The higher volume of 24.7 cfm per person will be required to keep the dry-bulb temperature from rising above the 75 F specified. The wet-bulb temperature will therefore not rise to the maximum of 65 F.

Example 10. Assume that a man performs work at a rate equivalent to 50,000 ft-lb per hour, in an atmosphere having a dry-bulb temperature of 70 F. Estimate the sensible and latent heat given off per hour.

Solution. Since the net mechanical efficiency of the human body is about 20 per cent, the increase in metabolism due to work, over the resting metabolism, will be $\frac{50,000}{778^* \times 0.20}$ = 320 Btu per hour. Assuming a resting metabolism of 400 Btu per hour (see Fig. 5), the total metabolism during work will be 400 + 320 = 720 Btu per hour, and the total heat loss $720 - \frac{50,000}{778}$ = 656 Btu per hour approximately. In Fig. 8, follow a vertical line from a dry-bulb temperature of 70 F to a point midway between Curves *A* and *B*. The sensible heat loss is about 46 per cent of the total loss, or 0.46 × 656 = 302 Btu per hour, and the latent heat 54 per cent of the total or 0.54 × 656 = 354 Btu per hour.

*Heat equivalent of mechanical work.

Table 3. Condition of Sensible Perspiration for Persons Seated at Rest for Various Atmospheric Conditions[b]

Degree of Perspiration[a]	Atmospheric Condition					
	95 per cent R. H.			20 per cent R. H.		
	E. T.	D. B.	W. B.	E. T.	D. B.	W. B.
Forehead clammy	73.0	73.6	72.4	75.0	87.0	60.7
Body clammy	73.0	73.6	72.4	75.0	87.0	60.7
Body damp	79.0	79.7	78.4	81.0	97.5	67.5
Beads on forehead	80.0	80.8	79.4	87.0	109.4	75.2
Body wet	84.5	85.4	84.0	86.5	108.5	74.6
Perspiration on forehead runs and drips	88.0	89.0	87.6	94.0	125.2	85.4
Perspiration runs down body	88.5	89.5	88.1	90.0	116.0	79.5

[a]Forty per cent of subjects registered degree of perspiration equal to or greater than indicated.

[b]Thermal Exchanges between the Human Body and its Atmospheric Environment, by F. C. Houghten, W. W. Teague, W. E. Miller, W. P. Yant (*American Journal Physiology*, Vol. 88, No. 3, April, 1929, pp. 386–406).

Table 4. Condition of Sensible Perspiration for Persons Working at Hard Labor for Various Atmospheric Conditions

Degree of Perspiration[a]	Atmospheric Condition					
	95 Per Cent Relative Humidity			20 Per Cent Relative Humidity		
	E. T.	D. B.	W. B.	E. T.	D. B.	W. B.
Forehead clammy	59.0	59.4	58.3	69.5	80.5	56.5
Body clammy	50.0	50.2	49.3	57.0	61.6	44.2
Body damp	60.0	60.3	59.3	62.5	69.6	49.5
Beads on forehead	68.0	68.5	67.5	76.0	91.0	63.4
Body wet	69.0	69.6	68.5	71.0	82.8	53.0
Perspiration on forehead runs and drips	78.5	79.3	78.0	82.0	100.5	70.2
Perspiration runs down body	79.0	79.8	78.5	81.0	99.8	69.0

[a]Forty per cent of subjects registered degree of perspiration equal to or greater than indicated.

In cases in which the external work is not appreciable, as for instance, in sewing, walking on a level road, and the like, the rate of heat loss will be approximately equal to the total metabolism.

AIR POLLUTION IN RELATION TO COMFORT AND HEALTH

Atmospheric Pollution

Under certain circumstances in which dusts and toxic gases are conspiciously present in the atmosphere, the factor of air purity becomes of utmost importance. Many kinds of dusts and gases are capable of producing profound pathologic effects and damage to property and vegetation. The harmful effects which may result depend largely upon the chemical and physical nature of the impurities, the concentration, length of time, and conditions under which they are breathed.

Aside from specific industrial processes which contaminate the factory atmosphere, the concensus of opinion is that the damage attributed to general atmospheric pollution is, in most instances, greatly exaggerated. The objection is largely economic. There is practically no subjective proof to show that the effect of dust in ordinary air is sufficient to cause demonstrable injury to health by inhalation or by obliteration of the sun's rays. The effects may be slow, cumulative, and insidious in their manifestations, but at present direct evidence is lacking.

Dust-borne bacteria are sometimes held responsible for the transmission of disease organisms through the medium of air, but this is not supported by epidemiologic evidence. Bacteria of the pathogenic variety were found to constitute but a very small proportion of the total dust-borne bacteria[25]. The non-pathogenic bacteria in air are, in general, considered harmless, but it is not known whether continuous inhalation of these organisms may eventually produce harmful effects.

Industrial Air Pollution

In many industrial processes, sufficient amounts of dusts, fumes and vapors are liberated to be injurious to the health of the workers. Some dusts are poisonous (lead, mercury, arsenic, manganese, cadmium, etc.) and some act as irritants (silica, steel, iron, granite, etc.). Certain dusts may produce catarrhal conditions and increase susceptibility to such diseases as bronchitis, pneumonia and tuberculosis. Silicious dust is especially harmful because it has a direct damaging action upon the tissue of the lungs. On the other hand, organic dusts, both animal and vegetable (hair, pollen, textile fibers, etc.), do not seem to affect the lungs at all, although they may cause considerable discomfort to persons sensitive to them by their action on the upper respiratory passages.

Industrial gases and fumes act specifically upon the mucous membranes, the lungs, blood, skin, and eyes. Some of these substances are extremely poisonous and their action sets in after very short exposures, as is true, for example, in the inhalation of carbon monoxide, hydrogen sulphide, ammonia, chlorine, bromine, arsine and cyanogen.

The industrial processes which liberate harmful substances are too

[25]*The Microbic Content of Indoor and Outdoor Air*, by C.-E. A. Winslow and W. W. Browne (*Monthly Weather Review*, Vol. 2, 1914, p. 452).