Airborne particles, the main ingredient of haze, smoke, or airborne dust, present a serious air quality problem in many parts of the United States. Particles (also known as particulate matter) can cause a number of serious health effects – even at relatively low levels. You can take simple steps, described in this pamphlet, to protect your health from particles in the air.

High levels of particles form a brown haze over Boston.

What are particles in the air?

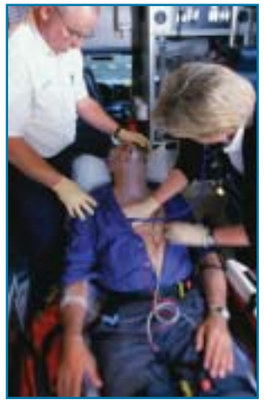
Particles are a mixture of solid particles and liquid droplets suspended in air. The size of the particles is very important. The smaller-sized particles – those 10 micrometers or less in diameter – tend to pose the greatest health concern because they can get deep into the lungs. These microscopic particles include "fine" particles which are 2.5 micrometers or less in diameter (found in smoke and haze) and "coarse" dust particles between 2.5 and 10 micrometers in diameter. Larger particles – those greater than 10 micrometers in diameter – can irritate the eyes, nose, and throat. But they are less likely to cause more serious problems since they usually do not get down into the lungs.

When breathed, small particles can be deposited in the airways or deep in the lungs. Once deposited, several things may happen. Particles may be cleared out by the body's natural defense mechanisms, they may accumulate on the surface where they deposit, or they may be absorbed into the underlying tissues. The soluble components of fine particles, along with very small ("ultrafine") particles, may enter the bloodstream. Some particles may react chemically in the body; others remain in their original form.

Particles are made up of a variety of components, including acids (such as nitrates and sulfates), organic chemicals, metals, elements from soil or dust, and allergens (for example, fragments of pollen or mold spores). Some components or types of particles may play a relatively more important role than others for various health effects. Scientists are working to understand how various aspects of particles may affect human health.

Are you at risk from particles?

You may be at greater risk from particles if you have heart or lung disease or diabetes, or are an older adult or a child. If so, you may be particularly sensitive to particles when you are active because physical activity causes you to breathe faster and more deeply and take more particles into your lungs.



People with heart or lung diseases, such as coronary artery disease, congestive heart failure, and asthma or chronic obstructive pulmonary disease, are at increased risk because particles can aggravate these diseases. In addition, people with chronic obstructive pulmonary disease (COPD) have obstructed air flow which may cause more particles to deposit in their lungs.

People with diabetes may be at increased risk of serious effects, possibly because of underlying cardiovascular disease.

Older adults are at increased risk from particles. Scientists are not exactly sure why, but this may be because older adults are more likely to have undiagnosed heart or lung disease or diabetes. Numerous studies show that when particle levels are high, older adults are more likely to be hospitalized, and some may die from aggravated heart or lung diseases.

Children are likely to be at risk from particles for a number of reasons. For example, children may be more vulnerable to particles because their lungs are still developing. Children spend more time at higher activity levels, which can lead to more particles being deposited in the lungs. Also, children are more likely to have asthma or acute respiratory diseases that can be aggravated by particle exposure.

Age-related susceptibility seems to be greatest in the very young and in older adults. There appears to be a continuum of risk that is high early in infancy and childhood, is generally low in healthy children and young adults, increases in middle age as the incidence of heart and lung disease and diabetes increases, and then is high again in older adults.

People who are more likely to have a heart attack because of their personal risk factors, may also be at greater risk from high particle levels. Factors that can increase the risk of heart attack are: age, family history of heart disease, smoking, high blood pressure, high blood cholesterol, obesity, physical inactivity, and diabetes.

Scientists do not yet know if pregnant women represent another sensitive group. Studies suggest that breathing high particle levels over long periods of time may be associated with low birth weight in infants, pre-term delivery, and fetal and infant mortality.

How can particles affect your health?

The most serious effects of particles are associated with aggravation of heart or lung disease. Numerous studies have linked particles in the air to increased admissions to hospitals and emergency room visits, and even to death from heart or lung diseases. Both long-term (years) and short-term (days) exposures have been linked with such serious effects. Short-term exposures have also been linked to aggravation of lung diseases, including asthma attacks in people with asthma, and acute bronchitis. Particles may alter the lung's defenses, increasing susceptibility to respiratory infections. In people with heart disease, particles have been linked to heart attacks and cardiac arrhythmias (irregular heart rhythms). Recent evidence suggests that some of these cardiac effects may result from very short-term exposures, possibly as short as an hour.

In healthy children and adults, exposure to elevated particle levels for short periods of time may cause minor irritation and the temporary symptoms described below. But most healthy people will recover quickly from these effects and are unlikely to experience long-term consequences. Long-term exposure to particles has also been associated with reduction in lung function and the development of chronic bronchitis.

What are the symptoms of exposure to particles?

Even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particles. Symptoms may include: irritation of the eyes, nose and throat; coughing; phlegm; chest tightness; and shortness of breath.

If you have lung disease, you may not be able to breathe as deeply or as vigorously as normal, and you may experience respiratory symptoms including: coughing, phlegm, chest discomfort, wheezing, shortness of breath, and unusual fatigue. The appearance of any of these symptoms is an indication to reduce exposure and follow the advice of your physician or health care provider. If symptoms persist or worsen you should contact your health care provider. **If you have asthma**, you should already have an asthma action plan that you routinely follow, but you may need to follow it more carefully when particle levels are high.

If you have heart disease, you can have serious effects, such as heart attacks, with no warning symptoms. So the absence of symptoms does not mean that you are safe. And if you do have symptoms – such as chest pain or tightness, palpitations, shortness of breath, and unusual fatigue – these may indicate a serious problem. In this case, you should follow the advice of your health care provider.

How can you avoid unhealthy exposure to particles?

Your chances of being affected by particles increase the longer you are active outdoors and the more strenuous the activity you engage in. If you're involved in an activity that

requires prolonged or heavy exertion, you can reduce the time you spend on the activity or substitute another activity that requires less exertion – for example, go for a walk instead of a jog. You can also plan outdoor activities when and where particle levels are lower. In general, levels of particles and other pollutants are higher near busy roadways, so these may not be the best places to exercise.The next section of this brochure tells you how to find out when particle levels are elevated in your area.

When particle levels are high outdoors, they can also be high indoors. Particles can enter buildings through doors, windows, and even the ventilation system. Certain filters and room air cleaners are available that can help reduce particle levels indoors. You can also reduce indoor sources of particles by eliminating tobacco smoke and reducing your use of candles, wood-burning stoves, and fireplaces.

When should you be concerned?

How can you know when particle levels are a concern? In many areas, local media – radio, television, and newspapers – will provide reports telling you when particle levels are unhealthy. Some national media, such as USA Today and The Weather Channel, also provide air quality information. These reports may refer to the Air Quality Index. For example, a typical report might say:

The Air Quality Index today is forecast to be 90 or "moderate" as a result of fine particles. Unusually sensitive individuals may want to reduce prolonged or heavy exertion during the morning inversion when particle levels will be highest.

What is the Air Quality Index, or AQI?

The AQI is a tool used by state and local agencies to report actual levels of particles (and other common pollutants) in air to the public. The higher the AQI value, the greater the health concern. Take a look at the table below. Notice how the AQI scale is divided into six categories, each corresponding to a different level of health concern? And notice how each category has a specific color, from green ("good") to purple ("very unhealthy")? This color scheme helps you quickly know if air pollutants are reaching unhealthy levels in your area. In the newspaper report below, for example, the black arrow points to orange, indicating that particle levels are "unhealthy for sensitive groups."

AIR QUALITY INDEX FOR PARTICLES

Air Quality Index	Air Quality	Protect Your Health
0 to 50	Good	None.
51 to 100	Moderate	Unusually sensitive people should consider reducing prolonged or heavy exertion.
101 to 150	Unhealthy for Sensitive Groups	People with heart or lung disease, older adults, and children should reduce prolonged or heavy exertion.
151 to 200	Unhealthy	People with heart or lung disease, older adults, and children should avoid prolonged or heavy exertion. Everyone else should reduce prolonged or heavy exertion.
201 to 300	Very Unhealthy	People with heart or lung disease, older adults, and children should avoid all physical activity outdoors. Everyone else should avoid prolonged or heavy exertion.

Daily air quality and health information are available on the AIRNOW web site.

AIRNOW

AIRNOW (*www.epa.gov/airnow*) is an Internet site that gives daily information about particles in the air and how they may affect you. AIRNOW contains:

- Real-time particle levels for many locations.
- Air quality forecasts for many cities across the country.
- Kids' web page and associated teacher curriculum.
- Smoke web page.
- Links to state and local air quality programs.
- Ideas about what you can do to reduce particle levels, such as making sure your car, boat and other engines are well-tuned, avoid using engines that smoke, and participating in your local utility's energy conservation programs.

**Photo courtesy of The Weather Channel.*

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EPA United States Environmental Protection Agency

Particles and Your Health

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