Safety bulletin

MINES

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Heat Stress

As hot weather approaches it is appropriate to discuss the risks from heat stress.

Heat stress occurs when heat builds up in the body faster than the body can lose it. Heat can either be absorbed from the environment or generated within the body by physical activity. These two sources of heat must be added together to obtain the total heat load or the level of **heat stress** on the worker.

Several factors may contribute to heat stress, such as the temperature, humidity and movement of the surrounding air, the type and duration of the work activity and the physical condition of the individual.

The body maintains a fairly constant internal or 'core' temperature even though it may be exposed to varying environmental conditions. To keep the body's core temperature within safe limits in hot conditions, the body has to lose excess heat – and it does this by increasing the blood flow to the skin, and by producing sweat which cools the body by evaporation.

These responses are controlled by the brain and occur when the body core temperature exceeds 37°C.

Environmental and seasonal factors that contribute to conditions causing heat stress include:

- high air temperatures
- high relative humidity
- low air movement
- high radiant heat levels - from working outdoors in the sun
- high radiant heat levels - from nearby hot objects such as machinery.

When some or all of the above conditions exist, heat stress situations are more likely to affect individual workers if the following factors are present:

- worker not acclimatised to heat (e.g. worker new to job or worker returning from a long break)
- insufficient water consumption
- inadequate cooling off or rest periods
- inappropriate clothing to allow evaporation of sweat
- older age, lack of fitness and obesity
- fatigue
- individual factors that may cause dehydration (such as poor diet, vomiting, diarrhoea, alcohol and caffeine consumption)
- individual medical conditions that may increase the risk of heat stress, such as heart conditions, hypertension (high blood pressure), diabetes and hyperthyroidism (overactive thyroid gland)
- individual medication that may affect the body's temperature regulation (may include some diuretics ("fluid tablets"), some antidepressants, and some antihistamines). Individuals on medication should check with their doctors.

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It is important to recognise heat illness when it occurs in a workplace, so that measures can be taken to prevent a serious situation from occurring. Heat illness can take a number of forms including:

- Prickly heat rash – an itching, prickling rash caused by blocked sweat ducts.
- Heat swelling – swelling of legs, ankles and feet, particularly in un-acclimatised workers.
- Heat fainting – giddiness and fainting, more likely with exertion or prolonged standing and with un-acclimatised workers.
- Heat cramps – cramps, particularly in the most used muscles, caused by inadequate replacement of salt lost through excessive sweating, particularly in un-acclimatised workers. This is treated by increasing salt intake in food or drinks.
- Heat exhaustion – a serious condition requiring urgent attention, with nausea, vomiting and weakness from dehydration and electrolyte imbalance. The person remains rational and the skin is clammy. Treat by taking the affected person to a cool place and giving them electrolyte drinks. Seek medical assistance.
- Heat stroke – a potentially fatal condition if not recognised early. The person is confused and may have a convulsion or become unconscious. The skin is hot and dry. Core temperature rises above 41°C and brain damage will occur if the person is not rapidly cooled. Treat as a medical emergency and commence treatment by stripping clothing and rapidly cooling with water or wet towels and fans. DO NOT WAIT - COMMENCE COOLING IMMEDIATELY WHILE AWAITING MEDICAL HELP.

Preventing heat illness

Measures for workers

1. Workers must be acclimatised before being exposed to high heat stress conditions for full shifts. Acclimatisation allows the body to adapt to a hot work environment. Depending on fitness, age and gender, the time required is 7-15 days. Start with exposures of 1 hour increasing to 4 hours over the first 6 days, then gradually increase to a full shift with regular supervision.
2. Fluid losses must be replaced with water, juice or non-alcoholic and low caffeine drinks, (strong coffee and "energy" drinks should be avoided). Drinking 250-500mL of water at frequent intervals is usually adequate with occasional "sports drinks" which contain essential electrolytes to replace sweat losses. Some of these drinks have high sugar content and should be used sparingly, as they have high kilojoule (calorie) content, and increase the risk of obesity and diabetes. They can also have a deleterious effect on the teeth, particularly in hot conditions when the mouth is dry.
3. Workers should be informed to monitor their fluid need by observing urine colour, which will be pale yellow if the person is adequately hydrated. Dark yellow urine indicates dehydration and a need for an increased water intake.
4. Workers should be allowed adequate rest periods in a cool place to lose excessive heat build-up which can raise core temperature. In severe heat-stress conditions, a strict work-rest regime should be instituted. Specialist occupational hygiene advice should be sought to determine a suitable regime.
5. Clothing should be the minimum which meets safety requirements. Since evaporation of sweat is the only way the body can lose heat when the ambient conditions are close to body temperature (37°C), it is important that as much skin as possible is uncovered. Ventilated safety vests should be used. For outdoor workers, a balance must be struck between impermeability of clothing to UV radiation and permeability for air flow.
6. Workers should be monitored for signs of heat illness.

Engineering controls

Various engineering controls are effective for reducing the risk of heat stress in mining and quarrying workplaces. Examples include:

- creating shade for outdoor workers to take rest breaks, such as portable shade structures
- automating and mechanising tasks as much as possible to reduce the need for heavy physical

activity in hot areas
- reducing radiant heat emission from hot roofing, hot surfaces and plant by insulation and / or shielding
- providing air-conditioning to cool and de-humidify work areas such as vehicle cabs, control rooms and crib rooms
- in high radiant heat workstations, such as smelter furnaces and converters, installing shielding and "spot cooling"
- improving airflow in hot areas by mechanical fans
- installing drinking water fountains close to all hot workstations and
- using exhaust ventilation to remove steam in high humidity operations such as quenching.

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