

requirements for controlling temperature, air distribution and air velocity usually predominate. Other factors which must be taken into consideration include the type and usage of the building, locality, climate, height of rooms, floor area, window area, extent of occupancy, and the operation of the system distributing the air supply. Frequently, some of these factors, particularly the need for air movement and good distribution, may be satisfied by recirculation of inside air rather than by outside air.

It will be noted that, with adequate air space, the rate of air change

TABLE 1. MINIMUM OUTDOOR AIR REQUIREMENTS TO REMOVE OBJECTIONABLE BODY ODORS¹

TYPE OF OCCUPANTS	AIR SPACE PER PERSON Cu Ft	OUTDOOR AIR SUPPLY CPM PER PERSON
<i>Heating season with or without recirculation. Air not conditioned.</i>		
Sedentary adults of average socio-economic status.....	100	25
Sedentary adults of average socio-economic status.....	200	16
Sedentary adults of average socio-economic status.....	300	12
Sedentary adults of average socio-economic status.....	500	7
Laborers.....	200	23
Grade school children of average class.....	100	29
Grade school children of average class.....	200	21
Grade school children of average class.....	300	17
Grade school children of average class.....	500	11
Grade school children of poor class.....	200	38
Grade school children of better class.....	200	18
Grade school children of best class.....	100	22
<i>Heating season. Air humidified by means of centrifugal humidifier. Water atomization rate 8 to 10 gph. Total air circulation 30 cfm per person.</i>		
Sedentary Adults.....	200	12
<i>Summer season. Air cooled and dehumidified by means of a spray dehumidifier. Spray water changed daily. Total air circulation 30 cfm per person.</i>		
Sedentary Adults.....	200	<4

indicated in Table 1 is from 10 to 30 cfm per person. In rooms occupied by only a few persons such a rate of air change will be automatically attained in cold weather by normal leakage around doors and windows while it can easily be secured in warm weather by the opening of windows. With a space allotment of 400 cu ft per person, only 1½ air changes per hour are necessary to provide an air change of 10 cfm per person. This space allotment is essential for other reasons.

Therefore, in the ordinary dwelling with adequate cubic space allotment, no special provision for controlling chemical purity of the air is necessary (aside from removal of fumes from heating appliances). For

¹Loc. Cit. Note 3, p. 156.

such conditions, the control of air temperature is the major factor to be considered.

In more crowded rooms (large offices, large workrooms, auditoriums), the whole picture changes. Cubic space per person is less and the size of the room makes it impossible to admit untempered outside air without drafts. Here, mechanical ventilation is essential, but as will be noted in a later paragraph, it is even more essential for thermal than for chemical reasons. It is control of the thermal properties of the air in order to effect the removal of the heat produced by human bodies, rather than dilution of chemical poisons, which must govern practice.

The Code of Minimum Requirements for Comfort Air Conditioning⁸ prescribes definite minimum requirements which should be familiar to the designing engineer. It should be emphasized, however, that the provisions of the code aim to provide *minimum*, rather than *adequate*, requirements.

Notwithstanding the rapid advance in the field of air conditioning during the past few years, there still remain those who believe in a superior, stimulating quality of outdoor air (particularly country, mountain and seashore air) under ideal weather conditions, as compared with properly conditioned air. While this point of view is usually held by persons not intimately acquainted with the complicated factors involved they nevertheless carry some weight. It is apparent, however, to anyone acquainted with the factors involved and the conditions effecting comfort that in modern air conditioning, like in most other branches of engineering, modern science makes it possible to control the phenomena of nature for the service and comfort of man beyond any possibilities found in nature itself. When the requirements for optimum comfort as determined by the atmospheric environment are known (and the comprehensive studies to date lead us to believe that they are known at least to a high degree), the air conditioning engineer can supply these requirements indoors to the same perfection as may accidentally be found at times outdoors and keep them under control. The freedom of movement, action and thought, together with the variability of stimulæ experienced by persons under ideal conditions in the country, mountains or seashore, and the psychological effect of these *wide open spaces* undoubtedly have some stimulating effect, which when compared with the monotony of confinement indoors even in the most favorable atmospheric environment accounts for the contrast. Ultra-violet light and ionization have been suggested but the evidence so far is inconclusive or negative⁹.

Ozone has been used with success for the destruction of micro-organisms (molds) in meat packing establishments and the like; and where considerable amounts of organic effluvia are present it may be useful as a deodorant. For ordinary ventilation practice, however, neither of these purposes can be usefully attained, since the concentration of ozone

⁸Loc. Cit. Note 1.

⁹A.S.H.V.E. RESEARCH REPORT No. 921—Changes in Ionic Content in Occupied Rooms, Ventilated by Natural and Mechanical Methods, by C. P. Yaglou, L. C. Benjamin and S. P. Choate (A.S.H.V.E. TRANSACTIONS, Vol. 38, 1932, p. 191). A.S.H.V.E. RESEARCH REPORT No. 965—Physiologic Changes During Exposure to Ionized Air, by C. P. Yaglou, A. D. Brandt and L. C. Benjamin (A.S.H.V.E. TRANSACTIONS, Vol. 39, 1933, p. 357). A.S.H.V.E. RESEARCH REPORT No. 985—Diurnal and Seasonal Variations in the Small Ion Content of Outdoor and Indoor Air, by C. P. Yaglou and L. C. Benjamin (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934, p. 271). "The Nature of Ions in Air and Their Possible Physiological Effects," by L. B. Loeb (A.S.H.V.E. TRANSACTIONS, Vol. 41, 1935, p. 101). The Influence of Ionized Air upon Normal Subjects, by L. P. Herrington (Journal Clinical Investigation, 14, January, 1935). The Effect of High Concentrations of Light Negative Atmospheric Ions on the Growth and Activity of the Albino Rat, by L. P. Herrington and Karl L. Smith (Journal Ind. Hygiene, 17, November, 1935). Subjective Reactions of Human Beings to Certain Outdoor Atmospheric Conditions, by C.-E. A. Winslow and L. P. Herrington (A.S.H.V.E. TRANSACTIONS, Vol. 42, 1936, p. 119).