

JULY 10, 2020

# 2019 ANNUAL REPORT

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**TRACKING SILICOSIS & OTHER WORK-RELATED LUNG DISEASES IN MICHIGAN**



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## *Silicosis & Other Work-Related Lung Disease Surveillance Program*

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There are many resources  
available to help employers,  
employees, health care  
professionals and others  
understand more about  
work-related lung disease.  
Links to these resources can  
be found at:  
[www.oem.msu.edu](http://www.oem.msu.edu).

### Acronyms

**AB** Asbestosis

**COPD** Chronic Obstructive  
Pulmonary Disease

**ED** Emergency Department

**LARA** MI Department of  
Licensing & Regulatory  
Affairs

**LEO** MI Department of  
Labor & Economic  
Opportunity

**MIOSHA** Michigan  
Occupational Safety &  
Health Administration

**NAICS** North American  
Industrial Classification  
System

**NIOSH** National Institute  
for Occupational Safety &  
Health

**OLDs** Other Work-Related  
Lung Diseases

**PEL** Permissible Exposure  
Limit



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

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

## Summary

This is the 28th annual report on silicosis in Michigan, and the 9th year of the expanded report to include surveillance data on the magnitude and nature of all work-related lung diseases in Michigan. In 2011, we expanded surveillance of silicosis in Michigan to include other lung disease, including asbestosis, work-related hypersensitivity pneumonitis, hard metal lung disease, minor pneumoconiosis, and emerging work-related lung diseases. Work-related asthma has always been covered under a separate annual report.



The annual average incidence rate of silicosis among African American males is 6.7 cases per 100,000 workers. Among white males the rate is 1.3 cases per 100,000 workers. Within specific counties in Michigan, the annual average incidence rates of silicosis range between two to 354 times higher for African American males than the rates for white males.

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

- ◆ From 1985-2019, 1,208 silicosis cases have been identified through the Michigan tracking system. Hospitalizations for silicosis increased in 2018.
- ◆ On average since 2000, 20 new cases of silicosis were reported to LEO each year.
- ◆ We estimate 67-139 adults in Michigan with silicosis were not reported in 2019.
- ◆ Asbestos-related lung changes are the most common work-related lung disease in Michigan; in 2018 there were 396 cases from the hospital discharge data (most recent year available), and in 2019 there were 94 cases reported by B-Readers, 134 cases from the courts and 34 from other sources.
- ◆ 238 cases of Other Work Related Lung Disease (OLDs) were identified in 2019; chemical irritation, asbestosis and chronic obstructive pulmonary disease (COPD) were among the conditions reported.
- ◆ Adherence to the new federal silica standard, which, beginning in 2018, requires medical monitoring for construction workers and in 2020 for general industry workers, should result in more timely identification of silicosis and silica overexposures.

## Background

In 1988, the State of Michigan instituted a tracking program for silicosis with financial assistance from NIOSH. In 2011, surveillance was expanded to include OLDs. This is a joint project of MIOSHA and Michigan State University, Department of Medicine, Division of Occupational and Environmental Medicine.

The reporting of an index patient is a sentinel health event that may lead to the identification of employees from the same facilities who are also at risk of developing silicosis or OLDs. The goal is to prevent work-related lung disease through the identification and workplace follow-up of these index patients.

## Work-Related Lung Disease Tracking Procedures

There are four main activities related to occupational lung disease surveillance in Michigan: identifying patients, interviewing patients and collecting relevant medical records, conducting workplace inspections, and sharing the overall results and lessons learned with industry, employees and other stakeholders.

### IDENTIFY PATIENTS

Patients are identified through mandatory reporting of any known *or suspected* occupational illnesses, including silicosis and other work-related lung diseases.

### SOURCES TO IDENTIFY PATIENTS IN MICHIGAN

- ◆ **Health Care Providers** Private practice, working for industry, NIOSH-certified “B” readers
- ◆ **Hospitals** International Classification of Disease 10th Revision (ICD-10) Silicosis (J62, J65), Hypersensitivity Pneumonitis (J67), Other Pneumoconioses (J63, J64), Other Respiratory Conditions (J66, J68, Z57.2, Z57.3, Z57.5)
- ◆ **Workers’ Compensation Agency**
- ◆ **Poison Control Center**
- ◆ **Reports from Co-Workers or MIOSHA Field Staff** confirmed by a health care provider
- ◆ **Death Certificates**
- ◆ **Michigan 3rd Judicial Court** for asbestos-related disease
- ◆ **Mine Safety and Health Administration**
- ◆ **Michigan Cancer Registry** for mesothelioma
- ◆ **Clinical Laboratories** for specific IgE allergy testing

## INTERVIEW PATIENTS

Once patients are identified, a letter is sent asking them to participate in a telephone interview. Afterwards, medical records are requested, including chest x-rays and pulmonary function test results.

## CLASSIFICATION OF WORK-RELATED LUNG DISEASE

A physician who is board-certified in internal and occupational/environmental medicine and also is a NIOSH certified B-reader reviews medical evidence which may include interview, medical records, breathing tests and chest x-rays. In addition, for silicosis and asbestosis the following criteria are applied:

### SILICOSIS

- 1) History of silica exposure.  
and
- 2a) Chest x-ray interpretation with rounded opacities of 1/0 or greater profusion in the upper lobes.  
or
- 2b) A biopsy report of lung tissue showing the characteristic silicotic nodule.

### ASBESTOSIS

- 1) History of asbestos exposure.  
and
- 2) Chest x-ray interpretation showing linear changes in the lower lobes and/or pleural thickening.

## WORKPLACE INSPECTION

After the patient interview is completed, MIOSHA determines whether a workplace enforcement inspection will be conducted. During an inspection, co-workers are interviewed to determine if other individuals are experiencing similar breathing problems from exposure to the agent. Any workers reporting breathing problems are sent a letter advising them to see their doctor. Chest x-rays may be reviewed if the company performs periodic chest x-ray surveillance. Air monitoring for any suspected agent is conducted. The company's health and safety program and its Injury and Illness Log are reviewed. After the investigation is complete, a report of air sampling results and any recommendations is sent to the company and made available to workers. A copy of the report is also sent to the reporting physician.

## OTHER FOLLOW UP ACTIVITIES

Outreach, educational activities, and recommendations may be developed. An annual report summarizing the activity is completed. Brochures or other materials may be developed to address specific emergent issues identified.

## *Results*

The following sections report results in this order: **silicosis** surveillance in Michigan from 1985-2019, **asbestos-related lung disease and mesothelioma**, and **all other OLDs surveillance** for calendar year 2019.

## REPORTS OF SILICOSIS

Table 1 shows that 1,201 people were confirmed with silicosis from 1985 - 2019. Figure 1 shows the number of confirmed silicosis cases by year, for 1987 - 2019. Figure 2 shows the overlap of reporting sources. In 2018 (most recent year available), there were 12 hospitalizations where silicosis was the primary or one of six secondary diagnoses and 26 hospitalizations where silicosis was the primary or one of 29 secondary diagnoses (Figure 7). This compares to five and 30, respectively in 2017.

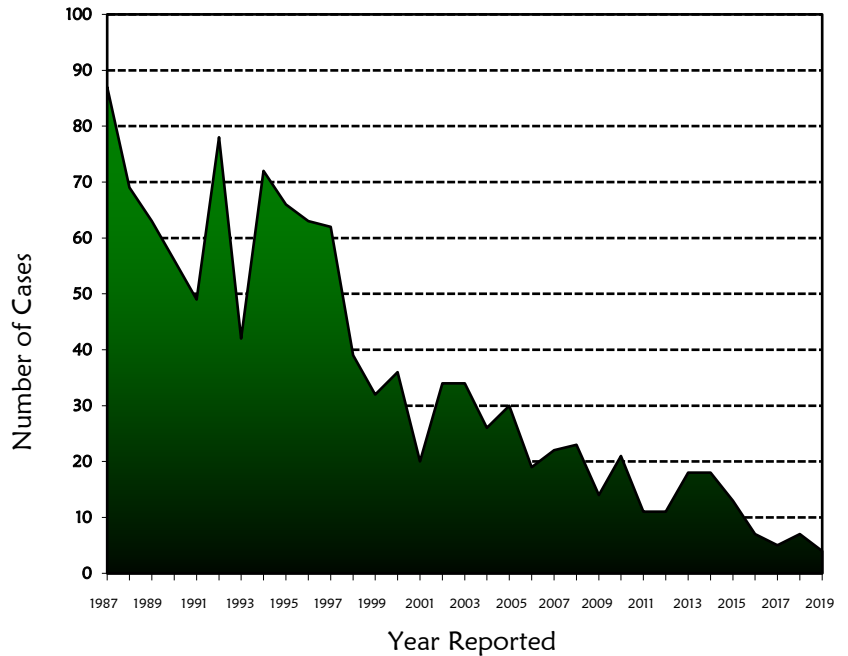
**TABLE 1**  
**Year and Reporting Source for 1,208**  
**Confirmed Silicosis Cases: 1985-2019**

Initial Reporting Source\*

<u>YEAR</u>	<u>PR</u>	<u>HDC</u>	<u>DC</u>	<u>WC</u>	<u>ICFU</u>
85-87	0	67	35	42	0
1988	0	56	6	7	0
1989	7	40	9	4	3
1990	5	44	0	6	1
1991	5	37	1	6	0
1992	16	54	6	2	0
1993	6	31	1	4	0
1994	7	36	1	28	0
1995	26	35	3	2	0
1996	28	35	0	0	0
1997	13	48	1	0	0
1998	10	28	1	0	0
1999	5	25	1	1	0
2000	4	32	0	0	0
2001	8	11	1	0	0
2002	1	32	1	0	0
2003	8	26	0	0	0
2004	2	24	0	0	0
2005	4	26	0	0	0
2006	1	17	1	0	0
2007	2	19	0	1	0
2008	4	18	0	1	0
2009	1	12	1	0	0
2010	2	19	0	0	0
2011	0	11	0	0	0
2012	0	11	0	0	0
2013	0	17	1	0	0
2014	1	17	0	0	0
2015	2	11	0	0	0
2016	0	7	0	0	0
2017	1	4	0	0	0
2018**	0	7	0	0	0
2019**	0	4	0	0	0
<b>TOTAL</b>	<b>169</b>	<b>861</b>	<b>70</b>	<b>104</b>	<b>4</b>



**FIGURE 1**  
**Confirmed Silicosis Cases by Year Reported**

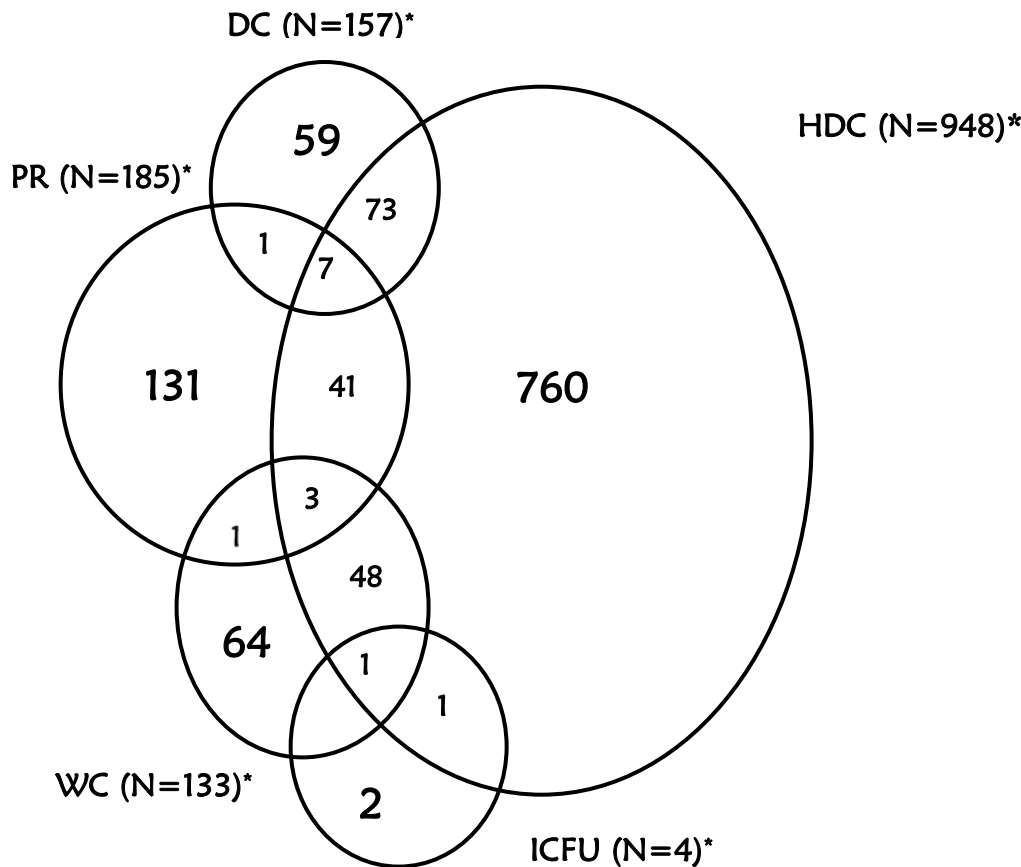


\*PR- Physician Referral; HDC-Hospital Discharge; DC-Death Certificate;

WC-Workers' Compensation; ICFU-Index Case Follow-Up.

\*\*Reports are still being processed for calendar years 2018 and 2019.

**FIGURE 2**  
**Overlap of Reporting Sources for 1,208**  
**Confirmed Silicosis Patients: 1985-2019**



Based on capture-recapture analysis we estimate that although on average we receive 20 reports of silicosis a year, there are an additional 67-139 cases that are diagnosed each year but are not reported. [2]

\*N's represent the total number reported at any time by that source.  
 Reporting Source Codes: HDC=Hospital Discharge Data; PR=Physician Referral; DC=Death Certificate; WC=Workers' Compensation; ICFU=Index Case Follow Up.  
 There was also an overlap of HDC-DC-WC for 13 individuals; an overlap of HDC-PR-WC-DC for one individual; an overlap of WC-DC for two individuals; and an overlap of HDC-DC-ICFU for one individual.

## Demographics – Silicosis

### GENDER

- ◆ Women 30 (2%)
- ◆ Men 1,178 (98%)

### YEAR OF BIRTH

- ◆ Range 1888 - 1971
- ◆ Average 1925

### RACE

- ◆ White 710 (59%)
- ◆ African American 453 (38%)
- ◆ Alaskan/American Ind. 1 (<1%)
- ◆ Asian 2 (<1%)
- ◆ Other 30 (2%)
- ◆ Unknown 12 (1%)

### AVERAGE ANNUAL INCIDENCE RATE

- ◆ African American 6.7 per 100,000
- ◆ White 1.3 per 100,000

The average annual incidence rate for African Americans is 5.2X greater than that of whites.

Numerator is the average number of silicosis cases by race for 1987-2017. Denominator Source: 2000 Census population data by race, age 40 and older.

## Medical Results – Silicosis

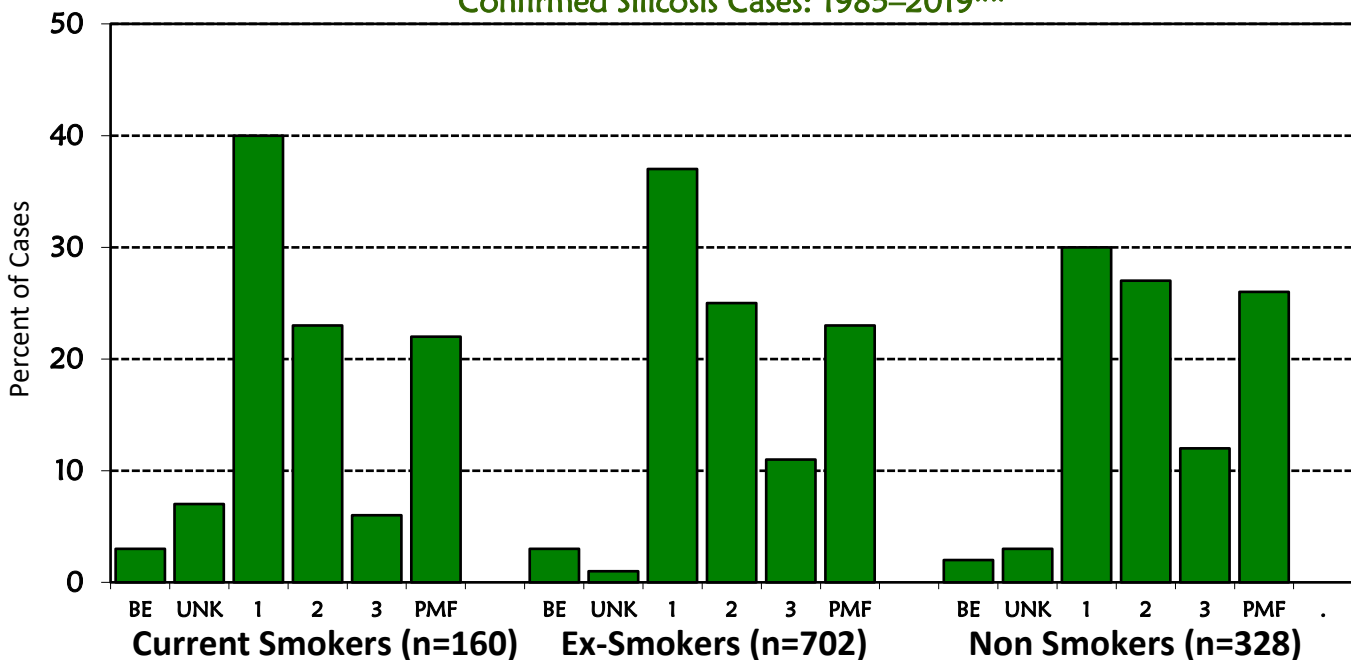
Overall, 857 (70.9%) of the people with silicosis had simple silicosis and 283 (23.4%) had progressive massive fibrosis. Thirty-six (3.0%) silicotics had normal x-rays with lung biopsy evidence. Thirty-two (2.6%) individuals had x-ray reports which were consistent with silicosis, but the actual radiograph could not be obtained to classify.

For the 1,190 silicosis cases with known history, 328 (27.6%) of the people with silicosis never smoked cigarettes, 702 (59.0%) had quit, and 160 (13.4%) were still smoking. No information was available on 18 individuals. Figure 3 shows the distribution of x-ray results according to the International Labor Organization (ILO) classification and smoking status. Non-smokers tended to have more severe silicosis. This latter finding may be an artifact of our reporting system, which is mainly based on reports of hospitalized individuals. Non-smoking individuals with simple silicosis are less likely to be symptomatic and hospitalized and therefore less likely to have been reported to the surveillance system.

Tables 2 and 3 show the distribution of percent predicted forced vital capacity (FVC) and the ratio of forced expiratory volume in one second (FEV<sub>1</sub>) to FVC by x-ray and cigarette smoking status. Approximately 60% of people with silicosis had reduced breathing function, either restrictive or obstructive. Obstructive changes (Table 3) were found in two-thirds of the individuals who had ever smoked cigarettes and among half of the individuals who had never smoked cigarettes. A more comprehensive analysis of spirometry results was published in 2010. [3]

Of the 831 cases with information on whether a TB skin test was performed, 677 (81%) indicated that they had ever had a skin test for TB; 104 (15%) had a positive result. The percentage with a positive TB skin test did not change over time. One hundred sixty-nine (17%) of 1,012 reported that they had ever had active TB, regardless of whether a skin test had ever been done. In comparison, the annual percentage of subjects with active TB in the United States from 1988 to 2016 was 0.003–0.010% and in Michigan from 2013 to 2017 was 0.001% [4].

**FIGURE 3**  
**Severity of X-Ray Results\* by Smoking Status for**  
**Confirmed Silicosis Cases: 1985–2019\*\***



\*BE = Biopsy Evidence; UNK = Unknown; 1-3 = International Labor Organization categorization system for grading pneumoconiosis; Category 1 = 1/0, 1/1, 1/2; Category 2 = 2/1, 2/2, 2/3; Category 3 = 3/2, 3/3, 3/+; PMF = Progressive Massive Fibrosis.

\*\*Total number of individuals: 1,190. Smoking status was unknown for 18 individuals.

**TABLE 2 – Percent Predicted Forced Vital Capacity (FVC) by X-Ray Results and Cigarette Smoking Status for Confirmed Silicosis Cases: 1985-2019**

X-Ray Results*	Percent Predicted FVC***					
	<60%		60-79%		≥80%	
	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	%	%	%	%	%	%
Biopsy Evidence	20	--	40	40	40	60
Unk Severity	38	50	38	25	25	25
Category 1	24	30	35	28	42	42
Category 2	30	38	36	33	34	29
Category 3	33	63	40	21	27	17
PMF	38	40	33	32	29	28
Total**	29	38	35	30	35	32

\*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconioses: Cat 1= 1/0, 1/1, 1/2; Cat 2= 2/1, 2/2, 2/3; Cat 3= 3/2, 3/3, 3+; PMF=Progressive Massive Fibrosis.

\*\*Total number of individuals: 761. Information was missing for 447 individuals.

\*\*\*Percentages represent the proportion of individuals in each x-ray result category, within smoking status category.

**TABLE 3 – Ratio of Forced Expiratory Volume in 1 Second (FEV<sub>1</sub>) to Forced Vital Capacity (FVC) by X-Ray Results and Cigarette Smoking Status for Confirmed Silicosis Cases: 1985-2019**

X-Ray Results*	≤40%		41-59%		60-74%		≥75%	
	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked	Ever Smoked	Never Smoked
	%	%	%	%	%	%	%	%
Biopsy Evidence	5	25	15	--	40	50	40	25
Unk Severity	8	--	8	--	25	75	58	25
Category 1	9	2	22	8	37	30	33	60
Category 2	4	5	22	14	42	29	32	52
Category 3	7	4	15	--	11	30	67	65
PMF	18	7	33	27	29	31	21	35
Total**	9	5	23	14	34	31	34	50

\*Biopsy Evidence if no x-ray available; International Labor Organization categorization system for grading pneumoconioses: Cat 1= 1/0, 1/1, 1/2; Cat 2= 2/1, 2/2, 2/3; Cat 3= 3/2, 3/3, 3+; PMF= Progressive Massive Fibrosis.

\*\*Total number of individuals: 734. Information was missing for 474 individuals.

\*\*\*Percentages represent the proportion of individuals in each x-ray result category, within smoking status category.



## Location



Table 4 shows the annual average incidence rates of silicosis among the working population, by race and county where there was at least one case in that county. Yellow-highlighted rates are for counties where both white and African American cases were reported. The highest rates were among African American males in Shiawassee (248 cases per 100,000), Muskegon (124 cases per 100,000), Saginaw (38 cases per 100,000), and Monroe (20 cases per 100,000). The incidence of African American silicosis cases was 5 times greater than white males. More information about health disparities and occupational lung disease, particularly silicosis, can be found in our Fall 2014 PS News

newsletter (V25N4), at: [www.oem.msu.edu](http://www.oem.msu.edu). Figure 4 shows the counties of the companies at which the patients' silica exposure occurred; Muskegon, Wayne and Saginaw were the main counties.

**TABLE 4**  
**Average Annual Incidence Rate of Silicosis**  
**Among Michigan Workers by Race and County of Exposure: 1987-2017**

County	County Pop'n	White* Males		African American** Males		County	County Pop'n	White* Males		African American** Males		
		#	Rate	#	Rate			#	Rate	#	Rate	
Allegan	20850	2	0.3	275	—	Lapeer	18176	1	0.2	226	—	
Alpena	7388	25	10.9	8	—	Lenawee	20192	4	0.6	573	—	
Arenac	4168	1	0.8	62	—	Livingston	32610	3	0.3	111	—	
Baraga	1815	1	1.8	78	—	Mackinac	2761	1	1.2	6	—	
Barry	12360	4	1.0	34	—	<b>Macomb</b>	<b>156926</b>	<b>27</b>	<b>0.6</b>	<b>3233</b>	<b>7</b>	<b>7.0</b>
Bay	23674	7	1.0	226	—	Manistee	5999	3	1.6	67	—	
Benzie	3898	1	0.8	9	—	Marquette	14199	18	4.1	224	—	
<b>Berrien</b>	<b>30479</b>	<b>8</b>	<b>0.8</b>	<b>3594</b>	<b>4</b>	<b>3.6</b>	Mason	6683	1	0.5	41	—
Branch	9525	4	1.4	288	—	Menominee	6054	12	6.4	2	—	
<b>Calhoun</b>	<b>25345</b>	<b>26</b>	<b>3.3</b>	<b>2650</b>	<b>14</b>	<b>17.0</b>	Midland	16605	3	0.6	128	—
Charlevoix	5942	3	1.6	5	—	<b>Monroe</b>	<b>29452</b>	<b>8</b>	<b>0.9</b>	<b>497</b>	<b>3</b>	<b>19.5</b>
Chippewa	7286	2	0.9	616	—	Montcalm	12433	3	0.8	335	—	
Delta	9045	3	1.1	5	—	Montmorency	2957	1	1.1	3	—	
Dickinson	6419	1	0.5	5	—	<b>Muskegon</b>	<b>30132</b>	<b>126</b>	<b>13.5</b>	<b>3564</b>	<b>137</b>	<b>124.0</b>
Eaton	20377	3	0.5	781	—	<b>Oakland</b>	<b>216359</b>	<b>17</b>	<b>0.3</b>	<b>20085</b>	<b>7</b>	<b>1.1</b>
<b>Genesee</b>	<b>69596</b>	<b>12</b>	<b>0.6</b>	<b>13423</b>	<b>6</b>	<b>1.4</b>	Ontonagon	2295	2	2.8	1	—
Gladwin	6615	1	0.5	8	—	<b>Ottawa</b>	<b>41916</b>	<b>4</b>	<b>0.3</b>	<b>270</b>	<b>1</b>	<b>11.9</b>
Gogebic	4353	3	2.2	22	—	Roscommon	7325	1	0.4	9	—	
Gd	16451	1	0.2	57	—	<b>Saginaw</b>	<b>36097</b>	<b>64</b>	<b>5.7</b>	<b>5936</b>	<b>70</b>	<b>38.0</b>
Traverse						<b>St. Clair</b>	<b>33209</b>	<b>6</b>	<b>0.6</b>	<b>623</b>	<b>1</b>	<b>5.2</b>
Gratiot	8356	2	0.8	371	—	<b>St. Joseph</b>	<b>12266</b>	<b>4</b>	<b>1.1</b>	<b>251</b>	<b>1</b>	<b>12.9</b>
Hillsdale	9857	9	2.9	36	—	Sanilac	9753	3	1.0	23	—	
Ingham	41166	11	0.9	3987	—	Schoolcraft	2121	1	1.5	18	—	
Iosco	7280	1	0.4	30	—	<b>Shiawassee</b>	<b>14737</b>	<b>3</b>	<b>0.7</b>	<b>26</b>	<b>2</b>	<b>248.1</b>
Iron	3531	3	2.7	28	—	Tuscola	12334	1	0.3	108	—	
Isabella	9294	1	0.3	77	—	Van Buren	15129	2	0.4	808	—	
<b>Jackson</b>	<b>31380</b>	<b>3</b>	<b>0.3</b>	<b>2685</b>	<b>2</b>	<b>2.4</b>	Washtenaw	47535	8	0.5	5758	—
Kalamazoo	39985	4	0.3	3004	—	<b>Wayne</b>	<b>236472</b>	<b>139</b>	<b>1.9</b>	<b>134974</b>	<b>169</b>	<b>4.0</b>
<b>Kent</b>	<b>93136</b>	<b>16</b>	<b>0.6</b>	<b>6768</b>	<b>3</b>	<b>1.4</b>	Wexford	6478	4	2.1	6	—
Keweenaw	639	1	5.0	1	—							
Lake	2817	2	2.3	251	—							

\*Rate per 100,000 among white men age 40+. Numerator: average number of white males with silicosis for the years 1987 – 2017; denominator: 2000 Census population data for white men age 40 and older, by county. In 2000, there were 1,730,017 white males 40 years and older living in Michigan.

\*\*Rate per 100,000 among African American (AA) men age 40+. Numerator: average number of AA males with silicosis for the years 1987 – 2017; denominator: 2000 Census population data for AA men age 40 and older, by county. In 2000, there were 219,076 AA males 40 years and older living in Michigan.

## Type of Industry – Silicosis

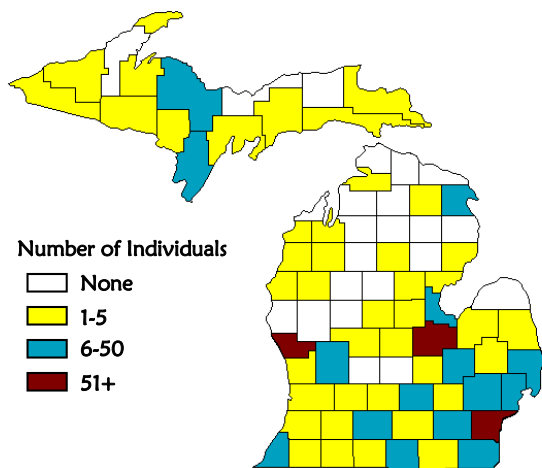
Table 5 shows the Michigan industries by NAICS codes, where exposure to silica occurred from 1985 to 2019. The predominant industries were in manufacturing (84%), construction (9%) and mining (4%). Most of the manufacturing jobs were in iron foundries. Exposure to silica is still occurring in foundries (Figures 5 and 6). In 2007, MIOSHA inspected all silica-using foundries in the state. Forty-seven foundries were inspected. Personal air monitoring for silica was conducted in 43 of the 47 facilities; 28 companies had silica levels below the MIOSHA PEL and 15 were above the PEL.

Although silicosis typically occurs after a long duration of exposure to silica, some patients develop silicosis after a relatively short period of time because of the severity of that exposure. The average year of hire is 1951, ranging from 1910 to 2007. Three individuals began working in the 2000s, seven began working in the 1990s, 25 in the 1980s, 88 in the 1970s and 186 in the 1960s. The average number of years worked at a silica-exposed job was 27.3 years.

**TABLE 5**  
**Primary Industrial Exposure for**  
**Confirmed Silicosis Patients: 1985-2019**

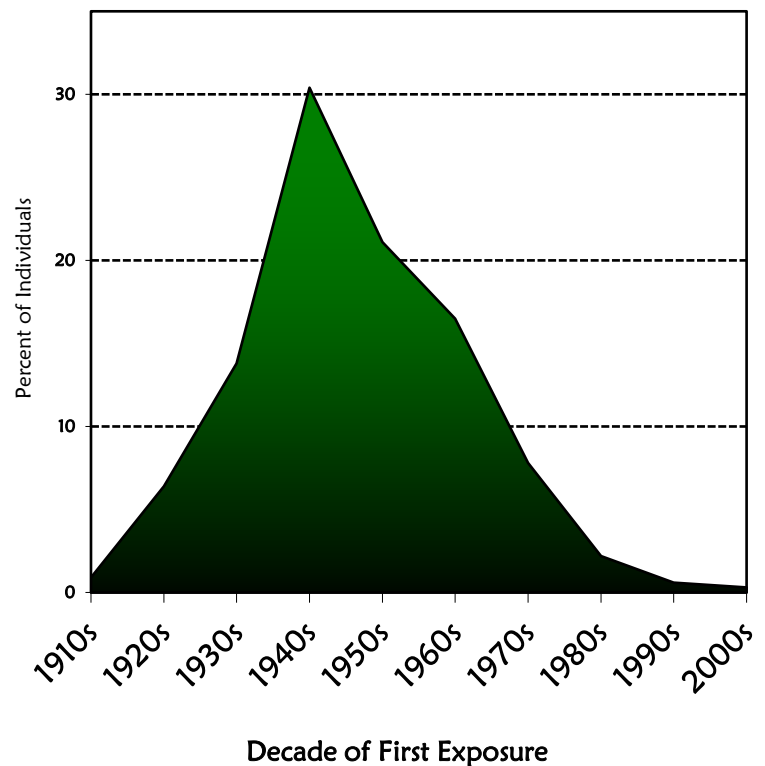
INDUSTRY (2002 NAICS)	#	%
11 Agriculture, Forestry, Fishing, & Hunting	2	0.2
21 Mining	52	4.3
22 Utilities	1	0.1
23 Construction	107	8.9
31-33 Manufacturing	1,016	84.1
42 Wholesale Trade	2	0.2
44-45 Retail Trade	3	0.2
48-49 Transportation & Warehousing	7	0.6
56 Administrative & Support & Waste Management	1	0.1
62, 81 Health Care & Social Assistance	7	0.6
92 Public Administration	4	0.3
00 Unknown	6	0.5
<b>Total</b>	<b>1,208</b>	

**FIGURE 4**  
**Distribution of Confirmed Silicosis Cases by**  
**County of Exposure: 1985-2019**



\*Seventy-seven individuals were exposed to silica out-of-state, and 33 individuals had an unknown county of exposure.

**FIGURE 5**  
**Distribution of Decade when Silica Exposure Began**  
**for Confirmed Silicosis Cases: 1985-2019\***



\*Decade of first exposure was unknown for 80 individuals with silicosis.

## Industrial Hygiene Results – Silicosis

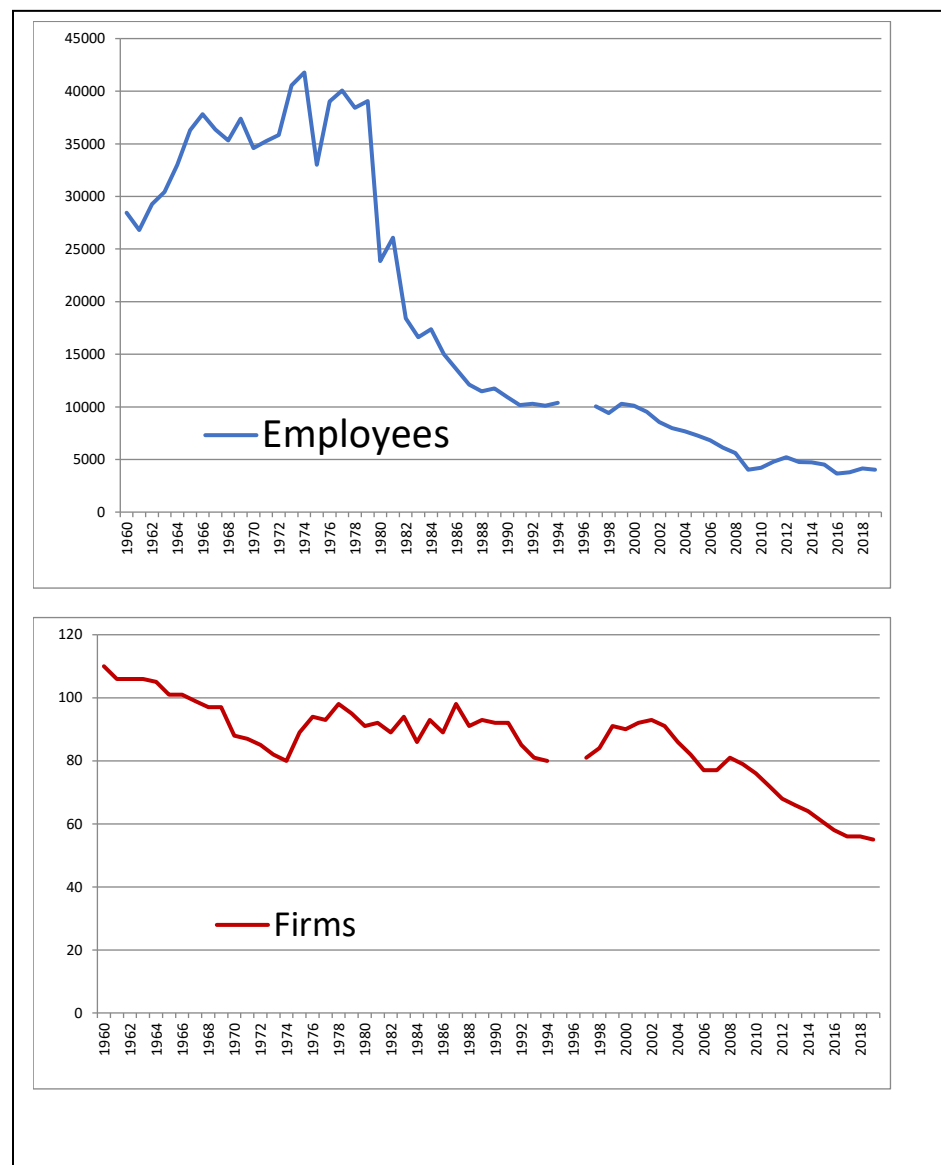
The 1,208 individuals with silicosis were exposed to silica in 506 facilities (Table 6). There was one silica-related inspection conducted in 2019. Since 1988, inspections were performed by MIOSHA at 92 (18.2%) of the 506 facilities associated with silicosis cases. One hundred fifty-nine (31.4%) facilities were no longer in operation, 70 (13.8%) were located out of state, 29 (5.7%) facilities no longer used silica, 77 (15.2%) workplaces were in the construction industry, eight (1.6%) were covered by the Mine Safety and Health Administration jurisdiction, and for 69 (13.6%), the specific location where the silica exposure occurred was unknown. Two (0.4%) facilities are scheduled for inspection.

Air sampling for silica was conducted in 65 of the 92 facilities inspected (Table 7). MIOSHA adopted a new enforceable permissible exposure limit (PEL) of 50  $\mu\text{g}/\text{m}^3$ , on June 23, 2018. This new enforceable limit is the same as the NIOSH recommended exposure level (REL). The previous MIOSHA PEL was 100  $\mu\text{g}/\text{m}^3$ . Thirty-nine of 65 (60.0%) facilities were above the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit for silica.

Twenty-three of the 65 (35.4%) were above the old enforceable MIOSHA permissible exposure limit (PEL) of 100  $\mu\text{g}/\text{m}^3$  for silica. The two (3.1%) most recent inspections were above the new MIOSHA PEL of 50  $\mu\text{g}/\text{m}^3$ . Another two (3.1%) companies were above the MIOSHA standard for beryllium and one company was above the MIOSHA standard for silica and silver.

Only eight of the 73 (11.0%) facilities where the medical surveillance program was evaluated provided medical screening for silicosis for its workers that included a periodic chest x-ray interpreted by a certified B-reader. Three (4.1%) companies provided periodic chest x-rays that were not interpreted by a certified B-reader. Twenty-two (30.1%) only performed pre-employment testing, 28 (38.4%) provided no medical surveillance, and 18 (24.7%) performed annual or biennial pulmonary function testing without chest x-rays.

**FIGURE 6**  
**Michigan Ferrous Foundries 1960-2019:**  
**Number of Employees and Number of Firms**



Source: [www.bls.gov](http://www.bls.gov) data extract from Quarterly Census of Employment and Wages, Michigan, NAICS 33151 Ferrous Metal Foundries, Private ownership, all establishment sizes.

**TABLE 6**  
**Status of Facilities Where 1,208 Confirmed**  
**Silicosis Cases were Exposed to Silica: 1985-2019**

Inspection Status	Cases		Facilities	
	#	#	#	%
Inspection Completed	495	92	18.2	
Scheduled for Inspection	2	2	0.4	
MSHA* Jurisdiction	21	8	1.6	
Facility Out-of-Business	435	159	31.4	
Facility Out-of-State	75	70	13.8	
Facility No Longer Uses Silica	34	29	5.7	
Building Trade: No Inspection	77	77	15.2	
Unknown	69	69	13.6	
<b>Total</b>	<b>1,208</b>	<b>506**</b>		

\*MSHA= Mine Safety and Health Administration.

\*\*Four facilities are related to one silicosis case's work history, and two facilities are related to another silicosis case's work history.

**TABLE 7**  
**MIOSHA Inspections of 91 Facilities of**  
**Silicosis Cases Exposed to Silica: 1985-2019**

	Companies	
	#	%
<b>Air Sampling Performed</b>	<b>65</b>	
Above NIOSH* Rec Std for Silica	39	60.0
Above MIOSHA Enforceable Std for Silica	25	38.5
<b>Medical Surveillance Evaluated</b>	<b>73</b>	
Periodic Chest X-Rays with a B-reader	8	11.0
Periodic Chest X-Rays without a B-reader	3	4.1
Pre-employment Testing Only	22	30.1
No Medical Surveillance	28	38.4
Periodic Pulmonary Function Testing	18	24.7

\*NIOSH National Institute for Occupational Safety & Health.

## *Sandblasting – Silicosis*

Three hundred twenty-six of the 898 individuals for whom sandblasting history was known (36.3%) stated they had done sandblasting as part of their work.

## *New Silica Standard*

The new silica standard was promulgated in Michigan on February 22, 2017

### **Key Provisions of the new OSHA Silica standard**

<https://www.osha.gov/Publications/OSHA3683.pdf>

- ◆ Reduces the permissible exposure limit (PEL) for respirable crystalline silica to 50 micrograms per cubic meter of air, averaged over an 8-hour shift.
- ◆ Requires employers to: use engineering controls (such as water or ventilation) to limit worker exposure to the PEL; provide respirators when engineering controls cannot adequately limit exposure; limit worker access to high exposure areas; develop a written exposure control plan, offer medical exams to highly exposed workers, and train workers on silica risks and how to limit exposures.
- ◆ Provides medical exams to monitor highly exposed workers and gives them information about their lung health.

### **Compliance Schedule**

#### **Construction -**

Fact sheet

[http://www.michigan.gov/documents/lara/lara\\_miosha\\_part690\\_553349\\_7.pdf](http://www.michigan.gov/documents/lara/lara_miosha_part690_553349_7.pdf)

- ◆ Employers are required to comply with all obligations of the standard including medical examinations (except methods of sample analysis) by June 23, 2017.

#### **General Industry and Maritime -**

Fact sheet

[http://www.michigan.gov/documents/lara/lara\\_miosha\\_part590\\_553335\\_7.pdf](http://www.michigan.gov/documents/lara/lara_miosha_part590_553335_7.pdf)

- ◆ Employers are required to comply with all obligations of the standard by June 23, 2018, with the exception of engineering controls and the action level trigger for medical surveillance which are delayed until June 23, 2021 .
- ◆ Employers are required to offer medical examinations to employees exposed above the PEL for 30 or more days a year beginning on

### **Brief history of three individuals first exposed to silica in the 2000s**

Case 1. A male in his 50s worked one year at a company that made sandpaper. He had never performed sandblasting. He formerly smoked cigarettes from his teens to his mid50s. He had advanced simple silicosis per x-ray ILO B-reader interpretation. He died in his 60s.

Case 2. A male in his 50s worked two years sandblasting metal parts. He was a lifelong non-smoker. He had progressive massive fibrosis (PMF) per x-ray ILO B-reader interpretation. He died in his 60s.

Case 3. A male in his 60s worked 13 years as a grinder at a foundry. He also performed sandblasting. He was a lifelong non-smoker. He had progressive massive fibrosis (PMF) per x-ray ILO B-reader interpretation.

June 23, 2018.

- ◆ Employers are required to offer medical examinations to employees exposed at or above the action level for 30 or more days a year beginning June 23, 2020.

### **Hydraulic Fracturing -**

- ◆ Employers are required to comply with all obligations of the standard, except for engineering controls and the action level trigger for medical surveillance, by June 23, 2018, except Engineering Controls, which have a compliance date of June 23, 2021.
- ◆ Employers are required to comply with requirements for engineering controls to limit exposures to the new PEL by June 23, 2021. From June 23, 2018 to June 23, 2021, employers can continue to have employees wear respirators if their exposures exceed the PEL.
- ◆ Employers are required to offer medical examinations to employees exposed above the PEL for 30 or more days beginning June 23, 2018.
- ◆ Employers are required to offer medical examinations to employees exposed at or above the action level for 30 or more days a year beginning June 23, 2020.

### **Content of Medical Examination - Appendix B – Medical Surveillance Guidelines**

[http://www.michigan.gov/documents/lara/lara\\_miosha\\_part690\\_553349\\_7.pdf](http://www.michigan.gov/documents/lara/lara_miosha_part690_553349_7.pdf)

- ◆ Medical and work history, with emphasis on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (e.g., shortness of breath, cough, wheezing); history of TB; and smoking status and history.
- ◆ Physical examination, with special emphasis on the respiratory system - Initial examination and every three years.
- ◆ TB testing - Initial examination.
- ◆ Spirometry - Initial examination and every three years. Must be administered by a spirometry technician with a current certificate from a NIOSH approved course.
- ◆ PA radiograph of the chest at full inspiration - Initial examination and every three years. Must be interpreted and classified according to the ILO International Classification of Radiographs by a NIOSH-certified B Reader.
- ◆ Additional testing the provider deems appropriate.

### **Requirements on Reporting Results of Medical Examination**

Written medical report to employee within 30 days must include:

- ◆ The results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;
- ◆ Any recommended limitations upon the use of a respirator;
- ◆ Any recommended limitations on exposure to respirable crystalline silica;
- ◆ A statement that the employee should be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine, where the B reading is 1/0 or higher for rounded opacities or where the PLHCP has determined such a referral is necessary.

Written medical report to employer within 30 days must include:

- ◆ Date of the examination;
- ◆ A statement that the examination has met the requirements of this section; and
- ◆ Any recommended limitations on the employee's use of a respirator.



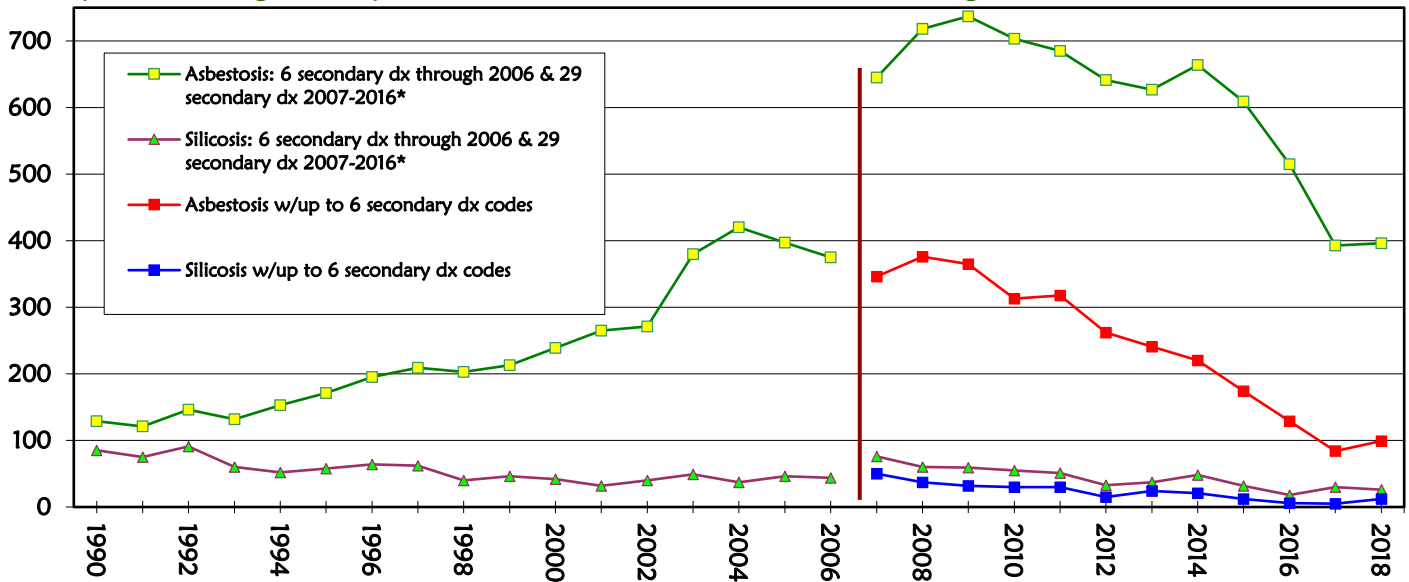
## *Asbestos-Related Lung Disease and Mesothelioma*

The following section reports the results of **asbestos-related lung disease and mesothelioma**.

Figure 7 shows the number of individuals hospitalized in Michigan with asbestosis and silicosis from 1990 to 2018 (most recent year available). Repeat admissions of the same individual within each calendar year are excluded from these counts of inpatient Hospital Discharge Data (HDC). For most patients, pneumoconiosis was not the primary discharge diagnosis listed on the discharge record. From 1993 to 2006, there has been a steady increase in the number of hospitalizations for asbestosis; from 2007-2016 the large increase in reports is due to the availability of additional secondary discharge diagnosis codes from up to six secondary codes through 2006 to up to 29 secondary diagnosis codes beginning in 2007 (Figure 7). There was a slight increase in the number of asbestosis-related hospitalizations in 2018, and a slight decrease in the number of silicosis-related hospitalizations in 2018. The horizontal red line in Figure 7 for 2007 - 2018 shows that the number of asbestosis cases would have been significantly lower if only up to six secondary discharge diagnoses had continued to be used.

FIGURE 7

## Hospital Discharges of Inpatients with Asbestosis &amp; Silicosis in Michigan: 1990 - 2006 &amp; 2007 - 2018



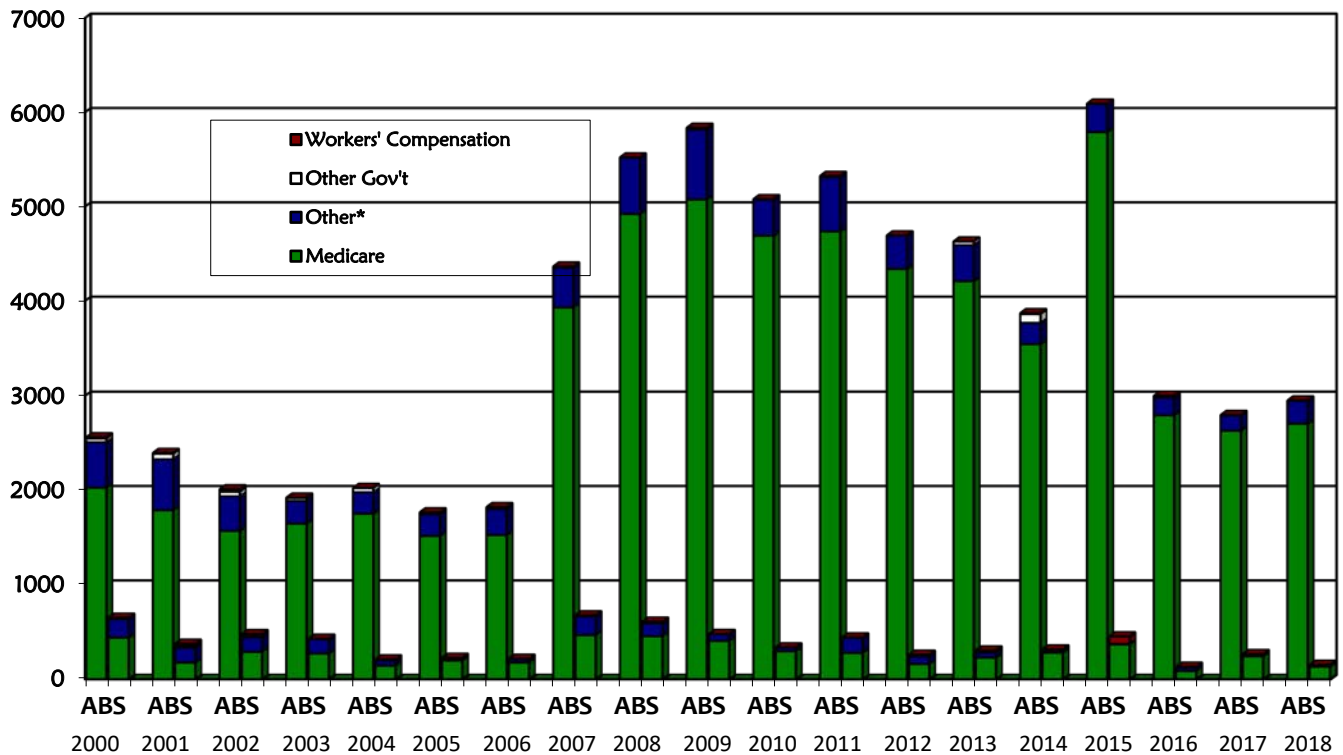
Regulations to control asbestos exposure were not promulgated until the early 1970s and were not widely implemented until the 1980s.

Given the 25-year or greater latency period from the time of first exposure to the development of asbestos-related radiographic changes, the cases being identified now represent exposures from these earlier less-regulated years. The trend we are seeing in Michigan is consistent with national data published by NIOSH through 2014. [5]

Payment source from the Michigan Health and Hospital Association (MHA) is the source of data displayed in Figure 8. Medicare is the primary payment source for hospitalizations for these dust diseases of the lung. WC insurance is very rarely the source of payment, which is consistent with previous reports in both Michigan and New Jersey that the majority of patients with pneumoconiosis never apply for WC insurance. [1,6] It should be noted that if the anticipated payment source was initially Workers' Compensation but then changed to a non-work-related payment source, the record in the MHA file would still indicate the initial source after the patient was discharged, or vice-versa. Again, for this discharge data of payment source, there is increased availability of secondary discharge diagnosis codes since 2007.

In addition to identifying asbestos-related disease from HDC inpatient data, occupational disease reports submitted to LEO constitute another large source of reports. In fact, asbestos-related lung disease is the most common dust disease reported to LEO (Figure 9), through individual physicians certified as B-Readers, death certificates and the Michigan Courts. The newer OLDs surveillance initiative is yet another source of reports on patients with asbestos-related lung disease (see page 17). In 2019, for example, 168 cases of asbestos-related lung disease were identified through physician review of medical records, death certificates or hospital records. Some of these patients reported may overlap with those reported in the HDC data (Figure 7). The total number of asbestos-related cases would therefore be less than the combined total of HDC cases (Figure 7) along with the cases reported directly to LEO (Figure 9 and Table 8) as this may or may not overlap as they each represent a different way to obtain a count of asbestos-related disease from these three different sources.

**FIGURE 8**  
**Days Hospitalized by Payment Source at Discharge for Asbestosis & Silicosis in Michigan:**  
**2000-2006 & 2007-2018**



\*Other includes: Medicaid, HMO's, PPO's, Other Insurance, Self-Pay and No-Charge payment sources. AB=Asbestosis, S=Silicosis.

## B-READER SURVEY

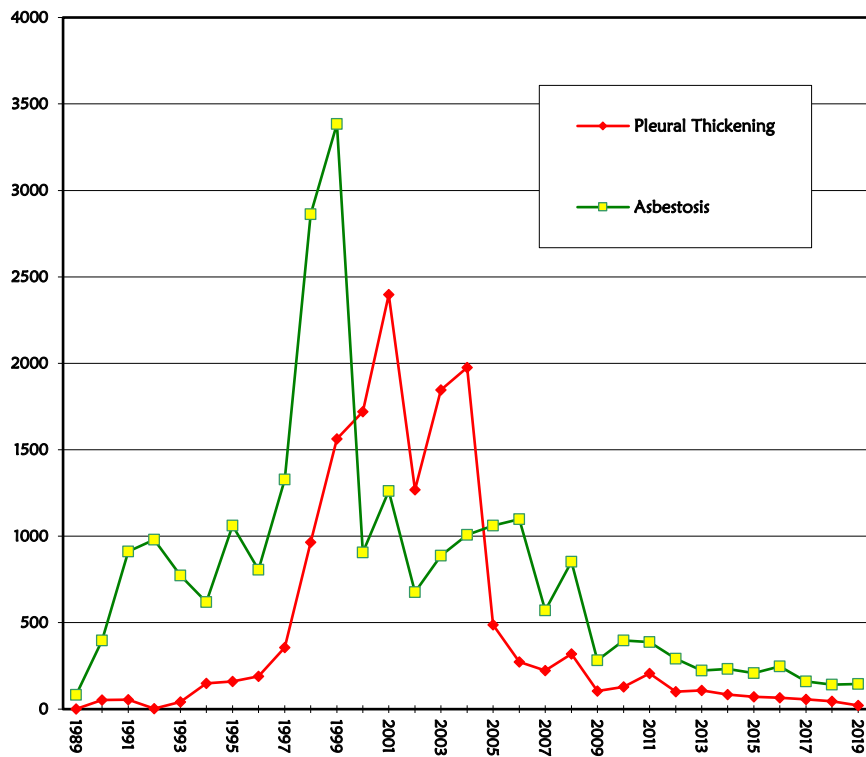
In 1995, there were 16 B-readers in Michigan. Since 2016, there are only five physicians in Michigan who were certified as B-readers. Table 8 shows the number of B-readers, chest x-rays that were reviewed, and x-rays that showed evidence of asbestos-related lung disease, with pleural and parenchymal changes separately and combined. Since 1995, about 20% of the x-rays reviewed showed evidence of occupational disease, ranging from a low of 96 (3%) of 3,841 x-rays reviewed in calendar year 2018, to a high of 3,640 (34%) of 10,575 x-rays reviewed in calendar year 1999. In 2019, 94 (4.6%) of the x-rays showed evidence of occupational disease. The overall downward change in percentages over time may represent a decreased incidence of radiographic changes and/or a change in the source of reports (more radiographs being interpreted from current rather than retired workers). Table 8 is based on an annual survey that the B-readers in Michigan complete. The numbers of reports listed in the survey are greater than the number of occupational disease reports received from B-readers.

## Mesothelioma

The association between exposure to asbestos and the risk of developing mesothelioma was first reported in the medical literature in 1943. [7] The only other exposure associated with the risk of developing mesothelioma has been the therapeutic, not diagnostic, use of x-rays. The percentage of patients with mesothelioma who have a history of occupational asbestos exposure is lower in studies that are based on review of medical records compared to studies based on a complete work history where 90% of mesothelioma has been attributed to asbestos exposure. [8] Among cohorts of asbestos-exposed workers, up to 10% of deaths have been attributed to mesothelioma.

The Michigan Cancer Registry collects data on the demographics of mesothelioma in Michigan. From 2001

**FIGURE 9**  
**Asbestos-Related Cases Reported from B-Readers, Death Certificates and the 3rd Judicial Court: 1989-2019**



**TABLE 8**  
**Results of Annual Survey\* of B-Readers in Michigan: 1995-2019**

YEAR	# B- Readers	Pleural Changes Only	Parenchymal Changes- W/ & W/out Pleural Changes	Pleural or Parenchymal Changes	Total X-Rays Reviewed	% of Total w/ any Changes
1995	16	--	--	1,406	8,165	17
1996	16	--	--	837	4,825	17
1997	16	446	522	968	6,652	15
1998	16	--	--	3,111	--	--
1999	18	1,045	2,595	3,640	10,575	34
2000	16	532	297	829	10,591	8
2001	17	1,211	1,316	2,527	11,149	23
2002	16	683	905	1,588	7,189	22
2003	11	1,440	1,289	2,729	10,589	26
2004	--	--	--	--	--	--
2005	9	502	343	845	3,060	28
2006	10	391	127	518	5,382	10
2007	9	201	130	331	3,661	9
2008	10	337	320	657	4,757	14
2009	9	247	66	313	4,170	8
2010	6	202	45	247	2,804	9
2011	6	183	46	229	2,862	8
2012	6	139	52	191	4,419	4
2013	6	130	46	176	2,802	6
2014	6	127	56	183	3,765	5
2015	6	67	43	110	3,572	3
2016	5	112	39	151	2,247	7
2017	5	75	28	103	2,600	4
2018	5	65	31	96	3,841	3
2019	6 (5 active)	70	24	94	2,034	5

\*Actual chest radiograph interpretations were not submitted with the surveys.

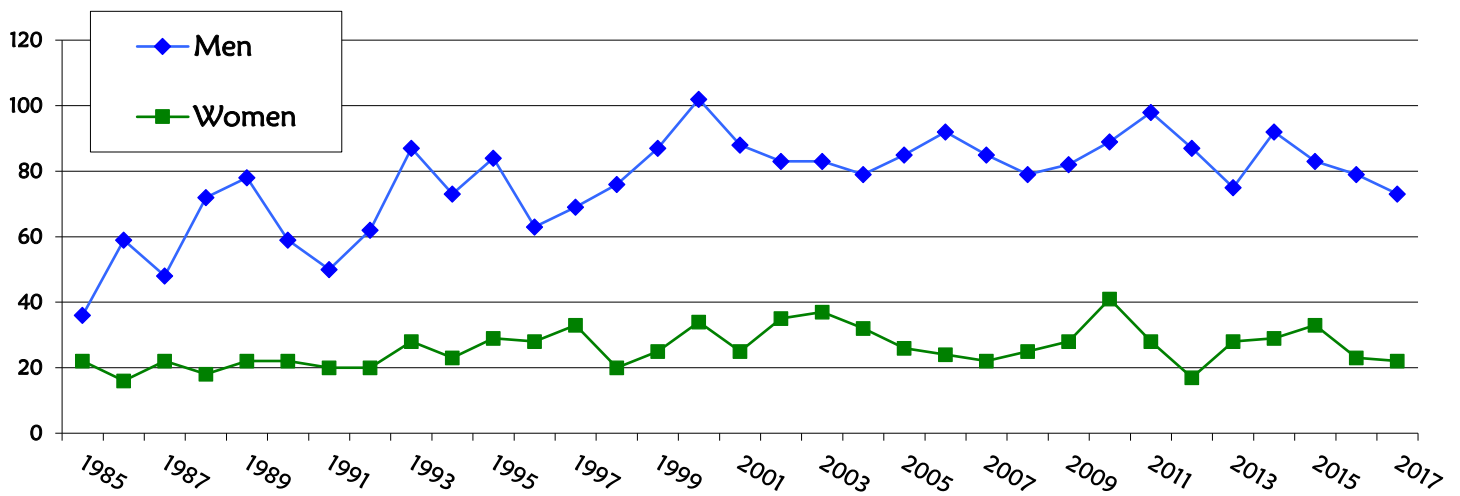
through 2017 (most recent year available), there were 1,969 Michigan residents reported to the Michigan Cancer Registry with invasive mesothelioma.

Figure 10 shows the number of men and women diagnosed with mesothelioma by year, from 1985 to 2017. Approximately 25% of the mesothelioma reports were women. In 2017, 23% of the 95 cases were women. In 2017, of the 95 new cases where race was known, 96% were white and 4% were African American.

Figure 11 shows the age at diagnosis separately for men and women. The peak age of occurrence of mesothelioma was for individuals 65 years and older for men and women.



**FIGURE 10**  
**Number of Men and Women in Michigan Diagnosed with Mesothelioma: 1985-2017**



**FIGURE 11**  
**Cases of Mesothelioma in Michigan by Gender and Age at Diagnosis: 1985-2017**

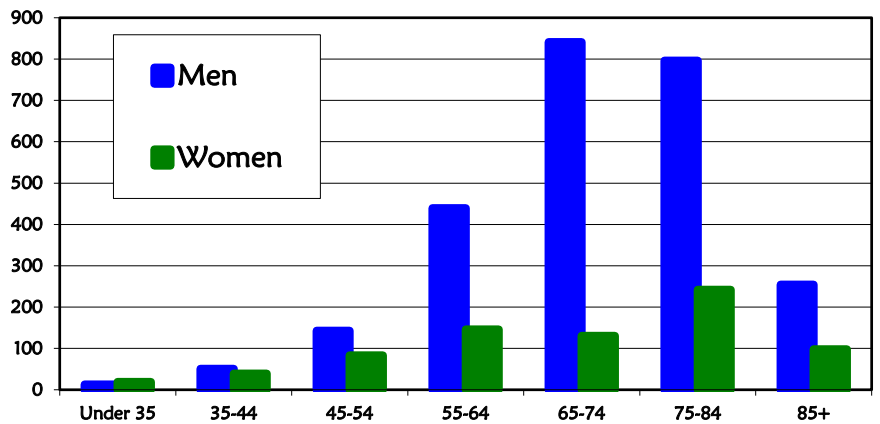


Figure 12 shows the distribution of the number of cases of mesothelioma among Michigan residents by county. The southeast and central region of Michigan has the highest number of cases of mesothelioma. Figure 13 shows the average annual incidence rates of mesothelioma among Michigan residents by county. The counties with the highest rates are: Marquette (2.4 per 100,000); Bay (1.9 per 100,000); Midland (1.8 per 100,000); St. Clair (1.6 per 100,000); and Muskegon (1.5 per 100,000). The annual average mesothelioma incidence rate for 2003-2017 in Michigan was 1.0 cases per 100,000.

**Mesothelioma Encasing Lung on Autopsy Specimen**

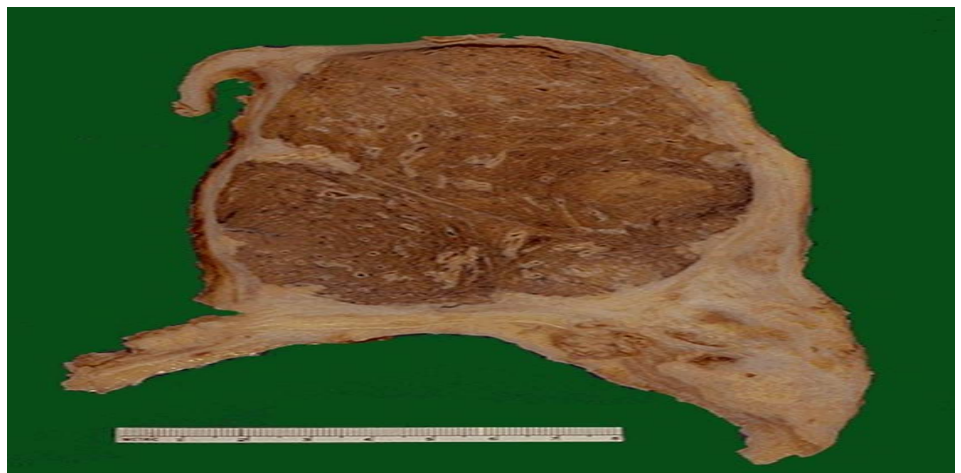


FIGURE 12

Distribution of MI Residents Diagnosed with Mesothelioma by County: 2003-2017

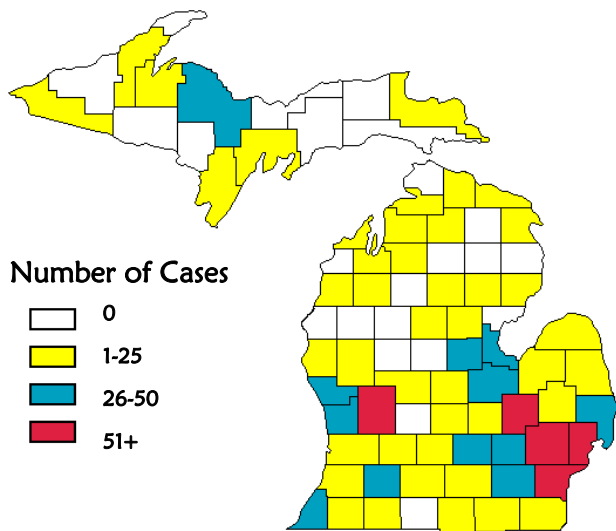
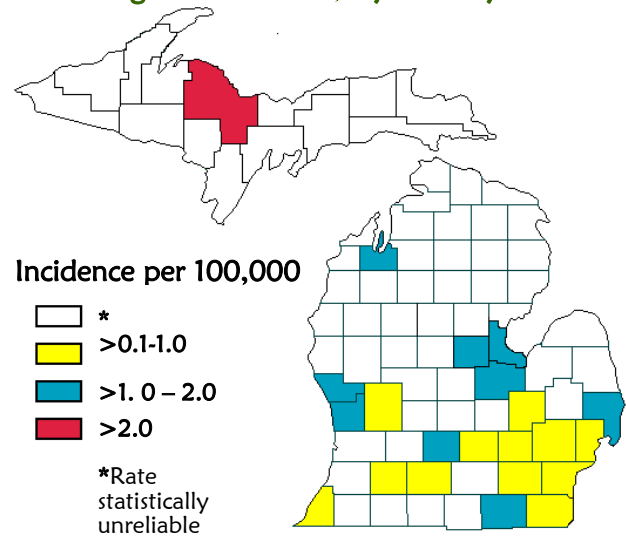


FIGURE 13

Age-Adjusted Incidence Rates of Mesothelioma among MI Residents, by County: 2003-2017



## Other Work-Related Lung Diseases (OLDs)

2011 was the first year of data collection for other work-related lung diseases (OLDs). Other lung diseases from exposures in the workplace include breathing problems that are not necessarily chronic in nature, in addition to those that are chronic. Conditions that we have identified since beginning OLDs surveillance include acute conditions such as chemical irritation/irritative bronchitis where an acute exposure results in a health provider visit and limited treatment, with resolution of symptoms. Other conditions covered include smoke inhalation from fires or burning material, infectious agents from exposures at work, and chemical pneumonitis. Chronic conditions are also included in this grouping, with other pneumoconioses, hard metal lung disease and coal workers' pneumoconiosis. A physician board-certified in internal and occupational medicine reviews all medical records to determine first, whether the condition is work-related and secondly, the nature of the illness and classification into general categories of disease. In cases where the work-relatedness of the exposure is unclear, additional medical records may be obtained and/or a patient interview completed.

Table 9 shows the distribution of diseases reported by year, from 2014-2019. 2011-2013 data can be found in prior annual reports. Over all the years, chemical irritation/irritative bronchitis and chemical pneumonitis were the most common conditions.

Each year varies slightly in the types of conditions reported, in part related to the reporting sources within a given year. In 2011 and 2012, hospitals and Workers' Compensation reported 72% of the 139 cases, and 68% of the 191 cases, respectively. In 2013 and 2014, the Poison Control Center and hospitals reported 69% of the 162 cases, and 63% of the 150 cases, respectively. In 2015, hospitals reported 59% of the 167 cases, followed by Workers' Compensation reporting 16% of the cases.

***The following statistics are based on the 238 cases of other lung diseases confirmed from 2019.***

Similar to delays in reporting cases of silicosis, OLDs reports are incomplete from delays in hospital reporting. Table 10 shows the primary reporting source of the 238 persons confirmed with OLDs in 2019. In 2019, the Poison Control Center reported 47% of the 238 cases, hospitals reported 32% of the cases, Workers' Compensation reported 16% of the cases, physicians reported 4% of the cases, and there was one report from a laboratory. In 2019, there were no reports from death certificates.

**TABLE 9**  
**Other Work-Related Lung Diseases Reported 2014-2019**

DISEASE	YEAR REPORTED											
	2014		2015		2016		2017		2018		2019	
	#	%	#	%	#	%	#	%	#	%	#	%
Chemical Irritation/Irritative Bronchitis	84	56	94	56	166	53	391	71	187	69	174	73
Chemical Pneumonitis	11	7	10	6	9	3	40	7	13	5	0	--
Asbestos-Related	8	5	9	5	75	24	18	3	9	3	3	1
Smoke Inhalation	7	5	5	3	3	1	13	2	6	2	7	3
COPD	3	2	14	8	13	4	12	2	11	4	10	4
Silo-Related Disease	2	1	0	--	0	--	1	<1	0	--	0	--
Acute Respiratory Distress Syndrome	1	<1	0	--	0	--	1	<1	1	<1	0	--
Allergies/Allergic Rhinitis	1	<1	1	1	3	1	4	1	1	<1	1	<1
Hard Metal Lung Disease	1	<1	2	1	2	1	1	<1	2	1	0	--
Hypersensitivity Pneumonitis	1	<1	7	4	7	2	23	4	4	1	5	2
Infectious Agent	1	<1	2	1	2	1	4	1	6	2	0	--
Metal Fume Fever	1	<1	0	--	1	<1	8	1	3	1	2	1
Sinus- related	1	<1	0	--	1	<1	0	--	0	--	0	--
Coal Workers' Pneumoconiosis	0	--	0	--	0	--	0	--	0	--	0	--
Pneumoconiosis NOS	0	--	0	--	1	<1	2	<1	0	--	0	--
Lung Trauma	0	--	1	1	3	1	0	--	1	<1	2	1
Respiratory Bronchiolitis	0	--	0	--	0	--	0	--	0	--	1	<1
Lung Cancer	0	--	0	--	0	--	0	--	0	--	0	--
Pneumothorax	0	--	0	--	1	<1	0	--	0	--	0	--
Pulmonary Embolism	0	--	0	--	0	--	0	--	1	<1	0	--
Beryllium Lung Disease	0	--	3	2	1	<1	0	--	0	--	0	--
Vocal Cord Dysfunction	0	--	1	1	0	--	0	--	0	--	0	--
Siderosis	0	--	0	--	0	--	0	--	2	1	1	<1
Respiratory Illness NOS	28	19	18	11	28	9	34	6	25	9	32	13
<b>TOTAL</b>	<b>150</b>		<b>167</b>		<b>316</b>		<b>552</b>		<b>272</b>		<b>238</b>	

**Other Work-Related Lung Disease Categories Reported in 2019**

One hundred seventy-four of the OLDs cases were classified as chemical irritation/irritative bronchitis, 10 had COPD, seven had smoke inhalation, five had hypersensitivity pneumonitis, three had asbestos-related lung disease, two each had metal fume fever and lung trauma, and one each had allergic rhinitis, respiratory bronchiolitis and siderosis. An additional 32 had a definite work-related respiratory illness that could not be classified more specifically (Table 9).

The following case narrative describes an exposure and symptoms related to an OLDs case reported in 2019:

**Chemical Irritation:** A female in her 30s developed chemical irritation while working for an auto parts manufacturer where she was exposed to a chemical lubricant. She developed chest tightness and shortness of breath and sought medical treatment in the emergency department. She quit because of her breathing problems. She was a lifelong non-smoker.

<b>TABLE 10</b> <b>Reporting Source for OLDs Cases: 2019</b>		
REPORTING SOURCE	#	%
Poison Control Ctr	112	47
Hospital	76	32
Workers' Comp	39	16
Physician Report	10	4
Laboratory	1	<1
Death Certificate	0	—
<b>TOTAL</b>	<b>238</b>	

### Demographic Characteristics

One hundred thirty-nine (62%) of the persons with OLDS were men; 86 (38%) were women, and gender was unknown for 13 cases. The average age of the OLDS cases was 40, ranging from 16 to 73 years of age.

### Type of Industry

Table 11 shows the primary type of industry where exposure occurred among the OLDS cases. The predominant industry where individuals were exposed was manufacturing with 34 cases (14%), followed by 11 cases (5%) in retail trade, 9 each (4%) in transportation and warehousing and accommodations and food services, and 8 (3%) in construction. The 101 individuals with a known workplace with OLDS worked at 94 different facilities. The workplace was unknown for 137 individuals.

### MIOSHA Inspections-Industrial Hygiene Results

There was one inspection for a hypersensitivity case in 2019 at a machine shop where the individual was exposed to metal working fluids. Air monitoring for total respirable dust exposure was below the OSHA permissible exposure limit. The company was cited for incomplete recording and reporting of occupational injuries and illnesses. The company was also given numerous recommendations including: Housekeeping-cutting oils were on the floors, this was recommended to be cleaned up; Occupational Noise- noise monitoring showed levels of 75-85 dbA, it was recommended to have a consultant review the company's hearing conservation program; and Hazard Communication- it was recommended to keep written proof of all training records.

### Discussion

We recently published a summary of silicosis surveillance in Michigan from 1988- 2016 [4]. The main characteristics of the individuals reported during Michigan's 29+ years of silicosis surveillance are that they are elderly men who mainly worked in foundries in three counties. The age distribution is similar to that reported in the 1960s. [9] The older age of the patient (average year of birth, 1924) is secondary to the chronic nature of the disease and the typical long exposure to silica required to develop the disease (average 27 years of exposure to silica). However, we continue to receive reports of individuals with short-term exposure, who began work in the 1970s, 1980s, 1990s and three in the 2000s. Overall, 98 (8.7%) of 1,126 silicosis cases with known duration worked for less than 10 years (data not shown). One hundred twenty-three (10.9%) of the 1,128 individuals with known decade of hire began work in the 1970s, 1980s, 1990s or 2000s; 30 of them had worked for less than ten years. Individuals with silicosis who began working since the 1970s were more likely to have done sandblasting than those who began working with silica before 1970 (52% vs. 34%). Of the 35 people who first were exposed to silica since the 1980s, seven worked in foundries, four worked in auto manufacturing, three did cement/masonry work, two were buffing and polishing metal, two worked in auto repair, two worked at a tool and die shop, two worked in construction, one worked in

<b>2002 North American Industry Classification System</b>		<b>#</b>	<b>%</b>
11	Ag, Forestry, Fishing & Hunting	4	2
21	Mining	1	<1
22	Utilities	2	1
23	Construction	8	3
31-33	Manufacturing	34	14
44-45	Retail Trade	11	5
48-49	Transportation & Warehousing	9	4
51	Information	0	--
52	Finance & Insurance	1	<1
54	Veterinary Services	1	<1
56	Administrative & Support & Waste Mgt & Remediation Svcs	3	1
61	Educational Services	1	<1
62	Health Care & Social Assistance	6	3
71	Arts, Entertainment, & Rec	2	1
72	Accommodation & Food Services	9	4
81	Auto Repair, Dry Cleaning, etc	2	1
92	Public Administration	7	3
00	Unknown	137	58
<b>TOTAL</b>		<b>238</b>	

mineral processing, one worked in a dental laboratory, one was a heavy equipment operator who did excavating, one was a painter, one was a painter/sandblaster, one was a welder/sandblaster, one worked as a miner in gold fields in the Southwest, one welded, one worked in a boiler fabrication shop, one worked for a small sandpaper manufacturing operation, one was an oiler in an iron ore mine, one worked at a bronze foundry, and one was a plumber.

African American men are over-represented (38%), reflecting previous hiring practices in foundries. [10] African American workers consistently had higher incidence rates of silicosis than their white counterparts in the counties where rates were compared between these groups (Table 4). Overall for the state, the average annual incidence of silicosis among African American workers was 6.7 per 100,000 versus 1.3 per 100,000 for white workers (a 5.2-fold greater incidence rate).

The individuals reported generally have advanced disease: 283 (23.4%) with progressive massive fibrosis and another 429 (35.5%) with advanced simple silicosis (category 2 or 3). Only 25% of the reported patients had normal breathing tests [4]. Individuals had both restrictive and obstructive changes. Obstructive changes, although more prevalent among individuals who had smoked cigarettes, were found in half of the individuals who never smoked cigarettes (Table 3). The incidence of TB in the confirmed silicosis cases was 7%; this is 1,000-fold greater than that in the general population in the last decade [4]. Despite the severity of their disease, 62% had not applied for Workers' Compensation.

The reports of Michigan silicotics having obstructive lung changes is consistent with published reports of increased chronic obstructive pulmonary disease (COPD) among silicotics, as well as among individuals without silicosis who have had silica exposure.[11] Individuals with silicosis are at risk of developing pulmonary hypertension, clinically significant bronchitis and chronic obstructive pulmonary disease.[12]

Hospitals are the primary reporting source of the patients identified through Michigan's surveillance system. Hospital discharge reporting is a more cost-effective method for identifying silica problem worksites than physician reporting, death certificates or Workers' Compensation data.[13] A comprehensive surveillance system for silicosis that combines all four reporting sources is as good, if not better, return for public health dollars invested as most other existing public health programs.[13]

Silicotics have an increased morbidity and mortality for malignant and non-malignant respiratory disease. [1,14] The increased risk for death is found both in patients who ever or never smoked cigarettes.[1] Individuals with silicosis also have an increased risk of developing connective tissue disease, particularly rheumatoid arthritis [15,16] as well as an increased risk of developing chronic renal disease, especially anti-neutrophilic cytoplasmic antibodies (ANCA) positive disease.[17,18,19]

The national employer-based surveillance system was not designed to count chronic diseases such as silicosis. We have previously estimated that there were 3,600 to 7,300 newly diagnosed cases of silicosis each year in the United States from 1987–1996. [2] Using the same methodology for the time period 1997–2003 we estimate there were 5,586–11,674 newly diagnosed cases of silicosis per year in the United States. A recent paper using national Medicare data on hospitalizations estimated 3,260–7,105 cases per year [20]. Using an alternative approach with hospital discharge data, we estimate there were 1,372–2,867 newly diagnosed cases of silicosis per year in the United States. Based on the results of the national Medicare data and our extrapolation from national death certificate data, we believe that the true number of new cases of silicosis is closer to these larger estimates than using the actual number of death certificates that mention silicosis (~150 per year) or the Bureau of Labor Statistics estimate based on employer reporting, which in 1999 reported only 2,200 cases for all dust diseases of the lung, including asbestosis and coal worker's pneumoconiosis in addition to silicosis.

Industrial hygiene inspections reveal violations of the exposure standard for silica in 39% of the facilities where sampling was done. However, follow-up inspections of these same companies have shown a significant decrease in silica exposures. Companies not in compliance with the silica standard are requiring their workers to use powered

air-purifying respirators or air-line respirators. However, because of an inadequate or absent medical surveillance program in 89% of the facilities, there is no way to monitor the adequacy of these controls in terms of health outcomes.

Silicosis remains an ongoing problem in Michigan with former foundry workers continuing to develop severe disease. In the last 10 years, the percentage of cases of silicosis from exposure to silica in foundries has decreased to 62% while cases from construction have increased to 22% and cases from mining have increased to 10% [4]. Michigan workers continue to be at risk of developing silicosis because of continued use of silica among abrasive blasters and inadequate controls in the construction industry, at foundries currently in operation, as well as in emerging industries with silica exposure including hydraulic fracturing [21] and engineered stone countertop fabrication. [22] Even without the development of silicosis, silica exposure is a risk factor for the development of lung cancer, connective tissue disease, tuberculosis and chronic obstructive pulmonary disease (COPD).[11,14,23] These risks justify tighter workplace controls for silica even if the number of new cases of silicosis continues to decline.

Michigan OSHA has promulgated a new comprehensive standard for silica that includes a lower allowable level of silica in the air, worker education and medical surveillance. The standard is needed despite a decreasing trend of silicosis cases identified in Michigan, since this trend is more likely a product of more automated work practices with a smaller number of workers at risk than safer workplaces. The major decrease in cases of silicosis in Michigan can be attributed to the decrease in the number of foundry workers. There was a 75% decrease of foundry workers from 1973 to 1991 (Figure 6) and an 83% decrease in reported cases of silicosis from 1993 to 2011, factoring in a 20-year latency period for the development of silicosis. Additionally, the number of abrasive blasting companies using silica decreased 71% from 1995 to 2011 (2011 Annual Report—Tracking Silicosis and Other Work-Related Diseases in Michigan).

We are optimistic about the downward trend in reported silicosis cases but remain concerned about ongoing silica exposure and the increased risk of lung cancer, TB, COPD, connective tissue disease, and kidney disease associated with silica exposure. The promulgated comprehensive silica standard will be helpful in the foundry industry as well as for newer exposures in highway reconstruction, engineered stone countertop fabrication and hydraulic fracturing; it is too soon to see any ill health effects of these newer silica exposure sources. The new silica regulations require medical examinations beginning June 23, 2017 in Construction regardless of measured air levels and in 2018 in General Industry if the silica air level is above the permissible exposure limit (PEL) and in 2020 if the silica level is at or above the PEL.

Asbestos-related disease, both malignant and non-malignant, is the single most commonly diagnosed occupational lung disease. Asbestos-related disease is tracked from a variety of reporting sources in Michigan, including hospital inpatient discharge data, the 3rd Judicial Circuit Court, B-readers and other physicians, death certificates, and an annual survey of Michigan B-readers.

Targeting smoking cessation programs to individuals who work or used to work with asbestos should be a high priority. Guidelines for lung cancer screening from the U.S. Preventive Services Task Force recommend low-dose CT scans for adults 55 to 80 years of age who have a 30-pack-year cigarette smoking history and currently smoke or quit smoking less than 15 years prior. The guidelines do not mention asbestos exposure as a criterion. Given the known synergism between cigarettes and asbestos in increasing the risk of lung cancer for either exposure alone, supports screening individuals 50 to 80 with 20 years of asbestos exposure who ever smoked cigarettes regardless of whether they quit. For more information on the background for including asbestosis and asbestos exposure history in the determination for performing screening for lung cancer, see the PS News Summer 2015 newsletter (V26N3) at: [www.oem.msu.edu](http://www.oem.msu.edu). Similar data for silicosis and silica exposure is not available, but such screening should also be considered for these individuals.

The 9th year of OLDs surveillance resulted in the identification of a variety of respiratory illnesses from workplace exposures. Future surveillance of OLDs cases will continue to identify workplaces where MIOSHA inspections are

warranted. Other activities will focus on characterizing the nature and extent of the OLDs cases, and the identification of areas where education could benefit individuals who develop OLDs and to help prevent OLDs in others with similar workplaces and exposures.

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