

illustrative information that is not available elsewhere, it is not meant to represent the universe of tree care occupational injury deaths.

NIOSH and others previously have made recommendations for preventing deaths and injuries associated with tree care and landscaping (5,8–10). Results from the analysis described in this report generally affirm those recommendations. Employers, regardless of establishment size, should seek out information on worker safety before initiating tree care operations, and should develop, implement, and enforce a comprehensive safety program that includes formal training in tree safety, fall protection, electrical hazards, machine safety, safety along roadways, first aid, and cardiopulmonary resuscitation (CPR). Worksite surveys should be conducted before each new job and daily, by a knowledgeable person, to identify workplace hazards and control strategies. NIOSH recommendations for safety during tree work include 1) wearing appropriate personal protective equipment; 2) always working in teams in visual contact with each other; 3) checking the condition of tree branches before cutting them, climbing on them, or tying off safety equipment; 4) inspecting equipment before each shift and removing damaged equipment from service until repaired; 5) maintaining minimum distances from power lines as specified by OSHA<sup>\*\*</sup>; and 6) prohibiting the use of conductive tools and equipment near power lines (5,9,10).

### Acknowledgments

This report is based, in part, on contributions by the Bureau of Labor Statistics, US Department of Labor; and DF Utterback, PhD, National Institute for Occupational Safety and Health, CDC.

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## Malignant Mesothelioma Mortality – United States, 1999–2005

Malignant mesothelioma is a fatal cancer primarily associated with exposure to asbestos. The latency period between first exposure to asbestos and clinical disease usually is 20–40 years (1). Although asbestos is no longer mined in the United States, the mineral is still imported, and a substantial amount of asbestos remaining in buildings eventually will be removed, either during remediation or demolition. Currently, an estimated 1.3 million construction and general industry workers potentially are being exposed to asbestos (2). To characterize mortality attributed to mesothelioma, CDC's National Institute for Occupational Safety and Health (NIOSH) analyzed annual multiple-cause-of-death records for 1999–2005, the most recent years for which complete data are available.\* For those years, a total of 18,068 deaths of persons with malignant mesothelioma were reported, increasing from 2,482 deaths in 1999 to 2,704 in 2005, but the annual death rate was stable (14.1 per million in 1999 and 14.0 in 2005). Maintenance, renovation, or demolition activities that might disturb asbestos should be performed with precautions that sufficiently prevent exposures for workers and the public. In addition, physicians

\* Since 1968, CDC's National Center for Health Statistics (NCHS) has compiled multiple-cause-of-death data annually from death certificates in the United States. CDC's NIOSH extracts information on deaths from occupationally related respiratory diseases and conditions from the NCHS data and stores the information in the National Occupational Respiratory Mortality System, available at <http://webappa.cdc.gov/ords/norms.html>.

\*\* US Department of Labor, Occupational Safety and Health Administration. Standard 29 CFR part 1926.416. Electrical. Available at [http://www.osha.gov/pls/oshweb/owadisp.show\\_document?p\\_table=standards&p\\_id=10717](http://www.osha.gov/pls/oshweb/owadisp.show_document?p_table=standards&p_id=10717).

should document the occupational history of all suspected and confirmed mesothelioma cases.

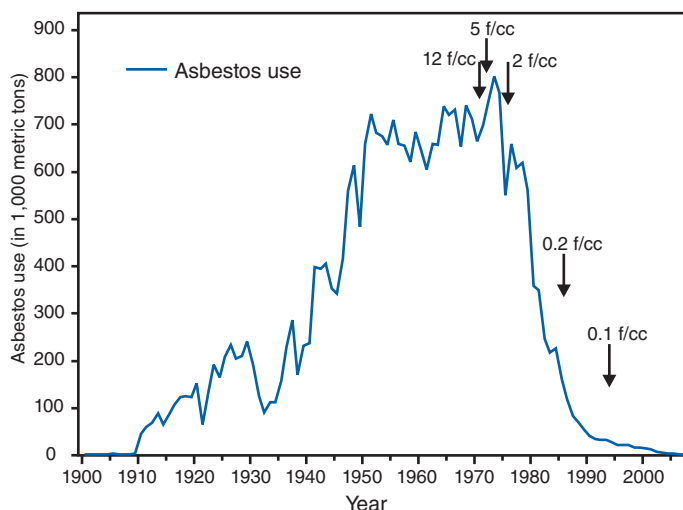
Asbestos was used in a wide variety of construction and manufacturing applications through most of the 20th century. In the United States, asbestos use peaked at 803,000 metric tons in 1973 and then declined to approximately 1,700 metric tons in 2007 (Figure 1) (3).

For this report, malignant mesothelioma deaths were identified for 1999–2005 from death certificates and included any deaths for which *International Classification of Diseases, 10th Revision* (ICD-10) codes<sup>†</sup> for malignant mesothelioma were listed in the multiple-cause-of-death mortality data entity axis.<sup>§</sup> Because mesothelioma predominantly is associated with occupational exposure and has a long latency, the analysis was restricted to deaths of persons aged  $\geq 25$  years. The annual death rate per 1 million persons aged  $\geq 25$  years was calculated using the July 1 population estimates for each year provided by the U.S. Census Bureau. Overall death rates were calculated based on the 2002 census population.

During 1999–2005, a total of 18,068 malignant mesothelioma deaths were reported in the United States; 14,591 (80.8%) occurred among males and 17,180 (95.1%) among whites (Table). Mesothelioma deaths were classified as mesothelioma of pleura (1,572; 8.7%), peritoneum (657; 3.6%), other anatomical site (2,605; 14.4%), and unspecified anatomical site (13,454; 74.5%).<sup>¶</sup> Mortality increased with age, with the greatest number of decedents aged  $\geq 75$  years; 311 deaths (1.7%) occurred in persons aged  $\leq 44$  years. From 1999 to 2005, the total number of malignant mesothelioma deaths increased 8.9%, from 2,482 in 1999 to 2,704 in 2005, but the annual death rate was stable (14.1 per million population in 1999 versus 14.0 in 2005). The death rate for males was 4.5 times that for females (23.2 versus 5.1 per million). During 1999–2005, the state death rate was greater than the national rate (13.8 per million population per year) in 26 states; in six states the rate exceeded 20 per million per year (Figure 2): Maine (173 deaths; rate: 27.5), Wyoming (50; 22.2), West Virginia (182; 21.0), Pennsylvania (1,210; 20.8), New Jersey (814; 20.2), and Washington (558; 20.1).

**Reported by:** KM Bang, PhD, JM Mazurek, MD, E Storey, MD, MD Attfield, PhD, PL Schleiff, MS, JM Wood, MS, Div of Respiratory

**FIGURE 1. Asbestos use and permissible exposure limits\* — United States, 1900–2007**



\* Arrows indicate year when the Occupational Safety and Health Administration permissible exposure limits were put in place (12 fibers per cubic centimeter [f/cc] in 1971, 5 f/cc in 1972, 2 f/cc in 1976, 0.2 f/cc in 1986, and 0.1 f/cc in 1994).

*Disease Studies, JT Wassell, PhD, Div of Safety Research, National Institute for Occupational Safety and Health, CDC.*

**Editorial Note:** Despite regulatory actions and the sharp decline in use of asbestos, potential exposure to asbestos continues, but most deaths from mesothelioma in the United States derive from exposures decades ago. Because mesothelioma manifests 20–40 years after first exposure, the number of mesothelioma deaths will likely peak by 2010 (4). The analysis described in this report indicates that the annual number of mesothelioma deaths is still increasing, and future cases will continue to reflect the extensive past use of asbestos. New cases also might result through occupational and environmental exposure to asbestos during remediation and demolition of existing asbestos in buildings if controls are insufficient to protect workers and the surrounding community.

The annual number of mesothelioma cases increased significantly from the late 1970s through the mid-1990s (4). Projections indicate that the number of mesothelioma cases involving males peaked during 2000–2004 at more than 2,000 cases and should be declining, with an expected return to background levels by 2055. The number of mesothelioma cases involving females (approximately 560 in 2003) is projected to increase slightly over time as a function of population size and shifting age distribution (4).

Previously, NIOSH examined industry and occupation data for 541 of the 2,482 mesothelioma deaths that occurred in 1999, the most recent year for which such data are available. After 1999, coding information for industry and occupation were no longer available. Of 130 industries reported, significant

<sup>†</sup> Codes C45.0 (mesothelioma of pleura), C45.1 (mesothelioma of peritoneum), C45.2 (mesothelioma of pericardium), C45.7 (mesothelioma of other sites), and C45.9 (mesothelioma, unspecified).

<sup>§</sup> Entity axis includes information on all of the diseases, injuries, or medical complications, and the location (part, line, and sequence) of the information recorded on each certificate. Detail record layouts available at <http://www.cdc.gov/nchs/about/major/dvs/mcd/msb.htm>.

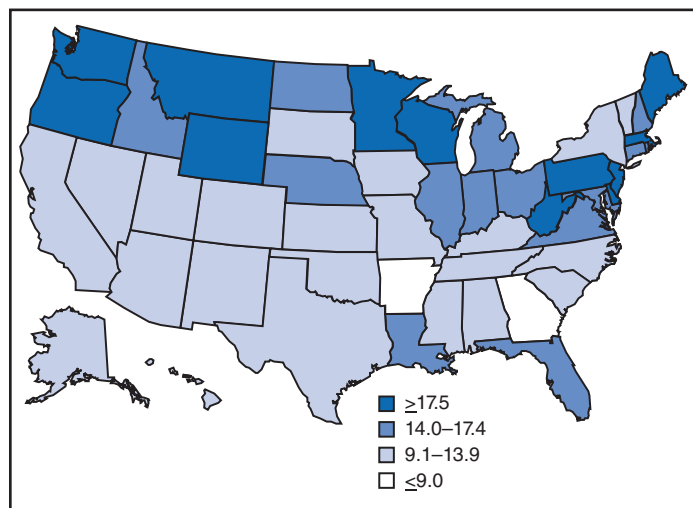
<sup>¶</sup> The sum of individual site death totals is greater than the total number of deaths because some decedents have more than one site of mesothelioma listed on their death certificates.

**TABLE. Number of malignant mesothelioma deaths among persons aged  $\geq 25$  years, by selected characteristics — United States, 1999–2005**

Characteristic	No. of deaths, by year							Total
	1999	2000	2001	2002	2003	2004	2005	
<b>Total</b>	<b>2,482</b>	<b>2,530</b>	<b>2,505</b>	<b>2,570</b>	<b>2,621</b>	<b>2,656</b>	<b>2,704</b>	<b>18,068</b>
<b>Death rate*</b>	14.1	13.9	13.6	13.7	13.9	13.9	14.0	13.8
<b>Age group (yrs)</b>								
25–34	4	6	7	10	7	11	6	51
35–44	33	34	39	40	38	42	34	260
45–54	138	131	144	106	148	121	118	906
55–64	388	372	361	380	386	400	438	2,725
65–74	818	814	748	764	715	674	735	5,268
75–84	888	918	942	975	1,028	1,097	1,014	6,862
$\geq 85$	213	255	264	295	299	311	359	1,996
Median age (yrs)	73	74	74	74	75	75	75	74
<b>Sex</b>								
Male	1,993	2,043	2,019	2,126	2,122	2,140	2,148	14,591
Female	489	487	486	444	499	516	556	3,477
<b>Race</b>								
White	2,353	2,398	2,405	2,447	2,481	2,535	2,561	17,180
Black	104	109	75	99	109	97	114	707
Other	25	23	25	24	31	24	29	181
<b>Anatomical site†</b>								
Pleura	252	225	269	238	206	196	186	1,572
Peritoneum	92	84	83	95	95	101	107	657
Other	426	433	388	377	329	326	326	2,605
Unspecified	1,750	1,817	1,806	1,901	2,013	2,063	2,104	13,454

\* Per 1 million population.

† The sum of anatomical site totals (18,288) is greater than the total number of deaths (18,068) because some decedents have more than one site listed on their death certificate.

**FIGURE 2. Malignant mesothelioma death rate per 1 million population,\* by state — United States, 1999–2005**

\* Decedents for whom the *International Classification of Diseases, 10th Revision* codes C45.0 (mesothelioma of pleura), C45.1 (mesothelioma of peritoneum), C45.2 (mesothelioma of pericardium), C45.7 (mesothelioma of other sites), or C45.9 (mesothelioma, unspecified) were listed on death certificates were identified using CDC mortality data for 1999–2005.

proportionate mortality ratios (PMRs) were found for ship and boat building and repairing (6.0; 95% confidence interval [CI] = 2.4–12.3); industrial and miscellaneous chemicals (4.8; CI = 2.9–7.5); petroleum refining (3.8; CI = 1.2–8.9); electric light and power (3.1; CI = 1.5–5.7); and construction (1.6; CI = 1.2–1.9). Of 163 occupations reported, significant PMRs were found for plumbers, pipefitters, and steamfitters (4.8; CI = 2.8–7.5); mechanical engineers (3.0; CI = 1.1–6.6); electricians (2.4; CI = 1.3–4.2); and elementary school teachers (2.1; CI = 1.1–3.6) (5).

Over the decades, the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency have taken various regulatory actions to control occupational exposure to asbestos (6). OSHA established a permissible exposure limit (PEL) for asbestos in 1971. This standard set the PEL at 12 fibers per cubic centimeter (f/cc) of air.\*\* This initial PEL was reduced to 5 f/cc in 1972, 2 f/cc in 1976, 0.2 f/cc in 1986, and 0.1 f/cc in 1994 (7). Inspection data for 1979–2003 show a general decline in asbestos exposure levels and in the percentage of samples exceeding designated occupational exposure limits in construction, manufacturing,

\*\* As an 8-hour time-weighted average based on the 1968 American Conference of Government Industrial Hygienists threshold limit value.



mining, and other industries (5). However, in 2003, 20% of air samples collected in the construction industry exceeded the OSHA PEL (5).

The findings in this report are subject to at least three limitations. First, death certificates do not include information on exposure to asbestos or a specific work history. This limits identification of industries and occupations associated with mesothelioma. Second, the state of residence issuing death certificate might not always be the state in which the decedent's exposures occurred, which might affect state death rates. Finally, some mesothelioma cases might be misdiagnosed and assigned less specific ICD codes (e.g., ICD-10 code C76, malignant neoplasm of other and ill-defined sites), and consequently not be captured in this analysis (8).

Although asbestos has been eliminated in the manufacture of many products, it is still being imported (approximately 1,730 metric tons in 2007) and used in the United States (3) in various construction and transportation products (6). Ensuring a future decrease in mesothelioma mortality requires meticulous control of exposures to asbestos and other materials that might cause mesothelioma. Recent studies suggest that carbon nanotubes (fiber-shaped nanoparticles), which are increasingly being used in manufacturing (9), might share the carcinogenic mechanism postulated for asbestos and induce mesothelioma (10), underscoring the need for documentation of occupational history in future cases. Capturing occupational history information for mesothelioma cases is important to identify industries and occupations placing workers at risk for this lethal disease.

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## HIV Infection – Guangdong Province, China, 1997–2007

In 2007, an estimated 700,000 persons in China were living with human immunodeficiency virus (HIV) infection. An estimated 50,000 new HIV infections and 20,000 deaths related to acquired immunodeficiency syndrome (AIDS) occurred in 2007, and an estimated 71% of persons with HIV infection were unaware of their HIV status (1). In 2007, 40.6% of those living with HIV had been infected through heterosexual transmission and 38.1% through injection-drug use (1,2). Guangdong Province in southeastern China is the country's most populous province, with an estimated 75.6 million permanent residents and 16.5 million migrants (3); the province has undergone rapid economic development (4). Since 1986, a case-based surveillance system (CBSS) in China has collected data on persons infected with HIV, including demographic characteristics and transmission categories. To assess recent trends in HIV infection in the province, the Guangdong Center for Disease Control, with technical assistance from CDC, analyzed CBSS data for the period 1997–2007. The results of that analysis indicated that the number of HIV cases increased from 102 in 1997 to 4,593 in 2007, although this increase resulted, in part, from expanded testing and surveillance. Among males classified by HIV transmission category, 82.1% of newly diagnosed infections were attributed to injection-drug use. Among females classified by HIV transmission category, 53.7% engaged in high-risk heterosexual conduct. Despite substantial methodologic limitations, these results can be useful to Guangdong public health agencies in targeting and evaluating HIV prevention, care, and treatment programs.

Instituted in 1985 as a paper-based system, CBSS was transitioned to a web-based system in 2004. CBSS data regarding HIV infection and patient characteristics are collected from



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## Morbidity and Mortality Weekly Report

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### Workers' Memorial Day — April 28, 2009

Workers' Memorial Day recognizes those workers who died or sustained work-related injuries or illnesses during the previous year. In 2007, a total of 5,488 U.S. workers died from occupational injuries (1). Another 49,000 annual deaths are attributed to work-related diseases each year (2). In 2007, an estimated 4.0 million private-sector workers had a nonfatal occupational injury or illness; approximately half of them were transferred, restricted, or took time away from work (3). An estimated 3.4 million workers were treated in emergency departments in 2004 (the most recent data available) because of occupational injuries, and approximately 80,000 were hospitalized (4).

Work-related injuries and illnesses are costly. In 2006, employers spent nearly \$87.6 billion on workers' compensation (5), but this represents only a portion of total work-related injury and illness costs borne by employers, workers, and society overall, including cost-shifting to other insurance systems and most costs of work-related illness. Additional information on workplace safety and health is available from CDC at <http://www.cdc.gov/niosh>.

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### Work-Related Fatalities Associated with Tree Care Operations — United States, 1992–2007

Workers in various industries and occupations are involved in the care and maintenance of trees, such as tree trimming, pruning, and removal. This work is recognized as having many safety hazards (1). Although previous analyses have involved subgroups of workers who perform this type of work (2), no analysis has focused on identifying injured workers from all industries and occupations that perform tree care operations. This report summarizes the characteristics of fatal occupational injuries, using data from the Census of Fatal Occupational Injuries (CFOI) and a case series of fatality investigations conducted by CDC's National Institute for Occupational Safety and Health (NIOSH) Fatality Assessment and Control Evaluation (FACE) program. During 1992–2007,\* a total of 1,285 workers died while performing tree care and maintenance; 44% were trimming or pruning a tree when fatally injured. The most common causes of death were being struck by or against an object (42% of deaths), most commonly a tree or branch; falls to a lower level (34%); and electrocutions (14%). Most of the decedents (57%) worked for small establishments with 10 or fewer employees. Employers, trade and

\*2007 data are preliminary. Final 2007 data are expected to be released in spring 2009 and will be available at <http://www.bls.gov/iif>.

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worker associations, and policymakers should take additional steps to improve the safety of workers involved in tree care, such as providing formal training to workers and ensuring that personal protective equipment (e.g., fall protection equipment) is used properly.

The analysis consisted of two parts. For the first part, NIOSH reviewed data for 1992–2007 (the most recent data available to NIOSH) from CFOI, a national surveillance system for work-related deaths attributed to traumatic injury maintained by the U.S. Department of Labor's Bureau of Labor Statistics.<sup>†</sup> CFOI derives fatality data from multiple sources (e.g., death certificates, medical examiner/coroner reports, workers' compensation reports, and police reports) (3). Potential cases of tree care–related deaths were identified in the CFOI database using specific data elements: industry, occupation, injury source, and narratives describing the injury event.<sup>§</sup> A case was defined as a fatal event that was a direct result of a tree care operation, as determined by the injury narrative. After the initial selection of potential cases, a manual case-by-case review of injury narrative confirmed relevance. Events among workers conducting the following activities were included: tree topping, tree trimming/pruning, tree felling, tree removing, and tree clearing. Because of changes in classification methods in 2002, industry and occupation are reported only for 2003–2007.

For the second part of the analysis, NIOSH reviewed all fatality investigation reports concerning tree care operations from the NIOSH FACE program for 1985–2007. Through on-site investigations, NIOSH and cooperating states<sup>¶</sup> collect detailed information on the circumstances for select incident types (including falls and electrocutions) for purposes of making recommendations for preventing future similar deaths (4).

<sup>†</sup> The Bureau of Labor Statistics provides the NIOSH Division of Safety Research with a special research file for analysis through a memorandum of understanding. The CFOI data analyzed by NIOSH include data for New York City for 2003–2007 but not for previous years.

<sup>§</sup> Cases were selected for initial review if 1) the decedent was coded as working in the tree services and ornamental shrubs industry (for 1992–2002, *Standard Industrial Classification Manual, 1987 Edition*, code 0783); 2) the decedent was coded as working in the landscaping services industry (for 2003–2007, *North American Industry Classification System, 2002 Edition*, code 56173); 3) the injury source was wood chippers (Occupational Injury and Illness Classification System (OIICS) source code 3231 and secondary source code 3231) or a tree (OIICS source code 587); or 4) the case narrative contained the keyword “tree” with the trunks of the following keywords: “fell,” “trim,” “prune,” “landscape,” “removal,” “excavation,” or “care.” The initial review excluded cases in which the decedent was coded as working in the logging industry (1992–2002, *Standard Industrial Classification Manual, 1987 Edition*, code 027; for 2003–2007, *North American Industry Classification System, 2002 Edition*, code 1133) or coded as a logger (1992–2002, 1990 Bureau of Census occupation classification system occupation code 613; 2003–2007, 2000 Standard Occupational Classification occupational code 45-4020).

<sup>¶</sup> States apply through a competitive process to receive funding to conduct state-based FACE programs. Since 1990, a total of 22 states have had cooperative agreements with CDC for varying periods.

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