

# Heat Stress

## FACT SHEET

### Introduction

For many people, summertime means warm, comfortable days, perfect for eating outside or long walks during breaks from air-conditioned offices. But for some of us working in hot conditions may pose special hazards to safety and health. This document provides an overview of the variety of illnesses and injuries associated with heat stress and gives guidance on how to recognize and prevent them.

### How Your Body Reacts to Hot Conditions

Four environmental factors affect the amount of stress a worker faces in a hot work area: *temperature*, *humidity*, *radiant heat* (such as from the sun or a furnace) and *wind speed*. Individuals with high blood pressure or some heart conditions and people who take diuretics (water pills) may be more sensitive to heat exposure.

The body defends itself from heat through three mechanisms: breathing, sweating, and changing the blood flow. The first reaction is to circulate blood to the skin, which increases skin temperature and allows the body to give off some heat. During heavy work, muscles need more blood flow, which reduces the amount of blood available to flow to the skin and release the heat.

Sweating also helps the body to cool off, but only when the humidity levels are low enough to allow the sweat to evaporate and if water and salts lost through sweating are replaced.

### Why is working in the heat bad for your health?

Human beings need to maintain a constant body temperature if they are to stay healthy. Working in high temperatures will induce heat stress when more heat is absorbed into the body than can be dissipated out. Heat illness such as prickly heat, fainting from heat exhaustion or heat cramps are visible signs that people are working in unbearable heat. In the most severe cases, the body's temperature control system breaks down altogether and body temperature rises rapidly. This is heat stroke, which can be fatal.

### Heat Stress Disorders

When the body becomes overheated, a condition of heat stress exists. Heat stress can lead to a number of problems, including heat exhaustion, heat stroke, heat cramps, fainting, or heat rash. Many people confuse these disorders, but it is important to be able to recognize each one and know what to do when it happens. Each of these heat stress disorders is described below.

#### *Heat exhaustion*

Although not the most serious health problem, heat exhaustion is the most common heat-related ailment. Heat exhaustion happens when a worker sweats a lot and does not drink enough fluids or take in enough salt or both. The simple way to describe the worker is wet, white and weak.

### Signs and symptoms

- ▶ clammy skin-pale-flush
- ▶ confusion
- ▶ light-headedness
- ▶ fainting-body temperature
- ▶ slurred speech
- ▶ nausea
- ▶ rapid pulse
- ▶ vomiting
- ▶ weak-tired-giddy short temper
- ▶ fatigue
- ▶ loss of concentration

## What to do

- ▶ Rest in a cool place
- ▶ Drink an electrolyte solution, such as Gatorade or another sports drink. Avoid caffeinated beverages such as colas, iced tea or coffee.
- ▶ In severe cases involving vomiting or fainting, call [911](#) and have the worker taken to the hospital or medical center.

### *Heat stroke*

Heat stroke is the most serious health problem for people working in the heat, but is not very common. It is caused by the failure of the body to regulate its core temperature. Sweating stops and the body can not get rid of excess heat. Victims will die unless they receive proper treatment promptly.

## Signs and symptoms

- |                    |                    |                              |
|--------------------|--------------------|------------------------------|
| ▶ staggering walk  | ▶ temperature rise | ▶ deliriousness              |
| ▶ mental confusion | (yet person may    | ▶ clammy skin-pale-flush     |
| ▶ delirium         | feel chilled)      | ▶ Hot, dry skin, usually red |
| ▶ fainting         | ▶ convulsions      | or bluish color              |
| ▶ seizures         | ▶ unconsciousness  | ▶ Body temperature of        |
| ▶ hot skin         | ▶ incoherence      | 106°F or higher              |

## What to do:

- ▶ Call 9-1-1 immediately and request an ambulance
- ▶ Move victim to a cool area
- ▶ Soak the victim with cool water
- ▶ Fan the victim vigorously to increase cooling

### *Heat cramps*

Heat cramps are painful muscle spasms. They occur when a worker drinks a lot of water, but does not replace salts lost from sweating. Tired muscles – those used for performing the work – are usually the most likely to have the cramps.

## Signs and symptoms:

- ▶ Cramping or spasms of muscles
- ▶ May occur during or after the work

## What to do

- ▶ Drink an electrolyte solution (sports drink) such as Gatorade
- ▶ If the cramps are severe or not relieved by drinking a sports drink, seek medical attention call [911](#).

### *Fainting (Heat Syncope)*

Fainting usually happens to someone who is not used to working in the hot environment and simply stands around. Moving around, rather than standing still, will usually reduce the likelihood of fainting.

## Signs and symptoms

- ▶ Brief loss of consciousness
- ▶ Sweaty skin, normal body temperature
- ▶ No signs of heat stroke or heat exhaustion

### What to do:

- ▶ Lie down in a cool place
- ▶ Seek medical attention if not recovered after brief period of lying down

### *Heat rash*

Heat rash, also called prickly heat, may occur in hot and humid environments where sweat cannot evaporate easily. When the rash covers a large area or if it becomes infected, it may become very uncomfortable. Heat rash may be prevented by resting in a cool place and allowing the skin to dry.

### Signs and symptoms

- ▶ rash characterized by small pink or red bumps
- ▶ irritation or *prickly* sensation
- ▶ itching

### What to do

- ▶ keep skin clean and dry to prevent infection
- ▶ wear loose cotton clothing
- ▶ cool baths and air conditioning are very helpful
- ▶ some over-the counter lotions may help ease pain and itching

### Preventing Heat Stress

In most cases, heat stress can be prevented or, at least, the risk of developing heat stress can be reduced.

### *Engineering Controls*

A number of engineering controls can help reduce heat exposure. These include:

- ▶ general and local exhaust ventilation in areas of high heat
- ▶ shielding of radiant heat sources, such as furnaces or hot machinery
- ▶ elimination of steam leaks
- ▶ use of cooling fans or personal cooling devices, such as cooling vests
- ▶ use of power tools to reduce manual labor

### *Work Practices*

- ▶ **Clothing:** Wear loose-fitting, lightweight clothing, such as cotton, to allow sweat to evaporate. Light colors absorb less heat than dark colors. When working outside, wear a lightweight hat with a good brim to keep the sun off your head and face.
- ▶ **Drinking:** Drink plenty of liquids, especially if your urine is dark yellow, to replace the fluids you lose from sweating – as much as one quart per hour may be necessary. Water and/or sports drinks are recommended. Since caffeine is a diuretic (makes you urinate more), beverage such as cola, iced tea and coffee should be avoided. Thirst is not a reliable sign that your body needs fluids. When doing heavy work, it is better to sip rather than gulp the liquids.
- ▶ **Work Schedule:** If possible, heavy work should be scheduled during the cooler parts of the day. Otherwise, alternate heavy work in the heat with lighter work or work in cooler areas. When the temperature humidity index (see next page) is between 84 and 93 (Warning Zone), try to minimize the amount of time working in the heat such that approximately half of each hour is spent doing heavy work in the heat. When the temperature humidity index is 94 or higher (Danger Zone), this should be further minimized to approximately one quarter of each hour spent doing heavy work in the extreme heat.

- ▶ **Acclimatization:** New employees and workers returning from an absence of two weeks or more should have 5 days to get used to the heat. Begin with 50 percent of the normal workload and time exposure the first day and gradually build up to 100 percent on the fifth day.
- ▶ **Body Weighing:** Workers may be at greater risk of heat stress if they lose more than 1.5% of their body weight in a single day from sweating.

### ***Personal Protective Equipment***

When work must proceed in hot conditions, personal cooling systems may help reduce the risk of heat stress. There are several systems available through health and safety catalogs, including the following:

- ▶ **Heat reflective clothing** may alleviate the problem of radiant heat sources, such as furnaces. However, if the worker is fully covered, he or she will have trouble evaporating sweat.
- ▶ **Ice vests or cooling vests** remove heat from the skin. They are relatively inexpensive and allow freedom of movement.
- ▶ **Liquid cooling systems** also remove heat from the skin. Cool liquid flows in the suit around the body and carries the heat away.

### ***Training***

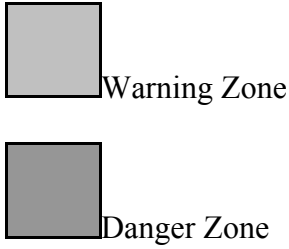
Employees and supervisors need to be trained to be able to detect early signs of heat stress. Employees must understand the need to replace fluids and salt from sweat and recognize the signs of dehydration, fainting, heat cramps, heat exhaustion, and heat stroke.

Supervisors should watch for signs of heat stress and allow workers to interrupt their work if they are extremely uncomfortable. Supervisors should also ensure that work schedules allow appropriate rest periods and ensure liquids are available. They should use appropriate engineering controls, personal protective equipment and work practices to reduce the risk of heat stress.

### **Temperature-Humidity Index**

A useful guide to summertime comfort is the Temperature-Humidity Index (THI). This table gives an approximation of how most people react to heat and humidity. To use the table, find out the temperature and relative humidity of the work area. Start at the temperature listed on the left, and read across to the number under the relative humidity level (round up to the higher percentage). This number is the temperature-humidity index. The values are for people wearing the right amount of clothing doing light work, with very little wind.

The lightly highlighted area is uncomfortable for everyone. For moderate to heavy activity, workers should be concerned about heat stress and should alternate time working in the heat and time in cooler areas or light work. When the THI is in the darkly highlighted area, extreme caution is indicated. Workers should try to schedule work to allow only 25% of time performing heavy work in such an environment. Workers should be encouraged to drink plenty of fluids and be on the lookout for signs of heat stress.



		Relative Humidity									
		10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
	80°	69	70	72	73	74	75	76	78	79	80
	81°	70	71	72	73	75	76	77	78	80	81
	82°	70	72	73	74	75	77	78	79	81	82
	83°	71	72	73	75	76	78	79	80	82	83
	84°	71	73	74	75	77	78	79	81	83	84
	85°	72	73	75	76	78	79	80	82	84	85
	86°	72	74	75	77	78	80	81	83	84	85
	87°	73	74	76	77	79	81	82	84	85	87
	88°	73	75	76	78	80	81	83	85	86	88
Temperature (Fahrenheit)	89°	74	75	77	79	81	82	84	86	87	89
	90°	74	76	77	79	81	83	85	87	88	90
	91°	75	76	78	80	82	84	85	87	89	91
	92°	75	77	79	81	83	85	86	88	90	92
	93°	76	78	80	81	83	85	87	89	91	93
	94°	73	78	80	82	84	86	88	90	92	94
	95°	77	79	81	83	85	87	89	91	93	95
	96°	77	79	81	84	86	88	90	92	94	96
	97°	78	80	82	84	86	88	91	93	95	
	98°	78	80	83	85	87	89	91	94	96	
	99°	79	81	83	85	88	90	92	95		
	100°	79	82	84	86	89	91	93	95		
	101°	80	82	84	87	89	91	94	96		
	102°	80	83	85	88	90	92	95			
	103°	81	83	86	88	91	93	96			
	104°	81	84	86	89	91	94	96			
	105°	82	84	87	90	92	95				
	106°	82	85	87	90	93	96				
	107°	83	85	88	91	94	96				
	108°	83	86	89	92	95					
	109°	84	87	89	92	95					
	110°	84	87	90	93	96					