

TABLE 1. RELATION OF SCREEN MESH TO PARTICLE SIZE

U. S. Standard Sieve Mesh...	400	325	200	140	100	60	35	18
Nominal Sieve Opening in Microns.....	37	44	74	105	149	250	500	1000

The lower limit of particle size visible to the naked eye cannot be stated definitely. It depends not only upon the individual eye, but also upon the shape and color of the particle, intensity and quality of the light, and nature of the background or opportunity for contrast. Under ideal conditions a particle of 10-micron size might be recognized, while under less favorable conditions it may be impossible to distinguish a particle smaller than 50 microns. The lower limit of visibility probably ranges from 10 to 50 microns.

Dusts, powders and granular materials are frequently classified by reference to the size of screens used for separation. Particles above 40 microns are said to be the *screen sizes* and those below, the *sub-screen* or *microscopic sizes*. Approximate or theoretical sizes of particles corresponding to the mesh scale of the U. S. Standard Sieve Series are given in Table 1.

Microscopic examination of screened dust indicates that the average diameter of a sample of irregular particles may be substantially larger than the openings of the screen through which it has passed, if the particle shapes deviate considerably from the spherical form². The smallest dimension of many such particles will correspond with the maximum permissible distance between the wires of commercial screens made to *ASTM* Standard specifications. Screening does not give sharp separation into size groups, and accordingly such a classification is statistical rather than absolute.

AIR POLLUTION BY SMOKE, ASH AND CINDERS

Total airborne solids settling in urban areas are usually reported as *soot fall* in tons per (square mile) (month). Such data published for the cities in this country range from 20 to 200 tons per (square mile) (month). To the air conditioning engineer this information may indicate the effectiveness of smoke abatement or fuel combustion control methods in his locality, but it does not provide a suitable index of the suspended dust that air cleaners in a ventilating system are expected to capture^{3, 4, 5}. Gravimetric or weight data of the type given in Table 2 are preferable. In some cases airborne particle counts may be necessary, as for pollen, bacteria, spores, and insoluble dusts causing illness or lung disease.

Dust concentrations by weight cannot be converted readily to concentrations by particle count because of the variability of particle size, shape

TABLE 2. DUST CONCENTRATION RANGES

LOCATION	GRAINS PER 1000 CU FT*	MILLIGRAMS PER CUBIC METER
Rural and suburban districts.....	0.02-0.2	0.05-0.5
Metropolitan district.....	0.04-0.4	0.1-1.0
Industrial districts.....	0.1-2.0	0.2-5.0
Ordinary factories or workrooms.....	0.2-4.0	0.5-10
Excessively dusty factories or mines.....	4-400	10-1000
Minimum explosive concentrations.....	4000-200,000	10,000-500,000

* 1 grain per 1000 cu ft = 2.3 milligrams per cubic meter.

† oz per cubic foot = 1 gram per liter = 1000 grams per cubic meter.

and specific gravity, and the inherent characteristics of dust counting and weighing procedures. One milligram of dust per cubic meter of air may represent dust counts from 1 million to 100 million particles per cubic foot of air (lightfield microscope technic) according to the size distribution of the airborne dust sample. Information of this type for a specified application is best obtained by simultaneous sampling for both counting and weighing and noting carefully at the time all factors that might affect the reproducibility of the count-weight ratio.

Smoke Abatement

Successful abatement of atmospheric pollution caused by smoke requires the combined efforts of the combustion engineer, industrial executive, public health officer, city planning commission and the community at large. Electrification of industry and railroads, increases in the use of domestic oil and gas furnaces, and segregation of industrial districts is gradually providing effective aid in the solution of this problem. In the large cities where nuisance from smoke, fly-ash and cinders is more serious, limited areas obtain some relief by the use of district heating. (See Chapters 16, 17 and 18 for further discussion on fuel burning technic.)

Legislative measures at the present time are largely concerned with reduction of the visible smoke discharged from chimneys. Practically all ordinances limit the number of minutes in any one hour that smoke of a specified density may be discharged, as measured by comparison with a Ringelmann Chart (Chapter 11, Instruments and Measurements). Ordinances generally do not make specific provision for control of the corrosive and irritant gases, such as oxides of sulphur and nitrogen discharged with the gases of combustion. Where high sulfur coals are burned, sulfur gases present a serious hazard to property, vegetation, and, in some cases, to health and comfort.

In foggy weather the accumulation of these gases in the lower strata of the atmosphere may cause irritation of the eyes, nose and respiratory passages, and possibly even more dangerous consequences. The Meuse Valley fog disaster (Belgium 1930) is a classic example in the history of gaseous air pollution. It is believed that sulfur dioxide, sulfur trioxide and other toxic gases released in a rare combination of atmospheric calm and dense fog were responsible for the 63 human deaths, the illness of several hundred persons, and also the death of many domestic and wild animals.

Absorption of Solar Radiation

Absorption of solar ultraviolet light by smoke and soot is recognized as a health problem in many industrial cities. Measurements of solar radiation in Baltimore⁶ by actinic methods demonstrated that ultraviolet light intensity in the country was 50 per cent greater than in the city. In New York City⁷ a loss as great as 50 per cent in visible light was found by photoelectric measurements.

ODOR NUISANCE

A problem companionate with smoke abatement is the control of odor nuisance in the neighborhood of industrial plants discharging noxious or offensive air contaminants. Community planning and zoning will avoid much of the difficulty in the future, but meanwhile many industrial cities must resort to corrective measures by requiring installation of air cleaning devices, the alteration of manufacturing processes, or termination of the offensive operation in residential or commercial districts.