Heat Stress Management

**FACT SHEET**

**Introduction**
High environmental temperatures prevail in the Palabora region. Maximum dry-bulb temperatures average 41°C in summer and 29°C in winter. Daytime dry-bulb temperatures exceed 30°C for 70% and 10% of the time respectively for summer and winter. Palabora’s workforce is stable and most employees have resided in the area for long periods. 72% of employees have worked at Palabora for more than 5 years and 43% for more than 15 years. Employees are, thus, acclimatised to local environmental conditions. This is borne out by there being no history of heat stress disorders amongst employees.

**Heat Sources**
In the underground workings, all rock contains latent heat that is transferred by conduction from the earth’s core. When in contact with underground air, the rock increases the air temperature. Underground equipment, such as load haul dumpers (LHD) and drilling equipment also generates heat and adds to the underground temperature. All the above heat is countered by the air coolers situated on the shaft bank area, that cool down all the air going down the mine to ±19°C (WB).

On surface, process and environmental heat create conditions that are conducive to the development of heat stress in the Smelter and the Vermiculite Pit. Wet-bulb globe temperatures (WBGT) indices exceed 30 on occasion in the vermiculite pit, the smelter and the underground mine.

**Heat Stress & Limits**
Temperature guideline limits for determining whether heat stress management is required are when wet-bulb temperature exceed 27.5°C. Due to the high summer temperatures, no specific limit is set for dry bulb temperatures but a heat stress warning is generated when temperatures exceed 37°C.

Heat stress develops from a combination of work rate, exposure time and thermal conditions. In the underground mine the wet-bulb temperature at times exceed 27.5°C which is conducive to heat stress disorders? On surface, heat stress can also develop at dry-bulb temperatures > 37°C.

Heat stress management is implemented when 27.5°C is exceeded in the undergrounds and > 37°C exceeded on surface.

**Heat Tolerance**
There are two main heat tolerance categories in personnel, viz. those who are heat tolerant or who can develop a required degree of heat tolerance through an acclimatization process, and those who are heat intolerant and who cannot develop a required degree of heat tolerance.

The derived metabolic rates of affected personnel show that workloads in affected areas are generally moderate. Very high metabolic rates are the exception and are of short duration. Very high workloads form a small percentage of the working shift. A high degree of self-pacing is exercised by personnel themselves. The thermal environment and metabolic heat produced by the body during physical work combine to result in personnel in the Underground Mine and the Smelter potentially being subjected to heat stress. This assumption dictates the implementation of heat stress management programme.

**Precautions observed in the workplace**
Accepted heat stress control methods are engineering controls, work practices and personal protection. Engineering controls are
not always practical or possible. Where it has been possible, heat stress controls were implemented, e.g. air conditioned cabins for LHD operators and haul truck operators. At Palabora the implementation of work practices control and personal protection are more appropriate options.

Measured thermal loads indicate that no specific heat stress management is required, except in the smelter, refinery vermiculite pit and underground mine.

On surface, personnel in these areas are notified at the beginning of their shift of the need to maintain water intake on days when high temperatures is expected. This estimation is based on weather reports and actual measurements. Other precautions are selection of heat tolerant persons, personnel self-pacing and provision of ice machines and cold water

Administrative Control and Infrastructure Support

The Health department conduct pre, during and post-employment medical examinations on all employees. For personnel in potential heat stress areas, specific emphasis is placed on heat intolerance history, age, body composition and size, hypertension, drug and alcohol abuse, intended work location.

Physical heat tolerance testing is not deemed appropriate for Palabora. Many of the mine employees hold valid first aid certificates, the training for which includes the treatment of heat stress. Heat stress disorders can, thus, be dealt with quickly and effectively.

The occupational hygiene and ventilation departments monitor wet-bulb, dry-bulb and wet bulb globe temperatures in affected areas. Results are analysed and, if required, remedial actions are taken. The department assists line management with the compilation of procedures for ensuring that personnel are not exposed to undue heat stress during the discharge of their duties.

Personnel required to work in 'hot' areas are trained in the potential adverse effects of heat stress, the recognition of signs and symptoms, emergency treatment, dangers and causes of dehydration and the need to maintain hydration during hot days.

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