room volume. The fact is, as Hemeon points out, the rule of thumb based on room air changes per minute, though in widespread use over many years, has been employed improperly more often than properly. This is especially true when there are unwanted contammants being released within the room.

Comfort ventilation

Ventilation is defined as the process of supplying air to, or removing air from, any space by natural or mechanical means The word implies quantity, not necessarily quality, of air supplied From the standpoint of comfort and health, however, the problem now is considered to involve both quantity and quality.

The term "air conditioning" implies control of the physical and chemical qualities of the air. The American Society of Heating, Refrigerating and Air-Conditioning Engineers defines it as "the process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the requirements of the conditioned space."*

General ventilation of the work place contributes to the comfort and efficiency of the workmen Good general ventilation also makes a definite contribution to health, since working under extreme conditions of temperature and humidity may have a definitely adverse affect on health It is difficult to say just where the dividing line between health and comfort falls

Vitiation of air

After being confined in a work place, air undergoes physical and chemical changes which may make it unpleasant or unhealthful to breathe It may even create an unhealthful environment although workers are breathing from an outside supply These changes usually include

An increase of carbon dioxide
A decrease of oxygen
An addition of bacteria
An addition of odors
An addition of objectionable dust, fumes, gases, or vapors
An increase in temperature
An increase or decrease of moisture

Contrary to old theories, the usual changes in carbon dioxide (CO_2) and oxygen are of no physiological concern, because they are too small to produce appreciable effects even under the worst conditions of normal human occupancy The average breath contains 20 cu in of air. At a respiration rate of 16 breaths per minute, air would be inhaled and exhaled at a rate of roughly 0 2 cfm Exhaled air contains 100 times as much CO_2 as normal room air, but since the latter has only 3 per cent CO_2 in it, the chance of building up a significantly high CO_2 concentration in any ordinary structure, with its usual leakage, is negligible Normal air contains 20 per cent oxygen, whereas exhaled air contains about 15 per cent Oxygen depletion would be almost impossible in most workrooms

Bacteria. Various studies indicate that ventilating systems may accelerate the spread of communicable diseases by recirculating bacterially contaminated dust and droplets throughout the ventilated area The problem is probably of practical interest only in special situations, such as in communicable disease wards in hospitals or in schools under some conditions

The bacterial content of the air in ventilating ducts can be greatly reduced by ultraviolet irradiation, by sprays of polyglycols, or by efficient filters One practical test in a large office has indicated that this reduction in bacterial content does not result in a reduction of respiratory infections among employees Other experiments with ultraviolet radiation in the air conditioning system of an office showed some success in reducing the incidence of respiratory infections Any such equipment must be well maintained or its efficiency will drop rapidly.

Odors Odors may be completely harmless, but as an index of air contamination they have some significance Disagreeable, though harmless, odors may cause so much discomfort that employees will refuse to work in their presence Even barely perceptible odors may have an influence on the

*American Society of Heating, Refrigerating and Air-Conditioning Engineers, 345 East 47th St, New York City *Guide and Data Book*, "Fundamentals and Equipment" 1963