

HEAT STRESS IN PROTECTIVE CLOTHING: INTERACTIONS AMONG PHYSICAL
AND PHYSIOLOGICAL FACTORS

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Industrial and military environments often require that workers wear protective clothing which incidentally produces significant heat stress in conditions that would otherwise fall within the range of thermal comfort. The three primary determinants of heat stress include work, clothing, and environment. Accumulating data from experiments on animals and humans have supported development of computer models that predict human response to various combinations of those three factors. However, recent application of such models in our laboratory reveals that the validity of the output is limited in part by the need to consider interactions among the primary heat stress factors and certain physiological variables. Examples of such interactions include: (1) Task-related movement alters the convective air exchange through clothing. (2) Profuse sweating that wets clothing alters its heat transfer characteristics. (3) Clothing system weight increases the metabolic cost of the task. (4) Aerobic capacity affects the thermoregulatory response to a given metabolic demand. (5) Sweat retention in clothing raises skin wettedness and may thereby produce sweat suppression. This paper summarizes available information on such interactions and identifies relevant gaps where further data are required. Improved understanding of these processes should allow better prediction of heat stress-strain relationships for both theoretical work and practical applications.