‘Alarm’ and ‘Danger’ Criteria in Foot Temperature to Prevent Heat Stroke in Workers Wearing Personal Protective Clothing

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Backgrounds

- Workers wearing personal protective equipment (PPE) in hot environments often encounter severe heat stress. To prevent heat stroke, numerous criteria have been put forth as guidelines: ISO 7243 (Wet Bulb Globe Temperature Index, WBGT) set “Safe” WBGTs. ISO 9793 (2004) provides physiological criteria for determining the maximum allowable exposure. However, the real-time monitoring of physiological variables during working is relatively less feasible for workers equipped with full protective clothing. To facilitate the assessment of the thermal state of PPE-workers, the development of non-invasive and simpler measurements is needed as a valid criterion.

- **Purpose:** Investigation of the feasibility of foot temperature as a non-invasive and simpler criterion to assess the heat strain of PPE-workers.

Methods

- A total of 20 experimental conditions through 2 series of studies with 16 subjects (8+8 subjects)

Results

- **Measurements:** Skin temp. on 11 sites (2s), Rectal temp; Tair (2s), Heart rate (2s), Total sweat rate, Thermal sensation (10min), Thermal comfort (10min).

- **Calculation:** Physiological Strain Index (PSI)

- **Tair** reached Tmis for the cases where Tyvek coverall was worn at 32°C.

- For Vinyl condition at 32°C, Tair finally exceeded Tmis during exercise.

- In most cases, mean Tmis was lower than Tfoot.

Summary and Conclusions

- Tfoot of 38.0°C and 38.5°C were determined as Alarm and Danger criteria, respectively.

- The Alarm level was set at the point that Tfoot reached rectal temperature during exercise.

- The Danger level was determined at the moments that extreme subjective perceptions were given (very uncomfortable, very hot, and very hard).

- The Alarm and Danger criteria that derived from Tfoot are valid for workers wearing full protective clothing (including protective boots) in hot environments, but cannot be applied to workers wearing light workwear in thermal neutral environments.

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