

# HAZARD FACTSHEET

## HEAT STRESS

### What is Work-Related Heat Stress?

Exposure to extreme heat on the job can result in injury, illness or death. Transit employees such as bus operators and maintenance workers may be exposed to excessive heat when working outdoors in the summer without enough

*Exposure to extreme heat can cause several types of heat-related illnesses and safety problems.*

ventilation or shade, or in enclosed spaces with poor ventilation. Additionally, hot work such as welding or brazing can increase exposure to extreme heat.

### What are the Effects of Work-Related Heat Stress?

Several factors combine to determine how heat affects workers on the job:

- Temperature
- Humidity (the amount of moisture in the air)
- Radiant heat (such as from the sun, from a hot engine, or from a welding torch)
- Air circulation
- Workload (level of activity)



The following may also affect how people handle exposure to extreme heat:

- Age
- Weight
- Physical fitness
- Health status
- Medications
- Alcohol intake
- Water and salt balance
- Acclimatization (how accustomed a worker is to the heat)

The human body tries to protect itself against high outside temperatures by making changes in blood circulation and the composition and amount of sweat. By increasing blood flow to the skin, the body uses sweat and conduction to cool the skin and remove excess heat.

When workers are engaged in hard physical labor, muscles are using more blood, so less blood is available to flow to the skin to help remove body heat.



Sweating is only effective when the humidity is low enough to allow for evaporation. Fluids and salts lost through sweating need to be replaced by drinking water or drinks containing electrolyte-carbohydrate solutions. Electrolyte-carbohydrate solutions such as those used by athletes, replace potassium, calcium, and magnesium salt in the body.

## What are Heat-Related Illnesses?

There are several types of heat-related illnesses. It is important to remember that workers can have more than one at the same time.

### Heat Stroke

This is the most severe heat illness. Those experiencing heat stroke have a sharp rise in body temperature resulting from a failure of the body's sweating mechanism. It can cause mental confusion, convulsions, loss of consciousness, or coma. The skin is at first hot, dry, and red, later turning gray in color. Body temperature may reach 106°F or higher.

Heat stroke can be fatal if not treated right away. First aid includes getting the person to a cool area, cool water sponge-downs or baths, and vigorous fanning. Prompt administration of first aid may prevent damage to the brain, liver, kidneys, and heart. If possible, immediately take the victim immediately to a hospital.

### Heat Exhaustion

This reaction occurs when otherwise healthy people are exposed to a hot environment to which they are unaccustomed. When a rise in skin temperature results in sweating, sweat production may be inefficient, producing little and/or excessively salty sweat. Inefficient sweating and inadequate fluid replacement can lead to a loss of necessary fluids and salt.

A person suffering heat exhaustion may become irritable, confused, giddy, nauseous, or dizzy, and may experience headache and muscular fatigue. Their skin will be moist and clammy, and their complexion pale or flushed. Their pulse may be weak and slow, and blood pressure low. Unlike with heatstroke, a person suffering from heat exhaustion may have a normal, or only slightly elevated body temperature. To treat heat exhaustion, the person should be taken to a cool environment and given water or electrolyte-carbohydrate solutions. Severely ill individuals may require hospitalization.

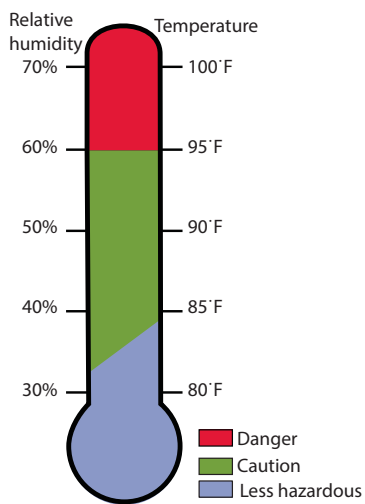
### Heat Cramps

When a person suffering from heat exhaustion tries to quickly replace lost body fluids, cramping may occur. This heat reaction includes painful muscle spasms due to liquid intake without adequate salt replacement. Cramps may occur during or after work. First aid includes taking the person to a cool environment and drinking a saline replacement solution. In some cases, saline solution may have to be administered intravenously.

### Fainting ("heat syncope")

People not used to high temperatures who stand still at work may experience lightheadedness or fainting. This condition occurs when blood vessels throughout the body dilate, resulting in lower blood pressure. Recovery is rapid when the victim rests lying down in a cool place and replaces fluids. Moving around, rather than standing still at work, usually reduces the possibility of fainting.

## High Temperature + High Humidity + Physical Work = Heat Illness



Adapted from: U.S. Department of Labor,  
Occupational Safety and Health Administration

## Heat Rash (“prickly heat”)

Clogging or inflammation of sweat glands or ducts can prevent evaporation of sweat and result in a rash. Heat rash can be severe enough to result in temporary total disability. Treatment consists of rest in a cool place and letting the skin dry. Individuals who have poorly functioning sweat glands, as evidenced by the onset of prickly heat, may be at greater risk for heat stroke.

## What Safety Problems are Caused by Heat?

Heat increases the risk of accidents. Hazards include dizziness, sweaty palms that become slippery, and fogged safety goggles and glasses. Working in a hot environment lowers mental alertness and physical performance. People also become more irritable and angry in hot environments, and this can divert attention from difficult tasks and safety procedures.

## What Can Be Done to Prevent Heat-Related Hazards?

Monitoring extremely hot environments is important. This may require measurements by an industrial hygienist. Special instruments are used to measure air temperature, humidity, air velocity, and surface heat radiation. The results are used in conjunction with standard formulas to obtain a measurement called the Wet Bulb Globe Temperature Index (WBGT).

Exposure to extreme heat can be limited through the use of engineering controls, administrative controls, personal protective equipment, or a combination of these three methods.

## Engineering Controls

Ventilation is the primary method that employers can use to control heat. Air-conditioning and adequate comfort ventilation on buses, as well as in work and maintenance areas, reduces

the risk of excess heat exposure. Fans will provide some comfort by creating air movement that can assist in evaporation of sweat and conduction of heat. It is important to note that ventilation for comfort is different than ventilation for contaminants.

Heat shielding can minimize heat from radiant sources such as engines. The use of power tools and mechanized processes to minimize exhausting manual labor can reduce the risk of heat stress in maintenance areas.



Cool rest areas for bus operators waiting for scheduled

departures reduces the risk of heat stress. These cool areas can be air-conditioned trailers, rooms or station houses. A rest area temperature of around 76°F is comfortable for those working in a hot environment.

## Administrative Controls

Scheduling rest breaks in a cool area is important. Work-rest cycles allow the body an opportunity to get rid of excess heat, slow down the production of internal heat, and provide greater blood flow to the skin. Shorter but frequent rest cycles are best for those working in hot environments. Ideally, the heaviest work should be scheduled during the coolest parts of the day.

During unusually hot weather or heat waves, special considerations may be appropriate. For example, schedule only priority tasks in these instances.

Have non-carbonated beverages and water readily available. Workers often don't replenish the two to three gallons of liquid they sweat daily. Thirst is not a reliable signal of the need for fluid intake. Workers should drink five to seven ounces of fluid every 15 or 20 minutes when working in a hot environment. In particularly hot environments, liquids with salt or other special additives are important. However, individuals with medical conditions requiring a low-sodium diet need to control their intake of salted beverages. The use of salt tablets is not recommended.

Identification of individuals with special medical problems is necessary. For example, people with heart or kidney problems and anyone who is overweight or not physically fit are more susceptible to heat stress.

Education and training for supervisors and workers about the recognition, prevention, and treatment of heat stress is critical.

Acclimatization is appropriate if an individual is going to be exposed to heat for an extended period of time. OSHA recommends that new employees and workers returning from an absence of two weeks or more begin with 50% of the normal workload and time exposure the first day and gradually build up to 100% over five work days.

## Personal Protective Equipment

Certain types of protective clothing may alleviate heat stress. Cool and comfortable summer work clothing is important. Loose-fitting, light-colored clothing, made out of natural fibers such as 100% cotton, is the most comfortable. Outdoors in the sun, head covering is essential. For extremely hot environments, there is special clothing that is reflective, air-cooled, or insulated with ice.

## What Are the Legal Requirements and Professional Guidelines for Limiting Heat Exposure?

The Occupational Health and Safety Administration (OSHA) has not adopted a standard for heat exposure. Nonetheless, federal and state OSHA agencies may issue general duty clause citations to employers whose workers are working in unsafe hot conditions based upon guidelines published by the American Conference of Governmental Industrial Hygienists (ACGIH). ACGIH, a private professional organization, has adopted threshold limit values (TLVs) for heat stress conditions designed to prevent the core temperature of workers from exceeding 100°F. TLVs are recommended limits for maximum exposures to hazards over an 8-hour work shift.

Using the WBGT Index described earlier, the ACGIH TLV for heat exposure establishes recommended work-rest regimes ranging from 25% to 75% rest during each work hour. The amount of work and rest each hour depends on the WBGT Index, clothing worn and physical workload being performed.



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*NTI's Hazard Factsheets provide transit workers and management with information to help recognize and resolve health and safety hazards. NTI offers a variety of other workplace health and safety training and educational resources.*