Information

Best Practices for Addressing Heat Stress in Surface and Underground Mining Operations

Purpose

This document provides best practices for recognizing, assessing, and preventing heat stress in surface and underground mining environments. It is intended for use by mine operators, supervisors, and safety professionals during the high-risk period of June through September. While applicable to a wide range of mining contexts, this guidance does not specifically address open pits or quarries.

Note: *If you're not already familiar with the concepts of heat stress, resource links are available on the webpage where this information sheet is posted.*

Understanding Heat Stress in Mining

Heat stress occurs when the total heat load on a worker exceeds the body's ability to dissipate heat. It results from a combination of:

- High ambient temperatures
- Metabolic heat generated through physical work
- Insulating effects of clothing or protective equipment

The American Conference of Governmental Industrial Hygienists (ACGIH) has established Threshold Limit Values (TLVs) for heat stress based on Wet Bulb Globe Temperature (WBGT). These TLVs provide screening criteria and adjustment factors based on:

- Type of clothing
- Exertion level
- Acclimatization status

Use a calibrated WBGT device for environmental or personal monitoring. Additional guidance is available through **CCOHS** or reach out to Workplace Safety North (WSN) for support.

Environmental and Individual Risk Factors

Key environmental contributors to heat stress include:

- Air temperature
- Relative humidity
- Air movement
- Radiant heat
- Climate change

Individual risk factors include:

- Age (older workers are at higher risk)
- Level of physical exertion
- Acclimatization (especially in rotational work)

Heat Stress by Work Environment

Surface Mining

Primary source of heat: Direct solar radiation

- Workers are exposed to weather changes, humidity, and fluctuating airflow.
- Risk increases when humidity is high and airflow is minimal.

Underground Mining

Primary sources of heat: Geothermal heat and machinery.

- Humidity is typically high, and ventilation is critical.
- Mines are getting deeper, exposing workers to warmer ambient rock and air temperatures.
- Dewatering can help reduce humidity.
- Cooling fresh air from surface intake can reduce underground temperatures significantly.

Mills and Smelters

Primary sources of heat: Molten materials.

Heat stress incidents are frequent, especially in metal and stone processing facilities.

Heat Illness Incidence in Mining

A U.S. study (1983–2001) documented 538 cases of heat illness in mining:

- 79% occurred during June, July, and August
- No fatalities reported
- Most common in underground metal mines, stone mills, and metal mills

Worksite Type	Highest Observed Rate (per million person-hours)
Underground Metal	0.168
Surface Stone	0.0644
Mills (Stone)	0.417

Special Considerations

Mine Rescue Teams

Mine rescuers are a unique group who may also be at risk of heat stress illnesses. A recent study has identified that Mine Rescuers may be subject to high physical and heat strain, especially during sustained response or competition scenarios (Konrad et al., 2019).

Workplace Safety North has produced a comprehensive **Mine Rescue Heat Stress report**.

Clothing Requirements

- Full-body PPE, including fire-resistant gear and Tyvek suits, significantly increases heat retention.
- Lack of exposed skin prevents sweat evaporation, reducing the body's cooling ability.

Rotational Work and Acclimatization

- Acclimatization takes several days and is disrupted by rotational schedules.
- Workers returning after a break are at increased risk during their first days back.
- Fatigue at end of rotations may also increase vulnerability to heat stress.
- In winter, surface-to-underground temperature changes can be extreme, complicating thermoregulation.

Impact of Climate Change

- Surface temperatures are rising due to global warming.
- Underground intake air is warmer, reducing natural cooling.
- These changes intensify the challenge of protecting workers from heat exposure.

Recommended Preventive Measures

- Provide cool water and electrolyte beverages
- Establish shaded or cooled rest areas
- Maximize air movement in hot zones
- Use dehumidifiers where practical
- Schedule high-exertion tasks earlier in the day
- Avoid hot-weather tasks requiring full-body PPE
- Implement task rotation, especially for unacclimatized workers
- Adjust schedules based on age and fitness level
- Explore thermal barriers, ventilation upgrades, or cooling technologies
- Use WBGT monitoring for job sites
- Follow ACGIH TLVs for work-rest cycles

For more information on heat stress assessment and prevention in mining, please contact:

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