the outdoor air inlet. They may also be used to reduce the odors caused by exhausts from processing. Adsorber beds, in all cases, should be protected from dust, free oil and grease.

PART 2—DUST COLLECTORS

Industrial development and growth of industrial areas have had a cumulative effect upon the problem of dust control. Not only has the atmosphere in many cities become more polluted, but the intensity of pollution at the points of control has increased. Accompanying this increase in pollution there has been a growing consciousness of the need for more effective air cleaning among housewives, store managers, industrialists and legal inspectors, and this has resulted in increasing severity of regulations pertaining to collection of dust and contaminants.

Air cleaning for the supply system is usually accomplished by means of some type of air filter. To prevent escape of industrial dust into the atmosphere, some type of dust collector is required. An industrial air cleaning installation is designed to perform one or more of the following functions:

1. Prevent a nuisance or physical damage to a plant or adjacent property.
2. Prevent re-entry of contaminants to working spaces.
3. Reclaim usable material.
4. Reduce fire, explosion, or other hazards.
5. Permit recirculation of cleaned air to working spaces.

DEGREE OF DUST REMOVAL REQUIRED

Minimum standards of dust removal required of a dust collector may be established by local or state regulations, prepared by municipal smoke abatement or health departments, or by state labor or health departments. Regardless of minimum standards, it is good practice to install the most effective collection equipment available in the light of practical operation features and installation and equipment costs. This is warranted because the required degree of effluent removal is increasing continually. 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 conditions of the areas must be evaluated in addition to existing regulations or codes of good practice.

Air cleanliness must be of the highest order where cleaned air is recirculated to the workroom. Such recirculation is considered poor practice and is prohibited by many states where toxic materials are involved, except for those cases where discharge to atmosphere is impossible or decidedly impracticable. Where air is recirculated, air contamination must not exceed the established maximum allowable concentrations listed in Chapter 8. Usual requirements are a fraction, often $\frac{1}{3}$ to $\frac{1}{2}$, of this standard, depending on: state involved, air quantities recirculated in relation to the cubical content of working space, and the presence of other exhaust systems discharging to the atmosphere.

FACTORS AFFECTING SELECTION

Selection of a dust collector for a given application requires an evaluation of:

1. Dust load and particle size of the contaminant.
2. Degree of removal required.

3. Conditions of air or gas stream with reference to temperature, moisture content, and chemical composition.
4. Characteristics of contaminant whether corrosive, sticky, or packing, and its specific gravity, particle size and shape.
5. Methods of disposal or salvage that meet the conditions imposed by material, process, or plant location.

With the range of variables that must be considered, selection of proper dust collection equipment is based largely on experience, and manufacturers of such equipment should be consulted for their recommendations.

TYPES AND APPLICATION OF DUST COLLECTORS

Dust collectors are available in a multiplicity of designs, frequently involving more than one principle of operation. Basic principles of operation are described in following sections. Manufacturers of various types can be found in the catalog section of THE GUIDE, or in handbooks featuring such equipment.

Electrostatic Dust Precipitators

Electrostatic dust and fume collectors differ materially from the low voltage designs described in Part I of this chapter, although the principles, methods of operation and efficiencies are similar. For dust collector loads, it is obvious that more severe demands are made upon methods of cleaning the collector, disposal of dust accumulations, and servicing practices. Low voltage cleaners to date do not have sufficient inherent dust holding capacity. One exception in the field of exhaust systems is that of the oil mist collector, which functions satisfactorily with the conventional low voltage type electrostatic precipitator.

The *heavy duty dust collectors* employ an assembly of parallel collector electrodes of various constructions, including corrugated plate, rod curtains or perforated plate. Air flow is usually horizontal, although special construction may permit vertical air flow. The earlier high voltage collectors were made in the form of vertical pipes, and are still used for high operating pressures and for *wet collector* designs where water continuously flows downward inside the pipe walls of the collector electrode. The negative discharge electrodes or rods are accurately centered between the usual 9 in. collector electrode spacing, the latter being of positive charge. Precipitation occurs in a single stage wherein ionization and collection are carried on simultaneously throughout the unit, and depend on high potentials of 60,000 to 75,000 volts. The two-stage type which has the added primary stage of ionizer and receiving electrodes, however, fulfills some needs better than the single stage type.

High efficiencies are obtained by allowing suitable time for contact in the collector zone, and by proper ratio of air flow velocity to that of transverse velocity of the negatively charged particles toward the positive charged collector plates. Air velocities vary from 4 fps to 8 fps with negligible pressure drops.

Attention should be directed to the prohibition of air recirculation to occupied spaces. High voltage cleaning equipment produces ozone in excessive quantities and, in addition, develops oxides of nitrogen.

Collector electrode cleaning is conveniently managed by a rapping device, either electrical or pneumatic, without interrupting operation. The dry plate surfaces release the dust readily into hoppers below the plates.

For longer than two decades, electrical precipitators of the heavy duty high voltage type have been used for the control of hazardous materials,