In this case, 73 per cent (about three-fourths) of the heat load under which the man works comes from radiant sources, and can be reduced in practice only through proper shielding (or occasionally, through special protective clothing)

Indexes of comfort. In comparing one work area with another, the *effective temperature,* already mentioned, is often used. However, if a significant part of the heat load is from radiant sources, a correction must be made

How is an effective temperature reading interpreted? The effective temperature most comfortable to the greatest number of persons in summer, with low air velocities, is 71 F. According to Bedford,° "Wherever practicable, the corrected effective temperature in spaces where men live or work should be kept below 80 F. It is especially desirable that this should not exceed 86 F . . . unless the temperature of the external air exceeds 100 F" Wartime studies at Fort Knox showed that effective temperatures of 95 to 97 F were "impossible" Yaglou°° concludes, "An effective temperature of 95 F is the ceiling limit for short periods of work in heat"

Any location where the *wet bulb* is 90 F approaches the upper limit for persons doing light sedentary work. When the wet bulb approaches 95 F, sustained work becomes impossible, and heat prostration is frequent When humidity approaches saturation, the wet bulb reading becomes all-important

Sometimes men have to expose themselves to temperatures as high as 300 F or more in kilns or in front of open furnaces—but only for 2 or 3 minutes at a time. Since air cannot be breathed at temperatures above 240 F, the nose and other upper respiratory passages have to be protected

Yaglou and Minard† developed a simple substitute for the corrected effective temperature called the *wet bulb-globe temperature* (WBGT) This requires no measurement of air velocity nor use of complicated charts It is determined merely from the usual wet-bulb thermometer and the globe thermometer readings in this manner·

$$\text{WBGT} = 0.7\,(\text{wet-bulb reading}) + 0.3\,(\text{globe thermometer reading}).$$

This gives directly a figure that correlates well with the corrected effective temperature, and is far more meaningful than the usual effective temperature when radiated heat is present For example, with a wet bulb of 70 F and a globe reading of 100 F, the WBGT = 79 F, using the formula just given.

The *heat stress index* (HSI) devised by Belding and Hatch†† is based on two criteria of tolerable heat stress (a) thermal balance in the body must be maintained (buildup of heat in the body must be avoided), and (b) the maximum sweat rate over a long period of time that a typical person must not exceed is approximately one liter per hour (equivalent to heat loss of 2,400 Btuh A liter has about 5.7 per cent more volume than a quart)

If the rate of body cooling through evaporation of sweat, for example, is 1,200 Btuh to prevent gain of heat by the body, then half the available evaporative capacity of the man is being utilized This is defined as the heat stress index, (HSI) which in this instance is 50

$$\text{HSI} = \frac{E_{required}}{E_{max}} \times 100 = \frac{1200}{2400} \times 100 = 50$$

°Bedford, T. *Environmental Warmth and Its Measurement* Medical Research Council War Memorandum No 17, 1946

°°Yaglou, C. P. "Thermal Standards in Industry" *American Journal of Public Health Year Book,* Part II, 40 131-142 (*May* 1950)

†Yaglou, C. P. and D. Minard. "Control of Heat Casualties at Military Training Centers." *A M A. Arch Indust Health,* 16 302, 1957 See correction p. 485, *loc. cit*

††Belding, H. S. and T. F. Hatch. "Index for Evaluating Heat Stress in Terms of Resulting Physiological Strains" *Heating, Piping and Air Conditioning,* 27 129 (Aug 1955) See subsequent correction due to effect of clothing (amounting to about 30 per cent reduction in HSI) in "Laboratory Simulation of Hot Industrial Job To Find Effective Heat Stress and Resulting Physiologic Strain" (H S. Belding, *et al*) *Amer Indust Hygiene Assoc. J,* 21 25 (Feb 1960)