



# Indoor Air Facts

# No. 5

## Environmental Tobacco Smoke

Environmental Tobacco Smoke (ETS) is one of the most widespread and harmful indoor air pollutants. ETS comes from secondhand smoke exhaled by smokers and sidestream smoke emitted from the burning end of cigarettes, cigars, and pipes. ETS is a mixture of irritating gases and carcinogenic tar particles. It is a known cause of lung cancer and respiratory symptoms, and has been linked to heart disease. Breathing in ETS is also known as "involuntary" or "passive" smoking.

### What's The Big Deal About A Little Smoke?

In the United States, 50 million smokers annually smoke approximately 600 billion cigarettes, 4 billion cigars, and the equivalent of 11 billion pipesful of tobacco. Since people spend approximately 90 percent of their time indoors, this means that about 467,000 tons of tobacco are burned indoors each year. Over a 16-hour day, the average smoker smokes about two cigarettes per hour, and takes about ten minutes per cigarette. Thus, it takes only a few smokers in a given space to release a more-or-less steady stream of ETS into the indoor air.

In 1985, three major bodies were independently convened to consider the public health implications of passive smoking. Commissioned by the U.S. Public Health Service under the Surgeon General, by the National Research Council (NRC) at the request of EPA, and by the congressionally-mandated Interagency Task Force on Environmental Cancer, Heart, and Lung Disease, the three bodies arrived at a consensus: passive smoking significantly increases the risk of lung cancer in adults. In the words of the Surgeon General, **"a substantial number of the lung cancer deaths that occur among nonsmokers can be attributed to involuntary smoking."** Moreover, there was agreement that passive smoking substantially increases respiratory illness in children and the NRC recommended eliminating ETS from the environments of small children.

### Why ETS Is Harmful

Because the organic material in tobacco doesn't burn completely, cigarette smoke contains more than 4,700 chemical compounds, including: carbon monoxide, nicotine, carcinogenic tars, sulfur dioxide, ammonia, nitrogen oxides, vinyl chloride, hydrogen cyanide, formaldehyde, radionuclides, benzene, and arsenic. These chemicals have been shown in animal studies to be highly toxic. Many are treated as hazardous when emitted into outdoor air by toxic-waste dumps and chemical plants.

There are 43 carcinogenic compounds in tobacco smoke. In addition, some substances are mutagenic, which means they can cause permanent, often harmful, changes in the genetic material of cells. EPA research has shown that ETS is the major source of mutagens indoors when smoking occurs. Higher levels of mutagenic particles are found in homes with ETS than in homes with wood stoves or in outdoor urban environments with numerous diesel trucks and buses.

Many studies have shown that nonsmokers absorb ETS components in their body fluids. The effect of ETS on nonsmokers depends on the duration of exposure. According to the National Research Council, short-term visitors to a smoking area are most likely to be annoyed by the tobacco smoke odors, whereas nonsmoking occupants of the area are more likely to complain about irritating effects to the eyes, nose or throat. Long-term exposure to ETS may lead to more serious health effects.

### Impact On Children

Passive smoking induces serious respiratory symptoms in children. Wheezing, coughing and sputum production among children of smoking parents increase by 20 percent to 80 percent depending on the symptom being assessed and the number of smokers in the household. Asthmatic children are particularly at risk.

Children of smokers have significantly higher rates of hospitalization for bronchitis and pneumonia, and a number of studies report that chronic ear infections are more common in young children whose parents smoke. Also lung development is slower in children exposed to ETS. Lung problems caused by ETS exposure in childhood can extend into adult life.

## **ETS And Cancer**

The U.S. Surgeon General and the NRC agree that ETS can cause cancer. The NRC estimates that the risk of lung cancer is roughly 30 percent higher for nonsmoking spouses of smokers than for nonsmoking spouses of nonsmokers. In 1986, an estimated 23,000 U.S. nonsmokers died from lung cancer, and the Surgeon General attributes a substantial number of those deaths to passive smoking.

## **ETS And Heart Disease**

The Interagency Task Force on Environmental Cancer, Heart, and Lung Disease Workshop on ETS concluded that the effects of ETS on the heart may be of even greater concern than its cancer-causing effects on the lungs. ETS aggravates the condition of people with heart disease, and several studies have linked involuntary smoking with heart disease.

## **ETS's Contribution To Indoor Air Pollution**

There are many potential sources of indoor air pollution, including chemicals emanating from building materials, furnishings, and consumer products; gases from combustion appliances like space heaters and furnaces; and biological contaminants from a variety of sources. Because cigarettes, pipes, and cigars produce clouds of tar particles when smoked, ETS is a major contributor of particulate indoor air pollution. ETS also contributes numerous toxic gases to indoor air, including carbon monoxide, formaldehyde and ammonia.

Field studies, controlled experiments, and mathematical models show that, under typical conditions of smoking and ventilation, ETS diffuses rapidly throughout buildings and homes, persists for long periods after smoking ends, and represents one of the strongest sources of indoor-air particulate pollution in buildings where smoking is permitted. Studies of indoor air quality in commercial and public buildings show that particulate levels in areas where smoking is permitted are considerably higher than in nonsmoking areas. Studies using personal air monitors have shown that a single smoker in a home

can double the amount of particulate air pollution inhaled by nonsmoking members of the household.

## **Evidence Of Nonsmoker Exposure**

Nicotine, a chemical unique to tobacco, has been found to be a widespread air contaminant in buildings where smoking occurs. Nicotine breaks down into cotinine as it passes through the body. Cotinine can be detected and measured in the saliva, blood, and urine of nonsmokers, indicating they have absorbed tobacco smoke from the air. Concentrations of cotinine have been found in the body fluids of infants of smoking parents, and of adults who were unaware they had been exposed to ETS.

## **Removal Of ETS From Indoor Air**

Environmental tobacco smoke can be totally removed from the indoor air only by removing the source (cigarette smoking). Separating smokers and nonsmokers in the same room may reduce, but will not eliminate, nonsmokers' exposure to tobacco smoke. Placing smokers and non-smokers in separate rooms that are on the same ventilation system also may reduce nonsmokers' exposure to tobacco smoke; this approach, however, will probably not eliminate exposure to tobacco smoke since most pollutants readily disperse through a common air space and since, in public or commercial buildings, most HVAC systems recirculate much of the contaminated indoor air.

In 1981, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), in its standard "Ventilation for Acceptable Indoor Air Quality" recommended five cubic feet of outside air per minute per occupant (cfm/occ) in smoke-free office buildings and 20 cfm/occ in buildings where smoking is permitted. These recommendations were not designed to reduce health risks (for example, limiting cancer incidence or eye irritation); rather, the recommendations were intended to control the *odor* from tobacco smoke so that 80 percent of visitors (smokers and nonsmokers combined) to the building find it acceptable. A proposed revision of this standard recommends a minimum of 15 cfm/occ in all buildings.

Research indicates that total removal of tobacco smoke through ventilation is both technically and economically impractical. The effectiveness of air filters for removing ETS particles from the indoor air is generally dependent on the type and efficiency of the air cleaner used; the effectiveness of air cleaners in removing the gaseous components of

tobacco smoke and other air pollutants requires further research.

Since there is no established, health-based threshold for exposure to environmental tobacco smoke and since EPA generally does not recognize a no-effect or safe level for cancer causing agents, the Agency recommends that exposure to environmental tobacco smoke be minimized wherever possible. The most effective way to minimize exposure is to restrict smoking to smoking areas that are separately ventilated and directly exhausted to the outside, or by eliminating smoking in the building entirely.

## The Public Reaction To ETS

People are becoming increasingly sensitized to the issue of ETS. Numerous surveys have documented that the majority of both smokers and nonsmokers support restrictions on smoking in public, particularly in the workplace. In a 1987 Gallup National Opinion Survey, 55 percent of all persons interviewed (including smokers and nonsmokers) were in favor of a total ban on all smoking in public places.

As a result, thousands of businesses and hundreds of cities, as well as over 40 states and the District of Columbia restrict smoking in various settings. The number continues to grow rapidly.

## Conclusion

EPA shares the recommendations of the 1986 Surgeon General's Report:

- o Adults should protect the health of children by not exposing them to environmental tobacco smoke.
- o Employers and employees should ensure that the act of smoking does not expose nonsmokers to environmental tobacco smoke by restricting smoking to separately ventilated areas or banning smoking from buildings.
- o Smokers should ensure that their behavior does not jeopardize the health of others.
- o Nonsmokers should support smokers who are trying to quit.

## For More Information

For additional information on environmental tobacco smoke, contact your state or local health departments, nonprofit agencies such as your local Lung

Association, Cancer Society or Heart Association, or the following:

Office on Smoking and Health  
U.S. Public Health Service  
5600 Fishers Lane, Room 1-10  
Rockville, MD 20857

Public Relations Office  
American Society of Heating  
Refrigerating and Air Conditioning  
Engineers (ASHRAE)  
1791 Tullie Circle, NE.  
Atlanta, GA 30329

Office of Cancer Communications  
National Cancer Institute  
1-800-4-CANCER

Smoking Policy Institute  
914 East Jefferson  
Suite 219  
P.O. Box 20271  
Seattle, WA 98102

Americans for Nonsmokers' Rights  
2054 University Avenue  
Suite 500  
Berkeley, CA 94704

Action on Smoking and Health  
2013 H Street, NW.  
Washington, DC 20006

Cigarette smoke is only one of many indoor air pollutants that can affect your health and comfort. Other EPA publications concerning the quality of indoor air include:

- o *The Inside Story: A Guide to Indoor Air Quality*
- o *Directory of State Indoor Air Contacts*
- o *Indoor Air Facts #1: EPA and Indoor Air Quality*
- o *Indoor Air Facts #2: EPA Indoor Air Quality Implementation Plan*
- o *Indoor Air Facts #3: Ventilation and Air Quality in Offices*
- o *Indoor Air Facts #4: Sick Buildings*

These publications, as well as additional copies of this fact sheet, are available from:

Public Information Center  
U.S. Environmental Protection Agency  
Mail Code PM-211B  
401 M Street, SW.  
Washington, DC 20460