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# WORK-RELATED LUNG DISEASE SURVEILLANCE REPORT 2002



Department of Health and Human Services  
Centers for Disease Control and Prevention  
National Institute for Occupational Safety and Health



# **Work-Related Lung Disease Surveillance Report 2002**

Division of Respiratory Disease Studies  
National Institute for Occupational Safety and Health

U.S. Department of Health and Human Services  
Public Health Service  
Centers for Disease Control and Prevention

May 2003

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This *Work-Related Lung Disease (WoRLD) Surveillance Report* is the sixth in a series of occupational respiratory disease surveillance reports (see page iv) produced by the National Institute for Occupational Safety and Health (NIOSH). It presents summary tables and figures of occupational respiratory disease surveillance data focusing on various occupationally-relevant respiratory diseases, including pneumoconioses, occupational asthma and other airways diseases, and several other respiratory conditions. For many of these diseases, selected data on related exposures are also presented.

The 2002 *WoRLD Surveillance Report* has three major sections: (1) a section that provides data highlights and data usage limitations; (2) a section comprised of 15 subsections, each concerning a major disease category and (where available) related occupational exposures, and one subsection concerning smoking status; (3) a section of appendices that provide descriptions of data sources, methods, and other supplementary information.

Similar to the 1999 *WoRLD Surveillance Report*, this report includes data on hypersensitivity pneumonitis, asthma, chronic obstructive pulmonary disease, respiratory conditions due to chemical fumes and vapors, and other work-related respiratory conditions, in addition to the pneumoconioses. This report updates pneumoconiosis mortality data published in the 1999 *WoRLD Surveillance Report* by the addition of currently available data for 1997 through 1999. Pneumoconiosis conditions highlighted include asbestosis, coal workers' pneumoconiosis, silicosis, byssinosis, and pneumoconioses coded as either "unspecified" or "other," and all pneumoconioses aggregated. The current report presents data on conditions not included in earlier reports (e.g., malignant mesothelioma, lung cancer, and other interstitial pulmonary disease), plus data on smoking status by industry and occupation.

For many of the conditions reported on, the 2002 *WoRLD Surveillance Report* presents national and state summary statistics such as counts, crude and age-adjusted mortality rates, and years of potential life lost to age 65 and to life expectancy. Proportionate mortality ratios by industry and occupation are based on the most recent decade of data from a subset of states (see state list, Appendix E) for which usual industry and occupation have been coded for decedents. Also presented are U.S. state- and county-level maps showing the geographic distribution of mortality and, for the pneumoconioses, tables and figures summarizing selected occupational exposure data for asbestos, coal mine dust, silica dust, cotton dust, etc. (see agent categories, Appendix F).

Data contained in the 2002 *WoRLD Surveillance Report* originate from various publications, reports, data files, and tabulations provided by the Association of Occupational and Environmental Clinics (AOEC), the Bureau of Labor Statistics (BLS), the Department of Labor (DOL), the Mine Safety and Health Administration (MSHA), the National Center for Health Statistics (NCHS), the Occupational Safety and Health Administration (OSHA), NIOSH, and the Social Security Administration (SSA). Details on the major data sources and on the methods used to compute specific statistics can be found in Appendices A and B, respectively.

Interpreted with appropriate caution, the information contained in this report can help to establish priorities for research and prevention. It is also useful for tracking progress toward the elimination of important preventable occupational respiratory diseases, including those targeted in U.S. Public Health Service *Healthy People* objectives for the nation.

Comments and suggestions from users of earlier editions of the *WoRLD Surveillance Report* have influenced the content and format of this 2002 edition. To increase the utility of future editions, comments on the current report, descriptions of how the information is or could be used, and suggestions of other data for inclusion in future reports are invited.

**See page ii of this report for information on how to order copies of previous *Work-Related Lung Disease Surveillance Reports*, described on the next page.**

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## ***Summary of Previous WoRLD Surveillance Reports***

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### ***WoRLD Surveillance Report (1991)***

**[www.cdc.gov/niosh/91-113.html](http://www.cdc.gov/niosh/91-113.html)**

The 1991 report is the first in the series of *WoRLD Surveillance Reports*. Data presented in the report, most of which relates to the 1968-1987 time period, originated from the National Institute for Occupational Safety and Health (NIOSH), the National Center for Health Statistics (NCHS), the Bureau of Labor Statistics (BLS), the Mine Safety and Health Administration (MSHA), the Occupational Safety and Health Administration (OSHA), the Department of Labor (DOL), the Health Care Financing Administration (HCFA), and the Social Security Administration (SSA). The 1991 report is organized into two major sections, one of figures and the other of tables. Within each section, data are presented in the following sub-headings: asbestosis, coal workers' pneumoconiosis, silicosis, exposure to cotton dust, pneumonopathy due to inhalation of other dust (i.e., byssinosis), hypersensitivity pneumonitis, toxic agents, dust diseases of the lung, and compensation.

### ***WoRLD Surveillance Report Supplement, 1992***

**[www.cdc.gov/niosh/91-113s.html](http://www.cdc.gov/niosh/91-113s.html)**

The 1992 supplement presents updated data for many of the figures and tables presented in the 1991 report, including mortality data through 1988. In addition, the 1992 supplement includes data not previously presented: (1) sex, race, geographic distribution, usual industry, and usual occupation, supplementing mortality data presented in the 1991 report; (2) number of discharges with silicosis, asbestosis, or coal workers' pneumoconiosis from the National Hospital Discharge Survey; and (3) reports of occupational asthma and silicosis from the Sentinel Event Notification Systems for Occupational Risks (SENSOR) Program.

### ***WoRLD Surveillance Report, 1994***

**[www.cdc.gov/niosh/94-120.html](http://www.cdc.gov/niosh/94-120.html)**

Data presented in the 1994 report originate generally from programs and activities described in the 1991 and 1992 reports. The 1994 report is divided into 11 major sections, most containing both figures and data tables. Ten sections summarize mortality and morbidity data and other information, such as occupational exposures, for types of pneumoconiosis, malignant neoplasms of the pleura, hypersensitivity pneumonitis, occupational asthma, and other lung conditions. The final section provides data from the Association of Occupational and Environmental Clinics (AOEC) Disease Surveillance Database. The 1994 report contains major additions, including previously unreported data, such as those from the National Health Interview Survey (NHIS) and the AOEC, and additional statistical measures, such as proportionate mortality ratios, both crude and age-adjusted rates at national and state levels, and years of potential life lost to age 65 and to life expectancy.

### ***WoRLD Surveillance Report, 1996***

**[www.cdc.gov/niosh/w7wrl96.html](http://www.cdc.gov/niosh/w7wrl96.html)**

The 1996 report focuses entirely on pneumoconiosis mortality and related exposures, providing updated mortality data from 1968 through 1992. It has three sections: (1) a section that describes data highlights and data limitations; (2) a section that updates and expands national data provided in the 1994 report; and (3) a section that provides detailed profiles of relevant data for each state in the U.S. Surveillance data include counts, crude and age-adjusted rates, years of potential life lost, and proportionate mortality ratios by industry and occupation. The 1996 report presents detailed tables of pneumoconiosis mortality data for each state and for the District of Columbia, as well as for counties within each state. It also presents county-level maps showing the geographic distribution of mortality for each pneumoconiosis and showing results of federal occupational exposure inspection sampling for agents that cause pneumoconiosis.

### ***WoRLD Surveillance Report, 1999***

**[www.cdc.gov/niosh/W99front.html](http://www.cdc.gov/niosh/W99front.html)**

The 1999 report is similar in content and organization to the 1994 *WoRLD Surveillance Report*. It is structured into three sections with 13 sub-sections which summarize mortality and morbidity data and other information, such as occupational exposures, for each type of pneumoconiosis and all pneumoconioses, malignant neoplasms of the pleura, hypersensitivity pneumonitis, occupational asthma, and other lung conditions. Major additions were sub-sections for pulmonary tuberculosis and chronic obstructive pulmonary disease. Mortality data published in the 1994 and 1996 *World Surveillance Reports* are updated through 1996. The 1994 report contains major additions, including previously unreported data, such as that from the National Health and Nutrition Examination Survey (NHANES). Reports of occupational asthma and silicosis from the Sentinel Event Notification Systems for Occupational Risks (SENSOR) Program are updated through 1995; updated summaries from the Association of Occupational and Environmental Clinics (AOEC) are provided for 1991-1996.

## *Acknowledgments*

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Draft portions of this report were provided for review and comment to individuals associated with public health agencies and other governmental organizations, as well as to others within NIOSH. Their comments have been considered in the final version of this report.

## Abbreviations

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ACGIH®	American Conference of Governmental Industrial Hygienists	MRE	Mining Research Establishment
AOEC	Association of Occupational and Environmental Clinics	MSHA	Mine Safety and Health Administration
BLS	Bureau of Labor Statistics	NCHS	National Center for Health Statistics
BoC	Bureau of the Census	n.e.c.	not elsewhere classified
CDC	Centers for Disease Control and Prevention	NHANES	National Health and Nutrition Examination Survey
CFR	<i>Code of Federal Regulations</i>	NHDS	National Hospital Discharge Survey
CI	confidence interval	NIOSH	National Institute for Occupational Safety and Health
CIC	Census Industry Code	n.o.s.	not otherwise specified
COC	Census Occupation Code	OA	occupational asthma
COPD	chronic obstructive pulmonary disease	OSHA	Occupational Safety and Health Administration
CWP	coal workers' pneumoconiosis	PEFR	peak expiratory flow rate
CWXSP	Coal Workers' X-ray Surveillance Program	PEL	permissible exposure limit
CXR	chest x-ray	PHS	Public Health Service
DFR	Doctor's First Report	PMF	progressive massive fibrosis
DHHS	Department of Health and Human Services	PMR	proportionate mortality ratio
DOL	Department of Labor	PPD	purified protein derivative
DRDS	Division of Respiratory Disease Studies	REL	NIOSH recommended exposure limit
f/cc	fibers per cubic centimeter	RADS	reactive airways dysfunction syndrome
FEV <sub>1</sub>	forced expiratory volume in one second	SIC	Standard Industrial Classification
GM	geometric mean	SSA	Social Security Administration
HCFA	Health Care Financing Administration	SENSOR	Sentinel Event Notification Systems for Occupational Risks
ICD	International Classification of Diseases	SOP	standard operating procedure
ILO	International Labour Office	SUDAAN®	Survey Data Analysis (software)
IMIS	Integrated Management Information System	TLV®	Threshold Limit Value
LCL	lower confidence limit	TWA	time-weighted average
MQC	minimum quantifiable concentration	UCL	upper confidence limit
µg/m <sup>3</sup>	micrograms per cubic meter	WOHL	Wisconsin Occupational Health Laboratory
mg/m <sup>3</sup>	milligrams per cubic meter	WoRLD	Work-Related Lung Disease
MMWR	<i>Morbidity and Mortality Weekly Report</i>	WRA	work-related asthma
MNMD	metal/nonmetal mine data	YPLL	years of potential life lost
mppcf	millions of particles per cubic foot		



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# **Highlights and Limitations**

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## Selected Highlights

*The following paragraphs highlight selected findings based on data from the United States presented in this and previous WoRLD Surveillance Reports.*

### Asbestosis and Related Exposures

- Asbestosis deaths among U.S. residents age 15 and over have increased from fewer than 100 in 1968 to more than 1,250 annually in 1999, the most recent year for which data are available, with no apparent leveling off of this trend. (Figure 1-1)

- Over the 10-year period from 1990 to 1999, there were more than 10,000 asbestosis deaths and annual asbestosis death counts increased by one-third. (Table 1-1)

- During the 10-year period from 1990 to 1999, asbestosis deaths represented about one-third of all pneumoconiosis deaths. (Table 6-6)

- For 1998 and for 1999, asbestosis deaths outnumbered coal workers' pneumoconiosis (CWP) deaths, displacing CWP as the most frequent type of pneumoconiosis death. (Tables 1-1, 2-1, 6-1)

- Asbestosis was designated as the underlying cause of death in one-third of all asbestosis deaths from 1990 to 1999. (Table 1-1)

- Residents of California, Pennsylvania, New Jersey, Texas, Florida, Washington, and Virginia together accounted for nearly half of all asbestosis deaths in the 1990 to 1999 period. (Table 1-4)

- For the period from 1985 to 1999, four counties (one in Virginia, one in Texas, one in Mississippi, and one in New Jersey) had age-adjusted asbestosis mortality rates that exceeded the national rate by more than 20-fold. (Table 1-10)

- Based on a large subset of the national data for which decedents' usual occupation and industry information was available, the *construction* industry

accounted for one-fourth of decedents with asbestosis from 1990 through 1999. Apart from *construction*, asbestosis deaths were reported in a wide range of industries, with no particular industry predominating. Similarly, no one occupation emerged as being particularly common, though the most frequently listed occupational group was *plumbers, pipefitters, and steamfitters*. (Tables 1-6, 1-7)

- From 1990 to 1999, decedents whose death certificate indicated that they worked in the *miscellaneous nonmetallic mineral and stone products* industry or the *ship and boat building and repairing* industry had proportionate asbestosis mortality more than 15 times higher than that of all industries combined. (Table 1-8)

- From 1990 to 1999, decedents whose death certificate indicated that they were *insulation workers* or *boilermakers* had proportionate asbestosis mortality 20 times higher than that in all occupations combined. (Table 1-9)

- Hospital discharges associated with asbestosis have been rising rapidly between 1995 and 2000. (Table 1-11)

- Data from the Occupational Safety and Health Administration (OSHA) and the Mine Safety and Health Administration (MSHA) indicate a trend towards lower exposure levels from 1979 to 1999, concomitant with mandated reductions in the OSHA permissible exposure limit (PEL). (Figure 1-5, Table 1-12)

- For the period 1990 to 1999, less than 5% of the MSHA and OSHA asbestos exposures exceeded the recommended exposure limit (REL). The *miscellaneous nonmetallic mineral and stone products* industry, which had the highest proportionate mortality ratio (PMR) for asbestosis, also had the highest geometric mean exposure and the highest percent of exposures



## ***Selected Highlights***

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exceeding the PEL and REL (26% and 41%, respectively). (Table 1-13)

### **Coal Workers' Pneumoconiosis (CWP) and Related Exposures**

- CWP deaths among U.S. residents age 15 and over continue a long-term decline, from well over 2,500 deaths annually in the early 1980s to just over 1,000 in the late 1990s. (Figure 2-1)
- Similarly, among active underground coal miners examined in a federally-administered CWP screening program, the prevalence of radiographically evident CWP continues to decline – from over 10% in the early 1970s to less than 2% in the late 1990s. (Table 2-12, Figure 2-5)
- CWP deaths accounted for nearly half of pneumoconiosis deaths during the 10-year period from 1990 to 1999, clearly outnumbering deaths associated with other types of pneumoconiosis. (Table 6-6)
- CWP was designated as the underlying cause of death in over one-third of all CWP deaths from 1990 to 1999. (Table 2-1)
- For the decade from 1990 to 1999, more than three-fourths of all CWP decedents were residents of Pennsylvania, West Virginia, Virginia, and Kentucky. Pennsylvania alone accounted for about half of all CWP deaths in this period. (Table 2-4)
- For the period from 1985 to 1999, four counties (one in Virginia, one in Pennsylvania, and two in West Virginia) had age-adjusted CWP mortality rates that exceeded the national rate by more than 100-fold. (Table 2-10)
- A large majority of CWP deaths are associated with employment in the *coal mining* industry, for which proportionate CWP mortality was more than 50 times higher than that of all occupations combined. (Tables 2-6, 2-8)

- Federal “Black Lung” Program payments totaled more the \$1.5 billion for nearly 190,000 beneficiaries in 1999. These figures reflect a continuing slow decline from over \$1.8 billion paid out for over 500,000 beneficiaries in 1980. The number of beneficiaries is now about one-third of what it was in 1980. (Table 2-13)

- Data from MSHA indicate that from the early 1980s to 1999 the underground *coal mining* industry experienced little change in level of exposure to respirable coal mine dust. Surface mine exposure levels have also remained fairly steady although there is some evidence of a decline in exposure levels since the early 1990s. (Figure 2-7, Table 2-14)

- During the period 1995 to 1999, one-fourth of coal mine dust exposures recorded by MSHA exceeded the REL. (Tables 2-15, 2-16)

### **Silicosis and Related Exposures**

- Silicosis deaths among U.S. residents age 15 and over represented nearly 8% of all pneumoconiosis deaths in the U.S. during the 10-year period from 1990 to 1999. (Table 6-6)
- Over the past several decades, silicosis mortality has declined, from well over 1,000 deaths annually in the late 1960s to fewer than 200 per year in the late 1990s. (Figure 3-1)
- Silicosis was designated as the underlying cause of death in half of all silicosis deaths from 1990 to 1999. (Table 3-1)
- Compared to asbestosis, CWP, and byssinosis, silicosis mortality appears to be somewhat less concentrated by geographic region or by industry. However, Pennsylvania, alone, accounts for nearly 18% of silicosis deaths for the 1990-1999 period, ranking first among all states in number of silicosis deaths and fourth in age-adjusted silicosis mortality rate behind West Virginia, Vermont, and Colorado. (Tables 3-4, 3-5)

- For the period from 1985 to 1999, six counties (two in North Carolina and one each in Montana, Idaho, Colorado, and Georgia) had age-adjusted silicosis mortality rates that exceeded the national rate by more than 25-fold. (Table 3-10)
  - Based on a large subset of the national data for which decedents' usual occupation and industry information was available, the *construction* and *mining* industries accounted for at least one-third of decedents with silicosis from 1990 through 1999. (Table 3-6)
  - Throughout the 1990-1999 period, silicosis mortality rates were higher among black males than among white males. (Table 3-2)
  - Based on data from the SENSOR silicosis programs in Michigan, New Jersey, and Ohio, more than 8% of confirmed silicosis cases for which duration of exposure was ascertained had less than 10 years of occupational exposure to silica dust. (Table 3-13)
  - Data from MSHA indicate that from 1979 to 1999 respirable quartz exposure levels have remained relatively constant in the *coal mining* industry. Levels in the *metal mining* and *nonmetallic mining and quarrying* industries appear to have declined from 1979 to 1987, increased substantially in 1988 when MSHA implemented a different quartz analytical standard, declined from 1989 to 1995 and increased thereafter. Data from OSHA indicate that from 1979 to 1999 respirable quartz exposure levels have declined in the non-mining industries during the period 1989 to 1992 when the OSHA PEL was changed from a formula for respirable dust containing quartz to a respirable quartz concentration of 0.1 mg/m<sup>3</sup>. (Figures 3-6a, 3-6b, Tables 3-16a, 3-16b, 3-20)
  - For the overall period 1993 to 1999, the percentages of exposures greater than the PEL were about 29% in *coal mining*, about 6% in *metal mining* and *nonmetallic mining and quarrying* industries, and 31% in other industries. (Tables 3-18 to 3-20)
  - For the overall period 1990 to 1999, *miscellaneous nonmetallic mineral and stone products*, *iron and steel foundries*, and *structural clay products* were the industries with elevated PMRs for silicosis in which at least 29% of their exposures exceeded the PEL and about half exceeded the REL. The *coal mining* industry had an elevated PMR for silicosis and about 30% of its exposures exceeded the MSHA PEL. (Tables 3-8, 3-17)
  - For the period 1993 to 1999, Indiana, Virginia, Tennessee, West Virginia, Oklahoma, Kentucky, Arizona, and Alabama had geometric mean respirable quartz exposure levels in the coal mining industry which exceeded 0.05 mg/m<sup>3</sup> MRE and at least 10 samples analyzed by MSHA. (Table 3-18, Figure 3-7)
  - For the period 1993 to 1999, 16 states had geometric mean respirable quartz exposure levels in non-mining industries which exceeded the REL of 0.05 mg/m<sup>3</sup> and at least 10 samples analyzed by OSHA. (Table 3-20, Figure 3-9)
- ### Byssinosis and Related Exposures
- In comparison with other pneumoconioses, byssinosis deaths among U.S. residents age 15 and over (as enumerated from death certificate data) remain very few – fewer than 20 annually since 1990, and fewer than 10 annually in 1998 and 1999. (Table 4-1)
  - Nearly one-third of byssinosis decedents in the 1990 to 1999 period were female. (Table 4-1)
  - Byssinosis was designated as the underlying cause of death in about half of all byssinosis deaths from 1990 to 1999. (Table 4-1)
  - Over one-half of byssinosis decedents in the period from 1990 to 1999 were residents of North Carolina, South Carolina, and Georgia. (Table 4-4)

## ***Selected Highlights***

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- For the period from 1985 to 1999, three counties (all in North Carolina) had age-adjusted byssinosis mortality rates that exceeded the national rate by more than 50-fold. (Table 4-10)

- Only one industry – *yarn, thread, and fabric mills* – was associated with a significantly high byssinosis mortality for the 1990 to 1999 period. (Table 4-8)

- Although cotton dust exposure data are sparse, nearly one-third of the exposures measured by OSHA exceeded the REL for the period 1990 to 1999. (Table 4-12)

### **Unspecified/Other Pneumoconioses**

- The pattern of deaths from unspecified/other pneumoconioses, which account for 10% of all pneumoconiosis deaths during the 1990-1999 period, tends to resemble coal workers' pneumoconiosis (and, less so, silicosis) mortality with respect to geographic distribution, a similar peak in 1972, and similar occupations and industries associated with high PMRs. This indicates that most unspecified pneumoconiosis deaths are likely to be CWP deaths. (Tables 5-1, 5-4, 5-8, 5-9, 6-6)

- For each year from 1979 to 1999, at least five percent of OSHA iron oxide fume exposures exceeded the REL. (Table 5-11)

### **All Pneumoconioses and Related Exposures**

- During the 10-year period from 1990 to 1999, there were more than 31,000 pneumoconiosis deaths nationwide, accounting for more than 300,000 years of potential life lost. (Tables 6-1, 6-3)

- Overall pneumoconiosis mortality in the U.S. has been gradually declining over the past two-and-one-half decades, from a peak of more than 5,000 deaths in 1972 to 2,745 pneumoconiosis deaths in 1999. (Figure 6-1, Table 6-1)

- Pneumoconiosis was designated as the underlying cause of death in over one-third of all pneumoconiosis deaths from 1990 to 1999. (Table 6-1)

- The pattern of all pneumoconiosis mortality is largely influenced by coal workers' pneumoconiosis (CWP), given that certified CWP deaths represent nearly half of all pneumoconiosis deaths from 1990 to 1999. However, asbestosis deaths have been increasing and exceeded CWP deaths in 1998 and 1999. (Tables 1-1, 2-1, 6-6)

- Based on a major survey of private industry employers, annual estimates for the number of new cases of pneumoconiosis over the late 1990s have ranged from 1,700 to 3,500 among employees. There is no clear trend in these estimates since 1980. The highest estimated rates have been consistently associated with mining, particularly with *coal mining*. (Tables 6-12 to 6-14)

- For the overall period 1990 to 1999, the *coal mining* industry had the highest PMR (33) for pneumoconiosis and over one-fourth of its exposures exceeded the REL. (Table 6-16)

### **Malignant Mesothelioma**

- There were nearly 2,500 malignant mesothelioma deaths among U.S. residents age 15 and over in 1999. (Table 7-1)

- Mesothelioma was designated as the underlying cause of death in nearly 95% of all malignant mesothelioma deaths in 1999. (Table 7-1)

- Nearly 20% of mesothelioma decedents were female. (Table 7-1)

- For 1999, more than one-third of mesothelioma decedents were residents of just five states (California, Florida, Pennsylvania, New York and Ohio). (Table 7-4)

- For 1999, seven counties (two in Virginia, and one each in Ohio, Maine, New Jersey, Mississippi, and Michigan) had age-adjusted malignant mesothelioma mortality rates that exceeded the national rate by more than 5-fold. (Table 7-9)

- Based on a large subset of the national data for which decedents' usual occupation and industry information was available, the *construction* industry accounted for nearly 15% of decedents with malignant mesothelioma in 1999. (Table 7-5)

- In addition to the *construction* industry, other industries associated with significantly increased mesothelioma mortality in 1999 include: *ship and boat building and repairing*; *industrial and miscellaneous chemicals*; *petroleum refining*; and *electric light and power*. (Table 7-7)

- Occupations associated with significantly elevated mesothelioma mortality in 1999 include: *plumbers, pipefitters, and steamfitters*; *mechanical engineers*; *electricians*; and *elementary school teachers*. (Table 7-8)

### Hypersensitivity Pneumonitis (HP)

- The annual number of hypersensitivity pneumonitis (HP) deaths has been generally increasing, from less than 20 per year in 1979 to 57 in 1999. (Figure 8-1, Table 8-1)

- HP was designated as the underlying cause of death in two-thirds of all HP deaths from 1990 to 1999. (Table 8-1)

- The highest HP mortality rates for the 1990-1999 period are in the upper Midwest, northern Plains, Mountain, and New England states. (Table 8-5)

- For the 1985-1999 period, two counties in Wisconsin had age-adjusted HP mortality rates that exceeded the national rate by more than 5-fold. (Table 8-10)

- For the 1990-1999 period, *Agricultural production* industries (both *livestock* and *crops*) and *farmers, except horticulture* were associated with significantly elevated PMRs for HP. (Tables 8-8, 8-9)

### Asthma

- For the 1990-1999 period, *agriculture production, livestock and farm machinery and equipment* were associated with the highest proportionate mortality ratios for asthma. Among the other top five industries with significantly elevated PMRs for asthma were: *child day care services*; *drug stores*; and *health services, not elsewhere classified*. Among the top ten industries associated with significantly elevated PMRs for asthma are two others related to the health care industry: *hospitals* and *offices and clinics of physicians*. (Table 9-1)

- For the 1990-1999 period, half of the 23 occupational groups associated with significantly elevated PMRs for asthma were related to health care and education. (Table 9-2)

- Public health surveillance programs in four states (California, Massachusetts, Michigan, and New Jersey) have identified over 2,500 cases of work-related asthma over a recent seven-year period (1993-1999). About 80% represented asthma caused by occupational exposure, while 20% represented preexisting asthma aggravated by occupational exposure. (Table 9-3)

- Of all the work-related asthma cases from California, Massachusetts, Michigan, and New Jersey associated with various categories of reported putative agents for 1993-1999, 20% were associated with miscellaneous chemicals, 12% with cleaning materials, 11% with mineral and inorganic dust, 10% with indoor air pollutants, and 4% with welding exposures, among others. (Figure 9-1)

## Selected Highlights

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- Based on a recent national survey of the U.S. population in which respondents' current industry was ascertained, *elementary and secondary schools and colleges* was the current industry sector associated with an estimated asthma prevalence among nonsmokers that significantly exceeded the estimated 8% prevalence of asthma among all U.S. adult nonsmokers. (Table 9-8)

- Based on the survey noted above, *teachers, librarians and counselors* was the current occupation associated with estimated asthma prevalence among nonsmokers that significantly exceeded the estimated 8% prevalence of asthma among all U.S. adult nonsmokers. (Table 9-11)

### Chronic Obstructive Pulmonary Disease (COPD)

- Coal mining* led the list of industries with significantly elevated PMRs for COPD in 1999. Two other mining sectors were in the top five industries for COPD mortality, as were *trucking service* and *automotive repair and related services*. (Table 10-1)

- The top five occupations for COPD mortality in 1999 included: *washing, cleaning, and pickling machine operators; helpers, mechanics and repairers; textile cutting machine operators; mining machine operators; and construction trades, not elsewhere classified*. (Table 10-2)

### Respiratory Conditions due to Toxic Agents

- Based on a major survey of private employers, the average annual estimated number of new cases of respiratory conditions due to toxic agents has decreased to approximately 15,000 for 1999 and 2000, down from annual estimates of about 25,000 in the early and mid-1990s. (Table 11-1)

- The major industry groups associated with the highest annual estimated rates of work-related respiratory conditions due to toxic agents in 2000 are *manufacturing* (3.0 per 10,000 full-time

workers), *services* (1.9 per 10,000 full-time workers), and *transportation and public utilities* (1.5 per 10,000 full-time workers). The *transportation equipment* industry, with annual estimated rates of about 10 per 10,000, has consistently ranked in the top three industry sectors during the 1996 to 2000 period. (Tables 11-2, 11-3)

### Respiratory Tuberculosis

- Among the industry sectors associated with significantly elevated tuberculosis mortality in the 1990-1999 period were: health-care industries (*offices and clinics of health practitioners; hospitals; and miscellaneous personal services*); *agricultural production, crops*; and industries with significantly elevated silicosis mortality (*nonmetallic mining and quarrying, except fuel; metal mining; other primary metal industries; coal mining; and construction*). (Tables 12-1, 3-8)

- Among occupations associated with significantly elevated tuberculosis mortality in the 1990-1999 period were agricultural occupations (*farm workers and farmers, except horticulture*), *sailors and deckhands, garbage collectors*, and occupations associated with significantly elevated silicosis mortality (*crushing and grinding machine operators; mining machine operators; construction laborers; and laborers, except construction*). (Tables 12-2, 3-9)

### Lung Cancer

- This edition of the *Work-Related Lung Disease Surveillance Report* is the first of the series to include a section on lung cancer – specifically PMRs by industry and occupation. A variety of industries and occupations associated with significantly elevated lung cancer mortality are listed in this section. (Tables 13-1, 13-2)

### Other Interstitial Pulmonary Diseases

- This edition of the *Work-Related Lung Disease Surveillance Report* is the first of the series to include a section on other interstitial pulmonary



diseases – specifically PMRs by industry and occupation. A variety of industries and occupations associated with significantly elevated other interstitial pulmonary diseases mortality are listed in this section. (Tables 14-1, 14-2)

#### **Various Work-Related Respiratory Conditions**

- Data from the Bureau of Labor Statistics Annual Survey and the Association of Occupational and Environmental Clinics Database, both of which include information on a wide range of work-related respiratory diseases, serve to remind readers that there is much more to work-related lung disease and other occupational respiratory diseases than they might otherwise realize. Data are presented on work-related upper airway disorders (e.g., allergic rhinitis, nasal septum perforation), malignant diseases (e.g., nasal and laryngeal, as well as pulmonary and pleural), infectious diseases (e.g., influenza, pneumonia, and Legionnaires' disease),

and other respiratory diseases (e.g., pneumonitis, interstitial fibrosis, etc.). (Tables 15-1 to 15-5)

#### **Smoking Prevalence by Occupation and Industry**

- This edition of the *Work-Related Lung Disease Surveillance Report* is the first of the series to include a section on smoking prevalence by industry and occupation. Smoking by itself is an important cause of lung disease and smoking can also compound the adverse effects of occupational exposures. Based on recent data from the National Health Interview Survey, estimated smoking prevalences range widely from 12% among *elementary and secondary schools and colleges* workers to over 40% among *repair services* workers. Similar wide-ranging smoking prevalences are seen among occupational groups. (Tables 16-1 to 16-6)



## Selected Limitations

*In addition to the following cautions, readers should see Appendix A for other limitations relating to specific sources of data presented in this report.*

### General

- In this report, every reasonable attempt has been made with the available resources to present comprehensive data on health outcomes and exposures of relevance to work-related lung diseases. The data are drawn from the major existing databases. However, other data may exist which would improve the completeness and reliability of the findings presented in this report. Readers who are aware of other data that should be considered for inclusion in future editions are encouraged to make their suggestions known (see Preface for contact information).

- Statistics in many tables and figures in this report are based on small numbers. Readers are cautioned that these can be unstable. Hence, inferences should be drawn with care, and should take the numerical basis into account.

- A decedent's or survey respondent's usual or current industry and occupation are not always indicative of the industry and occupation associated with the exposure responsible for that individual's work-related disease. Readers are therefore cautioned not to make definitive causative inferences about industries and occupations based solely on the various mortality and morbidity tables presented in this report.

### Disease Data

- Work-related respiratory diseases are typically, though not always, chronic and may also have long latencies. As reflected in median ages at death presented in this report for the pneumoconioses, many affected individuals live to or even beyond average life expectancy. The fact that many affected individuals do not die as a direct result of their work-related respiratory disease led to a decision to consider all causes of death, underlying and

contributing, in the development of the summary tables and figures of mortality data presented in this report. In the absence of national incidence and prevalence morbidity data specific to occupational diseases, the intent is to provide a better assessment of disease occurrence and distribution than would be possible if consideration were restricted to underlying causes of death.

- Certifying physicians typically do not list all of a decedent's diseases on the death certificate. Therefore, even though contributing causes of death are considered, the mortality data presented in this report probably underestimate the total occurrence of pneumoconioses and other diseases.

- As with any analysis based on death certificate data, there is undoubtedly some misclassification of cause of death. A treating physician may not correctly diagnose a particular disease during a patient's life or, as mentioned above, a certifying physician may fail to list a correctly diagnosed disease on the death certificate, particularly if another disease was directly responsible for the decedent's death. In addition, the diagnoses listed on the death certificate are sometimes miscoded.

- Data that depend, either directly or indirectly, on physician reporting or recording of occupational disease diagnoses can be influenced significantly by the physician's ability or willingness to suspect and evaluate a relationship between work and health. These, in turn, are influenced by evolving medical/ scientific information, and by the legal, political, and social environment. Some factors may lead to increased diagnosis and recording/reporting (e.g., the Coal Mine Health and Safety Act of 1969 increasing recognition and recording of coal workers' pneumoconiosis), while other factors may reduce occupational disease recognition or reporting by physicians (e.g., long latency between a work exposure and disease development, or concern about involvement in litigation).

## *Selected Limitations*

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- Byssinosis and asthma lack the characteristic fibrosis and associated radiographic appearance commonly observed in mineral dust pneumoconioses. In addition, advanced stages of asthma and byssinosis may be difficult to distinguish from other chronic obstructive pulmonary diseases, including those due solely to cigarette smoking. For both these reasons, under-diagnosis may be more likely for byssinosis and work-related asthma than for the radiographically apparent pneumoconioses.
- Categorization of lung diseases for which mortality data are presented in this report is limited by the ICD coding system used for the NCHS multiple cause of death data. Also, ICD-8, ICD-9, and ICD-10 disease rubrics differ somewhat for all types of pneumoconioses (see Appendix C). However, the effect of ICD changes is not substantial for most of the diseases under consideration (e.g., there is no indication of any changes in the yearly trend in national silicosis mortality related to changes in the rubrics for the ICD code related to silicosis).
- Prior to ICD-10, there was no discrete ICD code for malignant mesothelioma, a disease strongly associated with exposure to asbestos. ICD-10 coding of national death data in the United States began with 1999 deaths; thus, only one year of malignant mesothelioma data is presented in this report. Past reports in this *Work-Related Lung Disease Surveillance Report* series have presented data on mortality associated with “malignant neoplasm of the pleura,” but that former ICD category lacked specificity and sensitivity for malignant mesothelioma.
- A general assumption of work-relatedness for pneumoconiosis deaths is reasonable for surveillance purposes. However, a very small proportion of pneumoconiosis decedents may have developed their disease as a result of non-occupational (e.g., avocational) exposure to pneumoconiotic agents.
- Although respiratory diseases other than the pneumoconioses can be caused by occupational exposure to respiratory hazards, it is generally unreasonable to assume an automatic occupational etiology because of the strong influence of non-occupational factors. As a result, readers will note that the types of mortality tables presented in this report differ depending on the specific disease. More comprehensive tables are presented for those diseases that are highly specific for occupational etiology, while a more limited approach is used for diseases that are less likely to be caused solely by occupational exposure.
- Individuals affected by chronic diseases with long latency have much more time to change residences prior to death than individuals affected by acute diseases with short latency. Thus, state of residence at death does not necessarily represent the location of a decedent’s occupational exposure, even for a death that results directly from occupational respiratory disease.
- Readers are reminded that only about half the states provide data on usual industry and occupation of decedents which meet the National Center for Health Statistics’ quality criteria for the national death data files used to develop many of the tables presented in this report (see Appendix E).
- Apparent differences in mortality rates may reflect, in part or in whole, geographical as well as temporal changes in employment patterns affecting the number of workers at risk to various respiratory hazards. Denominators used to calculate mortality rates presented in this report are based on general population estimates for the location (e.g., national, state, or county) and for the years in which the deaths occurred. The resulting rates have clear public health significance. However, as suggested by some very high proportionate mortality ratios presented in this report for specific industrial and occupational groups, national and state-specific rates typically represent a dilution of very high mortality among

exposed groups of workers by very low mortality within the general population that is not significantly exposed.

- To comply with current CDC policy, population-based mortality rates for this edition of the *Work-Related Lung Disease Surveillance Report* have been adjusted to the U.S. Year 2000 Standard Population. This is a change from prior editions in which rates were adjusted to the 1940 standard population. Readers are cautioned that rates are not directly comparable with those shown in earlier editions.

- Proportionate mortality ratios (PMRs) reported in this edition of the *Work-Related Lung Disease Surveillance Report* are not directly comparable to those reported in earlier editions because PMRs in the current edition have been adjusted for age (in five-year categories), sex, and race, whereas PMRs in earlier editions were adjusted only for age (in 20-year categories). Readers are also reminded that, because of the lack of smoking information in the national death files, PMRs presented in this report have not been adjusted for smoking.

- Over the period covered by data presented in this report, median ages at death have generally increased for all pneumoconioses. The reader is cautioned to realize that this increase is the result of many factors, only one of which may be a general reduction of disease severity (e.g., due to enhanced diagnostic sensitivity and fewer severe cases). Another possible factor is a reduced number of younger workers at risk due to changing employment patterns. Reduced mortality from other causes of death is undoubtedly another important factor.

- Data from the Coal Workers X-Ray Surveillance Program (CWXSP) have a number of limitations. The program is restricted to currently employed miners and participation rates are generally low. Disease prevalence estimates may be biased due to

selective participation, and missing or inaccurate work history information may affect tenure calculations. Also, radiographic detection of pneumoconiosis is imperfect. Pathologic disease in some individuals may not be detected radiographically and, although rare among working populations, various non-occupational conditions may result in radiographic abnormalities consistent with pneumoconiosis.

- The main usefulness of the Bureau of Labor Statistics (BLS) Annual Survey of Injuries and Illnesses is to assess occupational injuries, because work-attribution of traumatic injuries is typically quite clear to the employers. In contrast, work-related diseases are generally under-recognized and under-reported by employers.

### Exposure Data

- The reported OSHA and MSHA exposure data should be considered provisional and subject to revision. The samples were collected for regulatory compliance purposes, rather than for the surveillance of worker exposures, and therefore may not represent exposures typically experienced by workers. Nonetheless, these data provide the best available national exposure information for industries in the U.S.

- MSHA and OSHA data for similar agents are presented in this report in a parallel format. The reader is cautioned that MSHA and OSHA are separate agencies with separate regulatory jurisdictions over different industries. The number of compliance samples collected by an agency depends upon many factors, including the size and nature of an industry, congressional actions, and regulatory policies.

- To identify pneumoconiotic agents included in the MSHA and OSHA data systems, the following documents were reviewed: *Documentation of TLVs® and BEIs®, 6<sup>th</sup> edition* (ACGIH7); *Occupational Respiratory Diseases* (NIOSH Pub.



## *Selected Limitations*

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No. 86-102); the *Pocket Guide to Chemical Hazards* (NIOSH Pub No. 97-140); and various NIOSH Criteria Documents. The resulting list of pneumoconiotic agents (see Table F-1 of Appendix F) represents those agents associated with the most prevalent types of pneumoconiosis, but is not intended to be a complete listing of all agents that may cause pneumoconiosis.

- Many of the reported geometric mean exposures include samples that could not be quantified with the sampling and analytical methods used. Rather than assume the values of these samples were zero, estimates of the sample results were used to calculate the geometric mean. The methods for estimating the sample result are described in the exposure section, and readers should keep in mind this uncertainty underlying the geometric mean concentrations presented in this report.

- Although OSHA adopted permissible exposure limits (PELs) of 0.1 mg/m<sup>3</sup> for quartz and 0.05 mg/m<sup>3</sup> for cristobalite that were enforced from March 1, 1989 through March 22, 1993, neither OSHA nor MSHA currently has a PEL specific to any form of crystalline silica. Instead, the relevant PELs are for respirable dust containing crystalline silica. These PELs take the form of formulas in which the PEL for respirable dust is reduced as the crystalline silica content of the dust increases. The PEL formulas vary with the agency and the industry, but, with all of them, the effective allowable exposure to quartz is less than or equal to 0.1 mg/m<sup>3</sup> and the effective allowable exposure to cristobalite is less than or equal to 0.05 mg/m<sup>3</sup>, regardless of silica content. Thus, the percentage of OSHA samples exceeding the PEL is greater in the years when the formula PEL is applied (in this report, all years except 1989 through 1993) than it would be if a 0.1 mg/m<sup>3</sup> quartz or 0.05 mg/m<sup>3</sup> cristobalite PEL had been applied for these years. Readers should keep the preceding explanation in mind when considering data presented in this report showing apparent temporal discontinuities in the annual percentage of OSHA silica samples exceeding the PEL.

- The percentage of respirable coal mine dust samples exceeding the PEL was calculated using the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing no more than 5% quartz. Because the quartz content could not be reliably identified for most of the respirable coal mine dust samples, no attempt was made to use the MSHA formula for reducing the PEL when the quartz content exceeded 5%. Thus, as presented in this report, the percentage of respirable coal mine dust samples exceeding the PEL is a lower limit, and the actual percentage exceeding the PEL is very likely higher than reported.

- In addition to samples in which quartz was identified, the respirable quartz data reported in Section 3 include MSHA samples identified as:

- nuisance dust, respirable fraction, less than 1% quartz;

- unlisted particulate, respirable fraction, less than 1% quartz; and

- respirable dust (not analyzed or below detection limit) from metal/nonmetal mines because, although the samples did not indicate quartz exposure, they were collected, in part, to assess exposure to quartz. This provides a more accurate estimate of the geometric mean exposures and the percentage of exposures that exceed a PEL or recommended exposure limit (REL).

- Available exposure data for agents associated with each type of pneumoconiosis are presented in this report following the presentation of mortality data for that same condition. The reader is reminded that the time period over which the exposure data were collected does not necessarily correspond to the time period during which most of the decedents represented in the mortality data acquired their disease. For most pneumoconiosis deaths, there is a latency period of at least several years between first occupational exposure and onset of disease. Subsequent death typically occurs many years after disease onset.

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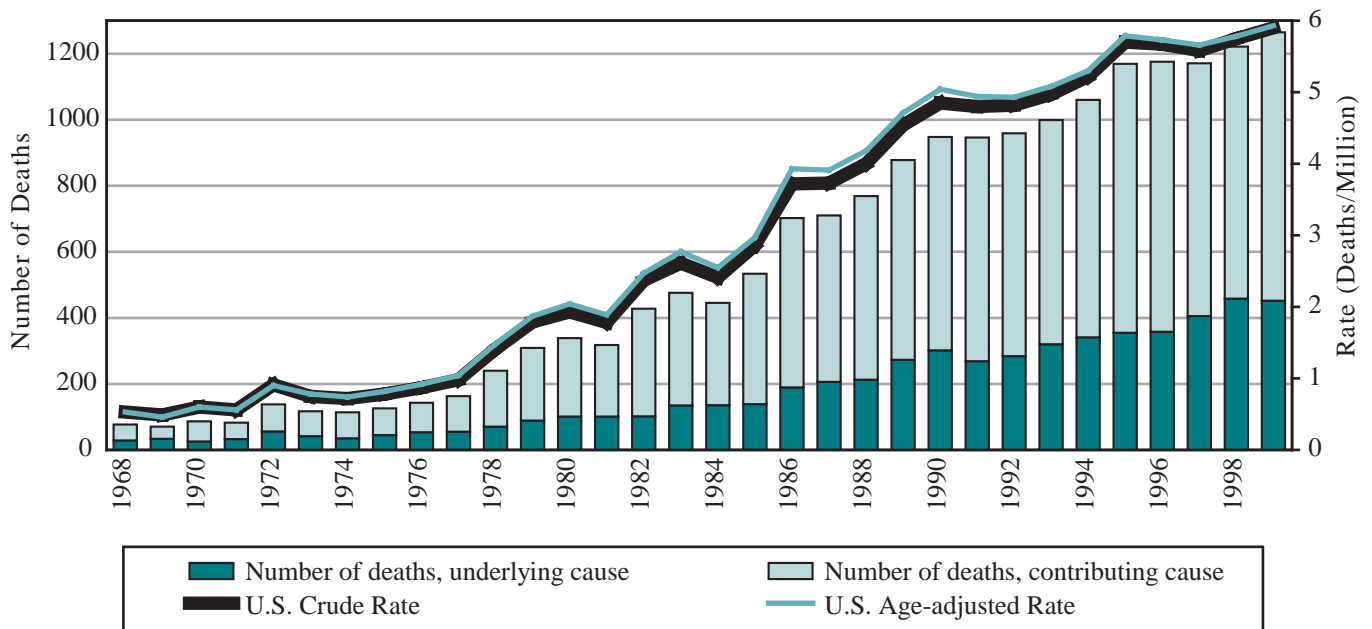
# **Section 1**

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## **Asbestosis and Related Exposures**



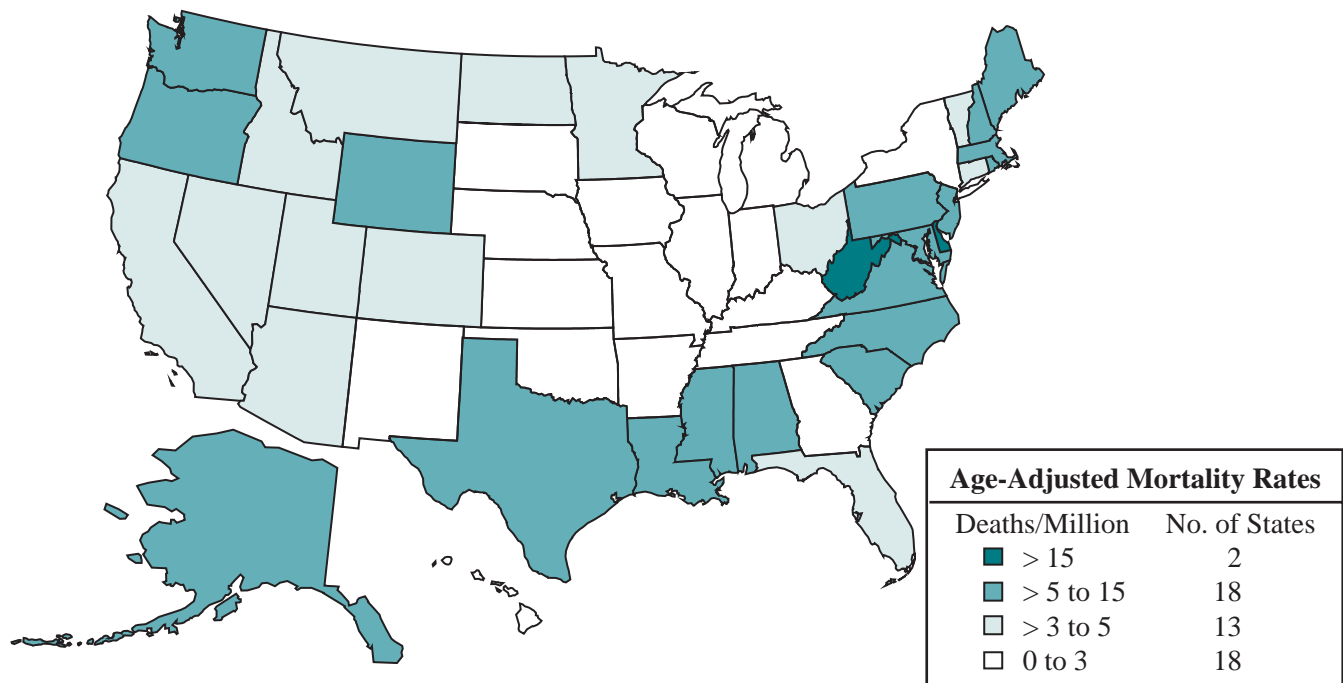
**Figure 1-1. Asbestosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 1-2. Asbestosis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 1-1. Asbestosis: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	948	31.9	901	47	864	78	6	—	—	4	18	142	359	336	89	74.0
1991	946	28.4	908	38	877	63	6	1	—	1	25	114	370	358	77	74.0
1992	959	29.6	923	36	898	57	4	—	—	3	13	124	371	355	93	74.0
1993	999	32.0	969	30	934	58	7	—	—	1	20	110	365	396	107	75.0
1994	1,060	32.2	1,026	34	993	62	5	—	—	2	21	94	410	422	111	75.0
1995	1,169	30.4	1,138	31	1,095	69	5	—	—	3	24	118	411	477	136	75.0
1996	1,176	30.4	1,123	53	1,088	84	4	—	—	3	16	104	428	480	145	75.0
1997	1,171	34.6	1,128	43	1,106	60	5	—	—	—	15	95	363	516	182	77.0
1998	1,221	37.5	1,177	44	1,153	62	6	—	1	1	11	97	394	524	193	76.0
1999	1,265	35.7	1,225	40	1,190	64	11	—	—	—	15	89	390	563	208	77.0
<b>TOTAL</b>	<b>10,914</b>	<b>32.5</b>	<b>10,518</b>	<b>396</b>	<b>10,198</b>	<b>657</b>	<b>59</b>	<b>1</b>	<b>1</b>	<b>18</b>	<b>178</b>	<b>1,087</b>	<b>3,861</b>	<b>4,427</b>	<b>1,341</b>	<b>75.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 1-2. Asbestosis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	4.85	10.23	0.51	7.40	0.17	1.44	0.27
1991	4.80	10.42	0.42	5.86	0.16	1.66	—
1992	4.82	10.63	0.37	5.00	0.32	1.06	—
1993	4.97	11.03	0.32	5.19	0.16	1.82	—
1994	5.22	11.62	0.35	5.38	0.23	1.26	—
1995	5.70	12.74	0.35	6.19	—	1.23	—
1996	5.67	12.26	0.57	7.22	0.15	0.93	—
1997	5.58	12.49	0.44	4.93	0.22	1.13	—
1998	5.75	12.94	0.45	5.09	0.15	1.09	0.28
1999	5.90	13.28	0.42	5.26	0.07	2.33	—
1990-1999	5.32	11.76	0.42	5.70	0.16	1.40	0.04
	Age-Adjusted Mortality Rate						
1990	5.04	12.34	0.43	12.59	0.18	3.43	0.40
1991	4.94	12.31	0.35	10.25	0.19	3.23	—
1992	4.93	12.54	0.30	8.51	0.38	1.94	—
1993	5.08	13.05	0.27	9.37	0.22	3.53	—
1994	5.30	13.57	0.29	8.96	0.31	2.58	—
1995	5.79	14.78	0.28	11.74	—	2.66	—
1996	5.73	14.21	0.46	12.30	0.18	1.89	—
1997	5.66	14.69	0.35	8.59	0.29	2.35	—
1998	5.78	14.89	0.36	9.08	0.19	1.87	0.36
1999	5.93	15.17	0.34	9.97	0.09	3.83	—
1990-1999	5.41	13.76	0.34	10.10	0.20	2.78	0.08

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Asbestosis: Mortality

**Table 1-3. Asbestosis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	930	25	90	25	10	—	1,080
1991	845	30	130	—	10	—	1,015
1992	780	15	50	30	15	—	890
1993	820	20	35	—	—	—	875
1994	710	15	110	—	—	—	835
1995	930	10	55	—	30	—	1,025
1996	715	25	70	—	25	—	835
1997	660	—	40	—	—	—	700
1998	605	45	50	—	10	—	710
1999	585	10	50	—	25	—	670
Total	7,580	195	680	55	125	—	8,635
	Years of Potential Life Lost to Life Expectancy						
1990	9,038	558	771	51	70	14	10,502
1991	9,294	466	664	28	87	—	10,539
1992	9,419	392	546	81	66	—	10,504
1993	9,541	357	529	17	87	—	10,531
1994	10,074	353	657	29	59	—	11,172
1995	11,245	351	637	—	87	—	12,320
1996	10,741	571	840	28	67	—	12,247
1997	10,652	408	582	30	54	—	11,726
1998	11,189	457	593	23	75	9	12,346
1999	11,436	407	592	14	170	—	12,619
Total	102,629	4,320	6,411	301	822	23	114,506

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 1-4. Asbestosis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	21	23	18	23	29	36	43	41	40	44	318
Alaska	1	1	1	2	2	—	2	2	5	2	18
Arizona	6	6	8	12	9	13	13	15	12	21	115
Arkansas	4	6	5	9	5	9	6	6	5	7	62
California	102	94	95	93	101	113	100	104	91	107	1,000
Colorado	4	5	4	7	12	6	13	9	6	7	73
Connecticut	11	14	17	8	7	13	18	13	12	15	128
Delaware	6	14	8	8	12	10	10	7	13	21	109
District of Columbia	—	1	—	1	2	—	1	—	—	—	5
Florida	43	54	52	39	60	67	84	61	65	95	620
Georgia	13	10	18	9	12	11	9	12	15	16	125
Hawaii	3	4	4	1	2	5	1	1	1	1	23
Idaho	4	6	3	2	3	4	4	4	3	7	40
Illinois	18	20	21	24	22	21	17	22	28	25	218
Indiana	8	4	4	4	6	6	7	7	11	7	64
Iowa	4	3	7	3	8	8	4	3	9	5	54
Kansas	2	3	7	9	5	10	6	6	4	4	56
Kentucky	1	5	5	11	5	3	9	12	10	4	65
Louisiana	20	20	14	20	15	18	20	21	27	19	194
Maine	17	8	8	13	12	8	6	8	16	15	111
Maryland	36	27	33	35	44	53	50	43	45	46	412
Massachusetts	36	27	48	25	45	40	39	43	40	37	380
Michigan	17	15	16	16	17	27	21	24	16	30	199
Minnesota	8	6	17	19	17	18	7	12	18	20	142
Mississippi	16	25	25	20	25	34	33	31	25	27	261
Missouri	9	11	14	18	13	11	11	11	13	13	124
Montana	6	2	4	4	4	—	4	2	6	2	34
Nebraska	3	3	2	6	4	4	2	5	1	6	36
Nevada	2	3	1	3	6	5	5	3	7	7	42
New Hampshire	2	1	4	8	6	6	4	7	6	6	50
New Jersey	115	93	80	80	81	93	109	78	93	93	915
New Mexico	2	3	1	3	6	8	2	1	1	4	31
New York	44	37	30	26	34	43	42	46	47	54	403
North Carolina	25	21	25	12	32	29	33	37	50	34	298
North Dakota	—	3	—	2	3	—	3	3	2	4	20
Ohio	27	24	32	29	31	35	43	43	31	45	340
Oklahoma	6	6	5	1	5	5	5	8	9	6	56
Oregon	12	22	22	29	26	18	30	21	33	31	244
Pennsylvania	67	83	100	114	90	114	106	112	99	77	962
Rhode Island	7	1	5	4	6	5	2	4	9	4	47
South Carolina	11	8	13	21	13	17	18	24	23	19	167
South Dakota	—	—	—	—	—	—	3	—	—	1	4
Tennessee	6	8	4	8	13	12	14	18	16	12	111
Texas	91	95	54	72	80	93	87	88	98	80	838
Utah	3	—	4	5	2	4	5	7	—	6	36
Vermont	1	—	3	3	—	2	2	1	2	2	16
Virginia	47	36	43	47	38	44	37	41	55	60	448
Washington	34	50	40	59	60	44	48	56	60	75	526
West Virginia	17	20	28	18	20	32	32	34	28	27	256
Wisconsin	9	11	6	10	9	10	3	13	13	15	99
Wyoming	1	4	1	4	1	2	3	1	2	—	19
<b>TOTAL</b>	<b>948</b>	<b>946</b>	<b>959</b>	<b>999</b>	<b>1,060</b>	<b>1,169</b>	<b>1,176</b>	<b>1,171</b>	<b>1,221</b>	<b>1,265</b>	<b>10,914</b>

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes. SOURCE: National Center for Health Statistics multiple cause of death data.

## Asbestosis: Mortality

**Table 1-5. Asbestosis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths Rank		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
			Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	318	12	9.59	10	9.29	11	4,047	12	12.7	8
Alaska	18	48	4.12	24	10.62	8	242	47	13.4	2
Arizona	115	25	3.54	29	3.48	31	1,358	26	11.8	28
Arkansas	62	33	3.21	32	2.82	35	819	31	13.2	3
California	1,000	1	4.10	25	4.90	21	11,489	1	11.5	38
Colorado	73	30	2.52	40	3.10	33	905	30	12.4	14
Connecticut	128	22	4.86	22	4.67	23	1,548	23	12.1	19
Delaware	109	28	19.29	1	20.63	1	1,311	27	12.0	23
District of Columbia	5	50	1.08	50	1.12	50	57	50	11.3	40
Florida	620	5	5.40	18	4.05	26	7,087	5	11.4	39
Georgia	125	23	2.25	46	2.75	38	1,641	22	13.1	4
Hawaii	23	45	2.49	42	2.89	34	285	45	12.4	14
Idaho	40	40	4.65	23	4.59	24	453	40	11.3	40
Illinois	218	17	2.37	45	2.37	44	2,579	17	11.8	28
Indiana	64	32	1.42	49	1.41	49	778	33	12.2	18
Iowa	54	36	2.44	44	2.02	48	654	35	12.1	19
Kansas	56	34	2.84	35	2.55	42	649	36	11.6	35
Kentucky	65	31	2.15	48	2.13	46	782	32	12.0	23
Louisiana	194	19	5.96	13	6.55	16	2,466	19	12.7	8
Maine	111	26	11.38	6	10.75	7	1,216	28	11.0	44
Maryland	412	8	10.35	7	12.40	6	5,219	8	12.7	8
Massachusetts	380	10	7.76	12	7.47	13	4,165	11	11.0	44
Michigan	199	18	2.69	37	2.79	36	2,575	18	12.9	7
Minnesota	142	21	4.01	27	4.01	27	1,774	21	12.5	13
Mississippi	261	14	12.81	4	12.71	5	3,398	14	13.0	6
Missouri	124	24	2.99	33	2.69	40	1,505	24	12.1	19
Montana	34	43	5.11	21	4.87	22	407	41	12.0	23
Nebraska	36	41	2.87	34	2.46	43	367	43	10.2	51
Nevada	42	39	3.49	31	4.26	25	528	39	12.6	12
New Hampshire	50	37	5.56	17	6.17	18	580	37	11.6	35
New Jersey	915	3	14.39	3	14.31	3	10,230	3	11.2	43
New Mexico	31	44	2.46	43	2.73	39	365	44	11.8	28
New York	403	9	2.79	36	2.79	36	4,752	9	11.8	28
North Carolina	298	13	5.21	20	5.46	19	3,702	13	12.4	14
North Dakota	20	46	4.08	26	3.63	30	271	46	13.5	1
Ohio	340	11	3.91	28	3.82	28	4,446	10	13.1	4
Oklahoma	56	34	2.21	47	2.05	47	668	34	11.9	27
Oregon	244	16	9.94	9	9.32	10	2,604	16	10.7	47
Pennsylvania	962	2	9.97	8	8.53	12	11,316	2	11.8	28
Rhode Island	47	38	5.89	15	5.21	20	546	38	11.6	35
South Carolina	167	20	5.85	16	6.62	15	1,967	20	11.8	28
South Dakota	4	51	0.73	51	0.60	51	45	51	11.3	40
Tennessee	111	26	2.68	39	2.69	40	1,404	25	12.7	8
Texas	838	4	5.92	14	7.11	14	10,131	4	12.1	19
Utah	36	41	2.69	37	3.42	32	380	42	10.6	48
Vermont	16	49	3.50	30	3.73	29	174	49	10.9	46
Virginia	448	7	8.56	11	10.50	9	5,259	7	11.7	34
Washington	526	6	12.50	5	13.49	4	5,490	6	10.4	49
West Virginia	256	15	17.60	2	15.29	2	3,074	15	12.0	23
Wisconsin	99	29	2.50	41	2.35	45	1,215	29	12.3	17
Wyoming	19	47	5.31	19	6.27	17	198	48	10.4	49

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 1-6. Asbestosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
060	Construction	702	24.6
360	Ship and boat building and repairing	171	6.0
192	Industrial and miscellaneous chemicals	124	4.3
400	Railroads	89	3.1
262	Miscellaneous nonmetallic and stone products	75	2.6
901	General government, n.e.c.	71	2.5
270	Blast furnaces, steelworks, rolling and finishing mills	67	2.3
392	Not specified manufacturing industries	61	2.1
460	Electric light and power	55	1.9
842	Elementary and secondary schools	53	1.9
	All other industries	1,286	45.0
	Industry not reported	105	3.7
	<b>TOTAL</b>	<b>2,859</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 1-7. Asbestosis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
585	Plumbers, pipefitters, and steamfitters	238	8.3
019	Managers and administrators, n.e.c.	129	4.5
575	Electricians	125	4.4
567	Carpenters	120	4.2
593	Insulation workers	108	3.8
889	Laborers, except construction	95	3.3
633	Supervisors, production occupations	85	3.0
783	Welders and cutters	78	2.7
453	Janitors and cleaners	74	2.6
804	Truck drivers	66	2.3
	All other occupations	1,639	57.3
	Occupation not reported	102	3.6
	<b>TOTAL</b>	<b>2,859</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Asbestosis: Mortality*

**Table 1-8. Asbestosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
262	Miscellaneous nonmetallic mineral and stone products	75	16.39	13.00	20.70
360	Ship and boat building and repairing	171	15.70	13.48	18.29
502	Lumber and construction materials	20	6.95	4.24	10.75
192	Industrial and miscellaneous chemicals	124	4.78	4.00	5.73
211	Other rubber products, and plastics footwear and belting	40	4.31	3.08	5.87
462	Electric and gas, and other combinations	14	3.05	1.66	5.11
180	Plastics, synthetics, and resins	12	2.80	1.44	4.89
200	Petroleum refining	31	2.74	1.86	3.89
272	Primary aluminum industries	16	2.65	1.52	4.31
460	Electric light and power	55	2.65	2.02	3.48
250	Glass and glass products	30	2.58	1.74	3.68
881	Membership organizations	13	2.47	1.31	4.22
060	Construction	702	2.38	2.21	2.57
282	Fabricated structural metal products	28	2.29	1.52	3.30
420	Water transportation	24	2.28	1.46	3.39
210	Tires and inner tubes	15	2.23	1.25	3.69
400	Railroads	89	1.64	1.33	2.03
270	Blast furnaces, steelworks, rolling and finishing mills	67	1.30	1.02	1.67

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 1-9. Asbestosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

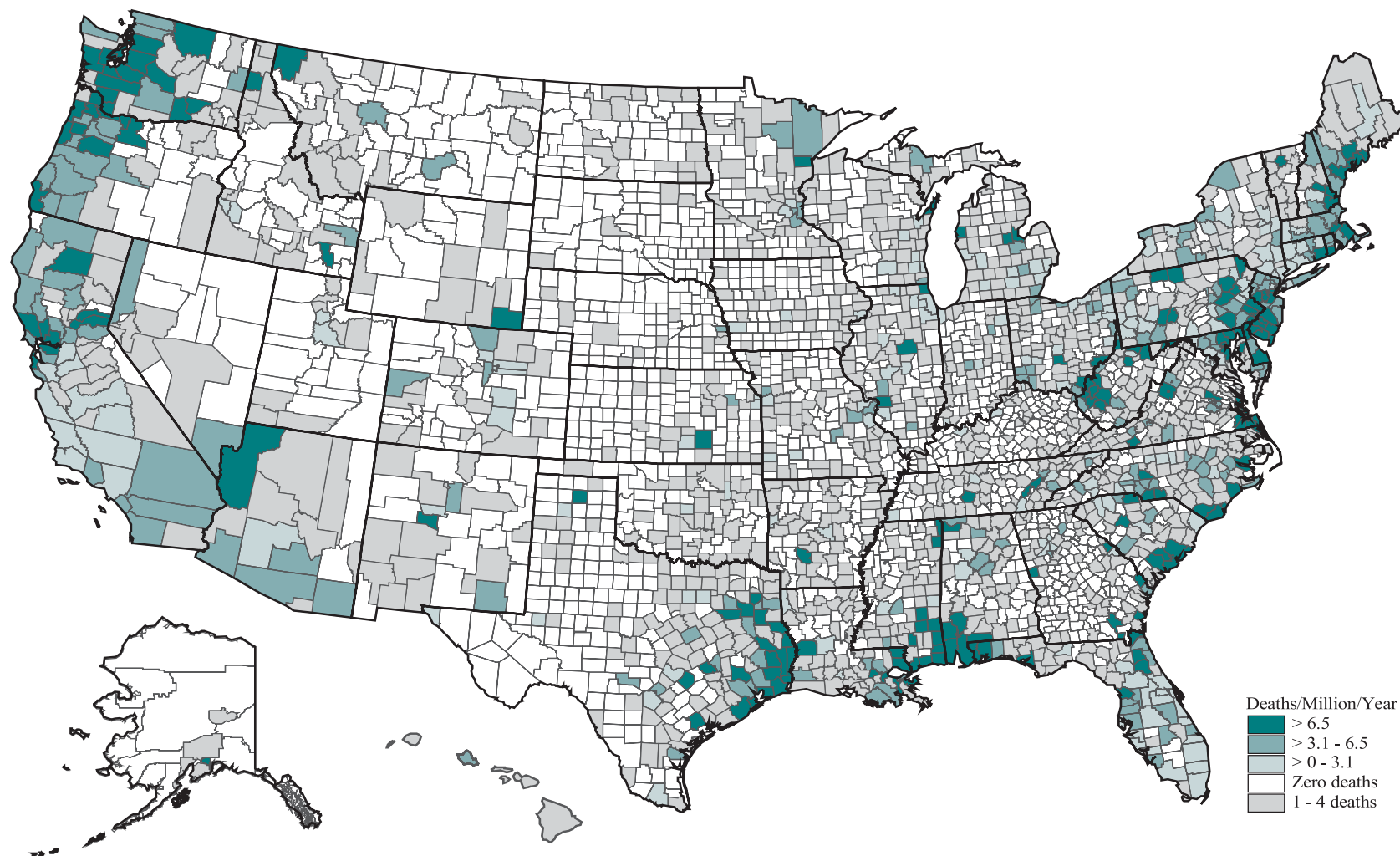
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
593	Insulation workers	108	84.30	69.54	102.28
643	Boilermakers	59	20.26	15.59	26.38
585	Plumbers, pipefitters, and steamfitters	238	9.38	8.25	10.68
058	Marine and naval architects	7	8.25	3.31	17.01
646	Lay-out workers	7	8.21	3.30	16.92
584	Plasterers	9	6.43	2.95	12.20
676	Patternmakers, lay-out workers, and cutters	5	6.34	2.05	14.82
653	Sheet metal workers	53	6.14	4.66	8.12
557	Supervisors: plumbers, pipefitters, and steamfitters	7	5.34	2.14	11.01
224	Chemical technicians	8	4.89	2.11	9.62
757	Separating, filtering, and clarifying machine operators	21	4.77	2.94	7.29
829	Sailors and deckhands	12	4.22	2.18	7.37
534	Heating, air conditioning, and refrigeration mechanics	16	4.13	2.36	6.71
544	Millwrights	34	4.10	2.85	5.73
575	Electricians	125	4.10	3.43	4.91
555	Supervisors, electricians, power transmission installers	9	3.62	1.66	6.87
783	Welders and cutters	78	3.08	2.46	3.87
547	Specified mechanics and repairers, n.e.c.	21	2.55	1.58	3.90
518	Industrial machinery repairers	34	2.22	1.54	3.10
563	Brickmasons and stonemasons	26	2.14	1.40	3.14
856	Industrial truck and tractor equipment operators	17	2.09	1.22	3.35
738	Winding and twisting machine operators	11	2.09	1.04	3.73
849	Crane and tower operators	15	2.05	1.14	3.38
696	Stationary engineers	26	1.88	1.23	2.76
503	Supervisors, mechanics and repairers	17	1.85	1.08	2.96
567	Carpenters	120	1.83	1.52	2.20
507	Bus, truck, and stationary engine mechanics	16	1.80	1.03	2.92
549	Not specified mechanics and repairers	22	1.75	1.09	2.65
777	Miscellaneous machine operators, n.e.c.	38	1.62	1.15	2.22
779	Machine operators, not specified	49	1.53	1.13	2.02
633	Supervisors, production occupations	85	1.34	1.08	1.67
869	Construction laborers	58	1.34	1.03	1.74

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

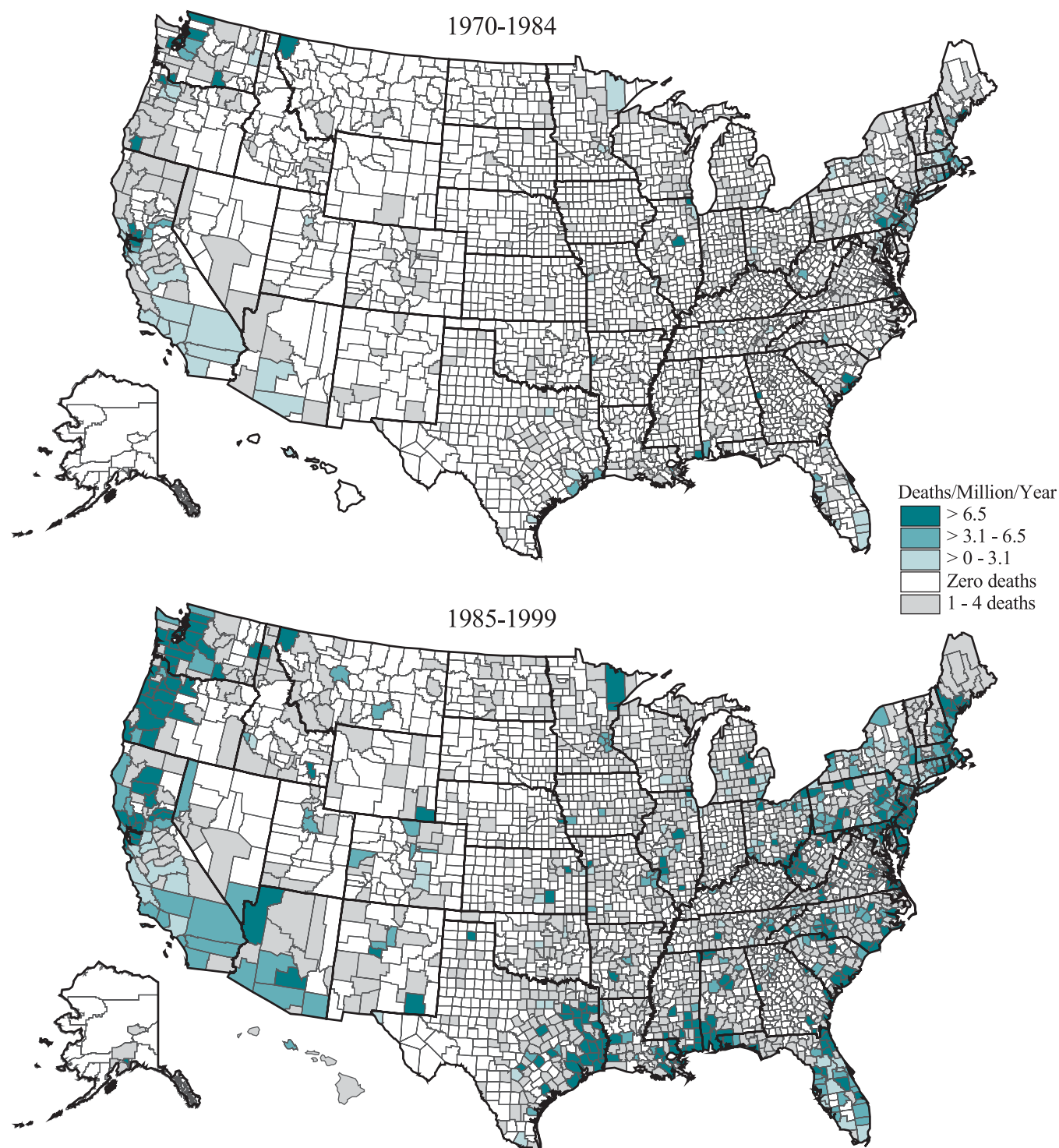
SOURCE: National Center for Health Statistics multiple cause of death data.

12 Figure 1-3. Asbestosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
 SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 1-4. Asbestosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Asbestosis: Mortality

**Table 1-10. Asbestosis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Poquoson City	Virginia	140.6	100.8	13	0.0
Orange County	Texas	127.3	108.3	102	3.9
Jackson County	Mississippi	111.2	81.0	110	3.6
Somerset County	New Jersey	105.7	86.5	263	17.1
George County	Mississippi	98.0	88.1	17	0.0
Lincoln County	Montana	96.2	96.2	19	5.3
Sagadahoc County	Maine	82.2	71.2	28	7.1
Kitsap County	Washington	68.1	57.2	137	2.2
Newport News City	Virginia	62.8	42.3	86	4.7
Greene County	Mississippi	61.6	57.9	7	0.0
Hampton City	Virginia	57.6	39.8	64	1.6
Isle of Wight County	Virginia	56.0	49.2	15	0.0
Camden County	New Jersey	52.6	49.6	291	3.1
Jefferson County	Texas	51.4	56.9	159	2.5
York County	Virginia	49.9	26.3	14	0.0
Gloucester County	New Jersey	48.6	40.0	109	1.8
Mason County	West Virginia	47.8	54.6	16	0.0
Jones County	Mississippi	44.7	50.2	36	2.8
Portsmouth City	Virginia	43.7	47.5	57	0.0
Currituck County	North Carolina	42.9	46.6	8	0.0
Washington County	Alabama	41.9	42.5	8	0.0
Putnam County	West Virginia	41.7	36.0	19	0.0
Suffolk City	Virginia	39.8	39.2	24	4.2
Jasper County	Texas	37.7	44.5	16	0.0
Chesapeake City	Virginia	37.7	25.1	47	4.3
Hardin County	Texas	37.0	36.7	18	0.0
Mobile County	Alabama	36.9	35.3	156	1.9
Newton County	Texas	36.4	39.7	6	0.0
Burleson County	Texas	35.6	43.5	7	0.0
Charleston County	South Carolina	34.3	25.1	89	10.1
Kanawha County	West Virginia	34.2	39.9	100	4.0
Berkeley County	South Carolina	33.8	15.0	22	22.7
Sabine County	Texas	29.6	58.6	7	0.0
Solano County	California	27.3	18.1	73	1.4
Delaware County	Pennsylvania	27.3	32.5	214	1.9
Tyler County	Texas	27.0	37.7	8	0.0
Lincoln County	West Virginia	26.0	28.0	7	0.0
Sussex County	Delaware	25.6	31.0	44	4.5
Galveston County	Texas	25.2	19.9	52	0.0
Jasper County	Mississippi	25.1	31.1	6	16.7
Napa County	California	25.0	30.0	41	0.0
Salem County	New Jersey	24.9	27.4	21	4.8
Clarke County	Alabama	24.0	25.5	8	0.0
Wayne County	Mississippi	23.8	23.2	5	0.0
Benton County	Washington	23.7	18.7	25	4.0
Boone County	West Virginia	22.8	19.3	6	0.0
Gloucester County	Virginia	22.2	22.2	8	0.0
Lincoln County	Maine	22.0	27.6	10	10.0
Effingham County	Georgia	21.8	16.5	5	0.0
Allegany County	Maryland	21.6	29.5	27	7.4
<b>Overall United States</b>		<b>5.0</b>	<b>4.9</b>	<b>14,507</b>	<b>3.6</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
 SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

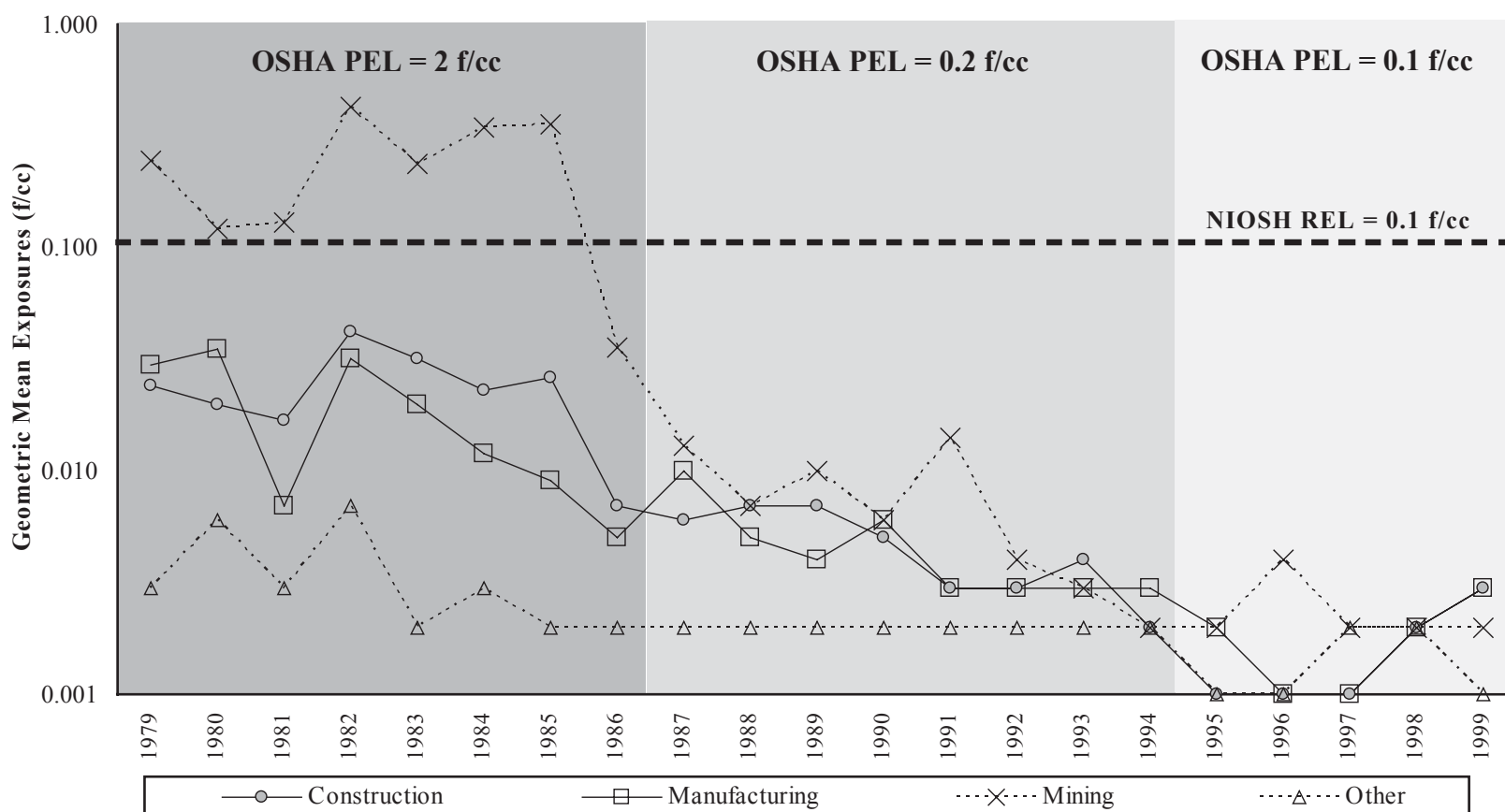
**Table 1-11. Asbestosis: Estimated number of discharges from short-stay nonfederal hospitals, 1970-2000**

Year	Number of Discharges
1970 .....	300
1971 .....	400
1972 .....	100
1973 .....	2,000
1974 .....	1,000
1975 .....	1,000
1976 .....	1,000
1977 .....	1,000
1978 .....	3,000
1979 .....	3,000
1980 .....	4,000
1981 .....	2,000
1982 .....	2,000
1983 .....	4,000
1984 .....	6,000
1985 .....	6,000
1986 .....	6,000
1987 .....	11,000
1988 .....	8,000
1989 .....	8,000
1990 .....	5,000
1991 .....	7,000
1992 .....	11,000
1993 .....	8,000
1994 .....	10,000
1995 .....	9,000
1996 .....	13,000
1997 .....	14,000
1998 .....	15,000
1999 .....	14,000
2000 .....	20,000

NOTE: Number of discharges has been rounded. NCHS recommends that, in statistical comparisons, estimates of less than 5,000 not be used and that estimates of 5,000 to 10,000 be used with caution. See appendices for source description and methods.

SOURCE: National Center for Health Statistics National Hospital Discharge Survey.

**Figure 1-5. Asbestos: Geometric mean exposures by major industry division, MSHA and OSHA samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      f/cc - fibers per cubic centimeter

NOTE: The MSHA PEL is 2 f/cc. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.



**Table 1-12. Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by major industry division, MSHA and OSHA samples, 1979-1999**

Industry Division		OSHA PEL = 2 f/cc								OSHA PEL = 0.2 f/cc								OSHA PEL = 0.1 f/cc				
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Construction SIC 15-17</b>	GM (f/cc)	0.024	0.020	0.017	0.042	0.032	0.023	0.026	0.007	0.006	0.007	0.007	0.005	0.003	0.003	0.004	0.002	0.001	0.001	0.001	0.002	0.003
	No. of samples	97	172	112	168	383	629	474	279	254	254	266	175	214	200	144	82	45	75	52	35	31
	% > PEL	3.1	3.5	1.8	7.7	4.2	5.1	5.3	3.2	4.7	9.1	11.3	9.7	2.8	4.5	1.4	3.7	2.2	0.0	0.0	0.0	12.9
	% > REL	36.1	30.2	22.3	32.1	37.9	32.4	30.4	12.9	9.1	12.2	15.0	13.7	4.7	7.5	4.9	6.1	2.2	0.0	0.0	0.0	12.9
<b>Manufacturing SIC 20-39</b>	GM (f/cc)	0.030	0.035	0.007	0.032	0.020	0.012	0.009	0.005	0.010	0.005	0.004	0.006	0.003	0.003	0.003	0.003	0.002	0.001	0.001	0.002	0.003
	No. of samples	335	313	153	181	372	438	428	278	447	347	292	203	277	142	131	76	108	149	48	33	18
	% > PEL	3.0	7.7	0.7	1.1	4.6	2.3	2.3	2.5	16.6	6.3	6.2	11.8	7.9	0.0	5.3	0.0	0.9	1.3	0.0	0.0	5.6
	% > REL	37.3	41.2	14.4	35.4	27.2	26.3	21.0	10.1	21.5	13.3	10.6	15.8	10.5	1.4	9.9	3.9	0.9	1.3	0.0	0.0	5.6
<b>Mining SIC 10-12, 14</b>	GM (f/cc)	0.244	0.121	0.129	0.430	0.239	0.346	0.359	0.036	0.013	0.007	0.010	0.006	0.014	0.004	0.003	0.002	0.002	0.004	0.002	0.002	0.002
	No. of samples	204	301	276	64	73	23	43	37	16	53	29	46	34	28	14	157	77	28	7	3	2
	% > PEL	10.8	5.6	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	2.9	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	% > REL	70.6	60.8	60.9	90.6	78.1	91.3	86.0	48.6	12.5	18.9	20.7	19.6	32.4	7.1	7.1	0.6	0.0	10.7	0.0	0.0	0.0
<b>Other SIC 1-9, 13, 40-99</b>	GM (f/cc)	0.003	0.006	0.003	0.007	0.002	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.001	0.002	0.002	0.001
	No. of samples	94	124	68	51	469	834	732	505	814	509	625	472	462	285	231	214	144	166	136	93	71
	% > PEL	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	1.0	0.6	0.5	0.2	0.0	0.0	0.0	0.0	0.7	0.6	0.0	0.0	0.0
	% > REL	7.4	13.7	2.9	9.8	1.5	2.6	2.3	1.0	1.4	1.8	1.0	0.6	0.4	1.1	1.3	0.5	0.7	0.6	0.0	0.0	0.0

SIC - Standard Industrial Classification      PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      f/cc - fibers per cubic centimeter

NOTE: The MSHA PEL is 2 f/cc. The NIOSH REL is 0.1 f/cc. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

## *Asbestosis: Asbestos Exposure*

**Table 1-13. Asbestos: Number of samples, geometric mean exposures, and percent exceeding designated occupational exposure limits by industries with elevated asbestosis mortality, MSHA and OSHA samples, 1990-1999**

Asbestosis Mortality, Selected States and Years, 1990-1999				Number of Samples	GM (f/cc)	% > PEL	% > REL
CIC	Industries with elevated PMRs and most frequently recorded on death certificates	Number of Deaths	PMR				
262	Miscellaneous nonmetallic mineral and stone products	75	16.39	115	0.031	26.1	40.9
360	Ship and boat building and repairing	171	15.70	21	0.002	0.0	9.5
192	Industrial and miscellaneous chemicals	124	4.78	19	0.003	0.0	5.3
211	Other rubber products, and plastics footwear and belting	40	4.31	28	0.002	0.0	0.0
200	Petroleum refining	31	2.74	11	0.001	0.0	0.0
460	Electric light and power	55	2.65	41	0.002	0.0	0.0
250	Glass and glass products	30	2.58	8	0.004	0.0	0.0
060	Construction	702	2.38	1,051	0.003	4.0	6.3
400	Railroads	89	1.64	9	0.001	0.0	0.0
270	Blast furnaces, steelworks, rolling and finishing mills	67	1.30	26	0.002	0.0	0.0
	All other industries	1,370		3,561	0.002	1.0	2.1
	<b>TOTAL</b>			<b>4,890</b>	<b>0.002</b>	<b>2.2</b>	<b>3.9</b>

CIC - Census Industry Code      PEL - permissible exposure limit      REL - recommended exposure limit      PMR - proportionate mortality ratio  
 GM - geometric mean      f/cc - fibers per cubic centimeter  
 NOTE: The MSHA PEL is 2 f/cc. The OSHA PEL is 2 f/cc before July 21, 1986, 0.2 f/cc from July 21, 1986 to October 10, 1994, and 0.1 f/cc after October 10, 1994. The NIOSH REL is 0.1 f/cc. See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states (and years) for which usual industry has been reported.  
 SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA): Integrated Management Information System. National Center for Health Statistics multiple cause of death data.

**Table 1-14 (page 1 of 2). Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA metal/nonmetal district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal District	All years		1979 - 1986				1987 - 1994				1995 - 1999			
	No. of Samples	GM (f/cc)	No. of Samples	GM (f/cc)	% > PEL	% > REL	No. of Samples	GM (f/cc)	% > PEL	% > REL	No. of Samples	GM (f/cc)	% > PEL	% > REL
<b>Northeast</b>	<b>318</b>	<b>0.159</b>	<b>240</b>	<b>0.430</b>	<b>6.3</b>	<b>85.0</b>	<b>70</b>	<b>0.009</b>	<b>7.1</b>	<b>21.4</b>	<b>8</b>	<b>0.002</b>	<b>0.0</b>	<b>0.0</b>
Connecticut	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Delaware	0	—	0	—	—	—	0	—	—	—	0	—	—	—
District of Columbia	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Maine	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Maryland	45	0.021	26	0.119	0.0	53.8	18	0.002	0.0	0.0	1	0.002	0.0	0.0
Massachusetts	1	0.002	0	—	—	—	1	0.002	0.0	0.0	0	—	—	—
New Hampshire	0	—	0	—	—	—	0	—	—	—	0	—	—	—
New Jersey	14	0.191	14	0.191	0.0	78.6	0	—	—	—	0	—	—	—
New York	40	0.187	34	0.439	0.0	91.2	6	0.002	0.0	0.0	0	—	—	—
Pennsylvania	19	0.001	0	—	—	—	12	0.002	0.0	0.0	7	0.002	0.0	0.0
Rhode Island	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Vermont	176	0.560	154	0.599	9.7	89.6	22	0.350	22.7	68.2	0	—	—	—
Virginia	20	0.031	12	0.239	0.0	83.3	8	0.002	0.0	0.0	0	—	—	—
West Virginia	3	0.002	0	—	—	—	3	0.002	0.0	0.0	0	—	—	—
<b>Southeast</b>	<b>91</b>	<b>0.036</b>	<b>71</b>	<b>0.086</b>	<b>5.6</b>	<b>42.3</b>	<b>14</b>	<b>0.002</b>	<b>0.0</b>	<b>0.0</b>	<b>6</b>	<b>0.002</b>	<b>0.0</b>	<b>0.0</b>
Alabama	1	0.020	0	—	—	—	1	0.020	0.0	0.0	0	—	—	—
Florida	6	0.013	6	0.013	0.0	33.3	0	—	—	—	0	—	—	—
Georgia	8	0.124	4	10.3	100.0	100.0	2	0.002	0.0	0.0	2	0.002	0.0	0.0
Kentucky	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Mississippi	0	—	0	—	—	—	0	—	—	—	0	—	—	—
North Carolina	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Puerto Rico	0	—	0	—	—	—	0	—	—	—	0	—	—	—
South Carolina	76	0.035	61	0.076	0.0	39.3	11	0.002	0.0	0.0	4	0.002	0.0	0.0
Tennessee	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Virgin Islands	0	—	0	—	—	—	0	—	—	—	0	—	—	—
<b>North Central</b>	<b>354</b>	<b>0.007</b>	<b>119</b>	<b>0.075</b>	<b>0.8</b>	<b>45.4</b>	<b>172</b>	<b>0.002</b>	<b>0.0</b>	<b>1.7</b>	<b>63</b>	<b>0.002</b>	<b>0.0</b>	<b>0.0</b>
Illinois	11	0.038	9	0.079	0.0	55.6	2	0.002	0.0	0.0	0	—	—	—
Indiana	1	0.010	1	0.010	0.0	0.0	0	—	—	—	0	—	—	—
Iowa	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Michigan	176	0.002	2	0.002	0.0	0.0	134	0.002	0.0	0.0	40	0.001	0.0	0.0
Minnesota	161	0.027	106	0.083	0.9	46.2	34	0.005	0.0	8.8	21	0.001	0.0	0.0
Ohio	1	0.010	1	0.010	0.0	0.0	0	—	—	—	0	—	—	—
Wisconsin	4	0.002	0	—	—	—	2	0.002	0.0	0.0	2	0.004	0.0	0.0

See footnotes at end of table.

**Table 1-14 (page 2 of 2). Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA metal/nonmetal district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal District	All years		1979 - 1986				1987 - 1994				1995 - 1999			
	No. of Samples	GM (f/cc)	No. of Samples	GM (f/cc)	% > PEL	% > REL	No. of Samples	GM (f/cc)	% > PEL	% > REL	No. of Samples	GM (f/cc)	% > PEL	% > REL
<b>South Central</b>	<b>304</b>	<b>0.017</b>	<b>231</b>	<b>0.035</b>	<b>1.3</b>	<b>39.0</b>	<b>47</b>	<b>0.002</b>	<b>0.0</b>	<b>2.1</b>	<b>26</b>	<b>0.001</b>	<b>0.0</b>	<b>0.0</b>
Arkansas	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Louisiana	45	0.002	0	—	—	—	45	0.002	0.0	2.2	0	—	—	—
Missouri	0	—	0	—	—	—	0	—	—	—	0	—	—	—
New Mexico	112	0.042	112	0.042	1.8	42.9	0	—	—	—	0	—	—	—
Oklahoma	27	0.033	27	0.033	0.0	40.7	0	—	—	—	0	—	—	—
Texas	120	0.014	92	0.028	1.1	33.7	2	0.002	0.0	0.0	26	0.001	0.0	0.0
<b>Rocky Mountain</b>	<b>254</b>	<b>0.211</b>	<b>225</b>	<b>0.324</b>	<b>4.9</b>	<b>87.1</b>	<b>29</b>	<b>0.008</b>	<b>0.0</b>	<b>20.7</b>	<b>0</b>	<b>0.000</b>	<b>0.0</b>	<b>0.0</b>
Arizona	89	0.525	89	0.525	11.2	92.1	0	—	—	—	0	—	—	—
Colorado	35	0.055	31	0.088	0.0	64.5	4	0.002	0.0	0.0	0	—	—	—
Kansas	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Montana	74	0.278	62	0.376	1.6	91.9	12	0.058	0.0	50.0	0	—	—	—
Nebraska	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Nevada	6	0.002	0	—	—	—	6	0.002	0.0	0.0	0	—	—	—
North Dakota	0	—	0	—	—	—	0	—	—	—	0	—	—	—
South Dakota	47	0.157	41	0.287	0.0	90.2	6	0.003	0.0	0.0	0	—	—	—
Utah	3	0.005	2	0.010	0.0	0.0	1	0.002	0.0	0.0	0	—	—	—
Wyoming	0	—	0	—	—	—	0	—	—	—	0	—	—	—
<b>Western</b>	<b>194</b>	<b>0.158</b>	<b>135</b>	<b>0.389</b>	<b>14.8</b>	<b>83.0</b>	<b>45</b>	<b>0.025</b>	<b>0.0</b>	<b>37.8</b>	<b>14</b>	<b>0.010</b>	<b>0.0</b>	<b>21.4</b>
Alaska	0	—	0	—	—	—	0	—	—	—	0	—	—	—
California	185	0.195	128	0.515	15.6	87.5	43	0.029	0.0	39.5	14	0.010	0.0	21.4
Hawaii	1	0.002	0	—	—	—	1	0.002	0.0	0.0	0	—	—	—
Idaho	1	0.002	0	—	—	—	1	0.002	0.0	0.0	0	—	—	—
Oregon	0	—	0	—	—	—	0	—	—	—	0	—	—	—
Washington	7	0.002	7	0.002	0.0	0.0	0	—	—	—	0	—	—	—
<b>TOTAL</b>	<b>1,515</b>	<b>0.046</b>	<b>1,021</b>	<b>0.165</b>	<b>5.3</b>	<b>67.2</b>	<b>377</b>	<b>0.004</b>	<b>1.3</b>	<b>11.1</b>	<b>117</b>	<b>0.002</b>	<b>0.0</b>	<b>2.6</b>

— indicates incalculable field

PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      f/cc - fibers per cubic centimeter

NOTE: The MSHA PEL is 2 f/cc. The NIOSH REL is 0.1 f/cc. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data.

**Table 1-15 (page 1 of 3). Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 – 1986 OSHA PEL=2 f/cc				1987 – 1994 OSHA PEL=0.2 f/cc				1995 – 1999 OSHA PEL=0.1 f/cc NIOSH REL=0.1 f/cc		
	Number of Samples	GM (f/cc)	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL
<b>Region 1</b>	<b>1,430</b>	<b>0.006</b>	<b>836</b>	<b>0.014</b>	<b>5.0</b>	<b>27.0</b>	<b>500</b>	<b>0.002</b>	<b>4.2</b>	<b>5.6</b>	<b>94</b>	<b>0.001</b>	<b>0.0</b>
Connecticut	619	0.003	319	0.005	1.3	16.0	254	0.001	0.0	0.4	46	0.001	0.0
Maine	103	0.008	83	0.010	2.4	16.9	20	0.004	20.0	20.0	0	–	–
Massachusetts	481	0.014	285	0.032	10.2	38.6	172	0.005	7.0	10.5	24	0.001	0.0
New Hampshire	156	0.007	89	0.021	1.1	37.1	44	0.002	2.3	2.3	23	0.001	0.0
Rhode Island	70	0.033	60	0.032	10.0	30.0	9	0.062	44.4	44.4	1	0.002	0.0
Vermont	1	0.002	0	–	–	–	1	0.002	0.0	0.0	0	–	–
<b>Region 2</b>	<b>2,891</b>	<b>0.004</b>	<b>1,279</b>	<b>0.006</b>	<b>1.5</b>	<b>14.9</b>	<b>1,359</b>	<b>0.003</b>	<b>4.3</b>	<b>6.7</b>	<b>253</b>	<b>0.002</b>	<b>2.4</b>
New Jersey	700	0.008	384	0.010	2.9	20.8	288	0.006	14.9	20.8	28	0.001	0.0
New York	2,061	0.003	861	0.005	0.9	12.5	991	0.003	1.2	2.6	209	0.002	2.9
Puerto Rico	109	0.002	29	0.003	0.0	6.9	64	0.002	1.6	4.7	16	0.001	0.0
Virgin Islands	21	0.005	5	0.002	0.0	0.0	16	0.007	12.5	12.5	0	–	–
<b>Region 3</b>	<b>1,773</b>	<b>0.010</b>	<b>1,043</b>	<b>0.013</b>	<b>3.4</b>	<b>25.8</b>	<b>659</b>	<b>0.007</b>	<b>14.0</b>	<b>18.4</b>	<b>71</b>	<b>0.001</b>	<b>0.0</b>
Delaware	22	0.022	20	0.029	0.0	40.0	2	0.002	0.0	0.0	0	–	–
District of Columbia	131	0.003	114	0.003	0.9	10.5	17	0.001	0.0	0.0	0	–	–
Maryland	129	0.003	71	0.003	0.0	4.2	31	0.008	16.1	19.4	27	0.001	0.0
Pennsylvania	1,014	0.008	587	0.013	3.4	25.7	394	0.004	5.6	7.9	33	0.001	0.0
Virginia	362	0.041	163	0.060	7.4	45.4	198	0.031	29.8	39.4	1	0.0003	0.0
West Virginia	115	0.010	88	0.012	2.3	23.9	17	0.015	35.3	35.3	10	0.001	0.0
<b>Region 4</b>	<b>2,128</b>	<b>0.004</b>	<b>714</b>	<b>0.014</b>	<b>4.1</b>	<b>24.6</b>	<b>1,085</b>	<b>0.003</b>	<b>2.0</b>	<b>4.2</b>	<b>331</b>	<b>0.002</b>	<b>0.9</b>
Alabama	187	0.009	104	0.020	6.7	28.8	74	0.003	0.0	0.0	9	0.008	11.1
Florida	269	0.003	93	0.008	3.2	14.0	161	0.002	1.9	3.7	15	0.001	0.0
Georgia	336	0.009	217	0.015	7.4	25.3	112	0.003	3.6	8.9	7	0.001	0.0
Kentucky	351	0.003	104	0.004	0.0	5.8	194	0.003	0.5	2.6	55	0.002	0.0
Mississippi	138	0.005	33	0.099	3.0	63.6	87	0.002	0.0	0.0	18	0.001	0.0
North Carolina	472	0.005	87	0.055	2.3	47.1	230	0.005	4.3	7.4	155	0.001	0.0
South Carolina	188	0.002	45	0.008	0.0	20.0	114	0.001	2.6	2.6	29	0.001	0.0
Tennessee	187	0.004	31	0.003	0.0	3.2	113	0.004	0.9	4.4	43	0.003	4.7

See footnotes at end of table.

**Table 1-15 (page 2 of 3). Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 – 1986 PEL=2 f/cc				1987 – 1994 PEL=0.2 f/cc				1995 – 1999 OSHA PEL=0.1 f/cc NIOSH REL=0.1 f/cc		
	Number of Samples	GM (f/cc)	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL
<b>Region 5</b>	<b>3,255</b>	<b>0.004</b>	<b>1,301</b>	<b>0.010</b>	<b>1.9</b>	<b>19.4</b>	<b>1,722</b>	<b>0.003</b>	<b>2.0</b>	<b>3.4</b>	<b>232</b>	<b>0.001</b>	<b>0.4</b>
Illinois	835	0.003	352	0.007	0.0	12.8	434	0.002	0.0	0.7	49	0.001	0.0
Indiana	440	0.006	213	0.033	4.2	41.8	152	0.001	0.0	0.7	75	0.001	0.0
Michigan	453	0.002	36	0.001	0.0	0.0	376	0.002	1.9	2.7	41	0.003	2.4
Minnesota	61	0.003	14	0.010	14.3	21.4	47	0.002	0.0	2.1	0	–	–
Ohio	863	0.005	381	0.009	0.8	18.4	435	0.004	5.5	7.8	47	0.001	0.0
Wisconsin	603	0.006	305	0.012	3.6	15.1	278	0.003	1.4	3.2	20	0.001	0.0
<b>Region 6</b>	<b>1,315</b>	<b>0.005</b>	<b>695</b>	<b>0.007</b>	<b>1.7</b>	<b>15.5</b>	<b>557</b>	<b>0.004</b>	<b>5.6</b>	<b>9.9</b>	<b>63</b>	<b>0.001</b>	<b>0.0</b>
Arkansas	253	0.005	100	0.005	4.0	13.0	143	0.006	7.0	14.0	10	0.001	0.0
Louisiana	121	0.005	69	0.006	1.4	8.7	52	0.003	1.9	1.9	0	–	–
New Mexico	30	0.002	2	0.002	0.0	0.0	27	0.002	0.0	0.0	1	0.001	0.0
Oklahoma	166	0.006	108	0.008	4.6	15.7	49	0.003	4.1	6.1	9	0.004	0.0
Texas	745	0.005	416	0.008	0.5	17.3	286	0.004	6.3	10.8	43	0.001	0.0
<b>Region 7</b>	<b>1,304</b>	<b>0.004</b>	<b>910</b>	<b>0.006</b>	<b>1.9</b>	<b>10.9</b>	<b>373</b>	<b>0.002</b>	<b>1.1</b>	<b>1.1</b>	<b>21</b>	<b>0.001</b>	<b>0.0</b>
Iowa	339	0.004	230	0.006	2.6	14.8	106	0.002	0.0	0.0	3	0.001	0.0
Kansas	247	0.010	177	0.018	2.8	19.2	64	0.003	3.1	3.1	6	0.001	0.0
Missouri	548	0.003	416	0.004	1.4	6.0	126	0.002	1.6	1.6	6	0.001	0.0
Nebraska	170	0.003	87	0.004	0.0	6.9	77	0.002	0.0	0.0	6	0.001	0.0
<b>Region 8</b>	<b>628</b>	<b>0.005</b>	<b>445</b>	<b>0.007</b>	<b>0.9</b>	<b>15.1</b>	<b>158</b>	<b>0.003</b>	<b>2.5</b>	<b>3.2</b>	<b>25</b>	<b>0.001</b>	<b>0.0</b>
Colorado	320	0.005	226	0.005	0.4	14.2	82	0.004	4.9	6.1	12	0.001	0.0
Montana	164	0.009	134	0.012	2.2	21.6	27	0.003	0.0	0.0	3	0.001	0.0
North Dakota	16	0.003	9	0.006	0.0	11.1	0	–	–	–	7	0.001	0.0
South Dakota	66	0.002	32	0.003	0.0	6.3	33	0.001	0.0	0.0	1	0.001	0.0
Utah	35	0.012	22	0.023	0.0	13.6	12	0.005	0.0	0.0	1	0.001	0.0
Wyoming	27	0.003	22	0.003	0.0	0.0	4	0.010	0.0	0.0	1	0.001	0.0

See footnotes at end of table.



**Table 1-15 (page 3 of 3). Asbestos: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 – 1986 PEL=2 f/cc				1987 – 1994 PEL=0.2 f/cc				1995 – 1999 OSHA PEL=0.1 f/cc NIOSH REL=0.1 f/cc		
	Number of Samples	GM (f/cc)	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL	% > REL	Number of Samples	GM (f/cc)	% > PEL
<b>Region 9</b>	<b>715</b>	<b>0.002</b>	<b>177</b>	<b>0.003</b>	<b>0.6</b>	<b>9.0</b>	<b>471</b>	<b>0.002</b>	<b>3.2</b>	<b>6.2</b>	<b>67</b>	<b>0.004</b>	<b>0.0</b>
American Samoa	0	–	0	–	–	–	0	–	–	–	0	–	–
Arizona	103	0.004	45	0.002	0.0	8.9	56	0.006	1.8	3.6	2	0.043	0.0
California	450	0.003	71	0.004	1.4	12.7	320	0.002	3.4	7.2	59	0.004	0.0
Guam	3	0.000	3	0.0003	0.0	0.0	0	–	–	–	0	–	–
Hawaii	50	0.001	29	0.001	0.0	3.4	19	0.001	0.0	0.0	2	0.001	0.0
Nevada	109	0.002	29	0.004	0.0	6.9	76	0.001	3.9	5.3	4	0.003	0.0
<b>Region 10</b>	<b>568</b>	<b>0.005</b>	<b>289</b>	<b>0.007</b>	<b>2.4</b>	<b>16.3</b>	<b>232</b>	<b>0.003</b>	<b>0.9</b>	<b>3.4</b>	<b>47</b>	<b>0.001</b>	<b>2.1</b>
Alaska	220	0.003	149	0.003	1.3	2.7	50	0.004	2.0	2.0	21	0.002	0.0
Idaho	95	0.003	27	0.013	0.0	22.2	66	0.002	0.0	0.0	2	0.001	0.0
Oregon	154	0.011	107	0.013	2.8	29.9	41	0.010	0.0	9.8	6	0.003	16.7
Washington	99	0.003	6	0.385	33.3	83.3	75	0.003	1.3	4.0	18	0.001	0.0
<b>TOTAL</b>	<b>16,007</b>	<b>0.005</b>	<b>7,689</b>	<b>0.009</b>	<b>2.5</b>	<b>18.9</b>	<b>7,116</b>	<b>0.003</b>	<b>4.0</b>	<b>6.3</b>	<b>1,204</b>	<b>0.001</b>	<b>0.9</b>

– indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

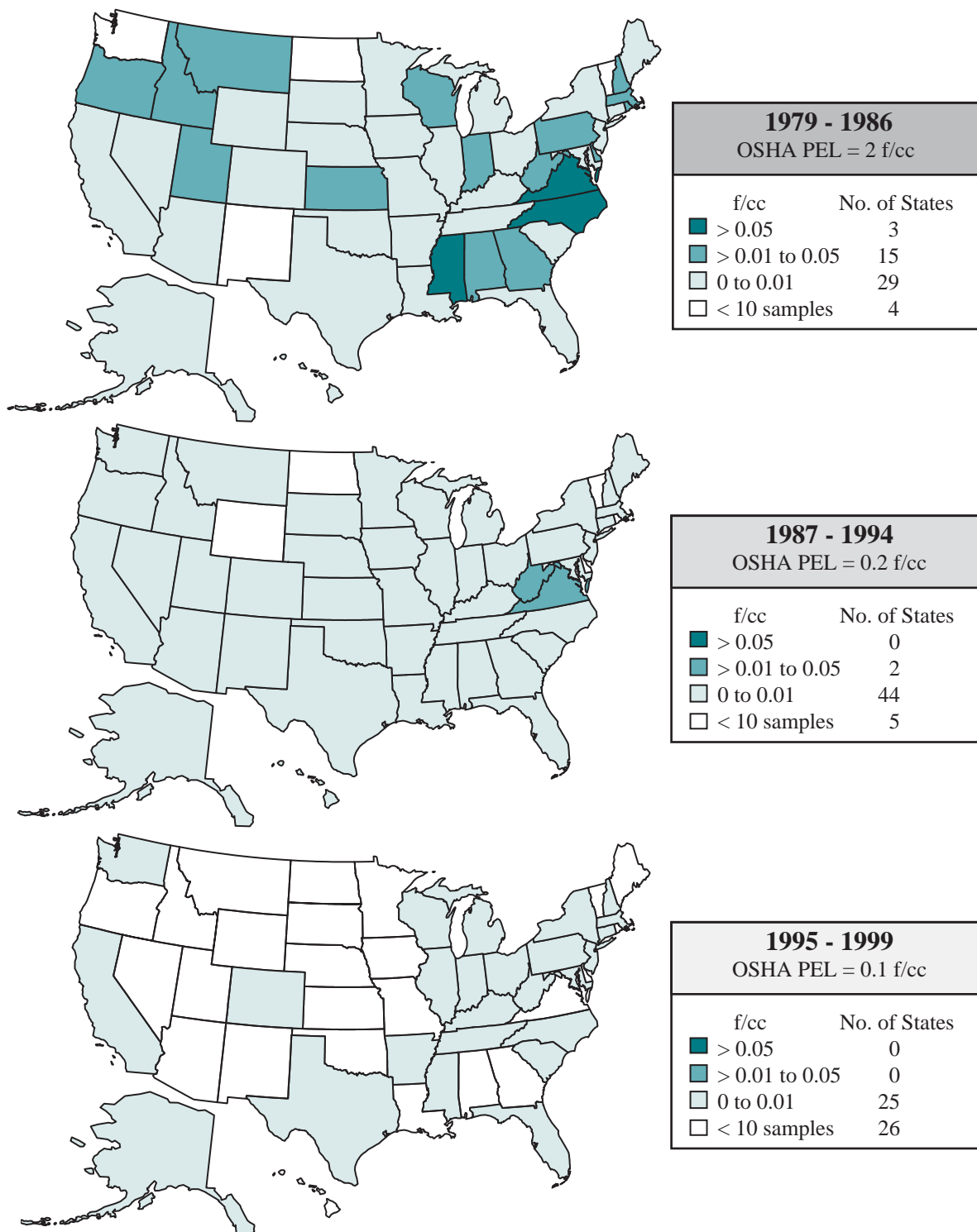
GM - geometric mean

f/cc - fibers per cubic centimeter

NOTE: The NIOSH REL is 0.1 f/cc. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Figure 1-6. Asbestos: Geometric mean exposures by state, OSHA samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      f/cc - fibers per cubic centimeter

NOTE: The NIOSH REL is 0.1 f/cc. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

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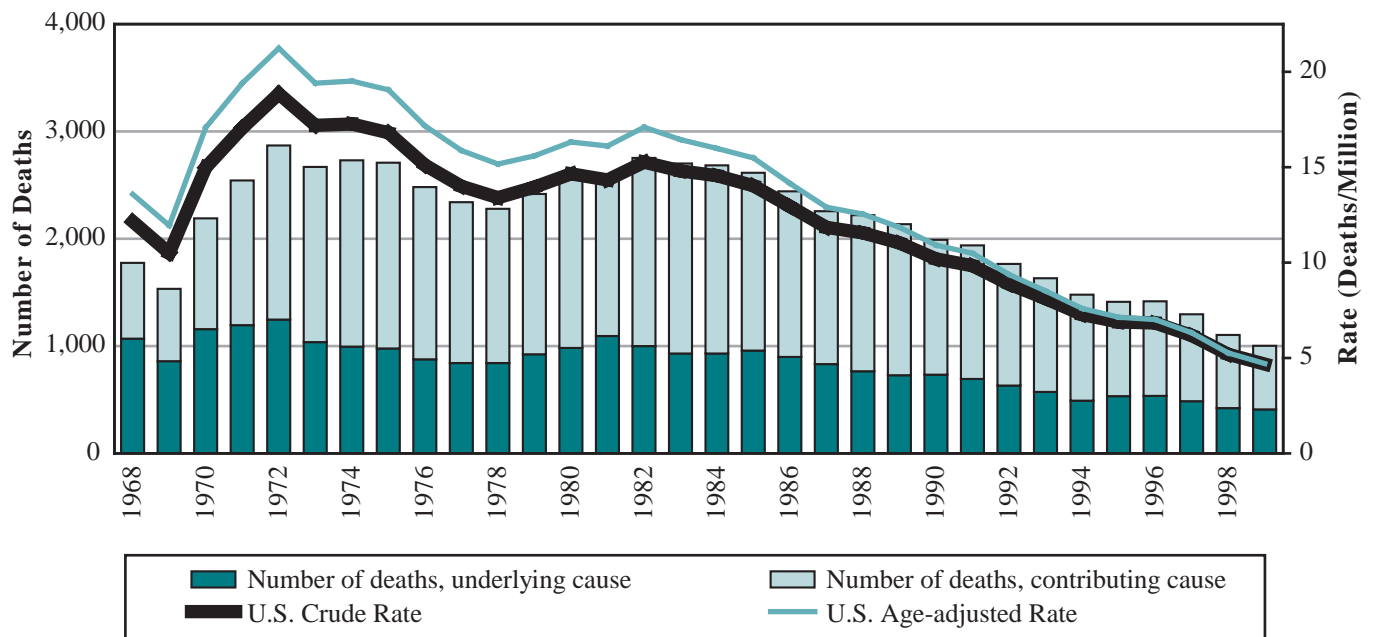
## **Section 2**

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# **Coal Workers' Pneumoconiosis and Related Exposures**



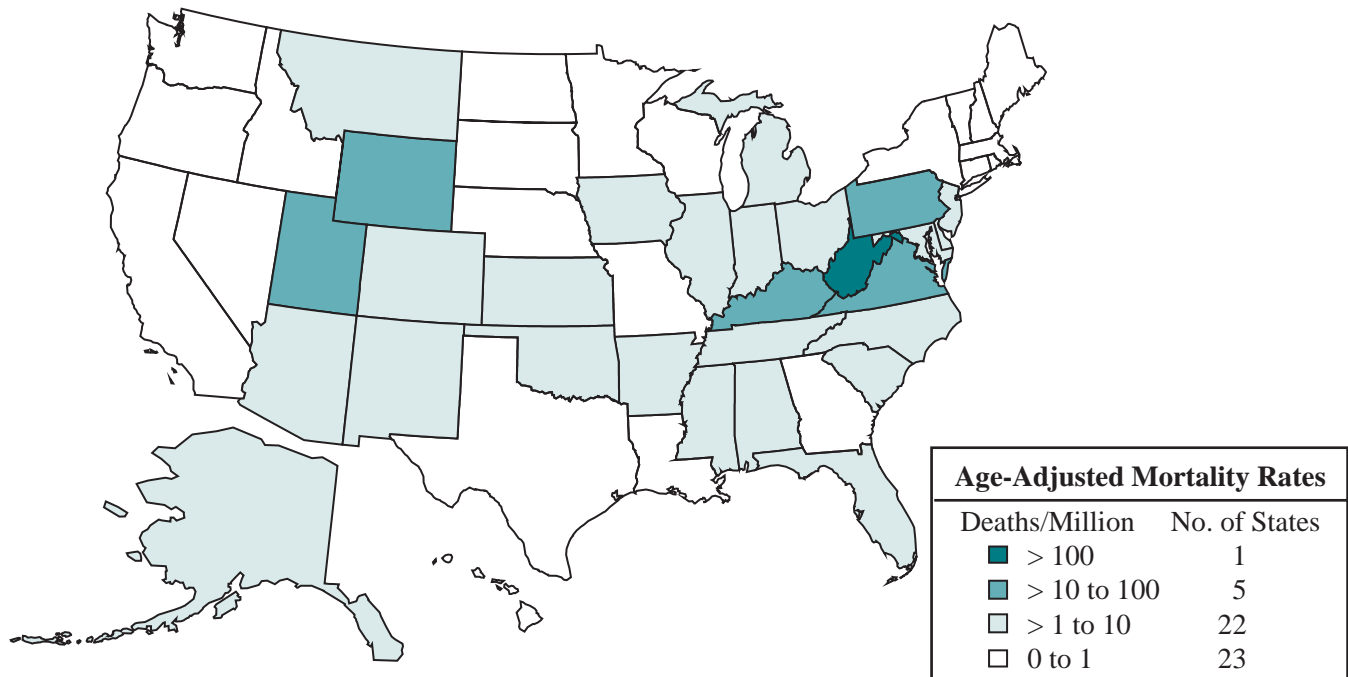
**Figure 2-1. Coal workers' pneumoconiosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 2-2. Coal workers' pneumoconiosis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 2-1. Coal workers' pneumoconiosis: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	1,990	36.9	1,975	15	1,912	72	6	-	-	6	30	120	607	893	334	77.0
1991	1,938	35.8	1,920	18	1,877	60	1	1	2	14	23	110	536	884	368	77.0
1992	1,766	35.7	1,761	5	1,707	55	4	-	2	6	14	90	457	858	339	78.0
1993	1,631	35.1	1,616	15	1,567	62	2	-	2	4	24	111	404	777	309	78.0
1994	1,478	33.3	1,465	13	1,434	42	2	-	-	6	15	78	345	741	293	79.0
1995	1,413	37.7	1,407	6	1,372	41	-	-	3	4	28	75	354	614	335	79.0
1996	1,417	37.8	1,407	10	1,375	39	3	-	-	4	22	51	327	673	340	79.0
1997	1,297	37.5	1,283	14	1,267	30	-	-	2	7	24	54	266	623	321	80.0
1998	1,103	38.2	1,093	10	1,066	35	2	-	1	4	15	51	235	503	294	80.0
1999	1,003	40.9	998	5	971	31	1	-	1	3	10	52	174	459	304	81.0
<b>TOTAL</b>	<b>15,036</b>	<b>36.6</b>	<b>14,925</b>	<b>111</b>	<b>14,548</b>	<b>467</b>	<b>21</b>	<b>1</b>	<b>13</b>	<b>58</b>	<b>205</b>	<b>792</b>	<b>3,705</b>	<b>7,025</b>	<b>3,237</b>	<b>78.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 2-2. Coal workers' pneumoconiosis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	10.19	23.70	0.14	6.82	0.17	1.44	0.27
1991	9.84	23.03	0.21	5.76	—	0.28	—
1992	8.87	20.89	0.06	5.19	—	1.06	—
1993	8.11	18.90	0.17	5.75	—	0.52	—
1994	7.28	17.16	0.15	3.83	—	0.50	—
1995	6.89	16.35	0.07	3.68	—	—	—
1996	6.83	16.15	0.10	3.43	—	0.46	0.21
1997	6.18	14.71	0.12	2.33	0.22	—	—
1998	5.20	12.31	0.09	2.89	0.07	0.22	0.20
1999	4.68	11.14	0.05	2.59	—	0.21	—
1990-1999	7.33	17.29	0.11	4.13	0.05	0.44	0.07
	Age-Adjusted Mortality Rate						
1990	10.91	31.16	0.12	14.22	0.21	3.68	0.66
1991	10.48	30.29	0.19	12.48	—	0.39	—
1992	9.38	27.29	0.05	10.84	—	2.69	—
1993	8.51	24.18	0.14	11.78	—	0.67	—
1994	7.60	21.82	0.12	8.58	—	1.08	—
1995	7.14	20.72	0.05	7.87	—	—	—
1996	7.02	20.30	0.09	7.25	—	1.30	0.42
1997	6.32	18.82	0.11	4.96	0.31	—	—
1998	5.26	14.98	0.07	5.96	0.09	0.49	0.40
1999	4.71	13.57	0.05	5.41	—	0.46	—
1990-1999	7.59	21.75	0.10	8.72	0.06	1.04	0.16

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Coal Workers' Pneumoconiosis: Mortality

**Table 2-3. Coal workers' pneumoconiosis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	1,145	—	25	5	25	—	1,200
1991	1,205	115	35	—	5	—	1,360
1992	810	20	50	—	—	—	880
1993	990	5	65	—	25	—	1,085
1994	745	5	15	—	—	—	765
1995	960	5	35	—	—	—	1,000
1996	650	30	5	—	—	—	685
1997	815	55	5	—	—	—	875
1998	580	—	35	—	—	—	615
1999	410	50	60	—	—	—	520
TOTAL	8,310	285	330	5	55	—	8,985
	Years of Potential Life Lost to Life Expectancy						
1990	17,883	126	548	29	75	8	18,669
1991	17,780	336	472	—	21	—	18,609
1992	15,428	89	463	—	43	—	16,023
1993	14,298	157	540	—	52	—	15,047
1994	12,828	137	306	—	22	—	13,293
1995	12,663	66	331	—	—	—	13,060
1996	12,135	124	296	—	15	8	12,578
1997	11,389	201	208	25	—	—	11,823
1998	9,563	94	296	14	9	6	9,982
1999	8,403	126	285	—	9	—	8,823
TOTAL	132,370	1,456	3,745	68	246	22	137,907

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-4. Coal workers' pneumoconiosis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	29	28	23	19	21	15	14	15	13	8	185
Alaska	-	-	1	-	1	-	-	-	-	1	3
Arizona	5	4	2	4	6	6	7	2	1	4	41
Arkansas	9	7	6	7	3	3	5	4	3	7	54
California	28	41	22	27	28	13	12	4	17	8	200
Colorado	15	15	19	18	6	10	7	11	8	9	118
Connecticut	2	1	3	1	7	1	-	-	1	1	17
Delaware	4	4	1	2	3	-	-	2	-	-	16
District of Columbia	-	-	-	-	-	1	-	-	-	-	1
Florida	25	33	23	25	15	21	28	23	14	16	223
Georgia	4	3	2	7	3	5	3	3	1	2	33
Hawaii	-	-	-	-	-	-	-	-	-	-	-
Idaho	-	-	1	1	-	-	1	2	2	1	8
Illinois	49	43	46	30	24	36	41	39	26	24	358
Indiana	19	33	19	15	16	19	16	22	22	12	193
Iowa	6	6	6	7	1	4	7	4	3	4	48
Kansas	2	2	2	4	3	6	4	1	2	1	27
Kentucky	115	112	116	114	81	84	129	99	90	90	1,030
Louisiana	1	3	-	2	2	1	2	2	1	1	15
Maine	-	-	-	1	-	-	-	-	11	-	12
Maryland	12	5	13	6	10	7	8	7	-	7	75
Massachusetts	2	2	2	-	-	-	-	-	1	-	7
Michigan	21	15	10	11	11	6	10	9	7	6	106
Minnesota	-	-	-	-	-	-	-	-	-	-	-
Mississippi	2	3	1	1	2	6	1	7	6	6	35
Missouri	4	6	11	7	5	3	1	2	2	3	44
Montana	-	-	-	-	1	3	2	2	-	-	8
Nebraska	-	-	-	-	-	-	-	1	1	-	2
Nevada	1	1	1	1	1	-	1	-	-	1	7
New Hampshire	-	-	-	1	-	-	-	1	-	-	2
New Jersey	11	8	14	7	3	8	8	4	5	4	72
New Mexico	3	3	4	4	4	5	7	5	5	4	44
New York	9	4	2	9	11	1	4	4	2	6	52
North Carolina	12	13	10	7	8	15	9	4	6	9	93
North Dakota	1	-	-	-	1	-	-	1	-	-	3
Ohio	79	83	74	64	57	71	64	41	52	31	616
Oklahoma	5	4	1	4	3	4	1	5	2	2	31
Oregon	1	1	1	2	-	1	1	1	1	1	10
Pennsylvania	1,030	961	836	730	681	592	622	550	464	409	6,875
Rhode Island	-	-	-	1	-	-	1	-	-	-	2
South Carolina	1	-	5	3	5	4	3	1	5	2	29
South Dakota	-	-	-	-	-	-	-	1	-	-	1
Tennessee	37	23	30	25	28	30	25	19	23	26	266
Texas	5	7	9	4	6	2	8	6	2	7	56
Utah	18	12	13	12	16	13	6	8	9	5	112
Vermont	-	1	-	-	-	1	-	129	-	-	131
Virginia	131	134	147	151	100	118	124	-	82	86	1,073
Washington	6	1	1	6	4	3	5	6	4	-	36
West Virginia	279	308	283	287	289	291	228	245	207	196	2,613
Wisconsin	3	1	-	1	1	1	-	3	1	1	12
Wyoming	4	7	6	3	11	3	2	2	1	2	41
<b>TOTAL</b>	<b>1,990</b>	<b>1,938</b>	<b>1,766</b>	<b>1,631</b>	<b>1,478</b>	<b>1,413</b>	<b>1,417</b>	<b>1,297</b>	<b>1,103</b>	<b>1,003</b>	<b>15,036</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Coal Workers' Pneumoconiosis: Mortality

**Table 2-5. Coal workers' pneumoconiosis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	185	11	5.58	9	5.75	9	1,756	11	9.5	31
Alaska	3	41	0.69	32	2.59	16	23	42	7.7	44
Arizona	41	24	1.26	23	1.35	23	363	26	8.9	34
Arkansas	54	19	2.79	15	2.39	17	487	21	9.0	32
California	200	9	0.82	31	0.97	30	3,063	7	15.3	5
Colorado	118	12	4.07	11	5.34	10	1,009	14	8.5	38
Connecticut	17	32	0.65	33	0.63	35	142	33	8.3	41
Delaware	16	33	2.83	14	3.25	14	142	33	8.9	34
District of Columbia	1	47	0.22	44	0.24	44	8	48	8.3	41
Florida	223	8	1.94	18	1.50	22	2,312	9	10.4	18
Georgia	33	28	0.59	35	0.76	34	357	27	10.8	16
Hawaii	-	-	-	-	-	-	-	-	-	-
Idaho	8	37	0.93	29	1.00	29	99	37	12.3	9
Illinois	358	6	3.89	12	4.01	13	3,711	6	10.4	18
Indiana	193	10	4.28	10	4.33	11	1,931	10	10.0	24
Iowa	48	21	2.17	16	1.68	20	405	24	8.4	39
Kansas	27	31	1.37	22	1.29	24	418	23	15.5	4
Kentucky	1,030	4	34.13	3	34.39	3	11,919	4	11.6	12
Louisiana	15	34	0.46	37	0.53	36	263	32	17.6	3
Maine	1	47	0.10	49	0.10	49	8	48	8.3	41
Maryland	86	16	2.16	17	2.79	15	842	17	9.8	25
Massachusetts	7	39	0.14	48	0.14	47	95	38	13.5	6
Michigan	106	14	1.43	21	1.56	21	1,131	12	10.7	17
Minnesota	-	-	-	-	-	-	-	-	-	-
Mississippi	35	27	1.72	19	1.80	19	914	16	26.1	2
Missouri	44	22	1.06	27	0.95	31	459	22	10.4	18
Montana	8	37	1.20	25	1.17	26	58	40	7.3	47
Nebraska	2	43	0.16	47	0.13	48	15	45	7.4	46
Nevada	7	39	0.58	36	0.82	33	68	39	9.7	27
New Hampshire	2	43	0.22	44	0.25	43	17	44	8.4	39
New Jersey	72	17	1.13	26	1.19	25	702	18	9.8	25
New Mexico	44	22	3.49	13	4.23	12	384	25	8.7	36
New York	52	20	0.36	41	0.37	40	537	20	10.3	21
North Carolina	93	15	1.62	20	1.83	18	951	15	10.2	22
North Dakota	3	41	0.61	34	0.50	37	23	42	7.6	45
Ohio	616	5	7.08	7	7.13	7	5,968	5	9.7	27
Oklahoma	31	29	1.22	24	1.16	27	355	28	11.5	13
Oregon	10	36	0.41	39	0.37	40	135	36	13.5	6
Pennsylvania	6,875	1	71.22	2	62.73	2	66,262	1	9.6	29
Rhode Island	2	43	0.25	43	0.23	45	14	47	7.2	49
South Carolina	29	30	1.02	28	1.14	28	341	30	11.8	10
South Dakota	1	47	0.18	46	0.19	46	39	41	38.7	1
Tennessee	266	7	6.41	8	6.65	8	2,677	8	10.1	23
Texas	56	18	0.40	40	0.49	38	693	19	12.4	8
Utah	112	13	8.37	6	10.74	6	1,073	13	9.6	29
Vermont	2	43	0.44	38	0.46	39	15	45	7.3	47
Virginia	1,202	3	22.96	4	28.26	4	14,223	3	11.8	10
Washington	36	26	0.86	30	0.94	32	323	31	9.0	32
West Virginia	2,613	2	179.64	1	157.33	1	29,547	2	11.3	14
Wisconsin	12	35	0.30	42	0.29	42	136	35	11.3	14
Wyoming	41	24	11.45	5	13.91	5	351	29	8.6	37

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 2-6. Coal workers' pneumoconiosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

<b>CIC</b>	<b>Industry</b>	<b>Number of Deaths</b>	<b>Percent</b>
041	Coal mining	3,765	77.0
060	Construction	188	3.8
270	Blast furnaces, steelworks, rolling and finishing mills	56	1.1
392	Not specified manufacturing industries	48	1.0
400	Railroads	39	0.8
010	Agricultural production, crops	35	0.7
351	Motor vehicles and motor vehicle equipment	30	0.6
410	Trucking service	29	0.6
040	Metal mining	25	0.5
961	Non-paid worker or non-worker or own home/at home	24	0.5
	All other industries	461	9.4
	Industry not reported	193	3.9
	<b>TOTAL</b>	<b>4,893</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-7. Coal workers' pneumoconiosis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

<b>COC</b>	<b>Occupation</b>	<b>Number of Deaths</b>	<b>Percent</b>
616	Mining machine operators	3,440	70.3
889	Laborers, except construction	147	3.0
575	Electricians	64	1.3
804	Truck drivers	62	1.3
019	Managers and administrators, n.e.c.	59	1.2
613	Supervisors, extractive occupations	49	1.0
567	Carpenters	48	1.0
453	Janitors and cleaners	47	1.0
869	Construction laborers	45	0.9
473	Farmers, except horticulture	39	0.8
844	Operating engineers	39	0.8
	All other occupations	655	13.4
	Occupation not reported	199	4.1
	<b>TOTAL</b>	<b>4,893</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Coal Workers' Pneumoconiosis: Mortality*

**Table 2-8. Coal workers' pneumoconiosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
041	Coal mining	3,765	53.18	51.50	54.91
040	Metal mining	25	1.98	1.28	2.92

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 2-9. Coal workers' pneumoconiosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

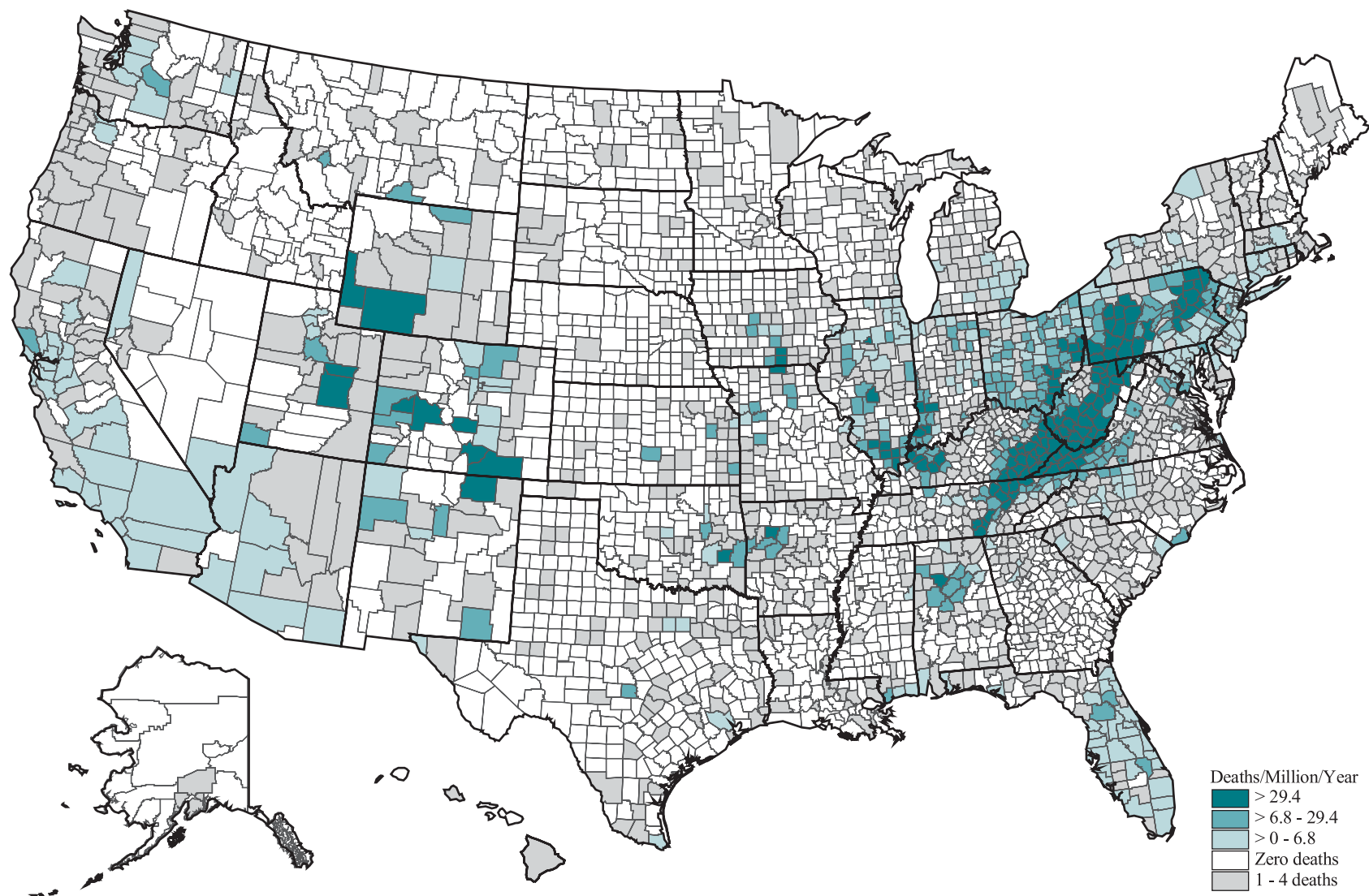
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
616	Mining machine operators	3,440	51.67	49.97	53.44
613	Supervisors, extractive occupations	49	14.36	10.64	18.99
046	Mining engineers	8	6.03	2.60	11.86
617	Mining occupations, n.e.c.	14	4.45	2.43	7.46
859	Miscellaneous material moving equipment operators	12	2.27	1.17	3.96
824	Locomotive operating occupations	23	2.03	1.29	3.05

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

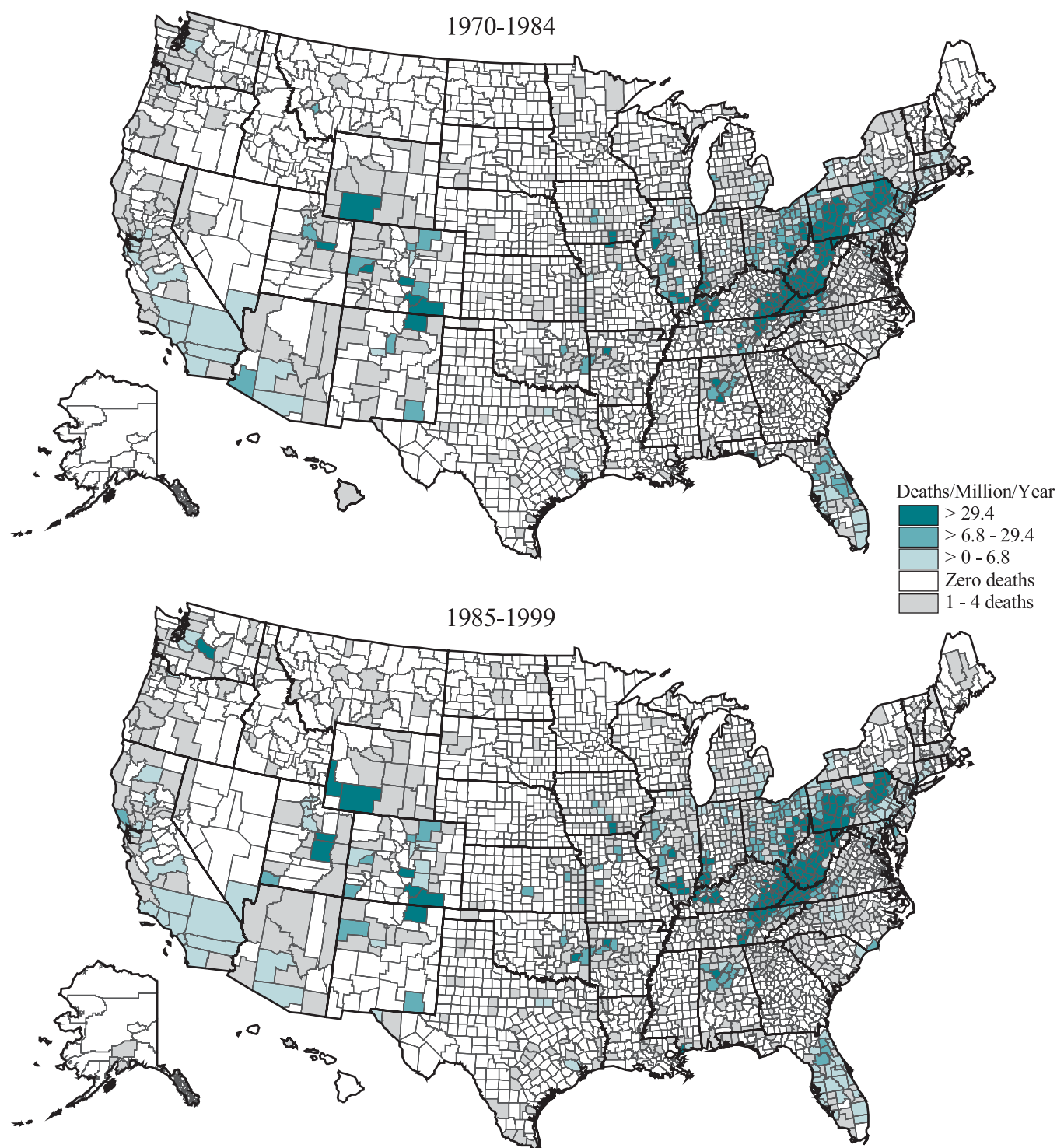
36 **Figure 2-3. Coal workers' pneumoconiosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 2-4. Coal workers' pneumoconiosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Coal Workers' Pneumoconiosis: Mortality

**Table 2-10. Coal workers' pneumoconiosis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Buchanan County	Virginia	1,659.8	1,170.4	430	0.2
Schuylkill County	Pennsylvania	1,042.4	1,454.2	2,744	0.1
McDowell County	West Virginia	1,019.1	1,141.7	447	0.0
Raleigh County	West Virginia	999.2	1,134.7	1,035	0.0
Wyoming County	West Virginia	922.0	769.3	258	0.0
Floyd County	Kentucky	890.2	799.2	401	0.0
Tazewell County	Virginia	741.0	763.6	426	0.2
Wise County	Virginia	739.4	746.4	349	0.3
Dickenson County	Virginia	716.8	703.8	146	0.7
Norton City	Virginia	660.8	655.7	33	0.0
Luzerne County	Pennsylvania	652.4	916.8	3,718	0.3
Boone County	West Virginia	581.3	557.2	173	0.0
Fayette County	West Virginia	536.8	677.8	388	0.0
Letcher County	Kentucky	524.8	492.4	152	0.7
Logan County	West Virginia	514.9	495.4	247	0.4
Harlan County	Kentucky	477.8	471.6	196	0.0
Russell County	Virginia	468.3	442.0	152	0.0
Northumberland County	Pennsylvania	458.2	640.6	744	0.1
Carbon County	Utah	408.8	449.4	97	0.0
Cambria County	Pennsylvania	388.3	512.4	1,008	0.1
Knott County	Kentucky	370.5	299.6	62	0.0
Somerset County	Pennsylvania	360.0	444.3	415	0.0
Lee County	Virginia	352.6	413.3	119	0.8
Mingo County	West Virginia	350.5	290.5	109	0.0
Webster County	West Virginia	341.7	409.2	50	0.0
Carbon County	Pennsylvania	332.6	437.4	308	0.3
Bell County	Kentucky	323.9	320.0	115	0.0
Lackawanna County	Pennsylvania	313.8	439.7	1,173	0.3
Fayette County	Pennsylvania	307.1	391.7	686	0.0
Nicholas County	West Virginia	300.2	322.6	101	1.0
Mercer County	West Virginia	288.3	353.4	277	0.4
Johnson County	Kentucky	287.1	240.9	66	0.0
Emery County	Utah	284.9	226.5	22	0.0
Pike County	Kentucky	253.1	209.2	177	0.6
Greene County	Pennsylvania	244.2	306.8	144	0.0
Franklin County	Illinois	241.0	347.9	168	0.0
Muhlenberg County	Kentucky	213.3	241.4	89	0.0
Knox County	Kentucky	203.6	206.8	72	1.4
Leslie County	Kentucky	201.0	162.6	25	0.0
Campbell County	Tennessee	198.1	213.1	90	0.0
Indiana County	Pennsylvania	194.2	196.6	214	0.0
Martin County	Kentucky	193.8	149.2	21	0.0
Perry County	Kentucky	187.1	157.9	56	0.0
Greenbrier County	West Virginia	184.9	237.4	101	0.0
Clay County	West Virginia	180.9	194.9	22	0.0
Preston County	West Virginia	176.3	196.2	67	0.0
Marion County	West Virginia	155.9	207.6	146	0.0
Whitley County	Kentucky	155.4	156.8	62	0.0
Grundy County	Tennessee	142.8	154.1	24	0.0
Sweetwater County	Wyoming	137.2	79.0	34	0.0
<b>Overall United States</b>		<b>9.4</b>	<b>8.9</b>	<b>26,706</b>	<b>0.7</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

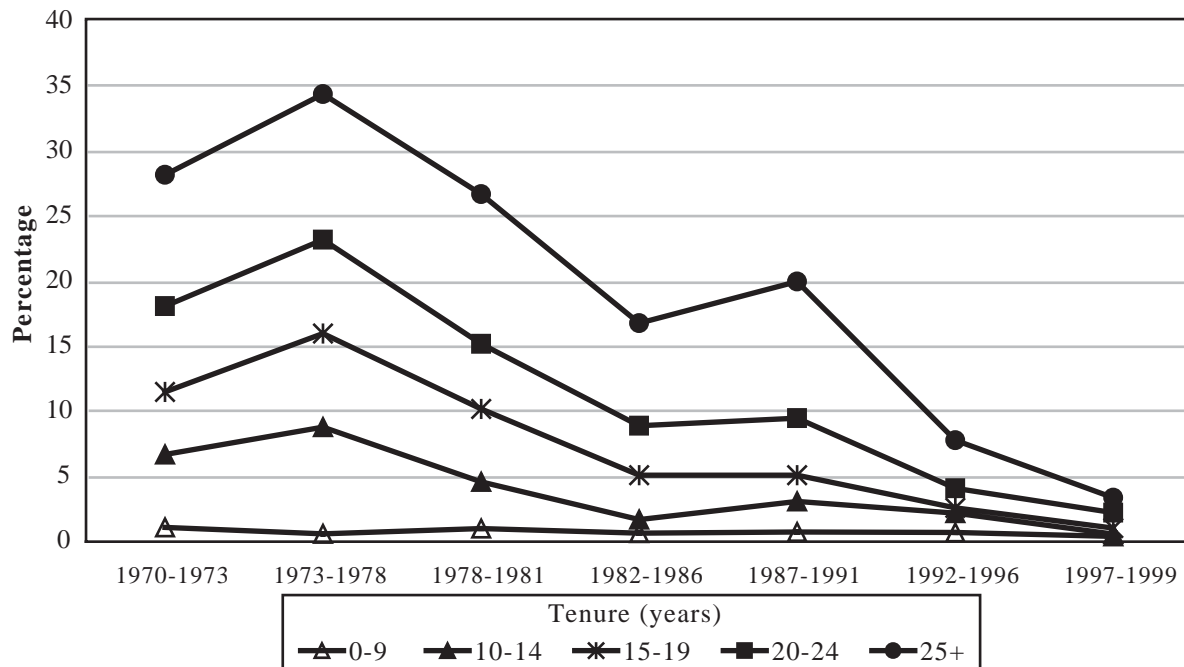
**Table 2-11. Coal workers' pneumoconiosis: Estimated number of discharges from short-stay nonfederal hospitals, 1970-2000**

Year	Number of Discharges
1970	6,000
1971	8,000
1972	11,000
1973	13,000
1974	14,000
1975	17,000
1976	18,000
1977	18,000
1978	13,000
1979	18,000
1980	17,000
1981	14,000
1982	17,000
1983	22,000
1984	23,000
1985	18,000
1986	16,000
1987	17,000
1988	15,000
1989	11,000
1990	7,000
1991	11,000
1992	10,000
1993	8,000
1994	9,000
1995	16,000
1996	11,000
1997	15,000
1998	8,000
1999	8,000
2000	10,000

NOTE: Number of discharges has been rounded. NCHS recommends that, in statistical comparisons, estimates of less than 5,000 not be used and that estimates of 5,000 to 10,000 be used with caution. See appendices for source description and methods.

SOURCE: National Center for Health Statistics National Hospital Discharge Survey.

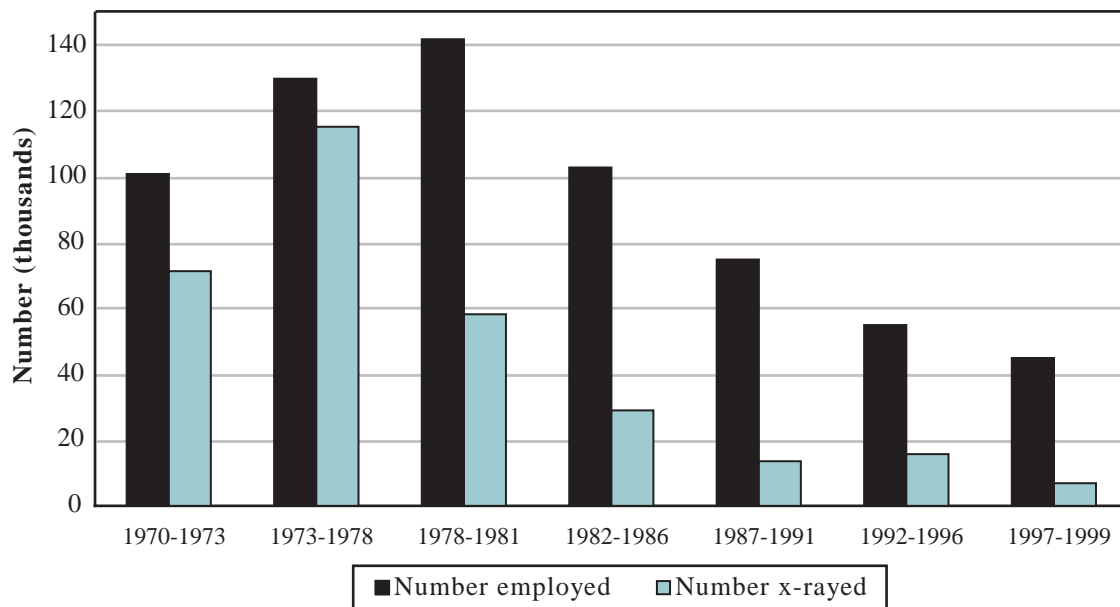
**Figure 2-5. CWXSP: Percentage of examined miners with coal workers' pneumoconiosis (category 1/0+) by tenure in mining, 1970-1999**



NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program.

**Figure 2-6. CWXSP: Estimated number of actively employed underground coal miners and number examined, 1970-1999**



NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program. Mine Safety and Health Administration (MSHA) coal mine employment data

**Table 2-12. CWXSP: Number and percentage of examined miners with coal workers' pneumoconiosis (category 1/0+), by round and tenure, 1970-1999**

Tenure Years in Mining	Round 1 1970-1973			Round 2 1973-1978			Round 3 1978-1981			Round 4 1982-1986			Round 5 1987-1991			Round 6 1992-1996			Round 7 1997-1999		
	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%
<b>0</b>	15,844	100	0.6	50,341	31	0.1	14,528	94	0.6	3,577	18	0.5	2,007	10	0.5	1,812	13	0.7	969	6	0.6
<b>1</b>	5,287	49	0.9	9,579	13	0.1	3,719	18	0.5	742	1	0.1	356	0	0.0	238	2	0.8	163	0	0.0
<b>2-4</b>	8,274	73	0.9	18,432	137	0.7	12,059	103	0.8	3,786	25	0.7	1,057	6	0.6	791	2	0.3	388	2	0.5
<b>5-9</b>	6,706	182	2.7	13,528	386	2.8	14,157	215	1.5	7,434	57	0.8	2,763	30	1.1	1,235	12	1.0	418	0	0.0
<b>10-14</b>	4,451	298	6.7	5,282	466	8.8	5,318	246	4.6	5,435	93	1.7	4,120	123	3.0	2,522	56	2.2	511	3	0.6
<b>15-19</b>	4,743	546	11.5	3,380	542	16.0	2,168	221	10.2	1,824	93	5.1	2,279	114	5.0	4,646	119	2.6	1,148	12	1.0
<b>20-24</b>	7,279	1,316	18.1	3,214	745	23.2	1,505	228	15.2	711	63	8.9	769	71	9.2	3,220	132	4.1	1,983	44	2.2
<b>25-29</b>	6,260	1,368	21.8	4,437	1,279	28.8	1,294	257	19.9	491	64	13.0	257	52	20.2	938	51	5.4	1,057	28	2.7
<b>30+</b>	12,602	3,947	31.3	7,193	2,722	37.8	3,546	1,034	29.2	1,154	213	18.5	312	61	19.6	365	51	14.0	277	17	6.1
<b>TOTAL</b>	<b>71,446</b>	<b>7,897</b>	<b>11.0</b>	<b>115,386</b>	<b>6,321</b>	<b>5.5</b>	<b>58,294</b>	<b>2,416</b>	<b>4.1</b>	<b>25,154</b>	<b>627</b>	<b>2.5</b>	<b>13,920</b>	<b>467</b>	<b>3.4</b>	<b>15,767</b>	<b>438</b>	<b>2.8</b>	<b>6,914</b>	<b>112</b>	<b>1.6</b>

NOTE: Tabulations are based on one chest x-ray per round for each participating miner.

Round 1: Jan. 1970 - July 1973

Round 2: Aug. 1973 - July 1978

Round 3: Aug. 1978 - Dec. 1981

Round 4: Jan. 1982 - Dec. 1986

Round 5: Jan. 1987 - Dec. 1991

Round 6: Jan. 1992 - Dec. 1996

Round 7: Jan. 1997 - Dec. 1999

NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program.



## *Coal Workers' Pneumoconiosis: Black Lung Benefits*

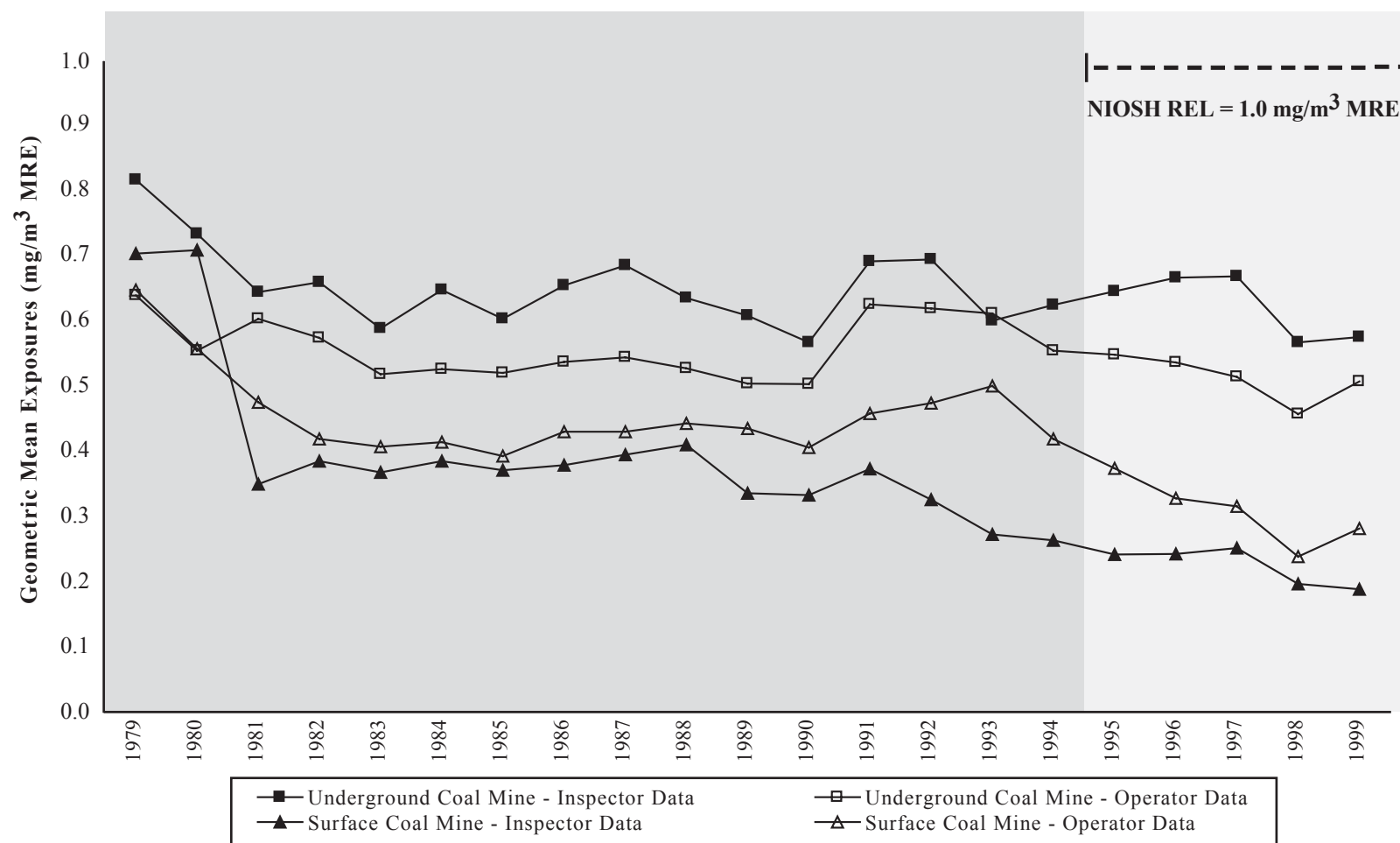
**Table 2-13. Federal Black Lung Program: Number of beneficiaries and total payments by the Social Security Administration and Department of Labor, 1980-1999**

Year	Social Security Administration (SSA)		Department of Labor (DOL)		SSA and DOL	
	Beneficiaries	Amount (dollars)	Beneficiaries	Amount (dollars)	Total Beneficiaries	Total Amount (dollars)
1980	399,477	1,032,000,000	139,073	813,205,000	538,550	1,845,205,000
1981	376,505	1,081,300,000	163,401	805,627,000	539,906	1,886,927,000
1982	354,569	1,076,000,000	173,972	784,085,000	528,541	1,860,085,000
1983	333,358	1,055,800,000	166,043	858,854,000	499,401	1,914,654,000
1984	313,822	1,038,000,000	163,166	873,932,000	476,988	1,911,932,000
1985	294,846	1,025,000,000	160,441	905,517,000	455,287	1,930,517,000
1986	275,783	971,000,000	156,892	629,075,000	432,675	1,600,075,000
1987	258,988	940,000,000	153,769	655,290,000	412,757	1,595,290,000
1988	241,626	904,000,000	150,123	656,689,000	391,749	1,560,689,000
1989	225,764	882,000,000	145,289	650,123,000	371,053	1,532,123,000
1990	210,678	863,400,000	139,854	626,521,000	350,532	1,489,921,000
1991	196,419	844,400,000	134,205	942,428,000	330,624	1,786,828,000
1992	182,396	822,500,000	128,761	973,636,000	311,157	1,796,136,000
1993	168,365	794,300,000	123,213	984,666,000	291,578	1,778,966,000
1994	155,122	751,900,000	117,569	994,655,000	272,691	1,746,555,000
1995	143,011	696,700,000	111,769	995,722,000	254,780	1,692,422,000
1996	131,143	654,600,000	105,923	992,128,000	237,066	1,646,728,000
1997	119,233	614,888,000	100,352	1,004,672,000	219,585	1,619,560,000
1998	109,271	576,389,000	94,488	999,822,000	203,759	1,576,211,000
1999	98,977	541,200,000	88,716	1,005,246,000	187,693	1,546,446,000

NOTE: The Social Security Administration (SSA) was assigned initial responsibility for administering the Black Lung benefits program. The Department of Labor (DOL) assumed responsibility for processing and paying claims on July 1, 1973. Most claims filed prior to July 1, 1973 remain within the jurisdiction of SSA, which also continues to be responsible for processing and paying claims filed by the survivors of these miners. The dollar amounts from the Department of Labor are for fiscal years. See appendices for source description.

SOURCE: Social Security Bulletin Annual Statistical Supplement (annual reports) and Black Lung Benefits Act Annual Report to Congress (annual reports).

**Figure 2-7. Respirable coal mine dust: Geometric mean exposures by type of mine, MSHA inspector and mine operator samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter      MRE - Mining Research Establishment  
 NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. See appendices for source description, methods, and agents.  
 SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.

**Table 2-14. Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by type of facility, MSHA inspector and mine operator samples, 1979-1999**

Type of Facility and Sample Source																		NIOSH REL = 1.0 mg/m <sup>3</sup> MRE				
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Underground Coal Mine Inspector Samples</b>	GM (mg/m <sup>3</sup> )	0.815	0.732	0.643	0.658	0.587	0.646	0.602	0.653	0.684	0.634	0.607	0.566	0.690	0.693	0.599	0.623	0.644	0.665	0.667	0.566	0.574
	No. of samples	1,897	13,125	13,533	13,882	13,588	12,884	13,115	13,010	13,118	14,372	13,608	12,450	10,912	10,709	9,582	10,334	11,919	11,826	16,441	23,689	33,419
	% > PEL	19.1	14.6	11.5	10.4	9.5	11.1	10.2	11.4	11.3	10.1	9.8	8.5	11.0	10.0	7.4	8.3	8.6	8.3	7.8	6.5	5.3
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.5	33.2	32.4	26.5	26.8
<b>Underground Coal Mine Operator Samples</b>	GM (mg/m <sup>3</sup> )	0.638	0.553	0.602	0.573	0.517	0.525	0.519	0.536	0.543	0.526	0.503	0.502	0.624	0.618	0.610	0.553	0.547	0.535	0.513	0.456	0.506
	No. of samples	166,582	190,771	31,337	68,926	69,591	70,222	66,473	65,948	65,197	66,098	65,169	65,403	62,729	60,749	55,960	52,835	47,892	43,300	42,375	41,601	37,663
	% > PEL	17.0	15.4	14.7	12.8	10.5	10.2	10.0	10.7	10.8	9.4	8.9	8.5	11.9	10.9	10.8	10.5	10.3	9.6	9.2	8.9	9.0
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.2	30.7	29.4	28.9	31.2
<b>Surface Coal Mine Inspector Samples</b>	GM (mg/m <sup>3</sup> )	0.702	0.707	0.349	0.384	0.367	0.384	0.370	0.378	0.394	0.409	0.335	0.332	0.372	0.325	0.272	0.263	0.241	0.242	0.251	0.196	0.188
	No. of samples	472	3,578	16,164	13,098	12,684	13,333	13,036	10,957	9,833	9,176	8,089	8,135	5,165	4,762	5,983	6,458	6,032	6,713	7,761	9,449	10,524
	% > PEL	16.3	14.8	5.2	5.7	6.3	7.7	5.9	5.9	5.9	6.4	4.5	4.4	4.6	4.1	2.8	2.4	1.8	1.4	1.3	1.0	1.1
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.4	7.3	7.3	5.5	6.1
<b>Surface Coal Mine Operator Samples</b>	GM (mg/m <sup>3</sup> )	0.646	0.556	0.474	0.418	0.406	0.413	0.392	0.429	0.429	0.442	0.434	0.405	0.457	0.473	0.499	0.418	0.373	0.327	0.315	0.238	0.281
	No. of samples	38,479	47,107	16,730	37,744	35,548	37,998	32,467	26,016	20,346	14,547	12,546	11,701	10,202	6,158	5,153	5,278	4,563	4,830	4,959	4,543	4,480
	% > PEL	17.0	15.7	9.1	8.1	8.1	8.4	7.2	7.6	8.1	6.9	6.8	5.7	8.0	6.9	8.1	6.6	4.8	3.6	3.7	2.2	3.4
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.0	16.1	15.6	12.2	15.0

- indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.

## *Coal Workers' Pneumoconiosis: Coal Mine Dust Exposures*

**Table 2-15. Respirable coal mine dust: Number of samples, geometric mean exposures, and percent exceeding designated occupational exposure limits by industries with elevated coal workers' pneumoconiosis mortality, MSHA inspector and mine operator samples, 1990-1999**

Coal Workers' Pneumoconiosis Mortality, Selected States and Years, 1990-1999							
CIC	Industries with elevated PMRs and most frequently recorded on death certificates	Number of Deaths	PMR	Number of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL 1995-1999
041	Coal mining	3,765	53.18	794,637	0.509	8.6	26.2
	All other industries	935		0	-	-	-
	<b>TOTAL</b>			<b>794,637</b>	<b>0.509</b>	<b>8.6</b>	<b>26.2</b>

- indicates incalculable field

CIC - Census Industry Code

PEL - permissible exposure limit

REL - recommended exposure limit

PMR - proportionate mortality ratio

GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter      MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states and years for which usual industry has been reported.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data. National Center for Health Statistics multiple cause of death data.

**Table 2-16 (page 1 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>MSHA Coal Mine District</b>												
<b>District 1</b> (Anthracite coal mining regions in Pennsylvania)	<b>40,660</b>	<b>0.203</b>	<b>22,717</b>	<b>0.219</b>	<b>2.7</b>	<b>9,277</b>	<b>0.184</b>	<b>2.4</b>	<b>8,666</b>	<b>0.186</b>	<b>2.6</b>	<b>8.9</b>
<b>District 2</b> (Bituminous coal mining regions in Pennsylvania)	<b>289,781</b>	<b>0.512</b>	<b>208,709</b>	<b>0.515</b>	<b>9.8</b>	<b>40,164</b>	<b>0.564</b>	<b>9.5</b>	<b>40,908</b>	<b>0.451</b>	<b>5.8</b>	<b>23.9</b>
<b>District 3</b>	<b>258,453</b>	<b>0.558</b>	<b>184,655</b>	<b>0.590</b>	<b>12.7</b>	<b>38,816</b>	<b>0.531</b>	<b>7.5</b>	<b>34,982</b>	<b>0.436</b>	<b>5.2</b>	<b>23.3</b>
Maryland	9,818	0.621	5,668	0.674	13.1	1,501	0.614	6.9	2,649	0.523	6.1	32.3
Ohio	85,691	0.606	66,440	0.672	16.3	9,792	0.479	6.0	9,459	0.372	4.7	22.5
Northern West Virginia	162,944	0.531	112,547	0.543	10.5	27,523	0.547	8.1	22,874	0.457	5.4	22.5
<b>District 4</b> (Southern West Virginia)	<b>451,111</b>	<b>0.551</b>	<b>306,083</b>	<b>0.572</b>	<b>14.6</b>	<b>76,284</b>	<b>0.531</b>	<b>10.6</b>	<b>68,744</b>	<b>0.485</b>	<b>9.0</b>	<b>27.4</b>
<b>District 5</b> (Virginia)	<b>287,317</b>	<b>0.467</b>	<b>189,909</b>	<b>0.465</b>	<b>9.3</b>	<b>55,143</b>	<b>0.512</b>	<b>8.4</b>	<b>42,265</b>	<b>0.421</b>	<b>5.9</b>	<b>20.7</b>
<b>District 6</b> (Eastern Kentucky)	<b>266,705</b>	<b>0.415</b>	<b>154,093</b>	<b>0.392</b>	<b>7.0</b>	<b>56,560</b>	<b>0.467</b>	<b>8.3</b>	<b>56,052</b>	<b>0.433</b>	<b>6.6</b>	<b>22.4</b>
<b>District 7</b>	<b>262,223</b>	<b>0.449</b>	<b>143,987</b>	<b>0.444</b>	<b>7.2</b>	<b>63,635</b>	<b>0.483</b>	<b>7.0</b>	<b>54,601</b>	<b>0.423</b>	<b>6.2</b>	<b>21.2</b>
Central Kentucky	216,315	0.457	112,157	0.453	7.5	54,830	0.492	7.2	49,328	0.430	6.3	21.4
North Carolina	9	0.147	6	0.159	0.0	3	0.126	0.0	0	-	-	-
South Carolina	0	-	0	-	-	0	-	-	0	-	-	-
Tennessee	45,870	0.411	31,795	0.413	6.5	8,802	0.432	6.0	5,273	0.366	6.1	19.2
Northern Georgia	29	0.328	29	0.328	0.0	0	-	-	0	-	-	-
<b>District 8</b>	<b>146,515</b>	<b>0.743</b>	<b>99,969</b>	<b>0.681</b>	<b>14.7</b>	<b>26,146</b>	<b>0.899</b>	<b>14.3</b>	<b>20,400</b>	<b>0.891</b>	<b>15.5</b>	<b>50.5</b>
Illinois	131,785	0.794	90,886	0.731	15.6	23,477	0.974	15.0	17,422	0.934	15.4	52.0
Indiana	13,033	0.424	7,575	0.342	5.2	2,514	0.459	8.6	2,944	0.687	16.6	42.8
Iowa	886	0.384	813	0.388	5.3	73	0.344	0.0	0	-	-	-
Michigan	0	-	0	-	-	0	-	-	0	-	-	-
Minnesota	0	-	0	-	-	0	-	-	0	-	-	-
Northern Missouri	811	0.249	695	0.260	1.7	82	0.240	2.4	34	0.107	0.0	0.0
Wisconsin	0	-	0	-	-	0	-	-	0	-	-	-

See footnotes at end of table.

**Table 2-16 (page 2 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

MSHA Coal Mine District	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>District 9</b>	<b>120,599</b>	<b>0.683</b>	<b>78,749</b>	<b>0.696</b>	<b>19.8</b>	<b>22,044</b>	<b>0.759</b>	<b>15.0</b>	<b>19,806</b>	<b>0.565</b>	<b>9.3</b>	<b>33.8</b>
Alaska	246	0.338	181	0.408	6.6	48	0.237	2.1	17	0.123	0.0	0.0
Arizona	913	0.252	484	0.310	5.0	201	0.308	4.5	228	0.136	1.3	1.9
Arkansas	311	0.172	238	0.205	2.5	37	0.149	2.7	36	0.064	0.0	0.0
California	12	0.218	0	-	-	1	0.400	0.0	11	0.206	0.0	9.1
Colorado	38,040	0.844	25,744	0.845	24.1	6,616	0.915	16.4	5,680	0.765	10.4	40.7
Hawaii	0	-	0	-	-	0	-	-	0	-	-	-
Idaho	0	-	0	-	-	0	-	-	0	-	-	-
Kansas	510	0.216	383	0.235	2.6	49	0.190	0.0	78	0.152	1.3	1.4
Louisiana	105	0.186	14	0.163	0.0	39	0.228	0.0	52	0.165	0.0	0.0
Southern Missouri	647	0.236	453	0.255	2.0	56	0.160	0.0	138	0.216	1.4	7.0
Montana	1,720	0.296	1,096	0.368	7.2	213	0.250	2.8	411	0.181	2.7	5.6
Nebraska	0	-	0	-	-	0	-	-	0	-	-	-
Nevada	0	-	0	-	-	0	-	-	0	-	-	-
New Mexico	5,222	0.615	3,535	0.767	23.7	876	0.753	20.2	811	0.188	3.5	6.2
North Dakota	1,345	0.187	1,029	0.221	1.9	163	0.157	0.6	153	0.073	0.0	0.0
Oklahoma	4,857	0.331	2,972	0.345	6.9	985	0.325	6.7	900	0.297	3.4	9.8
Oregon	0	-	0	-	-	0	-	-	0	-	-	-
Texas	4,005	0.179	2,740	0.194	1.4	664	0.198	3.9	601	0.109	1.0	3.5
Utah	52,952	0.852	34,017	0.834	21.8	10,277	0.928	16.4	8,658	0.834	12.1	43.6
Washington	346	0.178	124	0.166	0.0	74	0.257	2.7	148	0.158	0.7	4.3
Wyoming	9,368	0.463	5,739	0.479	12.5	1,745	0.569	14.1	1,884	0.345	7.0	21.9

See footnotes at end of table.

**Table 2-16 (page 3 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	% > REL
<b>MSHA Coal Mine District</b>												
<b>District 10 (Western Kentucky)</b>	<b>77,891</b>	<b>0.676</b>	<b>50,923</b>	<b>0.603</b>	<b>12.1</b>	<b>14,282</b>	<b>0.847</b>	<b>14.8</b>	<b>12,686</b>	<b>0.829</b>	<b>14.2</b>	<b>48.4</b>
<b>District 11</b>	<b>85,776</b>	<b>0.686</b>	<b>52,600</b>	<b>0.714</b>	<b>15.7</b>	<b>18,307</b>	<b>0.724</b>	<b>10.7</b>	<b>14,869</b>	<b>0.556</b>	<b>6.6</b>	<b>29.8</b>
Alabama	85,776	0.686	52,600	0.714	15.7	18,307	0.724	10.7	14,869	0.556	6.6	29.8
Central and Southern Georgia	0	-	0	-	-	0	-	-	0	-	-	-
Florida	0	-	0	-	-	0	-	-	0	-	-	-
Mississippi	0	-	0	-	-	0	-	-	0	-	-	-
Puerto Rico	0	-	0	-	-	0	-	-	0	-	-	-
Virgin Islands	0	-	0	-	-	0	-	-	0	-	-	-
<b>TOTAL</b>	<b>2,287,031</b>	<b>0.520</b>	<b>1,492,394</b>	<b>0.526</b>	<b>11.6</b>	<b>420,658</b>	<b>0.545</b>	<b>9.5</b>	<b>373,979</b>	<b>0.472</b>	<b>7.5</b>	<b>26.2</b>

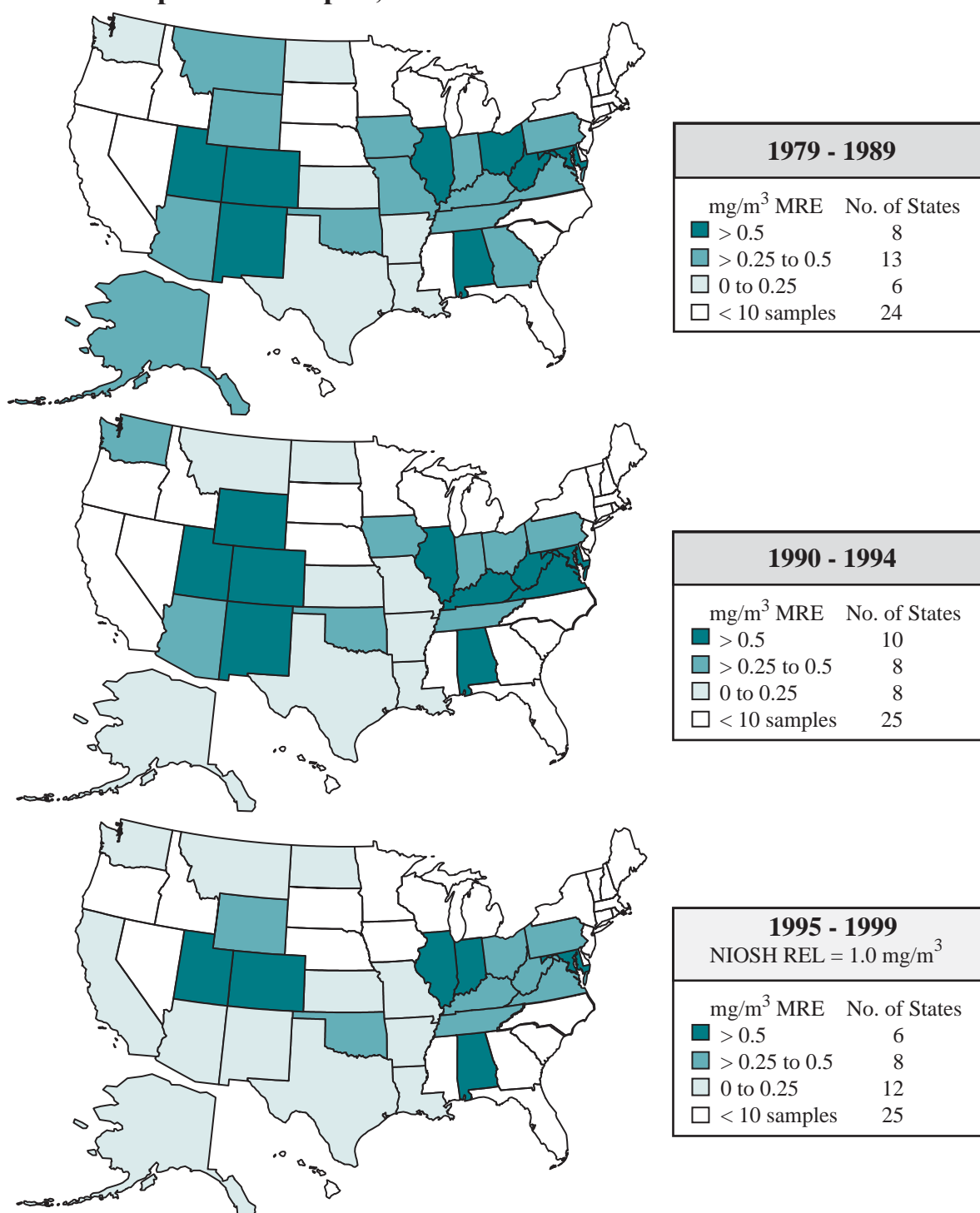
- indicates incalculable field      PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter  
MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.



**Figure 2-8. Respirable coal mine dust: Geometric mean exposures by state, MSHA inspector and mine operator samples, 1979-1999**



PEL - permissible exposure limit REL - recommended exposure limit mg/m<sup>3</sup> - milligrams per cubic meter MRE - Mining Research Establishment  
 NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. See appendices for source description, methods, and agents.  
 SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.



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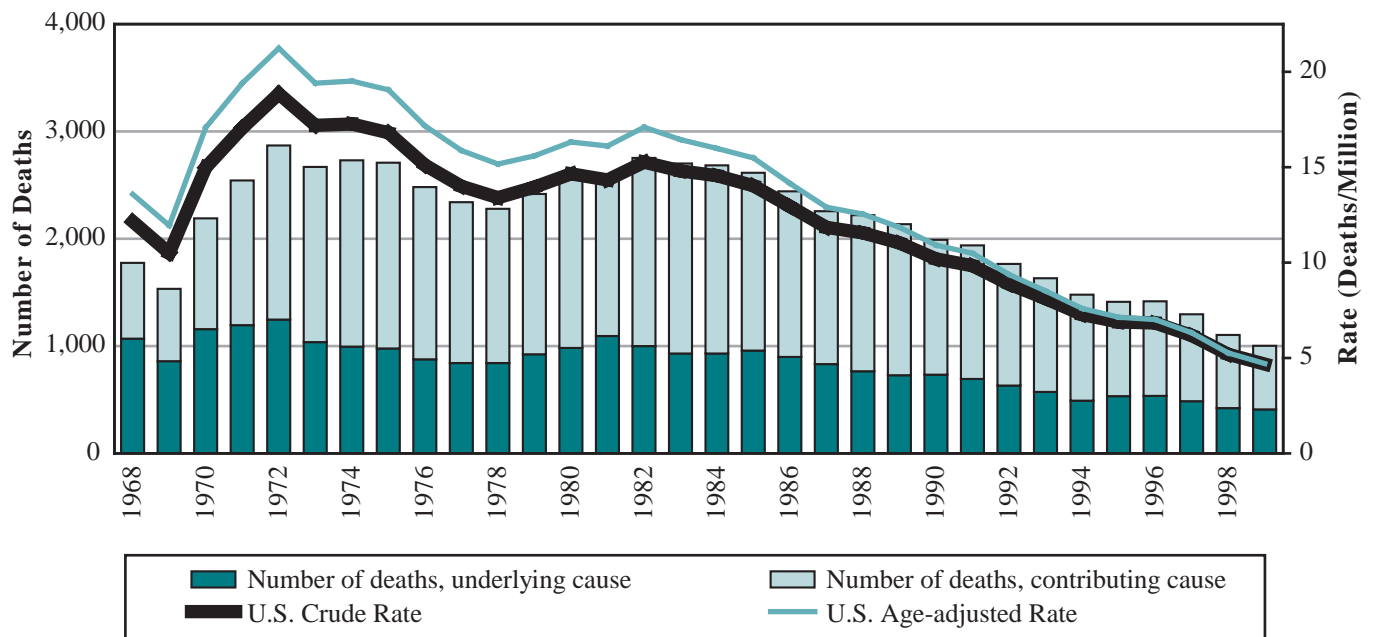
## **Section 2**

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# **Coal Workers' Pneumoconiosis and Related Exposures**



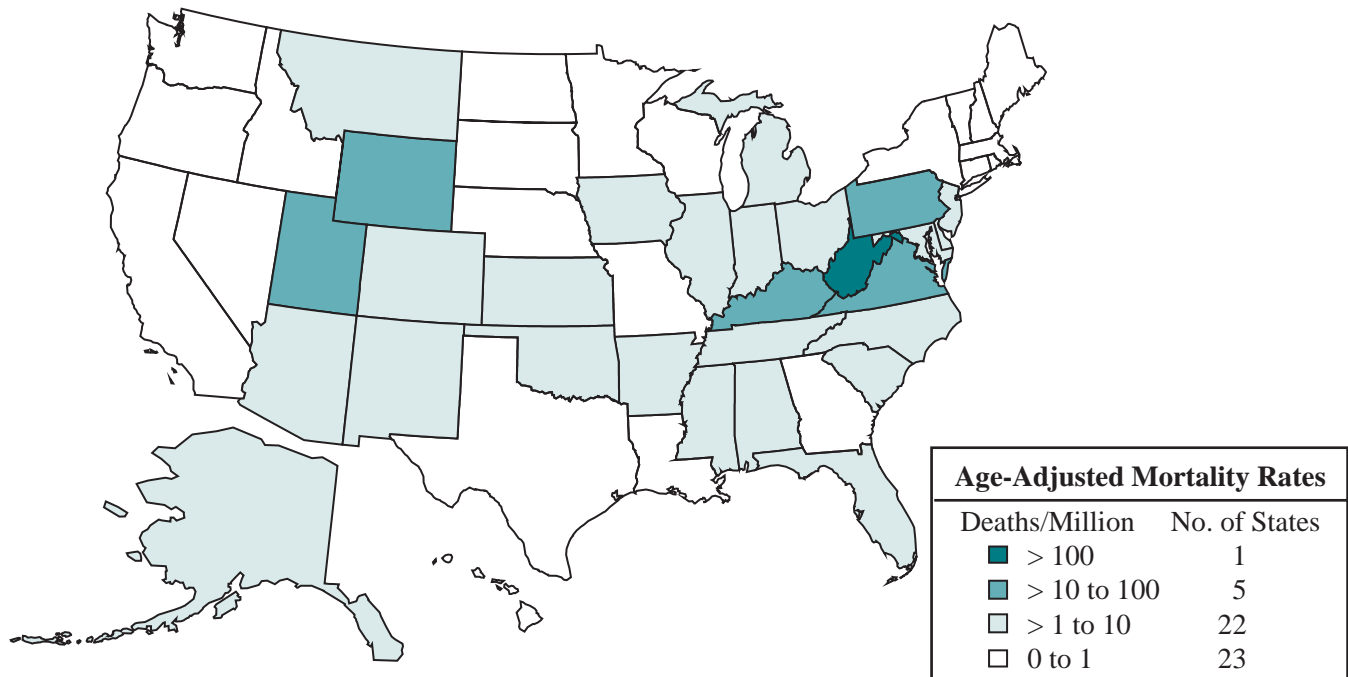
**Figure 2-1. Coal workers' pneumoconiosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 2-2. Coal workers' pneumoconiosis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 2-1. Coal workers' pneumoconiosis: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	1,990	36.9	1,975	15	1,912	72	6	-	-	6	30	120	607	893	334	77.0
1991	1,938	35.8	1,920	18	1,877	60	1	1	2	14	23	110	536	884	368	77.0
1992	1,766	35.7	1,761	5	1,707	55	4	-	2	6	14	90	457	858	339	78.0
1993	1,631	35.1	1,616	15	1,567	62	2	-	2	4	24	111	404	777	309	78.0
1994	1,478	33.3	1,465	13	1,434	42	2	-	-	6	15	78	345	741	293	79.0
1995	1,413	37.7	1,407	6	1,372	41	-	-	3	4	28	75	354	614	335	79.0
1996	1,417	37.8	1,407	10	1,375	39	3	-	-	4	22	51	327	673	340	79.0
1997	1,297	37.5	1,283	14	1,267	30	-	-	2	7	24	54	266	623	321	80.0
1998	1,103	38.2	1,093	10	1,066	35	2	-	1	4	15	51	235	503	294	80.0
1999	1,003	40.9	998	5	971	31	1	-	1	3	10	52	174	459	304	81.0
<b>TOTAL</b>	<b>15,036</b>	<b>36.6</b>	<b>14,925</b>	<b>111</b>	<b>14,548</b>	<b>467</b>	<b>21</b>	<b>1</b>	<b>13</b>	<b>58</b>	<b>205</b>	<b>792</b>	<b>3,705</b>	<b>7,025</b>	<b>3,237</b>	<b>78.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-2. Coal workers' pneumoconiosis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	10.19	23.70	0.14	6.82	0.17	1.44	0.27
1991	9.84	23.03	0.21	5.76	—	0.28	—
1992	8.87	20.89	0.06	5.19	—	1.06	—
1993	8.11	18.90	0.17	5.75	—	0.52	—
1994	7.28	17.16	0.15	3.83	—	0.50	—
1995	6.89	16.35	0.07	3.68	—	—	—
1996	6.83	16.15	0.10	3.43	—	0.46	0.21
1997	6.18	14.71	0.12	2.33	0.22	—	—
1998	5.20	12.31	0.09	2.89	0.07	0.22	0.20
1999	4.68	11.14	0.05	2.59	—	0.21	—
1990-1999	7.33	17.29	0.11	4.13	0.05	0.44	0.07
	Age-Adjusted Mortality Rate						
1990	10.91	31.16	0.12	14.22	0.21	3.68	0.66
1991	10.48	30.29	0.19	12.48	—	0.39	—
1992	9.38	27.29	0.05	10.84	—	2.69	—
1993	8.51	24.18	0.14	11.78	—	0.67	—
1994	7.60	21.82	0.12	8.58	—	1.08	—
1995	7.14	20.72	0.05	7.87	—	—	—
1996	7.02	20.30	0.09	7.25	—	1.30	0.42
1997	6.32	18.82	0.11	4.96	0.31	—	—
1998	5.26	14.98	0.07	5.96	0.09	0.49	0.40
1999	4.71	13.57	0.05	5.41	—	0.46	—
1990-1999	7.59	21.75	0.10	8.72	0.06	1.04	0.16

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



## Coal Workers' Pneumoconiosis: Mortality

**Table 2-3. Coal workers' pneumoconiosis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	1,145	—	25	5	25	—	1,200
1991	1,205	115	35	—	5	—	1,360
1992	810	20	50	—	—	—	880
1993	990	5	65	—	25	—	1,085
1994	745	5	15	—	—	—	765
1995	960	5	35	—	—	—	1,000
1996	650	30	5	—	—	—	685
1997	815	55	5	—	—	—	875
1998	580	—	35	—	—	—	615
1999	410	50	60	—	—	—	520
TOTAL	8,310	285	330	5	55	—	8,985
	Years of Potential Life Lost to Life Expectancy						
1990	17,883	126	548	29	75	8	18,669
1991	17,780	336	472	—	21	—	18,609
1992	15,428	89	463	—	43	—	16,023
1993	14,298	157	540	—	52	—	15,047
1994	12,828	137	306	—	22	—	13,293
1995	12,663	66	331	—	—	—	13,060
1996	12,135	124	296	—	15	8	12,578
1997	11,389	201	208	25	—	—	11,823
1998	9,563	94	296	14	9	6	9,982
1999	8,403	126	285	—	9	—	8,823
TOTAL	132,370	1,456	3,745	68	246	22	137,907

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-4. Coal workers' pneumoconiosis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	29	28	23	19	21	15	14	15	13	8	185
Alaska	-	-	1	-	1	-	-	-	-	1	3
Arizona	5	4	2	4	6	6	7	2	1	4	41
Arkansas	9	7	6	7	3	3	5	4	3	7	54
California	28	41	22	27	28	13	12	4	17	8	200
Colorado	15	15	19	18	6	10	7	11	8	9	118
Connecticut	2	1	3	1	7	1	-	-	1	1	17
Delaware	4	4	1	2	3	-	-	2	-	-	16
District of Columbia	-	-	-	-	-	1	-	-	-	-	1
Florida	25	33	23	25	15	21	28	23	14	16	223
Georgia	4	3	2	7	3	5	3	3	1	2	33
Hawaii	-	-	-	-	-	-	-	-	-	-	-
Idaho	-	-	1	1	-	-	1	2	2	1	8
Illinois	49	43	46	30	24	36	41	39	26	24	358
Indiana	19	33	19	15	16	19	16	22	22	12	193
Iowa	6	6	6	7	1	4	7	4	3	4	48
Kansas	2	2	2	4	3	6	4	1	2	1	27
Kentucky	115	112	116	114	81	84	129	99	90	90	1,030
Louisiana	1	3	-	2	2	1	2	2	1	1	15
Maine	-	-	-	1	-	-	-	-	11	-	12
Maryland	12	5	13	6	10	7	8	7	-	7	75
Massachusetts	2	2	2	-	-	-	-	-	1	-	7
Michigan	21	15	10	11	11	6	10	9	7	6	106
Minnesota	-	-	-	-	-	-	-	-	-	-	-
Mississippi	2	3	1	1	2	6	1	7	6	6	35
Missouri	4	6	11	7	5	3	1	2	2	3	44
Montana	-	-	-	-	1	3	2	2	-	-	8
Nebraska	-	-	-	-	-	-	-	1	1	-	2
Nevada	1	1	1	1	1	-	1	-	-	1	7
New Hampshire	-	-	-	1	-	-	-	1	-	-	2
New Jersey	11	8	14	7	3	8	8	4	5	4	72
New Mexico	3	3	4	4	4	5	7	5	5	4	44
New York	9	4	2	9	11	1	4	4	2	6	52
North Carolina	12	13	10	7	8	15	9	4	6	9	93
North Dakota	1	-	-	-	1	-	-	1	-	-	3
Ohio	79	83	74	64	57	71	64	41	52	31	616
Oklahoma	5	4	1	4	3	4	1	5	2	2	31
Oregon	1	1	1	2	-	1	1	1	1	1	10
Pennsylvania	1,030	961	836	730	681	592	622	550	464	409	6,875
Rhode Island	-	-	-	1	-	-	1	-	-	-	2
South Carolina	1	-	5	3	5	4	3	1	5	2	29
South Dakota	-	-	-	-	-	-	-	1	-	-	1
Tennessee	37	23	30	25	28	30	25	19	23	26	266
Texas	5	7	9	4	6	2	8	6	2	7	56
Utah	18	12	13	12	16	13	6	8	9	5	112
Vermont	-	1	-	-	-	1	-	129	-	-	131
Virginia	131	134	147	151	100	118	124	-	82	86	1,073
Washington	6	1	1	6	4	3	5	6	4	-	36
West Virginia	279	308	283	287	289	291	228	245	207	196	2,613
Wisconsin	3	1	-	1	1	1	-	3	1	1	12
Wyoming	4	7	6	3	11	3	2	2	1	2	41
<b>TOTAL</b>	<b>1,990</b>	<b>1,938</b>	<b>1,766</b>	<b>1,631</b>	<b>1,478</b>	<b>1,413</b>	<b>1,417</b>	<b>1,297</b>	<b>1,103</b>	<b>1,003</b>	<b>15,036</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Coal Workers' Pneumoconiosis: Mortality

**Table 2-5. Coal workers' pneumoconiosis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	185	11	5.58	9	5.75	9	1,756	11	9.5	31
Alaska	3	41	0.69	32	2.59	16	23	42	7.7	44
Arizona	41	24	1.26	23	1.35	23	363	26	8.9	34
Arkansas	54	19	2.79	15	2.39	17	487	21	9.0	32
California	200	9	0.82	31	0.97	30	3,063	7	15.3	5
Colorado	118	12	4.07	11	5.34	10	1,009	14	8.5	38
Connecticut	17	32	0.65	33	0.63	35	142	33	8.3	41
Delaware	16	33	2.83	14	3.25	14	142	33	8.9	34
District of Columbia	1	47	0.22	44	0.24	44	8	48	8.3	41
Florida	223	8	1.94	18	1.50	22	2,312	9	10.4	18
Georgia	33	28	0.59	35	0.76	34	357	27	10.8	16
Hawaii	-	-	-	-	-	-	-	-	-	-
Idaho	8	37	0.93	29	1.00	29	99	37	12.3	9
Illinois	358	6	3.89	12	4.01	13	3,711	6	10.4	18
Indiana	193	10	4.28	10	4.33	11	1,931	10	10.0	24
Iowa	48	21	2.17	16	1.68	20	405	24	8.4	39
Kansas	27	31	1.37	22	1.29	24	418	23	15.5	4
Kentucky	1,030	4	34.13	3	34.39	3	11,919	4	11.6	12
Louisiana	15	34	0.46	37	0.53	36	263	32	17.6	3
Maine	1	47	0.10	49	0.10	49	8	48	8.3	41
Maryland	86	16	2.16	17	2.79	15	842	17	9.8	25
Massachusetts	7	39	0.14	48	0.14	47	95	38	13.5	6
Michigan	106	14	1.43	21	1.56	21	1,131	12	10.7	17
Minnesota	-	-	-	-	-	-	-	-	-	-
Mississippi	35	27	1.72	19	1.80	19	914	16	26.1	2
Missouri	44	22	1.06	27	0.95	31	459	22	10.4	18
Montana	8	37	1.20	25	1.17	26	58	40	7.3	47
Nebraska	2	43	0.16	47	0.13	48	15	45	7.4	46
Nevada	7	39	0.58	36	0.82	33	68	39	9.7	27
New Hampshire	2	43	0.22	44	0.25	43	17	44	8.4	39
New Jersey	72	17	1.13	26	1.19	25	702	18	9.8	25
New Mexico	44	22	3.49	13	4.23	12	384	25	8.7	36
New York	52	20	0.36	41	0.37	40	537	20	10.3	21
North Carolina	93	15	1.62	20	1.83	18	951	15	10.2	22
North Dakota	3	41	0.61	34	0.50	37	23	42	7.6	45
Ohio	616	5	7.08	7	7.13	7	5,968	5	9.7	27
Oklahoma	31	29	1.22	24	1.16	27	355	28	11.5	13
Oregon	10	36	0.41	39	0.37	40	135	36	13.5	6
Pennsylvania	6,875	1	71.22	2	62.73	2	66,262	1	9.6	29
Rhode Island	2	43	0.25	43	0.23	45	14	47	7.2	49
South Carolina	29	30	1.02	28	1.14	28	341	30	11.8	10
South Dakota	1	47	0.18	46	0.19	46	39	41	38.7	1
Tennessee	266	7	6.41	8	6.65	8	2,677	8	10.1	23
Texas	56	18	0.40	40	0.49	38	693	19	12.4	8
Utah	112	13	8.37	6	10.74	6	1,073	13	9.6	29
Vermont	2	43	0.44	38	0.46	39	15	45	7.3	47
Virginia	1,202	3	22.96	4	28.26	4	14,223	3	11.8	10
Washington	36	26	0.86	30	0.94	32	323	31	9.0	32
West Virginia	2,613	2	179.64	1	157.33	1	29,547	2	11.3	14
Wisconsin	12	35	0.30	42	0.29	42	136	35	11.3	14
Wyoming	41	24	11.45	5	13.91	5	351	29	8.6	37

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 2-6. Coal workers' pneumoconiosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

<b>CIC</b>	<b>Industry</b>	<b>Number of Deaths</b>	<b>Percent</b>
041	Coal mining	3,765	77.0
060	Construction	188	3.8
270	Blast furnaces, steelworks, rolling and finishing mills	56	1.1
392	Not specified manufacturing industries	48	1.0
400	Railroads	39	0.8
010	Agricultural production, crops	35	0.7
351	Motor vehicles and motor vehicle equipment	30	0.6
410	Trucking service	29	0.6
040	Metal mining	25	0.5
961	Non-paid worker or non-worker or own home/at home	24	0.5
	All other industries	461	9.4
	Industry not reported	193	3.9
	<b>TOTAL</b>	<b>4,893</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-7. Coal workers' pneumoconiosis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

<b>COC</b>	<b>Occupation</b>	<b>Number of Deaths</b>	<b>Percent</b>
616	Mining machine operators	3,440	70.3
889	Laborers, except construction	147	3.0
575	Electricians	64	1.3
804	Truck drivers	62	1.3
019	Managers and administrators, n.e.c.	59	1.2
613	Supervisors, extractive occupations	49	1.0
567	Carpenters	48	1.0
453	Janitors and cleaners	47	1.0
869	Construction laborers	45	0.9
473	Farmers, except horticulture	39	0.8
844	Operating engineers	39	0.8
	All other occupations	655	13.4
	Occupation not reported	199	4.1
	<b>TOTAL</b>	<b>4,893</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Coal Workers' Pneumoconiosis: Mortality*

**Table 2-8. Coal workers' pneumoconiosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
041	Coal mining	3,765	53.18	51.50	54.91
040	Metal mining	25	1.98	1.28	2.92

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 2-9. Coal workers' pneumoconiosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

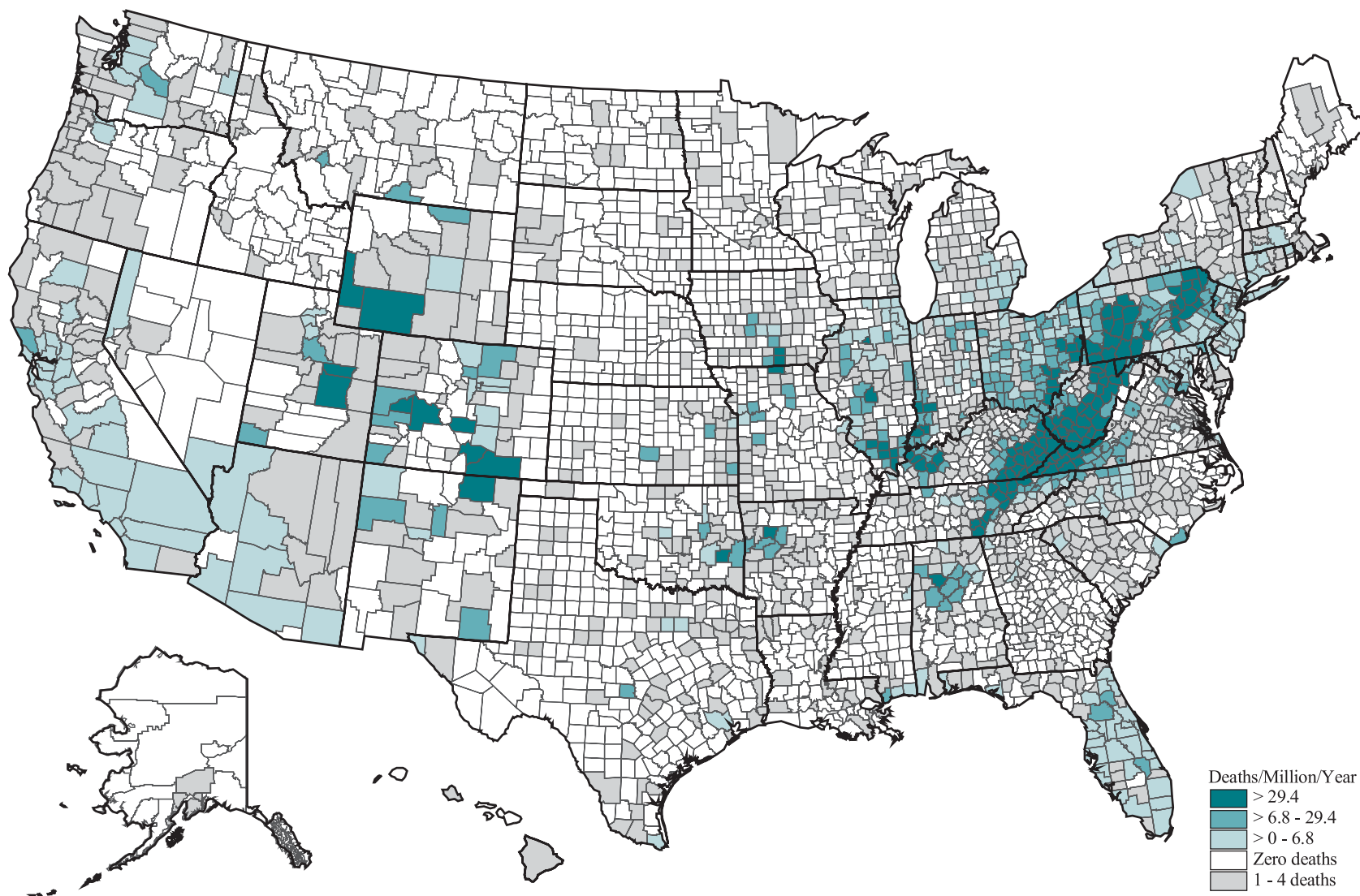
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
616	Mining machine operators	3,440	51.67	49.97	53.44
613	Supervisors, extractive occupations	49	14.36	10.64	18.99
046	Mining engineers	8	6.03	2.60	11.86
617	Mining occupations, n.e.c.	14	4.45	2.43	7.46
859	Miscellaneous material moving equipment operators	12	2.27	1.17	3.96
824	Locomotive operating occupations	23	2.03	1.29	3.05

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

36 **Figure 2-3. Coal workers' pneumoconiosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999**

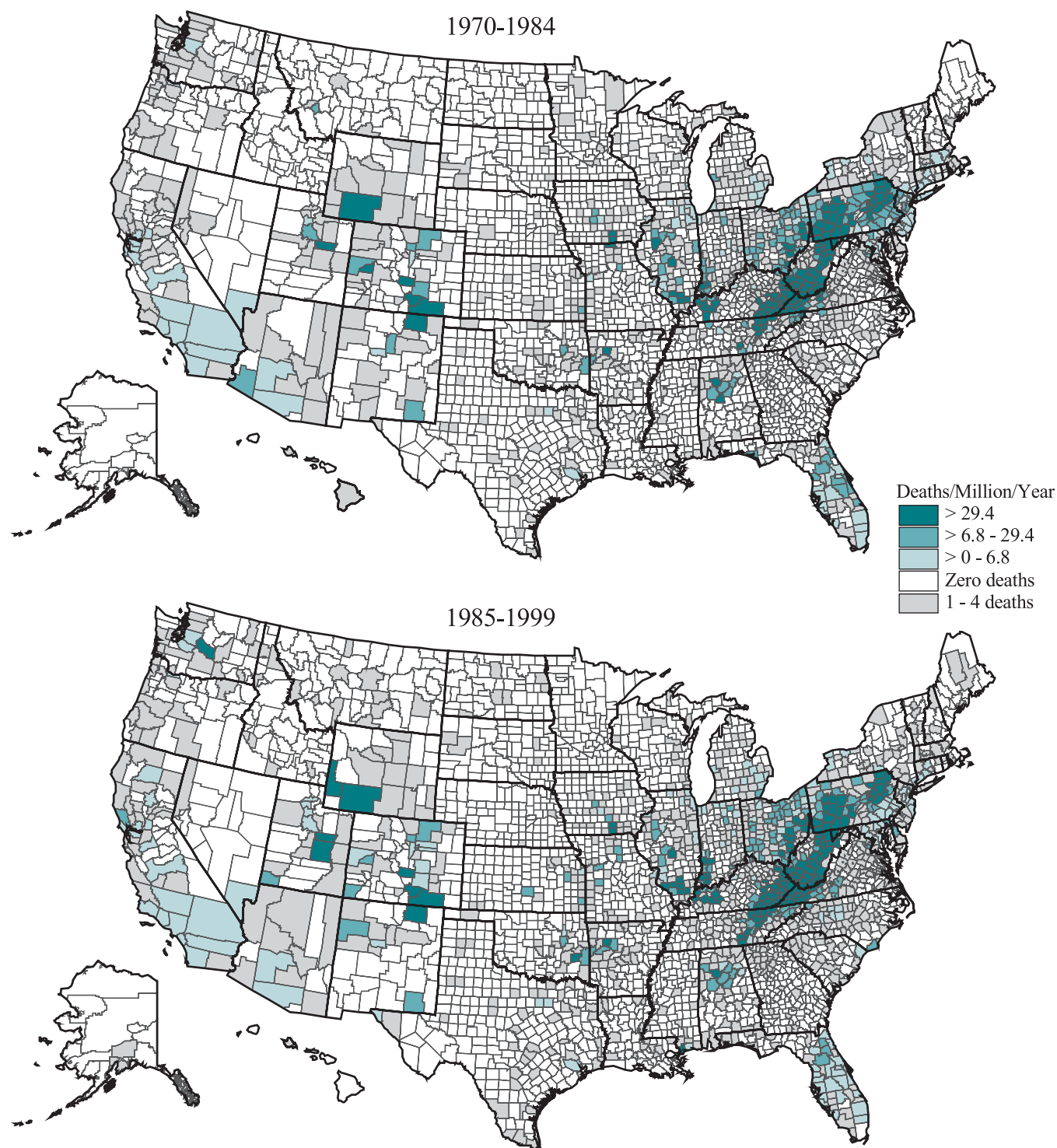


NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



**Figure 2-4. Coal workers' pneumoconiosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Coal Workers' Pneumoconiosis: Mortality

**Table 2-10. Coal workers' pneumoconiosis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Buchanan County	Virginia	1,659.8	1,170.4	430	0.2
Schuylkill County	Pennsylvania	1,042.4	1,454.2	2,744	0.1
McDowell County	West Virginia	1,019.1	1,141.7	447	0.0
Raleigh County	West Virginia	999.2	1,134.7	1,035	0.0
Wyoming County	West Virginia	922.0	769.3	258	0.0
Floyd County	Kentucky	890.2	799.2	401	0.0
Tazewell County	Virginia	741.0	763.6	426	0.2
Wise County	Virginia	739.4	746.4	349	0.3
Dickenson County	Virginia	716.8	703.8	146	0.7
Norton City	Virginia	660.8	655.7	33	0.0
Luzerne County	Pennsylvania	652.4	916.8	3,718	0.3
Boone County	West Virginia	581.3	557.2	173	0.0
Fayette County	West Virginia	536.8	677.8	388	0.0
Letcher County	Kentucky	524.8	492.4	152	0.7
Logan County	West Virginia	514.9	495.4	247	0.4
Harlan County	Kentucky	477.8	471.6	196	0.0
Russell County	Virginia	468.3	442.0	152	0.0
Northumberland County	Pennsylvania	458.2	640.6	744	0.1
Carbon County	Utah	408.8	449.4	97	0.0
Cambria County	Pennsylvania	388.3	512.4	1,008	0.1
Knott County	Kentucky	370.5	299.6	62	0.0
Somerset County	Pennsylvania	360.0	444.3	415	0.0
Lee County	Virginia	352.6	413.3	119	0.8
Mingo County	West Virginia	350.5	290.5	109	0.0
Webster County	West Virginia	341.7	409.2	50	0.0
Carbon County	Pennsylvania	332.6	437.4	308	0.3
Bell County	Kentucky	323.9	320.0	115	0.0
Lackawanna County	Pennsylvania	313.8	439.7	1,173	0.3
Fayette County	Pennsylvania	307.1	391.7	686	0.0
Nicholas County	West Virginia	300.2	322.6	101	1.0
Mercer County	West Virginia	288.3	353.4	277	0.4
Johnson County	Kentucky	287.1	240.9	66	0.0
Emery County	Utah	284.9	226.5	22	0.0
Pike County	Kentucky	253.1	209.2	177	0.6
Greene County	Pennsylvania	244.2	306.8	144	0.0
Franklin County	Illinois	241.0	347.9	168	0.0
Muhlenberg County	Kentucky	213.3	241.4	89	0.0
Knox County	Kentucky	203.6	206.8	72	1.4
Leslie County	Kentucky	201.0	162.6	25	0.0
Campbell County	Tennessee	198.1	213.1	90	0.0
Indiana County	Pennsylvania	194.2	196.6	214	0.0
Martin County	Kentucky	193.8	149.2	21	0.0
Perry County	Kentucky	187.1	157.9	56	0.0
Greenbrier County	West Virginia	184.9	237.4	101	0.0
Clay County	West Virginia	180.9	194.9	22	0.0
Preston County	West Virginia	176.3	196.2	67	0.0
Marion County	West Virginia	155.9	207.6	146	0.0
Whitley County	Kentucky	155.4	156.8	62	0.0
Grundy County	Tennessee	142.8	154.1	24	0.0
Sweetwater County	Wyoming	137.2	79.0	34	0.0
<b>Overall United States</b>		<b>9.4</b>	<b>8.9</b>	<b>26,706</b>	<b>0.7</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

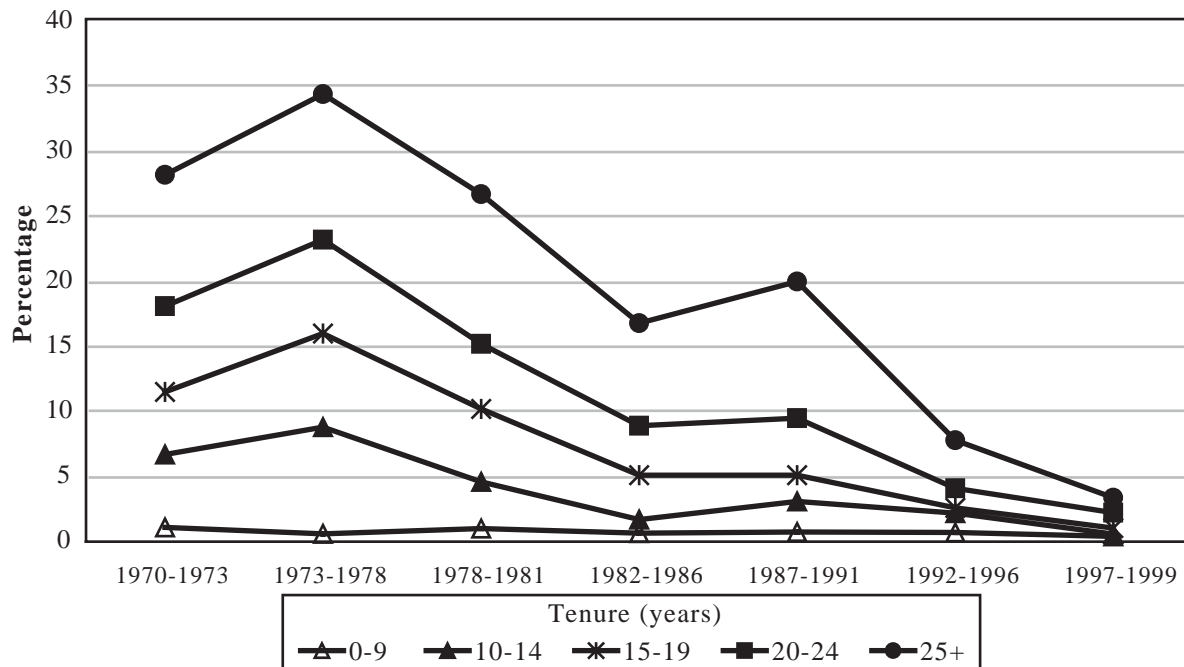
**Table 2-11. Coal workers' pneumoconiosis: Estimated number of discharges from short-stay nonfederal hospitals, 1970-2000**

Year	Number of Discharges
1970	6,000
1971	8,000
1972	11,000
1973	13,000
1974	14,000
1975	17,000
1976	18,000
1977	18,000
1978	13,000
1979	18,000
1980	17,000
1981	14,000
1982	17,000
1983	22,000
1984	23,000
1985	18,000
1986	16,000
1987	17,000
1988	15,000
1989	11,000
1990	7,000
1991	11,000
1992	10,000
1993	8,000
1994	9,000
1995	16,000
1996	11,000
1997	15,000
1998	8,000
1999	8,000
2000	10,000

NOTE: Number of discharges has been rounded. NCHS recommends that, in statistical comparisons, estimates of less than 5,000 not be used and that estimates of 5,000 to 10,000 be used with caution. See appendices for source description and methods.

SOURCE: National Center for Health Statistics National Hospital Discharge Survey.

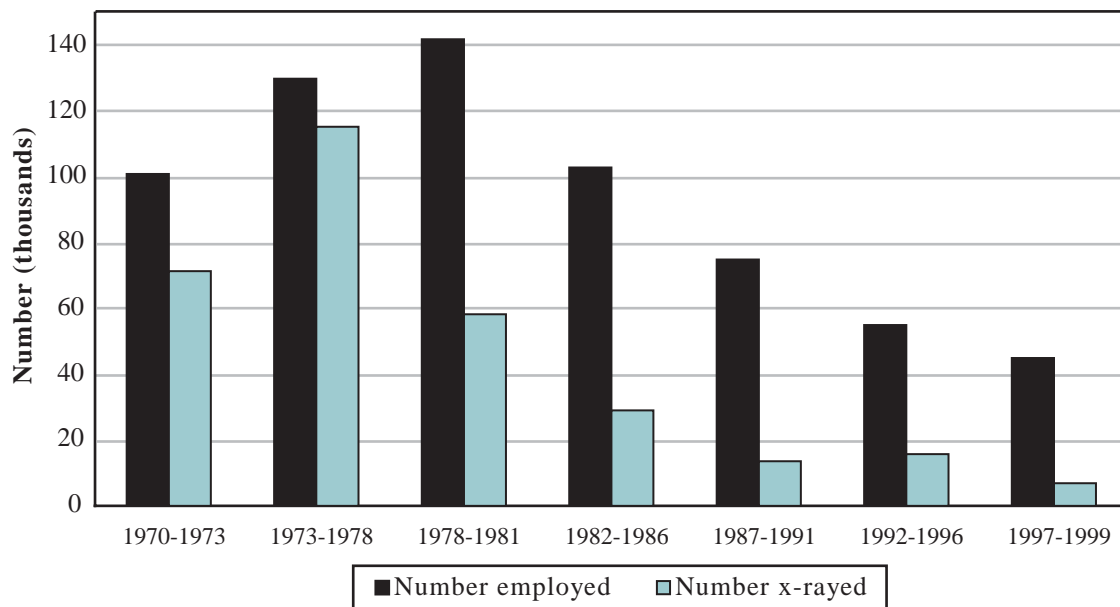
**Figure 2-5. CWXSP: Percentage of examined miners with coal workers' pneumoconiosis (category 1/0+) by tenure in mining, 1970-1999**



NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program.

**Figure 2-6. CWXSP: Estimated number of actively employed underground coal miners and number examined, 1970-1999**



NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program. Mine Safety and Health Administration (MSHA) coal mine employment data

**Table 2-12. CWXSP: Number and percentage of examined miners with coal workers' pneumoconiosis (category 1/0+), by round and tenure, 1970-1999**

Tenure Years in Mining	Round 1 1970-1973			Round 2 1973-1978			Round 3 1978-1981			Round 4 1982-1986			Round 5 1987-1991			Round 6 1992-1996			Round 7 1997-1999		
	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%	Miners examined No.	Cat. 1/0+ No.	%
<b>0</b>	15,844	100	0.6	50,341	31	0.1	14,528	94	0.6	3,577	18	0.5	2,007	10	0.5	1,812	13	0.7	969	6	0.6
<b>1</b>	5,287	49	0.9	9,579	13	0.1	3,719	18	0.5	742	1	0.1	356	0	0.0	238	2	0.8	163	0	0.0
<b>2-4</b>	8,274	73	0.9	18,432	137	0.7	12,059	103	0.8	3,786	25	0.7	1,057	6	0.6	791	2	0.3	388	2	0.5
<b>5-9</b>	6,706	182	2.7	13,528	386	2.8	14,157	215	1.5	7,434	57	0.8	2,763	30	1.1	1,235	12	1.0	418	0	0.0
<b>10-14</b>	4,451	298	6.7	5,282	466	8.8	5,318	246	4.6	5,435	93	1.7	4,120	123	3.0	2,522	56	2.2	511	3	0.6
<b>15-19</b>	4,743	546	11.5	3,380	542	16.0	2,168	221	10.2	1,824	93	5.1	2,279	114	5.0	4,646	119	2.6	1,148	12	1.0
<b>20-24</b>	7,279	1,316	18.1	3,214	745	23.2	1,505	228	15.2	711	63	8.9	769	71	9.2	3,220	132	4.1	1,983	44	2.2
<b>25-29</b>	6,260	1,368	21.8	4,437	1,279	28.8	1,294	257	19.9	491	64	13.0	257	52	20.2	938	51	5.4	1,057	28	2.7
<b>30+</b>	12,602	3,947	31.3	7,193	2,722	37.8	3,546	1,034	29.2	1,154	213	18.5	312	61	19.6	365	51	14.0	277	17	6.1
<b>TOTAL</b>	<b>71,446</b>	<b>7,897</b>	<b>11.0</b>	<b>115,386</b>	<b>6,321</b>	<b>5.5</b>	<b>58,294</b>	<b>2,416</b>	<b>4.1</b>	<b>25,154</b>	<b>627</b>	<b>2.5</b>	<b>13,920</b>	<b>467</b>	<b>3.4</b>	<b>15,767</b>	<b>438</b>	<b>2.8</b>	<b>6,914</b>	<b>112</b>	<b>1.6</b>

NOTE: Tabulations are based on one chest x-ray per round for each participating miner.

Round 1: Jan. 1970 - July 1973

Round 2: Aug. 1973 - July 1978

Round 3: Aug. 1978 - Dec. 1981

Round 4: Jan. 1982 - Dec. 1986

Round 5: Jan. 1987 - Dec. 1991

Round 6: Jan. 1992 - Dec. 1996

Round 7: Jan. 1997 - Dec. 1999

NOTE: 1997-1999 represents a partial round. See appendices for source description.

SOURCE: NIOSH Coal Workers' X-ray Surveillance Program.

## *Coal Workers' Pneumoconiosis: Black Lung Benefits*

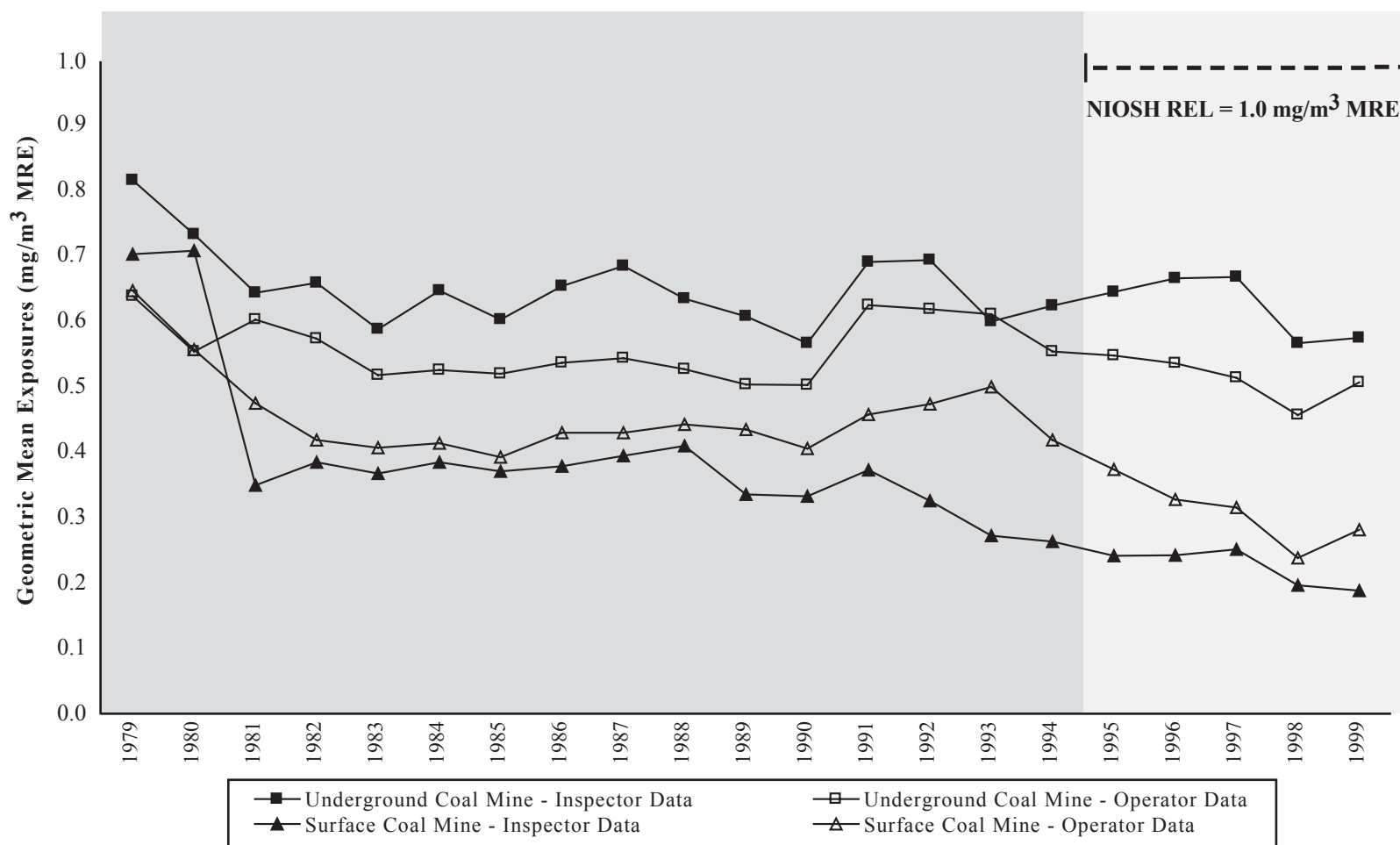
**Table 2-13. Federal Black Lung Program: Number of beneficiaries and total payments by the Social Security Administration and Department of Labor, 1980-1999**

Year	Social Security Administration (SSA)		Department of Labor (DOL)		SSA and DOL	
	Beneficiaries	Amount (dollars)	Beneficiaries	Amount (dollars)	Total Beneficiaries	Total Amount (dollars)
1980	399,477	1,032,000,000	139,073	813,205,000	538,550	1,845,205,000
1981	376,505	1,081,300,000	163,401	805,627,000	539,906	1,886,927,000
1982	354,569	1,076,000,000	173,972	784,085,000	528,541	1,860,085,000
1983	333,358	1,055,800,000	166,043	858,854,000	499,401	1,914,654,000
1984	313,822	1,038,000,000	163,166	873,932,000	476,988	1,911,932,000
1985	294,846	1,025,000,000	160,441	905,517,000	455,287	1,930,517,000
1986	275,783	971,000,000	156,892	629,075,000	432,675	1,600,075,000
1987	258,988	940,000,000	153,769	655,290,000	412,757	1,595,290,000
1988	241,626	904,000,000	150,123	656,689,000	391,749	1,560,689,000
1989	225,764	882,000,000	145,289	650,123,000	371,053	1,532,123,000
1990	210,678	863,400,000	139,854	626,521,000	350,532	1,489,921,000
1991	196,419	844,400,000	134,205	942,428,000	330,624	1,786,828,000
1992	182,396	822,500,000	128,761	973,636,000	311,157	1,796,136,000
1993	168,365	794,300,000	123,213	984,666,000	291,578	1,778,966,000
1994	155,122	751,900,000	117,569	994,655,000	272,691	1,746,555,000
1995	143,011	696,700,000	111,769	995,722,000	254,780	1,692,422,000
1996	131,143	654,600,000	105,923	992,128,000	237,066	1,646,728,000
1997	119,233	614,888,000	100,352	1,004,672,000	219,585	1,619,560,000
1998	109,271	576,389,000	94,488	999,822,000	203,759	1,576,211,000
1999	98,977	541,200,000	88,716	1,005,246,000	187,693	1,546,446,000

NOTE: The Social Security Administration (SSA) was assigned initial responsibility for administering the Black Lung benefits program. The Department of Labor (DOL) assumed responsibility for processing and paying claims on July 1, 1973. Most claims filed prior to July 1, 1973 remain within the jurisdiction of SSA, which also continues to be responsible for processing and paying claims filed by the survivors of these miners. The dollar amounts from the Department of Labor are for fiscal years. See appendices for source description.

SOURCE: Social Security Bulletin Annual Statistical Supplement (annual reports) and Black Lung Benefits Act Annual Report to Congress (annual reports).

**Figure 2-7. Respirable coal mine dust: Geometric mean exposures by type of mine, MSHA inspector and mine operator samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter      MRE - Mining Research Establishment  
 NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. See appendices for source description, methods, and agents.  
 SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.

**Table 2-14. Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by type of facility, MSHA inspector and mine operator samples, 1979-1999**

Type of Facility and Sample Source																		NIOSH REL = 1.0 mg/m <sup>3</sup> MRE				
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Underground Coal Mine Inspector Samples</b>	GM (mg/m <sup>3</sup> )	0.815	0.732	0.643	0.658	0.587	0.646	0.602	0.653	0.684	0.634	0.607	0.566	0.690	0.693	0.599	0.623	0.644	0.665	0.667	0.566	0.574
	No. of samples	1,897	13,125	13,533	13,882	13,588	12,884	13,115	13,010	13,118	14,372	13,608	12,450	10,912	10,709	9,582	10,334	11,919	11,826	16,441	23,689	33,419
	% > PEL	19.1	14.6	11.5	10.4	9.5	11.1	10.2	11.4	11.3	10.1	9.8	8.5	11.0	10.0	7.4	8.3	8.6	8.3	7.8	6.5	5.3
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.5	33.2	32.4	26.5	26.8
<b>Underground Coal Mine Operator Samples</b>	GM (mg/m <sup>3</sup> )	0.638	0.553	0.602	0.573	0.517	0.525	0.519	0.536	0.543	0.526	0.503	0.502	0.624	0.618	0.610	0.553	0.547	0.535	0.513	0.456	0.506
	No. of samples	166,582	190,771	31,337	68,926	69,591	70,222	66,473	65,948	65,197	66,098	65,169	65,403	62,729	60,749	55,960	52,835	47,892	43,300	42,375	41,601	37,663
	% > PEL	17.0	15.4	14.7	12.8	10.5	10.2	10.0	10.7	10.8	9.4	8.9	8.5	11.9	10.9	10.8	10.5	10.3	9.6	9.2	8.9	9.0
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.2	30.7	29.4	28.9	31.2
<b>Surface Coal Mine Inspector Samples</b>	GM (mg/m <sup>3</sup> )	0.702	0.707	0.349	0.384	0.367	0.384	0.370	0.378	0.394	0.409	0.335	0.332	0.372	0.325	0.272	0.263	0.241	0.242	0.251	0.196	0.188
	No. of samples	472	3,578	16,164	13,098	12,684	13,333	13,036	10,957	9,833	9,176	8,089	8,135	5,165	4,762	5,983	6,458	6,032	6,713	7,761	9,449	10,524
	% > PEL	16.3	14.8	5.2	5.7	6.3	7.7	5.9	5.9	5.9	6.4	4.5	4.4	4.6	4.1	2.8	2.4	1.8	1.4	1.3	1.0	1.1
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.4	7.3	7.3	5.5	6.1
<b>Surface Coal Mine Operator Samples</b>	GM (mg/m <sup>3</sup> )	0.646	0.556	0.474	0.418	0.406	0.413	0.392	0.429	0.429	0.442	0.434	0.405	0.457	0.473	0.499	0.418	0.373	0.327	0.315	0.238	0.281
	No. of samples	38,479	47,107	16,730	37,744	35,548	37,998	32,467	26,016	20,346	14,547	12,546	11,701	10,202	6,158	5,153	5,278	4,563	4,830	4,959	4,543	4,480
	% > PEL	17.0	15.7	9.1	8.1	8.1	8.4	7.2	7.6	8.1	6.9	6.8	5.7	8.0	6.9	8.1	6.6	4.8	3.6	3.7	2.2	3.4
	% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.0	16.1	15.6	12.2	15.0

- indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.



## *Coal Workers' Pneumoconiosis: Coal Mine Dust Exposures*

**Table 2-15. Respirable coal mine dust: Number of samples, geometric mean exposures, and percent exceeding designated occupational exposure limits by industries with elevated coal workers' pneumoconiosis mortality, MSHA inspector and mine operator samples, 1990-1999**

Coal Workers' Pneumoconiosis Mortality, Selected States and Years, 1990-1999							
CIC	Industries with elevated PMRs and most frequently recorded on death certificates	Number of Deaths	PMR	Number of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL 1995-1999
041	Coal mining	3,765	53.18	794,637	0.509	8.6	26.2
	All other industries	935		0	-	-	-
	<b>TOTAL</b>			<b>794,637</b>	<b>0.509</b>	<b>8.6</b>	<b>26.2</b>

- indicates incalculable field

CIC - Census Industry Code

PEL - permissible exposure limit

REL - recommended exposure limit

PMR - proportionate mortality ratio

GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter      MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states and years for which usual industry has been reported.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data. National Center for Health Statistics multiple cause of death data.

**Table 2-16 (page 1 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>MSHA Coal Mine District</b>												
<b>District 1</b> (Anthracite coal mining regions in Pennsylvania)	<b>40,660</b>	<b>0.203</b>	<b>22,717</b>	<b>0.219</b>	<b>2.7</b>	<b>9,277</b>	<b>0.184</b>	<b>2.4</b>	<b>8,666</b>	<b>0.186</b>	<b>2.6</b>	<b>8.9</b>
<b>District 2</b> (Bituminous coal mining regions in Pennsylvania)	<b>289,781</b>	<b>0.512</b>	<b>208,709</b>	<b>0.515</b>	<b>9.8</b>	<b>40,164</b>	<b>0.564</b>	<b>9.5</b>	<b>40,908</b>	<b>0.451</b>	<b>5.8</b>	<b>23.9</b>
<b>District 3</b>	<b>258,453</b>	<b>0.558</b>	<b>184,655</b>	<b>0.590</b>	<b>12.7</b>	<b>38,816</b>	<b>0.531</b>	<b>7.5</b>	<b>34,982</b>	<b>0.436</b>	<b>5.2</b>	<b>23.3</b>
Maryland	9,818	0.621	5,668	0.674	13.1	1,501	0.614	6.9	2,649	0.523	6.1	32.3
Ohio	85,691	0.606	66,440	0.672	16.3	9,792	0.479	6.0	9,459	0.372	4.7	22.5
Northern West Virginia	162,944	0.531	112,547	0.543	10.5	27,523	0.547	8.1	22,874	0.457	5.4	22.5
<b>District 4</b> (Southern West Virginia)	<b>451,111</b>	<b>0.551</b>	<b>306,083</b>	<b>0.572</b>	<b>14.6</b>	<b>76,284</b>	<b>0.531</b>	<b>10.6</b>	<b>68,744</b>	<b>0.485</b>	<b>9.0</b>	<b>27.4</b>
<b>District 5</b> (Virginia)	<b>287,317</b>	<b>0.467</b>	<b>189,909</b>	<b>0.465</b>	<b>9.3</b>	<b>55,143</b>	<b>0.512</b>	<b>8.4</b>	<b>42,265</b>	<b>0.421</b>	<b>5.9</b>	<b>20.7</b>
<b>District 6</b> (Eastern Kentucky)	<b>266,705</b>	<b>0.415</b>	<b>154,093</b>	<b>0.392</b>	<b>7.0</b>	<b>56,560</b>	<b>0.467</b>	<b>8.3</b>	<b>56,052</b>	<b>0.433</b>	<b>6.6</b>	<b>22.4</b>
<b>District 7</b>	<b>262,223</b>	<b>0.449</b>	<b>143,987</b>	<b>0.444</b>	<b>7.2</b>	<b>63,635</b>	<b>0.483</b>	<b>7.0</b>	<b>54,601</b>	<b>0.423</b>	<b>6.2</b>	<b>21.2</b>
Central Kentucky	216,315	0.457	112,157	0.453	7.5	54,830	0.492	7.2	49,328	0.430	6.3	21.4
North Carolina	9	0.147	6	0.159	0.0	3	0.126	0.0	0	-	-	-
South Carolina	0	-	0	-	-	0	-	-	0	-	-	-
Tennessee	45,870	0.411	31,795	0.413	6.5	8,802	0.432	6.0	5,273	0.366	6.1	19.2
Northern Georgia	29	0.328	29	0.328	0.0	0	-	-	0	-	-	-
<b>District 8</b>	<b>146,515</b>	<b>0.743</b>	<b>99,969</b>	<b>0.681</b>	<b>14.7</b>	<b>26,146</b>	<b>0.899</b>	<b>14.3</b>	<b>20,400</b>	<b>0.891</b>	<b>15.5</b>	<b>50.5</b>
Illinois	131,785	0.794	90,886	0.731	15.6	23,477	0.974	15.0	17,422	0.934	15.4	52.0
Indiana	13,033	0.424	7,575	0.342	5.2	2,514	0.459	8.6	2,944	0.687	16.6	42.8
Iowa	886	0.384	813	0.388	5.3	73	0.344	0.0	0	-	-	-
Michigan	0	-	0	-	-	0	-	-	0	-	-	-
Minnesota	0	-	0	-	-	0	-	-	0	-	-	-
Northern Missouri	811	0.249	695	0.260	1.7	82	0.240	2.4	34	0.107	0.0	0.0
Wisconsin	0	-	0	-	-	0	-	-	0	-	-	-

See footnotes at end of table.

**Table 2-16 (page 2 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

MSHA Coal Mine District	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>District 9</b>	<b>120,599</b>	<b>0.683</b>	<b>78,749</b>	<b>0.696</b>	<b>19.8</b>	<b>22,044</b>	<b>0.759</b>	<b>15.0</b>	<b>19,806</b>	<b>0.565</b>	<b>9.3</b>	<b>33.8</b>
Alaska	246	0.338	181	0.408	6.6	48	0.237	2.1	17	0.123	0.0	0.0
Arizona	913	0.252	484	0.310	5.0	201	0.308	4.5	228	0.136	1.3	1.9
Arkansas	311	0.172	238	0.205	2.5	37	0.149	2.7	36	0.064	0.0	0.0
California	12	0.218	0	-	-	1	0.400	0.0	11	0.206	0.0	9.1
Colorado	38,040	0.844	25,744	0.845	24.1	6,616	0.915	16.4	5,680	0.765	10.4	40.7
Hawaii	0	-	0	-	-	0	-	-	0	-	-	-
Idaho	0	-	0	-	-	0	-	-	0	-	-	-
Kansas	510	0.216	383	0.235	2.6	49	0.190	0.0	78	0.152	1.3	1.4
Louisiana	105	0.186	14	0.163	0.0	39	0.228	0.0	52	0.165	0.0	0.0
Southern Missouri	647	0.236	453	0.255	2.0	56	0.160	0.0	138	0.216	1.4	7.0
Montana	1,720	0.296	1,096	0.368	7.2	213	0.250	2.8	411	0.181	2.7	5.6
Nebraska	0	-	0	-	-	0	-	-	0	-	-	-
Nevada	0	-	0	-	-	0	-	-	0	-	-	-
New Mexico	5,222	0.615	3,535	0.767	23.7	876	0.753	20.2	811	0.188	3.5	6.2
North Dakota	1,345	0.187	1,029	0.221	1.9	163	0.157	0.6	153	0.073	0.0	0.0
Oklahoma	4,857	0.331	2,972	0.345	6.9	985	0.325	6.7	900	0.297	3.4	9.8
Oregon	0	-	0	-	-	0	-	-	0	-	-	-
Texas	4,005	0.179	2,740	0.194	1.4	664	0.198	3.9	601	0.109	1.0	3.5
Utah	52,952	0.852	34,017	0.834	21.8	10,277	0.928	16.4	8,658	0.834	12.1	43.6
Washington	346	0.178	124	0.166	0.0	74	0.257	2.7	148	0.158	0.7	4.3
Wyoming	9,368	0.463	5,739	0.479	12.5	1,745	0.569	14.1	1,884	0.345	7.0	21.9

See footnotes at end of table.

**Table 2-16 (page 3 of 3). Respirable coal mine dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1979-1999**

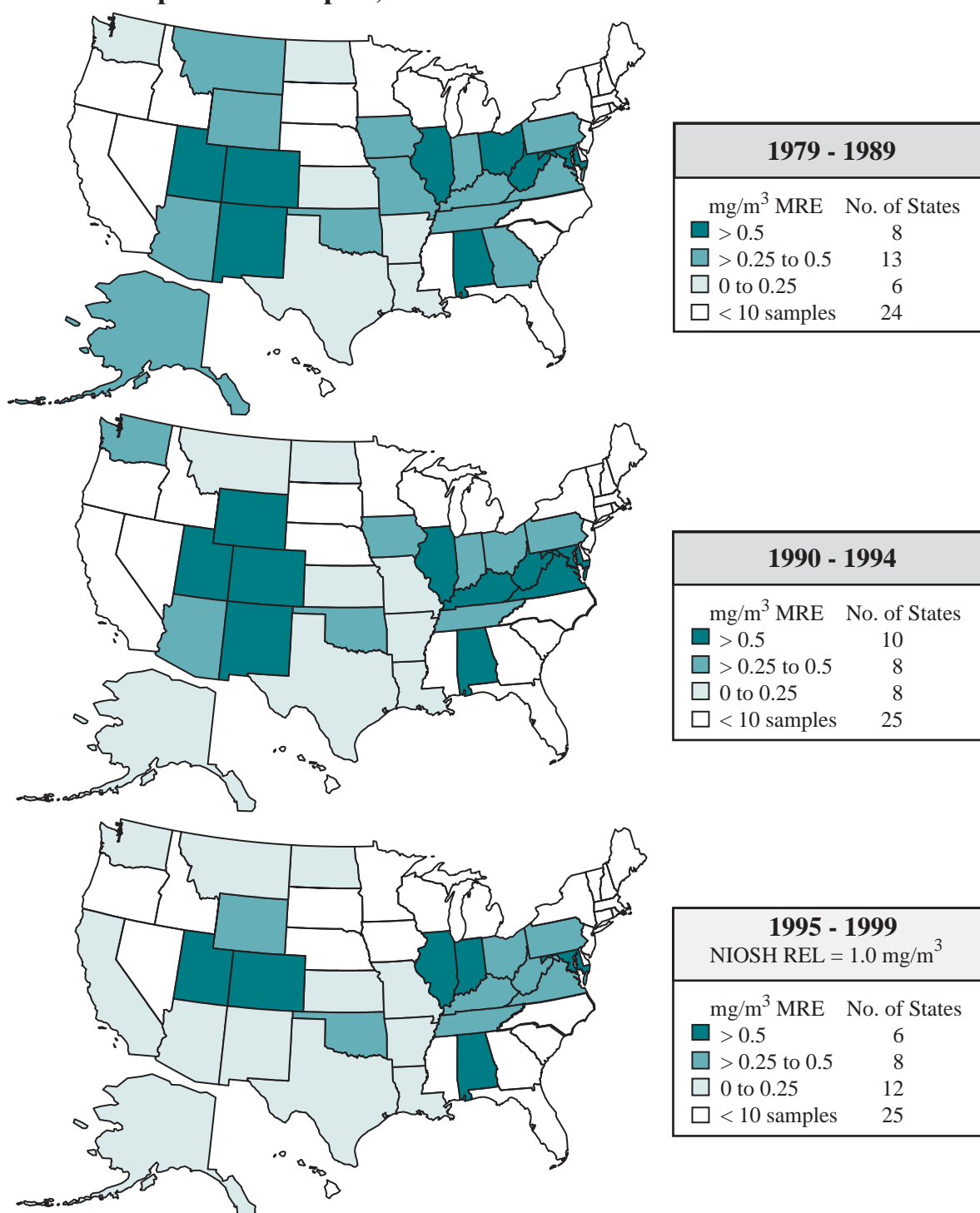
	All years		1979 – 1989			1990 – 1994			1995 - 1999 NIOSH REL = 1.0 mg/m <sup>3</sup> MRE			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > REL	% > REL
<b>MSHA Coal Mine District</b>												
<b>District 10 (Western Kentucky)</b>	<b>77,891</b>	<b>0.676</b>	<b>50,923</b>	<b>0.603</b>	<b>12.1</b>	<b>14,282</b>	<b>0.847</b>	<b>14.8</b>	<b>12,686</b>	<b>0.829</b>	<b>14.2</b>	<b>48.4</b>
<b>District 11</b>	<b>85,776</b>	<b>0.686</b>	<b>52,600</b>	<b>0.714</b>	<b>15.7</b>	<b>18,307</b>	<b>0.724</b>	<b>10.7</b>	<b>14,869</b>	<b>0.556</b>	<b>6.6</b>	<b>29.8</b>
Alabama	85,776	0.686	52,600	0.714	15.7	18,307	0.724	10.7	14,869	0.556	6.6	29.8
Central and Southern Georgia	0	-	0	-	-	0	-	-	0	-	-	-
Florida	0	-	0	-	-	0	-	-	0	-	-	-
Mississippi	0	-	0	-	-	0	-	-	0	-	-	-
Puerto Rico	0	-	0	-	-	0	-	-	0	-	-	-
Virgin Islands	0	-	0	-	-	0	-	-	0	-	-	-
<b>TOTAL</b>	<b>2,287,031</b>	<b>0.520</b>	<b>1,492,394</b>	<b>0.526</b>	<b>11.6</b>	<b>420,658</b>	<b>0.545</b>	<b>9.5</b>	<b>373,979</b>	<b>0.472</b>	<b>7.5</b>	<b>26.2</b>

- indicates incalculable field      PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter  
MRE - Mining Research Establishment

NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. All samples are compared to the MSHA PEL for respirable coal mine dust containing less than 5% quartz, regardless of actual quartz content. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.

**Figure 2-8. Respirable coal mine dust: Geometric mean exposures by state, MSHA inspector and mine operator samples, 1979-1999**



PEL - permissible exposure limit REL - recommended exposure limit mg/m<sup>3</sup> - milligrams per cubic meter MRE - Mining Research Establishment  
 NOTE: In coal mining, for respirable dust containing less than 5% quartz, the MSHA PEL is 2 mg/m<sup>3</sup> MRE; for respirable dust containing greater than 5% quartz, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)]. The NIOSH REL of 1 mg/m<sup>3</sup> MRE for respirable coal mine dust was adopted in September of 1995. Geometric means are reported in MRE equivalent. See appendices for source description, methods, and agents.  
 SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust data.



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# **Section 3**

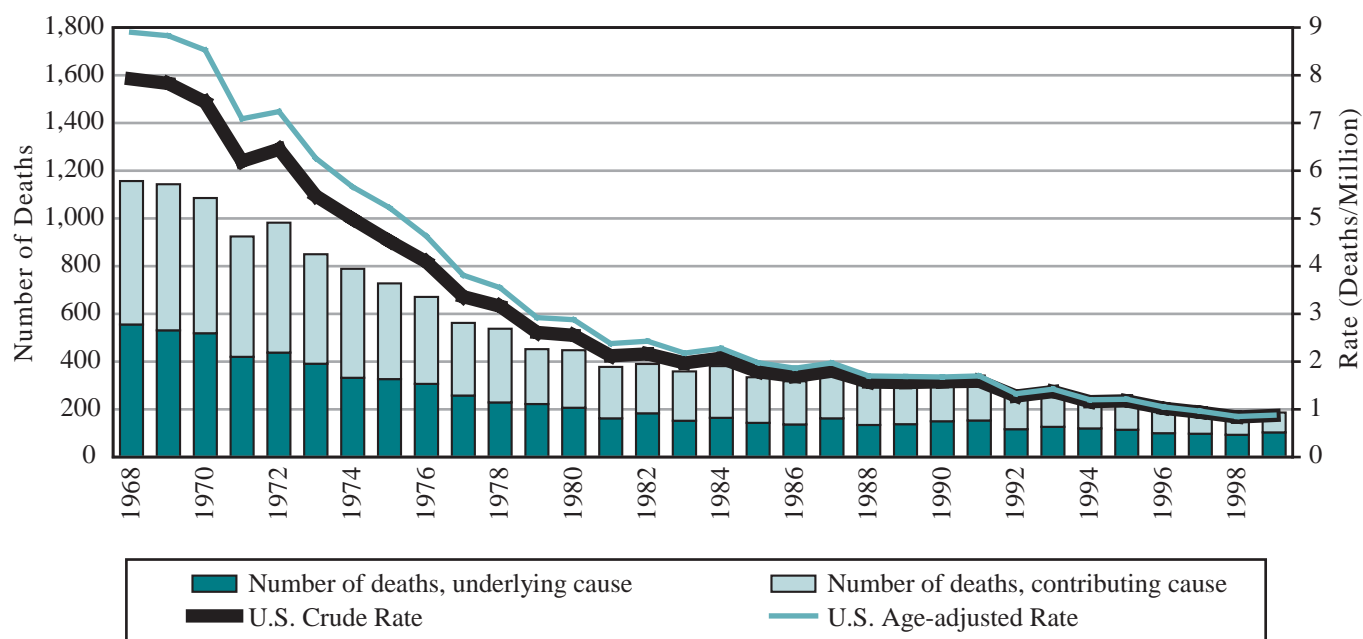
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## **Silicosis and Related Exposures**





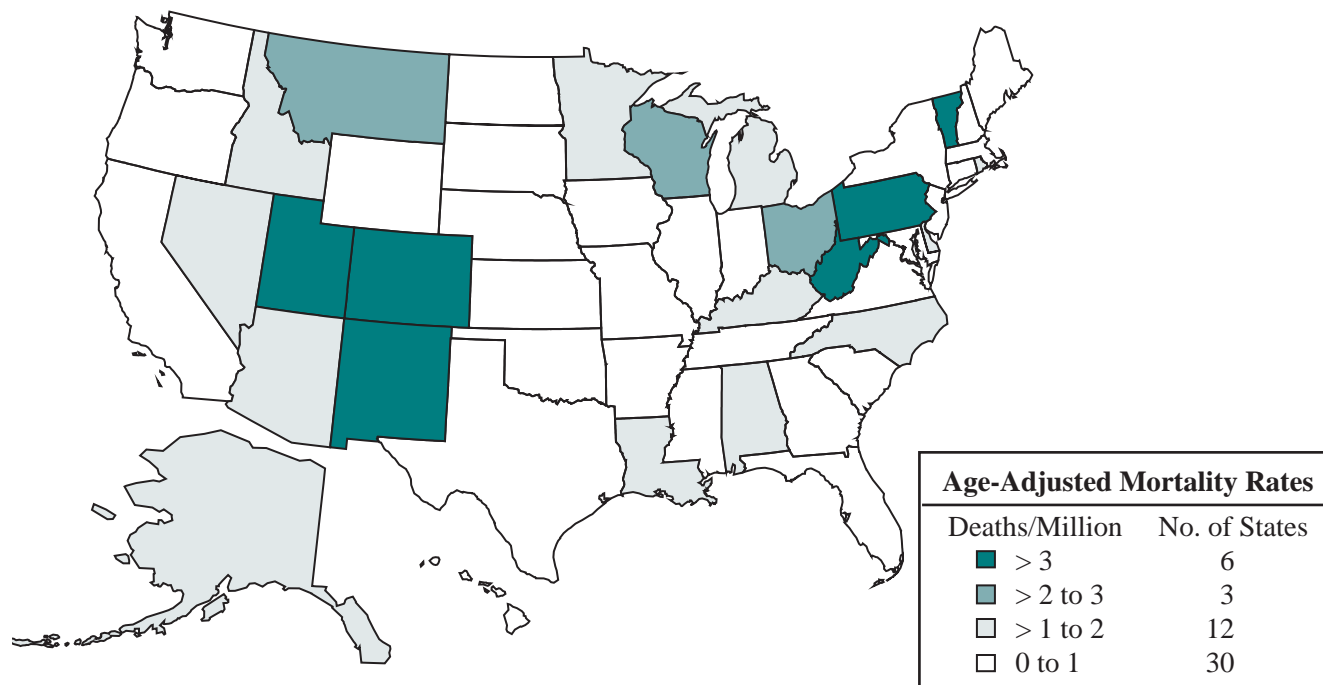
**Figure 3-1. Silicosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 3-2. Silicosis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 3-1. Silicosis: Number of deaths by sex, race, age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	308	48.7	298	10	261	46	1	-	2	6	11	46	81	125	37	75.0
1991	314	48.7	305	9	257	56	1	1	1	4	12	40	78	135	43	76.0
1992	255	45.9	240	15	212	39	4	-	1	3	8	36	79	96	32	75.0
1993	276	46.0	268	8	240	32	4	-	1	5	10	32	88	96	44	75.0
1994	235	51.1	222	13	206	27	2	-	-	1	7	35	59	100	33	77.0
1995	242	47.1	232	10	198	42	2	-	-	2	8	28	70	98	36	76.0
1996	212	47.2	206	6	184	26	2	-	1	2	7	25	54	83	40	76.0
1997	198	49.5	189	9	163	32	3	-	-	4	7	26	67	58	36	74.0
1998	178	52.2	174	4	158	18	2	-	-	5	9	17	47	68	32	76.0
1999	187	55.1	181	6	154	30	3	-	-	3	9	21	58	61	35	75.0
<b>TOTAL</b>	<b>2,405</b>	<b>48.9</b>	<b>2,315</b>	<b>90</b>	<b>2,033</b>	<b>348</b>	<b>24</b>	<b>1</b>	<b>6</b>	<b>35</b>	<b>88</b>	<b>306</b>	<b>681</b>	<b>920</b>	<b>368</b>	<b>76.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 3-2. Silicosis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	1.58	3.14	0.11	4.38	0.08	0.29	—
1991	1.59	3.08	0.09	5.28	0.08	0.28	—
1992	1.28	2.46	0.14	3.49	0.16	0.80	0.25
1993	1.37	2.85	0.07	2.78	0.16	1.04	—
1994	1.16	2.34	0.14	2.37	0.08	0.50	—
1995	1.18	2.27	0.09	3.59	0.15	0.49	—
1996	1.02	2.10	0.07	2.29	—	0.46	—
1997	0.94	1.82	0.09	2.68	0.07	0.68	—
1998	0.84	1.80	0.03	1.44	0.07	0.44	—
1999	0.87	1.72	0.05	2.42	0.07	0.64	—
1990-1999	1.17	2.34	0.09	3.01	0.09	0.56	0.02
	Age-Adjusted Mortality Rate						
1990	1.68	4.01	0.09	7.15	0.09	0.50	—
1991	1.70	3.92	0.08	9.60	0.12	0.39	—
1992	1.33	2.99	0.12	6.74	0.19	1.59	0.55
1993	1.42	3.45	0.06	4.98	0.19	3.42	—
1994	1.20	2.87	0.11	4.00	0.08	1.02	—
1995	1.21	2.73	0.07	6.60	0.21	0.72	—
1996	1.05	2.57	0.05	3.86	—	1.00	—
1997	0.96	2.14	0.08	4.57	0.10	1.10	—
1998	0.85	2.10	0.03	2.44	0.07	0.84	—
1999	0.88	1.97	0.04	3.93	0.07	1.25	—
1990-1999	1.21	2.81	0.07	5.27	0.11	1.23	0.05

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *Silicosis: Mortality*

**Table 3-3. Silicosis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	430	—	160	25	—	—	615
1991	415	50	90	—	5	—	560
1992	325	15	45	25	—	—	410
1993	325	5	115	25	—	—	470
1994	230	5	40	25	5	—	305
1995	220	5	65	15	5	—	310
1996	240	—	60	—	15	—	315
1997	225	35	75	—	—	—	335
1998	260	5	55	25	—	—	345
1999	180	—	110	25	—	—	315
TOTAL	2,850	120	815	165	30	—	3,980
	Years of Potential Life Lost to Life Expectancy						
1990	2,758	92	557	37	14	—	3,458
1991	2,732	136	571	6	21	—	3,466
1992	2,278	188	348	46	37	9	2,906
1993	2,545	69	365	45	34	—	3,058
1994	2,044	127	279	37	29	—	2,516
1995	1,995	100	405	37	35	—	2,572
1996	1,875	57	301	—	36	—	2,269
1997	1,758	132	371	9	43	—	2,313
1998	1,737	39	204	38	23	—	2,041
1999	1,643	41	385	37	35	—	2,141
TOTAL	21,365	981	3,786	292	307	9	26,740

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 3-4. Silicosis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	3	9	3	1	3	4	3	1	8	4	39
Alaska	1	-	-	1	-	-	-	-	-	-	2
Arizona	5	2	1	4	7	6	3	3	3	4	38
Arkansas	-	2	1	1	-	3	1	2	2	3	15
California	15	16	12	13	9	14	13	5	4	6	107
Colorado	10	15	9	11	6	9	10	7	6	7	90
Connecticut	2	2	3	5	4	2	3	1	4	1	27
Delaware	1	-	1	-	-	1	1	1	-	1	6
District of Columbia	1	-	1	-	-	1	-	1	-	-	4
Florida	12	7	4	5	6	6	5	6	6	5	62
Georgia	4	3	3	3	3	6	4	4	3	2	35
Hawaii	-	-	-	-	-	-	-	-	-	-	-
Idaho	2	-	2	3	-	2	3	2	1	-	15
Illinois	10	8	11	9	6	5	7	8	7	5	76
Indiana	8	4	4	4	4	1	2	5	5	5	42
Iowa	2	2	2	4	1	2	1	4	4	1	23
Kansas	-	1	1	1	2	3	-	1	1	1	11
Kentucky	6	2	6	3	5	5	3	4	5	2	41
Louisiana	6	5	2	8	2	2	2	2	1	5	35
Maine	2	2	-	2	2	-	1	-	-	1	10
Maryland	3	4	1	2	2	2	4	1	3	5	27
Massachusetts	4	3	1	1	4	2	2	5	3	1	26
Michigan	12	9	14	15	7	12	16	5	9	6	105
Minnesota	5	3	9	5	5	6	6	5	-	4	48
Mississippi	3	1	1	-	-	1	1	3	1	2	13
Missouri	5	7	4	2	7	6	3	5	3	3	45
Montana	2	-	3	2	-	2	2	1	1	2	15
Nebraska	-	3	1	-	-	-	1	-	-	1	6
Nevada	3	-	-	3	4	2	-	1	-	-	13
New Hampshire	1	2	1	-	1	-	-	2	-	-	7
New Jersey	10	11	5	5	5	3	3	4	4	3	53
New Mexico	6	4	5	3	8	4	1	5	2	2	40
New York	15	18	6	13	12	9	10	6	8	8	105
North Carolina	5	14	8	11	7	12	6	9	5	6	83
North Dakota	-	-	-	-	-	-	1	-	-	-	1
Ohio	33	35	24	23	21	20	16	12	16	23	223
Oklahoma	4	4	5	1	3	-	-	1	-	5	23
Oregon	3	3	3	2	2	2	2	-	1	5	23
Pennsylvania	61	53	53	54	44	43	38	33	24	20	423
Rhode Island	1	-	2	-	-	-	2	3	-	2	10
South Carolina	5	3	1	3	3	-	3	2	1	2	23
South Dakota	1	-	-	-	1	-	1	1	-	1	5
Tennessee	3	3	2	6	3	2	2	3	5	3	32
Texas	7	11	11	12	8	11	9	11	8	12	100
Utah	2	5	4	10	4	4	-	3	3	1	36
Vermont	5	1	4	1	1	-	1	2	2	1	18
Virginia	3	2	3	5	4	3	2	3	6	1	32
Washington	-	7	5	3	2	2	2	2	4	3	30
West Virginia	6	12	4	6	10	8	6	6	5	6	69
Wisconsin	10	16	9	10	7	14	10	6	4	6	92
Wyoming	-	-	-	-	-	-	-	1	-	-	1
<b>TOTAL</b>	<b>308</b>	<b>314</b>	<b>255</b>	<b>276</b>	<b>235</b>	<b>242</b>	<b>212</b>	<b>198</b>	<b>178</b>	<b>187</b>	<b>2,405</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Silicosis: Mortality

**Table 3-5. Silicosis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	39	19	1.18	16	1.20	19	515	19	13.2	15
Alaska	2	48	0.46	47	1.29	16	22	48	11.2	38
Arizona	38	20	1.17	17	1.23	17	439	23	11.6	31
Arkansas	15	35	0.78	33	0.72	42	308	29	20.5	1
California	107	3	0.44	48	0.54	44	1,284	5	12.0	27
Colorado	90	8	3.11	5	3.92	3	1,054	10	11.7	30
Connecticut	27	27	1.03	23	1.00	22	319	27	11.8	29
Delaware	6	44	1.06	21	1.23	17	52	47	8.6	49
District of Columbia	4	47	0.86	29	0.96	25	73	44	18.3	2
Florida	62	12	0.54	44	0.43	47	781	12	12.6	21
Georgia	35	22	0.63	41	0.80	36	404	25	11.5	34
Hawaii	-	-	-	-	-	-	-	-	-	-
Idaho	15	35	1.74	10	1.74	10	136	39	9.1	48
Illinois	76	10	0.82	31	0.84	32	1,086	8	14.3	11
Indiana	42	16	0.93	26	0.94	26	616	14	14.7	9
Iowa	23	30	1.04	22	0.89	28	296	31	12.9	19
Kansas	11	40	0.56	43	0.53	45	159	37	14.5	10
Kentucky	41	17	1.36	13	1.38	14	622	13	15.2	7
Louisiana	35	22	1.07	20	1.14	21	601	15	17.2	4
Maine	10	41	1.03	23	0.97	24	130	41	13.0	17
Maryland	27	27	0.68	39	0.83	33	299	30	11.1	39
Massachusetts	26	29	0.53	45	0.51	46	265	32	10.2	43
Michigan	105	4	1.42	12	1.52	12	1,222	6	11.6	31
Minnesota	48	14	1.36	13	1.34	15	581	18	12.1	26
Mississippi	13	38	0.64	40	0.64	43	232	34	17.8	3
Missouri	45	15	1.08	18	0.99	23	592	16	13.2	15
Montana	15	35	2.26	9	2.11	9	139	38	9.2	47
Nebraska	6	44	0.48	46	0.40	48	57	45	9.6	45
Nevada	13	38	1.08	18	1.42	13	135	40	10.4	42
New Hampshire	7	43	0.78	33	0.87	30	81	43	11.6	31
New Jersey	53	13	0.83	30	0.85	31	587	17	11.1	39
New Mexico	40	18	3.17	4	3.65	5	457	21	11.4	35
New York	105	4	0.73	36	0.73	40	1,307	4	12.4	24
North Carolina	83	9	1.45	11	1.57	11	1,035	11	12.5	23
North Dakota	1	49	0.20	50	0.16	50	6	50	6.1	50
Ohio	223	2	2.56	7	2.53	7	2,816	2	12.6	21
Oklahoma	23	30	0.91	27	0.83	33	252	33	11.0	41
Oregon	23	30	0.94	25	0.88	29	224	35	9.7	44
Pennsylvania	423	1	4.38	2	3.85	4	4,835	1	11.4	35
Rhode Island	10	41	1.25	15	1.17	20	128	42	12.8	20
South Carolina	23	30	0.81	32	0.94	26	318	28	13.8	14
South Dakota	5	46	0.91	27	0.73	40	57	45	11.4	35
Tennessee	32	24	0.77	35	0.78	37	474	20	14.8	8
Texas	100	6	0.71	37	0.83	33	1,636	3	16.4	5
Utah	36	21	2.69	6	3.44	6	434	24	12.0	27
Vermont	18	34	3.94	3	4.16	2	174	36	9.6	45
Virginia	32	24	0.61	42	0.74	39	452	22	14.1	13
Washington	30	26	0.71	37	0.76	38	369	26	12.3	25
West Virginia	69	11	4.74	1	4.23	1	1,061	9	15.4	6
Wisconsin	92	7	2.32	8	2.23	8	1,193	7	13.0	17
Wyoming	1	49	0.28	49	0.29	49	14	49	14.3	11

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 3-6. Silicosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
060	Construction	118	13.4
040	Metal mining	86	9.8
041	Coal mining	69	7.8
270	Blast furnaces, steelworks, rolling and finishing mills	51	5.8
050	Nonmetallic mining and quarrying, except fuel	48	5.5
271	Iron and steel foundries	48	5.5
262	Miscellaneous nonmetallic mineral and stone products	44	5.0
392	Not specified manufacturing industries	33	3.8
331	Machinery, except electrical, n.e.c.	23	2.6
252	Structural clay products	20	2.3
	All other industries	317	36.0
	Industry not reported	23	2.6
	<b>TOTAL</b>	<b>880</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 3-7. Silicosis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
616	Mining machine operators	138	15.7
889	Laborers, except construction	84	9.6
019	Managers and administrators, n.e.c.	34	3.9
633	Supervisors, production occupations	32	3.6
453	Janitors and cleaners	30	3.4
779	Machine operators, not specified	30	3.4
869	Construction laborers	26	3.0
719	Molding and casting machine operators	25	2.8
243	Supervisors and proprietors, sales occupations	18	2.1
804	Truck drivers	18	2.1
	All other occupations	423	48.1
	Occupation not reported	22	2.5
	<b>TOTAL</b>	<b>880</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Silicosis: Mortality*

**Table 3-8. Silicosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
040	Metal mining	86	41.70	33.60	51.82
262	Miscellaneous nonmetallic mineral and stone products	44	30.72	22.26	41.23
261	Pottery and related products	17	29.35	17.06	46.96
050	Nonmetallic mining and quarrying, except fuel	48	29.27	21.52	38.82
271	Iron and steel foundries	48	21.14	15.55	28.04
252	Structural clay products	20	19.72	12.02	30.47
041	Coal mining	69	6.17	4.84	7.86
300	Miscellaneous fabricated metal products	18	5.71	3.38	9.02
251	Cement, concrete, gypsum, and plaster products	8	4.24	1.83	8.35
280	Other primary metal industries	9	3.48	1.59	6.60
270	Blast furnaces, steelworks, rolling and finishing mills	51	3.19	2.41	4.25
682	Miscellaneous retail stores	7	3.15	1.27	6.50
250	Glass and glass products	10	3.00	1.44	5.51
331	Machinery, except electrical, n.e.c.	23	2.48	1.57	3.73
392	Not specified manufacturing industries	33	1.55	1.07	2.18
060	Construction	118	1.26	1.05	1.51

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 3-9. Silicosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

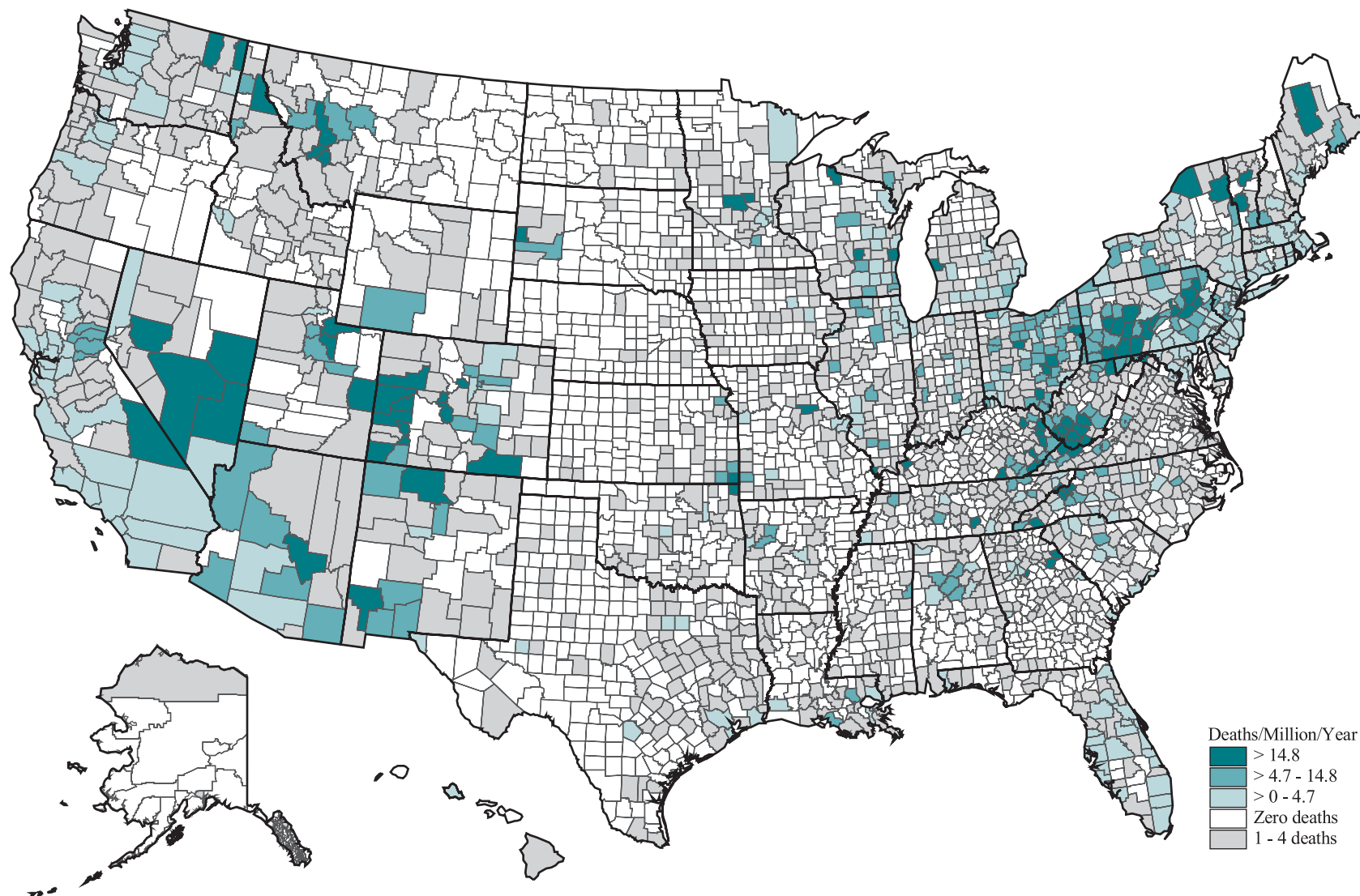
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
725	Miscellaneous metal and plastic processing machine operators	10	92.71	44.57	170.42
787	Hand molding, casting, and forming occupations	8	41.97	18.09	82.61
675	Hand molders and shapers, except jewelers	14	38.91	21.26	65.28
768	Crushing and grinding machine operators	16	31.12	17.78	50.52
719	Molding and casting machine operators	25	19.36	12.49	28.55
617	Mining occupations, n.e.c.	8	15.86	6.84	31.22
616	Mining machine operators	138	13.08	11.04	15.51
613	Supervisors, extractive occupations	7	12.86	5.17	26.52
599	Construction trades, n.e.c.	8	6.77	2.92	13.33
766	Furnace, kiln, and oven operators, except food	11	5.23	2.62	9.36
709	Grinding, abrading, buffing, and polishing machine operators	7	4.53	1.82	9.34
849	Crane and tower operators	9	3.87	1.78	7.35
544	Millwrights	8	3.49	1.50	6.87
779	Machine operators, not specified	30	2.94	1.99	4.20
844	Operating engineers	15	2.31	1.29	3.82
889	Laborers, except construction	84	2.19	1.76	2.73
579	Painters, construction and maintenance	14	2.16	1.18	3.62
633	Supervisors, production occupations	32	1.77	1.21	2.50
869	Construction laborers	26	1.56	1.02	2.28

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

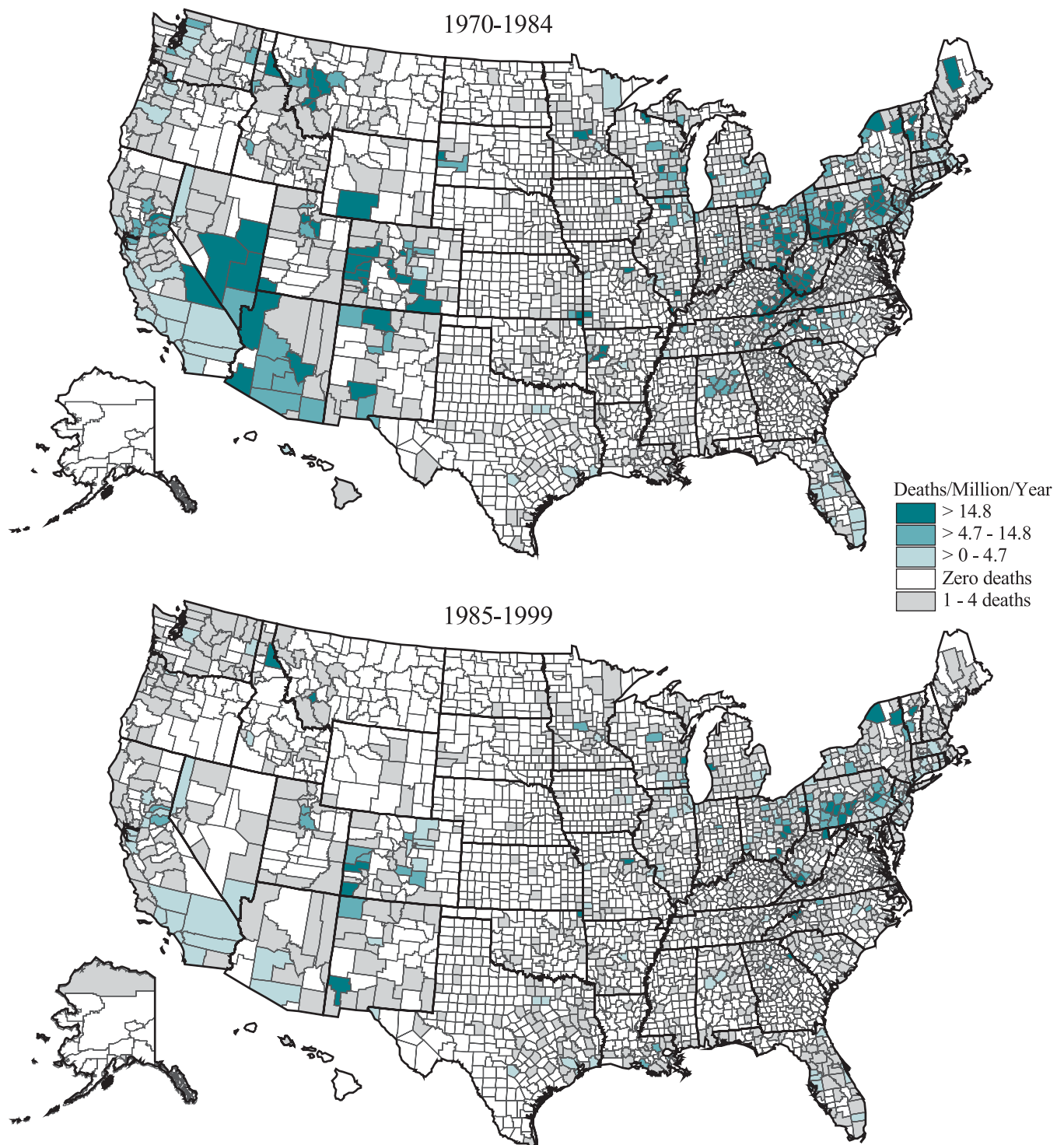
62 **Figure 3-3. Silicosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 3-4. Silicosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Silicosis: Mortality

**Table 3-10. Silicosis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Mitchell County	North Carolina	62.5	84.5	15	0.0
Silver Bow County	Montana	44.7	56.7	23	0.0
Shoshone County	Idaho	41.8	55.9	9	0.0
Yancey County	North Carolina	40.3	51.9	10	0.0
Montrose County	Colorado	35.3	44.4	13	0.0
Elbert County	Georgia	35.1	41.1	9	0.0
Huntingdon County	Pennsylvania	33.9	35.4	19	5.3
Avery County	North Carolina	32.1	33.0	6	0.0
Perry County	Ohio	31.6	32.8	12	25.0
Montezuma County	Colorado	29.8	32.6	7	0.0
Washington County	Vermont	26.8	27.6	18	0.0
Grant County	New Mexico	26.0	28.2	9	0.0
Audrain County	Missouri	25.7	36.3	10	0.0
Muskegon County	Michigan	24.4	24.4	45	0.0
Morgan County	West Virginia	23.1	32.3	5	20.0
Essex County	New York	22.3	24.7	11	0.0
Jackson County	Ohio	21.8	24.9	9	0.0
Preston County	West Virginia	21.0	20.5	7	0.0
Schuylkill County	Pennsylvania	19.9	28.1	53	0.0
Cambria County	Pennsylvania	18.9	25.9	51	0.0
Sheboygan County	Wisconsin	18.4	21.3	26	0.0
Rockdale County	Georgia	17.9	10.4	7	0.0
Columbiana County	Ohio	16.8	19.4	25	12.0
St. Lawrence County	New York	16.6	15.6	21	0.0
Muskingum County	Ohio	16.5	17.7	17	29.4
Indiana County	Pennsylvania	16.2	16.5	18	0.0
Ottawa County	Oklahoma	15.8	22.0	8	0.0
Bedford County	Pennsylvania	15.5	17.4	10	0.0
Mifflin County	Pennsylvania	15.4	18.1	10	0.0
Wyoming County	West Virginia	15.0	14.9	5	0.0
Stearns County	Minnesota	14.7	12.3	17	5.9
San Juan County	New Mexico	14.5	10.3	10	0.0
Somerset County	Pennsylvania	14.2	15.0	14	7.1
Armstrong County	Pennsylvania	13.7	18.1	16	0.0
Delta County	Colorado	12.6	18.9	5	0.0
Mesa County	Colorado	11.6	13.2	15	0.0
Fremont County	Colorado	11.0	15.0	6	0.0
Marion County	Ohio	11.0	10.7	8	0.0
McDowell County	West Virginia	11.0	12.8	5	0.0
St. Mary Parish	Louisiana	10.8	9.6	6	0.0
Coshocton County	Ohio	10.5	12.2	5	0.0
Logan County	West Virginia	10.0	10.0	5	0.0
Surry County	North Carolina	9.9	10.4	8	0.0
Rutland County	Vermont	9.7	10.7	8	0.0
Clearfield County	Pennsylvania	9.2	11.8	11	0.0
Carbon County	Pennsylvania	9.0	11.4	8	0.0
Steuben County	New York	8.4	8.7	10	0.0
Knox County	Ohio	8.4	8.7	5	0.0
Northumberland County	Pennsylvania	8.3	11.2	13	0.0
Nevada County	California	7.9	9.1	9	0.0
<b>Overall United States</b>		<b>1.4</b>	<b>1.3</b>	<b>4,002</b>	<b>3.7</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 3-11. Silicosis: Estimated number of discharges from short-stay nonfederal hospitals, 1970-2000**

Year	Number of Discharges
1970	6,000
1971	7,000
1972	6,000
1973	5,000
1974	4,000
1975	4,000
1976	5,000
1977	4,000
1978	2,000
1979	3,000
1980	1,000
1981	2,000
1982	3,000
1983	2,000
1984	2,000
1985	3,000
1986	3,000
1987	3,000
1988	3,000
1989	2,000
1990	3,000
1991	4,000
1992	3,000
1993	1,000
1994	3,000
1995	3,000
1996	4,000
1997	3,000
1998	1,000
1999	1,000
2000	1,000

NOTE: Number of discharges has been rounded. NCHS recommends that, in statistical comparisons, estimates of less than 5,000 not be used and that estimates of 5,000 to 10,000 be used with caution. See appendices for source description and methods.

SOURCE: National Center for Health Statistics National Hospital Discharge Survey.

## *Silicosis: SENSOR*

**Table 3-12. Silicosis: Number of cases by ascertainment source and state, 1989-1998**

Source	Michigan		New Jersey		Ohio		Total	
	No.	%	No.	%	No.	%	No.	%
Health care professional report	123	20.9	18	9.4	22	5.5	163	13.8
Hospital discharge data	387	65.7	164	85.9	327	81.8	878	74.4
Death certificate data	23	3.9	5	2.6	19	4.8	47	4.0
Workers' compensation files	52	8.8	-	-	21	5.3	73	6.2
Other	4	0.7	4	2.1	11	2.8	19	1.6
<b>TOTAL</b>	<b>589</b>	<b>100.0</b>	<b>191</b>	<b>100.0</b>	<b>400</b>	<b>100.0</b>	<b>1,180</b>	<b>100.0</b>

- indicates no cases reported.

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by K Rosenman, MJ Reilly, and D Kalinowski (Michigan); D Valiante and D Schill (New Jersey); and E Socie and A Migliozi (Ohio).

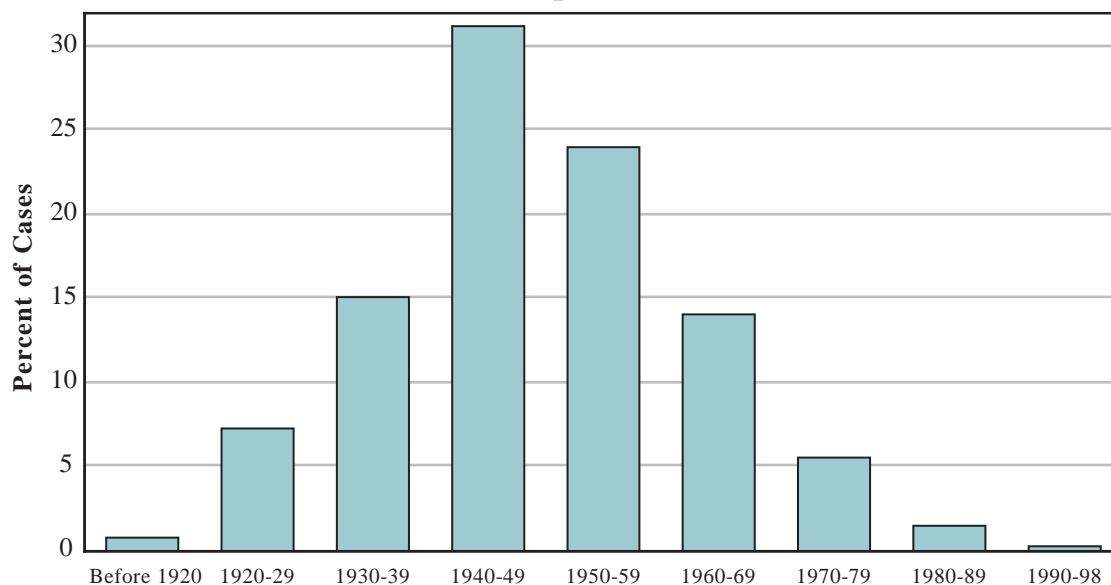
**Table 3-13. Silicosis: Number of cases by duration of occupational exposure to silica and by state, 1989-1998**

Years of Employment in Jobs with Potential Silica Exposure	Michigan		New Jersey		Ohio		Total	
	No.	%	No.	%	No.	%	No.	%
<10	41	7.0	19	9.9	23	5.8	83	7.0
10 to 20	112	19.0	44	23.0	71	17.8	227	19.2
21-30	194	32.9	46	24.1	84	21.0	324	27.5
>30	215	36.5	56	29.3	110	27.5	381	32.3
Unknown	27	4.6	26	13.6	112	28.0	165	14.0
<b>TOTAL</b>	<b>589</b>	<b>100.0</b>	<b>191</b>	<b>100.0</b>	<b>400</b>	<b>100.0</b>	<b>1,180</b>	<b>100.0</b>

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by K Rosenman, MJ Reilly, and D Kalinowski (Michigan); D Valiante and D Schill (New Jersey); and E Socie and A Migliozi (Ohio).

**Figure 3-5. Silicosis: Decade of first exposure for 986 confirmed cases, 1989-1998**



NOTE: Cases with unknown or missing values are excluded.

SOURCE: Provisional SENSOR surveillance data as of September, 2002, aggregated by reporting source years, and reported by K. Rosenman, MJ Reilly, and D Kalinowski (Michigan); D Valiante and D Schill (New Jersey); and E Socie and A Migliozi (Ohio).



**Table 3-14. Silicosis: Primary industries associated with silica exposure of silicosis cases by state, 1989-1998**

Industry (SIC Code)	Michigan		New Jersey		Ohio		Total	
	No.	%	No.	%	No.	%	No.	%
<b>Mining</b>	<b>17</b>	<b>2.9</b>	<b>22</b>	<b>11.5</b>	<b>20</b>	<b>5.0</b>	<b>59</b>	<b>5.0</b>
Mining and quarry of nonmetal minerals except fuel (14)	1	0.2	17	8.9	15	3.8	33	2.8
Metal mining (10)	15	2.5	4	2.1	-	-	19	1.6
All others (12,13)	1	0.2	1	0.5	5	1.3	7	0.6
<b>Construction</b>	<b>33</b>	<b>5.7</b>	<b>16</b>	<b>8.4</b>	<b>20</b>	<b>5.0</b>	<b>69</b>	<b>5.9</b>
Construction, special trade contractors (17)	24	4.1	8	4.2	16	4.0	48	4.1
Heavy construction other than building construction (16)	4	0.7	8	4.2	4	1.0	16	1.4
All others (15)	5	0.8	-	-	-	-	5	0.4
<b>Manufacturing</b>	<b>526</b>	<b>90.2</b>	<b>149</b>	<b>78.0</b>	<b>351</b>	<b>88.0</b>	<b>1,026</b>	<b>87.5</b>
Primary metal industries (33)	454	77.1	45	23.6	187	46.8	686	58.1
Stone, clay, glass, and concrete products (32)	28	4.8	82	42.9	88	22.0	198	16.8
Fabricated metal products except machinery and transportation equipment (34)	9	1.5	6	3.1	31	7.8	46	3.9
Transportation equipment (37)	20	3.4	4	2.1	10	2.5	34	2.9
Industrial and commercial machinery and computer equipment (35)	5	0.8	1	0.5	20	5.0	26	2.2
Chemicals and allied products (28)	2	0.3	5	2.6	5	1.3	12	1.0
All others (22,25,26,29,30,36,38,39)	8	1.4	6	3.1	10	2.5	24	2.0
<b>Transportation (40,41,42,46,49)</b>	<b>4</b>	<b>0.7</b>	<b>2</b>	<b>1.0</b>	<b>-</b>	<b>-</b>	<b>6</b>	<b>0.5</b>
<b>Wholesale trade (50)</b>	<b>1</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>0.3</b>	<b>2</b>	<b>0.2</b>
<b>Finance, insurance, and real estate (65)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>0.3</b>	<b>1</b>	<b>0.1</b>
<b>Services (75,76,80)</b>	<b>2</b>	<b>0.3</b>	<b>2</b>	<b>1.0</b>	<b>2</b>	<b>0.5</b>	<b>6</b>	<b>0.5</b>
<b>Public administration (92)</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>0.3</b>	<b>1</b>	<b>0.1</b>
<b>Nonclassifiable (99)</b>	<b>6</b>	<b>1.0</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>0.8</b>	<b>9</b>	<b>0.8</b>
<b>TOTAL</b>	<b>589</b>	<b>100.0</b>	<b>191</b>	<b>100.0</b>	<b>400</b>	<b>100.0</b>	<b>1,180</b>	<b>100.0</b>

- indicates no cases reported.

SIC - 1987 Standard Industrial Classification

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by K Rosenman, MJ Reilly, and D Kalinowski (Michigan); D Valiante and D Schill (New Jersey); and E Socie and A Migliozi (Ohio).

**Table 3-15. Silicosis: Primary occupations associated with silica exposure of silicosis cases by state, 1989-1998**

Occupation (COC)	Michigan		New Jersey		Ohio		Total	
	No.	%	No.	%	No.	%	No.	%
<b>Managerial and professional specialty</b>	<b>1</b>	<b>0.2</b>	<b>4</b>	<b>2.1</b>	<b>3</b>	<b>0.8</b>	<b>8</b>	<b>0.7</b>
<b>Technical, sales, and administrative</b>	<b>5</b>	<b>0.8</b>	<b>2</b>	<b>1.0</b>	<b>1</b>	<b>0.3</b>	<b>8</b>	<b>0.7</b>
<b>Service</b>	<b>4</b>	<b>0.7</b>	<b>1</b>	<b>0.5</b>	<b>3</b>	<b>0.8</b>	<b>8</b>	<b>0.7</b>
<b>Precision production, craft, and repair</b>	<b>142</b>	<b>24.1</b>	<b>50</b>	<b>26.2</b>	<b>73</b>	<b>18.3</b>	<b>265</b>	<b>22.5</b>
Hand molders and shapers, except jewelers (675)	55	9.3	3	1.6	5	1.3	63	5.3
Supervisors, production (628)	20	3.4	9	4.7	13	3.3	42	3.6
Brickmasons and stonemasons (563)	12	2.0	7	3.7	12	3.0	31	2.6
Construction trades, n.e.c. (599)	6	1.0	4	2.1	12	3.0	22	1.9
Mining machine operators (616)	6	1.0	6	3.1	3	0.8	15	1.3
Millwrights (544)	9	1.5	-	-	2	0.5	11	0.9
Mining occupations, n.e.c. (617)	5	0.8	2	1.0	4	1.0	11	0.9
All others	29	4.9	19	9.9	22	5.5	70	5.9
<b>Operators, fabricators, and laborers</b>	<b>360</b>	<b>61.1</b>	<b>107</b>	<b>56.0</b>	<b>301</b>	<b>75.3</b>	<b>768</b>	<b>65.1</b>
Laborers, except construction (889)	123	20.9	15	7.9	66	16.5	204	17.3
Molding and casting machine operators (719)	59	10.0	7	3.7	39	9.8	105	8.9
Grinding, abrading, buffing, and polishing machine op. (709)	49	8.3	3	1.6	24	6.0	76	6.4
Crushing and grinding machine operators (768)	9	1.5	10	5.2	35	8.8	54	4.6
Miscellaneous metal and plastic processing machine op. (725)	19	3.2	8	4.2	22	5.5	49	4.2
Furnace, kiln, and oven operators, excluding food (766)	11	1.9	5	2.6	18	4.5	34	2.9
Miscellaneous machine operators, n.e.c. (777)	10	1.7	4	2.1	17	4.3	31	2.6
Hand molding, casting, forming occupations (787)	3	0.5	14	7.3	12	3.0	29	2.5
Miscellaneous hand working occupations (795)	19	3.2	1	0.5	1	0.3	21	1.8
Mixing and blending machine operators (756)	4	0.7	5	2.6	8	2.0	17	1.4
Machine operators, not specified (779)	3	0.5	2	1.0	12	3.0	17	1.4
Welders and cutters (783)	9	1.5	3	1.6	4	1.0	16	1.4
Construction laborers (869)	2	0.3	6	3.1	4	1.0	12	1.0
Production inspectors, checkers, and examiners (796)	5	0.8	2	1.0	4	1.0	11	0.9
Crane and tower operators (849)	5	0.8	2	1.0	4	1.0	11	0.9
Painting and paint spraying machine operators (759)	-	-	7	3.7	3	0.8	10	0.8
All others	30	5.1	13	6.8	28	7.0	71	6.0
<b>Unclassifiable and miscellaneous unemployed</b>	<b>77</b>	<b>13.1</b>	<b>27</b>	<b>14.1</b>	<b>19</b>	<b>4.8</b>	<b>123</b>	<b>10.4</b>
Occupation not reported	77	13.1	27	14.1	19	4.8	123	10.4
<b>TOTAL</b>	<b>589</b>	<b>100.0</b>	<b>191</b>	<b>100.0</b>	<b>400</b>	<b>100.0</b>	<b>1,180</b>	<b>100.0</b>

- indicates no cases reported.

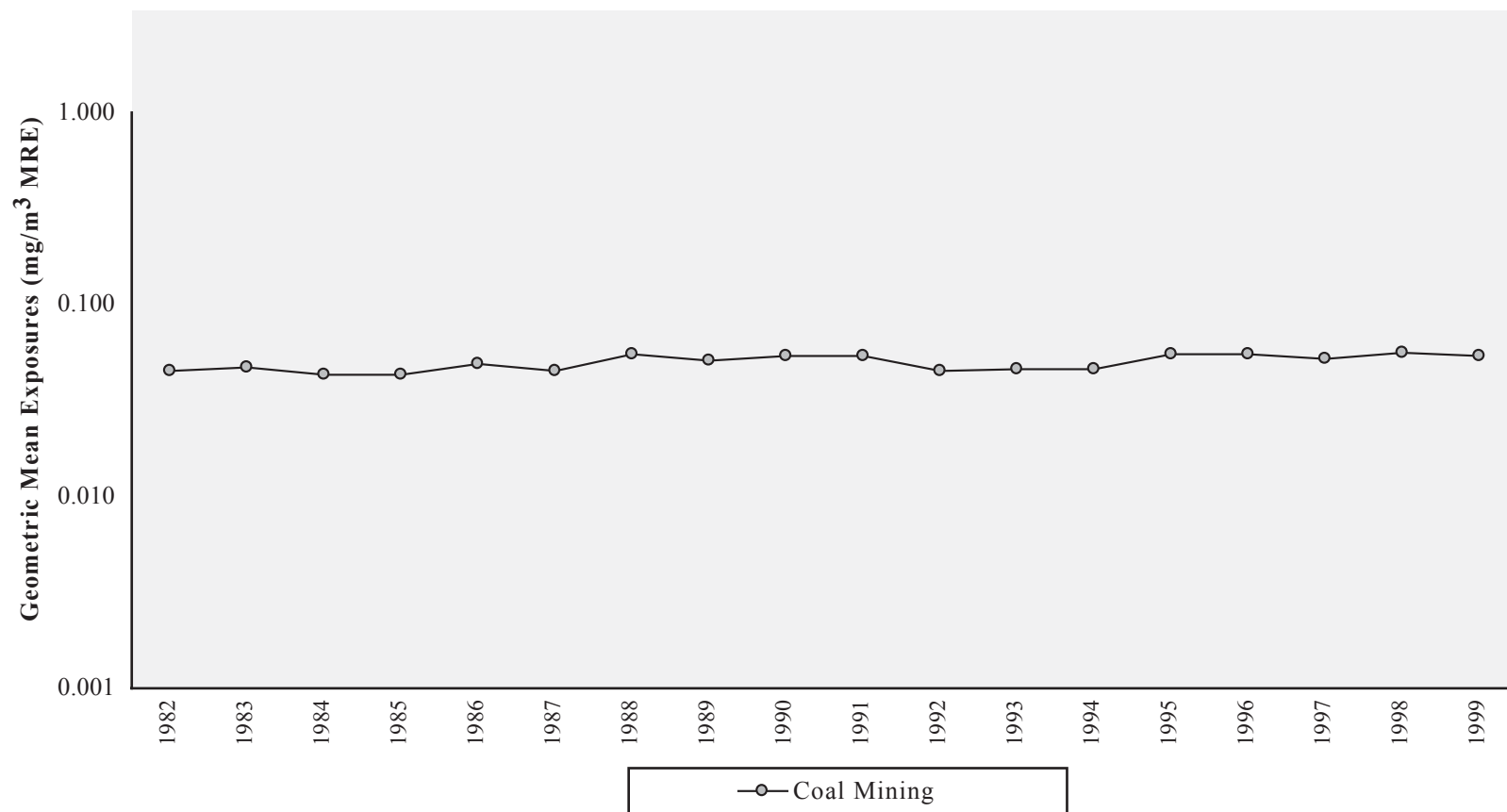
COC - 1990 Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

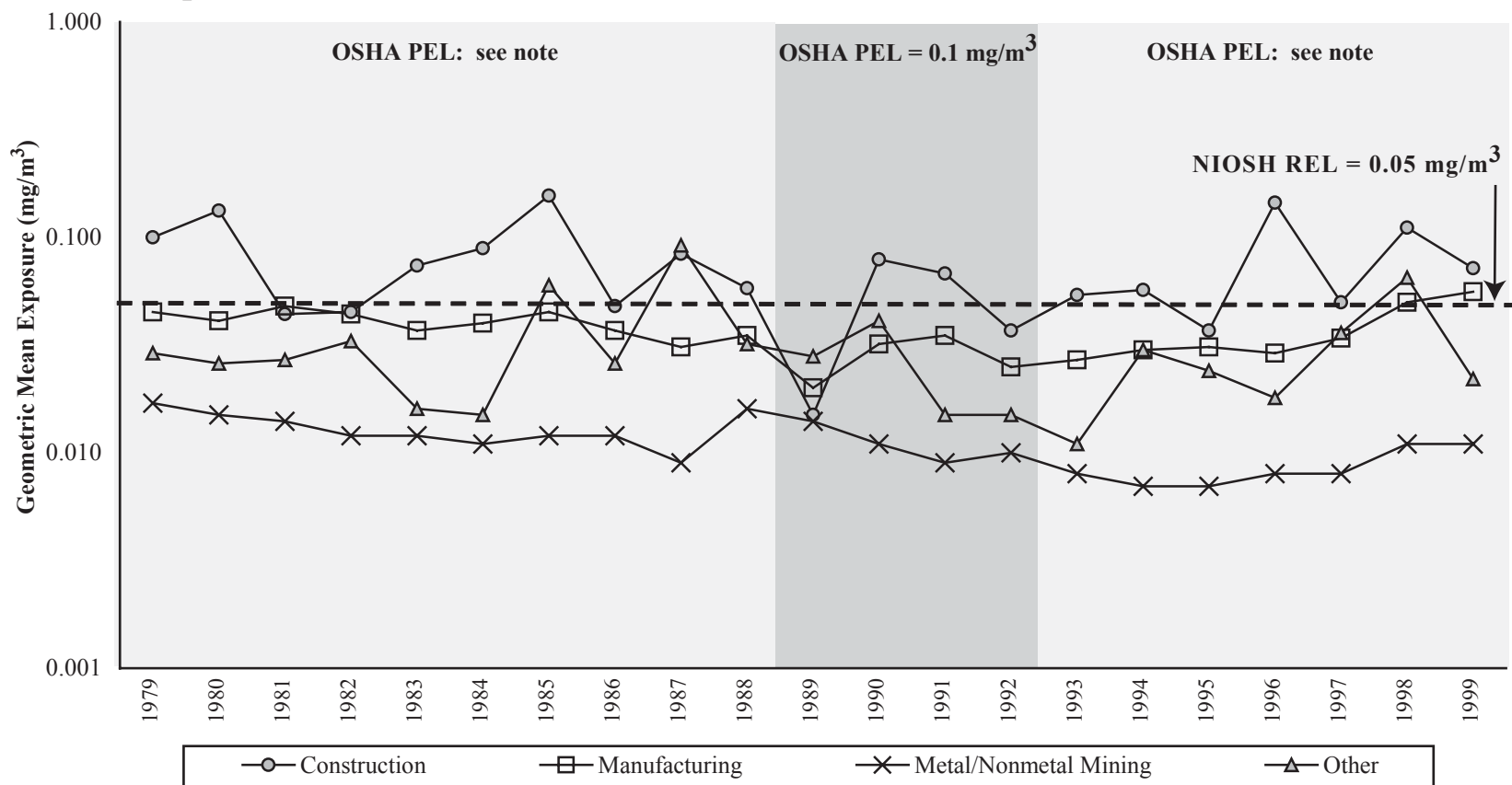
SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by K Rosenman, MJ Reilly, and D Kalinowski (Michigan); D Valiante and D Schill (New Jersey); and E Socie and A Migliozi (Ohio).

**Figure 3-6a. Respirable quartz: Geometric mean exposures in coal mining, MSHA inspector and mine operator samples, 1982-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter      MRE - Mining Research Establishment  
 NOTE: For coal mining, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)] for respirable dust containing greater than 5 percent quartz. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.  
 SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator quartz data.

**Figure 3-6b. Respirable quartz: Geometric mean exposures by major industry division, MSHA and OSHA samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m³ - milligrams per cubic meter

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is  $[(10 \text{ mg/m}^3) / (\% \text{ quartz} + 2)]$ , for respirable dust containing at least 1 percent quartz. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.1 mg/m³ for respirable quartz. For metal/nonmetal mining, the MSHA PEL is  $[(10 \text{ mg/m}^3) / (\% \text{ quartz} + 2)]$  for respirable dust containing at least 1 percent quartz. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Table 3-16a. Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits in coal mining, MSHA inspector and mine operator samples, 1982-1999**

Industry Division		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Coal Mining SIC 11, 12	GM (mg/m <sup>3</sup> MRE)	0.045	0.047	0.043	0.043	0.049	0.045	0.055	0.051	0.054	0.054	0.045	0.046	0.046	0.055	0.055	0.052	0.056	0.054
	No. of samples	2,682	4,962	4,613	4,242	4,731	4,556	5,238	4,566	4,524	5,816	8,692	7,668	7,557	8,090	6,332	8,560	10,613	12,790
	% > PEL	38.5	40.1	40.8	36.8	39.7	37.9	38.1	39.0	36.9	35.4	28.4	27.9	29.3	32.3	30.7	29.1	29.7	27.4

- indicates incalculable field

SIC - Standard Industrial Classification

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

MRE - Mining Research Establishment

NOTE: For coal mining, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)] for respirable dust containing greater than 5 percent quartz. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator quartz data.

**Table 3-16b. Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by major industry division, MSHA and OSHA samples, 1979-1999**

Industry Division		OSHA PEL: see note										OSHA PEL = 0.1 mg/m <sup>3</sup>				OSHA PEL: see note							
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
Construction SIC 15-17	GM (mg/m <sup>3</sup> )	0.100	0.133	0.044	0.045	0.074	0.089	0.156	0.048	0.084	0.058	0.015	0.079	0.068	0.037	0.054	0.057	0.037	0.145	0.050	0.111	0.072	
	No. of samples	24	71	26	36	56	44	57	33	42	35	15	36	43	65	29	21	31	56	103	138	165	
	% > PEL	50.0	59.2	38.5	27.8	41.1	45.5	59.6	36.4	47.6	45.7	13.3	33.3	32.6	23.1	34.5	38.1	25.8	50.0	34.0	51.4	47.3	
	% > REL	58.3	67.6	50.0	44.4	64.3	52.3	64.9	39.4	64.3	51.4	20.0	52.8	39.5	35.4	55.2	61.9	29.0	62.5	47.6	63.0	58.2	
Manufacturing SIC 20-39	GM (mg/m <sup>3</sup> )	0.045	0.041	0.048	0.044	0.037	0.040	0.045	0.037	0.031	0.035	0.020	0.032	0.035	0.025	0.027	0.030	0.031	0.029	0.034	0.050	0.056	
	No. of samples	745	1,394	1,269	1,298	1,065	852	1,075	715	744	644	527	641	595	606	422	346	299	277	400	606	653	
	% > PEL	30.3	30.8	33.2	30.5	26.9	31.9	34.3	27.3	26.5	30.7	16.1	20.1	22.2	13.5	18.2	24.3	24.7	23.8	26.0	37.8	38.3	
	% > REL	49.1	47.5	50.9	48.7	42.4	46.8	50.3	39.9	38.4	42.9	28.1	39.2	42.0	32.2	30.1	39.0	36.8	30.7	36.0	52.1	56.4	
Metal/ Nonmetal Mining SIC 10, 14	GM (mg/m <sup>3</sup> )	0.017	0.015	0.014	0.012	0.012	0.011	0.012	0.012	0.009	0.016	0.014	0.011	0.009	0.010	0.008	0.007	0.007	0.008	0.008	0.011	0.011	
	No. of samples	9,038	6,001	6,299	2,553	6,048	7,118	6,002	6,625	6,069	7,062	8,307	10,512	12,495	12,244	10,382	15,940	12,594	16,253	7,893	4,615	4,974	
	% > PEL	11.7	11.1	11.7	11.1	10.5	10.2	10.2	10.3	7.7	17.7	14.7	11.1	9.4	9.2	7.3	5.6	5.5	6.2	6.4	6.7	8.0	
	% > REL	17.3	17.7	17.8	16.8	16.5	15.4	15.4	16.5	11.5	26.6	22.1	16.7	14.2	14.7	11.3	8.6	8.4	9.2	10.2	12.7	15.9	
Other SIC 1-9, 13, 40-99	GM (mg/m <sup>3</sup> )	0.029	0.026	0.027	0.033	0.016	0.015	0.060	0.026	0.092	0.032	0.028	0.041	0.015	0.015	0.011	0.030	0.024	0.018	0.036	0.065	0.022	
	No. of samples	36	36	15	15	30	46	26	39	71	62	56	31	48	40	22	33	26	41	29	26	49	
	% > PEL	13.9	16.7	13.3	20.0	10.0	13.0	38.5	28.2	52.1	30.6	28.6	38.7	6.3	7.5	4.5	15.2	26.9	12.2	20.7	30.8	20.4	
	% > REL	36.1	22.2	26.7	26.7	20.0	21.7	61.5	35.9	60.6	40.3	33.9	41.9	22.9	12.5	9.1	27.3	26.9	19.5	27.6	57.7	24.5	

SIC - Standard Industrial Classification    PEL - permissible exposure limit    REL - recommended exposure limit    GM - geometric mean    mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz + 2)], for respirable dust containing at least 1 percent quartz. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.1 mg/m<sup>3</sup> for respirable quartz. For metal/nonmetal mining, the MSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz+2)] for respirable dust containing at least 1 percent quartz. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Table 3-17. Respirable quartz: Number of samples, geometric mean exposures, and percent exceeding designated occupational exposure limits by industries with elevated silicosis mortality, MSHA inspector and mine operator and OSHA samples, 1990-1999**

Silicosis Mortality, Selected States and Years, 1990-1999				Number of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
CIC	Industries with elevated PMRs and most frequently recorded on death certificates	Number of Deaths	PMR				
040	Metal mining	86	41.70	8,382	0.013	12.4	19.4
262	Miscellaneous nonmetallic mineral and stone products	44	30.72	391	0.041	30.2	47.3
050	Nonmetallic mining and quarrying, except fuel	48	29.27	99,529	0.008	7.0	11.1
271	Iron and steel foundries	48	21.14	1,766	0.047	29.3	50.8
252	Structural clay products	20	19.72	213	0.045	32.9	51.6
041	Coal mining	69	6.17	80,642	0.052*	30.1	- <sup>†</sup>
270	Blast furnaces, steelworks, rolling and finishing mills	51	3.19	44	0.011	2.3	6.8
331	Machinery, except electrical, n.e.c.	23	2.48	204	0.046	32.4	48.0
392	Not specified manufacturing industries	33	1.55	0	-	-	-
060	Construction	118	1.26	687	0.070	40.6	53.0
	All other industries	317		2,562	0.026	19.9	30.2
	<b>TOTAL (excluding CIC 041)</b>			<b>113,778</b>	<b>0.009</b>	<b>8.4</b>	<b>13.2</b>

- indicates incalculable field

\* MRE equivalent

<sup>†</sup> The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria.

CIC - Census Industry Code      PEL - permissible exposure limit

REL - recommended exposure limit

PMR - proportionate mortality ratio

GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter

MRE - Mining Research Establishment

n.e.c. - not elsewhere

classified

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz + 2)], for respirable dust containing at least 1 percent quartz. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.1 mg/m<sup>3</sup> for respirable quartz. For coal mining, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)] for respirable dust containing greater than 5 percent quartz; for metal/nonmetal mining, the MSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz + 2)] for respirable dust containing at least 1 percent quartz. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states and years for which usual industry has been reported.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal and coal mine inspector and mine operator quartz data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System. National Center for Health Statistics: multiple cause of death data.

**Table 3-18 (page 1 of 2). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1982-1999**

MSHA Coal Mine District	All years		1982 - 1988			1989 - 1992			1993 - 1999		
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL
<b>District 1 (Anthracite coal mining regions in Pennsylvania)</b>	<b>1,274</b>	<b>0.027</b>	<b>321</b>	<b>0.025</b>	<b>41.4</b>	<b>184</b>	<b>0.024</b>	<b>39.7</b>	<b>769</b>	<b>0.028</b>	<b>26.4</b>
<b>District 2 (Bituminous coal mining regions in Pennsylvania)</b>	<b>13,802</b>	<b>0.043</b>	<b>4,123</b>	<b>0.043</b>	<b>34.7</b>	<b>2,564</b>	<b>0.041</b>	<b>25.7</b>	<b>7,115</b>	<b>0.044</b>	<b>20.8</b>
<b>District 3</b>	<b>12,214</b>	<b>0.036</b>	<b>3,867</b>	<b>0.032</b>	<b>28.8</b>	<b>1,923</b>	<b>0.040</b>	<b>23.5</b>	<b>6,424</b>	<b>0.036</b>	<b>19.6</b>
Maryland	761	0.042	128	0.056	39.8	46	0.037	4.3	587	0.040	16.9
Ohio	4,334	0.040	1,962	0.040	33.3	823	0.040	24.5	1,549	0.042	21.8
Northern West Virginia	7,119	0.032	1,777	0.025	23.1	1,054	0.040	23.5	4,288	0.034	19.1
<b>District 4 (Southern West Virginia)</b>	<b>21,177</b>	<b>0.060</b>	<b>7,130</b>	<b>0.053</b>	<b>40.3</b>	<b>4,338</b>	<b>0.058</b>	<b>38.1</b>	<b>9,709</b>	<b>0.068</b>	<b>36.9</b>
<b>District 5 (Virginia)</b>	<b>14,293</b>	<b>0.062</b>	<b>4,492</b>	<b>0.057</b>	<b>45.1</b>	<b>3,341</b>	<b>0.061</b>	<b>39.0</b>	<b>6,460</b>	<b>0.066</b>	<b>34.4</b>
<b>District 6 (Eastern Kentucky)</b>	<b>15,255</b>	<b>0.061</b>	<b>2,845</b>	<b>0.050</b>	<b>40.7</b>	<b>2,748</b>	<b>0.066</b>	<b>41.5</b>	<b>9,662</b>	<b>0.064</b>	<b>33.6</b>
<b>District 7</b>	<b>17,116</b>	<b>0.059</b>	<b>2,991</b>	<b>0.066</b>	<b>49.7</b>	<b>3,762</b>	<b>0.055</b>	<b>36.9</b>	<b>10,363</b>	<b>0.058</b>	<b>32.4</b>
Central Kentucky	15,102	0.059	2,463	0.068	51.2	3,152	0.056	37.3	9,487	0.058	32.4
North Carolina	0	-	0	-	-	0	-	-	0	-	-
South Carolina	0	-	0	-	-	0	-	-	0	-	-
Tennessee	2,014	0.057	528	0.057	42.4	610	0.053	34.8	876	0.060	32.3
Northern Georgia	0	-	0	-	-	0	-	-	0	-	-
<b>District 8</b>	<b>7,297</b>	<b>0.046</b>	<b>2,122</b>	<b>0.047</b>	<b>33.8</b>	<b>1,567</b>	<b>0.042</b>	<b>22.0</b>	<b>3,608</b>	<b>0.048</b>	<b>27.1</b>
Illinois	6,160	0.045	1,719	0.046	32.8	1,399	0.041	20.9	3,042	0.045	24.5
Indiana	1,042	0.061	342	0.051	38.0	156	0.056	32.1	544	0.070	41.5
Iowa	54	0.024	39	0.023	38.5	9	0.027	22.2	6	0.022	0.0
Michigan	0	-	0	-	-	0	-	-	0	-	-
Minnesota	0	-	0	-	-	0	-	-	0	-	-
Northern Missouri	41	0.051	22	0.071	40.9	3	0.031	0.0	16	0.036	31.3
Wisconsin	0	-	0	-	-	0	-	-	0	-	-

See footnotes at end of table.



**Table 3-18 (page 2 of 2). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA coal mine district and state, MSHA inspector and mine operator samples, 1982-1999**

MSHA Coal Mine District	All years		1982 - 1988			1989 - 1992			1993 - 1999		
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL
<b>District 9</b>	<b>5,372</b>	<b>0.036</b>	<b>1,403</b>	<b>0.041</b>	<b>42.3</b>	<b>1,357</b>	<b>0.031</b>	<b>33.8</b>	<b>2,612</b>	<b>0.036</b>	<b>23.9</b>
Alaska	12	0.017	10	0.014	10.0	2	0.051	50.0	0	-	-
Arizona	42	0.056	6	0.023	33.3	12	0.056	41.7	24	0.070	20.8
Arkansas	9	0.082	6	0.120	66.7	1	0.009	100.0	2	0.077	50.0
California	1	0.025	0	-	-	0	-	-	1	0.025	0.0
Colorado	1,678	0.037	447	0.041	45.0	425	0.033	36.0	806	0.036	21.5
Hawaii	0	-	0	-	-	0	-	-	0	-	-
Idaho	0	-	0	-	-	0	-	-	0	-	-
Kansas	24	0.061	9	0.115	66.7	7	0.027	0.0	8	0.061	12.5
Louisiana	10	0.009	0	-	-	2	0.038	0.0	8	0.006	0.0
Southern Missouri	42	0.068	16	0.114	62.5	4	0.077	25.0	22	0.046	18.2
Montana	97	0.042	36	0.038	38.9	14	0.051	42.9	47	0.042	29.8
Nebraska	0	-	0	-	-	0	-	-	0	-	-
Nevada	0	-	0	-	-	0	-	-	0	-	-
New Mexico	299	0.048	117	0.050	34.2	48	0.050	35.4	134	0.046	23.1
North Dakota	47	0.012	29	0.012	13.8	15	0.010	20.0	3	0.026	0.0
Oklahoma	382	0.080	162	0.121	62.3	84	0.068	39.3	136	0.055	29.4
Oregon	0	-	0	-	-	0	-	-	0	-	-
Texas	133	0.041	52	0.098	57.7	25	0.016	24.0	56	0.028	23.2
Utah	2,031	0.033	338	0.033	38.8	608	0.028	32.9	1,085	0.036	25.2
Washington	21	0.028	2	0.016	0.0	9	0.019	0.0	10	0.044	20.0
Wyoming	544	0.021	173	0.017	28.3	101	0.020	31.7	270	0.025	25.2
<b>District 10 (Western Kentucky)</b>	<b>4,515</b>	<b>0.023</b>	<b>1,156</b>	<b>0.021</b>	<b>26.0</b>	<b>951</b>	<b>0.023</b>	<b>19.6</b>	<b>2,408</b>	<b>0.025</b>	<b>17.4</b>
<b>District 11</b>	<b>3,917</b>	<b>0.056</b>	<b>574</b>	<b>0.058</b>	<b>40.2</b>	<b>863</b>	<b>0.063</b>	<b>36.8</b>	<b>2,480</b>	<b>0.053</b>	<b>27.5</b>
Alabama	3,917	0.056	574	0.058	40.2	863	0.063	36.8	2,480	0.053	27.5
Central and Southern Georgia	0	-	0	-	-	0	-	-	0	-	-
Florida	0	-	0	-	-	0	-	-	0	-	-
Mississippi	0	-	0	-	-	0	-	-	0	-	-
Puerto Rico	0	-	0	-	-	0	-	-	0	-	-
Virgin Islands	0	-	0	-	-	0	-	-	0	-	-
<b>TOTAL</b>	<b>116,232</b>	<b>0.050</b>	<b>31,024</b>	<b>0.047</b>	<b>38.9</b>	<b>23,598</b>	<b>0.050</b>	<b>33.8</b>	<b>61,610</b>	<b>0.052</b>	<b>29.3</b>

- indicates incalculable field    PEL - permissible exposure limit    REL - recommended exposure limit    GM - geometric mean    mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: All geometric means are reported in MRE (Mining Research Establishment) equivalents. For coal mining, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)] for respirable dust containing greater than 5 percent quartz. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator quartz data.

**Table 3-19 (page 1 of 2). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA metal/nonmetal mine district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal Mine District	All years		1979 - 1988				1989 - 1992				1993 - 1999			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Northeast</b>	<b>26,788</b>	<b>0.011</b>	<b>8,979</b>	<b>0.015</b>	<b>12.4</b>	<b>19.4</b>	<b>6,060</b>	<b>0.011</b>	<b>9.9</b>	<b>16.1</b>	<b>11,749</b>	<b>0.009</b>	<b>6.5</b>	<b>10.9</b>
Connecticut	718	0.013	285	0.027	26.3	38.2	156	0.013	13.5	23.1	277	0.006	2.5	5.1
Delaware	91	0.005	17	0.006	0.0	0.0	33	0.005	0.0	3.0	41	0.004	4.9	0.0
District of Columbia	0	-	0	-	-	-	0	-	-	-	0	-	-	-
Maine	623	0.012	199	0.025	16.6	24.6	169	0.009	3.0	7.7	255	0.009	4.3	9.8
Maryland	1,440	0.008	518	0.009	4.2	8.1	314	0.007	2.9	7.0	608	0.007	2.6	6.3
Massachusetts	1,280	0.013	476	0.025	17.4	28.6	250	0.010	9.6	16.0	554	0.008	3.6	7.0
New Hampshire	497	0.014	131	0.028	15.3	33.6	133	0.010	7.5	16.5	233	0.012	7.7	12.9
New Jersey	2,524	0.012	992	0.020	17.5	27.5	623	0.012	12.4	20.1	909	0.007	4.2	8.0
New York	6,153	0.010	1,875	0.014	11.4	17.0	1,649	0.009	6.2	11.8	2,629	0.008	5.6	9.7
Pennsylvania	6,344	0.012	2,324	0.014	9.3	15.2	1,212	0.014	13.8	20.5	2,808	0.010	8.1	12.5
Rhode Island	201	0.018	57	0.030	22.8	36.8	35	0.014	8.6	25.7	109	0.015	16.5	25.7
Vermont	1,435	0.016	372	0.019	22.0	31.5	334	0.013	19.2	26.3	729	0.016	19.5	29.8
Virginia	4,009	0.008	1,126	0.011	6.6	12.0	808	0.009	8.5	13.2	2,075	0.007	4.2	7.4
West Virginia	1,473	0.013	607	0.018	17.5	24.4	344	0.015	13.7	19.8	522	0.009	6.9	10.5
<b>Southeast</b>	<b>37,427</b>	<b>0.008</b>	<b>13,902</b>	<b>0.010</b>	<b>7.5</b>	<b>12.4</b>	<b>9,250</b>	<b>0.008</b>	<b>8.2</b>	<b>12.8</b>	<b>14,275</b>	<b>0.007</b>	<b>4.9</b>	<b>8.2</b>
Alabama	3,246	0.007	1,034	0.007	4.2	6.6	876	0.007	8.0	11.9	1,336	0.007	6.3	9.6
Florida	2,998	0.005	830	0.006	3.7	7.1	827	0.005	2.2	5.0	1,341	0.004	1.3	2.3
Georgia	6,163	0.010	2,464	0.014	11.0	19.6	1,567	0.010	10.6	15.3	2,132	0.007	5.3	7.7
Kentucky	2,424	0.008	943	0.009	7.5	10.4	480	0.008	9.4	11.0	1,001	0.006	3.7	5.7
Mississippi	1,690	0.008	273	0.007	4.4	6.6	476	0.007	5.5	8.2	941	0.009	7.0	11.8
North Carolina	8,090	0.008	3,347	0.010	6.4	11.4	2,166	0.008	6.7	11.1	2,577	0.006	3.8	6.9
Puerto Rico	1,237	0.005	586	0.004	0.9	0.2	29	0.007	3.4	10.3	622	0.005	3.1	3.1
South Carolina	4,011	0.009	1,054	0.016	17.3	27.6	1,130	0.009	9.7	16.1	1,827	0.007	3.6	7.7
Tennessee	7,490	0.009	3,327	0.009	6.3	9.9	1,698	0.010	10.5	16.3	2,465	0.009	7.8	13.8
Virgin Islands	78	0.006	44	0.004	0.0	0.0	1	0.010	0.0	0.0	33	0.011	3.0	9.1
<b>North Central</b>	<b>35,491</b>	<b>0.009</b>	<b>12,515</b>	<b>0.011</b>	<b>9.3</b>	<b>13.8</b>	<b>8,549</b>	<b>0.011</b>	<b>10.8</b>	<b>15.8</b>	<b>14,427</b>	<b>0.008</b>	<b>5.2</b>	<b>8.9</b>
Illinois	6,542	0.011	2,796	0.014	16.3	21.0	1,387	0.011	13.0	19.3	2,359	0.007	4.7	8.3
Indiana	4,021	0.007	1,174	0.007	2.9	3.3	917	0.007	4.5	6.0	1,930	0.006	3.0	5.0
Iowa	2,118	0.006	675	0.007	4.9	5.0	570	0.006	5.3	4.9	873	0.005	1.5	1.8
Michigan	5,112	0.011	1,397	0.012	8.4	15.3	1,459	0.013	14.3	19.9	2,256	0.009	6.8	11.3
Minnesota	6,982	0.010	3,402	0.010	5.7	10.6	1,475	0.012	10.5	17.0	2,105	0.008	5.4	8.7
Ohio	6,034	0.010	1,361	0.013	13.2	19.2	1,710	0.010	9.0	14.4	2,963	0.008	6.7	11.8
Wisconsin	4,682	0.010	1,710	0.011	8.8	13.3	1,031	0.013	14.9	20.5	1,941	0.008	5.6	9.9

See footnotes at end of table.

**Table 3-19 (page 2 of 2). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by MSHA metal/nonmetal mine district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal Mine District	All years		1979 - 1988				1989 - 1992				1993 - 1999			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>South Central</b>	<b>31,305</b>	<b>0.009</b>	<b>7,465</b>	<b>0.013</b>	<b>13.0</b>	<b>17.6</b>	<b>9,403</b>	<b>0.009</b>	<b>9.5</b>	<b>13.7</b>	<b>14,437</b>	<b>0.007</b>	<b>5.5</b>	<b>7.9</b>
Arkansas	2,396	0.015	544	0.038	31.6	45.8	660	0.017	16.7	28.5	1,192	0.009	7.9	13.8
Louisiana	2,421	0.006	279	0.007	7.2	11.8	716	0.005	4.2	6.3	1,426	0.006	4.3	7.6
Missouri	7,486	0.010	2,347	0.013	13.0	16.4	2,008	0.011	11.6	15.1	3,131	0.007	5.0	7.5
New Mexico	3,729	0.013	1,013	0.014	14.4	19.7	1,059	0.015	13.1	21.1	1,657	0.011	11.9	16.0
Oklahoma	4,890	0.009	1,570	0.011	9.9	13.2	1,340	0.011	10.9	16.6	1,980	0.007	4.3	7.7
Texas	10,383	0.007	1,712	0.011	10.0	14.1	3,620	0.007	6.4	8.4	5,051	0.006	4.0	4.4
<b>Rocky Mountain</b>	<b>31,645</b>	<b>0.015</b>	<b>15,364</b>	<b>0.017</b>	<b>14.5</b>	<b>22.2</b>	<b>5,927</b>	<b>0.017</b>	<b>16.7</b>	<b>26.2</b>	<b>10,354</b>	<b>0.012</b>	<b>10.5</b>	<b>16.6</b>
Arizona	5,176	0.017	2,380	0.023	18.0	27.1	717	0.019	18.8	29.0	2,079	0.011	9.8	15.3
Colorado	6,090	0.015	3,459	0.014	12.5	19.9	1,168	0.019	17.4	27.6	1,463	0.017	12.5	23.3
Kansas	2,713	0.011	1,280	0.013	12.3	14.1	542	0.011	9.8	12.5	891	0.009	7.2	8.3
Montana	2,930	0.014	1,370	0.012	10.4	15.3	667	0.023	22.5	33.7	893	0.013	11.8	19.6
Nebraska	780	0.006	53	0.006	5.7	5.7	254	0.006	2.8	4.7	473	0.005	1.9	2.5
Nevada	3,649	0.020	1,224	0.025	24.4	33.7	1,032	0.021	20.4	31.8	1,393	0.017	15.9	25.8
North Dakota	527	0.010	194	0.014	12.9	18.6	72	0.009	1.4	11.1	261	0.008	2.3	7.7
South Dakota	2,536	0.015	1,597	0.018	13.2	23.0	281	0.013	9.3	16.0	658	0.010	8.1	12.8
Utah	4,183	0.015	2,083	0.014	12.6	20.0	889	0.020	18.1	30.4	1,211	0.013	9.7	18.3
Wyoming	3,061	0.014	1,724	0.020	15.1	26.4	305	0.013	13.8	21.0	1,032	0.008	12.5	11.0
<b>Western</b>	<b>16,368</b>	<b>0.011</b>	<b>4,590</b>	<b>0.016</b>	<b>13.5</b>	<b>20.7</b>	<b>4,369</b>	<b>0.013</b>	<b>12.1</b>	<b>19.1</b>	<b>7,409</b>	<b>0.008</b>	<b>6.0</b>	<b>9.2</b>
Alaska	326	0.016	88	0.024	21.6	28.4	33	0.053	24.2	39.4	205	0.011	8.3	15.6
California	7,453	0.013	2,326	0.018	15.2	23.3	2,425	0.014	12.0	21.0	2,702	0.009	7.9	11.7
Hawaii	265	0.004	11	0.005	0.0	0.0	57	0.005	3.5	1.8	197	0.004	1.0	1.0
Idaho	2,609	0.015	912	0.022	15.9	26.1	534	0.017	17.0	27.2	1,163	0.010	7.6	14.3
Oregon	2,685	0.006	413	0.007	4.1	6.3	698	0.007	7.4	8.0	1,574	0.005	1.9	1.8
Washington	3,030	0.009	840	0.011	10.1	13.8	622	0.011	13.3	17.8	1,568	0.007	6.0	8.5
<b>TOTAL</b>	<b>179,024</b>	<b>0.010</b>	<b>62,815</b>	<b>0.013</b>	<b>11.3</b>	<b>17.3</b>	<b>43,558</b>	<b>0.011</b>	<b>10.8</b>	<b>16.5</b>	<b>72,651</b>	<b>0.008</b>	<b>6.3</b>	<b>10.0</b>

– indicates incalculable field

PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: For metal/nonmetal mining, the MSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz+2)] for respirable dust containing at least 1 percent quartz. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data.

**Table 3-20 (page 1 of 3). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 - 1988 OSHA PEL: see note				1989 - 1992 OSHA PEL=0.1 mg/m <sup>3</sup>				1993 - 1999 OSHA PEL: see note			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 1</b>	<b>1,376</b>	<b>0.032</b>	<b>980</b>	<b>0.034</b>	<b>25.8</b>	<b>40.2</b>	<b>144</b>	<b>0.018</b>	<b>9.7</b>	<b>22.2</b>	<b>252</b>	<b>0.034</b>	<b>26.6</b>	<b>40.9</b>
Connecticut	446	0.023	344	0.027	19.2	33.7	55	0.014	3.6	16.4	47	0.015	8.5	21.3
Maine	22	0.034	19	0.033	36.8	42.1	0	-	-	-	3	0.038	33.3	33.3
Massachusetts	468	0.038	296	0.041	31.4	46.3	58	0.022	15.5	24.1	114	0.041	30.7	46.5
New Hampshire	227	0.029	143	0.033	23.8	39.9	30	0.020	10.0	30.0	54	0.027	24.1	37.0
Rhode Island	213	0.044	178	0.039	29.8	42.7	1	0.007	0.0	0.0	34	0.084	41.2	55.9
Vermont	0	-	0	-	-	-	0	-	-	-	0	-	-	-
<b>Region 2</b>	<b>1,587</b>	<b>0.041</b>	<b>904</b>	<b>0.043</b>	<b>33.2</b>	<b>48.5</b>	<b>232</b>	<b>0.025</b>	<b>15.9</b>	<b>32.8</b>	<b>451</b>	<b>0.047</b>	<b>36.4</b>	<b>49.2</b>
New Jersey	443	0.035	283	0.041	32.5	45.9	103	0.027	13.6	34.0	57	0.027	19.3	26.3
New York	1,131	0.044	619	0.044	33.3	49.4	125	0.025	18.4	32.8	387	0.052	39.5	53.5
Puerto Rico	9	0.021	2	0.914	100.0	100.0	3	0.007	0.0	0.0	4	0.007	0.0	0.0
U.S. Virgin Islands	4	0.007	0	-	-	-	1	0.007	0.0	0.0	3	0.007	0.0	0.0
<b>Region 3</b>	<b>2,622</b>	<b>0.047</b>	<b>1,996</b>	<b>0.047</b>	<b>30.1</b>	<b>49.2</b>	<b>259</b>	<b>0.034</b>	<b>22.8</b>	<b>39.8</b>	<b>367</b>	<b>0.058</b>	<b>37.3</b>	<b>52.0</b>
Delaware	20	0.020	17	0.014	5.9	11.8	0	-	-	-	3	0.117	66.7	66.7
District of Columbia	0	-	0	-	-	-	0	-	-	-	0	-	-	-
Maryland	215	0.038	123	0.034	29.3	37.4	60	0.037	36.7	51.7	32	0.059	28.1	43.8
Pennsylvania	1,912	0.048	1,406	0.048	29.2	51.1	180	0.032	17.8	36.1	326	0.057	37.4	52.5
Virginia	247	0.041	246	0.040	27.6	41.5	0	-	-	-	1	0.412	100.0	100.0
West Virginia	228	0.061	204	0.062	42.2	55.9	19	0.049	26.3	36.8	5	0.051	60.0	60.0
<b>Region 4</b>	<b>2,523</b>	<b>0.034</b>	<b>1,449</b>	<b>0.039</b>	<b>30.2</b>	<b>43.8</b>	<b>419</b>	<b>0.030</b>	<b>21.0</b>	<b>35.1</b>	<b>655</b>	<b>0.028</b>	<b>20.3</b>	<b>33.3</b>
Alabama	479	0.033	323	0.037	32.2	45.8	98	0.037	23.5	44.9	58	0.015	12.1	20.7
Florida	88	0.037	58	0.034	29.3	37.9	22	0.027	22.7	27.3	8	0.148	62.5	62.5
Georgia	636	0.045	470	0.044	34.5	49.1	73	0.026	19.2	30.1	93	0.072	29.0	53.8
Kentucky	338	0.033	157	0.044	33.1	44.6	64	0.047	29.7	43.8	117	0.018	15.4	17.9
Mississippi	106	0.050	74	0.046	33.8	48.6	22	0.030	13.6	22.7	10	0.295	60.0	90.0
North Carolina	360	0.025	155	0.026	12.3	26.5	25	0.023	16.0	28.0	180	0.024	20.0	31.7
South Carolina	144	0.022	49	0.021	26.5	26.5	40	0.017	15.0	22.5	55	0.027	23.6	29.1
Tennessee	372	0.033	163	0.040	27.6	44.8	75	0.028	18.7	34.7	134	0.027	15.7	35.8

See footnotes at end of table.

**Table 3-20 (page 2 of 3). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 - 1988 OSHA PEL: see note				1989 - 1992 OSHA PEL=0.1 mg/m <sup>3</sup>				1993 - 1999 OSHA PEL: see note			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 5</b>	<b>5,121</b>	<b>0.041</b>	<b>2,819</b>	<b>0.048</b>	<b>35.3</b>	<b>52.7</b>	<b>1,013</b>	<b>0.027</b>	<b>15.8</b>	<b>35.7</b>	<b>1,289</b>	<b>0.039</b>	<b>30.6</b>	<b>42.9</b>
Illinois	947	0.041	538	0.043	34.2	47.8	147	0.030	17.7	33.3	262	0.045	35.1	46.9
Indiana	410	0.032	262	0.037	31.3	45.0	84	0.018	8.3	23.8	64	0.039	37.5	43.8
Michigan	765	0.016	27	0.014	0.0	3.7	262	0.012	2.7	12.6	476	0.019	10.3	20.6
Minnesota	93	0.051	71	0.048	50.7	54.9	9	0.029	0.0	44.4	13	0.098	46.2	46.2
Ohio	1,638	0.047	1,191	0.047	32.3	50.1	229	0.034	20.5	39.7	218	0.069	42.2	57.3
Wisconsin	1,268	0.061	730	0.061	42.3	64.9	282	0.052	25.9	58.5	256	0.074	51.6	67.6
<b>Region 6</b>	<b>1,215</b>	<b>0.040</b>	<b>885</b>	<b>0.036</b>	<b>29.8</b>	<b>41.4</b>	<b>171</b>	<b>0.037</b>	<b>28.7</b>	<b>43.3</b>	<b>159</b>	<b>0.087</b>	<b>44.0</b>	<b>53.5</b>
Arkansas	118	0.031	93	0.023	23.7	31.2	14	0.084	64.3	64.3	11	0.098	63.6	63.6
Louisiana	91	0.064	68	0.056	41.2	64.7	11	0.032	27.3	36.4	12	0.240	41.7	58.3
New Mexico	18	0.073	11	0.041	54.5	54.5	1	0.007	0.0	0.0	6	0.306	100.0	100.0
Oklahoma	198	0.036	153	0.034	19.6	37.3	10	0.044	30.0	50.0	35	0.045	28.6	48.6
Texas	790	0.040	560	0.037	31.8	41.1	135	0.034	25.2	41.5	95	0.089	44.2	50.5
<b>Region 7</b>	<b>1,050</b>	<b>0.033</b>	<b>720</b>	<b>0.035</b>	<b>25.3</b>	<b>38.9</b>	<b>181</b>	<b>0.023</b>	<b>14.4</b>	<b>33.1</b>	<b>149</b>	<b>0.040</b>	<b>33.6</b>	<b>42.3</b>
Iowa	579	0.030	336	0.031	22.6	32.7	116	0.022	14.7	30.2	127	0.038	34.6	41.7
Kansas	105	0.038	75	0.033	25.3	36.0	19	0.051	31.6	68.4	11	0.049	27.3	63.6
Missouri	289	0.040	242	0.046	30.6	50.0	43	0.017	7.0	23.3	4	0.021	25.0	25.0
Nebraska	77	0.027	67	0.023	19.4	32.8	3	0.055	0.0	66.7	7	0.076	28.6	28.6
<b>Region 8</b>	<b>737</b>	<b>0.039</b>	<b>493</b>	<b>0.032</b>	<b>23.7</b>	<b>35.5</b>	<b>122</b>	<b>0.032</b>	<b>25.4</b>	<b>39.3</b>	<b>122</b>	<b>0.107</b>	<b>54.9</b>	<b>70.5</b>
Colorado	458	0.030	321	0.026	20.9	30.8	74	0.025	17.6	32.4	63	0.079	46.0	63.5
Montana	78	0.059	64	0.044	25.0	35.9	11	0.250	72.7	81.8	3	0.141	66.7	66.7
North Dakota	94	0.070	56	0.041	23.2	50.0	2	0.069	50.0	50.0	36	0.161	69.4	80.6
South Dakota	57	0.065	27	0.033	33.3	44.4	10	0.102	70.0	70.0	20	0.132	55.0	75.0
Utah	45	0.043	20	0.142	60.0	60.0	25	0.017	8.0	28.0	0	-	-	-
Wyoming	5	0.022	5	0.022	0.0	20.0	0	-	-	-	0	-	-	-

See footnotes at end of table.

**Table 3-20 (page 3 of 3). Respirable quartz: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	All years		1979 - 1988 OSHA PEL: see note				1989 - 1992 OSHA PEL=0.1 mg/m <sup>3</sup>				1993 - 1999 OSHA PEL: see note			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 9</b>	<b>374</b>	<b>0.045</b>	<b>235</b>	<b>0.057</b>	<b>43.4</b>	<b>55.3</b>	<b>77</b>	<b>0.028</b>	<b>29.9</b>	<b>32.5</b>	<b>62</b>	<b>0.031</b>	<b>27.4</b>	<b>32.3</b>
American Samoa	0	-	0	-	-	-	0	-	-	-	0	-	-	-
Arizona	49	0.036	31	0.060	45.2	61.3	10	0.010	0.0	10.0	8	0.024	25.0	25.0
California	186	0.026	115	0.025	22.6	36.5	30	0.017	13.3	16.7	41	0.036	29.3	36.6
Guam	0	-	0	-	-	-	0	-	-	-	0	-	-	-
Hawaii	8	0.008	5	0.008	0.0	0.0	0	-	-	-	3	0.007	0.0	0.0
Nevada	131	0.117	84	0.191	73.8	82.1	37	0.056	51.4	51.4	10	0.030	30.0	30.0
<b>Region 10</b>	<b>501</b>	<b>0.041</b>	<b>130</b>	<b>0.046</b>	<b>33.1</b>	<b>40.8</b>	<b>85</b>	<b>0.034</b>	<b>21.2</b>	<b>31.8</b>	<b>286</b>	<b>0.041</b>	<b>25.9</b>	<b>42.0</b>
Alaska	7	0.100	2	0.152	50.0	50.0	5	0.085	60.0	80.0	0	-	-	-
Idaho	42	0.041	18	0.055	50.0	55.6	21	0.040	14.3	42.9	3	0.007	0.0	0.0
Oregon	175	0.029	107	0.046	30.8	39.3	4	0.010	0.0	0.0	64	0.015	12.5	18.8
Washington	277	0.050	3	0.007	0.0	0.0	55	0.032	21.8	25.5	219	0.057	30.1	49.3
<b>TOTAL</b>	<b>17,106</b>	<b>0.039</b>	<b>10,611</b>	<b>0.042</b>	<b>31.1</b>	<b>46.5</b>	<b>2,703</b>	<b>0.028</b>	<b>18.7</b>	<b>35.3</b>	<b>3,792</b>	<b>0.041</b>	<b>31.0</b>	<b>43.8</b>

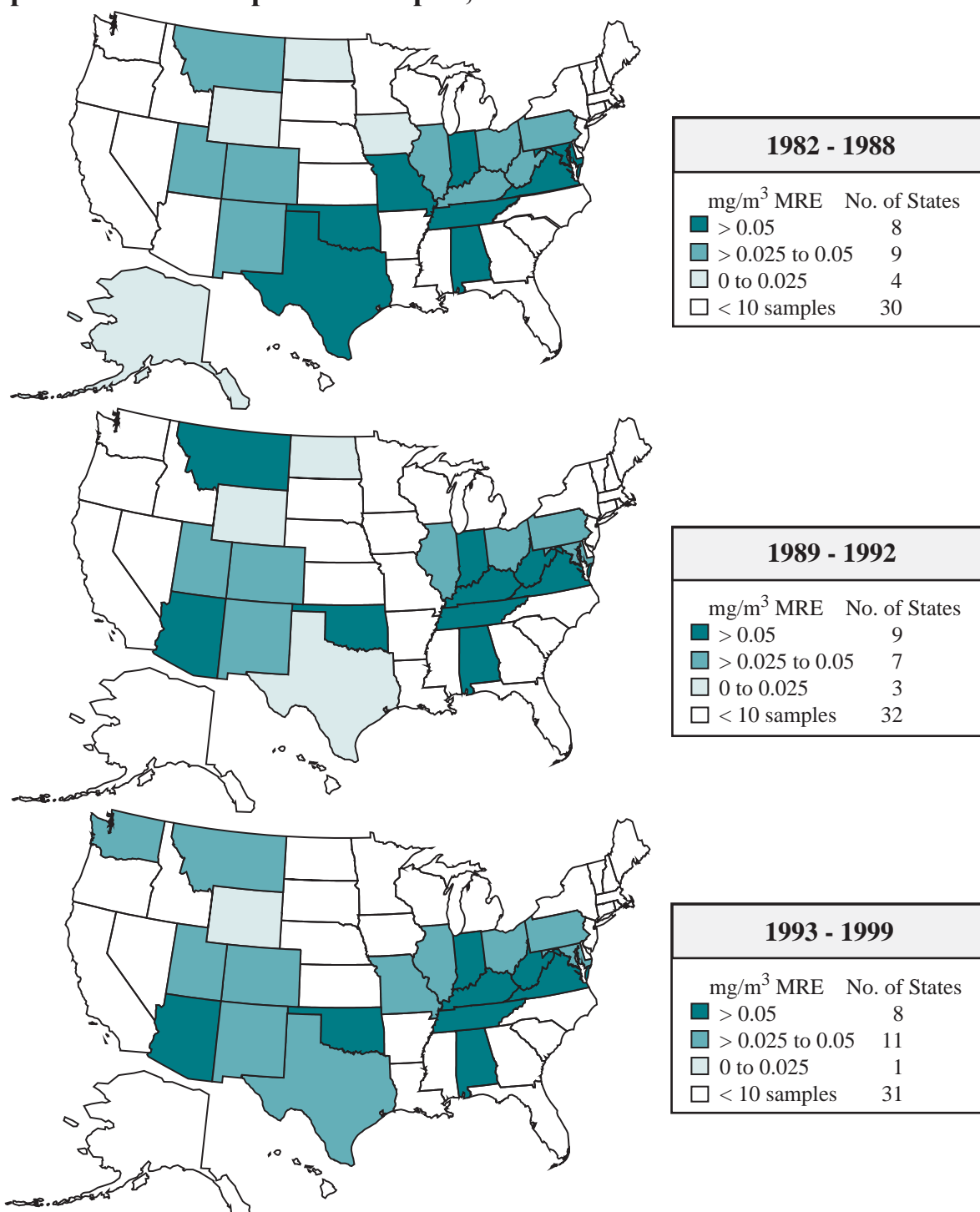
– indicates incalculable field

PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz + 2)] for respirable dust containing at least 1 percent quartz. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.1 mg/m<sup>3</sup> for respirable quartz. The NIOSH REL is 0.05mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Figure 3-7. Respirable quartz: Geometric mean coal mining exposures by state, MSHA inspector and mine operator samples, 1982-1999**



PEL - permissible exposure limit

REL - recommended exposure limit

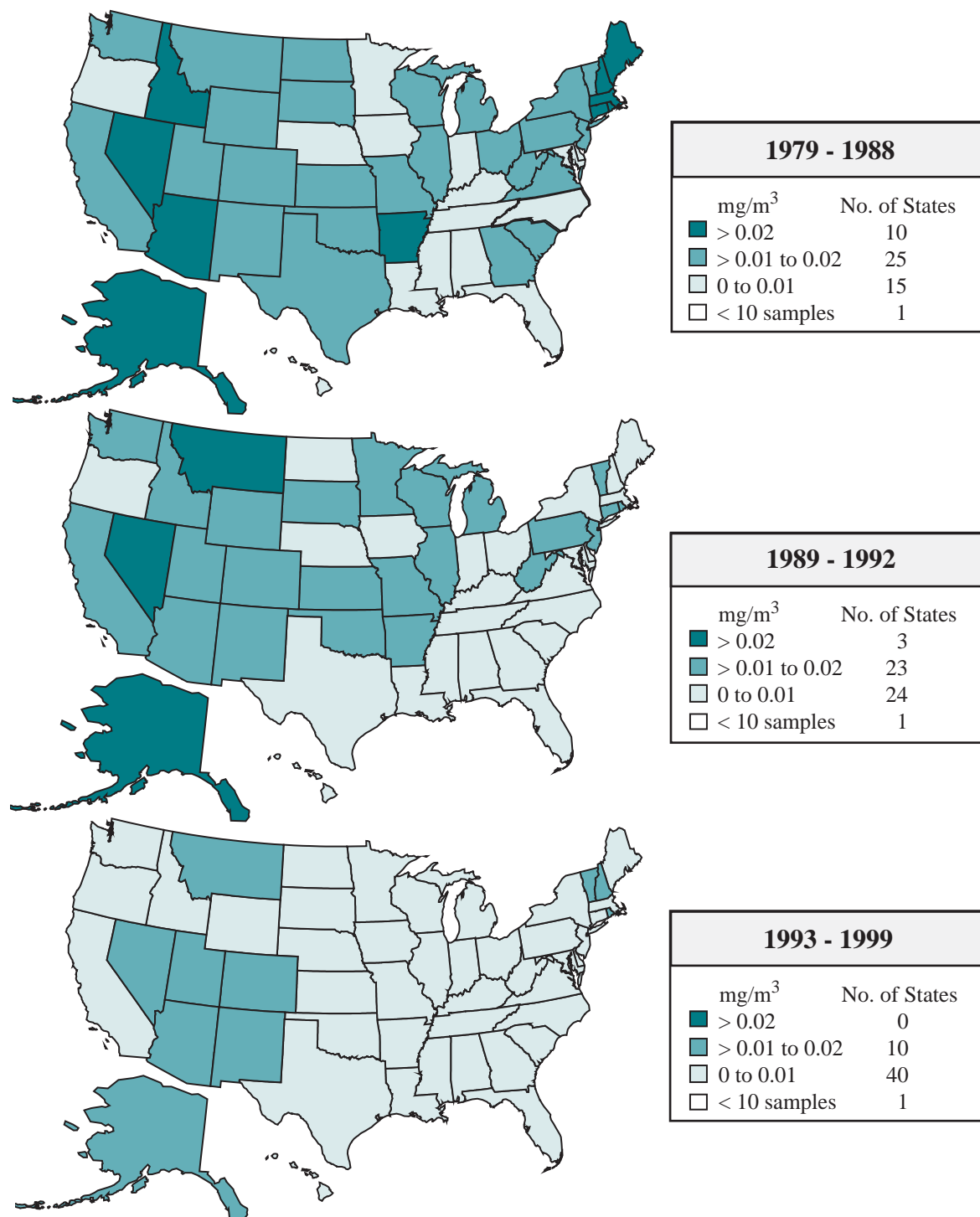
mg/m<sup>3</sup> - milligrams per cubic meter

MRE - Mining Research Establishment, not comparable to NIOSH REL

NOTE: For coal mining, the MSHA PEL is [(10 mg/m<sup>3</sup> MRE) / (% quartz)] for respirable dust containing greater than 5 percent quartz. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and operator quartz data.

**Figure 3-8. Respirable quartz: Geometric mean metal/nonmetal mining exposures by state, MSHA samples, 1979-1999**



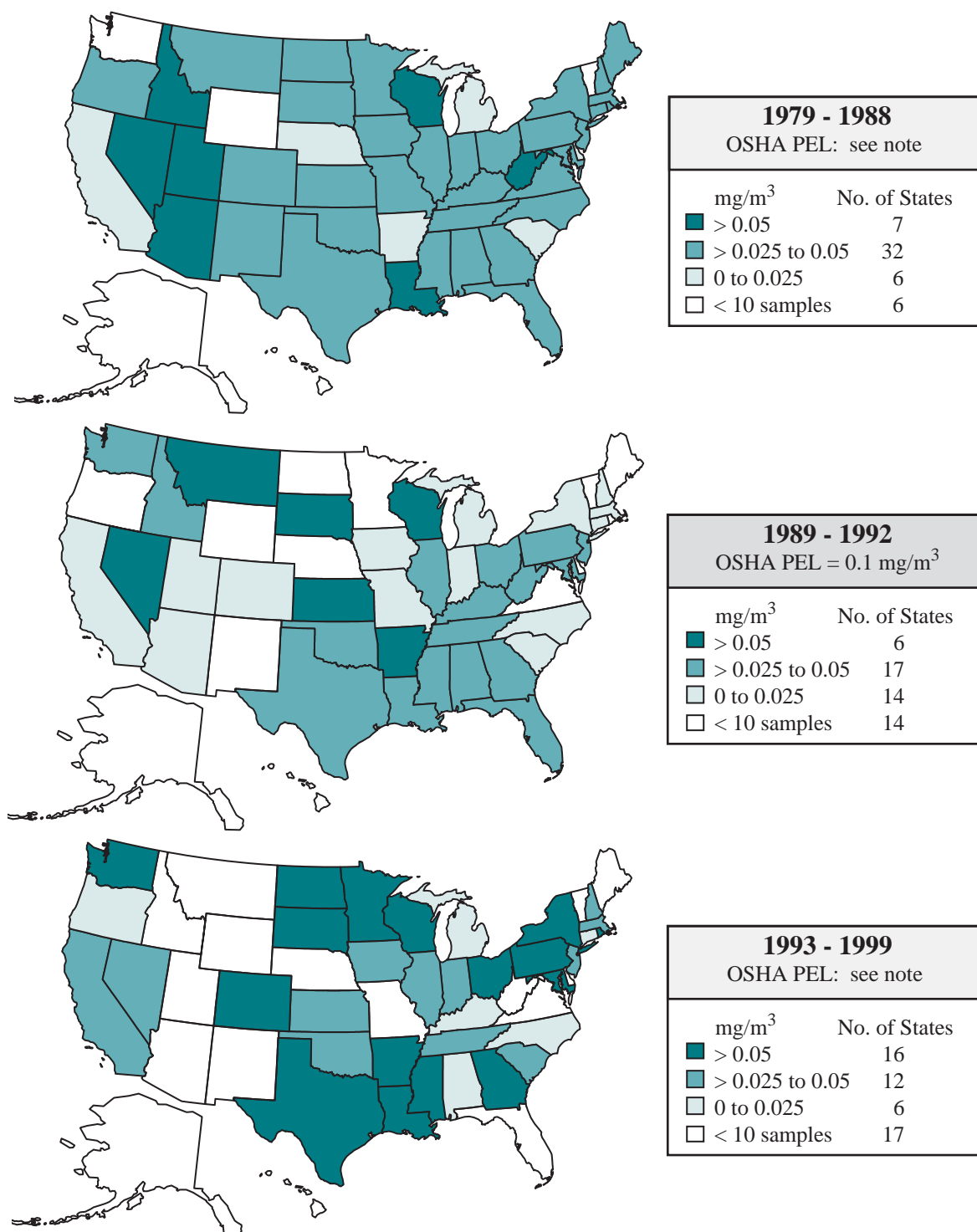
PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: For metal/nonmetal mining, the MSHA PEL is  $[(10 \text{ mg/m}^3) / (\% \text{ quartz} + 2)]$  for respirable dust containing at least 1 percent quartz. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data.



**Figure 3-9. Respirable quartz: Geometric mean exposures by state, OSHA samples, 1979-1999**



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is [(10 mg/m<sup>3</sup>) / (% quartz + 2)] for respirable dust containing at least 1 percent quartz. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.1 mg/m<sup>3</sup> for respirable quartz. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Table 3-21. Respirable cristobalite: Geometric mean exposures and percent exceeding designated occupational exposure limits, MSHA and OSHA samples, 1979-1999**

	OSHA PEL: see note										OSHA PEL = 0.05 mg/m <sup>3</sup>				OSHA PEL: see note							
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
Cristobalite, respirable - MSHA																						
GM (mg/m <sup>3</sup> )	0.056	0.050	0.031	0.055	0.037	0.035	0.024	0.025	0.032	0.027	0.032	0.037	0.028	0.020	0.031	0.065	0.033	0.020	0.030	0.015	0.010	
No. of samples	12	53	21	5	34	26	23	10	14	22	28	19	13	22	23	12	3	12	7	5	1	
% > PEL	58.3	54.7	42.9	100.0	44.1	23.1	26.1	10.0	14.3	31.8	28.6	52.6	46.2	9.1	30.4	66.7	0.0	8.3	28.6	0.0	0.0	
% > REL	50.0	43.4	28.6	60.0	23.5	15.4	13.0	10.0	14.3	22.7	21.4	36.8	30.8	0.0	26.1	50.0	0.0	8.3	28.6	0.0	0.0	
Cristobalite, respirable - OSHA																						
GM (mg/m <sup>3</sup> )	0.033	0.020	0.022	0.022	0.027	0.020	0.024	0.021	0.022	0.020	0.021	0.021	0.021	0.021	0.020	0.032	0.024	0.021	0.021	0.020	0.023	
No. of samples	26	193	101	84	26	62	112	78	52	61	101	90	51	154	48	52	39	26	47	26	37	
% > PEL	19.2	0.0	3.0	4.8	7.7	0.0	8.0	2.6	1.9	1.6	0.0	2.2	2.0	1.9	0.0	19.2	7.7	7.7	6.4	0.0	8.1	
% > REL	19.2	0.0	3.0	4.8	7.7	0.0	7.1	2.6	1.9	1.6	0.0	2.2	2.0	1.9	0.0	19.2	7.7	0.0	2.1	0.0	8.1	

– indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: Before March 1, 1989 and after March 22, 1993, the OSHA PEL is [(5 mg/m<sup>3</sup>) / (% cristobalite + 2)], for respirable dust containing at least 1 percent cristobalite. From March 1, 1989 to March 22, 1993, the OSHA PEL was 0.05 mg/m<sup>3</sup> for respirable cristobalite. For metal/nonmetal mining, the MSHA PEL is [(5 mg/m<sup>3</sup>) / (% cristobalite + 2)] for respirable dust containing at least 1 percent cristobalite. The NIOSH REL is 0.05 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

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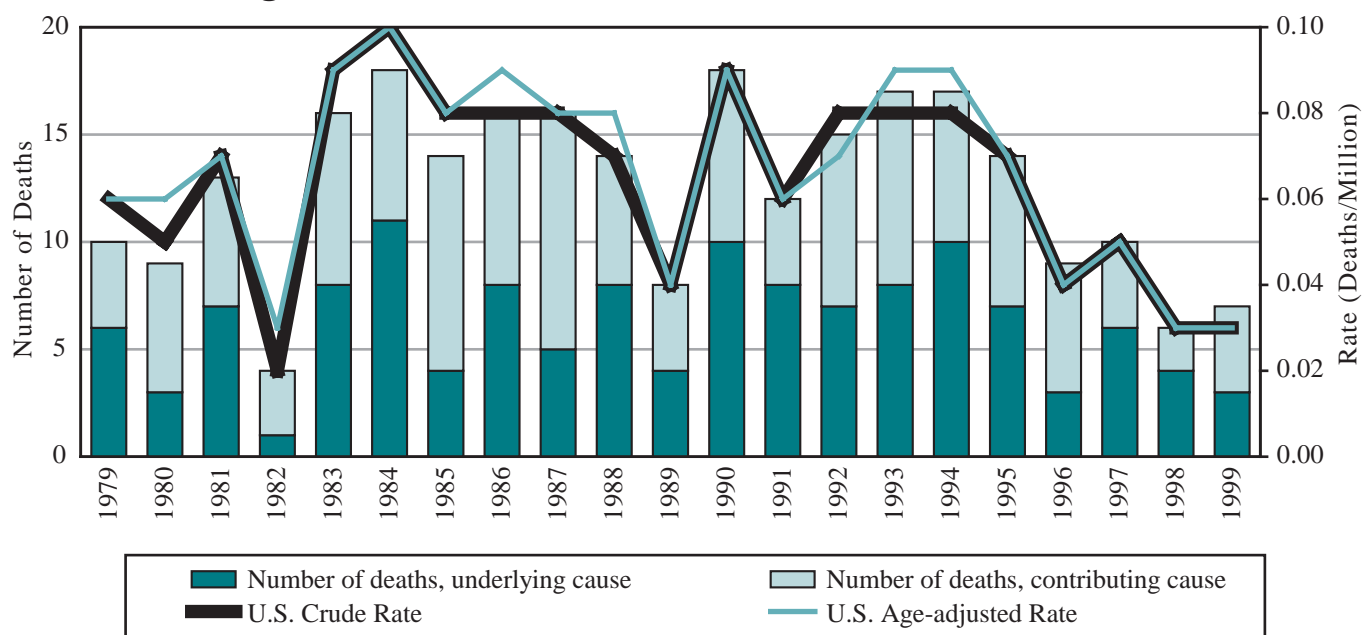
## **Section 4**

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# **Byssinosis and Related Exposures**



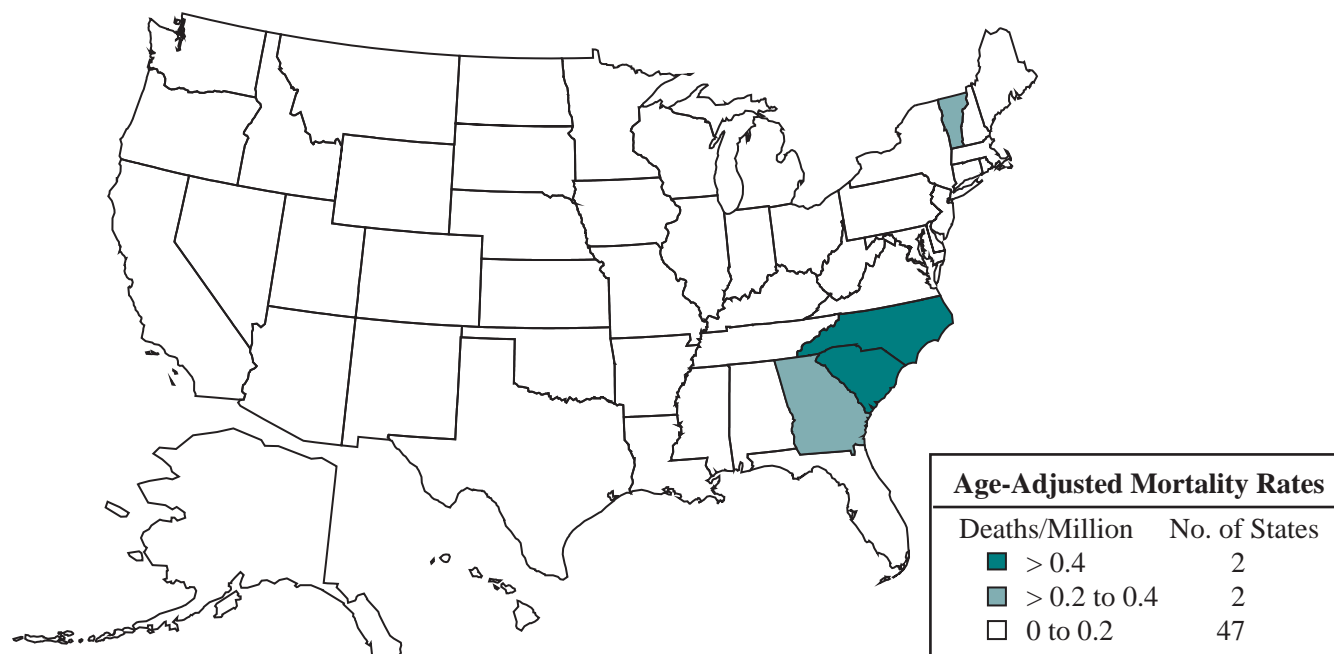
**Figure 4-1. Byssinosis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1979-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 4-2. Byssinosis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 4-1. Byssinosis: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	18	55.6	13	5	17	1	-	-	1	-	-	4	7	4	2	71.0
1991	12	66.7	8	4	11	1	-	-	-	-	1	1	4	4	2	75.0
1992	15	46.7	9	6	10	5	-	3	1	-	-	1	8	2	-	67.0
1993	17	47.1	11	6	12	5	-	-	1	1	1	4	3	3	4	73.0
1994	17	58.8	11	6	15	2	-	-	-	1	1	3	4	5	3	72.0
1995	14	50.0	11	3	14	-	-	-	1	1	-	-	6	6	-	74.0
1996	9	33.3	4	5	9	-	-	-	-	-	1	2	2	4	-	71.0
1997	10	60.0	9	1	9	1	-	-	-	-	-	1	3	4	2	76.5
1998	6	66.7	5	1	6	-	-	-	-	-	-	1	1	3	1	77.0
1999	7	42.9	3	4	7	-	-	-	-	1	-	1	2	2	1	68.0
<b>TOTAL</b>	<b>125</b>	<b>52.8</b>	<b>84</b>	<b>41</b>	<b>110</b>	<b>15</b>	<b>0</b>	<b>3</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>18</b>	<b>40</b>	<b>37</b>	<b>15</b>	<b>72.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data

**Table 4-2. Byssinosis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	0.09	0.15	0.06	0.10	—	—	—
1991	0.06	0.09	0.05	0.10	—	—	—
1992	0.08	0.06	0.06	0.38	0.08	—	—
1993	0.08	0.09	0.06	0.37	0.08	—	—
1994	0.08	0.11	0.07	0.18	—	—	—
1995	0.07	0.13	0.03	—	—	—	—
1996	0.04	0.05	0.06	—	—	—	—
1997	0.05	0.09	0.01	0.09	—	—	—
1998	0.03	0.06	0.01	—	—	—	—
1999	0.03	0.03	0.04	—	—	—	—
1990-1999	0.06	0.08	0.04	0.12	0.02	—	—
	Age-Adjusted Mortality Rate						
1990	0.09	0.17	0.05	0.14	—	—	—
1991	0.06	0.12	0.05	0.20	—	—	—
1992	0.07	0.06	0.05	0.46	0.11	—	—
1993	0.09	0.10	0.05	0.47	0.11	—	—
1994	0.09	0.13	0.06	0.39	—	—	—
1995	0.07	0.14	0.03	—	—	—	—
1996	0.04	0.05	0.05	—	—	—	—
1997	0.05	0.11	0.01	0.18	—	—	—
1998	0.03	0.07	0.01	—	—	—	—
1999	0.03	0.03	0.03	—	—	—	—
1990-1999	0.06	0.10	0.04	0.18	0.02	—	—

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Byssinosis: Mortality

**Table 4-3. Byssinosis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	55	—	—	—	—	—	55
1991	—	20	—	—	—	—	20
1992	50	35	90	—	—	—	175
1993	45	5	45	—	—	—	95
1994	25	30	—	—	—	—	55
1995	60	—	—	—	—	—	60
1996	5	20	—	—	—	—	25
1997	5	—	—	—	—	—	5
1998	5	—	—	—	—	—	5
1999	30	—	—	—	—	—	30
TOTAL	280	110	135	—	—	—	525
	Years of Potential Life Lost to Life Expectancy						
1990	187	55	11	—	—	—	253
1991	64	79	7	—	—	—	150
1992	111	113	112	9	—	—	345
1993	120	54	80	6	—	—	260
1994	117	104	16	—	—	—	237
1995	167	40	—	—	—	—	207
1996	47	88	—	—	—	—	135
1997	85	7	7	—	—	—	99
1998	48	16	—	—	—	—	64
1999	70	40	—	—	—	—	110
TOTAL	1,016	596	233	15	—	—	1,860

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 4-4. Byssinosis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	1	1	-	-	-	-	-	1	-	-	3
Alaska	-	-	-	-	-	-	-	-	-	-	-
Arizona	1	-	-	-	-	-	-	-	-	-	1
Arkansas	-	-	-	-	-	-	1	-	-	-	1
California	-	-	1	2	2	1	-	1	-	1	8
Colorado	-	-	-	-	1	-	-	-	-	1	2
Connecticut	-	-	-	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	-	-	-	-	-	-
District of Columbia	-	-	-	-	-	-	-	-	-	-	-
Florida	1	-	1	-	1	-	-	1	-	-	4
Georgia	-	1	-	3	1	1	1	1	2	1	11
Hawaii	-	-	-	-	-	-	-	-	-	-	-
Idaho	-	-	-	-	-	-	-	-	-	-	-
Illinois	1	-	1	-	-	-	-	-	-	-	2
Indiana	-	1	-	-	-	-	-	-	-	-	1
Iowa	-	-	-	-	1	-	-	-	-	-	1
Kansas	1	-	-	-	-	-	-	-	-	-	1
Kentucky	-	-	-	-	-	1	-	-	-	-	1
Louisiana	-	-	1	-	-	-	-	-	-	-	1
Maine	-	-	-	-	-	-	-	-	-	-	-
Maryland	-	-	-	-	-	1	-	-	-	-	1
Massachusetts	1	-	1	1	-	-	-	-	-	-	3
Michigan	1	-	-	2	-	-	-	-	-	-	3
Minnesota	1	-	-	-	-	-	-	2	-	-	3
Mississippi	-	-	-	-	-	-	-	-	-	-	-
Missouri	-	-	-	-	-	1	-	-	-	-	1
Montana	-	-	-	-	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-	-	-	-
New Hampshire	-	1	-	-	-	-	-	-	-	-	1
New Jersey	-	-	-	-	-	-	-	-	-	-	-
New Mexico	-	-	-	-	-	-	-	-	-	-	-
New York	-	-	-	-	1	-	-	-	-	-	1
North Carolina	5	2	8	4	8	8	4	-	3	1	43
North Dakota	-	-	-	-	-	-	-	-	-	-	-
Ohio	1	-	-	-	-	-	-	-	-	-	1
Oklahoma	-	1	-	1	-	-	-	-	-	-	2
Oregon	-	-	-	-	-	-	-	-	-	-	-
Pennsylvania	1	1	-	-	1	-	-	-	-	1	4
Rhode Island	-	-	-	-	-	-	1	-	-	-	1
South Carolina	1	3	2	-	-	1	1	1	1	1	11
South Dakota	-	-	-	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	-	-	-	-	-
Texas	-	-	-	2	-	-	1	1	-	-	4
Utah	-	-	-	-	-	-	-	-	-	-	-
Vermont	-	-	-	-	-	-	-	-	-	1	1
Virginia	2	-	-	1	-	-	-	-	-	-	3
Washington	-	-	-	-	-	-	-	-	-	-	-
West Virginia	-	1	-	1	-	-	-	-	-	-	2
Wisconsin	-	-	-	-	1	-	-	2	-	-	3
Wyoming	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>	<b>18</b>	<b>12</b>	<b>15</b>	<b>17</b>	<b>17</b>	<b>14</b>	<b>9</b>	<b>10</b>	<b>6</b>	<b>7</b>	<b>125</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Byssinosis: Mortality

**Table 4-5. Byssinosis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	3	8	0.09	8	0.09	8	31	17	10.3	25
Alaska	-	-	-	-	-	-	-	-	-	-
Arizona	1	18	0.03	20	0.03	21	21	20	20.8	9
Arkansas	1	18	0.05	15	0.04	16	8	28	8.4	27
California	8	4	0.03	20	0.04	16	134	4	16.7	13
Colorado	2	14	0.07	12	0.08	10	47	13	23.6	6
Connecticut	-	-	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	-	-	-	-	-
District of Columbia	-	-	-	-	-	-	-	-	-	-
Florida	4	5	0.03	20	0.03	21	85	6	21.4	7
Georgia	11	2	0.20	4	0.26	3	151	3	13.7	20
Hawaii	-	-	-	-	-	-	-	-	-	-
Idaho	-	-	-	-	-	-	-	-	-	-
Illinois	2	14	0.02	27	0.02	27	104	5	52.1	1
Indiana	1	18	0.02	27	0.02	27	14	23	14	19
Iowa	1	18	0.05	15	0.04	16	14	23	14.1	17
Kansas	1	18	0.05	15	0.05	15	8	28	8.3	29
Kentucky	1	18	0.03	20	0.03	21	48	11	47.5	2
Louisiana	1	18	0.03	20	0.03	21	48	11	47.5	2
Maine	-	-	-	-	-	-	-	-	-	-
Maryland	1	18	0.03	20	0.03	21	14	23	14.1	17
Massachusetts	3	8	0.06	13	0.06	14	34	16	11.4	24
Michigan	3	8	0.04	18	0.04	16	83	7	27.5	5
Minnesota	3	8	0.08	9	0.09	8	57	8	18.8	11
Mississippi	-	-	-	-	-	-	-	-	-	-
Missouri	1	18	0.02	27	0.02	27	8	28	8.3	29
Montana	-	-	-	-	-	-	-	-	-	-
Nebraska	-	-	-	-	-	-	-	-	-	-
Nevada	-	-	-	-	-	-	-	-	-	-
New Hampshire	1	18	0.11	7	0.13	5	29	18	29.2	4
New Jersey	-	-	-	-	-	-	-	-	-	-
New Mexico	-	-	-	-	-	-	-	-	-	-
New York	1	18	0.01	30	0.01	30	21	20	21.1	8
North Carolina	43	1	0.75	1	0.78	1	577	1	13.4	21
North Dakota	-	-	-	-	-	-	-	-	-	-
Ohio	1	18	0.01	30	0.01	30	21	20	20.8	9
Oklahoma	2	14	0.08	9	0.07	12	14	23	7.2	31
Oregon	-	-	-	-	-	-	-	-	-	-
Pennsylvania	4	5	0.04	18	0.04	16	50	9	12.5	22
Rhode Island	1	18	0.13	6	0.11	7	8	28	8.4	27
South Carolina	11	2	0.39	2	0.43	2	174	2	15.8	14
South Dakota	-	-	-	-	-	-	-	-	-	-
Tennessee	-	-	-	-	-	-	-	-	-	-
Texas	4	5	0.03	20	0.03	21	50	9	12.5	22
Utah	-	-	-	-	-	-	-	-	-	-
Vermont	1	18	0.22	3	0.22	4	14	23	14.3	16
Virginia	3	8	0.06	13	0.07	12	28	19	9.4	26
Washington	-	-	-	-	-	-	-	-	-	-
West Virginia	2	14	0.14	5	0.12	6	35	15	17.5	12
Wisconsin	3	8	0.08	9	0.08	10	46	14	15.4	15
Wyoming	-	-	-	-	-	-	-	-	-	-

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 4-6. Byssinosis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
142	Yarn, thread, and fabric mills	39	48.2
961	Non-paid worker or non-worker or own home/at home	7	8.6
060	Construction	4	4.9
041	Coal mining	3	3.7
010	Agricultural production, crops	2	2.5
151	Apparel and accessories, except knit	2	2.5
351	Motor vehicles and motor vehicle equipment	2	2.5
392	Not specified manufacturing industries	2	2.5
831	Hospitals	2	2.5
901	General government, n.e.c.	2	2.5
	All other industries	15	18.5
	Industry not reported	1	1.2
	<b>TOTAL</b>	<b>81</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 4-7. Byssinosis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
749	Miscellaneous textile machine operators	11	13.6
738	Winding and twisting machine operators	8	9.9
518	Industrial machinery repairers	7	8.6
914	Housewife/Homemaker	7	8.6
616	Mining machine operators	4	4.9
744	Textile sewing machine operators	4	4.9
473	Farmers, except horticulture	2	2.5
633	Supervisors, production occupations	2	2.5
637	Machinists	2	2.5
739	Knitting, looping, taping, and weaving machine operators	2	2.5
754	Packaging and filling machine operators	2	2.5
889	Laborers, except construction	2	2.5
	All other occupations	26	32.1
	Occupation not reported	2	2.5
	<b>TOTAL</b>	<b>81</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## ***Byssinosis: Mortality***

**Table 4-8. Byssinosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
142	Yarn, thread, and fabric mills	39	22.26	15.79	30.41

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 4-9. Byssinosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

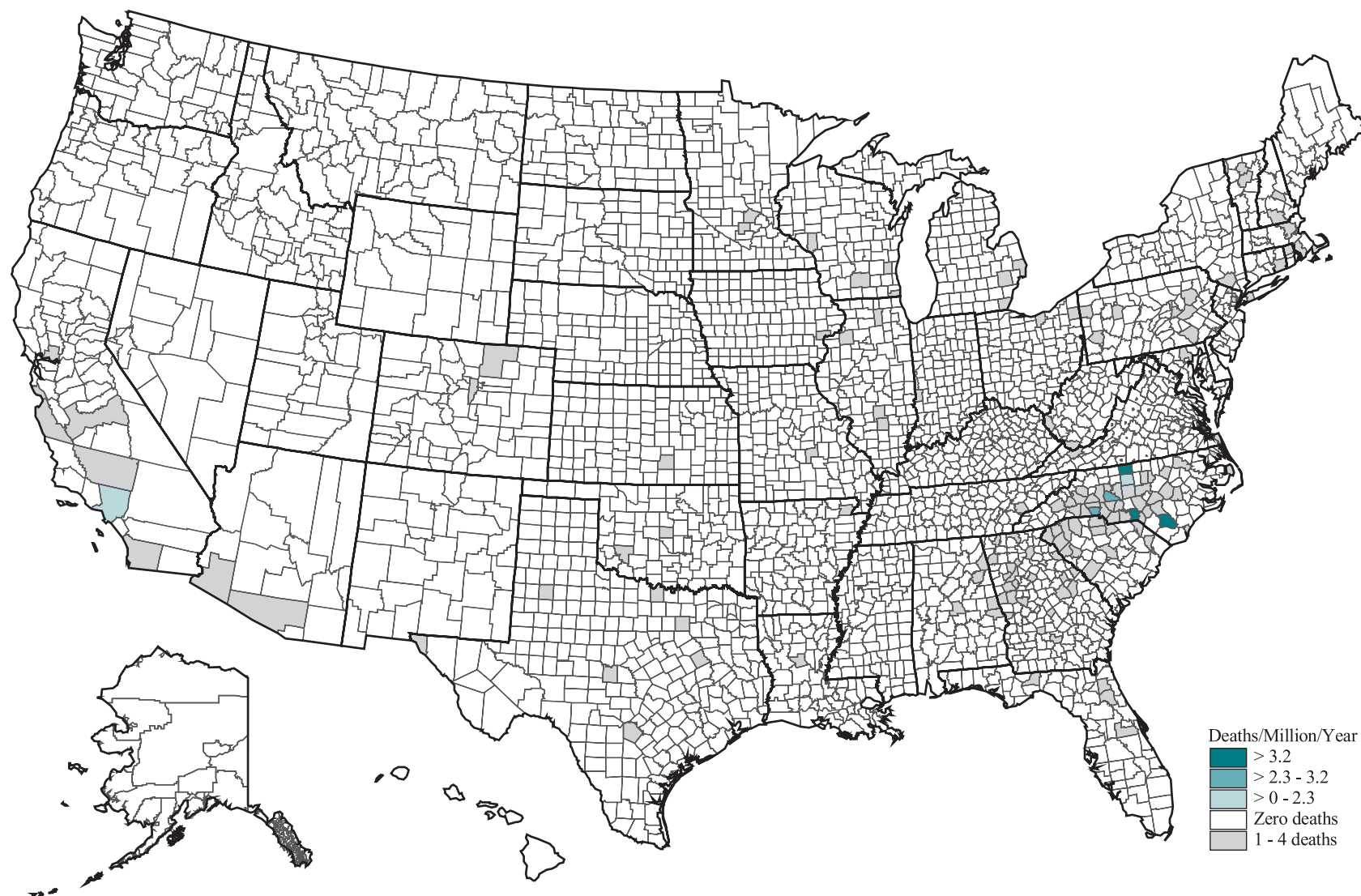
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
749	Miscellaneous textile machine operators	11	35.76	17.88	63.97
518	Industrial machinery repairers	7	28.07	11.28	57.89
738	Winding and twisting machine operators	8	27.50	11.85	54.14

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

86 **Figure 4-3. Byssinosis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1980-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 4-10. Byssinosis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Richmond County	North Carolina	18.95	20.87	11	54.5
Bladen County	North Carolina	12.38	14.69	5	60.0
Rockingham County	North Carolina	4.25	4.78	5	60.0
Gaston County	North Carolina	2.98	2.84	6	16.7
Guilford County	North Carolina	1.97	1.84	8	12.5
Los Angeles County	California	0.06	0.05	5	20.0
<b>Overall United States</b>		<b>0.07</b>	<b>0.06</b>	<b>193</b>	<b>29.0</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

Figure 4-4. Cotton dust: Geometric mean exposures by cotton process, OSHA samples, 1980-1999



PEL - permissible exposure limit      REL - recommended exposure limit      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: The OSHA PEL is 0.2 mg/m<sup>3</sup> for yarn manufacturing and cotton washing operations, 0.5 mg/m<sup>3</sup> for textile mill waste house operations or for dust from lower grade washed cotton used during yarn manufacturing, 0.75 mg/m<sup>3</sup> for textile slashing and weaving operations, and 1.0 mg/m<sup>3</sup> for cotton waste processing operations or waste recycling (i.e., sorting, blending, cleaning, and willowing) and garnetting. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.



**Table 4-11. Cotton dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by cotton process, OSHA samples, 1980-1999**

Process		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Yarn Manufacturing &amp; Cotton Washing</b> (PEL = 0.2 mg/m <sup>3</sup> )	GM (mg/m <sup>3</sup> )	-	0.233	0.131	0.163	0.169	0.208	0.215	0.300	0.139	0.170	0.147	0.147	0.131	0.185	0.088	0.088	0.070	0.465	-	0.137
	No. of samples	0	7	67	130	54	70	46	17	35	8	17	88	104	39	36	31	6	4	0	7
	% > PEL	-	57.1	28.4	28.5	40.7	52.9	45.7	70.6	28.6	37.5	23.5	25.0	28.8	35.9	13.9	12.9	0.0	100.0	-	14.3
	% > REL	-	57.1	28.4	28.5	40.7	52.9	45.7	70.6	28.6	37.5	23.5	25.0	28.8	35.9	13.9	12.9	0.0	100.0	-	14.3
<b>Textile Mill Waste House or Dust from Lower-Grade Cotton Washing During Yarn Manufacturing</b> (PEL = 0.5 mg/m <sup>3</sup> )	GM (mg/m <sup>3</sup> )	-	-	0.157	0.174	0.088	0.172	-	0.703	-	-	0.371	0.230	0.156	0.593	-	0.192	-	-	-	-
	No. of samples	0	0	5	10	8	7	0	4	0	0	1	7	8	17	0	4	0	0	0	0
	% > PEL	-	-	0.0	20.0	0.0	14.3	-	100.0	-	-	0.0	14.3	0.0	70.6	-	50.0	-	-	-	-
	% > REL	-	-	40.0	20.0	25.0	28.6	-	100.0	-	-	100.0	28.6	25.0	94.1	-	50.0	-	-	-	-
<b>Textile Slashing and Weaving</b> (PEL = 0.75 mg/m <sup>3</sup> )	GM (mg/m <sup>3</sup> )	-	-	0.396	0.054	0.252	0.616	0.223	-	0.035	-	0.383	0.127	0.978	-	0.143	0.196	0.261	-	0.096	-
	No. of samples	0	0	12	16	7	9	4	0	2	0	3	11	4	0	3	4	5	0	6	0
	% > PEL	-	-	25.0	6.3	14.3	11.1	0.0	-	0.0	-	0.0	0.0	100.0	-	0.0	0.0	0.0	-	0.0	-
	% > REL	-	-	83.3	18.8	71.4	100.0	50.0	-	0.0	-	100.0	45.5	100.0	-	66.7	75.0	80.0	-	33.3	-
<b>Cotton Waste Processing/ Recycling &amp; Garnetting</b> (PEL = 1.0 mg/m <sup>3</sup> )	GM (mg/m <sup>3</sup> )	0.002	4.90	0.485	0.597	-	1.77	0.818	0.949	-	0.896	0.212	0.233	0.173	0.521	3.00	-	-	0.078	0.372	-
	No. of samples	1	3	4	8	0	4	13	7	0	2	2	16	10	5	1	0	0	2	2	0
	% > PEL	0.0	100.0	25.0	37.5	-	50.0	23.1	42.9	-	0.0	0.0	0.0	0.0	20.0	100.0	-	-	0.0	0.0	-
	% > REL	0.0	100.0	100.0	50.0	-	75.0	100.0	100.0	-	100.0	50.0	50.0	30.0	80.0	100.0	-	-	0.0	100.0	-

- indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: The NIOSH REL is 0.2 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

## Byssinosis: Cotton Dust Exposure

**Table 4-12. Cotton Dust: Number of samples, geometric mean exposures, and percent exceeding designated occupational exposure limits by industries with elevated byssinosis mortality, OSHA samples, 1990-1999**

Byssinosis Mortality, Selected States and Years, 1990-1999				Number of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
CIC	Industries with elevated PMRs and most frequently recorded on death certificates	Number of Deaths	PMR				
142	Yarn, thread, and fabric mills	39	22.26	404	0.133	23.3	31.9
	All other industries	41		64	0.086	17.2	31.3
	<b>TOTAL</b>			<b>468</b>	<b>0.125</b>	<b>22.4</b>	<b>31.8</b>

CIC - Census Industry Code      PEL - permissible exposure limit      REL - recommended exposure limit      PMR - proportionate mortality ratio  
GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: The OSHA PEL is 0.2 mg/m<sup>3</sup> for yarn manufacturing and cotton washing operations, 0.5 mg/m<sup>3</sup> for textile mill waste house operations or for dust from lower grade washed cotton used during yarn manufacturing, 0.75 mg/m<sup>3</sup> for textile slashing and weaving operations, and 1.0 mg/m<sup>3</sup> for cotton waste processing operations or waste recycling (i.e., sorting, blending, cleaning, and willowing) and garnetting. The NIOSH REL is 0.2 mg/m<sup>3</sup>. See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states (and years) for which usual industry has been reported.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System. National Center for Health Statistics multiple cause of death data.

**Table 4-13 (page 1 of 3). Cotton dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region, state and process, OSHA samples, 1980-1999**

OSHA Region	All years		1980 - 1989				1990 - 1994				1995 - 1999			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 1</b>	<b>7</b>	<b>0.044</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>0.139</b>	<b>0.0</b>	<b>0.0</b>	<b>4</b>	<b>0.019</b>	<b>0.0</b>	<b>0.0</b>
<b>Massachusetts</b>	<b>3</b>	<b>0.139</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>0.139</b>	<b>0.0</b>	<b>0.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
Cotton Waste Proc/Recycl & Garnetting	3	0.139	0	-	-	-	3	0.139	0.0	0.0	0	-	-	-
<b>New Hampshire</b>	<b>4</b>	<b>0.019</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>0.019</b>	<b>0.0</b>	<b>0.0</b>
Yarn Manufacturing & Cotton Washing	2	0.121	0	-	-	-	0	-	-	-	2	0.121	0.0	0.0
Undetermined Process	2	0.003	0	-	-	-	0	-	-	-	2	0.003	-	0.0
<b>Region 2</b>	<b>10</b>	<b>1.093</b>	<b>10</b>	<b>1.093</b>	<b>50.0</b>	<b>90.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>New Jersey</b>	<b>9</b>	<b>2.119</b>	<b>9</b>	<b>2.119</b>	<b>55.6</b>	<b>100.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
Textile Mill Waste House	1	0.965	1	0.965	100.0	100.0	0	-	-	-	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	8	2.338	8	2.338	50.0	100.0	0	-	-	-	0	-	-	-
<b>Puerto Rico</b>	<b>1</b>	<b>0.003</b>	<b>1</b>	<b>0.003</b>	<b>-</b>	<b>0.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
Undetermined Process	1	0.003	1	0.003	-	0.0	0	-	-	-	0	-	-	-
<b>Region 3</b>	<b>4</b>	<b>0.029</b>	<b>4</b>	<b>0.029</b>	<b>0.0</b>	<b>25.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Maryland</b>	<b>1</b>	<b>0.014</b>	<b>1</b>	<b>0.014</b>	<b>-</b>	<b>0.0</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
Undetermined Process	1	0.014	1	0.014	-	0.0	0	-	-	-	0	-	-	-
<b>Pennsylvania</b>	<b>3</b>	<b>0.038</b>	<b>3</b>	<b>0.038</b>	<b>0.0</b>	<b>33.3</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0</b>	<b>-</b>	<b>-</b>	<b>-</b>
Textile Mill Waste House	1	0.260	1	0.260	0.0	100.0	0	-	-	-	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	1	0.072	1	0.072	0.0	0.0	0	-	-	-	0	-	-	-
Undetermined Process	1	0.003	1	0.003	-	0.0	0	-	-	-	0	-	-	-

See footnotes at end of table.

**Table 4-13 (page 2 of 3). Cotton dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region, state and process, OSHA samples, 1980-1999**

OSHA Region	All years		1980 - 1989				1990 - 1994				1995 - 1999			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 4</b>	<b>909</b>	<b>0.136</b>	<b>470</b>	<b>0.154</b>	<b>30.2</b>	<b>37.2</b>	<b>367</b>	<b>0.123</b>	<b>22.1</b>	<b>29.7</b>	<b>72</b>	<b>0.096</b>	<b>13.9</b>	<b>29.2</b>
<b>Alabama</b>	<b>83</b>	<b>0.230</b>	<b>37</b>	<b>0.282</b>	<b>56.8</b>	<b>56.8</b>	<b>46</b>	<b>0.196</b>	<b>19.6</b>	<b>41.3</b>	<b>0</b>	-	-	-
Yarn Manufacturing & Cotton Washing	62	0.196	33	0.223	54.5	54.5	29	0.168	31.0	31.0	0	-	-	-
Textile Mill Waste House	3	0.154	1	0.115	0.0	0.0	2	0.179	0.0	50.0	0	-	-	-
Textile Slashing & Weaving	1	0.449	0	-	-	-	1	0.449	0.0	100.0	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	17	0.431	3	4.898	100.0	100.0	14	0.256	0.0	57.1	0	-	-	-
<b>Georgia</b>	<b>196</b>	<b>0.156</b>	<b>131</b>	<b>0.160</b>	<b>43.5</b>	<b>46.6</b>	<b>53</b>	<b>0.146</b>	<b>24.5</b>	<b>28.3</b>	<b>12</b>	<b>0.156</b>	<b>41.7</b>	<b>41.7</b>
Yarn Manufacturing & Cotton Washing	177	0.168	120	0.175	47.5	47.5	46	0.147	28.3	28.3	11	0.184	45.5	45.5
Textile Mill Waste House	4	0.159	1	0.098	0.0	0.0	3	0.187	0.0	0.0	0	-	-	-
Textile Slashing & Weaving	11	0.086	6	0.089	0.0	33.3	4	0.111	0.0	50.0	1	0.026	0.0	0.0
Cotton Waste Proc/Recycl & Garnetting	2	0.376	2	0.376	0.0	100.0	0	-	-	-	0	-	-	-
Undetermined Process	2	0.003	2	0.003	-	0.0	0	-	-	-	0	-	-	-
<b>Mississippi</b>	<b>1</b>	<b>0.050</b>	<b>1</b>	<b>0.050</b>	<b>0.0</b>	<b>0.0</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
Yarn Manufacturing & Cotton Washing	1	0.050	1	0.050	0.0	0.0	0	-	-	-	0	-	-	-
<b>North Carolina</b>	<b>495</b>	<b>0.124</b>	<b>250</b>	<b>0.129</b>	<b>21.2</b>	<b>28.0</b>	<b>208</b>	<b>0.128</b>	<b>21.6</b>	<b>27.9</b>	<b>37</b>	<b>0.076</b>	<b>8.1</b>	<b>18.9</b>
Yarn Manufacturing & Cotton Washing	380	0.132	189	0.144	24.9	24.9	166	0.131	24.1	24.1	25	0.074	12.0	12.0
Textile Mill Waste House	27	0.118	15	0.087	0.0	13.3	11	0.201	9.1	36.4	1	0.037	0.0	0.0
Textile Slashing & Weaving	53	0.161	31	0.141	12.9	51.6	16	0.255	25.0	68.8	6	0.096	0.0	33.3
Cotton Waste Proc/Recycl & Garnetting	22	0.202	9	0.255	22.2	55.6	9	0.172	0.0	33.3	4	0.170	0.0	50.0
Undetermined Process	13	0.003	6	0.003	-	0.0	6	0.003	-	0.0	1	0.003	-	0.0
<b>South Carolina</b>	<b>118</b>	<b>0.156</b>	<b>47</b>	<b>0.202</b>	<b>21.3</b>	<b>40.4</b>	<b>51</b>	<b>0.115</b>	<b>27.5</b>	<b>33.3</b>	<b>20</b>	<b>0.184</b>	<b>10.0</b>	<b>45.0</b>
Yarn Manufacturing & Cotton Washing	78	0.123	26	0.130	15.4	15.4	43	0.125	30.2	30.2	9	0.098	0.0	0.0
Textile Mill Waste House	12	0.247	9	0.224	44.4	55.6	0	-	-	-	3	0.332	66.7	66.7
Textile Slashing & Weaving	20	0.403	12	0.489	16.7	83.3	0	-	-	-	8	0.302	0.0	87.5
Cotton Waste Proc/Recycl & Garnetting	5	0.521	0	-	-	-	5	0.521	20.0	80.0	0	-	-	-
Undetermined Process	3	0.003	0	-	-	-	3	0.003	-	0.0	0	-	-	-
<b>Tennessee</b>	<b>16</b>	<b>0.011</b>	<b>4</b>	<b>0.645</b>	<b>25.0</b>	<b>100.0</b>	<b>9</b>	<b>0.003</b>	<b>0.0</b>	<b>0.0</b>	<b>3</b>	<b>0.003</b>	<b>0.0</b>	<b>0.0</b>
Yarn Manufacturing & Cotton Washing	1	7.400	1	7.400	100.0	100.0	0	-	-	-	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	3	0.286	3	0.286	0.0	100.0	0	-	-	-	0	-	-	-
Undetermined Process	12	0.003	0	-	-	-	9	0.003	-	0.0	3	0.003	-	0.0

See footnotes at end of table.

**Table 4-13 (page 3 of 3). Cotton dust: Geometric mean exposures and percent exceeding designated occupational exposure limits by OSHA region, state and process, OSHA samples, 1980-1999**

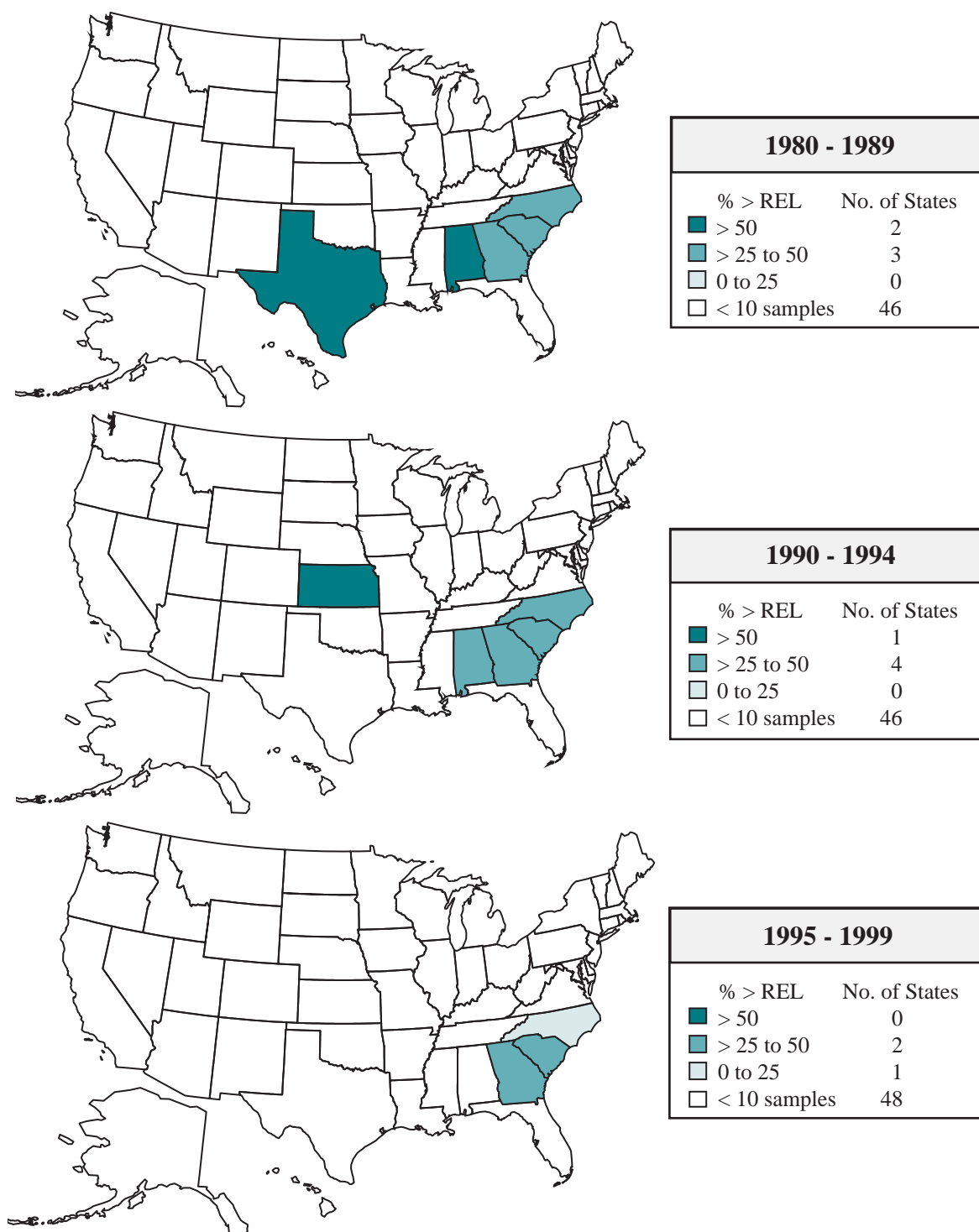
OSHA Region	All years		1980 - 1989				1990 - 1994				1995 - 1999			
	No. of Samples	GM (mg/m <sup>3</sup> )	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL	No. of Samples	GM (mg/m <sup>3</sup> )	% > PEL	% > REL
<b>Region 5</b>	<b>8</b>	<b>3.415</b>	<b>7</b>	<b>3.479</b>	<b>71.4</b>	<b>71.4</b>	<b>1</b>	<b>3.000</b>	<b>100.0</b>	<b>100.0</b>	<b>0</b>	-	-	-
<b>Illinois</b>	<b>7</b>	<b>3.479</b>	<b>7</b>	<b>3.479</b>	<b>71.4</b>	<b>71.4</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
Yarn Manufacturing & Cotton Washing	2	0.200	2	0.200	0.0	0.0	0	-	-	-	0	-	-	-
Textile Mill Waste House	2	7.421	2	7.421	100.0	100.0	0	-	-	-	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	3	14.092	3	14.092	100.0	100.0	0	-	-	-	0	-	-	-
<b>Michigan</b>	<b>1</b>	<b>3.000</b>	<b>0</b>	-	-	-	<b>1</b>	<b>3.000</b>	<b>100.0</b>	<b>100.0</b>	<b>0</b>	-	-	-
Cotton Waste Proc/Recycl & Garnetting	1	3.000	0	-	-	-	1	3.000	100.0	100.0	0	-	-	-
<b>Region 6</b>	<b>77</b>	<b>0.281</b>	<b>75</b>	<b>0.283</b>	<b>54.7</b>	<b>62.7</b>	<b>2</b>	<b>0.212</b>	<b>0.0</b>	<b>50.0</b>	<b>0</b>	-	-	-
<b>Texas</b>	<b>77</b>	<b>0.281</b>	<b>75</b>	<b>0.283</b>	<b>54.7</b>	<b>62.7</b>	<b>2</b>	<b>0.212</b>	<b>0.0</b>	<b>50.0</b>	<b>0</b>	-	-	-
Yarn Manufacturing & Cotton Washing	62	0.278	62	0.278	61.3	61.3	0	-	-	-	0	-	-	-
Textile Mill Waste House	4	0.139	4	0.139	0.0	25.0	0	-	-	-	0	-	-	-
Textile Slashing & Weaving	1	0.410	1	0.410	0.0	100.0	0	-	-	-	0	-	-	-
Cotton Waste Proc/Recycl & Garnetting	10	0.380	8	0.439	37.5	87.5	2	0.212	0.0	50.0	0	-	-	-
<b>Region 7</b>	<b>19</b>	<b>0.493</b>	<b>1</b>	<b>0.740</b>	<b>0.0</b>	<b>100.0</b>	<b>18</b>	<b>0.482</b>	<b>66.7</b>	<b>88.9</b>	<b>0</b>	-	-	-
<b>Kansas</b>	<b>18</b>	<b>0.482</b>	<b>0</b>	-	-	-	<b>18</b>	<b>0.482</b>	<b>66.7</b>	<b>88.9</b>	<b>0</b>	-	-	-
Textile Mill Waste House	17	0.593	0	-	-	-	17	0.593	70.6	94.1	0	-	-	-
Undetermined Process	1	0.014	0	-	-	-	1	0.014	-	0.0	0	-	-	-
<b>Missouri</b>	<b>1</b>	<b>0.740</b>	<b>1</b>	<b>0.740</b>	<b>0.0</b>	<b>100.0</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
Cotton Waste Proc/Recycl & Garnetting	1	0.740	1	0.740	0.0	100.0	0	-	-	-	0	-	-	-
<b>Region 8</b>	<b>4</b>	<b>0.714</b>	<b>4</b>	<b>0.714</b>	<b>0.0</b>	<b>100.0</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
<b>Colorado</b>	<b>2</b>	<b>0.570</b>	<b>2</b>	<b>0.570</b>	<b>0.0</b>	<b>100.0</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
Cotton Waste Proc/Recycl & Garnetting	2	0.570	2	0.570	0.0	100.0	0	-	-	-	0	-	-	-
<b>Utah</b>	<b>2</b>	<b>0.896</b>	<b>2</b>	<b>0.896</b>	<b>0.0</b>	<b>100.0</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-
Cotton Waste Proc/Recycl & Garnetting	2	0.896	2	0.896	0.0	100.0	0	-	-	-	0	-	-	-
<b>Region 9</b>	<b>1</b>	<b>1.958</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-	<b>1</b>	<b>1.958</b>	<b>100.0</b>	<b>100.0</b>
<b>Hawaii</b>	<b>1</b>	<b>1.958</b>	<b>0</b>	-	-	-	<b>0</b>	-	-	-	<b>1</b>	<b>1.958</b>	<b>100.0</b>	<b>100.0</b>
Yarn Manufacturing & Cotton Washing	1	1.958	0	-	-	-	0	-	-	-	1	1.958	100.0	100.0
<b>TOTAL</b>	<b>1,039</b>	<b>0.153</b>	<b>571</b>	<b>0.180</b>	<b>33.8</b>	<b>42.4</b>	<b>391</b>	<b>0.133</b>	<b>24.0</b>	<b>32.5</b>	<b>77</b>	<b>0.091</b>	<b>14.3</b>	<b>28.6</b>

- indicates incalculable field      PEL - permissible exposure limit      REL - recommended exposure limit      GM - geometric mean      mg/m<sup>3</sup> - milligrams per cubic meter

NOTE: The OSHA PEL is 0.2 mg/m<sup>3</sup> for yarn manufacturing and cotton washing operations, 0.5 mg/m<sup>3</sup> for textile mill waste house operations or for dust from lower grade washed cotton used during yarn manufacturing, 0.75 mg/m<sup>3</sup> for textile slashing and weaving operations, and 1.0 mg/m<sup>3</sup> for cotton waste processing operations or waste recycling (i.e., sorting, blending, cleaning, and willowing) and garnetting. The NIOSH REL is 0.2 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Figure 4-5. Cotton dust: Percent of exposures exceeding the NIOSH recommended exposure limit by state, OSHA samples, 1980-1999**



REL - recommended exposure limit

NOTE: The NIOSH REL is 0.2 mg/m<sup>3</sup>. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

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# **Section 5**

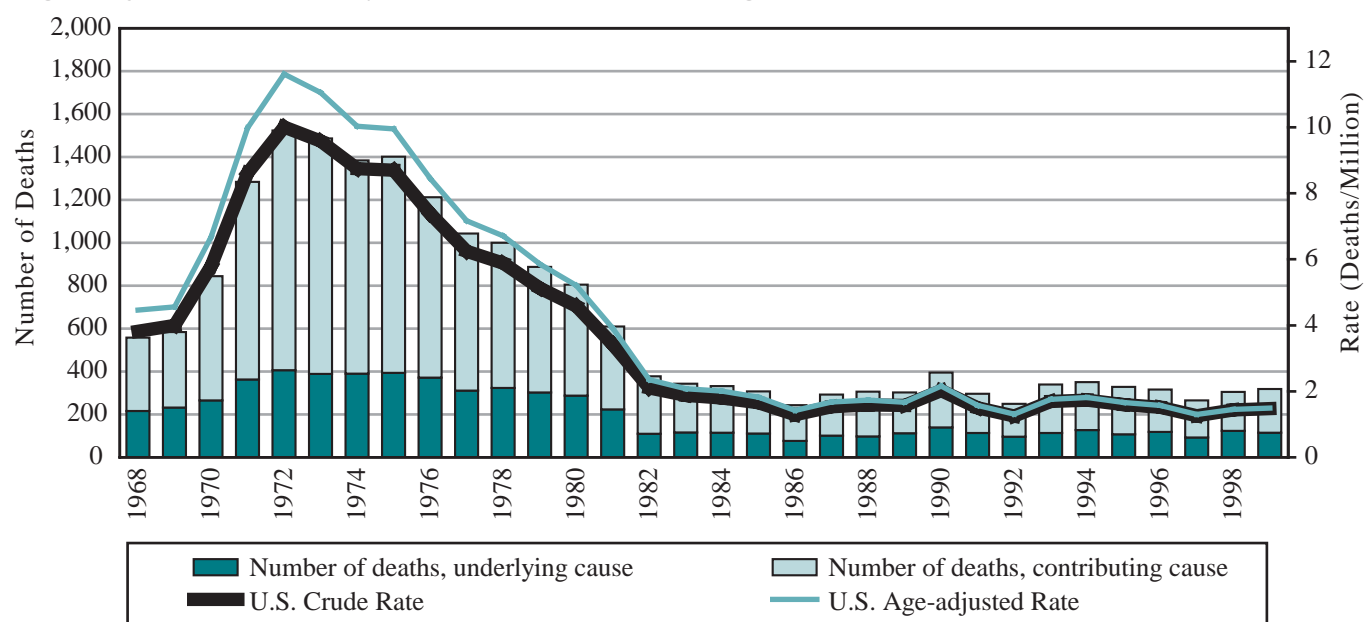
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## **Unspecified and Other Pneumoconioses and Selected Agent Exposures**





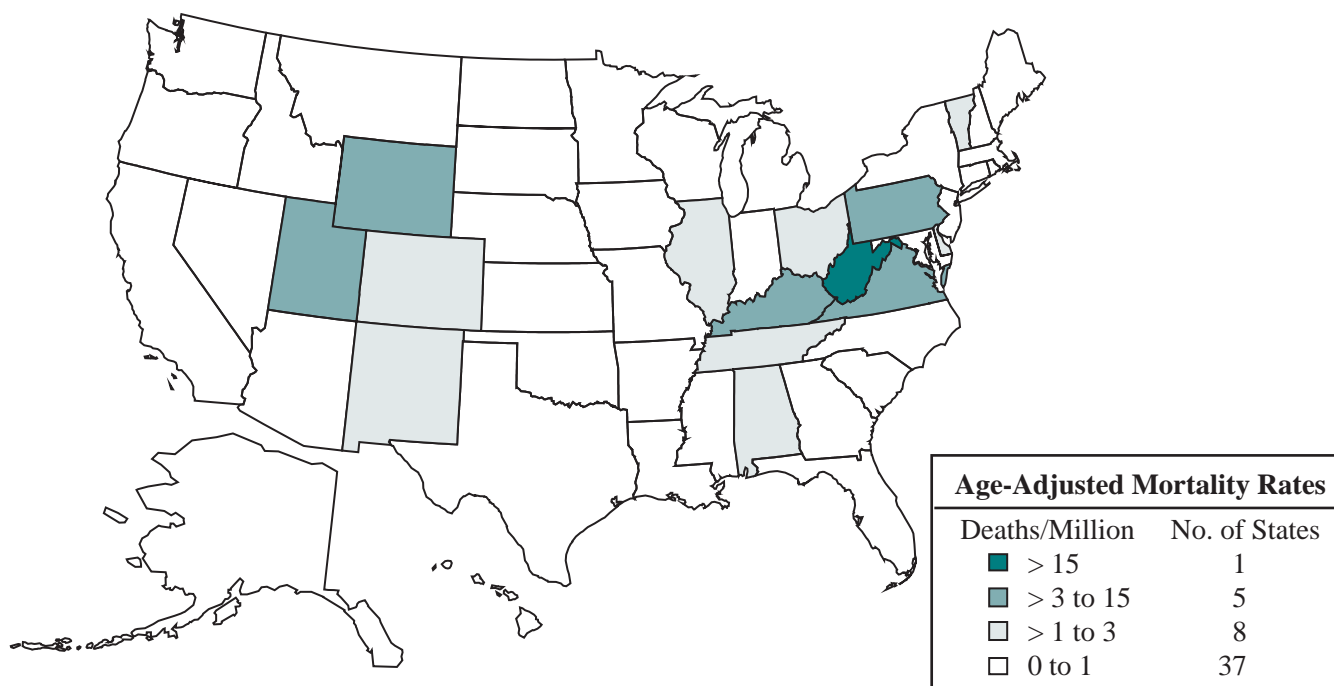
**Figure 5-1. Unspecified and other pneumoconioses: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 5-2. Unspecified and other pneumoconioses: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 5-1. Unspecified and other pneumoconioses: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Underlying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	395	35.2	385	10	367	26	2	-	2	1	7	48	114	152	71	76.0
1991	296	38.5	282	14	271	24	1	-	1	6	3	22	103	110	51	76.0
1992	249	38.6	234	15	231	18	-	1	-	-	8	19	76	104	41	76.0
1993	340	33.5	331	9	319	18	3	-	1	3	1	21	101	151	62	77.0
1994	351	36.2	343	8	330	21	-	-	-	-	1	25	81	173	71	78.0
1995	329	32.8	320	9	318	10	1	-	-	-	9	26	80	144	70	78.0
1996	316	37.7	306	10	295	16	5	-	-	2	5	28	76	132	73	78.0
1997	265	34.7	255	10	248	16	1	-	-	1	3	17	53	119	72	80.0
1998	305	40.3	293	12	288	14	3	-	1	1	6	24	65	137	71	79.0
1999	318	36.2	311	7	300	16	2	-	-	2	4	19	70	138	85	79.0
<b>TOTAL</b>	<b>3,164</b>	<b>36.3</b>	<b>3,060</b>	<b>104</b>	<b>2,967</b>	<b>179</b>	<b>18</b>	<b>1</b>	<b>5</b>	<b>16</b>	<b>47</b>	<b>249</b>	<b>819</b>	<b>1,360</b>	<b>667</b>	<b>78.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Unspecified and Other Pneumoconioses: Mortality*

**Table 5-2. Unspecified and other pneumoconioses: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	2.02	4.47	0.11	2.43	0.08	0.58	—
1991	1.50	3.20	0.15	2.21	0.08	0.28	—
1992	1.25	2.66	0.16	1.60	0.08	—	—
1993	1.69	3.77	0.10	1.67	—	0.78	—
1994	1.73	3.89	0.09	1.92	—	—	—
1995	1.60	3.70	0.10	0.90	—	0.25	—
1996	1.52	3.37	0.11	1.41	—	1.16	—
1997	1.26	2.79	0.11	1.38	—	0.23	—
1998	1.44	3.25	0.10	1.10	0.07	0.22	0.39
1999	1.48	3.38	0.08	1.34	—	0.42	—
1990-1999	1.54	3.43	0.11	1.57	0.03	0.39	0.04
	Age-Adjusted Mortality Rate						
1990	2.16	5.80	0.09	4.60	0.09	2.10	—
1991	1.57	4.06	0.13	4.13	0.09	0.47	—
1992	1.31	3.37	0.14	3.12	0.09	—	—
1993	1.76	4.76	0.09	3.40	—	1.55	—
1994	1.81	4.98	0.07	3.85	—	—	—
1995	1.66	4.65	0.09	1.82	—	0.29	—
1996	1.57	4.22	0.10	2.72	—	2.13	—
1997	1.30	3.50	0.09	2.88	—	0.37	—
1998	1.45	3.91	0.09	2.09	0.09	0.62	0.50
1999	1.49	4.06	0.06	2.33	—	0.72	—
1990-1999	1.59	4.29	0.09	3.05	0.04	0.87	0.06

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Unspecified and Other Pneumoconioses: Mortality

**Table 5-3. Unspecified and other pneumoconioses: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	365	10	65	—	—	—	440
1991	220	30	90	—	—	—	340
1992	235	15	10	—	—	—	260
1993	210	10	10	—	—	—	230
1994	125	—	15	—	—	—	140
1995	220	20	10	—	15	—	265
1996	205	40	5	—	15	—	265
1997	130	15	10	—	—	—	155
1998	220	10	30	5	—	5	270
1999	155	—	45	—	5	—	205
TOTAL	2,085	150	290	5	35	5	2,570
	Years of Potential Life Lost to Life Expectancy						
1990	3,635	100	263	14	14	—	4,026
1991	2,652	182	269	14	14	—	3,131
1992	2,226	176	148	14	—	—	2,564
1993	2,901	135	154	—	36	—	3,226
1994	2,860	89	183	—	—	—	3,132
1995	2,921	127	86	—	29	—	3,163
1996	2,700	164	140	—	78	—	3,082
1997	2,143	117	137	—	14	—	2,411
1998	2,639	140	139	21	6	36	2,981
1999	2,683	59	189	—	30	—	2,961
TOTAL	27,360	1,289	1,708	63	221	36	30,677

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Unspecified and Other Pneumoconioses: Mortality*

**Table 5-4. Unspecified and other pneumoconioses: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	7	10	5	8	1	3	5	7	3	5	54
Alaska	-	-	-	-	-	-	-	-	-	-	-
Arizona	3	1	2	3	-	3	2	1	-	1	16
Arkansas	1	2	1	-	1	-	1	-	-	-	6
California	7	4	4	8	7	5	3	5	6	7	56
Colorado	1	3	3	7	4	5	7	4	6	3	43
Connecticut	2	2	4	4	-	-	1	1	2	-	16
Delaware	-	-	-	1	-	4	1	-	2	1	9
District of Columbia	-	1	-	-	-	-	1	-	-	-	2
Florida	5	10	11	5	7	8	11	5	8	1	71
Georgia	2	1	2	3	1	3	5	3	2	1	23
Hawaii	-	-	-	-	-	-	1	-	-	-	1
Idaho	-	-	-	-	-	-	1	-	-	-	1
Illinois	16	19	13	14	13	10	20	10	7	14	136
Indiana	6	4	4	3	1	5	6	6	-	8	43
Iowa	-	-	4	1	1	4	-	-	1	1	12
Kansas	-	3	-	1	1	-	1	-	-	-	6
Kentucky	47	32	34	14	26	29	14	24	25	38	283
Louisiana	3	4	-	-	1	-	1	-	2	-	11
Maine	-	-	-	-	-	-	2	-	-	-	2
Maryland	4	4	1	1	5	6	3	2	3	3	32
Massachusetts	-	2	3	1	1	2	4	-	2	1	16
Michigan	8	3	7	5	4	3	4	3	5	6	48
Minnesota	1	1	1	1	-	-	-	1	1	-	6
Mississippi	-	-	-	-	2	1	-	1	-	-	4
Missouri	6	3	1	4	2	3	-	2	2	1	24
Montana	1	-	-	2	-	-	-	-	1	-	4
Nebraska	-	1	1	-	-	-	-	-	-	-	2
Nevada	-	-	-	3	-	-	-	-	1	1	5
New Hampshire	-	-	1	-	-	1	-	-	-	1	3
New Jersey	9	7	7	2	6	9	1	3	3	2	49
New Mexico	4	-	1	3	3	2	1	4	2	-	20
New York	10	3	9	7	6	3	8	4	1	5	56
North Carolina	4	2	4	2	3	1	2	1	4	5	28
North Dakota	1	-	-	-	-	-	-	-	-	1	2
Ohio	29	42	27	15	24	16	20	8	29	28	238
Oklahoma	2	1	2	2	1	1	-	-	-	2	11
Oregon	1	1	-	-	-	1	-	-	1	-	4
Pennsylvania	51	49	33	159	130	98	94	83	64	75	836
Rhode Island	-	-	-	-	-	-	-	-	-	-	-
South Carolina	-	3	-	-	-	-	-	-	-	-	3
South Dakota	1	-	-	-	-	-	-	-	-	-	1
Tennessee	11	8	3	5	5	6	-	2	7	3	50
Texas	6	1	3	4	-	3	6	3	2	6	34
Utah	5	1	2	3	7	6	7	12	2	6	51
Vermont	-	-	-	1	-	1	1	2	-	1	6
Virginia	17	7	4	10	36	32	15	9	36	26	192
Washington	4	3	3	1	1	-	1	-	-	-	13
West Virginia	118	58	44	36	49	50	60	54	68	58	595
Wisconsin	2	-	2	-	-	1	1	1	1	1	9
Wyoming	-	-	3	1	2	4	5	4	6	6	31
<b>TOTAL</b>	<b>395</b>	<b>296</b>	<b>249</b>	<b>340</b>	<b>351</b>	<b>329</b>	<b>316</b>	<b>265</b>	<b>305</b>	<b>318</b>	<b>3,164</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Unspecified and Other Pneumoconioses: Mortality

**Table 5-5. Unspecified and other pneumoconioses: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	54	10	1.63	8	1.71	11	520	13	9.6	40
Alaska	-	-	-	-	-	-	-	-	-	-
Arizona	16	24	0.49	24	0.47	24	185	26	11.5	23
Arkansas	6	33	0.31	35	0.25	39	62	37	10.3	36
California	56	8	0.23	39	0.28	36	736	8	13.2	10
Colorado	43	15	1.48	11	1.95	8	360	19	8.4	45
Connecticut	16	24	0.61	20	0.58	19	192	25	12.0	21
Delaware	9	31	1.59	9	1.78	10	95	32	10.6	34
District of Columbia	2	43	0.43	26	0.44	27	77	35	38.3	1
Florida	71	7	0.62	19	0.47	24	761	7	10.7	33
Georgia	23	22	0.41	29	0.53	21	301	21	13.1	13
Hawaii	1	47	0.11	48	0.09	49	14	47	14.1	5
Idaho	1	47	0.12	47	0.12	48	8	48	8.4	45
Illinois	136	6	1.48	11	1.51	12	1,349	6	9.9	37
Indiana	43	15	0.95	15	0.96	16	464	16	10.8	32
Iowa	12	28	0.54	23	0.42	28	112	31	9.4	42
Kansas	6	33	0.30	37	0.27	38	68	36	11.3	25
Kentucky	283	3	9.38	2	9.46	3	3,141	3	11.1	28
Louisiana	11	29	0.34	32	0.37	31	151	28	13.7	9
Maine	2	43	0.21	41	0.19	42	23	44	11.3	25
Maryland	32	18	0.80	16	0.99	15	400	17	12.5	17
Massachusetts	16	24	0.33	33	0.32	35	206	24	12.9	14
Michigan	48	14	0.65	18	0.69	18	610	11	12.7	15
Minnesota	6	33	0.17	44	0.17	43	94	33	15.6	3
Mississippi	4	38	0.20	42	0.20	41	44	40	11.0	29
Missouri	24	21	0.58	22	0.52	22	339	20	14.1	5
Montana	4	38	0.60	21	0.57	20	35	41	8.7	44
Nebraska	2	43	0.16	45	0.14	46	28	42	14.1	5
Nevada	5	37	0.42	28	0.47	24	93	34	18.6	2
New Hampshire	3	41	0.33	33	0.37	31	27	43	8.9	43
New Jersey	49	13	0.77	17	0.78	17	624	10	12.7	15
New Mexico	20	23	1.59	9	1.84	9	213	23	10.6	34
New York	56	8	0.39	31	0.39	30	641	9	11.4	24
North Carolina	28	20	0.49	24	0.51	23	388	18	13.8	8
North Dakota	2	43	0.41	29	0.35	33	22	46	11.2	27
Ohio	238	4	2.74	7	2.74	7	2,618	4	11.0	29
Oklahoma	11	29	0.43	26	0.41	29	134	29	12.2	19
Oregon	4	38	0.16	45	0.16	44	50	39	12.5	17
Pennsylvania	836	1	8.66	3	7.70	4	8,131	1	9.7	39
Rhode Island	-	-	-	-	-	-	-	-	-	-
South Carolina	3	41	0.11	48	0.14	46	23	44	7.7	49
South Dakota	1	47	0.18	43	0.15	45	8	48	8.3	47
Tennessee	50	12	1.21	14	1.24	14	610	11	12.2	19
Texas	34	17	0.24	38	0.28	36	519	14	15.3	4
Utah	51	11	3.81	5	4.92	5	505	15	9.9	37
Vermont	6	33	1.31	13	1.37	13	57	38	9.6	40
Virginia	192	5	3.67	6	4.59	6	2,119	5	11.0	29
Washington	13	27	0.31	35	0.33	34	172	27	13.2	10
West Virginia	595	2	40.91	1	35.63	1	6,938	2	11.7	22
Wisconsin	9	31	0.23	39	0.22	40	119	30	13.2	10
Wyoming	31	19	8.66	3	10.61	2	249	22	8.0	48

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *Unspecified and Other Pneumoconioses: Mortality*

**Table 5-6. Unspecified and other pneumoconioses: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
041	Coal mining	801	58.9
060	Construction	81	6.0
270	Blast furnaces, steelworks, rolling and finishing mills	31	2.3
392	Not specified manufacturing industries	27	2.0
040	Metal mining	18	1.3
351	Motor vehicles and motor vehicle equipment	18	1.3
010	Agricultural production, crops	16	1.2
842	Elementary and secondary schools	16	1.2
400	Railroads	15	1.1
961	Non-paid worker or non-worker or own home/at home	14	1.0
	All other industries	291	21.4
	Industry not reported	33	2.4
	<b>TOTAL</b>	<b>1,361</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 5-7. Unspecified and other pneumoconioses: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
616	Mining machine operators	727	53.4
889	Laborers, except construction	63	4.6
453	Janitors and cleaners	28	2.1
019	Managers and administrators, n.e.c.	27	2.0
575	Electricians	24	1.8
783	Welders and cutters	22	1.6
633	Supervisors, production occupations	21	1.5
869	Construction laborers	19	1.4
473	Farmers, except horticulture	18	1.3
804	Truck drivers	18	1.3
	All other occupations	365	26.8
	Occupation not reported	29	2.1
	<b>TOTAL</b>	<b>1,361</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Unspecified and Other Pneumoconioses: Mortality*

**Table 5-8. Unspecified and other pneumoconioses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
041	Coal mining	801	42.37	39.51	45.43
040	Metal mining	18	5.19	3.07	8.20
252	Structural clay products	7	4.71	1.89	9.71
262	Miscellaneous nonmetallic mineral and stone products	7	3.22	1.29	6.63
271	Iron and steel foundries	8	2.36	1.02	4.64
250	Glass and glass products	11	2.02	1.01	3.62

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.



## *Unspecified and Other Pneumoconioses: Mortality*

**Table 5-9. Unspecified and other pneumoconioses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

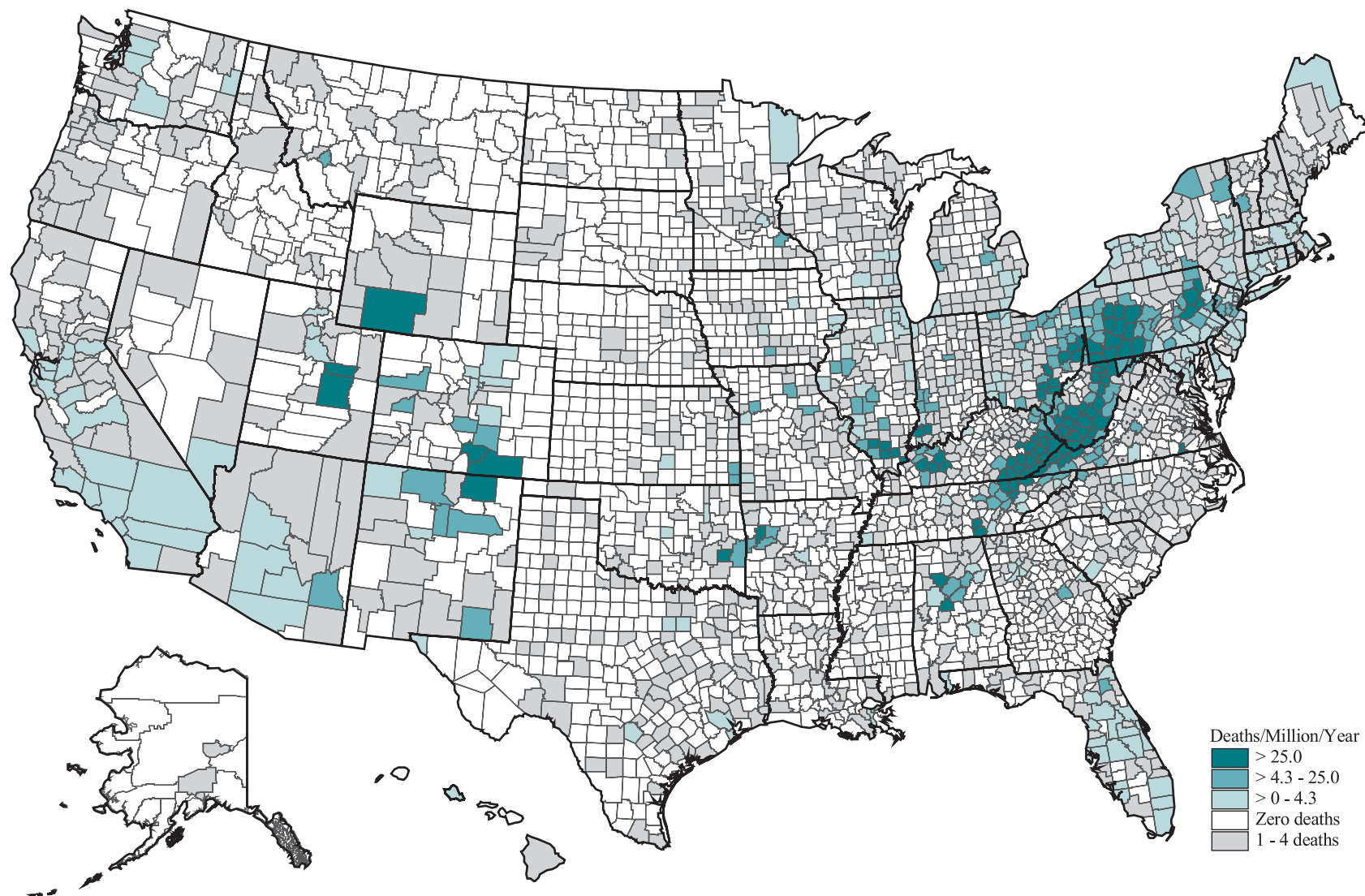
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
616	Mining machine operators	727	40.86	37.97	43.98
613	Supervisors, extractive occupations	17	18.40	10.70	29.44
768	Crushing and grinding machine operators	5	6.41	2.07	14.98
783	Welders and cutters	22	1.86	1.16	2.81
575	Electricians	24	1.66	1.06	2.47

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

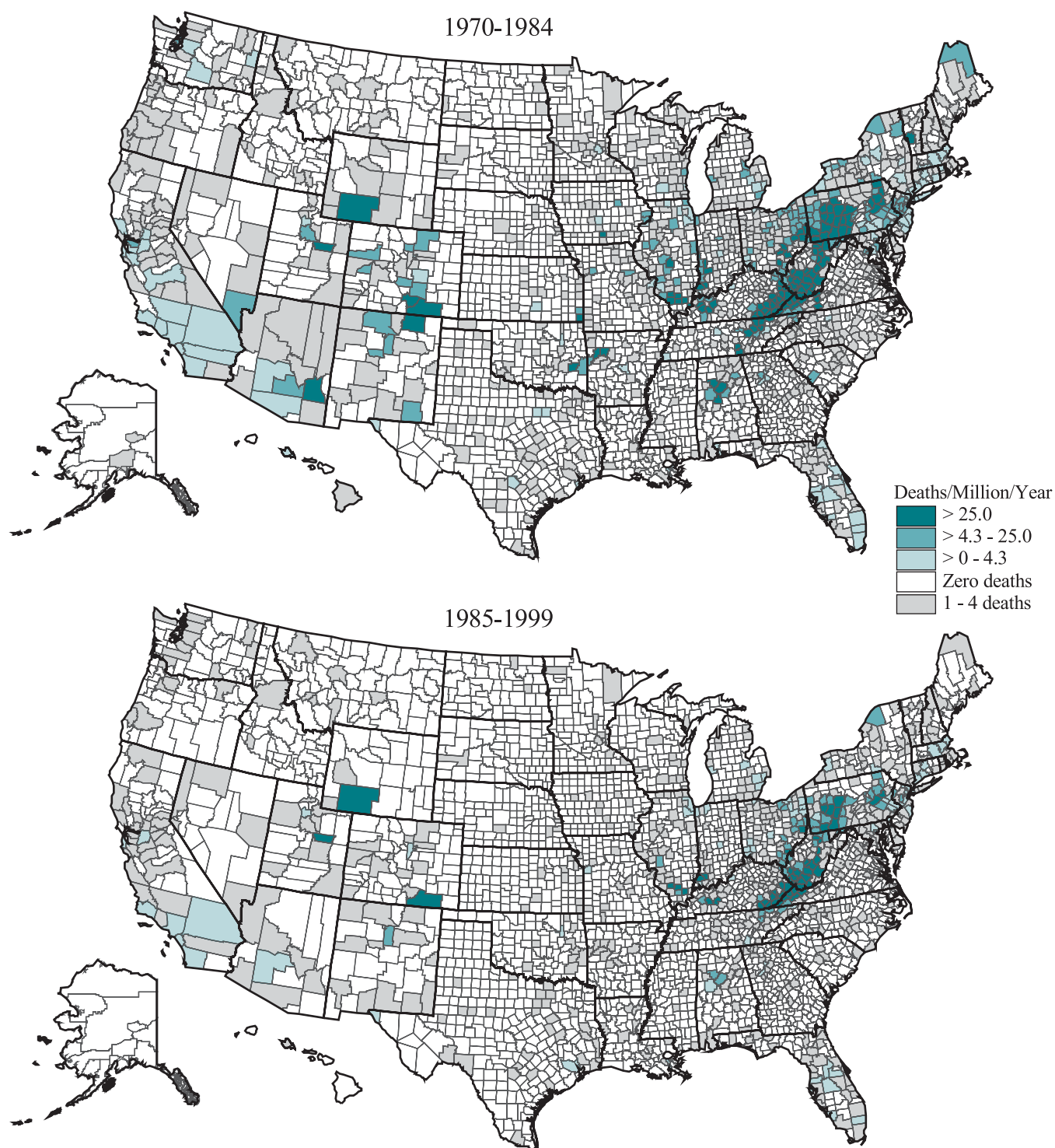
**Figure 5-3. Unspecified and other pneumoconioses: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 5-4. Unspecified and other pneumoconioses: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## Unspecified and Other Pneumoconioses: Mortality

**Table 5-10. Unspecified and other pneumoconioses: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Carbon County	Utah	178.9	185.3	40	0.0
Harlan County	Kentucky	167.9	168.4	70	0.0
Boone County	West Virginia	160.6	148.1	46	0.0
Dickenson County	Virginia	155.8	139.8	29	0.0
Norton City	Virginia	143.7	119.2	6	0.0
Wyoming County	West Virginia	140.1	128.2	43	0.0
Sweetwater County	Wyoming	139.7	79.0	34	0.0
Logan County	West Virginia	133.5	130.4	65	0.0
Mingo County	West Virginia	125.3	103.9	39	0.0
Raleigh County	West Virginia	121.2	138.1	126	0.0
Wise County	Virginia	120.7	117.6	55	0.0
Fayette County	West Virginia	119.1	152.0	87	1.1
Las Animas County	Colorado	111.3	179.7	29	3.4
Bell County	Kentucky	110.2	114.1	41	0.0
Muhlenberg County	Kentucky	107.8	124.7	46	0.0
Leslie County	Kentucky	101.9	78.0	12	0.0
McDowell County	West Virginia	101.8	114.9	45	0.0
Franklin County	Illinois	96.4	145.0	70	0.0
Tazewell County	Virginia	93.5	93.2	52	0.0
Nicholas County	West Virginia	85.6	92.6	29	0.0
Butler County	Kentucky	80.4	90.4	12	0.0
Cambria County	Pennsylvania	78.5	102.7	202	1.0
Russell County	Virginia	76.7	69.8	24	0.0
Buchanan County	Virginia	69.8	54.4	20	0.0
Floyd County	Kentucky	64.9	59.8	30	0.0
Letcher County	Kentucky	62.5	58.3	18	5.6
Knox County	Kentucky	61.9	63.2	22	0.0
Saline County	Illinois	60.1	94.1	30	0.0
Pike County	Kentucky	60.1	49.6	42	0.0
Clay County	West Virginia	58.1	62.0	7	14.3
Mercer County	West Virginia	57.8	71.4	56	0.0
Webster County	West Virginia	54.4	65.5	8	0.0
Marion County	West Virginia	52.6	69.7	49	2.0
Pike County	Indiana	50.5	60.7	9	0.0
Meigs County	Ohio	50.3	58.7	16	0.0
Whitley County	Kentucky	44.9	45.5	18	0.0
Somerset County	Pennsylvania	44.6	52.5	49	0.0
Taylor County	West Virginia	40.5	50.3	9	0.0
Lee County	Virginia	38.2	45.2	13	0.0
Indiana County	Pennsylvania	37.6	35.8	39	0.0
Clearfield County	Pennsylvania	34.9	42.0	39	0.0
Upshur County	West Virginia	33.8	40.3	11	0.0
Perry County	Kentucky	33.2	28.2	10	0.0
Fayette County	Pennsylvania	31.8	38.8	68	0.0
Carbon County	Pennsylvania	30.4	39.8	28	3.6
Perry County	Illinois	29.7	40.1	10	0.0
Gibson County	Indiana	29.6	37.5	14	0.0
Schuylkill County	Pennsylvania	27.7	37.6	71	0.0
Armstrong County	Pennsylvania	26.5	32.7	29	0.0
Lincoln County	West Virginia	26.5	24.0	6	0.0
<b>Overall United States</b>		<b>1.6</b>	<b>1.5</b>	<b>4,615</b>	<b>3.4</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 5-11 (page 1 of 4). Selected pneumoconiotic agents: Geometric mean exposures and percent exceeding designated occupational exposure limits, MSHA and OSHA samples, 1979-1999**

Agent	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Aluminum Oxide Fume and Dust - MSHA</b>																					
GM (mg/m <sup>3</sup> )	0.115	0.025	0.017	0.010	0.017	0.017	0.020	0.019	0.031	0.032	0.025	0.030	0.022	0.028	0.009	0.011	0.011	0.006	0.008	0.005	0.002
No. of samples	145	152	170	85	148	160	177	121	139	112	133	182	143	120	140	241	206	765	227	67	101
% > PEL	0.0	0.0	0.6	1.2	0.0	0.0	0.0	0.0	0.7	1.8	0.0	1.6	0.7	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Aluminum Oxide and Alpha Aluminum - OSHA</b>																					
GM (mg/m <sup>3</sup> )	0.209	1.16	0.196	1.235	0.396	0.035	0.007	0.016	0.004	0.034	0.031	0.050	0.003	0.019	0.013	0.035	0.049	0.031	0.002	0.008	0.022
No. of samples	22	15	6	27	11	70	96	28	24	50	47	41	44	16	42	41	35	13	145	85	65
% > PEL	18.2	0.0	0.0	18.5	18.2	0.0	4.2	3.6	0.0	2.0	2.1	0.0	0.0	0.0	2.4	0.0	5.7	7.7	0.0	0.0	0.0
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Antimony and Compounds - OSHA</b>																					
GM (mg/m <sup>3</sup> )	0.013	0.010	0.016	0.010	0.009	0.009	0.009	0.009	0.009	0.009	0.008	0.009	0.008	0.009	0.009	0.009	0.007	0.008	0.009	0.010	0.009
No. of samples	96	213	145	158	104	714	756	640	910	901	650	915	733	672	561	432	502	411	557	370	346
% > PEL	5.2	0.9	4.8	1.9	0.0	0.6	0.8	0.3	0.8	0.3	0.5	0.3	0.8	0.3	0.5	0.2	1.0	0.7	0.2	2.4	0.6
% > REL	5.2	0.9	4.8	1.9	0.0	0.6	0.8	0.3	0.8	0.3	0.5	0.3	0.8	0.3	0.5	0.2	1.0	0.7	0.2	2.4	0.6
<b>Beryllium Fume and Dust - MSHA</b>																					
GM (µg/m <sup>3</sup> )	0.334	0.164	0.176	0.183	0.189	0.161	0.164	0.215	0.172	0.189	0.166	0.160	0.169	0.159	0.150	0.152	0.152	0.153	0.162	0.166	0.169
No. of samples	65	53	83	72	171	155	168	81	81	97	75	64	48	39	107	217	183	582	113	44	88
% > PEL	13.8	0.0	1.2	4.2	2.9	0.0	0.0	1.2	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See footnotes at end of table.

**Table 5-11 (page 2 of 4). Selected pneumoconiotic agents: Geometric mean exposures and percent exceeding designated occupational exposure limits, MSHA and OSHA samples, 1979-1999**

Agent	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Beryllium and Compounds - OSHA</b>																					
GM (µg/m <sup>3</sup> )	0.043	0.079	0.037	0.031	0.044	0.031	0.035	0.026	0.034	0.039	0.031	0.033	0.032	0.031	0.034	0.029	0.027	0.029	0.029	0.027	0.032
No. of samples	31	71	110	151	102	698	683	579	864	991	711	911	707	676	595	452	408	349	558	372	410
% > PEL	6.5	7.0	2.7	0.7	2.9	1.4	2.9	0.3	1.9	1.2	0.8	1.4	0.3	0.6	1.3	0.4	0.0	0.9	0.5	0.8	1.2
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Carbon Black - OSHA</b>																					
GM (mg/m <sup>3</sup> )	0.460	1.53	1.38	1.01	1.14	1.16	1.71	0.976	0.692	0.659	0.716	1.05	0.712	0.556	0.686	0.705	0.918	0.513	0.798	0.620	0.325
No. of samples	16	30	30	29	29	26	29	28	22	27	20	27	17	32	28	18	39	21	35	26	23
% > PEL	0.0	20.0	16.7	10.3	10.3	23.1	24.1	10.7	13.6	3.7	15.0	18.5	17.6	6.3	7.1	11.1	10.3	14.3	17.1	7.7	0.0
% > REL	0.0	20.0	16.7	10.3	10.3	23.1	24.1	10.7	13.6	3.7	15.0	18.5	17.6	6.3	7.1	11.1	10.3	14.3	17.1	7.7	0.0
<b>Cobalt Fume and Dust - MSHA</b>																					
GM (µg/m <sup>3</sup> )	1.20	26.0	1.44	-	0.485	0.313	0.382	0.426	0.410	0.389	0.366	0.375	0.367	0.393	0.286	0.329	0.306	0.270	0.309	0.287	0.308
No. of samples	2	3	4	0	111	124	123	55	89	60	102	105	72	41	105	212	187	580	102	45	90
% > PEL	100.0	33.3	0.0	-	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.2	0.0	0.0	0.0
% > REL	100.0	33.3	0.0	-	1.8	0.0	0.8	0.0	0.0	0.0	0.0	1.0	1.4	0.0	0.0	1.9	0.0	0.2	1.0	0.0	0.0
<b>Cobalt, Metal, Fume and Dust - OSHA</b>																					
GM (µg/m <sup>3</sup> )	4.32	7.41	5.74	6.19	7.52	3.19	3.83	3.59	3.07	3.10	2.61	3.60	4.01	3.29	2.96	2.53	2.96	1.87	1.84	2.13	1.97
No. of samples	51	71	168	288	222	829	785	809	990	1069	760	987	836	823	653	512	595	582	748	511	476
% > PEL	3.9	4.2	3.6	8.3	13.1	2.5	3.3	3.6	2.7	3.5	2.1	5.3	6.1	3.9	1.1	0.8	3.5	1.0	1.6	1.6	0.0
% > REL	5.9	12.7	6.5	14.2	15.8	4.0	5.6	4.9	4.4	5.1	2.1	5.3	6.1	3.9	3.5	1.8	5.0	2.6	2.8	2.2	0.0

See footnotes at end of table.

**Table 5-11 (page 3 of 4). Selected pneumoconiotic agents: Geometric mean exposures and percent exceeding designated occupational exposure limits, MSHA and OSHA samples, 1979-1999**

Agent	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Iron Oxide Fume - MSHA</b>																					
GM (mg/m <sup>3</sup> )	0.430	0.480	0.333	0.394	0.210	0.279	0.301	0.238	0.214	0.327	0.282	0.198	0.199	0.198	0.097	0.109	0.110	0.062	0.059	0.130	0.027
No. of samples	155	155	226	119	152	182	211	171	181	136	163	213	177	136	136	200	173	381	155	59	40
% > PEL	1.9	0.6	0.9	2.5	1.3	1.6	0.5	0.6	1.1	0.7	2.5	2.3	1.1	1.5	1.5	3.0	0.0	1.0	0.0	0.0	0.0
% > REL	3.2	5.2	2.2	4.2	4.6	3.3	4.7	2.3	5.0	3.7	5.5	5.2	3.4	5.9	4.4	4.0	2.9	3.4	2.6	0.0	0.0
<b>Iron Oxide Fume - OSHA</b>																					
GM (mg/m <sup>3</sup> )	1.33	1.10	0.974	0.924	0.514	0.421	0.456	0.356	0.245	0.277	0.502	0.360	0.264	0.261	0.280	0.301	0.406	0.238	0.315	0.333	0.279
No. of samples	575	901	1204	1347	1303	1315	1759	1586	1540	1818	1674	1760	1338	1258	1146	925	859	968	986	833	668
% > PEL	6.3	5.4	5.7	5.3	3.4	3.2	4.3	1.3	2.4	2.7	5.0	3.4	2.5	2.0	1.9	3.7	2.9	3.9	2.7	3.4	1.8
% > REL	18.3	16.5	17.1	13.8	9.7	10.7	12.5	6.6	6.9	8.0	13.4	10.1	6.3	6.1	5.9	7.4	6.8	6.9	5.5	7.9	5.5
<b>Talc, Nonfibrous, &lt; 1% quartz - MSHA</b>																					
GM (mppcf)	7.98	5.39	3.93	5.97	1.70	2.08	2.87	4.75	5.41	4.90	5.66	8.11	3.41	2.55	6.50	-	-	26.0	3.00	-	-
No. of samples	56	35	61	33	68	22	14	29	18	30	24	9	6	13	11	0	0	5	1	0	0
% > PEL	14.3	8.6	4.9	6.1	7.4	9.1	7.1	3.4	11.1	6.7	8.3	33.3	0.0	0.0	18.2	-	-	40.0	0.0	-	-
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Tin, inorganic compounds except oxide, as Sn - OSHA</b>																					
GM (µg/m <sup>3</sup> )	6.76	5.84	8.66	5.25	8.64	4.88	5.03	10.4	6.70	5.80	4.94	5.02	7.32	7.36	10.8	4.58	11.3	3.60	9.25	4.22	4.40
No. of samples	124	130	63	46	27	57	99	62	69	88	46	182	111	79	51	75	52	125	37	66	45
% > PEL	1.6	0.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0
% > REL	1.6	0.8	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	0.0	0.0	0.0	0.0	0.0

See footnotes at end of table.



**Table 5-11 (page 4 of 4). Selected pneumoconiotic agents: Geometric mean exposures and percent exceeding designated occupational exposure limits, MSHA and OSHA samples, 1979-1999**

Agent	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Titanium Dioxide Fume and Dust - MSHA</b>																					
GM (µg/m <sup>3</sup> )	1.48	4.11	6.49	2.57	3.70	2.42	3.43	3.22	4.95	7.22	7.27	4.24	6.48	3.73	1.29	1.37	1.06	0.677	0.822	1.55	0.488
No. of samples	111	56	116	97	124	129	145	100	123	104	106	145	108	55	119	215	188	578	128	49	86
% > PEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Welding Fumes (total particulate) - MSHA</b>																					
GM (mg/m <sup>3</sup> )	2.39	1.59	1.07	0.931	0.907	0.931	1.57	1.34	1.98	1.77	1.53	0.169	1.95	0.070	1.00	-	-	-	-	-	-
No. of samples	165	175	212	117	94	47	79	45	31	44	20	5	2	1	1	0	0	0	0	0	0
% > PEL	13.3	9.1	4.7	2.6	3.2	4.3	11.4	0.0	16.1	6.8	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Welding Fumes (total particulate) - OSHA</b>																					
GM (mg/m <sup>3</sup> )	7.05	3.34	3.05	2.33	2.75	4.12	2.75	1.09	2.36	2.12	3.55	2.18	1.67	2.22	1.79	1.46	1.20	1.00	0.978	1.20	0.975
No. of samples	7	35	35	128	48	27	38	32	146	33	230	435	629	585	457	261	230	480	216	304	203
% > PEL	-	-	-	-	-	-	-	-	-	-	52.5	34.7	25.4	24.4	36.8	-	-	-	-	-	-
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

GM - geometric mean

mg/m<sup>3</sup> - milligrams per cubic meter

µg/m<sup>3</sup> - micrograms per cubic meter

mppcf - millions of particles per cubic foot

NOTE: Pneumoconiotic agents with at least 300 total samples in MSHA or OSHA are presented. From March 1, 1989 to March 22, 1993, the OSHA PELs in force differed from those employed before and after those dates. NIOSH has designated beryllium and titanium dioxide as potential occupational carcinogens, and recommends reducing exposures to as low as feasible. The % > REL cannot be calculated for talc because the REL is in units of mg/m<sup>3</sup>, but MSHA samples and analyzes for talc using units of millions of particles per cubic foot (mppcf). For welding fumes - OSHA, the % > PEL is based on fewer samples than the number reported for the years 1989 and 1993 because OSHA adopted a PEL for welding fumes that was enforced from March 1, 1989 through March 22, 1993. Samples collected in 1989 before March 1, or in 1993 after March 23 are not compared to a PEL. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.



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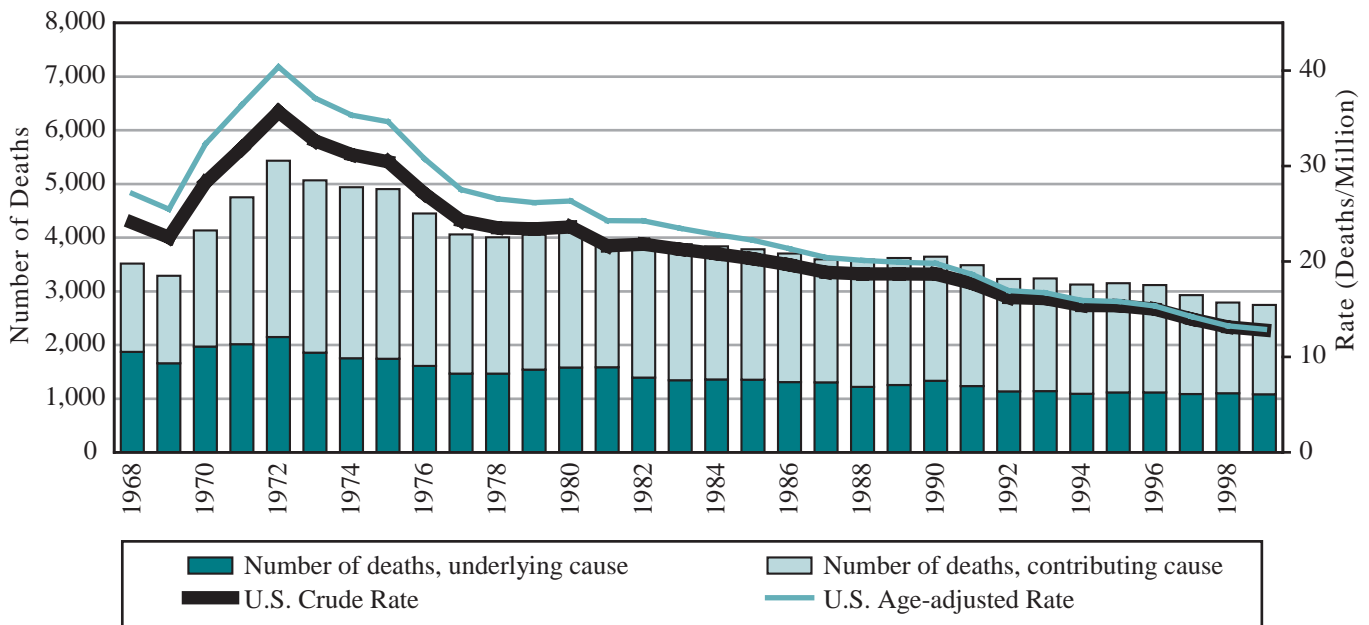
## **Section 6**

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# **All Pneumoconioses and Related Exposures**



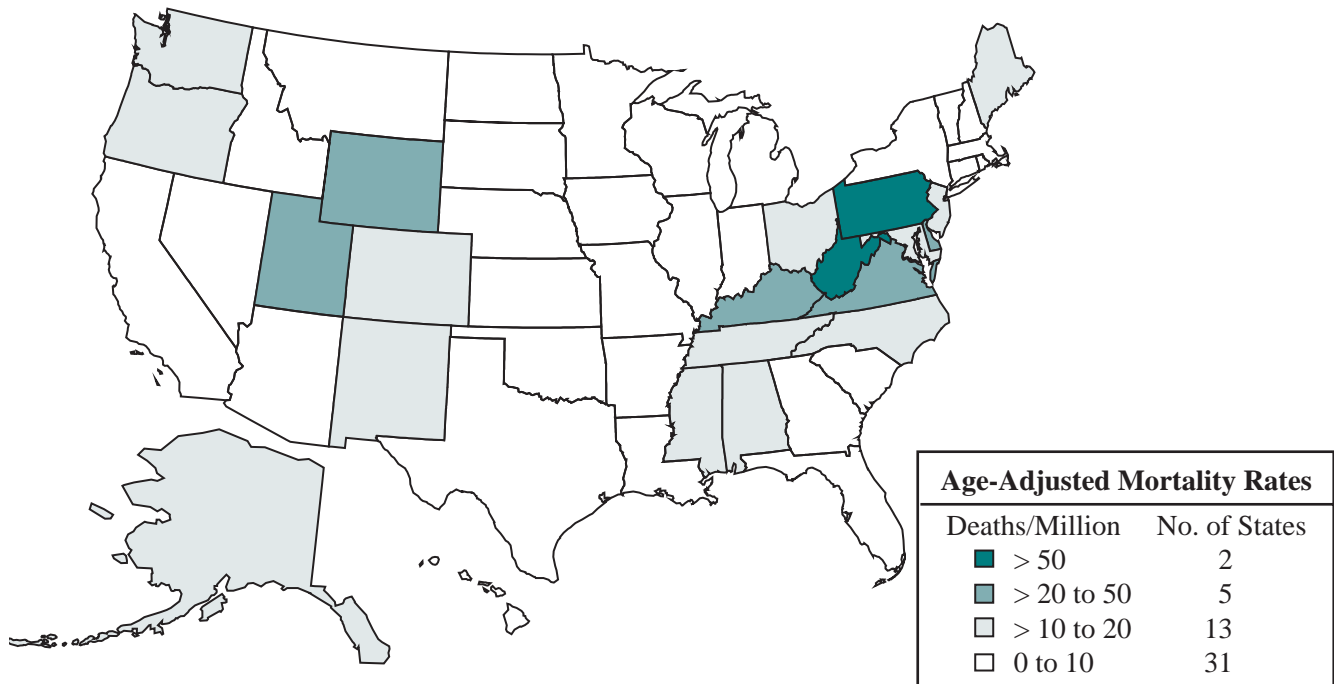
**Figure 6-1. All pneumoconioses: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1968-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 6-2. All pneumoconioses: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 6-1. All pneumoconioses: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	3,644	36.6	3,557	87	3,407	222	15	-	5	17	66	358	1,162	1,503	533	76.0
1991	3,486	35.5	3,403	83	3,275	202	9	3	4	25	63	283	1,084	1,484	540	76.0
1992	3,230	35.1	3,153	77	3,044	174	12	4	4	12	42	265	989	1,409	505	77.0
1993	3,238	35.3	3,170	68	3,049	173	16	-	4	14	56	277	953	1,410	524	77.0
1994	3,126	34.9	3,052	74	2,963	154	9	-	-	10	45	233	893	1,434	511	77.0
1995	3,151	35.4	3,092	59	2,983	160	8	-	4	10	68	245	913	1,337	574	77.0
1996	3,114	35.8	3,030	84	2,936	164	14	-	1	11	51	210	883	1,364	594	78.0
1997	2,928	37.1	2,851	77	2,780	139	9	-	2	12	48	191	751	1,313	611	78.0
1998	2,790	39.4	2,719	71	2,650	127	13	-	3	11	41	189	733	1,225	588	78.0
1999	2,745	39.5	2,683	62	2,592	136	17	-	1	9	38	177	683	1,210	627	78.0
<b>TOTAL</b>	<b>31,452</b>	<b>36.4</b>	<b>30,710</b>	<b>742</b>	<b>29,679</b>	<b>1,651</b>	<b>122</b>	<b>7</b>	<b>28</b>	<b>131</b>	<b>518</b>	<b>2,428</b>	<b>9,044</b>	<b>13,689</b>	<b>5,607</b>	<b>77.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 6-2. All pneumoconioses: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	18.66	41.52	0.92	21.03	0.50	3.74	0.54
1991	17.69	39.59	0.92	19.02	0.33	2.49	—
1992	16.22	36.53	0.78	15.66	0.65	2.92	0.25
1993	16.11	36.36	0.72	15.57	0.40	4.15	—
1994	15.40	34.94	0.79	13.68	0.31	2.27	—
1995	15.37	35.03	0.64	14.17	0.15	1.96	—
1996	15.00	33.75	0.91	14.26	0.15	3.02	0.21
1997	13.96	31.74	0.78	11.41	0.52	2.04	—
1998	13.15	30.11	0.68	10.36	0.37	1.96	0.79
1999	12.81	29.21	0.65	11.19	0.14	3.61	—
1990-1999	15.34	34.71	0.78	14.40	0.35	2.80	0.18
	Age-Adjusted Mortality Rate						
1990	19.81	53.28	0.77	38.57	0.58	9.71	1.06
1991	18.65	50.44	0.80	36.33	0.40	4.49	—
1992	16.95	46.05	0.66	29.67	0.78	6.23	0.55
1993	16.73	45.21	0.60	29.67	0.52	9.18	—
1994	15.92	43.17	0.65	25.77	0.38	4.68	—
1995	15.80	42.82	0.53	27.71	0.21	3.67	—
1996	15.33	41.12	0.75	26.01	0.18	6.32	0.42
1997	14.22	38.57	0.64	21.18	0.70	3.82	—
1998	13.26	35.66	0.55	19.28	0.43	3.81	1.25
1999	12.88	34.41	0.52	20.91	0.16	6.27	—
1990-1999	15.76	42.46	0.64	27.08	0.43	5.92	0.34

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *All Pneumoconioses: Mortality*

**Table 6-3. All pneumoconioses: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	2,915	35	340	55	35	—	3,380
1991	2,655	245	340	—	20	—	3,260
1992	2,160	100	245	55	15	—	2,575
1993	2,350	45	270	25	25	—	2,715
1994	1,825	55	180	25	5	—	2,090
1995	2,365	40	165	15	50	—	2,635
1996	1,815	115	140	—	55	—	2,125
1997	1,810	105	130	—	—	—	2,045
1998	1,665	60	170	30	10	5	1,940
1999	1,340	60	260	25	30	—	1,715
TOTAL	20,900	860	2,240	230	245	5	24,480
	Years of Potential Life Lost to Life Expectancy						
1990	33,353	931	2,139	131	173	22	36,749
1991	32,303	1,199	1,959	49	143	—	35,653
1992	29,270	959	1,616	149	146	9	32,149
1993	29,159	772	1,651	69	209	—	31,860
1994	27,761	810	1,441	66	111	—	30,189
1995	28,815	684	1,440	37	152	—	31,128
1996	27,380	1,004	1,566	28	195	8	30,181
1997	25,884	865	1,305	63	111	—	28,228
1998	24,969	746	1,213	95	112	51	27,186
1999	23,921	673	1,397	51	243	—	26,285
TOTAL	282,815	8,643	15,727	738	1,595	90	309,608

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 6-4. All pneumoconioses: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	61	71	49	51	54	57	65	65	62	61	596
Alaska	2	1	2	3	3	-	2	2	5	3	23
Arizona	20	13	13	23	22	28	25	21	16	29	210
Arkansas	14	17	13	17	9	15	14	12	10	16	137
California	151	155	134	142	147	145	127	119	117	128	1,365
Colorado	30	38	35	43	29	30	37	30	26	27	325
Connecticut	17	19	27	17	18	16	22	15	19	17	187
Delaware	10	18	10	11	15	15	12	10	15	23	139
District of Columbia	1	2	1	1	2	2	2	1	-	-	12
Florida	86	102	91	73	88	102	128	95	91	116	972
Georgia	23	18	25	24	20	26	22	23	22	22	225
Hawaii	3	4	4	1	2	5	2	1	1	1	24
Idaho	6	6	6	6	3	6	9	8	6	8	64
Illinois	94	90	91	77	65	72	85	78	68	64	784
Indiana	40	46	31	26	27	31	30	40	38	32	341
Iowa	12	11	19	15	12	18	12	11	16	11	137
Kansas	5	9	10	15	11	19	11	8	7	6	101
Kentucky	169	150	161	142	117	122	154	139	129	134	1,417
Louisiana	30	31	17	30	20	21	25	25	31	25	255
Maine	19	10	8	16	14	8	9	8	16	16	124
Maryland	55	40	48	44	60	68	65	53	60	60	553
Massachusetts	42	34	55	28	49	44	45	48	46	39	430
Michigan	59	42	47	48	39	47	49	41	37	47	456
Minnesota	15	10	26	24	22	24	13	19	19	24	196
Mississippi	21	29	27	21	29	42	35	41	32	35	312
Missouri	24	27	30	30	27	23	15	20	20	20	236
Montana	9	2	7	8	5	5	8	5	8	4	61
Nebraska	3	7	4	6	4	4	3	6	2	7	46
Nevada	6	4	2	10	10	7	6	4	8	9	66
New Hampshire	3	3	6	9	7	7	4	10	6	7	62
New Jersey	144	118	105	92	95	112	121	89	104	102	1,082
New Mexico	15	10	11	13	21	19	11	15	10	10	135
New York	77	61	46	55	64	56	64	59	57	72	611
North Carolina	50	52	54	36	58	65	54	49	67	54	539
North Dakota	2	3	-	2	4	-	4	4	2	5	26
Ohio	167	183	156	129	133	140	141	104	128	122	1,403
Oklahoma	17	16	13	9	12	10	6	14	11	15	123
Oregon	17	27	26	32	28	22	33	22	35	37	279
Pennsylvania	1,206	1,143	1,018	1,050	939	842	856	775	647	574	9,050
Rhode Island	8	1	7	5	6	5	5	7	9	6	59
South Carolina	18	17	21	27	21	22	25	28	30	24	233
South Dakota	2	-	-	-	1	-	4	2	-	2	11
Tennessee	57	42	39	44	49	50	41	42	50	44	458
Texas	108	112	76	93	92	109	109	109	110	101	1,019
Utah	28	18	22	29	29	27	18	30	14	18	233
Vermont	6	2	7	5	1	4	4	5	4	5	43
Virginia	200	179	196	213	178	197	178	181	178	172	1,872
Washington	44	60	48	69	67	48	56	64	68	78	602
West Virginia	420	395	359	345	366	379	324	338	305	282	3,513
Wisconsin	23	27	17	21	18	26	14	25	19	23	213
Wyoming	5	11	10	8	14	9	10	8	9	8	92
<b>TOTAL</b>	<b>3,644</b>	<b>3,486</b>	<b>3,230</b>	<b>3,238</b>	<b>3,126</b>	<b>3,151</b>	<b>3,114</b>	<b>2,928</b>	<b>2,790</b>	<b>2,745</b>	<b>31,452</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## All Pneumoconioses: Mortality

**Table 6-5. All pneumoconioses: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
	Deaths	Rank	Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	596	13	17.98	7	17.95	8	6,839	12	11.5	27
Alaska	23	49	5.27	43	14.49	14	287	49	12.5	7
Arizona	210	29	6.47	34	6.53	35	2,352	30	11.2	31
Arkansas	137	33	7.09	32	6.18	38	1,663	32	12.1	18
California	1,365	6	5.59	38	6.69	33	16,647	4	12.2	14
Colorado	325	20	11.22	16	14.34	15	3,367	22	10.4	46
Connecticut	187	31	7.11	31	6.85	32	2,186	31	11.7	23
Delaware	139	32	24.61	6	26.69	6	1,592	33	11.5	27
District of Columbia	12	50	2.59	49	2.76	50	215	50	17.9	1
Florida	972	9	8.47	24	6.43	37	10,928	9	11.2	31
Georgia	225	27	4.05	47	5.07	42	2,818	26	12.5	7
Hawaii	24	48	2.59	49	2.98	49	299	48	12.5	7
Idaho	64	41	7.44	28	7.45	30	696	42	10.9	40
Illinois	784	10	8.51	23	8.68	24	8,775	10	11.2	31
Indiana	341	19	7.56	27	7.62	29	3,775	20	11.1	37
Iowa	137	33	6.19	35	5.00	43	1,473	34	10.7	41
Kansas	101	38	5.11	44	4.68	44	1,302	38	12.9	5
Kentucky	1,417	4	46.96	3	47.30	3	16,462	5	11.6	25
Louisiana	255	23	7.83	26	8.57	26	3,520	21	13.8	3
Maine	124	36	12.71	14	12.01	17	1,376	37	11.1	37
Maryland	553	14	13.90	13	16.89	10	6,729	13	12.2	14
Massachusetts	430	18	8.78	22	8.45	27	4,743	18	11.0	39
Michigan	456	17	6.16	36	6.52	36	5,575	16	12.2	14
Minnesota	196	30	5.54	39	5.53	39	2,448	28	12.5	7
Mississippi	312	21	15.31	11	15.29	13	4,566	19	14.6	2
Missouri	236	24	5.68	37	5.13	40	2,834	24	12.0	20
Montana	61	43	9.18	21	8.73	23	638	44	10.5	43
Nebraska	46	45	3.66	48	3.13	48	467	45	10.2	47
Nevada	66	40	5.49	40	6.88	31	810	40	12.3	13
New Hampshire	62	42	6.90	33	7.65	28	712	41	11.5	27
New Jersey	1,082	7	17.01	9	17.01	9	12,068	8	11.2	31
New Mexico	135	35	10.72	18	12.45	16	1,419	36	10.5	43
New York	611	11	4.23	46	4.25	47	7,183	11	11.8	21
North Carolina	539	15	9.42	19	10.04	20	6,564	14	12.2	14
North Dakota	26	47	5.30	42	4.64	45	322	47	12.4	12
Ohio	1,403	5	16.12	10	16.07	11	15,701	6	11.2	31
Oklahoma	123	37	4.85	45	4.52	46	1,423	35	11.6	25
Oregon	279	22	11.37	15	10.66	19	2,990	23	10.7	41
Pennsylvania	9,050	1	93.76	2	82.40	2	90,030	1	9.9	50
Rhode Island	59	44	7.40	29	6.61	34	690	43	11.7	23
South Carolina	233	25	8.17	25	9.27	22	2,823	25	12.1	18
South Dakota	11	51	2.00	51	1.68	51	149	51	13.5	4
Tennessee	458	16	11.04	17	11.34	18	5,151	17	11.2	31
Texas	1,019	8	7.20	30	8.63	25	12,856	7	12.6	6
Utah	233	25	17.42	8	22.32	7	2,377	29	10.2	47
Vermont	43	46	9.40	20	9.94	21	434	46	10.1	49
Virginia	1,872	3	35.76	4	44.04	4	22,032	3	11.8	21
Washington	602	12	14.31	12	15.45	12	6,323	15	10.5	43
West Virginia	3,513	2	241.51	1	211.31	1	40,366	2	11.5	27
Wisconsin	213	28	5.38	41	5.11	41	2,659	27	12.5	7
Wyoming	92	39	25.69	5	31.08	5	812	39	8.8	51

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



**Table 6-6. All pneumoconioses: Percent of deaths by condition and state, U.S. residents age 15 and over, 1990-1999**

State	Asbestosis	Silicosis	Coal Workers' Pneumoconiosis	Byssinosis	Unspecified/Other Pneumoconioses
Alabama	53.4	6.5	31.0	0.5	9.1
Alaska	78.3	8.7	13.0	-	-
Arizona	54.8	18.1	19.5	0.5	7.6
Arkansas	45.3	10.9	39.4	0.7	4.4
California	73.3	7.8	14.7	0.6	4.1
Colorado	22.5	27.7	36.3	0.6	13.2
Connecticut	68.4	14.4	9.1	-	8.6
Delaware	78.4	4.3	11.5	-	6.5
District of Columbia	41.7	33.3	8.3	-	16.7
Florida	63.8	6.4	22.9	0.4	7.3
Georgia	55.6	15.6	14.7	4.9	10.2
Hawaii	95.8	-	-	-	4.2
Idaho	62.5	23.4	12.5	-	1.6
Illinois	27.8	9.7	45.7	0.3	17.3
Indiana	18.8	12.3	56.6	0.3	12.6
Iowa	39.4	16.8	35.0	0.7	8.8
Kansas	55.4	10.9	26.7	1.0	5.9
Kentucky	4.6	2.9	72.7	0.1	20.0
Louisiana	76.1	13.7	5.9	0.4	4.3
Maine	89.5	8.1	0.8	-	1.6
Maryland	74.5	4.9	15.6	0.2	5.8
Massachusetts	88.4	6.0	1.6	0.7	3.7
Michigan	43.6	23.0	23.2	0.7	10.5
Minnesota	72.4	24.5	-	1.5	3.1
Mississippi	83.7	4.2	11.2	-	1.3
Missouri	52.5	19.1	18.6	0.4	10.2
Montana	55.7	24.6	13.1	-	6.6
Nebraska	78.3	13.0	4.3	-	4.3
Nevada	63.6	19.7	10.6	-	7.6
New Hampshire	80.6	11.3	3.2	1.6	4.8
New Jersey	84.6	4.9	6.7	-	4.5
New Mexico	23.0	29.6	32.6	-	14.8
New York	66.0	17.2	8.5	0.2	9.2
North Carolina	55.3	15.4	17.3	8.0	5.2
North Dakota	76.9	3.8	11.5	-	7.7
Ohio	24.2	15.9	43.9	0.1	17.0
Oklahoma	45.5	18.7	25.2	1.6	8.9
Oregon	87.5	8.2	3.6	-	1.4
Pennsylvania	10.6	4.7	76.0	-	9.2
Rhode Island	79.7	16.9	3.4	1.7	-
South Carolina	71.7	9.9	12.4	4.7	1.3
South Dakota	36.4	45.5	9.1	-	9.1
Tennessee	24.2	7.0	58.1	-	10.9
Texas	82.2	9.8	5.5	0.4	3.3
Utah	15.5	15.5	48.1	-	21.9
Vermont	37.2	41.9	4.7	2.3	14.0
Virginia	23.9	1.7	64.2	0.2	10.3
Washington	87.4	5.0	6.0	-	2.2
West Virginia	7.3	2.0	74.4	0.1	16.9
Wisconsin	46.5	43.2	5.6	1.4	4.2
Wyoming	20.7	1.1	44.6	-	33.7
<b>TOTAL</b>	<b>34.7</b>	<b>7.6</b>	<b>47.8</b>	<b>0.4</b>	<b>10.1</b>

- indicates no deaths listed.

NOTE: Percentages may total more than 100% due to deaths with multiple pneumoconioses. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *All Pneumoconioses: Mortality*

**Table 6-7. All pneumoconioses: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
041	Coal mining	4,623	46.2
060	Construction	1,078	10.8
270	Blast furnaces, steelworks, rolling and finishing mills	203	2.0
360	Ship and boat building and repairing	176	1.8
392	Not specified manufacturing industries	170	1.7
192	Industrial and miscellaneous chemicals	159	1.6
400	Railroads	146	1.5
040	Metal mining	131	1.3
262	Miscellaneous nonmetallic mineral and stone products	127	1.3
901	General government, n.e.c.	105	1.1
	All other industries	2,741	27.4
	Industry not reported	354	3.5
	<b>TOTAL</b>	<b>10,013</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 6-8. All pneumoconioses: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
616	Mining machine operators	4,299	42.9
889	Laborers, except construction	389	3.9
585	Plumbers, pipefitters, and steamfitters	257	2.6
019	Managers and administrators, n.e.c.	248	2.5
575	Electricians	220	2.2
567	Carpenters	198	2.0
453	Janitors and cleaners	179	1.8
633	Supervisors, production occupations	167	1.7
804	Truck drivers	163	1.6
869	Construction laborers	142	1.4
	All other occupations	3,397	33.9
	Occupation not reported	354	3.5
	<b>TOTAL</b>	<b>10,013</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 6-9. All pneumoconioses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
041	Coal mining	4,623	33.13	32.19	34.10
262	Miscellaneous nonmetallic mineral and stone products	127	7.86	6.58	9.39
040	Metal mining	131	5.19	4.36	6.18
360	Ship and boat building and repairing	176	4.48	3.86	5.21
261	Pottery and related products	27	3.81	2.51	5.55
050	Nonmetallic mining and quarrying, except fuel	69	3.58	2.81	4.57
271	Iron and steel foundries	70	2.77	2.18	3.53
361	Railroad locomotives and equipment	7	2.66	1.07	5.48
252	Structural clay products	29	2.62	1.76	3.77
502	Lumber and construction materials	23	2.26	1.43	3.40
192	Industrial and miscellaneous chemicals	159	1.75	1.50	2.05
211	Other rubber products, and plastics footwear and belting	48	1.45	1.07	1.93
250	Glass and glass products	55	1.37	1.04	1.80

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit  
 NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.  
 SOURCE: National Center for Health Statistics multiple cause of death data.

## *All Pneumoconioses: Mortality*

**Table 6-10. All pneumoconioses: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

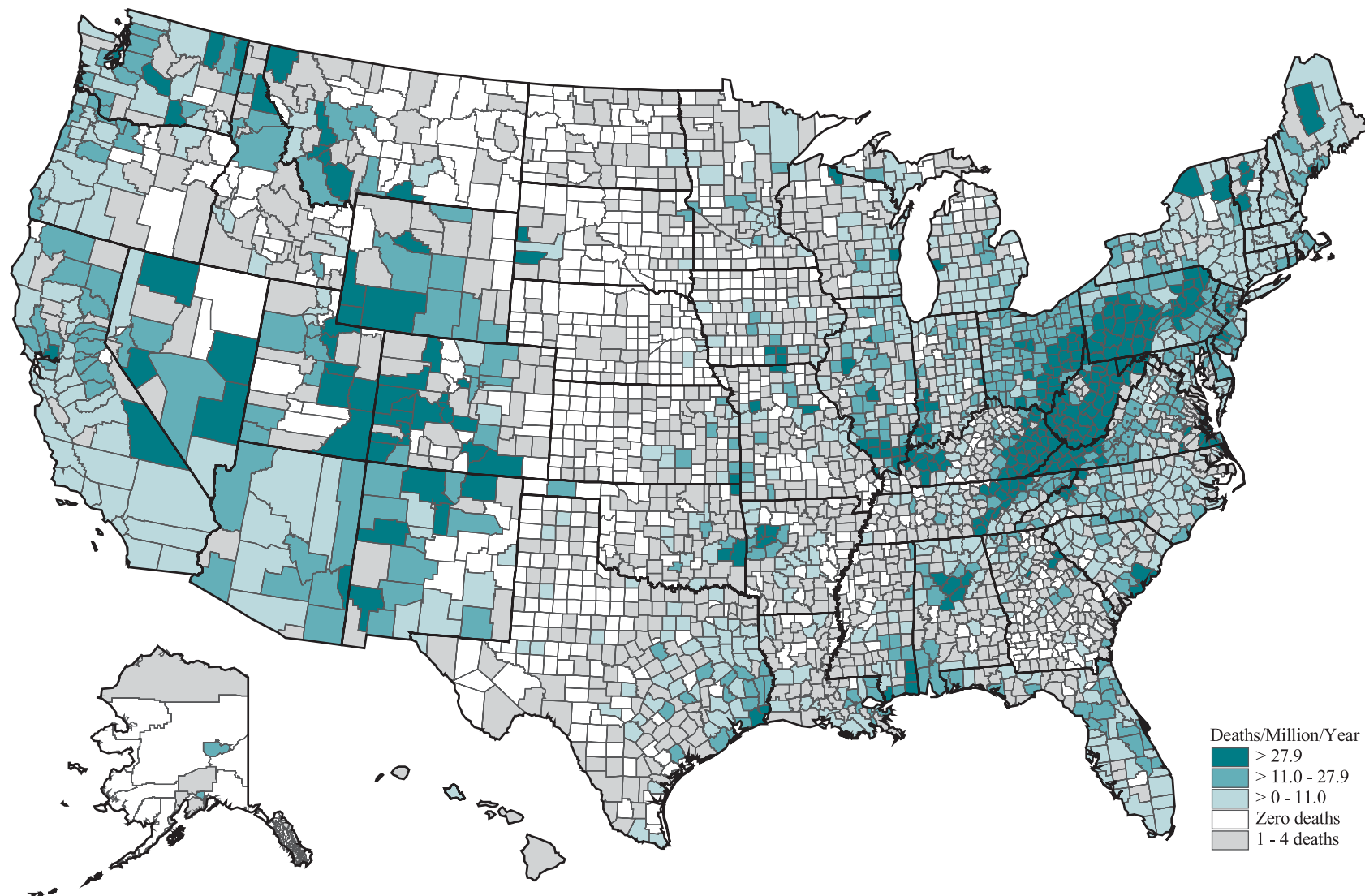
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
616	Mining machine operators	4,299	32.79	31.82	33.79
593	Insulation workers	109	25.52	21.07	30.94
613	Supervisors, extractive occupations	73	10.74	8.49	13.61
725	Miscellaneous metal and plastic processing machine operators	11	10.47	5.23	18.72
046	Mining engineers	16	6.11	3.49	9.93
643	Boilermakers	61	5.91	4.57	7.67
615	Explosives workers	6	5.03	1.84	10.96
787	Hand molding, casting, and forming occupations	10	4.58	2.20	8.42
768	Crushing and grinding machine operators	26	4.51	2.95	6.61
617	Mining occupations, n.e.c.	26	4.16	2.72	6.11
675	Hand molders and shapers, except jewelers	16	3.67	2.10	5.95
585	Plumbers, pipefitters, and steamfitters	257	2.89	2.55	3.27
719	Molding and casting machine operators	38	2.70	1.92	3.71
843	Supervisors, material moving equipment operators	9	2.39	1.10	4.53
859	Miscellaneous material moving equipment operators	23	2.17	1.37	3.26
584	Plasterers	11	2.12	1.06	3.80
575	Electricians	220	2.07	1.81	2.37
653	Sheet metal workers	58	1.95	1.50	2.54
544	Millwrights	52	1.81	1.37	2.39
824	Locomotive operating occupations	36	1.63	1.14	2.25
783	Welders and cutters	139	1.58	1.34	1.87

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

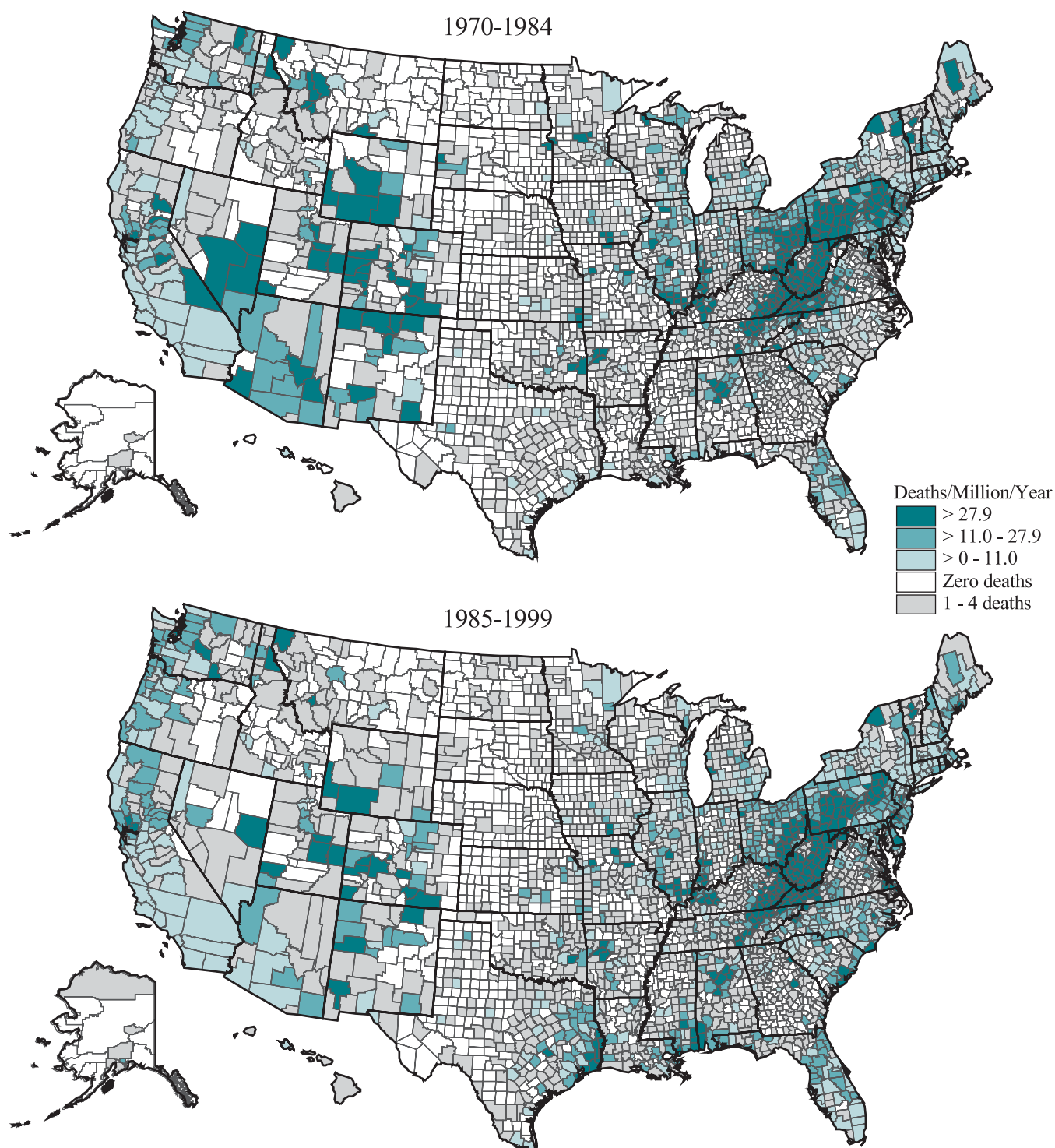
SOURCE: National Center for Health Statistics multiple cause of death data.

**Figure 6-3. All pneumoconioses: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
 SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 6-4. All pneumoconioses: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1970-1984 and 1985-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



**Table 6-11. All pneumoconioses: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Buchanan County	Virginia	1,732.5	1,227.6	451	0.2
Raleigh County	West Virginia	1,128.7	1,281.6	1,169	0.0
McDowell County	West Virginia	1,127.8	1,264.3	495	0.2
Schuylkill County	Pennsylvania	1,100.9	1,535.8	2,898	0.2
Wyoming County	West Virginia	1,067.5	903.5	303	0.0
Floyd County	Kentucky	961.3	864.9	434	0.0
Dickenson County	Virginia	884.3	853.2	177	0.6
Wise County	Virginia	864.1	868.3	406	0.2
Tazewell County	Virginia	846.9	869.4	485	0.4
Norton City	Virginia	841.7	814.7	41	0.0
Boone County	West Virginia	774.8	734.3	228	0.4
Luzerne County	Pennsylvania	684.1	960.7	3,896	0.4
Fayette County	West Virginia	669.8	847.3	485	0.2
Logan County	West Virginia	658.1	635.9	317	0.3
Harlan County	Kentucky	648.7	642.4	267	0.0
Carbon County	Utah	595.2	644.1	139	0.0
Letcher County	Kentucky	590.7	553.9	171	1.2
Russell County	Virginia	548.2	514.7	177	0.0
Cambria County	Pennsylvania	494.1	653.2	1,285	0.2
Northumberland County	Pennsylvania	478.7	669.0	777	0.3
Mingo County	West Virginia	478.5	397.1	149	0.0
Bell County	Kentucky	436.8	436.8	157	0.0
Somerset County	Pennsylvania	426.9	522.4	488	0.2
Webster County	West Virginia	402.3	482.9	59	0.0
Knott County	Kentucky	401.9	323.8	67	0.0
Lee County	Virginia	393.6	462.0	133	0.8
Nicholas County	West Virginia	391.3	421.6	132	0.8
Carbon County	Pennsylvania	386.5	508.4	358	0.6
Mercer County	West Virginia	352.1	432.5	339	0.3
Fayette County	Pennsylvania	348.2	443.0	776	0.0
Franklin County	Illinois	343.7	503.3	243	0.0
Emery County	Utah	339.0	267.7	26	0.0
Lackawanna County	Pennsylvania	336.4	470.5	1,255	0.2
Muhlenberg County	Kentucky	327.6	374.2	138	0.0
Pike County	Kentucky	318.3	263.6	223	0.4
Johnson County	Kentucky	306.1	259.2	71	0.0
Leslie County	Kentucky	302.9	240.6	37	0.0
Sweetwater County	Wyoming	277.0	158.0	68	0.0
Greene County	Pennsylvania	274.6	343.1	161	0.0
Knox County	Kentucky	265.5	270.0	94	1.1
Indiana County	Pennsylvania	249.8	250.8	273	0.0
Clay County	West Virginia	239.0	256.9	29	3.4
Martin County	Kentucky	231.7	177.6	25	0.0
Preston County	West Virginia	229.0	251.8	86	0.0
Las Animas County	Colorado	227.0	365.6	59	1.7
Perry County	Kentucky	223.4	188.9	67	0.0
Campbell County	Tennessee	220.5	236.8	100	1.0
Greenbrier County	West Virginia	216.3	275.0	117	0.0
Marion County	West Virginia	213.6	284.4	200	0.5
Whitley County	Kentucky	210.7	212.4	84	0.0
<b>Overall United States</b>		<b>17.4</b>	<b>16.7</b>	<b>49,740</b>	<b>2.2</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
 SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *All Pneumoconioses: Morbidity*

**Table 6-12. Occupational dust diseases of the lungs: Estimated number of cases reported by employers, by industry division, U.S. private sector, 1973-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Total
1973	100	-	100	700	200	200	-	100	1,500
1974	100	300	100	900	-	300	-	100	1,700
1975	-	-	200	600	-	100	-	-	1,000
1976	-	-	200	800	100	-	-	-	1,200
1977	100	200	800	700	100	100	100	100	2,000
1978	-	300	200	800	100	200	-	100	1,600
1979	-	300	200	900	100	100	-	100	1,700
1980	-	300	200	1,300	100	100	-	200	2,300
1981	-	300	200	1,500	-	-	-	100	2,100
1982	-	300	100	1,200	100	100	-	100	2,000
1983	-	200	100	900	-	200	-	200	1,700
1984	-	200	200	1,000	100	100	-	100	1,800
1985	-	200	100	800	100	200	-	200	1,700
1986	100	600	100	-	-	-	100	300	3,200
1987	-	900	500	1,200	200	-	-	400	3,400
1988	-	700	200	1,200	300	-	-	300	2,900
1989	-	500	200	1,300	100	100	-	200	2,600
1990	100	300	300	1,600	400	100	-	300	3,000
1991	100	500	200	1,000	200	-	-	300	2,500
1992	-	600	100	1,000	-	200	-	500	2,600
1993	100	600	200	900	300	-	-	600	2,700
1994	-	400	200	900	300	300	-	500	2,700
1995	-	200	100	700	200	200	-	1,100	2,700
1996	-	100	100	2,600	200	100	-	400	3,500
1997	-	100	300	900	300	200	300	800	2,900
1998	-	300	200	800	300	200	-	400	2,100
1999	-	100	100	900	300	100	100	500	2,200
2000	-	100	100	500	200	300	100	400	1,700

- indicates data do not meet BLS publication guidelines.

NOTE: Dust diseases of the lungs (pneumoconioses) include silicosis, asbestosis, coal workers' pneumoconiosis, byssinosis, siderosis, and other pneumoconioses. The sum of industry divisions may not equal the total due to rounding. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.



**Table 6-13. Occupational dust diseases of the lungs: Estimated rate (based on cases reported by employers, per 10,000 full-time workers) by industry division, U.S. private sector, 1973-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Overall
1973	1.3	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.3
1974	0.8	4.8	0.3	0.4	-	0.2	0.0	0.1	0.3
1975	0.4	0.2	0.6	0.4	0.1	-	-	-	0.2
1976	0.2	0.1	0.5	0.4	0.2	-	-	-	0.2
1977	1.3	2.0	2.5	0.4	0.1	-	0.1	0.1	0.3
1978	0.3	4.0	0.6	0.4	0.1	0.1	-	-	0.3
1979	0.1	3.4	0.5	0.4	0.1	0.1	-	0.1	0.3
1980	0.4	3.3	0.6	0.7	0.1	0.1	-	0.1	0.4
1981	0.3	2.5	0.5	0.8	0.1	-	-	0.1	0.3
1982	0.4	3.2	0.3	0.7	0.2	0.1	-	0.1	0.3
1983	0.4	1.9	0.4	0.5	0.1	0.1	-	0.1	0.3
1984	0.4	1.7	0.5	0.5	0.2	0.1	-	0.1	0.3
1985	0.5	2.7	0.3	0.4	0.2	0.1	-	0.1	0.2
1986	1.0	8.4	0.3	0.9	-	-	-	0.1	0.5
1987	0.5	12.9	1.2	0.6	0.3	-	-	0.2	0.5
1988	-	10.2	0.5	0.6	0.6	-	-	0.1	0.4
1989	0.2	7.5	0.5	0.7	0.2	-	-	0.1	0.3
1990	0.6	4.4	0.6	0.9	0.7	-	-	0.1	0.4
1991	0.5	7.3	0.4	0.5	0.3	-	-	0.1	0.3
1992	0.2	9.0	0.3	0.6	-	0.1	-	0.2	0.3
1993	0.5	8.7	0.4	0.5	0.5	-	-	0.3	0.3
1994	0.3	6.6	0.5	0.5	0.5	0.1	0.1	0.2	0.3
1995	0.1	3.4	0.3	0.4	0.4	0.1	0.1	0.5	0.3
1996	0.1	1.6	0.1	1.4	0.3	-	0.1	0.2	0.4
1997	0.3	1.7	0.5	0.5	0.5	0.1	0.5	0.3	0.3
1998	0.2	4.3	0.3	0.4	0.4	0.1	0.1	0.2	0.2
1999	0.2	2.2	0.1	0.5	0.5	0.1	0.1	0.2	0.2
2000	0.2	1.7	0.1	0.3	0.3	0.1	0.1	0.2	0.2

- indicates no data reported or data that do not meet BLS publication guidelines.

NOTE: Dust diseases of the lungs (pneumoconioses) include silicosis, asbestosis, coal workers' pneumoconiosis, byssinosis, siderosis, and other pneumoconioses. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

*All Pneumoconioses: Morbidity*

**Table 6-14 (page 1 of 2). Occupational dust diseases of the lungs: Industries with highest estimated incidence rates (based on cases reported by employers, per 10,000 full-time workers) by industry division, U.S. private sector, 1996-2000**

Year/Industry	SIC	Estimated Number of Cases	Rate (per 10,000 full- time workers)
<b>1996</b>			
Coal mining	12	100	8.6
Primary metal industries	33	200	2.2
Local and interurban passenger transit	41	100	1.7
Chemical and allied products	28	100	1.1
Transportation equipment	37	200	1.0
Electric, gas, and sanitary services	49	100	0.9
Lumber and wood products	24	100	0.9
Nonmetallic minerals, except fuels	14	-	0.9
Stone, clay, and glass products	32	-	0.9
Transportation by air	45	100	0.6
<b>ALL INDUSTRIES</b>		<b>3,500</b>	<b>0.4</b>
<b>1997</b>			
Coal mining	12	100	9.5
Fishing, hunting, and trapping	09	-	7.8
Local and interurban passenger transit	41	100	3.7
Primary metal products	33	100	1.8
Insurance carriers	63	200	1.4
Metal mining	10	-	0.9
Nonmetallic minerals, except fuels	14	-	0.9
General building contractors	15	100	0.9
Fabricated metal products	34	100	0.9
Electric, gas, and sanitary services	49	100	0.9
<b>ALL INDUSTRIES</b>		<b>2,900</b>	<b>0.3</b>
<b>1998</b>			
Coal mining	12	200	25.3
Museums, botanical, zoological gardens	84	-	4.7
Nonmetallic minerals, except fuels	14	-	2.3
Electric, gas, and sanitary services	49	200	2.3
Primary metal industries	33	100	2.0
Transportation equipment	37	300	1.4
Agricultural production livestock	02	-	0.9
Local and interurban passenger transit	41	-	0.9
Stone, clay, and glass products	32	-	0.8
Leather and leather products	31	-	0.8
<b>ALL INDUSTRIES</b>		<b>2,100</b>	<b>0.2</b>

See footnotes at end of table.

**Table 6-14 (page 2 of 2). Occupational dust diseases of the lungs: Industries with highest estimated incidence rates (based on cases reported by employers, per 10,000 full-time workers) by industry division, U.S. private sector, 1996-2000**

<b>Year/Industry</b>	<b>SIC</b>	<b>Estimated Number of Cases</b>	<b>Rate (per 10,000 full- time workers)</b>
<b><u>1999</u></b>			
Coal mining	12	100	13.0
Primary metal industries	33	200	3.2
Water transportation	44	-	1.9
Electric, gas, and sanitary services	49	100	1.7
Chemicals and allied products	28	200	1.7
Legal services	81	200	1.7
Leather and leather products	31	-	1.2
Transportation equipment	37	200	1.0
Textile mill products	22	-	0.7
Trucking and warehousing	42	100	0.7
<b>ALL INDUSTRIES</b>		<b>2,200</b>	<b>0.2</b>
<b><u>2000</u></b>			
Coal mining	12	100	10.4
Forestry	08	-	10.2
Metal mining	10	-	1.2
Tobacco products	21	-	1.2
Water transportation	44	-	1.2
Nonmetallic minerals, except fuels	14	-	0.9
Electric, gas, and sanitary services	49	100	0.8
Primary metal industries	33	-	0.6
Transportation equipment	37	100	0.5
Petroleum and coal products	29	-	0.5
<b>ALL INDUSTRIES</b>		<b>1,700</b>	<b>0.2</b>

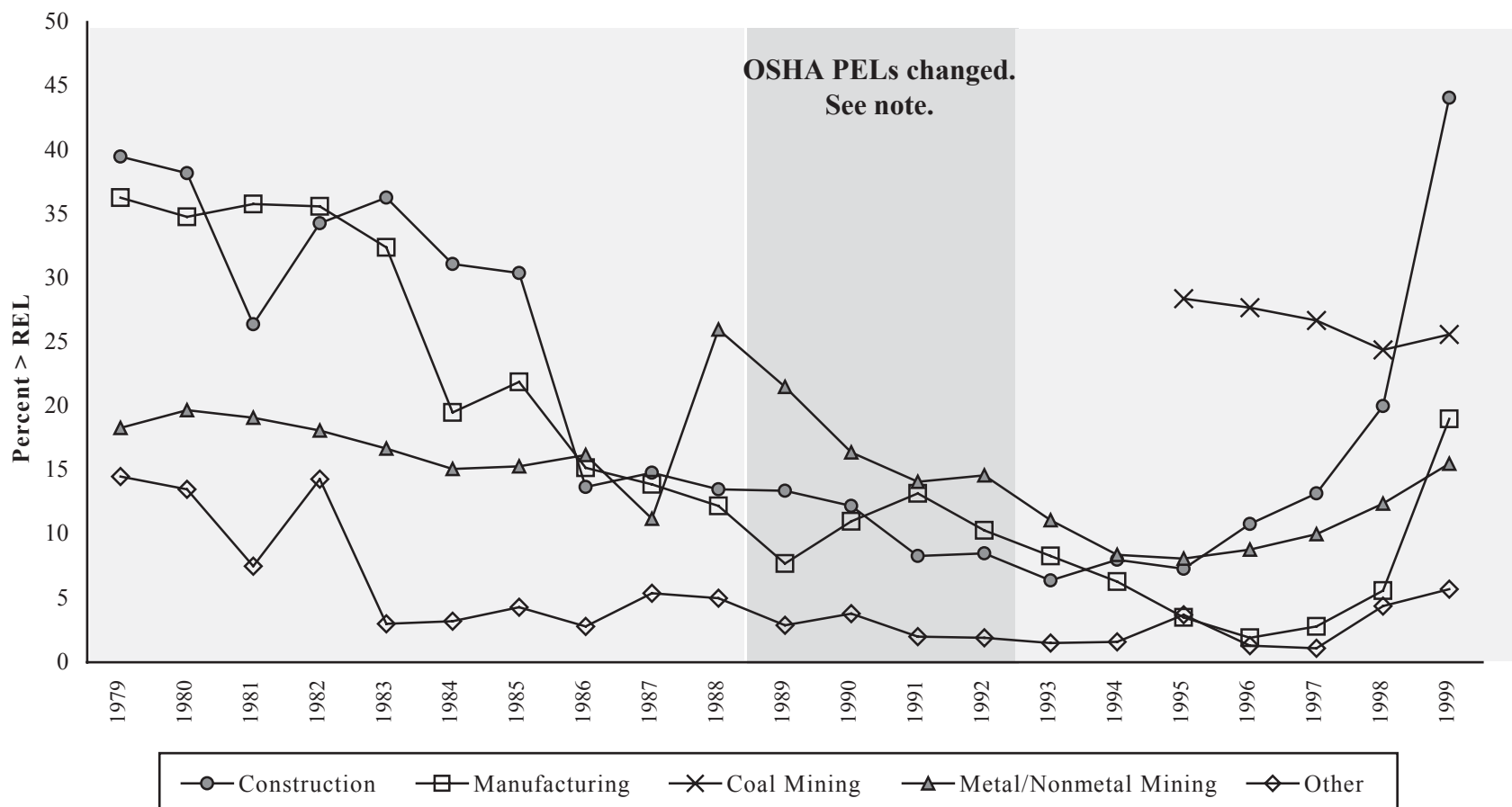
- indicates no data reported or data that do not meet BLS publication guidelines.

SIC - 1987 Standard Industrial Classification

NOTE: Dust diseases of the lungs (pneumoconioses) include silicosis, asbestosis, coal workers' pneumoconiosis, byssinosis, siderosis, and other pneumoconioses. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

**Figure 6-5. Pneumoconiotic agents: Percent of exposures exceeding the NIOSH recommended exposure limits by major industry division, MSHA inspector and mine operator and OSHA samples, 1979-1999**



REL - recommended exposure limit

NOTE: From March 1, 1989 to March 22, 1993, the OSHA PELs in force differed from those employed before and after those dates. The NIOSH REL for respirable coal mine dust of 1.0 mg/m<sup>3</sup> was adopted in September 1995. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine and coal mine inspector and mine operator dust and quartz data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Table 6-15a. Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by type of mine, MSHA inspector and mine operator samples, 1979-1999**

Major Industry	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
<b>Coal Mining SIC 11, 12</b>																					
No. of samples with PEL	207,430	254,581	77,764	136,332	136,373	139,050	129,333	120,662	113,050	109,431	103,978	102,213	94,824	91,070	84,346	82,462	78,496	73,001	80,096	89,895	98,876
% > PEL	17.0	15.4	11.0	11.1	10.4	10.6	9.8	10.8	11.0	10.3	9.8	9.1	12.4	11.8	11.2	11.0	11.3	10.1	9.9	9.5	9.0
No. of samples with REL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21,625	66,669	71,536	79,282	86,086
% > REL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28.4	27.7	26.7	24.4	25.6
<b>Metal/Nonmetal Mining SIC 10, 14</b>																					
No. of samples with PEL	9,953	6,988	7,474	3,153	7,075	8,008	6,996	7,279	6,761	7,722	8,990	11,304	13,100	12,707	11,038	17,199	13,611	19,207	8,636	4,889	5,382
% > PEL	11.5	10.7	11.0	10.5	12.0	11.6	12.4	10.9	8.9	17.7	14.9	11.1	9.4	9.0	7.1	5.4	5.2	5.4	6.1	6.5	7.8
No. of samples with REL	9,411	6,513	6,826	2,741	6,418	7,473	6,406	6,898	6,369	7,333	8,629	10,899	12,791	12,473	10,660	16,526	13,034	17,255	8,164	4,728	5,107
% > REL	18.3	19.6	19.0	18.1	16.7	15.1	15.2	16.2	11.2	25.9	21.5	16.4	14.1	14.5	11.1	8.4	8.1	8.8	10.0	12.4	15.5

- indicates incalculable field

PEL - permissible exposure limit

REL - recommended exposure limit

SIC - Standard Industrial Classification

NOTE: The NIOSH REL for respirable coal mine dust of 1.0 mg/m<sup>3</sup> was adopted in September 1995. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data and coal mine inspector and mine operator dust and quartz data.

**Table 6-15b. Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by major industry division, OSHA samples, 1979-1999**

Major Industry											OSHA PELs changed. See note.													
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999			
Construction SIC 15-17																								
No. of samples with PEL	132	309	194	218	599	796	658	435	396	435	405	523	526	655	521	296	195	433	498	368	294			
% > PEL	11.4	16.2	6.2	11.0	7.0	7.4	9.1	5.1	8.3	9.2	10.9	8.6	7.2	5.5	4.8	7.1	10.8	13.2	8.4	22.8	29.6			
No. of samples with REL	124	262	144	204	498	731	596	357	337	363	328	362	374	472	359	250	165	334	395	454	238			
% > REL	39.5	38.2	26.4	34.3	36.3	31.1	30.4	13.7	14.8	13.5	13.4	12.2	8.3	8.5	6.4	7.6	7.3	10.8	12.9	19.8	43.3			
Manufacturing SIC 20-39																								
No. of samples with PEL	1,944	3,212	3,194	3,665	3,192	4,768	5,678	4,391	5,512	5,682	4,827	5,664	4,981	4,788	3,686	2,998	3,612	3,558	4,087	2,893	2,721			
% > PEL	15.0	16.1	16.2	14.5	13.3	7.9	10.0	6.4	6.8	5.7	5.8	7.1	8.1	6.6	5.4	4.1	3.2	2.6	3.7	9.1	9.9			
No. of samples with REL	1,395	2,322	1,959	2,189	1,962	3,005	3,455	2,630	3,346	3,262	2,644	3,099	2,809	2,761	2,447	2,713	3,947	5,903	6,510	6,090	1,974			
% > REL	36.3	34.8	35.8	35.6	32.4	19.5	21.7	15.1	13.9	12.2	7.7	11.0	13.2	10.3	8.3	6.3	3.5	1.9	2.7	5.6	18.9			
Other SIC 1-9, 13, 40-99																								
No. of samples with PEL	219	239	144	92	591	1,188	962	1,023	1,168	1,068	1,104	1,089	1,056	769	657	615	656	773	663	340	260			
% > PEL	3.7	4.6	5.6	4.3	1.2	0.9	1.7	2.0	4.3	3.5	2.7	3.7	1.4	1.7	0.6	2.6	3.5	1.3	1.2	3.2	4.2			
No. of samples with REL	138	185	93	77	530	1,033	870	798	1,040	818	899	783	793	577	538	613	794	798	833	362	209			
% > REL	14.5	13.5	7.5	14.3	3.0	3.2	4.3	2.8	5.4	5.0	2.9	3.8	2.0	1.9	1.5	1.6	3.7	1.3	1.1	4.4	5.7			

PEL - permissible exposure limit      REL - recommended exposure limit      SIC - Standard Industrial Classification

NOTE: From March 1, 1989 to March 22, 1993, the OSHA PELs in force differed from those employed before and after those dates. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Table 6-16. Pneumoconiotic agents: Number of samples and percent of exposures exceeding designated occupational exposure limits by industries with elevated pneumoconiosis mortality, MSHA inspector and mine operator and OSHA samples, 1990-1999**

<b>All Pneumoconioses Mortality, Selected States and Years, 1990-1999</b>							
<b>CIC</b>	<b>Industries with elevated PMRs and most frequently recorded on death certificates</b>	<b>Number of Deaths</b>	<b>PMR</b>	<b>No. of Samples with PEL</b>	<b>% &gt; PEL</b>	<b>No. of Samples with REL</b>	<b>% &gt; REL</b>
041	Coal mining	4,623	33.13	875,279	10.5	325,198	26.2*
262	Miscellaneous nonmetallic mineral and stone products	127	7.86	709	22.4	643	37.3
040	Metal mining	131	5.19	13,439	9.0	10,362	16.1
360	Ship and boat building and repairing	176	4.48	540	8.7	393	3.6
050	Nonmetallic mining and quarrying, except fuel	69	3.58	103,665	6.9	101,292	10.9
271	Iron and steel foundries	70	2.77	4,022	14.6	3,348	27.3
252	Structural clay products	29	2.62	314	22.3	307	35.8
192	Industrial and miscellaneous chemicals	159	1.75	541	7.0	413	11.1
211	Other rubber products, and plastics footwear and belting	48	1.45	245	8.2	310	7.7
250	Glass and glass products	55	1.37	348	0.3	289	2.4
	All other industries	2,741		43,383	4.6	42,171	4.2
	<b>TOTAL</b>			<b>1,042,485</b>	<b>9.9</b>	<b>484,726</b>	<b>20.8</b>

CIC - Census Industry Code      PEL - permissible exposure limit      REL - recommended exposure limit      PMR - proportionate mortality ratio

\*This number is based solely on the the NIOSH REL for respirable coal mine dust of 1.0 mg/m<sup>3</sup> which was adopted in September 1995. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria.

NOTE: See appendices for source description, methods, ICD codes, industry codes, agents, and list of selected states (and years) for which usual industry has been reported.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust and quartz data and metal/nonmetal data. Occupational Safety and Health Administration (OSHA) Integrated Management Information System. National Center for Health Statistics multiple cause of death data.

**Table 6-17 (page 1 of 2). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by MSHA coal mine district and states, MSHA inspector and mine operator samples, 1979-1999**

MSHA Coal Mine District	All Years				1979 - 1988		1989 - 1992		1993 - 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with PEL	% > PEL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>District 1</b> (Anthracite coal mining regions in Pennsylvania)	<b>41,934</b>	<b>3.5</b>	<b>7,576</b>	<b>8.9</b>	<b>20,987</b>	<b>3.4</b>	<b>7,975</b>	<b>2.8</b>	<b>12,972</b>	<b>4.0</b>	<b>7,576</b>	<b>8.9</b>
<b>District 2</b> (Bituminous coal mining regions in Pennsylvania)	<b>303,583</b>	<b>9.9</b>	<b>35,457</b>	<b>23.9</b>	<b>202,334</b>	<b>10.3</b>	<b>38,816</b>	<b>11.0</b>	<b>62,433</b>	<b>8.0</b>	<b>35,457</b>	<b>23.9</b>
<b>District 3</b>	<b>270,667</b>	<b>11.5</b>	<b>30,269</b>	<b>23.3</b>	<b>178,203</b>	<b>13.3</b>	<b>37,109</b>	<b>8.8</b>	<b>55,355</b>	<b>7.3</b>	<b>30,269</b>	<b>23.3</b>
Maryland	10,579	11.0	2,323	32.3	5,405	13.9	1,179	8.7	3,995	7.7	2,323	32.3
Ohio	90,025	14.5	8,242	22.5	65,421	17.1	10,168	9.0	14,436	6.5	8,242	22.5
Northern West Virginia	170,063	9.9	19,704	22.5	107,377	10.9	25,762	8.7	36,924	7.6	19,704	22.5
<b>District 4</b> (Southern West Virginia)	<b>472,288</b>	<b>14.2</b>	<b>60,324</b>	<b>27.4</b>	<b>294,243</b>	<b>15.6</b>	<b>74,563</b>	<b>11.7</b>	<b>103,482</b>	<b>12.1</b>	<b>60,324</b>	<b>27.4</b>
<b>District 5</b> (Virginia)	<b>301,610</b>	<b>10.1</b>	<b>36,399</b>	<b>20.7</b>	<b>181,204</b>	<b>10.4</b>	<b>52,466</b>	<b>9.9</b>	<b>67,940</b>	<b>9.4</b>	<b>36,399</b>	<b>20.7</b>
<b>District 6</b> (Eastern Kentucky)	<b>281,960</b>	<b>8.8</b>	<b>49,022</b>	<b>22.4</b>	<b>144,798</b>	<b>7.8</b>	<b>49,971</b>	<b>9.1</b>	<b>87,191</b>	<b>10.1</b>	<b>49,022</b>	<b>22.4</b>
<b>District 7</b>	<b>279,339</b>	<b>8.8</b>	<b>47,325</b>	<b>21.2</b>	<b>133,482</b>	<b>8.3</b>	<b>57,363</b>	<b>8.6</b>	<b>88,494</b>	<b>9.6</b>	<b>47,325</b>	<b>21.2</b>
Central Kentucky	231,417	9.0	42,746	21.4	103,604	8.7	47,796	8.6	80,017	9.8	42,746	21.4
North Carolina	9	0.0	0	-	2	0.0	7	0.0	0	-	0	-
South Carolina	0	-	0	-	0	-	0	-	0	-	0	-
Tennessee	47,884	7.6	4,579	19.2	29,847	7.1	9,560	8.2	8,477	8.5	4,579	19.2
Northern Georgia	29	0.0	0	-	29	0.0	0	-	0	-	0	-
<b>District 8</b>	<b>153,812</b>	<b>15.3</b>	<b>17,574</b>	<b>50.5</b>	<b>95,380</b>	<b>15.3</b>	<b>25,822</b>	<b>14.0</b>	<b>32,610</b>	<b>16.5</b>	<b>17,574</b>	<b>50.5</b>
Illinois	137,945	15.9	14,857	52.0	86,573	16.2	23,347	14.7	28,025	16.2	14,857	52.0
Indiana	14,075	10.7	2,696	42.8	7,312	6.9	2,298	7.5	4,465	18.5	2,696	42.8
Iowa	940	6.4	0	-	794	6.5	127	6.3	19	0.0	0	-
Michigan	0	-	0	-	0	-	0	-	0	-	0	-
Minnesota	0	-	0	-	0	-	0	-	0	-	0	-
Northern Missouri	852	3.3	21	0.0	701	3.0	50	0.0	101	6.9	21	0.0
Wisconsin	0	-	0	-	0	-	0	-	0	-	0	-

See footnotes at end of table.



**Table 6-17 (page 2 of 2). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by MSHA coal mine district and states, MSHA inspector and mine operator samples, 1979-1999**

MSHA Coal Mine District	All Years				1979 - 1988		1989 - 1992		1993 - 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with PEL	% > PEL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>District 9</b>	<b>125,971</b>	<b>17.8</b>	<b>17,367</b>	<b>33.8</b>	<b>74,282</b>	<b>20.4</b>	<b>21,315</b>	<b>17.2</b>	<b>30,374</b>	<b>11.8</b>	<b>17,367</b>	<b>33.8</b>
Alaska	258	5.8	14	0.0	179	7.3	54	3.7	25	0.0	14	0.0
Arizona	955	5.0	207	1.9	424	6.1	212	3.3	319	4.7	207	1.9
Arkansas	320	4.1	36	0.0	232	4.3	33	6.1	55	1.8	36	0.0
California	13	0.0	11	9.1	0	-	0	-	13	0.0	11	9.1
Colorado	39,718	21.2	4,937	40.7	24,351	24.8	6,438	19.0	8,929	12.6	4,937	40.7
Hawaii	0	-	0	-	0	-	0	-	0	-	0	-
Idaho	0	-	0	-	0	-	0	-	0	-	0	-
Kansas	534	3.4	73	1.4	368	4.3	70	0.0	96	2.1	73	1.4
Louisiana	115	0.0	44	0.0	12	0.0	23	0.0	80	0.0	44	0.0
Southern Missouri	689	3.8	114	7.0	439	4.3	59	1.7	191	3.1	114	7.0
Montana	1,817	7.2	391	5.6	1,087	8.6	160	5.6	570	4.9	391	5.6
Nebraska	0	-	0	-	0	-	0	-	0	-	0	-
Nevada	0	-	0	-	0	-	0	-	0	-	0	-
New Mexico	5,521	20.5	696	6.2	3,551	24.3	622	18.2	1,348	11.6	696	6.2
North Dakota	1,392	2.0	144	0.0	975	2.3	227	2.6	190	0.0	144	0.0
Oklahoma	5,239	9.1	799	9.8	2,835	10.0	1,025	10.7	1,379	6.0	799	9.8
Oregon	0	-	0	-	0	-	0	-	0	-	0	-
Texas	4,138	2.9	515	3.5	2,613	2.4	609	5.6	916	2.5	515	3.5
Utah	54,983	19.5	7,585	43.6	31,598	22.1	10,247	18.8	13,138	13.8	7,585	43.6
Washington	367	1.4	115	4.3	124	0.0	41	4.9	202	1.5	115	4.3
Wyoming	9,912	12.5	1,686	21.9	5,494	12.9	1,495	15.2	2,923	10.5	1,686	21.9
<b>District 10 (Western Kentucky)</b>	<b>82,406</b>	<b>13.3</b>	<b>11,047</b>	<b>48.4</b>	<b>49,001</b>	<b>12.6</b>	<b>13,128</b>	<b>14.1</b>	<b>20,277</b>	<b>14.7</b>	<b>11,047</b>	<b>48.4</b>
<b>District 11</b>	<b>89,693</b>	<b>13.9</b>	<b>12,838</b>	<b>29.8</b>	<b>50,092</b>	<b>16.1</b>	<b>13,557</b>	<b>13.4</b>	<b>26,044</b>	<b>9.9</b>	<b>12,838</b>	<b>29.8</b>
Alabama	89,693	13.9	12,838	29.8	50,092	16.1	13,557	13.4	26,044	9.9	12,838	29.8
Central and Southern Georgia	0	-	0	-	0	-	0	-	0	-	0	-
Florida	0	-	0	-	0	-	0	-	0	-	0	-
Mississippi	0	-	0	-	0	-	0	-	0	-	0	-
Puerto Rico	0	-	0	-	0	-	0	-	0	-	0	-
Virgin Islands	0	-	0	-	0	-	0	-	0	-	0	-
<b>TOTAL</b>	<b>2,403,263</b>	<b>11.6</b>	<b>325,198</b>	<b>26.2</b>	<b>1,424,006</b>	<b>12.4</b>	<b>392,085</b>	<b>10.7</b>	<b>587,172</b>	<b>10.3</b>	<b>325,198</b>	<b>26.2</b>

– indicates incalculable field      PEL - permissible exposure limit      REL - recommended exposure limit

NOTE: The NIOSH REL for respirable coal mine dust of 1.0 mg/m<sup>3</sup> was adopted in September 1995. The MSHA respirable coal mine quartz exposure data and the NIOSH REL for respirable quartz cannot be compared to each other because they are based on different sampling criteria. See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) coal mine inspector and mine operator dust and quartz data.

**Table 6-18 (page 1 of 2). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by MSHA metal/nonmetal district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal Mine District	1979 - 1988				1989 - 1992				1993 - 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>Northeast</b>	<b>10,176</b>	<b>12.5</b>	<b>9,471</b>	<b>20.9</b>	<b>6,612</b>	<b>10.1</b>	<b>6,311</b>	<b>15.7</b>	<b>12,607</b>	<b>6.3</b>	<b>12,101</b>	<b>10.6</b>
Connecticut	351	26.2	308	36.0	167	13.2	162	22.2	342	5.3	303	5.3
Delaware	30	33.3	23	0.0	33	0.0	33	3.0	41	4.9	41	0.0
District of Columbia	0	-	0	-	0	-	0	-	0	-	0	-
Maine	207	15.9	201	24.4	169	3.0	169	7.7	255	4.3	255	9.8
Maryland	563	4.1	556	10.1	364	3.3	341	6.7	645	2.5	624	6.1
Massachusetts	497	17.5	483	28.2	263	9.9	256	15.6	554	3.6	554	7.0
New Hampshire	132	15.2	132	33.3	133	7.5	133	16.5	248	7.3	239	12.6
New Jersey	1,055	17.0	1,013	28.1	625	12.3	623	20.1	914	4.2	911	8.0
New York	2,221	11.5	1,970	17.9	1,733	6.6	1,679	11.6	2,973	5.3	2,776	9.3
Pennsylvania	2,413	9.5	2,351	15.1	1,371	13.4	1,286	19.4	2,988	7.7	2,884	12.2
Rhode Island	64	23.4	60	35.0	35	8.6	35	25.7	114	15.8	111	25.2
Vermont	708	15.7	549	47.5	350	20.0	348	27.9	729	19.5	729	29.8
Virginia	1,312	8.6	1,215	13.2	939	9.1	869	12.7	2,188	4.2	2,115	7.4
West Virginia	623	17.3	610	24.3	430	13.0	377	18.6	616	5.8	559	10.0
<b>Southeast</b>	<b>15,562</b>	<b>7.9</b>	<b>14,577</b>	<b>12.2</b>	<b>9,936</b>	<b>8.2</b>	<b>9,560</b>	<b>12.4</b>	<b>15,192</b>	<b>4.6</b>	<b>14,647</b>	<b>8.0</b>
Alabama	1,097	4.4	1,055	6.5	876	8.0	876	11.9	1,351	6.2	1,342	9.5
Florida	1,215	5.3	966	6.4	841	2.1	836	5.0	1,481	1.3	1,397	2.4
Georgia	2,526	11.0	2,494	19.6	1,585	10.5	1,576	15.2	2,149	5.3	2,140	7.7
Kentucky	1,055	7.8	998	10.1	534	9.4	501	11.0	1,001	3.7	1,001	5.7
Mississippi	301	4.3	286	6.3	480	5.4	478	8.2	941	7.0	941	11.8
North Carolina	3,480	6.6	3,385	11.3	2,223	6.7	2,199	11.0	2,668	3.7	2,614	6.9
Puerto Rico	1,106	5.9	788	0.3	230	10.0	114	3.5	829	2.7	704	2.7
South Carolina	1,176	16.2	1,145	27.5	1,371	8.8	1,235	14.8	2,195	3.0	1,978	7.1
Tennessee	3,517	7.0	3,401	9.8	1,774	10.5	1,735	16.0	2,516	7.7	2,486	13.6
Virgin Islands	89	6.7	59	0.0	22	9.1	10	0.0	61	1.6	44	6.8
<b>North Central</b>	<b>14,704</b>	<b>10.0</b>	<b>13,332</b>	<b>13.5</b>	<b>8,922</b>	<b>11.0</b>	<b>8,755</b>	<b>15.6</b>	<b>15,428</b>	<b>5.2</b>	<b>14,928</b>	<b>8.7</b>
Illinois	3,046	17.6	2,912	20.4	1,414	13.0	1,396	19.2	2,564	4.8	2,426	8.1
Indiana	1,247	4.2	1,204	3.2	929	4.7	925	5.9	2,001	2.9	1,958	5.0
Iowa	692	5.5	681	5.1	573	5.2	572	4.9	883	1.6	877	1.8
Michigan	2,062	8.0	1,577	13.8	1,559	14.6	1,506	19.5	2,664	6.2	2,520	10.4
Minnesota	4,477	7.0	3,846	10.9	1,663	10.6	1,594	16.2	2,311	5.2	2,202	8.4
Ohio	1,414	14.1	1,387	18.8	1,716	9.0	1,713	14.4	2,987	6.7	2,973	11.7
Wisconsin	1,766	9.3	1,725	13.2	1,068	15.5	1,049	20.6	2,018	5.6	1,972	9.9

See footnotes at end of table.

**Table 6-18 (page 2 of 2). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by MSHA metal/nonmetal district and state, MSHA samples, 1979-1999**

MSHA Metal/Nonmetal Mine District	1979 - 1988				1989 - 1992				1993 - 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>South Central</b>	<b>8,315</b>	<b>13.4</b>	<b>7,860</b>	<b>17.9</b>	<b>9,558</b>	<b>9.4</b>	<b>9,483</b>	<b>13.6</b>	<b>15,513</b>	<b>5.3</b>	<b>14,775</b>	<b>7.8</b>
Arkansas	596	32.4	556	44.8	672	16.4	664	28.3	1,231	7.6	1,207	13.6
Louisiana	319	7.8	288	11.5	748	4.0	748	6.1	1,475	4.2	1,451	7.5
Missouri	2,532	12.9	2,393	16.0	2,037	11.6	2,021	15.0	3,511	4.8	3,219	7.3
New Mexico	1,331	13.7	1,189	20.9	1,095	13.0	1,072	20.9	2,054	10.0	1,764	15.1
Oklahoma	1,628	9.9	1,600	13.7	1,340	10.9	1,340	16.6	2,067	4.2	2,016	7.7
Texas	1,909	11.8	1,834	14.9	3,666	6.4	3,638	8.4	5,175	4.0	5,118	4.3
<b>Rocky Mountain</b>	<b>17,435</b>	<b>15.3</b>	<b>16,211</b>	<b>22.7</b>	<b>6,434</b>	<b>16.5</b>	<b>6,164</b>	<b>25.3</b>	<b>13,136</b>	<b>8.7</b>	<b>11,310</b>	<b>15.3</b>
Arizona	2,709	17.6	2,548	28.5	745	18.8	733	28.4	3,098	6.8	2,348	13.7
Colorado	3,872	13.2	3,609	19.8	1,255	16.9	1,211	26.7	1,496	12.2	1,472	23.2
Kansas	1,316	12.6	1,289	14.0	553	9.8	544	12.5	1,036	6.2	949	7.8
Montana	1,915	10.7	1,568	17.6	842	20.3	733	31.2	1,071	10.2	958	18.3
Nebraska	54	5.6	53	5.7	260	2.7	257	4.7	490	1.8	480	2.5
Nevada	1,357	25.8	1,331	33.1	1,073	19.9	1,053	31.1	1,816	12.4	1,535	23.6
North Dakota	194	12.9	194	18.6	72	1.4	72	11.1	266	2.3	263	7.6
South Dakota	1,814	14.4	1,698	24.5	356	9.8	321	14.6	1,075	5.5	835	10.4
Utah	2,433	16.2	2,165	19.5	957	19.1	919	29.4	1,627	8.8	1,384	16.2
Wyoming	1,771	15.2	1,756	26.1	321	15.0	321	20.9	1,161	11.6	1,086	10.9
<b>Western</b>	<b>5,217</b>	<b>13.8</b>	<b>4,937</b>	<b>21.8</b>	<b>4,639</b>	<b>11.7</b>	<b>4,519</b>	<b>19.1</b>	<b>8,086</b>	<b>5.7</b>	<b>7,713</b>	<b>9.0</b>
Alaska	93	20.4	91	27.5	88	10.2	56	25.0	399	4.3	282	11.3
California	2,511	15.1	2,482	26.5	2,571	11.7	2,513	21.2	2,880	7.6	2,799	11.6
Hawaii	11	0.0	11	0.0	57	3.5	57	1.8	208	1.0	202	1.0
Idaho	1,230	16.4	1,034	23.4	590	15.9	560	26.1	1,374	6.7	1,244	13.5
Oregon	422	4.3	422	6.4	705	7.4	705	7.9	1,595	1.9	1,586	1.8
Washington	950	10.6	897	13.8	628	13.7	628	18.0	1,630	6.1	1,600	8.7
<b>TOTAL</b>	<b>71,409</b>	<b>11.8</b>	<b>66,388</b>	<b>17.6</b>	<b>46,101</b>	<b>10.8</b>	<b>44,792</b>	<b>16.2</b>	<b>79,962</b>	<b>5.9</b>	<b>75,474</b>	<b>9.7</b>

— indicates incalculable field

PEL - permissible exposure limit      REL - recommended exposure limit

NOTE: See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data.

**Table 6-19 (page 1 of 3). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	1979 – 1988				1989 – 1992 OSHA PELs changed. See note.				1993 – 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>Region 1</b>	<b>4,523</b>	<b>8.6</b>	<b>3,332</b>	<b>20.6</b>	<b>2,460</b>	<b>2.3</b>	<b>1,526</b>	<b>3.4</b>	<b>2,917</b>	<b>3.3</b>	<b>3,822</b>	<b>3.7</b>
Connecticut	1,159	7.2	987	17.7	785	2.4	542	2.8	1,037	0.5	1,191	0.9
Maine	186	16.1	135	23.7	94	0.0	62	0.0	90	12.2	57	1.8
Massachusetts	1,889	8.3	1,280	22.4	1,206	2.4	693	3.2	1,345	3.9	1,704	5.3
New Hampshire	637	6.3	459	20.7	342	1.5	209	5.3	394	3.6	488	4.1
Rhode Island	650	11.8	469	21.1	31	12.9	19	21.1	51	27.5	376	5.1
Vermont	2	0.0	2	0.0	2	0.0	1	0.0	0	-	6	0.0
<b>Region 2</b>	<b>4,520</b>	<b>9.8</b>	<b>3,653</b>	<b>20.6</b>	<b>2,267</b>	<b>3.2</b>	<b>1,646</b>	<b>7.2</b>	<b>3,309</b>	<b>7.0</b>	<b>2,760</b>	<b>8.7</b>
New Jersey	1,576	12.4	1,236	25.0	846	3.5	568	8.8	1,069	3.4	912	2.6
New York	2,872	8.5	2,353	18.5	1,330	3.1	998	6.6	2,194	8.8	1,763	12.3
Puerto Rico	67	4.5	59	11.9	66	0.0	58	0.0	43	0.0	82	0.0
U.S. Virgin Islands	5	0.0	5	0.0	25	8.0	22	9.1	3	0.0	3	0.0
<b>Region 3</b>	<b>6,629</b>	<b>12.2</b>	<b>4,685</b>	<b>29.3</b>	<b>1,768</b>	<b>16.5</b>	<b>1,070</b>	<b>21.5</b>	<b>2,022</b>	<b>9.2</b>	<b>1,832</b>	<b>10.8</b>
Delaware	136	5.1	65	15.4	0	-	0	-	11	18.2	7	28.6
District of Columbia	130	0.8	124	9.7	20	10.0	14	0.0	22	9.1	12	0.0
Maryland	514	8.9	297	19.5	319	12.2	131	26.7	224	7.1	104	13.5
Pennsylvania	4,164	13.0	3,040	31.3	1,044	17.0	663	19.6	1,422	11.3	1,257	14.1
Virginia	849	12.5	652	31.0	211	26.5	159	32.7	236	1.3	379	0.3
West Virginia	836	12.3	507	27.0	174	9.2	103	12.6	107	2.8	73	4.1
<b>Region 4</b>	<b>6,433</b>	<b>12.0</b>	<b>4,586</b>	<b>24.3</b>	<b>4,276</b>	<b>5.8</b>	<b>2,752</b>	<b>10.0</b>	<b>5,666</b>	<b>4.2</b>	<b>7,937</b>	<b>4.3</b>
Alabama	998	17.2	686	33.2	550	7.1	388	16.5	836	1.3	917	1.5
Florida	644	4.3	427	10.3	548	1.8	353	2.3	251	2.8	1,801	0.5
Georgia	1,878	14.2	1,387	26.2	1,182	3.4	755	6.6	946	6.7	1,393	6.7
Kentucky	733	8.2	519	16.0	414	8.2	274	10.9	938	3.9	478	6.9
Mississippi	287	10.5	193	30.1	272	2.2	182	2.7	264	2.3	614	1.5
North Carolina	783	11.9	621	26.9	525	11.4	403	17.6	1,494	3.9	1,574	5.5
South Carolina	653	8.6	441	16.8	482	5.4	229	7.9	636	4.4	914	4.5
Tennessee	457	14.9	312	30.8	303	11.6	168	16.7	301	8.3	246	21.5

See footnotes at end of table.

**Table 6-19 (page 2 of 3). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	1979 – 1988				1989 – 1992 OSHA PELs changed. See note.				1993 – 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>Region 5</b>	<b>13,020</b>	<b>9.8</b>	<b>8,134</b>	<b>22.8</b>	<b>8,564</b>	<b>6.3</b>	<b>4,776</b>	<b>8.9</b>	<b>10,161</b>	<b>4.7</b>	<b>8,643</b>	<b>6.7</b>
Illinois	3,263	7.6	2,043	15.9	2,230	7.2	1,110	5.6	3,888	2.9	3,407	3.7
Indiana	927	12.6	591	36.0	327	4.6	229	11.4	474	7.0	298	11.4
Michigan	214	0.5	158	2.5	1,341	5.1	798	6.0	1,855	3.6	1,106	9.5
Minnesota	116	32.8	98	52.0	114	3.5	76	5.3	24	25.0	24	25.0
Ohio	5,494	9.4	3,310	22.1	2,181	4.5	1,332	8.5	1,305	9.2	1,543	8.8
Wisconsin	3,006	11.9	1,934	27.2	2,371	8.3	1,231	14.1	2,615	5.5	2,265	7.7
<b>Region 6</b>	<b>6,303</b>	<b>6.8</b>	<b>3,686</b>	<b>15.6</b>	<b>2,360</b>	<b>4.2</b>	<b>1,376</b>	<b>9.0</b>	<b>2,043</b>	<b>4.8</b>	<b>5,421</b>	<b>2.0</b>
Arkansas	606	6.9	332	13.9	176	7.4	123	12.2	224	8.9	1,973	1.2
Louisiana	449	7.6	265	19.2	190	2.1	87	4.6	42	11.9	38	18.4
New Mexico	22	27.3	17	35.3	18	0.0	18	0.0	15	40.0	22	27.3
Oklahoma	1,698	3.5	877	9.8	447	2.2	245	3.3	296	3.4	1,361	1.2
Texas	3,528	8.1	2,195	17.6	1,529	4.6	903	10.7	1,466	4.0	2,027	2.6
<b>Region 7</b>	<b>3,951</b>	<b>6.2</b>	<b>2,509</b>	<b>15.5</b>	<b>1,647</b>	<b>8.4</b>	<b>954</b>	<b>7.8</b>	<b>1,187</b>	<b>10.1</b>	<b>1,724</b>	<b>5.3</b>
Iowa	1,585	6.8	880	16.5	609	6.4	322	10.9	416	11.8	242	23.1
Kansas	700	4.3	418	14.8	248	3.2	157	9.6	376	8.0	1,013	2.5
Missouri	1,200	7.4	920	16.4	619	12.3	345	6.1	122	30.3	297	3.0
Nebraska	466	4.3	291	11.0	171	8.8	130	2.3	273	1.5	172	1.2
<b>Region 8</b>	<b>4,158</b>	<b>4.3</b>	<b>2,374</b>	<b>10.7</b>	<b>1,604</b>	<b>5.9</b>	<b>824</b>	<b>6.6</b>	<b>1,527</b>	<b>5.9</b>	<b>2,238</b>	<b>4.5</b>
Colorado	2,385	4.4	1,285	11.1	1,078	3.1	600	4.5	756	4.2	718	6.0
Montana	709	3.0	471	11.0	261	12.6	117	8.5	205	7.3	209	6.2
North Dakota	455	4.8	236	12.3	71	4.2	29	3.4	164	15.2	177	16.4
South Dakota	484	2.9	278	5.0	126	18.3	25	28.0	203	8.4	522	3.1
Utah	95	16.8	77	22.1	58	3.4	48	18.8	22	4.5	267	0.0
Wyoming	30	0.0	27	3.7	10	0.0	5	0.0	177	0.0	345	0.0

See footnotes at end of table.

**Table 6-19 (page 3 of 3). Pneumoconiotic agents: Percent of exposures exceeding designated occupational exposure limits by OSHA region and state, OSHA samples, 1979-1999**

OSHA Region	1979 – 1988				1989 – 1992 OSHA PELs changed. See note.				1993 – 1999			
	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL	No. of Samples with PEL	% > PEL	No. of Samples with REL	% > REL
<b>Region 9</b>	<b>1,707</b>	<b>8.1</b>	<b>1,150</b>	<b>16.3</b>	<b>792</b>	<b>7.1</b>	<b>570</b>	<b>10.0</b>	<b>389</b>	<b>5.1</b>	<b>789</b>	<b>2.9</b>
American Samoa	0	-	0	-	0	-	0	-	0	-	0	-
Arizona	165	10.3	123	20.3	136	1.5	62	4.8	31	6.5	22	9.1
California	1,306	4.1	837	10.3	492	5.9	385	7.8	307	3.9	714	2.1
Guam	3	0.0	3	0.0	0	-	0	-	0	-	0	-
Hawaii	47	0.0	44	2.3	8	0.0	8	0.0	22	13.6	18	16.7
Nevada	186	36.6	143	53.1	156	16.0	115	20.9	29	10.3	35	8.6
<b>Region 10</b>	<b>876</b>	<b>8.0</b>	<b>627</b>	<b>17.9</b>	<b>664</b>	<b>10.1</b>	<b>409</b>	<b>8.3</b>	<b>930</b>	<b>9.0</b>	<b>786</b>	<b>16.7</b>
Alaska	194	2.1	178	3.4	47	6.4	42	9.5	26	0.0	38	0.0
Idaho	215	4.2	141	11.3	308	2.6	182	4.9	167	0.0	109	0.0
Oregon	439	11.2	299	28.4	61	9.8	31	6.5	252	5.2	142	11.3
Washington	28	28.6	9	55.6	248	20.2	154	12.3	485	14.6	497	23.1
<b>TOTAL</b>	<b>52,120</b>	<b>9.1</b>	<b>34,736</b>	<b>21.0</b>	<b>26,402</b>	<b>6.3</b>	<b>15,903</b>	<b>9.1</b>	<b>30,151</b>	<b>5.4</b>	<b>35,952</b>	<b>5.4</b>

– indicates incalculable field

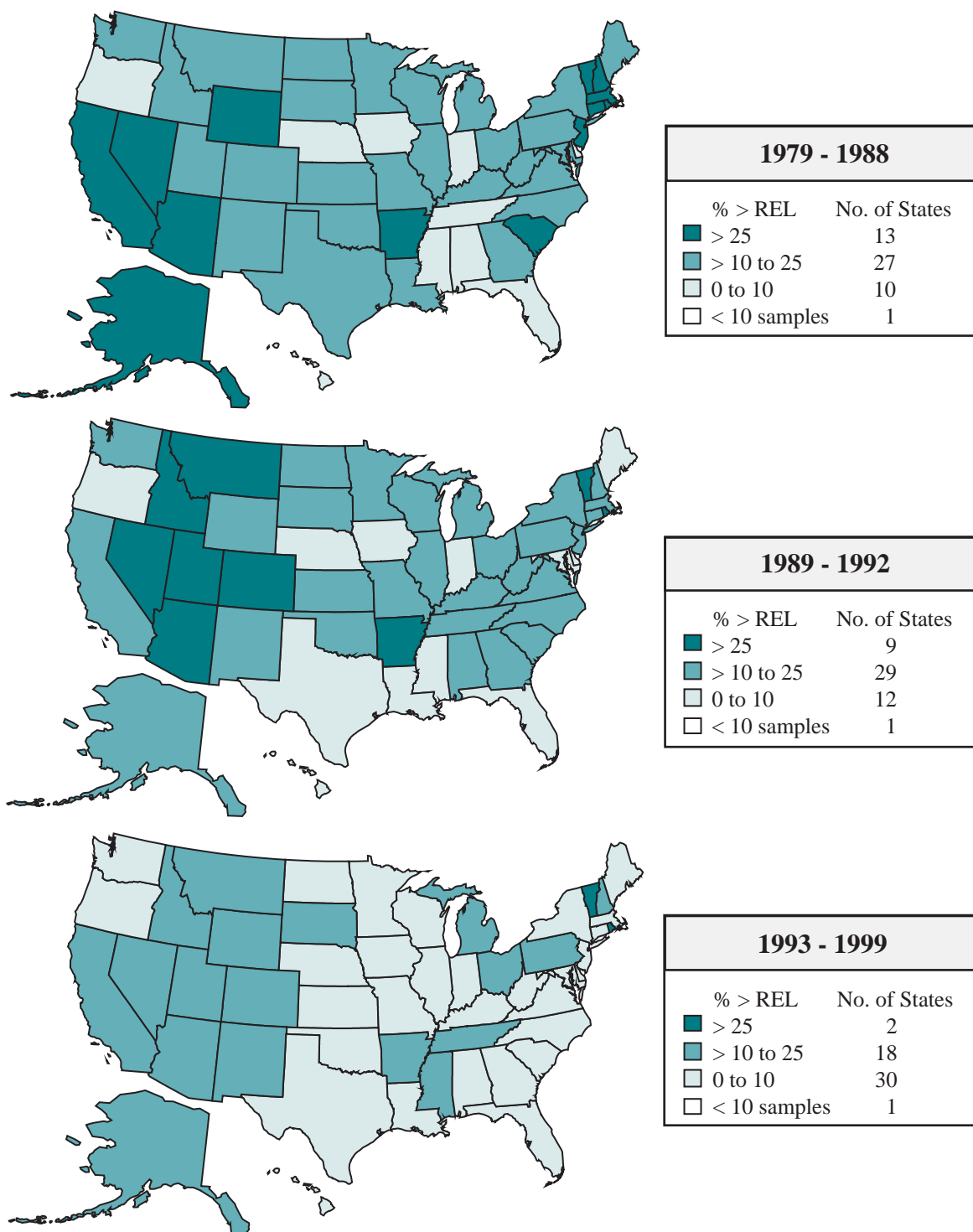
PEL - permissible exposure limit

REL - recommended exposure limit

NOTE: From March 1, 1989 to March 22, 1993, the OSHA PELs in force differed from those employed before and after those dates. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.

**Figure 6-6. Pneumoconiotic agents: Percent of exposures exceeding the NIOSH recommended exposure limits by state, MSHA metal/nonmetal mine samples, 1979-1999**

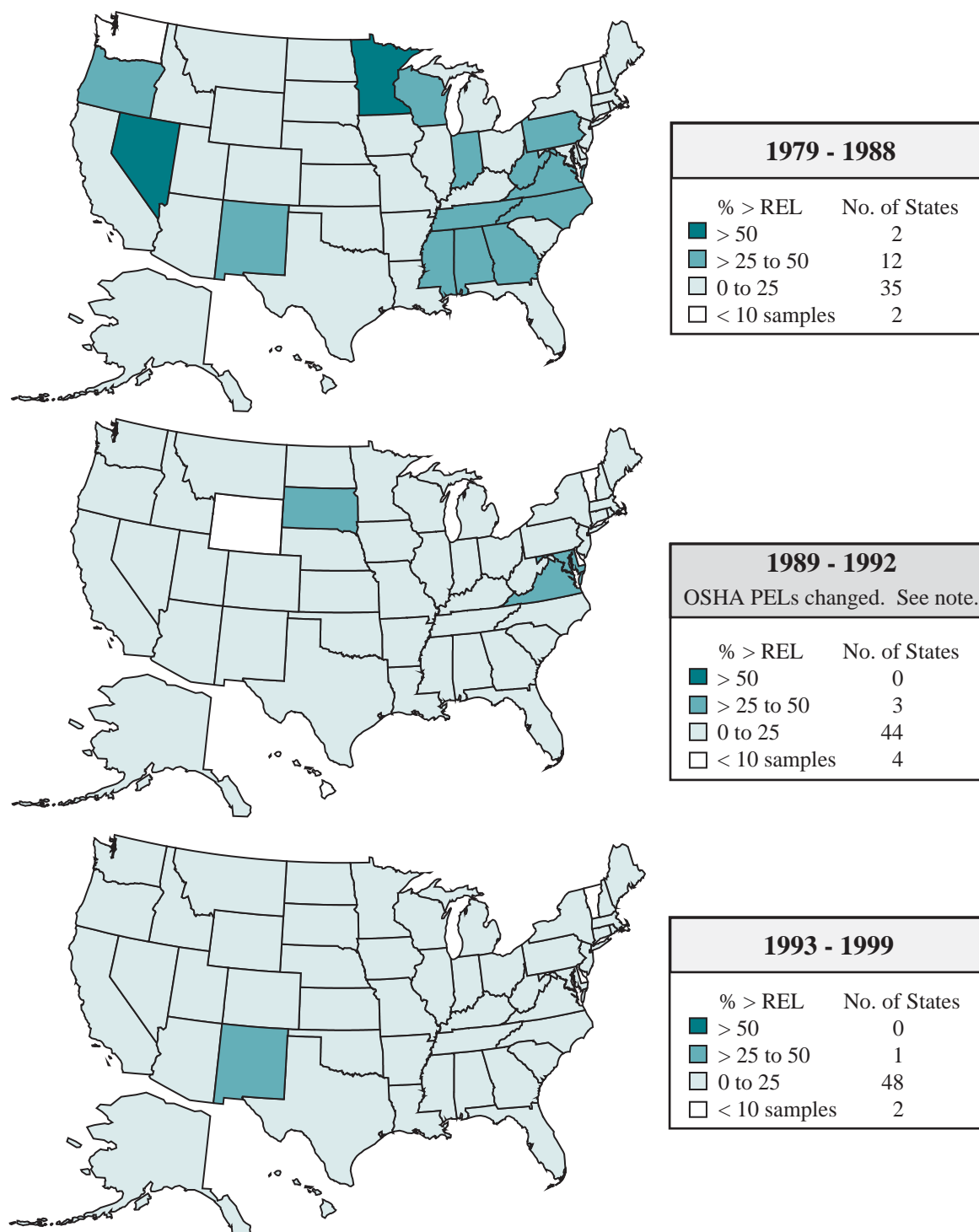


REL - recommended exposure limit

NOTE: See appendices for source description, methods, and agents.

SOURCE: Mine Safety and Health Administration (MSHA) metal/nonmetal mine data

**Figure 6-7. Pneumoconiotic agents: Percent of exposures exceeding the NIOSH recommended exposure limits by state, OSHA samples, 1979-1999**



REL - recommended exposure limit      PEL - permissible exposure limit

NOTE: From March 1, 1989 to March 22, 1993, the OSHA PELs in force differed from those employed before and after those dates. See appendices for source description, methods, and agents.

SOURCE: Occupational Safety and Health Administration (OSHA) Integrated Management Information System.



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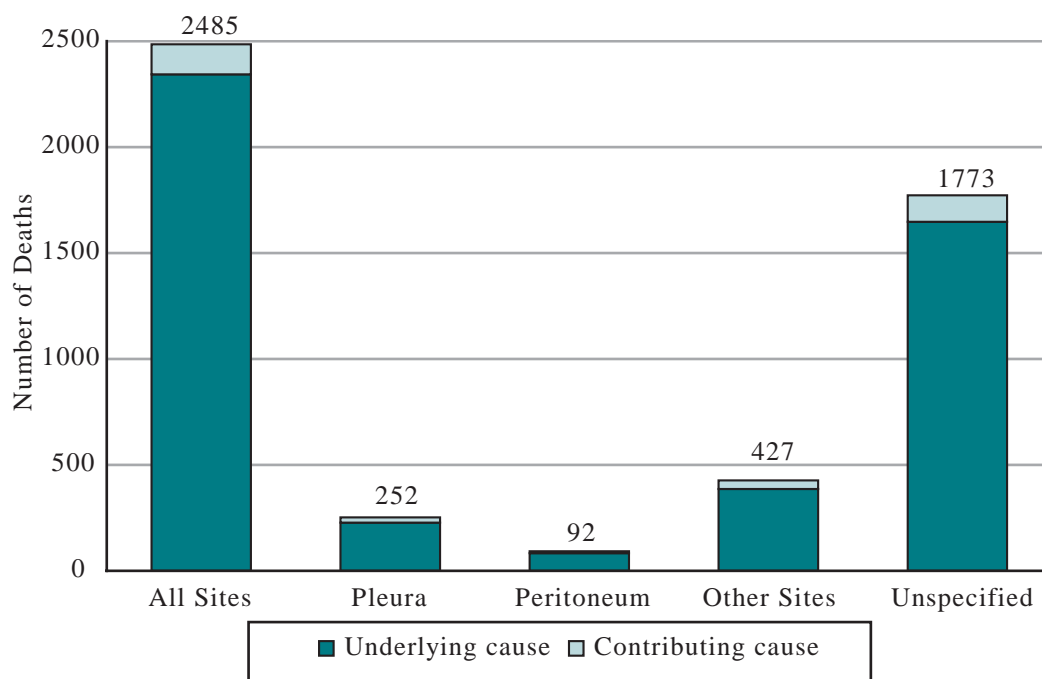
## **Section 7**

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# **Malignant Mesothelioma**



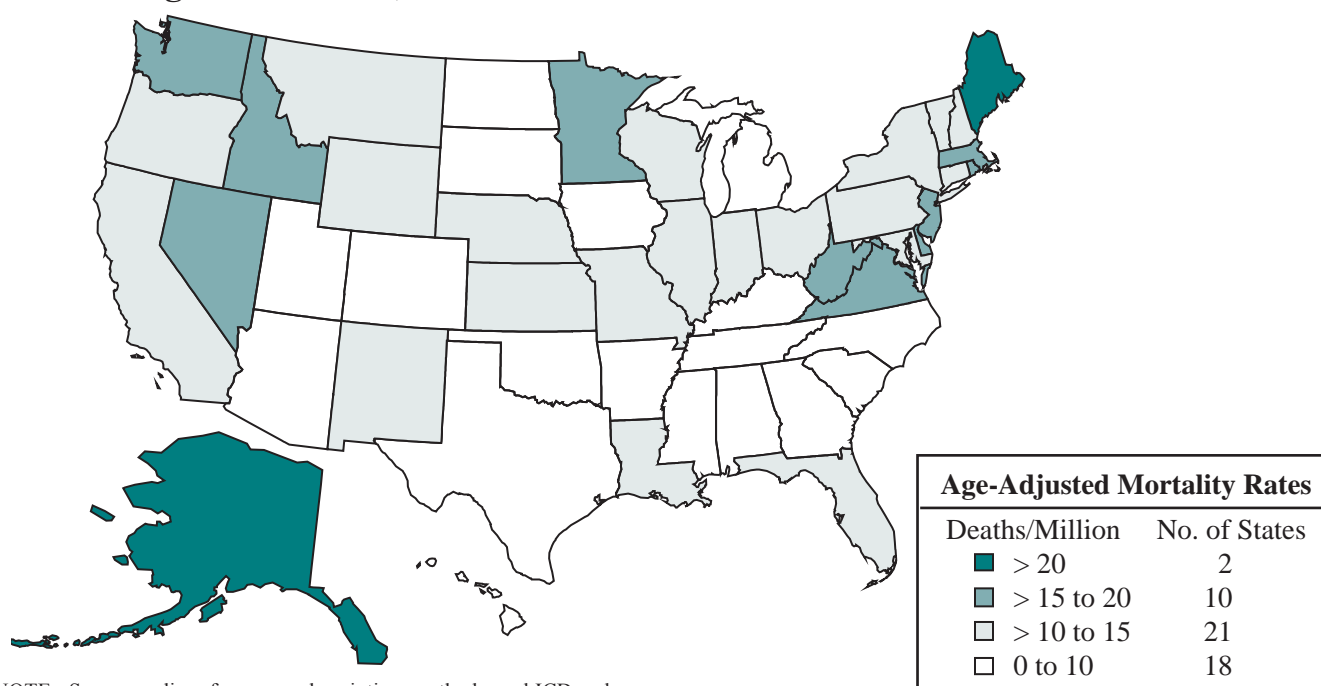
**Figure 7-1. Malignant mesothelioma: Number of deaths by anatomical site, U.S. residents age 15 and over, 1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Figure 7-2. Malignant mesothelioma: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 7-1. Malignant mesothelioma: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1999**

Site	No. of Deaths	Under-lying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
Pleura	252	90.1	219	33	240	10	2	-	-	2	12	32	101	86	19	72.0
Peritoneum	92	90.2	62	30	90	2	-	-	-	2	10	23	31	20	6	69.5
Other Sites	427	90.4	345	82	407	14	6	1	2	3	23	61	134	154	49	74.0
Unspecified	1,773	92.9	1,424	349	1,673	83	17	1	2	26	94	279	572	654	145	73.0
<b>Any Site</b>	<b>2,485</b>	<b>94.3</b>	<b>1,995</b>	<b>490</b>	<b>2,355</b>	<b>105</b>	<b>25</b>	<b>2</b>	<b>4</b>	<b>33</b>	<b>138</b>	<b>389</b>	<b>818</b>	<b>888</b>	<b>213</b>	<b>73.0</b>

- indicates no deaths listed.

NOTE: The sum of individual site death totals may be greater than the the total number of deaths for “any site” because some decedents have more than one site of mesothelioma listed on their death certificates. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 7-2. Malignant mesothelioma: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
1999	Crude Mortality Rate						
	11.60	21.93	4.95	6.43	2.02	3.61	1.53
1999	Age-Adjusted Mortality Rate						
	11.65	23.89	4.29	10.32	2.57	6.47	2.18

– indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *Malignant Mesothelioma: Mortality*

**Table 7-3. Malignant mesothelioma: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1999	3,395	1,205	320	95	25	30	5,070
	Years of Potential Life Lost to Life Expectancy						
1999	23,535	7,120	1,060	408	230	132	32,485

– indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 7-4. Malignant mesothelioma: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1999**

State	No. of Deaths    Rank		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
			Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	33	20	9.46	34	9.35	37	525	20	15.9	8
Alaska	8	45	17.53	5	32.81	1	132	44	16.5	4
Arizona	32	22	8.76	39	8.40	40	423	24	13.2	32
Arkansas	15	37	7.47	45	6.70	47	205	37	13.7	25
California	259	1	10.12	33	11.42	28	3,670	1	14.2	20
Colorado	17	35	5.35	49	6.46	48	239	36	14.1	21
Connecticut	33	20	12.77	22	11.60	27	435	23	13.2	32
Delaware	12	41	19.96	2	19.71	3	157	41	13.1	36
District of Columbia	5	47	11.45	30	11.15	29	51	51	10.2	51
Florida	163	2	13.44	19	10.16	33	2,134	2	13.1	36
Georgia	30	25	4.94	51	6.05	50	453	22	15.1	13
Hawaii	5	47	5.30	50	4.95	51	73	48	14.6	16
Idaho	14	39	14.48	14	15.33	12	192	39	13.7	25
Illinois	128	6	13.52	18	13.76	17	1,844	6	14.4	17
Indiana	58	14	12.40	25	12.53	22	916	13	15.8	10
Iowa	21	33	9.19	37	7.92	42	258	34	12.3	49
Kansas	27	28	12.97	21	12.25	24	336	30	12.4	45
Kentucky	24	30	7.58	44	7.63	43	400	27	16.7	3
Louisiana	47	19	13.83	16	14.78	14	718	16	15.3	11
Maine	28	27	27.50	1	26.40	2	363	28	13.0	38
Maryland	51	16	12.52	24	13.74	18	680	17	13.3	31
Massachusetts	81	9	16.39	8	15.40	10	1,006	11	12.4	45
Michigan	69	12	8.91	38	9.07	38	1,028	10	14.9	14
Minnesota	61	13	16.34	9	16.82	7	875	14	14.3	19
Mississippi	20	34	9.30	35	9.61	35	257	35	12.9	39
Missouri	49	17	11.35	31	10.73	31	618	19	12.6	43
Montana	10	43	14.21	15	13.38	20	124	46	12.4	45
Nebraska	15	37	11.50	29	10.77	30	191	40	12.7	41
Nevada	22	31	15.79	11	17.73	4	280	32	12.7	41
New Hampshire	11	42	11.58	28	12.31	23	147	42	13.4	30
New Jersey	111	8	17.20	6	16.30	8	1,515	8	13.6	27
New Mexico	17	35	12.77	22	13.05	21	362	29	21.3	1
New York	156	4	10.79	32	10.46	32	2,121	3	13.6	27
North Carolina	56	15	9.30	35	9.45	36	773	15	13.8	24
North Dakota	4	50	7.92	43	7.37	45	53	50	13.2	32
Ohio	131	5	14.70	12	14.26	15	2,005	5	15.3	11
Oklahoma	22	31	8.34	41	7.93	41	262	33	11.9	50
Oregon	32	22	12.14	26	11.66	25	405	25	12.6	43
Pennsylvania	162	3	16.80	7	14.14	16	2,095	4	12.9	39
Rhode Island	14	39	17.74	4	15.56	9	202	38	14.4	17
South Carolina	26	29	8.40	40	8.79	39	322	31	12.4	45
South Dakota	4	50	6.98	47	6.36	49	65	49	16.2	6
Tennessee	31	24	7.09	46	7.30	46	499	21	16.1	7
Texas	125	7	8.19	42	9.62	34	1,832	7	14.7	15
Utah	9	44	5.83	48	7.52	44	143	43	15.9	8
Vermont	7	46	14.55	13	14.85	13	128	45	18.2	2
Virginia	75	10	13.67	17	15.36	11	1,047	9	14.0	22
Washington	72	11	15.90	10	17.29	6	947	12	13.2	32
West Virginia	29	26	19.59	3	17.37	5	402	26	13.9	23
Wisconsin	49	17	11.80	27	11.61	26	663	18	13.5	29
Wyoming	5	47	13.20	20	13.73	19	83	47	16.5	4

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## ***Malignant Mesothelioma: Mortality***

**Table 7-5. Malignant mesothelioma: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states, 1999**

<b>CIC</b>	<b>Industry</b>	<b>Number of Deaths</b>	<b>Percent</b>
060	Construction	77	14.2
961	Non-paid worker or non-worker or own home/at home	38	7.0
842	Elementary and secondary schools	20	3.7
192	Industrial and miscellaneous chemicals	19	3.5
901	General government, n.e.c.	13	2.4
010	Agricultural production, crops	10	1.9
392	Not specified manufacturing industries	10	1.9
460	Electric light and power	10	1.9
400	Railroads	9	1.7
831	Hospitals	9	1.7
	All other industries	303	56.0
	Industry not reported	23	4.3
	<b>TOTAL</b>	<b>541</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 7-6. Malignant mesothelioma: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states, 1999**

<b>COC</b>	<b>Occupation</b>	<b>Number of Deaths</b>	<b>Percent</b>
019	Managers and administrators, n.e.c.	41	7.6
914	Housewife/Homemaker	37	6.8
585	Plumbers, pipefitters, and steamfitters	18	3.3
453	Janitors and cleaners	17	3.1
243	Supervisors and proprietors, sales occupations	16	3.0
567	Carpenters	16	3.0
156	Teachers, elementary school	13	2.4
473	Farmers, except horticulture	12	2.2
575	Electricians	12	2.2
633	Supervisors, production occupations	12	2.2
804	Truck drivers	12	2.2
	All other occupations	307	56.8
	Occupation not reported	28	5.2
	<b>TOTAL</b>	<b>541</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 7-7. Malignant mesothelioma: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states, 1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
360	Ship and boat building and repairing	7	5.95	2.39	12.27
192	Industrial and miscellaneous chemicals	19	4.81	2.90	7.51
200	Petroleum refining	5	3.80	1.23	8.87
460	Electric light and power	10	3.08	1.48	5.66
060	Construction	77	1.55	1.23	1.94

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

## ***Malignant Mesothelioma: Mortality***

**Table 7-8. Malignant mesothelioma: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states, 1999**

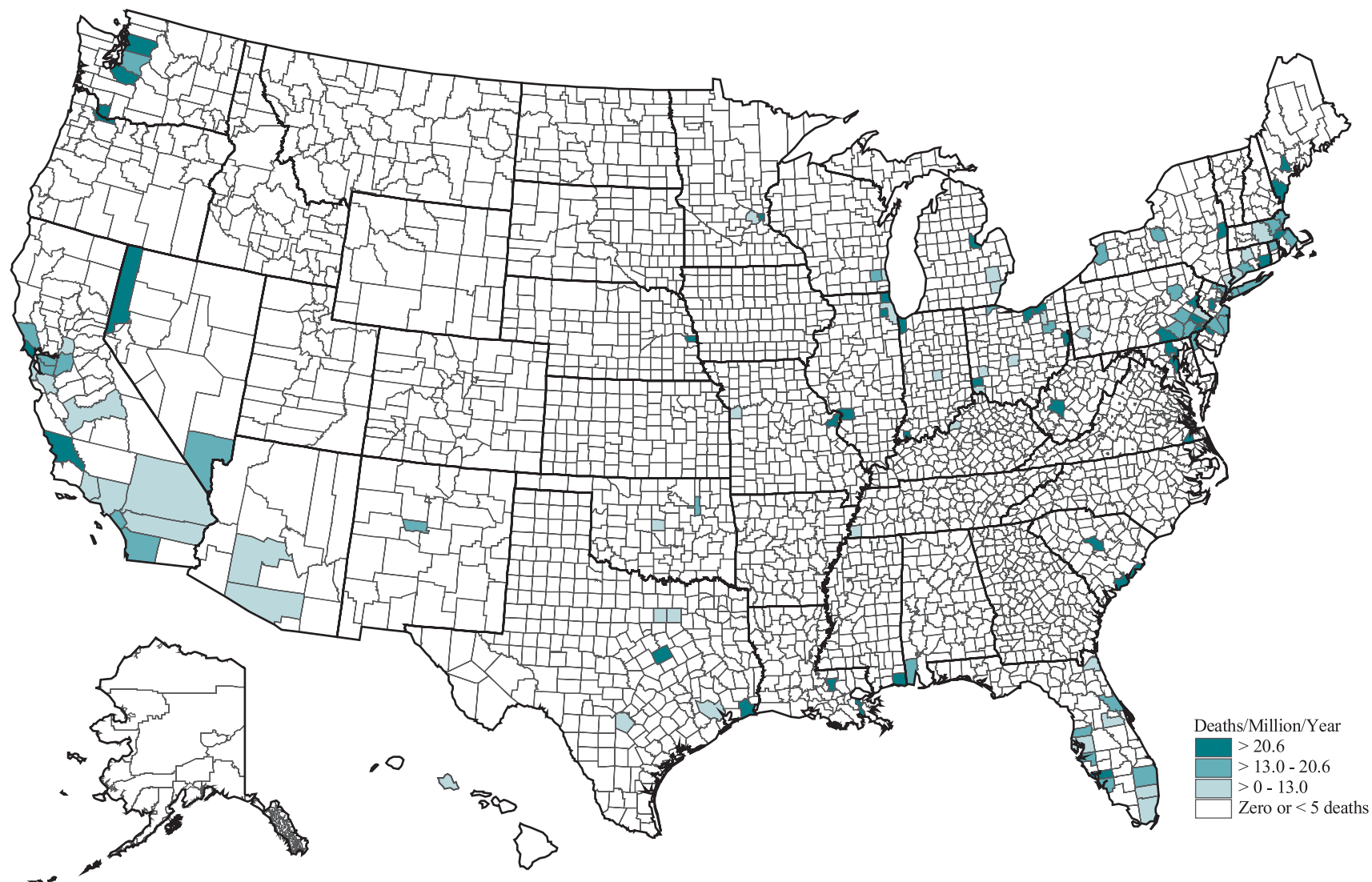
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
585	Plumbers, pipefitters, and steamfitters	18	4.76	2.81	7.51
057	Mechanical engineers	6	3.04	1.11	6.62
575	Electricians	12	2.42	1.25	4.22
156	Teachers, elementary school	13	2.13	1.13	3.64

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Figure 7-3. Malignant mesothelioma: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.  
 SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *Malignant Mesothelioma: Mortality*

**Table 7-9. Malignant mesothelioma: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Suffolk City	Virginia	111.7	99.5	5	40.0
Hampton City	Virginia	95.9	82.6	9	0.0
Jefferson County	Ohio	90.1	115.6	7	0.0
Androscoggin County	Maine	82.2	85.7	7	57.1
Somerset County	New Jersey	73.9	64.7	15	33.3
Jackson County	Mississippi	70.0	48.4	5	20.0
Bay County	Michigan	63.1	69.3	6	0.0
Kanawha County	West Virginia	45.6	54.4	9	22.2
York County	Maine	42.1	42.0	6	33.3
Rensselaer County	New York	40.3	41.5	5	40.0
Jefferson Parish	Louisiana	39.9	39.2	14	42.9
Washoe County	Nevada	37.8	32.0	8	12.5
Lake County	Illinois	35.8	27.5	13	30.8
Lorain County	Ohio	34.1	31.7	7	42.9
Vanderburgh County	Indiana	33.3	37.0	5	0.0
Norfolk County	Massachusetts	32.5	36.0	19	0.0
McLennan County	Texas	31.8	31.4	5	40.0
Delaware County	Pennsylvania	31.1	36.7	16	25.0
Pierce County	Washington	30.6	26.2	14	7.1
Douglas County	Nebraska	30.0	25.7	9	33.3
Jefferson County	Texas	29.6	31.7	6	33.3
Anne Arundel County	Maryland	28.2	23.8	9	22.2
San Luis Obispo County	California	27.2	31.4	6	0.0
Camden County	New Jersey	26.2	26.2	10	30.0
Madison County	Illinois	26.1	29.3	6	0.0
Clark County	Washington	25.8	19.3	5	40.0
Northampton County	Pennsylvania	25.6	28.7	6	0.0
New London County	Connecticut	25.5	26.1	5	0.0
Butler County	Ohio	25.3	22.8	6	33.3
Richland County	South Carolina	25.0	20.0	5	20.0
Baltimore County	Maryland	24.7	28.9	17	23.5
Marin County	California	24.6	25.0	5	40.0
St. Louis County	Missouri	23.4	25.0	20	20.0
York County	Pennsylvania	22.7	23.3	7	0.0
Charleston County	South Carolina	22.7	19.6	5	0.0
Ramsey County	Minnesota	22.6	23.4	9	11.1
Snohomish County	Washington	22.2	17.3	8	12.5
Du Page County	Illinois	21.9	18.7	13	15.4
Charlotte County	Florida	21.3	50.8	6	50.0
Multnomah County	Oregon	21.2	19.5	10	0.0
East Baton Rouge Parish	Louisiana	21.0	16.1	5	20.0
Cuyahoga County	Ohio	20.7	23.6	26	23.1
Lake County	Indiana	20.6	21.5	8	37.5
Montgomery County	Pennsylvania	20.6	25.4	15	6.7
Union County	New Jersey	19.9	22.4	9	0.0
Manatee County	Florida	19.8	35.1	7	42.9
Chester County	Pennsylvania	19.0	17.6	6	33.3
Philadelphia County	Pennsylvania	19.0	21.5	24	12.5
Waukesha County	Wisconsin	19.0	17.5	5	0.0
New Castle County	Delaware	18.8	18.0	7	14.3
<b>Overall United States</b>		<b>11.6</b>	<b>11.6</b>	<b>2,485</b>	<b>19.7</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.  
SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

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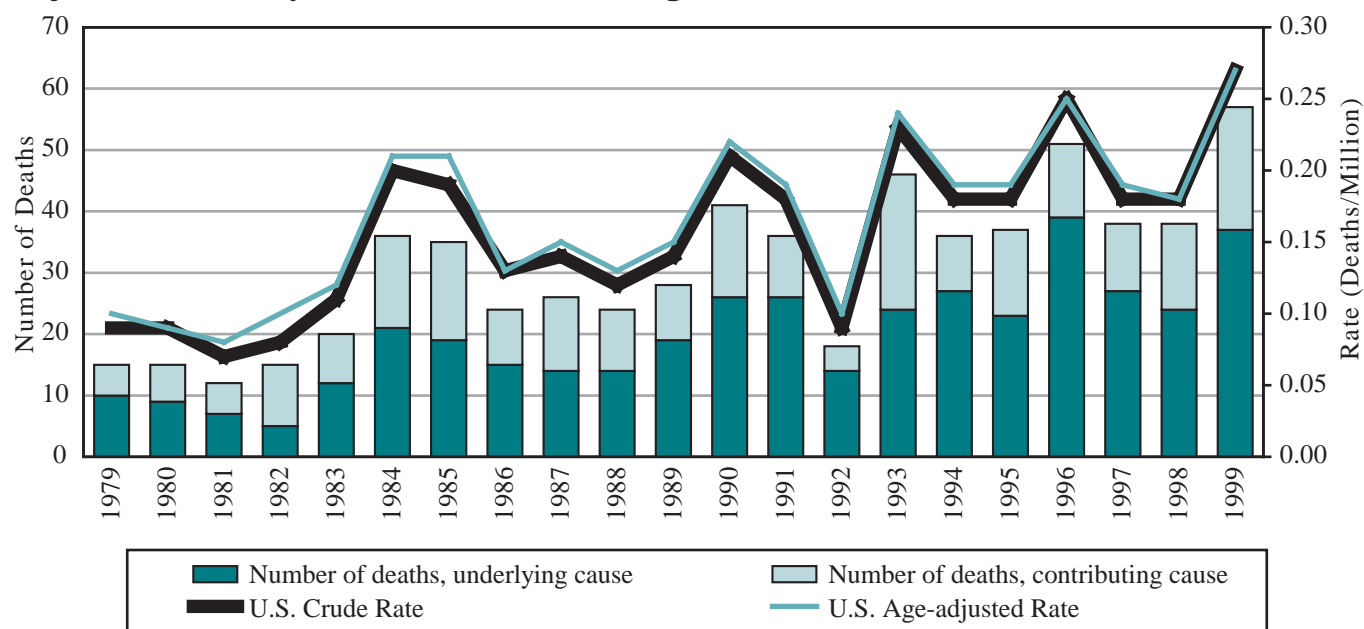
## **Section 8**

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# **Hypersensitivity Pneumonitis**



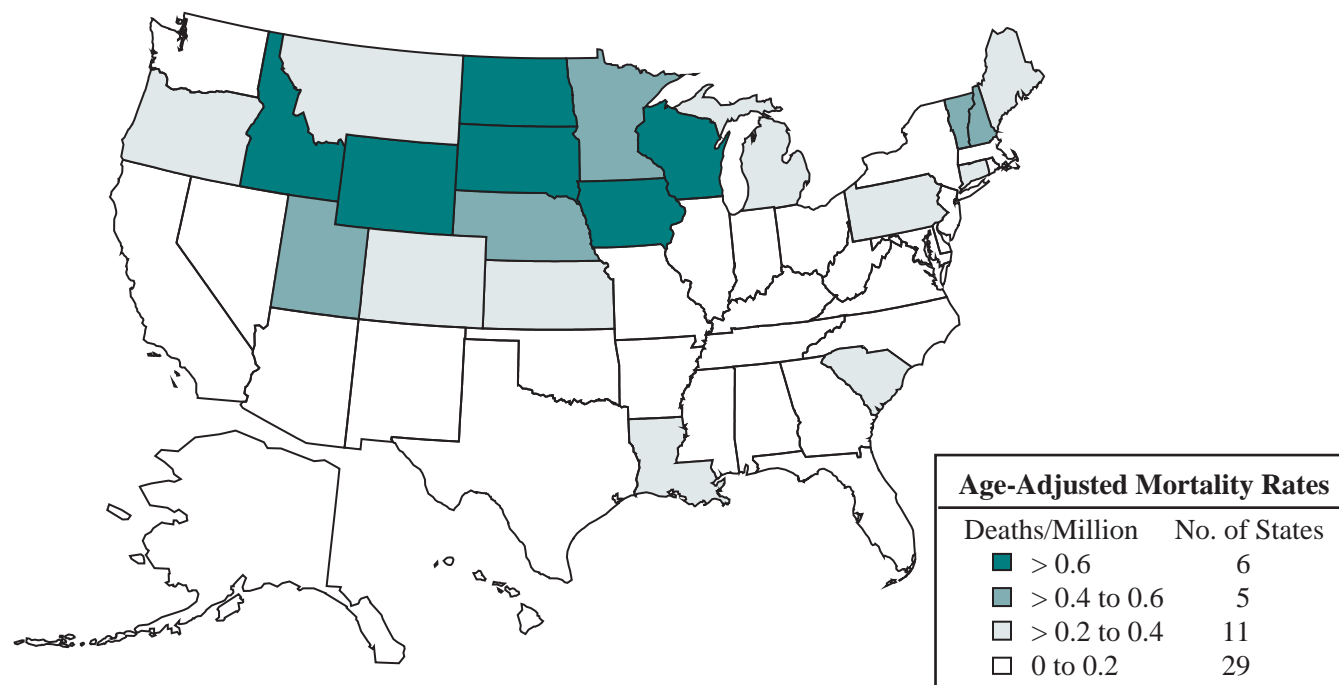
**Figure 8-1. Hypersensitivity pneumonitis: Number of deaths, crude and age-adjusted mortality rates, U.S. residents age 15 and over, 1979-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Figure 8-2. Hypersensitivity pneumonitis: Age-adjusted mortality rates by state, U.S. residents age 15 and over, 1990-1999**



NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 8-1. Hypersensitivity pneumonitis: Number of deaths by sex, race, and age, and median age at death, U.S. residents age 15 and over, 1990-1999**

Year	No. of Deaths	Underlying Cause (%)	Sex		Race			Age Group (yrs)								Median Age (yrs)
			Male	Female	White	Black	Other	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	
1990	41	63.4	31	10	38	1	2	-	1	1	3	8	11	15	2	73.0
1991	36	72.2	28	8	34	-	2	2	-	1	2	4	11	11	5	73.5
1992	18	77.8	14	4	17	1	-	-	1	2	2	2	3	7	1	72.5
1993	46	52.2	31	15	44	1	1	-	1	1	4	7	14	14	5	71.5
1994	36	75.0	28	8	36	-	-	-	-	-	2	5	8	12	9	76.5
1995	37	62.2	24	13	32	5	-	-	1	-	6	4	7	14	5	75.0
1996	51	76.5	35	16	49	2	-	-	3	3	5	7	11	16	6	73.0
1997	38	71.1	25	13	38	-	-	-	-	1	2	6	8	14	7	76.0
1998	38	63.2	31	7	37	1	-	-	-	-	2	3	10	17	6	78.5
1999	57	64.9	36	21	56	1	-	-	3	2	9	5	11	19	8	74.0
<b>TOTAL</b>	<b>398</b>	<b>67.1</b>	<b>283</b>	<b>115</b>	<b>381</b>	<b>12</b>	<b>5</b>	<b>2</b>	<b>10</b>	<b>11</b>	<b>37</b>	<b>51</b>	<b>94</b>	<b>139</b>	<b>54</b>	<b>74.0</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.



**Table 8-2. Hypersensitivity pneumonitis: Mortality rates (per million population) by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	Overall	White		Black		Other	
		Male	Female	Male	Female	Male	Female
	Crude Mortality Rate						
1990	0.21	0.36	0.11	0.10	—	0.29	0.27
1991	0.18	0.32	0.09	—	—	0.55	—
1992	0.09	0.16	0.05	0.09	—	—	—
1993	0.23	0.38	0.15	—	0.08	—	0.24
1994	0.18	0.34	0.09	—	—	—	—
1995	0.18	0.26	0.11	0.18	0.23	—	—
1996	0.25	0.40	0.17	0.09	0.08	—	—
1997	0.18	0.29	0.14	—	—	—	—
1998	0.18	0.35	0.08	0.08	—	—	—
1999	0.27	0.40	0.23	0.08	—	—	—
1990-1999	0.19	0.33	0.12	0.06	0.04	0.07	0.04
	Age-Adjusted Mortality Rate						
1990	0.22	0.41	0.09	0.07	—	0.42	0.34
1991	0.19	0.40	0.08	—	—	0.95	—
1992	0.10	0.18	0.05	0.20	—	—	—
1993	0.24	0.45	0.13	—	0.11	—	0.54
1994	0.19	0.43	0.08	—	—	—	—
1995	0.19	0.33	0.10	0.31	0.28	—	—
1996	0.25	0.46	0.14	0.07	0.09	—	—
1997	0.19	0.35	0.12	—	—	—	—
1998	0.18	0.40	0.06	0.10	—	—	—
1999	0.27	0.46	0.20	0.10	—	—	—
1990-1999	0.20	0.39	0.11	0.09	0.05	0.12	0.08

— indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

## *Hypersensitivity Pneumonitis: Mortality*

**Table 8-3. Hypersensitivity pneumonitis: Years of potential life lost to age 65 and to life expectancy by race and sex, U.S. residents age 15 and over, 1990-1999**

Year	White		Black		Other		Total
	Male	Female	Male	Female	Male	Female	
	Years of Potential Life Lost to Age 65						
1990	95	5	35	-	5	5	145
1991	75	45	-	-	45	-	165
1992	85	40	-	-	-	-	125
1993	115	25	-	15	-	-	155
1994	40	15	-	-	-	-	55
1995	85	35	-	25	-	-	145
1996	190	65	35	-	-	-	290
1997	40	45	-	-	-	-	85
1998	30	-	15	-	-	-	45
1999	190	110	15	-	-	-	315
TOTAL	945	385	100	40	50	5	1,525
	Years of Potential Life Lost to Life Expectancy						
1990	396	103	38	-	21	21	579
1991	344	134	-	-	65	-	543
1992	218	92	7	-	-	-	317
1993	425	196	-	28	-	8	657
1994	301	100	-	-	-	-	401
1995	280	162	18	70	-	-	530
1996	542	242	39	14	-	-	837
1997	283	202	-	-	-	-	485
1998	311	78	24	-	-	-	413
1999	531	387	24	-	-	-	942
TOTAL	3,631	1,696	150	112	86	29	5,704

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 8-4. Hypersensitivity pneumonitis: Number of deaths by state, U.S. residents age 15 and over, 1990-1999**

State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
Alabama	-	2	-	-	-	-	-	1	-	-	3
Alaska	-	-	-	-	-	-	-	-	-	-	-
Arizona	-	1	1	-	-	-	1	2	-	-	5
Arkansas	-	-	-	-	1	-	-	-	-	-	1
California	2	1	1	6	3	2	7	7	4	6	39
Colorado	-	1	-	1	1	1	-	1	-	1	6
Connecticut	1	2	1	-	-	-	1	1	-	1	7
Delaware	-	-	-	-	1	-	-	-	-	-	1
District of Columbia	-	-	1	-	-	-	-	-	-	-	1
Florida	-	1	-	3	5	1	2	1	1	2	16
Georgia	-	-	-	-	1	-	-	-	1	-	2
Hawaii	-	-	-	-	-	-	-	-	-	-	-
Idaho	-	1	1	-	1	-	-	-	4	-	7
Illinois	1	1	1	2	1	2	1	-	2	3	14
Indiana	1	1	-	-	1	1	1	1	-	2	8
Iowa	1	1	1	2	-	3	2	3	7	2	22
Kansas	1	-	-	-	2	1	2	-	-	2	8
Kentucky	-	1	-	1	-	1	-	-	-	-	3
Louisiana	4	-	-	-	1	-	2	-	-	-	7
Maine	-	1	-	-	-	-	1	1	-	1	4
Maryland	1	-	1	-	1	1	-	-	-	1	5
Massachusetts	1	-	-	1	-	-	-	-	-	-	2
Michigan	5	1	2	-	2	2	2	2	2	3	21
Minnesota	2	3	2	1	3	1	2	1	1	3	19
Mississippi	-	-	-	-	-	-	-	-	-	-	-
Missouri	-	1	1	1	-	-	2	-	-	2	7
Montana	-	-	-	-	1	-	1	-	-	-	2
Nebraska	1	1	1	-	2	-	2	-	-	1	8
Nevada	-	-	-	-	-	-	-	-	-	-	-
New Hampshire	1	1	-	-	-	1	-	-	1	-	4
New Jersey	-	1	1	-	-	-	1	-	-	2	5
New Mexico	-	-	-	-	-	-	-	-	-	-	-
New York	3	1	1	4	2	3	3	1	-	3	21
North Carolina	-	-	-	1	1	1	1	4	1	-	9
North Dakota	1	1	-	1	-	-	-	1	-	-	4
Ohio	-	2	1	-	-	2	2	-	2	3	12
Oklahoma	-	1	-	1	-	-	-	-	-	-	2
Oregon	1	-	-	1	1	2	-	2	2	-	9
Pennsylvania	5	1	-	3	2	4	4	1	3	1	24
Rhode Island	-	-	-	1	-	-	-	-	-	-	1
South Carolina	1	-	-	2	-	1	1	-	1	1	7
South Dakota	1	-	-	2	-	-	-	-	2	-	5
Tennessee	-	1	-	-	-	-	1	-	-	-	2
Texas	-	2	-	1	1	2	1	1	1	5	14
Utah	-	-	-	1	1	-	-	-	1	2	5
Vermont	-	1	-	1	-	-	-	-	-	-	2
Virginia	-	-	-	2	-	-	1	-	-	1	4
Washington	-	-	-	-	-	2	-	1	-	-	3
West Virginia	-	-	-	-	-	-	1	-	-	-	1
Wisconsin	7	3	1	7	1	3	6	6	2	7	43
Wyoming	-	1	-	-	-	-	-	-	-	2	3
<b>TOTAL</b>	<b>41</b>	<b>36</b>	<b>18</b>	<b>46</b>	<b>36</b>	<b>37</b>	<b>51</b>	<b>38</b>	<b>38</b>	<b>57</b>	<b>398</b>

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Hypersensitivity Pneumonitis: Mortality

**Table 8-5. Hypersensitivity pneumonitis: Number of deaths, mortality rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1990-1999**

State	No. of Deaths    Rank		Crude Mortality		Age-Adjusted Mortality		YPLL to Life Expectancy			
			Rate	Rank	Rate	Rank	Total	Rank	YPLL/death	Rank
Alabama	3	32	0.09	37	0.10	36	53	30	17.7	15
Alaska	-	-	-	-	-	-	-	-	-	-
Arizona	5	23	0.15	28	0.14	31	107	17	21.4	4
Arkansas	1	42	0.05	43	0.05	43	21	40	21.0	6
California	39	2	0.16	26	0.18	23	751	1	19.3	11
Colorado	6	22	0.21	21	0.25	19	103	19	17.2	16
Connecticut	7	17	0.27	17	0.27	17	158	12	22.6	3
Delaware	1	42	0.18	23	0.18	23	21	40	21.0	6
District of Columbia	1	42	0.22	20	0.24	20	9	45	9.0	42
Florida	16	8	0.14	31	0.12	33	220	8	13.8	24
Georgia	2	36	0.04	45	0.05	43	17	43	8.5	44
Hawaii	-	-	-	-	-	-	-	-	-	-
Idaho	7	17	0.81	6	0.80	4	83	26	11.9	34
Illinois	14	9	0.15	28	0.16	27	199	10	14.2	21
Indiana	8	14	0.18	23	0.18	23	106	18	13.3	27
Iowa	22	4	0.99	2	0.84	3	279	5	12.7	30
Kansas	8	14	0.41	11	0.39	13	124	14	15.5	19
Kentucky	3	32	0.10	35	0.10	36	64	29	21.3	5
Louisiana	7	17	0.21	21	0.23	21	124	14	17.7	14
Maine	4	28	0.41	11	0.40	12	53	30	13.3	27
Maryland	5	23	0.13	33	0.15	28	94	24	18.8	13
Massachusetts	2	36	0.04	45	0.04	46	28	36	14.0	22
Michigan	21	5	0.28	16	0.31	15	332	3	15.8	18
Minnesota	19	7	0.54	8	0.53	8	225	7	11.8	36
Mississippi	-	-	-	-	-	-	-	-	-	-
Missouri	7	17	0.17	25	0.15	28	83	26	11.9	34
Montana	2	36	0.30	15	0.27	17	22	39	11.0	40
Nebraska	8	14	0.64	7	0.57	7	97	22	12.1	32
Nevada	-	-	-	-	-	-	-	-	-	-
New Hampshire	4	28	0.44	9	0.47	9	48	33	12.0	33
New Jersey	5	23	0.08	38	0.08	39	120	16	24.0	2
New Mexico	-	-	-	-	-	-	-	-	-	-
New York	21	5	0.15	28	0.15	28	266	6	12.7	31
North Carolina	9	12	0.16	26	0.18	23	103	19	11.4	38
North Dakota	4	28	0.82	5	0.78	5	139	13	34.8	1
Ohio	12	11	0.14	31	0.14	31	165	11	13.8	24
Oklahoma	2	36	0.08	38	0.07	41	14	44	7.0	46
Oregon	9	12	0.37	13	0.37	14	100	21	11.1	39
Pennsylvania	24	3	0.25	18	0.22	22	315	4	13.1	29
Rhode Island	1	42	0.13	33	0.11	35	8	46	8.0	45
South Carolina	7	17	0.25	18	0.28	16	93	25	13.3	26
South Dakota	5	23	0.91	3	0.73	6	51	32	10.2	41
Tennessee	2	36	0.05	43	0.05	43	38	34	19.0	12
Texas	14	9	0.10	35	0.12	33	203	9	14.5	20
Utah	5	23	0.37	13	0.44	10	97	22	19.4	10
Vermont	2	36	0.44	9	0.44	10	28	36	14.0	22
Virginia	4	28	0.08	38	0.09	38	82	28	20.5	9
Washington	3	32	0.07	41	0.08	39	26	38	8.7	43
West Virginia	1	42	0.07	41	0.07	41	21	40	21.0	6
Wisconsin	43	1	1.09	1	1.05	1	680	2	15.8	17
Wyoming	3	32	0.84	4	0.94	2	35	35	11.7	37

- indicates no deaths listed.

NOTE: See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.

**Table 8-6. Hypersensitivity pneumonitis: Most frequently recorded industries on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	Percent
011	Agricultural production, livestock	30	24.6
010	Agricultural production, crops	22	18.0
961	Non-paid worker or non-worker or own home/at home	13	10.7
060	Construction	4	3.3
410	Trucking service	4	3.3
831	Hospitals	4	3.3
142	Yarn, thread, and fabric mills	3	2.5
630	Apparel and accessory stores, except shoe	3	2.5
601	Grocery stores	2	1.6
842	Elementary and secondary schools	2	1.6
850	Colleges and universities	2	1.6
942	Military	2	1.6
	All other industries	23	18.9
	Industry not reported	8	6.6
	<b>TOTAL</b>	<b>122</b>	<b>100.0</b>

CIC - Census Industry Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 8-7. Hypersensitivity pneumonitis: Most frequently recorded occupations on death certificate, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	Percent
473	Farmers, except horticulture	51	41.8
914	Housewife/Homemaker	12	9.8
019	Managers and administrators, n.e.c.	4	3.3
633	Supervisors, production occupations	3	2.5
804	Truck drivers	3	2.5
095	Registered nurses	2	1.6
243	Supervisors and proprietors, sales occupations	2	1.6
637	Machinists	2	1.6
889	Laborers, except construction	2	1.6
905	Military occupations	2	1.6
	All other occupations	32	26.2
	Occupation not reported	7	5.7
	<b>TOTAL</b>	<b>122</b>	<b>100.0</b>

COC - Census Occupation Code

n.e.c. - not elsewhere classified

NOTE: Percentages may not total to 100% due to rounding. See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Hypersensitivity Pneumonitis: Mortality*

**Table 8-8. Hypersensitivity pneumonitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
011	Agricultural production, livestock	30	17.61	11.90	25.15
010	Agricultural production, crops	22	4.44	2.78	6.73

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 8-9. Hypersensitivity pneumonitis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

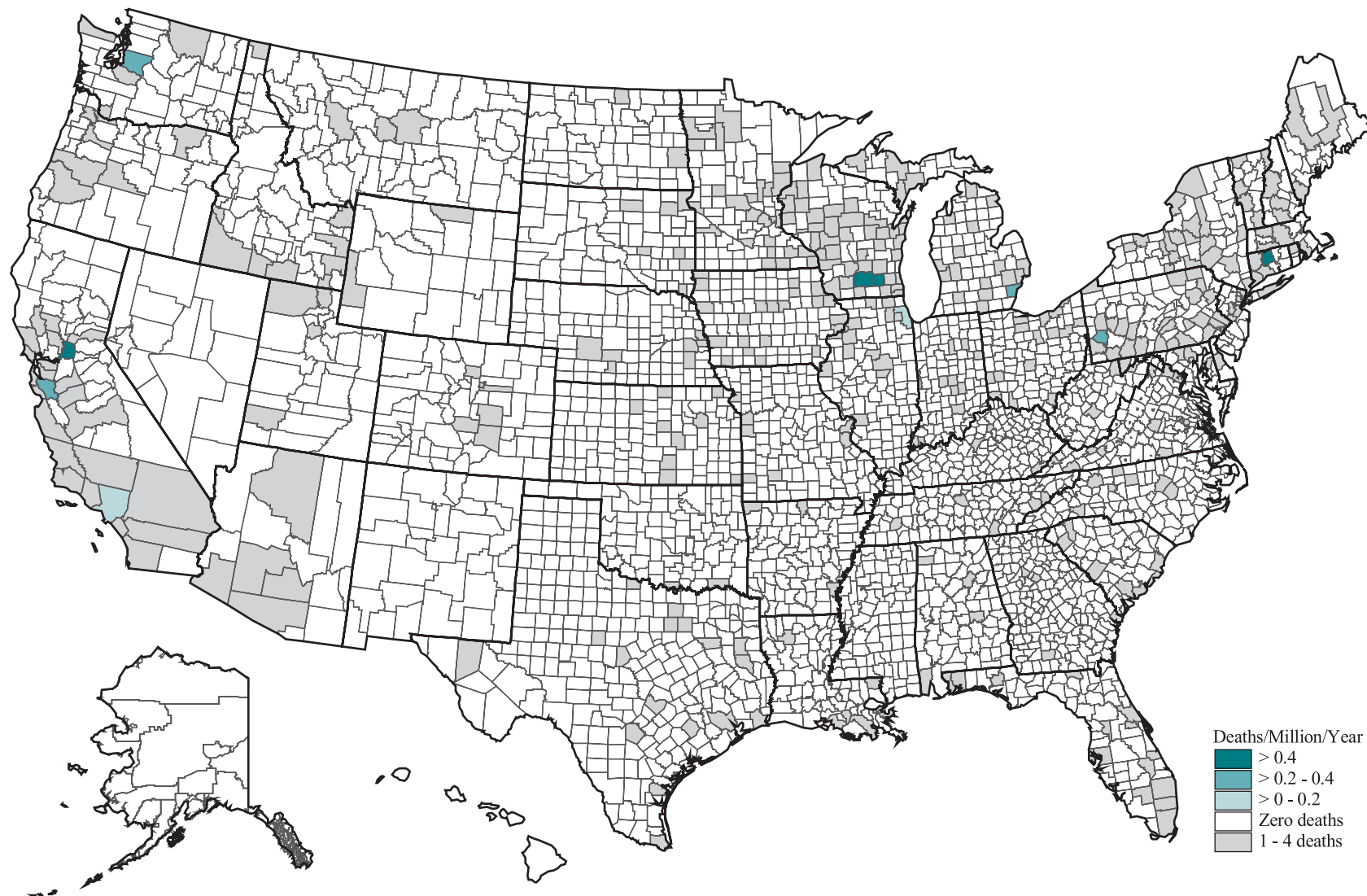
COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
473	Farmers, except horticulture	51	8.51	6.42	11.32

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

180 **Figure 8-3. Hypersensitivity pneumonitis: Age-adjusted mortality rates by county, U.S. residents age 15 and over, 1980-1999**



NOTE: Age-adjusted rates are not calculated for those counties with 1-4 deaths. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



**Table 8-10. Hypersensitivity pneumonitis: Counties with highest age-adjusted mortality rates (per million population), U.S. residents age 15 and over, 1985-1999**

County	State	Age-Adjusted Rate	Crude Rate	Number of Deaths	% Female
Jefferson County	Wisconsin	6.9	7.4	6	0.0
Dane County	Wisconsin	1.5	1.1	5	0.0
Hartford County	Connecticut	0.7	0.7	7	42.9
Sacramento County	California	0.5	0.5	6	33.3
Wayne County	Michigan	0.3	0.2	6	50.0
Allegheny County	Pennsylvania	0.2	0.3	5	40.0
Los Angeles County	California	0.1	0.1	11	54.5
Cook County	Illinois	0.1	0.1	6	50.0
<b>Overall United States</b>		<b>0.2</b>	<b>0.2</b>	<b>535</b>	<b>29.9</b>

NOTE: Only counties with at least 5 deaths from the disease of interest are included. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics multiple cause of death data. Population estimates from U.S. Bureau of the Census.



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# **Section 9**

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## **Asthma**



**Table 9-1. Asthma: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
011	Agricultural production, livestock	272	1.51	1.34	1.71
311	Farm machinery and equipment	28	1.51	1.01	2.18
862	Child day care services	68	1.40	1.09	1.78
642	Drug stores	83	1.32	1.06	1.64
840	Health services, n.e.c.	228	1.29	1.13	1.47
850	Colleges and universities	268	1.25	1.11	1.41
812	Offices and clinics of physicians	119	1.21	1.01	1.45
771	Laundry, cleaning, and garment services	177	1.17	1.01	1.36
831	Hospitals	1,102	1.14	1.07	1.21
901	General government, n.e.c.	498	1.13	1.03	1.23
010	Agricultural production, crops	684	1.10	1.02	1.18
961	Non-paid worker or non-worker or own home/at home	9,047	1.06	1.04	1.08

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Asthma: Mortality*

**Table 9-2. Asthma: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
098	Respiratory therapists	13	3.11	1.65	5.31
169	Social scientists, n.e.c.	8	2.88	1.24	5.67
758	Compressing and compacting machine operators	9	2.78	1.28	5.28
028	Purchasing agents and buyers, farm products	10	2.21	1.06	4.06
089	Health diagnosing practitioners, n.e.c.	11	2.20	1.10	3.94
197	Public relations specialists	17	2.09	1.21	3.34
317	Hotel clerks	13	2.02	1.07	3.45
085	Dentists	25	1.84	1.19	2.72
154	Postsecondary teachers, subject not specified	61	1.59	1.23	2.06
203	Clinical laboratory technologists and technicians	47	1.43	1.05	1.90
186	Musicians and composers	47	1.43	1.05	1.90
446	Health aides, except nursing	52	1.39	1.05	1.85
015	Managers, medicine and health	46	1.37	1.00	1.83
686	Butchers and meat cutters	64	1.33	1.04	1.72
915	Student	313	1.29	1.15	1.44
055	Electrical and electronic engineers	69	1.28	1.00	1.63
157	Teachers, secondary school	86	1.26	1.01	1.56
473	Farmers, except horticulture	791	1.21	1.13	1.30
917	Unemployed, never worked, disabled	599	1.19	1.10	1.29
207	Licensed practical nurses	152	1.18	1.01	1.39
095	Registered nurses	455	1.17	1.07	1.29
447	Nursing aides, orderlies, and attendants	461	1.15	1.05	1.26
914	Housewife/Homemaker	8,145	1.04	1.02	1.06

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

**Table 9-3. Work-related asthma: Number of cases by classification and state, 1993-1999**

Classification	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Work-aggravated asthma*	328	35.7	34	9.2	124	11.7	22	12.2	508	20.1
New-onset asthma <sup>†</sup>	590	64.2	334	90.7	936	88.3	158	87.7	2,018	79.9
<i>Reactive airways dysfunction syndrome (RADS)</i>	60	6.5	34	9.2	97	9.2	47	26.1	238	9.4
<i>Occupational asthma (OA)</i>	530	57.7	300	81.5	839	79.1	111	61.6	1,780	70.5
Known asthma inducer <sup>‡</sup> with objective evidence	-	-	-	-	19	1.8	2	1.1	21	0.8
Known asthma inducer with no objective evidence	91	9.9	104	28.3	382	36.0	47	26.1	624	24.7
Other	439	47.8	196	53.2	438	41.3	62	34.4	1,135	44.9
<b>TOTAL</b>	<b>918</b>	<b>100.0</b>	<b>368</b>	<b>100.0</b>	<b>1,060</b>	<b>100.0</b>	<b>180</b>	<b>100.0</b>	<b>2,526</b>	<b>100.0</b>

- indicates no cases reported.

\* Pre-existing asthma aggravated by exposure or condition at work.

<sup>†</sup> Includes cases of RADS and OA.

<sup>‡</sup> Known asthma inducers, defined by medical literature review, are designated in the Association of Occupational and Environmental Clinics (AOEC) exposure coding scheme ([www.aoec.org/aoeccode.htm](http://www.aoec.org/aoeccode.htm)).

.NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).

## Work-Related Asthma: *SENSOR*

**Table 9-4. Work-related asthma: Number of cases by ascertainment source and state, 1993-1999**

Source	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Physician Report*	918	100.0	363	98.6	806	76.0	145	80.6	2,232	88.4
Hospital discharge	-	-	5	1.4	231	21.8	34	18.9	270	10.7
Other†	-	-	-	-	23	2.2	1	0.6	24	1.0
<b>Total</b>	<b>918</b>	<b>100.0</b>	<b>368</b>	<b>100.0</b>	<b>1,060</b>	<b>100.0</b>	<b>180</b>	<b>100.0</b>	<b>2,526</b>	<b>100.0</b>

- indicates no cases reported.

\* Massachusetts, Michigan, and New Jersey actively solicit reports from physicians; California uses an existing administrative data source to passively identify physician reports of work-related asthma.

† Some cases have been identified through workers' compensation data, screening co-workers, reports from OSHA or MSHA, etc.

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).



**Table 9-5 (page 1 of 2). Work-related asthma: Most frequently reported putative agents associated with work-related asthma cases by state, 1993-1999**

Code* Agent	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
320.06 Chemicals, n.o.s.	108	11.8	32	8.7	87	8.2	20	11.1	247	9.8
320.01 Air pollutants, indoor	66	7.2	76	20.7	64	6.0	22	12.2	228	9.0
010.00 Dust, n.o.s.	116	12.6	37	10.1	21	2.0	9	5.0	183	7.2
322.00 Cleaning materials, n.o.s.	63	6.9	33	9.0	64	6.0	6	3.3	166	6.6
170.01 Cutting oils	-	-	6	1.6	126	11.9	2	1.1	134	5.3
330.03 Smoke, n.o.s. <sup>†</sup>	47	5.1	19	5.2	47	4.3	5	2.8	118	4.7
171.01 Paint	48	5.2	14	3.8	45	4.2	3	1.7	110	4.4
270.02 Latex, natural rubber	16	1.7	38	10.3	40	3.8	6	3.3	100	4.0
221.00 Diisocyanates, n.o.s.	9	1.0	14	3.8	69	6.5	2	1.1	94	3.7
390.01 Mold, n.o.s.	54	5.9	36	9.8	-	-	4	2.2	94	3.7
171.00 Solvents, n.o.s.	11	1.2	17	4.6	36	3.4	10	5.6	74	2.9
023.01 Welding fume, stainless steel	1	0.1	-	-	72	6.8	-	-	73	2.9
120.03 Formaldehyde	17	1.9	19	5.2	26	2.5	5	2.8	67	2.7
221.01 Toluene diisocyanate	9	1.0	4	1.1	50	4.7	2	1.1	65	2.6
320.16 Pesticides, n.o.s.	42	4.6	7	1.9	5	0.5	1	0.6	55	2.2
320.11 Glues, n.o.s.	24	2.6	10	2.7	14	1.3	5	2.8	53	2.1
322.10 Bleach	15	1.6	7	1.7	23	2.2	3	1.7	48	1.9
221.02 Methylene diisocyanate	2	0.2	-	-	41	3.9	2	1.1	45	1.8
030.02 Chlorine	17	1.9	1	0.3	18	1.7	5	2.8	41	1.6
010.09 Man-made mineral fibers	19	2.1	14	3.8	7	0.7	-	-	40	1.6
330.01 Cigarette smoke	22	2.4	6	1.6	8	0.8	1	0.6	37	1.5
331.01 Diesel exhaust	13	1.4	4	1.1	10	0.9	9	5.0	36	1.4
120.05 Glutaraldehyde	9	1.0	11	3.0	4	0.4	7	3.9	31	1.2
320.23 Perfume, n.o.s.	28	3.1	2	0.5	-	-	-	-	30	1.2
373.00 Wood dust, n.o.s.	9	1.0	3	0.8	15	1.4	3	1.7	30	1.2
050.00 Acids, bases, oxidizers, n.o.s.	1	0.1	5	1.4	21	2.0	2	1.1	29	1.1
023.00 Welding, n.o.s.	9	1.0	10	2.7	2	0.2	8	4.4	28	1.1
330.02 Plastic smoke	9	1.0	1	0.3	16	1.5	2	1.1	28	1.1
010.02 Asbestos	13	1.4	9	2.4	4	0.4	-	-	26	1.0
110.02 Epoxy resins	2	0.2	5	1.4	18	1.7	1	0.6	26	1.0
320.33 Air pollutants, indoor-building renovation	25	2.7	-	-	-	-	-	-	25	1.0
322.19 Cleaners, disinfectant, n.o.s.	17	1.9	6	1.6	2	0.2	-	-	25	1.0
060.11 4-Phenylcyclohexene (4-PC)	20	2.2	4	1.1	-	-	-	-	24	1.0
142.00 Acrylates, n.o.s.	-	-	-	-	21	2.0	-	-	21	0.8

See footnotes at end of table.

## Work-Related Asthma: *SENSOR*

**Table 9-5 (page 2 of 2). Work-related asthma: Most frequently reported putative agents associated with work-related asthma cases by state, 1993-1999**

Code* Agent	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
370.01 Paper dust	9	1.0	2	0.5	2	0.2	7	3.9	20	0.8
010.03 Cement dust	11	1.2	3	0.8	5	0.5	-	-	19	0.8
322.16 Cleaners, carpet	12	1.3	-	-	6	0.6	1	0.6	19	0.8
322.21 Cleaners, floor stripping	5	0.5	2	0.5	9	0.8	2	1.1	18	0.7
370.00 Plant material, n.o.s.	15	1.6	2	0.5	1	0.1	-	-	18	0.7
380.00 Animal material, n.o.s.	8	0.9	3	0.8	6	0.6	1	0.6	18	0.7
331.00 Exhaust, n.o.s.	11	1.2	4	1.1	-	-	2	1.1	17	0.7
161.00 Polycyclic aromatic hydrocarbons, n.o.s.	14	1.5	-	-	2	0.2	-	-	16	0.6
331.02 Engine exhaust	4	0.4	1	0.3	5	0.5	6	3.3	16	0.6
050.24 Sulfuric acid	8	0.9	-	-	4	0.4	2	1.1	14	0.6
160.02 Toluene	1	0.1	4	1.1	3	0.3	6	3.3	14	0.6
322.07 Ammonia solution, n.o.s.	9	1.0	3	0.8	1	0.1	1	0.6	14	0.6
350.03 Heat	11	1.2	-	-	3	0.3	-	-	14	0.6
370.10 Pollen	14	1.5	-	-	-	-	-	-	14	0.6
050.18 Sodium hydroxide	1	0.1	3	0.8	6	0.6	2	1.1	12	0.5
052.01 Ammonia gas	-	-	-	-	10	0.9	2	1.1	12	0.5
231.00 Ethanolamines, n.o.s.	9	1.0	-	-	3	0.3	-	-	12	0.5
320.29 Printing chemicals, n.o.s.	-	-	4	1.1	8	0.8	-	-	12	0.5
371.00 Flour, n.o.s.	2	0.2	4	1.1	4	0.4	2	1.1	12	0.5
380.04 Dander, animal	11	1.2	1	0.3	-	-	-	-	12	0.5
040.20 Sulfur oxides	4	0.4	2	0.5	3	0.3	2	1.1	11	0.4
050.10 Hydrochloric acid	4	0.4	2	0.5	1	0.1	4	2.2	11	0.4
171.06 Paint, oil-based	9	1.0	2	0.5	-	-	-	-	11	0.4
221.04 Hexamethylene diisocyanate	-	-	-	-	11	1.0	-	-	11	0.4
320.17 Photo developing chemicals, n.o.s.	6	0.7	2	0.5	2	0.2	1	0.6	11	0.4
360.04 Stress	10	1.1	-	-	1	0.1	-	-	11	0.4
010.13 Silica, crystalline	7	0.8	1	0.3	1	0.1	1	0.6	10	0.4
021.00 Metal dust, n.o.s.	8	0.9	1	0.3	-	-	1	0.6	10	0.4
061.00 Petroleum fractions, n.o.s.	3	0.3	-	-	5	0.5	2	1.1	10	0.4
320.14 Lubricants, n.o.s.	2	0.2	1	0.3	5	0.5	2	1.1	10	0.4
<b>All others</b>	<b>324</b>	<b>35.3</b>	<b>139</b>	<b>37.8</b>	<b>137</b>	<b>12.9</b>	<b>107</b>	<b>59.4</b>	<b>707</b>	<b>28.0</b>

- indicates no cases reported. n.o.s. - not otherwise specified

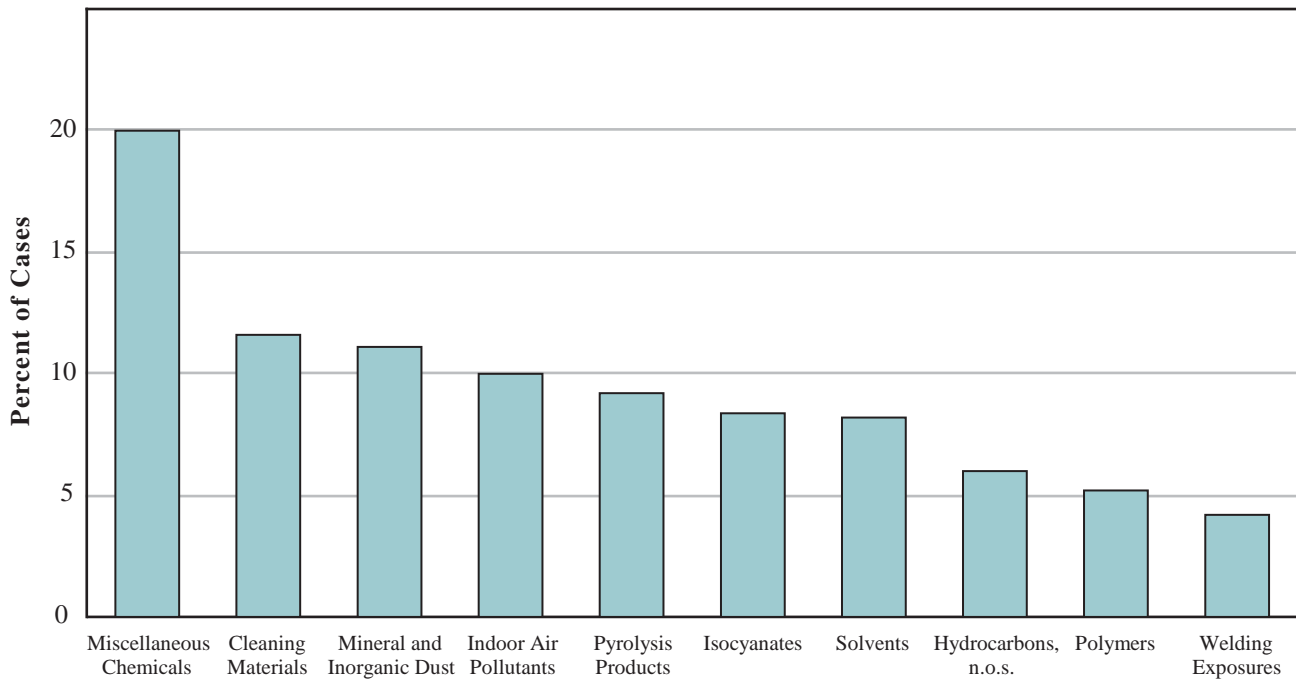
\* Association of Occupational and Environmental Clinics (AOEC) exposure codes, 12/2000

† Smoke includes pyrolysis products other than incinerator fume or cigarette, plastic, marijuana, or lead-containing smoke.

NOTE: Number column sums exceed the corresponding number of cases because each case was associated with up to three putative agents. Percentages are based on the actual number of cases; refer to Table 9-3 for actual number of cases. See appendices for source description and methods.

SOURCE: Provisional *SENSOR* surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).

**Figure 9-1. Work-related asthma: Most frequently reported agent categories associated with cases of work-related asthma, 1993-1999**



n.o.s. - not otherwise specified

NOTE: Total number of WRA cases was 2,526. The category 'Miscellaneous Chemicals' accounts for a large range of exposures including pesticides, perfume, enzymes, and odors; 'Mineral and Inorganic Dust' includes exposures such as plaster, fiberglass, and cement; 'Indoor Air Pollutants' includes pollutants from building renovation; 'Pyrolysis Products' includes smoke and diesel exhaust; 'Solvents' includes paint and paint thinners; 'Hydrocarbons' includes cutting oils; and 'Polymers' includes natural rubber latex.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).

## Work-Related Asthma: *SENSOR*

**Table 9-6 (page 1 of 2). Work-related asthma: Primary industries associated with work-related asthma cases by state, 1993-1999**

Industry (SIC)	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Agriculture, forestry, fishing</b>	<b>44</b>	<b>4.8</b>	<b>3</b>	<b>0.8</b>	<b>4</b>	<b>0.4</b>	<b>1</b>	<b>0.6</b>	<b>52</b>	<b>2.1</b>
Agricultural production, crops (01)	20	2.2	-	-	-	-	-	-	20	0.8
Agricultural services (07)	10	1.1	1	0.3	2	0.2	1	0.6	14	0.6
Forestry (08)	10	1.1	-	-	-	-	-	-	10	0.4
All others (02, 09)	4	0.4	2	0.5	2	0.2	-	-	8	0.3
<b>Mining (10,13,14)</b>	<b>2</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>4</b>	<b>0.2</b>
<b>Construction</b>	<b>23</b>	<b>2.5</b>	<b>15</b>	<b>4.1</b>	<b>24</b>	<b>2.3</b>	<b>13</b>	<b>7.2</b>	<b>75</b>	<b>3.0</b>
Construction, special trade contractors (17)	11	1.2	12	3.3	19	1.8	12	6.7	54	2.1
Heavy construction other than building construction, contractors (16)	9	1.0	1	0.3	1	0.1	-	-	11	0.4
Building construction, general contractors and operative builders (15)	3	0.3	2	0.5	4	0.4	1	0.6	10	0.4
<b>Manufacturing</b>	<b>144</b>	<b>15.7</b>	<b>98</b>	<b>26.6</b>	<b>728</b>	<b>68.9</b>	<b>76</b>	<b>42.2</b>	<b>1,046</b>	<b>41.5</b>
Transportation equipment (37)	26	2.8	3	0.8	450	42.5	3	1.7	482	19.1
Chemicals and allied products (28)	12	1.3	18	4.9	37	3.5	19	10.6	86	3.4
Fabricated metal products except machinery and transportation equipment (34)	12	1.3	9	2.4	50	4.7	1	0.6	72	2.9
Rubber and miscellaneous plastics products (30)	3	0.3	6	1.6	44	4.2	5	2.8	58	2.3
Industrial and commercial machinery and computer equipment (35)	5	0.5	13	3.5	37	3.5	-	-	55	2.2
Food and kindred products (20)	21	2.3	5	1.4	12	1.1	14	7.8	52	2.1
Primary metal industries (33)	5	0.5	-	-	33	3.1	7	3.9	45	1.8
Electronic and other electrical equipment and components except computer equipment (36)	16	1.7	11	3.0	9	0.8	6	3.3	42	1.7
Lumber and wood products, except furniture (24)	18	2.0	1	0.3	11	1.0	-	-	30	1.2
Miscellaneous manufacturing industries (39)	5	0.5	7	1.9	10	0.9	2	1.1	24	1.0
Measuring, analyzing, and controlling instruments (38)	4	0.4	8	2.2	6	0.6	2	1.1	20	0.8
Paper and allied products (26)	1	0.1	5	1.4	6	0.6	7	3.9	19	0.8
Stone, clay, glass, and concrete products (32)	7	0.8	2	0.5	6	0.6	2	1.1	17	0.7
Printing, publishing, and allied industries (27)	2	0.2	3	0.8	9	0.8	2	1.1	16	0.6
All others (22,23,25,29,31)	7	0.8	7	1.9	8	0.8	6	3.3	28	1.1
<b>Transportation</b>	<b>62</b>	<b>6.8</b>	<b>7</b>	<b>1.9</b>	<b>18</b>	<b>1.7</b>	<b>9</b>	<b>5.0</b>	<b>96</b>	<b>3.8</b>
Electric, gas, and sanitary services (49)	15	1.6	4	1.1	5	0.5	1	0.6	25	1.0
Local and suburban transit and interurban highway passenger transportation (41)	13	1.4	1	0.3	2	0.2	4	2.2	20	0.8
Motor freight transportation and warehousing (42)	10	1.1	-	-	3	0.3	2	1.1	15	0.6
Communications (48)	13	1.4	-	-	1	0.1	-	-	14	0.6
All others (40,43,44,45,47)	11	1.2	2	0.5	7	0.7	2	1.1	22	0.9
<b>Wholesale trade</b>	<b>13</b>	<b>1.4</b>	<b>4</b>	<b>1.1</b>	<b>14</b>	<b>1.3</b>	<b>4</b>	<b>2.2</b>	<b>35</b>	<b>1.4</b>
Wholesale trade, nondurable goods (51)	8	0.9	3	0.8	5	0.5	2	1.1	18	0.7
Wholesale trade, durable goods (50)	5	0.5	1	0.3	9	0.8	2	1.1	17	0.7

See footnotes at end of table.

**Table 9-6 (page 2 of 2). Work-related asthma: Primary industries associated with work-related asthma cases by state, 1993-1999**

Industry (SIC)	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Retail trade</b>	<b>41</b>	<b>4.5</b>	<b>12</b>	<b>3.3</b>	<b>27</b>	<b>2.6</b>	<b>4</b>	<b>2.2</b>	<b>84</b>	<b>3.3</b>
Food stores (54)	10	1.1	3	0.8	7	0.7	1	0.6	21	0.8
Eating and drinking places (58)	8	0.9	4	1.1	4	0.4	-	-	16	0.6
Miscellaneous retail (59)	9	1.0	2	0.5	4	0.4	1	0.6	16	0.6
Automotive dealers and gasoline service stations (55)	4	0.4	1	0.3	6	0.6	1	0.6	12	0.5
General merchandise stores (53)	6	0.7	-	-	4	0.4	1	0.6	11	0.4
All others (52,56,57)	4	0.4	2	0.5	2	0.2	-	-	8	0.3
<b>Finance, Insurance, and Real Estate</b>	<b>32</b>	<b>3.5</b>	<b>1</b>	<b>0.3</b>	<b>5</b>	<b>0.5</b>	<b>1</b>	<b>0.6</b>	<b>39</b>	<b>1.5</b>
Insurance carriers (63)	10	1.1	1	0.3	-	-	1	0.6	12	0.5
Real estate (65)	10	1.1	-	-	2	0.2	-	-	12	0.5
All others (60,61,64)	12	1.3	-	-	3	0.3	-	-	15	0.6
<b>Services</b>	<b>412</b>	<b>44.9</b>	<b>190</b>	<b>51.6</b>	<b>202</b>	<b>19.1</b>	<b>59</b>	<b>32.8</b>	<b>863</b>	<b>34.2</b>
Health services (80)	156	17.0	108	29.3	112	10.6	29	16.1	405	16.0
Educational services (82)	128	13.9	49	13.3	38	3.6	14	7.8	229	9.1
Social services (83)	37	4.0	2	0.5	6	0.6	3	1.7	48	1.9
Business services (73)	27	2.9	3	0.8	9	0.8	1	0.6	40	1.6
Amusement and recreation services (79)	19	2.1	3	0.8	4	0.4	-	-	26	1.0
Engineering, accounting, research, management, and related services (87)	11	1.2	6	1.6	4	0.4	4	2.2	25	1.0
Hotels, rooming houses, camps and other lodging places (70)	8	0.9	3	0.8	10	0.9	2	1.1	23	0.9
Personal services (72)	5	0.5	7	1.9	6	0.6	3	1.7	21	0.8
Automotive repair, services and parking (75)	7	0.8	6	1.6	7	0.7	1	0.6	21	0.8
All others (76,78,81,84,86,88,89)	14	1.5	3	0.8	6	0.6	2	1.1	25	1.0
<b>Public Administration</b>	<b>142</b>	<b>15.5</b>	<b>38</b>	<b>10.3</b>	<b>33</b>	<b>3.1</b>	<b>13</b>	<b>7.2</b>	<b>226</b>	<b>9.0</b>
Justice, public order, and safety (92)	69	7.5	15	4.1	14	1.3	3	1.7	101	4.0
Executive, legislative, general government, except finance (91)	27	2.9	3	0.8	1	0.1	3	1.7	34	1.3
Administration of economic programs (96)	10	1.1	13	3.5	6	0.6	1	0.6	30	1.2
Administration of human resource programs (94)	17	1.9	2	0.5	5	0.5	3	1.7	27	1.1
National security and international affairs (97)	5	0.5	3	0.8	2	0.2	2	1.1	12	0.5
Public finance, taxation, and monetary policy (93)	9	1.0	1	0.3	-	-	1	0.6	11	0.4
Administration of environmental quality and housing programs (95)	5	0.5	1	0.3	5	0.5	-	-	11	0.4
<b>Nonclassifiable</b>	<b>3</b>	<b>0.3</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>0.3</b>	<b>-</b>	<b>-</b>	<b>6</b>	<b>0.2</b>
<b>TOTAL</b>	<b>918</b>	<b>100.0</b>	<b>368</b>	<b>100.0</b>	<b>1,060</b>	<b>100.0</b>	<b>180</b>	<b>100.0</b>	<b>2,526</b>	<b>100.0</b>

- indicates no cases reported.

SIC - 1987 Standard Industrial Classification

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description and methods.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).

## Work-Related Asthma: *SENSOR*

**Table 9-7 (page 1 of 2). Work-related asthma: Primary occupations associated with work-related asthma cases by state, 1993-1999**

Occupation (COC)	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Managerial and professional specialty</b>	<b>235</b>	<b>25.6</b>	<b>125</b>	<b>34.0</b>	<b>108</b>	<b>10.2</b>	<b>41</b>	<b>22.8</b>	<b>509</b>	<b>20.2</b>
Registered nurses (095)	53	5.8	59	16.0	27	2.5	10	5.6	149	5.9
Teachers, secondary school (157)	12	1.3	14	3.8	5	0.5	3	1.7	34	1.3
Teachers, n.e.c. (159)	8	0.9	12	3.3	10	0.9	3	1.7	33	1.3
Teachers, elementary school (156)	22	2.4	1	0.3	2	0.2	2	1.1	27	1.1
Managers and administrators, n.e.c. (022)	17	1.9	5	1.4	4	0.4	-	-	26	1.0
Social workers (174)	11	1.2	3	0.8	5	0.5	2	1.1	21	0.8
Management related occupations, n.e.c. (37)	16	1.7	-	-	3	0.3	-	-	19	0.8
Teachers, special education (158)	9	1.0	1	0.3	1	0.1	1	0.6	12	0.5
Chemists, except biochemists (73)	2	0.2	3	0.8	2	0.2	4	2.2	11	0.4
All others	85	9.3	27	7.3	49	4.6	16	8.9	177	7.0
<b>Technical, sales, and administrative support</b>	<b>289</b>	<b>31.5</b>	<b>75</b>	<b>20.4</b>	<b>86</b>	<b>8.1</b>	<b>35</b>	<b>19.4</b>	<b>485</b>	<b>19.2</b>
General office clerks (379)	30	3.3	15	4.1	5	0.5	2	1.1	52	2.1
Secretaries (313)	26	2.8	13	3.5	7	0.7	3	1.7	49	1.9
Health technologists and technicians, n.e.c. (208)	13	1.4	2	0.5	6	0.6	4	2.2	25	1.0
Licensed practical nurses (207)	14	1.5	4	1.1	5	0.5	1	0.6	24	1.0
Investigators and adjusters, except insurance (376)	12	1.3	2	0.5	1	0.1	3	1.7	18	0.7
Administrative support, n.e.c. (389)	13	1.4	2	0.5	2	0.2	-	-	17	0.7
Typists (315)	9	1.0	4	1.1	1	0.1	1	0.6	15	0.6
Bookkeepers, accounting, and auditing clerks (337)	12	1.3	1	0.3	-	-	-	-	13	0.5
Clinical laboratory technologists and technicians (203)	3	0.3	6	1.6	2	0.2	1	0.6	12	0.5
Receptionists (319)	10	1.1	-	-	1	0.1	1	0.6	12	0.5
Science technicians, n.e.c. (225)	1	0.1	-	-	6	0.6	4	2.2	11	0.4
Cashiers (276)	9	1.0	1	0.3	1	0.1	-	-	11	0.4
Supervisors, general office (303)	6	0.7	2	0.5	2	0.2	-	-	10	0.4
Teachers' aides (387)	7	0.8	-	-	2	0.2	1	0.6	10	0.4
All others	124	13.5	23	6.2	45	4.2	14	7.8	206	8.2
<b>Service</b>	<b>136</b>	<b>14.8</b>	<b>43</b>	<b>11.7</b>	<b>98</b>	<b>9.2</b>	<b>20</b>	<b>11.1</b>	<b>297</b>	<b>11.8</b>
Janitors and cleaners (453)	27	2.9	6	1.6	32	3.0	4	2.2	69	2.7
Nursing aides, orderlies, and attendants (447)	13	1.4	8	2.2	5	0.5	2	1.1	28	1.1
Firefighting (417)	20	2.2	4	1.1	2	0.2	1	0.6	27	1.1
Health aides, except nursing (446)	3	0.3	1	0.3	12	1.1	3	1.7	19	0.8
Supervisors, cleaning and building service workers (448)	3	0.3	1	0.3	15	1.4	-	-	19	0.8
Maids and housemen (449)	4	0.4	3	0.8	5	0.5	3	1.7	15	0.6
Cooks (436)	4	0.4	2	0.5	4	0.4	2	1.1	12	0.5
Miscellaneous food preparation (444)	5	0.5	2	0.5	5	0.5	-	-	12	0.5
Hairdressers and cosmetologists (458)	4	0.4	5	1.4	2	0.2	-	-	11	0.4
All others	53	5.8	11	3.0	16	1.5	5	2.8	85	3.4
<b>Farming, forestry, and fishing</b>	<b>42</b>	<b>4.6</b>	<b>4</b>	<b>1.1</b>	<b>6</b>	<b>0.6</b>	<b>-</b>	<b>-</b>	<b>52</b>	<b>2.1</b>
Farm workers (479)	17	1.9	-	-	-	-	-	-	17	0.7
Groundskeepers and gardeners, except farm (486)	14	1.5	1	0.3	-	-	-	-	15	0.6
All others	11	1.2	3	0.8	6	0.6	-	-	20	0.8

See footnotes at end of table.

**Table 9-7 (page 2 of 2). Work-related asthma: Primary occupations associated with work-related asthma cases by state, 1993-1999**

Occupation (COC)	California		Massachusetts		Michigan		New Jersey		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
<b>Precision production, craft, and repair</b>	<b>75</b>	<b>8.2</b>	<b>50</b>	<b>13.6</b>	<b>156</b>	<b>14.7</b>	<b>30</b>	<b>16.7</b>	<b>311</b>	<b>12.3</b>
Supervisors, production (628)	7	0.8	5	1.4	31	2.9	3	1.7	46	1.8
Millwrights (544)	1	0.1	1	0.3	20	1.9	-	-	22	0.9
Machinists (637)	3	0.3	4	1.1	10	0.9	2	1.1	19	0.8
Specified mechanics and repairers, n.e.c. (547)	3	0.3	-	-	11	1.0	2	1.1	16	0.6
Electricians (575)	6	0.7	-	-	5	0.5	5	2.8	16	0.6
Optical goods workers (677)	1	0.1	-	-	15	1.4	-	-	16	0.6
Plumbers, pipefitters, and steamfitters (585)	3	0.3	2	0.5	9	0.8	-	-	14	0.6
Carpenters (567)	5	0.5	5	1.4	-	-	2	1.1	12	0.5
Industrial machinery repairers (518)	2	0.2	2	0.5	4	0.4	2	1.1	10	0.4
All others	44	4.8	31	8.4	51	4.8	14	7.8	140	5.5
<b>Operators, fabricators, and laborers</b>	<b>137</b>	<b>14.9</b>	<b>71</b>	<b>19.3</b>	<b>568</b>	<b>53.6</b>	<b>54</b>	<b>30.0</b>	<b>830</b>	<b>32.9</b>
Assemblers (785)	9	1.0	7	1.9	139	13.1	1	0.6	156	6.2
Welders and cutters (783)	8	0.9	6	1.6	51	4.8	1	0.6	66	2.6
Laborers, except construction (889)	5	0.5	2	0.5	48	4.5	1	0.6	56	2.2
Miscellaneous machine operators, n.e.c. (777)	8	0.9	5	1.4	30	2.8	5	2.8	48	1.9
Miscellaneous metal, plastic, stone, and glass working (715)	-	-	-	-	35	3.3	-	-	35	1.4
Production inspectors, checkers and examiners (796)	2	0.2	2	0.5	29	2.7	1	0.6	34	1.3
Painting and paint spray machine operators (759)	5	0.5	8	2.2	13	1.2	2	1.1	28	1.1
Mixing and blending machine operators (756)	6	0.7	6	1.6	9	0.8	1	0.6	22	0.9
Hand painting, coating, and decorating (789)	-	-	-	-	20	1.9	1	0.6	21	0.8
Separating, filtering, and clarifying machine operators (757)	4	0.4	3	0.8	5	0.5	8	4.4	20	0.8
Truck drivers (804)	8	0.9	-	-	5	0.5	4	2.2	17	0.7
Molding and casting machine operators (719)	3	0.3	-	-	13	1.2	-	-	16	0.6
Pressing machine operators (747)	-	-	-	-	16	1.5	-	-	16	0.6
Packaging and filling machine operators (754)	2	0.2	2	0.5	4	0.4	8	4.4	16	0.6
Machine operators, not specified (779)	5	0.5	6	1.6	0	0.0	5	2.8	16	0.6
Freight, stock, and material handlers, n.e.c. (883)	6	0.7	1	0.3	8	0.8	-	-	15	0.6
Grinding, abrading, buffing, and polishing machine operators (709)	-	-	3	0.8	10	0.9	1	0.6	14	0.6
Machine feeders and offbearers (878)	1	0.1	-	-	13	1.2	-	-	14	0.6
Bus drivers (808)	11	1.2	-	-	2	0.2	-	-	13	0.5
Hand packers and packagers (888)	3	0.3	1	0.3	7	0.7	1	0.6	12	0.5
Textile sewing machine operators (744)	2	0.2	1	0.3	7	0.7	-	-	10	0.4
Miscellaneous hand working occupations (795)	2	0.2	-	-	8	0.8	-	-	10	0.4
All others	47	5.1	18	4.9	96	9.1	14	7.8	175	6.9
<b>Military occupations</b>	<b>2</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>0.1</b>
<b>Unclassifiable and miscellaneous unemployed</b>	<b>2</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>38</b>	<b>3.6</b>	<b>-</b>	<b>-</b>	<b>40</b>	<b>1.6</b>
<b>TOTAL</b>	<b>918</b>	<b>100.0</b>	<b>368</b>	<b>100.0</b>	<b>1,060</b>	<b>100.0</b>	<b>180</b>	<b>100.0</b>	<b>2,526</b>	<b>100.0</b>

- indicates no cases reported. n.e.c. - not elsewhere classified COC - 1990 Census Occupation Code

NOTE: Percentages may not sum to 100% due to rounding. See appendices for source description and methods.

SOURCE: Provisional SENSOR surveillance data as of September 2002, aggregated by reporting source years, and reported by R Harrison and J Flattery (California); L Davis, E Pechter, and B Pazos (Massachusetts); K Rosenman, MJ Reilly, and D Kalinowski (Michigan); and D Valiante and D Schill (New Jersey).

## *Asthma: Morbidity*

**Table 9-8. Asthma: Estimated prevalence by current industry and smoking status, U.S. residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
General merchandise stores	208	13.0	7.3 - 18.7	106	14.7	6.9 - 22.5
Food, bakery and dairy stores	215	12.8	7.5 - 18.1	154	11.7	5.8 - 17.6
Furniture, lumber and wood	115	12.5	4.7 - 20.3	61	5.7	0.4 - 11.0
Banking and credit agencies	266	11.3	6.6 - 16.0	89	11.2	3.4 - 19.0
Elementary and secondary schools and colleges	1,160	10.8	8.6 - 13.0	211	6.1	2.8 - 9.4
Trucking service and warehousing	181	10.7	5.2 - 16.2	126	10.1	4.4 - 15.8
Health services, except hospitals	654	10.2	7.5 - 12.9	252	12.1	7.6 - 16.6
Primary metal industries	46	10.1	0.9 - 19.3	40	10.5	0.5 - 20.5
Utilities and sanitary	107	10.1	4.0 - 16.2	38	3.4	0.0 - 9.9
Transportation equipment	166	10.0	4.7 - 15.3	83	9.9	2.8 - 17.0
Other and not specified durable goods	139	9.8	3.7 - 15.9	60	1.7	0.0 - 5.0
Fabricated metal industries, including ordnance	82	9.7	1.9 - 17.5	67	11.1	1.9 - 20.3
Insurance, real estate, and other finance	479	9.7	5.0 - 14.4	194	11.2	6.3 - 16.1
Social services, religious and membership orgs.	491	9.7	6.2 - 13.2	148	6.5	2.6 - 10.4
Legal, engineering and other professional services	422	9.6	6.5 - 12.7	145	11.8	5.7 - 17.9
Communications	195	9.5	4.8 - 14.2	79	6.1	0.0 - 12.2
Private households	121	9.5	2.4 - 16.6	27	5.4	0.0 - 15.6
Other transportation	227	9.3	4.6 - 14.0	110	7.4	1.1 - 13.7
Hospitals	510	8.8	5.7 - 11.9	164	9.1	4.4 - 13.8
Other and not specified retail trade	510	8.1	5.6 - 10.6	229	10.6	5.7 - 15.5
Other nondurable goods	113	8.0	1.1 - 14.9	61	1.9	0.0 - 5.6
Eating and drinking places	426	8.0	5.1 - 10.9	353	12.4	8.7 - 16.1
Public administrations	534	7.9	5.0 - 10.8	194	8.3	4.0 - 12.6
Other personal services	296	7.7	4.0 - 11.4	151	12.1	6.2 - 18.0
Railroads	22	7.6	0.0 - 19.9	12	0.0	- -
Wholesale trade	367	7.4	4.3 - 10.5	172	8.9	4.0 - 13.8
Entertainment and recreation services	200	7.4	2.7 - 12.1	89	10.5	3.2 - 17.8
Printing, publishing and allied industries	132	7.2	1.5 - 12.9	47	5.9	0.0 - 12.4
Business services	678	7.1	4.9 - 9.3	350	13.1	9.0 - 17.2
Electrical machinery, equipment and supplies	161	6.3	2.8 - 9.8	75	11.9	3.7 - 20.1
Textile mill and finished textile products	114	6.2	0.0 - 12.9	45	3.5	0.0 - 8.0
Construction	547	5.7	3.3 - 8.1	450	4.7	2.9 - 6.5
Other educational services	53	5.3	0.0 - 10.6	10	14.7	0.0 - 36.5
Repair services	112	5.0	0.9 - 9.1	113	10.9	4.0 - 17.8
Agriculture	277	4.4	2.0 - 6.8	109	5.0	0.3 - 9.7
Machinery, except electrical	148	4.4	1.1 - 7.7	93	11.3	4.1 - 18.6
Automotive dealers and gasoline stations	142	4.4	0.1 - 8.7	119	5.9	1.4 - 10.4
Mining	28	4.0	0.0 - 11.6	25	18.3	1.4 - 35.2
Chemicals and allied products	93	3.7	0.0 - 8.0	36	2.8	0.0 - 8.3
Food and kindred products	121	1.5	0.0 - 3.1	83	5.9	0.0 - 13.0
Forestry and fisheries	17	0.0	- -	7	6.3	0.0 - 18.8
Armed forces	2	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>11,230</b>	<b>8.4</b>	<b>7.8 - 9.0</b>	<b>5,082</b>	<b>9.1</b>	<b>8.3 - 9.9</b>

- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.



**Table 9-9. Asthma: Estimated prevalence by current industry and smoking status, U.S. male residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Private households	6	17.0	0.0 - 47.6	2	0.0	- -
Food, bakery and dairy stores	100	14.4	5.8 - 23.0	57	12.6	1.2 - 24.0
General merchandise stores	49	11.4	0.0 - 23.4	40	10.6	1.2 - 20.0
Communications	105	11.2	4.5 - 17.9	42	4.0	0.0 - 9.5
Primary metal industries	31	10.7	0.0 - 22.1	30	9.5	0.0 - 19.9
Trucking service and warehousing	136	10.7	4.4 - 17.0	96	7.6	1.5 - 13.7
Other nondurable goods	75	10.5	1.3 - 19.7	46	0.0	- -
Elementary and secondary schools and colleges	313	10.1	6.8 - 13.4	56	1.3	0.0 - 3.8
Fabricated metal industries, including ordnance	57	9.8	0.2 - 19.4	54	11.0	0.8 - 21.2
Printing, publishing and allied industries	65	9.5	0.0 - 19.3	32	6.0	0.0 - 13.8
Health services, except hospitals	103	8.9	2.0 - 15.8	32	0.0	- -
Furniture, lumber and wood	81	8.8	1.9 - 15.7	41	8.6	0.6 - 16.6
Insurance, real estate, and other finance	181	8.7	4.0 - 13.4	80	8.5	2.0 - 15.0
Other and not specified durable goods	78	8.5	1.1 - 15.9	47	2.1	0.0 - 6.0
Banking and credit agencies	55	8.5	0.3 - 16.7	23	5.7	0.0 - 14.3
Transportation equipment	114	8.4	2.9 - 13.9	58	10.7	2.5 - 18.9
Legal, engineering and other professional services	211	8.2	4.1 - 12.3	59	11.8	2.6 - 21.0
Railroads	19	8.0	0.0 - 20.9	12	0.0	- -
Entertainment and recreation services	116	8.0	1.5 - 14.5	48	4.8	0.0 - 12.4
Wholesale trade	218	7.4	3.3 - 11.5	115	6.6	1.7 - 11.5
Public administrations	258	7.4	3.5 - 11.3	91	12.2	4.6 - 19.8
Utilities and sanitary	83	7.1	1.4 - 12.8	29	4.1	0.0 - 12.1
Other and not specified retail trade	214	7.0	3.5 - 10.5	103	10.0	2.6 - 17.4
Eating and drinking places	195	6.8	2.5 - 11.1	161	12.3	6.2 - 18.4
Business services	350	6.6	3.7 - 9.5	186	13.6	7.9 - 19.3
Social services, religious and membership orgs.	98	6.5	1.4 - 11.6	21	3.2	0.0 - 9.3
Construction	490	5.8	3.3 - 8.3	423	5.0	3.0 - 7.0
Machinery, except electrical	105	5.8	1.5 - 10.1	72	12.2	3.8 - 20.6
Hospitals	112	5.8	0.9 - 10.7	26	2.4	0.0 - 7.1
Chemicals and allied products	54	5.6	0.0 - 12.1	21	0.0	- -
Electrical machinery, equipment and supplies	87	5.3	1.2 - 9.4	43	17.6	3.9 - 31.3
Automotive dealers and gasoline stations	98	4.8	0.0 - 10.3	82	6.6	0.7 - 12.5
Mining	24	4.4	0.0 - 12.6	21	14.8	0.0 - 31.1
Textile mill and finished textile products	33	3.5	0.0 - 10.8	23	0.0	- -
Agriculture	203	3.4	0.9 - 5.9	87	2.8	0.0 - 6.9
Repair services	99	3.0	0.1 - 5.9	96	11.4	3.8 - 19.0
Other transportation	125	2.7	0.0 - 5.4	69	6.4	0.0 - 14.0
Other personal services	75	2.1	0.0 - 4.6	60	15.4	5.2 - 25.6
Food and kindred products	62	1.3	0.0 - 3.1	56	7.6	0.0 - 17.0
Forestry and fisheries	12	0.0	- -	6	7.9	0.0 - 23.6
Other educational services	7	0.0	- -	3	0.0	- -
Armed forces	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>5,056</b>	<b>7.2</b>	<b>6.4 - 8.0</b>	<b>2,714</b>	<b>8.0</b>	<b>6.8 - 9.2</b>

-- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Asthma: Morbidity

**Table 9-10. Asthma: Estimated prevalence by current industry and smoking status, U.S. female residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Utilities and sanitary	24	28.0	5.1 - 50.9	9	0.0	- -
Repair services	13	22.9	0.0 - 50.5	17	7.0	0.0 - 20.3
Furniture, lumber and wood	34	20.7	0.5 - 40.9	20	0.0	- -
Other transportation	102	19.1	8.9 - 29.3	41	9.9	0.0 - 20.9
Transportation equipment	52	14.5	2.2 - 26.8	25	7.3	0.0 - 19.3
General merchandise stores	159	13.4	6.9 - 19.9	66	17.4	6.6 - 28.2
Banking and credit agencies	211	12.2	6.7 - 17.7	66	13.5	3.7 - 23.3
Other and not specified durable goods	61	11.7	1.3 - 22.1	13	0.0	- -
Food, bakery and dairy stores	115	11.4	5.5 - 17.3	97	11.2	4.9 - 17.5
Legal, engineering and other professional services	211	11.3	6.6 - 16.0	86	11.7	3.3 - 20.1
Elementary and secondary schools and colleges	847	11.1	8.6 - 13.6	155	8.0	3.7 - 12.3
Trucking service and warehousing	45	10.7	0.0 - 22.7	30	19.6	4.7 - 34.5
Social services, religious and membership orgs.	393	10.7	6.6 - 14.8	127	7.2	2.7 - 11.7
Insurance, real estate, and other finance	298	10.5	3.1 - 17.9	114	13.1	6.2 - 20.0
Health services, except hospitals	551	10.5	7.6 - 13.4	220	13.9	8.6 - 19.2
Other personal services	221	10.1	5.0 - 15.2	91	9.7	2.6 - 16.8
Hospitals	398	9.7	6.0 - 13.4	138	10.4	4.9 - 15.9
Eating and drinking places	231	9.3	5.0 - 13.6	192	12.5	7.4 - 17.6
Fabricated metal industries, including ordnance	25	9.2	0.0 - 21.7	13	11.8	0.0 - 33.2
Private households	115	9.2	1.9 - 16.5	25	5.8	0.0 - 16.8
Other and not specified retail trade	296	9.0	5.3 - 12.7	126	11.1	5.0 - 17.2
Public administrations	276	8.4	4.3 - 12.5	103	4.3	0.4 - 8.2
Primary metal industries	15	8.0	0.0 - 23.1	10	14.6	0.0 - 40.7
Agriculture	74	7.7	1.4 - 14.0	22	14.0	0.0 - 29.7
Business services	328	7.7	4.6 - 10.8	164	12.4	6.3 - 18.5
Textile mill and finished textile products	81	7.6	0.0 - 16.8	22	6.1	0.0 - 13.7
Electrical machinery, equipment and supplies	74	7.6	1.5 - 13.7	32	4.3	0.0 - 10.4
Wholesale trade	149	7.5	3.4 - 11.6	57	15.0	3.2 - 26.8
Communications	90	6.6	0.9 - 12.3	37	9.1	0.0 - 21.8
Entertainment and recreation services	84	6.4	0.0 - 13.1	41	18.7	4.6 - 32.8
Other educational services	46	6.0	0.0 - 12.1	7	18.4	0.0 - 46.0
Printing, publishing and allied industries	67	4.9	0.0 - 10.4	15	5.5	0.0 - 15.9
Construction	57	3.8	0.0 - 8.5	27	0.0	- -
Automotive dealers and gasoline stations	44	3.2	0.0 - 7.1	37	4.3	0.0 - 10.2
Food and kindred products	59	1.9	0.0 - 4.4	27	1.7	0.0 - 5.0
Other nondurable goods	38	1.3	0.0 - 3.8	15	8.8	0.0 - 25.1
Forestry and fisheries	5	0.0	- -	1	0.0	- -
Mining	4	0.0	- -	4	31.8	0.0 - 81.0
Chemicals and allied products	39	0.0	- -	15	6.8	0.0 - 19.7
Machinery, except electrical	43	0.0	- -	21	8.0	0.0 - 19.4
Railroads	3	0.0	- -	0	-	- -
Armed forces	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>6,174</b>	<b>9.7</b>	<b>8.7 - 10.7</b>	<b>2,368</b>	<b>10.5</b>	<b>9.1 - 11.9</b>

- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

**Table 9-11. Asthma: Estimated prevalence by current occupation and smoking status, U.S. residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Computer equipment operators	29	17.3	0.2 - 34.4	6	0.0	- -
Financial records processing occupations	202	16.5	6.7 - 26.3	79	10.2	3.3 - 17.1
Mail and message distributing	75	12.5	0.5 - 24.5	28	15.7	0.4 - 31.0
Teachers, librarians and counselors	779	12.1	9.4 - 14.8	117	11.2	5.3 - 17.1
Other protective service occupations	78	12.1	1.3 - 22.9	49	15.6	4.1 - 27.2
Other sales	511	11.4	8.1 - 14.7	239	12.4	7.3 - 17.5
Writers, artists, entertainers and athletes	200	10.9	6.0 - 15.8	64	8.5	0.5 - 16.5
Other professional specialty occupations	266	10.9	6.4 - 15.4	72	10.5	2.9 - 18.1
Health technologists and technicians	165	10.8	4.9 - 16.7	71	15.2	6.2 - 24.2
Forestry and fishing occupations	12	10.8	0.0 - 30.0	7	7.6	0.0 - 22.5
Secretaries, stenographers and typists	239	10.7	5.6 - 15.8	91	6.1	1.6 - 10.6
Supervisors and proprietors	312	10.2	6.5 - 13.9	151	5.7	2.0 - 9.4
Private household occupations	109	10.1	2.3 - 17.9	18	7.5	0.0 - 21.6
Personal service	290	10.1	4.8 - 15.4	96	8.0	1.3 - 14.7
Other administrative support	1,118	10.0	7.8 - 12.2	473	10.3	7.0 - 13.6
Health diagnosing occupations	122	9.9	2.6 - 17.2	5	0.0	- -
Technologists, technicians except health	220	9.8	5.5 - 14.1	75	10.2	2.6 - 17.8
Natural mathematical and computer scientists	235	9.5	5.2 - 13.8	65	10.2	3.5 - 16.9
Food service	399	9.0	5.5 - 12.5	324	9.4	5.9 - 12.9
Freight, stock and material handlers	310	8.9	4.8 - 13.0	194	11.0	5.3 - 16.7
Managers and administrators, except public admin.	984	8.5	6.3 - 10.7	463	7.0	4.5 - 9.5
Health service	257	8.3	4.6 - 12.0	154	18.1	11.0 - 25.2
Construction and extractive trades	332	8.3	4.6 - 12.0	325	4.6	2.4 - 6.8
Fabricators, assemblers, inspectors and samplers	217	8.1	4.4 - 11.8	117	11.6	4.9 - 18.3
Health assessment and treating occupations	324	7.5	4.6 - 10.4	76	5.3	0.2 - 10.4
Management related occupations	476	6.1	3.9 - 8.3	161	5.4	2.3 - 8.5
Engineers	199	5.9	2.4 - 9.4	41	13.3	1.3 - 25.3
Machine operators and tenderers, except precision	370	5.9	3.0 - 8.8	239	5.7	2.4 - 9.0
Sales representatives, commodities and finance	346	5.5	2.8 - 8.2	131	14.0	6.9 - 21.1
Police and firefighters	120	5.5	0.0 - 11.0	33	14.3	0.0 - 29.0
Cleaning and building service	289	4.8	1.7 - 7.9	166	9.5	5.0 - 14.0
Motor vehicle operators	268	4.6	2.4 - 6.8	207	6.4	2.9 - 9.9
Precision production occupations	240	4.3	1.8 - 6.8	185	13.2	7.1 - 19.3
Construction laborers	80	3.9	0.0 - 8.8	52	4.3	0.0 - 9.4
Farm workers and other agricultural workers	195	3.7	1.2 - 6.2	97	10.4	2.6 - 18.2
Architects and surveyors	17	3.5	0.0 - 10.4	6	14.5	0.0 - 42.5
Material moving equipment operators	64	3.2	0.0 - 8.1	56	7.3	0.0 - 15.3
Mechanics and repairers	283	3.1	1.1 - 5.1	200	9.3	4.8 - 13.8
Farm operators and managers	69	2.5	0.0 - 5.8	19	0.0	- -
Officials and administrators, public administration	56	1.3	0.0 - 3.8	25	2.9	0.0 - 7.6
Other transportation, except motor vehicles	15	0.0	- -	11	22.1	0.0 - 59.1
Military	3	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>11,230</b>	<b>8.4</b>	<b>7.8 - 9.0</b>	<b>5,082</b>	<b>9.1</b>	<b>8.3 - 9.9</b>

- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Asthma: Morbidity

**Table 9-12. Asthma: Estimated prevalence by current occupation and smoking status, U.S. male residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Private household occupations	4	28.8	0.0 - 77.0	1	0.0	- -
Computer equipment operators	15	17.3	0.0 - 42.2	3	0.0	- -
Other protective service occupations	49	15.7	1.0 - 30.4	31	17.0	1.7 - 32.3
Writers, artists, entertainers and athletes	107	12.9	5.6 - 20.2	34	4.2	0.0 - 12.2
Teachers, librarians and counselors	193	11.6	6.9 - 16.3	30	3.7	0.0 - 10.8
Forestry and fishing occupations	11	11.3	0.0 - 32.3	6	8.6	0.0 - 25.6
Other professional specialty occupations	110	11.1	4.6 - 17.6	22	9.1	0.0 - 22.8
Mail and message distributing	34	10.0	0.0 - 28.0	16	10.9	0.0 - 30.7
Freight, stock and material handlers	200	10.0	4.9 - 15.1	137	11.2	4.5 - 17.9
Food service	161	9.6	3.5 - 15.7	133	8.5	3.0 - 14.0
Natural mathematical and computer scientists	147	9.2	4.1 - 14.3	50	11.9	3.9 - 19.9
Technologists, technicians except health	139	9.1	3.8 - 14.3	43	13.8	2.2 - 25.4
Other sales	174	9.1	3.8 - 14.4	87	14.7	5.1 - 24.3
Health technologists and technicians	34	8.9	0.0 - 21.1	7	0.0	- -
Other administrative support	241	8.7	4.6 - 12.8	120	7.2	2.1 - 12.3
Construction and extractive trades	322	8.5	4.6 - 12.4	319	4.7	2.5 - 6.9
Machine operators and tenderers, except precision	193	8.4	3.7 - 13.1	167	6.4	2.3 - 10.5
Supervisors and proprietors	169	8.0	4.1 - 11.9	79	4.5	0.0 - 9.0
Managers and administrators, except public admin.	507	7.4	4.7 - 10.1	264	5.7	2.8 - 8.6
Fabricators, assemblers, inspectors and samplers	103	7.4	2.7 - 12.1	77	10.8	2.8 - 18.8
Management related occupations	166	6.7	3.0 - 10.4	57	3.0	0.0 - 7.3
Sales representatives, commodities and finance	186	6.4	2.5 - 10.3	73	15.7	5.1 - 26.3
Personal service	38	6.2	0.0 - 13.5	14	0.0	- -
Financial records processing occupations	20	6.1	0.0 - 14.9	4	0.0	- -
Cleaning and building service	129	5.7	0.6 - 10.8	70	5.3	0.6 - 10.0
Police and firefighters	98	5.5	0.0 - 11.6	26	18.4	0.2 - 36.6
Engineers	172	4.7	1.4 - 8.0	34	15.5	1.4 - 29.6
Health diagnosing occupations	77	4.6	0.0 - 9.9	1	0.0	- -
Motor vehicle operators	226	4.3	1.6 - 7.0	174	6.5	2.8 - 10.2
Precision production occupations	168	4.2	1.1 - 7.3	131	12.7	5.4 - 20.0
Construction laborers	77	4.0	0.0 - 8.9	52	4.3	0.0 - 9.4
Material moving equipment operators	56	3.5	0.0 - 8.8	53	7.8	0.0 - 16.6
Health service	16	3.3	0.0 - 10.2	19	3.9	0.0 - 11.5
Mechanics and repairers	252	3.0	1.0 - 5.0	188	9.3	4.6 - 14.0
Health assessment and treating occupations	38	2.8	0.0 - 6.7	9	0.0	- -
Farm workers and other agricultural workers	152	2.4	0.2 - 4.6	81	11.5	2.5 - 20.5
Farm operators and managers	54	1.4	0.0 - 4.1	15	0.0	- -
Officials and administrators, public administration	23	0.0	- -	12	0.0	- -
Architects and surveyors	13	0.0	- -	6	14.5	0.0 - 42.5
Secretaries, stenographers and typists	4	0.0	- -	3	0.0	- -
Other transportation, except motor vehicles	15	0.0	- -	11	22.1	0.0 - 59.1
Military	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>5,056</b>	<b>7.2</b>	<b>6.4 - 8.0</b>	<b>2,714</b>	<b>8.0</b>	<b>6.8 - 9.2</b>

- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

**Table 9-13. Asthma: Estimated prevalence by current occupation and smoking status, U.S. female residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Health diagnosing occupations	45	20.1	3.0 - 37.2	4	0.0	- -
Architects and surveyors	4	18.9	0.0 - 52.8	0	-	- -
Financial records processing occupations	182	17.6	7.0 - 28.2	75	10.7	3.4 - 18.0
Computer equipment operators	14	17.3	0.0 - 37.9	3	0.0	- -
Engineers	27	16.3	1.8 - 30.8	7	0.0	- -
Mail and message distributing	41	15.6	0.9 - 30.3	12	23.4	0.0 - 47.5
Supervisors and proprietors	143	13.3	5.9 - 20.7	72	7.4	1.1 - 13.7
Other sales	337	12.8	8.7 - 16.9	152	11.0	5.5 - 16.5
Teachers, librarians and counselors	586	12.3	9.0 - 15.6	87	13.6	6.0 - 21.2
Health technologists and technicians	131	11.5	4.8 - 18.2	64	18.4	7.8 - 29.0
Technologists, technicians except health	81	11.3	4.2 - 18.4	32	4.8	0.0 - 11.7
Secretaries, stenographers and typists	235	10.9	5.8 - 16.0	88	6.3	1.8 - 10.8
Other professional specialty occupations	156	10.7	4.4 - 17.0	50	11.2	2.0 - 20.4
Personal service	252	10.7	4.8 - 16.6	82	10.0	2.0 - 18.0
Other administrative support	877	10.5	8.0 - 13.0	353	11.5	7.6 - 15.4
Natural mathematical and computer scientists	88	10.2	3.3 - 17.1	15	4.0	0.0 - 12.6
Farm workers and other agricultural workers	43	10.1	0.0 - 20.3	16	4.5	0.0 - 13.3
Managers and administrators, except public admin.	477	10.0	6.9 - 13.1	199	8.9	4.8 - 13.0
Private household occupations	105	9.5	1.5 - 17.5	17	8.0	0.0 - 22.9
Fabricators, assemblers, inspectors and samplers	114	9.1	2.8 - 15.4	40	13.2	1.8 - 24.6
Health service	241	8.7	4.6 - 12.8	135	20.1	12.1 - 28.1
Writers, artists, entertainers and athletes	93	8.5	2.2 - 14.8	30	13.7	0.0 - 27.8
Food service	238	8.5	4.6 - 12.4	191	10.3	6.0 - 14.6
Health assessment and treating occupations	286	8.2	4.9 - 11.5	67	6.2	0.5 - 11.9
Farm operators and managers	15	7.1	0.0 - 20.4	4	0.0	- -
Motor vehicle operators	42	6.4	0.0 - 14.2	33	6.2	0.0 - 15.8
Freight, stock and material handlers	110	6.3	0.2 - 12.4	57	10.7	0.9 - 20.5
Management related occupations	310	5.6	2.9 - 8.3	104	6.8	2.7 - 10.9
Police and firefighters	22	5.3	0.0 - 12.2	7	0.0	- -
Precision production occupations	72	4.5	0.0 - 9.2	54	14.8	3.6 - 26.0
Sales representatives, commodities and finance	160	4.1	0.8 - 7.4	58	11.6	3.2 - 20.0
Other protective service occupations	29	4.0	0.0 - 9.7	18	12.5	0.0 - 28.6
Mechanics and repairers	31	3.9	0.0 - 11.3	12	9.0	0.0 - 26.1
Cleaning and building service	160	3.8	0.3 - 7.3	96	13.4	6.0 - 20.8
Officials and administrators, public administration	33	2.6	0.0 - 7.7	13	7.2	0.0 - 18.8
Machine operators and tenderers, except precision	177	2.6	0.1 - 5.1	72	3.9	0.0 - 8.4
Forestry and fishing occupations	1	0.0	- -	1	0.0	- -
Construction and extractive trades	10	0.0	- -	6	0.0	- -
Other transportation, except motor vehicles	0	-	- -	0	-	- -
Material moving equipment operators	8	0.0	- -	3	0.0	- -
Construction laborers	3	0.0	- -	0	-	- -
Military	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>6,174</b>	<b>9.7</b>	<b>8.7 - 10.7</b>	<b>2,368</b>	<b>10.5</b>	<b>9.1 - 11.9</b>

- No estimates due to no asthma cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.



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## **Section 10**

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# **Chronic Obstructive Pulmonary Disease**





## *Chronic Obstructive Pulmonary Disease: Mortality*

**Table 10-1. Chronic obstructive pulmonary disease: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states, 1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
041	Coal mining	783	1.98	1.84	2.12
410	Trucking service	1,281	1.29	1.22	1.37
050	Nonmetallic mining and quarrying, except fuel	77	1.28	1.01	1.61
751	Automotive repair and related services	627	1.26	1.17	1.37
040	Metal mining	115	1.26	1.04	1.52
230	Logging	172	1.25	1.07	1.46
042	Oil and gas extraction	129	1.24	1.04	1.48
641	Eating and drinking places	1,373	1.23	1.17	1.30
760	Miscellaneous repair services	183	1.23	1.06	1.42
060	Construction	4,288	1.19	1.16	1.23
242	Furniture and fixtures	335	1.19	1.06	1.32
762	Hotels and motels	335	1.18	1.06	1.32
771	Laundry, cleaning, and garment services	257	1.15	1.01	1.30
802	Miscellaneous entertainment and recreation services	291	1.15	1.02	1.29
832	Nursing and personal care facilities	310	1.13	1.01	1.27
942	Military	855	1.11	1.04	1.19
142	Yarn, thread, and fabric mills	1,423	1.07	1.01	1.12
831	Hospitals	1,380	1.06	1.01	1.12

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Chronic Obstructive Pulmonary Disease: Mortality

**Table 10-2. Chronic obstructive pulmonary disease: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states, 1999**

COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
764	Washing, cleaning, and pickling machine operators	10	2.35	1.13	4.33
864	Helpers, mechanics and repairers	9	2.22	1.02	4.22
743	Textile cutting machine operators	11	2.02	1.01	3.62
616	Mining machine operators	768	2.01	1.87	2.16
599	Construction trades, n.e.c.	69	1.81	1.42	2.31
617	Mining occupations, n.e.c.	28	1.81	1.21	2.62
853	Excavating and loading machine operators	28	1.73	1.15	2.50
595	Roofers	71	1.66	1.31	2.11
435	Waiters and waitresses	434	1.61	1.46	1.77
573	Drywall installers	33	1.48	1.02	2.08
709	Grinding, abrading, buffing, and polishing machine operators	53	1.44	1.09	1.91
747	Pressing machine operators	70	1.43	1.12	1.82
888	Hand packers and packagers	84	1.39	1.12	1.73
885	Garage and service station related occupations	44	1.39	1.01	1.86
579	Painters, construction and maintenance	308	1.37	1.22	1.53
727	Sawing machine operators	63	1.32	1.03	1.71
507	Bus, truck, and stationary engine mechanic	149	1.30	1.11	1.54
514	Automobile body and related repairers	66	1.30	1.02	1.67
567	Carpenters	938	1.30	1.21	1.38
783	Welders and cutters	351	1.28	1.15	1.43
496	Timber cutting and logging occupations	135	1.26	1.06	1.50
804	Truck drivers	1,617	1.26	1.20	1.32
869	Construction laborers	664	1.25	1.15	1.35
844	Operating engineers	318	1.23	1.10	1.38
505	Automobile mechanics	499	1.23	1.13	1.35
585	Plumbers, pipefitters, and steamfitters	326	1.17	1.05	1.31
889	Laborers, except construction	1,586	1.17	1.11	1.23
447	Nursing aides, orderlies, and attendants	569	1.17	1.07	1.27
449	Maids and housemen	176	1.16	1.00	1.35
777	Miscellaneous machine operators, n.e.c.	293	1.16	1.04	1.31
479	Farm workers	217	1.16	1.01	1.33
563	Brickmasons and stonemasons	186	1.16	1.00	1.34
436	Cooks	484	1.15	1.05	1.25
779	Machine operators, not specified	632	1.14	1.05	1.23
905	Military occupations	746	1.10	1.03	1.19

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-3. Chronic obstructive pulmonary disease: Estimated prevalence by current industry and smoking status, U.S. residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Forestry and fisheries	17	15.0	0.0 - 41.3	7	0.0	- -
General merchandise stores	208	7.2	2.5 - 11.9	106	16.3	8.5 - 24.1
Furniture, lumber and wood	115	5.6	0.0 - 13.2	61	4.3	0.0 - 9.0
Other transportation	227	5.5	2.0 - 9.0	109	5.9	2.2 - 9.6
Banking and credit agencies	265	5.1	2.2 - 8.0	90	7.6	0.0 - 16.2
Social services, religious and membership orgs.	490	4.5	2.3 - 6.7	148	6.9	2.0 - 13.7
Machinery, except electrical	148	4.1	0.4 - 7.8	92	6.0	0.7 - 11.3
Textile mill and finished textile products	114	4.0	0.0 - 9.3	45	5.1	0.0 - 12.2
Automotive dealers and gasoline stations	142	3.9	0.0 - 8.2	119	7.6	2.3 - 12.9
Health services, except hospitals	653	3.7	2.1 - 5.3	252	10.1	5.8 - 14.4
Legal, engineering and other professional services	422	3.7	1.7 - 5.7	144	8.6	3.5 - 13.7
Elementary and secondary schools and colleges	1,160	3.6	2.2 - 5.0	211	10.1	4.2 - 16.0
Agriculture	278	3.4	1.2 - 5.6	109	6.6	1.1 - 12.1
Other and not specified retail trade	510	3.4	1.4 - 5.4	229	6.4	2.9 - 9.9
Other nondurable goods	113	3.2	0.0 - 7.2	60	6.3	0.0 - 12.8
Primary metal industries	46	3.1	0.0 - 9.0	40	6.5	0.0 - 14.1
Utilities and sanitary	107	2.9	0.0 - 6.0	38	4.2	0.0 - 12.2
Insurance, real estate, and other finance	479	2.8	1.2 - 4.4	194	4.8	1.5 - 8.1
Other personal services	297	2.7	0.9 - 4.5	151	4.4	0.9 - 7.9
Communications	195	2.6	0.3 - 5.0	79	5.7	0.0 - 11.4
Food, bakery and dairy stores	215	2.4	0.4 - 4.4	154	8.2	2.5 - 13.9
Public administration	534	2.3	1.1 - 3.5	193	7.8	3.9 - 11.7
Printing, publishing and allied industries	132	2.1	0.0 - 6.0	47	5.6	0.0 - 12.1
Transportation equipment	166	2.0	0.0 - 4.4	84	10.2	3.1 - 17.3
Wholesale trade	367	2.0	0.4 - 3.6	172	3.7	0.8 - 6.6
Hospitals	510	2.0	0.6 - 3.4	164	3.8	1.3 - 6.3
Business services	679	1.8	0.8 - 2.8	349	8.9	5.6 - 12.2
Entertainment and recreation services	200	1.8	0.0 - 3.6	89	4.1	0.0 - 8.4
Food and kindred products	121	1.7	0.0 - 4.2	83	2.7	0.0 - 6.4
Eating and drinking places	426	1.7	0.1 - 3.3	353	7.9	4.6 - 11.2
Other educational services	53	1.7	0.0 - 4.1	10	46.5	5.5 - 87.5
Construction	547	1.6	0.4 - 2.8	450	4.1	2.1 - 6.1
Electrical machinery, equipment and supplies	161	1.2	0.0 - 2.8	75	3.8	0.0 - 7.9
Repair services	112	1.2	0.0 - 2.8	113	6.6	1.9 - 11.3
Other and not specified durable goods	139	1.1	0.0 - 2.7	60	0.0	- -
Trucking service and warehousing	181	1.1	0.0 - 2.5	126	6.7	2.6 - 10.8
Private households	120	0.9	0.0 - 2.7	27	13.1	0.0 - 29.8
Mining	28	0.0	- -	25	11.8	0.0 - 25.2
Chemicals and allied products	93	0.0	- -	36	8.7	0.0 - 20.1
Fabricated metal industries, including ordnance	82	0.0	- -	67	3.3	0.0 - 8.0
Railroads	22	0.0	- -	12	10.2	0.0 - 29.2
Armed forces	2	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>11,229</b>	<b>2.8</b>	<b>2.4 - 3.2</b>	<b>5,078</b>	<b>6.8</b>	<b>6.0 - 7.6</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-4. Chronic obstructive pulmonary disease: Estimated prevalence by current industry and smoking status, U.S. male residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Forestry and fisheries	12	22.2	0.0 - 58.7	6	0.0	- -
Other educational services	7	6.0	0.0 - 18.0	3	22.6	0.0 - 66.9
Social services, religious and membership orgs.	97	5.4	0.3 - 10.5	21	4.0	0.0 - 11.6
Banking and credit agencies	55	5.2	0.0 - 12.3	23	0.0	- -
Textile mill and finished textile products	33	4.8	0.0 - 12.6	23	4.3	0.0 - 12.9
Machinery, except electrical	105	4.3	0.0 - 8.8	71	6.8	0.3 - 13.3
Printing, publishing and allied industries	65	4.1	0.0 - 11.7	32	3.5	0.0 - 10.2
Primary metal industries	31	3.9	0.0 - 11.5	30	3.2	0.0 - 9.5
Legal, engineering and other professional services	211	3.8	1.1 - 6.5	59	3.9	0.0 - 8.6
Other transportation	125	3.2	0.0 - 7.1	68	3.5	0.0 - 8.0
Utilities and sanitary	83	2.8	0.0 - 6.1	29	0.0	- -
General merchandise stores	49	2.5	0.0 - 6.8	40	13.9	1.7 - 26.1
Communications	105	2.3	0.0 - 5.0	42	3.6	0.0 - 10.5
Automotive dealers and gasoline stations	98	2.3	0.0 - 6.8	82	6.1	0.2 - 12.0
Transportation equipment	114	2.1	0.0 - 5.0	59	11.5	3.1 - 19.9
Insurance, real estate, and other finance	181	2.1	0.0 - 4.5	80	5.7	0.2 - 11.2
Eating and drinking places	195	1.9	0.0 - 4.4	161	2.7	0.0 - 5.8
Agriculture	204	1.8	0.0 - 3.8	87	6.4	0.5 - 12.3
Other and not specified retail trade	214	1.8	0.0 - 4.3	103	2.0	0.0 - 4.4
Construction	490	1.5	0.3 - 2.7	423	4.1	1.9 - 6.3
Elementary and secondary schools and colleges	313	1.4	0.2 - 2.6	56	10.1	0.7 - 19.5
Food, bakery and dairy stores	100	1.3	0.0 - 3.1	57	10.1	0.0 - 21.7
Repair services	99	1.3	0.0 - 3.1	96	3.6	0.0 - 7.5
Public administration	258	1.2	0.0 - 2.6	91	4.2	0.0 - 8.7
Entertainment and recreation services	116	1.0	0.0 - 3.0	48	2.8	0.0 - 8.3
Food and kindred products	62	0.8	0.0 - 2.4	56	0.0	- -
Other nondurable goods	75	0.8	0.0 - 2.4	45	3.8	0.0 - 9.1
Wholesale trade	218	0.7	0.0 - 1.5	115	1.8	0.0 - 4.0
Trucking service and warehousing	136	0.6	0.0 - 1.8	96	2.7	0.0 - 6.0
Business services	351	0.6	0.0 - 1.2	186	9.0	4.3 - 13.7
Hospitals	112	0.6	0.0 - 1.8	26	2.8	0.0 - 8.3
Electrical machinery, equipment and supplies	87	0.5	0.0 - 1.5	43	0.0	- -
Mining	24	0.0	- -	21	14.8	0.0 - 31.1
Chemicals and allied products	54	0.0	- -	21	7.4	0.0 - 21.3
Furniture, lumber and wood	81	0.0	- -	41	6.5	0.0 - 13.6
Fabricated metal industries, including ordnance	57	0.0	- -	54	3.9	0.0 - 9.4
Other and not specified durable goods	78	0.0	- -	47	0.0	- -
Railroads	19	0.0	- -	12	10.2	0.0 - 29.2
Private households	6	0.0	- -	2	0.0	- -
Other personal services	75	0.0	- -	60	5.8	0.0 - 12.9
Health services, except hospitals	103	0.0	- -	32	4.1	0.0 - 11.7
Armed forces	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>5,057</b>	<b>1.7</b>	<b>1.3 - 2.1</b>	<b>2,712</b>	<b>4.6</b>	<b>3.6 - 5.6</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-5. Chronic obstructive pulmonary disease: Estimated prevalence by current industry and smoking status, U.S. female residents age 18 and over, 2000**

Industry	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Furniture, lumber and wood	34	18.1	0.0 - 40.2	20	0.0	- -
Other nondurable goods	38	9.7	0.0 - 22.4	15	15.4	0.0 - 36.8
Other transportation	102	8.8	2.1 - 15.5	41	11.8	0.6 - 23.0
General merchandise stores	159	8.6	2.5 - 14.7	66	17.8	8.0 - 27.6
Automotive dealers and gasoline stations	44	8.6	0.0 - 19.6	37	11.2	0.0 - 22.6
Agriculture	74	8.3	1.0 - 15.6	22	7.7	0.0 - 22.0
Banking and credit agencies	210	5.1	2.2 - 8.0	67	10.8	0.0 - 22.6
Other and not specified retail trade	296	4.8	1.9 - 7.7	126	11.1	4.4 - 17.8
Health services, except hospitals	550	4.6	2.6 - 6.6	220	11.0	6.1 - 15.9
Elementary and secondary schools and colleges	847	4.5	2.7 - 6.3	155	11.5	4.4 - 18.6
Wholesale trade	149	4.3	0.6 - 8.0	57	8.8	0.4 - 17.2
Social services, religious and membership orgs.	393	4.2	1.8 - 6.6	127	7.5	2.0 - 13.0
Utilities and sanitary	24	3.9	0.0 - 11.5	9	23.6	0.0 - 61.8
Other personal services	222	3.8	1.3 - 6.3	91	3.3	0.2 - 6.4
Public administration	276	3.7	1.3 - 6.1	102	11.7	4.8 - 18.6
Textile mill and finished textile products	81	3.6	0.0 - 10.7	22	5.7	0.0 - 16.1
Machinery, except electrical	43	3.6	0.0 - 10.5	21	2.7	0.0 - 8.0
Legal, engineering and other professional services	211	3.6	0.7 - 6.5	85	12.6	4.2 - 21.0
Business services	328	3.5	1.3 - 5.7	163	8.9	4.0 - 13.8
Food, bakery and dairy stores	115	3.4	0.3 - 6.5	97	6.9	1.6 - 12.2
Insurance, real estate, and other finance	298	3.3	1.3 - 5.3	114	4.2	0.1 - 8.3
Trucking service and warehousing	45	3.1	0.0 - 8.4	30	21.9	7.4 - 36.4
Communications	90	3.1	0.0 - 7.4	37	8.8	0.0 - 18.4
Entertainment and recreation services	84	3.1	0.0 - 6.8	41	6.0	0.0 - 13.3
Food and kindred products	59	2.9	0.0 - 8.6	27	9.4	0.0 - 22.1
Other and not specified durable goods	61	2.7	0.0 - 6.6	13	0.0	- -
Construction	57	2.6	0.0 - 6.7	27	4.2	0.0 - 10.3
Hospitals	398	2.5	0.7 - 4.3	138	4.0	1.1 - 6.9
Electrical machinery, equipment and supplies	74	2.3	0.0 - 5.8	32	8.9	0.0 - 18.3
Transportation equipment	52	1.6	0.0 - 4.5	25	6.0	0.0 - 14.8
Eating and drinking places	231	1.5	0.0 - 3.1	192	13.2	7.5 - 18.9
Other educational services	46	1.1	0.0 - 3.3	7	52.4	6.3 - 98.5
Private households	114	0.9	0.0 - 2.7	25	14.2	0.0 - 32.1
Forestry and fisheries	5	0.0	- -	1	0.0	- -
Mining	4	0.0	- -	4	0.0	- -
Printing, publishing and allied industries	67	0.0	- -	15	12.5	0.0 - 28.8
Chemicals and allied products	39	0.0	- -	15	10.4	0.0 - 29.4
Primary metal industries	15	0.0	- -	10	19.3	0.0 - 46.3
Fabricated metal industries, including ordnance	25	0.0	- -	13	0.0	- -
Railroads	3	0.0	- -	0	-	- -
Repair services	13	0.0	- -	17	29.0	4.5 - 53.5
Armed forces	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>6,172</b>	<b>4.0</b>	<b>3.4 - 4.6</b>	<b>2,366</b>	<b>9.7</b>	<b>8.1 - 11.3</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-6. Chronic obstructive pulmonary disease: Estimated prevalence by current occupation and smoking status, U.S. residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Supervisors and proprietors	312	5.5	2.0 - 9.0	151	5.7	1.6 - 9.8
Financial records processing occupations	202	5.4	1.9 - 8.9	78	10.8	2.6 - 19.0
Other administrative support	1117	5.2	3.6 - 6.8	472	9.7	6.4 - 13.0
Other professional specialty occupations	265	5.0	2.1 - 7.9	72	9.5	2.8 - 16.2
Other protective service occupations	78	4.8	0.0 - 9.9	49	17.2	5.0 - 29.4
Mail and message distributing	75	4.7	0.0 - 9.4	28	5.7	0.0 - 16.5
Health service	257	4.7	1.8 - 7.6	154	8.4	2.5 - 14.3
Secretaries, stenographers and typists	239	4.3	1.4 - 7.2	91	9.9	3.4 - 16.4
Fabricators, assemblers, inspectors and samplers	217	3.9	0.6 - 7.2	117	6.0	1.1 - 10.9
Teachers, librarians and counselors	779	3.8	2.2 - 5.4	117	10.9	8.9 - 12.9
Writers, artists, entertainers and athletes	200	3.4	0.1 - 6.7	64	1.9	0.0 - 5.4
Management related occupations	475	3.3	1.3 - 5.3	161	4.1	1.2 - 7.0
Technologists, technicians except health	220	3.2	0.5 - 5.9	75	4.1	0.0 - 9.8
Food service	399	3.2	0.8 - 5.6	324	9.0	5.1 - 12.9
Other sales	511	3.1	1.1 - 5.1	239	7.3	3.8 - 10.8
Farm workers and other agricultural workers	196	3.1	0.2 - 6.0	97	8.7	2.2 - 15.2
Officials and administrators, public administration	56	2.7	0.0 - 6.6	25	5.4	0.0 - 13.0
Sales representatives, commodities and finance	346	2.6	1.0 - 4.2	131	2.3	0.0 - 4.7
Farm operators and managers	69	2.6	0.0 - 5.9	19	6.2	0.0 - 18.0
Managers and administrators, except public admin.	985	2.4	1.4 - 3.4	463	5.2	2.3 - 8.1
Personal service	290	2.3	0.5 - 4.1	96	8.9	2.0 - 15.8
Cleaning and building service	289	2.0	0.0 - 4.2	167	8.5	4.0 - 13.0
Construction laborers	80	1.9	0.0 - 5.4	52	7.2	0.1 - 14.3
Health technologists and technicians	165	1.8	0.0 - 4.0	71	12.4	4.2 - 20.6
Freight, stock and material handlers	310	1.8	0.2 - 3.4	194	8.0	3.5 - 12.5
Engineers	199	1.6	0.0 - 3.4	41	6.9	0.0 - 14.3
Machine operators and tenderers, except precision	370	1.5	0.3 - 2.7	237	3.5	1.0 - 6.0
Health assessment and treating occupations	324	1.4	0.0 - 2.8	76	4.8	0.0 - 9.7
Mechanics and repairers	283	1.2	0.0 - 2.6	200	5.5	2.2 - 8.8
Natural mathematical and computer scientists	236	1.0	0.0 - 2.2	65	6.5	0.0 - 13.2
Private household occupations	108	1.0	0.0 - 3.0	18	18.3	0.0 - 40.6
Construction and extractive trades	332	0.8	0.0 - 1.6	325	4.4	2.0 - 6.8
Motor vehicle operators	268	0.6	0.0 - 1.6	206	6.9	3.0 - 10.8
Precision production occupations	240	0.5	0.0 - 1.1	185	6.1	1.8 - 10.4
Health diagnosing occupations	122	0.2	0.0 - 0.6	5	0.0	- -
Architects and surveyors	17	0.0	- -	6	0.0	- -
Computer equipment operators	29	0.0	- -	6	0.0	- -
Police and firefighters	120	0.0	- -	33	7.0	0.0 - 17.2
Forestry and fishing occupations	12	0.0	- -	7	0.0	- -
Other transportation, except motor vehicles	15	0.0	- -	11	18.3	0.0 - 40.1
Material moving equipment operators	64	0.0	- -	56	2.2	0.0 - 6.3
Military	3	0.0	- -	3	0.0	- -
<b>TOTAL</b>	<b>11,229</b>	<b>2.8</b>	<b>2.4 - 3.2</b>	<b>5,078</b>	<b>6.8</b>	<b>6.0 - 7.6</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-7. Chronic obstructive pulmonary disease: Estimated prevalence by current occupation and smoking status, U.S. male residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Writers, artists, entertainers and athletes	107	5.8	0.0 - 11.7	34	0.0	- -
Other protective service occupations	49	5.1	0.0 - 12.0	31	17.9	2.6 - 33.2
Management related occupations	166	4.5	0.4 - 8.6	57	1.2	0.0 - 3.6
Other administrative support	241	4.3	1.6 - 7.0	120	3.4	0.1 - 6.7
Other professional specialty occupations	109	4.1	0.4 - 7.8	22	13.2	0.0 - 27.9
Technologists, technicians except health	139	3.9	0.2 - 7.6	43	6.8	0.0 - 16.2
Financial records processing occupations	20	3.4	0.0 - 10.1	4	0.0	- -
Mail and message distributing	34	3.1	0.0 - 9.2	16	9.3	0.0 - 26.5
Other sales	174	2.9	0.0 - 6.4	87	3.7	0.2 - 7.2
Supervisors and proprietors	169	2.3	0.0 - 5.0	79	2.2	0.0 - 5.5
Food service	161	2.2	0.0 - 5.1	133	5.0	0.0 - 10.7
Farm workers and other agricultural workers	153	1.9	0.0 - 4.4	81	8.3	1.4 - 15.2
Construction laborers	77	1.9	0.0 - 5.6	52	7.2	0.1 - 14.3
Teachers, librarians and counselors	193	1.8	0.0 - 4.0	30	16.6	1.4 - 33.1
Farm operators and managers	54	1.5	0.0 - 4.2	15	8.0	0.0 - 22.7
Managers and administrators, except public admin.	507	1.4	0.2 - 2.6	264	3.9	1.4 - 6.4
Engineers	172	1.4	0.0 - 3.4	34	3.2	0.0 - 9.3
Sales representatives, commodities and finance	186	1.4	0.0 - 3.0	73	2.9	0.0 - 6.6
Mechanics and repairers	252	1.3	0.0 - 2.9	188	5.0	1.7 - 8.3
Fabricators, assemblers, inspectors and samplers	103	1.2	0.0 - 2.8	77	4.9	0.0 - 10.4
Freight, stock and material handlers	200	1.1	0.0 - 2.5	137	5.2	0.9 - 9.5
Construction and extractive trades	322	0.8	0.0 - 1.6	319	4.5	2.0 - 7.0
Cleaning and building service	129	0.7	0.0 - 1.7	71	3.9	0.0 - 8.6
Precision production occupations	168	0.6	0.0 - 1.4	131	5.8	0.7 - 10.9
Machine operators and tenderers, except precision	193	0.6	0.0 - 1.4	165	3.1	0.4 - 5.8
Health diagnosing occupations	77	0.3	0.0 - 0.9	1	0.0	- -
Motor vehicle operators	226	0.2	0.0 - 0.6	173	4.2	1.1 - 7.3
Officials and administrators, public administration	23	0.0	- -	12	0.0	- -
Architects and surveyors	13	0.0	- -	6	0.0	- -
Natural mathematical and computer scientists	148	0.0	- -	50	5.9	0.0 - 13.5
Health assessment and treating occupations	38	0.0	- -	9	0.0	- -
Health technologists and technicians	34	0.0	- -	7	10.0	0.0 - 29.4
Computer equipment operators	15	0.0	- -	3	0.0	- -
Secretaries, stenographers and typists	4	0.0	- -	3	0.0	- -
Private household occupations	4	0.0	- -	1	0.0	- -
Police and firefighters	98	0.0	- -	26	6.6	0.0 - 18.9
Health service	16	0.0	- -	19	0.0	- -
Personal service	38	0.0	- -	14	0.0	- -
Forestry and fishing occupations	11	0.0	- -	6	0.0	- -
Other transportation, except motor vehicles	15	0.0	- -	11	18.3	0.0 - 40.1
Material moving equipment operators	56	0.0	- -	53	2.4	0.0 - 6.9
Military	2	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>5,057</b>	<b>1.7</b>	<b>1.3 - 2.1</b>	<b>2,712</b>	<b>4.6</b>	<b>3.6 - 5.6</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.



## Chronic Obstructive Pulmonary Disease: Morbidity

**Table 10-8. Chronic obstructive pulmonary disease: Estimated prevalence by current occupation and smoking status, U.S. female residents age 18 and over, 2000**

Occupation	Nonsmokers			Current Smokers		
	Number of Respondents	Prevalence (%)	95% Confidence Interval	Number of Respondents	Prevalence (%)	95% Confidence Interval
Supervisors and proprietors	143	10.0	2.9 - 17.1	72	10.7	1.9 - 19.5
Farm workers and other agricultural workers	43	9.1	0.0 - 20.1	16	10.9	0.0 - 30.7
Fabricators, assemblers, inspectors and samplers	114	7.2	0.5 - 13.9	40	8.4	0.0 - 17.8
Farm operators and managers	15	7.1	0.0 - 20.4	4	0.0	- -
Mail and message distributing	41	6.6	0.0 - 14.0	12	0.0	- -
Other professional specialty occupations	156	5.8	1.7 - 9.9	50	7.7	0.6 - 14.8
Financial records processing occupations	182	5.6	1.7 - 9.5	74	11.4	2.8 - 20.0
Other administrative support	876	5.5	3.5 - 7.5	352	12.1	8.6 - 15.6
Officials and administrators, public administration	33	5.4	0.0 - 13.0	13	13.3	0.0 - 31.1
Health service	241	5.2	1.9 - 8.5	135	9.6	2.9 - 16.3
Teachers, librarians and counselors	586	4.5	2.5 - 6.5	87	9.1	3.2 - 15.0
Sales representatives, commodities and finance	160	4.4	1.3 - 7.5	58	1.3	0.0 - 3.8
Secretaries, stenographers and typists	235	4.4	1.3 - 7.5	88	10.2	3.5 - 16.9
Other protective service occupations	29	4.2	0.0 - 10.1	18	15.7	0.0 - 33.9
Food service	238	4.0	0.5 - 7.5	191	12.6	6.9 - 18.3
Managers and administrators, except public admin.	478	3.8	1.8 - 5.8	199	7.3	3.6 - 11.0
Freight, stock and material handlers	110	3.6	0.0 - 7.7	57	14.9	4.1 - 25.7
Engineers	27	3.4	0.0 - 10.1	7	29.2	0.0 - 65.3
Cleaning and building service	160	3.4	0.0 - 7.5	96	12.8	5.2 - 20.4
Other sales	337	3.2	1.2 - 5.2	152	9.7	4.6 - 14.8
Natural mathematical and computer scientists	88	3.0	0.0 - 6.5	15	8.6	0.0 - 21.7
Motor vehicle operators	42	3.0	0.0 - 8.7	33	22.8	5.4 - 40.2
Machine operators and tenderers, except precision	177	2.7	0.2 - 5.2	72	4.7	0.0 - 10.6
Management related occupations	309	2.6	0.8 - 4.4	104	5.9	1.6 - 10.2
Personal service	252	2.6	0.6 - 4.6	82	11.1	2.7 - 19.5
Health technologists and technicians	131	2.3	0.0 - 5.0	64	12.9	3.9 - 21.9
Technologists, technicians except health	81	1.8	0.0 - 4.3	32	0.0	- -
Health assessment and treating occupations	286	1.6	0.0 - 3.2	67	5.5	0.0 - 11.2
Private household occupations	104	1.0	0.0 - 3.0	17	19.5	0.0 - 43.2
Writers, artists, entertainers and athletes	93	0.6	0.0 - 1.6	30	4.1	0.0 - 11.9
Architects and surveyors	4	0.0	- -	0	-	- -
Health diagnosing occupations	45	0.0	- -	4	0.0	- -
Computer equipment operators	14	0.0	- -	3	0.0	- -
Police and firefighters	22	0.0	- -	7	8.4	0.0 - 24.9
Forestry and fishing occupations	1	0.0	- -	1	0.0	- -
Mechanics and repairers	31	0.0	- -	12	17.1	0.0 - 39.6
Construction and extractive trades	10	0.0	- -	6	0.0	- -
Precision production occupations	72	0.0	- -	54	6.9	0.0 - 14.0
Other transportation, except motor vehicles	0	-	- -	0	-	- -
Material moving equipment operators	8	0.0	- -	3	0.0	- -
Construction laborers	3	0.0	- -	0	-	- -
Military	1	0.0	- -	0	-	- -
<b>TOTAL</b>	<b>6,172</b>	<b>4.0</b>	<b>3.4 - 4.6</b>	<b>2,366</b>	<b>9.7</b>	<b>8.1 - 11.3</b>

- No estimates due to no chronic obstructive pulmonary disease cases or no respondents.

Nonsmokers - Those respondents who indicated that they never smoked or smoked less than 100 cigarettes in their lifetime.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description, methods, and ICD codes.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.



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## **Section 11**

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# **Respiratory Conditions Due to Toxic Agents**



## *Occupational Respiratory Conditions Due to Toxic Agents: Morbidity*

**Table 11-1. Occupational respiratory conditions due to toxic agents: Estimated number of cases reported by employers, by industry division, U.S. private sector, 1973-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Total
1973	100	-	1,000	7,300	700	1,100	100	1,100	11,500
1974	200	100	900	8,500	700	1,200	100	1,000	12,700
1975	200	100	900	7,100	900	1,400	300	1,100	11,900
1976	200	100	1,100	7,700	1,100	1,000	200	1,600	13,100
1977	100	-	1,100	7,500	1,100	1,400	100	1,700	13,100
1978	100	100	1,100	7,900	1,100	1,600	200	1,600	13,600
1979	100	100	1,100	7,800	900	1,300	200	1,700	13,100
1980	100	100	700	6,700	1,000	1,300	100	1,300	11,400
1981	100	100	1,000	5,900	800	1,100	100	1,600	10,800
1982	100	100	600	4,700	700	700	100	1,600	8,800
1983	100	100	700	4,000	600	700	100	1,700	7,900
1984	100	100	700	5,500	700	1,200	200	2,100	10,600
1985	200	100	800	6,000	900	1,400	400	1,800	11,600
1986	100	-	600	6,400	700	1,600	400	2,400	12,300
1987	700	-	700	7,500	900	1,700	400	2,400	14,300
1988	200	100	900	9,200	1,000	1,300	500	3,000	16,100
1989	100	-	700	9,900	800	3,500	300	3,500	18,900
1990	200	100	1,200	10,300	1,200	2,200	800	4,700	20,500
1991	300	-	800	8,800	1,100	1,600	700	4,800	18,300
1992	400	100	1,000	10,000	1,100	3,300	900	6,800	23,500
1993	300	100	800	10,100	2,000	3,000	1,500	6,400	24,200
1994	200	100	900	11,000	1,700	3,000	800	7,700	25,300
1995	200	100	800	9,400	1,800	2,900	1,400	7,900	24,400
1996	200	-	600	7,800	1,800	2,000	700	8,500	21,700
1997	400	-	700	7,500	1,600	2,300	900	6,800	20,300
1998	500	-	800	6,600	1,200	2,600	600	5,100	17,500
1999	300	-	600	6,600	1,800	1,700	500	5,000	16,500
2000	100	-	500	5,500	1,000	1,700	600	5,400	14,700

- indicates no data reported or data that do not meet BLS publication guidelines.

NOTE: Respiratory conditions due to toxic agents include pneumonitis, pharyngitis, rhinitis or acute congestions due to chemicals, dusts, gases or fumes. The sum of industry divisions may not equal the total due to rounding. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

## *Occupational Respiratory Conditions Due to Toxic Agents: Morbidity*

**Table 11-2. Occupational respiratory conditions due to toxic agents: Estimated rate (based on cases reported by employers, per 10,000 full-time workers) by industry division, U.S. private sector, 1973-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Overall
1973	1.8	1.7	3.2	3.8	1.7	0.8	0.2	1.2	2.1
1974	2.4	0.9	3.0	4.4	1.6	0.8	0.2	0.9	2.2
1975	1.7	0.8	3.1	4.1	2.1	1.0	0.7	1.1	2.2
1976	3.1	1.6	3.7	4.3	2.6	0.7	0.5	1.5	2.3
1977	2.0	0.5	3.3	4.0	2.5	0.9	0.2	1.4	2.2
1978	2.2	0.8	2.9	4.0	2.4	1.0	0.6	1.3	2.2
1979	1.1	0.8	2.8	3.9	1.9	0.8	0.5	1.3	2.0
1980	2.0	0.8	2.0	3.5	2.0	0.8	0.2	1.0	1.8
1981	1.1	1.0	2.9	3.1	1.7	0.7	0.2	1.1	1.7
1982	1.7	0.5	1.9	2.7	1.5	0.5	0.3	1.1	1.4
1983	1.4	0.8	2.0	2.3	1.4	0.4	0.2	1.1	1.2
1984	1.5	0.9	1.8	2.9	1.4	0.7	0.5	1.3	1.6
1985	2.4	1.0	1.9	3.2	1.8	0.8	0.8	1.1	1.7
1986	1.3	-	1.5	3.5	1.5	0.9	0.6	1.4	1.7
1987	7.9	0.6	1.6	4.0	1.7	0.9	0.7	1.3	2.0
1988	2.1	0.7	2.0	4.9	1.9	0.6	0.9	1.6	2.2
1989	1.5	0.5	1.5	5.2	1.6	1.7	0.5	1.7	2.5
1990	1.6	0.7	2.6	5.6	2.2	1.1	-	2.2	2.7
1991	2.7	0.6	2.1	5.0	2.1	0.8	-	2.3	2.4
1992	3.8	1.3	2.4	5.6	2.1	1.6	1.4	3.1	3.1
1993	2.5	0.9	2.0	5.6	3.7	1.5	2.5	2.8	3.1
1994	1.8	1.2	1.9	6.0	3.0	1.4	1.2	3.3	3.1
1995	1.4	1.5	1.7	5.1	3.2	1.3	2.3	3.4	3.0
1996	1.7	0.3	1.2	4.2	3.1	0.9	1.2	3.5	2.6
1997	2.7	0.6	1.4	4.0	2.7	1.0	1.4	2.7	2.4
1998	3.7	0.8	1.4	3.5	2.0	1.1	1.0	1.9	2.0
1999	1.8	0.6	1.0	3.6	2.8	0.7	0.8	1.9	1.8
2000	0.8	0.4	0.9	3.0	1.5	0.7	0.9	1.9	1.6

- indicates no data reported or data that do not meet BLS publication guidelines.

NOTE: Respiratory conditions due to toxic agents include pneumonitis, pharyngitis, rhinitis or acute congestions due to chemicals, dusts, gases or fumes. The sum of industry divisions may not equal the total due to rounding. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

## *Occupational Respiratory Conditions Due to Toxic Agents: Morbidity*

**Table 11-3 (page 1 of 2). Occupational respiratory conditions due to toxic agents: Industries with the highest estimated incidence rates (based on cases reported by employers, per 10,000 full-time workers), U.S. private sector, 1996-2000**

<b>Year/Industry</b>	<b>SIC</b>	<b>Estimated Number of Cases</b>	<b>Rate (per 10,000 full- time workers)</b>
<b><u>1996</u></b>			
Transportation equipment	37	3,000	11.2
Fishing, hunting, and trapping	09	-	7.4
Health services	80	5,200	6.9
Hotels and other lodging places	70	900	6.3
Food and kindred products	20	1,000	5.7
Primary metal industries	33	400	4.8
Communications	48	600	4.7
Fabricated metal products	34	700	4.7
Chemicals and allied products	28	500	4.5
Leather and leather products	31	-	4.5
Rubber and miscellaneous plastic products	30	400	4.5
<b>ALL INDUSTRIES</b>		<b>21,700</b>	<b>2.6</b>
<b><u>1997</u></b>			
Fishing, hunting, and trapping	09	-	15.7
Leather and leather products	31	100	15.2
Transportation equipment	37	1,900	10.1
Museums, botanical, zoological gardens	84	100	9.7
Instruments and related products	38	400	5.0
Food and kindred products	20	800	5.0
Electronic and other electric equipment	36	800	4.6
Primary metal industries	33	300	4.4
Health services	80	3,400	4.4
Chemicals and allied products	28	400	4.3
<b>ALL INDUSTRIES</b>		<b>20,300</b>	<b>2.4</b>
<b><u>1998</u></b>			
Agricultural production-livestock	02	100	11.2
Transportation equipment	37	1,800	9.1
Primary metal industries	33	500	6.9
Food and kindred products	20	100	5.7
Fishing, hunting, and trapping	09	-	5.4
Furniture and fixtures	25	200	4.6
Electronic and other electric equipment	36	700	4.0
Amusement and recreation services	79	400	3.9
Health services	80	2,800	3.6
Transportation by air	45	400	3.6
<b>ALL INDUSTRIES</b>		<b>17,500</b>	<b>2.0</b>

See footnotes at end of table.

## *Occupational Respiratory Conditions Due to Toxic Agents: Morbidity*

**Table 11-3 (page 2 of 2). Occupational respiratory conditions due to toxic agents: Industries with the highest estimated incidence rates (based on cases reported by employers, per 10,000 full-time workers), U.S. private sector, 1996-2000**

<b>Year/Industry</b>	<b>SIC</b>	<b>Estimated Number of Cases</b>	<b>Rate (per 10,000 full- time workers)</b>
<b><u>1999</u></b>			
Petroleum and coal products	29	100	9.8
Transportation equipment	37	1,700	8.7
Communications	48	900	5.9
Food and kindred products	20	1,000	5.8
Primary metal industries	33	300	4.7
Rubber and miscellaneous plastic products	30	400	4.2
Museums, botanical, zoological gardens	84	-	3.8
Electronic and other electric equipment	36	600	3.5
Health services	80	2,800	3.5
Chemicals and allied products	28	300	3.3
<b>ALL INDUSTRIES</b>		<b>16,500</b>	<b>1.8</b>
<b><u>2000</u></b>			
Transportation equipment	37	1,300	7.0
Food and kindred products	20	900	5.3
Health services	80	3,200	4.0
Primary metal industries	33	300	3.8
Petroleum and coal products	29	-	3.7
Instruments and related products	38	300	3.2
Chemicals and allied products	28	300	3.2
Stone, clay, and glass products	32	200	3.1
Agricultural production-livestock	02	-	3.0
Electronic and other electric equipment	36	500	3.0
<b>ALL INDUSTRIES</b>		<b>14,700</b>	<b>1.6</b>

- indicates no data reported or data that do not meet BLS publication guidelines.

SIC - 1987 Standard Industrial Classification

NOTE: Respiratory conditions due to toxic agents include pneumonitis, pharyngitis, rhinitis or acute congestions due to chemicals, dusts, gases or fumes. See appendices for source description.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

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## **Section 12**

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# **Respiratory Tuberculosis**





**Table 12-1. Respiratory tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states and years, 1990-1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
830	Offices and clinics of health practitioners, n.e.c.	13	3.04	1.62	5.19
141	Carpets and rugs	12	2.10	1.08	3.67
332	Not specified machinery	10	2.09	1.01	3.84
050	Nonmetallic mining and quarrying, except fuel	16	1.92	1.10	3.12
791	Miscellaneous personal services	29	1.87	1.26	2.69
040	Metal mining	17	1.86	1.08	2.97
280	Other primary metal industries	23	1.64	1.04	2.46
760	Miscellaneous repair services	35	1.60	1.11	2.22
010	Agricultural production, crops	429	1.49	1.35	1.63
041	Coal mining	66	1.41	1.10	1.81
831	Hospitals	227	1.18	1.04	1.35
961	Non-paid worker or non-worker or own home/at home	1,487	1.09	1.03	1.14
060	Construction	663	1.08	1.00	1.17

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit  
 NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.  
 SOURCE: National Center for Health Statistics multiple cause of death data.

## *Respiratory Tuberculosis: Mortality*

**Table 12-2. Respiratory tuberculosis: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states and years, 1990-1999**

COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
768	Crushing and grinding machine operators	11	3.50	1.75	6.26
829	Sailors and deckhands	11	2.29	1.14	4.09
534	Heating, air conditioning, and refrigeration mechanics	14	2.18	1.19	3.66
479	Farm workers	96	1.73	1.41	2.12
616	Mining machine operators	75	1.70	1.35	2.14
875	Garbage collectors	22	1.64	1.03	2.49
913	Retired, with no other occupation reported	33	1.53	1.05	2.14
917	Unemployed, never worked, disabled	226	1.41	1.23	1.60
449	Maids and housemen	55	1.40	1.07	1.84
869	Construction laborers	216	1.35	1.18	1.55
473	Farmers, except horticulture	352	1.26	1.14	1.40
379	General office clerks	76	1.26	1.00	1.59
567	Carpenters	131	1.20	1.01	1.43
889	Laborers, except construction	370	1.15	1.04	1.28

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states and years.

SOURCE: National Center for Health Statistics multiple cause of death data.

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## **Section 13**

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# **Lung Cancer**



**Table 13-1. Lung cancer: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states, 1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
801	Bowling alleys, billiard and pool parlors	19	1.80	1.08	2.81
371	Scientific and controlling instruments	55	1.42	1.08	1.86
360	Ship and boat building and repairing	84	1.32	1.06	1.65
472	Not specified utilities	63	1.31	1.02	1.70
772	Beauty shops	211	1.30	1.14	1.49
130	Tobacco manufactures	95	1.30	1.06	1.60
271	Iron and steel foundries	90	1.29	1.05	1.60
041	Coal mining	327	1.25	1.12	1.39
802	Miscellaneous entertainment and recreation services	251	1.22	1.07	1.38
351	Motor vehicles and motor vehicle equipment	493	1.21	1.11	1.33
410	Trucking service	1,004	1.21	1.14	1.29
682	Miscellaneous retail stores	142	1.20	1.02	1.42
282	Fabricated structural metal products	124	1.20	1.00	1.44
172	Printing, publishing, and allied industries, except newspapers	270	1.19	1.06	1.35
060	Construction	3,336	1.19	1.15	1.23
641	Eating and drinking places	907	1.16	1.08	1.23
942	Military	680	1.14	1.06	1.23
751	Automotive repair and related services	452	1.14	1.04	1.25
400	Railroads	385	1.12	1.01	1.23
392	Not specified manufacturing industries	782	1.11	1.03	1.19

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

## Lung Cancer: Mortality

**Table 13-2. Lung cancer: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states, 1999**

COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
205	Health record technologists and technicians	5	3.13	1.01	7.32
646	Lay-out workers	13	2.50	1.33	4.28
636	Precision assemblers, metal	14	2.40	1.31	4.02
459	Attendants, amusement and recreation facilities	48	1.73	1.27	2.30
614	Drillers, oil well	18	1.71	1.01	2.69
556	Supervisors: painters, paperhangers, and plasterers	30	1.52	1.03	2.18
029	Buyers, wholesale and retail trade except farm products	38	1.47	1.04	2.01
435	Waiters and waitresses	258	1.43	1.26	1.62
756	Mixing and blending machine operators	48	1.42	1.04	1.88
534	Heating, air conditioning, and refrigeration mechanics	57	1.41	1.08	1.84
469	Personal service occupations, n.e.c.	54	1.40	1.06	1.84
683	Electrical and electronic equipment assemblers	90	1.37	1.11	1.70
823	Railroad conductors and yardmasters	58	1.36	1.04	1.77
689	Inspectors, testers, and graders	54	1.35	1.02	1.78
518	Industrial machinery repairers	205	1.31	1.14	1.50
544	Millwrights	64	1.29	1.01	1.66
653	Sheet metal workers	83	1.29	1.03	1.61
616	Mining machine operators	317	1.27	1.13	1.42
579	Painters, construction and maintenance	227	1.26	1.10	1.44
503	Supervisors, mechanics and repairers	113	1.25	1.04	1.51
458	Hairdressers and cosmetologists	190	1.25	1.08	1.44
633	Supervisors, production occupations	632	1.24	1.14	1.34
585	Plumbers, pipefitters, and steamfitters	240	1.21	1.07	1.38
337	Bookkeepers, accounting, and auditing clerks	343	1.21	1.09	1.35
783	Welders and cutters	253	1.21	1.07	1.37
575	Electricians	307	1.20	1.08	1.35
844	Operating engineers	241	1.18	1.04	1.34
869	Construction laborers	557	1.17	1.08	1.28
804	Truck drivers	1,258	1.16	1.10	1.23
505	Automobile mechanics	364	1.15	1.03	1.27
567	Carpenters	588	1.15	1.06	1.24
905	Military occupations	591	1.14	1.06	1.24
785	Assemblers	345	1.12	1.00	1.24
453	Janitors and cleaners	756	1.12	1.04	1.20
019	Managers and administrators, n.e.c.	2,074	1.09	1.04	1.13

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

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## **Section 14**

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# **Other Interstitial Pulmonary Diseases**





## *Other Interstitial Pulmonary Disease: Mortality*

**Table 14-1. Other interstitial pulmonary diseases: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual industry, U.S. residents age 15 and over, selected states, 1999**

CIC	Industry	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
232	Wood buildings and mobile homes	5	4.75	1.54	11.10
040	Metal mining	15	2.18	1.22	3.60
891	Research, development and testing services	15	2.14	1.19	3.52
812	Offices and clinics of physicians	31	1.81	1.23	2.57
282	Fabricated structural metal products	19	1.80	1.08	2.81
460	Electric light and power	32	1.65	1.13	2.34
700	Banking	43	1.44	1.04	1.94
831	Hospitals	128	1.22	1.03	1.46

CIC - Census Industry Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

## *Other Interstitial Pulmonary Disease: Mortality*

**Table 14-2. Other interstitial pulmonary diseases: Proportionate mortality ratio (PMR) adjusted for age, sex, and race by usual occupation, U.S. residents age 15 and over, selected states, 1999**

COC	Occupation	Number of Deaths	PMR	95% Confidence Interval	
				LCL	UCL
086	Veterinarians	7	5.71	2.29	11.77
155	Teachers, prekindergarten and kindergarten	5	3.41	1.10	7.98
508	Aircraft engine mechanics	8	2.42	1.04	4.76
319	Receptionists	14	2.05	1.12	3.44
084	Physicians	23	2.03	1.28	3.04
095	Registered nurses	74	1.57	1.24	1.98

COC - Census Occupation Code      n.e.c. - not elsewhere classified      LCL - lower confidence limit      UCL - upper confidence limit

NOTE: See appendices for source description, methods, and ICD codes, industry and occupation codes, and list of selected states.

SOURCE: National Center for Health Statistics multiple cause of death data.

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## **Section 15**

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# **Various Work-Related Respiratory Conditions**



*Various Work-Related Respiratory Conditions: Morbidity*

**Table 15-1. Work-related respiratory illnesses (with days away from work): Estimated number, 1996-2000**

	1996	1997	1998	1999	2000
<b>Acute respiratory infections (including common cold)</b>	<b>212</b>	<b>267</b>	<b>193</b>	<b>149</b>	<b>307</b>
<b>Other diseases of upper respiratory tract</b>	<b>169</b>	<b>155</b>	<b>193</b>	<b>320</b>	<b>117</b>
Allergic rhinitis	51	71	-	121	-
Chronic conditions of upper respiratory tract (including chronic sinusitis, pharyngitis)	41	-	-	-	-
Other diseases of upper respiratory tract, unspecified or n.e.c.	42	-	-	167	-
<b>Pneumonia, influenza</b>	<b>79</b>	<b>115</b>	<b>144</b>	<b>197</b>	<b>95</b>
Influenza	-	-	-	63	-
Pneumonia	46	-	72	99	46
Legionnaires' disease	17	-	-	-	-
<b>Chronic obstructive pulmonary disease (COPD) and allied conditions</b>	<b>2,160</b>	<b>1,005</b>	<b>1,097</b>	<b>760</b>	<b>1,083</b>
Bronchitis	738	127	-	171	205
Extrinsic asthma	403	606	154	282	618
COPD and allied conditions, unspecified or n.e.c.	926	173	237	133	171
Extrinsic alveolitis and pneumonitis (including farmers' lung, bagassosis)	87	98	161	145	88
<b>Pneumoconioses</b>	<b>45</b>	<b>-</b>	<b>108</b>	<b>82</b>	<b>70</b>
Coal workers' pneumoconiosis (including anthracosis, black lung, miners' asthma)	-	-	73	-	-
Pneumoconioses, unspecified	18	-	-	-	19
<b>Pneumonopathy</b>	<b>39</b>	<b>-</b>	<b>-</b>	<b>19</b>	<b>101</b>
Byssinosis, mill fever	-	-	-	-	-
Metal fume fever	-	-	-	-	80
Pneumonopathy, unspecified	-	-	-	-	-
<b>Other respiratory system diseases</b>	<b>80</b>	<b>289</b>	<b>182</b>	<b>114</b>	<b>139</b>
Pneumonitis, n.e.c.	-	-	-	18	-
Atelectasis, collapsed lung	18	103	-	-	-
Other respiratory system diseases, unspecified or n.e.c.	47	163	76	83	101
<b>Respiratory system diseases, unspecified</b>	<b>882</b>	<b>357</b>	<b>544</b>	<b>517</b>	<b>679</b>
<b>All respiratory system diseases</b>	<b>3,665</b>	<b>2,270</b>	<b>2,490</b>	<b>2,158</b>	<b>2,591</b>

- indicates no data reported or data do not meet BLS publication guidelines. n.e.c. - not elsewhere classified.

NOTE: Numbers may not sum to totals due to rounding. See appendices for source description and methods.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

## Various Work-Related Respiratory Conditions: Morbidity

**Table 15-2. Work-related respiratory illnesses (with days away from work): Median days away from work, 1996-2000**

	1996	1997	1998	1999	2000
<b>Acute respiratory infections (including common cold)</b>	<b>5</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>3</b>
<b>Other diseases of upper respiratory tract</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>
Allergic rhinitis	3	-	-	1	-
Chronic conditions of upper respiratory tract (including chronic sinusitis, pharyngitis)	-	-	-	-	-
Other diseases of upper respiratory tract, unspecified or n.e.c.	4	3	3	2	-
<b>Pneumonia, influenza</b>	<b>10</b>	<b>9</b>	<b>4</b>	<b>9</b>	<b>23</b>
Influenza	-	-	-	2	-
Pneumonia	10	-	4	10	8
Legionnaires' disease	12	-	-	-	-
<b>Chronic obstructive pulmonary disease (COPD) and allied conditions</b>	<b>6</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>3</b>
Bronchitis	2	3	-	5	7
Extrinsic asthma	6	3	1	8	3
COPD and allied conditions, unspecified or n.e.c.	9	5	3	5	15
Extrinsic alveolitis and pneumonitis (including farmers' lung, bagassosis)	5	2	5	3	12
<b>Pneumoconioses</b>	<b>14</b>	<b>-</b>	<b>157</b>	<b>81</b>	<b>41</b>
Coal workers' pneumoconiosis (including anthracosis, black lung, miners' asthma)	-	-	190	-	-
Pneumoconioses, unspecified	14	-	-	-	8
<b>Pneumonopathy</b>	<b>15</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>3</b>
Byssinosis, mill fever	-	-	-	-	-
Metal fume fever	-	-	-	-	3
Pneumonopathy, unspecified	-	-	-	-	-
<b>Other respiratory system diseases</b>	<b>5</b>	<b>5</b>	<b>2</b>	<b>11</b>	<b>2</b>
Pneumonitis, n.e.c.	-	-	-	3	-
Atelectasis, collapsed lung	11	5	-	-	-
Other respiratory system diseases, unspecified or n.e.c.	2	-	5	24	2
<b>Respiratory system diseases, unspecified</b>	<b>2</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>1</b>
<b>All respiratory system diseases</b>	<b>5</b>	<b>5</b>	<b>2</b>	<b>3</b>	<b>4</b>

- indicates no data reported or data do not meet BLS publication guidelines.

n.e.c. - not elsewhere classified.

NOTE: See appendices for source description and methods.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

## *Various Work-Related Respiratory Conditions: Morbidity*

**Table 15-3a. Annual average employment: Estimated number (in thousands) by major industry division, 1996-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Total
1996	1,717	578	5,360	18,461	5,989	28,027	6,746	31,895	98,773
1997	1,765	596	5,637	18,657	6,171	28,584	6,952	33,305	101,667
1998	1,815	589	5,950	18,807	6,307	29,087	7,219	34,624	104,641
1999	1,861	535	6,337	18,538	6,578	29,716	7,400	36,374	107,612
2000	1,912	536	6,623	18,425	6,792	30,305	7,436	37,686	110,065

NOTE: The sum of individual industries may not equal yearly total due to rounding. See appendices for source description and methods.  
SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

**Table 15-3b. Work-related respiratory illnesses (with days away from work): Estimated number by industry division, 1996-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Total
1996	-	15	178	840	503	589	161	1,365	3,665
1997	-	33	177	671	163	490	42	667	2,270
1998	-	91	67	681	244	423	162	798	2,490
1999	-	38	59	682	236	381	84	665	2,158
2000	-	37	80	527	222	705	247	750	2,591

- indicates no data reported or data that do not meet BLS publication guidelines.

NOTE: The sum of individual industries may not equal yearly total due to rounding. See appendices for source description and methods.

SOURCE: Bureau of Labor Statistics annual reports of occupational injuries and illnesses.

**Table 15-3c. Work-related respiratory illnesses (with days away from work): Estimated rate (per 100,000 workers) by industry division, 1996-2000**

Year	Agriculture	Mining	Construction	Manufacturing	Transportation & Public Utilities	Wholesale & Retail Trade	Finance	Services	Total
1996	-	2.6	3.3	4.6	8.4	2.1	2.4	4.3	3.7
1997	-	5.5	3.1	3.6	2.6	1.7	0.6	2.0	2.2
1998	-	15.4	1.1	3.6	3.8	1.5	2.2	2.3	2.4
1999	-	7.1	0.9	3.7	3.6	1.3	1.1	1.8	2.0
2000	-	6.9	1.2	2.9	3.3	2.3	3.3	2.0	2.4

- indicates no data reported or data that do not meet BLS publication guidelines.

NOTE: See appendices for source description and methods.

## Various Work-Related Respiratory Conditions: Morbidity

**Table 15-4. Work-related respiratory conditions: Number of diagnoses related to asbestos or to other occupational exposures, based on physician's judgement, selected occupational and environmental medical clinics, 1991-2000**

	Asbestos-related (4,471 patients)		Other (2,021 patients)		
	No.	%	No.	%	Most frequent hazard (No. of cases)
<b>MALIGNANT DISEASES</b>					
Lung cancer	37	0.8	9	0.4	crystalline silica (3)
Nasal/pharyngeal cancer	-	-	2	0.1	wood dust (1), smoke n.o.s. (1)
Laryngeal cancer	7	0.2	3	0.1	various (1 each)
Mesothelioma	10	0.2	-	-	
<b>OTHER CONDITIONS</b>					
<b>Upper airway diseases</b>	<b>4</b>	<b>0.1</b>	<b>457</b>	<b>22.1</b>	
Upper respiratory irritation	2	0.1	440	21.3	indoor air pollutants (132)
Laryngeal disorders (other than irritation or cancer)	2	0.1	12	0.6	indoor air pollutants (4),
Nasal septum perforation	-	-	3	0.1	NaOH (1), NH <sub>3</sub> gas (1), Cr (1)
Nasal polyps	-	-	2	0.1	petroleum (1), solvents n.o.s. (1)
<b>Lower airway diseases</b>	<b>60</b>	<b>1.3</b>	<b>1,075</b>	<b>52.0</b>	
Asthma & reactive airways dysfunction syndrome	7	0.2	847	41.0	indoor air pollutants (134)
COPD & emphysema & chronic bronchitis	53	1.1	128	6.2	smoke n.o.s. (14), dust n.o.s. (8)
Bronchitis, acute	-	-	16	0.8	welding fume n.o.s. (2), smoke n.o.s. (2)
Bronchitis, n.o.s.	-	-	82	4.0	indoor air pollutants (9)
Bronchiectasis & pneumonia	-	-	2	0.2	indoor air pollutants (1), late effects of traumatic injury (1)
<b>Interstitial inflammatory/fibrotic diseases</b>	<b>3,930</b>	<b>86.5</b>	<b>273</b>	<b>13.2</b>	
Asbestosis	3,921	86.3	-	-	
Silicosis	-	-	145	7.0	crystalline silica (145)
Coal workers' pneumoconiosis	-	-	58	2.8	coal (58)
Pneumoconiosis due to other or mixed dust	7	0.2	18	0.9	crystalline silica (4)
Interstitial pulmonary fibrosis	2	0.1	19	0.9	methyl chloroform (3), paint (3)
Chemical pneumonitis	-	-	15	0.7	chlorine (3), solvents n.o.s. (3)
Hypersensitivity pneumonitis	-	-	18	0.9	cutting oils (3), mold n.o.s. (3)
<b>Pleural disease (without apparent lung disease)</b>	<b>463</b>	<b>10.1</b>	<b>2</b>	<b>0.1</b>	crystalline silica (1), latex gloves n.o.s. (1)
<b>Lung function abnormalities (n.o.s.)</b>	<b>10</b>	<b>0.2</b>	<b>11</b>	<b>0.5</b>	crystalline silica (2), solvents n.o.s. (2)
<b>Abnormal CXR (n.o.s.)</b>	<b>10</b>	<b>0.2</b>	-	-	
<b>Symptoms</b>	<b>8</b>	<b>0.2</b>	<b>57</b>	<b>2.8</b>	
Cough	2	0.1	18	0.9	indoor air pollutants (4)
Shortness of breath	5	0.1	20	1.0	various (1 each)
Chest pain	-	-	9	0.4	various (1 each)
Hoarseness	-	-	7	0.3	indoor air pollutants (2)
Nosebleeds	-	-	2	0.1	glutaraldehyde (1), chromium n.o.s. (1)
Hemoptysis	1	0.1	1	0.1	cutting oils (1)
<b>Non-specific respiratory disorders</b>	<b>4</b>	<b>0.1</b>	<b>21</b>	<b>1.0</b>	indoor air pollutants (2)
<b>Chemical poisonings</b>	<b>-</b>	<b>-</b>	<b>70</b>	<b>3.4</b>	
Metal fume fever	-	-	16	0.8	zinc (5), metal fumes n.o.s. (5)
Toxic effects of carbon monoxide or cyanides	-	-	21	1.0	carbon monoxide (13)
Toxic effects of gas/fumes/vapors/misc. chemicals (excl. lead, other heavy metals, pesticides, solvents)	-	-	32	1.5	ethylene oxide (6)
Hypoxia	-	-	1	0.1	Freon® (1)
<b>Selected miscellaneous conditions</b>	<b>-</b>	<b>-</b>	<b>87</b>	<b>4.2</b>	
Positive PPD skin test	-	-	83	4.0	tuberculosis (83)
Sarcoidosis	-	-	4	0.2	cleaning materials n.o.s. (2)
<b>TOTAL</b>	<b>4,543</b>	<b>100.0</b>	<b>2,067</b>	<b>100.0</b>	

- indicates no cases      n.o.s. - not otherwise specified

NOTE: In the Symptoms and the Chemical Poisonings categories, all diagnoses in the subcategories shown have been included as "respiratory" in this table, though some may not have been respiratory. In addition to the diagnoses shown in this table, there were 17 non-respiratory diagnoses related to asbestos and 5,413 non-respiratory diagnoses related to other occupational hazards. See appendices for source description.

SOURCE: AOEC Occupational and Environmental Disease Database.



*Various Work-Related Respiratory Conditions: Morbidity*

**Table 15-5. Most frequent hazards associated with respiratory diagnoses, patients without asbestos-related diagnoses, selected occupational and environmental medical clinics, 1991-2000**

<b>Respiratory hazards</b>	<b>Number</b>	<b>Percent</b>
Indoor air pollutants	320	12.8
Crystalline silica	171	6.8
Solvents n.o.s.	128	5.1
Dust n.o.s.	94	3.8
Smoke n.o.s.	84	3.4
Coal	77	3.1
Isocyanates n.o.s.	72	2.9
Welding n.o.s.	59	2.4
Paint	55	2.2
Chemicals n.o.s.	48	1.9
Mold	47	1.9
Cutting oils	46	1.8
Formaldehyde	36	1.4
Latex, natural rubber	36	1.4
Ammonia solution n.o.s.	29	1.2
Glutaraldehyde	27	1.1
Chlorine	26	1.0
Metal fumes n.o.s.	23	0.9
Toluene diisocyanate	22	0.9
Toluene	22	0.9
Epoxy resins	21	0.8
Methyl chloroform (1,1,1-trichloroethane)	19	0.8
Wood dust n.o.s.	19	0.8
Hydrocarbons n.o.s.	18	0.7
Methyl ethyl ketone	18	0.7
Glues n.o.s.	18	0.7
Cleaning materials n.o.s.	17	0.7
Acids, bases, oxidizers n.o.s.	17	0.7
Man-made mineral fibers	16	0.6
Carbon monoxide	16	0.6
Diesel exhaust	16	0.6
Lubricants n.o.s.	15	0.6
Metal dust n.o.s.	15	0.6
Sulfuric acid	14	0.6
Bleach	12	0.5
Xylene	12	0.5
Perchloroethylene	12	0.5
Cigarette smoke	12	0.5
Sodium hydroxide	11	0.4
Pesticides n.o.s.	11	0.4
Hydrochloric acid	10	0.4
Flour n.o.s.	10	0.4
All others	753	30.1
<b>TOTAL</b>	<b>2,504</b>	<b>100.0</b>

n.o.s. - not otherwise specified

NOTE: The hazards in this table relate to the 2,021 patients with respiratory (excluding asbestos-related) diagnoses shown in Table 15-4. Percentages may not total to 100% due to rounding. See appendices for source description and methods.

SOURCE: AOEC Occupational and Environmental Disease Database.



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## **Section 16**

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# **Smoking Prevalence by Industry and Occupation**



**Table 16-1. Smoking status: Estimated prevalence by current industry, U.S. residents age 18 and over, 2000**

Industry	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Repair services	283	43.4	36.5 - 50.3	19.6	14.5 - 24.7
Eating and drinking places	901	39.7	35.8 - 43.6	12.1	9.6 - 14.6
Automotive dealers and gasoline stations	317	38.9	32.6 - 45.2	18.3	13.4 - 23.2
Construction	1,226	37.4	34.1 - 40.7	18.7	16.2 - 21.2
Food, bakery and dairy stores	434	36.1	31.0 - 41.2	13.5	10.2 - 16.8
Fabricated metal industries, including ordnance	184	34.1	26.7 - 41.5	21.4	14.0 - 28.8
Primary metal industries	114	33.3	23.9 - 42.7	26.1	16.9 - 35.3
Trucking service and warehousing	367	33.2	27.7 - 38.7	17.4	12.9 - 21.9
Food and kindred products	241	32.8	25.7 - 39.9	18.0	11.7 - 24.3
Mining	66	32.6	21.0 - 44.2	22.3	9.6 - 35.0
Machinery, except electrical	303	31.9	25.8 - 38.0	23.2	17.7 - 28.7
Furniture, lumber and wood	207	29.9	23.6 - 36.2	13.8	8.5 - 19.1
Textile mill and finished textile products	185	29.5	21.1 - 37.9	14.9	8.8 - 21.0
Electrical machinery, equipment and supplies	280	29.2	23.1 - 35.3	14.8	9.5 - 20.1
Forestry and fisheries	31	28.3	8.9 - 47.7	16.2	4.4 - 28.0
Business services	1,219	27.0	24.1 - 29.9	16.0	13.5 - 18.5
Other nondurable goods	229	26.7	20.0 - 33.4	24.0	18.1 - 29.9
Other personal services	541	26.7	22.4 - 31.0	18.3	14.6 - 22.0
Other and not specified durable goods	245	26.4	20.5 - 32.3	18.7	13.4 - 24.0
General merchandise stores	363	25.7	20.6 - 30.8	14.7	10.4 - 19.0
Transportation equipment	317	25.4	19.7 - 31.1	22.9	18.0 - 27.8
Railroads	44	24.8	10.5 - 39.1	24.0	9.5 - 38.5
Wholesale trade	703	24.2	20.5 - 27.9	25.0	21.7 - 28.3
Entertainment and recreation services	362	24.2	19.1 - 29.3	16.8	12.5 - 21.1
Other and not specified retail trade	922	23.9	20.8 - 27.0	20.0	17.1 - 22.9
Other transportation	453	23.5	18.6 - 28.4	27.0	21.7 - 32.3
Chemicals and allied products	167	22.9	15.5 - 30.3	23.4	16.7 - 30.1
Banking and credit agencies	421	22.4	17.9 - 26.9	16.8	12.7 - 20.9
Health services, except hospitals	1,107	21.9	19.2 - 24.6	18.8	16.1 - 21.5
Insurance, real estate, and other finance	852	21.0	18.1 - 23.9	22.0	18.7 - 25.3
Communications	334	20.6	15.7 - 25.5	19.7	14.8 - 24.6
Utilities and sanitary	178	20.6	13.7 - 27.5	20.0	12.9 - 27.1
Printing, publishing and allied industries	243	20.3	14.2 - 26.4	25.5	19.4 - 31.6
Agriculture	465	20.2	16.3 - 24.1	17.9	14.0 - 21.8
Public administrations	940	20.1	17.0 - 23.2	24.6	21.5 - 27.7
Private households	170	19.3	11.7 - 26.9	16.6	8.8 - 24.4
Hospitals	823	18.8	15.9 - 21.7	18.0	14.9 - 21.1
Legal, engineering and other professional services	720	18.7	15.2 - 22.2	22.2	18.9 - 25.5
Social services, religious and membership organizations	793	16.9	14.2 - 19.6	20.7	17.6 - 23.8
Other educational services	89	12.8	3.6 - 22.0	30.0	19.6 - 40.4
Elementary and secondary schools and colleges	1,710	11.8	10.0 - 13.6	20.9	18.7 - 23.1
Armed forces	4	0.0	- -	33.3	0.0 - 78.0
<b>TOTAL</b>	<b>20,094</b>	<b>25.0</b>	<b>24.2 - 25.8</b>	<b>19.4</b>	<b>18.8 - 20.0</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Smoking Status

**Table 16-2. Smoking status: Estimated prevalence by current industry, U.S. male residents age 18 and over, 2000**

Industry	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Repair services	248	42.8	35.2 - 50.4	20.2	14.7 - 25.7
Eating and drinking places	410	40.4	34.7 - 46.1	10.1	7.2 - 13.0
Construction	1,120	38.3	34.8 - 41.8	18.5	15.8 - 21.2
Automotive dealers and gasoline stations	223	37.0	29.9 - 44.1	20.1	14.2 - 26.0
Fabricated metal industries, including ordnance	142	36.0	27.6 - 44.4	23.4	15.2 - 31.6
Food and kindred products	145	35.6	26.6 - 44.6	20.6	12.6 - 28.6
Forestry and fisheries	21	34.8	10.3 - 59.3	7.9	0.0 - 17.3
General merchandise stores	108	34.2	23.2 - 45.2	17.9	9.5 - 26.3
Other personal services	162	33.5	25.9 - 41.1	18.7	11.4 - 26.0
Other and not specified durable goods	151	33.1	25.1 - 41.1	17.0	10.3 - 23.7
Textile mill and finished textile products	65	32.9	18.8 - 47.0	15.9	6.7 - 25.1
Primary metal industries	86	32.6	22.4 - 42.8	28.7	18.3 - 39.1
Trucking service and warehousing	283	32.6	26.7 - 38.5	18.5	13.2 - 23.8
Machinery, except electrical	225	32.3	25.4 - 39.2	24.5	18.0 - 31.0
Food, bakery and dairy stores	191	30.9	23.3 - 38.5	16.9	11.6 - 22.2
Mining	57	29.3	17.9 - 40.7	24.3	10.0 - 38.6
Electrical machinery, equipment and supplies	157	28.6	20.4 - 36.8	16.4	9.7 - 23.1
Furniture, lumber and wood	147	28.5	20.7 - 36.3	15.8	8.9 - 22.7
Other nondurable goods	165	27.1	19.1 - 35.1	26.3	19.0 - 33.6
Printing, publishing and allied industries	132	26.7	17.5 - 35.9	25.7	17.7 - 33.7
Business services	642	26.3	22.2 - 30.4	16.6	13.1 - 20.1
Other transportation	263	26.1	19.2 - 33.0	27.9	20.5 - 35.3
Transportation equipment	220	26.0	19.7 - 32.3	22.3	16.8 - 27.8
Private households	10	25.7	0.0 - 54.3	24.9	0.0 - 55.5
Railroads	41	25.5	10.8 - 40.2	24.6	9.7 - 39.5
Wholesale trade	447	25.5	20.8 - 30.2	26.8	22.5 - 31.1
Other and not specified retail trade	415	24.8	19.9 - 29.7	23.0	18.3 - 27.7
Entertainment and recreation services	202	23.8	16.9 - 30.7	14.4	9.3 - 19.5
Banking and credit agencies	106	22.6	13.8 - 31.4	27.8	18.6 - 37.0
Agriculture	360	20.9	16.4 - 25.4	18.6	13.9 - 23.3
Chemicals and allied products	102	20.1	11.3 - 28.9	26.0	17.0 - 35.0
Utilities and sanitary	139	19.8	12.2 - 27.4	20.5	12.9 - 28.1
Insurance, real estate, and other finance	341	19.6	15.3 - 23.9	25.4	19.9 - 30.9
Communications	188	18.9	12.8 - 25.0	22.7	16.0 - 29.4
Public administrations	468	18.0	13.9 - 22.1	27.0	22.1 - 31.9
Legal, engineering and other professional services	344	16.6	12.1 - 21.1	20.7	16.4 - 25.0
Health services, except hospitals	181	15.1	9.6 - 20.6	25.3	18.2 - 32.4
Hospitals	176	13.4	7.1 - 19.7	20.9	14.0 - 27.8
Other educational services	19	11.8	0.0 - 26.5	55.2	31.1 - 79.3
Elementary and secondary schools and colleges	468	11.2	8.1 - 14.3	21.2	16.9 - 25.5
Social services, religious and membership organizations	171	10.5	5.8 - 15.2	30.8	22.8 - 38.8
Armed forces	2	0.0	- -	28.3	0.0 - 84.6
<b>TOTAL</b>	<b>9,818</b>	<b>27.0</b>	<b>26.0 - 28.0</b>	<b>21.0</b>	<b>20.0 - 22.0</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

**Table 16-3. Smoking status: Estimated prevalence by current industry, U.S. female residents age 18 and over, 2000**

Industry	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Mining	9	57.4	23.7 - 91.1	6.6	0.0 - 19.5
Repair services	35	48.7	29.9 - 67.5	14.2	1.7 - 26.7
Automotive dealers and gasoline stations	94	44.4	32.2 - 56.6	13.1	5.5 - 20.7
Food, bakery and dairy stores	243	40.6	33.7 - 47.5	10.6	6.5 - 14.7
Eating and drinking places	491	39.0	33.5 - 44.5	14.2	10.3 - 18.1
Primary metal industries	28	36.6	16.2 - 57.0	14.4	0.0 - 31.1
Trucking service and warehousing	84	35.9	23.2 - 48.6	12.8	4.0 - 21.6
Furniture, lumber and wood	60	33.3	21.7 - 44.9	8.8	0.8 - 16.8
Machinery, except electrical	78	30.4	17.9 - 42.9	18.1	8.9 - 27.3
Electrical machinery, equipment and supplies	123	30.1	20.3 - 39.9	12.6	5.3 - 19.9
Chemicals and allied products	65	28.3	15.8 - 40.8	18.1	7.7 - 28.5
Business services	577	27.8	23.7 - 31.9	15.3	12.0 - 18.6
Construction	106	27.5	17.1 - 37.9	21.1	11.3 - 30.9
Food and kindred products	96	27.3	16.7 - 37.9	13.0	5.4 - 20.6
Textile mill and finished textile products	120	27.3	16.1 - 38.5	14.2	6.8 - 21.6
Fabricated metal industries, including ordnance	42	26.5	12.6 - 40.4	13.4	0.0 - 26.9
Other nondurable goods	64	25.6	13.3 - 37.9	16.1	7.7 - 24.5
Utilities and sanitary	39	24.9	8.8 - 41.0	17.4	3.5 - 31.3
Entertainment and recreation services	160	24.7	17.3 - 32.1	20.5	13.6 - 27.4
Communications	146	23.9	16.1 - 31.7	14.2	7.5 - 20.9
Health services, except hospitals	926	23.5	20.4 - 26.6	17.3	14.4 - 20.2
Transportation equipment	97	23.4	13.8 - 33.0	24.4	14.2 - 34.6
Other personal services	379	23.2	18.1 - 28.3	18.0	13.7 - 22.3
Other and not specified retail trade	507	23.0	18.9 - 27.1	17.0	13.3 - 20.7
Public administrations	472	22.9	18.6 - 27.2	21.4	16.9 - 25.9
Banking and credit agencies	315	22.3	16.8 - 27.8	12.1	8.0 - 16.2
General merchandise stores	255	22.2	16.5 - 27.9	13.3	8.6 - 18.0
Insurance, real estate, and other finance	511	22.0	18.3 - 25.7	19.4	15.5 - 23.3
Wholesale trade	256	21.4	15.9 - 26.9	21.0	15.5 - 26.5
Legal, engineering and other professional services	376	20.8	15.9 - 25.7	23.7	18.8 - 28.6
Hospitals	647	20.3	16.8 - 23.8	17.1	13.8 - 20.4
Social services, religious and membership organizations	622	19.2	15.9 - 22.5	17.2	13.9 - 20.5
Other transportation	190	19.0	12.5 - 25.5	25.2	18.5 - 31.9
Private households	160	18.9	11.1 - 26.7	16.1	7.9 - 24.3
Agriculture	105	17.6	10.0 - 25.2	15.6	5.8 - 25.4
Forestry and fisheries	10	16.2	0.0 - 44.8	31.8	0.2 - 63.4
Other and not specified durable goods	94	13.2	5.8 - 20.6	21.9	12.7 - 31.1
Other educational services	70	13.1	2.1 - 24.1	23.0	12.2 - 33.8
Elementary and secondary schools and colleges	1,242	12.1	9.9 - 14.3	20.8	18.3 - 23.3
Printing, publishing and allied industries	111	11.4	6.1 - 16.7	25.1	16.7 - 33.5
Railroads	3	0.0	- -	0.0	- -
Armed forces	2	0.0	- -	41.5	0.0 - 100.0
<b>TOTAL</b>	<b>10,276</b>	<b>22.8</b>	<b>21.8 - 23.8</b>	<b>17.6</b>	<b>16.8 - 18.4</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Smoking Status

**Table 16-4. Smoking status: Estimated prevalence by current occupation, U.S. residents age 18 and over, 2000**

Occupation	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Machine operators and tenderers, except precision	743	45.9	41.9 - 49.8	18.2	15.3 - 21.1
Forestry and fishing occupations	20	42.0	16.3 - 67.7	2.4	0.0 - 7.1
Construction and extractive trades	806	41.3	37.4 - 45.2	18.6	15.3 - 21.9
Material moving equipment operators	139	40.5	31.3 - 49.7	15.8	8.5 - 23.1
Food service	839	39.8	35.5 - 44.1	11.4	9.2 - 13.6
Precision production occupations	527	36.2	31.5 - 40.9	19.0	15.3 - 22.7
Motor vehicle operators	597	34.8	30.5 - 39.1	20.4	16.9 - 23.9
Construction laborers	149	34.3	26.3 - 42.3	13.2	6.1 - 20.3
Health service	475	32.8	27.7 - 37.9	14.3	10.6 - 18.0
Freight, stock and material handlers	583	32.5	28.0 - 37.0	13.8	10.5 - 17.1
Mechanics and repairers	623	31.5	27.2 - 35.8	22.0	18.5 - 25.5
Cleaning and building service	534	30.8	26.3 - 35.3	15.0	11.7 - 18.3
Other protective service occupations	158	28.6	20.6 - 36.6	20.0	12.9 - 27.1
Farm workers and other agricultural workers	337	28.6	22.9 - 34.3	14.1	9.2 - 19.0
Fabricators, assemblers, inspectors and samplers	401	28.1	22.8 - 33.4	18.2	13.5 - 22.9
Other transportation, except motor vehicles	36	25.3	7.9 - 42.7	28.8	11.6 - 46.0
Managers and administrators, except public administration	1,857	25.2	23.0 - 27.4	23.0	20.8 - 25.2
Health technologists and technicians	281	24.9	18.8 - 30.9	15.2	10.5 - 19.9
Other sales	905	24.4	21.3 - 27.5	17.2	14.3 - 20.1
Supervisors and proprietors	601	23.4	19.7 - 27.1	24.2	19.9 - 28.5
Financial records processing occupations	343	23.1	18.0 - 28.2	18.1	13.4 - 22.8
Personal service	467	20.8	16.7 - 24.9	17.5	13.4 - 21.6
Secretaries, stenographers and typists	405	20.5	16.2 - 24.8	19.7	14.8 - 24.6
Officials and administrators, public health administration	117	20.1	11.7 - 28.5	31.6	22.6 - 40.6
Management related occupation	793	19.9	16.6 - 23.2	20.2	16.9 - 23.5
Mail and message distributing	133	19.3	11.9 - 26.7	24.0	15.2 - 32.8
Other administrative support	1,941	19.3	11.8 - 26.7	19.0	17.0 - 21.0
Sales representatives, commodities and finances	623	18.9	15.4 - 22.4	26.5	22.6 - 30.4
Writers, artists, entertainers and athletes	343	18.6	14.1 - 23.1	23.3	18.4 - 28.2
Technologists, technicians except health	378	18.5	14.4 - 22.6	20.9	16.4 - 25.4
Architects and surveyors	27	17.1	1.6 - 32.6	16.5	0.6 - 32.4
Police and firefighters	188	16.3	10.8 - 21.8	21.5	14.8 - 28.2
Private households occupations	147	16.0	8.4 - 23.6	18.3	9.3 - 27.3
Natural mathematical and computer scientists	377	15.6	11.3 - 19.9	19.6	15.5 - 23.7
Other professional specialty occupations	434	14.6	11.1 - 18.1	24.2	19.3 - 29.1
Engineers	292	13.4	9.3 - 17.5	18.6	13.9 - 23.3
Farm operators and managers	127	13.2	7.9 - 18.5	25.9	18.1 - 33.7
Health assessment and treating occupations	510	12.5	9.8 - 15.2	22.5	18.6 - 26.4
Computer equipment operators	42	10.3	1.9 - 18.7	17.4	3.3 - 31.5
Teachers, librarians and counselors	1,115	9.6	7.6 - 11.6	20.9	18.0 - 23.8
Health diagnosing occupations	153	3.7	0.2 - 7.2	18.1	11.2 - 25.0
Military	5	0.0	- -	30.9	0.0 - 71.9
<b>TOTAL</b>	<b>20,094</b>	<b>25.0</b>	<b>24.2 - 25.8</b>	<b>19.4</b>	<b>18.8 - 20.0</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.



**Table 16-5. Smoking status: Estimated prevalence by current occupation, U.S. male residents age 18 and over, 2000**

Occupation	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Food service	339	41.9	35.2 - 48.6	9.3	6.6 - 12.0
Construction and extractive trades	787	41.3	37.2 - 45.4	18.8	15.5 - 22.1
Machine operators and tenderers, except precision	451	40.4	35.1 - 45.7	20.2	16.3 - 24.1
Material moving equipment operators	127	40.0	30.6 - 49.4	16.5	8.9 - 24.1
Forestry and fishing occupations	18	39.8	13.3 - 66.3	2.6	0.0 - 7.7
Health service	46	38.0	20.4 - 55.6	22.0	8.3 - 35.7
Precision production occupations	377	35.4	29.7 - 41.1	20.4	15.9 - 24.9
Construction laborers	146	34.7	26.5 - 42.9	13.3	6.2 - 20.4
Motor vehicle operators	504	34.5	30.0 - 39.0	20.8	16.9 - 24.7
Mechanics and repairers	572	32.2	27.5 - 36.9	22.5	18.8 - 26.2
Freight, stock and material handlers	398	32.2	27.1 - 37.3	14.9	10.8 - 19.0
Secretaries, stenographers and typists	8	31.6	0.0 - 67.9	10.4	0.0 - 30.2
Fabricators, assemblers, inspectors and samplers	226	30.9	24.2 - 37.6	21.6	15.1 - 28.1
Farm workers and other agricultural workers	275	28.7	22.6 - 34.8	14.7	9.4 - 20.0
Cleaning and building service	251	28.1	22.0 - 34.2	18.6	13.7 - 23.5
Personal service	63	28.1	13.6 - 42.6	21.4	14.1 - 28.7
Other protective service occupation	106	26.8	17.4 - 36.2	24.0	15.2 - 32.8
Managers and administrators, except public administration	996	25.9	23.0 - 28.8	23.5	20.8 - 26.2
Other transportation, except motor vehicles	35	25.8	8.0 - 43.6	27.5	10.3 - 44.7
Other administrative support	456	25.6	20.9 - 30.3	20.4	16.1 - 24.7
Other sales	336	23.7	18.2 - 29.2	22.2	16.9 - 27.5
Supervisors and proprietors	334	22.9	17.6 - 28.2	26.8	20.9 - 32.7
Private household occupations	6	22.4	0.0 - 60.8	30.6	0.0 - 77.1
Officials and administrators, public health administration	56	21.4	9.8 - 33.0	36.0	21.7 - 50.3
Mail and message distributing	66	20.9	10.1 - 31.7	23.6	11.8 - 35.4
Architects and surveyors	22	20.1	1.9 - 38.3	16.4	0.0 - 34.2
Health technologists and technicians	49	19.6	4.7 - 34.5	15.9	4.1 - 27.7
Writers, artists, entertainers and athletes	176	19.3	12.4 - 26.2	21.0	14.5 - 27.5
Management related occupation	292	17.9	12.2 - 23.6	23.9	17.8 - 30.0
Natural mathematical and computer scientists	245	17.9	12.4 - 23.4	18.7	13.6 - 23.8
Sales representatives, commodities and finances	353	17.8	13.5 - 22.1	30.1	24.8 - 35.4
Technologists, technicians except health	234	16.9	11.8 - 22.0	21.0	15.7 - 26.3
Police and firefighters	153	14.5	8.6 - 20.4	21.4	14.1 - 28.7
Financial records processing occupations	32	13.2	0.0 - 28.5	23.0	7.5 - 38.5
Farm operators and managers	104	12.7	7.2 - 18.2	27.0	17.6 - 36.4
Engineers	257	12.6	8.5 - 16.7	20.3	15.2 - 25.4
Health assessment and treating occupations	62	12.5	3.9 - 21.1	22.9	11.5 - 34.3
Other professional specialty occupations	181	10.3	5.8 - 14.8	30.4	22.4 - 38.4
Computer equipment operators	23	8.6	0.0 - 18.8	24.0	3.4 - 44.6
Teachers, librarians and counselors	292	8.3	5.0 - 11.6	24.0	18.7 - 29.3
Health diagnosing occupations	98	0.7	0.0 - 2.1	22.8	13.6 - 32.0
Military	3	0.0	- -	25.1	0.0 - 73.7
<b>TOTAL</b>	<b>9,818</b>	<b>27.0</b>	<b>26.0 - 28.0</b>	<b>21.0</b>	<b>20.0 - 22.0</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

## Smoking Status

**Table 16-6. Smoking status: Estimated prevalence by current occupation, U.S. female residents age 18 and over, 2000**

Occupation	Number of Respondents	Current Smokers		Former Smokers	
		Prevalence (%)	95% Confidence Interval	Prevalence (%)	95% Confidence Interval
Forestry and fishing occupations	2	67.8	7.2 - 128.	0.0	- -
Material moving equipment operators	12	47.0	9.0 - 85.0	5.2	0.0 - 15.6
Construction and extractive trades	19	41.1	8.6 - 73.6	11.3	0.0 - 25.6
Precision production occupations	150	38.5	29.5 - 47.5	14.3	8.2 - 20.4
Food service	500	38.0	32.9 - 43.1	13.1	10.0 - 16.2
Motor vehicle operators	93	36.2	25.0 - 47.4	17.7	9.3 - 26.1
Cleaning and building service	283	33.9	27.4 - 40.4	11.0	6.5 - 15.5
Other protective service occupation	52	33.3	18.2 - 48.4	9.8	0.6 - 19.0
Freight, stock and material handlers	185	33.3	25.3 - 41.3	10.9	6.0 - 15.8
Health service	429	32.2	26.9 - 37.5	13.3	9.6 - 17.0
Police and firefighters	35	28.0	9.8 - 46.2	22.4	5.2 - 39.6
Farm workers and other agricultural workers	62	27.8	14.3 - 41.3	11.0	0.0 - 23.9
Machine operators and tenderers, except precision	292	27.7	21.4 - 34.0	14.6	10.7 - 18.5
Health technologists and technicians	232	26.3	20.0 - 32.6	15.0	10.1 - 19.9
Other sales	569	24.9	21.2 - 28.6	13.6	10.3 - 16.9
Supervisors and proprietors	267	24.2	18.3 - 30.1	20.1	14.6 - 25.6
Managers and administrators, except public administration	861	24.2	20.7 - 27.7	22.5	19.4 - 25.6
Financial records processing occupations	311	24.0	18.7 - 29.3	17.6	12.5 - 22.7
Fabricators, assemblers, inspectors and samplers	175	23.4	14.8 - 32.0	12.7	7.4 - 18.0
Other administrative support	1,485	23.4	21.0 - 25.8	18.5	16.1 - 20.9
Engineers	35	21.7	6.4 - 37.0	1.5	0.0 - 4.4
Technologists, technicians except health	144	21.6	14.5 - 28.7	20.6	13.0 - 28.2
Management related occupation	501	21.2	17.1 - 25.3	17.6	13.9 - 21.3
Sales representatives, commodities and finance	270	20.7	15.6 - 25.8	20.5	15.2 - 25.8
Secretaries, stenographers and typists	397	20.3	16.0 - 24.6	19.8	14.9 - 24.7
Mechanics and repairers	51	20.2	8.0 - 32.4	15.2	3.8 - 26.6
Personal service	404	19.5	15.4 - 23.6	17.7	13.2 - 22.2
Officials and administrators, public health administration	61	18.5	8.3 - 28.7	26.1	13.9 - 38.3
Other professional specialty occupations	253	18.3	12.8 - 23.8	18.8	13.5 - 24.1
Writers, artists, entertainers and athletes	167	17.7	11.2 - 24.2	25.8	18.7 - 32.9
Mail and message distributing	67	17.2	8.4 - 26.0	24.6	11.5 - 37.7
Private household occupations	141	15.7	7.9 - 23.5	17.7	8.7 - 26.7
Farm operators and managers	23	15.4	1.1 - 29.7	21.1	3.7 - 38.5
Computer equipment operators	19	13.4	0.0 - 29.1	5.3	0.0 - 12.7
Health assessment and treating occupations	448	12.5	9.4 - 15.6	22.4	18.5 - 26.3
Natural mathematical and computer scientists	132	10.6	3.7 - 17.5	21.7	14.1 - 29.3
Teachers, librarians and counselors	823	10.2	7.8 - 12.6	19.7	16.6 - 22.8
Health diagnosing occupations	55	9.7	0.1 - 19.3	8.3	1.4 - 15.2
Construction laborers	3	0.0	- -	0.0	- -
Other transportation, except motor vehicles	1	0.0	- -	0.0	- -
Architects and surveyors	5	0.0	- -	17.3	0.0 - 48.9
Military	2	0.0	- -	0.0	- -
<b>TOTAL</b>	<b>10,276</b>	<b>22.8</b>	<b>21.8 - 23.8</b>	<b>17.6</b>	<b>16.8 - 18.4</b>

- No estimates due to no smokers/former smokers among respondents.

NOTE: Industries were classified according to 1995 Standard Industrial Classification System and then regrouped by NCHS. See appendices for source description and methods.

SOURCE: National Center for Health Statistics 2000 National Health Interview Survey.

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# Appendices

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# Appendix A

## Sources of Data

### **Annual Survey of Occupational Injuries and Illnesses, BLS**

After passage of the Occupational Safety and Health Act of 1970, the responsibility for collecting statistics on occupational injuries and illnesses was delegated to the Bureau of Labor Statistics (BLS). The BLS Annual Survey of Occupational Injuries and Illnesses, done in cooperation with participating State agencies, involves data collection by mail from a sample of approximately 250,000 establishments each calendar year. Nearly all industries in the private sector (employers covered by the Occupational Safety and Health Act of 1970) are included. Annual BLS reports of these data incorporate corresponding data from mine operators, provided to BLS by the Mine Safety and Health Administration (MSHA), and from railroad transportation employers, provided to BLS by the Federal Railroad Administration. National estimates of injury and illness incidence rates by industry are developed from the survey data. Beginning in 1992, the survey was expanded to provide more information on illnesses resulting in days away from work, allowing for more detailed classification of respiratory system diseases. For this report, annual summary data on respiratory illnesses were abstracted from BLS annual reports on occupational injuries and illnesses.

In contrast with injury data, illness data presented in the BLS annual reports are quite limited because employers typically do not recognize and report illnesses, particularly illnesses with a long latency. Also, the survey does not cover all workers since it excludes the self-employed; farm operators with fewer than 11 employees; private households; employees in federal, state, and local government agencies; and independent mining contractors.

For more information refer to annual reports: *Occupational Injuries and Illnesses: Counts, Rates, and Characteristics*, Office of Safety, Health and Working Conditions, U.S. Department of Labor, Bureau of Labor Statistics; and [www.bls.gov/iif/home.htm](http://www.bls.gov/iif/home.htm).

### **Black Lung Benefit Awards, SSA and DOL**

Title IV of the Coal Mine Health and Safety Act of 1969 authorizes a benefits program, providing medical payments and cash stipends for miners totally disabled because of pneumoconiosis arising out of employment in underground coal mining, as well as for widows of coal miners whose death resulted from the disease or who were entitled to Black Lung benefits at the time of death. The Social Security Administration (SSA) was assigned initial responsibility for operating the benefits program. The Black Lung Benefits Act of 1972 continued SSA responsibility for payments to miners granted claims before July 1973, assigned the Department of Labor responsibility for claims filed after July 1973, and extended eligibility for benefits to surface coal miners and to surviving children of miners. This latter provision allowed children to receive benefits if both parents were deceased, or if a widow ceased to qualify for benefits through remarriage. (In September 1997, in an effort to enhance customer service to Black Lung program beneficiaries, the responsibility for managing all active SSA Black Lung claims was assigned to DOL.)

For more information refer to annual reports: *Social Security Bulletin, Annual Statistical Supplements*; [www.ssa.gov/statistics/Supplement/2000/9d.pdf](http://www.ssa.gov/statistics/Supplement/2000/9d.pdf); annual reports to Congress: *Office of Workers' Compensation Programs*, U.S. Department of Labor, Employment Standards Administration; and [www.dol.gov/esa/regs/compliance/owcp/bltable.htm](http://www.dol.gov/esa/regs/compliance/owcp/bltable.htm).

### **Coal Mine Employment Data, MSHA**

Initiated in 1970, annual informational reports from the Mine Safety and Health Administration (MSHA) summarize occupational injury and illness experience of United States miners, based on data reported by mine operators. Each operator subject to the Federal Mine Safety and Health Act of 1977 is required to submit annual reports of all injuries and occupational illnesses (see section on Annual

## Appendix A: Sources of Data

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Survey of Occupational Injuries and Illnesses, above), as well as related data, including average number of employees during the year. The MSHA informational reports on coal mining provide annual estimates for size of the mining workforce, including separate figures for underground mines. Similar estimates are provided based on data reported by contractors performing certain work at mining operations.

For more information refer to annual reports: *Injury Experience in Coal Mining*, U.S. Department of Labor, Mine Safety and Health Administration; and [www.msha.gov/stats/part50/p50y2k/aetable.htm](http://www.msha.gov/stats/part50/p50y2k/aetable.htm).

### **Coal Workers' X-ray Surveillance Program, NIOSH**

The Coal Workers' X-ray Surveillance Program (CWXSP) is a NIOSH-administered occupational health program mandated by the Coal Mine Health and Safety Act of 1969. The primary objective of the CWXSP is to screen miners for coal workers' pneumoconiosis (CWP). Since 1970, coal mine operators have been required to offer a chest radiograph to all underground coal miners at the time of hire and again three years later. Subsequently, miners can volunteer for radiographs at approximately five-year intervals. The chest x-rays are taken at no cost to the miners. In addition to the posterior-anterior chest x-ray, other information is collected, including miner identification, age, tenure, and specific job in the mine.

The chest films are read by physicians certified by NIOSH as proficient in use of the International Labour Office (ILO) classification system for radiographs of the pneumoconioses. Each film is read by at least two readers, and a consensus rule is used to reach a final determination for each film. The CWXSP defines CWP as small opacity profusion category of at least 1/0 or large opacities (i.e., larger than one centimeter in diameter). Miners with radiographic evidence of CWP on their chest

radiographs are offered the option to work in an area of the mine with a respirable coal mine dust level of 1 mg/m<sup>3</sup> or less and have personal dust exposures monitored at frequent intervals.

The large number of chest x-ray examinations since 1970 provide a means of monitoring the prevalence of CWP among active underground coal miners. However, coal miner participation rates have generally decreased since 1970 to less than 30% of working underground coal miners. Thus, tenure-specific prevalence estimates may be biased due to selective participation. Also, overall crude prevalence estimates may reflect overrepresentation of newly employed miners. Inferences regarding the entire coal mine work force that are based on CWXSP data should be drawn with caution. Tabulations of CWXSP data presented in this report vary from those presented in some earlier editions of the *Work-Related Lung Disease Surveillance Report* due to revised criteria for categorizing tenure and round.

For more information: Coal Workers' Health Surveillance Program, Surveillance Branch, Division of Respiratory Disease Studies, NIOSH, 1095 Willowdale Road, Morgantown, WV 26505. Phone (304) 285-5724.

### **Integrated Management Information System, OSHA**

The Integrated Management Information System (IMIS) includes most of the industrial hygiene sample data from Occupational Safety and Health Administration (OSHA) compliance inspections and consultation surveys conducted since May 1979. The data are reported by OSHA compliance safety and health officers and OSHA state consultants. Each IMIS record includes sample date, substance code, airborne concentration, sample type and exposure type, occupation, OSHA permissible exposure limit (PEL), and standard industrial classification (see Methods, Appendix B). OSHA consultation data were not included in previous

NIOSH *Work-Related Lung Disease Surveillance Reports*. Therefore, most numbers of samples reported for a given year, or period of years, are greater than reported previously.

For more information: Directorate of Information Technology, Occupational Safety and Health Administration, 200 Constitution Avenue, NW, Washington, DC 20210. Phone (202) 693-1700.

### **Metal/Nonmetal Mine Data, MSHA**

The metal/nonmetal mine data (MNMD) are records of industrial hygiene samples collected by Mine Safety and Health Administration (MSHA) inspectors in non-coal surface and underground mines and mills since 1974. This report presents data since 1979, which represent both personal and area samples. Each MNMD record includes sample date, contaminant code, airborne concentration, occupation, MSHA permissible exposure limit (PEL), percent silica and silica concentration where available, standard industrial classification, and the mine and/or mill at which the sample was obtained. In 1982, Congress temporarily removed the surface stone and sand and gravel industries from MSHA's jurisdiction. During this year the number of respirable dust samples collected are fewer than in other years. The quartz reference standard used for MNMD samples changed in 1988. As a result, the reported percent quartz content, quartz concentrations, and the percentage of samples exceeding the PEL increased in 1988 from 1987. MSHA occasionally revises and updates MNMD files, so the number of records reported for a given year, or period of years, may differ from previous reports.

For more information: Metal and Nonmetal Health Division, Mine Safety and Health Administration, Room 2453, 1100 Wilson Blvd., Arlington, VA 22209. Phone (202) 693-9630.

For more information on the quartz reference standard used for the MNMD samples: Dust

Division, Pittsburgh Safety and Health Technology Center, Mine Safety and Health Administration, P.O. Box 18233, Pittsburgh, PA 15236. Phone (412) 386-6858.

### **Multiple Cause of Death Data, NCHS**

The National Center for Health Statistics (NCHS) has made available annual public-use multiple cause of death data files since 1968. These files contain records of all deaths in the United States (approximately two million annually) that are reported to state vital statistics offices. Each death record includes codes for up to 20 conditions listed on the death certificate, including both underlying and contributing causes of death in two fields: the entity axis, which preserves diagnostic detail for all listed conditions and their placement on the death certificate; and the record axis, which reorders the codes, removes redundancies, and (infrequently) combines some associated conditions (see "Detail Record Layout" at [www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm](http://www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm)). Other data include age, race, sex, and state and county of residence at time of death. In addition, usual industry and occupation codes are available for decedents from some states since 1985. NCHS annually determines that certain quality criteria have been met by usual industry and occupation data from selected states (see Appendix E).

Potential limitations of multiple cause of death data include: under- or over-reporting of conditions on the death certificate by certifying physicians; incomplete or unclassified reporting of usual occupation and industry; and non-specificity of codes.

For more information: Mortality Statistics Branch, Division of Vital Statistics, National Center for Health Statistics, Centers for Disease Control and Prevention, 6525 Belcrest Road, Room 820, Hyattsville, Maryland 20782. Phone (301) 458-4666; and [www.cdc.gov/nchs/products/elec\\_prods/subject/mortmcd.htm](http://www.cdc.gov/nchs/products/elec_prods/subject/mortmcd.htm). Also refer to the annual reports: *Vital Statistics of the United States, Vol. II Mortality* (Parts A and B), Public Health



## Appendix A: Sources of Data

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Service, National Center for Health Statistics; and [www.cdc.gov/nchs/products/pubs/pubd/vsus/vsus.htm](http://www.cdc.gov/nchs/products/pubs/pubd/vsus/vsus.htm).

For more information on usual industry and occupation codes: see “Technical Appendix for 1995” at [www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm](http://www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm).

### **National Health Interview Survey, NCHS**

The National Center for Health Statistics (NCHS) makes available public-use data from the National Health Interview Survey (NHIS), an annual health survey that has been conducted since 1960. NHIS is a cross-sectional household interview survey on the health of the civilian non-institutionalized population of the United States. The main objective of the NHIS is to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics. NHIS data are collected annually from approximately 40,000 households and include about 100,000 persons. The households selected for interview in the NHIS are a probability sample representative of the target population. The annual response rate of the NHIS is near 90% of the eligible households in the sample.

For more information: Division of Health Interview Statistics, National Center for Health Statistics, 6525 Belcrest Road, Hyattsville, MD 20782; and [www.cdc.gov/nchs/nhis.htm](http://www.cdc.gov/nchs/nhis.htm).

### **National Hospital Discharge Survey, NCHS**

Estimated numbers of hospital discharges presented in this report have been abstracted from National Hospital Discharge Survey (NHDS) reports published by the National Center for Health Statistics (NCHS). The NHDS, conducted yearly by NCHS, collects data on the use of short-stay non-Federal hospitals in the United States. Federal, military, and Department of Veterans Affairs hospitals were excluded in the survey. In recent years, data have been abstracted from approximately 300,000 records from about 500 hospitals. Each

discharge record includes information on patient age, race, sex, ethnicity (since 1985), marital status, length of stay, source of payment (since 1977), diagnoses and surgical procedures, hospital size, ownership, and region of the United States.

Only hospitals with six or more beds for patient use and those in which the average length of stay for all patients is less than 30 days are included in the survey. One limitation of NHDS data is that they represent number of discharges, not number of patients. In addition, information is available only nationally and by region, but not by state. The NHDS relies on the completeness of hospital medical records, and findings can be influenced by diagnostic practices.

For more information: *National Hospital Discharge Survey: Annual Summary with Detailed Diagnosis and Procedure Data*, Division of Health Care Statistics, National Center for Health Statistics ([www.cdc.gov/nchs/about/major/hdasd/nhdsdes.htm](http://www.cdc.gov/nchs/about/major/hdasd/nhdsdes.htm)).

### **Occupational and Environmental Disease Surveillance Database, AOEC**

A database for occupational and environmental diseases and chronic injuries has been developed by the Association of Occupational and Environmental Clinics (AOEC). For inclusion in the database, a case must have at least one diagnosed condition that, in the physician's judgment, is more likely than not to be related to occupational or environmental exposure. Twenty-four AOEC member clinics contributed cases for the period 1991-2000. Six clinics participated over the entire 10-year period and contributed 80% of the cases. An additional seven clinics contributed over 125 cases each and submitted 14% of the cases. While not necessarily representative of all patients with work-related conditions, these case reports provide insight into the types of occupational conditions being treated by occupational medicine specialists, as well as into the types of exposures that are causing or exacerbating these diseases.

For more information: Association of Occupational and Environmental Clinics, 1010 Vermont Ave., NW, #513, Washington, DC 20005. Phone (202) 347-4976; and [www.aoec.org](http://www.aoec.org).

### **Population Data Estimates, BoC and CDC**

National population estimates used in this report are based on national and state level data from the United States Bureau of the Census (BoC). All population estimates used to compute rates in this report have been those obtainable through the CDC computer system. BoC decennial census population data were used for 1970, 1980, and 1990. In all other years prior to 1990, estimates from intercensal Demo Detail files were used. Estimates from postcensal Demo Detail files were used for 1991-1995. Since 1996, comparable postcensal population estimates prepared by the BoC were used. [Note: Comparing population statistics from Demo-Detail and BoC postcensal estimates for each year from 1990 through 1995, we observed a maximum annual difference of less than 0.05 percent, and a difference of 0.01 percent or less in a majority of years. State-specific differences for the same years were less than one percent for all states, with very rare exceptions.]

For more information: *1990 Census of the Population, General Population Characteristics*, U.S. Bureau of the Census, Series 1900, CP-1; and [www.census.gov/prod/www/abs/decennial.html](http://www.census.gov/prod/www/abs/decennial.html). For more information on population estimates: <http://eire.census.gov/popest/estimates.php>.

### **Respirable Coal Mine Dust Data, MSHA**

The data consist of respirable coal mine dust measurements collected by MSHA inspectors and mine operators at surface and underground coal mines and preparation plants since 1974. Each record includes sample date, duration, and airborne concentration, as well as occupation and the mine or preparation plant at which the sample was obtained.

For more information: Information Resource Center, Mine Safety and Health Administration, P.O. Box 25367, Denver, CO 80225. Phone (303) 231-5475.

### **Respirable Coal Mine Quartz Dust Data, MSHA**

The data consist of respirable quartz measurements collected by MSHA inspectors and mine operators at surface and underground coal mines and preparation plants since 1982. Each record includes sample date, duration, percent quartz, and airborne concentration, as well as occupation and the mine or preparation plant at which the sample was obtained.

For more information: Dust Division, Pittsburgh Safety and Health Technology Center, Mine Safety and Health Administration, P.O. Box 18233, Pittsburgh, PA 15236. Phone (412) 386-6858.

### **Sentinel Event Notification Systems for Occupational Risks (SENSOR), NIOSH**

Since 1987, NIOSH has awarded cooperative agreements to various state health departments to develop models for state-based and condition-specific surveillance and preventive intervention. Two of the conditions for which states have been funded through the SENSOR program are silicosis and work-related asthma. States and years funded for these two conditions are shown in Table A-1.

*SENSOR Silicosis.* A total of three states (MI, NJ, OH) maintained silicosis surveillance programs during the 10-year period covered by the SENSOR tables included in this report (1989-1998). All three states identified potential cases using a variety of sources: review of state death certificate data, case reports from physicians, review of hospital discharge data or direct hospital reporting to the state health department. In addition, Michigan and Ohio review workers' compensation records.

In all three states, demographic, work history, and medical information used for case confirmation and



## Appendix A: Sources of Data

description was obtained through a combination of the initial case ascertainment source, a review of medical records, and follow-up telephone interview with the reported cases or their surviving next of kin. For SENSOR surveillance purposes, silicosis case confirmation requires a history of occupational exposure to airborne silica dust and either: (a) a chest radiograph interpreted as characteristic of silicosis, or (b) lung histopathology characteristic of silicosis (see Appendix G).

For more information: Maxfield R, Alo C, Reilly MJ, et al. Surveillance for silicosis, 1993–Illinois, Michigan, New Jersey, North Carolina, Ohio, Texas, and Wisconsin. *MMWR Surveill Summ* 1997/46 (SS-1); 13-28 ([www.cdc.gov/mmwr/preview/mmwrhtml/00046046.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/00046046.htm)).

*SENSOR Work-Related Asthma (WRA).* A total of four states (CA, MA, MI, NJ) maintained WRA surveillance programs during the seven-year period covered by the SENSOR tables included in this report (1993-1999). Physician case reports represented the primary ascertainment source in all four states. Massachusetts, Michigan, and New Jersey actively solicited physicians for case reports, whereas California identified potential cases by reviewing data from Doctor's First Reports (DFR) of Occupational Injury or Illness, a longstanding statewide physician reporting system linked to physician reimbursement for medical services. In addition, Michigan and New Jersey actively solicited hospital reports and reviewed hospital discharge records for potential WRA cases. In 1993, Massachusetts also began supplementing case ascertainment with review of state-wide hospital discharge data.

In all four states, surveillance staff collected demographic, work history, and medical information used for case confirmation, classification, and description through a combination of the initial case ascertainment source, a review of medical records, and follow-up telephone interview with reported

cases. For SENSOR surveillance purposes, WRA surveillance case confirmation requires a healthcare professional's diagnosis of asthma (or a related diagnosis consistent with asthma) and an association between symptoms of asthma and work. Confirmed WRA cases are classified according to established criteria (see Appendix G). To facilitate consistency in agent coding across states, putative causes of WRA are coded using the Association of Occupational and Environmental Clinics (AOEC) exposure coding scheme ([www.aoec.org/aoeccode.htm](http://www.aoec.org/aoeccode.htm)), which flags "known asthma inducers."

For more information: Jajosky RA, Harrison R, Reinisch F, et al. Surveillance of work-related asthma in selected U.S. states using surveillance guidelines for state health departments—California, Massachusetts, Michigan, and New Jersey, 1993-1995. *MMWR Surveill Summ* 1999/48 (SS-3); 1-20 ([www.cdc.gov/mmwr/preview/mmwrhtml/ss4803a1.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/ss4803a1.htm)).

**Table A-1. States with SENSOR Silicosis (S) and/or Work-Related Asthma (A) Surveillance and Intervention Programs, 1988-2002**

State	Oct. 1988 - Sept. 1992	Oct. 1992 - Sept. 1997	Oct. 1997 - Sept. 2002
CA		A	A
CO	A		
IL		S	
MA	A	A	A
MI	A, S	A, S	A, S*
NJ	A, S	A, S	A*, S
NY	A		
NC		S	
OH	S	S	S
TX		S	
WI	A, S	S	

\*Not funded by NIOSH for this condition during this period but continued to collaborate with NIOSH.



# Appendix B

## Methods

### MORTALITY

#### Number of Deaths

In this report, the number of deaths for each occupational respiratory condition is the number of decedents for which the condition was coded as either underlying or contributing cause of death. For the years 1968-1998, these numbers were tabulated from the record axis of the NCHS multiple cause of death data files. Beginning with the 1999 data, these numbers were tabulated from the entity axis and the underlying cause of death of the multiple cause of death data files. (This change was made to permit more complete ascertainment of the diseases of interest.) In the current report, a small number of deaths in 1999 with underlying cause code J65 (pneumoconiosis associated with tuberculosis) were included in the underlying cause of death tabulations of each specific type of pneumoconiosis. Similarly, deaths in 1999 with underlying cause code J92.0 (pleural plaque with asbestos) were included in asbestosis underlying cause of death tabulations. Cause of death codes are defined as shown in Appendix C: International Classification of Diseases (ICD) Codes. The number of deaths by condition are reported both annually and for selected time periods. Reported deaths are restricted to United States residents, 15 years or older, based on state of residence at death. Race was classified as white, black, and all others.

#### Crude Mortality Rates

To compute annual cause-specific crude mortality rates, the total number of decedents, 15 years and older, with a specified condition coded as either underlying or contributing cause in a given year was divided by the population, 15 years and older, of the same geopolitical unit in the same year. Race- and sex-specific rates were computed from the appropriate subsets of the data. Crude mortality rates were computed at the national and state level for the multi-year period 1990-1999, and at the county level for the multi-year period 1985-1999. For each time period, the average annual number of

decedents, 15 years and older, with a specified condition coded as either underlying or contributing cause was divided by the mid-year population (1995, 1992, respectively), 15 years and older, of the same geopolitical unit.

#### Age-Adjusted Mortality Rates

Age-adjusted mortality rates presented in this report were based on deaths with the condition of interest mentioned as either underlying or contributing cause of death. Rates were calculated annually for each specified condition from 1968 through 1999, as well as for selected periods. For a given year, the age-adjusted rates represent the rates that would have been observed if the age-specific rates for specified age groups had occurred in a population with the same age distribution as that of the standard population. To conform with current NCHS guidelines, the U.S. Year 2000 Standard Population was used as the standard. (All earlier editions of the *Work-Related Lung Disease Surveillance Report* have used the 1940 standard population.) The specific age intervals used were 15-24, 25-34, 35-44, 45-54, 55-64, 65-74, 75-84, and 85 years and older. Rates for the entire United States population and for each sex-race group were age-adjusted separately, using the same standard population.

Age-adjusted rates were computed by the direct method. First, the annual age-specific rates for the population of interest were calculated. The product of the age-specific rates and the number in the comparable age-specific group in the standard population equals the expected number of deaths per million population for each age group. The total expected numbers of deaths were then obtained by summing over all age groups. The total expected number of deaths was divided by the sum of the standard population and the resulting quotient was multiplied by 1,000,000 to produce the age-adjusted rate (per million).

Age-adjusted rates were computed at the national and state level for the multi-year period 1990-1999.

## **Appendix B: Methods**

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Rates also were computed at the county level either for two 15-year periods and one 30-year period (1970-1984, 1985-1999, and 1970-1999), or for a single 20-year period (1980-1999), depending on whether or not the condition of interest was discretely classified during those time periods (see Appendix C). Rates for malignant mesothelioma were computed for 1999 only. For each time period (1970-1984, 1970-1999, 1980-1999, 1985-1999, and 1990-1999), age-specific rates first were computed by dividing the average annual number of deaths in each age group by the corresponding age-grouped, mid-year population (1977, 1985, 1990, 1992, and 1995, respectively) in the comparable geopolitical unit. Age-adjusted rates then were computed as described above.

### **Years of Potential Life Lost (YPLL)**

YPLL were based on deaths with the condition of interest mentioned as either underlying or contributing cause of death. They were calculated using the method described by the Centers for Disease Control (CDC) (*MMWR Surveill Summ* 1986/35(2S); [www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/00001773.htm)). YPLL were calculated both to age 65 and to life expectancy. YPLL to age 65 may be considered as a loss of years from a traditional working life, while YPLL to life expectancy may be considered as a loss of years from the overall life span. To compute YPLL to life expectancy, the number of deaths in each race/sex age group (the same age intervals used for computing age-adjusted rates) first was multiplied by the difference between the mid-point of the age group and life-expectancy for that race/sex age-group. Life tables published annually by NCHS ([www.cdc.gov/nchs/products/pubs/pubd/lftbls/life/1966.htm](http://www.cdc.gov/nchs/products/pubs/pubd/lftbls/life/1966.htm)) were used to determine race/sex life-expectancies for white/male, white/female, black/male, and black/female. The overall U.S. population life-expectancy was used for other/male and other/female. To compute YPLL to age 65, the number of deaths in age groups 15-24 through 55-64 was multiplied by the difference between 65 years and

the mid-point of each age group (e.g., 65 minus 20 years for the 15-24 age group). These age-specific YPLLs then were summed over all age groups to obtain total YPLLs (to life expectancy, and to age 65) for each race/sex/year from 1990 to 1999.

State-specific YPLLs (to life expectancy) per death also were calculated for the period 1990-1999. To calculate this index, the total number of all race/sex deaths in each age group was multiplied by the corresponding U.S. population life-expectancy, then summed over all age groups to obtain the total YPLL, and then divided by the total number of deaths for each state during this time period.

### **Rank Order**

For each state, a rank order is presented for each of several mortality measures. Depending on the specific mortality measures, a rank order of "1" indicates the greatest number of deaths, highest mortality rate, or highest YPLL among all states in the U.S.

### **Most Frequently Recorded Industries/Occupations**

In this report, the ten most frequently recorded Bureau of Census industries (CIC) and occupations (COC) with at least two decedents have generally been listed for specified causes of death (from selected states and years in Appendix E). Where more than one industry/occupation was tied for tenth place, all those that were tied were listed.

### **Proportionate Mortality Ratio (PMR)**

The data used for PMR analyses are a subset of the NCHS multiple cause of death files for which usual industry and occupation codes are available and meet quality criteria set by NCHS (see Appendix E for a list of states and years for which data qualified).

The PMR is defined as the observed number of deaths with the condition of interest (mentioned as either underlying or contributing) in a specified industry/occupation (from selected states and years

in Appendix E), divided by the expected number of deaths with that condition. The expected number of deaths is the total number of deaths in the Bureau of Census industry (CIC) or occupation (COC) of interest multiplied by a proportion defined as the number of cause-specific deaths for the condition of interest in all industries/occupations, divided by the total number of deaths in all industries/occupations. The PMRs in this report have been internally adjusted by five-year age groups (i.e., 15-19, 20-24, ... 110-114, and 115 years and over), sex, and race (i.e., white, black, and all other). (PMRs presented in the 1999 *Work-Related Lung Disease Surveillance Report* were internally adjusted for age only, using the age groupings 15-34, 35-54, 55-74, and 75 years and over.) Confidence intervals were calculated assuming Poisson distribution of the data.

A PMR greater than 1.0 indicates that there were more deaths associated with the condition in a specified occupation or industry than expected. This report includes only those industries/occupations with five or more decedents with the condition of interest and a lower 95% confidence limit exceeding 1.0.

## MORBIDITY

### **Prevalence (Asthma, COPD, and Smoking)**

The prevalence of asthma, chronic obstructive pulmonary disease (COPD), and cigarette smoking was based on the 2000 NHIS data collected from adult (18 years and older) household interview survey. Asthma was defined as a “yes” response to the question, “Have you ever been told by a doctor or other health professional that you had asthma?” COPD was defined as a “yes” response to either of the following questions: (1) “Have you ever been told by a doctor or other health professional that you had chronic bronchitis?” or (2) “Have you ever been told by a doctor or other health professional that you had emphysema?” Cigarette smoking status was classified as three groups: nonsmokers, current smokers, and former smokers. Nonsmokers were

defined as those who smoked less than 100 cigarettes during their entire life. Former smokers were defined as those who smoked at least 100 cigarettes in their entire life and do not currently smoke. Information on current occupation and industry was coded according to the revised 1995 Standard Industrial and Occupational Classification. These detailed occupation and industry codes were collapsed in the NHIS public-use data set (available at [www.cdc.gov/nchs/about/major/hdasd/nhdsdes.htm](http://www.cdc.gov/nchs/about/major/hdasd/nhdsdes.htm)).

Prevalence rates for asthma and COPD were estimated (using sample weights and adjustment for non-responses) by gender, smoking status, industry, and occupation as regrouped by NCHS in the NHIS data files. The prevalence of cigarette smoking was estimated by gender, industry, and occupation. Survey Data Analysis (SUDAAN®) software was used to estimate variances, enabling calculation of 95% confidence intervals for asthma, COPD, and smoking prevalence rates. Lower 95% confidence limits less than zero were converted to 0.0 and upper 95% confidence limits greater than 100 were converted to 100.0.

### **Prevalence (CWP)**

Prevalence of CWP, presented by tenure and time period, was based solely on “final determinations” (consensus values) of ILO category 1/0 or higher of chest radiographs taken for the Coal Workers’ X-ray Surveillance Program (CWXSP). Administrative and regulatory guidelines have varied over the life of the program. From 1970 through 1981, the program was administered in structured rounds. After a change in procedure in 1981, examinations have been arranged on a continual basis. For this report, CWXSP data collected after 1981 are grouped into 5-year periods (referred to as “rounds”), which roughly correspond to cycles during which all working underground coal miners could elect to receive a chest x-ray. In cases where more than one chest x-ray was available for a single participant in the same round—usually due



## Appendix B: Methods

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to a change in employer—the final determination for the most recent chest x-ray was used. Tenure in underground coal mining was based on summation of years in various mining occupations, as reported by the miner at the time of x-ray.

### Incidence Rates (Occupational Respiratory Illnesses)

Estimated numbers of work-related respiratory illness (with days away from work) and incidence rates of occupational respiratory conditions due to toxic agents were generally abstracted from the BLS annual reports of occupational injuries and illnesses, 1992-2000. Where data were not directly abstracted from BLS reports, incidence rates for occupational respiratory illnesses (with days away from work) were computed by dividing the BLS-estimated annual number of incident cases in the industry by the BLS-estimated industry-specific employment for the corresponding year. The resulting quotients were multiplied by 100,000 to yield rates per 100,000 workers.

### Association of Occupational and Environmental Clinics (AOEC) Diagnoses

In this report, the frequency distributions of work-related respiratory conditions diagnosed in AOEC clinics and respiratory hazards associated with respiratory diagnoses were tabulated by AOEC from the AOEC database.

## EXPOSURE

### Occupational Exposure Limits

*Permissible Exposure Limits.* OSHA and MSHA each enforce regulations that establish the legal limits of workplace exposures to pneumoconiotic agents. These legal limits are described in this report as permissible exposure limits (PELs), although the regulations sometimes use the term “standard” or “exposure limit.” The current legal limits may be found in the U.S. Code of Federal Regulations (CFR), as follows:

#### OSHA

general industry	construction industry
29 CFR 1910.1000	29 CFR 1926.55
29 CFR 1910.1001	29 CFR 1926.1101
29 CFR 1910.1043	

#### MSHA

coal mine industry	non-coal mining industry
30 CFR 70.100	30 CFR 56.5001
30 CFR 70.101	30 CFR 57.5001
30 CFR 71.100	
30 CFR 71.101	
30 CFR 71.700	
30 CFR 75.321	
30 CFR 90.100	
30 CFR 90.101	

Although OSHA has PELs for the maritime industry [29 CFR 1915], very few samples have been collected and are not reported here.

The OSHA PELs for several pneumoconiotic agents were changed on March 1, 1989, but a legal challenge to the modified OSHA PELs was upheld, and the modified OSHA PELs reverted to the previous OSHA PELs on March 23, 1993. Therefore, data for respirable quartz, selected pneumoconiotic agents, and all pneumoconiotic agents are reported for the three time periods: 1979 to 1988; 1989 to 1992; and 1993 to 1999. Some pneumoconiotic agents had a substance-specific OSHA PEL only from March 1, 1989 to March 22, 1993, including: aluminum as welding fumes, respirable dust of natural graphite, mica containing less than 1% crystalline silica, tin oxide, inorganic compounds of tin oxide, fused respirable silica dust, fibrous talc not containing tremolite, talc not containing asbestos, insoluble tungsten & compounds, and welding fumes (total particulate).

The MSHA metal/nonmetal mining PELs for pneumoconiotic agents were adopted from the 1973 edition of the American Conference of Governmental Industrial Hygienists (ACGIH®)

publication entitled “*TLV<sup>®</sup>s Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1973*.” MSHA has not adopted a PEL for the pneumoconiotic agents: tin oxide dust/fume; inorganic dusts of tin; insoluble tungsten dusts/fumes; and welding fumes (total particulate). In this report a MSHA PEL of 10 milligrams per cubic meter (mg/m<sup>3</sup>) is used for welding fumes (total particulate) through 1993, but since then it has been MSHA policy not to collect samples for welding fumes.

OSHA and MSHA do not have PELs specific for any form of crystalline silica. The PELs apply to respirable dust containing crystalline silica, and the allowable exposure to respirable dust is reduced as the crystalline silica content increases. The formulas for allowable exposure vary with the agency and the industry. In metal/nonmetal mining, the MSHA PEL is the same as the OSHA PEL for respirable dust containing at least 1% quartz:

$$OSHA\ PEL = \frac{10\ mg / m^3}{\% Quartz + 2}$$

However, OSHA adopted a PEL of 0.1 mg/m<sup>3</sup> for quartz that was enforced from March 1, 1989 through March 22, 1993.

Since December 1972, the MSHA PEL for respirable coal mine dust has been 2 mg/m<sup>3</sup> MRE<sup>1</sup> unless the quartz concentration of the respirable coal mine dust at the mine exceeds 5%. When the quartz content of the respirable dust exceeds 5% in a coal mine sample, the MSHA PEL is reduced based on the following formula:

<sup>1</sup> The MRE designation refers to the Mining Research Establishment of the National Coal Board, London, England. MSHA’s PELs for respirable coal mine dust and respirable coal mine dust containing quartz are based on sampling criteria developed by MRE, but OSHA’s are based on different sampling criteria. To clearly indicate the difference, the MSHA PELs and sample results are designated by “MRE” in this report.

$$MSHA\ PEL = \frac{10\ mg / m^3\ MRE}{\% Quartz}$$

The OSHA PEL of 2 fibers per cubic centimeter (f/cc) for asbestos was reduced to 0.2 f/cc on July 21, 1986, and to 0.1 f/cc on October 11, 1994. Therefore, asbestos exposures are reported for three time periods: 1979 to 1986; 1987 to 1994; and 1994 to 1999. The MSHA PEL for asbestos has not changed from 2 f/cc since it was adopted.

The OSHA PELs for cotton dust (raw) vary by processing operation. They are:

- 1 mg/m<sup>3</sup> for the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garneting;
- 0.75 mg/m<sup>3</sup> for textile slashing and weaving operations;
- 0.50 mg/m<sup>3</sup> for textile mill waste house operations or for dust from “lower grade washed cotton” used during yarn manufacturing; and
- 0.20 mg/m<sup>3</sup> for yarn manufacturing and cotton washing operations.

Reporting of cotton dust data began when the process-specific OSHA PELs became effective on March 27, 1980.

**Recommended Exposure Limits.** NIOSH develops and periodically revises recommended exposure limits (RELs) for hazardous substances or conditions in the workplace. The RELs are then published and transmitted to OSHA and MSHA for use in promulgating legal standards. The RELs for mineral dusts and chemical hazards, including pneumoconiotic agents, are published in the NIOSH *Pocket Guide to Chemical Hazards* (NIOSH Pub. No. 97-140). The REL for coal mine dust was adopted in September 1995, while RELs for the other pneumoconiotic agents in this report were adopted before 1979, which is the first year OSHA and MSHA data are reported. The REL for beryllium and compounds is based on cancer, rather

## Appendix B: Methods

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than pneumoconiotic effects. NIOSH has no full-shift RELs for the following pneumoconiotic agents: aluminum oxide; emery; synthetic graphite; rouge; fused respirable silica dust; titanium dioxide; and welding fumes (total particulate).

### Data Selection

MSHA coal mine dust samples included in this report met all of the following criteria:

- (1) obtained in the United States or one of its territories;
- (2) designated by MSHA as valid;
- (3) coded as “designated occupation,” “non-designated occupation,” “designated work position,” “non-designated work position” with valid occupation codes, or “designated area” other than “intake air.”

*MSHA Coal Mine Quartz.* MSHA coal mine quartz samples included in this report met all of the following criteria:

- (1) obtained in the United States or one of its territories;
- (2) designated by MSHA as valid;
- (3) sample duration greater than zero;
- (4) quartz concentration greater than or equal to zero;
- (5) coded as “designated occupation,” “non-designated occupation,” “designated work position,” “non-designated work position” with valid occupation codes, or “designated area” other than “intake air.”

*MSHA Metal/Nonmetal Mine Data (MNMD).* MSHA metal/nonmetal mine data (MNMD) included in this report met the following criteria:

- (1) obtained in the United States or one of its territories;
- (2) not duplicated by another record, as determined by a comparison of all data fields.

NIOSH staff edited the MNMD provided by MSHA to remove duplicate records and records with

internal inconsistencies, similarly to the methods previously used by the U.S. Bureau of Mines for data presented in earlier *Work-Related Lung Disease Surveillance Reports*.

*OSHA Integrated Management Information System (IMIS).* IMIS samples included in this report met all of the following criteria:

- (1) the state code was one of the 50 U.S. states, Washington, DC, American Samoa, Guam, Puerto Rico, or the U.S. Virgin Islands;
- (2) the sample type was “area” or “personal” (excludes: “bulk,” “wipe,” “screen,” “blood,” and “urine” samples);
- (3) the exposure type was “time-weighted average,” or “not detected” (excludes: “ceiling,” “peak,” “dose,” “sound reading,” “not analyzed,” and “not valid”);
- (4) the indicated OSHA PEL and units were applicable to the contaminant indicated by the substance code for the recorded date of sampling.

### Data Analysis for MSHA and OSHA Samples

The reported number of samples for an agent was the total number of samples meeting the above criteria. The percent of samples exceeding the PEL for an agent category was calculated as the number of samples in that category with measured exposures exceeding the PEL enforced at the time the sample was collected, divided by the total number of samples for the agent, and finally multiplying by 100. The percent of samples exceeding the REL for an agent was calculated as the number of samples in that category with measured exposure exceeding the REL, divided by the total number of samples for the agent, and multiplying by 100.

Exposures are commonly log normally distributed, rather than normally distributed. For this reason we present geometric means of the exposure. To calculate a geometric mean exposure, samples less than the minimum quantifiable concentration (MQC) were assigned a value, either the (MQC/2)



or (MQC/2<sup>1/2</sup>), depending on the distribution of samples that were quantifiable.<sup>2</sup> The analytical methods used to calculate the MQC for selected pneumoconiotic agents are presented in Table F-2 of Appendix F. The calculation assumes a sample duration of 6 hours for cotton dust, and 7 hours for other agents.

The OSHA and MSHA asbestos MQCs changed during the 1979 to 1999 period; therefore, appropriate MQCs were used for each time period.

OSHA analyzed cotton dust or welding fumes (total particulate) samples by using their standard operating procedure (SOP) for nuisance dusts. The limit of detection of 10 micrograms was determined by the sensitivity of the balance. Results for cotton dust samples below the MQC, 4.3% of all cotton dust samples, could not be assigned to a specific cotton dust processing operation and were not included in Figure 4-4 and Table 4-11.

The MSHA respirable coal mine quartz data are based on analyses of respirable coal mine dust samples. However, the quartz content could not be reliably identified for most of these samples. Therefore, in Section 2, the percent of respirable coal mine dust samples exceeding the MSHA PEL were calculated using the MSHA PEL of 2 mg/m<sup>3</sup> MRE for respirable coal mine dust containing no more than 5% quartz.

In Section 3 the geometric means of exposure to quartz are reported for OSHA samples. However, the reported percentage greater than the PEL (% > PEL) compares only the respirable dust samples containing at least 1% quartz to the PEL for respirable dust containing at least 1% quartz. The exception is from March 1, 1989 through March 22, 1993, when OSHA enforced a PEL of 0.1 mg/m<sup>3</sup> for

respirable quartz. During this period the percentage greater than the PEL (% > PEL) compares the exposure to quartz to 0.1 mg/m<sup>3</sup>.

### **Industries with Elevated PMRs and Most Frequently Recorded on Death Certificates**

This report includes number of samples, geometric mean exposures, and percent of samples exceeding the PEL or REL by selected industries for exposure agents related to elevated occupational lung disease mortality. For asbestosis, CWP, silicosis, byssinosis, and all pneumoconiosis, separate tables present data for the ten most frequently recorded industries with five or more decedents and significantly elevated PMRs.

## **STATE AND COUNTY DESIGNATIONS**

The “number of states” displayed on maps in this report sums to 51 because the District of Columbia is included.

Counties in this report are coded according to the 1990 Federal Information Processing Standards (FIPS) Codes system. A small number of counties or county equivalents have split, merged with, or separated from surrounding or adjacent subdivisions (see Appendix H). Readers should be cautious in assessing geographic patterns and temporal trends for subdivisions that have split or merged.

## **INDUSTRY/OCCUPATION CODES AND TITLES**

Since 1993, the 1990 Bureau of Census (BoC) Index of Industries and Occupations classification system (see “Technical Appendix for 1995” at [www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm](http://www.cdc.gov/nchs/about/major/dvs/mcd/1998mcd.htm)) has been used for coding death certificate information on the NCHS multiple cause of death data files. Most codes and titles in the 1990 system do not differ from the 1980 system. All tables

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<sup>2</sup> Hornung, R., Reed, L. 1990. Estimation of average concentration in the presence of nondetectable values. *Applied Occupational and Environmental Hygiene* 5:46-51.

## ***Appendix B: Methods***

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reporting BoC industry (CIC) and occupation (COC) codes and titles that are presented in the mortality and exposure sections of this report, except those listed in Appendix D, follow the 1980 BoC classification system.

Industry/occupation titles ranked by estimated prevalence of asthma, COPD, and smoking, which are presented in the morbidity sections of this report, had been classified according to the 1995 Standard Industrial Classification (SIC) System and then regrouped by NCHS. Incidence rates of the pneumoconioses (including siderosis) and

respiratory conditions due to toxic agents follow the 1987 SIC System. Tables summarizing temporal patterns of geometric means in selected exposure sections (i.e., asbestos, silica, and pneumoconiotic agents) of this report also group industries by the 1987 SIC System.

The primary industries associated with silicosis and work-related asthma cases in the SENSOR sections of this report are grouped by the 1987 SIC System; however, the primary occupations (COC) are grouped by the 1990 BoC classification system.

# Appendix C

## International Classification of Diseases (ICD) Codes

Condition (as defined for this report)	ICD-8 (1968-1978)		ICD-9 (1979-1998)		ICD-10 (1999)	
	Rubrics	Codes	Rubrics	Codes	Rubrics	Codes
Asbestosis	Asbestosis	515.2	Asbestosis	501	Pneumoconiosis due to asbestos and other mineral fibers Asbestosis	J61*
Coal Workers' Pneumoconiosis	Anthracosilicosis Anthracosis Coal miners' lung	515.1	Coal workers' pneumoconiosis Anthracosilicosis Anthracosis Black lung disease Coal workers' lung Miners' asthma	500	Coal workers' pneumoconiosis Anthracosilicosis Anthracosis Coal workers' lung	J60*
Silicosis	Silicosis Calcicosis Chalicosis	515.0	Pneumoconiosis due to other silica or silicates Pneumoconiosis due to talc Silicotic fibrosis (massive) of lung Silicosis (simple) / (complicated)	502	Pneumoconiosis due to dust containing silica Silicotic fibrosis (massive) of lung Pneumoconiosis due to talc dust Pneumoconiosis due to other dust containing silica	J62*
	Silicotuberculosis Colliers' phthisis Grinders' phthisis Miners' phthisis Stonemasons' phthisis	010	No discrete ICD-9 code		No discrete ICD-10 code	
Byssinosis	No discrete ICD-8 code		Pneumonopathy due to inhalation of other dust Byssinosis Cannabinosis Flax-dressers' disease	504	Airway disease due to specific organic dust Byssinosis Flax-dresser's disease Cannabinosis Airway disease due to other specific organic dusts	J66
Unspecified/Other Pneumoconioses	Pneumoconiosis due to inhalation of other inorganic dust Aluminosis (of lung) Bauxite fibrosis (of lung) Berylliosis Graphite fibrosis (of lung)	516.0	Pneumoconiosis due to other inorganic dust Aluminosis (of lung) Bauxite fibrosis (of lung) Berylliosis Graphite fibrosis (of lung) Siderosis Stannosis	503	Pneumoconiosis due to other inorganic dusts Aluminosis (of lung) Bauxite fibrosis (of lung) Berylliosis Graphite fibrosis (of lung) Siderosis Stannosis Pneumoconiosis due to other specified inorganic dusts	J63*
	Other pneumoconiosis, including unspecified Pneumoconiosis: n.o.s. due to: silicates n.e.c. talc	515.9	Pneumoconiosis, unspecified	505	Unspecified pneumoconiosis	J64*

See footnotes at end of table.

## Appendix C: International Classification of Diseases (ICD) Codes

Condition (as defined for this report)	ICD-9 (1979-1998)		ICD-10 (1999)	
	Rubrics	Codes	Rubrics	Codes
<b>Malignant Mesothelioma</b>	<i>No discrete ICD-9 code</i>		<b>Mesothelioma</b> Mesothelioma of pleura Mesothelioma of peritoneum Mesothelioma of pericardium** Mesothelioma of other sites Mesothelioma, unspecified	<b>C45</b>
<b>Hypersensitivity Pneumonitis</b>	<b>Extrinsic allergic alveolitis</b> Farmers' lung Bagassosis Bird-Fanciers' lung Suberosis Malt workers' lung Mushroom workers' lung Maple bark-strippers' lung Ventilation pneumonitis Other specified allergic alveolitis and pneumonitis Unspecified allergic alveolitis and pneumonitis	<b>495</b>	<b>Hypersensitivity pneumonitis due to organic dust</b> Farmer's lung Bagassosis Bird fancier's lung Suberosis Maltworker's lung Mushroom-worker's lung Maple-bark-stripper's lung Air-conditioner and humidifier lung Hypersensitivity pneumonitis due to other organic dusts Hypersensitivity pneumonitis due to unspecified organic dust	<b>J67</b>
<b>Asthma</b>	<b>Asthma</b> Extrinsic asthma Intrinsic asthma Asthma, unspecified	<b>493</b>	<b>Asthma</b> Predominantly allergic asthma Nonallergic asthma Mixed asthma Asthma, unspecified	<b>J45</b>
			<b>Status asthmaticus</b> Acute severe asthma	<b>J46</b>
<b>Chronic Obstructive Pulmonary Disease</b>	<i>No data included in this report</i>		<b>Bronchitis, not specified as acute or chronic</b> Bronchitis: n.o.s. catarrhal with tracheitis n.o.s. Tracheobronchitis n.o.s.	<b>J40</b>
			<b>Simple and mucopurulent chronic bronchitis</b> Simple chronic bronchitis Mucopurulent chronic bronchitis Mixed simple and mucopurulent chronic bronchitis	<b>J41</b>
			<b>Unspecified chronic bronchitis</b>	<b>J42</b>
			<b>Emphysema</b> MacLeod's syndrome Panlobular emphysema Centrilobular emphysema Other emphysema Emphysema, unspecified	<b>J43</b>
			<b>Other chronic obstructive pulmonary disease</b> Chronic obstructive pulmonary disease with acute lower respiratory infection Chronic obstructive pulmonary disease with acute exacerbation, unspecified Other specified chronic obstructive pulmonary disease Chronic obstructive pulmonary disease, unspecified	<b>J44</b>
			<b>Bronchiectasis</b>	<b>J47</b>

See footnotes at end of table.

### Appendix C: International Classification of Diseases (ICD) Codes

Condition (as defined for this report)	ICD-9 (1979-1998)		ICD-10 (1999)	
	Rubrics	Codes	Rubrics	Codes
Respiratory Tuberculosis	<b>Primary tuberculous infection</b> Primary tuberculous infection Tuberculous pleurisy in primary progressive Other primary progressive tuberculosis Primary tuberculous infection, unspecified	010	<b>Respiratory tuberculosis, bacteriologically and histologically confirmed</b> Tuberculosis of lung, confirmed by sputum microscopy with or without culture Tuberculosis of lung, confirmed by culture only Tuberculosis of lung, confirmed histologically Tuberculosis of lung, confirmed by unspecified means Tuberculosis of intrathoracic lymph nodes, confirmed bacteriologically and histologically Tuberculosis of larynx, trachea and bronchus, confirmed bacteriologically and histologically Tuberculous pleurisy, confirmed bacteriologically and histologically Primary respiratory tuberculosis, confirmed bacteriologically and histologically Other respiratory tuberculosis, confirmed bacteriologically and histologically Respiratory tuberculosis unspecified, confirmed bacteriologically and histologically	A15
	<b>Pulmonary tuberculosis</b> Tuberculosis of lung, infiltrative Tuberculosis of lung, nodular Tuberculosis of lung with cavitation Tuberculosis of bronchus Tuberculous fibrosis of lung Tuberculous bronchiectasis Tuberculous pneumonia [any form] Tuberculous pneumothorax Other specified pulmonary tuberculosis Pulmonary tuberculosis, unspecified	011		
	<b>Other respiratory tuberculosis</b> Tuberculous pleurisy Tuberculosis of intrathoracic lymph nodes Isolated tracheal or bronchial tuberculosis Tuberculous laryngitis Other specified respiratory tuberculosis	012		
	<b>Miliary tuberculosis</b> Acute miliary tuberculosis Other specified miliary tuberculosis Miliary tuberculosis, unspecified	018	<b>Respiratory tuberculosis, not confirmed bacteriologically or histologically</b> Tuberculosis of lung, bacteriologically and histologically negative Tuberculosis of lung, bacteriological and histological examination not done Tuberculosis of lung, without mention of bacteriological or histological confirmation Tuberculosis of intrathoracic lymph nodes, without mention of bacteriological or histological confirmation Tuberculosis of larynx, trachea, and bronchus, without mention of bacteriological or histological confirmation Tuberculous pleurisy, without mention of bacteriological or histological confirmation Primary respiratory tuberculosis without mention of bacteriological or histological confirmation Other respiratory tuberculosis, without mention of bacteriological or histological confirmation Respiratory tuberculosis unspecified, without mention of bacteriological or histological confirmation	A16
	<b>Late effects of tuberculosis</b> Late effects of respiratory or unspecified tuberculosis	137.0		
			<b>Miliary tuberculosis</b> Acute miliary tuberculosis of a single specified site Acute miliary tuberculosis of multiple sites Acute miliary tuberculosis, unspecified Other miliary tuberculosis Miliary tuberculosis, unspecified	A19
			<b>Sequelae of tuberculosis</b> Sequelae of respiratory and unspecified tuberculosis	B90.9

See footnotes at end of table.

## Appendix C: International Classification of Diseases (ICD) Codes

Condition (as defined for this report)	ICD-9 (1979-1998)		ICD-10 (1999)	
	Rubrics	Codes	Rubrics	Codes
<b>Respiratory Conditions due to Chemical Fumes and Vapors</b>	<b>Respiratory conditions due to chemical fumes and vapors</b> Bronchitis and pneumonitis due to fumes and vapors Acute pulmonary edema due to fumes and vapors Upper respiratory inflammation due to fumes and vapors Other acute and subacute respiratory conditions due to fumes and vapors Chronic respiratory conditions due to fumes and vapors Unspecified respiratory conditions due to fumes and vapors	<b>506</b>	<b>Respiratory conditions due to inhalation of chemicals, gases, fumes, and vapors</b> Bronchitis and pneumonitis due to chemicals, gases, fumes, and vapors Acute pulmonary edema due to chemicals, gases, fumes, and vapors Upper respiratory inflammation due to chemicals, gases, fumes, and vapors, n.e.c. Other acute and subacute respiratory conditions due to chemicals, gases, fumes, and vapors Chronic respiratory conditions due to chemicals, gases, fumes, and vapors Other respiratory conditions due to chemicals, gases, fumes, and vapors Unspecified respiratory condition due to chemicals, gases, fumes, and vapors	<b>J68</b>
<b>Lung Cancer</b>	<i>No data included in this report</i>		<b>Malignant neoplasm of trachea</b>  <b>Malignant neoplasm of bronchus and lung</b> Main bronchus Upper lobe, bronchus or lung Middle lobe, bronchus or lung Lower lobe, bronchus or lung Overlapping lesion of bronchus and lung Bronchus or lung, unspecified	<b>C33</b>  <b>C34</b>
<b>Other Interstitial Pulmonary Diseases</b>	<i>No data included in this report</i>		<b>Other Interstitial Pulmonary Diseases</b> Alveolar and parietoalveolar conditions Other interstitial pulmonary diseases with fibrosis Other specified interstitial pulmonary diseases Interstitial pulmonary diseases, unspecified	<b>J84</b>

n.o.s. - not otherwise specified

n.e.c. - not elsewhere classified

\* A small number of deaths with underlying cause equal to ICD-10 code J65 or J92.0 are included in underlying cause of death tabulations. See methods for more detailed explanation.

\*\* In this report, mesothelioma of the pericardium is grouped into mesothelioma of other sites.

SOURCES: U.S. Department of Health, Education, and Welfare: Eighth Revision International Classification of Diseases, Volume 1.

U.S. Department of Health and Human Services: International Classification of Diseases 9th Revision, Volume 1.

World Health Organization: International Statistical Classification of Diseases and Related Health Problems 10th Revision, Volume 1.

# Appendix D

## Changes in Bureau of Census Industry and Occupation Codes and Titles

1980		1990	
Code	Title	Code	Title
Industry: 1980 codes merged into 1990 codes			
382	Not specified professional equipment (manufacturing)	392	Not specified manufacturing industries
392	Not specified manufacturing industries		
510	Sporting goods, toys and hobby goods	532	Miscellaneous wholesale, durable goods
522	Not specified electrical and hardware (wholesale trade)		
532	Miscellaneous wholesale, durable goods		
730	Commercial research, development, and testing labs	891	Research, development and testing services
891	Noncommercial educational and scientific research		
Industry: 1980 title changed to 1990 title			
042	Crude petroleum and natural gas extraction	042	Oil and gas extraction
102	Canned and preserved fruits and vegetables	102	Canned, frozen and preserved fruits and vegetables
141	Floor coverings, except hard surface	141	Carpets and rugs
281	Cutlery, handtools, and other hardware	281	Cutlery, handtools, and general hardware
322	Electronic computing equipment	322	Computers and related equipment
372	Optical and health services supplies	372	Medical, dental, optical instruments and supplies
440	Radio and television broadcasting	440	Radio and television broadcasting and cable
441	Telephone (wire and radio)	441	Telephone communications
672	Fuel and ice dealers	672	Fuel dealers
701	Savings and loan associations	701	Savings institutions, including credit unions
712	Real estate, including real estate-insurance-law offices	712	Real estate, including real estate-insurance offices
751	Automotive repair shops	751	Automotive repair and related services
812	Offices of physicians	812	Offices and clinics of physicians
820	Offices of dentists	820	Offices and clinics of dentists
821	Offices of chiropractors	821	Offices and clinics of chiropractors
822	Offices of optometrists	822	Offices and clinics of optometrists
830	Offices of health practitioners, n.e.c.	830	Offices and clinics of health practitioners, n.e.c.
851	Business, trade, and vocational schools	851	Vocational schools
961	Homemaker, student, unemployed, volunteer	961	Non-paid worker or non-worker or own home/at home
Occupation: 1980 codes merged into 1990 codes			
349	Telegraphers	353	Communications equipment operators, n.e.c.
353	Communications equipment operators, n.e.c.		
368	Weighers, measurers, and checkers	368	Weighers, measurers, checkers, and samplers
369	Samplers		
436	Cooks, except short-order	436	Cooks
437	Short-order cooks		
673	Apparel and fabric patternmakers	674	Miscellaneous precision apparel and fabric workers
674	Miscellaneous precision apparel fabric workers		
794	Hand grinding and polishing occupations	795	Miscellaneous hand working occupations
795	Miscellaneous hand working occupations		
804	Truck drivers, heavy	804	Truck drivers
805	Truck drivers, light		
Occupation: 1980 title changed to 1990 title			
098	Inhalation therapists	098	Respiratory therapists
558	Supervisors, n.e.c.	558	Supervisors, construction, n.e.c.
734	Printing machine operators	734	Printing press operators

n.e.c. - not elsewhere classified





# Appendix E

## States (and Years) for which Industry and Occupation Codes from Death Certificates Met NCHS Quality Criteria, 1985-1999

State	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Alaska			X	X											
Colorado	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Georgia	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hawaii									X	X		X		X	X
Idaho				X	X	X	X	X	X	X	X	X	X	X	X
Indiana		X	X	X	X	X	X	X	X		X			X	X
Kansas	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Kentucky	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maine	X	X	X	X	X	X	X	X	X	X	X	X		X	
Missouri	X	X													
Nebraska	X														X
Nevada	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
New Hampshire	X	X	X	X	X	X	X	X	X	X	X	X		X	X
New Jersey				X	X	X	X	X	X	X	X	X	X	X	X
New Mexico		X	X	X	X	X	X	X	X	X	X	X	X	X	X
North Carolina			X	X	X	X	X	X	X	X	X	X	X	X	X
Ohio	X	X	X	X	X	X	X	X	X		X	X	X	X	
Oklahoma	X	X	X	X	X	X	X	X	X						
Rhode Island	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
South Carolina	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tennessee	X	X	X	X											
Utah	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vermont		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Washington					X	X	X	X							
West Virginia				X	X	X	X	X	X	X	X	X	X	X	X
Wisconsin	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X



## Appendix F

### Exposure Categories

**Table F-1. Pneumoconiotic agent categories for MSHA and OSHA data**

Pneumoconiotic Agent Category (as defined for this report)	MSHA Agents in Category	OSHA Agents in Category
<b>Asbestos</b>	Asbestos, fibers > 5 µm in length (3MgO·2SiO <sub>2</sub> ·2H <sub>2</sub> O)	Asbestos [actinolite, anthophyllite, chrysotile, crocidolite, tremolite] Talc, containing fibrous tremolite
<b>Cotton Dust</b>		Cotton dust (raw) Flax dust*
<b>Coal Mine Dust</b>	Respirable coal mine dust, ≤ 5% quartz	
<b>Quartz</b>	Respirable coal mine dust, > 5% quartz Respirable dust, > 1% quartz Nuisance dust (respirable fraction), < 1% quartz** Unlisted particulate (respirable fraction), < 1% quartz** Respirable dust (not analyzed or below detection limit)**	Respirable crystalline silica (as quartz) Respirable crystalline silica/tripoli (as quartz) Respirable coal dust, > 5% quartz
<b>Other</b>	Aluminum oxide dust (as Al <sub>2</sub> O <sub>3</sub> ) Aluminum oxide fume (as Al <sub>2</sub> O <sub>3</sub> ) Antimony dusts (as Sb) Beryllium dusts (as Be) Beryllium fumes (as Be) Carbon black Cobalt dusts (as Co) Cobalt fumes (as Co) Cristobalite (respirable fraction) Graphite, natural Iron oxide fume (as Fe <sub>2</sub> O <sub>3</sub> ) Mica Silica (Amorphous) Talc, fibers > 5 µm in length (Mg <sub>3</sub> Si <sub>4</sub> O <sub>10</sub> (OH) <sub>2</sub> ) Talc, nonfibrous, < 1% quartz Tin oxide dust (as SnO <sub>2</sub> ) Tin oxide fume (as SnO <sub>2</sub> ) Tin, inorganic dusts, except SnO <sub>2</sub> (as Sn) Titanium dioxide dust (as TiO <sub>2</sub> ) Titanium dioxide fume (as TiO <sub>2</sub> ) Tridymite (respirable fraction) Tungsten fumes (as W) Tungsten, insoluble dusts (as W) Welding fumes (total dust)	Alpha-alumina (total dust) Alpha-alumina (respirable fraction) Aluminum oxide Aluminum (as Al), metal (total dust) Aluminum (as Al), metal (respirable fraction) Aluminum (as Al), welding fumes Antimony and compounds (as Sb) Barium (insoluble compounds) Barium sulfate (total dust) Barium sulfate (respirable fraction) Beryllium and compounds (as Be) Carbon black Cobalt, metal, fume and dust (as Co) Emery (total dust) Emery (respirable fraction) Graphite, natural (respirable fraction) Graphite, synthetic (total dust) Graphite, synthetic (respirable fraction) Iron oxide fume (as Fe <sub>2</sub> O <sub>3</sub> ) Kaolin (total dust) Kaolin (respirable fraction) Magnesite (total dust) Magnesite (respirable fraction)* Mica (< 1% crystalline silica) Rouge (total dust) Rouge (respirable fraction) Silica, amorphous, diatomaceous earth (<1% crystalline silica) Silica, respirable cristobalite Silica, respirable tridymite Silica, fused (respirable fraction) Talc (containing no asbestos) Talc, fibrous non-tremolite Tin, inorganic compounds, except oxide (as Sn) Tin oxide (as Sn) Titanium dioxide (total dust) Tungsten and compounds (insoluble as W) Welding fumes (total dust)

\* No data reported for these agents in most recent provisional data.

\*\* See Selected Limitations section.

The following documents were reviewed to identify pneumoconiotic agents: ACGIH® *Documentation of TLV®s*, 6<sup>th</sup> edition; *Occupational Respiratory Diseases Report*, NIOSH Pub. No. 86-102; *The NIOSH Pocket Guide to Chemical Hazards*, NIOSH Pub No. 97-140; and NIOSH Criteria Documents.

## Appendix F: Exposure Categories

**Table F-2. MSHA analytical methods for selected pneumoconiotic agents**

Pneumoconiotic Agent Category (as defined for this report)	MSHA Agents in Category	MSHA Analytical Method
<b>Asbestos</b>	Asbestos, fibers > 5 µm in length (3MgO·2SiO <sub>2</sub> ·2H <sub>2</sub> O)	NIOSH 7400
<b>Coal Mine Dust</b>	Respirable coal mine dust, ≤ 5% quartz	NIOSH 7603/MSHA P7
<b>Quartz</b>	Respirable coal mine dust, > 5% quartz Respirable dust, > 1% quartz Nuisance dust (respirable fraction), < 1% quartz Unlisted particulate (respirable fraction), < 1% quartz Respirable dust (not analyzed or below detection limit)	MSHA coal: MSHA P7/NIOSH 7300 MSHA metal/nonmetal: MSHA P2/NIOSH 7500
<b>Selected Pneumoconiotic Agents</b>	Aluminum oxide dust (as Al <sub>2</sub> O <sub>3</sub> ) Aluminum oxide fume (as Al <sub>2</sub> O <sub>3</sub> ) Beryllium dusts (as Be) Beryllium fumes (as Be) Cobalt dusts (as Co) Cobalt fumes (as Co) Iron oxide fume (as Fe <sub>2</sub> O <sub>3</sub> ) Titanium dioxide dust (as TiO <sub>2</sub> ) Titanium dioxide fume (as TiO <sub>2</sub> )	OSHA 121/125
	Cristobalite (respirable fraction)	MSHA P2/NIOSH 7500
	Welding fumes (total dust)	OSHA 121/125
	Talc, nonfibrous, < 1% quartz	NIOSH 0600 (gravimetric)/MSHA P8 (impinger)

**Table F-3. Most commonly used OSHA analytical methods for selected pneumoconiotic agents**

<b>Pneumoconiotic Agent Category</b> (as defined for this report)	<b>OSHA Agents in Category</b>	<b>OSHA Compliance Analytical Method</b> (SLCTC)	<b>OSHA Consultation Analytical Method</b> (WOHL)
<b>Asbestos</b>	Asbestos [actinolite, anthophyllite, chrysotile, crocidolite, tremolite] Talc containing fibrous tremolite	ID-160	WOHL method (based on NIOSH 7400 and OSHA ID-160)
<b>Cotton Dust</b>	Cotton dust (raw)	1910.1043 - Appendix A; SOP for nuisance dust	WW001.6.0 (5um PVC filter)
<b>Quartz</b>	Respirable crystalline silica (as quartz) Respirable crystalline silica/tripoli (as quartz) Respirable coal dust, > 5% quartz	ID-142	WOHL method (based on NIOSH 7500 and OSHA ID-142)
<b>Selected Pneumoconiotic Agents</b>	Alpha-alumina (total dust) Aluminum oxide Antimony and compounds (as Sb) Beryllium and compounds (as Be) Cobalt, metal, fume and dust (as Co) Iron oxide fume (as Fe) Tin (Inorganic Compounds, Except oxide as Sn)	ID-125G	WW001.3.1
	Silica, respirable crystalline cristobalite	ID-142	WOHL method (based on NIOSH 7500 and OSHA ID-142)
	Carbon black	ID-196	WC019cb.4.0
	Welding fumes (total particulate)	SOP for nuisance dust	WW001.6.0 (5um PVC filter)

SLCTC - Salt Lake City Technical Center

WOHL - Wisconsin Occupational Health Laboratory



# Appendix G

## Surveillance Guidelines for State Health Departments

### Silicosis

#### Reporting Guidelines

State health departments should encourage physicians, including radiologists and pathologists, as well as other health-care professionals, to report all diagnosed or suspected cases of silicosis. These reports should include persons with:

- A. A physician's provisional or working diagnosis of silicosis.
- OR**
- B. A chest radiograph interpreted as consistent with silicosis.
- OR**
- C. Pathologic findings consistent with silicosis.

State health departments should collect appropriate clinical, epidemiologic, and workplace information on reported persons with silicosis as needed to set priorities for workplace investigations.

#### Surveillance Case Definition

- A. History of occupational exposure to airborne silica dust.\*

#### **AND EITHER OR BOTH OF THE FOLLOWING:**

- B1. Chest radiograph or other imaging technique interpreted as consistent with silicosis.+
- B2. Pathologic findings characteristic of silicosis.§

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- \* Exposure settings associated with silicosis are well characterized and have been summarized in several reviews. The induction period between initial silica exposure and development of radiographically detectable nodular silicosis is usually >10 years. Shorter induction periods are associated with heavy exposures, and acute silicosis may develop within months following massive silica exposure.
  - + Cases can be classified as nodular or acute. Common radiographic findings of nodular silicosis include multiple, bilateral, and rounded opacities in the upper lung zones; other patterns have been described. Since patients may have mixed dust exposure, irregular opacities may be present or even predominant. To be considered consistent with silicosis, radiographs of nodular silicosis classified by NIOSH-certified "B" readers should have small opacity profusion categories of 1/0 or greater by the International Labour Organization classification system. If the largest opacity is >1 cm in diameter, progressive massive fibrosis [PMF] (also known as 'complicated' silicosis) is present. A bilateral alveolar filling pattern is characteristic of acute silicosis and may be followed by rapid development of bilateral small or large opacities.
  - § Characteristic lung tissue pathology in nodular silicosis consists of fibrotic nodules with concentric "onion-skinned" arrangement of collagen fibers, central hyalinization, and a cellular peripheral zone, with lightly birefringent particles seen under polarized light. In acute silicosis, microscopic pathology shows a periodic acid-Schiff positive alveolar exudate (alveolar lipoproteinosis) and a cellular infiltrate in the alveolar walls.

## **Work-Related Asthma**

### **Reporting Guidelines**

State health departments should encourage health-care professionals to report all diagnosed or suspected cases of asthma that are caused by or exacerbated by workplace exposures or conditions. Reported cases should include asthma caused by sensitizers or irritants and should include cases of reactive airways dysfunction syndrome (RADS).

### **Surveillance Case Definition**

A. Healthcare professional's diagnosis consistent with asthma.\*

**AND**

B. An association between symptoms of asthma and work.†

### **Surveillance Case Classification Criteria (see next page)**

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\* Asthma is a chronic condition characterized by inflammation of the tracheobronchial tree associated with increased airways responsiveness to a variety of stimuli. Symptoms of asthma include episodic wheezing, chest tightness, cough, and dyspnea, or recurrent attacks of bronchitis with cough and sputum production. The primary physiologic manifestation of airways hyperresponsiveness is variable or reversible airflow obstruction. It is commonly demonstrated by significant changes in the forced expiratory volume in 1 second (FEV<sub>1</sub>) or peak expiratory flow rate (PEFR). Airflow changes can occur spontaneously, with treatment, with a precipitating exposure, or with diagnostic maneuvers such as nonspecific inhalation challenge.

+ Patterns of association can vary and include: (1) symptoms of asthma that develop or worsen after a worker starts a new job or after new materials are introduced on a job (a substantial period can elapse between initial exposure and development of symptoms); (2) symptoms that develop within minutes of specific activities or exposures at work; (3) delayed symptoms that occur several hours after exposure (e.g., during the evenings of workdays); (4) symptoms that occur less frequently or not at all on days away from work and on vacations; (5) symptoms that occur more frequently when the affected worker returns to work; and (6) symptoms that are temporally associated with workplace exposure to an agent with irritant properties. Work-related changes in medication requirements can accompany these symptom patterns.



### **Work-Related Asthma (continued)**

#### **Surveillance Case Classification Criteria (see decision logic on next page)**

- C1) Increased asthma symptoms or increased use of asthma medication (upon entering an occupational exposure setting) experienced by a person with preexisting asthma who was symptomatic or treated with asthma medication within the two years prior to entering that occupational setting.
- C2) New asthma symptoms that develop within 24 hours after a one-time high-level inhalation exposure (at work) to an irritant gas, fume, smoke, or vapor and that persist for at least three months.
- C3) Workplace exposure to an agent previously associated with occupational asthma.\*
- C4) Work-related changes in serially measured forced expiratory volume in one second (FEV<sub>1</sub>) or peak expiratory flow rate (PEFR).<sup>+</sup>
- C5) Work-related changes in bronchial responsiveness as measured by serial nonspecific inhalation challenge testing.<sup>§</sup>
- C6) Positive response to specific inhalation challenge testing<sup>¶</sup> with an agent to which the patient has been exposed at work.

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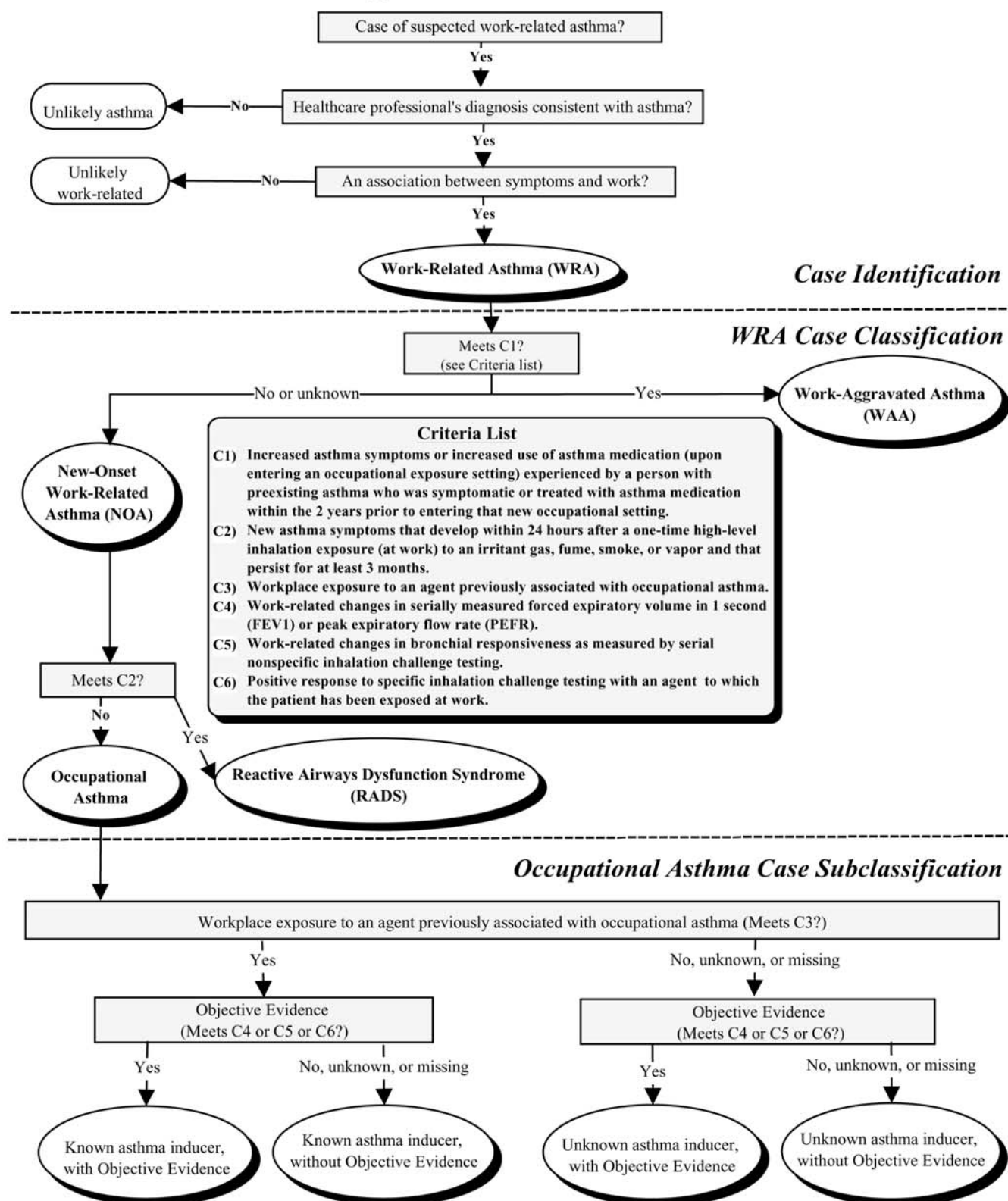
\* Many agents can induce occupational asthma via a specific hypersensitivity mechanism. A comprehensive list of these asthma inducers is used for this criterion. Known asthma inducers have been designated with the letter “A” in the Association of Occupational and Environmental Clinics (AOEC) coding scheme ([www.aoec.org/aoeccode.htm](http://www.aoec.org/aoeccode.htm)).

+ Spirometric measurements (e.g., FEV<sub>1</sub>) can be obtained before and after a person’s work shift (i.e., cross-shift spirometry). However, many cases of occupational asthma can fail to demonstrate a significant cross-shift reduction in FEV<sub>1</sub>, either because of a delayed bronchoconstrictor response or because of intermittent exposure patterns. Cross-shift spirometry testing on multiple days might help confirm the association with work. Alternatively, PEFR can be measured serially throughout the day on multiple days at and away from work using a portable peak flow meter.

§ Changes in bronchial responsiveness can be measured by serial inhalation challenge testing with nonspecific agents (e.g., using methacholine or histamine). Evidence of work-relatedness is manifested by increased bronchial responsiveness (i.e., bronchoconstriction at lower inhaled doses of methacholine or histamine) following work exposures and decreased or normal bronchial responsiveness after a period away from work.

¶ Specific inhalation challenge testing has distinct objectives, including the following: (1) identifying previously unrecognized causes of occupational asthma; (2) confirming a diagnosis of occupational asthma; and (3) identifying the causative agent when more than one allergen is present in the occupational environment and identification of the causative agent is essential for management. Specific inhalation challenge testing is potentially dangerous and should be performed by experienced personnel in a hospital setting where resuscitation facilities are available and frequent observations can be made over sufficient time to monitor for delayed reactions. Specific inhalation challenge testing is usually not necessary for clinical diagnosis of occupational asthma.

## Decision Logic for Work-Related Asthma



# Appendix H

## Split, Merged, or Renamed Counties and County Equivalents

State	Subdivision	County Representation in this Report		
		Same*	Other	
Alaska	Aleutian Islands	-	Aleutians East Borough	1968-1993
	Aleutians West Census Area	1994-1999	**	**
	Anchorage District	-	Anchorage Borough	1968-1981
	Bethel District	-	Bethel Census Area	1968-1981
	Kuskokwim District	-		1968-1981
	Bristol Bay Division	-	Bristol Bay Borough	1968-1981
	Dillingham Census Area	1982-1999		1968-1981
	Lake and Peninsula Borough	1994-1999	Dillingham Census Area	1982-1993
	Southeast Fairbanks Census Area	1982-1999	Fairbanks North Star Borough	1968-1981
	Fairbanks District	-		1968-1981
	Juneau District	-	Juneau Borough	1968-1981
	Kenai-Cook Inlet District	-	Kenai Peninsula Borough	1968-1981
	Seward District	-		1968-1981
	Ketchikan District	-	Ketchikan Gateway Borough	1968-1981
	Kodiak District	-	Kodiak Island Borough	1968-1981
	Palmer-Wasilla District	-	Matanuska-Susitna Borough	1968-1981
	Nome District	-	Nome Census Area	1968-1981
	Barrow District	-	North Slope Borough	1968-1981
	Kobuk District	-	Northwest Arctic Borough	1968-1981
	Kobuk Borough	-		1982-1993
	Outer Ketchikan District	-	Prince of Wales-Outer Ketchikan Census Area	1968-1981
	Prince of Wales District	-		1968-1981
	Sitka District	-	Sitka Borough	1968-1981
	Haines Borough	1982-1999		1968-1981
	Lynn Canal-Icy District	-		1968-1981
	Skagway-Yakutat District	-	Skagway-Yakutat-Angoon Census Area	1968-1981
	Skagway-Hoonah-Angoon Census Area	-		1994-1999
	Yakutat Census Area	-		1994-1999
	Cordova-McCarthy District	-	Valdez-Cordova Census Area	1968-1981
	Valdez-Chitina-Whittier District	-		1968-1981
	Wade Hampton District	-	Wade Hampton Census Area	1968-1981
	Wrangell District	-	Wrangell-Petersburg Census Area	1968-1981
	Upper Yukon District	-		1968-1981
	Yukon-Koyukuk District	-	Yukon-Koyukuk Census Area	1968-1981
	Denali Borough	-		1994-1999
Arizona	La Paz County	1994-1999	Yuma County	1968-1993
Hawaii	Kalawao County	1982-1999	Maui County	1968-1981
New Mexico	Cibola County	1982-1999	Valencia County	1968-1981
New York	Bronx Borough	-	Bronx County	1968-1981
	Brooklyn Borough	-	Kings County	1968-1981
	Manhattan Borough	-	New York County	1968-1981
	Queens Borough	-	Queens County	1968-1981
	Staten Island Borough	-	Richmond County	1968-1981
South Dakota	Washabaugh County	-	Jackson County	1968-1979
Virginia	Waynesboro City	1970-1999	Augusta County	1968-1969
	Portsmouth City	1970-1999		1968-1969
	Virginia Beach City	1970-1999	Chesapeake City	1968-1969
	Winchester City	1970-1999	Frederick County	1968-1969
	South Boston City	1968-1995	Halifax County	1996-1999
	Williamsburg City	1970-1999	James City County	1968-1969
	Manassas City	1982-1999		1968-1981
	Manassas Park City	1982-1999	Prince William County	1968-1981
	Nansemond County	-		1968-1974
	Nansemond City	-	Suffolk City	1970-1981
	Poquoson City	1982-1999	York County	1968-1981

- indicates subdivisions that no longer existed as of the 1990 Census, or were renamed or split after the 1990 Census.

\* During the indicated years, population and mortality data are assigned to the subdivision itself.

\*\* All data from Aleutian Islands (1968-1993) were assigned to Aleutians East Borough.

NOTE: The primary political divisions of most states are termed counties. Prior to 1982, Alaskan county equivalents were called districts, divisions, or islands. Since 1982, Alaskan county equivalents were reclassified as boroughs or census areas. Virginia has many county-equivalent cities that are or were independent of any county organization.

