Relative Humidity: A ratio, although usually expressed in per cent, used to indicate the degree of saturation existing in any given space resulting from the water vapor present in that space. The presence of air or other gases in the same space at the same time has nothing to do with the relative humidity of the space, which depends merely on the temperature and partial pressure of the vapor.

Spaces in Which the Only Source of Contamination Is the Occupant: Spaces in which the atmospheric contamination results entirely from the respiratory processes of the occupant, including heat, moisture, and odors given off by the body. No manufacturing or industrial processes or other sources of atmospheric contamination, including heat and moisture, than people are considered under this title.

FACTORS INFLUENCING APPLICATIONS

The conditions and limitations outlined under the heading Application of Comfort Chart should be noted in applying the temperatures and relative humidities specified in Tables *A* and *B* of the preceding A.S.H.V.E. Ventilation Standards.

Air Quality

In occupied spaces in which the vitiation is entirely of human origin, the chemical composition of the air, the dust, and bacteria content may be dismissed from consideration so that the problem consists in maintaining a suitable temperature with a moderate humidity, and in keeping the atmosphere free from objectionable odors. Such unpleasant odors, human or otherwise, can be easily detected by persons entering the room from clean, odorless air. A further discussion of air quality will be found in Chapters 15 and 16.

Air Motion

The air in occupied spaces must be in constant gentle motion sufficient to maintain a satisfactory uniformity of temperature and humidity, but not such as to cause objectionable drafts in any occupied portion of such spaces. Stagnant air, no matter how pure, is depressing, and it fails to produce the pleasant and stimulating effect of cool air in gentle motion.

Studies by Baetjer[26] on the influence of air motion on comfort indicate that in ordinary air conditioning work the velocity of air currents should never be allowed to fall below 5 fpm, nor should it be allowed to exceed 50 fpm, except when the temperature of the air current striking the face is higher than the temperature of the room. The lower limit of 5 fpm may be taken as the minimum during the heating season, and the upper limit of 50 fpm as the maximum during the cooling season.

Air Distribution[27]

As a rule satisfactory distribution is secured when the air movement or turbulence as measured by the Kata thermometer (see p. 573, Chapter 40) is uniform in all parts of the occupied space and when simultaneous readings of temperature at any two points on the same level within the occupied space do not differ by more than 3 deg. Measurements of CO_2 are acceptable in lieu of temperature and air motion variations, but the usual method of determining CO_2 in air is much more laborious than the

[26] Threshold Air Currents in Ventilation (*American Journal of Hygiene*, Vol. IV, No. 6, p. 650, 1924).

[27] Indices of Air Change and Air Distribution, by F. C. Houghten and J. L. Blackshaw (A.S.H.V.E. Journal Section, *Heating, Piping and Air Conditioning*, June, 1933, p. 324).

determination of temperature and air movement. When CO_2 is used as an index of distribution, the variation in the concentration of the gas at a height of 36 in. above the floor should not exceed one part in 10,000 parts of air.

Air Quantity

The quantity of air to be circulated through an occupied space, whether by natural or mechanical means, or whether the air is conditioned or not, must in all cases be sufficient to maintain the required standards of air temperature, quality, motion and distribution. The factors which determine air quantity include the type and nature of the building, locality, climate, height of rooms, floor area, window area, extent of occupancy, and last but not least, the method of distribution.

Actually there are two air quantities to be considered, namely, (1) total air required and (2) outside air required. The difference between these two quantities represents the amount to be recirculated, or

$$\text{Total air} = \text{outside air} + \text{recirculated air.}$$

Sometimes the ratio of the outside air to the total air can be decreased if the air introduced is conditioned, but in the light of present information, a minimum of 10 cfm of outdoor air per person should be provided. If the air is not conditioned as in a ventilating system, the vitiated air is usually exhausted to the atmosphere, in which case all of the air introduced is outside air.

Temperature Rise

The total quantity of air introduced is governed largely by the allowable *temperature rise* when cooling is required and the allowable *temperature drop* when heating is required. As a rule, the introduction and distribution of warm air into an occupied space does not present as many difficulties as does the introduction of cold air. The former is determined from the amount of heat to be given up to the space, and the latter is determined from the amount of heat to be removed from the space, using a temperature rise that will produce uniform distribution without the production of disagreeable drafts.

Two of the most important factors on which the *temperature rise* depends are (1) the method of distribution and (2) the most economical temperature rise for the conditions involved. Some systems of distribution produce drafts with but a few degrees temperature rise, while other systems operate successfully with a temperature rise as high as 35 deg. The total air quantity introduced in any particular case is inversely proportional to the temperature rise, and depends largely upon the judgment and ingenuity of the engineer in designing the most suitable system for the particular conditions. Small quantities of air reduce the size of equipment, ducts, space, and initial cost, but require lower air temperatures. In any specific case, the cost of refrigeration must be balanced against the extra cost in increased size of equipment and running expense.

Outside Air. In order to provide uniform temperature conditions, it