

HEALTH EFFECTS OF BREATHING WOODSMOKE

Summary: Numerous scientific studies report potentially serious adverse health effects from breathing smoke emitted by residential wood combustion. Smoke contains fine particles, which can affect both the lungs and the heart. Residential wood smoke may be a significant source of exposure to fine particle pollution.

Smoke and Residential Wood Combustion

Residential wood combustion refers to the burning of wood in fireplaces, woodstoves and other devices used to heat the home. These devices produce smoke when wood does not burn completely. If operated incorrectly, even the most modern wood-burning devices can produce smoke.

Smoke from wood-burning stoves and fireplaces contains a complex mixture of gases and particles. The size of particles is directly linked to their potential for causing health problems. Small particles less than 10 micrometers in diameter pose the greatest problems, because they can get deep into the lungs, and some may even get into the bloodstream. Among these particles are “fine particles,” which are 2.5 micrometers in diameter and smaller. These fine particles can affect both your lungs and your heart.

Smoke and Health

When people are not at work they typically spend 60-70 percent of their time at home, (Szalar,¹ 1972; Chapin², 1974; Sexton et al.³, 1986) and if they heat their home with wood they are potentially exposed to fine particle pollution. In addition to the smoke that can be released inside the home, studies show that an estimated 70 percent of smoke from chimneys can actually reenter the home and neighborhood dwellings (Pierson⁴ et al., 1989).

Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- premature death in people with heart or lung disease.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution. For more information about particle pollution, visit www.epa.gov/particles. For more information about asthma, visit www.epa.gov/asthma.

Woodsmoke and Health: A Survey of Research

Many researchers have studied the health effects of RWC emissions on people in both indoor and outdoor environments in North and South America, Europe and the Far East since the early 1980's. They have documented their results in various environmental and medical journals. Selected excerpts from these studies form the basis of the following discussion and are referenced in the endnotes of this section, as well as a glossary of medical terms used.

The following conclusions are from a review article by Judith T. Zelikoff⁵ that examines many of the health effects studies published in the last 25 years. The article appeared in the Journal of Toxicology & Environmental Health in 2002:

With regard to adults, studies show that prolonged inhalation of wood smoke contributed to [chronic bronchitis](#) (Rajpandey⁶, 1984), [chronic interstitial lung disease](#), [pulmonary arterial hypertension](#) and [cor pulmonale](#) (Sandoval⁷ et al., 1993), and altered pulmonary immune defense mechanisms (Demarest⁸ et al., 1979; Ramage⁹ et al., 1988).

While adverse effects on adults are notable, children appear to be at greatest risk. Many studies that focused specifically on RWC have concluded that young children living in homes heated by a wood-burning stove had a greater occurrence of moderate and severe chronic respiratory symptoms than children of the same age and sex who did not live in homes heated with a wood burning stove. Exposure of preschool children living in homes heated with wood burning stoves or in houses with open fireplaces yielded these effects: decreased pulmonary lung function in young asthmatics (Koenig¹⁰ et al., 1993); increased incidence of [acute bronchitis](#) and severity/frequency of wheezing and coughing (Butterfield¹¹ et al., 1989); and increased incidence, duration, and possibly severity of acute respiratory infections (Honicky^{12 13} et al., 1983, 1985; Rajpandey, 1984; Morris¹⁴ et al., 1990; Collings¹⁵ et al., 1990; Honicky and Osborne¹⁶, 1991; Kammen¹⁷ et al., 1998).

Residential wood combustion emissions also contain sulfur oxides, nitrogen oxides, carbon monoxide and potentially carcinogenic compounds including polycyclic aromatic hydrocarbons, benzene, formaldehyde and dioxins (NEIPTG, 2000¹⁸; Larson and Koenig, 1994¹⁹; ERMD, 2000²⁰). Some of these pollutants are known to cause cancer but their effects on human health via exposure to wood smoke have not been extensively studied.

Reduce Smoke to Reduce Exposure

People who heat with wood should do so as cleanly as possible. As a result of federal air quality regulations, wood stoves and fireplace inserts manufactured after 1992 are significantly cleaner-burning than those built earlier. These newer appliances -- properly installed, in good working order, well-maintained and used correctly -- help reduce outdoor and indoor air pollution resulting from burning wood, and consequently, help reduce risks to health. Homeowners can further reduce those risks by switching to cleaner fuels, such as gas. If people are burning wood for recreational purposes, they should consider the impacts on their health, their family's health, and their neighbors' health.

References:

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Glossary (source: U.S. National Library of Medicine)

Interstitial Lung Disease: Interstitial lung diseases (ILD) are a group of diseases caused by inflammation and scarring of the alveoli (air sacs) and their supporting structures (the interstitium). This leads to reduced blood oxygen levels. Most cause progressive scarring of lung tissue that eventually affects a person's ability to breathe and obtain enough oxygen. Beyond this, the disorders vary greatly. For more information see:

<http://www.nlm.nih.gov/medlineplus/ency/article/000128.htm>

Cor Pulmonale: Cor pulmonale is failure of the right side of the heart caused by prolonged high blood pressure in the pulmonary artery and right ventricle of the heart. Almost any chronic lung disease or condition causing prolonged low blood oxygen can lead to cor pulmonale. For more information see:

<http://www.nlm.nih.gov/medlineplus/ency/article/000129.htm>

Pulmonary arterial hypertension: Pulmonary hypertension is abnormally high blood pressure in the arteries of the lungs. The small arteries of the lung narrow throughout the lungs. Pulmonary hypertension is the result of greater resistance to blood flow. As a result of the increased workload caused by this resistance, the right side of the heart becomes enlarged. Eventually, progressive heart failure may develop. For more information see: <http://www.nlm.nih.gov/medlineplus/ency/article/000112.htm>

Bronchitis: Bronchitis is an inflammation of the main air passages to the lungs. Bronchitis may be short-lived (acute) or chronic, meaning that it lasts a long time and often recurs. There are two types of bronchitis:

Acute Bronchitis: generally follows a viral respiratory infection. Initially, it affects the nose, sinuses, and throat and then spreads to the lungs. Sometimes, a person may get another (secondary) bacterial infection in the airways. This means that bacteria infect the airways, in addition to the virus. People at risk for acute bronchitis include: the elderly, infants, and young children; smokers; and people with heart or lung disease.

Chronic Bronchitis: is a long-term condition. People have a cough that produces excessive mucus. To be diagnosed with chronic bronchitis, a person must have a cough with mucus most days of the month for at least three months. Chronic bronchitis is also known as chronic obstructive pulmonary disease, or COPD for short. (Emphysema is another type of COPD.) As the condition gets worse, people with COPD may become increasingly short of breath, have difficulty walking or exerting themselves physically, and may need supplemental oxygen on a regular basis. Cigarette smoke, including long-term exposure to second-hand smoke, is the main cause of chronic bronchitis. The severity of the disease often relates to how much a person smoked or was exposed to the smoke. The following things can make bronchitis worse: air pollution, certain occupations (like coal mining, textile manufacturing, or grain handling), infection, and allergies. For more information see:

<http://www.nlm.nih.gov/medlineplus/ency/article/001087.htm>