

Preventing Heat Stress at Work



About WorkSafeBC

At WorkSafeBC, we're dedicated to promoting safe and healthy workplaces across B.C. We partner with workers and employers to save lives and prevent injury, disease, and disability. When work-related injuries or diseases occur, we provide compensation and support injured workers in their recovery, rehabilitation, and safe return to work. We also provide no-fault insurance and work diligently to sustain our workers' compensation system for today and future generations. We're honoured to serve the workers and employers in our province.

Prevention Information Line and contact information

We provide information and assistance with health and safety issues in the workplace.

Call the information line 24 hours a day, 7 days a week to report unsafe working conditions, a serious incident, or a major chemical release. Your call can be made anonymously. We can provide assistance in almost any language.

If you have questions about workplace health and safety or the Occupational Health and Safety Regulation, call during our office hours (Monday to Friday, 8:05 a.m. to 4:30 p.m.) to speak to a WorkSafeBC officer.

If you're in the Lower Mainland, call 604.276.3100, or toll-free at 1.888.621.7233 (621.SAFE) in Canada.

Health and safety resources

You can find our health and safety resources at [worksafebc.com/forms-resources](https://www.worksafebc.com/forms-resources). Printed copies are available for some resources and can be ordered from [worksafebcstore.com](https://www.worksafebcstore.com).

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Introduction

Many jobs require working in hot environments, both outdoors and indoors. Working in the heat can affect the body's cooling system. If the body is unable to cool itself, a worker can experience heat stress. If heat stress is not recognized and treated in the early stages, more serious conditions called heat-related illnesses may quickly develop.

If workers are required to work in conditions that put them at risk of heat stress, employers must take steps to prevent heat-related illnesses. The risk of heat stress may be present year-round in work settings such as bakeries, industrial laundries, boiler rooms, and steel and cement manufacturing plants. During the hot summer months, the risk increases in indoor work settings without air conditioning and in most outdoor work settings. Workers exposed to hot environments must be trained to recognize the early symptoms of heat stress in themselves and co-workers and to know what to do in response.

This booklet provides a basic overview of risk factors that increase the chances of experiencing heat stress, how to prevent heat stress, and how to recognize and treat heat-related illnesses. Whether you are a worker or an employer, this booklet contains information essential to health and safety.

Note

Early symptoms of heat stress — such as excessive fatigue, lethargy, irritability, lack of coordination, and altered judgment — can result in serious incidents.

What is heat stress?

Human bodies naturally maintain temperatures between 36°C and 38°C. When the body temperature rises above this range, the body responds to get rid of the excess heat. However, if the body continues to gain heat faster than it can get rid of it, the body temperature increases and the person experiences heat stress. Health problems that result from heat stress are known as heat-related illnesses. These illnesses can occur in hot, humid environments and when the body loses too much fluid and salt as sweat.

Many variables contribute to heat stress. To prevent it, employers must assess the risk of heat stress and put in place effective control measures. Workers at risk of heat-related illnesses must follow control measures and know what to do to prevent these illnesses in themselves or their co-workers.

Note

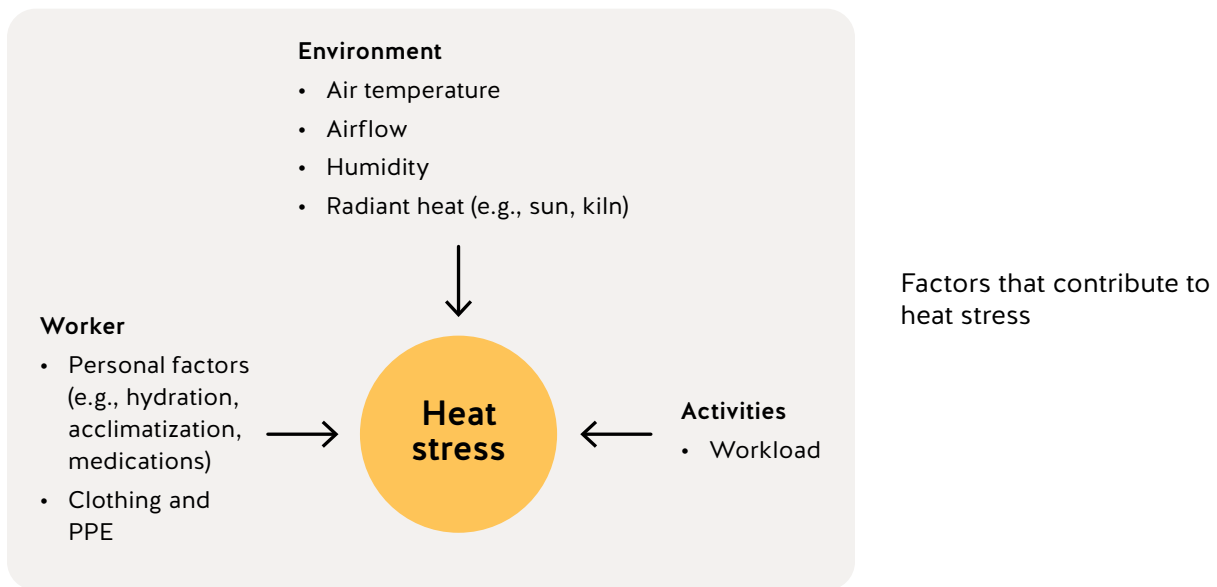
If the body is unable to cool itself, a worker can experience heat stress.

Primary factors contributing to heat stress

The body can gain heat in two ways: It can absorb heat from the environment, and it can generate heat itself through work activity. Both the environment and work activity are important sources of heat, and sometimes the work activity itself can be the main source of heat stress. Cases of heat stress have been reported when the air temperature was relatively low but the physical activity level of the work was very high.

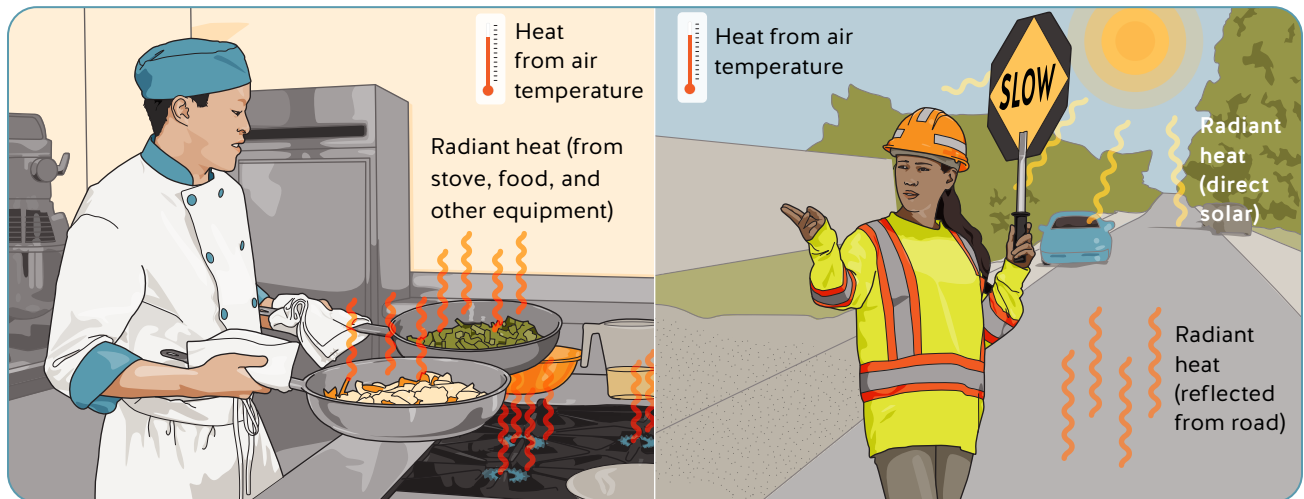
In addition, the amount of heat stress a worker is exposed to may be affected by factors such as the following:

- Personal factors (such as hydration, acclimatization, medications, age, and weight). These factors may decrease the body's ability to respond to heat stress.
- Clothing and personal protective equipment (PPE) worn by the worker. These items may add to heat stress by inhibiting cooling.



Environment

The amount of heat gained from the environment (external heat) depends on the surrounding air temperature, the amount of airflow, and any radiant heat. Some examples of radiant heat sources are kilns, smelters, boilers, ovens, fires, and sunlight. The addition of heat from radiant sources can cause overheating even when the air temperature is not high.



These illustrations show examples of heat sources in the environment.

Activities

The amount of heat generated by the worker (internal heat) depends on the workload (the level of physical activity). The following table gives some examples of light, moderate, heavy, and very heavy workloads.

Workload	Activity	Examples
Light	Sitting, with moderate movement of arms and legs Standing, doing light work, with mostly arm movement Casual walking	Desk work; typing; driving in light traffic Assembly-line work Supervising a worksite
Moderate	Brisk walking Sitting, with vigorous arm and leg movement Standing, doing light to moderate work, including some walking Moderate lifting or pushing	Delivering mail Driving heavy machinery; industrial cleaning Picking fruits and vegetables; cooking food in a commercial kitchen Warehouse work; loading and unloading trucks
Heavy	Some construction tasks Intermittent heavy lifting, pushing, or pulling	Sawing; planing; roofing Restocking shelves; asbestos removal
Very heavy	Some construction tasks Very intense activity at fast to maximum pace Climbing stairs with heavy gear	Intense digging or shovelling; sledgehammer work Stone or brick masonry Firefighting

Note

Workload is only one factor to consider. Heat from the environment must also be taken into account when determining the risk of heat stress.

Worker

Personal factors

People respond differently to heat. As a worker, it is important to know the common personal factors that may increase your chance of developing heat stress. These factors include the following:

- **Dehydration.** Drinking enough fluids is necessary for the body to function properly, especially in a hot environment.
- **Poor physical fitness.** Physically fit people are generally better able to cope with heat stress and less likely to develop heat-related illnesses.
- **Obesity.** Excess fat provides increased insulation, which reduces heat loss. People with excess weight may also generate more heat during activity.
- **Increased age.** Older workers are generally less able to cope with heat. In older adults, heart function becomes less efficient, and sweating starts later and occurs at a slower rate.

- **Pregnancy.** Pregnant workers are at higher risk of heat stress because their bodies have to work harder to cool down. These workers are also at higher risk for dehydration.
- **Pre-existing medical conditions or treatments.** Some common medical conditions and treatments can decrease a person's ability to cope with heat stress. For example, heart problems and treatments such as low-salt (low-sodium) diets weaken the body's ability to efficiently remove excess heat. Heart disease can also be aggravated by heat. Other conditions that may increase the risk of heat-related illnesses include diabetes mellitus, cystic fibrosis, and hyperthyroidism. If there is any doubt whether you are medically able to work in a hot environment or to do heavy work, seek medical advice from your doctor or an occupational health professional.
- **Short-term disorders and minor illnesses.** Feverish illnesses, diarrhea, and vomiting can all cause excess loss of fluids, which may decrease a person's ability to cope with heat. If you feel unwell, you should not work in hot conditions until you feel well again. Sleep deprivation can also increase the risk of heat stress.
- **Chronic skin disorders.** Rashes, dermatitis, healed burns, and other skin conditions that involve large skin surface areas may limit the body's ability to sweat properly. Skin problems can also worsen when exposed to heat.
- **Use of medications, street drugs, and alcohol.** Some substances may increase the risk of heat-related illnesses. Examples include:
 - Medications (such as antidepressants, antihistamines, antipsychotics, and diuretics). Some medications can affect a worker's ability to feel heat and/or to sweat. If you work in a hot environment, discuss the potential side effects of your medications with your doctor.
 - Street drugs (such as opioids, methamphetamines, and cocaine). Some street drugs increase body temperature and decrease the ability to lose or feel heat.
 - Alcohol. Alcohol intake increases water loss and can cause even acclimatized workers to become dehydrated.
- **Previous heat stroke.** Workers who have previously suffered from heat stroke are at increased risk for recurrence.
- **Lack of acclimatization.** Getting the body accustomed to a hot working environment is known as acclimatization. A person who regularly works in a hot environment will be at a lower risk of developing heat-related illnesses than a person who works in a hot environment only occasionally. (Acclimatization is discussed further on pages 14–15.)

Clothing and PPE

The types of clothing worn by workers may contribute to heat stress by trapping heat and sweat. This can inhibit the body from cooling itself. Workers who wear the following types of clothing are at higher risk:

- Encapsulation suits
- Impermeable or thermally insulating clothing
- Multiple layers of clothing (such as coveralls over work clothes)

Clothing may also limit the methods available to measure heat stress.

How the body removes heat

The body has two main ways to get rid of excess heat: by increasing blood flow to the skin and by sweating. If these cooling mechanisms are disrupted, the risk of heat-related illnesses increases.

Increasing blood flow

The bloodstream takes excess body heat to the surface of the body — that is, to the skin. When the air is cooler than the skin, heat is transferred to the surrounding air. This process is known as simple heat exchange by convection. Heart rate and blood flow increase as excess body heat increases. Increased blood flow to the skin often causes redness in the face or a flushed appearance.

In hot weather, shaded areas can provide much cooler air than those in direct sun. Working or resting in shaded areas allows the body to get rid of excess heat by transferring it to the surrounding air. If a person is very hot, taking a cool shower can further speed cooling by transferring body heat to the cooler water.

At air temperatures over 35°C, when the air is hotter than the skin, heat will not be transferred to the surrounding air. In such cases, sweating becomes the most effective way for the body to cool itself.

Working in temperatures above 35°C

A thin layer of air is always trapped next to the skin. When the air temperature is higher than the skin temperature (skin temperature is generally about 35°C), this trapped layer of air protects the skin from direct contact with the hotter air in the environment. Airflow from fans or wind at these high temperatures can strip away this protective layer of air and cause the body to be heated by the warmer air. This is known as convective heating. (This is basically how convection ovens work to cook food faster.) Wearing a light layer of loose-fitting clothing helps to maintain the protective layer of air. This is why people in hot desert climates cover themselves in clothing from head to toe.

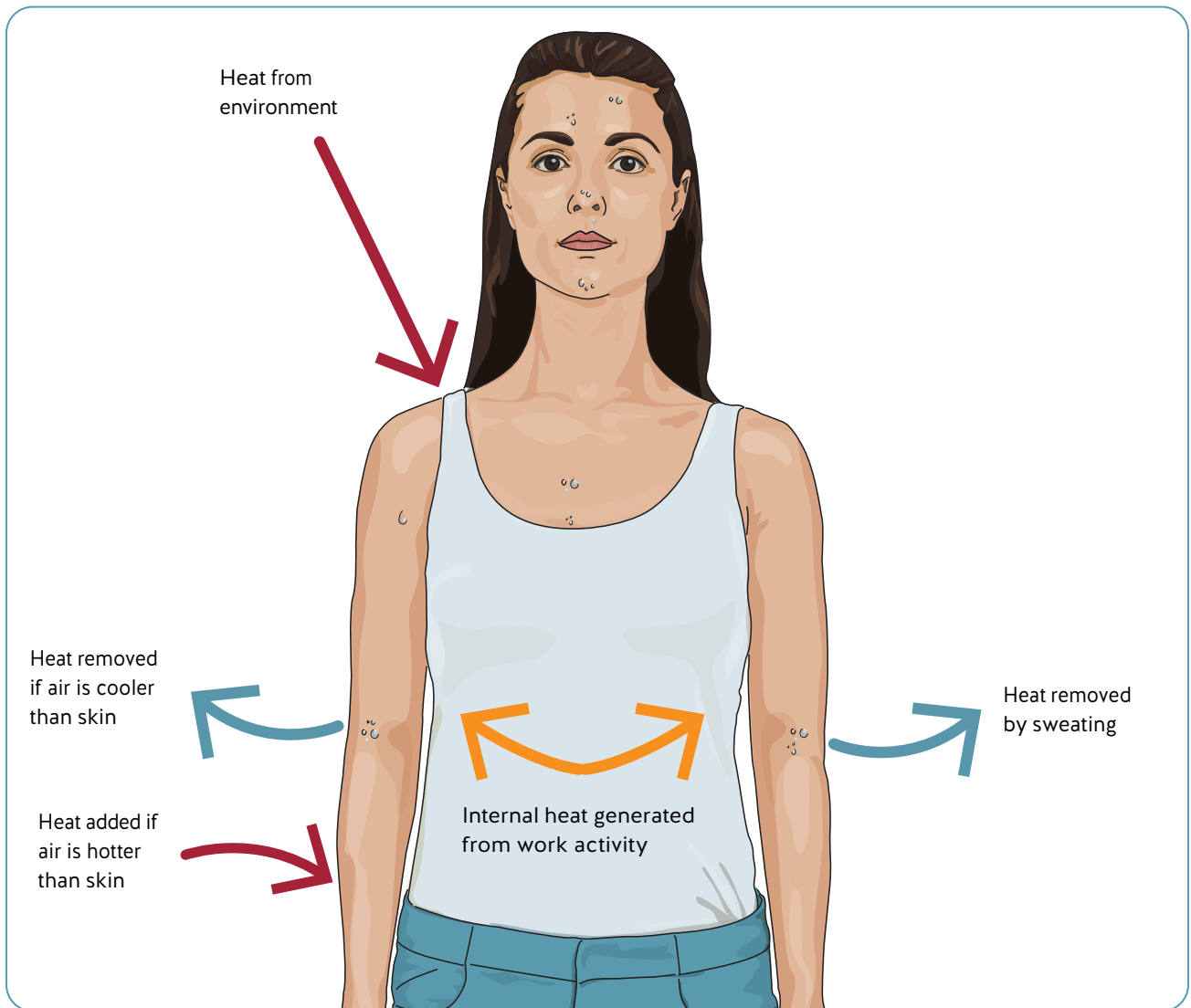
Sweating

When the body gets hot, the brain tells the body to sweat. Sweating itself does not cool the body; the cooling effect occurs when sweat evaporates from the skin.

The amount of sweat that evaporates determines the amount of cooling provided to the body. For this reason, any factor that affects sweating or the evaporation of sweat will also affect the body's ability to cool itself by sweating. Individual workers' ability to sweat can be reduced by factors such as the following:

- Not drinking enough fluids
- Wearing non-breathable clothing or equipment that limits sweating
- Not being properly acclimatized to a hot environment
- Having a skin condition that limits sweating
- Using a medication that limits sweating

Evaporation of sweat is affected by humidity, airflow, and the type of clothing worn. Low humidity and high airflow increase evaporation, whereas high humidity and protective clothing are likely to reduce evaporation. Although protective clothing protects workers from other hazards, it can contribute to heat stress.



This illustration shows the three main sources of heat and the two main ways heat is removed from the body.

Preventing heat stress

Employer responsibilities

Employers must identify work activities and work areas where a worker is, or may be, exposed to environmental conditions that could cause heat-related illnesses. If a worker is exposed to such conditions, employers must conduct a heat stress assessment and develop and implement a heat stress exposure control plan. As part of this plan, employers, supervisors, and workers must have a basic understanding of how heat affects the body if they are to prevent heat stress.

In the Regulation

For more information on employers' responsibilities when it comes to heat exposure, see the following:

- [Sections 7.26 to 7.32 of the OHS Regulation](#)
- [Guidelines G7.27 to G7.30 of the OHS Guidelines](#)

Examples of key steps that employers can take as part of a heat stress exposure control plan include the following:

- Determine whether it's necessary to work in hot conditions.
- Monitor environmental conditions.
- Make modifications to facilities, equipment, and processes to reduce heat exposure.
- Assign workers to work in pairs or groups where feasible.
- Change work practices and policies to limit the risk. For example, consider whether work can be done during cooler parts of the day.
- Determine appropriate work-rest cycles. When a worker feels ill, it may be too late.
- Rotate work activities or use additional workers to reduce exposure.
- Establish cooling areas with shade and water.
- Educate and train workers at risk for heat stress. Workers need to know how to recognize signs and symptoms of the early stages of heat stress and what to do in response.
- Ensure there is adequate first aid coverage and that emergency procedures are in place.

If a heat warning has been declared in your region, take steps to protect workers. In case of an extreme heat emergency, employers should consider stopping work if they cannot protect workers from the risk of heat-related illnesses. The table on the next page provides more information on heat warnings and extreme heat emergencies, as set out in the BC Provincial Heat Alert and Response System.

Note

Heat warnings are issued for vulnerable populations and may not reflect occupational exposure limits. Heat stress assessments must be performed to ensure worker safety.

	Alert level				
	Heat warning		Extreme heat emergency		
Public health risk	Moderate (5% increase in mortality)		Very high (20% or more increase in mortality)		
Descriptor	Very hot		Dangerously hot		
Historic frequency	1-3 per summer season		1-2 per decade		
Criteria		Temperatures (°C)			Heat warning criteria have been met and forecast indicates that daily highs will substantively increase day-over-day for 3 or more consecutive days
	Region of B.C.	Daytime high	Nighttime high	Daytime high	
	Southwest	29	16	29	
	Fraser	33	17	33	
	Southeast	35	18	35	
	Northeast	29	14	29	
	Northwest	28	13	28	

Source: BC Provincial Heat Alert and Response System, 2022. Alert level criteria may change over time.

Identify areas, tasks, or occupations that may be at risk

The first step to reducing the risk of heat stress to workers is to determine the areas, tasks, or occupations that put workers at risk of heat-related illnesses. Such conditions can develop in areas with temperatures above 23°C (summer or winter), and where any of the following factors are also present:

- Areas with high humidity.
- Jobs or tasks that require moderate to high exertion.
- Jobs that require workers to wear protective clothing over most of their body and head. Some types of protective clothing (e.g., impermeable or encapsulating suits) can inhibit the body’s ability to cool itself through sweating.
- Areas, tasks, or occupations that have been identified as high risk for heat-related illnesses through accident investigation reports, first aid treatment record books, and records of injury and illness.
- Areas, tasks, or occupations about which workers have expressed concern about heat stress.

The following are examples of workplaces where heat stress is likely to pose a risk to workers:

- Where workers work around extremely hot material or equipment, such as in foundries, sawmills, pulp mills, or smelters, and near cement kilns or furnaces
- In outdoor occupations, such as construction, road repair, agriculture, and motion picture location shooting, where summer sunshine, radiant heat, and physical demands may contribute to heat stress

- Laundries, restaurant kitchens, bakeries, and canneries, where high humidity and/or radiant heat may contribute to heat stress
- In occupations such as asbestos abatement, where a combination of heavy physical demands and impermeable PPE may increase heat stress to intolerable levels

During extreme heat emergencies, heat stress poses a risk in indoor workplaces without air conditioning.

Conduct a heat stress assessment

Once the occupations, tasks, or areas that put workers at risk of heat-related illnesses have been identified, conduct a heat stress assessment. This involves evaluating risk factors that contribute to heat stress (i.e., environment, activities, and worker). The specific risk factors at the worksite play a key role in determining the appropriate method of measuring heat stress. Several different methods of measuring heat stress are available, including the following:

- Direct measurement of body temperature
- Measurement of other physiological responses, such as heart rate
- Measurement of environmental factors, such as air temperature, air velocity, humidity, and radiant heat

While WorkSafeBC accepts all of these methods under certain conditions, employers need to understand the limitations of each method. For more information on heat stress assessment methods, see G7.29 of the OHS Guidelines.

Note

Personal factors may affect a worker's response to heat. Symptoms of heat stress should never be ignored, even if heat stress screening criteria are not met.

Using environmental factors to measure heat stress

Using environmental factors is the most common way to measure heat stress in a work setting. WorkSafeBC accepts several environmental methods for measuring heat stress. The most common methods include the following:

- The American Conference of Governmental Industrial Hygienists (ACGIH) Standard method uses a wet bulb globe thermometer to measure air temperature, air velocity, humidity, and radiant heat.
- The Humidex method uses a hygrometer and a thermometer to measure humidity and temperature, respectively (or a psychrometer to measure both). Digital versions of these devices are relatively inexpensive and available from most hardware stores. The Humidex method cannot be used when workers are exposed to industrial sources of heat or humidity.

For both of these methods, it is important to adjust measured values for the types of clothing worn by workers. It is also important to measure environmental conditions at each worksite and not rely on temperature and humidity values reported on the news or recorded at other locations.

For more information on these methods and their limitations, see G7.29 of the OHS Guidelines.

Limitations of household thermometers

Household thermometers that do not measure humidity, airflow, and radiant heat are not sufficient for performing heat stress assessments unless coupled with physiological monitoring. However, don't ignore the readings on household thermometers. Implement a heat stress exposure control plan as soon as temperatures approach 30°C.

Develop and implement a heat stress exposure control plan

If the heat stress assessment determines that workers are exposed to conditions that put them at risk of heat-related illnesses, the employer must develop and implement a heat stress exposure control plan (ECP).

An effective heat stress ECP would include the following elements:

- Statement of purpose
- Responsibilities
- Risk identification, assessment, and control
- Education and training
- Written procedures

For more information on what should be included in a heat stress ECP, see page 21 or guideline G7.29, Heat stress assessment and exposure control plan.

Note

Depending on the method used for assessing heat stress, additional elements (such as health monitoring and other documentation) may also be required as part of a heat stress ECP.

Educate and train workers

Employers must provide adequate training and education to all workers at risk for heat stress, their immediate co-workers, and their supervisors. Training should include the following information:

- How heat stress develops
- Personal factors
- How to prevent heat stress
- How to recognize symptoms
- What workers should do if they, or co-workers, develop a heat-related illness

Workers have the right to refuse unsafe work

As a worker, you have the right and responsibility to refuse unsafe work. If heat stress is not being adequately controlled, and you believe your health is at risk, report this issue to your employer and follow the steps outlined in [sections 3.12 to 3.13 of the Regulation](#) and their [related guidelines](#). Employers must not reassign work that has been refused, except in accordance with [section 3.12.1 of the Regulation](#).

It is important for workers to recognize the signs and symptoms of the early stages of heat stress. If workers are able to remove themselves or co-workers from a hot environment in the early stages, more serious illness can be avoided. Workers should also be able to recognize the range of symptoms for different stages of heat stress in themselves and co-workers. However, since a decrease in alertness is one of the early symptoms, workers may not be able to recognize the development of heat stress in themselves.

Provide drinking water

The body naturally sweats to cool itself. Sweating can use up a significant amount of fluid, which must be replaced continuously throughout the workday. If fluid is not regularly replaced, workers will become dehydrated, increasing their risk for heat stress.

Employers are required to provide an adequate supply of cool drinking water close to the work area for workers exposed to heat. Suitable drinks include tap water, mineral water, and fruit juices. Fluids do not need to be iced; cooled drinks between 10°C and 15°C are adequate. Fluids that contain caffeine or alcohol are not suitable because they increase dehydration. Eating fresh fruits will also help to replace lost fluids.

It is important to drink water (without added salt) **before** as well as during and after work in a hot environment. As a starting point, workers should drink about two glasses (about 0.5 litres) of water before starting work in a hot environment and one glass every 20 minutes throughout the workday. In very hot environments or where sweating is profuse, even more water may be required. Workers must not wait until they are thirsty to replace fluids.

Although the average North American diet usually contains enough salt for most work conditions, working in hot environments can cause salt deficiencies. To replace the salt lost by sweating, workers can eat foods that contain moderate levels of salt. Salt tablets are not recommended.

Controlling heat exposure

If the work cannot be altered to prevent workers from being exposed to environmental conditions that could cause heat-related illnesses, the employer must implement *engineering controls* to reduce exposure. If engineering controls are not practical, the employer must provide *administrative controls* (such as an appropriate work-rest cycle) or *personal protective equipment* if the equipment provides protection as effective as administrative controls. Combinations of various control methods often provide the most effective protection from heat stress.

Elimination

Elimination involves identifying if there is a need to work in a hot environment and finding ways to avoid exposing workers to conditions that could cause heat-related illnesses. While elimination is the most effective control measure, it may not be practicable for some types of work. (Under the Regulation, *practicable* means “that which is reasonably capable of being done.”)

Engineering controls

If elimination is not practicable, engineering controls are the most effective and preferred means to reduce excessive heat exposure. The following are some examples of engineering controls:

- Where feasible, automate tasks to reduce worker exposure to heat.
- Cover or insulate hot surfaces to reduce radiant heat.
- Shield workers from radiant heat.
- Provide air conditioning or increased ventilation to remove hot air.
- Provide misting stations where humidity is low and where it is safe to do so.
- Provide fans for spot cooling. (Caution: Fans may interfere with local exhaust ventilation, and they may not be effective at high temperatures. See “Working in temperatures above 35°C” on page 6 for more information.)
- Where humidity is high, use dehumidifiers or reduce the sources of moisture (for example, open water baths, drains, leaky steam valves).

In the Regulation

Section 4.80 of the Regulation states, “The employer must ensure that temperature and humidity levels within the indoor work environment are maintained within acceptable comfort ranges, as far as is practicable.”

Administrative controls

If engineering controls are not practicable — which is often the case when work is done outdoors during the summer months — administrative controls must be considered. The following are some common administrative controls used to reduce the risk of heat stress.

Determine appropriate work-rest cycles

Appropriate work-rest cycles should be determined and scheduled to allow adequate time for workers’ bodies to cool. Workers cannot rely on their bodies to indicate when a rest period is needed. By the time a worker feels ill, it may be too late.

As the heat and humidity increase in the work environment, work periods should be shortened, allowing workers more time to cool down.

It is important to have cool areas, such as shaded or well-ventilated areas, for breaks and rests. Showering or soaking in cool water, when possible, can cool the body very quickly.

Schedule work to minimize heat exposure

When organizing and scheduling work, consider taking the following steps to minimize heat exposure:

- Schedule the hardest physical tasks for the coolest part of the day.
- Rotate work activities between hotter and cooler environments, or increase the number of workers per shift to cover for workers taking breaks to cool off.
- Allow for slower-paced work during the hottest periods of the day.
- Move or relocate the work away from direct sunlight and/or other radiant heat sources whenever possible.
- For outside work, schedule routine maintenance and repair work during cooler seasons of the year.
- For inside work, schedule routine maintenance and repair work for times when hot operations are shut down.

Assign workers to work in pairs or groups

Workers should not work alone in conditions where heat stress is possible. They should be closely supervised or work in pairs or groups to ensure that heat-related illnesses are identified and treated as soon as possible. Supervisors need to ensure that there is adequate first aid coverage and must establish emergency procedures to deal with serious conditions such as heat exhaustion and heat stroke.

Acclimatize workers

The body will adapt to working in hot environments if it is given a chance to gradually get used to the new conditions. This process, known as acclimatization, allows the body to modify its own functions to better cope with heat stress and to remove excess heat more efficiently.

Acclimatization has three main benefits:

- **Enhanced cardiovascular fitness.** Both heart rate and core body temperature stay lower when working in a hot environment.
- **Enhanced sweating.** The person sweats sooner and sweats more, which has a cooling effect on the body.
- **Lower salt content in sweat.** Losing less salt in sweat helps to prevent salt depletion. (Caution: There can still be significant salt loss because the total volume of sweat increases.)

In general, acclimatized workers will be able to work in hotter work conditions and for longer periods than unacclimatized workers.

Note

Acclimatization only works in a very narrow range of circumstances. During sudden, short-term heat waves, for example, workers cannot acclimatize to the high temperatures. In such conditions, employers should not rely on acclimatization as a control measure for heat stress.

Healthy workers can normally acclimatize to working in hot environments if all of the following factors are present:

- **Time.** The body needs time to adjust to working in the heat. Exposure should happen gradually over 7 to 14 days to prevent heat-related illnesses. The same personal factors that put individuals at risk for heat stress can increase the amount of time required for acclimatization.
- **Workload.** The body will only acclimatize to the level of workload experienced during the acclimatization period.
- **Environmental conditions.** The body will only acclimatize to the level of heat and humidity experienced during the acclimatization period. If it gets hotter, workers will be at risk again.

The benefits of acclimatization are lost more quickly than they are gained. After seven consecutive days away from work in a hot environment, a worker is considered to be unacclimatized. That worker should begin the acclimatization process from the beginning.

Wear cool clothing

Clothing suitable for hot conditions and heavy work helps the body to cool itself. Loose-fitting clothes made from fabrics such as cotton and silk allow air to pass through. Air passing over the skin will help cool the body by evaporating the sweat from the skin.

For work outside in the sun, light-coloured clothing reflects the heat better than dark-coloured clothing and helps to keep the body cool. Large-brimmed hats worn on hot sunny days provide shade for the head, face, and neck area. If safety headgear such as a hard hat is required, attaching a piece of light-coloured fabric to the back and side rim of the hat will provide shade for much of the neck area. Items attached to hard hats must not affect the integrity of the hard hat — for example, do not use glue or drill holes.

Wool clothing can help to minimize heat stress for work near radiant heat sources (such as boilers and kilns) and where the air temperature is higher than 35°C. Wool clothing deflects radiant heat away from the skin while allowing sweat to evaporate. In very hot climates with a lot of direct sun exposure, outdoor workers often wear wool hats to keep cool.

Note

Wear clean, light-coloured, loose-fitting clothing made of breathable fabric.

Post warning signs

Employers should consider posting heat stress hazard warning signs in indoor work areas where the heat exposure limits could be exceeded.

Personal protective clothing and equipment

In extremely hot environments — for example, near kilns — specialized heat-protective clothing may be required when the risk of heat stress is not adequately controlled by the methods described previously. This type of protective clothing can also be used in moderately hot environments to allow longer work periods between breaks. A proper assessment of all heat sources is required to determine which, if any, specialized clothing would be effective in reducing heat stress.

Specialized heat-protective clothing should be worn only by properly trained workers following the manufacturer's instructions. The clothing's effectiveness must be monitored through physiological measurements (e.g., of heart rate or body temperature). Heat-protective clothing may not provide a complete solution to the problem of heat stress, so precautions such as close supervision should be maintained until the effectiveness of the clothing is known.

There are two main types of specialized heat-protective clothing: temperature-controlled clothing and anti-radiant heat or reflective clothing.

Temperature-controlled clothing

Various types of temperature-controlled clothing are available, including air-cooled suits, water-cooled suits, and ice-cooled waistcoats. There are some practical limitations on the use of such equipment, especially when access to the working area is restricted.

Anti-radiant heat or reflective clothing

Anti-radiant heat or reflective clothing may be necessary where there is excessive radiant heat from a hot surface that cannot be otherwise covered or shielded (for example, from a boiler). This clothing is available in different forms, varying from aprons and jackets to suits that will completely cover the worker from the neck to the feet. These types of protective clothing protect only against radiant heat and provide little or no protection from high air temperatures unless the clothing is also temperature controlled.

Recognizing and treating heat-related illnesses

Where there is a risk of a heat-related illness, employers must inform their workers about the early signs and symptoms, such as excessive sweating, dizziness, and nausea. **If heat stress is not recognized and treated in the early stages, it can have serious effects on the body, such as heat cramps, heat exhaustion, or heat stroke, which can be life-threatening.**

However, since a decrease in alertness is one of the early symptoms, workers may not be able to recognize the development of heat stress in themselves. People should not work alone or unsupervised in conditions that have the potential to cause heat-related illnesses.

This section describes heat-related illnesses and how to recognize and treat them. The illnesses are presented in order of increasing severity. If workers show signs or report symptoms of heat-related illnesses, they should be removed from the hot environment and, if necessary, treated by an occupational first aid attendant or a physician.

Heat rash

Heat exposure can cause a rash or make existing skin problems worse. People working in hot, humid conditions may develop a rash that is often accompanied by intense itching spasms and prickly sensations. This is also known as prickly heat. Heat rashes are most likely to occur in areas where clothing traps hot, humid air next to the skin.

Prevention steps include the following:

- Avoid repeated exposure to heat.
- Change clothing often when sweating.
- Wear clean, light-coloured, loose-fitting clothing made of breathable fabric.

Signs and symptoms

- Rash or worsening of existing skin problems
- Intense itching
- Prickly sensations

Treatment

- Leave the hot environment, preferably until the rash has healed.
- Keep the affected areas clean, cool, and dry as much as possible.

Heat cramps

Heat cramps are painful muscle cramps caused by losing too much salt through sweating. They are usually the result of heavy exercise or physical work in a hot environment. Heat cramps usually occur in the muscles that have been used the most strenuously, such as those in the legs and abdomen. The cramps typically occur late in a workday or after the muscles have cooled (for example, during a shower after work).

It is important to distinguish heat cramps from the more common cramps that occur during strenuous work. Common cramps will be cured with rest and massage. Heat cramps, in contrast, are cured only after the lost salt has been replaced.

Signs and symptoms

- Muscular pain or spasms
- Excessive sweating

Treatment

- Move the worker to a cooler environment. If possible, lay the worker down and remove or loosen tight-fitting clothing.
- Cool the worker by sponging with cool water and fanning. Take care not to cool the worker too much. If the worker begins to shiver, stop cooling.
- If the worker is fully alert and not nauseated, provide oral fluids. Juice, non-caffeinated soft drinks, commercially available oral rehydrating solutions (sport drinks), or a solution of salt water (1 teaspoon of salt in 0.5 litres of water) are best. Alcoholic and caffeinated beverages are not recommended.

More importantly, continued work under conditions of heat stress can lead to heat exhaustion, a more serious illness (see next section). If a worker has cramps along with other symptoms, such as fatigue, weakness, headache, gastrointestinal illness, or changes in mental state, then the worker may already be suffering from heat exhaustion or heat stroke. These conditions are medical emergencies that need to be treated as such. (See the next two sections for more information.)

Heat exhaustion

Heat exhaustion is caused by depletion of both water and salt due to sweating during prolonged periods of exertion, when fluid replacement has not been sufficient to match losses. It is more serious than heat cramps, and the worker will have a number of other signs and symptoms.

Signs and symptoms

- Shallow respiration
- Increased respiratory rate
- Weak, rapid pulse
- Cool, pale, clammy skin
- Sweating

- Weakness, fatigue, dizziness
- Headache and nausea
- Fainting
- Muscle cramps

Signs and symptoms are the same as for mild shock. The presence of sweating is an important finding, because it is often the only way to differentiate heat exhaustion from the life-threatening heat stroke. If untreated, heat exhaustion may progress to heat stroke. Workers suffering from heat exhaustion should be transported to medical aid.

Treatment

- Move the worker to a cooler environment; if possible, lay the worker down and remove or loosen tight-fitting clothing.
- Cool the worker by sponging with cool water and fanning. Take care not to cool the worker too much. If the worker begins to shiver, stop cooling.
- If the worker is fully alert and not nauseated, provide oral fluids. Juice, non-caffeinated soft drinks, commercially available oral rehydrating solutions (sport drinks), or a solution of salt water (1 teaspoon of salt in 0.5 litres of water) are best. Alcoholic and caffeinated beverages are not recommended.

In most cases, the patient's symptoms will improve dramatically within 30 minutes. These patients should still be transported to medical aid.

Heat stroke

Heat stroke occurs when the body's mechanisms for heat dissipation are overwhelmed and fail. Heat stroke is a life-threatening condition in which the body's core temperature rises above 41°C. At core body temperatures over 41°C, sweating stops and the body is unable to get rid of heat, causing body temperature to continue to rise. The person's mental functions may become disturbed. Without immediate first aid, heat stroke can result in loss of consciousness, permanent brain damage, and death. Notify the first aid attendant, and arrange for transportation to medical aid immediately.

Note

Heat stroke is a medical emergency! Notify the first aid attendant, call 911, and/or arrange for immediate transportation to medical aid.

Heat stroke can come about relatively quickly or may be preceded by heat exhaustion (see page 18).

Signs and symptoms

- Hot, dry, flushed skin
- Absence of sweating
- Agitation, confusion
- Decreased level of consciousness
- Headache
- Nausea and vomiting
- Seizures
- Increased respiratory rate
- Irregular pulse rate
- Shock
- Cardiac arrest

The presence of hot, dry, flushed skin without any evidence of sweating is one of the important findings that differentiate heat stroke from other heat-related illnesses. Heat stroke can occur quickly and without warning.

Treatment

- Maintain airway, breathing, and circulation as required.
- Move the worker to the coolest place available.
- Lay the worker down on their back unless the worker is actively vomiting or having a seizure. In this situation, place them in the three-quarter prone or on-the-side position.
- Remove all outer clothing and apply cold water to the worker by either dousing or applying wet cool sheets. Spraying or sponging the entire body with cold water is also effective. Fanning will also help.
- If the worker is fully alert and not nauseated, provide oral fluids. Juice, non-caffeinated soft drinks, commercially available oral rehydrating solutions (sport drinks), or a solution of salt water (1 teaspoon of salt in 0.5 litres of water) are best. Alcoholic and caffeinated beverages are not recommended.
- Transport the worker to medical aid and continue to cool during transport.

Appendix: Key elements of a heat stress exposure control plan

Employers are required to develop and implement a heat stress exposure control plan (ECP) if a heat stress assessment determines that workers are exposed to conditions that may put them at risk of heat-related illnesses. Every workplace is unique, so as an employer you need to develop an ECP that is specific to your workplace.

An effective heat stress ECP would typically include the following elements:

1. **Statement of purpose.** The purpose of a heat stress ECP is to prevent harmful exposure of workers to heat.
2. **Responsibilities.** The ECP should include responsibilities for employers, supervisors, and workers. It should incorporate the following:
 - Employer responsibilities
 - Identify and assess areas, tasks, and occupations where there is the potential for heat stress.
 - Implement and/or provide controls (engineering, administrative, or personal protective equipment) to minimize heat stress.
 - Provide training and education regarding heat stress, including early signs and symptoms of heat-related illnesses.
 - Ensure there is adequate first aid coverage and that emergency procedures are in place.
 - Consider stopping work if workers cannot be protected from the risk of heat-related illnesses.
 - Supervisor responsibilities
 - Ensure workers are adequately instructed on heat stress signs, symptoms, and controls.
 - Direct work in a manner that eliminates or minimizes risk to workers.
 - Monitor workers for signs and symptoms of heat stress.
 - Ensure workers are aware of the requirement to stay hydrated and that they have access to cool, potable water.
 - Worker responsibilities
 - Participate in physiological monitoring if required.
 - Adhere to all control measures or work procedures that have been designed and implemented to reduce exposure to conditions that could cause heat stress.
 - If heat stress is not being adequately controlled, report this to the employer. Consider exercising the right to refuse unsafe work.
 - Monitor for and report signs and symptoms of heat-related illness (in the worker or in co-workers) to the supervisor or employer.

3. **Risk identification, assessment, and control.** The ECP should state the following:

- How the employer will determine those workers who may be at risk of heat-related illnesses.
- Who will conduct the heat stress assessments. (If specific individuals are not identified to conduct the assessments, this element should contain easy-to-read instructions outlining how to conduct a heat stress assessment and the methods of control that should be used.)
- How the heat stress hazard will be assessed (such as the measurements that will be used).
- What controls will be used to eliminate or minimize worker exposure to conditions that could cause heat stress, as well as when and how the controls will be implemented.

Refer to G7.29 of the OHS Guidelines for guidance on conducting a heat stress assessment and to guideline G7.30 for information on controlling risk.

4. **Education and training.** The ECP should describe training and education, initial and ongoing, that will be provided to all workers who work in areas, tasks, or occupations where there is a risk of heat stress.

It is important for workers to recognize the signs and symptoms of the early stages of heat stress. If heat-related illness can be addressed in the early stages, more serious illness can be avoided. Workers should be able to recognize the range of symptoms for different stages of heat stress in themselves and co-workers. However, since a decrease in alertness is one of the early symptoms, workers may not be able to recognize the development of heat stress in themselves.

The training and education material provided to workers should include the following information:

- How heat stress develops
- Types of heat-related illnesses (heat rash, heat cramps, heat exhaustion, and heat stroke)
- Signs and symptoms of heat-related illnesses
- Personal factors that increase the risk of heat-related illnesses, including the following:
 - Poor physical fitness
 - Obesity
 - Increased age
 - Dehydration
 - Pre-existing medical conditions and treatment (for example, diabetes or hyperthyroidism)
 - Short-term disorders and minor illnesses (for example, cold, flu, or diarrhea)
 - Chronic skin disorders (for example, rashes or dermatitis)
 - Use of medication that may inhibit sweating, reduce blood flow, or cause dehydration (for example, antihistamines)
 - Use of alcohol and/or street drugs
 - Previous heat illness
 - Lack of acclimatization

- First aid procedures for heat stress
- Safe work procedures for work in areas that pose a risk of heat stress
- The importance of staying hydrated
- The requirement to report signs or symptoms of heat-related illnesses to the employer
- Purpose and description of the heat stress monitoring program, as well as the benefits to the worker of participating in this program
- Proper use of protective clothing and equipment, if required

For workers exposed to environments that could cause heat stress, refresher training and education should be provided to ensure that workers remain knowledgeable about the above-mentioned items. Continuing education should be provided at least annually.

5. **Written procedures.** The employer should prepare written procedures for carrying out heat stress assessments, as well as for using control measures to minimize heat stress. (Examples of control measures include positioning and using supplemental fans for cooling, using and caring for radiant heat reflective clothing, or using vortex or ice-pack cooling suits.)

Note

Depending on the method used for assessing heat stress, additional elements (such as health monitoring and other documentation) may also be required as part of a heat stress ECP. For more information, see guideline G7.29.

