Particulate Matter
Total Suspended Particulates

Sources
Tiny airborne particles or aerosols that are less than 100 micrometers are collectively referred to as total suspended particulate matter (TSP). These particles constantly enter the atmosphere from many sources. Human sources include:

- Motor vehicle use.
- Combustion products from space heating.
- Industrial processes.
- Power generation.

Natural sources include:

- Soil.
- Bacteria and viruses.
- Fungi, molds and yeast.
- Pollen.
- Salt particles from evaporating sea water.

Health Effects
Over 99% of inhaled particulate matter is either exhaled or trapped in the upper areas of the respiratory system and expelled. The balance enter the windpipe and lungs, where some particulates, known as inhalable particulates, cling to protective mucous and are removed. Other mechanisms, such as coughing, also filter out or remove particles. Collectively, these "pulmonary clearance" mechanisms protect the lungs from the majority of inhalable particles.

Some of the smallest particles, called respirable particulates, lodge in the lung capillaries and alveoli, causing the following effects:

- Slowing down the exchange of oxygen and carbon dioxide in the blood, causing shortness of breath.
- Straining the heart, because it must work harder to compensate for oxygen loss.

The people most sensitive to these conditions include those with heart problems, or respiratory diseases like emphysema, bronchitis and asthma. The elderly and children are also very sensitive.

The adverse health effects from particulate matter exposure are often not immediately noticed. Particulates can accumulate in the lungs after repeated, long-term exposure causing respiratory distress and other health problems.

Some particles themselves may be poisonous if inhaled or absorbed, and can damage remote organs like the kidneys or liver. Swallowed mucous laden with poisonous particulate matter may also damage the gastrointestinal system.

Irritating odors are often associated with particulates. Some examples of sources are gasoline and diesel engine exhausts, large-scale coffee roasting, paint spraying, street paving and trash burning.

U.S. EPA replaced TSP as the indicator for both the annual and 24-hour primary (i.e., health-related) standards in 1987. The indicator includes only those particles with an aerodynamic diameter smaller than or equal to a nominal ten micrometers (PM$_{10}$ - Particulate Matter 10 microns or less). Exposure to PM$_{10}$ particles, which are retained deep in the lungs, may cause health problems. The specific health effects PM$_{10}$ causes are discussed below.

Materials/Vegetative Damage and Other Effects
Particulate matter is what most people see and feel when they experience "dirty air." Particulate matter can:
- Corrode metals and masonry.
- Soil structures and motor vehicles. (Cleaning, e.g., window washing, sand blasting, and repainting, costs millions of dollars annually.)
- Dust the leaf surfaces of crops, trees and shrubs, which may injure or inhibit the growth of these valuable plants.
- Impair visibility and reduce solar radiation. (Very small particles remain suspended in the air for long periods of time, and also effectively scatter light. The haze caused by these particles can affect crop productivity by reducing solar radiation; it can also adversely affect property values; aesthetics in urban, country-side and wilderness areas; transportation safety; and potentially the weather.)