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2008 ANNUAL REPORT

TRACKING WORK-RELATED ASTHMA IN MICHIGAN



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Work-Related Asthma Surveillance Program

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There are many resources available to help employers, employees, health care professionals and others understand more about work-related asthma. Links to these resources can be found at: www.oem.msu.edu.

Summary

This is the 18th annual report on work-related asthma (WRA) in Michigan.

There have been eight Michigan WRA deaths since 2003.

Most recently, in 2008 a man in his 50s died from WRA af-

Acronyms

OA Occupational Asthma

AA Work-Aggravated Asthma

POA Possible Occupational Asthma

RADS Reactive Airways Dysfunction Syndrome

MDELEG MI Department of Energy, Labor & Economic Growth

MIOSHA MI Occupational Safety & Health Administration

NAICS North American Industrial Classification System

NIOSH National Institute for Occupational Safety & Health

PEL Permissible Exposure Limit

REL Recommended Exposure Limit

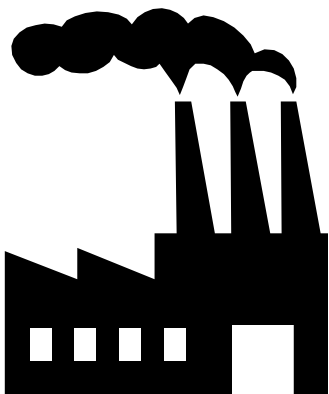


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Thanks to the commitment of those health care providers who understand the public health significance of diagnosing a patient with an occupational illness, as well as the Michigan employees who took the time to share their experiences about their work and subsequent development of work-related asthma.

ter working for three months at a factory that made brakes for airplanes and helicopters. He was a machinist, performing grinding of metal parts. He was exposed to metal-working fluids. He had never been diagnosed with

asthma prior to this job. He went to the emergency department and was subsequently hospitalized and placed on a ventilator for one month before he died. He died four months after beginning to work at this factory.



There are over 350 known asthma-causing agents used in the workplace. Thousands more substances have not been evaluated for their asthma-causing potential.

Summary, continued...

- ◆ On average, 148 new cases of WRA are reported to MDELEG each year.
- ◆ From 1988-2008, 2,765 WRA cases have been identified through the MI tracking system.
- ◆ We estimate there are 65,000-97,000 adults in MI with WRA.
- ◆ 86% of the MI WRA patients have new-onset asthma; 14% have pre-existing asthma aggravated by an exposure at work.
- ◆ MIOSHA enforcement inspections at the workplaces reveal that, on average, one out of every five fellow workers has asthma or respiratory symptoms compatible with asthma.
- ◆ Isocyanates-14%, and metal-working fluids-11%, are the most commonly reported exposures causing WRA in MI.
- ◆ About 1% of the MI workforce is employed in manufacturing where isocyanates are used.
- ◆ The average incidence rate of WRA among African Americans is 2.1 times greater than that of Caucasians.

Background

In 1988, the State of Michigan instituted a tracking program for WRA with financial assistance from NIOSH. This is a joint project of MIOSHA (DELEG) and Michigan State University (MSU), Department of Medicine, Division of Occupational and Environmental Medicine.

The reporting of an index patient is a sentinel health event that may lead to the identification of employees from the same facilities who are also at risk of developing asthma or who have developed similar breathing problems. The goal is to prevent WRA through the identification of these index patients.

Work-Related Asthma Tracking Procedures...

SOURCES TO IDENTIFY PATIENTS

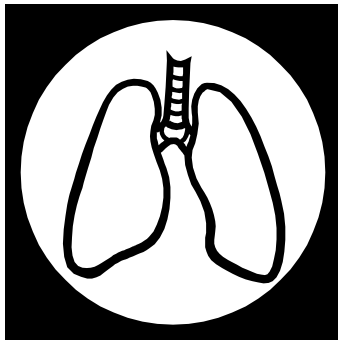
Patients are identified through mandatory reporting of any known or suspected occupational illnesses, including WRA.

- ◆ **Health Care Providers** Private practice, working for industry
- ◆ **Hospitals** ICD-9 506.0-9 & 493, workers' compensation payer
- ◆ **Workers' Compensation Agency**
- ◆ **Poison Control Centers**
- ◆ **Reports from Co-Workers or MIOSHA Field Staff** confirmed by a health care provider
- ◆ **Death Certificates**

Part 56 of the Michigan Public Health Code requires the reporting of all known or suspected occupational illnesses or work-aggravated health conditions to the Michigan Department of Energy, Labor & Economic Growth within 10 days of discovery.

WRA Tracking Procedures in Michigan

IDENTIFY PATIENTS	INTERVIEW PATIENTS	WORKPLACE INSPECTION	FOLLOW UP ACTIVITIES
<ul style="list-style-type: none"> ◆ Review OD Reports Submitted to MDELEG ◆ Known or Suspected Work-Related Asthma ◆ Letter to Patient 	<ul style="list-style-type: none"> ◆ Telephone Interview -Medical and work history ◆ Obtain Medical Records -Breathing test results ◆ Physician Review 	<ul style="list-style-type: none"> ◆ Inspection Referral -MIOSHA determines inspection type ◆ On-Site Inspection -Assess exposures, conduct air monitoring -Injury & Illness Log -MSU interviews workers -Evaluate medical program ◆ Off-Site Inspection -Company addresses issues -MSU interviews co-workers -Report to company and MIOSHA 	<ul style="list-style-type: none"> ◆ Inspection Results -Company -Workers -Reporting Physician ◆ Letters to Individual Co-Workers -See doctor if breathing problems reported during interview ◆ Analyze Data -Annual Report -Other outreach & educational materials



INTERVIEW PATIENTS

A telephone interview with the suspected WRA patient is conducted, and medical records are obtained, including any pulmonary function test results. A board-certified internist and occupational medicine physician reviews all collected information.

WORK-RELATED ASTHMA REQUIRES

- A) Physician diagnosis of asthma.
- B) Onset of respiratory symptoms associated with a particular job that resolve or improve away from work.
- C) Work with a known allergen, or an association between work exposure and a decrease in pulmonary function.

THESE ARE THE SUBCATEGORIES OF WRA

New Onset

- 1) Occupational Asthma (OA) if A), B), and C) are met.
- 2) Possible WRA (POA) if only A) and B) are met.
- 3) Reactive Airways Dysfunction Syndrome (RADS) if symptoms develop after an acute exposure.¹

Exacerbation

- 4) Work-Aggravated Asthma (AA) if had asthma in 2 years prior to job, but asthma worsens at work.

15% of all adult asthma is attributed to exposures to asthma-causing agents in the workplace.

Workplace Inspections



Wheat flour is an allergen that can cause Bakers' Asthma, affecting workers in bakeries as well as in institutional food manufacturing facilities.

After the patient interview is completed and the work-relatedness is determined, a MIOSHA workplace enforcement inspection may be conducted, or the patient's company may be directed by MIOSHA to conduct their own investigation.

With Either Approach:

- ◆ Co-workers are interviewed to determine if other individuals

are experiencing similar breathing problems from exposure to the allergen.

- ◆ Air monitoring for any suspected allergens is conducted.
- ◆ The company's health and safety program is reviewed.

After the investigation is complete, a report of air sampling results and any recommendations is sent

to the company and made available to workers. A copy of the report is also sent to the reporting physician.

OTHER FOLLOW UP ACTIVITIES

Outreach, educational activities, and recommendations may be developed based on the findings. An annual report summarizing the activity is completed each year.

Results

The following sections report the cumulative results of WRA surveillance from 1988 to date.

REPORTS

Table 1 shows that 2,765 people were confirmed with WRA between 1988—2008. The reports are divided into: occupational asthma (OA), possible occupational asthma (POA), aggravated asthma (AA) and Reactive Airways Dysfunction Syndrome (RADS). Eighty-nine additional patients have been confirmed since last year's report. Figure 1 shows the overlap of the patients by reporting sources, for 1988—2007.

TABLE 1
Number of Confirmed Cases of Work-Related Asthma by Year and Type
Disease Status

YEAR	OA	POA	AA	RADS	TOTAL
1988	23	7	0	1	31
1989	43	12	3	5	63
1990	87	35	14	8	144
1991	55	30	14	16	115
1992	82	36	14	18	150
1993	75	69	13	19	176
1994	65	59	15	13	152
1995	57	34	19	17	127
1996	61	59	24	11	155
1997	53	74	19	16	162
1998	46	74	18	9	147
1999	48	65	16	12	141
2000	49	67	31	17	164
2001	50	51	20	19	140
2002	39	59	24	21	143
2003	29	64	28	23	144
2004	38	62	37	30	167
2005	42	67	21	23	153
2006	33	60	28	14	135 ^a
2007	16	39	25	22	102 ^a
2008	12	28	9	5	54 ^a
Total	1,003	1,051	392	319	2,765

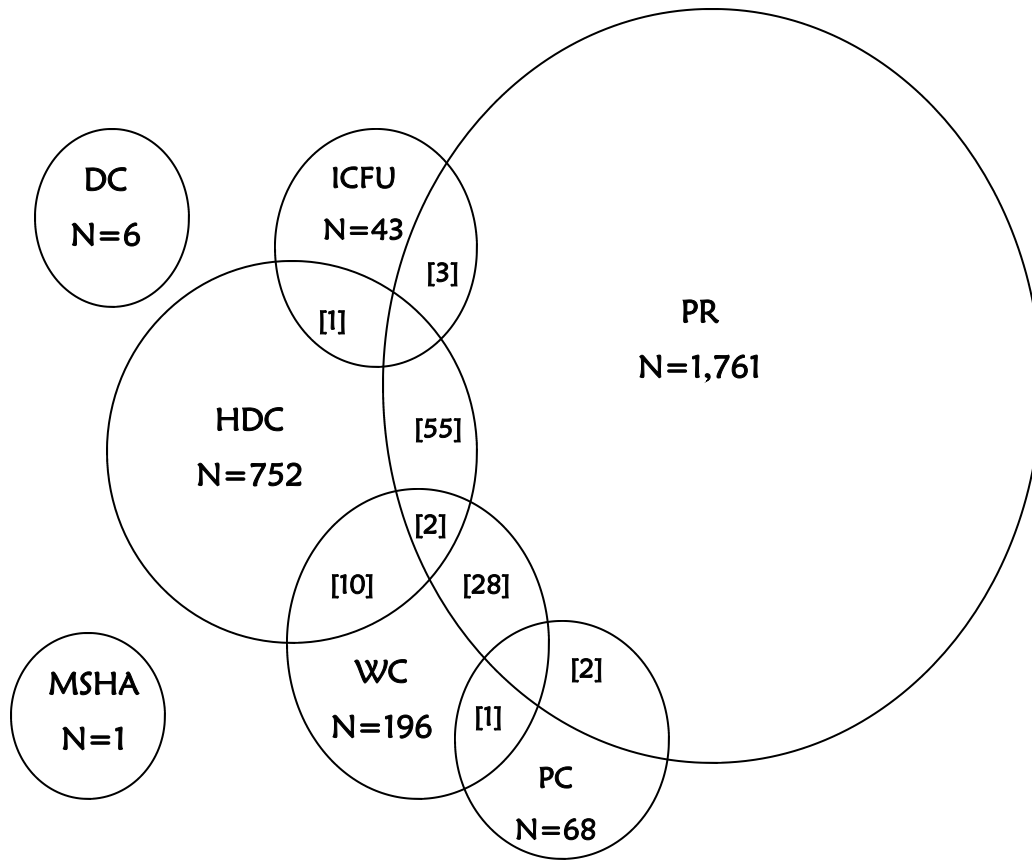
^aReports are still being processed for calendar years 2006, 2007 and 2008; an increase in these totals will be reflected in next year's annual report.

86% of WRA in Michigan is new onset; 14% is pre-existing asthma aggravated by exposure to an allergen or trigger at work.

FIGURE 1
Overlap of Reporting Sources for 2,711 Confirmed
Work-Related Asthma Patients: 1988-2007^a



Workers can be reported from many different sources, depending on the type of health care assistance they seek.



^a N's represent the total number for that source.
 Numbers in [] represent the overlap of reporting sources.
 There was an overlap of PC-HDC for 11 individuals and of PR-DC for one individual.
 Reporting Source: HDC=Hospital Discharge; PR=Physician Referral; DC=Death Certificate; WC=Workers' Compensation; ICFU=Index Case Follow-Up; MSHA=Mine, Safety & Health Administration; PC=Poison Control Center.

The sooner an individual with WRA is diagnosed and removed from the agent associated with their asthma, the better the prognosis for improvement in symptoms.

Demographics

GENDER

- ◆ Women 1,452, 53%
- ◆ Men 1,313, 48%

YEAR OF BIRTH

- ◆ Range 1905—1989
- ◆ Average 1956

RACE

- ◆ Caucasian 2,074, 77%
- ◆ African American 515, 19%
- ◆ Hispanic 51, 2%
- ◆ Alaskan/American Ind. 23, 1%
- ◆ Asian 11, <1%
- ◆ Other 31, 1%
- ◆ Unknown 60

ANNUAL INCIDENCE RATE

- ◆ African American 5.4
- ◆ Caucasian 2.6

The annual incidence rate for African Americans is 2.1X greater than that of Caucasians.

Location in State



Table 2 and Figure 2 show the annual average incidence rates of WRA among the working population, by county. The highest rates were in Luce (12.3 cases per 100,000), Clare (13.0 cases per 100,000), Osceola (8.3 cases per 100,000), Branch (7.4 cases per 100,000) and Cheboygan (7.1 cases per 100,000).

TABLE 2
Average Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by County of Exposure: 1989-2006

County	Avg Annual Inc		Cases 1989-2006	County	Avg Annual Inc		Cases 1989-2006
	# EE's ^a	Rate ^b			# EE's ^a	Rate ^b	
Alcona- Iosco	11,775	1.4	3	Isabella	26,325	2.7	13
Alpena	13,600	2.9	7	Jackson	60,500	3.7	40
Antrim	5,750	1.9	2	Kalamazoo-Calhoun-Van Buren	208,900	1.8	68
Arenac	4,650	4.8	4	Kent-Ottawa-Muskegon-Allegan	550,100	1.4	135
Baraga	3,750	4.4	3	Lake	1,650	6.7	2
Barry	12,075	0.9	2	Luce	2,700	12.3	6
Berrien	70,900	1.6	22	Mackinac	5,400	1.0	1
Branch	14,225	7.4	19	Manistee	7,625	1.5	2
Cass	10,500	2.1	4	Marquette	28,000	3.2	16
Charlevoix	10,975	2.0	4	Mason	10,500	1.6	3
Cheboygan	7,800	7.1	10	Mecosta	13,075	0.8	2
Chippewa	15,425	1.1	3	Menominee	9,450	0.6	1
Clare	7,675	13.0	18	Montcalm	18,825	4.1	14
Clinton-Eaton-Ingham	232,200	2.5	106	Montmorency	2,250	4.9	2
Crawford	4,525	6.1	5	Newaygo	10,325	4.3	8
Delta	15,525	1.4	4	Oceana	6,750	1.6	2
Dickinson	14,325	3.9	10	Ogemaw	6,450	3.4	4
Emmet	15,900	1.4	4	Osceola	8,000	8.3	12
Genesee	178,600	6.4	206	Otsego	11,225	4.5	9
Gladwin	5,125	2.2	2	Roscommon	6,500	4.3	5
Gogebic	6,525	1.7	2	Sanilac	13,125	6.3	15
Grand Traverse-Benzie-Kalkaska-Leelanau	60,575	2.4	26	Schoolcraft	2,900	1.9	1
Gratiot	14,150	3.9	10	Shiawassee	19,525	1.7	6
Hillsdale	15,525	3.6	10	St. Joseph	25,150	1.3	6
Houghton-Keweenaw	15,225	2.2	6	Tuscola	14,275	5.1	13
Huron	13,875	5.2	13	Washtenaw-Lenawee-Livingston	266,200	4.1	198
Ionia	15,975	3.5	10	Wexford-Missaukee	17,325	1.6	5
Iron	4,200	4.0	3	Saginaw-Bay-Midland	177,800	4.1	132
				<u>Detroit, MSA^c</u>	<u>2,077,000</u>	<u>3.4</u>	<u>1,276</u>
				All Michigan Counties^d	4,448,000	3.1	2,515

^a Source: MDCD/Employment Service Agency 1997 Annual Average Labor Statistics for Employment by Place of Work. Some employee population data is only at a multi-county level, as indicated (i.e., not available at a single county level). Therefore, some data is presented with grouped counties.

^b Rates are based on the average number of cases per year from 1989-2006, per 100,000 Michigan workers.

^c MSA=Metropolitan Statistical Area and includes Lapeer (26 cases), Macomb (233 cases), Monroe (24 cases), Oakland (332 cases), St. Clair (41 cases) and Wayne (620 cases) counties.

^dForty-two cases had an out-of-state exposure and 21 had an unknown county of exposure, for the 1989-2006 reporting period.

Type of Industry

Table 3 shows the Michigan industries by NAICS codes, where the exposures to occupational allergens occurred from 1988 to 2008. The predominant industries were in manufacturing (63%) and health care and social assistance (11%).

The incidence rate of WRA by industry type ranges from <0.1 cases per 100,000 in utilities to a high of 11.1 cases per 100,000 in manufacturing. Industries with the next highest annual average incidence rates were: mining with 6.6 cases per 100,000 workers and health care and social assistance with 3.2 cases per 100,000 workers.

Table 4 shows the average annual incidence rates for WRA cases *within manufacturing*.

FIGURE 2
Average Annual Incidence Rate of WRA by County of Exposure: 1989-2006

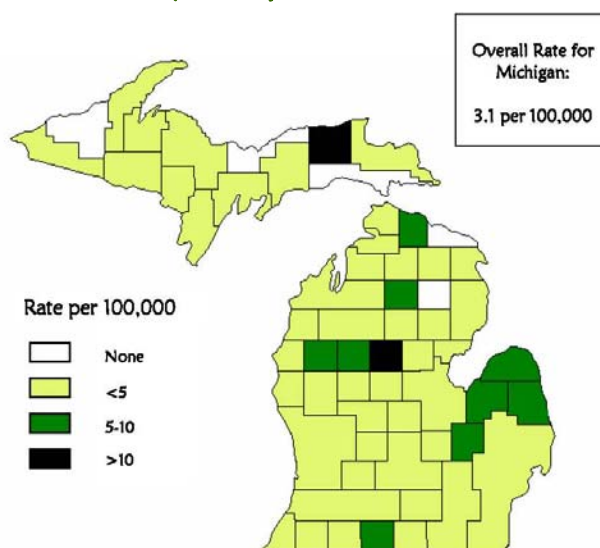


TABLE 3
Primary Industrial Exposure for Confirmed Work-Related Asthma Patients: 1988-2008

2002 North American Industry Classification System		WRA Cases 1988-2008		Number of Employees ^a	Ann. Average Incidence Rate ^b	
		#	%		Rate	# Cases
11	Agriculture, Forestry, Fishing, & Hunting	15	0.5	81,664	0.9	13
21	Mining	11	0.4	9,300	6.6	11
22	Utilities	6	0.2	861,200	<0.1	6
23	Construction	69	2.5	206,100	1.7	63
31-33	Manufacturing	1,738	62.9	823,100	11.1	1,651
42	Wholesale Trade	36	1.3	180,400	1.0	34
44-45	Retail Trade	62	2.2	548,800	0.6	60
48-49	Transportation & Warehousing	50	1.8	132,000	1.9	44
51	Information	17	0.6	76,000	1.2	17
52	Finance & Insurance	21	0.8	154,800	0.6	18
53	Real Estate & Rental & Leasing	13	0.5	55,500	1.2	12
54	Professional, Scientific & Technical Services	25	0.9	268,000	0.5	24
55	Management of Companies & Enterprises	1	<0.1	69,100	0.1	1
56	Administrative & Support & Waste Management	38	1.4	267,000	0.7	32
61	Educational Services	116	4.2	423,300	1.4	103
62	Health Care & Social Assistance	304	11.0	482,700	3.2	277
71	Arts, Entertainment & Recreation	16	0.6	61,500	1.4	16
72	Accommodation & Food Services	68	2.5	332,700	1.0	58
81	Other Services (except Public Administration)	55	2.0	176,900	1.5	49
92	Public Administration	95	3.4	685,000	0.7	81
00	Unknown	9	0.3	--	--	8
Total		2,765		4,645,864	3.1	2,578

^aSource: Non-Agriculture: MDLEG Bureau of Labor Market Information & Strategic Initiatives: Michigan Current Employment Statistics 2001. Agriculture: 2002 U.S. Census of Agriculture-State Data. Selected Operator Characteristics by Race: 2002.

^bRates are based on average number of cases from 1989-2006 per 100,000 adult workers in each industrial category.

TABLE 4
1,651 Work-Related Asthma Cases from Manufacturing Industries:
1989-2006

	2002 North American Industry Classification System	WRA Cases #	Ann Avg Rate ^a	# Employees ^b
311	Food Mfg	47	7.4	35,300
323	Printing & Related Support Activities	18	4.6	21,900
325	Chemical Mfg	85	13.6	34,600
326	Plastics & Rubber Products Mfg	83	10.1	45,800
327	Nonmetallic Mineral Product Mfg	15	4.5	18,500
331	Primary Metal Mfg	60	10.6	31,400
332	Fabricated Metal Product Mfg	91	5.7	89,000
333	Machinery Mfg	119	7.4	89,600
334	Computer & Electronic Product Mfg	12	2.8	23,700
336	Transportation Equipment Mfg	1,011	17.7	317,000
337	Furniture & Related Product Mfg	9	1.4	36,900
	Miscellaneous Mfg (*includes NAICS: 312-16,321-322,324,335,339)	101	7.1	79,400

^aAverage annual incidence rate, total number of cases for 1989-2006 (the years with complete case reporting results). Rates are based on average number of cases from 1989-2006 per 100,000 adult workers in each industrial category.

^bSource: MDLEG Bureau of Labor Market Information & Strategic Initiatives: Michigan Current Employment Statistics 2001.

Workers can be exposed to sensitizing agents in any type of industry.



Type of Exposure

Table 5 shows the exposures associated with WRA among Michigan workers. The most frequent exposures reflect the heavy auto manufacturing industry base of the State. Most frequently identified exposures include: isocyanates (MDI, TDI, HDI and others) accounting for 13.5% of the WRA case exposures and metal working fluids (coolants) accounting for 10.8% of Michigan worker exposures.

Other important and emerging exposures include cleaning products. Cleaning products are associated with 270 (9.8%) of Michigan’s WRA patients. There has been increased awareness and interest in the past few years of ingredients in cleaning products that can cause new-onset asthma and aggravate existing asthma. These products, used both in the home and in all indus-

try sectors (services, manufacturing, etc.) can contain disinfectants, often in the form of quaternary amines, which have been repeatedly shown to cause asthma among workers who use them.

The Michigan WRA Tracking Program is working with other states to identify these agents, provide case-based evidence of the potential harm these substances can cause, and offer suggestions for alternative cleaning agents with less potential for harm.

The Michigan WRA Tracking Program has developed a brochure on the hazards of cleaning agents. It is available at: www.oem.msu.edu, and can be found under the **Resources Section**.

TABLE 5
Top Work Place Exposures Associated with
Confirmed WRA Patients: 1988-2008

<u>Exposure Agent</u>	<u>#</u>	<u>%</u>
Isocyanates	373	13.5
Metal Working Fluids	299	10.8
Cleaning Solutions	270	9.8
Unknown (Mfg.)	211	7.6
Unknown (Office)	176	6.4
Exhaust/Smoke/Fumes	151	5.5
Welding Fumes	126	4.6
Solvents	96	3.5
Paint Fumes	66	2.4
Epoxy	63	2.3
Latex/Rubber	57	2.1
Formaldehyde	55	2.0
Acids	50	1.8
Fungus	41	1.5
Acrylates	38	1.4
Chlorine	39	1.4
Plastic Fumes	40	1.4
Cobalt	30	1.1
Fire	30	1.1
Ammonia	23	0.8
Styrene	22	0.8
Wood Dust	23	0.8
Flour	20	0.7
Animal Dander	19	0.7
Chemicals Used in Construction	21	0.8
Cigarette Smoke	18	0.7
Fragrances	17	0.6
Glutaraldehyde	16	0.6
Herbicide/Pesticide	17	0.6
Chromium	14	0.5
Fiberglass	13	0.5
Caustics	12	0.4
Printing Inks	12	0.4
Amines	12	0.4
Grain Dust	12	0.4
Cement Dust	10	0.4
Cosmetology Chemicals	9	0.3
Anhydrides	8	0.3
Asphalt	8	0.3
Meat Wrapper's Asthma	7	0.3
Plants/Organic Matter	8	0.3
Rust Inhibitor	10	0.4
<u>Other^a</u>	<u>223</u>	<u>8.1</u>
Total	2,765	100.3

^aThere were 6 cases each w/exposure to: Azodicarbonamide, Insecticides, Paper Dust, Pickling Ingredients.

There were 5 cases each w/exposure to: 1,1,1 Trichloroethane, Enzymes, Heat, Nitrogen, Solder Fume, Textile Lint.

There were 4 cases each w/ exposure to: Asbestos, Ethyl Alcohol, Freon, Photo Developing Fluids, Rose Hips, Sulfonate, Sulfur Dioxide, Trichloroethylene, X-Ray Developing Fluids.

There were 3 cases each w/exposure to: Cadmium Solder, Colophony, Drywall Dust, Fire Extinguisher Powder, Hydraulic Oil, Lime Dust, Mold Release Spray, Natural Gas, Nickel, Psyllium, Sand, Sewage, Sludge, Tar Fume.

There were 2 cases each w/exposure to: Acetates, Cellulose, Coal Dust, Concrete Sealer, Copier Toner, Copper Oxide, Dimethyl Benzyl Ammonium Chloride, Exercise, Fireproofing Chemicals, Gas and Oil Refinery Exposures, Kerosene, Medications, Ozone, Pepper Gas, Perchloroethylene, Phosgene, Polyester, Polyethylene, Polyurethane, Polyvinyl Butyrate, Sulfite, Teflon, Zinc, Zinc Oxide.

There was 1 case each w/exposure to: 1,3,Dichloro-2-Propanol, 1,3 Dichloro 5 5-Dimethyl Hydrantoin, Ammonium Bifluoride, Ammonium Chloride, Anesthesia, Benzoate Esters, Blood, Blue Prints, Car Window Sealant, Ceramic Powder, Cold Air, Cooking Oil, Cyanide, Ethylene Oxide, Explosion, Fertilizer, Flares, Flux, Glaze, Gortex, Iodine, Isopropyl Alcohol, Methamphetamine Lab, Methanol, Mica, Monoammonium Phosphate, Ninhydrin, Nylon-polyhexamethylene Adipamide, Odor, Phenol, Pigment, Plating Chemicals, Platinum, Potassium Aluminum Fluoride, Soda Ash, Soot, Stress, Swimming Pool Shock, Talcum Powder, Tuberculosis Vaccine, White Lithium, World Trade Center Exposure, Zinc Borate.



A personal or family history of allergies does not predict who will develop work-related asthma. One of the best ways to monitor workers for the development of WRA is through medical monitoring. A sample protocol is available at: www.oem.msu.edu.

Medical Results

SMOKING STATUS

Table 6 shows patients' cigarette smoking status. Twenty percent of patients were smoking when their asthma developed. This is a lower percentage than the state average (21.1%) and markedly lower than that found in blue collar working populations.

ALLERGIES AND ASTHMA

Forty-four percent of WRA patients had a family history of allergies (Table 7).

Forty-eight percent of the asthma patients had a personal history of allergies

or asthma (Table 8). Six hundred nine (48%) of the 1,279 patients with a personal history of allergies or asthma previously had asthma.

SYMPTOMS

Two thousand two hundred sixty-three of the patients with WRA had persistence of their asthma symptoms (Table 9). Higher percentages of those *still exposed* continued to have breathing problems and take asthma medicine compared to those *no longer exposed*. Higher percentages of those *no longer exposed* had improved breathing and were taking less medicine.

TABLE 6
Cigarette Smoking Status of 2,683^a
Confirmed WRA Patients: 1988-2008
Smoking Status

	Current Smoker		Ex-Smoker		Non-Smoker	
	#	%	#	%	#	%
OA	206	21.0	384	39.1	393	40.0
POA	158	15.4	431	42.0	436	42.5
AA	83	22.7	104	28.4	179	48.9
RADS	90	29.1	115	37.2	104	33.7
All	537	20.0	1,034	38.5	1,112	41.4

^aMissing data on 82 patients.



Smoke-free workplaces contribute to better respiratory health.

The percentage of Michigan adult smokers has decreased over time, from a high of 28.4% in 1998, to a low of 21.1% in 2007.

TABLE 7
Family History of Allergies Among 2,395^a Confirmed WRA Patients: 1988-2008

	Family History of Allergies			
	Yes		No	
	#	%	#	%
OA	361	39.7	549	60.3
POA	408	43.6	527	56.4
AA	183	61.2	116	38.8
RADS	97	38.6	154	61.4
All	1,049	43.8	1,346	56.2

^aMissing data on 370 patients.

TABLE 8
Personal History of Allergies or Asthma Among 2,685^a Confirmed WRA Patients: 1988-2008

	Personal History of Allergies			
	Yes		No	
	#	%	#	%
OA	370	37.8	608	62.2
POA	442	43.2	580	56.8
AA	360	95.7	16	4.3
RADS	107	34.6	202	65.4
All	1,279	47.6	1,406	52.4

^aMissing data on 80 patients.

Medical Results, continued...

OBJECTIVE MEDICAL TESTING

Few of the WRA patients had objective pulmonary function testing performed to determine the relationship of their asthma to workplace exposures.

- ◆ Methacholine challenge 20%
- ◆ Pre-post bronchoprovocation 54%
- ◆ Specific antigen <1%
- ◆ Peak flow monitoring 3%
- ◆ Pre-post work-shift 3%



Respirators should be the last line of protection workers use when exposed to asthma-causing agents. Chemical substitution or engineering controls with ventilation and enclosure are preferred methods of protection.

Workplace Investigations

WORKERS' COMPENSATION

About half of the WRA patients applied for workers' compensation benefits; about a third of those who applied for benefits were awarded compensation for their breathing problems.

- ◆ Applied 49%
- ◆ Pending approval 49%
- ◆ Denied benefits 16%
- ◆ Received benefits 35%

INDUSTRIAL HYGIENE

A total of 706 workplace inspections have been conducted since 1988 (Table 10); 106 of those facilities had been inspected more than once. Eleven inspections have been completed since last year's report.

Air sampling for allergens was conducted during 501 inspections (Table 11); 24 (4.8%) of the 501 facilities with a MIOSHA standard for the allergen were above the enforceable permissible exposure limit.

TABLE 9
Persistence of Symptoms and Medication Use in 2,536
Confirmed WRA Patients: 1988-2008

Still Exposed?	Total	Breathing Problems Still Present?				Still Taking Asthma Medications?			
		Yes		Less		Yes		Less	
		#	%	#	%	#	%	#	%
Yes	734	708	96.5	222	30.2	631	86.0	134	18.3
No	1,802	1,555	86.3	868	48.2	1,418	78.7	503	27.9
Total	2,536 ^a	2,263		1,090		2,049		637	

^aInformation missing on 229 individuals.

TABLE 10
Status of Facilities Where Confirmed WRA Patients Were Exposed to Allergens: 1988-2008

Inspection Status	# Patients Represented	Companies	
		#	%
Inspected	1,133	706 ^a	35.8
No Follow-up Planned	1,426	1,078	54.6
Scheduled for Inspection	16	15	0.8
Out of Business	66	58	2.9
No Longer Use Occupational Allergen	26	25 ^b	1.3
Sent Company Letter to Check Exposures ^d	98	92	4.7
Total	2,765	1,974 ^c	100.1

^a706 inspections were conducted in 600 different inspections.

^bEight companies that no longer use the allergen were previously inspected.

^cRepresents 1,868 different facilities.

^dThe company was sent information on how to address potential exposures including indoor air issues in their workplace that may be causing respiratory health problems.

TABLE 11
Air Monitoring Results from 706
Workplace Inspections: 1988-2008

<u>Air Sampling – NIOSH Standard</u>	<u>#</u>	<u>%</u>
Above NIOSH Standard	60	8.5
Below NIOSH Standard	426	60.3
No NIOSH Standard	20	2.8
Unknown (no report yet)	5	0.7
Did Not Sample for an Allergen	22	3.1
<u>Did Not Sample</u>	<u>173</u>	<u>24.5</u>
Total	706	99.9^a

<u>Air Sampling – MIOSHA Standard</u>	<u>#</u>	<u>%</u>
Above MIOSHA Standard	24	3.4
Below MIOSHA Standard	477	67.6
No MIOSHA Standard	4	0.6
Unknown (no report yet)	5	0.7
Did Not Sample for an Allergen	23	3.3
<u>Did Not Sample</u>	<u>173</u>	<u>24.5</u>
Total	706	100.1^a

^aPercentages do not add to 100 due to rounding.



There are many substances that have no method for air monitoring and that have not been evaluated for their asthma-causing potential.

AIR MONITORING

Table 12 shows the allergens that were above the NIOSH and/or MIOSHA limits. One exposure was above the MIOSHA PEL and NIOSH REL for cobalt during an inspection that was conducted this past year. The top three allergens found to be above the NIOSH REL were:

- ◆ Formaldehyde
- ◆ Styrene
- ◆ Metal Working Fluids

The top four allergens found to be above the MIOSHA enforceable PEL were:

- ◆ Welding Fume
- ◆ Styrene
- ◆ Cobalt
- ◆ Glutaraldehyde

TABLE 12
Allergens Above the MIOSHA Permissible Exposure Limit (PEL) and/or
NIOSH Recommended Exposure Limit (REL): Michigan 1988-2008

<u>Asthma-Causing Agents</u>	<u>Above NIOSH REL</u>		<u>Above MIOSHA PEL</u>	
	<u>#</u>	<u>%</u>	<u>#</u>	<u>%</u>
Formaldehyde	25	43.9	1	4.3
Styrene	6	10.5	4	17.4
Metal-Working Fluids	5	8.8	1	4.3
Glutaraldehyde	4	7.0	3	13.0
HDI	4	7.0	No PEL	--
Cobalt	4	7.0	3	13.0
MDI	3	5.3	0	--
Wood Dust	2	3.5	2	8.7
Chromic Acid	1	1.8	1	4.3
Ethylene Oxide	1	1.8	0	--
Phthalic Anhydride	1	1.8	1	4.3
Starch	1	1.8	0	--
Welding Fume (Total Particulate)	No REL	--	5	21.7
<u>Flour Dust</u>	<u>No REL</u>	<u>--</u>	<u>2</u>	<u>8.7</u>
TOTAL	57	100.2^a	23	99.7^a

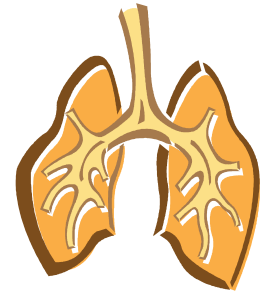
^aPercentages do not add to 100 due to rounding.

Workers exposed to asthma-causing agents BELOW permissible limits can still develop work-related

Co-Worker Interviews at Workplace Investigations

Co-workers were interviewed at 540 of the 706 inspections. They reported daily or weekly breathing symptoms or new onset asthma since beginning to work at 362 of the 540 (67%) companies. The average percentage of co-workers with symptoms in these 362 companies was 20.4%. All 1,377 co-workers from the remaining 178 companies reported no breathing symptoms. One thousand five hundred nine of the 9,495 (15.9%) co-workers interviewed had symptoms con-

sistent with work-related asthma (Table 13). The MIOSHA Injury and Illness Logs (Form 300) kept by employers listed 571 workers from 127 companies with asthma or asthma-like symptoms. Only nine workers identified in the interviews with daily or weekly chest tightness, shortness of breath or wheezing were also listed on the MIOSHA Log. A total of 2,071 symptomatic workers were identified during the 706 MIOSHA enforcement inspections.



Co-workers who report breathing problems are encouraged to seek medical care for their symptoms.

TABLE 13
Breathing Symptoms Among Co-Workers of the 2,765 Confirmed WRA Patients

Symptoms	Disease Status of the Index Patient									
	ALL		OA		POA		AA		RADS	
	#	%	#	%	#	%	#	%	#	%
Daily or Weekly SOB, Wheezing or Chest Tightness	1,509	15.9	1,068	16.3	392	14.9	4	16.0	45	14.8
Workers Interviewed	9,495		6,542		2,623		25		305	
OSHA Log	571	18.0	399	21.3	160	13.6	2	9.1	10	12.0
# Companies w/Employee on Log	127		88		35		1		3	
# Companies Inspected	706		413		257		11		25	
Total ^a	2,080		1,467		552		6		55	

^aNine individuals were identified both on the co-worker questionnaire and the OSHA Log.

Work-Related Asthma Deaths

Fortunately, a very small percent (0.01-0.02%) of asthma patients die from asthma. Since 2003, we have identified eight work-related asthma deaths.

Most recently, in 2008 a man in his 50s died from WRA after working for three months at a factory that made brakes for airplanes and helicopters. He was a

machinist, performing grinding of metal parts. He was exposed to metal-working fluids. He had never been diagnosed with asthma prior to this job. He went to the emergency department and was subsequently hospitalized and placed on a ventilator for one month before he died. He died four months after beginning to work at this factory.



Limiting asthma management to just the treatment of symptoms is an unacceptable way to manage work-related asthma.

Michigan Workforce Exposed to Isocyanates

Isocyanates are the most commonly reported cause of WRA in Michigan. The United States Environmental Protection Agency (EPA) requires reporting by facilities that use any one of 650 different chemicals in amounts greater than 10,000 pounds per year and are a manufacturer, a mine or an electrical generator and have at least 10 employees. Isocyanates are one of the 650 substances for which reporting is required. Queries of reportable chemicals can be generated to identify state-level statistics.

We identified Michigan's isocyanate-using companies in the EPA Toxic Release Inventory (TRI) to estimate the number of workers employed by manufacturers that use isocyanates. This estimate under-counts non-

manufacturing exposed employees such as auto body paint shop repairers since the EPA does not include non-manufacturing establishments. Conversely, it over-counts manufacturing employees since the total number of employees at each facility that reported isocyanate use are included, even though fewer of those workers would have worked with or around isocyanates and therefore have been potentially exposed to isocyanates.

The companies that reported the use of isocyanates in calendar year 2007 (the most recent year available) can be found in Table 14. The number of workers employed in companies that use isocyanates, the total number of workers in these counties, and the percentage of workers where isocyanates are used is listed.

TABLE 14

Michigan Workers Employed in Manufacturing Facilities Where Isocyanates are Used, by County

County	# Workers Employed ^a by Isocyanate-Using Facilities	Total # Workers in the County ^b	% Workers Potentially Exposed to Isocyanates	Company Name ^c
Allegan	275	51,115	0.5	GMP Industries Johnson Controls
Barry	1,100	28,202	3.9	Bradford White
Berrien	545	73,644	0.7	Ancast Tyler Refrigeration
Calhoun	243	63,746	0.4	Bostik Cello-Foil Products Comcast Urethane
Charlevoix	500	12,554	4.0	East Jordan Iron Works
Clare	300	11,549	2.6	Renosol Seating
Clinton	10	35,398	0.1	Innovative Polymers
Dickinson	580	13,494	4.3	Grede Foundry Louisiana-Pacific Sagola OSB
Eaton	3,426	55,267	6.2	Axson North America GM/Lansing Delta Township

Table 14, continued...

County	# Workers Employed ^a by Isocyanate-Using Facilities	Total # Workers in the County ^b	% Workers Potentially Exposed to Isocyanates	Company Name ^c
Genesee	1,000	181,545	0.6	Delphi Energy & Chassis Flint East
Hillsdale	160	18,920	0.8	Dow Chemical Company
Ingham	1,690	142,401	1.2	GMVM Lansing Huntsman Advanced Materials Williamston Products
Isabella	550	36,523	1.5	Delfield
Jackson	1,250	69,845	1.8	ADCO Products ^d Milsco/MI Seat/Hurst & Brooklyn TAC Manufacturing
Kalamazoo	260	125,148	0.2	Azon USA Premier Products ^d
Kent	2,994	298,782	1.0	Conway Products/Emerald Spas Detroit Diesel Remanufacturing North Grand Rapids Foam Technologies HB Fuller Knappe & Vogt Manufacturing Purforms Wolverine World Wide
Lapeer	26	39,173	0.1	ITW/TACC
Lenawee	355	43,806	0.8	Anderson Development Pilkington Clinton
Livingston	1,040	86,365	1.2	Atreum Brighton Atreum Howell Package Design & Manufacturing
Luce	129	2,476	5.2	Louisiana-Pacific Corporation
Macomb	5,619	376,026	1.5	Auto Components/Chesterfield Auto Components/Shelby Twp Daimler/Chrysler Sterling Heights Assembly DuPont Mount Clemens Plant Faurecia Automotive Seating International Casting Corporation Rivas Romeo Rim US Farathane Wolverine Bronze

Table 14, continued...

County	# Workers Employed ^a by Isocyanate-Using Facilities	Total # Workers in the County ^b	% Workers Potentially Exposed to Isocyanates	Company Name ^c
Mason	1,220	13,581	9.0	Great Lakes Castings
Mecosta	1,000	18,065	5.5	Wolverine World Wide
Midland	1,000			Dow Chemical
Monroe	175	69,469	0.3	Sunrise Windows
Montcalm	172	23,412	0.7	Kent Foundry Northland Corporation
Muskegon	160	81,191	0.2	MI Steel
Oakland	766	566,231	0.1	Armaly Sponge Behr America Cass Polymers of Michigan Eagle Industries ITW Devcon Futura Recticel Interiors North America Recticel UREPP North America
Ogemaw	150	8,663	1.7	Taylor Building Products
Ottawa	685	125,019	0.5	Almond Products Eagle Packaging Izzy/Counterpoint Magna Donnelly Corporation
Saginaw	2,318	86,540	2.7	Delphi Saginaw Steering Systems Glastender Lendell Manufacturing Saginaw Metal Casting Operations
St. Clair	250	73,694	0.3	IAC Port Huron
Sanilac	900	18,841	4.8	Grupo Antolin Marlette ASCO/Numatics Trelleburg YSH
Shiawassee	70	32,013	0.2	Tegant Diversified Brands
Van Buren	182	36,698	0.5	BASF Construction Chemicals Special-Lite
Washtenaw	1,600	174,225	0.9	Automotive Components Holdings Kalitta Charters ^d (not mfg)

Table 14, continued...

County	# Workers Employed ^a by Isocyanate-Using Facilities	Total # Workers in the County ^b	% Workers Potentially Exposed to Isocyanates	Company Name ^c
Wayne	3,757	780,704	0.5	Alpha Resins Arvinmeritor BASF Corporation, Livonia BASF Corporation, Wyandotte Daimler/Chrysler JNAP EFTEC North Americas EQ Detroit Lear Corporation Plastomer Corporation Poof-Slinky Recycled Polymeric Materials Spraytek ^d Woodbridge Corporation
Wexford	800	12,880	6.2	Genmar Cadillac Four Winns
TOTAL	37,257	4,519,000	0.8	

^aSource: Michigan Manufacturers’ Directory, 2008 and www.acinet.org accessed June 10, 2008.

^bSource: Michigan Labor Market Information, Data Explorer, www.milmi.org accessed April 2, 2009.

^cSource: U.S. Environmental Protection Agency. Toxics Release Inventory, Michigan Companies Using Isocyanates in 2007 (report April 2, 2009).

^dSource: Michigan Department of Environmental Quality, FOIA Request for SARA Title III Emergency Planning and Release Reporting of select chemicals (isocyanates), received June 26, 2008.

Michigan Workforce Exposed to Selected Causes of WRA

Another source to identify chemical exposures that are associated with WRA comes from the Michigan Department of Environmental Quality (DEQ). The chemicals listed in the Michigan Facilities’ Guide to SARA Title III, Emergency Planning and Release Reporting (December 2007, 6th edition) are subject to reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA) section 313, which is triggered by threshold amounts of 25,000 pounds manufactured or processed or 10,000 pounds otherwise used at facilities in Michigan.

Unlike the EPA TRI data, all companies must report

if they meet the threshold amount of chemical used; there are no limitations to reporting based on the type of facility or the number of individuals employed. The companies listed are current as of April 13, 2009, the date of the report generated by the Michigan DEQ.

The chemicals shown can be categorized in two ways: those that are known to cause asthma and those that are irritants and capable of causing Reactive Airways Dysfunction Syndrome. Those that can cause asthma are: Bisphenol A, Cobalt, Epichlorohydrin, Formaldehyde, Methyl Acrylate, Phthalic Anhydride and Styrene. Ammonia and Chlorine are classified as irritants.

TABLE 15
Michigan Facilities by County, Reporting Toxic Chemicals to the
Michigan Department of Environmental Quality (DEQ) Under Section 313
of the Emergency Planning and Right-to-Know Act (EPCRA)^a

SUBSTANCES CAPABLE OF CAUSING ASTHMA:
Cobalt, Epichlorohydrin, Formaldehyde, Methyl Acrylate, Phthalic Anhydride, & Styrene
SUBSTANCES CAPABLE OF CAUSING REACTIVE AIRWAYS DYSFUNCTION SYNDROME:
Ammonia & Chlorine

County	Company Name	Type of Exposure
Alger	Munising City of (POTW)	Chlorine
	Neenah Paper—Michigan Inc.	Ammonia
Allegan	Airgas Great Lakes—Wayland	Chlorine
	Birds Eye Foods	Ammonia, Chlorine
	Dr. Pepper/Seven Up Bottling	Ammonia
	Green Valley Agricultural	Ammonia
	Hamilton Farm Bureau Co-Op	Ammonia
	Hudsonville Creamery & Ice Cream	Ammonia
	Otsego City of, Waste Water Treatment Plant (WWTP)	Chlorine
	Otsego City of, Wells #3, #4, #5	Chlorine
	Packerland Plainwell—Smithfield Beef Group	Ammonia
	Plainwell City of, WWTP & Water Renewal	Chlorine
	Sherwin Williams Company	Ammonia
Tiara Yachts—S2 Yachts	Styrene	
Alpena	Airgas Great Lakes	Chlorine
	Alpena Supply Company	Chlorine
Antrim	Great Lakes Packing Company	Ammonia
	US Fish & Wildlife Svc—Jordan Riv Natural Fish Hatchery	Formaldehyde
Arenac	Saginaw-Midland Municipal Water—Whitestone Station	Chlorine
Baraga	Custom Composites Division	Styrene
Barry	Caledonia Farmers Elevator	Ammonia
	VeraSun Woodbury	Ammonia
Bay	Airgas Great Lakes—Bay City	Chlorine
	Auburn Fertilizer	Ammonia
	Bay City of, Bay Metropolitan Water Treatment	Chlorine
	Carbone of America—Ultra Carbon Division	Chlorine
	Crop Production Services	Ammonia
	Essexville Waste Water Treatment	Chlorine
	Mammel Farm	Ammonia
	Quantum Composites, Inc.—Premix	Styrene
	West Bay County Regional Waste Water	Chlorine

Table 15, continued...

County	Company Name	Type of Exposure
Benzie	Frankfort Cold Storage	Ammonia
	Graceland Fruit	Ammonia
	MI DNR—Platte River St. Fish Hatchery	Formaldehyde
	Smeltzer Orchard Company	Ammonia
Berrien	Advanced Products	Ammonia
	Andrews University WWTP	Chlorine
	Benton Harbor Water Plant	Chlorine
	Buchanan Agronomy & Petroleum	Ammonia
	Buchanan Waste Water Treatment Plant	Chlorine
	Buchanan Water Treatment Plant	Chlorine
	Coloma Frozen Foods	Ammonia
	Greg Orchards & Produce	Ammonia
	Hanson Cold Storage	Ammonia
	Harbor Metal Treating	Ammonia
	Leco Corporation	Ammonia
	Modar	Formaldehyde
	NCP Coatings	Ammonia, Phthalic Anhydride
	New Buffalo Water Plant	Chlorine
	Niles City of, Airport, Decker, Front and Fort St. Wells	Chlorine
	Niles Waste Water Treatment Plant	Chlorine
	Niles Water Department—Iron Removal Plant	Chlorine
Old Europe Cheese	Ammonia	
Saint Joseph Water Plant	Chlorine	
Sandvik Materials Technology	Ammonia	
Branch	Alchem Aluminum—Aleris International	Chlorine
	Colwater Water Treatment Plant	Chlorine
	North Central Cooperative	Ammonia
	Quality Spring/Togo	Ammonia
	Star of the West Milling	Chlorine
Calhoun	Airgas Great Lakes	Chlorine
	Anatech	Formaldehyde
	Battle Creek City of, Waste Water Treatment Plant	Chlorine
	Battle Creek City of, Verona Pumping Station	Chlorine
	Continental Carbonic—Albion Plant	Ammonia
	Eaton Corporation PSCO	Ammonia
	Guardian Fiberglass	Formaldehyde
	House of Raeford Farms	Ammonia
	Musashi Auto Parts	Ammonia
	Post Foods	Chlorine
	Prairie Farms Dairy	Ammonia
The Andersons Albion Ethanol	Ammonia	

Table 15, continued...

County	Company Name	Type of Exposure
Cass	Marcellus Agronomy	Ammonia
	Mennel Milling Company of Michigan	Chlorine
Charlevoix	Airgas Great Lakes	Chlorine
Cheboygan	Cheboygan City of, Waste Water Treatment Plant	Chlorine
	Cheboygan City of, Well House #4, #7	Chlorine
Clinton	Crop Production Services	Ammonia
	Mahle Engine Components USA	Ammonia
	Michigan Milk Producers Association	Ammonia
	Save-A-Lot, Moran Foods	Ammonia
	SCCMUA	Chlorine
	St. Johns City of, Waste Water Treatment Facility	Chlorine
Crawford	Arctic Glacier	Ammonia
	Georgia-Pacific Chemicals	Ammonia, Formaldehyde
	Grayling Generating Station	Chlorine
	Weyerhaeuser NR Company	Formaldehyde
Delta	Escanaba Paper Company—Newpage Corporation	Ammonia, Chlorine
Dickinson	Verso Paper Company—Quinnesec Mill	Chlorine
Eaton	Airgas Great Lakes—Lansing Plant	Ammonia, Chlorine
	Axson North America	Styrene
	Cass Polymers of Michigan	Styrene
	Citizens, Otto Rd. Plant	Ammonia
	Crop Production Services	Ammonia
	ETM Enterprises	Styrene
	Lansing Board of Water & Light—Erickson & River Intake	Chlorine
	Meijer Lansing Distribution	Ammonia
	Owens Brockway Glass	Ammonia
	S.P. Kish Industries	Ammonia
Emmett	Airgas Great Lakes—Petoskey	Chlorine
	Michigan DNR—Oden State Fish Hatchery	Formaldehyde
Genesee	Airgas Great Lakes—Flint	Chlorine
	Arctic Glacier—Party Time	Ammonia
	Coca-Cola Enterprises—Flint	Ammonia
	Country Fresh	Ammonia
	Flint City of, Water Plant	Chlorine
	Flint City of, Water Pollution Control Facility	Chlorine
	Genesee County Drain Commission—Ragnone Trt. Plt.	Chlorine
	Genesee County Water—Henderson Road Pump Station	Chlorine
	GMC Powertrain Flint, North	Ammonia
	Koegel Meats	Ammonia
	Rogers Elevator Company	Ammonia

Table 15, continued...

County	Company Name	Type of Exposure
Genesee	Stokes Steel Treating Company	Ammonia
Grand Traverse	Airgas Great Lakes—Traverse City	Chlorine
	CentreICE	Ammonia
	Century Sun Metal Treating	Ammonia
	Cherry Growers	Ammonia
	Morrison Orchards	Ammonia
	Sara Lee Bakery	Ammonia
	Traverse Cold Storage	Ammonia
Gratiot	Alma City of, Waste Water Plant	Chlorine
	Crop Production Services	Ammonia
	Pompeii Farm Center	Ammonia
	St. Louis City of, Waste Water Treatment Plant	Chlorine
Hillsdale	Bob Evans Farms	Ammonia
	Conagra Foods	Ammonia
	Hillsdale Waste Water Treatment	Chlorine
	Michigan South Central Power Agency	Chlorine
	Prattville Fertilizer & Grain	Ammonia
	The Andersons Litchfield Farm	Ammonia
Houghton	Michigan—American Water Company	Chlorine
	Peninsula Copper Inds.	Ammonia
	Vollwerth's	Ammonia
Huron	Bad Axe City of, Waste Water Treatment Plant	Chlorine
	Caseville Village of, Water Treatment Plant	Chlorine
	Co-Op Elevator Elkton NH3 Site	Ammonia
	Co-Op Elevator Sebewaing Plant	Ammonia
	Cooperative Elevator Company	Ammonia
	Crop Production Services	Ammonia
	Dow Agrosiences	Ammonia
	Farmers Co-Op Grain	Ammonia
	Harbor Beach Waste Water Treatment Plant	Chlorine
	Harbor Beach Water Works	Chlorine
	Port Austin Area Sewer and Water	Chlorine
	Thumb Tool & Engineering	Ammonia
	Ingham	Airgas Great Lakes—Lansing Mint Road
Aldi Inc., Webberville		Ammonia
Alexander Chemical Corporation		Ammonia, Chlorine
Arctic Glacier—Lansing Plant		Ammonia
Aurora Specialty Chemistries		Ammonia, Epichlorohydrin
East Lansing—Meridian Water & Sewer		Ammonia

Table 15, continued...

County	Company Name	Type of Exposure
Ingham	Jorgensen Farm Elevator	Ammonia
	Lansing Board of Water & Light—Dye Water Cond. Plt.	Ammonia
	Leslie City of, WWTP	Chlorine
	Linde Gas	Ammonia
	Mason City of, POTW Plant	Chlorine
	Melody Farms	Ammonia
	Nitrex—Michigan Operations	Ammonia
	Quality Dairy Company	Ammonia
	Symmetry Medical—Jet Engineering	Cobalt
The Andersons Webberville	Ammonia	
Ionia	Belding Tank Technologies	Styrene
	Cargill Kitchen Solutions	Ammonia
	Crop Production Services	Ammonia
	Herbruck Poultry Ranch	Ammonia
	Portland City of, Waste Water Treatment Plant	Chlorine
	Stahlin Enclosures	Styrene
	TRW Automotive US	Ammonia
	Twin City Foods	Ammonia, Chlorine
Iosco	Huron Shore Regional Utility—Earth Tech	Chlorine
	Rose Ice Company	Ammonia
	Tawas Utility Authority WWTP	Chlorine
	Tip-Top Screw Mfg.	Ammonia
Jackson	Industrial Steel Treating	Ammonia
	Jackson City of, Water Treatment	Chlorine
	Springport Elevator	Ammonia
	Summit Township—Coventry Pk, JCC, Kimmel Rd, Meadow Hts, Southview & West Chester	Chlorine
	Tenneco-Jackson Engineering	Ammonia
Kalamazoo	AGA Gas	Ammonia, Chlorine
	Cytec Industries	Epichlorohydrin
	Haviland Products	Formaldehyde
	Kal Blue Reprographics	Ammonia
	Kalamazoo City of, Water Division Stations: 1-5, 8-9, 11- 12, 14, 17, 18, 22, 24-25, 28, 31, 39	Chlorine
	Knappen Milling	Chlorine
	Pharmacia & Upjohn—Pfizer Manufacturing Complex	Ammonia, Chlorine, Epichlorohydrin, Formaldehyde
	Precision Heat Treating Company	Ammonia
	Thermo Fisher Scientific	Formaldehyde
	Total Logistics Control	Ammonia

Table 15, continued...

County	Company Name	Type of Exposure
Kent	AGA Gas	Ammonia
	Airgas Great Lakes—Grandville	Ammonia, Chlorine
	Allied Finishing	Formaldehyde
	Brenntag Great Lakes	Ammonia, Formaldehyde, Styrene
	Butterball Farms	Ammonia
	Coca-Cola Bottling	Ammonia
	Cook Composites & Polymers	Phthalic Anhydride
	Country Fresh	Ammonia
	CPA: 14	Ammonia
	Delphi Powertrain Systems	Ammonia
	Duda Farm Fresh Foods—Michigan	Ammonia
	Electro-Chemical Finishing Company—44th St. Facility	Ammonia
	Electro-Chemical Finishing Company—Remico St. Facility	Ammonia, Chlorine, Formaldehyde
	Emerald Spas	Styrene
	Finishmaster	Styrene
	Gordon Food Service	Ammonia
	Grand Rapids Controls	Formaldehyde
	GRF Industries	Formaldehyde
	Grocers Baking Company—Sara Lee	Ammonia
	IBP Foods	Ammonia
	Jolly Roger Ice Arena	Ammonia
	Kent Quality Foods	Ammonia
	King Milling	Chlorine
	Lack's Trim System—Airline Plant	Formaldehyde
	Lack's Wheel Systems	Formaldehyde
	Lowell City of, WWTTP	Chlorine
	Lowell City of, Water Treatment & Filtration	Chlorine
	MacDonald's Industrial Products—Plant 3	Formaldehyde
	Michigan Natural Storage	Ammonia
	Michigan Turkey Producers	Ammonia
	Old Orchard Brands	Ammonia
	Patterson Ice Center	Ammonia
	Plastic Plate—Plant II	Formaldehyde
	Ridgeking Apple Packing	Ammonia
	Sellner-Behr Corporation	Styrene
	Southside Ice Center	Ammonia
	Sparta Village of, Water Department	Chlorine
	Spartan Stores Distribution	Ammonia
	Specialty Heat Treating	Ammonia
	State Heat Treating	Ammonia
Superior Seafood	Ammonia	

Table 15, continued...

County	Company Name	Type of Exposure
Kent	Superior Stone Products	Styrene
	SYSCO Food Services of Grand Rapids	Ammonia
	Univar—Grand Rapids	Formaldehyde, Styrene
	Vi-Chem Corporation	Styrene
	Wolverine Leathers	Ammonia
	Wyoming Clean Water Plant	Chlorine
	Young Chemical Company	Formaldehyde
Keweenaw	Tootsie Roll Movers	Ammonia, Cobalt
	Susan's Big Dummy	Ammonia
	Susan's Farm	Ammonia
Lapeer	Deco' Plate Manufacturing—DOTT Industries	Formaldehyde
	Royster-Clark—Crop Production Services	Ammonia
Leelanau	Cherry Growers—Plant 2	Ammonia
	Leelanau Fruit Company	Ammonia
Lenawee	Anderson Development—Main Plant	Formaldehyde, Phthalic Anhydride, Styrene
	Anderson Development—NF3 Plant	Ammonia
	Biolab—Chemtura	Ammonia, Chlorine
	Crop Production Services	Ammonia
	Dairy Farmers of America	Ammonia
	Munson Agri-Services	Ammonia
	Tecumseh City of, Well House #3, #8-#12 & #14	Chlorine
	War-Ag Farms Services	Ammonia
Livingston	Alpha Technology Corporation	Styrene
	Chemco Products	Formaldehyde
	Gordon Food Service	Ammonia
	Howell City of, Waste Water Treatment Plant	Chlorine
	Howell City of, Water Plant	Chlorine
	Kelsey-Hayes Company, TRW Automotive	Chlorine
	May & Scofield	Styrene
	Pepsi Cola Metropolitan Bottling	Ammonia
Mackinac	Department of Public Works—WWTP	Chlorine
	Department of Public Works—Water Treatment Plant	Chlorine
Macomb	Ashland Distribution	Styrene
	Chemtech Finishing System	Epichlorohydrin, Formaldehyde
	Du Pont—Mt. Clemens Plant	Formaldehyde, Styrene
	Everfresh/La Croix Beverages	Ammonia
	Fini Finish Products	Chlorine
	GMC Technical Center	Ammonia
	Metallurgical Processing Company	Ammonia

Table 15, continued...

County	Company Name	Type of Exposure
Macomb	Mt. Clemens City of, Waste Water Treatment Plant	Chlorine
	New Baltimore City of, WWTP	Chlorine
	Nitro-Vac Heat Treating	Ammonia
	Norbrook Plating	Ammonia
	RCO Engineering	Formaldehyde
	Reinhart Foodservice	Ammonia
	Specialty Steel Treating	Ammonia
	Steel Processing Company	Ammonia
	TI Automotive Systems	Chlorine
	Warren City of, Waste Water Treatment	Chlorine
Manistee	Bear Lake Storage	Ammonia
Marquette	Airgas North Central	Chlorine
	KI Sawyer WWTP	Chlorine
	Negaunee Waste Water Treatment	Chlorine
Mason	House of Flavors	Ammonia
	Jos, Sanders	Ammonia
	Ludington City of, Waste Water Plant	Chlorine
	Michigan Food Processors	Ammonia
	Noron Composite Technologies	Styrene
Mecosta	Leprino Foods Company—Remus	Ammonia
	United States Marble	Styrene
Menominee	L.E. Jones Company	Ammonia, Cobalt
	Menominee Paper Company	Chlorine
	Menominee Waste Water Treatment Plant	Chlorine
	Menominee Water Treatment Plant	Chlorine
	Ruleau Brothers	Ammonia
Midland	Airgas Great Lakes—Midland	Chlorine
	Dow Chemical USA—Midland Operations—MI Division	Ammonia, Chlorine Epichlorohydrin, Methyl Acrylate, Styrene
	Dow Corning—Midland Plant	Ammonia, Chlorine
	Homestead Tool & Machine—SMC Plant	Styrene
	Midland City of, Waste Water Plant	Chlorine
	Midland City of, Water Treatment	Chlorine
	Midland Materials Research—Carbone of America	Chlorine
	Monroe	Advanced Heat Treat
Detroit Edison—Monroe Power	Ammonia	
Home City Ice Company	Ammonia	
Independent Dairy	Ammonia	
Maybee Farmers	Ammonia	

Table 15, continued...

County	Company Name	Type of Exposure
Monroe	Meijer Newport Distribution	Ammonia
	Monroe City of, Waste Water	Chlorine
	Ottawa Lake Co-Op Elevator	Ammonia
	Royster-Clark	Ammonia
Montcalm	Crop Production Services	Ammonia
	Federal Mogul	Ammonia
Muskegon	Bayer Cropsience USA	Ammonia
	Brunswick Bowling & Billiards	Styrene
	Cannon—Muskegon, Precision Castparts	Cobalt
	Cole's Quality Foods	Ammonia
	ESCO Company LTD Partnership	Phthalic Anhydride
	GMI Composites	Styrene
	Howmet Corporation—Plants 1 & 3	Cobalt
	Howmet Corporation—Plant 5	Cobalt
	Howmet Corporation—Plant 10	Cobalt
	L-3 Communications-Combat Propulsion Systems	Ammonia
	Lake Welding Supply Company	Ammonia
	Muskegon Heights Filtration Plant	Chlorine
	S.D. Warren Company	Chlorine
	Snappy Apple Farms	Ammonia
	Sun Chemical Corporation	Ammonia
Webb Chemical Service Corporation	Formaldehyde	
Newaygo	Gerber Products Company	Ammonia
	Wilbur-Ellis Company, Grant	Ammonia
Oakland	Airgas Great Lakes—Ferndale	Chlorine
	Behr America	Ammonia
	Chor Industries	Ammonia
	Commercial Steel Treating	Ammonia
	Detroit Skating Club	Ammonia
	Drayton Pool & Spa Supply	Chlorine
	Eagle Ottawa Rochester Hills	Formaldehyde
	Engineered Heat Treat	Ammonia
	Farmington Hills Ice Arena	Ammonia
	Foglers Orchard & Farm Market	Ammonia
	General Motors Proving Ground	Chlorine
	Hazel Park Viking Arena	Ammonia
	Holly Village of, Waste Water Treatment Plant	Chlorine
	Husky Injection Molding Systems	Ammonia
	JHP Pharmaceuticals	Chlorine
	John Lindell Ice Arena	Ammonia
	K.C. Jones Plating Company	Ammonia

Table 15, continued...

County	Company Name	Type of Exposure
Oakland	Lakeland Arena	Ammonia
	Lakeland High School	Chlorine
	MacDermid	Ammonia, Formaldehyde
	Marbelite	Styrene
	Milford Village of, Iron Removal Plant	Chlorine
	Milford Village of, Waste Water Treatment Plant	Chlorine
	ND Industries, Chemical Blending	Formaldehyde
	Novi Ice Arena	Ammonia
	Onxy-Rochester Ice Arena	Ammonia
	Palace Sport & Entertainment	Ammonia
	RMT Southfield	Ammonia
	Specialty Steel Treating	Ammonia
	Stone Soap Company	Formaldehyde
	Suburban Training Center	Ammonia
	Sulzer Metco (US)	Cobalt
	United Paint & Chemical Corporation	Ammonia
	US Foodservice	Ammonia
Valley National Gases	Ammonia	
Waterford Township Iron Removal Plants	Chlorine	
Oceana	Chase Farms	Ammonia
	Hanson Logistics Group	Ammonia
	Michigan Freeze Pack	Ammonia
	Oceana County Freezer Storage	Ammonia
	Peterson Farms Main Plant	Ammonia
Ogemaw	Sandvik Hard Materials	Cobalt
Ontonagon	Smurfit-Stone Container Enterprises	Chlorine
Osceola	Advanced Fibermolding	Styrene
	Liberty Dairy Company	Ammonia
	Ventra Evert	Formaldehyde
	Yoplait USA	Ammonia
Otsego	Airgas Great Lakes—Gaylord	Chlorine
Ottawa	Boar's Head Provisions	Ammonia
	Crème Curls Bakery	Ammonia
	Edge Ice Arena	Ammonia
	Georgetown Ice Center	Ammonia
	Grand Haven Board of Light—JB Sims Generating Station	Chlorine
	Interstate Warehousing	Ammonia
	Juana's Packing Company—Brady Farms	Ammonia
	Lake Welding Supply Company	Ammonia
	Lakeshore Filtration Plant—Grand Rapids	Chlorine

Table 15, continued...

County	Company Name	Type of Exposure
Ottawa	Leprino Foods—Allendale Plant	Ammonia
	Mead Johnson & Company	Chlorine
	Miedema Produce	Ammonia
	Polyply Composites	Styrene
	Quincy Street	Ammonia
	Request Foods	Ammonia
	Sara Lee Foods—Zeeland	Ammonia
	Specialty Heat Treating of Holland	Ammonia
	Total Logistic Control	Ammonia
	Wyoming City of, Water Treatment Plant	Chlorine
	Zeeland Farm Services	Ammonia
Saginaw	Agriliance	Ammonia
	Agrium Advanced Technologies (US)	Ammonia
	Airgas Great Lakes—Saginaw Stoker Drive	Chlorine
	Bridgeport Waste Water Treatment Plant	Chlorine
	Buena Vista Waste Water Treatment Plant	Chlorine
	Delphi Saginaw Steering Systems	Ammonia
	Dow Corning	Ammonia
	Eaton Corporation	Ammonia
	Frankenmuth City of, Waste Water Treatment Plant	Chlorine
	Hi-Tech Steel Treating	Ammonia
	Linear Motion	Ammonia
	Nash Finch (Super Foods)	Ammonia
	Saginaw Charter Township Retention Basin	Chlorine
	Saginaw City of, Water Treatment Plant	Chlorine
	Saginaw City of, WWTP	Chlorine
	Star of the West Milling Company	Chlorine
Winfield Solutions	Ammonia	
Saint Clair	Dunn Paper	Chlorine
	Lake Huron Water Treatment Plant	Chlorine
	Marysville City of, WWTP	Chlorine
	Marysville Ethanol	Ammonia
Saint Joseph	Abbott Nutrition	Ammonia
	Crop Production Services—Mendon Unit	Ammonia
	Fastener Coatings	Formaldehyde
	Forest River—Vanguard	Formaldehyde
	Grav-I-Flo—Main Plant	Formaldehyde
	Lasco Bathware	Styrene
	Michigan Milk Producers	Ammonia
	Sturgis City of, Waste Water Treatment Plant	Chlorine
	Three Rivers Waste Water Treatment Plant	Chlorine

Table 15, continued...

County	Company Name	Type of Exposure
Sanilac	Crop Production Services	Ammonia
	Croswell Water Plant	Chlorine
	DGP	Styrene
Shiawassee	Airgas Specialty Products—Owosso	Ammonia
	Crop Production Services	Ammonia
	Machine Tool & Gear	Ammonia
	Wausaukee Composites	Styrene
Tuscola	Caro Village of, Waste Water Treatment Plant	Chlorine
	Cass City Village of, Waster Water Treatment Plant	Chlorine
	Co-Operative Elevator	Ammonia
	Dykhouse Pickle Company	Ammonia
	Precision Concepts	Styrene
Van Buren	Albemarle Corporation—South Haven	Ammonia
	Alloy Steel Treating	Ammonia
	Coca-Cola North America	Ammonia, Chlorine
	Crop Production Services	Ammonia
	Dole Packaged Foods—Decatur	Ammonia
	Fruit Belt Foods, Canning	Ammonia
	Hanson Logistics, Hartford Warehouse	Ammonia
	Knouse Foods—Paw Paw Plant	Ammonia
	Lawrence Freezer	Ammonia
	MBG Marketing—Grand Junction Facility	Ammonia
	Sill Farms Market	Ammonia
	South Haven City of, Water Filtration Plant	Chlorine
	St. Julian Wine Company	Ammonia
	Total Logistic Control—Paw Paw Logistic Center	Ammonia
Welch Foods	Ammonia	
Washtenaw	Airgas Great Lakes—Ann Arbor	Ammonia, Chlorine
	Arbor Hills Electric, Gas Recovery Systems	Ammonia
	Arctic Glacier—Ypsilanti	Ammonia
	Astro Cap Manufacturing	Styrene
	Chelsea Milling Company	Chlorine
	Crop Production Services	Ammonia
	Dapco Industries	Ammonia
	Electro Arc Manufacturing	Ammonia
	Kalitta Charters	Formaldehyde
	Photo Systems	Formaldehyde
	Thetford Corporation	Formaldehyde
Wayne	3M Detroit Abrasives	Ammonia, Formaldehyde
	A & R Packing	Ammonia
	Aldoa Company	Epichlorohydrin

Table 15, continued...

County	Company Name	Type of Exposure
Wayne	Apollo Plating	Ammonia
	Arctic Cold Storage	Ammonia
	Arted Chrome Plating	Chlorine
	BASF Corporation	Ammonia, Formaldehyde, Styrene
	Bottling Group, LLC, Pepsi Bottling	Ammonia
	C.F. Burger Company	Ammonia
	Cardinal Health	Formaldehyde
	Chrysler JNAP	Formaldehyde
	City Sports Center	Ammonia
	Classic Plating	Ammonia
	Coca Cola Enterprises	Ammonia
	Compuware Arena	Ammonia
	Country Fresh—Livonia	Ammonia
	Dairy Fresh Foods Inc., Detroit City Dairy	Ammonia
	Detroit City of, NE, SE, Park & Springwells Water Plants	Chlorine
	Detroit City of, Waste Water Treatment	Chlorine
	Detroit Edison Company—Trenton	Ammonia
	Durcon Laboratory Tops	Phthalic Anhydride
	Dynamic Surface Technologies	Ammonia
	Eddie Edgar Arena	Ammonia
	Farmer's Cold Storage	Ammonia
	Faygo Beverages	Ammonia
	Freezer & Dry Storage	Ammonia
	Freezer Services of MI	Ammonia
	Fritz Products	Chlorine
	Gutter Suppliers	Formaldehyde
	Home City Ice Company	Ammonia
	Inland Waters Pollution Control	Styrene
	Interstate Chemical	Ammonia, Formaldehyde
	JCI Jones Chemicals	Chlorine
	KA Steel Chemicals	Chlorine
	Lincoln Distributing—Painters Supply & Equipment	Styrene
	Linde Gas—Canton	Ammonia, Chlorine
	Marathon Petroleum	Ammonia
	McGean-Rohco	Ammonia
	McLane Food Service—Plymouth	Ammonia
	Melody Farms—Detroit	Ammonia
	Michigan Dairy—The Kroger Company	Ammonia
	Norquick Distributing Company	Ammonia
	Polychemie	Formaldehyde
Polymer Concrete Corporation	Styrene	
Praxair Distribution	Ammonia	

Table 15, continued...

County	Company Name	Type of Exposure
Wayne	Progressive Distribution Centers—Evans Distribution	Styrene
	PVS Nolwood Chemicals	Formaldehyde
	PVS Technologies	Chlorine
	Quaker Chemical	Formaldehyde
	S & F Foods	Ammonia
	Sherwood Food Distributers	Ammonia
	South Huron Valley Waste Water Treatment Plant	Chlorine
	SYSCO Food Services of Detroit	Ammonia
	Tanner Industries	Ammonia
	Trenton City of, Waste Water Treatment Plant	Chlorine
	Unistrut-Wayne Manufacturing	Ammonia
	White Tower Industrial Laundry	Chlorine
	Wolverine Packing Company	Ammonia
	Woodworth Incorporated	Ammonia
Wyandotte City of, Municipal Power Plant	Chlorine	
Wexford	AAR Mobility Systems	Formaldehyde
	Airgas Great Lakes—Cadillac	Chlorine
	Fiber-Tech Industries—Cadillac Plant	Styrene
	Four Winns, Cruiser & Sport Division	Styrene
	Haring Township Water Supply	Chlorine
	TD Heat Treat	Ammonia

^aSource: Michigan Department of Environmental Quality (DEQ). Michigan Facilities' Guide to SARA Title III, Emergency Planning and Release Reporting, December 2007, 6th edition. The chemicals listed in this table are subject to reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA) section 313, which is triggered by threshold amounts of 25,000 pounds manufactured or processed or 10,000 pounds otherwise used at facilities in Michigan. The companies listed in this table were current as of a report generated by the Michigan DEQ on April 13, 2009.

Discussion

The consensus in the medical literature is that the true number of WRA cases is much greater than what is actually reported in public health surveillance systems, including Michigan's. Studies suggest that work exposures are important etiologic agents in a significant percentage (15%) of adults with asthma.⁴

On average, 148 new people each year are reported to the Michigan Department of Energy, Labor and Economic Growth (DELEG) with confirmed WRA. One hundred thirty-five reports were confirmed in 2006, the most recent year with complete data. Although the total number of WRA cases has not varied significantly (115-176), the number of individuals with exposure to a known occupational sensitizer (disease category OA)

appears to show a downward trend, although there was a slight increase in 2004 that persisted in 2005 (Table 1). The reason for this trend is unknown and may be related to changes in reporting sources or to the success of workplaces in better controlling their employees' exposures to known sensitizers.

Based on responses from the 2001 BRFSS random sample of Michigan residents, we estimate that there are a total of 62,000 (95% CI 42,000—83,000) Michigan adults with WRA in the state.⁵ Based on the medical literature we would estimate that there are 97,500 Michigan adults with WRA.⁴ Using capture-recapture analysis, we estimate 228—801 adults in Michigan develop WRA each year.⁶



Local exhaust ventilation is one way to help control exposures to asthma-causing agents at work.

The hiring of temporary workers is a special concern in the identification of workers with sensitivity to allergens in the workplace.

As in the previous annual reports on WRA in Michigan, the workers are generally young to middle age Caucasian men and women, with the greatest number being reported from the Detroit metropolitan area. However, the rate of WRA in African Americans is 2.1 times greater than among Caucasians. Based on an analysis conducted for previous annual reports, factors from the WRA surveillance data that would contribute to greater morbidity among African Americans include: a greater likelihood to continue to be exposed to allergens, having a longer time of exposure before leaving work, and being less likely to receive workers' compensation.

Another concern is the hiring of temporary workers. As companies find new ways to trim costs, especially in light of reduced production schedules, more temporary workers are being hired to do work on an as-needed basis. The transient nature of temporary work underscores the potential for under-counting of cases of WRA when employees move from job to job, especially those jobs that have a high potential for exposure to sensitizing agents.

Individuals in the Michigan work force tend to develop their asthma from exposure to agents in the manufacturing sector, particularly automobiles, machinery, metals, chemicals, and rubber and plastics. The predominant causes of WRA remain isocyanates (14%) and metal working fluids (11%). We updated the table first presented in the 2002 Work-Related Asthma Annual Report (Table 14) on the number of manufacturing workers in companies that use isocyanates. In some counties, 0.1-9.0% of the work force is employed in facilities where isocyanates are used: Mason (9.0%), Eaton and Wexford (each 6.2%), Mecosta (5.5%) and Luce (5.2%). Health care providers can use this information to heighten their awareness

of potential exposures to isocyanates among their patients with asthma.

Table 15 shows selected agents by county and company that have been associated with WRA. Health care providers can use this table as an initial step in evaluating possible exposure for their patients if they work at one of the facilities listed.

Asthma symptoms persist despite removal from the precipitating work exposures (Table 9). Studies show that the sooner an individual is removed from the exposure after symptoms develop, the more likely the individual's symptoms will resolve.⁷ On the average, among the 1,802 individuals no longer exposed, almost three years elapse from onset of respiratory symptoms at work to date last exposed. We do not have data on how much of this delay is secondary to the individual not seeking medical care and how much is related to the physician not recommending that the individual leave the exposure.

Personal habits like cigarette smoking and individual susceptibility measured through personal or family history of allergies do not predict who develops WRA. About 50% of the WRA patients identified through the Michigan Tracking System have no personal or family history of allergies and 80% are not smoking cigarettes at the time their asthma symptoms develop (Table 6-8).

Although most facilities where the patient developed asthma were in compliance with exposure standards, there were high percentages of symptomatic co-workers identified in those facilities. It is possible that air sampling was not conducted under similar enough conditions as the exposures associated with the development of the index cases' asthma, such as spills or leaks, or that the current standards are not protective enough.

We identified 1,509 fellow workers with symptoms compatible with WRA (Table 13). Five hundred seventy-one individuals were listed on the MIOSHA Injury and Illness Log (Form 300) as having WRA or symptoms compatible with WRA. There was only an overlap of nine individuals of co-workers reporting symptoms on co-worker interviews and those being reported on the MIOSHA Log. Part of the reason for the lack of overlap is that half of the symptomatic individuals indicate they have never seen a doctor for their respiratory symptoms.

The high percentages of symptomatic individuals are consistent with estimates of the prevalence of WRA in the state. The presence of symptomatic co-workers suggests that some of the occupational health standards may not be sufficiently protective to ensure a safe workplace. The adoption of comprehensive standards for known causes of WRA, such as the isocyanates or metal working fluids, would better protect exposed workers. These standards would ideally cover medical surveillance programs for potentially exposed workers, work practices, education, and procedures to handle non-routine exposures such as during maintenance, as well as spills or leaks and other unexpected releases.

Medical monitoring is particularly relevant to reducing the burden of work-related causes of asthma. The longer a person with asthma remains exposed, the more likely their asthma will become a chronic problem.⁷ MIOSHA is currently promulgating a new standard for the diisocyanates that incorporates education, medical monitoring and a new permissible exposure limit. The deaths in 2003 and 2005 of workers from exposure to isocyanates might have been prevented if more com-

prehensive standards had been in place. The 2003 death occurred in a small three-person shop and reflects the spread of the use of new technology without adequate information on safe work practices. Small employers require additional knowledge of safe work practices to prevent sensitization of their employees.

The 2005 death occurred in a company that, although it provided medical monitoring, did not properly utilize the results of that information. Employers, employees and medical professionals need to be aware of the hazards related to returning sensitized individuals to their places of employment. If an individual is returned to the work environment where the substance is being used, there must be well-defined and frequent medical assessments of the sensitized employee.

The percentages of individuals reported with WRA that this surveillance system documented with breathing tests performed in relation to work is less than 10%. This reflects the standard of medical care in the United States where the diagnosis of WRA is made from the patient's history. More frequent use of objective pulmonary function testing performed in relation to work would allow health care providers to feel more confident about advising their patients to leave their work exposure.

Cessation of exposure is the most important aspect of treatment; patients who are removed from exposure the soonest have the best prognosis.⁷ Effective asthma treatment requires that the health care providers consider a patient's asthma triggers. Many times the health care provider reacts to concerns that their patient raises about workplace exposures, rather than proactively inquiring whether their patient



Foundries have many potential exposures to sensitizing agents.

An excellent resource on the management of WRA, available through the British Occupational Health Research Foundation can be found at:
www.bohrf.org.uk



Physicians and employers must work together to continue to identify and protect employees who develop asthma from exposures in the workplace.

Deaths from asthma in the workplace are preventable.

has triggers at work that contribute to their respiratory symptoms. One of the factors related to the 2005 death caused by isocyanate exposure was that the primary care physician waited until the patient requested a medical restriction, rather than instructing the patient at an earlier time that he needed to be removed from any further exposure to isocyanates at work.

The report of a patient with known or suspected WRA is a sentinel health event that is critical to effective occupational disease surveillance. Case reporting from physicians offers the opportunity for the most timely workplace interventions, compared to receiving reports from hospitals. With continued

support and increasing awareness of WRA by physicians and other health professionals, we can continue to provide timely intervention in the workplace, offer suggestions for reducing workplace exposures even if they are below the current permissible exposure limits, document the need for the development of new standards, identify new occupational allergens, and prevent co-workers from developing disease.

Given the potential that 15% or more of adults with asthma have WRA, work-related asthma must be integrated into all asthma initiatives planned on surveillance and education, both for health care providers and the public.

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APPENDIX

2008 PATIENT NARRATIVES BY TYPE OF INDUSTRY & EXPOSURE

Abbreviations:

- POA = Possible Occupational Asthma
- OA = Occupational Asthma with a Known Sensitizer
- AA = Aggravated Asthma (Pre-Existing Asthma Exacerbated at Work)
- RADS = Reactive Airways Dysfunction Syndrome

The patient narratives that follow are based on information collected from interviews of patients about their health and work status.

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MANUFACTURING

EXPOSURE TO METAL WORKING FLUIDS AND OTHER LUBRICANTS

POA-Case 2728 A man in his 50s died after working for three months at a factory that made brakes for airplanes and helicopters. His job as a machinist required him to perform grinding of metal parts. Metal working fluids were used in this process; the MSDS from the products used indicated soy bean oil, monoethanolamine and diethanolamine. He developed wheezing, cough, and shortness of breath one month after starting to work at this factory. He saw a doctor who told him to wear a mask at work. However, wearing the mask made him feel short of breath. The doctor also recommended if this employee continued to have breathing problems, he may have to change his work environment and find a different job. He had smoked a half pack of cigarettes a day for the past 20 years. He had never been diagnosed with asthma prior to this job. He went to the emergency department and was subsequently hospitalized and placed on a ventilator. He could not be weaned off the ventilator and died one month later. He died four months after beginning to work at this factory.

POA-Case 2738 A man in his 40s worked on production and assembly for an automobile parts manufacturer. He experienced wheezing, chest tightness and shortness of breath from exposure to differential fluid. He went to the emergency room twice, was hospitalized twice for respiratory symptoms, and was prescribed Albuterol and Symbicort. After going on disability leave from his job, his symptoms lessened. He still took Albuterol and Symbicort but in lesser doses. He had smoked three cigarettes a day for 35 years but had quit recently.

EXPOSURE TO INDOOR AIR CONTAMINANTS

POA-Case 2815 A man in his 50s worked as a welder and millwright at an automobile company. He experienced wheezing, coughing, chest tightness and shortness of breath. He described exposures to mold and bacteria. He was prescribed a nebulizer and inhalers and continued taking the steroids/antibiotics which he had used

for a “long time”. He was still exposed to both the mold and bacteria, and, though his breathing problems remained, his symptoms improved. He used the nebulizer periodically and stopped taking steroids. He had smoked an average of 60 cigarettes a day for 13 years but had stopped in his 30s.



AA-Case 2760 A woman in her 30s worked as a final line inspector at a vehicle production company where her pre-existing asthma worsened following exposure to humidity and cold air. She experienced wheezing, coughing, chest tightness and shortness of breath and was prescribed Claritin. In addition, she continued taking her previously prescribed regimen of Advair, Albuterol and a nebulizer. Spirometry indicated moderate obstruction as well as low vital capacity. She continued to work at this company, though her symptoms remained. She had smoked 15 cigarettes a day for 16 years from her late teens to early 30s but had stopped two years ago.

MULTIPLE EXPOSURES

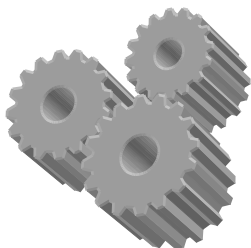
OA-Case 2750 A man in his 70s worked at an automobile factory. He described exposures to sulfur, iron, coke dust and coal dust. He experienced wheezing and coughing, both of which had been present for close to 40 years, and chest tightness and shortness of breath, which had been present for 10 and 14 years, respectively. He had been in the emergency room many times because of his breathing problems, and he had been hospitalized three-to-four times since the late 2000s for breathing issues. He was prescribed an inhaler in the mid-1960s which he continued to take. Since going on sick leave from his job, his breathing problems persisted and his symptoms worsened. He started on a nebulizer and oral medications. He had never smoked cigarettes.

OA-Case 2757 A man in his 40s was a maintenance supervisor for an automotive systems manufacturer. He developed asthma from exposure to unknown substances while removing concrete blocks from waste containers. He experienced wheezing, chest tightness and shortness of breath for which he was prescribed Symbicort. Spirometry indicated a mild restrictive pattern. His breathing problems persisted, and he started taking Albuterol, Epinephrine and Theophylline.

OA-Case 2761 A woman in her 50s worked in production at a plastic and glue factory for four years. She developed asthma, describing exposures to white lithium, glue and Benzoflex. After one exposure, she visited the local hospital emergency room for wheezing, coughing, chest tightness and shortness of breath. She returned to the hospital multiple times and was prescribed Prednisone, Albuterol, Combivent, Singulair and Pulmicort. Spirometry was abnormal. She smoked 20 cigarettes a day for 38 years but had recently quit. She left her job on sick leave, and both her symptoms and medication doses had reduced since then.

OA-Case 2792 A man in his 50s developed asthma while working as a millwright for an automobile manufacturer for 20 years. He described exposure to drawing compounds and smoke from cutting torches. He experienced wheezing, coughing, chest tightness and shortness of breath and was prescribed Advair, two additional inhalers, and Claritin. After going on disability leave from his job, his breathing problems persisted though his symptoms lessened. He continued to take the same amounts of the above-mentioned medications. He had never smoked cigarettes.

Individuals with work-related asthma are often exposed to low levels of a sensitizer for a long period of time before their breathing problems



OA-Case 2768 A man in his 50s developed asthma while working for an automobile manufacturer as a packer of boxes of auto parts. He described exposures to paint fumes from a nearby paint line and cardboard dust. He experienced chest tightness, wheezing and shortness of breath, for which he made two visits to a local hospital. He was prescribed Combivent, Advair and Albuterol. After going on sick leave from this job, his breathing problems persisted with less severe symptoms, and he continued taking Advair and Albuterol. He had smoked 10 cigarettes a day for 10 years but had quit in his early 40s.

EXPOSURE TO WOOD DUST

OA-Case 2813 A man in his 30s worked for a door-making company for two years. He developed asthma from exposure to dust from sanding maple and red oak wood. He experienced chest tightness and shortness of breath and was prescribed Albuterol and Symbicort. After being fired from his job, his breathing problems persisted, though his symptoms lessened. He continued taking Albuterol and Symbicort. He had never smoked cigarettes.

EXPOSURE TO FLOUR

POA-Case 2737 A woman in her 40s worked for a company that made pie shells and other baked goods where she developed breathing difficulties from exposure to flour. She was prescribed Albuterol. Spirometry indicated a normal pattern. Despite being transferred to a new production line with less flour, her breathing problems persisted. She continued to take Albuterol. She had smoked an average of 10 cigarettes a day for 26 years but had quit in her early 40s.

EXPOSURE TO ISOCYANATES

OA-Case 2739 A man in his 40s worked as a machine operator and assembler at a refrigerator manufacturer for one year. He developed asthma from exposure to isocyanates, which were present in the plant's foaming department. He experienced wheezing, coughing, chest tightness and shortness of breath. He made two visits to the emergency room because of breathing difficulties and was prescribed Symbicort, Advair, Singulair, Xopenex, and Combivent. Despite going on sick leave from his job, his symptoms persisted. He continued to take Symbicort and Xopenex. He had never smoked cigarettes.

OA-Case 2766 A man in his 30s worked on the production line in the foaming area of an auto parts plant where he developed asthma from exposure to MDI. He had worked at the plant for close to two years when he started to experience wheezing, coughing and shortness of breath. He was prescribed Asmanex and Albuterol. He quit this job on doctor's advice, and his breathing symptoms ceased. He stopped taking breathing medication. He smoked 10 cigarettes a day for 10 years in his 20s but had recently quit.



Exposure to red cedar is a common cause of work-related asthma. Other wood dusts can also be sensitizers.

Even after removal from the exposure, many work-related asthma patients continue to experience breathing problems.

EXPOSURE TO CLEANING PRODUCTS

OA-Case 2741 A woman in her 60s worked in production and packing for a frozen baking product company. She developed asthma after exposure to cleaning products. She experienced shortness of breath, chest tightness, wheezing and coughing. She was prescribed Advair, Singulair, Prednisone, Albuterol, and sinus medications. Spirometry indicated an essentially normal pattern with potentially small airway disease. She continued her job, and her symptoms worsened. She took larger doses of Prednisone, Advair, and Albuterol. She had never smoked cigarettes.

EXPOSURE TO GLUES

AA-Case 2791 A man in his 40s worked as a facilitator at an industrial packaging manufacturer. His pre-existing asthma was exacerbated by exposure to glue fumes from a laminating machine. He experienced wheezing, coughing, chest tightness and shortness of breath. He visited the emergency room once for his breathing problems, but was initially prescribed no medication. After quitting his job, his breathing problems lessened, though he was prescribed Advair and Albuterol for emergency situations. He smoked 10 cigarettes a day for 15 years but had quit 10 years ago.

POA-Case 2788 A man in his 20s worked setting an epoxy floor mixture for an industrial flooring manufacturer where he experienced wheezing, coughing, chest tightness and shortness of breath. He visited the hospital emergency room once because of breathing problems and was prescribed Asmanex and Proventil. Spirometry indicated a normal pattern. After going on sick leave from his job, his breathing problems and symptoms persisted. He continued taking Asmanex and Proventil. He had never smoked cigarettes.

EXPOSURE TO SEALANT

OA-Case 2783 A woman in her 40s worked as a painter/sealant applier at an automobile manufacturer where she developed asthma from exposure to sealant. She experienced coughing, wheezing and shortness of breath. She was prescribed Singulair and Symbicort. After taking sick leave from her job, her symptoms decreased. She continued taking breathing medications and started on Pulmicort in place of Symbicort. She had never smoked cigarettes.

EXPOSURE TO COBALT CARBIDE

OA-Case 2724 A man in his 50s was a ball mill mixer operator in a facility that made tungsten carbide products when he developed asthma from exposure to cobalt carbide. He visited a local emergency room multiple times and was hospitalized once as a result of his exposures. He was prescribed Advair, Albuterol and DuoNeb. After going on sick leave from the facility, his symptoms stopped, and he no longer took medications for breathing problems. He had never smoked cigarettes.



Cleaning agents contain ingredients that can cause asthma.

Visit www.oem.msu.edu, under newsletters, Project SENSOR, to read about the hazards of exposure to cleaning agents.



OFFICE

EXPOSURE TO CLEANING PRODUCTS

OA-Case 2811 A woman in her 50s worked in an office for a cabinet retail store and wholesaler. She developed asthma after exposure to “TopCoat” spray, which was applied to the cabinets every day. She experienced wheezing, coughing, chest tightness and shortness of breath and was prescribed Qvar and Albuterol. Spirometry indicated a normal pattern. She continued to work at the store, and her symptoms worsened. In addition, her medication doses for both Qvar and Albuterol increased. She smoked six cigarettes a day for three years but had quit 30 years ago.

AA-Case 2785 A woman in her 40s worked as a building department coordinator at an office where her pre-existing asthma was exacerbated by exposure to bathroom deodorizers, cleaners, colognes and perfumes. She experienced wheezing, coughing, chest tightness and shortness of breath. She went to a local emergency room and was hospitalized. In addition to continuing on Albuterol, which she had taken for 10 years, she was prescribed an inhaler, a Medial Dose Pack, Symbicort and Singulair. Spirometry showed airway obstruction, though this lasted only about a week before clearing. After quitting her job because of her lung problems, her breathing problems persisted though her symptoms became less severe. She continued to take Singulair, Symbicort and Albuterol. She had never smoked cigarettes.

EXPOSURE TO INDOOR AIR CONTAMINANTS

OA-Case 2787 A man in his 50s worked as a loan officer for a reverse mortgage company where he developed asthma. He described an office area with mold and water-AC system coolant exposures. He experienced wheezing, coughing, chest tightness and shortness of breath. He visited the emergency room twice in the past year and was prescribed Singulair and an inhaler in addition to the Allegra D he had taken prior to this. Spirometry indicated a normal pattern. After continuing at the same job, his breathing problems persisted and his symptoms worsened. He continued taking the same medications. He had never smoked cigarettes.

AA-Case 2734 A woman in her 40s worked as a project manager at an insurance company. Her pre-existing asthma was aggravated by exposure to unknown substances in the building in which she worked. She was prescribed Advair, Singulair, Flonase and Albuterol. Spirometry showed no obstruction. She continued working at the same job in the same location, and her symptoms worsened. She continued on the same doses of medication. She had never smoked cigarettes.

AA-Case 2721 A woman in her 50s worked as a word processor and back-up support technician at a human services firm. Her pre-existing asthma was aggravated by exposure to dust and other unknown substances on the walls and in the vents of her work area. She experienced shortness of breath, chest tightness, wheezing and coughing. She visited local hospitals multiple times and was prescribed Advair, in addition to the Prednisone and Albuterol that she had taken for 30 years. Spirometry indicated no obstruction but possibly small airway disease. After taking sick leave from her job, her symptoms worsened. She increased her medication doses



Material Safety Data Sheets (MSDS) can be used to identify ingredients in products that may cause asthma. However, a physician may have to write the company to find out about trade secret ingredients not listed on the MSDS.



and started taking Combivent and a nebulizer. She had never smoked cigarettes.

POA-Case 2720 A woman in her 40s worked as an assistant to the CFO of a door manufacturer. She was exposed to mold and experienced coughing, wheezing and chest tightness. She was prescribed Singulair and Proventil. Spirometry showed no obstruction. After taking sick leave from her job, her symptoms worsened, and she increased her medication doses. She had never smoked cigarettes.

POA-Case 2711 A woman in her 40s worked as a customer service agent at an airline. She described exposures to carbon monoxide at a specific terminal in the airport and to asbestos and dust in the airline's cargo facility, and she experienced wheezing, coughing, shortness of breath and chest tightness. She was prescribed Spiriva, Nasacort, and other inhalers. Spirometry showed no obstruction. After quitting the airline because of lung problems, her symptoms lessened. She continued to take Spiriva and Nasacort, though her dosages were reduced. She had smoked 10 cigarettes a day in her 20s and 30s but had quit in her early 40s.

AA-Case 2764 A woman in her 50s worked as a customer service agent at a shipping company warehouse where her pre-existing asthma was aggravated by exposure to diesel fumes, rat fur and rat excrement. She developed a headache, chest pain, nasal congestion and felt acute burning in her eyes. She increased her doses of Albuterol and Advair and was prescribed Singulair. After she was hospitalized following an acute onset of symptoms, she went on sick leave. Since then, her symptoms had decreased. She had never smoked cigarettes.

EDUCATIONAL SERVICES

EXPOSURE TO CLEANING PRODUCTS

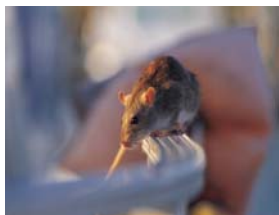
POA-Case 2754 A woman in her 40s worked as a custodian at a high school for close to 10 years when she developed asthma. She described exposures to bleach and noticed a worsening of her symptoms when the gym's exhaust fan was shut down during the winter. She experienced chest tightness, wheezing, coughing, and shortness of breath and was prescribed Prednisone, antibiotics and a nebulizer. Spirometry was abnormal. After going on sick leave from her job, her symptoms worsened, and she started taking Advair and Albuterol in addition to the Prednisone and the nebulizer. She had never smoked cigarettes.

EXPOSURE TO RATS

OA-Case 2727 A woman in her 20s worked as an animal handler, feeding rats and cleaning their cages at a university. She developed asthma from these exposures and experienced chest tightness, wheezing and shortness of breath. She was prescribed Ventolin and Flovent. She continued to work as an animal handler, and both her symptoms and medication doses remained the same. She had never smoked cigarettes.



At schools, teachers, support staff, custodial staff and students can all be exposed to potential asthma-causing agents.



Animal dander can cause work-related asthma.

EXPOSURE TO INDOOR AIR CONTAMINANTS

POA-Case 2771 A woman in her 30s worked as a student account technician for a community college. She experienced wheezing, coughing and shortness of breath, and described exposures to noxious fumes, including mold, sewage and a nearby biology lab. Furthermore, she worked in a closed room with no ventilation. She visited a local emergency room and was prescribed an inhaled steroid. Spirometry showed no obstruction. She continued to work at the college. Her symptoms persisted, and she increased her medications, starting on Advair and Prednisone. She smoked five cigarettes a day for 18 years.

HEALTH CARE SERVICES

EXPOSURE TO WAX AND FLOOR STRIPPERS

OA-Case 2753 A woman in her 40s was a registered nurse in a hospital for one year when she developed asthma from exposure to floor stripper. She experienced wheezing, coughing, chest tightness and shortness of breath. She was admitted to the emergency room three times due to breathing difficulties, and was prescribed Asmanex, Albuterol, Xopenex, Nasonex and an Epi-pen. Spirometry indicated a normal pattern. After going on sick leave from her job, her symptoms lessened. She continued to take Asmanex and Xopenex. She had never smoked cigarettes.

AA-Case 2784 A woman in her 20s worked as an ICU-RN at a medical center for close to two years when her pre-existing asthma was aggravated by exposure to wax, floor strippers and latex. She experienced wheezing, chest tightness and shortness of breath. She was prescribed Albuterol, Atrovent, Benadryl, Solu-medrol and a nebulizer. Spirometry showed possible small airways. After taking sick leave from her job, her symptoms worsened; she increased medication, starting on Singulair, Advair and Prednisone in addition to a nebulizer. She had never smoked cigarettes.

EXPOSURE TO CLEANING PRODUCTS

POA-Case 2774 A woman in her 50s worked as a pharmacy technician at a hospital for 18 years. She developed episodic coughing, wheezing, chest tightness and shortness of breath from exposure to flooring glue and cleaning supplies. She visited the emergency room three times in the early 2000s for her breathing problems and was prescribed Advair. She remained exposed to the substances causing her problems, though her symptoms lessened. She began taking Symbicort, Claritin, Singulair and a nasal spray in place of the Advair. She had never smoked cigarettes.

OA-Case 2812 A woman in her 30s worked as lab assistant at a hospital for 13 years. She developed asthma from exposure to formaldehyde and other unknown chemicals. She experienced wheezing, coughing, chest tightness and shortness of breath and was prescribed Asmanex, Astelin, Solu-medrol, Claritin, Diflucan and an additional steroid. Spirometry indicated a normal pattern. After leaving her job on workers' compensation, her breathing problems and symptoms persisted. She continued taking her prescribed medications in increased doses. She had smoked an average of six cigarettes a day for 15 years but had quit recently.



Medical care personnel are exposed to allergens such as cleaning agents, disinfectants, and latex.





Restaurant workers are exposed to allergens such as cleaners and food products.



OA-Case 2748 A woman in her 40s worked as a secretary at a hospital for four years. She developed asthma from exposure to cleaning supplies and floor buffer and wax (which contained phenol, ethylene derivatives, and monoethanolamine). She experienced wheezing, coughing and shortness of breath. She visited the emergency room one time and was prescribed Prednisone, Albuterol and antibiotics. Spirometry indicated a normal pattern. After going on disability leave from her job, her symptoms lessened, and her dosage of Albuterol was reduced. She had smoked 15 cigarettes a day for 16 years but had quit in her early 40s.

OA-Case 2717 A woman in her 50s worked as an RN in the dialysis unit of a hospital for 30 years. Her pre-existing breathing problems were worsened by exposure to formaldehyde in the dialysis unit and other strong smells in the hospital. She experienced coughing, wheezing, shortness of breath and chest tightness, though none of these symptoms worsened at work. She had visited the emergency room once in the 1970s for breathing problems, and she was prescribed Pulmicort in the 1990s. She continued to work at the hospital, and both her symptoms and medication doses stayed the same. She smoked 10 cigarettes a day for over 40 years.

EXPOSURE TO INDOOR AIR CONTAMINANTS

AA-Case 2780 A woman in her 50s worked as a director for a professional liability and claims department at a hospital where her pre-existing asthma was exacerbated by possible exposure to mold. She experienced wheezing, chest tightness and shortness of breath and was prescribed Prednisone, Augmentin, Proventil, Atrovent and Singulair. She visited the emergency room roughly 20 times in a two-year span because of her breathing difficulties. Spirometry indicated an essentially normal pattern with possibly small airway disease. After going on sick leave, her breathing problems persisted, though her symptoms lessened. She started taking Zyflo, Atrovent, Flonase, Mucinex, Singulair, Proventil and a nebulizer in place of the abovementioned regimen. She had never smoked cigarettes.

POA-Case 2744 A man in his 40s worked as a phlebotomy supervisor at a hospital for five years. He experienced wheezing, coughing, chest tightness and shortness of breath following a specific exposure to perfume oils. He visited the emergency room and was admitted after this exposure, and he was prescribed Albuterol and Spiriva. After new engineering controls which made his workspace a “scent-free” area, his breathing problems remained, though his symptoms decreased. He continued taking Albuterol. He had smoked 20 cigarettes a day for 28 years but had stopped in his early 40s.

FOOD AND BEVERAGE SERVICES

EXPOSURE TO EXHAUST FUMES

POA-Case 2814 A woman in her 50s worked as a cook for an elementary school. She developed asthma from exposure to fumes from a furnace near the kitchen. She experienced coughing, chest tightness and shortness of breath and was prescribed Proventil, Codeine, a steroid and an antibiotic. After the school instituted new engi-

neering controls and fixed its ventilation system, her breathing problems persisted though her symptoms lessened. She continued to take Qvar and Proventil, though her medication doses decreased. She had never smoked cigarettes.

POA-Case 2743 A woman in her 30s worked as a kitchen helper at an elementary school. She was exposed to exhaust fumes while working in the kitchen and experienced wheezing, coughing and shortness of breath. She was prescribed Ventolin, Methylpred and SMZ/TMP DS tablets. After being reassigned, her breathing problems persisted, though her symptoms lessened significantly. She continued using Ventolin in emergency situations. She had smoked an average of three cigarettes a day for two years but had stopped altogether in her 20s.

EXPOSURE TO CLEANING PRODUCTS

OA-Case 2765 A woman in her 30s worked as a waitress at a restaurant for four years when she developed asthma. She described exposure to pesticides used to spray the entire restaurant, and bleach. She experienced coughing, wheezing, chest tightness and shortness of breath. She visited an urgent care clinic and was prescribed Xopenex. After quitting the restaurant on her doctor's advice, her symptoms became less severe. She continued taking Xopenex and also started on Prednisone. She had never smoked cigarettes.

MISCELLANEOUS SERVICES & OTHER INDUSTRIES

MULTIPLE EXPOSURES

POA-Case 2710 A man in his 30s worked as a plumber where he developed asthma after being exposed to chlorine, cyanide, potassium, mercury, chromium, copper and potassium gases. He experienced chest tightness, shortness of breath and felt a "burning" feeling in his lungs. He was prescribed Proventil, Singulair and Azmacort but only started taking Proventil since he claimed his insurance would most likely not cover the other two. Spirometry showed no obstruction. After being reassigned to a different work location, his symptoms persisted at the same level of severity. He increased his dose of Proventil. He had never smoked cigarettes.

POA-Case 2770 A man in his 30s worked as a heavy equipment operator for a waste management firm. He was exposed to ammonium bifluoride and hydrochloric acid while disposing waste from a specific company and experienced wheezing, a cough, chest tightness, and shortness of breath. He went to a local hospital, where he was diagnosed with asthma and was prescribed Prednisone, Albuterol, Pulmicort, Maxair, Accolate and a nebulizer, all of which he continued to take. Spirometry showed mild obstruction. He had smoked cigarettes for eight years but had recently stopped. After leaving this job on workers' compensation, his symptoms lessened though they were still present.

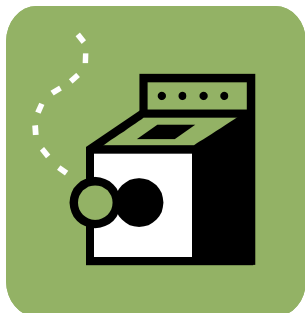


Workers in the services industry are exposed to a range of agents that can cause asthma or aggravate pre-existing asthma.



EXPOSURE TO ISOCYANATES

OA-Case 2758 A man in his late 40s worked as a paint booth cleaner and maintenance worker for a paint subcontractor. He developed asthma, and described exposures to many substances, including isocyanates, acetone, H69, resin, mold cleaners, floor strippers and degreasers. He experienced wheezing and shortness of breath. He made one visit to the emergency room and was prescribed both antibiotics and steroids. Spirometry indicated airway obstruction. After quitting his job on his doctor's advice, his breathing problems and symptoms persisted. He continued taking medications, including Prednisone, Combivent and Advair. He smoked six cigarettes a day since he was in his 20s.



EXPOSURE TO DUST AND LINT

OA-Case 2767 A woman in her 40s worked for a commercial laundry company. After a few months, she developed asthma and experienced wheezing, coughing, shortness of breath and chest tightness from exposure to dust and lint from dirty clothes and linens. She made multiple visits to a local hospital's emergency room where she was prescribed Advair, Symbicort, Singulair and DuoNeb. Spirometry showed moderate obstruction. After leaving this job on her doctor's advice, her breathing problems worsened though she continued with the same doses of medication. She smoked 10 cigarettes a day for 23 years but had quit a few years ago.

Industrial laundries use chemicals that can cause asthma, in addition to having a dusty atmosphere.

OA-Case 2759 A woman in her 50s worked for a commercial laundry company where she developed asthma from exposure to dust and lint. She made multiple visits to a local hospital for wheezing, coughing, chest tightness and shortness of breath and was prescribed Advair, Singulair, Prednisone, Atrovent, and Xopenex. Spirometry showed mixed obstructive and restrictive lung disease. After being fired from this company, her breathing problems lessened, and she continued on all of her medications. She had smoked 10 cigarettes a day for 16 years but had stopped recently.

EXPOSURE TO CLEANING PRODUCTS

POA-Case 2772 A woman in her 30s worked as a housekeeper in a retirement center. She was exposed to bleach, Lime-Away and other cleaning agents. She developed wheezing, chest tightness and shortness of breath. Spirometry showed moderately severe obstruction. After visiting a local physician, she was prescribed an inhaled steroid. She left her job because of her breathing problems and has not worked since then. After leaving the center, her symptoms became less severe and she took less medication. She smoked one cigarette a day for one year in her early 20s but had since quit.

OA-Case 2769 A woman in her 50s worked as a corrections officer at a county corrections center where she developed asthma from exposure to aerosol disinfectants. Almost immediately after she started working at this location, she experienced wheezing, coughing, shortness of breath, chest tightness, and nausea. She was prescribed Albuterol, Prednisone and antibiotics. Spirometry showed mild obstruction. After taking sick leave from work, her symptoms became less severe though her



breathing problems persisted. She continued using Albuterol and was also prescribed a nebulizer and Symbicort, though her overall doses were decreased. She had never smoked cigarettes.

OA-Case 2790 A woman in her 40s worked for a funeral home for ten years. She developed asthma from exposure to formaldehyde, paraformaldehyde, glutaraldehyde and bleach. She experienced coughing, chest tightness and shortness of breath and was prescribed Singulair, Asmanex and Proventil. Spirometry indicated a normal pattern. After going on sick leave from her job, her breathing problems persisted, though her symptoms lessened. She continued taking the same amounts of the abovementioned medications. She had never smoked cigarettes.

EXPOSURE TO SMOKE

POA-Case 2752 A man in his 50s worked as a firefighter for 17 years where he developed asthma from exposure to smoke during incidents that occurred over a 13 year period. He experienced wheezing and shortness of breath, though these symptoms were triggered only by the three specific incidents. He visited the emergency room three times, once following each incident, and was prescribed with a rescue inhaler and oral medications. His breathing problems had not persisted since his last exposure incident. He continued taking the rescue inhaler as needed. He had never smoked cigarettes



Fire fighters often are exposed to unknown chemicals or their thermal decomposition byproducts.

TRANSPORTATION SERVICES

EXPOSURE TO JET FUEL AND EXHAUST

OA-Case 2773 A woman in her 50s worked as a customer service agent for an airline company for 23 years. She developed asthma from exposure to jet fuel and exhaust. She had experienced wheezing, coughing, chest tightness and shortness of breath since the 1990s, but these symptoms became worse in the past couple of years. She visited the emergency room once and was prescribed Albuterol, Advair and Singulair. Spirometry indicated a normal pattern. After quitting her job on her doctor's advice, her symptoms lessened. Her medication doses lessened as well, and she only took Albuterol as needed. She had smoked 20 cigarettes a day for 13 years but had stopped in her 30s.

CONSTRUCTION

EXPOSURE TO DUST AND FUMES

POA-Case 2715 A man in his 50s worked as a construction worker where he experienced shortness of breath from exposure to dust and fumes. After seeking medical treatment for his breathing problems, he was prescribed Advair and an inhaler. Spirometry showed a restrictive pattern. He continued to work in construction, and his symptoms worsened. His medication doses were also increased. He smoked 10 cigarettes a day for 10 years in his teens and 20s.

