

# Particle Sizes

## Sizes of airborne particles such as dust, pollen, bacteria, viruses and many more

The size of contaminants and particles are usually described in microns, a metric unit of measure where

- one micron is one-millionth of a meter

There are

- *25400 microns* in one inch

The eye can see particles to about 40 microns.

The size of some contaminants and particles are indicated in the table below.

<b>Particle</b>	<b>Particle Size (microns)</b>
one inch	25400
dot (.)	615
Eye of a Needle	1230
Glass Wool	1000
Spanish Moss Pollen	150 - 750
Beach Sand	100 - 10000
Mist	70 - 350
Fertilizer	10 - 1000
Pollens	10 - 1000
Cayenne Pepper	15 - 1000
Textile Fibers	10 - 1000
Fiberglass Insulation	1 - 1000
Grain Dusts	5 - 1000
Human Hair	40 - 300
Dust Mites	100 - 300
Saw Dust	30 - 600
Ground Limestone	10 - 1000
Tea Dust	8 - 300
Coffee	5 - 400
Bone Dust	3 - 300

<b>Particle</b>	<b>Particle Size (microns)</b>
Cement Dust	3 - 100
Ginger	25 - 40
Mold Spores	10 - 30
Starches	3 - 100
Red Blood Cells	5 - 10
Mold	3 - 12
Mustard	6 - 10
Antiperspirant	6 - 10
Textile Dust	6 - 20
Gelatin	5 - 90
Spider web	2 - 3
Spores	3 - 40
Combustion-related - motor vehicles, wood burning, open burning, industrial processes	up to 2.5
Fly Ash	1 - 1000
Milled Flour, Milled Corn	1 - 100
Coal Dust	1 - 100
Iron Dust	4 - 20
Smoke from Synthetic Materials	1 - 50
Lead Dust	2
Face Powder	0.1 - 30
Talcum Dust	0.5 - 50
Asbestos	0.7 - 90
Calcium Zinc Dust	0.7 - 20
Paint Pigments	0.1 - 5
Auto and Car Emission	1 - 150
Metallurgical Dust	0.1 - 1000
Metallurgical Fumes	0.1 - 1000
Clay	0.1 - 50
Humidifier	0.9 - 3
Copier Toner	0.5 - 15
Liquid Droplets	0.5 - 5
Insecticide Dusts	0.5 - 10
Anthrax	1 - 5
Yeast Cells	1 - 50
Carbon Black Dust	0.2 - 10

<b>Particle</b>	<b>Particle Size (microns)</b>
Atmospheric Dust	0.001 - 40
Smoldering or Flaming Cooking Oil	0.03 - 0.9
Corn Starch	0.1 - 0.8
Sea Salt	0.035 - 0.5
Bacteria	0.3 - 60
Bromine	0.1 - 0.7
Lead	0.1 - 0.7
Radioactive Fallout	0.1 - 10
Rosin Smoke	0.01 - 1
Combustion	0.01 - 0.1
Smoke from Natural Materials	0.01 - 0.1
Burning Wood	0.2 - 3
Coal Flue Gas	0.08 - 0.2
Oil Smoke	0.03 - 1
Tobacco Smoke	0.01 - 4
Viruses	0.005 - 0.3
Typical Atmospheric Dust	0.001 to 30
Sugars	0.0008 - 0.005
Pesticides & Herbicides	0.001
Carbon Dioxide	0.00065
Oxygen	0.0005

## **Airborne particles**

Airborne particles are solids suspended in the air.

### **Larger particles - larger than 100 $\mu\text{m}$**

- terminal velocities  $> 0.5 \text{ m/s}$
- fall out quickly
- includes hail, snow, insect debris, room dust, soot aggregates, coarse sand, gravel, and sea spray

### **Medium-size particles - in the range 1 to 100 $\mu\text{m}$**

- sedimentation velocities greater than  $0.2 \text{ m/s}$
- settles out slowly
- includes fine ice crystals, pollen, hair, large bacteria, windblown dust, fly ash, coal dust, silt, fine sand, and small dust

### **Small particles - less than 1 $\mu\text{m}$**

- falls slowly, take days to years to settle out of a quiet atmosphere. In a turbulent atmosphere they may never settle out
- can be washed out by water or rain
- includes viruses, small bacteria, metallurgical fumes, soot, oil smoke, tobacco smoke, clay, and fumes

### **Hazardous Dust Particles**

Smaller dust particles can be hazardous for humans. In many jurisdictions dust fractions at specified particle sizes in working environments are required to be measured.

#### **Inhalable Dust**

Airborne particles which can enter the nose and mouth during normal breathing. Particles of 100 microns diameter or less.

#### **Thoracic Dust**

Particles that will pass through the nose and throat, reaching the lungs. Particles of 10 microns diameter and less. Referred to as  $\text{PM}_{10}$  in the USA.

#### **Respirable Dust**

Particles that will penetrate into the gas exchange region of the lungs. A hazardous particulate size less than 5 microns. Particle sizes of 2.5 micron ( $\text{PM}_{2.5}$ ) are often used in USA.

The total allowable particle concentration - building materials, combustion products, mineral fibers and synthetic fibers (particles less than 10  $\mu\text{m}$ ) - specified by EPA (U.S. Environmental Protection Agency)

- 50  $\mu\text{g}/\text{m}^3$  (0.000022 grain/ $\text{ft}^3$ ) - allowable exposure per day over the course of 1 year
- 150  $\mu\text{g}/\text{m}^3$  (0.000022 grain/ $\text{ft}^3$ ) - allowable exposure over 24 hours

Source: [http://www.engineeringtoolbox.com/particle-sizes-d\\_934.html](http://www.engineeringtoolbox.com/particle-sizes-d_934.html)