industrialist for protecting his equipment, improving his product, and providing a clean working environment. The re-entry of contaminants to working spaces is prevented by effective air cleaning devices since only a clean effluent is discharged to the ambient atmosphere. Public nuisance complaints often occur even when the effluent concentration discharged to the atmosphere is below the permissible limits of concentration and visibility. Plant location, contaminants involved, and meteorological condition of the areas must be evaluated in addition to existing regulations or codes of good practice.

Fire and explosion hazards are created by combustible dusts, vapors, or gases. Safety may be affected by loss of visibility, settlement, or accumulation of various materials. The cleaning device can prevent these hazards by providing an effluent below the inflammation limit, visibility index, and point where settlement or accumulation will occur.

The degree of air cleaning for the recovery of useable material is a matter of economic evaluation which will vary with such factors as quantity and value of material collected, capital cost, and operating cost.

Air cleanliness must be of the highest order where toxic materials are involved and the cleaned air is recirculated to the workroom. Such recirculation is considered poor practice and is prohibited by many regulations where toxic materials are involved, except for those cases where discharge to atmosphere is impossible or decidedly impracticable. Where air is recirculated, its contamination must not exceed the established maximum allowable concentrations listed in Chapter 8. Usual requirements are a fraction, often 1/5 to 1/2, of this standard, depending on: regulation involved, air quantities recirculated in relation to the cubical content of working space, and the presence of other exhaust systems discharging to the atmosphere.

Cleaning requirements for the utilization of cleaned gases are dependent on the process and are generally of the highest order (usually comparable to atmospheric air cleanliness).

Regardless of standards it is good practice to install the most effective collection equipment available in the light of practical operation features, installation, and equipment costs. This is warranted because the required degree of cleaning is increasing continually.

FACTORS AFFECTING SELECTION

Selection of an industrial air cleaner for a given application requires an evaluation of the following 5 considerations:

1. Concentration, particle size, and size distribution of the contaminant.
2. Degree of cleaning required.
3. Conditions of air or gas stream with reference to temperature, moisture content, and chemical composition.
4. Characteristics of the contaminant, corrosiveness, solubility, adhesion, or packing, and its specific gravity, surface, and shape.
5. Methods of disposal or salvage that meet the conditions imposed by material, process, or plant location.

In view of the range of these variables, all available test data, application experience, and manufacturers' performance data should be considered.

TYPES AND APPLICATION

There are a number of principles involved in the operation of industrial air and gas cleaners. They are illustrated by the following types of cleaners:

1. *Inertial Separators* (Gravitational or inertial force principle): Baffle Chambers Centrifugal Collectors.
2. *Scrubbers and other Wet Collectors:* Air Washers, Wet Filters or Packed Towers, Spray Towers, Centrifugal or Inertial Scrubbers, Venturi Scrubbers.
3. *Filters:* Fabric Filters, Ultra or Absolute Filters.
4. *Electrostatic Precipitators.*
5. *Adsorbers, Absorbers, and Combustion Devices.*

Units employing these principles may apply them singly or in combination. The important characteristics of any unit are: its collection efficiency, resistance to air or gas flow (power requirements), ability to maintain specified air or gas flow during its operating cycle, and maintenance requirements.

In relation to industrial air cleaners, efficiency of collection is generally presented on a basis of weight removal. In many instances, collection efficiency is expressed in terms of weight removal in specific particle size ranges. Occasionally efficiencies are given in terms of visibility or photometric evaluation. Under other circumstances efficiencies are stated by particle count. For most process recovery problems and air pollution control, the weight basis has been adequate. When loss of visibility is the major problem, light opacity measurements may be required.

From a hygienic viewpoint where air is to be recirculated, only the contaminant concentration in the recirculated air stream, rather than the collection efficiency, should be considered.

Correlation between the various efficiencies is poor due to the wide variation in particle size, size distribution, and shape.

Resistance or pressure drop through any given collector is related to the operating principle, and varies about as follows: low resistance collectors—up to 2 in. water; medium resistance collectors—2 to 8 in. water; high resistance collectors—8 to 25 in. water.

In mechanical centrifugal collectors of the wet or dry type (power driven impellers or rotors) resistance alone is not of significance since these devices are also air movers and therefore the factor of paramount importance is the overall power consumption of the unit. This is also true of certain types of wet collectors which require auxiliary pumping power.

The ability of any unit to maintain specified air or gas flow during its operating cycle is also a function of its operating principle. For example, inertial collectors of the simple and centrifugal type are able to maintain constant resistance regardless of concentration and particle size. However, adhesive materials may collect at the entry, throughout the unit, and at the exit, and thus cause a reduction in air flow and serious maintenance problems. With the exception of packed towers and wet filters, wet collectors operate at constant resistance throughout their operating cycles. However they may also be adversely affected by adhesive or corrosive