DO WGBT HEAT STRESS LIMITS APPLY TO BOTH PHYSIOLOGICAL AND PSYCHOLOGICAL RESPONSES?

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INTRODUCTION

Both the International Organization for Standardization (ISO) and the American Congress of Governmental Industrial Hygienists (ACGIH) have adopted limiting values for heat stress which ace intended to protect nearly all workers from adverse health effects. These limits are based on those combinations of environmental and work characteristics (environmental heat and metabolic heat) which prcduce a total heat load below the point of onset for increased risk of heat strain (i.e., maintenance of a deep body temperature less than 38°C). NIOSH has recommended an additional alert limit for persons who are unacclimatized (NIOSH, 1986). These limits have served industry well for several years as guidelines for physiological responses to the heat. Figure 1 depicts the Recommended Alert Limits (RAL) and the Recommended Exposure Limits (REL) proposed by NIOSH for occupational exposure to hot environments. Points A, B, and C represent these limits at levels of metabolic heat normally associated with sedentary or standing activity found in performing most perceptual motor tasks.

RESULTS

The effects of heat on psychologically-based responses and on perceptual motor task performance have been less well defined and even contradictory. Over 150 research studies concerning perceptual motor task performance in the heat and reported in the literature were collected and evaluated (Ramsey and Kwon, 1988). Equivalent WBGT temperatures were determined and compared with reported performance results. Previous research has indicated differing effects of heat on performance based on the category or type of task (Ramsey and Morrissey, 1978). These data were separated into only two task categories: a) mental and very simple tasks, b) all other perceptual motor tasks. This categorization removed much of the contradictory nature of published results. The mental/simple tasks (Category a) tended to show no performance decrement and indeed enhanced performance was often associated with short duration high temperature exposures. Figure 2 displays data for the other (Category b) tasks. Also shown are the equivalent A, B and C levels which represent the onset points for increasing risk of physiological heat stress.

CONCLUSIONS

There are many variables other than heat which affect performance on such tasks. However, these data do show a dominant heat effect on performance, in that decrements onset for most such tasks at the temperature levels suggested by the ISO, ACGIH and NIOSH limits. Results also indicate that task performance is much less sensitive to the length of time a worker is exposed to the heat than it is to the environmental temperature level of the exposure. Further, performance decrements appear to be more highly correlated with the rapidly responding body temperatures (e.g., cranial, blood) than with the deep body temperatures (rectal) which have appreciable lag time in response.

The levels of environmental heat (30"-33°C) which create onset of physiological heat stress for the worker performing sedentary or very light work tasks appear to be the same levels where perceptual motor performance will deteriorate for all but the strictly mental or very simple tasks.

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Figure 1. Recommended Heat-Stress Alert Limits (RAL) and Exposure Limits (REL), (NIOSH, 1986)

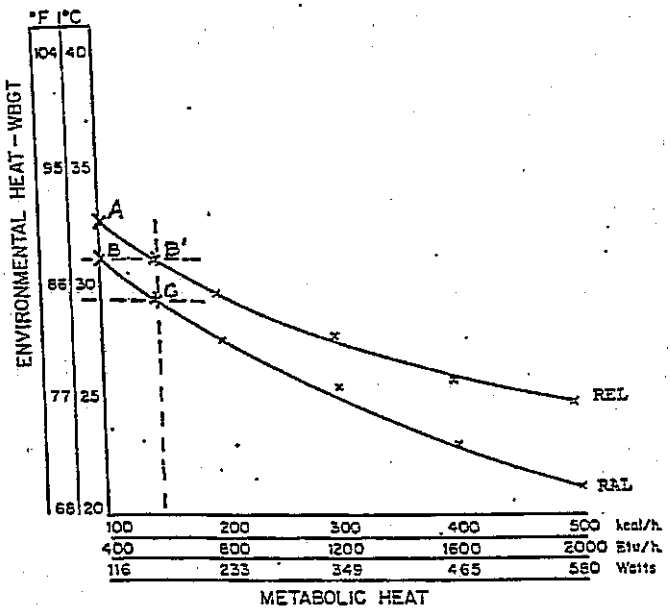
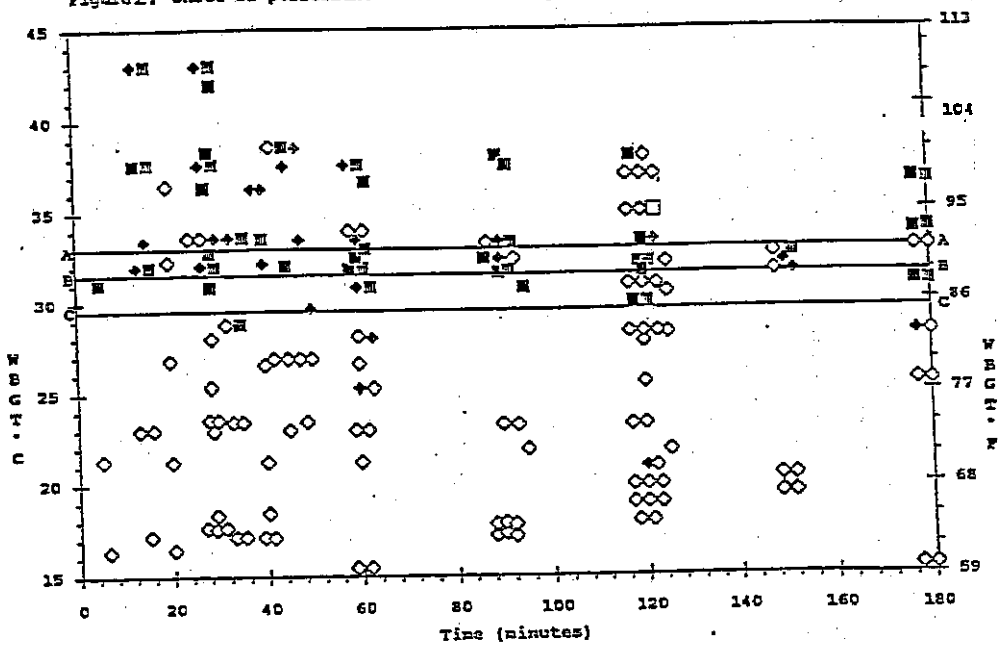


Figure 2. Onset of performance decrement for perceptual motor tasks in the heat.



■ Significant Decrement ✦ Partial Decrement ◇ No Change □ Enhancement

REL-Sedentary:A-A REL-Very Light:B-B RAL-Sedentary:B-B RAL-Very Light:C-C