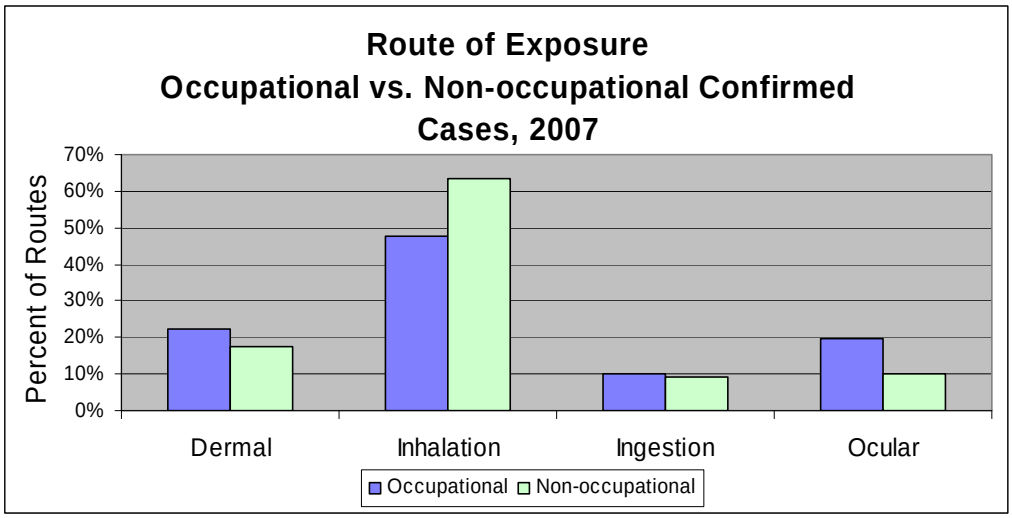


* Age was unknown for 32 of the 138 confirmed non-occupational cases.

Exposures

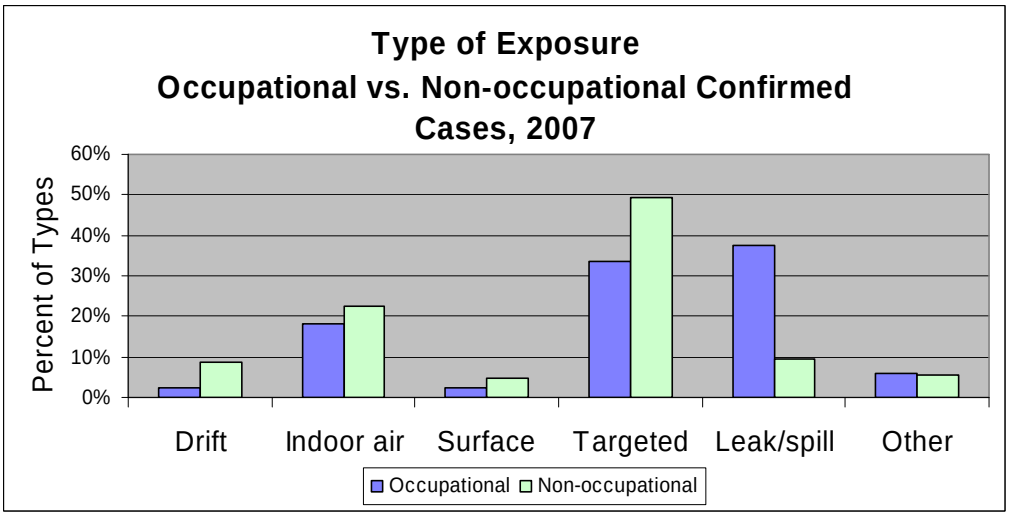
Route of Exposure
Route of exposure was identified for the 136 of the 138 confirmed non-occupational cases. There were 167 identified routes of exposure. There were 18 cases with two routes of exposure, and five cases with three routes. The most common route was inhalation (105). See Figure 15 for a comparison of routes of exposure for occupational and non-occupational cases.

Figure 15



Type of Exposure
Type of exposure was also identified for 116 of the confirmed non-occupational cases. There were 104 cases with one type of exposure and 12 with two types. For non-occupational cases, the most common type of exposure was from a targeted application (63). See Figure 16 for a comparison of type of exposure for occupational and non-occupational cases.

Figure 16



Product Used

Table 13 compares the products to which confirmed occupational cases and confirmed non-occupational cases were exposed. While antimicrobials were the most common exposure for occupational cases, non-occupational exposures were most likely to be due to insecticides.

Table 13

Product Type of Confirmed Cases, 2007						
	Occupational		Non-Occupational		Total	
Product Type	Number	Percent	Number	Percent	Number	Percent
Insecticide	33	37.9	73	52.9	106	47.1
Antimicrobial	37	42.5	20	14.5	57	25.3
Herbicide	8	9.2	21	15.2	29	12.9
Insect repellent	0	0.0	12	8.7	12	5.3
Fungicide	3	3.4	1	0.7	4	1.8
Rodenticide	3	3.4	4	2.9	7	3.1
Fumigant	1	1.1	0	0.0	1	0.4
Other	0	0.0	3	2.1	3	1.3
Mixture	2	2.3	3	2.1	5	2.2
Total	87	100.0	144	100.0	231	100.0

Severity

Table 14 compares the severity of confirmed occupational cases with confirmed non-occupational cases.

Table 14

Severity of Confirmed Cases, 2007				
	Occupational		Non-occupational	
Severity	Number	Percent	Number	Percent
Death	1	1.1	0	0.0
High	0	0.0	1	0.7
Moderate	14	16.1	9	6.5
Low	72	82.8	128	92.8
Total	87	100.0	138	100.0

Activity at Time of Exposure

Activity at time of exposure was unknown for 13 non-occupational confirmed cases in 2007. When known, more than half of all non-occupational cases (72 or 57.6%) were not involved with the pesticide application when they were exposed. Most of these of these bystander cases (46 or 63.9%) were exposed indoors.

Comparison of Occupational and Non-occupational Exposures

There were a number of similarities between occupational and non-occupational cases in Michigan. Most cases, both occupational (82.8%) and non-occupational (92.8%), were classified as low severity. The majority of exposures were through inhalation (47.7% of occupational cases

and 63.5% of non-occupational cases). Exposed individuals were frequently bystanders rather than pesticide applicators (37.8 % of occupational cases and 57.6% of non-occupational cases).

There were also some differences between the two populations. Figure 16 shows some variations in type of exposure with leaks and spills being the most common type of exposure for occupational cases (37.31%), but relatively uncommon for non-occupational cases (9.4%). The type of product the individual was exposed to also differed, with 61.6% of non-occupational cases being exposed to insecticides or insect repellents (vs. 37.9% of occupational cases), while only 14.5% were exposed to antimicrobials (vs. 42.5% of occupational cases).

A woman in her 70s developed a headache, dizziness, and nausea after her son placed mothballs under her trailer.

A man in his 20s returned to his home and did not realize it was being treated with a carbamate containing total release fogger (signal word: Caution). He went to sleep for four to five hours and woke up feeling lightheaded, with nausea, sweating, diarrhea, urinary frequency, tachycardia, and a fever. He went to an emergency department the next day.

Appendix

Case Narratives, 2007 Confirmed Occupational Cases

Below are descriptions of the confirmed occupational cases reported in 2007. The narratives are organized by product type and include a description of the signs and symptoms that resulted from the exposure and medical care received. Where known, age, 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

MI00381 – A male pesticide applicator in his 20s for a lawn care company sprayed an organophosphorous insecticide for about three hours. “He was covered from head to toe in protective gear except for his face.” The wind was blowing and he inhaled some of the powder. He became lightheaded, nauseous, and vomited. Early on, he had lots of salivation. He also developed a headache, was diaphoretic, and his eyes were burning. He went to an emergency department.

MI00823 – A certified pesticide handler in his 30s had two exposures. In one, he used a pyrethroid insecticide and an insect growth regulator. He developed paresthesia on his scalp and sinus pressure. He went to an urgent care clinic. In the second event, he was working in a vacant house, using two pyrethroid insecticides (both signal word: Caution), when he began to feel dizzy and faint. He had difficulty breathing, a headache, anxiety, and nausea. EMS was called and he was taken to an emergency department. He lost two days of work.

MI00871 – A female social worker in her 20s was making a home visit and a child walked into the room after spilling an unknown flea powder on herself. She helped clean up the little girl and fifteen minutes later had welts and hives. She also developed a sore throat, cough, nasal irritation and tearing. She called poison control.

MI00876 – A male farmer in his 40s was spraying a pyrethroid insecticide (signal word Caution) when the pressure apparatus broke. He was sprayed in the face, neck, and forearms. He developed a red, itching, burning rash and red, irritated, tearing eyes. He called poison control and went to an emergency department.

MI00932 – An adult woman was working in an office in which a coworker sprayed some pyrethroid insecticide. She developed a headache, cough, shortness of breath, watery eyes, and felt lightheaded. She went to her primary care physician.

MI00968 – An adult male was nearby when a pyrethrin and pyrethroid (signal word Caution) insecticide was sprayed at work. He developed a headache, nosebleed and sore throat and called poison control.

MI00970 – A male fire fighter in his 40s entered a house where eight bug bombs had been set off. He had a sore throat and a cough and went to an emergency department.

MI00971 – Another fire fighter, in his 40s, entered the same house where the eight bug bombs had been set off. He had tearing eyes, a cough and upper airway irritation. He went to an emergency department.

MI00992 – A deputy sheriff in his 30s entered a trailer that was reportedly being used as a 'flophouse'. Three deputies entered through the open door and when they got to the back of the trailer smelled the remains of pyrethroid insecticide foggers that had been set off. They immediately left the trailer. This deputy had a headache, cough, and fever. The supervisor had all three deputies go to an emergency department to be checked out.

MI00993 – Another deputy sheriff in his 30s was one of three deputies who entered a trailer through the open door. When they got to the back of the trailer, they smelled the remains of pyrethroid insecticide foggers that had been set off. They immediately left the trailer. This deputy had a headache, cough, and throat irritation. The supervisor had all three deputies go to an emergency department to be checked out.

MI00994 – Another deputy sheriff in his 30s was one of three deputies who entered a trailer through the open door. When they got to the back of the trailer, they smelled the remains of pyrethroid insecticide foggers that had been set off. They immediately left the trailer. This deputy had a headache, cough, and eye, skin, and throat irritation. The supervisor had all three deputies go to an emergency department to be checked out.

MI01003 – A manager of a trailer park became ill after his home/office was treated with two pyrethroid insecticides (both signal word: Caution). He contacted MDA and an investigation was conducted. Streaking of the pesticide on the walls was noticed and samples were positive for cyfluthrin. The manager and his family moved out of the trailer.

MI01015 – A restaurant server in her 30s was prepping food when a pesticide applicator sprayed a pyrethroid insecticide (signal word: Caution) around her. She developed a headache, which did not go away until she went home and took Motrin. The next day, she went down to the basement at work to get supplies. The smell was very strong there and her headache came back. In addition, she developed altered vision, 'like looking through a kaleidoscope', and nausea. Two weeks later, the applicator came back. This time she had some shortness of breath, a headache, and a cough. She went to an emergency room. This case was referred to MDA.

MI1019 – A woman in her 20s was working in a drug store when a coworker sprayed an unknown insecticide for ants. She had a history of exercise-induced asthma, and after being exposed to the spray developed shortness of breath and throat tightness. She went to an emergency department.

MI01052 – An administrative assistant in her 50s worked in an aluminum can recycling office that is frequently sprayed for roach control. She was in the office when it was sprayed with a pyrethroid insecticide (signal word: Caution). She had an asthma attack with a headache, dizziness, cough and sore throat. She went to an emergency department and called poison control. The case was reported to MDA, which investigated and found information missing from the firm's application records and written customer information as well as irregularities related to the firm's name and contracts. MDA issued the application firm a warning letter, requiring a written response indicating what changes have been made to bring the firm into compliance.

MI01054 – A male lawn care worker in his 40s was exposed to pyrethroid insecticide at work. He developed a runny nose, cough, burning eyes, and sinus problems and called poison control. As he studied for the pesticide certification test, he realized his employer was violating many safety regulations. He asked his employer to comply with regulations and was not called back to work.

MI01055 – A man in his 50s used some pyrethroid insecticide (signal word: Caution) in an open garage at work and some rebounded into his face. The next day he felt weak and dizzy. He called poison control and went to an emergency department.

MI01061 – A hospital cleaner in her 50s was at a meeting. The hallway outside had been recently sprayed with an insecticide (signal word Caution). By the time the meeting was over, she had a migraine. She also had eye irritation, difficulty breathing, coughing, and burning in her nose. She went to an emergency department.

MI01066 – A gas station shift leader in her 20s sprayed the parking area for bees with an insecticide (signal word: Caution). The wind shifted and she got spray on her face, in her eyes, and in her mouth. Her throat started to swell and she had difficulty breathing. Her tongue became numb, she coughed, her eyes were red and tearing, and she had a headache. She called poison control.

MI01078 – A male volunteer in his 20s sprayed the perimeter of a high school with pyrethroid insecticide (signal word Caution). He developed a headache, fever, muscle tightening, sore throat, and earache. The symptoms abated and two days later he sprayed again with the same spray and another insecticide containing an organophosphate and a pyrethroid (signal word Caution). Within a few hours, the symptoms returned and he called poison control.

MI01082 – A teenage male house painting project manager was spraying bees with a pyrethroid insecticide (signal word: Caution) when the cap fell off the can. When he tried to get the cap back on, the sprayer depressed and it sprayed in his face. He felt nauseous and vomited and called poison control.

MI01092 – A stocker in his 40s was stocking shelves with a pyrethroid insecticide (signal word: Caution). Some had leaked on the package, but he continued to stack them. He scratched his ear, which started to burn so he washed it. Three days later it was still red and itching and developed pustules. He went to an emergency department.

MI01093 – A telephone repairman in his 30s sprayed some hornets up a pole with a pyrethroid insecticide (signal word: Caution). The wind shifted and he got spray in his face and on his shirt. He developed a headache, nausea, a numb tongue, and felt dizzy and anxious. He called poison control and went to a health care clinic.

MI01101 – A man in his 20s was inspecting power poles for carpenter ants or hollow spots. When found, he would drill holes to be filled with a fungicide (signal word: Danger). Some traveled through a hollow area and out another of the drilled holes, directly into his mouth. He swallowed some and had a sore throat and nausea. He felt dizzy and was acting “high”. He sat in the truck for a couple of hours and then went back to light duty work. This case was reported to MDA because the worker was not a certified or registered applicator. Upon investigation, MDA was told that a coworker, who was certified, was the person who made the application.

MI01102 – A truck driver in his 50s drove on a road where a mosquito control agency was spraying an organophosphate insecticide (signal word: Caution). He developed nausea and vomiting, eye irritation, headache, dizziness, and confusion. He contacted poison control and went to an emergency department.

MI01109 – A gardener in her 30s was trimming bushes. Someone told her she should leave the area because they were going to spray for spiders. She thought she had a few minutes to finish the bush she was working on, but the person started spraying above her before she left. She began to feel burning in her eyes and throat. A coworker saw the mist around her and shouted to her to leave the area. She developed nausea and vomiting and was hoarse for about three days. Her coworker called poison control the next day.

MI01124 – A pregnant fast-food cashier in her 20s walked around a corner into a mist of a pyrethroid insecticide (signal word: Caution) being sprayed by her manager. She remained in the unventilated area for about an hour, contrary to the product label recommendations. She developed nausea, stomach pain and vomiting; shortness of breath, wheezing, and pain on deep breathing; flushing, sweating, and headache. She went to an emergency department and was admitted overnight. She lost four days of work.

MI01140 – A teenager working on a dairy farm cleaned a wall in the milking room with ammonia water, and then sprayed the wall with a pyrethrin insecticide (signal word: Caution). The next day she developed chills, fever, headache, nausea and diarrhea. She went to her doctor and called poison control.

MI01151 – A maintenance man in his 30s set off an insecticide fogger containing pyrethrins plus pyrethroids (signal word: Caution) in an apartment. He forgot to turn off the smoke detector, which if alarmed, would shut down the elevator for the apartment complex. His supervisor went back in to turn off the alarm, and he went in to help his supervisor. About an hour later, he had an irritated throat and a cough. He called poison control. He and his supervisor spoke to their employer, which now hires a pesticide application company when an application is needed.

MI01152 – A maintenance man in his 40s sprayed an inorganic insecticide (signal word: Caution) in a food manufacturing facility, including some areas with poor ventilation. He became lightheaded and dizzy and went outside for fresh air. He fainted and EMS was called. He

vomited twice in the ambulance and was taken to an emergency department. He also had a headache and shortness of breath. He was diagnosed with inhalation injury and missed 2 ½ days of work.

MI01154 – A female grocery store cashier in her 30s was stocking a shelf, putting new stock behind the old stock, when a can of pyrethroid insecticide (signal word: Caution) fell off the shelf. It splashed on her arms, legs, and clothing. She developed an itching, burning rash and called poison control.

MI01196 – A high-rise window cleaner in his 30s was applying an organophosphorous insecticide (signal word: Warning) after washing the windows. The insecticide was painted on, and some dripped down the paintbrush onto his skin. In addition, he inhaled fumes. He felt dizzy; nauseous; had some difficulty breathing; and his hands were cramping. He called poison control.

Herbicides

MI00928 – A farm worker in his 20s was mixing a chlorophenoxy herbicide (signal word Danger) on his grandfather's farm. He was a registered pesticide applicator. He was not wearing his goggles and a line burst, splashing product in his face and eyes. He washed them immediately and went to an emergency room where he was diagnosed with bilateral corneal abrasions.

MI00929 – A lawn care route manager in his 20s, who is a certified pesticide applicator, was spraying a lawn with a fertilizer and a mixture of herbicides when the trigger got stuck. He loosened the nozzle and spray shot out. He was not wearing the required protective eye wear and got some spray in his eyes, on his face, and in his mouth. He was nauseous and vomited once, his face was itchy and burning, and his eyes were burning, itchy, and tearing. He went to an emergency department.

MI00943 – A worker for a farm chemical supplier in his 20s was transferring glyphosate herbicide from 250 gallon tanks to 2.5 gallon jugs. He developed a headache, nausea, and vomiting, which smelled like the chemical. He went to an emergency room.

MI00952 – A teenage male worker for a lawn care service used an herbicide (signal word: Caution) for about an hour. He developed a headache and vomiting and had to go home. His employer called poison control. It is unknown if he was a certified or registered applicator.

MI00959 – A golf course worker in his 40s spread a combination of fertilizer and chlorophenoxy herbicide (signal word Caution) at a golf course. He began feeling weak, unsteady, and diaphoretic and went to an emergency department. It is unknown if he was a certified or registered applicator.

MI01042 – A farm worker in his 20s used an herbicide on the job. He felt weak, and fainted. He also had nausea and vomiting. He went to an emergency department.

MI01048 – A self-employed gardener in his 50s was pulling weeds that had been treated with a glyphosate herbicide with his bare hands. He then wiped off his drink bottle and drank from it. He started to feel shaky and not himself. He felt palpitations and his mouth was dry. He went to an emergency department.

MI01094 – An intern at a golf course in his 20s, who was a certified applicator, sprayed a pond with two herbicides (signal word for both: Caution). He removed his PPE and was rinsing the tank out when the nozzle on the end of the hose popped off and rinse solution went into his eye. His eye became red and irritated, and his vision was blurry. He went to an urgent care center where he was diagnosed with bilateral corneal abrasions.

MI01159 – A laborer in his 40s was mixing and loading pesticides for a lawn and garden service company without always wearing required PPE. He worked with five different herbicides and developed chest pain; a cough; cold, sweaty hands; nausea; and bradycardia. He went to an emergency department where he was diagnosed with chemical pneumonitis.

Antimicrobials

MI00825 – A bagel shop worker in her 40s was cleaning a toilet bowl that had a disinfectant (signal word Danger) already in it. She added bleach and inhaled the fumes. She was coughing, had difficulty breathing, a sore throat, and her heart was racing. She went to an emergency department. Her symptoms lasted about five days.

MI00835 – A janitor in her 20s was preparing mop water, adding a disinfectant with the signal word Danger. The pump malfunctioned and some splashed in her face. When she wiped it off, some got in her eyes. Her eyes stung, and her face and eyes were red. She went to an emergency department and had a follow-up visit with an ophthalmologist.

MI00877 – A veterinary technician in her 20s was mixing a sterilant, signal word Danger. The manufacturer shipped a different formulation by mistake, and she had not realized this. As she mixed, she noticed fumes and became short of breath with chest tightness and later developed a headache. She went to an emergency department two days later and was diagnosed with reactive airway disease.

MI00890 – A laundry worker in a nursing home in her 50s, was exposed to bleach fumes from an open container that was near a dryer. She had a history of asthma and complained of shortness of breath and then collapsed. EMS was called; they intubated her and took her to a hospital where she was admitted. She never regained consciousness and died five days later. This case was referred to the work-related asthma surveillance and MIFACE programs. The incident was referred by those programs to MIOSHA.

MI00890 – A custodian in a nursing home in his 40s was also exposed to bleach fumes from an open container that was near a dryer (See MI00890 above). He developed shortness of breath and a cough. EMS was called and he went to the emergency department.

MI00912 – A student in her 20s working as a movie theater manager left her water glass sitting at work overnight with water in it. To clean it, she used a diluted quaternary ammonium chloride-based disinfectant (signal word Danger) that is used to clean the counters, ice scoops, and other equipment. She rinsed the glass until there were no soapsuds, but there was a subtle soapy flavor to her water. She drank about half the cup and gradually began to feel sick. She was nauseous, had stomach pain, and lost her appetite for about three days. That night she felt feverish. She called poison control and missed two days of school.

MI00927 – A pet care specialist for a pet-grooming establishment in her 20s was trying to get the cap off a concentrated solution of quaternary ammonium chloride-based disinfectant (signal word Danger). When the cap popped off, some went into her face and eyes. Her eyes were red, irritated, itchy, and tearing. She went to an urgent care clinic where her eyes were rinsed and she was diagnosed with chemical conjunctivitis and superficial bilateral corneal abrasions. She lost one day of work and it took about two weeks for the symptoms to disappear completely.

MI00933 – A groomer at a pet supply store in her 40s was moving a big box of concentrated quaternary ammonium chloride-based disinfectant (signal word Danger). The box had some product that had leaked on the outside. It was slippery, and she dropped it, splashing some directly into her left eye. She immediately washed with an eyewash at work but her eye was burning, tearing, red, itchy, and blurry. She went to an emergency department, where her eye was irrigated. Her sclera and conjunctiva were injected. She had a follow-up appointment with her eye doctor and missed several of days of work.

MI00949 – A woman in her 20s got some quaternary ammonium chloride-based disinfectant (signal word Danger) on her legs. She was not allowed to wash it off and continued working for eight hours. Her legs became red, painful, and blistered. The next day she went to an urgent care where she was diagnosed with chemical burns.

MI00963 – A teenage worker in a fast-food restaurant got some sanitizer in her eye (signal word Warning). She irrigated her eye for about 20 minutes and then went to an urgent care clinic where her eye was irrigated again.

MI00964 – A school employee in her 40s was changing a hose and some quaternary ammonium chloride-based disinfectant (signal word Danger) splashed in her eye. She felt a burning sensation and immediately irrigated her eye. She continued to have some irritation, so went to a clinic where her eye was irrigated again and she was diagnosed with chemical conjunctivitis.

MI00975 – An owner/manager of a bar and grill in his 20s was in the basement doing inventory. A drain had previously backed up, and been cleaned out by a plumber. Then a handyman put down bleach to get rid of the odor. When the dishwasher drained into the drain, the acid detergent reacted with the bleach to form chlorine gas. The owner lost his ability to smell or taste for a few days. He also became lightheaded and developed nausea, headache, and wheezing. He called poison control.

MI01001 – A warehouse clerk in his 20s was adjusting a box on a pallet when it fell and splashed some sodium hypochlorite sanitizer (signal word: Danger) on his leg. His sock was wet about half an hour when he began to feel pain. He went to an occupational health clinic where he was diagnosed with a second-degree burn.

MI01008 – A manager for a fast food restaurant in her 40s was washing towels. She reached up to get down the detergent. A box of powdered bleach sanitizer (signal word: Warning) was on top of the detergent, and some of the powder had come out of the box and went into her eyes. Her eyes were burning and tearing and she had blurry vision. She went to an emergency department and lost one day of work.

MI01013 – A assistant manager in her 20s mopped a floor with a mixture of bleach and ammonia for about 45 minutes. She felt lightheaded, nauseous, had a runny nose and a headache. She called poison control.

MI01051 – A self-employed carpenter in his 30s was working on a house. Someone sprayed the room next to the one he was working in with a disinfectant (signal word Danger) to clean up mold. He felt tired, nauseous, and "high" and went to an emergency department four days later.

MI01056 – A waitress at a sports bar in her 40s drank some bleach (sodium hypochlorite) water that was in a pitcher ready to use for cleaning. The pitcher was next to a pitcher of drinking water. She vomited and her supervisor called poison control.

MI01067 – A teenage lifeguard was adding sodium hypochlorite to a receptacle bin. The chemical in the bin splashed up on him. He was wearing glasses but some went over his glasses and into his eye. His eye became red and swollen, with burning, tearing, and photophobia. He rinsed it at an eyewash station and called poison control because the symptoms continued. He went to an emergency department where his eye was irrigated again.

MI01071 – A female day care aid in her 20s prepared Kool-Aid for the children using tap water, although she and the children had been told earlier to use bottled water that day, because the well was being treated with sodium hypochlorite. She drank a small cup of the Kool-Aid and felt nauseous. She vomited four times and called poison control.

MI01080 – A woman in her 30s mixed bleach and ammonia at work, and then smoked a cigarette. She developed shortness of breath and a cough. She called poison control.

MI01114 – A cook in his 20s checked on the repairs on a dishwasher. A hose came loose and he was splashed in the ear and eyes with a sodium hypochlorite solution. His eyes were red, tearing, and burning, and he had photophobia. He went to an emergency department and then an eye doctor and lost three days from work.

MI01129 – A male school custodian in his 50s accidentally mixed chlorine and muriatic acid in the school pool. He developed skin and eye irritation and went to an emergency department.

MI01138 – A dairy farm worker in his 30s had some sanitizer (signal word: Danger) splash in his face and eye. The eye was immediately irrigated at work, but it continued to burn. The eye was also red and tearing, and his vision was blurry. He went to an emergency department where he was diagnosed with chemical conjunctivitis.

MI01143 – An adult male spilled some sanitizer (signal word: Danger) on his arm, which had a previous wound with blisters and broken skin. The next day the blisters and breaking skin were worse. He called poison control and the manufacturer.

MI01148 – An adult woman rinsed glasses with a diluted disinfectant (signal word: Danger) at work, and then dried them. She did not use gloves. Her skin became blistered, dry, and scaly. She called the manufacturer.

MI01186 – A grocery store worker in her 20s was splashed in the eye with bleach (sodium hypochlorite) when a bottle fell off a shelf. Her eye was red and painful, with some swelling and blurry vision. She called poison control and went to an emergency department.

MI01190 – A woman in her 50s got a splash of sodium hypochlorite disinfectant in her eye at work. It was red and irritated and a friend called poison control.

MI01192 – A man in his 40s was cleaning a house and accidentally mixed chlorine with some acid. A large cloud appeared. He had eye irritation, a cough, and hypoxia. He went to an emergency department.

MI01197 – A hospital housekeeper in her 30s was exposed to a phenolic disinfectant (signal word: Danger). She developed a cough, sneezing, mouth and throat irritation, and dizziness. She went to an emergency department and was admitted overnight for observation.

MI01198 – A hospital housekeeper in her 50s was exposed to a phenolic disinfectant (signal word: Danger) while preparing supplies. She developed a cough, sneezing, mouth and throat irritation, and dizziness. She went to an emergency department and was admitted overnight for observation. (See MI01197)

MI01199 – A hospital housekeeper in her 60s was exposed to a phenolic disinfectant (signal word: Danger). She developed a cough, sneezing, mouth irritation, dizziness and vomiting. She went to an emergency department and was admitted overnight for observation. (See MI01197)

MI01207 – A hair stylist in her 20s got some quaternary ammonium chloride-based disinfectant (signal word Danger) in her eye. It became red and itchy. She called poison control.

MI01208 – A casino dishwasher in his 40s used lime cleaner to clean the water intake on a dishwasher. The cleaner mixed with sodium hypochlorite disinfectants in the dishwasher, creating a cloud of chlorine gas, which he inhaled. He had a history of asthma and developed trouble breathing, so he went outside. An ambulance was called and he was taken to an emergency room. He also had a cough, runny nose, burning throat, headache and nausea. The nausea lasted about two days.

MI01214 – A worker in his 30s mixed bleach with a detergent in a mop bucket. He developed a cough, burning sensation in his throat, and shortness of breath. He called poison control.

MI01216 – A dishwasher at a bakery café in his 20s splashed some quaternary ammonium chloride-based sanitizer (signal word Danger) in his eyes. They became red and irritated. He called poison control.

MI01218 – A bus aid in her 50s was cleaning the back of the bus with a disinfectant (signal word: Warning) while the bus driver was using another cleaner to clean the front of the bus. They usually open the door and two back windows while cleaning, but did not this time. She developed a bad taste in her mouth that lasted two days, and some trouble breathing for a little while. She called poison control.

MI1219 – A nursing home cleaner in her 40s got a splash of a quaternary ammonium chloride sanitizer (signal word Danger) in her eyes. She rinsed it out on site. It became red and itchy and she went to an emergency department where she was diagnosed with chemical conjunctivitis.

Fumigant
MI01194 – A truck driver for a farm in his 40s was transporting a fumigant (signal word: Danger) on a bumpy road. He pulled over to check his directions and noticed that a pipe was loose and the fumigant was leaking out. He tried to fix it and got splashed with it. His skin was burning, red and itchy. He could smell it and had a bad taste in his mouth. He tried to clean off with a vinegar solution and then was taken to an emergency department. He had three to four showers there before his skin stopped burning.

Fungicides
MI00967 – A man in his 50s was exposed to a fungicide (signal word: Caution) while mowing grass 2-3 hours after an apple orchard had been sprayed. He developed a cough that lasted a month, and a dry, painful throat. He went to an urgent care center.

Rodenticide
MI01209 – A juvenile detention center maintenance worker in his 50s opened a bag of a coumarin rodenticide (signal word: Caution). Some of the powder blew into his face and eye, causing his eye to become red and irritated. He went to the detention center nurse.

MI01223 – A hardware store employee in her 60s stocked a rodenticide (signal word: Caution) on a high shelf. She felt a burning sensation in back of nose, then a day or two later her eyes became red, swollen, tearing, and had a gritty feeling. She went to her physician and was diagnosed with conjunctivitis. She also called poison control. Two months later, her eyes were still red and swollen and she was still seeing an ophthalmologist.

Mixtures
MI00981 – A groundskeeper at a theme park in her 20s was applying an herbicide and an algaecide (signal word Danger on both products) to a lake from a boat. She was told to wear gloves, but not long pants. The wind misted the product back onto her bare legs, and about an hour later they began to itch. She then washed them off, but they began to burn and she developed a red rash. She went to an urgent care clinic and was diagnosed with leg burns. The case was referred to MDA because she was neither certified nor registered as a pesticide handler and not under the direct supervision of a certified handler. In addition, she did not wear the protective clothing required by the label.

MI01077 – A man in his 20s, who cleans lakes for a living, spilled some of a combination fungicide/herbicide (signal word: Danger) on himself. He jumped in the lake to wash off, and later took a shower. His scrotum was irritated, so he went to an emergency department where he was diagnosed with a second-degree chemical burn.

Jennifer M. Granholm, Governor
Janet Olszewski, Director

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