

Heat stress in an open-pit iron ore mine and its relationship with physiological strain

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Abstract

Introduction: Workers in open pit iron ore mines are exposed to heat stress which can cause health and safety problems. The purpose of this study was to evaluate heat stress among open-pit mine workers of iron ore based on Wet Bulb Globe Temperature (WBGT) index and also to investigate its relationship with physiological Strain.

Material and Method: This cross-sectional study was conducted on 120 healthy miners, working in an open-pit mine, during summer season, in 2014. Physiological parameters, including core body temperatures and heart rate, were measured according to ISO 9886 standard and physiological strain indices, including Physiological Strain Index (PSI) and Physiological Strain Index based on Heart Rate (PSI_{HR}), were calculated using the equation. Environmental variables as well as physiological parameters were simultaneously measured and recorded during work shift. WBGT index was calculated according to ISO 7243 and using the equation. Statistical analysis was performed using the SPSS software version 22.

Result: The mean WBGT index was estimated 29.09°C for workers. “Drilling” and “factory and Krasher” units showed the highest and lowest WBGT index values of 31.06°C and 29.05°C, respectively. Workers occupational exposure to heat stress were higher than recommended thresholds based on WBGT index in all work units. A statistically significant correlation was found between WBGT index and physiological strain indices (P value<0.001). The Pearson’s correlation coefficients were obtained 0.658 and 0.566 respectively, between WBGT index and values of PSI and PSI_{HR}.

Conclusion: WBGT index showed a higher correlation with physiological strain Index; and level of heat stress in all work units of mine was higher than recommended thresholds. Thus, countermeasures should be adopted to control heat stress for the workers in this field.

Key words: Heat Stress, Iron Ore, Open-Pit Mine, Physiological Strain

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