phere has a beneficial effect in screening out some of the harmful rays of the sun Inhalation of this dust may not be harmful because either the dust may be nontoxic or body mechanisms capture, remove and eliminate, or isolate the small amounts of dust trapped in the lungs. Air pollution, radioactive fallout, pollens, and similar contaminants may have an adverse effect on some individuals. Also, when the air breathed contains excessive amounts of dust, the body has difficulty in handling the load and dust may remain in the lungs

## Sources

*Dust* is a term used in industry to describe airborne solid particles that range in size from 0.1 to 25 μ (1 μ = 1/10,000 cm = 1/25,000 in.). Process dusts below 0 5 μ in size are rare. Dusts above 5 μ in size usually will not stay airborne long enough to present an inhalation problem

Dust may enter the air from various sources It may be dispersed when a dusty material is handled, such as when lead oxide is dumped into a mixer or a product is dusted with talc. When solid materials are reduced to small sizes in processes such as grinding, crushing, blasting, shaking, and drilling, the mechanical action of the grinding or shaking device supplies a source of energy to disperse the dust formed.

*A fume* is formed when a volatized solid, such as a metal, condenses in cool air The solid particles that make up a fume are extremely fine, usually less than 0 5 μ In most cases, the hot material reacts with the air to form an oxide. Examples are lead oxide fume from smelting, and iron oxide fume from arc welding. A fume can also be formed when a material such as magnesium metal is burned or when welding or gas cutting is done on galvanized metal

*Mist* is formed when a finely divided liquid is suspended in air. An example is the oil mist produced during cutting and grinding operations.

*Smoke* may be formed by the incomplete combustion of organic materials and generally contains droplets as well as dry particles. Tobacco, for instance, produces a wet smoke composed of minute tarry droplets The size of the particles contained in tobacco smoke is about 0.25 μ.

*Radioactive dust* may be dispersed in the same ways as other industrial dusts Radium, thorium, polonium, and other radioactive elements are present in extremely minute amounts in the atmosphere

## Magnitude of particles

When a solid is broken into finely divided particles, its surface area is increased many times For example, 1 cu cm (0 061 cu in ) of quartz in the form of a cube when crushed into 1 μ cubes will give $10^{12}$ (1,000,000,000,000 or one trillion) particles with a total surface area of 6 sq m (9,300 sq in ), as compared with 6 sq cm (0 930 sq in ) for the original cube

When a solid is broken into finely divided particles, the volume occupied by the mass is also increased because of the voids between the particles A dust concentration of 50 million particles per cu ft of air (mppcf), resulting from 1 cu cm of material reduced to particles 1 cu μ in size, will occupy an air space of 20,000 cu ft

Even smaller amounts of toxic dusts, fumes, and mists will make a workroom atmosphere hazardous For example, the threshold limit value for lead, as adopted by the American Conference of Governmental Industrial Hygienists, is 0 2 mg per cu m of air, which is 0 0000002 oz per cu ft Therefore, the dispersion of only 0 002 oz of lead will be enough to give the threshold limit value of 0 2 mg per cu m of dust or fume in an air space of 10,000 cu ft (280 cu m).

A person with normal eyesight can detect dust particles as small as 50 μ in diameter. Smaller airborne particles can be detected individually by the naked eye only when strong light is reflected from them Dust of respirable size (below 10 μ) cannot be seen without the aid of a microscope Most industrial dusts consist of particles that vary widely in size, with the small particles greatly outnumbering the large ones. Consequently, with few exceptions, when dust is noticeable in the air around an operation, probably more invisible dust particles than visible ones are present.

## Dispersion

In order for particulate matter to become airborne, some form of energy is required A solid or liquid particle of sufficient mass will be thrown a considerable distance if ejected from its source with a high enough