



# fast facts

advancing safety, health, and workplace rights in the legislative branch

## Heat Stress

*Don't Let the Heat Get You Down*

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In 2006, 3,100 U.S. workers had a heat-related illness that caused them to miss work. Heat can build up in the worker's body and cause symptoms that range from headaches and dizziness to seizures, convulsions and death. (See "Heat-Related Illnesses" in the box below.)

When we think of work-related heat illnesses, working outdoors in the heat of the summer immediately comes to mind. Construction workers, maintenance staff, gardeners, and police officers are all exposed to hot conditions outdoors.

Hot conditions can also occur indoors. Boilers, steam pipes, ovens, heated tanks, and other such items can produce hot environments. Power plants, heat-treating operations, welding shops, plating shops, and steam tunnels, such as the one depicted in the photograph, are examples of indoor hot environments.

A hot environment and physical exertion can combine to increase the body's core temperature. A person working hard produces more heat than a worker whose pace is less intense. Another condition that can increase the body's core temperature is radiant heat from direct sunlight or from nearby hot objects such as steam pipes, ovens, etc.

In general, the human body cools itself by producing sweat. Sweat evaporating from the skin keeps the body cool. Higher humidity, limited air movement, and wearing protective equipment can reduce evaporation. Less evaporation means less cooling.

Poor physical condition, certain health conditions, use of alcohol, and some food and medicines also affect the way a person's body cools itself.

A worker "acclimatizes" to hot environments, in essence, as the body "learns" to sweat. Becoming acclimatized is an important aspect of preventing heat illnesses.

### Heat Illness Prevention

Measures to prevent heat illness include environmental monitoring, engineering controls, acclimatizing workers, frequent intake of water, work practices, training, and medical screening.

*Monitoring the environment* to compare with screening criteria provides basic information needed to prevent heat stress. One screening criterion in common use is the wet-bulb globe temperature (WBGT). The WBGT is an index for the potential heat stress hazard. It accounts for ambient temperature, air movement, humidity, and radiant heat load. It is a useful guide for scheduling breaks in cool areas to make sure the body has sufficient time to cool down.

Another screening criterion widely used is the heat index (apparent temperature). It can be used in some situations, but its limitations must be recognized. It does not account for air movement, radiant heat, or other factors, such as the effects of personal protective equipment.

*Engineering control* measures include ventilation to provide cool and/or dry air to a work area; air-conditioning to cool the air; portable blowers including those that provide a mist to directly cool the area where workers are located; and insulation and shields to reduce heat radiating from hot surfaces. Engineering changes are usually the most reliable means for preventing heat illnesses.

*Acclimatization* can be done by gradually increasing exposure to heat as time passes. New employees and workers returning from an absence of two weeks or more should have a 5-day period of acclimatization. This period should begin with 50 percent of the normal workload and exposure time the first day and gradually building up to 100 percent on the fifth day.

*Frequent intake* of liquids is necessary to prevent dehydration through loss of sweat. Plenty of cool (50°F - 60°F) water or other cool liquids (except beverages with alcohol or high caffeine levels) should be available. Encourage workers to drink small amounts frequently; for example, one cup every 20 minutes. Although some commercial replacement drinks contain salt and other electrolytes, these types of liquids are not usually necessary. Most people add enough salt to their summer diets.



Worker exiting a heat stress environment—steam tunnel

## Heat-Related Illnesses

### Heat stroke

*Heat stroke is a medical emergency.* It occurs when the body's internal mechanism fails to regulate the core temperature. Sweating stops. The body can no longer rid itself of excess heat. Signs include: a distinct absence of sweating (usually); hot red or flushed dry skin; rapid pulse; difficulty breathing; constricted pupils; severe dizziness, headache, nausea, vomiting, or confusion; bizarre behavior; and high blood pressure. Advance symptoms may be seizure or convulsions, collapse, loss of consciousness, and a core temperature of 106°F or higher.

If not treated promptly, victims of heat stroke can die or have permanent damage to the vital organs. If a victim appears to suffer from heat stroke, call 9-1-1 immediately. Move the victim to a cool, shaded area; soak the victim's clothing with cool water; apply cold packs; and fan vigorously to increase cooling.

### Heat syncope (fainting)

Fainting can result when the brain does not receive enough oxygen due to blood pooling in the extremities. This reaction does not affect the body's heat balance. Acclimatizing and avoiding standing motionless for long periods can reduce the likelihood of fainting.

### Heat exhaustion

Heat exhaustion results when fluid or salt is lost through sweating without being replaced. A person with heat exhaustion may experience a headache, heavy

sweating, intense thirst, dizziness, fatigue, loss of coordination, nausea, impaired judgment, loss of appetite, hyperventilation, tingling in hands or feet, anxiety, cool moist skin, or a weak, rapid pulse. The body still produces sweat and the body temperature is normal or slightly higher than normal.

The victim should rest in a cool place and drink water or other cool liquids. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

### Heat cramps

Heat cramps are painful muscle spasms, usually affecting the arms, legs, or stomach. Heavy sweating can cause heat cramps, especially when drinking water to replace fluids. Remember to avoid liquids that contain salt or potassium. Cramps can occur during work, but they typically take place after the work shift has ended. Eating bananas and taking sufficient salt – without overdoing it – can help prevent heat cramps.

### Heat rash (prickly heat)

A heat rash can break out where sweat is not effectively removed from the skin through evaporation. A heat rash that is extensive or complicated by an infection can inhibit sleep, impede performance, or even result in temporary total disability. Heat rashes can usually be prevented by making sure the skin is allowed to dry during rest breaks.

Work practices must be implemented to prevent heat from building up within the body and to allow the body to cool down. Such practices include:

- Reducing the physical demands of work;
- Providing air-conditioned enclosures and rooms for recovery;
- Scheduling work for the cool part of the day or at night;
- Using intermittent rest periods with water breaks;
- Using relief workers and reduced work pacing; and
- Work-rest cycles, where workers rest for a set period in a cool area so their bodies don't become overheated. The rest times are generally based on the WBGT discussed above.

Other work practices can be very useful where employees work in areas where rest breaks cannot be taken in cool areas. An important practice in such instances is a "buddy system." Workers

are designated to observe each other for signs of heat stress. Some signs of heat stress, such as bizarre behavior, can best be observed by another person. A buddy system should be employed in each remote area where maintenance work is done.

Another useful practice is self-monitoring. Workers should take their pulse rates. Exposure to heat should be ceased if the sustained pulse rate exceeds 180 beats per minute minus the person's age. In other words, a 40-year-old person should not have a pulse rate greater than 140 beats per minute during work in hot environments. Recovery heart rate, taken one minute after rest begins, should not exceed 110 beats per minute.

Another self-monitoring practice is for workers to weigh themselves before and after exposure to hot environments. A risk of dehydration exists if the weight lost through sweat exceeds 1.5% of body weight.

Training is vital so workers will recognize the effects of heat and how to avoid them. Workers should understand the following subjects:

- hazards of heat stress;
- environmental factors that affect heat stress;
- predisposing factors, danger signs, and symptoms;
- first-aid procedures for heat stroke;
- signs of heat stroke, dehydration, and heat exhaustion;
- work practices used in the employers' protection program;
- importance of fluid intake and acclimatizing;
- use of protective equipment such as ice vests or reflective clothing, if applicable;
- environmental monitoring employed; and
- medical screening programs.

Medical screening should identify predisposing illnesses, use of drugs, and other risk factors that might predispose a worker to risk of heat stroke.

## fast stats

### Occupational Fatalities and Illnesses

- Number of non-fatal heat illnesses that resulted in days away from work reported in the U.S. in 2006 – 3,100.
- Number of heat-related occupational fatalities reported in the U.S. in 2006 – 44.
- Hot weather causes more fatalities than any other weather-related source. According to the National Weather Service 10-year average for heat fatalities was 170 between 1998 and 2007. During the same period, the average number of fatalities caused by hurricanes was 117.

### OSHA References

- Fact Sheet No. OSHA 95-16, "Protecting Workers in Hot Environments."
- OSHA Technical Manual, TED 01-00-015, Section III. Chapter 4, "Heat Stress."
- OSHA Quick Card™, "Protect Yourself: Heat Stress."

### References from Other Agencies

- *Working in Hot Environments*, available free from National Institute for Occupational Safety and Health (NIOSH) Publications.
- "Heat Stress and Heat Strain," *Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices*, published by the American Conference of Governmental Industrial Hygienists. The latest version of this booklet will include the up-to-date version of the WBGT and work-rest cycles for acclimatized workers and for workers not acclimatized.
- National Oceanic and Atmospheric Administration's National Weather Service Heat Index may be found at [www.nws.noaa.gov/om/heat/index.shtml](http://www.nws.noaa.gov/om/heat/index.shtml).



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