MMWR™
Morbidity and Mortality Weekly Report
Weekly April 26, 2002 / Vol. 51 / No. 16

Workers' Memorial Day — April 28, 2002

April 28, 2002, has been designated Workers' Memorial Day to remember workers who have died from occupational injuries or diseases. Although workers in the United States are experiencing substantial improvements in occupational health and safety (*1*), occupational injuries and fatalities continue to occur.

During 1980–1998, approximately 109,000 civilian workers died from work-related injuries, an average of 16 deaths per day (CDC, unpublished data, 1998). In 1998, 3.6 million workers were seen in hospital emergency departments in the United States because of injuries that occurred on the job (*2*). In 2000, costs of fatal and nonfatal unintentional work-related injuries were an estimated $131.2 billion (*3*).

Workers' Memorial Day can serve as a reminder of the need to continue efforts to reduce the burden of work-related injuries and illnesses. Data and research findings on occupational injuries and illnesses can help focus such efforts. This issue of *MMWR* presents three reports of work-related injuries, illnesses, and deaths.

Information about causes and prevention of work-related injury and disease is available from CDC's National Institute for Occupational Safety and Health, telephone 800-356-4674, or at http://www.cdc.gov/niosh/homepage.html.

References

1. CDC. Improvements in workplace safety—United States, 1900–1999. MMWR 1999;48:461–9.
2. National Institute for Occupational Safety and Health. Worker health chartbook, 2000. Atlanta, Georgia: U.S. Department of Health and Human Services, Public Health Service, CDC, 2000 (DHHS [NIOSH] publication no. 2000-127).
3. National Safety Council. Injury Facts, 2001 Edition. Itasca, Illinois: National Safety Council, 2002.

Fixed Obstructive Lung Disease in Workers at a Microwave Popcorn Factory — Missouri, 2000–2002

In May 2000, an occupational medicine physician contacted the Missouri Department of Health and Senior Services (MoDHSS) to report eight cases of fixed obstructive lung disease in former workers of a microwave popcorn factory. Four of the patients were on lung transplant lists. All eight had a respiratory illness resembling bronchiolitis obliterans with symptoms of cough and dyspnea on exertion, had worked at the same popcorn factory (factory A) at some time during 1992–2000, and had spirometric test results that were lower than normal for both FEV_1 (forced expiratory volume in 1 second) and FEV_1/FVC (forced vital capacity) ratio. Employment durations ranged from 8 months to 9 years. MoDHSS requested assistance from CDC's National Institute for Occupational Safety and Health in evaluating factory A for respiratory hazards to workers. This report summarizes the epidemiologic findings motivating the technical assistance request and preliminary results. The findings of this investigation indicate that workers exposed to flavorings at microwave popcorn factories are at risk for developing fixed obstructive lung disease. Public health authorities, employers, and health-care providers are collaborating to prevent obstructive lung disease in popcorn factory workers.

At factory A, soybean oil, salt, and flavorings are mixed into a large heated tank in a process that produces visible dust,

INSIDE

The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

SUGGESTED CITATION
Centers for Disease Control and Prevention. [Article Title]. MMWR 2002;51:[inclusive page numbers].

aerosols, and vapors with a strong buttery odor. To determine whether exposure to inhaled mixing-tank substances was associated with disease, MoDHSS analyzed patients according to job categories determined by work proximity to the mixing tank: workers who were mixers of oil, salt, and flavorings and who had direct contact with the tank; microwave-packaging workers who worked 5–30 meters from the tank; and workers in other areas of the factory who were >30 meters from the tank.

During 1992–2000, factory A employed approximately 560 workers; 425 no longer worked at the factory as of May 2000. Of the eight patients reported, four were mixers and four were microwave-packaging workers. No microwave-packaging workers had ever worked as mixers. Discussions with workers and management staff at factory A indicated that an estimated 13 (3%) of the 425 former workers had been mixers, 276 (65%) had worked in microwave packaging, and 136 (32%) had worked in other areas of the factory. On the basis of this estimated distribution, the crude incidence of illness was highest in mixers (four of 13 [31%]) and microwave-packaging workers (four of 276 [1%]) (Table 1); no cases were reported in the estimated 136 workers in other areas of the factory (Chi square for trend=19.0, p=0.00001).

Assuming exposure to factory work contributed to reported occupational lung disease, former workers had 1,148–2,819 person-years at risk, depending on assumptions about whether risk for disease continues after employment ceases. On the basis of the eight cases reported during this period, the calculated rate of illness was 28–70 cases per 10,000 person-years. Assuming that all eight reported patients represented cases of occupational lung disease, this represents a five- to 11-fold excess over the expected number of reported occupational respiratory conditions attributed to toxins (*1*).

MoDHSS and CDC investigated the worksite for possible exposures to airborne respiratory toxins, but found no known substance that could explain the illnesses. The focus shifted to assessing risk for current workers and a possible new cause of occupational airways obstruction. Because of the apparent high risk to mixers and microwave-packaging workers, CDC recommended that all workers in both groups wear

TABLE 1. Reported fixed-airways obstruction among former factory A workers, by job category — Missouri, 1992–2000*

Job category	No. workers reporting fixed-airways obstruction	Estimated no. workers in job category	Total
Mixer	4	9	**13**
Microwave packaging	4	272	**276**
Other	0	136	**136**
Total	**8**	**417**	**425**

* Chi square for trend=19.0, p=0.00001

respirators while the investigation proceeded, with the minimum recommended respirator being a half-face, nonpowered respirator equipped with P-100 filters and organic vapor cartridges.

In November 2000, CDC conducted a cross-sectional survey of 117 current workers that included interviews, pulmonary-function testing, and air sampling for volatile organic compounds (VOCs) and dusts at factory A. On the basis of national data adjusted for smoking and age, current workers had two to three times the expected rates of respiratory symptoms and self-reports of physician diagnoses of asthma or chronic bronchitis; the rate of obstruction on spirometry was 3.3 times higher than expected (*2*).

Industrial hygiene sampling conducted during the November 2000 survey detected approximately 100 VOCs in the plant air. Diacetyl, a ketone with butter-flavor characteristics, was measured as a marker for exposure to flavoring vapors. The geometric mean air concentration of diacetyl was 18 parts per million parts air (ppm) in the room where the mixing tank was located, 1.3 ppm in the microwave-packaging area, and 0.02 ppm in other areas of the plant. Rates of obstructive abnormalities on spirometry increased with increasing cumulative exposure to airborne flavoring chemicals. Concentrations of total and respirable dust were below SHA-permissible exposure limits (PELs) for particulates not otherwise regulated. No OSHA-PELs or NIOSH-recommended exposure levels exist for diacetyl. To reduce exposures, CDC investigators recommended engineering controls including increased ventilation and isolation of VOC sources.

CDC is conducting repeated air sampling and medical surveillance at 4-month intervals to monitor response to interventions. To date, serial pulmonary function testing has documented excessive declines in FEV_1 and additional persons with airways obstruction among those working in the plant before engineering controls lowered exposures by several orders of magnitude. The adequacy of controls in protecting workers hired since exposures were lowered is being assessed by interval changes in FEV_1.

Reported by: *E Simoes, MD, P Phillips, DVM, R Maley, Missouri Dept of Health and Senior Svcs. K Kreiss, MD, Div of Respiratory Disease Studies, National Institute for Occupational Safety and Health; J Malone, MD, R Kanwal, MD, EIS officers, CDC.*

Editorial Note: Bronchiolitis obliterans, a rare, severe lung disease characterized by cough, dyspnea on exertion, and airways obstruction that does not respond to bronchodilators, can occur after certain occupational exposures. Inhalation exposure to agents such as nitrogen dioxide, sulfur dioxide, anhydrous ammonia, chlorine, phosgene, and certain mineral and organic dusts can cause irreversible damage to small airways without affecting chest radiograph and diffusing capacity (*3*).

This investigation initiated by MoDHSS identified a large cluster of conditions resembling bronchiolitis obliterans associated with occupation at a microwave popcorn factory. The results of this investigation raise concern about possible risk for workers in other flavoring and food production industries. Recent reports to CDC document bronchiolitis obliterans cases in the settings of flavoring manufacture and a case of fixed-airways obstruction in a worker at a microwave popcorn factory in Nebraska (CDC, unpublished data, 2001).

Preliminary animal studies at CDC suggest severe damage to airway epithelium after inhalation exposure to high air concentrations of a butter flavoring used in factory A. Further animal studies are planned to determine the causal ingredients in the complex butter-flavoring mixture.

The Food and Drug Administration regulates flavorings based on the safety of the amounts consumed, not the safety of prolonged worker inhalation of high concentrations. CDC has no evidence to suggest risk for consumers in the preparation and consumption of microwave popcorn.

CDC is investigating whether other cases of fixed obstructive lung disease have occurred in workers at other microwave popcorn factories. Health-care providers should report to state health authorities and CDC any cases of suspected occupational respiratory disease in workers exposed to food flavorings.

References

1. CDC. Work-related lung disease surveillance report, 1999. Washington, DC: U.S. Department of Health and Human Services, Public Health Service, CDC, National Institute for Occupational Safety and Health, 1999.
2. CDC. Third National Health and Nutrition Examination Survey, 1988–1994, NHANES III Examination Data File [CD-ROM]. Hyattsville, Maryland: U.S. Department of Health and Human Services, Public Health Service, CDC, 1996. (Public use data file documentation No. 76200.)
3. King TE, Jr. Bronchiolitis. In: Fishman's Pulmonary Diseases and Disorders, 3rd ed. New York, New York: McGraw Hill, 1998.

Factors Associated with Pilot Fatalities in Work-Related Aircraft Crashes — Alaska, 1990–1999

Despite its large geographic area, Alaska has only 12,200 miles of public roads, and 90% of the state's communities are not connected to a highway system (*1*). Commuter and air-taxi flights are essential for transportation of passengers and delivery of goods, services, and mail to outlying communities (Figure 1). Because of the substantial progress in decreasing