



HEALTH EFFECTS OF BREATHING WOOD SMOKE

Summary: Numerous scientific studies report potentially serious adverse health effects from breathing smoke emitted by residential wood combustion (RWC). 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 contain 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, 1972; Chapin, 1974; Sexton et al., 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 (Pierson 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.

Wood Smoke 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 used¹.

The following conclusions are from a review article by Judith T. Zelikoff 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 (Rajpandey, 1984), chronic interstitial lung disease, pulmonary arterial hypertension and cor pulmonale (Sandoval et al., 1993), and altered pulmonary immune defense mechanisms (Demarest et al., 1979; Ramage 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 (Koenig et al., 1993); increased incidence of acute bronchitis and severity/frequency of wheezing and coughing (Butterfield et al., 1989); and increased incidence, duration, and possibly severity of acute respiratory infections (Honicky et al., 1983, 1985; Rajpandey, 1984; Morris et al., 1990; Collings et al., 1990; Honicky and Osborne, 1991; Kammen 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, 2000; Larson and Koenig, 1994; ERMD, 2000). 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.

¹ To read the complete discussion with references go to <http://www.epa.gov/woodstoves/healtheffects.html>