

10 cfm for each occupant. As a general rule, recirculation impairs the quality of the air by excessive humidity (if not conditioned), excessive odors, or both, and it tends to deprive the air of its ionic content, but the influence of this factor on comfort and health is at present a matter of speculation.

Ozone has been used as an adjunct to ventilation as a deodorant, particularly where a portion of the air is recirculated in order to effect a saving in both heating and refrigeration. At proper concentrations ozone exerts practically no effect on pathogenic air borne organisms, but will eliminate most of the undesirable odors usually present in recirculated air. It is very important to use only equipment which provides for positive control of ozone output, as higher concentrations produce a pungent and

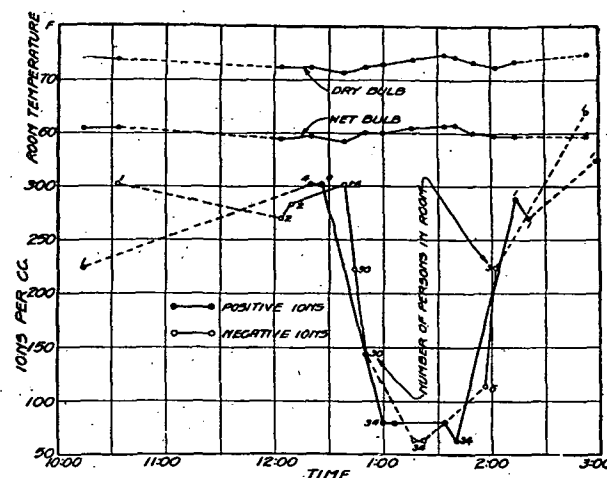


FIG. 7. INFLUENCE OF ROOM OCCUPANCY ON IONIC CONTENT³⁵
(Cubical Contents of Room, 10,000 Cu Ft; Number of Occupants, 34)

unpleasant odor, with considerable discomfort to human beings so exposed.

Toilets, kitchens, and similar rooms, in buildings using recirculation, should be separately mechanically ventilated by exhausting the air from them in order to prevent objectionable odors from diffusing into other parts of the building.

ULTRA-VIOLET RADIATION AND IONIZATION

In spite of the rapid advances made in the field of air conditioning during the past few years, the secret of reproducing, in indoor spaces, atmospheres of as stimulating qualities as those existing outdoors in the country, under ideal weather conditions, has not as yet been found. In fact, extensive studies have failed to elucidate the cause of the stimulating quality of outdoor country air, qualities which are lost when such air is brought indoors and particularly when it is handled by mechanical

TABLE 3. RELATION BETWEEN METABOLIC RATE AND ACTIVITY³⁵

ACTIVITY	METABOLIC RATE BTU PER HOUR FOR AVERAGE MAN (19.5 Sq Ft SURFACE AREA)	AUTHORITY
Seated at rest.....	384	Research Laboratory, American Society of Heating and Ventilating Engineers.
Standing at rest.....	431	Research Laboratory, American Society of Heating and Ventilating Engineers.
Walking 2 mph.....	761	Average values from Douglas, Haldane, Henderson and Schneider; and Henderson and Haggard.
Walking 3 mph.....	1049	Douglas, Haldane, Henderson and Schneider
Walking 4 mph.....	1388	Average values from Douglas, Haldane, Henderson and Schneider; and Henderson and Haggard.
Walking 5 mph.....	2530	Douglas, Haldane, Henderson and Schneider
Slow run.....	2285	Henderson and Haggard
Very severe exercise.....	2555	Benedict and Carpenter
Maximum exertion.....	3333 to 4762+	Henderson and Haggard
Tailor.....	482	Becker and Hamalainen
Bookbinder.....	626	Becker and Hamalainen
Shoemaker.....	661	Becker and Hamalainen
Carpenter.....	762 to 963	Becker and Hamalainen
Metal worker.....	862	Becker and Hamalainen
Painter (of furniture).....	876	Becker and Hamalainen
Stonemason.....	1488	Becker and Hamalainen
Man sawing wood.....	1797	Becker and Hamalainen

means. It is true that many suggestions have been advanced to account for the stimulating quality of outdoor air, such as ultra-violet light and ionization. At the present time neither of these suggestions has received any degree of scientific confirmation.

It is generally recognized that total outdoor solar radiation has marked curative value in certain diseases and is also a powerful germicidal agent. A critical review of the literature, however, does not substantiate the theory that ultra-violet radiation is of importance in air conditioning, since the use of ultra-violet sources fails to produce indoors, the previously mentioned stimulating qualities found in outdoor air.

Experiments³⁵ show that in occupied rooms there is a marked decrease in both positive and negative small ions. As shown in Fig. 7, soon after the occupants assembled the ionic content fell abruptly to a very low level which was maintained until the occupants left the room. Both positive and negative ions began to rise again as soon as the occupants departed.

The effects of the decrease in the ionic content of indoor air on comfort and health have not yet been subjected to sufficient scientific investigation. It would appear, however, from the evidence at hand, that comfort is not associated with a high ion content—but this must be considered, at least for the time being, as still a subject for further study.

³⁵A.S.H.V.E. research paper entitled 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. 37, 1931). 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). 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). The Nature of Ions in Air and their Possible Physiological Effects, L. B. Loeb (A.S.H.V.E. TRANSACTIONS, Vol. 40, 1934).