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BC Construction Safety Alliance

MANAGING HEAT STRESS AT WORK

Prevention Guidelines

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PREVENTION GUIDELINES

Heat stress can be a serious health emergency. These guidelines are to help employers to minimize the effects of excessive heat on workers who work in outdoor or indoor environments at high temperatures.

What is Heat Stress?

"Heat stress" is the net heat load on the body. It is partly caused by the temperature, but there are also other factors that contribute to heat stress. These include environmental conditions, demands of the work, clothing, and personal characteristics.

Environmental factors:

- Temperature
- Humidity
- Air velocity
- Radiant heat (either from the sun or from another source such as a furnace)

Job related factors:

- Work rate
- Physical effort required
- Type of clothing and protective equipment used
- Duration of work activity
- Frequency of breaks

Personal characteristics:

- Age
- Weight
- Physical fitness
- Heat acclimatization

All these factors need to be considered to minimize the risk to the worker, and to identify people and situations that are high risk.

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What is a Heat Disorder?

If the body is unable to cool itself, by sweating or increasing blood flow to the skin, the body temperature increases and the person experiences heat stress. There are a range of heat disorders that can result from heat stress which are outlined in greater detail below. Some of these heat disorders are very serious and potentially fatal.

HEAT DISORDERS	CAUSE	SYMPTOMS	TREATMENT	PREVENTION
HEAT RASH	Hot humid environment; plugged sweat glands.	Red bumpy rash with severe itching.	Change into dry clothes and avoid hot environments. Rinse skin with cool water.	Wash regularly to keep skin clean and dry.
HEAT CRAMPS	Heavy sweating from strenuous physical activity drains a person's body of fluid and salt, which cannot be replaced just by drinking water.Heat cramps occur from salt imbalance resulting from failure to replace salt lost from heavy sweating.	Painful cramps occur commonly in the most worked muscles (arms, legs or stomach); this can happen suddenly at work or later at home. Heat cramps are serious because they can be a warning of other more dangerous heat-induced illnesses.	Move to a cool area; loosen clothing, gently massage and stretch affected muscles and drink cool salted water (1½ to 2½ mL salt in 1 litre of water) or a balanced commercial fluid electrolyte replacement beverage. If the cramps are severe or don't go away after salt and fluid.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.
FAINTING	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.	Sudden fainting after at least two hours of work; cool moist skin; weak pulse.	GET MEDICAL ATTENTION. Assess need for cardiopulmonary resuscitation (CPR). Move to a cool area; loosen clothing; have the person lie down; and if the person is conscious, offer sips of cool water. Fainting may also be due to other illnesses.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Move around and avoid standing in one place for too long. Workers should check on each other to help spot the symptoms that often precede heat stroke.
HEAT EXHAUSTION	Fluid loss and inadequate salt and water intake causes a person's body's cooling system to start to break down.	Heavy sweating; cool moist skin; body temperature over 38°C; weak pulse; normal or low blood pressure; person is tired and weak and has nausea and vomiting; is very thirsty; or is panting or breathing rapidly; vision may be blurred.	GET MEDICAL ATTENTION. This condition can lead to heat stroke, which can cause death quickly. Move the person to a cool shaded area; loosen or remove excess clothing; provide cool water to drink; fan and spray with cool water. Do not leave affected person alone.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.
HEAT STROKE	If a person's body has used up all its water and salt reserves, it will stop sweating. This can cause body temperature to rise. Heat stroke may develop suddenly or may follow from heat exhaustion.	High body temperature (over 41°C) and any one of the following: the person is weak, confused, upset or acting strangely; has hot, dry, red skin; a fast pulse; headache or dizziness. In later stages, a person may pass out and have convulsions.	CALL AMBULANCE. This condition can kill a person quickly. Remove excess clothing; fan and spray the person with cool water; offer sips of cool water if the person is conscious.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms that often precede heat stroke.

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Prevention

There are things you can do to feel more comfortable and prevent heat stress:

- Familiarize yourself with the signs and symptoms of heat stress in yourself & co-workers. Avoid working alone.
- Stay hydrated and drink plenty of water frequently (every 20 minutes) throughout the day. Avoid dehydrating beverages such as coffee and alcohol.
- Acclimatize your body (gradually expose yourself to heat and work) especially if you are a new & young worker.
- Wear clean, light-coloured, loose fitting clothing made of breathable fabric.
- Take rest breaks in a cool or well-ventilated area. Take more breaks during the hottest part of the day or when doing hard physical work. Allow your body to cool down before beginning again.
- Schedule work to minimize heat exposure. Do the hardest physical work during the coolest part of the day.
- Lather on sunscreen very frequently. Wear sunglasses and hats when possible.
- Have a shift-buddy to check in for symptoms of heat stress. Talk to each other and look for slurred words and/or confusion.

For more information on Heat Stress, visit WorkSafeBC or go here:

Regulatory Requirements:

There is no maximum temperature limit in the regulations because heat stress is also influenced by job and personal characteristics. There are two commonly used methods for assessing the risk posed by different environmental and work factors. One is based on Wet Bulb Glove Thermometer (WBGT) measurements, and the other is based on Humidex.

Wet Bulb Globe Thermometer (WBGT)

To determine acceptable temperature levels in the workplace, WorkSafeBC uses Wet Bulb Globe Temperature (WBGT) as the standard measure for heat. The WBGT is not the same as the ambient (dry) temperature, as it is a composite temperature which takes into account the levels of radiation, wind movement, humidity and the ambient temperature and is measured using specialized thermometers. These measurements should be completed by a qualified person.

As the WBGT and physical work demands increase, work schedules may be modified to provide rest/recovery periods. Note that a recovery period does not necessarily mean a complete break from work but could include resting or performing light physical activities.

The American Congress of Governmental industrial Hygienists (ACGIH) have provided recommended screening criteria for heat stress exposure in workers. They have also recommended a work/rest cycle for different WBGT measurements and workload levels (light, moderate, heavy, or very heavy). The recommended work/rest cycles range from 75-100% work and 25-0% rest at lower risk levels, to 0 – 25% work and 75-100% rest at higher risk levels. They have recommended both a 'threshold limit value' or TLV where the exposure to heat is too great, and an 'action limit.'

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ACGIH SCREENING CRITERIA FOR HEAT STRESS EXPOSURE (WBGT VALUES IN °C) FOR 8-HOUR WORKDAY FIVE DAYS PER WEEK WITH CONVENTIONAL BREAKS								
ALLOCATION OF WORK IN A WORK/REST CYCLE	TLV®				ACTION LIMIT			
	LIGHT	MODERATE	HEAVY	VERY HEAVY	LIGHT	MODERATE	HEAVY	VERY HEAVY
75-100%	31.0	28.0	-	-	28.0	25.0	-	-
50-75%	31.0	29.0	27.5	-	28.5	26.0	24.0	-
25-50%	31.0	30.0	29.0	28.0	29.5	27.0	25.5	24.5
0-25%	31.0	31.5	30.5	30.0	30.0	29.0	28.0	27.0

NOTES:

Assumes 8-hour workdays in a 5-day workweek with conventional breaks.

The TLV or Threshold Limit Value is the level at which the worker is overexposed to heat.

The Action Limit is the level at which the worker is at risk of overexposure and actions should be taken to reduce risk.

The above table assumes that workers exposed to these conditions are adequately hydrated, are not taking medication, are wearing lightweight clothing, and are in generally good health.

See the TLV® booklet for more guidance notes and documentation.

Examples of work loads:

Rest - sitting

Light work - sitting or standing to control machines; performing light hand or arm work (e.g., using a table saw); occasional walking; driving.

Moderate work - sustained moderate hand and arm work; light pushing or pulling; walking at a moderate pace; or moderate arm, leg, and trunk work.

Heavy work – intense arm and trunk work; pick and shovel work, digging, carrying, pushing/pulling heavy loads; walking at fast pace.

Very Heavy - very intense activity at fast to maximum pace

Adapted from: 2017 TLVs® and BEIs® - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2017, p.238.

Humidex

Another simpler way to assess potential exposure to heat is to use the Humidex, which involves using temperature and humidity measurements and a Humidex calculator. Weather stations can provide accurate readings for outdoor temperature and humidity. Environment Canada reports Humidex values for many cities in Canada: **https://weather.gc.ca/forecast/canada/index_e.html?id=BC** . This outdoor reading should be used as a guideline for indoors and would generally considered the "worst case scenario" as indoor temperature and humidity levels are typically lower than outdoors. The humidex can only be used to assess exposure to heat stress from environmental sources of heat. It cannot be used when industrial sources of heat or humidity are present.

The Occupational Health Clinics for Ontario Workers (OHCOW) provides a useful Humidex Calculator **https://www.ohcow.on.ca/edit/files/general_handouts/humidex_calculator.html** and a response guide (see next page) for protecting workers from heat stress.

The table below is based on the exposure limits in wet bulb globe temperatures (WBGT) to estimate heat strain and translated into Humidex. Most healthy, well-hydrated, acclimatized workers not on medications, will be able to tolerate heat stress up to the exposure limit. Humidex 1 should be used for workers with moderate workloads and Humidex 2 for workers with light workloads. Between Humidex 1 and Humidex 2, general heat stress controls are needed and above Humidex 2 job-specific controls are needed.

HUMIDEX 1 (°C)	RESPONSE	HUMIDEX 2 (°C)
25 - 29	• supply water to workers on an "as needed" basis	**32 - 35**
30 - 33	• post Heat Stress Alert notice • encourage workers to drink extra water • start recording hourly temperature & relative humidity	**36 - 39**
34 - 37	• post Heat Stress Warning notice • notify workers that they need to drink extra water • ensure workers are trained to recognize symptoms	**40 - 42**
38 - 39	• work within 15 minutes relief per hour can continue • provide adequate cool (10-15°C) water • at least 1 cup (240mL) of water every 20 minutes • worker with symptoms should seek medical attention	**38 - 39**
40 - 41	• work within 30 minutes relief per hour can continue in addition to the provisions listed previously	**40 - 41**
42 - 44	• If feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above	**42 - 44**
45 OR OVER	• only medically supervised work can continue	**50 OR OVER**

Source: Ontario Ministry of Labour Health and Safety Guidelines: Heat Stress (June 2014)

For more information on Humidex, please refer to the OHCOW:
https://www.ohcow.on.ca/posts/heat-stress-humidex-response-plan/

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Personal Protective Equipment

Clothing can contribute to heat stress and personal protective equipment (PPE) is no exception. Clothing; including coveralls, boots, and gloves; can reduce the body's ability to cool itself. Respirators and masks can increase the effort required to breathe and can reduce the cooling effect of sweating underneath the mask. Take the use of PPE into consideration when creating heat-stress mitigation procedures.

If a worker is exhibiting signs of heat stress, removing clothing may be necessary to help them cool down and recover. It may be appropriate to remove the clothing and/or PPE. A first aid attendant can determine if this is appropriate.

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