

# Heat stress

## Risk Control services from Liberty Mutual Insurance



### Highlights:

- Three major heat-related illnesses
- Prevention
- First aid
- Exposure limits

When the body cannot adequately cool itself, injury, illness, or even death can occur. Indoor and outdoor activities conducted in hot environments have the potential to cause heat stress.

Heat stress is dangerous and produces increased body temperature, heart rate, and sweating. The more intense the work, the hotter the conditions, and the higher the humidity, the faster heat will be generated and the body will struggle to rid itself of excess heat. A rise in core body temperature of just two degrees Fahrenheit can cause mental impairment and disorientation.

An impaired worker is endangering themselves and others if operating machinery, using tools, or performing other job functions. If an individual's core body temperature elevates to 106°F (41.1°C) or more, serious damage to bodily systems may occur, with potentially fatal results.

Common operations and activities that may have a high heat stress potential include the following:

- Agriculture
- Construction
- Foundries
- Hazardous waste remediation
- Smelters
- Student athletic activities
- Restaurant kitchens
- Food processors
- Laundries

## **Heat-related illnesses**

Three major illnesses can occur because of the body's inability to cope with excess heat.

1. Heat stroke is the most serious. It is a medical emergency and may be fatal unless treated promptly and adequately. It is caused by the body's inability to regulate its core temperature and may be associated with mental confusion, delirium, loss of consciousness, convulsions, or coma. Sweating stops and the body can no longer rid itself of excess heat. If an individual's deep body temperature approaches 41.1°C (106°F), heat stroke is likely. Early recognition and treatment of heat stroke are a way to prevent permanent brain damage or death.
2. Heat exhaustion is less severe than heat stroke but still dangerous. It may be associated with clammy moist skin, extreme weakness or fatigue, nausea or vomiting, headache, dizziness or lightheadedness, low blood pressure, and normal or slightly elevated body temperature. Collapse can occur without immediate treatment. An individual who is already experiencing heat exhaustion has the potential to develop heat stroke with continued exposure to a hot environment and without adequate rehydration. Heat exhaustion most often occurs in individuals with a low level of cardiovascular fitness or those not acclimatized to heat.

3. Heat cramps is the least serious of the three heat-related illnesses. These tend to occur in individuals who sweat profusely during heavy work without replacing salt losses. Symptoms include painful spasms in one or more of the skeletal muscles, with legs, arms, and abdominal muscles being most commonly affected. Resting in a cool place and drinking water or an electrolyte drink will usually result in rapid recovery. Note: Persons on a low-sodium diet should consult with a physician about what to do under these conditions.

Minor heat-related conditions include:

- Heat syncope (fainting). This may occur when an unacclimated worker or athlete stands still in a hot environment. Fainting occurs due to blood pooling in the lower extremities resulting in insufficient blood flowing to the brain.
- Heat rash (prickly heat). This may occur in hot and humid environments when sweat cannot be easily removed from the skin by evaporation. When the skin remains wet, the sweat ducts become plugged and skin rash appears.
- Transient heat fatigue. This is a temporary state of discomfort and mental or physiologic strain resulting from prolonged heat exposure. Unacclimated workers and athletes can suffer to varying degrees, including declining task performance, coordination, alertness, and vigilance. Gradual heat acclimatization can ease the severity of transient heat fatigue.

## Prevention

Heat-related conditions can be prevented through a heat stress management program that includes engineering and procedural modifications in the facilities, equipment, and/or work practices.

### Engineering modifications

- Substitute a high heat generating process with one that generates less heat.
- Provide power tools that decrease manual labor demands or reduce physical workload.
- Reduce heat in the work area by isolating, enclosing, ventilating, or shielding workers from the heat source.
- Cool the work space with evaporative coolers or air conditioners, or spot cool by using portable air conditioners or cooling systems at high heat production points.

### Procedural controls

- Provide a cooler (air-conditioned or temperature controlled) rest area or control station intermittently throughout the work period.

- Educate workers and athletes in maintaining proper hydration. Provide water and encourage frequent drinking of small amounts (a cup of cool water about every 15 to 20 minutes). Avoid soda, caffeine, alcohol, or diuretics that may reduce fluids in the body.
- Hold a physician-supervised medical screening for athletes prior to program participation, or a physician-signed proof of screening should be provided by each participant. Have a “heat policy” worked into the outdoor athletic program. Local jurisdiction, state high school athletic associations, NFHS (National Federation of State High School Associations) and NATA (National Athletic Trainer’s Association) are a few of the organizations that can be helpful in establishing a heat policy.
- Check environmental conditions before and during work, and adjust accordingly.

### **Administrative controls**

- Allow workers/athletes to become acclimatized to the hot environment. Increase intensity and duration slowly.
- Perform labor-intensive tasks during the cooler part of the day, when practical, and provide rest breaks to match environmental conditions.
- Personal protective equipment (PPE)
  - Provide cooling vests or sun-protective clothing for employees at risk
  - Limit the amount of clothing worn by athletes during workout sessions
- Properly select employees for the task based on medical history and physical condition.
- Use a buddy system and train employees/supervisors to recognize the signs and symptoms of heat-related disorders and appropriate first aid measures.
- Train employees in good heat stress hygiene practices, such as the importance of fluid and electrolyte replacement, diet, lifestyle, and health issues. Workers with heart problems or those on low sodium diets who work in hot environments should consult their physicians about treatment options for heat exhaustion and heat cramps. Some medications increase the risk of heat-related stress conditions.

## First aid

Address any signs or symptoms of heat stress immediately!  
Get the person out of the heat and cool them down as soon as possible. Help them replenish their fluids with small sips of water. If heat stroke is suspected, seek medical attention immediately.

## Exposure limits

OSHA has no established standards for heat stress. The American Conference of Governmental Industrial Hygienists® (ACGIH®) has adopted threshold limit values (TLV®) for heat stress. The TLV refers to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. These TLVs assume that nearly all acclimatized, fully clothed (e.g., lightweight pants and shirt) workers with adequate water and electrolyte intake should be able to function effectively under the given work conditions without exceeding a deep body temperature of 38°C (100.4°F). The action limit (AL) is similarly protective of unacclimatized workers and represents conditions for which a heat stress management program should be considered.

One needs to be able to measure the environmental factors that closely correlate with deep body temperature to determine specific heat stress exposure for comparison to the TLV. The Wet Bulb Globe Temperature (WBGT) index is the simplest and most suitable technique to measure environmental factors.

## Additional resources

American Conference of Governmental Industrial Hygienists (ACGIH). (2014). *2014 TLVs® and BEIs® Based on the documentation of the threshold limit values for chemical substances and physical agents and biological exposure indices*. Published by the ACGIH.

National Athletic Trainers' Association. <http://www.nata.org>

OSHA-NIOSH Infosheet: *Protecting workers from heat illness*. (May, 2011). <http://www.cdc.gov/niosh/docs/2011-174>

OSHA. *Occupational heat exposure*. <https://www.osha.gov/SLTC/heatstress>

U.S. Environmental Protection Agency. (March, 1994). *A guide to heat stress in agriculture*, (703) 305-7666.



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