is because the older and more experienced men have learned how to get along in heat. They regulate their work rate and balance periods of exposure with periods of rest in cooler environments. In this way, they keep their over-all exposure within tolerable limits. In contrast, young, inexperienced men are apt to continue to work in excessive heat to the point of exhaustion. Such individuals require supervision to avoid overexposure.

A. SAFE TOLERANCE LIMITS AND INTERMITTENT REST PERIODS

In a review of thermal standards for industry, the APHA Committee on Atmospheric Comfort[4] presented the following summary of findings and recommendations respecting safe tolerance times and duration of intermittent rest periods for persons exposed to extreme heat:

Safe Tolerance Limits

The tolerance contours (Figure 5) have been constructed from joint studies by the American Society of Heating and Ventilating Engineers and the U. S. Bureau of Mines during 1922-

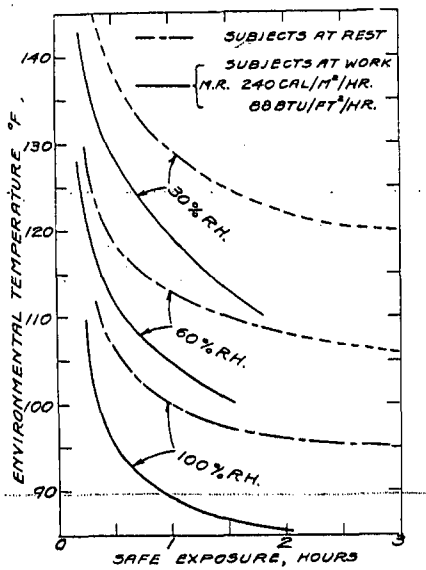

Figure 5. Permitted duration of heat exposure at rest and at work, for various environmental temperatures and relative humidities. (Courtesy *Am. J. Public Health.*)

1926. Safe tolerance time, for the purpose of this report, is defined as the average time required to raise the pulse rate to 125 beats per minute from initial rates of 70 to 80, and the rectal temperature to 101° F. from initial levels of 98 to 99° F. Symptoms of heat distress do not appear in healthy persons until the pulse rate rises well above 130 and the rectal temperature above 101° F., in exposure lasting more than one hour.

The proposed safe tolerance times are within the practical limits found in hot industries. . . . Long-continued exposure is known to lead to deterioration of performance and morale even in the fittest and well acclimatized individuals. Any safe limits that may be set must, therefore, allow for a wide margin of safety to be generally acceptable.

Intermittent Rest Periods

The length of recovery periods in a relatively cool environment will depend upon the rate and duration of work, the severity of heat, and on individual constitutional factors.

In laboratory experiments in which the rectal temperature was raised to between 100 and 102° F. by working for an hour or so in a saturated atmosphere of 95° F., the resting period required to drop the rectal temperature to 99° F. in a room at 85° F. dry-bulb and 50 RH was 30 to 40 minutes starting with 100° F. rectal temperature, and 60 to 90 minutes starting with 102° F. rectal temperature. Recovery of heart rate was much faster. However, after repeated exposures on the same day, neither the pulse nor the rectal temperature returned to normal but stabilized at higher levels.

As a rule, the workers themselves set the pace and the length of recovery periods in industries. In mines where temperatures approach 95° F., with humidities close to the saturation point, men work only one-half to one-third of the shift time, alternating short periods of work in the heat with rest periods of 40 to 45 minutes in cooler areas.

In aluminum and steel manufacturing processes in which environmental temperatures between 120 and 160° F. with relative humidities of 3 to 15% (ET, 90–100° F.) are encountered, men doing light duties work for about one hour and rest for an equal period, while those engaged in heavy occupations work for about 30 minutes and rest during the next 30 minutes.

B. MEDICAL SUPERVISION

Proper selection of persons best fitted for heat exposure, proper acclimatization before undertaking routine exposure to extreme heat, regulation of periods of work and rest, control of fatigue, and maintenance of an adequate intake of salt and water are essential measures for the protection of employees in the hot industries.

Preplacement and periodic examinations to detect circulatory and other physiological deficiencies help to keep unfit men away from excessive heat exposures. Acclimatization has dramatic benefits in preventing early cases of heat exhaustion. Maintenance of water and salt balance is essential to successful performance in the heat. The water supply should be conveniently located and the men encouraged to drink water beyond the dictates of thirst, which has been found in extreme heat exposures to be an unreliable index of water needs. The direct supply of salted water (0.1 per cent) has been found beneficial in hot industries (Chapter V).

There is evidence that the stress of physiological disturbances from causes other than heat is added to the heat stress, so that men with temporary respiratory infection, digestive disturbance, and other departures from normal health are more susceptible to heat exhaustion; during periods of such disturbances heat exposures should be limited. This is a responsibility of medical supervision, as is the continued observation of men exposed to heat to detect signs of long-term impairment, as in the circulatory system.