2006
Annual Report on Work-Related Asthma in Michigan

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November 13, 2007

This report was funded by the National Institute for Occupational Safety and Health, under cooperative agreement #1U60-OH008466.

Summary:

This is the 16th annual report on work-related asthma (WRA) in Michigan. For the years 1989-2004, where all reports have been processed, an average of 143 new people each year have been reported to the Michigan Department of Labor and Economic Growth with asthma caused or aggravated by exposures in the workplace. From 1988 to 2006, a total of 2,546 people with WRA have been identified through the Michigan Surveillance System that tracks occupational illness. Additional reports for 2005 and 2006 are still being reviewed. In this year's report we have again included brief clinical summaries on each of the new cases of work-related asthma reported in 2006 (see Appendix I).

There have been five work-related asthma deaths since 2003. In 2006, an individual died from a progressive worsening of her asthma 18 years after retiring from the company where she had worked for 30 years; she had developed her asthma from exposure to toluene diisocyanate (TDI) at an automotive seat manufacturer. In December 2005, a production worker died from isocyanate exposure in an adhesive manufacturing facility. In May 2004, a waitress died from an asthma attack triggered from second hand cigarette smoke exposure in the bar where she worked. In 2004, a dairy farmer died from an asthma attack while cleaning out a bulk milk tank, after a sodium hypochlorite/sodium hydroxide solution was mistakenly mixed with the product used in the second rinse, an acid, and chlorine gas was generated. In the year 2003, one worker died after repeated exposure to an isocyanate used in the spray-on truck-bed lining industry (1).

We know that the reports received are an under-representation of the true number of individuals with WRA in our state. There are a number of ways to estimate the extent of WRA in a given population, including: the use of self-reports from surveys, statistical estimates from studies, and an actual census count of disease. A consensus statement from the American Thoracic Society concluded: "The median value of 15% is a reasonable estimate of the occupational contribution to the population burden of asthma" (2). A survey of the adult population in Michigan found that 9.7% of Michigan residents reported they had been told by a doctor or told a doctor that their asthma was related to a job they had, either currently or in the past (3). All of these methods to develop an estimate of the magnitude of work-related asthma in Michigan indicate that WRA is a significant problem in our state. We estimate there are 65,000 – 97,000 people in Michigan with work-related asthma.

Workplace exposures may cause new onset asthma from exposure to an allergen or an irritant that precipitates inflammatory changes, or work exposures may exacerbate pre-existing asthma from exposure to an irritant. Almost ninety percent of the reports received in Michigan involve the new onset of asthma. Michigan Occupational Safety and Health Administration (MIOSHA) enforcement inspections at the workplaces of these individuals reveal a large number of fellow workers with asthma or respiratory symptoms compatible with asthma.

There are over 400 documented agents or work processes associated with work-related asthma. The most comprehensive listing of known causes of work-related asthma can be

found at the following web site: www.remcomp.fr/asmanet/asmapro/agents.htm. Known allergens such as isocyanates and metal working fluids are the most commonly reported cause of work-related asthma in Michigan, representing 14.2% and 11.2% of the Michigan WRA cases, respectively. About 1% of the Michigan workforce is employed in manufacturing companies where isocyanates are used.

Work-related asthma is affecting men and women equally, generally in the 30-50 year age range. The average annual incidence rate of work-related asthma among African Americans is 2.1 times greater than among Caucasians. Exposures are occurring in a wide range of workplaces. When an inspection is conducted at the workplace, significant numbers of symptomatic individuals have been identified. However, air monitoring at these same facilities typically reveals that the exposures to the suspected allergen or irritant are within existing workplace standards (95% of the time).

A recent initiative this past year was to evaluate intervention activity where individuals had developed work-related asthma. Despite the lack of specific standards or standards with sufficiently protective air levels, these interventions were useful to identify other symptomatic individuals and identify correctable workplace hazards (4).

Another ongoing initiative in Michigan has been the development and presentation of a training workshop on work-related asthma to both the State's industrial safety and health staff and companies with employees at risk for work-related asthma. The workshop's aim is to increase awareness of asthma, including its causes and triggers in the workplace so that MIOSHA field staff as well as company Health and Safety Representatives can evaluate the potential for exposures and develop work-related asthma prevention strategies. An additional initiative to increase awareness of WRA among health care providers is needed to reduce morbidity and mortality from the condition.

Background:

In 1988, the State of Michigan instituted a surveillance program for work-related asthma with financial assistance from the National Institute for Occupational Safety and Health (NIOSH). The surveillance program is a joint project of the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Growth (MDLEG) and Michigan State University (MSU). The goal of the surveillance program is to prevent work-related asthma through the identification of index patients. The reporting of the index patient is regarded as 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.

There are three major sources used to identify persons with work-related asthma: reports from physicians, reports from hospitals (since 1989), and claims filed with the Bureau of Workers' Compensation (since 1988). Both physicians in private practice and those working for industry send reports to the MDLEG. Reports from hospitals are requested once each year. Hospital discharge summaries for individuals with a primary or secondary diagnosis of a respiratory condition due to chemical fumes and vapors (ICD-9 506.0-.9) as

well as individuals with a primary or secondary diagnosis of asthma (ICD-9 493) where the principal payer is listed as workers' compensation are obtained from the Michigan Health and Hospital Association's (MHA) Michigan inpatient database to verify the completeness of reporting by the hospitals. Other sources used to identify cases include: Michigan's two Poison Control Centers (since 2001), reports from co-workers or from the State's industrial hygienists, one report from the Mine Safety and Health Administration, and four reports from death certificates.

A person is considered to have work-related asthma from sensitization to a workplace exposure if: A) they have a physician diagnosis of asthma, B) onset of respiratory symptoms associated with a particular job that then improve or are relieved when the patient is not working, and C) they work with a known occupational allergen, or have evidence of an association between work exposures and a decrease in pulmonary function testing.

Additional criteria are used to record three other categories of asthma associated with work. If only criteria A) and B) above are met, the person is considered to have possible work-related asthma. An enforcement industrial hygiene investigation at the patient's work site may be conducted by MIOSHA to determine the allergen and to document its associated exposure levels. If a person had physician-diagnosed asthma before beginning work and their asthma became worse at a particular job, the person is considered to have work-aggravated asthma. Occupational asthma from exposure to an allergen at work typically develops after a variable period of symptom-less exposure to the sensitizing agent. However, if a person develops asthma for the first time immediately after an acute exposure to an irritating chemical at work, the patient is considered to have Reactive Airways Dysfunction Syndrome (RADS) (5).

After the patient is interviewed and the work-relatedness of the condition evaluated, an industrial hygiene investigation may be conducted at the patient's workplace. At this follow-up investigation, co-workers are interviewed to determine if other individuals are experiencing similar breathing problems from exposure to the suspected allergen. An industrial hygienist conducts air monitoring for any suspected allergens and reviews the company's health and safety program. After the investigation is completed, a report of air sampling results and any recommendations are sent to the company and union (or designated labor representative, if the company does not have a union).

In 1998, the surveillance program also began sending letters to some of the companies where the index cases were exposed to an allergen but a MIOSHA inspection was not planned. These letters, in lieu of inspections, are sent to the company health and safety director, and require the company to evaluate exposures to whatever suspected allergens were identified through the telephone interview with the index case.

Results:

Reports

Table 1 shows that 2,546 people were confirmed with work-related asthma between 1988

- 2006. Figure 1 presents the same data in a bar graph of the number of cases identified each year and the types of work-related asthma that were confirmed. The reports are divided into four categories: occupational asthma, possible occupational asthma, aggravated asthma, and RADS. One hundred forty-six additional patients have been confirmed since last year's report. Figure 2 shows the overlap of the 2,441 patients by reporting sources for 1988-2005.

The data is incomplete for 1988 since the surveillance system was initiated in that year. To date we have not yet received complete hospital reporting for the years 2005 and 2006. Patient interviews are still needed for three reports of patients from hospitals, three reports from physicians, and one report from a poison control center in 2005. Patient interviews are still needed for 14 reports of patients from hospitals, 27 reports from workers' compensation, nine reports of patients from physicians, and three reports of patients from a poison control center in 2006.

Gender

One thousand three hundred and thirty (52.2%) of the persons with work-related asthma are women and 1,216 (47.8%) are men.

Race

Race was known for 2,497 of the 2,546 individuals with work-related asthma. Of the 2,497, 1,916 (76.7%) of the persons with work-related asthma are Caucasian, 474 (19.0%) are African American, 46 (1.8%) are Hispanic, 22 (0.9%) are Alaskan or American Indian, nine (0.4%) are Asian, and 30 (1.2%) were listed as "other."

The average number of incident cases of African Americans with work-related asthma each year for 1992-2004 was 29. In 1998 there were 539,621 African Americans in the Michigan labor force (6). The annual incidence rate for work-related asthma in African Americans, therefore, was 5.4/100,000 workers. The respective data for Caucasians was 112 new cases per year and 4,368,720 Caucasians in the Michigan labor force. The annual incidence rate of work-related asthma in Caucasians, therefore, was 2.6/100,000 workers. The African American rate of work-related asthma was 2.1 times greater than the rate for Caucasians.

Age

The dates of birth range from 1905-1988. The average year of birth for the individuals included in this year's report is 1955.

Location in State

Figure 3 shows the county of employment where the patient developed work-related asthma. The main locations are: Wayne (618 cases, 24.9%), Oakland (328 cases, 13.2%), and Macomb (232 cases, 9.3%). Table 2 and Figure 4 show the annual average incidence rates of work-related asthma among the general working population in each county. Based on the annual average incidence of reports of confirmed cases per 100,000 adult workers, Luce (14.0 per 100,000), Clare (12.0 per 100,000), Osceola (8.8 per 100,000), and Cheboygan (8.1 per 100,000) have the highest rates. It should be noted that, even

though Luce had the highest incidence rate of work-related asthma, the rate is based on only six cases (see Table 2). Table 3 shows the annual incidence rates for the larger metropolitan areas and the whole state for the years 1990 through 2004 separately. The 2004 rate was the highest in the 15-year period of WRA surveillance.

Type of Industry

Figure 5 shows the distribution of major industry types for all asthma cases identified from 1988-2006. Sixty-five percent of the WRA cases worked in manufacturing, followed by 20% in the services industry, 5% in the trade industry, 3% in construction and mining, and 8% in miscellaneous industries. Table 4 shows the specific types of Michigan industries where the exposures to the occupational allergens occurred from 1988 to 2006. The predominant industries for the total number of cases identified between 1988 and 2006 were in the manufacturing sector: automobile (38.8%), industrial and commercial machinery and computer equipment (4.1%), fabricated metal products (4.0%), rubber and miscellaneous plastic products (3.4%), and foundries (2.9%). Workers in the health field also accounted for a high percentage of the total number of patients (9.9%).

The incidence rate of work-related asthma by industry type ranges from 0.4 cases per 100,000 in miscellaneous retail shops, to a high of 19.4 cases per 100,000 in the manufacture of transportation equipment. The industries with the highest annual average incidence rates besides auto manufacturing included: foundries with 11.5 cases per 100,000 workers, the manufacture of other non-durables with 10.3 cases per 100,000 workers, the manufacture of rubber products with 7.4 cases per 100,000 workers, and the manufacture of other durables with 7.2 cases per 100,000 workers.

Table 5 shows the annual incidence rates for the 1990 through 2004 work-related cases within those industries that had 20 or more reports. Overall, by broad industrial classification (data not shown), the average annual incidence rates were: 10.7 cases per 100,000 workers in the manufacturing industry, 2.6 cases per 100,000 workers in the construction and mining industry, and 1.0 case per 100,000 workers in the service producing industry.

Table 6 shows the predominant exposures associated with work-related asthma in Michigan. The most frequent exposures were to isocyanates (14.2%), metal working fluids (11.2%), cleaning solutions (9.2%), exhaust, smoke and fumes (5.7%), welding fumes (4.4%), and solvents (3.5%). The agent has not yet been identified for 363 patients (14.3%). The exposures to unknown agents occurred 199 times in the manufacturing sector and 164 times in an office setting.

Medical Results

Table 7 shows patients' cigarette smoking status. Twenty percent of patients were smoking when their work-related asthma developed. This is a lower percentage than the state average and markedly lower than that found in blue collar working populations.

Forty-three percent of the WRA patients had a family history of allergies (Table 8). Forty-six percent of the asthma patients had a personal history of allergies or asthma (Table 9).

Five hundred forty-one (46.1%) of the 1,174 patients with a personal history of allergies or asthma previously had asthma.

Two thousand eighty-four of the patients identified with work-related asthma had persistence of their asthma symptoms (Table 10). This was true for 652 of 677 (96.3%) of those still exposed as well as 1,432 of 1,657 (86.4%) no longer exposed to the substance causing their asthma. Among those no longer exposed, 48.8% stated their symptoms were less severe compared to 30.1% among those still exposed who reported their symptoms were less severe. Similarly, 86.3% of those still exposed were continuing to take asthma medications while 78.1% of those no longer exposed were still taking asthma medications. Among those no longer exposed, 28.1% stated they were taking fewer medications while only 18.6% of those still exposed were taking fewer medications (Table 10).

One thousand one hundred nine of 2,269 (48.9%) patients with known workers' compensation status had applied for workers' compensation. Cases were pending for 553 (49.9%) of those who applied, while 381 (34.4%) had received awards and 175 (15.8%) had been denied.

Although 2,546 individuals were confirmed with work-related asthma, we could find objective testing for hyper-reactivity by methacholine challenge or pre- and post-bronchoprovocation for only 64% of cases. In addition, we found only 0.7% of cases had specific antigen bronchoprovocation, 3.3% of cases had peak flow monitoring and only 2.8% of cases had pre- and post-work shift testing.

Industrial Hygiene

The 2,546 people with work-related asthma worked at 1,726 different facilities. Five hundred seventy-five facilities were inspected 660 times. Eighty-five of the 1,726 facilities were inspected more than once. Thirty-seven inspections were completed since last year's report. Inspections are scheduled at 25 (1.4%) facilities (Table 11). Ninety companies received letters notifying them that a disease report had been received and asked them to investigate potential exposures causing the respiratory problem, including indoor air problems. No follow-up was planned for 955 companies, 56 companies were no longer in business, and 25 companies no longer used the occupational allergen associated with the development of asthma in the index case.

Air sampling for allergens was conducted during 464 of the inspections. Fifty-one of the 446 (11.4%) facilities with a NIOSH recommended exposure limit (REL) for the allergen were above the NIOSH REL. Twenty-one (4.6%) of the 460 facilities with a MIOSHA standard for the allergen were above the enforceable MIOSHA permissible exposure limit (PEL) (Table 12).

Table 13 shows the allergens that were found to be above the NIOSH and/or MIOSHA limits. No exposures above MIOSHA permissible limits for allergens were identified during this past year's inspections. However, six companies inspected this past year had exposures above the NIOSH recommended exposure levels (REL): three for formaldehyde, two for isocyanates, and one for glutaraldehyde. Formaldehyde (41.2%) was the most frequently

sampled allergen found to be above the NIOSH REL, followed by styrene (11.8%) and metal working fluids (9.8%). Welding fume (23.8%) was the most frequently sampled allergen found to be above the MIOSHA enforceable PEL, followed by styrene (19.0%) and glutaraldehyde (14.3%).

Interviews of fellow workers were performed at 514 of the 660 inspections. Co-workers of the index cases reported daily or weekly breathing symptoms or onset of new asthma since beginning to work at that company in 351 of the 514 (68.3%) companies. The average percentage of co-workers with symptoms in these 351 companies was 20.1%, ranging from 2% to 100%. Interviews of 1,214 co-workers from 163 companies found no co-workers with symptoms. One thousand four hundred sixty-six of the 9,069 (16.2%) co-workers interviewed had symptoms consistent with work-related asthma (new onset asthma or bothered at work by daily or weekly shortness of breath, wheezing or chest tightness) (Table 14).

The Michigan Occupational Safety and Health Administration (MIOSHA) Injury and Illness Logs kept by employers listed 562 workers from 122 companies as having asthma or asthma-like symptoms. Only nine workers identified in the interviews with daily or weekly breathing symptoms were also listed on the Michigan OSHA Log. A total of 2,019 symptomatic workers were identified during the 660 inspections.

Michigan Workforce Exposed to Isocyanates

Isocyanates are the most commonly reported cause of work-related asthma 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 in manufacturing companies that use isocyanates. This estimate under-counts non-manufacturing exposed workers such as auto body paint shop employees since the EPA database does not include these types of non-manufacturing establishments. Conversely, it over-counts manufacturing employees since the total number of employees at a given facility that reported isocyanate use are included even though only a smaller percentage of the workers would have worked with or around isocyanates and therefore have been potentially exposed to isocyanates.

A list of counties with the companies that reported the use of isocyanates in calendar year 2005 (the most recent year for which this information is available) can be found in Table 15. 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.

Michigan Workforce Exposed to Other Workplace Agents

Another source available to identify chemical exposures in the workplace that are

associated with work-related asthma 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 2006, 5th 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 TRIS 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. From this report, a county listing of companies where chemicals potentially associated with work-related asthma was obtained. The companies listed in this Table 16 are current as of October 5, 2007, the date of the report generated by the Michigan DEQ. The chemicals shown are: Bisphenol A, Cobalt, Epichlorohydrin, Formaldehyde, Methyl Acrylate, Phthalic Anhydride, Styrene, Ammonia and Chlorine.

Work-Related Asthma Fatalities

Fortunately, a very small percent (0.01-0.02%) of individuals with asthma die from asthma. In 2006, an individual died from asthma that developed during 30 years of working with toluene diisocyanate at an automotive seat manufacturer. In prior reports, we described investigations of four asthma deaths: a production worker who died from exposure to isocyanates in an adhesive manufacturing facility in December 2005, a waitress who died from exposure to second hand cigarette smoke in a bar in May 2004, a dairy farmer who died in 2004 from exposure to the chemicals used to clean a milk tank, and a worker who died in 2003 from exposure to methylene diphenyl diisocyanate (MDI) used in the truck bed spray-on lining business. A description of the most recent death follows:

In 2006, a 77-year-old female automotive worker died from long term complications of her asthma, which she developed from toluene diisocyanate (TDI) exposure after working 22 years as a machine operator. She continued to work at the company, exposed to TDI for eight more years before she was placed on permanent medical disability. Before she died, she had multiple hospitalizations related to her increasing breathing difficulties. Her death occurred 18 years after she had retired on disability from the automotive seat manufacturer. The death of this employee illustrates the potential long term negative consequences of work-related asthma.

Discussion:

In our previous annual reports, we emphasized that the cases reported in Michigan's surveillance system are likely an undercount of the true number of cases of work-related asthma in the state. This continues to be true. Studies suggest that work exposures are important etiologic agents in a significant percentage (15%) of adults with asthma (2,3).

On average, 143 new people each year are reported to the Michigan Department of Labor and Economic Growth (DLEG) with confirmed work-related asthma. One hundred sixty-seven reports were confirmed in 2004, the most recent year with complete data. Although the total number of work-related asthma 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 (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. Overall, 2004 had the highest incidence rate of work-related asthma. Given the relatively small number of cases reported, this increase is probably more likely due to changes in reporting rather than a true increase in the incidence of this disease.

Based on responses from the 2001 BRFSS random sample of Michigan residents, we would estimate that there are a total of 62,693 (95% CI 42,011 - 83,375) Michigan adults with work-related asthma in the state (3). Based on the medical literature we would estimate that there are 97,500 Michigan adults with work-related asthma (2). Using capture-recapture analysis, we estimate 228 - 801 adults in Michigan develop work-related asthma each year (7).

As in the previous annual reports on work-related asthma in Michigan, the workers reported 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 work-related asthma in African Americans is 2.1 times greater than among Caucasians. Based on an analysis conducted for previous annual reports, factors from the work-related asthma surveillance data that would contribute to greater morbidity among African-Americans include: a greater likelihood to continue to be exposed to the allergen, 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, more temporary workers are being hired to do work on an as-needed basis. The transient nature of temporary work underscores the potential for undercounting 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 exposures to agents in the manufacturing sector, particularly automobiles, machinery, metals, chemicals, and rubber and plastics. The predominant causes of work-related asthma remain isocyanates (14.2%) and metal working fluids (11.2%). We have again updated the table first presented in the 2002 Work-Related Asthma Annual Report (Table 15) on the number of manufacturing workers in companies that use isocyanates. In some counties, more than 5% of the workforce is employed in manufacturing facilities where isocyanates are used: Wexford (9%), Allegan (7%), and Mecosta and Luce (5% each). Health care providers can use this information to heighten their awareness of potential exposure to isocyanates among their patients with asthma. One of the asthma deaths investigated in 2005 highlights the critical need for properly identifying and managing work-related asthma. The worker was involved with three doctors. If one of the doctors had removed him from the exposure as recommended in the medical literature, the death would have been prevented.

Asthma symptoms persist despite removal from the precipitating work exposures (Table 10). Studies have shown that the sooner an individual is removed from the exposure

causing their asthma after symptoms develop, the more likely the individual's symptoms will resolve (8). On the average, among the 1,657 individuals no longer exposed, 2.9 years elapse from time of 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.

Neither personal habits such as cigarette smoking nor individual susceptibility as measured by personal or family history of allergies are predictive of who will develop work-related asthma. Approximately 50% of the asthma patients have no personal or family history of allergies and 80% are not smoking cigarettes at the time their asthma symptoms develop (Tables 7-9).

Although most facilities where the patient developed asthma were found to be in compliance with exposure standards, there were high percentages of symptomatic fellow workers in those facilities. Inspections of these sites also found that 50% were in violation of other MIOSHA standards. It is possible that sampling was not conducted under similar enough working conditions as the exposures associated with the development of the index cases' asthma, such as incidents of spills or leaks or that the current standards are not protective enough. We identified 1,466 fellow workers with symptoms compatible with work-related asthma (Table 14). Five hundred sixty-two individuals were listed on the Michigan OSHA log as having work-related asthma. There was a small overlap (nine individuals), although one might expect a greater overlap of the co-workers with symptoms to be reported on the 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 work-related asthma 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. If the state would institute comprehensive standards that 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, workers would be better protected.

Medical monitoring is particularly relevant to reducing the burden of work-related causes of asthma. The longer a person with symptoms remains exposed, the more likely their asthma will become a chronic problem (8). MIOSHA is currently promulgating a new standard for the diisocyanates. An advisory committee of the Michigan Occupational Health Standards Commission has drafted a diisocyanate standard for consideration. The deaths in 2003 and 2005 of workers from exposure to isocyanates might have been prevented if more comprehensive standards for the use of isocyanates were in place. The proposed standard should better inform employers and employees of the hazards related to the use of diisocyanates. 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 the medical monitoring. 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 work-related asthma that this surveillance system documented as having had 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 work-related asthma 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 exposure. Cessation of exposure is the most important aspect of treatment; patients who are removed from exposure the soonest have the best prognosis (8).

Ongoing vigilance in the identification of WRA and using opportunities for education and intervention at many levels continues to be a priority in Michigan. For example, the Michigan Chapter of the American Lung Association, under contract to the Michigan Department of Community Health, maintains a web site of resources on asthma called the Michigan Asthma Communication Network (MACN). The web site can be accessed at: www.getasthmahelp.com, and includes information on work-related asthma.

Recognition of work-related asthma is critical in managing adults with asthma. The deaths in 2003 and 2005 of individuals with asthma from isocyanate exposures are attributable to the lack of recognition of an association between the individual's respiratory problems and work exposure to occupational sensitizers by both the employer and health care provider. The deaths of these Michigan workers underscore the importance of efforts aimed at the understanding and reduction of WRA in our state.

The report of a patient with known or suspected work-related asthma 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 work-related asthma 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 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 work-related asthma, work-related asthma needs to be integrated into all asthma initiatives planned on surveillance and education, both for health care providers and the public.

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Figure 1. Number of Confirmed Cases of Work-Related Asthma by Year and Type

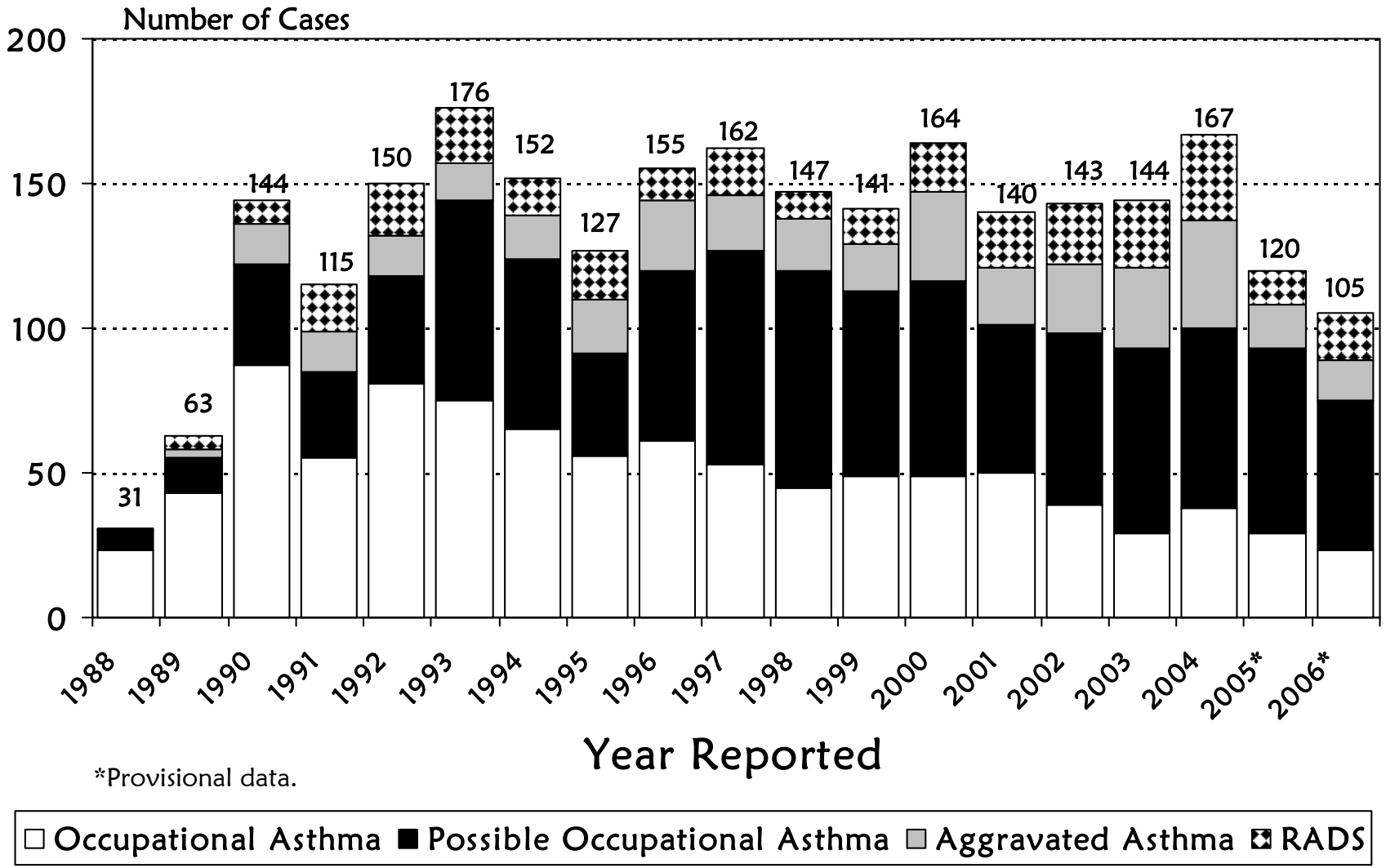
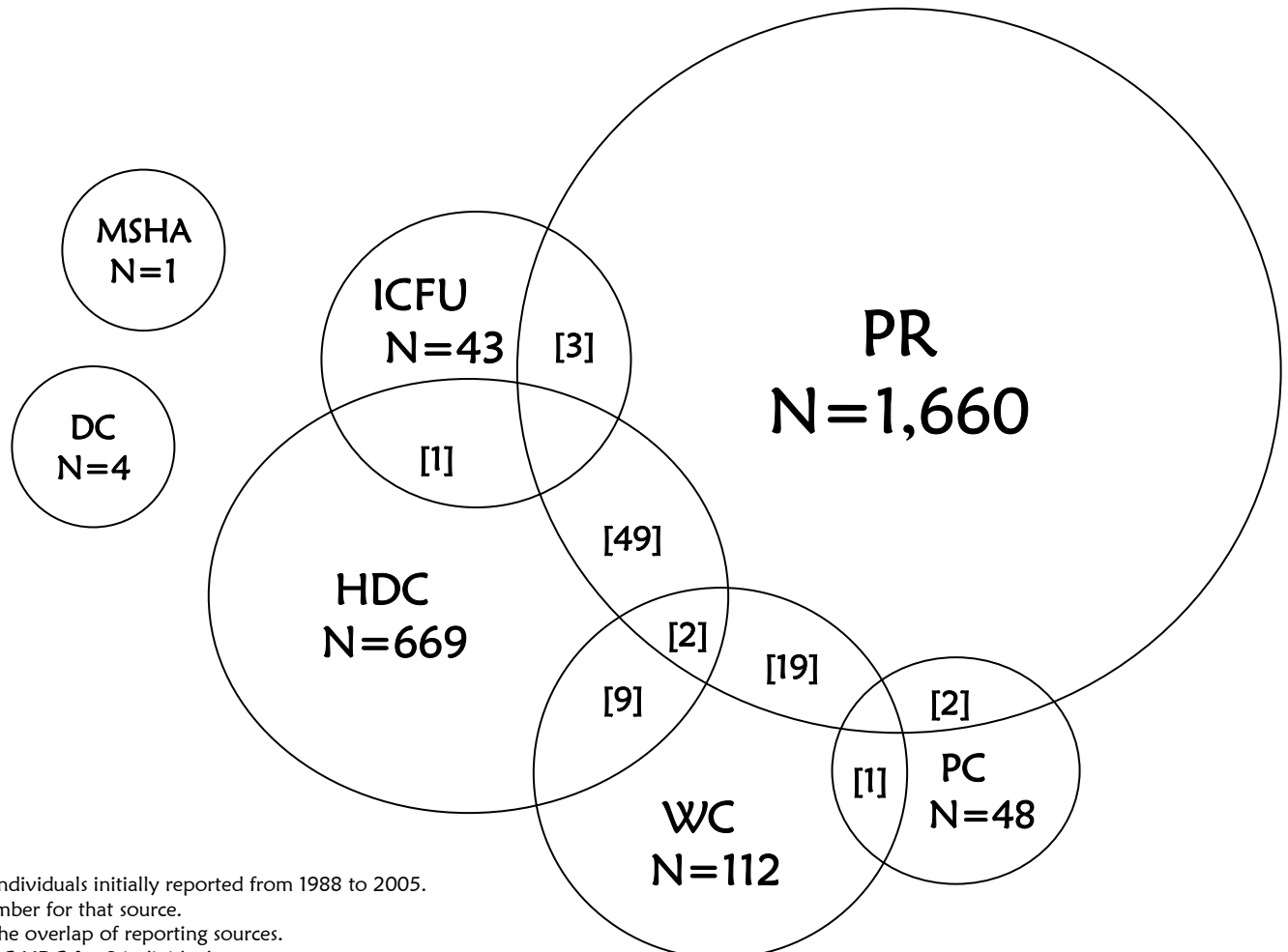
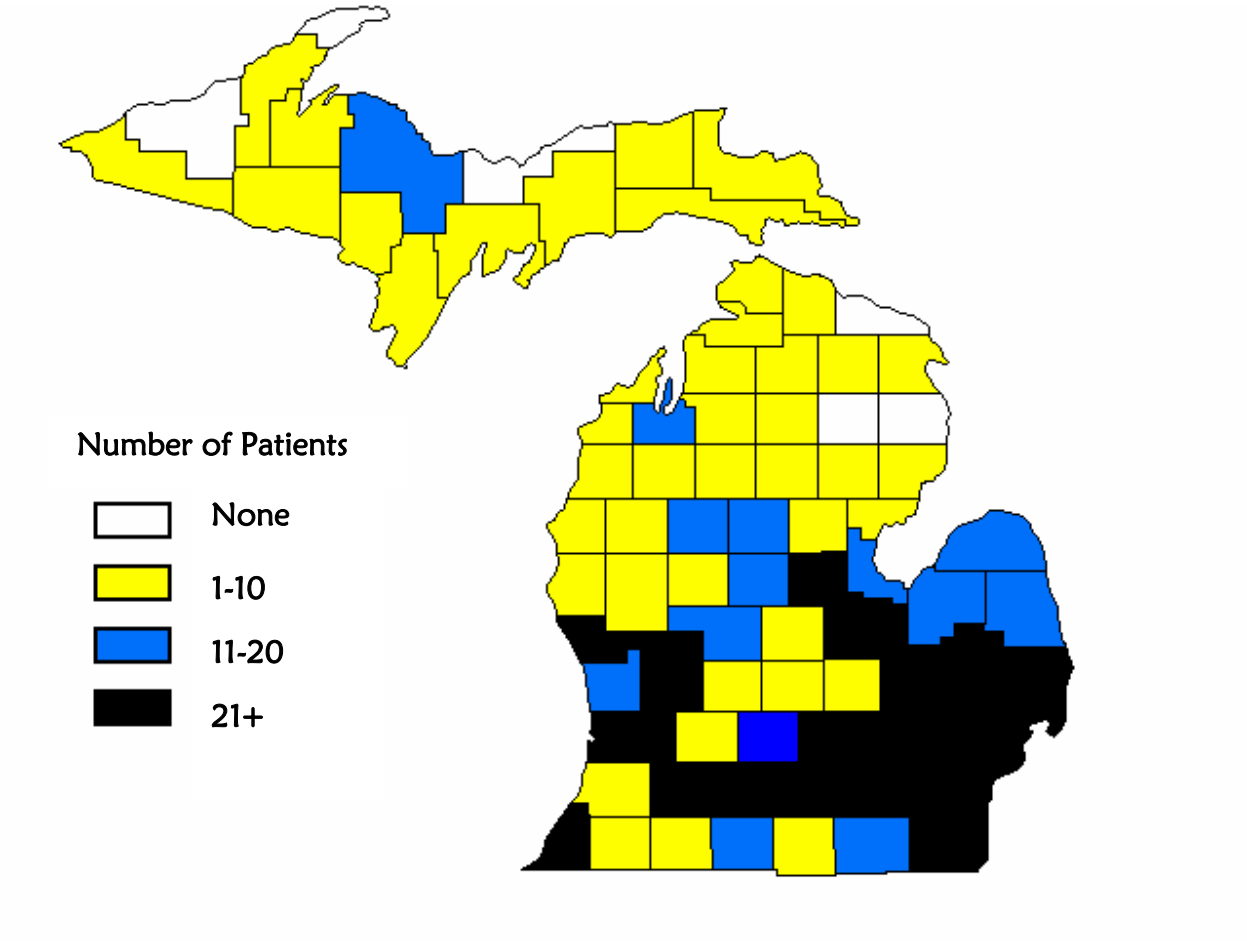


Figure 2. Overlap of Reporting Sources for Confirmed Work-Related Asthma Patients: 1988-2005[a]



[a]Diagram represents 2,441 individuals initially reported from 1988 to 2005.
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 8 individuals.
Reporting Source Codes: HDC=Hospital Discharge Data; PR=Physician Referral; DC=Death Certificate; WC=Workers' Compensation; ICFU=Index Case Follow Up; MSHA=Mine Safety and Health Administration; PC=Poison Control Center.

Figure 3. Distribution of Confirmed Work-Related Asthma Patients by County of Exposure: 1988-2006

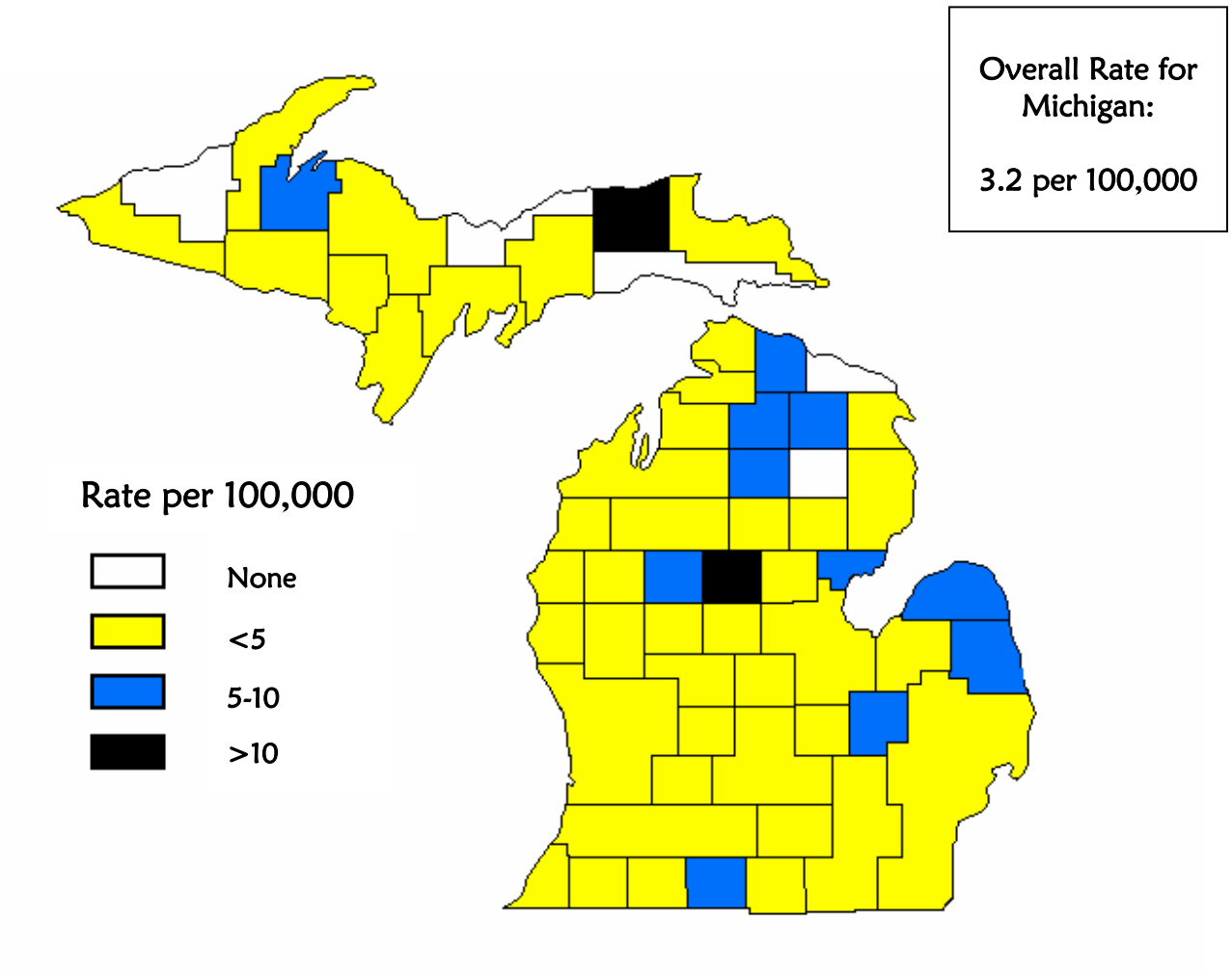


Total Michigan Patients: 2,484[a]

Oakland and **Wayne** counties had the highest number of work-related asthma patients, with 328 and 618 individuals, respectively.

[a] County of exposure was unknown for 21 patients. Forty-one patients were exposed out-of-state to an allergen.

Figure 4. Average Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by County of Exposure: 1989-2004[a]



[a] Rate per 100,000 among Michigan workers. Source: MESC 1996 Annual Average Labor Statistics for Employment by Place of Work. In 1996, there were a total of 4,345,000 Michigan workers.

Figure 5. Major Industry Type for Confirmed Work-Related Asthma Patients: 1988-2006

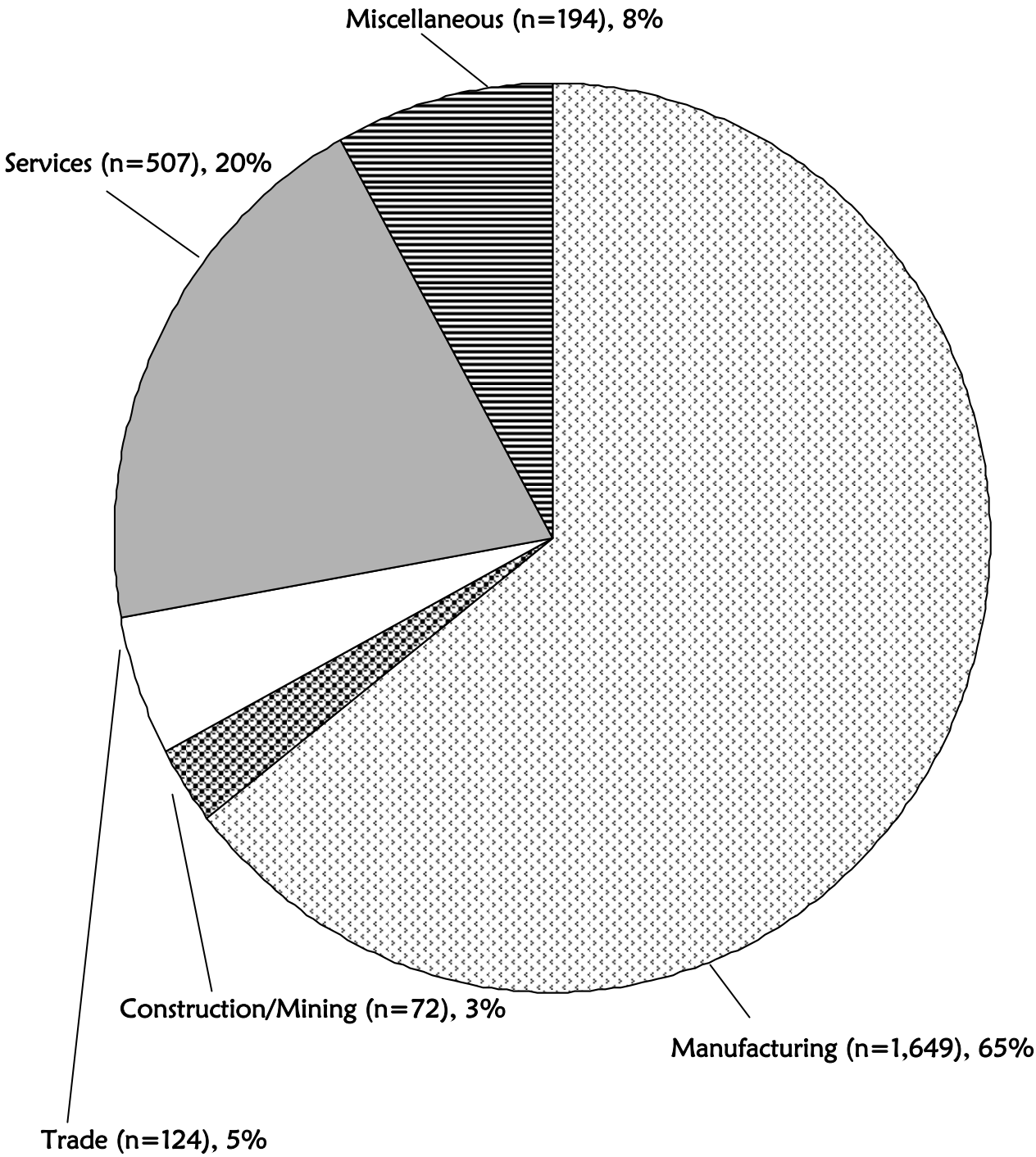


Table 1. Number of Confirmed Cases of Work-Related Asthma by Year and Type

	Disease Status[a]				
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	81	37	14	18	150
1993	75	69	13	19	176
1994	65	59	15	13	152
1995	56	35	19	17	127
1996	61	59	24	11	155
1997	53	74	19	16	162
1998	45	75	18	9	147
1999	49	64	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	29	64	15	12	120[b]
2006	23	52	14	16	105[b]
Total	950	975	338	283	2,546

[a]OA = occupational asthma; POA = possible occupational asthma; AA = aggravated asthma; RADS = reactive airway dysfunction syndrome.

[b]Reports are still being processed for calendar years 2005 and 2006; an increase in these totals will be reflected in next year's annual report.

Table 2. Average Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by County of Exposure: 1989-2004

County	Number of Employees[a]	Avg.Annual Inc. Rate[b]	Total Cases 1989-2004	County	Number of Employees[a]	Avg.Annual Inc. Rate[b]	Total Cases 1989-2004
Alcona- Iosco	11,425	1.1	2	Isabella	25,250	2.2	9
Alpena	13,325	3.3	7	Jackson	60,200	3.6	35
Antrim	5,475	2.3	2	Kalamazoo-Calhoun-VanBuren	206,300	1.8	60
Arenac	4,575	5.5	4	Kent-Ottawa-Muskegon-Allegan	534,300	1.4	117
Baraga	3,500	5.4	3	Lake	1,600	3.9	1
Barry	11,775	1.1	2	Luce	2,675	14.0	6
Berrien	71,200	1.8	21	Manistee	7,450	1.7	2
Branch	13,550	5.1	11	Marquette	27,875	3.1	14
Cass	10,650	1.8	3	Mason	10,325	1.8	3
Charlevoix	10,250	2.4	4	Mecosta	13,100	1.0	2
Cheboygan	7,675	8.1	10	Menominee	9,500	0.7	1
Chippewa	15,475	1.2	3	Montcalm	18,725	3.7	11
Clare	7,300	12.0	14	Montmorency	2,200	5.7	2
Clinton-Eaton-Ingham	228,700	2.6	95	Newaygo	10,375	3.6	6
Crawford	4,425	5.6	4	Oceana	6,200	2.0	2
Delta	15,100	1.7	4	Ogemaw	6,225	1.0	1
Dickinson	14,375	3.9	9	Osceola	7,775	8.8	11
Emmet	14,950	1.7	4	Otsego	11,050	5.1	9
Genesee	181,800	6.5	189	Roscommon	6,550	2.9	3
Gladwin	5,025	2.5	2	Sanilac	13,125	5.7	12
Gogebic	6,475	1.9	2	Schoolcraft	2,775	2.3	1
Grand Traverse-Benzie-Kalkaska-Leelanau	57,950	2.6	24	Shiawassee	19,150	2.0	6
Gratiot	14,200	3.1	7	St. Joseph	25,250	1.5	6
Hillsdale	15,200	3.7	9	Tuscola	14,100	4.4	10
Houghton-Keweenaw	14,700	1.3	3	Washtenaw-Lenawee-Livingston	260,500	4.3	180
Huron	13,225	5.7	12	Wexford-Missaukee	16,950	1.5	4
Ionia	16,125	3.5	9	Saginaw-Bay-Midland	175,000	4.3	120
Iron	4,125	4.5	3	Detroit, MSA[c]	2,051,000	3.5	1,135
				All Michigan Counties[d]	**4,345,000**	**3.2**	**2,231**

[a] Source: MESC 1996 Annual Average Labor Statistics for Employment by Place of Work. Some employee population data is only available 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 1989-2004, per 100,000 Michigan workers.

[c] MSA=Metropolitan Statistical Area and includes Lapeer (26 cases), Macomb (212 cases), Monroe (19 cases), Oakland (297 cases), St. Clair (24 cases) and Wayne (557 cases) counties.

[d] Thirty-nine cases had an out-of-state exposure and 20 had an unknown county of exposure, for the 1989-2004 reporting period.

Table 3. Annual Incidence Rates of Work-Related Asthma Among Michigan Workers by Major Metropolitan Area: 1990-2004

	Clinton-Eaton-Ingham[a]	Kent-Ottawa-Muskegon-Allegan	Saginaw-Bay-Midland	Detroit MSA[b]	Total (all Michigan)
1990	1.4 (3)	2.2 (8)	2.4 (4)	3.0 (58)	3.6 (144)
1991	3.8 (8)	1.4 (5)	4.3 (7)	2.7 (50)	3.0 (115)
1992	5.6 (12)	0.7 (3)	1.8 (3)	4.6 (86)	3.8 (150)
1993	3.7 8)	1.3 (6)	1.8 (4)	6.4 (121)	4.4 (176)
1994	1.8 (4)	3.5 (7)	1.8 (3)	4.4 (85)	3.7 (152)
1995	2.2 (5)	1.2 (6)	1.7 (3)	3.4 (69)	3.0 (127)
1996	1.3 (3)	0.9 (5)	2.9 (5)	4.0 (91)	3.5 (155)
1997	2.2 (5)	1.1 (6)	4.5 (8)	3.7 (77)	3.6 (162)
1998	2.6 (6)	1.4 (8)	3.9 (7)	3.7 (79)	3.3 (147)
1999	0.9 (2)	1.7 (10)	5.5 (10)	2.7 (59)	3.1 (141)
2000	1.3 (3)	1.5 (9)	8.7 (16)	3.0 (66)	3.6 (164)
2001	3.8 (9)	1.0 (6)	6.2 (11)	3.4 (72)	3.1 (140)
2002	3.4 (8)	1.0 (6)	4.6 (8)	3.2 (68)	3.2 (143)
2003	3.4 (8)	1.2 (6)	9.6 (13)	2.7 (56)	3.2 (144)
2004	6.3 (10)	1.5 (6)	9.0 (10)	4.7 (82)	4.5 (167)

[a]Rate per 100,000 Michigan workers. Rate, number of cases in parentheses. Source: MDCD (formerly the MESC) Annual Average Labor Statistics for Employment by Place of Work, for each year 1990-2004 separately.

[b]MSA=Metropolitan Statistical Area. For the years 1990-1995, includes Lapeer, Livingston, Macomb, Monroe, Oakland, St. Clair, and Wayne counties. For 1996- 2004 does not include Livingston county because of a change in the counties associated with certain MSA's (including Detroit).

Table 4. Primary Industrial Exposure for Confirmed Work-Related Asthma Patients: 1988-2006

Industry (SIC Code)[a]	Number of Cases 1988-2006[b]		Number of Employees[c]	Ann. Average Incidence Rate 1989-2004[d]	
MANUFACTURING					
Automobile (37)	989	(38.8)	291,000	19.4	(905)
Ind. & Comm. Mach. & Computer Equipment (35)	105	(4.1)	133,000	4.2	(89)
Fabricated Metal Products (34)	101	(4.0)	128,000	4.5	(93)
Rubber and Misc. Plastic Products (30)	87	(3.4)	67,000	7.4	(79)
Foundries (33)	75	(2.9)	37,000	11.5	(68)
Food and Kindred Products (20)	50	(2.0)	44,000	7.1	(50)
Electrical Equipment (36)	22	(0.9)	34,000	3.5	(19)
Lumber and Wood (24)	21	(0.8)	18,000	6.3	(18)
Paper and Allied Products (26)	20	(0.8)	21,000	5.7	(19)
Printing and Publishing (27)	20	(0.8)	43,000	2.9	(20)
Furniture and Fixtures (25)	9	(0.4)	38,000	1.3	(8)
Apparel Made from Fabric (23)	2	(0.1)	20,000	0.6	(2)
Other Durables (32,38,39)	55	(2.2)	45,000	7.2	(52)
Other Nondurables (22,28,29,31)	93	(3.7)	49,000	10.3	(81)
WHOLESALE AND RETAIL TRADE					
Eating and Drinking Places (58)	31	(1.2)	286,000	0.5	(25)
Wholesale-Nondurable Goods (51)	20	(0.8)	75,000	1.4	(17)
Wholesale-Durable Goods (50)	15	(0.6)	143,000	0.7	(15)
Automotive Dealers and Gasoline Services (55)	15	(0.6)	86,000	0.9	(12)
Food Stores (54)	14	(0.5)	106,000	0.8	(13)
General Merchandise Stores (53)	11	(0.4)	128,000	0.5	(10)
Miscellaneous Retail (52, 56, 57,59)	18	(0.7)	201,000	0.4	(14)
SERVICES					
Health (80)	253	(9.9)	391,000	3.7	(233)
Education (82)	106	(4.2)	379,000	1.5	(88)
Business (73)	28	(1.1)	266,000	0.6	(27)
Social Services (83)	20	(0.8)	86,000	1.3	(18)
Automotive Repair (75)	17	(0.7)	39,000	2.4	(15)
Engineering, Accounting, etc. (87)	12	(0.5)	101,000	0.7	(12)
Other Services (70,72,76,78,79,81,86,89)	71	(2.8)	272,000	1.4	(62)
CONSTRUCTION AND MINING					
Special Trade Construction (17)	55	(2.2)	115,000	2.7	(50)
Other Construction (15-16)	9	(0.4)	53,000	1.1	(9)
Mining (10-14)	8	(0.3)	8,000	4.7	(6)
MISCELLANEOUS INDUSTRIES					
Government (91-97)	80	(3.1)	275,000	1.5	(68)
Transportation and Utilities (40-49)	63	(2.5)	168,000	1.7	(46)
Finance, Insurance and Real Estate (60-67)	30	(1.2)	201,000	0.9	(28)
Agricultural Production and Services (01,02,07)[e]	13	(0.5)	40,176	1.9	(12)
Unknown	8	(0.3)	–	–	(7)
Total	**2,546**		**4,385,176**	**3.3**	**(2,290)**

[a]1987 Standard Industrial Classification code.

[b]Number of cases, percentages are in parentheses. These numbers represent cases identified from 1988 through 2006.

[c]Source:MESC 1996 civilian labor force and industrial employment estimates.

[d]Average annual incidence rate, total number of cases for 1989-2004 (the years with complete case reporting results) are in parentheses. Rates are based on average number of cases from 1989-2004 per 100,000 adult workers in each industrial category.

[e]Source: Michigan Department of Career Development, Statewide Average Monthly Industry Employment, 1996.

Table 5. Primary Industrial Exposure for Confirmed Work-Related Asthma Patients: 1990-2004

INDUSTRY (SIC)[a]	1990[b]	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Manufacturing															
Food (20)	20.0	6.7	2.3	--	2.3	4.4	6.8	4.9	7.5	2.6	8.1	10.8	10.5	12.3	15.2
Chemicals (28,29)	17.0	4.3	14.0	12.0	7.8	14.3	6.1	14.3	10.0	10.2	10.6	6.5	4.3	15.4	6.5
Rubber & Plastics (30)	9.3	19.6	--	7.3	11.3	15.1	10.4	13.2	4.5	5.8	6.2	1.6	6.5	11.5	7.0
Foundries (33)	9.5	23.7	8.1	19.4	18.9	5.4	18.9	8.1	10.5	7.9	13.2	8.3	8.6	18.2	3.6
Fabricated Metals (34)	6.6	4.4	2.6	3.4	5.7	3.1	12.5	8.6	4.7	1.6	3.8	0.8	5.0	8.4	6.0
Industrial Machinery (35)	6.3	1.7	6.1	8.5	6.6	3.0	3.0	2.2	3.7	2.3	6.0	5.7	0.9	5.2	11.9
Transportation Equipment (37)	19.0	15.6	28.7	26.5	25.0	17.3	21.1	21.1	23.7	23.9	23.0	22.5	16.8	11.9	17.2
Other Durables (38,39)	19.2	8.0	4.9	9.8	--	--	6.7	4.4	6.5	8.9	10.6	4.4	2.3	--	17.0
Miscellaneous Industries															
Special Trade Construction (17)	1.1	2.3	4.6	6.7	3.2	0.9	1.7	0.8	2.4	2.3	1.4	3.6	3.7	2.3	4.7
Transportation & Utilities (40-49)	0.6	1.3	1.9	4.5	2.5	1.2	--	0.6	0.6	1.7	1.6	2.2	2.2	0.7	2.4
Health Care Services (80)	1.6	1.9	3.4	3.6	3.8	3.7	3.3	6.3	6.0	4.6	4.6	3.8	5.0	2.5	4.9
Education Services (82)	0.6	0.6	0.8	2.2	0.8	1.1	2.1	2.3	1.3	0.3	1.2	0.7	3.3	1.4	2.1
Government (91-97)	8.1	6.6	7.9	14.3	6.3	1.1	0.8	0.5	0.5	0.2	0.7	0.7	1.4	0.6	1.0
Total (all industries)	3.6	3.0	3.8	4.4	3.7	3.0	3.5	3.6	3.3	3.1	3.6	3.1	3.2	3.2	4.5

[a]1987 Standard Industrial Classification code.

[b]Annual incidence rate (number of cases for each year). Rates are based on the number of cases per 100,000 adult workers in MI for each year separately.

Source: MI Department of Career Development, Employment Service Agency, Annual Average civilian labor force and industrial employment estimates (formerly the MESC).

Table 6. Occupational Agents Associated with 2,546 Confirmed Work-Related Asthma Patients: 1988-2006

Allergen	Number	Percent
Isocyanates	362	14.2
Metal Working Fluids	285	11.2
Cleaning Solutions	233	9.2
Unknown (Mfg.)	199	7.8
Unknown (Office)	164	6.4
Exhaust/Smoke/Fumes	146	5.7
Welding Fumes	113	4.4
Solvents	90	3.5
Epoxy	61	2.4
Paint Fumes	61	2.4
Latex/Rubber	56	2.2
Formaldehyde	50	2.0
Acids	46	1.8
Acrylates	37	1.5
Plastic Fumes	35	1.4
Chlorine	34	1.3
Fungus	31	1.2
Cobalt	29	1.1
Fire	26	1.0
Wood Dust	22	0.9
Styrene	21	0.8
Ammonia	20	0.8
Flour	19	0.7
Cigarette Smoke	18	0.7
Animal Dander	16	0.6
Chemicals Used in Construction	16	0.6
Glutaraldehyde	15	0.6
Herbicide/Pesticide	15	0.6
Chromium	14	0.5
Fiberglass	13	0.5
Printing Inks	12	0.5
Grain Dust	11	0.4
Amines	11	0.4
Cement Dust	10	0.4
Caustics	9	0.4
Meat Wrapper's Asthma	7	0.3
Rust Inhibitor	7	0.3
Asphalt	6	0.2
Perfume	6	0.2
Pickling Ingredients	6	0.2
1,1,1 Trichloroethane	5	0.2
Cosmetology Chemicals	5	0.2
Enzymes	5	0.2
Insecticide	5	0.2
Nitrogen	5	0.2
Paper Dust	5	0.2
Solder Fumes	5	0.2
Asbestos	4	0.2
Ethyl Alcohol	4	0.2
Fragrances/Air Fresheners	4	0.2
Freon	4	0.2
Photo Developing Fluids	4	0.2
Rose Hips	4	0.2

Table 6, continued.

Sulfonate	4	0.2
Sulfur Dioxide	4	0.2
Trichloroethylene	4	0.2
Cadmium Solder	3	0.1
Colophony	3	0.1
Drywall Dust	3	0.1
Heat	3	0.1
Lime Dust	3	0.1
Maleic Anhydride	3	0.1
Mold Release	3	0.1
Phthalic Anhydride	3	0.1
Plants/Flowers/Weeds	3	0.1
Polyhexamethylene Biquanide	3	0.1
Psyllium	3	0.1
Sand	3	0.1
Sludge	3	0.1
Tar Fumes	3	0.1
X-ray Developing Fluids	3	0.1
Other[a]	98	3.8
Total	**2546**	**99.8[b]**

[a]There were two cases each with the following exposures: Azodicarbonamide, Cellulose, Coal Dust, Concrete Sealer, Copier Toner, Copper Oxide, Exercise, Fire Extinguisher Powder, Fireproofing Chemicals, Gas and Oil Refinery Exposures, Hair Dye, Hay, Hydraulic Oil, Kerosene, Medications, Methylene Chloride, Natural Gas, Nickel, Ozone, Pepper Gas, Phosgene, Polyester, Polyethylene, Polyvinyl Butyrate, Sewage, Sulfite, Teflon, Textile Lint, Zinc, Zinc Oxide.

There was one case each with the following exposures: 1,3, Dichloro-2-Propanol, 1,3 Dichloro 5 5-Dimethyl Hydrantoin, Anesthesia, Blood, Blue Prints, Ceramic Powder, Cyanide, Ethylene Oxide, Explosion, Fertilizer, Flares, Flux, Glaze, Gortex, Hair Remover, Iodine, Methamphetamine Lab, Methanol, Mica, Monoammonium Phosphate, Ninhydrin, Nylon-polyhexamethylene Adipamide, Odor, Peppermint Oil, Perchloroethylene, Pigment, Platinum, Potassium Aluminum Fluoride, Soda Ash, Sodium Acetate, Soot, Stress, Talcum Powder, Tuberculosis Vaccine, Vinyl Acetate, W-D 40, World Trade Center Exposure, Zinc Borate.

[b]Percentages do not add to 100 due to rounding.

Table 7. Cigarette Smoking Status of Confirmed Work-Related Asthma Patients: 1988-2006

	Disease Status[b]									
Smoking Status	ALL[a]		OA		POA		AA		RADS	
Current Smoker	503	(20.4)	201	(21.4)	146	(15.4)	73	(23.2)	83	(30.4)
Ex-Smoker	958	(38.8)	367	(39.1)	395	(41.8)	93	(29.6)	103	(37.7)
Non-Smoker	1,009	(40.9)	370	(39.4)	404	(42.8)	148	(47.1)	87	(31.9)
Total	**2,470**		**938**		**945**		**314**		**273**	

[a]Total number of cases: 2,470. Smoking status was missing on 76 individuals. Number of patients, percentages are in parentheses.
[b]OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RADS=reactive airway dysfunction syndrome.

Table 8. Family History of Allergies Among Confirmed Work-Related Asthma Patients: 1988-2006

Family History of Allergies	Disease Status[b] ALL[a]		OA		POA		AA		RADS	
YES	959	(43.2)	341	(39.2)	375	(43.2)	155	(59.8)	88	(39.3)
NO	1,261	(56.8)	528	(60.8)	493	(56.8)	104	(40.2)	136	(60.7)
Total	**2,220**		**869**		**868**		**259**		**224**	

[a]Total number of cases: 2,220. Missing data on 326 patients. Number of patients, percentages are in parentheses.
[b]OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RADS=reactive airway dysfunction syndrome.

Table 9. Personal History of Allergies or Asthma Among Confirmed Work-Related Asthma Patients: 1988-2006

	Disease Status[b]									
Personal History	ALL[a]		OA		POA		AA		RADS	
YES	1,174	(46.1)	360	(37.7)	412	(42.5)	309	(91.4)	93	(32.9)
NO	1,372	(53.9)	596	(62.3)	557	(57.5)	29	(8.6)	190	(67.1)
Total	**2,546**		**956**		**969**		**338**		**283**	

[a]Number of patients, percentages are in parentheses.
[b]OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RADS=reactive airway dysfunction syndrome.

Table 10. Persistence of Symptoms and Medication Use in Confirmed Work-Related Asthma Patients: 1988-2006

Medication		*Breathing Problems Still Present*				*Still Taking Asthma Medications*			
		Yes		Less		Yes		Less	
Exposure Status	Total[a]								
Still Exposed	677	652	(96.3)	204	(30.1)	584	(86.3)	126	(18.6)
No Longer Exposed	1,657	1,432	(86.4)	809	(48.8)	1,294	(78.1)	466	(28.1)
Total	**2,334**	**2,084**		**1,013**		**1,878**		**592**	

[a]Total number of cases: 2,334. Information missing on 212 individuals. Number of patients, percentages are in parentheses.

Table 11. Status of Facilities Where 2,546 Patients with Confirmed Work-Related Asthma were Exposed to Allergens: 1988-2006

Inspection Status	Number of Patients Represented	Companies Number	Companies Percent
Inspected	1,076	660[a]	36.4
No Follow-up Planned	1,256	955	52.7
Scheduled for Inspection	28	25	1.4
Out of Business	64	56	3.1
No Longer Use Occupational Allergen	26	25[b]	1.4
Sent Company an Indoor Air Letter[d]	47	41	2.3
Sent Company Letter to Check Exposures[e]	49	49	2.7
Total	**2,546**	**1,811[c]**	**100.0**

[a]660 inspections were conducted in 575 different facilities.
[b]Eight companies that no longer use the allergen were previously inspected.
[c]Represents 1,726 different facilities.
[d]The company was sent information on how to address issues related to indoor air quality and respiratory heath.
[e]The company was sent information on how to address potential exposures in their workplace that may be causing respiratory health problems.

Table 12. Results of 660 Industrial Hygiene Inspections in 575 Facilities Where Patients with Confirmed Work-Related Asthma were Exposed to Allergens: 1988-2006

Inspection Results

Air Sampling – NIOSH Standard	Number	Percent
Above NIOSH Standard	51	7.7
Below NIOSH Standard	395	59.8
No NIOSH Standard	18	2.7
Unknown (no report yet)	7	1.1
Did Not Sample for an Allergen	21	3.2
Did Not Sample	168	25.5
Total	**660**	**100.0**

Air Sampling – MIOSHA Standard	Number	Percent
Above MIOSHA Standard	21	3.2
Below MIOSHA Standard	439	66.5
No MIOSHA Standard	3	0.5
Unknown (no report yet)	7	1.1
Did Not Sample for an Allergen	22	3.3
Did Not Sample	168	25.5
Total	**660**	**100.1[a]**

[a]Percentages do not add to 100 due to rounding.

Table 13. Allergens Found to be Above the MIOSHA Permissible Exposure Limit (PEL) and/or NIOSH Recommended Exposure Limit (REL): Michigan 1988-2006

	Above NIOSH REL		Above MIOSHA PEL	
Asthma-Causing Agents	Number	Percent	Number	Percent
Formaldehyde	21	41.2	1	4.8
Styrene	6	11.8	4	19.0
Metal-Working Fluids	5	9.8	1	4.8
Glutaraldehyde	4	7.8	3	14.3
HDI	4	7.8	No PEL	--
Cobalt	3	5.9	2	9.5
MDI	3	5.9	0	--
Wood Dust	2	3.9	2	9.5
Chromic Acid	1	2.0	1	4.8
Ethylene Oxide	1	2.0	0	--
Starch	1	2.0	0	--
Welding Fume (Total Particulate)	No REL	--	5	23.8
Flour Dust	No REL	--	2	9.5
TOTAL	51	100.1[a]	21	100.0

[a]Percentages do not add to 100 due to rounding.

Table 14. Symptoms Consistent with Work-Related Asthma Among Fellow Workers of the 2,546 Confirmed Work-Related Asthma Patients

Symptoms[a]	ALL[b]		Disease Status of the Index Patient OA		POA		AA		RADS	
Daily or Weekly SOB, Wheezing or Chest Tightness	**1,466**	**(16.2)**	**1,090**	**(16.9)**	**340**	**(14.4)**	**4**	**(16.0)**	**32**	**(13.2)**
# Workers Interviewed	9,069		6,447		2,355		25		242	
OSHA Log[c]	**562**	**(18.5)**	**401**	**(22.3)**	**150**	**(13.0)**	**2**	**(12.5)**	**9**	**(9.1)**
# Companies w/Employee on Log	122		89		30		1		2	
# Companies Inspected	660		400		230		8		22	
Total[d]	**2,028**		**1,491**		**490**		**6**		**41**	

[a]Denominator for calculating percentages was the number of workers interviewed. SOB=shortness of breath.
[b]Number of individuals with symptoms, percentages are in parentheses. OA=occupational asthma; POA=possible occupational asthma; AA=aggravated asthma; RADS=reactive airways dysfunction syndrome.
[c]Numerator for calculating percentages was the number of companies with an employee other than the index patient on the OSHA log. Denominator for calculating percentages was the number of companies inspected.
[d]Nine individuals were identified both on the questionnaire and the OSHA log.

Table 15. 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	3,375	52,085	6.5	GPM Industries Inc.
				Haworth Inc.
				Johnson Controls Interiors LLC
Barry	1,100	29,314	3.8	Bradford White Corp.
Berrien	2,045	71,590	2.9	Ancast Inc.
				Lear Corp.
				Robert Bosch Corp. Chassis Div.
				Tyler Refrigeration
Calhoun	180	65,826	0.3	Cello-foil Products Inc.
Cass	618	26,140	2.4	Georgie Boy Manufacturing LLC
Charlevoix	500	12,744	3.9	East Jordan Iron Works Inc.
Clare	300	12,075	2.5	Renosol Seating LLC
Dickinson	580	13,700	4.2	Grede Foundries Inc.
				Louisiana-Pacific Sagola OSB
Eaton	30	55,979	0.1	Axson North America Inc.
Genesee	1,000	191,799	0.5	Delphi Energy & Chassis Systems Flint East
Hillsdale	160	20,179	0.8	Dow Chemical Co.
Ingham	1,750	143,867	1.2	ASC Lansing Trim
				Collins & Aikman Plastics
				GMVM Lansing
				Huntsman Advanced Materials
Iosco	75	9,646	0.8	Tawas Industries Inc.
Isabella	550	35,976	1.5	Delfield Co.
Jackson	800	71,302	1.1	ADCO Products Inc.
				TAC Manufacturing Inc.
Kalamazoo	160	125,304	0.1	Azon USA Inc.
				Premier Products[d]

Kent	4,359	303,024	1.4	Detroit Diesel Remanufacturing North
				HB Fuller Co.
				Knape & Vogt Manufacturing Co.
				Steelcase Inc.
				Wolverine World Wide Inc.
				Zondervan
Lapeer	26	40,931	0.1	ITW TACC
Lenawee	605	45,672	1.3	Anderson Development Co.
				Ixtlan Technologies LLC
				Pilkington Clinton
Livingston	890	88,122	1.0	Atreum Brighton
				Atreum Howell
				Package Design & Manufacturing Inc.
Luce	129	2,632	4.9	Louisiana-Pacific Corporation
Macomb	3,430	386,464	0.9	Automotive Components Holdings LLC
				Du Pont Mount Clemens Plant
				International Casting Corp.
				Rivas Inc.
				Romeo Rim Inc.
				US Farathane
				Wolverine Bronze Co.
Mason	220	12,817	1.7	Great Lakes Castings LLC
Mecosta	1,000	18,697	5.3	Wolverine World Wide Inc.
Monroe	275	72,226	0.4	Autolign Manufacturing Group Inc.
				Sunrise Windows Ltd.
Montcalm	172	24,295	0.7	Kent Foundry
				Northland Corp.
Muskegon	250	82,593	0.3	Brunswick Bowling
Oakland	286	587,086	<0.1	Armaly Sponge Co.
				Cass Polymers of Michigan Inc.
				Eagle Industries Inc.
				ITW Devcon Futura
				Lymtal International Inc.
				Recticel Interiors North America LLC
				Recticel UREPP North America Inc.
Ogemaw	150	8,741	1.7	Taylor Building Products Inc.
Ottawa	585	129,291	0.5	Eagle Packaging Inc.
				Izzy/Counter Point
				Magna Donnelly Corp.

Saginaw	2,328	90,190	2.6	Delphi Saginaw Steering Systems
				Glastender Inc.
				GM Power Train Saginaw Malleable Iron
				Lendell Manufacturing Inc.
				Saginaw Metal Casting Operations
St. Clair	710	76,471	0.9	Blue Water Automotive Systems Inc.
				Collins & Aikman
				Lear Corp.
				Takata Petri Inc.
Sanilac	150	20,208	0.7	Numatics Inc.
Shiawassee	70	33,564	0.2	SCA Packaging NA Inc.
Van Buren	182	37,901	0.5	Degussa Construction Chemicals Operations Inc.
				Special-Lite Inc.
Washtenaw	1,600	180,378	0.9	Automotive Components Holdings LLC
				Kalitta Charters, LLC[d] (Note: not a manufacturing facility)
Wayne	6,380	813,663	0.8	ASC Gibraltar
				BASF Corp., Livonia
				BASF Corp., Wyandotte
				Daimler Chrysler Jefferson N Assembly Plant
				EFTEC North Americas LLC
				EQ Detroit Inc.
				General Motors Corp MLCG Detroit Hamtramck
				Lear Corp.
				Plastomer Corp.
				Poof-Slinky Inc.
				Recycled Polymeric Materials Inc.
				SprayTek, Inc. [d]
				Wayne Disposal Inc.
				Woodbridge Corp.
Wexford	1,230	13,580	9.1	Cadillac Casting Inc.
				Genmar Cadillac Four Winns
TOTAL	38,250	4,206,900	0.9	

[a]Source: Michigan Manufacturer's Directory, 2007 and www.acinet.org accessed July 3, 2007.

[b]Source: Michigan Labor Market Information, Data Explorer, www.milmi.org accessed July 4, 2007.

[c]Source: U. S Environmental Protection Agency. Toxics Release Inventory, Michigan Companies Using Isocyanates in 2005 (report generated May 29, 2007).

[d]Source: Michigan Department of Environmental Quality, FOIA Request for SARA TITLE III Emergency Planning and Release Reporting of select chemicals (isocyanates), received October 5, 2007.

Table 16. Michigan Facilities by County, Reporting Toxic Chemicals to the Michigan Department of Environmental Quality (DEQ) Under Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA)[a]:

- ✓ Substances Capable of Causing Asthma—Bisphenol A, Cobalt, Epichlorohydrin, Formaldehyde, Methyl Acrylate, Phthalic Anhydride, and Styrene
- ✓ Irritants Capable of Causing Reactive Airways Dysfunction Syndrome (RADS)—Ammonia and Chlorine

County	Company Name	Type of Exposure
Alger	Munising, City of (POTW)	Chlorine
	Neenah Paper – Michigan, Inc.	Chlorine
Allegan	Birds Eye Foods, Inc.	Chlorine
	Linde Gas, LLC	Ammonia, Chlorine
	Otsego City of, Waste Water Treatment Plant	Chlorine
	Otsego City of, Wells #3, #4, #5	Chlorine
	Packerland Plainwell – Smithfield Beef Group	Ammonia
	Plainwell City of, Waste Water Treatment Plant	Chlorine
Alpena	Airgas Great Lakes, Inc.	Chlorine
	Alpena Supply Company	Chlorine
	Thunder Bay Manufacturing	Formaldehyde
Arenac	Saginaw-Midland Municipal Water	Chlorine
Baraga	Custom Composites Division	Styrene
Bay	Airgas Great Lakes, Inc.	Chlorine
	Bay City of, Bay Metropolitan Water Treatment	Chlorine
	Carbone of America – Ultra Carbon Division	Chlorine
	Essexville Waste Water Treatment	Chlorine
	Quantum Composites, Inc. – Premix, Inc.	Styrene
	West Bay County Regional Waste Water	Chlorine
Berrien	Benton Harbor Water Plant	Chlorine
	Buchanan Waste Water Treatment Plant	Chlorine
	Buchanan Water Treatment Plant	Chlorine
	Coloma Frozen Foods, Inc.	Ammonia

	Greg Orchards & Produce, Inc.	Ammonia
	Harbor Metal Treating Company	Ammonia
	Lake Township Water Plant	Chlorine
	Leco Corporation	Ammonia
	Mittler Supply, Inc.	Ammonia, Chlorine
	NCP Coatings, Inc.	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 Dept. – Iron Removal Plant	Chlorine
	Saint Joseph Water Plant	Chlorine
	Sandvik Materials Technology	Ammonia
	Wilbur-Ellis Company	Formaldehyde
Branch	Alchem Aluminum – Aleris International	Chlorine
	Coldwater Water Treatment Plant	Chlorine
	Conagra Foods, Inc.	Ammonia, Chlorine
	Star of the West Milling Company	Chlorine
Calhoun	Airgas Great Lakes, Inc.	Chlorine
	Anatech, Ltd.	Formaldehyde
	Battle Creek City of, Waste Water Treatment Plant	Chlorine
	Guardian Fiberglass, Inc.	Formaldehyde
	Kraft Foods Global, Inc.	Chlorine
	Prairie Farms Dairy, Inc.	Ammonia
	Verona Pumping Station	Chlorine
Cass	Mennel Milling Co. of Michigan	Chlorine
Charlevoix	Airgas Great Lakes, Inc.	Chlorine
Cheboygan	Cheboygan City of, Waste Water Treatment Plant	Chlorine
	Cheboygan City of, Well house #4, #7	Chlorine
Clinton	SCCMUA	Chlorine
	St. Johns City of, Waste Water Treatment Facility	Chlorine
Crawford	Arctic Glacier, Inc.	Ammonia
	Grayling Generating Station	Chlorine
Delta	Escanaba Paper Company – Newpage Corp.	Chlorine
Dickinson	Iron Mountain/Kingsford Waste Water Treatment Plant	Chlorine
	Verso Paper Company – Quinnesec Mill	Chlorine
Eaton	Axson North America, Inc.	Styrene
Emmett	Airgas Great Lakes, Inc.	Chlorine
Genesee	Airgas Great Lakes, Inc.	Chlorine

	Flint City of, Water Plant	Chlorine
	Flint City of, Water Pollution Control Facility	Chlorine
	Genesee County Drain Comm. – A. Ragnone Treatment Plant	Chlorine
	GMC Powertrain Flint, North	Ammonia
	Kelsey-Hayes Company	Chlorine
Gogebic	Ironwood City of, Water Pump Station	Chlorine
Grand Traverse	Airgas Great Lakes, Inc.	Chlorine
	Century Sun Metal Treating	Ammonia
	Linde Gas, LLC	Ammonia
	Morrison Orchards	Ammonia
	Wilbur-Ellis Company	Formaldehyde
Gratiot	Alma City of, Waste Water Plant	Chlorine
	St. Louis City of, Waste Water Treatment Plant	Chlorine
Hillsdale	Bob Evans Farms	Ammonia
	Hillsdale Waste Water Treatment	Chlorine
	Michigan South Central Power Agency	Chlorine
	Prattville Fertilizer & Grain	Ammonia
Houghton	Michigan-American Water Company	Chlorine
Huron	Caseville Village of, Water Treatment Plant	Chlorine
	Dow Agrosciences, LLC	Ammonia
Ingham	Airgas Great Lakes, Inc.	Chlorine
	Alexander Chemical Corporation	Chlorine
	Aurora Specialty Chemistries	Epichlorohydrin
	East Lansing – Meridian Water and Sewer	Ammonia
	Lansing Board of Water & Light – Erickson Station	Chlorine
	Linde Gas, LLC	Ammonia
	Michigan State University	Chlorine
	Molded Plastic Ind., Inc.	Styrene
	Nitrex, Inc. – Michigan Operation	Ammonia
	Quality Dairy Company	Ammonia
	Summetry Medical, Inc. – Jet Engineering	Cobalt
Ionia	Herbruck Poultry Ranch	Ammonia
	Portland Waste Water Treatment Plant	Chlorine
	Twin City Foods, Inc.	Chlorine
Iosco	Huron Shore Regional Utility – Earth Tech	Chlorine
Jackson	Nalco Company – Plant 135	Formaldehyde
Kalamazoo	AGA Gas, Inc.	Ammonia, Chlorine
	Cytec Industries, Inc.	Epichlorohydrin
	Kal Blue Reprographics	Ammonia

	Knappen Milling Co.	Chlorine
	Pharmacia & Upjohn, LLC – Pfizer, Inc. Mfg. Complex	Ammonia, Chlorine, Epichlorohydrin, Formaldehyde
	Total Logistics Control, LLC	Ammonia
Kent	AGA Gas, Inc.	Ammonia
	Allied Finishing, Inc.	Formaldehyde
	Coca-Cola Bottling Co.	Ammonia
	Cook Composites & Polymers	Ammonia
	Country Fresh, Inc.	Ammonia
	Electro-Chemical Finishing Company-44th St. Facility	Ammonia
	Electro-Chemical Finishing Company-Remico St. Facility	Ammonia, Formaldehyde
	Haviland Products Company	Formaldehyde
	Kent County Waste-to-Energy Facility	Chlorine
	King Milling Company	Chlorine
	Lack's Trim System – Airline Plant	Formaldehyde
	MacDonald's Industrial Products – Plant 3	Formaldehyde
	Mittler Supply Company	Chlorine
	Old Orchard Brands, LLC	Ammonia
	Southside Ice Center	Ammonia
	Sparta Village of, Water Dept.	Chlorine
	Spartan Stores Distribution, LLC	Ammonia
	Univar – Grand Rapids	Formaldehyde
	Wilbur-Ellis Company	Formaldehyde
	Wyoming Clean Water Plant	Chlorine
Lapeer	Deco Plate Manufacturing – DOTT Industries	Formaldehyde
Leelanau	Leelanau Fruit Company	Ammonia
	Wilbur-Ellis Company	Formaldehyde
Lenawee	Adrian City of, Carl R. Nelson Waste Water Treatment Plant	Chlorine
	Anderson Development Company – Main Plant	Styrene
	Biolab, Inc. – Chemtura	Ammonia, Chlorine
	Tecumseh City of, Waste Water Treatment Plant	Chlorine
	Tecumseh City of, Well house #3, #8 - #12 & #14	Chlorine
Livingston	Alpha Technology Corporation	Styrene
	Cor-Met, Inc.	Cobalt
	Howell City of, Waste Water Treatment Plant	Chlorine
	Howell City of, Water Plant	Chlorine
	Pepsi Cola Metropolitan Bottling	Ammonia
Macomb	Chemtech Finishing System, Inc.	Epichlorohydrin, Formaldehyde
	CN Cargoflo	Formaldehyde
	Du Pont – Mt. Clemens Plant	Styrene
	Fini Finish Products, Inc.	Chlorine

	Metallurgical Processing Company	Ammonia
	Mount Clemens City of, Waste Water Treatment Plant	Chlorine
	New Baltimore City of, WPCF	Chlorine
	Specialty Steel Treating, Inc.	Ammonia
	Steel Processing Company, LLC	Ammonia
	Warren City of, Waste Water Treatment	Chlorine
Marquette	Airgas North Central, Inc.	Chlorine
	Negaunee Waste Water Treatment	Chlorine
Mason	Dow Chemical Company	Ammonia, Chlorine
	Ludington City of, Waste Water Plant	Chlorine
	Michigan Food Processors	Ammonia
Menominee	L.E. Jones Company	Cobalt
	Menominee Paper Company	Chlorine
	Menominee Waste Water Treatment Plant	Chlorine
	Menominee Water Treatment Plant	Chlorine
Midland	Airgas Great Lakes, Inc. – Midland Store	Chlorine
	Dow Chemical USA – Midland Operations – MI Div.	Ammonia, Chlorine, Epichlorohydrin, Methyl Acrylate, Styrene
	Dow Corning Corporation – 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, Inc. – Carbone of America	Chlorine
Monroe	Advanced Heat Treat Corp.	Ammonia
	Independent Dairy, Inc.	Ammonia
	Meijer Newport Distribution	Ammonia
	Monroe City of, Waste Water	Chlorine
Montcalm	Federal Mogul Corporation	Ammonia
Muskegon	Cole's Quality Foods, Inc.	Ammonia
	ESCO Company LTD Partnership	Phthalic Anhydride
	Howmet Corporation – Plants 1 & 3	Cobalt
	Howmet Corporation – Plant 5	Bisphenol A, Cobalt
	Howmet Corporation – Plant 10	Cobalt
	Intra City Dispatch	Bisphenol A
	Lake Welding Supply Company, Inc.	Ammonia
	M. Arguesi & Co., Inc.	Bisphenol A
	Muskegon Heights Filtration Plant	Chlorine
	S.D. Warren Company	Chlorine
	Webb Chemical Service Corp., Inc.	Formaldehyde
	Yale Lift-Tech	Ammonia

Oakland	Drayton Pool & Spa Supply Inc.	Chlorine
	Engineered Heat Treat, Inc.	Ammonia
	General Motors Proving Ground	Chlorine
	Holly Village of, Waste Water Treatment Plant	Chlorine
	Lakeland Arena	Ammonia
	MacDermid, Inc.	Formaldehyde
	Milford Village of, Iron Removal Plant	Chlorine
	Milford Village of, Waste Water Treatment Plant	Chlorine
	Parkdale Pharmeceuticals	Chlorine
	Scott Specialty Gases, Inc.	Ammonia, Chlorine
	Specialty Steel Treating, Inc.	Ammonia
	Stone Soap Company, Inc.	Formaldehyde
	Sulzer Metco (US), Inc.	Cobalt
Oceana	Hanson Logistics Group	Ammonia
	Oceana Foods	Ammonia
	Wilbur-Ellis Company	Formaldehyde
Ogemaw	Sandvik Hard Materials	Cobalt
Ontonagon	Smurfit-Stone Container Enterprises	Chlorine
Osceola	Advanced Fibermolding	Styrene
	Yoplait USA	Ammonia
Ottawa	Airgas Great Lakes, Inc.	Chlorine
	Board of Light & Power	Chlorine
	Crème Curls Bakery, Inc.	Ammonia
	Hudsonville Creamery & Ice Cream, LLC	Ammonia
	Lake Welding Supply Company, Inc.	Ammonia
	Lakeshore Filtration Plant	Chlorine
	Mead Johnson and Company	Chlorine
	Pfizer Global Manufacturing	Formaldehyde
	Polyply Composites, Inc.	Styrene
	Tiara Yachts, Inc.	Styrene
	Wyoming Water Treatment Plant	Chlorine
Saginaw	Airgas Great Lakes, Inc.	Chlorine
	Bridgeport Waste Water Treatment Plant	Chlorine
	Buena Vista Waste Water Treatment Plant	Chlorine
	Dow Corning Corporation	Ammonia
	Frankenmuth City of, Waste Water Treatment Plant	Chlorine
	Saginaw Charter Township Retention Basin	Chlorine
	Saginaw Water Treatment Plant	Chlorine
	Star of the West Milling Company	Chlorine
	Waste Water Treatment Plant	Chlorine
Saint Clair	Dunn Paper, Inc.	Chlorine
	Lake Huron Water Treatment Plant	Chlorine

Saint Joseph	Abbott Laboratories	Ammonia
	Benton Harbor – St. Joseph Waste Water Treatment Plant	Chlorine
	Sturgis Waste Water Treatment Plant	Chlorine
	Three Rivers Waste Water Treatment	Chlorine
Sanilac	Croswell Water Plant	Chlorine
	DGP, Inc.	Styrene
Shiawassee	Machine Tool & Gear, Inc.	Ammonia
Tuscola	Caro Village of, Waste Water Treatment Plant	Chlorine
	Cass City Village of, Waste Water Treatment Plant	Chlorine
	Precision Concepts, Inc.	Styrene
Van Buren	Coca-Cola North America	Ammonia, Chlorine
	DSM Pharma Chemicals, Inc.	Formaldehyde
	Knouse Foods Coop, Inc.	Ammonia
	South Haven City of, Water Filtration Plant	Chlorine
	Total Logistic Control – Paw Paw Logistic Center	Ammonia
	Welch's	Ammonia
Washtenaw	Airgas Great Lakes, Inc.	Chlorine
	Kalitta Charters, LLC	Ammonia, Formaldehyde
	Chelsea Milling Company	Chlorine
	Photo Systems, Inc.	Formaldehyde
	Thetford Corporation	Formaldehyde
Wayne	Aldoa Company	Epichlorohydrin
	Arbor Hills Electric	Ammonia
	Arted Chrome Plating, Inc.	Chlorine
	B & J Enameling, Inc.	Epichlorohydrin
	BASF Corporation	Styrene
	Bottling Group LLC, Pepsi Bottling	Ammonia
	Cardinal Health	Formaldehyde
	Dairy Fresh Foods, Inc. – Detroit City Dairy	Ammonia
	Detroit Waste Water Treatment	Chlorine
	Durcon Laboratory Tops, Inc.	Phthalic Anhydride
	Dynamic Metal Treating, Inc.	Ammonia
	Freezer Services of MI, LLC	Ammonia
	Fritz Products	Chlorine
	High-Po-Chlor, Inc.	Chlorine
	Hughes Supply	Chlorine
	Interstate Chemical Co., Inc.	Formaldehyde
	JCI Jones Chemicals, Inc.	Chlorine
	Lincoln Distributing – Painters Supply & Equipment	Styrene
	Linde Gas, LLC	Ammonia, Chlorine
	Norquick Distributing Company	Ammonia
	Northeast Water Plant	Chlorine
	Pepsi Bottling Group, LLC	Chlorine

	Praxair Distribution, Inc.	Ammonia
	PVS Nolwood Chemicals, Inc.	Formaldehyde
	PVS Technologies, Inc.	Chlorine
	Quaker Chemical Corporation	Formaldehyde
	South Huron Valley Waste Water Treatment Plant	Chlorine
	Trenton City of, Waste Water Treatment Plant	Chlorine
	Water Works Park Plant	Chlorine
	White Tower Industrial Laundry	Chlorine
	Wyandotte City of, Municipal Power Plant	Chlorine
Wexford	AAR Mobility Systems	Formaldehyde
	Airgas Great Lakes, Inc.	Chlorine
	Fiber-Tech Industries	Styrene
	Four Winns, Cruiser	Styrene
	Four Winns Inc., Sport Division	Styrene
	Haring Township Water Supply	Chlorine

[a]Source: Michigan Department of Environmental Quality (DEQ). Michigan Facilities' Guide to SARA Title III, Emergency Planning and Release Reporting. December 2006, 5th 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 October 5, 2007.

Appendix I

2006 Case Narratives by Type of Exposure & Industry

Abbreviations:
POA = Possible Occupational Asthma
OA = Occupational Asthma with a Known Sensitizer
AA = Aggravated Asthma (Pre-existing Asthma Exacerbated at Work)
RADS = Reactive Airway Dysfunction Syndrome

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

TABLE OF CONTENTS

Cleaning Products

EATING AND DRINKING ESTABLISHMENTS

AA- Case 2605. A female in her mid 50s experienced an exacerbation of her pre-existing asthma at her job in a restaurant, when cleaning chemicals were mixed in the kitchen. She continued to work at the restaurant, but stopped entering the kitchen area to avoid any further exposures to cleaners in the kitchen. She never smoked cigarettes. Her symptoms of shortness of breath, cough, wheezing and chest tightness continued and she took a short acting beta-2 agonist.

RADS- Case 2535. A male developed RADS in his mid 60s after an acute exposure to cleaning agents being used to clean a kitchen at the manufacturing plant where he worked. After this incident, he was prescribed an inhaled corticosteroid, an anticholinergic bronchodilator, and a short acting beta-2 agonist. He had never smoked cigarettes. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. He had to leave work because of his increased breathing difficulties.

EDUCATIONAL SERVICES

POA- Case 2534. A female developed asthma in her late 40s while working as a custodian at a school. She was exposed to a floor cleaner for a short period of time when her breathing difficulties developed. The floor cleaner was not properly diluted. She was treated at the emergency room and prescribed a short acting beta-2 agonist and oral corticosteroids. She had never smoked cigarettes. Baseline spirometry was normal. After this incident she was provided a paper mask. She continued to be exposed to the cleaners at her job and took a beta-2 agonist.

AA- Case 2604. A female in her early 50s experienced an exacerbation of her pre-existing asthma while working in a computer lab at a school. Her asthma was triggered at work when she was exposed to cleaning agents used to clean up the lab and air ducts after the room had been vandalized. She smoked an average of

ten cigarettes a day for six years but had stopped smoking over 30 years ago. She took a short acting beta-2 agonist and an antihistamine. Other than this incident, there were no other exposures at work that triggered her asthma.

POA- Case 2536. A female developed asthma in her late 40s after working as a teacher for almost ten years. Her breathing difficulties began when intense cleaning, including carpet cleaning, was done in the building where she worked. She was treated at the emergency room four times and prescribed a short acting beta-2 agonist, leukotriene inhibitor and inhaled corticosteroid. Baseline spirometry was reduced. She never smoked cigarettes. She left work on sick leave and took more asthma medication for her breathing difficulties.

POA- Case 2588. A female developed asthma in her early 50s, while working at a school. She developed asthma about 15 years after beginning this job, after exposure to carpet deodorizers. She was prescribed a short acting beta-2 agonist, leukotriene inhibitor, inhaled corticosteroid, anticholinergic bronchodilator and theophylline. She had smoked an average of 20 cigarettes a day for 16 years but had stopped smoking 31 years ago. Baseline spirometry was significantly reduced. She had a negative pre-and post-bronchodilator test. She retired approximately six years later; her breathing problems worsened and she used more asthma medication.

HEALTH CARE SERVICES

RADS- Case 2582. A female developed RADS in her mid 40s from an acute exposure to cleaning agents. She had worked for an EMS unit for almost ten years before the incident that caused her asthma. She had never smoked cigarettes. The cleaning agents were on the clothing of a patient being transported by the ambulance where she was assigned. She was prescribed an inhaled corticosteroid. She did not have any further exposures at work to trigger her symptoms. Her symptoms improved and she used less asthma medication.

HOTEL INDUSTRY

AA- Case 2574. A female in her late 30s experienced an exacerbation of her pre-existing asthma while working as a housekeeper for a hotel. Her symptoms were aggravated at work when she was exposed to a chemical deodorizer and cleaners. She developed worsening symptoms of wheezing, cough, shortness of breath and chest tightness. She continued to work at the hotel, her breathing difficulties worsened further while at work and she took increased amounts of a short acting beta-2 agonist.

MANUFACTURING

OA- Case 2457. A female in her late 40s developed asthma while working as a press operator for an automobile parts plant. Exposure to various cleaning solutions led to her developing breathing difficulties. She had smoked approximately 1-5 cigarettes a day since she was 22 years old. Baseline spirometry was reduced. She had a negative pre-and post-bronchodilator test. She was prescribed a leukotriene inhibitor and an inhaled corticosteroid and continued to work in the same facility. Her breathing problems did not improve.

PUBLIC ORDER

AA- Case 2485. A female in her 40s developed asthma while working in a correctional facility. She was assigned to watch prisoners who were using various cleaning solutions and disinfectants while on a work assignment at a factory. After the second exposure she ended up on oxygen in the company health facility. She was prescribed a short acting beta-2 agonist, inhaled corticosteroid, antihistamine and a combined long acting beta-2 agonist and inhaled corticosteroid to help control her symptoms of cough, shortness of breath and chest tightness. She continued to work at this facility and her breathing problems worsened.

AA- Case 2566. A male in his late 30s experienced an exacerbation of his pre-existing asthma while working as a supervisor in a prison kitchen. His symptoms of shortness of breath, wheezing, cough and chest tightness were triggered after exposure to cleaning agents used in the kitchen. He began smoking cigarettes at age 16 and smoked an average of 20 cigarettes a day. He was diagnosed with emphysema three years prior. He was prescribed a leukotriene inhibitor, an anticholinergic bronchodilator, a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. He continued to work at the prison. His breathing problems worsened and he took the same amount of asthma medication.

RETAIL SERVICES

RADS- Case 2564. A female developed RADS in her mid 50s from an acute exposure to mixed cleaning agents in her job at a retail store. She had worked at the store for over five years without breathing difficulties prior to a large effort to clean the entire store. She developed symptoms of wheezing, cough, shortness of breath and chest tightness and was treated at the emergency room four times and hospitalized twice. She had smoked an average of five cigarettes a day off and on since she was 21 years old. Baseline spirometry was reduced. She had a negative pre-and post-bronchodilator test. Although the store changed cleaning products, her symptoms worsened and she took more asthma medication, including a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. In addition, the triggers for her breathing difficulties broadened to include many other non-work exposures such as perfumes and products with fragrances.

TRANSPORTATION SERVICES

AA- Case 2576. A female in her late 40s experienced an exacerbation of her pre-existing asthma while working for an airline carrier. She was exposed to a bathroom cleaner that had leaked onto the floor and triggered her asthma. She was prescribed a combined long acting beta-2 agonist and inhaled corticosteroid and a short acting beta-2 agonist. Baseline spirometry was normal. She never smoked cigarettes. She did not experience any other episodes after that leak and avoided exposures to the particular cleaner that triggered her asthma at work.

MISCELLANEOUS INDUSTRIES

RADS- Case 2463. A male in his 30s developed asthma after working with cleaning solutions for five months. His job was to clean equipment, which he did by mixing various cleaning solutions along with bleach. He had previously smoked cigarettes. He was prescribed a short acting beta-2 agonist and oral corticosteroid to help with his symptoms of wheezing and shortness of breath.

RADS- Case 2556. A female developed RADS in her 30s from an acute exposure to a toilet bowl cleaner, while cleaning bathrooms at the company she began working for one month prior to the incident. She was treated at the emergency room and given a short acting beta-2 agonist. She had smoked cigarettes since the age of 21, with an average of 15 cigarettes a day. After that incident, she quit her job. Her breathing problems worsened and she used more asthma medication despite no longer working with cleaning agents.

POA- Case 2573. A male developed asthma in his early 20s shortly after beginning to work for a landscape construction company. He was exposed to chemicals used with decorative residential ponds, as well as exposures from existing stagnant ponds. He used a paper mask while doing this work. He was prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid, which he stopped taking after leaving this job several months after he was hired. He smoked an average of 100 cigarettes a day for two years but had stopped smoking eight years ago. His symptoms improved; however he was unable to obtain new employment because of his breathing difficulties.

RADS- Case 2550. A male developed RADS in his mid 40s from an acute exposure to a mixture of chlorine and muriatic acid. These chemicals were being used to clean a swimming pool and surrounding area where he worked in maintenance. He was hospitalized five times after this incident and was prescribed a leukotriene inhibitor, an anticholinergic bronchodilator, a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. He smoked an average of 50 cigarettes a day for 28 years but stopped smoking earlier in the year. Baseline spirometry was reduced and he had a negative pre-and post-bronchodilator test. He left this job and despite avoiding those exposures, experienced a worsening of his breathing difficulties as well as increased usage of his asthma medications.

RADS- Case 2577. A female developed RADS in her mid 30s, after an acute exposure to cleaning agents at work. She worked in the service industry and was required to do heavy cleaning during her shift, using food service-grade disinfectants. She had smoked an average of 20 cigarettes a day since she was 18 years old. She was prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid that she stopped using about a year after her initial exposure. She continued to work at this job, and still experienced breathing problems.

Glutaraldehyde

HEALTH CARE SERVICES

OA- Case 2544. A female developed asthma in her late 30s from exposure to glutaraldehyde at a hospital. She was employed as an endoscopy technician when her asthma began. She had a negative pre-and post-bronchodilator test. She had never smoked cigarettes. She was prescribed a short acting beta-2 agonist and an antihistamine. Upon transferring to another department, she experienced an improvement in her symptoms of wheezing, cough, shortness of breath and chest tightness.

OA- Case 2542. A female developed asthma in her early 30s from exposure to glutaraldehyde at the hospital where she worked. She had worked in this location for over 15 years before her asthma developed. She had never smoked cigarettes. The exposure was from leaking of sterilization units used to sterilize endoscopes and bronchoscopes, along with poor ventilation in the small room where the work was done. She left her job approximately two years later. Her symptoms improved and she used less asthma medication, including a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid.

Indoor Air Quality

EDUCATIONAL SERVICES

POA- Case 2456. A female in her 50s developed asthma after working at a junior high school. She had been teaching in a very old building when her symptoms of wheezing and cough began. She was exposed to dust and possibly mold for 23 years. She was given a leukotriene inhibitor and an inhaled corticosteroid for her symptoms. She never smoked cigarettes. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. Five years after her symptoms began, her breathing problems had worsened and she used more asthma medication. She continued to teach at the same school.

POA- Case 2455. A female in her 20s developed asthma after possible exposure to mold while teaching. Her classroom had flooded over the summer and mold had begun growing in it. Her symptoms of wheezing, chest tightness, shortness of breath and cough began within a month of school being in session. She was started on a short acting beta-2 agonist and inhaled corticosteroid and her symptoms lessened. She never smoked cigarettes. Baseline spirometry was normal. She continued to work in the same classroom.

RADS- Case 2546. A male developed RADS in his mid 40s after an acute exposure during a fire at the high school where he worked. He was exposed to fumes from burning chemicals as well as the chemicals used in

putting out the fire. He was treated at the emergency room after the fire and prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and an inhaled corticosteroid. Baseline spirometry was markedly reduced. He never smoked cigarettes. He had a negative pre-and post-bronchodilator test. One year after the fire, his breathing problems had not improved and he continued to take asthma medication.

POA- Case 2587. A female developed asthma in her late 40s, after working as a teacher at a school for over five years. Her breathing difficulties developed after exposure to a perfume sprayed in her classroom. She was treated at the emergency room. She was prescribed a leukotriene inhibitor, antihistamine, inhaled corticosteroid and a short acting beta-2 agonist. She never smoked cigarettes. She was reassigned to a different building, her symptoms improved and she took less asthma medication.

POA- Case 2497. A female developed asthma in her mid 50s while working at a school. She had been a teacher at this school for over ten years. She was exposed to construction dust and possible mold when renovations were done in the building where she taught. She had never smoked cigarettes. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She was treated at the emergency room and prescribed an inhaled corticosteroid and short acting beta-2 agonist. After being off work for a few months she had an improvement in her symptoms but continued to take asthma medication.

HEALTH CARE SERVICES

POA- Case 2538. A female developed asthma in her late 30s after working for over 20 years as a nurse at a hospital. Her asthma developed after exposure to floor wax and paint fumes in the area where she worked. She was prescribed a leukotriene inhibitor, short acting beta-2 agonist and oral corticosteroid. She had never smoked cigarettes. She continued to work in this environment with these periodic exposures for another ten years until she eventually went on disability leave. Her breathing difficulties worsened and she took increased asthma medication.

AA- Case 2591. A female in her mid 40s experienced an exacerbation of her pre-existing asthma at her job at a hospital. At the hospital, her breathing difficulties were triggered by exposure to cigarette smoke and perfume. She had never smoked cigarettes. She continued to work at the hospital, and over time reported a worsening of her symptoms, including cough, wheezing and shortness of breath. She took a short acting beta-2 agonist, leukotriene inhibitor, inhaled corticosteroid and a combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2557. A female developed asthma in her early 50s. She had worked in home healthcare for over five years with exposure to cat and dog dander, dust mites and cigarette smoke in patients' homes. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She stated she had never smoked cigarettes but was diagnosed with emphysema earlier in the year. She was prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. After her asthma developed, she worked fewer hours, which helped her symptoms improve, and decreased her use of asthma medication.

OFFICE WORK

POA- Case 2465. A female in her late 30s developed asthma while working as a secretary. The building she worked in had roof leaks and she was exposed to possible mold for two months before her breathing problems began. She had smoked an average of four cigarettes a day for 11 years but had stopped smoking ten years ago. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She was prescribed a leukotriene inhibitor and antihistamine soon thereafter. Her symptoms worsened. She continued to work in the same office.

POA- Case 2529. A female developed asthma in her early 40s after exposure to diesel fumes, dirt, dust, and other agents. She worked in an office, which was located next to the company garage where diesel trucks were housed. Her asthma triggers increased to include other exposures, including perfume. She had smoked an average of 20 cigarettes a day for 14 years but had stopped smoking 15 years ago. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She used increased amounts of a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. Her symptoms of chest tightness, shortness of breath, cough and wheezing improved after the company initiated guidelines to ban the use of perfumes and air fresheners in the work area.

AA- Case 2528. A female in her early 50s experienced an exacerbation of her asthma at work. She worked in an office setting and experienced breathing difficulties when old carpet was removed near her work area and new carpet was glued down. She had smoked approximately 10-20 cigarettes a day since she was 22 years old. Her symptoms were so severe from this exposure that she was out on medical leave for over a year after this incident, with no improvement in her breathing difficulties. She was prescribed an inhaled corticosteroid, short acting beta-2 agonist, antihistamine and leukotriene inhibitor but a year after the exposure took only an antihistamine.

POA- Case 2460. A female in her early 50s developed asthma while working as a secretary in an office building. She had worked there for three years before she developed shortness of breath from possible exposure to mold. Baseline spirometry was reduced. She had a positive methacholine challenge test. She had previously smoked cigarettes. Her physician prescribed an inhaled corticosteroid, short acting beta-2 agonist and an anticholinergic bronchodilator. She continued to work in the same office and her symptoms remained unchanged.

AA- Case 2522. A female in her late 50s experienced an exacerbation of her pre-existing asthma while working as a secretary in a building undergoing extensive renovations. The dust from the construction activities aggravated her breathing difficulties. Baseline spirometry was reduced and she had a positive pre- and post-bronchodilator test. She never smoked cigarettes. Her symptoms improved after leaving this employment upon the advice of her doctor. She continued to use a leukotriene inhibitor, short acting beta-2 agonist, antihistamine and a combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2603. A female employed in the social services industry developed asthma in her early 30s from possible exposure to mold in the building where she worked. She was prescribed a leukotriene inhibitor and short acting beta-2 agonist. She had smoked an average of 15 cigarettes a day for 20 years but had stopped smoking the previous year. Shortly after her breathing difficulties developed, she was transferred to another building. After her move, her breathing difficulties worsened and she took more asthma medication.

POA- Case 2595. A female developed asthma in her early 40s while working at an office. She had worked for over seven years in a billing office with no breathing difficulties until renovations were done to the building. She was eventually transferred to a different building to avoid the residual construction dust and possible mold exposures in the area where she worked. Baseline spirometry was normal. She never smoked cigarettes. After being transferred to a new building, her symptoms of cough, shortness of breath and chest tightness improved and she used less of a short acting beta-2 agonist and numbing agent.

POA- Case 2498. A female developed asthma in her mid 50s while working in an office/laboratory. She had been at this job for ten years before her breathing difficulties began. She had been exposed to diesel fumes and disinfectants. The diesel fumes were from the proximity of her work area to a loading dock area; the disinfectant was used in the processing of specimens in the lab. She never smoked cigarettes. Baseline spirometry was reduced. She was removed from the work area and her symptoms improved although she continued to take a short acting beta-2 agonist, leukotriene inhibitor and a combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2569. A male developed asthma in his mid 30s in his job as a parole officer. He had worked in the same building for over ten years before his symptoms of cough and chest tightness developed. He had possible exposure to mold and other indoor air pollutants, along with poor ventilation. He smoked an average of two cigarettes a day for one year but stopped smoking 15 years ago. Baseline spirometry was normal. He was prescribed an inhaled corticosteroid and antihistamine and took increasing amounts to control his symptoms. He continued to work in the same building.

POA- Case 2562. A female developed asthma in her early 60s while working in an office building. She had worked in the building for about three years and was exposed to unknown indoor air pollutants including possible mold. After her asthma developed, other exposures at work triggered her asthma, including perfumes and scented room air fresheners. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She never smoked cigarettes. In the five years after her asthma began, she used an increased amount of asthma medication, including an inhaled corticosteroid and an antihistamine. She continued to work in the same office.

TRANSPORTATION SERVICES

POA- Case 2444. A male in his 40s developed asthma while working as an air traffic controller. He began developing symptoms of chest tightness and cough after three years of working in an air traffic control tower. Five years later he began taking a short acting beta-2 agonist and a leukotriene inhibitor. His breathing difficulties improved, although they were still present. He had never smoked cigarettes. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. He continued to work as an air traffic controller.

OA- Case 2441. A female in her 50s developed asthma while working as an air traffic controller. She was exposed to glutaraldehyde and isopropyl alcohol, which were used as disinfectants against mold growth. She began having breathing problems within 24 hours after the exposure. She was treated at the emergency room and her doctor prescribed a short acting beta-2 agonist, leukotriene inhibitor, anticholinergic bronchodilator and an inhaled corticosteroid. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She never smoked cigarettes. She left work on sick leave and her breathing difficulties persisted. She continued to use asthma medication.

POA- Case 2445. A male in his 40s developed asthma while working as an air traffic controller. He was possibly exposed to mold while working in the tower. His breathing problems continued to worsen. Five months after his symptoms of wheezing and cough began; he was prescribed a short acting beta-2 agonist, inhaled corticosteroid and a leukotriene inhibitor. Baseline spirometry was normal and he had a negative pre- and post-bronchodilator test. He never smoked cigarettes. He continued to work in the same air traffic control tower. His breathing problems lessened considerably.

POA- Case 2449. A male in his early 40s developed asthma from possible exposure to mold. He worked as an air traffic controller. Baseline spirometry was normal and he had a negative pre- and post-bronchodilator test. He never smoked cigarettes. Eleven months after his symptoms of wheezing, cough and chest tightness began he was started on an inhaled corticosteroid, short acting beta-2 agonist and a leukotriene inhibitor. His symptoms stopped immediately and he no longer had breathing difficulties, although he still took asthma medication. He continued to work in the same air traffic control tower.

POA- Case 2448. A male in his early 50s developed asthma from possible exposure to mold. He worked as an air traffic controller. He developed a cough within a month of working in the air traffic control tower, but did not begin to develop symptoms of wheezing, chest tightness and shortness of breath until almost three years later. Soon thereafter he was started on a leukotriene inhibitor, short acting beta-2 agonist and an inhaled corticosteroid and stopped working because of the severity of his symptoms. He had never smoked

cigarettes. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. His breathing problems lessened and he continued to take medication.

POA- Case 2450. A male in his early 40s developed asthma from possible exposure to mold. He worked as an air traffic controller when he developed symptoms of cough, wheezing, shortness of breath and chest tightness. He was started on a short acting beta-2 agonist, inhaled corticosteroid and a leukotriene inhibitor for his breathing problems. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. He never smoked cigarettes. His symptoms remained the same, and he continued to work in the same job.

Isocyanates

MANUFACTURING

OA- Case 2581. A male developed asthma in his early 50s, a few months after beginning to work in a part spray painting operation. The paint was isocyanate-based. At this job, the spray booth lacked adequate ventilation and the filters for the booth were heavily clogged with paint from previous over-spraying. He developed symptoms of wheezing, cough, chest tightness and shortness of breath and was prescribed a leukotriene inhibitor, inhaled corticosteroid and a short acting beta-2 agonist. He had smoked about five cigarettes a day for two years but quit smoking 30 years ago. Baseline spirometry was slightly reduced and he had a negative pre-and post-bronchodilator test. He left work on sick leave but his breathing problems remained the same and he took more asthma medication.

OA- Case 2567. A female developed asthma in her late 30s after working for ten years at an automotive parts manufacturer. She was exposed to isocyanates. She had never smoked cigarettes. After her asthma developed, she was reassigned to an office job at the company. She was prescribed a short acting beta-2 agonist, an inhaled corticosteroid and a leukotriene inhibitor. Her breathing difficulties continued to worsen after she was moved and she took the same amount of asthma medication.

OA- Case 2537. A female developed asthma in her early 30s while working for a chemical manufacturer. She had worked at the company for almost ten years before her breathing problems developed. She was exposed to isocyanates, including MDI, in her job as a chemist. Baseline spirometry was normal and she had a negative methacholine challenge test. She never smoked cigarettes. She was prescribed a combined long acting beta-2 agonist and inhaled corticosteroid but stopped taking them when her work team was moved to a different location. Her breathing problems improved dramatically after she moved.

OA- Case 2533. A female developed asthma in her early 50s from exposure to isocyanates. She had worked at a manufacturing facility as a mold machine operator for over 25 years before her asthma developed. She never smoked cigarettes. Baseline spirometry was normal. She had a positive methacholine challenge test. She was prescribed a combined long acting beta-2 agonist and an inhaled corticosteroid. Approximately one year later the company went out of business; her symptoms improved and she took less asthma medication.

OA- Case 2515. A female developed asthma in her early 50s, while working at an automotive seat manufacturer. She had worked at the company, and was exposed to TDI, for over 20 years before her asthma developed. She had smoked an average of two cigarettes a day for seven years but had stopped smoking more than three decades before she developed breathing problems. Baseline spirometry was markedly reduced and she had a positive pre-and post-bronchodilator test. She was prescribed a short acting beta-2 agonist, an anticholinergic bronchodilator and an inhaled corticosteroid. She continued to work with TDI for another 10 years until her retirement, and ultimately died from an asthma attack in her late 70s.

OA- Case 2511. A male developed asthma in his early 30s, while working in a refrigerator manufacturing plant. He was exposed to isocyanates for approximately five years before his asthma developed. He was

prescribed an anticholinergic bronchodilator. Baseline spirometry was normal. He had a positive pre-and post-bronchodilator test. He never smoked cigarettes. He continued to work at the facility for over 25 years; after he left this job, he used less asthma medication although his breathing problems remained unchanged.

Medications

PHARMACEUTICAL INDUSTRY

OA- Case 2452. A female in her late 20s developed asthma while working at a pharmaceutical company. She was exposed to Psyllium while training others to package orders. She was treated for her breathing difficulties with a short acting beta-2 agonist, an inhaled corticosteroid and a combined long acting beta-2 agonist and inhaled corticosteroid. In addition, she was given antibiotics for a Staphylococcus infection. She had smoked an average of three cigarettes a day for four years but had stopped smoking the previous year. Baseline spirometry was normal. She was transferred to another plant and her breathing difficulties decreased.

Metal Working Fluids

MANUFACTURING

OA- Case 2483. A female in her 40s developed asthma from exposure to metal working fluids and mist while working in an automobile parts facility. Her job was to make metal worms for rack and pinion steering. Her breathing difficulties began about a year after starting the job. A short acting beta-2 agonist, an inhaled corticosteroid, an antihistamine and a combined long acting beta-2 agonist and inhaled corticosteroid were prescribed, and a year later she left the company. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She smoked about six cigarettes a day off and on since the age of 15. Although she no longer worked, her breathing difficulties persisted.

OA- Case 2540. A male developed asthma in his mid 30s while working at a screw machine factory. He had worked there for over ten years before his breathing difficulties began. He was exposed to coolant mists while operating the screw machines. He had smoked an average of ten cigarettes a day for two years but stopped smoking over 15 years ago. After his asthma developed, he was transferred to a different plant in the same company. Following this move, his symptoms improved and he stopped using his inhaler.

OA- Case 2514. After working in an auto manufacturing plant for over 30 years, a male developed asthma in his early 50s. He was exposed to metal working fluids while performing machine repairs. He never smoked cigarettes. Baseline spirometry was markedly reduced. He had a positive methacholine challenge test. Three years after he retired, he continued to have breathing difficulties but did not use any asthma medication.

OA- Case 2507. A male developed asthma in his mid 40s, four years after beginning to work at an automotive engine block manufacturer. He was exposed to metal working fluid mist in the air from high pressure application of the coolants during the machining of the engine blocks. He was prescribed a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and an anticholinergic bronchodilator. Baseline spirometry was significantly reduced and he had a positive pre-and post-bronchodilator test. He smoked an average of 25 cigarettes a day for 13 years but stopped smoking 16 years ago. According to the employee, the company tried to solve this coolant problem. His symptoms lessened but were still present after leaving work and he still took asthma medication.

OA- Case 2539. A male developed asthma in his mid 30s while working at an automotive engine manufacturing plant. He was exposed to metal working fluids as a skilled trade job setter. He was prescribed a short acting beta-2 agonist for his symptoms of wheezing, cough, shortness of breath and chest tightness. He had smoked an average of 20-30 cigarettes a day since he was 25 years old. He continued to work in this

environment for more than 15 years, and continued to take his prescribed asthma medication to control his symptoms.

OA- Case 2517. A male developed asthma in his early 40s, while working at an automotive parts manufacturer. He was exposed to coolants for over 20 years before he developed symptoms of wheezing and cough. He reported a lack of adequate ventilation around the machines where he worked. Baseline spirometry was reduced. He had never smoked cigarettes. He continued to work an additional seven years around the coolants until he was reassigned to another area. After being moved, his symptoms improved although he continued to take a short acting beta-2 agonist.

TRANSPORTATION SERVICES

RADS- Case 2530. A male developed RADS in his mid 50s when he was exposed to a chemical spill at an automotive manufacturing plant where he was delivering parts. The spill was a coolant used in the machines at the plant. He was treated at the emergency room and prescribed a combined long acting beta-2 agonist and inhaled corticosteroid and a short acting beta-2 agonist. He had smoked an average of five cigarettes a day for 14 years but had stopped smoking 27 years ago. Baseline spirometry was markedly reduced. One year later, his symptoms had worsened and he continued to take asthma medication.

Multiple Exposures

AUTOMOTIVE REPAIR AND OTHER SERVICES

OA- Case 2471. A male in his 50s developed asthma while supervising laborers in a body and paint shop for automobiles and trucks. He was exposed to many substances including isocyanates, epoxy primers, spray-in bed liner, paints and paint dust and began displaying symptoms after working there for three months. Often the chemicals were sprayed in the open, outside of the paint spray booth. He had smoked an average of 20 cigarettes a day since he was 20 but had reduced that number to five cigarettes a day. He was diagnosed with emphysema when he was 55 years old. Baseline spirometry was reduced and he had a negative pre-and post-bronchodilator test. He quit working at this shop. His breathing problems lessened but were still present and he took an anticholinergic bronchodilator and a combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2464. A male in his mid-40s developed asthma while working in a tire shop, spending the majority of his time in the buffing room. The exact substance that caused his asthma is unknown; however, he was exposed to tire materials and products, solvents, glues, paints and dust. His symptoms included coughing up black particulate matter for several months. He had smoked an average of 20 cigarettes a day for 24 years but had stopped smoking earlier in the year. Baseline spirometry was markedly reduced and he had a positive pre-and post-bronchodilator test. He was placed on a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and an anticholinergic bronchodilator and continued to have the same level of breathing difficulties. He stopped working for the tire company.

RADS- Case 2487. A female in her 20s developed RADS after an acute exposure to gasoline and bleach fumes. She was a cashier at a gas station when a gas spill occurred; she helped clean it up using bleach. She was exposed for five hours before seeking treatment for symptoms of shortness of breath, cough and wheezing. She was started on a combined short acting beta-2 agonist and anticholinergic bronchodilator, which she continued to take although her symptoms were no longer present.

EATING AND DRINKING ESTABLISHMENTS

POA- Case 2531. A female developed asthma in her early 30s, eight years after she began working in a cafeteria at an automotive manufacturing plant. She was exposed to smoke from cooking and cleaning

agents, as well as exposures when she would walk through the plant. She was treated at the emergency room 15 times and hospitalized once because of her breathing problems. She had never smoked cigarettes. She was prescribed a long acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and a combined short acting beta-2 agonist and anticholinergic bronchodilator. She left this job three years after her symptoms began. Her breathing problems continued to worsen and she used more asthma medication.

EDUCATIONAL SERVICES

OA- Case 2437. A male in his 50s developed asthma while working as a mechanic in a school bus maintenance shop. He began having breathing problems, including wheezing, cough and shortness of breath, after being exposed to diesel fumes and ether for about 15 years. He smoked an average of 15 cigarettes a day since the age of 19 but had reduced that number to only two cigarettes a week. Baseline spirometry was markedly reduced. He had a negative pre-and post-bronchodilator test. He was prescribed an anticholinergic bronchodilator and a combined long acting beta-2 agonist and inhaled corticosteroid. His breathing problems did not improve, and he left work on a disability leave.

FOOD AND BEVERAGE PRODUCTION

POA- Case 2439. A male in his late 40s developed asthma after exposure to smoke and paint fumes. He worked for 16 years painting vehicles at a beverage company. He smoked an average of 20 cigarettes a day for 22 years but stopped smoking seven years ago. He was diagnosed with emphysema three years ago. Baseline spirometry was normal. He had a positive methacholine challenge test. His breathing problems remained unchanged and he took a short acting beta-2 agonist and an anticholinergic bronchodilator. He stopped working at the beverage company.

HEALTH CARE SERVICES

POA- Case 2480. A male in his 30s developed asthma while working in the radiation department of a hospital. His job was molding and cutting lead blocks. His breathing difficulties developed from exposure to some unknown substance and welding fumes. A poorly ventilated enclosed area exacerbated the exposure. He had smoked an average of six cigarettes a day for ten years but had stopped smoking earlier in the year. Baseline spirometry was significantly reduced. He had a negative pre-and post-bronchodilator test. He stopped working at this job. His breathing problems were still present three months after he left and he took a short acting beta-2 agonist, leukotriene inhibitor and an inhaled corticosteroid.

AA- Case 2602. A female in her mid 50s experienced an exacerbation of her pre-existing asthma while working at a hospital. She was working as a surgical technician when the hospital had its parking lot paved with new asphalt. The fumes from the hot asphalt triggered an asthma attack. After this initial exposure, other agents began to trigger her asthma at work, including alcohol fumes, floor cleaners, latex, and cleaning agents. She had smoked an average of ten cigarettes a day for 17 years but had stopped smoking 13 years ago. She reported a worsening of her asthma in the past year and she took a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. She continued to work at the hospital and was allowed to leave work when different agents triggered her asthma.

MANUFACTURING

RADS- Case 2481. A female in her 40s developed asthma while working as a laborer in an automotive plant. Her symptoms began immediately following a spill of paint primer. She was in the same vicinity as the spill and was exposed to it for about ten minutes. Her symptoms included cough and chest tightness and she was treated in an emergency room. She continued to have breathing problems, but they were less severe than immediately after the spill. She was prescribed a leukotriene inhibitor, short acting beta-2 agonist and a

combined long acting beta-2 agonist and inhaled corticosteroid for her symptoms and she continued to work at the plant.

RADS- Case 2596. A male developed RADS in his early 40s from an acute exposure to fumes in the casting department of a steel casting manufacturing facility where he worked. He had worked at this company for five years before this incident. He had a negative pre-and post-bronchodilator test. He never smoked cigarettes. He was prescribed a short acting beta-2 agonist, leukotriene inhibitor, inhaled corticosteroid and an antihistamine. After this incident he left work; his symptoms remained the same and he required less asthma medication.

POA- Case 2590. A male developed asthma in his early 30s while working at a plastic injection automotive parts manufacturer. He was exposed to plastic fumes for only a few months before his symptoms of chest tightness, shortness of breath, cough and wheezing developed. He had smoked an average of 20 cigarettes a day since he was 20 years old. Baseline spirometry was slightly reduced. He had a negative pre-and post-bronchodilator test. He was prescribed a leukotriene inhibitor, an anticholinergic bronchodilator, an inhaled corticosteroid and a combined long acting beta-2 agonist and inhaled corticosteroid and continued to work in this environment. His breathing problems worsened and he took the same amount of asthma medication.

POA- Case 2552. A female developed asthma in her late 30s after working for six years as an assembler at an automotive manufacturer. She was exposed to transmission fluid from a work station across from her assembly station, and noted the presence of occasional leaks of these fluids. In response to her asthma, the company moved her work station to a new location; however, the new location had other exposures that triggered her asthma. She was treated multiple times at the emergency room and was hospitalized four times. She never smoked cigarettes. Baseline spirometry was reduced and she had a negative pre- and post-bronchodilator test. She was prescribed a leukotriene inhibitor, short acting beta-2 agonist and an inhaled corticosteroid. She left work on disability leave and had no change in her symptoms but took less asthma medication.

POA- Case 2521. A male developed asthma in his mid 40s while working at an automotive assembly plant. He had worked in the paint department of this facility for eight years before his asthma developed. He was exposed to paint fumes and phosphoric acid. He was prescribed an inhaled corticosteroid. He had smoked about two cigarettes a day for one year but stopped smoking 30 years ago. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. He continued to work at the same job at this company and reported that the company had improved the environment in the paint department resulting in reduced exposures. His breathing problems were still present and he took the same amount of asthma medication.

POA- Case 2549. A male developed asthma in his late 20s, after working for an automotive manufacturer for almost five years. He worked in the headliner area and was exposed to fiberglass used in the headliners. He continued to work another 25 years at the company, until his retirement. He smoked an average of 20 cigarettes a day since the age of 16 and was diagnosed with emphysema when he was 50 years old. Baseline spirometry was markedly reduced and he had a positive pre-and post-bronchodilator test. After his retirement, he used increased amounts of a combined long acting beta-2 agonist and inhaled corticosteroid and a short acting beta-2 agonist and his breathing difficulties continued to worsen.

POA- Case 2509. After working for an automotive parts manufacturer for over 20 years, a female developed asthma in her early 40s. She ran a plastic injection mold machine. Her exposures included burning plastic, paints and polystyrene. She was prescribed a leukotriene inhibitor, an inhaled corticosteroid, an anticholinergic bronchodilator and a short acting beta-2 agonist. She had smoked an average of 60 cigarettes a day for 24 years but stopped smoking 12 years ago. She continued to work in the same job with the same exposures and experienced a worsening of her breathing difficulties and increased use of asthma medication.

POA- Case 2525. A female developed asthma in her late 50s while working at a plastic injection mold making company. She had worked at the company for about three years before her asthma developed. She was exposed to plastic fumes and mold release spray. She continued to work in this environment for another ten years and experienced a worsening of her breathing difficulties during this time. She smoked an average of 20 cigarettes a day for 38 years but had stopped smoking 15 years ago. After retiring, her symptoms did not improve and she continued to take a combined long acting beta-2 agonist and inhaled corticosteroid and oxygen as needed.

POA- Case 2496. A female developed asthma in her mid 20s while working at an automotive assembly plant. She was exposed to rust inhibitor that was applied to the engine parts being assembled. After her breathing difficulties developed, she was reassigned to another area of the plant. She had never smoked cigarettes. Baseline spirometry was significantly reduced. She continued to take a leukotriene inhibitor and short acting beta-2 agonist and her breathing problems remained the same.

AA- Case 2606. A female in her early 30s experienced an exacerbation of her pre-existing asthma while working for a temporary agency. She was assigned to spray paint furniture parts at a company that made office chairs. She was given a face mask to wear while doing this job. She had smoked about ten cigarettes a day since she was 18 years old. She stopped working at this assignment about one month later, her symptoms decreased and she used less of her prescribed combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2499. A male developed asthma in his late 20s after working for three years as an assembler at an automotive assembly plant. The exact substance he was exposed to is unknown; however, in this job he was exposed to sealer, paint and asbestos fibers. He had never smoked cigarettes. This plant was closed a year after his symptoms began and he moved to another automotive assembly plant. His breathing problems were still present and he used a short acting beta-2 agonist.

POA- Case 2491. A male in his 20s developed asthma after exposure to fumes generated from melting and casting steel. He worked for a parts plant that served the automotive industry. His breathing difficulties began immediately after melting down a new form of steel, which was cheaper than the previous steel the plant had used. After his exposure he was prescribed a combined long acting beta-2 agonist and inhaled corticosteroid and a short acting beta-2 agonist. He never smoked cigarettes. Baseline spirometry was normal. He was reassigned to a metal lab; he was also given a face mask. His breathing difficulties were less severe but still present and he used the same amount of asthma medication.

POA- Case 2547. A male developed asthma in his mid 40s after working over 25 years at an automotive chrome plating shop. He was exposed primarily to paint fumes in his job in quality control. Baseline spirometry was normal and he had a negative pre-and post-bronchodilator test. He never smoked cigarettes. He left work on sick leave but his breathing problems continued to worsen. He took a leukotriene inhibitor, antihistamine and inhaled corticosteroid.

POA- Case 2461. A male in his early 40s developed asthma while working in a paint shop for an automobile manufacturer. He was exposed to paint fumes and solvent for five years before his breathing difficulties began. He was prescribed a leukotriene inhibitor, a short acting beta-2 agonist, an inhaled corticosteroid and a combined long acting beta-2 agonist and inhaled corticosteroid and he stopped working for two months. He had smoked an average of 20 cigarettes a day since he was 24 years old. Baseline spirometry was normal. He had a negative pre-and post-bronchodilator test. Although he was transferred to a new job at the same company, this time in the body shop, his breathing problems worsened.

POA- Case 2462. A male in his 50s developed asthma while working as a machine repairman in an automobile plant. He was exposed to smoke and fumes from heat treatment operations next to his work area. His breathing problems began within five and a half years of working in the plant. He had smoked an average of 20 cigarettes a day for 31 years but had stopped smoking seven years ago. Baseline spirometry

was normal and he had a negative pre-and post-bronchodilator test. He was prescribed a short acting beta-2 agonist but stopped taking it even though his breathing difficulties persisted. He took a leave of absence for three months and then returned to his job.

OA- Case 2492. A male in his mid-40s developed asthma while working as a shop supervisor in a sealant equipment company. His work involved exposure to epoxy and acrylates. He had smoked an average of 20 cigarettes a day for ten years but had stopped smoking 11 years ago. Baseline spirometry was reduced. He was prescribed a leukotriene inhibitor, a combined long acting beta-2 agonist and inhaled corticosteroid and a combined short acting beta-2 agonist and anticholinergic bronchodilator. He continued to work in the same facility.

POA- Case 2478. A male in his 20s developed asthma while running a sizing machine for a sandpaper manufacturing company. About two years after starting he began to have breathing difficulties. He never smoked cigarettes. Baseline spirometry was reduced. He had a negative pre-and post-bronchodilator test. He was treated at the emergency room four times for symptoms of wheezing, cough, chest tightness and shortness of breath. He stopped working for this company on his doctor's advice. His symptoms lessened and he continued to take a short acting beta-2 agonist, an anticholinergic bronchodilator, a leukotriene inhibitor and a combined long acting beta-2 agonist and inhaled corticosteroid.

POA- Case 2474. A female in her late 20s developed asthma while working in the production line of an automobile plant. During her work she was exposed to axle dust and mold in addition to having a work area with poor ventilation. She had smoked an average of six cigarettes a day for three years but had stopped smoking five years ago. Baseline spirometry was slightly reduced and she had a positive pre-and post-bronchodilator test. She was prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid for her breathing problems, which did not improve. She continued to work for the same company but was relocated within the plant.

POA- Case 2545. A male developed asthma in his early 40s while working at a factory where he was exposed to cellulose insulation for approximately three years. He was prescribed a combined long acting beta-2 agonist and inhaled corticosteroid and an anticholinergic bronchodilator which he took to control symptoms of wheezing, shortness of breath and chest tightness. He had smoked about 20-30 cigarettes a day since he was 15 years old. He left work on his doctor's advice. Although he was no longer exposed to the cellulose insulation, his symptoms persisted and he took the same amount of asthma medication.

POA- Case 2524. A female developed asthma in her mid 50s while working at a pharmaceutical manufacturer. She was exposed to perfume fragrances in the small office where she worked for over 35 years, in addition to numerous agents related to production at the facility. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She never smoked cigarettes. She was prescribed an anticholinergic bronchodilator, a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. She continued to work at this facility, and tried to modify what she did to prevent exposures that triggered her breathing difficulties.

METAL RECYCLING

AA- Case 2459. A male in his 40s developed asthma after exposure to smoke and fumes while working at an aluminum recycling company. His breathing difficulties began within a month after he started working at this facility. Within three months he began taking a short acting beta-2 agonist and an inhaled corticosteroid. He smoked an average of 20 cigarettes a day for one year but stopped smoking 25 years ago. Baseline spirometry was significantly reduced and he had a positive methacholine challenge test. After four years on the job he quit on his doctor's advice. His breathing difficulties worsened and he took additional medication for his symptoms.

PUBLIC SAFETY AND ORDER

POA- Case 2592. A male developed asthma in his mid 30s after doing volunteer work at the World Trade Center site. While helping as a police canine handler at the site, he was exposed to numerous chemicals, dusts and other agents. Baseline spirometry was slightly reduced. He had a negative methacholine challenge test. He never smoked cigarettes. He was prescribed a short acting beta-2 agonist for the breathing difficulties he developed, and almost two years later his symptoms of wheezing, shortness of breath and chest tightness improved and he stopped taking asthma medication.

RADS- Case 2594. A male developed RADS in his early 20s, while working as a fire fighter. He had been a fire fighter for about two years before his asthma developed from an acute high level of smoke inhalation while fighting a wild fire. Baseline spirometry was normal. He never smoked cigarettes. He was prescribed a short acting beta-2 agonist, which he discontinued using when his symptoms of wheezing, cough, shortness of breath and chest tightness improved. He left his job and moved out of state, but planned to continue to work as a fire fighter.

TRANSPORTATION SERVICES

RADS- Case 2527. A female developed RADS in her mid 30s, approximately four years after beginning to work at a transportation company. She was exposed to smoke from a fire in the garage where buses were housed. After this fire, she was prescribed a leukotriene inhibitor, a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She had never smoked cigarettes. Over one year after the incident, her medication use had increased and her breathing problems had worsened.

WASTE WATER TREATMENT

RADS- Case 2523. A male developed RADS in his late 30s after an acute exposure to a deodorizing agent while working as a maintenance mechanic at a waste water treatment plant. He had worked at this job for over ten years before his asthma developed. He was started on a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid for his symptoms, which did not improve so he stopped taking any asthma medication. He never smoked cigarettes. Baseline spirometry was normal. He left his job after the incident and remained out of work.

Solvents and Other Chemicals

MANUFACTURING

POA- Case 2548. A female developed asthma in her early 40s after working for a boat motor manufacturer for over five years. She was exposed to petroleum distillates used in cleaning the motors for touch up painting. In the area where she worked there were other chemical exposures from wash tank stations. She was prescribed a leukotriene inhibitor, a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. Baseline spirometry was normal and she had a negative pre-and post-bronchodilator test. She smoked an average of ten cigarettes a day for 20 years but had stopped smoking nine years ago. She left work on her doctor's advice but her symptoms persisted and she took increased amounts of asthma medication.

AA- Case 2493. A female in her mid 20s experienced an exacerbation of her pre-existing asthma while working at a hair salon. Her asthma was triggered by exposure to hair products containing persulfates. Baseline spirometry was normal. She never smoked cigarettes. She started working at a different hair salon with better ventilation, which helped to control her asthma. She continued to use a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and a leukotriene inhibitor.

OA- Case 2599. A female developed asthma in her mid 20s while working for a boat manufacturer. She was exposed to formaldehyde and acetone for about a year before her asthma developed. She reported problems with the ventilation system. She smoked an average of one cigarette a day for 11 years but had stopped smoking earlier in the year. She was prescribed a short acting beta-2 agonist and a combined long acting beta-2 agonist and inhaled corticosteroid. She left that employment, her symptoms improved and she stopped taking asthma medication.

OA- Case 2575. A male developed asthma in his late 40s while working with isocyanates and a mold release spray. He was a press operator for a plastic injection mold company that made parts for cars and trucks. He described the ventilation system as inadequate to rid the mist from around the injection mold machine. He had been working in this exposure for almost 20 years before his asthma developed, with symptoms of wheezing, cough, chest tightness and shortness of breath. He had smoked an average of 30 cigarettes a day for 19 years but had stopped smoking 15 years ago. Baseline spirometry was reduced. He was prescribed a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and an anticholinergic bronchodilator and was reassigned to a new location in the plant. He continued to experience asthma symptoms and took asthma medication.

AA- Case 2516. A female in her mid 30s experienced an exacerbation of her pre-existing asthma while working for an automotive parts manufacturer. She worked in assembly; her asthma was triggered by cigarette smoke from coworkers as well as transmission fumes when the assembled vehicles were being tested. She had never smoked cigarettes. She was reassigned to an area in the plant without those exposures. After her move, she used less of a short acting beta-2 agonist and her breathing problems improved.

POA- Case 2526. A female developed asthma in her late 40s working at a car part manufacturer. She was exposed to mica powder and glues when the powder was used to clean the dried glue off the laminator machines. She worked in this exposure for over five years before her asthma developed. She had smoked an average of ten cigarettes a day for more than 25 years but had attempted to stop smoking earlier that year. She had been diagnosed with emphysema. Baseline spirometry was markedly reduced. She was prescribed a short acting beta-2 agonist, an inhaled corticosteroid and an anticholinergic bronchodilator and was put on medical leave. Her symptoms worsened and she used more asthma medication.

POA- Case 2541. A male developed asthma in his mid 30s, while working for an automotive parts manufacturer. He was exposed to ceramic power for 12 years prior to the development of his asthma. He was prescribed a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and a leukotriene inhibitor and continued to work in the exposure area for 15 additional years. He described poor ventilation in his work area, and was offered a mask, but stated it was too hot to wear. He had smoked an average of 50 cigarettes a day for 11 years but had stopped smoking 24 years ago. Over a year after retiring from this job, his symptoms had improved although he still used the same amount of asthma medication.

RADS- Case 2589. A female developed RADS in her late 20s, after she was exposed to burning plastic fumes from a storage facility fire. She had worked as a firefighter for a few years prior to this incident. Baseline spirometry was reduced and she had a positive pre-and post-bronchodilator test. She never smoked cigarettes. She found new employment after this incident, her symptoms improved and she used a short acting beta-2 agonist less frequently.

Welding Fume

EDUCATIONAL SERVICES

POA- Case 2570. A female developed asthma in her early 40s. She had worked as a teacher for four years prior to the development of her breathing difficulties. Her classroom was located next to the auto body and welding shop, which lacked adequate ventilation. She smoked an average of 20 cigarettes a day for 20 years but had stopped smoking four years ago. Baseline spirometry was normal. She had a positive methacholine challenge test. She was prescribed a short acting beta-2 agonist, inhaled corticosteroid and oral corticosteroid and her breathing problems lessened significantly.

MANUFACTURING

POA- Case 2532. A female developed asthma in her early 40s, two years after she began working as a machine operator in an automotive stamping plant. She was exposed to welding fumes. She was prescribed a short acting beta-2 agonist, a combined long acting beta-2 agonist and inhaled corticosteroid and a leukotriene inhibitor. Seven years after her asthma began she left this job on her doctor's advice. Her symptoms of cough, chest tightness and shortness of breath improved although she took more asthma medication. She was unable to find new work in the year after she quit.

POA- Case 2543. A female developed asthma in her mid 40s while working at an automotive part stamping plant. She had worked there for over five years and was exposed to welding fumes before her asthma developed. Paper masks were optional at her work station. She had smoked an average of seven cigarettes a day for 29 years but had stopped smoking three years ago. Baseline spirometry was normal. She was prescribed an inhaled corticosteroid and a short acting beta-2 agonist and had an improvement in her asthma after she identified the exposures causing her symptoms. The company was working to reassign her to a new job away from these exposures.

POA- Case 2551. A male developed asthma in his early 50s while working as a welder. He worked for a company that manufactured guns and he was exposed to welding fumes. He had smoked approximately 10-20 cigarettes since he was 25 years old. He was prescribed a short acting beta-2 agonist. His asthma worsened in the year after he left this job.

Wood Dust

MANUFACTURING

OA- Case 2553. A male developed asthma in his early 40s while working at a lumber mill. He was exposed to wood dust for 14 years at his job before his asthma developed. He had smoked an average of 30 cigarettes a day for 24 years but had stopped smoking two years ago. Baseline spirometry was markedly reduced and he had a positive pre-and post-bronchodilator test. He was prescribed a combined long acting beta-2 agonist and inhaled corticosteroid, a leukotriene inhibitor, oral corticosteroids and a bronchodilator and placed on medical leave. Over two years later his symptoms had not improved, despite being away from the exposure.

MUSICAL INSTRUMENT MAKING

OA- Case 2436. A male in his mid 40s developed asthma while working for a musical instrument company as a craftsman. He was exposed to ebony wood dust. His symptoms of shortness of breath, chest tightness, wheezing and cough began within two months of starting the job and he was immediately prescribed a short acting beta-2 agonist. He had smoked an average of 15 cigarettes a day since he was 18 years old. Baseline spirometry was normal. He stopped working at the musical instrument company and his symptoms lessened.