Occupational Pesticide Illness and Injury Surveillance in Michigan

June 2001 - December 2003

August 2005

Division of Environmental and Occupational Epidemiology
Michigan Department of Community Health

Jennifer M. Granholm, Governor
Janet Olszewski, Director

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State of Michigan

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Occupational Pesticide Illness and Injury Surveillance in Michigan: June 2001 - December 2003

Summary

This is the first report on surveillance of acute, work-related pesticide illnesses and injuries in Michigan. It summarizes data collected from mid-2001 through 2003. During that time period, 196 individuals were reported with a suspected injury or illness from exposure to pesticides at work. Over 80% of the cases were reported through Michigan's poison control centers. One hundred twenty-eight (65.3%) were confirmed as cases according to the surveillance case definition.

Agriculture and landscaping accounted for over a third of the cases where the industry was known. The occupations most frequently reported were agricultural workers, pest control applicators, and cleaners/janitors/housekeepers. Where the activity of the exposed person was known, over 30% were exposed inadvertently while doing routine work that did not involve pesticide application.

Insecticide exposure accounted for the one case classified as high severity and for over half of the moderately severe cases, even though only 43% of all cases were related to an insecticide exposure.

Three confirmed cases were referred to the Michigan Department of Agriculture (MDA) for investigation of possible pesticide use violations. The number of investigations that are initiated by MDA is expected to increase in the future now that the surveillance system is well established.

Background

In 2001 the Michigan Department of Community Health (MDCH) instituted an occupational pesticide illness and injury surveillance program with financial assistance from the National Institute for Occupational Safety and Health (NIOSH), joining eleven other states who received NIOSH funding and/or technical support for pesticide-related illness and injury surveillance.[1] The surveillance program received an additional five years of funding in May 2005.

MDCH developed this surveillance system because of the recognized need for data on work-related pesticide exposures and adverse health effects in Michigan. Agriculture is the second largest income-producing industry in Michigan, and pesticide use is widespread. The adverse

[1] http://www.cdc.gov/niosh/topics/pesticides/

health effects of pesticides are of concern to workers exposed in agricultural settings. Also of concern is occupational exposure in non-agricultural settings such as landscaping, structural applications, disinfectant use in health care or food service situations, or bystander exposure during workplace pesticide applications.

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).

The goals of the pesticide surveillance system are to characterize the occupational pesticide poisoning problem in Michigan and to take actions to prevent others from experiencing adverse health effects from occupational pesticide exposure. 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, including names, of individuals with suspected or confirmed work-related diseases to the State.

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 required to conduct investigations to address potential violations of pesticide laws.

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 (see Appendix 1) to be included in the surveillance system. Data are collected according to standardized variable definitions in a database developed for states that are conducting pesticide surveillance.

A suspected case is any person reporting an exposure at work to a pesticide product. Individuals 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

exposure occurred, and other details about the incident. When possible, medical records are obtained to confirm and clarify the conditions reported.

Suspected 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. See Appendix 2 for the case classification system. Cases classified as definite, probable, possible, or suspicious are considered confirmed cases.

Confirmed cases are evaluated regarding the severity of the health effect: low, moderate, high and death. The severity index is based on the signs and symptoms experienced, whether medical care was sought, if a hospital stay was involved, and whether work time was lost. For more information see Appendix 3.

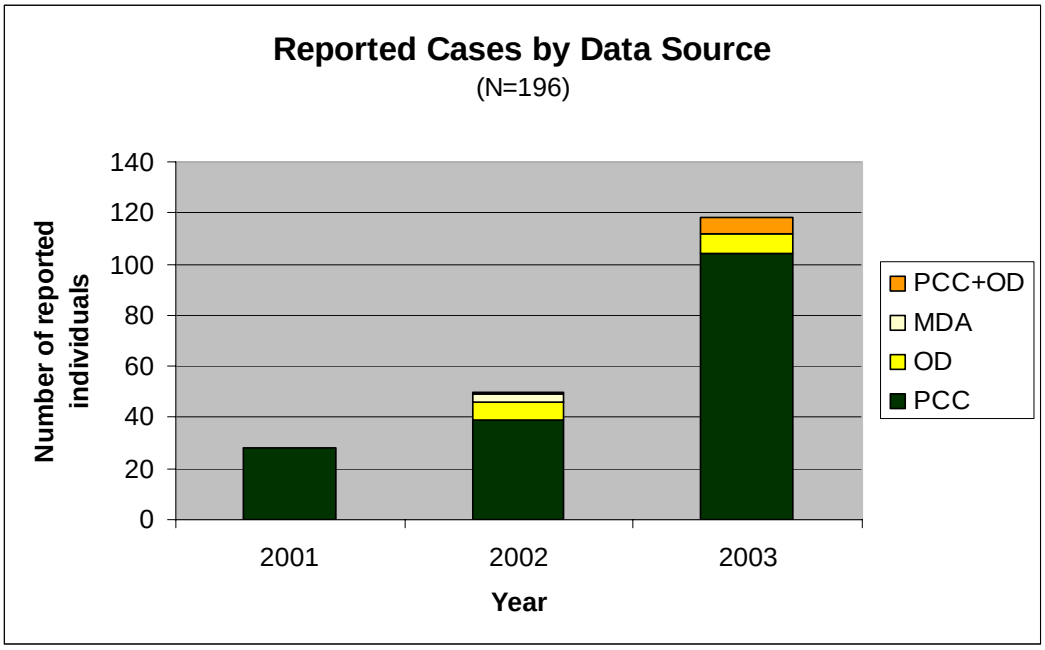
Work sites or work practices where other workers may be at risk are identified. When appropriate, referrals are made to two other state agencies with regulatory responsibility for worker health and pesticide use: the MDA and the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan 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 Environmental Protection Agency's (EPA) Worker Protection Standard, which includes requirements to protect agricultural workers from adverse health effects of pesticides. DLEG enforces MIOSHA standards and performs training in health and safety. If appropriate, MDCH surveillance staff provide educational consultations to reported individuals and their employers about reducing hazards related to pesticide exposures.

Results

Reports

Michigan’s Poison Control Centers (PCCs) began reporting de-identified data on calls from individuals with work-related pesticide exposures in mid-2001. Occupational Disease (OD) cases reported under the Public Health Code and reporting from the MDA pesticide use complaints system began mid-2002, and data from the PCCs began to include names at the end of 2002. PCC case information has been reported electronically since 2003.The distribution of the sources of the reports is shown by year of report in Figure 1. The PCCs are the major source of reports; 171 (87.2%) of cases were reported solely by the PCCs. Seven (3.6%) cases were independently reported by two sources (PCC and an OD report from a health care facility).

Figure 1.



A total of 196 cases were reported in the first 2 ½ years (mid-2001 through 2003) of this surveillance system. Of the reported cases, 128 (65.3%) met the criteria to be considered confirmed cases.

Table 1.

Reported Cases by Classification 2001-2003
(N=196)

Classification	Number	%
Confirmed cases		
Definite	29	14.8%
Probable	20	10.2%
Possible	74	37.8%
Suspicious	5	2.5%
total confirmed	*128*	*65.3%*
Not confirmed		
Unlikely	2	1.0%
Insufficient Information	48	24.5%
Exposed, Asymptomatic	14	7.2%
Unrelated	4	2.0%
total not confirmed	*68*	*34.7%*
Total	196	100.0%

The summary information that follows includes data on the 128 confirmed cases. Appendix 4 contains a brief narrative of each confirmed case.

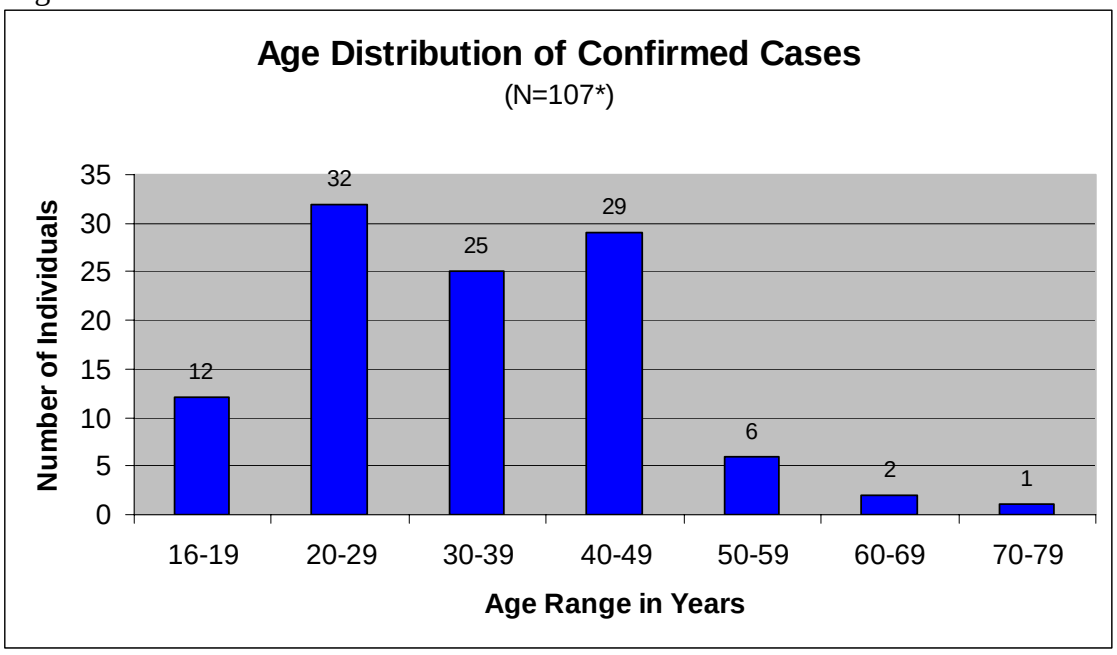
Patient demographics

Gender
For one of the confirmed cases gender was unknown. Of the other 127 persons with confirmed work-related pesticide illnesses or injuries, seventy-eight (61.4%) were men and forty-nine (38.6%) were women.

Race
For the majority (96 or 75.0%) of individuals, race was unknown. Where race was known, 29, or 90.6% were white. Likewise, ethnicity was usually unknown (103 or 80.5% of cases).

Age
The age distribution of the 107 individuals where the age was known is shown in Figure 2. The median age was 34, with a range of 16 to 77.

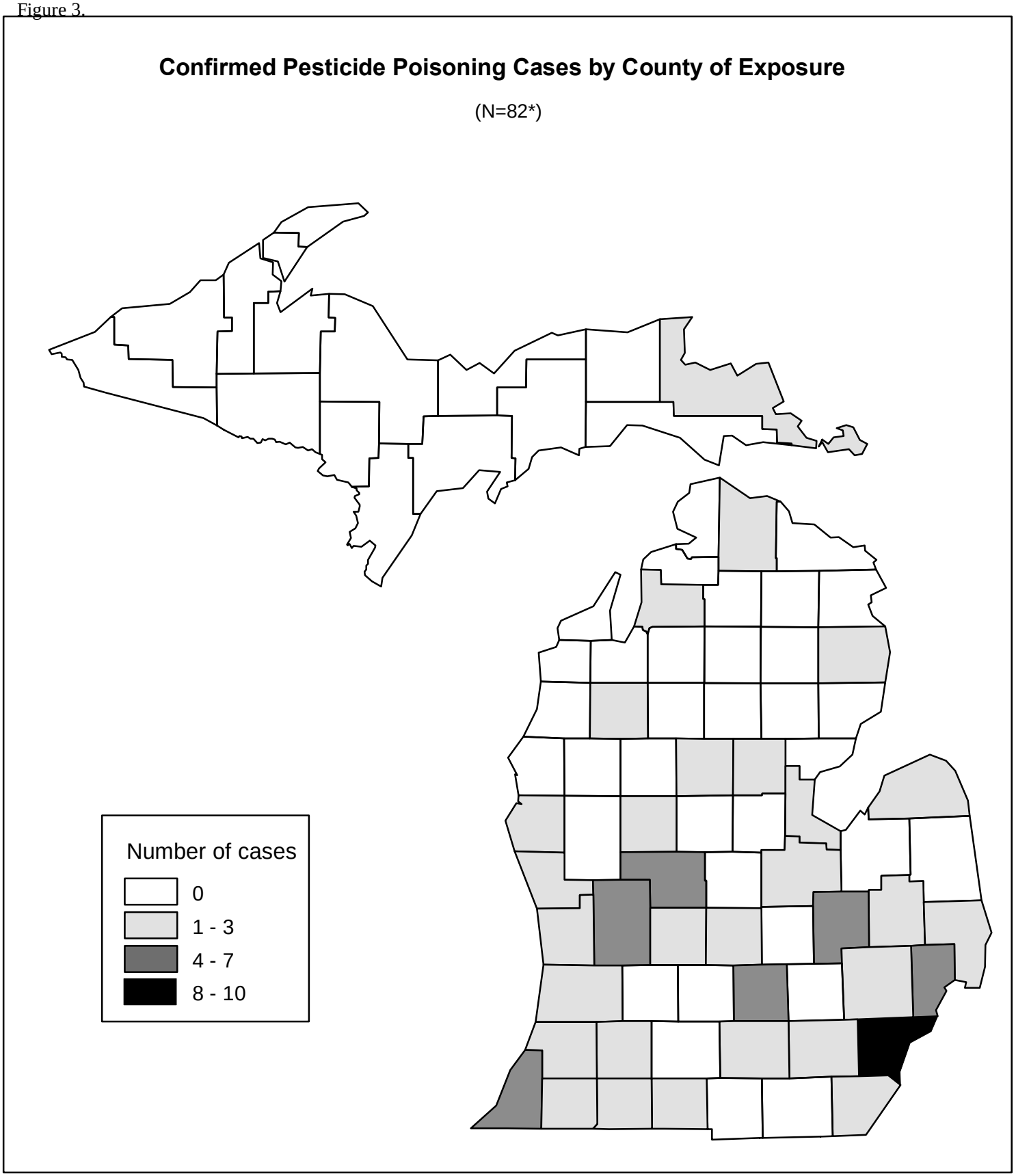
Figure 2.



* Age was unknown for 21 confirmed cases.

Location in State
The county of exposure was unknown for 46 (35.9%) confirmed cases. There were no reported cases in more than half of Michigan's counties (43 of 83 counties), generally the least populous. The two counties with the largest number of confirmed cases were Wayne County (10 or 12.2%) and Kent County (7 or 8.5%). See Figure 3.

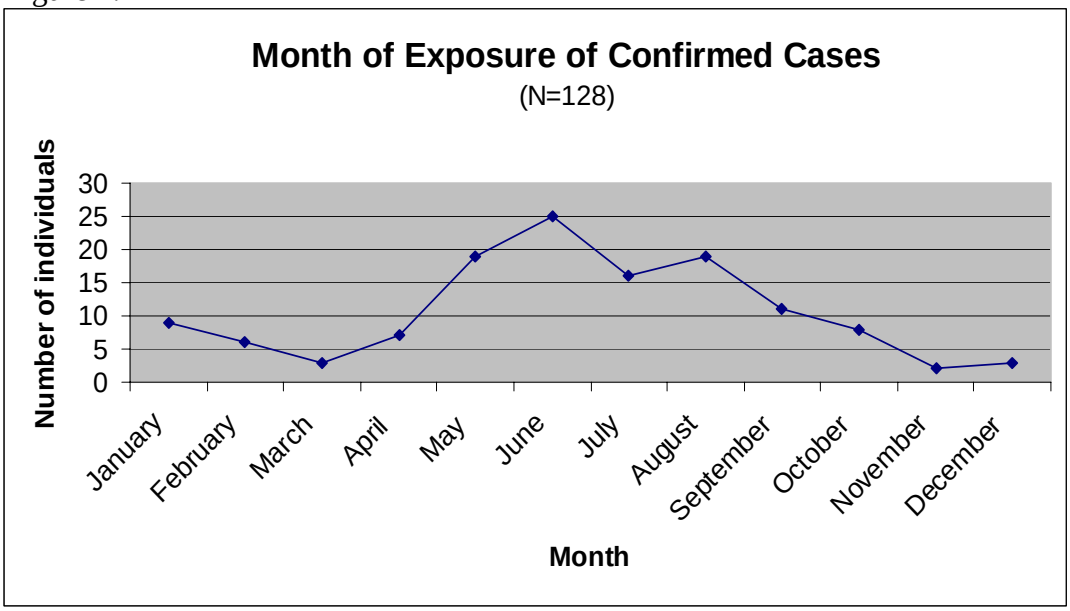
Figure 3.



* County of exposure was unknown in 46 cases.

Month of Exposure
Figure 4 shows that, as might be expected, confirmed cases were more likely to be exposed in the spring and summer months than the winter.

Figure 4.



Industry
The type of industry where individuals were employed provides information on where to target interventions. Industry of employment was known for 75 of the 128 confirmed cases.

Table 2 shows that 15 (20.0%) of the 75 individuals became sick from exposure to pesticides while working in agricultural production or other agricultural services. An additional 13 (17.3%) became ill while working in landscaping or horticultural industries. Eleven (14.7%) were involved in retail trades such as stores or eating and drinking places. These illnesses were the result of spills in stores selling pesticides, worker exposure while using pesticides including disinfectants, and exposure to occupants where pesticides were used in or around the place of employment. Nine (12.0%) workers became ill in hospitals or other health-care related settings. These usually were exposed to disinfectants. Seven (9.3%) became ill while providing services to buildings. These generally involved structural pesticide applicators.

Table 2.

Industry of Confirmed Cases (N=75*)		
Type of Industry	**Number**	**%**
Agriculture	15	20.0%
Landscape and horticultural	13	17.3%
Retail	11	14.7%
Hospitals and health services	9	12.0%
Services to dwellings and other buildings	7	9.3%
Miscellaneous	20	26.7%
Total	75	100.0%

* Industry was unknown for 53 confirmed cases.

Occupation

The occupation of the workers who become ill also provides additional information that may help to direct interventions and activities. For example some of the individuals who became ill on farms were farm workers, while others were pesticide applicators. Likewise, in a hospital setting some affected workers were nurses while others were housekeepers.

Of the 86 confirmed cases for whom occupation was determined, 17 (19.5%) were pesticide applicators, 16 (18.4%) were cleaners/housekeepers, 13 (14.9%) were agricultural workers, 8 (9.2%) were nursery workers or gardeners/groundskeepers and an additional 8 (9.2%) were retail workers.

Table 3.

Occupation of Confirmed Cases (N=86*)		
Occupation	**Number**	**%**
Pest control occupations	17	19.5%
Cleaners/housekeepers/janitors	16	18.4%
Agricultural production	13	14.9%
Nursery/gardeners/groundskeepers	8	9.2%
Retail	8	9.2%
Miscellaneous	25	28.7%
Total	86	100.0%

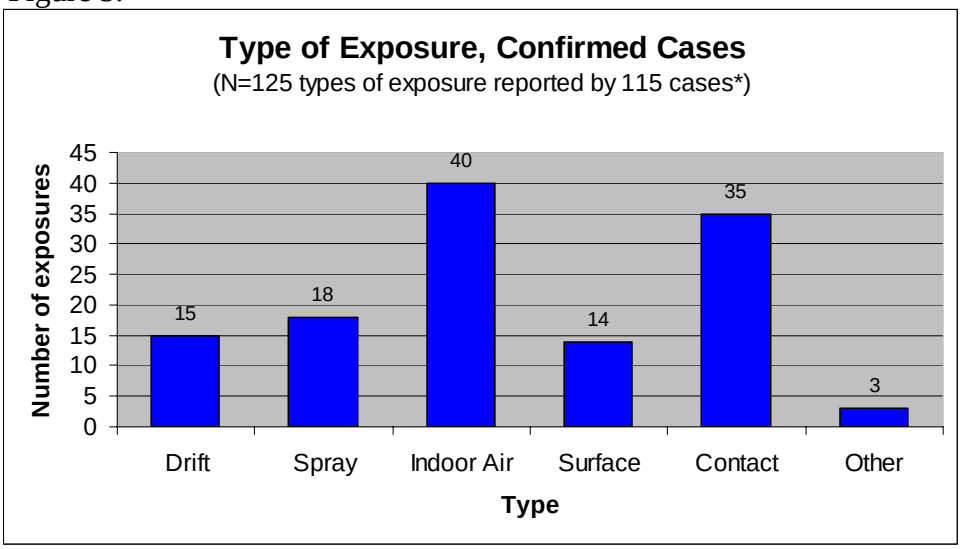
* Occupation was unknown for 41 confirmed cases.

Exposures

Type of Exposure

Figure 5 shows how workers who become ill were exposed to pesticides. Exposure via indoor air accounted for 40 (32.0%) of the types, and direct contact with the pesticide, such as might occur with an accidental spill, accounted for 35 (28.0%). Some workers experienced more than one type of exposure.

Figure 5.

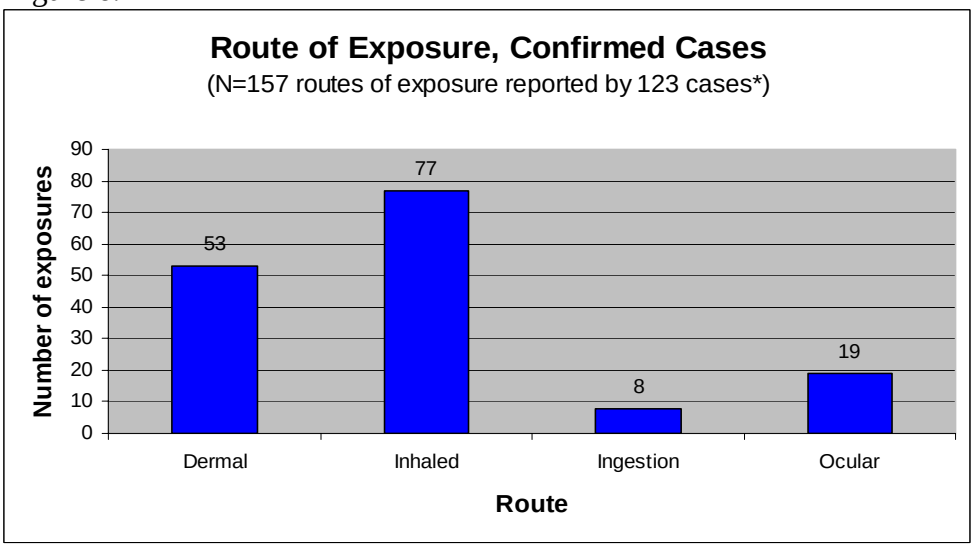


* Type of exposure was unknown for 13 confirmed cases; more than one type is possible per case.

Route of Exposure

Route of exposure indicates how the pesticide entered the body. Figure 6 shows that 123 individuals identified one or more routes of exposure for a total of 157 routes, including 77 (49.0%) inhalations and 53 (33.8%) dermal exposures.

Figure 6.

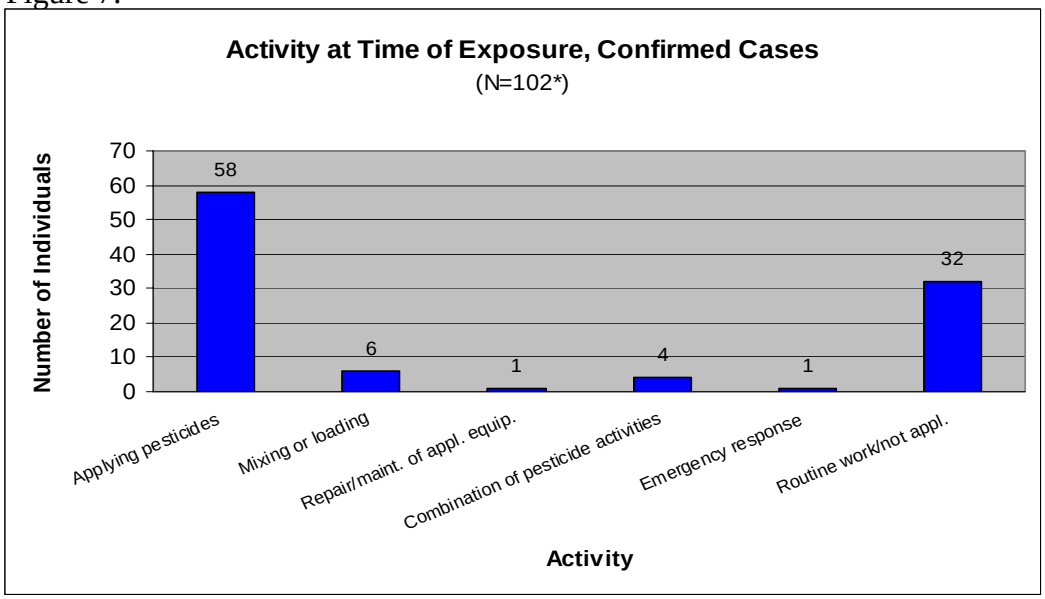


* Route of exposure was unknown for 5 confirmed cases; more than one route is possible per case.

Activity at Time of Exposure

Activity at time of exposure was determined for 102 (79.7%) of the confirmed cases. Of those, Figure 7 shows that 58 (56.9%) individuals who became ill were applying pesticides when they were exposed. Thirty-two (31.4%) were doing routine work activities that did not involve pesticide applications and thus had "bystander" exposure.

Figure 7.



* Activity was unknown for 26 confirmed cases.

Product Used

Among confirmed cases, the largest number of reported exposures, 55 (43.0%), were due only to insecticide use. Eighteen (32.3%) of the 55 insecticide exposures were organophosphates. Disinfectants (28 or 21.9%) and herbicides (27 or 21.1%) account for most of the remaining cases (Table 4). Table 5 shows the severity of the case by the type of product used. Insecticide use accounts for the one case with a high severity and over half (52.4%) of the moderately severe cases.

Table 4.

Product Type, Confirmed Cases
(N=128)

Product Type	Number	%
Insecticide	55	43.0%
Disinfectant	28	21.9%
Herbicide	27	21.1%
Rodenticide	4	3.1%
Fungicide	3	2.3%
Fumigant	2	1.6%
Insect repellent	2	1.6%
Mixtures	7	5.5%
Total	128	100.0%

Table 5.

Severity by Product Type, Confirmed Cases (N=128)						
Product Type	**Low**		**Moderate**		**High**	
	Number	**%**	**Number**	**%**	**Number**	**%**
Insecticide	43	40.6%	11	52.4%	1	100.0%
Herbicide	25	23.6%	2	9.5%	0	0.0%
Disinfectant	25	23.6%	3	14.3%	0	0.0%
Mixtures	4	3.8%	3	14.3%	0	0.0%
Other	9	8.5%	2	9.5%	0	0.0%
Total	106	100.0%	21	100.0%	1	100.0%

Medical Care

Table 6 shows where confirmed cases first sought medical care. Fifty-five (43.7%) of the 126 cases about whom this information was known first sought medical advice from the PCC; many were referred by the PCC to seek additional medical care. Fifty (39.7%) first received medical care in an emergency department or urgent care center, and in some instances medical personnel called the PCC for advice.

Table 6.

First Source of Medical Care, Confirmed Cases (N=126*)		
First care	**Number**	**%**
Advice from Poison Control Center	55	43.7%
Emergency room/Urgent care	50	39.7%
Physician office visit	10	7.9%
Employee health center/occupational health center	6	4.8%
Other (EMS)	2	1.6%
No medical care sought	2	1.6%
Hospital admission	1	0.8%
Total	126	100.0%

* First source of medical care was unknown in 2 cases.

Outreach, education, and prevention activities

To improve awareness of the surveillance program and case reporting, the program developed a brochure, which has been translated into Spanish and is available on the MDCH's website.[2] A staff member of the surveillance program is the MDCH representative on the MDA Pesticide Advisory Committee. Staff regularly attend the Michigan Primary Care Association's Migrant and Seasonal Farmworkers Workgroup. Material on pesticide reporting has been presented to both groups. In addition, surveillance staff visited several migrant health clinics in 2002,

[2] http://www.michigan.gov/mdch-toxics

providing information about the program, pesticide safety, and occupational disease reporting requirements. A reminder letter requesting pesticide illness and injury occupational disease reports was sent to the migrant health clinics in 2003.

In 2003, staff had a booth at the Michigan Agricultural Exposition and distributed information about the surveillance program and fact sheets on a variety of related topics. A survey of attitudes regarding farm safety and health was administered to 767 attendees involved in farming. The top two health and safety concerns were found to be injuries and accidents (495 or 64.2%) and pesticides and chemicals (223 or 29.1%). A poster including these data was presented at the Western Region Agricultural Safety and Health Workshop in 2003 and the Michigan Public Health Association's Epidemiology Conference in 2004.

Additional outreach activities included an article describing the surveillance program and providing preliminary information for "EpiInsight," a newsletter for state and local public health epidemiologists. Surveillance staff also developed a chapter on acute occupational pesticide poisoning for a June 2004 MDCH report, *Profiles of Occupational Injuries and Diseases in Michigan.*[3]

Procedures for referrals to MDA for regulatory investigations were established in 2003, and subsequently three worksites were reported to the MDA. One case involved a 23-year-old woman who had been working for a mosquito control agency for about two weeks. After spraying a larvicide in a swampy area on a breezy day she went to an emergency department with a swollen face and eyes, difficulty breathing, dizziness, and a cough. She was in a training program for registered technicians, working under the direct supervision of a registered technician. MDA cited this as a violation of Regulation 636, Rule 8, Part 4 because she should have been under the direct supervision of a certified applicator during her two week training period. In addition MDA found that the pesticide product was not registered in Michigan at the time it was purchased and used.

The second case referred to MDA involved a 17-year-old sales worker in a greenhouse. She was showing two customers plants in a greenhouse when the owner started spraying. They began coughing and had to leave immediately. She had difficulty breathing, a sore throat, cough, red face and eyes, and tearing. During the MDA inspection, the owner said he hung red danger tape at the entrance to the greenhouse and the employee and customers went under the tape to enter the greenhouse. However, red danger tape does not meet official standards for signage. The inspector cited 13 areas of non-compliance and one area of partial compliance. These included failure to use signs for posting that meet criteria listed in §170.120(c)(1), failure to provide specific information about applications, failure to post or remove signs from the treated area within time constraints, failure to follow label directions regarding Personal Protective Equipment (PPE), failure to provide pesticide safety information to untrained workers, failure to properly train workers every 5 years, and failure to properly train handlers. The inspector went back about two months later and interviewed the owner, a pesticide handler, and two agricultural workers. At that follow-up inspection the owner showed documentation that he had provided pesticide safety training using EPA approved videos. The inspector also observed appropriate

[3] http://www.michigan.gov/mdch-toxics

signage being used, a decontamination area that met all requirements, proper PPE, and documentation that pesticides were being used according to label directions.

A third worksite that was referred to MDA involved a reported case that was not confirmed because the product could not be identified. An 18-year-old stock boy was required to work at his employer's property, spraying for mosquitoes. He developed a sore throat, shortness of breath, nausea, dizziness, and faint wheezing. He said the employer mixed two products, one from an old glass bottle. He asked if he should wear a mask and was told no. He also said that at one point the wind picked up and he got a face full of spray and his employer said he should wash it off by dunking his face in the water he had just sprayed. Because of the irregularities in mixing the chemicals, unavailability of PPE or decontamination facilities, and the employee's concerns that this could happen to other employees, the case was referred to MDA. The inspector told the employer that since the stock boy had been an employee, he should have been a certified applicator. The inspector also discussed the proper use of PPE.

Discussion

In the first two and a half years of occupational pesticide illness and injury surveillance in Michigan, 196 cases were reported to the surveillance system of which 128 (65.3%) were confirmed as acute pesticide illness or injury cases using the published NIOSH case definition. Timeliness and completeness of reporting and data quality improved markedly as the new surveillance system matured.

Pesticide poisoning is a complex condition for surveillance because it encompasses many kinds of illnesses and injuries from skin rash to nerve toxicity. In addition, health care providers receive limited education in the toxic effects of pesticides and pesticide related illnesses are frequently 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, which 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.

Twenty-four percent of exposures occurred among workers in agricultural, horticultural, or gardening occupations and almost 20% occurred among pest control occupations. Illnesses peaked in the summer months, coinciding with peak pesticide application times. Insecticides were the most common cause of illnesses and injuries, involved in over 40% of the cases. They account for a disproportionate number of moderate and high severity cases.

The neurotoxic effects of one class of pesticides, organophosphates, are well known, and this class of pesticides is highly regulated (Strong et al, 2004). The MDCH surveillance system included 18 cases with illness from exposure to organophosphate pesticides and these individuals generally were more likely to have more severe (17 moderately severe and one high severity) illness than those with other types of exposure. It should be noted, however, that case reports encompassed a wide variety of pesticide types, and illnesses were often associated with commonly used, less restricted, products like disinfectants.

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 mimic allergic reactions, heat exposure, or viral infections. In these cases, patients may not seek medical care. Migrant workers face additional barriers such as language difficulties, lack of access to care, and fear of job loss or deportation. When patients do seek medical care, physicians may have difficulty in recognizing the cause of the symptoms, especially if the history taken does not ask about pesticide exposure. 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.

As in many other occupational disease and illness surveillance systems, the Michigan occupational pesticide surveillance data are likely a significant undercount of the true number of work-related pesticide poisoning cases in Michigan. A study done in the State of Washington, (State of Washington, 2004) 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 data quality challenges due to the time lag between the occurrence and the reporting of the incident for occupational disease (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, and has launched follow-up prevention activities. As the system matures, reporting and prevention activities can be expected to increase. Future efforts to expand the system to include non-occupational pesticide injuries and illnesses will be dependent on regulatory changes because current Michigan law only requires reporting of work-related events.

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Additional Resources

NIOSH occupational pesticides surveillance system: www.cdc.gov/niosh/topics/pesticides/

Information on pesticide products: www.cdpr.ca.gov/docs/epa/epamenu.htm

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

Where to report occupational pesticide exposures in Michigan: www.chm.msu.edu/oem

Appendix 1

Case Definition for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System[1]

Clinical Description

This surveillance case definition refers to any acute adverse health effect resulting from exposure to a pesticide product (defined under the Federal Insecticide Fungicide and Rodenticide Act [FIFRA][2]) including health effects due to an unpleasant odor, injury from explosion of a product, inhalation of smoke from a burning product, and allergic reaction. Because public health agencies seek to limit all adverse effects from regulated pesticides, notification is needed even when the responsible ingredient is not the active ingredient.

A case is characterized by an acute onset of symptoms that are dependent on the formulation of the pesticide product and involve one or more of the following:

- Systemic signs or symptoms (including respiratory, gastrointestinal, allergic and neurological signs/symptoms)
- Dermatologic lesions
- Ocular lesions

This case definition and classification system is designed to be flexible permitting classification of pesticide-related illnesses from all classes of pesticides. Consensus case definitions for specific classes of chemicals may be developed in the future.

A case will be classified as occupational if exposure occurs while at work (this includes: working for compensation; working in a family business, including a family farm; working for pay at home; and, working as a volunteer Emergency Medical Technician (EMT), firefighter, or law enforcement officer). All other cases will be classified as non-occupational. All cases involving suicide or attempted suicide should be classified as non-occupational.

A case is reportable to the national surveillance system when there is (see the Classification Criteria section for a more detailed description of these criteria):

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[1]http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_2.pdf

[2]Pesticides are defined under the Federal Insecticide Fungicide and Rodenticide Act (FIFRA) as any substance or mixture of substances intended to prevent, destroy, repel or mitigate insects, rodents, nematodes, fungi, weeds, microorganisms, or any other form of life declared to be a pest by the Administrator of the US EPA and any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant. Pesticides include herbicides, insecticides, rodenticides, fungicides, disinfectants, wood treatment products, growth regulators, insect repellents, etc.

Please note that adverse health effects resulting from exposure to disinfectant products are not reportable in many states because the volume of reports could overwhelm the state's surveillance system; therefore, these cases will not be routinely reported to the national surveillance system. However, states may collect data on health effects resulting from disinfectant exposure, and report relevant cases to the national surveillance system.

- Documentation of new adverse health effects that are temporally-related to a documented pesticide exposure; AND
- Consistent evidence of a causal relationship between the pesticide and the health effects based on the known toxicology of the pesticide from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case series or positive epidemiologic investigations; OR
- Insufficient toxicologic information available to determine whether a casual relationship exists between the pesticide exposure and the health effects

Laboratory criteria for diagnosis

If available, the following laboratory data can confirm exposure to a pesticide:

- Biological tests for the presence of, or toxic response to, the pesticide and/or its metabolite (in blood, urine, etc.);
  - Measurement of the pesticide and/or its metabolite(s) in the biological specimen
  - Measurement of a biochemical response to the pesticide in a biological specimen (e.g. cholinesterase levels)
- Environmental tests for the pesticide (e.g. foliage residue, analysis of suspect liquid)
- Pesticide detection on clothing or equipment used by the case subject.

Appendix 2

Case Classification Criteria[1]

Reports received and investigated by state programs are scored on the three criteria provided below (criteria A, B and C). Scores are either 1, 2, 3, or 4, and are assigned based on all available evidence. The classification matrix follows the criteria section (Table 1). The matrix provides the case classification categories and the criteria scores needed to place the case into a specific category. Definite, probable, possible and suspicious cases (see the classification matrix) are reportable to the national surveillance system. Additional classification categories are provided for states that choose to track reports that do not fit the criteria for national reporting.

A. Documentation of Pesticide Exposure

1. Laboratory, clinical or environmental evidence corroborate exposure (*at least one of the following must be satisfied to receive a score of "1"*):
   a. analytical results from foliage residue, clothing residue, air, soil, water or biologic samples;
   b. observation of residue and/or contamination (including damage to plant material from herbicides) by a trained professional [Note: a trained professional may be a plant pathologist, agricultural inspector, agricultural extension agent, industrial hygienist or any other licensed or academically trained specialist with expertise in plant pathology and/or environmental effects of pesticides. A licensed pesticide applicator not directly involved with the application may also be considered a trained professional.];
   c. biologic evidence of exposure (e.g. response to administration of an antidote such as 2-PAM, Vitamin K1, or repeated doses of atropine);
   d. documentation by a licensed health care professional of a characteristic eye injury or dermatologic effects at the site of direct exposure to a pesticide product known to produce such effects (these findings must be sufficient to satisfy criteria B.1 under "documentation of adverse health effect");
   e. clinical description by a licensed health care professional of two or more post-exposure health effects (at least one of which is a sign) characteristic for the pesticide.

2. Evidence of exposure based solely upon written or verbal report (at least one of the following must be satisfied to receive a score of "2"):
   a. report by case;
   b. report by witness;
   c. written records of application;
   d. observation of residue and/or contamination (including damage to plant material from herbicides) by other than a trained professional;
   e. other evidence suggesting that an exposure occurred.

3. Strong evidence that no pesticide exposure occurred.

[1]http://www.cdc.gov/niosh/topics/pesticides/pdfs/casedef2003_2.pdf

4. Insufficient data.

B. Documentation of Adverse Health Effect

1. Two or more new post-exposure abnormal signs and/or test/laboratory findings reported by a licensed health care professional.

2. At least one of the following must be satisfied to receive a score of “2":
   a. Two or more new post-exposure abnormal symptoms were reported. When new post-exposure signs and test/laboratory findings are insufficient to satisfy a B1 score, they can be used in lieu of symptoms toward satisfying a B2 score.
   b. Any new illness or exacerbation of pre-existing illness diagnosed by a licensed physician, but information on signs, symptoms and/or test findings are not available or insufficient for a B.1 or B.2.a score.

3. No new post-exposure abnormal signs, symptoms, or test/laboratory findings were reported.

4. Insufficient data (includes having only one new post-exposure abnormal sign, symptom, or test/laboratory finding).

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

1. Where the findings documented under the Health Effects criteria (criteria B) are:
   a. characteristic for the pesticide as provided in Appendix 2, and the temporal relationship between exposure and health effects is plausible (the pesticide refers to the one classified under criteria A), and/or;
   b. consistent with an exposure-health effect relationship based upon the known toxicology (i.e. exposure dose, symptoms and temporal relationship) of the putative agent (i.e. the agent classified under criteria A) from commonly available toxicology texts, government publications, information supplied by the manufacturer, or two or more case series or positive epidemiologic studies published in the peer-reviewed literature;

2. Evidence of exposure-health effect relationship is not present. This may be because the exposure dose was insufficient to produce the observed health effects. Alternatively, a temporal relationship does not exist (i.e. health effects preceded the exposure, or occurred too long after exposure). Finally, it may be because the constellation of health effects are not consistent based upon the known toxicology of the putative agent from information in commonly available toxicology texts, government publications, information supplied by the manufacturer, or the peer-reviewed literature;

3. Definite evidence of non-pesticide causal agent;

4. Insufficient toxicologic information is available to determine causal relationship between exposure and health effects. (This includes circumstances where minimal human health effects data is available, or where there are less than two published case series or positive

epidemiologic studies linking health effects to the particular pesticide product/ingredient or class of pesticides.)

Table 1 ~ Case Classification Matrix:

CLASSIFICATION CATEGORIES[2]											
CLASSIFICATION CRITERIA	Definite Case	Probable Case		Possible Case	Suspicious Case	Unlikely Case	Insufficient Information		Not a Case		
									Asymptomatic[3]	Unrelated[4]	
A. Exposure	1	1	2	2	1 or 2	1 or 2	4	-	-	3	
B. Health Effects	1	2	1	2	1 or 2	1 or 2	-	4	3	-	
C. Causal Relationship	1	1	1	1	4	2	-	-	-	-	3

[2] Only reports meeting case classifications of Definite, Probable, Possible and Suspicious are reportable to the National Public Health Surveillance system. Additional classification categories are provided for states that choose to track the reports that do not fit the reporting criteria.

[3] The matrix does not indicate whether asymptomatic individuals were exposed to pesticides although some states may choose to track the level of evidence of exposure for asymptomatic individuals.

[4] Unrelated = Illness determined to be caused by a condition other than pesticide exposure, as indicated by a '3' in the evidence of 'Exposure' or 'Causal Relationship' classification criteria.

Appendix 3

Severity Index
for Use in State-based Surveillance of Acute Pesticide-Related Illness and Injury[1]

Purpose: The purpose of the severity index is to provide simple, standardized criteria for assigning severity to cases of acute pesticide-related illness and injury.

Rationale: It is important to assign a severity category to each case of acute pesticide-related illness and injury. An understanding of illness severity will be useful for evaluating the morbidity of acute pesticide-related illness and injury, for assessing its impact on society, and to assist the targeting of limited intervention/prevention resources toward the most pressing pesticide problems.

Description: This severity index is based upon existing systems for ranking severity of poisonings, including pesticide illness[2, 3, 4, 5]. It takes into account the following: signs and symptoms; whether medical care was sought; whether the individual was hospitalized; and, whether there was lost time from work or usual activities. Severity should only be assigned to acute pesticide-related illnesses or injuries classified as definite, probable, possible, or suspicious. As such, this severity index should be used in conjunction with the Case Definition for Acute Pesticide-Related Illness and Injury Cases Reportable to the National Public Health Surveillance System[6].

This severity index provides standardized criteria to ensure inter-rater uniformity in assigning severity. However, we recognize that this severity index cannot address all conceivable clinical situations. Therefore, it is not realistic to insist on strict adherence to these criteria. The user must be flexible when using this severity index, given that the user will not infrequently need to employ judgment and experience when assigning severity.

A brief description of each of the four severity categories follows.

S-1 Death
This category describes a human fatality resulting from exposure to one or more pesticides.

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[1] http://www.cdc.gov/niosh/topics/pesticides/pdfs/pest-sevindexv6.pdf
[2]AAPCC, 1992. Toxic Exposure Surveillance System (TESS) Manual. American Association of Poison Control Centers, Washington, D.C.
[3]Washington Department of Health, 1999. 1998 Annual Report, Pesticide Incident Reporting and Tracking Review Panel. Washington State Department of Health, Office of Environmental Health and Safety, Olympia, WA.
[4]EPA, 1998. Expanded Explanation for the new FIFRA 6(a)(2)'159.814 (5)(i)(A-E) and (5)(ii)(A-E) Exposure Severity Categories.
[5]Persson HE, Sjoberg GK, Haines JA, de Garbino JP. 1998. Poisoning severity score. Grading of acute poisoning. Clin Toxicol 36:205-213.
[6]NIOSH, 2000. Case definition for acute pesticide-related illness and injury cases reportable to the national public health surveillance system. Cincinnati, OH: National Institute for occupational Safety and Health, Centers for Disease Control and Prevention. 2000. Unpublished.

S-2 High severity illness or injury
The illness or injury is severe enough to be considered life threatening and typically requires treatment. This level of effect commonly involves hospitalization to prevent death. Signs and symptoms include, but are not limited to, coma, cardiac arrest, renal failure and/or respiratory depression. The individual sustains substantial loss of time (> 5 days) from regular work (this can include assignment to limited/light work duties) or normal activities (if not employed). This level of severity might include the need for continued health care following the exposure event, prolonged time off of work, and limitations or modification of work or normal activities. The individual may sustain permanent functional impairment.

S-3 Moderate severity illness or injury
This category includes cases of less severe illness or injury often involving systemic manifestations. Generally, treatment was provided. The individual is able to return to normal functioning without any residual disability. Usually, less time is lost from work or normal activities (= 3-5 days), compared to those with severe illness or injury. No residual impairment is present (although effects may be persistent).

S-4 Low severity illness or injury
This is the category of lowest severity. It is often manifested by skin, eye or upper respiratory irritation. It may also include fever, headache, fatigue or dizziness. Typically the illness or injury resolves without treatment. There is minimal lost time (<3 days) from work or normal activities.

Appendix 4

Case Narratives, Confirmed Cases

Cases reported in 2001

Insecticide Exposures

MI00001 – A 40-year-old woman shampooed a dog with a carbaryl containing flea shampoo at work without wearing gloves. She was exposed for about 20 minutes. The next day her hands were beet red, dry, and tender.

MI00226 – A 41-year-old male worker at a veterinary clinic was exposed to an organophosphate insecticide used to control cockroaches. He had been cleaning the dog runs where the insecticide has been used for 15 years, with gradually worsening symptoms. His symptoms included headaches, dizziness, and memory loss.

MI00193 – A 36-year-old man sprayed pesticides, including at least one insecticide, on a farm. Four months later he had shortness of breath, fluid in his lungs and could not breathe lying on his back (orthopnea).

MI00235 – A 34-year-old man was exposed to an organophosphate and a carbamate insecticide at work and was feeling tired and having tremors in his right arm. The tremors lasted several days.

MI00011 – A 49-year-old male office worker was exposed to an organophosphate insecticide when a coworker used it in an adjacent cubicle. He had a headache and nausea all day.

MI00012 – A 48-year-old woman was exposed to a wasp spray (either an organophosphate or a carbamate) at work. She developed watery eyes, coughing, sneezing, and her equilibrium was off. Several days later she still had a headache, blurred vision and an upset stomach.

MI00010 – An adult male sprayed an organophosphate insecticide on lawns. He developed a headache and nausea.

MI00002 – A 29-year-old male logger felt ill after 10 minutes of exposure to Bacillus thuringiensis that had been sprayed on the trees two days before. The spraying was to control tent worms. He felt tired, had a headache, a heavy-feeling chest, and his eyes were tearing.

MI00004 – A 22-year-old woman was exposed to an aerosol insecticide containing pyrethrins for 5-10 minutes. She felt dizzy and lightheaded, and vomited. The next morning she had a cough, her throat burned, and her lungs hurt.

MI00005 – An adult female home health aide walked into a home where a permethrin and pyrethrin containing insecticide had been sprayed. She started choking and went outside for air. She went back in to care for the patient. After leaving her symptoms worsened and she

experienced coughing, wheezing, and shortness of breath. She went to an emergency department and received two respiratory treatments and other medication.

Herbicide Exposures
MI00238 – An adult male landscaper was exposed to a glyphosate herbicide. The next day he was nauseous and had trouble eating.

MI00013 – A 40 year-old-man inhaled a chlorophenoxy herbicide from a bag at work. He felt dizzy and nauseous.

MI00014 – A 30-year-old woman had an herbicide contact her chest while cleaning up at work. That evening her chest began to itch and she broke out into a rash.

MI00015 – An adult man dumped out a diluted herbicide at work. Some spilled on his leg. He washed within 10 minutes and again in an hour. Later that evening his leg was red and irritated.

MI00009 – A 30-year-old man got a chlorophenoxy herbicide in his eye. His eye became swollen, red, painful, and began tearing. He irrigated it for 15 minutes right away, but the symptoms remained. He went to an emergency department where his eye was irrigated again.

MI00008 – A 23-year-old male pesticide applicator for a lawn company was exposed to two herbicides. He developed itching and irritation to his legs and was seen in an emergency department.

MI00007 – An adult male sprayed a chlorophenoxy herbicide and developed dermal symptoms that night. The next week he went to the ER with a worsening rash on his arm.

Cases reported in 2002
Insecticide Exposures
MI00017 – An adult woman was exposed to an organophosphate insecticide when a contractor sprayed the plants in the atrium of the building where she worked. She and several other persons became ill with symptoms such as nausea, sweating, headaches, shaking, disorientation, numbness, and dizziness. No one sought medical care. MDA investigated the incident and issued a warning letter to the company responsible for the spraying.

MI00019 – A 27-year-old male pesticide applicator for a lawn company had been applying an insecticide for the past 2 weeks. He went to the emergency department with a nauseated feeling in his chest, icy hot sensations radiating through body from his chest, headache, irritability, and fatigue.

MI00046 – A 26-year-old male farm worker was sprayed with an organophosphate insecticide when the line on his sprayer blew. His face was swollen and he had a slight fever, cough, wheeze, and vomiting.

MI00016 – A 47-year-old female pesticide applicator applied a carbamate insecticide wearing a respirator that did not fit well. She had headaches, dizziness, irritated eyes, blurred vision,

nausea, and vomiting. The doctor who evaluated her recommended that she not return to her current work.

MI00025 – A 47-year-old man was exposed to a bug spray at work. Others at the worksite were also exposed. He was coughing up blood, had a headache, shoulder pain, a weak grip in both hands, and was hospitalized for 2 days.

MI00038 - An adult male farmer sprayed his fields with a combination of six insecticides and fungicides. The next week he had a headache, muscle weakness, and felt itchy.

MI00023 – A 50-year-old man exposed to an organophosphate insecticide at work developed a metallic taste in his mouth and fatigue.

MI00018 – A 31-year-old man was exposed to a boric acid roach powder. He developed throat irritation, cough, and a headache.

MI00026 – A 16-year-old man sprayed an organophosphate insecticide on a rooftop and some blew back on him. He had dilated pupils, was confused and lethargic. He was kept in an emergency department overnight for observation.

MI00028 – A 42-year-old woman was sprayed while working with an organophosphate insecticide. She went to an emergency department with irritated, tearing eyes.

MI00041 – A 28-year-old woman got an organophosphate insecticide in her eye at work. The eye was flushed immediately, but became red and irritated.

MI00029 – A 52-year-old man got a pyrethrin wasp spray in his mouth while spraying at work. He rinsed his mouth and went to an emergency department. He had oral irritation and clammy skin.

MI00030 – A 27-year-old man had been using an insecticide on the job. He went to an emergency department feeling tired, weak, with palpitations, chest pressure, left arm numbness, nausea, and headache.

MI00042 – An adult woman was at work when a pest control company sprayed a carbamate insecticide for bees. A small amount of the powder contaminated her cigarette. She took 2-3 puffs and noticed mouth and throat pain, and then felt shaky.

MI00032 – A 29-year-old male pesticide applicator used an organophosphate insecticide to spray apartments. He developed nausea and headache.

MI00048 – An adult man got a carbamate insecticide in his eyes. He rinsed immediately but his eyes were irritated and he had blurred vision.

MI00045 – A 19-year-old male farm worker had been having symptoms at work, but not at home. His symptoms included stomachache, nausea, constipation, vomiting, fever, dizziness,

blurred vision, muscle cramps, and a headache. A blood test showed his cholinesterase level to be below the lab reference range, consistent with organophosphate poisoning.

MI00049 – A 23-year-old female graduate student entered an orchard to check insect traps. The orchard had been sprayed the morning before with a carbamate insecticide and a fungicide. She had a headache, fatigue, and decreased alertness and concentration.

MI00056 – An adult man was at work when someone discharged a pyrethroid insecticide fogger. He had some shortness of breath and nasal irritation.

MI00160 – An 18-year-old male pesticide applicator was spraying a pyrethroid insecticide for mosquitoes. Several times a week spray would blow back on his face and he would develop a painful, burning rash.

MI00157 – A 29-year-old male irrigation worker got a pyrethroid insecticide on his head and arm from a pesticide application going on where he was working. His arm initially burned but the burning went away after he washed it. He then developed a headache.

MI00053 – A 19-year-old man had been working with a carbamate insecticide all summer. He had diarrhea and vomited one time.

MI00054 – A 16-year-old male roofer was sprayed in his face with a pyrethroid wasp spray when the wind changed direction. He felt dizzy, lightheaded, and his face was numb.

MI00190 – A 35-year-old female security guard went to the bathroom after it had been sprayed with a pyrethrin insecticide because she did not notice the sign on the door saying it had been sprayed. She had palpitations that day and later that week was anorexic.

Herbicide Exposures
MI00020 – A 40-year-old male farm worker was in a field that had been sprayed with herbicides the day before. He developed a rash on his face and his eyes were swollen and irritated.

MI00021 – A 53-year-old female secretary was sent outside to cleanup and spray bushes with a glyphosate herbicide for 5 hours. She went to an emergency department hyperventilating, with tachycardia, chest tightness, a cough, pain on breathing, and feeling numb and tingly all over.

MI00022 – A 48-year-old man inhaled fumes from mothballs at work. He had a cough and a unpleasant odor in his nostrils.

MI00036 – A 65-year-old man was spraying a glyphosate herbicide in a field when the wind shifted. He developed wheezing and shortness of breath.

MI00039 – A 40-year-old male farmer sprayed a paraquat herbicide wearing protective clothing. The next day he had a sore chest and arm and black stools.

MI00040 – A 20-year-old was sprayed with a paraquat herbicide. He showered immediately for 30 minutes but had vomiting and diarrhea for a couple of days.

MI00027 – A 32-year-old man had a glyphosate herbicide powder sprayed on his face. His face was red and irritated.

MI00044 – An adult man had skin contact with a mixture of herbicides (chlorophenoxy and glyphosate). He did not wash his hands and developed a rash. He had also became fatigued.

MI00043 – A 40-year-old woman sprayed a sidewalk for weeds at work using a glyphosate herbicide. She developed diarrhea and one episode of vomiting.

Other Exposures
MI00035 – An adult female cashier reported that mothballs had been put in the checkout lanes some time ago. She worked in a lane that had not been cleaned out and felt nauseous, lightheaded, and had chest discomfort.

MI00037 – An adult man was exposed to a fungicide at work. He had a cough and shortness of breath. The doctor at the urgent care center spoke to the employer and recommended the use of a mask to prevent future exposures.

MI00034 – A 39-year-old male carpenter tearing down a roof was exposed for several days to chewed up boxes of an anticoagulant rodenticide. His face felt tight and was red and puffy. He also felt fatigue, nausea, chills, diarrhea, and a clenching stomach.

MI00047 – A 27-year-old woman opened a box of an anticoagulant rodenticide at work and a dry powder blew in her face. She developed a headache right away and the next day had a cough, fever, and chest congestion.

MI00050 – A 44-year-old female clerk at a bread outlet store was exposed to an anticoagulant rodenticide at work. She felt achy for several days after the pesticide applications, had a scratchy throat, repeated sneezing and a bloody nose.

MI00051 – Another adult female employee of the same bread outlet store experienced headache and sneezing as well.

Cases reported in 2003
Insecticide Exposures
MI00060 – A 38-year-old female maintenance worker at a discount store moved liquids containing insecticides and fungicides from bins and inhaled fumes. She was nauseous and her hands felt as if they were burning under the skin although there was no visible sign of irritation.

MI00063 – A 17-year-old man working on a roof inhaled a pyrethroid insecticide. He had a sore throat and was congested.

MI00064 – A 48-year-old male farmer used a pyrethroid insecticide for two days. His face was red, swollen, and burning (felt like it was ‘on fire’).

MI00066 – A 45-year-old man inhaled a pyrethroid insecticide for about 25 minutes. He had increased respiration and a tingling sensation.

MI00068 – A 35-year-old man inhaled a boric acid containing insecticide while applying it to control roaches. His throat and lungs were irritated.

MI00067 – A 41-year-old male employee of a coop elevator had an organophosphate insecticide splash in his eye. He irrigated his eye at work, and it was irrigated again in an emergency department. His eye was irritated, and he had a corneal flare.

MI00189 – A 33-year-old female delivery person unloaded boxes containing an organo-phosphate insecticide and noticed that the bottom boxes were crushed. She had a headache and was nauseous.

MI00080 – A 25-year-old male correctional facility worker was exposed to an organophosphate bug spray in a closed room. He had a headache, nausea, vomiting, diarrhea, irritated eyes, cough, and chest tightness.

MI00081 – A 54-year-old female employee of the same correctional facility was also exposed to the bug spray. She had a headache, nausea, vomiting, diarrhea, burning eyes, itchy skin, nosebleed, cough, sore throat, chest tightness, and shortness of breath.

MI00085 – A 37-year-old male exterminator sprayed a pyrethroid insecticide outside when the wind changed and some sprayed on his face. He had a rash and swelling around his eyes and his face felt burnt.

MI00156 – A 57-year-old male greenhouse owner sprayed an insecticide on potted plants in the evening. The next morning he went into the greenhouse and felt dizzy and developed a headache.

MI00084 – A 23-year-old woman spraying for mosquitoes developed difficulty breathing, swelling of her face and eyes, trouble swallowing, dizziness, sore throat, chest pain, and a cough. This case was referred to MDA, and they found that the employee was not certified or registered to apply pesticides and was not working under the direct supervision of a certified applicator. In addition, the pesticide used was no longer registered in Michigan.

MI00140 – A 36-year-old female supervisor at an ice cream store came to work shortly after the premises had been sprayed with a pyrethroid insecticide. She did not smell it, but after an hour or so she developed some wheezing and shortness of breath and felt lightheaded.

MI00138 – A 49-year-old man was cleaning a building and accidentally used a carbamate insecticide instead of a cleanser. His voice changed, he was dizzy and disoriented, coughing, had chest discomfort, shortness of breath, and increased urination.

MI00094 – A 46-year-old male greenhouse owner splashed a pyrethroid insecticide on his face. His face, neck and chest were red and he felt an intense burning sensation.

MI00096 – An adult male nursery worker was exposed to an insecticide and a fungicide for about 10 minutes. He became very nauseated and vomited.

MI00124 – Another adult male was also exposed at the same time as the previous case to the same insecticide and fungicide at the same nursery. He also became nauseous and vomited.

MI00087 – A 42-year-old male truck driver hauled what his manifest said was a non-hazardous cargo to a dumpsite in Michigan. At the dumpsite he took a sample of what he'd been carrying to the lab for testing as required by the dumpsite. He wore gloves but no other PPE. He then dumped his load, wearing full PPE, and before he could leave the site he became too sick to drive. He was nauseous, vomiting, and in a lot of pain. He later found that his load was contaminated with a carbamate insecticide.

MI00099 – A 34-year-old female payroll employee worked in a building infested with mites. The exterminator would not come because they had not been paid for previous work. A coworker sprayed with a pyrethroid insecticide. She developed a cough, shortness of breath, headache, and numbness in her legs. She said other coworkers also had sore throats and headaches.

MI00134 – A 47-year-old man splashed a pyrethroid insecticide in his eyes when loading it onto a helicopter. He had eye spasms, pain, and conjunctivitis.

MI00102 – A 77-year-old male farmer was using a carbamate insecticide to spray a soybean field for bugs. He was fixing a malfunctioning nozzle and some splashed on his arm. He did not wash it off for half an hour. He developed nausea and dizziness.

MI00100 – A 35-year-old male school principal sprayed the school grounds for bees with a pyrethroid insecticide. The nozzle popped out and some sprayed in his eyes. He experienced pain and conjunctivitis.

MI00115 – A 26-year-old firefighter inhaled fumes from a pyrethroid insecticide when responding to a call involving a pest control company truck where about 100 gallons of the insecticide spilled. He experienced stomach pain, nausea, vomiting, a cough, trouble breathing and tachycardia

MI00106 – A 36-year-old man was stacking bags of an organophosphate insecticide in a retail store. He developed many symptoms, including eye irritation, coughing, lung irritation, nausea, diarrhea, and insomnia.

MI00098 – A 26-year-old migrant farm worker applied an organophosphate insecticide. The wind shifted and he inhaled spray. He developed a headache, nausea, vomiting, congestion, shortness of breath, tearing, dizziness, and generalized weakness.

MI00110 – A 17-year-old female sales worker entered a greenhouse where an insecticide was being sprayed. She developed a sore throat, cough, difficulty breathing and red face and eyes. Upon referral by MDCH, MDA conducted an inspection that resulted in 14 citations for noncompliance or partial compliance of regulations, mostly related to lack of training and posting. On a follow-up visit a few months later, the greenhouse had provided pesticide safety training, improved the protocol for notifying workers of applications, had EPA approved warning signs, and were in compliance with all regulations.

MI00122 – A 25-year-old male cleaner sprayed a basement for spiders with a pyrethroid insecticide. He developed shortness of breath and wheezing.

Herbicide Exposures
MI00058 – A 24-year-old male farm worker put a gloved hand to his face and chest. Three different herbicides may have been on the glove. He developed severe dermatitis.

MI00061 – A 19-year-old female greenhouse worker applied an herbicide for about 30 minutes. The next morning she woke up with a headache, sweats, sore and achy all over, crampy and feeling faint.

MI00069 – A 20-year-old man mixed chlorophenoxy and glyphosate herbicides with oils without wearing a mask or gloves. The nozzle sprayed in his face. He developed nausea, vomiting, and chest pain.

MI00078 – A 24-year-old male farm worker was exposed to two herbicides while picking asparagus. He urinated frequently, had a rash, felt dizzy and weak, nauseous, and had a headache.

MI00083 – A 49-year-old male worker in a general merchandise store cleaned up a spill of three herbicides. He experienced bronchospasm and diaphoresis.

MI00148 – An adult was exposed to a chlorophenoxy herbicide that was sprayed near an air conditioner and entered through the ventilation system. This person had a headache and vomited. Five other employees were also exposed.

MI00092 – A 22-year-old male landscaper was spraying an herbicide for two days. He had a red, itchy face.

MI00086 – A 43-year-old male owner of a used vehicle business sprayed a glyphosate herbicide around the building. The wind blew some back in his face. About 30-45 minutes after he stopped spraying he developed shortness of breath, sore throat, chest pain, and fatigue.

MI00135 – A 28-year-old male was exposed to an herbicide mixed by his company. He was nauseous and vomited.

MI00112 – A 22-year-old man sprayed a glyphosate herbicide for two hours at work. He was nauseous, had dry heaves, and his skin itched.

MI00105 – A 20-year-old male migrant worker used a concentrated glyphosate herbicide. He was shaky, nauseous, and had a low-grade fever.

MI00116 – A 49-year-old woman was splashed with a glyphosate herbicide. Her skin peeled and flaked for over three months.

Disinfectant Exposures
MI00070 – An adult female housekeeper at a hospital had a rash on her arm and neck after using ammonium disinfectants.

MI00072 – A 22-year-old woman had been working with an alcohol disinfectant for two years. She gradually became wheezy and developed boils under her skin.

MI00074 – An adult female food service worker at a school splashed an ammonia-based disinfectant in her eye while trying to refill a container. Her eye was red and irritated.

MI00073 – A 28-year-old woman splashed a hypochlorite disinfectant in her eye. It was red, swollen, and tearing.

MI00075 – An adult man opened a container of an ammonia-based disinfectant at work and some splashed into his face and eyes. His face was red and face and eye were irritated.

MI00077 – An adult woman working in a doctor's office had a splash of an aldehyde disinfectant to her eye. Her eye was red and irritated.

MI00221 – An adult female ER technician had a can of an aldehyde disinfectant explode in her hands. She had no dermal reaction but her eyes were irritated and she had a cough from the fumes.

MI00222 – An adult male ER technician was also present when the disinfectant can exploded. The fumes irritated his eyes and throat and caused him to cough. He was prescribed a nebulizer.

MI00213 – A 28-year-old man washed walls in a bathroom that had been burned using a hydrochloric acid and phenol-containing product, for about 15 minutes without a mask. He became dizzy and lightheaded.

MI00214 – A 39-year-old female custodian mixed three disinfectants, one of which was a hypochlorite to clean a bathroom in a school. She developed a cough, head congestion, dizziness and a headache. The cough and congestion lasted about two weeks.

MI00071 – A 34-year-old female nurse walked into a room where disinfectants had been used. She felt a burning sensation in her nose and throat and developed shortness of breath.

MI00076 – A 42-year-old man cleaned up a spill of an aldehyde disinfectant in the operating room of a hospital. He inhaled fumes for about an hour and developed nausea, a headache, and eye irritation.

MI00196 – A 60-year-old male butcher was exposed to a hypochlorite disinfectant at work. He needed two breathing treatments over a two-week period and his x-ray showed possible pneumonitis.

MI00212 – An adult woman splashed a hypochlorite disinfectant in her eyes. She rinsed the left eye at work but the right eye was red and irritated.

MI00218 – A 47-year-old woman got a drop of quaternary ammonia disinfectant in her eye. Her eye was painful and she had a corneal abrasion.

MI00215 – A 19-year-old female convenience store employee had a splash of disinfectant containing ammonia and pine oil to her eye. Her eye was red, swollen, with blurry vision and irritation. She continued to have blurry vision two days after exposure.

MI00198 – A 23-year-old female school janitor reached for a bottle of an ammonia-based cleaner. The top was not on and some splashed in her eye. Her eye was painful and tearing.

MI00197 – A 42-year-old female housekeeper in a hospital got an ammonia-based disinfectant on her mouth. Initially her mouth was swollen and she had a burning sensation. A week later she still had a tingling sensation.

MI00195 – An adult female custodian splashed an ammonia-based disinfectant in her eye. Her eye was painful, red, and tearing.

MI00194 – A 19-year-old female was cleaning a bathroom with a hypochlorite-based disinfectant with the door closed. She became short of breath and her lungs hurt. She also felt a little wheezy. EMTs were called and gave her oxygen.

MI00178 – A 35-year-old female housekeeper in a hospital was exposed to an ammonium-based disinfectant. She developed a red, itchy rash.

MI00217 – An adult woman was cleaning a bathroom in a factory. A chunk of the crystalline disinfectant block broke off and hit her in the eye. Her eye was irritated and burning.

MI00206 – A 20-year-old male dishwasher’s hand came into contact with concentrated iodine and phosphoric acid containing detergent. His hands were red and itchy.

MI00209 – An adult woman used a hypochlorite-based disinfectant to clean. She developed a cough and had red, painful eyes.

MI00208 – An 18-year-old woman used a hypochlorite-based disinfectant at work. She was nauseous, had difficulty breathing, her chest felt heavy, and she developed a cough. In addition, her hands were red and irritated.

MI00199 – A 16-year-old male teenager mixed two products to clean a restaurant floor. The two products reacted to release chlorine gas. He was dizzy, coughing, and had difficulty breathing.

MI00201 – A 46-year-old woman cleaned the floor with a mixture of ammonia and a hypochlorite, releasing chloramine gas. She developed a cough, had a tight feeling in her chest and tachycardia.

MI00171 – A 32-year-old female building cleaner splashed a disinfectant in her eye. Her eye was irritated and she had a corneal abrasion.

MI00169 – An adult woman used toilet bowl cleaners and disinfectants. Her fingers became swollen and white around the knuckles.

Other Exposures
MI00052 – A 43-year-old man was exposed to a fungicide at work. He had two welt-like areas on his arm and one on his leg. He was treated for chemical burns.

MI00062 – A 30-year-old man was using a fumigant at work for three days. He had a headache, nausea, chills, and postnasal drainage.

MI00082 – A 59-year-old female secretary was exposed to fumes from a nearby burning grain elevator for about 5 hours. The elevator contained a fungicide. Her nose and throat felt raw, she had a headache and shortness of breath.

MI00141 – A 30-year-old male builder was building two basements using pressure treated foundation lumber, which has a higher CCA (Copper, Chromates and Arsenic) concentration than regular pressure treated lumber. After cutting wood for two to three weeks he had a rash, his skin hurt, he had chills, a fever, and no energy.

MI00104 – A 46-year-old male pesticide applicator sprayed in a cornfield. Over a period of several weeks he was exposed to several insecticides, an herbicide, fungicides, and a disinfectant. His symptoms included nausea, vomiting, diarrhea, stomach pain, aching joints, burning with urination, cyanosis, pain with deep breathing, wheezing, sweating, fever, eye pain with scleral irritation and cobblestoning in the conjunctiva, and a headache. He was taken off work on two occasions for a few days.

Jennifer M. Granholm, Governor
Janet Olszewski, Director

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