



Heat Stress Prevention Guide

Last update: June 2023

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INTRODUCTION

The purpose of this guide is to provide information about the health risks associated with working in extreme heat, ways to assess an environment for heat stress, and control measures that can be included in a heat stress control plan. As with any health hazard, heat-related illnesses, which are referred to generally as heat stress, are preventable and manageable.

High temperatures can leave workers at risk of developing heat-related illnesses, including heat exhaustion and heat stroke. **Heat stroke can be life-threatening and is considered a medical emergency.** Any heat illness is a negative outcome for a worker's health and can have a significant impact on a worker's performance. Employers must take every reasonable precaution to protect the health and safety of workers which includes planning to reduce the risk of heat stress.

Outdoor workplaces with high physical demands have traditionally been of highest concern for heat stress like construction sites, farms, and road building. Indoor workplaces that require heat sources like kitchens, bakeries, greenhouses and foundries are also of highest concern. In addition, climate change has resulted in trends of increased hot weather events that impact all Islanders. Heat waves and periods of extended high temperatures heighten the concerns of heat stress in outdoor and indoor work environments. Extreme weather also extends heat stress concerns to work in buildings that lack adequate cooling systems.

This guide provides summary information on heat stress prevention. It does not address all workplace health and safety legislation. Always refer to the PEI *Occupational Health & Safety Act* or Regulations for requirements that apply to your specific workplace.

For additional support, please contact:

Workers Compensation Board (WCB)
Occupational Health and Safety (OHS) Division
ohs@wcb.pe.ca
902-368-5680 or toll-free in Atlantic Canada 1-800-237-5049
24-Hour OHS Emergency Line 902-628-7513

For additional resources, visit our website at wcb.pe.ca and download our **Guide to OHS Legislation App** available for iOS and Android.



LEGISLATIVE REQUIREMENTS

Employers have a duty under Section 12 of the *Occupational Health and Safety Act* (OHS Act) to take every reasonable precaution to ensure the health and safety of persons at or near the workplace. This includes establishing and implementing policies and procedures for hot environments.

Part 42.1 of the OHS Act General Regulations states that an employer must comply with the heat and cold exposure Threshold Limit Values (TLVs) as established by the American Conference of Governmental Industrial Hygienists (ACGIH).

Section 36 of the OHS Act states that serious workplace injuries must be reported to the WCB's OHS Division by the fastest means available within 24 hours. Severe symptoms of heat stroke include unconsciousness. Unconsciousness is considered a serious injury and as such, employers have a duty to report this to the WCB.



WHAT IS HEAT STRESS

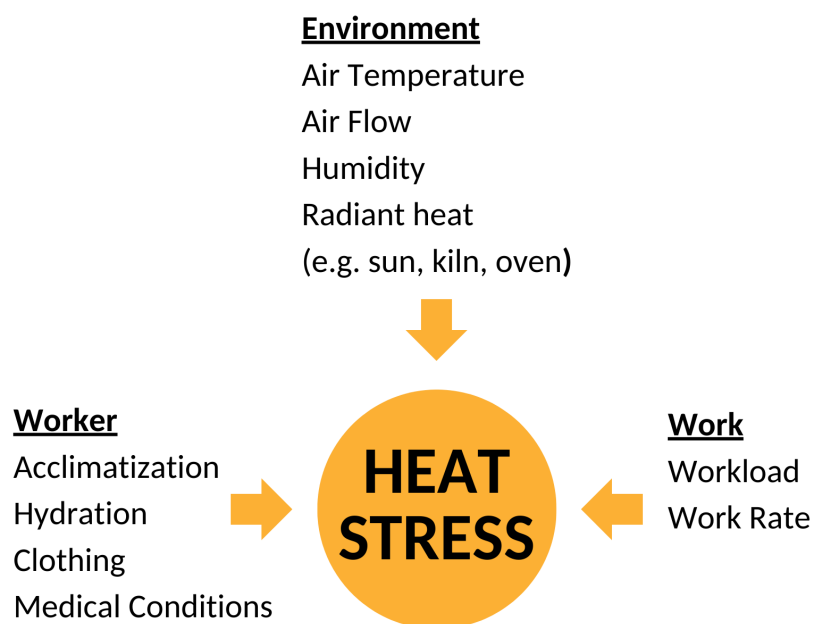
Heat stress is the buildup of heat in the body to the point where the body's thermostat has difficulty maintaining normal internal body temperature. When the body is unable to cool itself through sweating, serious heat illnesses may occur. **The most severe heat-related illnesses are heat exhaustion and heat stroke.** If actions are not taken to treat heat exhaustion, the illness could progress to heat stroke and possibly death.

Heat stress signs and symptoms tell you that something needs to be done to balance your body's heating and cooling system. As your body heats up, it tries to rid itself of excess heat through the evaporation of sweat. If it is unable to cool itself by sweating, your body temperature will increase. When body temperature gets above 38-39°C, the brain starts to overheat, leading to a shutdown of your body's cooling system and sweating stops. Your temperature now rises even faster, leading to heat stroke and possibly death.

PRIMARY FACTORS CONTRIBUTING TO HEAT STRESS

Generally speaking, the primary contributing factors to heat stress are the environment, the worker and the work. See Figure 1. A heat stress control plan will consider all primary factors, not just the work environment. Controls to address these factors can help to reduce the risk of heat-related illnesses.

Figure 1



HOW IS HEAT STRESS MEASURED

There are two common methods for determining the heat stress in the workplace:

- **Wet-Bulb Globe Temperature (WBGT) Index** - This method is the best practice for assessing risks for physical work in hot environments. It uses thermal stress Threshold Limit values (TLVs) which form the basis of PEI regulatory requirements for extreme temperatures. This method is the most precise, but it is not common in many workplaces due to the cost and the knowledge required to interpret the measurements.
- **Humidex Values** - This method is more common as most people are familiar with the concept of the humidex. The humidex, also known as the “feels like” temperature from heat and humidity, provides an accessible way to help manage the risks associated with hot work environments, although the measurements are less precise.

The Wet-Bulb Globe Temperature (WBGT) Index

In Prince Edward Island, thermal stress Threshold Limit Values (TLVs) are used to assess heat stress in the workplace. As part of the TLV screening procedure, WBGT readings must be taken. The WBGT thermometer factors in the air temperature, radiant heat (e.g., sun, kiln, oven), air movements and humidity. See Figure 2.

Figure 2



The criteria for working in heat related conditions can be difficult to interpret, especially since WBGT devices are not commonly available in most workplaces and often require specialized expertise to conduct accurate readings. To be done properly, the person taking the readings must be knowledgeable in the method and understand how to interpret the reading charts. For these reasons, it is prudent to enlist professional judgement when making initial decisions about heat stress control plans if the workplace involves hot processes.

WBGT measures the environment only. It is important to note that WBGT measures are typically lower than temperatures taken by a regular thermometer. For example, a WBGT reading of 31°C is a significantly hotter environment than a 31°C day

After taking a WBGT reading, the values will need to be adjusted to factor in non-environmental contributors of heat stress to be accurate, such as:

- Clothing that limits a worker’s ability to cool down will add to a worker’s heat stress. Clothing such as polyolefin coveralls can add 1°C to the WBGT and vapour-barrier coveralls can add up to 11°C to the WBGT.
- The physical work demands and resulting metabolic rate also contribute to the risk of heat stress. For more demanding work, higher adjustments are required.

Table 1 provides guidance on applying adjusted WBGT readings to the level of work demand to identify work-rest cycles to help workers recover from heat stress conditions.

Table 1 - Screening Criteria for TLV and Action Limit for Heat Stress Exposure

Allocation of work in a cycle of work and recovery	TLV (WBGT values in °C)				Action Limit (WBGT values in °C)			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75 to 100%	31.0	28.0			28.0	25.0		
50 to 75%	31.0	29.0	27.5		28.5	26.0	24.0	
25 to 50%	32.0	30.0	29.0	28.0	29.5	27.0	25.5	24.5
0 to 25%	32.5	31.5	30.5	30.0	30.0	29.0	28.0	27.0

The allocation of work in a cycle of work and recovery refers to the ratio of time spent working in the work cycle. For example, if the allocation of work is 75 to 100% and the work cycle is 60 minutes, this translates into 45 to 60 minutes of work in that period.

The TLVs in Table 1 refer to the **maximum exposure limits** in OHS regulations using WBGT values for the type of work. Appropriate plans must be in place based on these limits.

Action limits are recommendations where heat stress control plans should be in place as proactive preventative measures

Humidex Values

Humidex is a measure of the combined effects of warm temperatures and humidity. It provides a number that describes how hot people feel, much in the same way the equivalent chill temperature, or wind chill factor, describes how cold people feel.

The Occupational Health Clinics for Ontario Workers Inc. (OHCOW) created a humidex-based response plan that translates the TLVs and WBGT estimates of heat strain to response tables. The OHCOW tables rely on measurements of temperature and humidity within the work environment, not to be confused with Environment Canada general humidex warnings.

The humidex values can be used in indoor or outdoor work environments. If applicable, adjustments for clothing and radiant heat, like direct sunlight, should be made. Humidex tables, such as Table 2 on the next page, are divided into action ranges for the following categories:

- **Humidex 1** is for non-acclimatized workers doing moderate work like workers who do not regularly work around heat sources, and acclimatized workers doing heavy work. The controls for workers who fall into the Humidex 1 response plan include:
 - Training in heat stress.
 - Encouraging adequate fluid replacement.
 - Permitting self-limitation of exposure.
 - Encouraging watching out for symptoms in co-workers.
 - Adjusting expectations for workers coming back to work after an absence.
- **Humidex 2** is for acclimatized workers doing moderate work or unacclimatized workers doing light work. The controls for workers who fall into the Humidex 2 response plan include the general controls listed in Humidex 1, as well as job-specific controls, such as:
 - Engineering controls to reduce physical job demands.
 - Shielding of radiant heat.
 - Increasing air movement.
 - Reducing heat and moisture emissions at the source.
 - Adjusting exposure times to allow sufficient recovery.
 - Personal protective equipment (PPE) that provides for body cooling.



Table 2 - Humidex Based Heat Response Plan

Humidex 1	Response	Humidex 2
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 and 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 with 15 minutes relief per hour can continue; provide adequate cool (10-15°C) water; at least 1 cup (240 mL) of water every 20 minutes worker with symptoms should seek medical attention	43 – 44
40 – 41	work with 30 minutes relief per hour can continue in addition to the provisions listed previously;	45 – 46*
42 – 44	if feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above.	47 – 49*
45 or over	only medically supervised work can continue	50* or over

Humidex calculator: http://www.ohcow.on.ca/edit/files/general_handouts/heat-stress-calculator.html

***at Humidex exposures above 45, heat stress should be managed as per the ACGIH TLV®**

Humidex Reader

To assess the humidex, workplace temperature must be measured with a humidex reader, or thermal hygrometer. See Figure 3. These are inexpensive and can be purchased at most hardware or office-supply stores. However, make sure to avoid placing them in direct sunlight or in contact with hot surfaces.

Figure 3



SUSCEPTIBILITY TO HEAT STRESS

Susceptibility to heat stress varies depending on the individual and the conditions.

- Some workers may be more vulnerable to heat stress because of an underlying health condition.
- New and inexperienced workers are at higher risk of developing heat-related illness because their bodies have not had time to become accustomed to working in the heat.
- Particular attention should be focused on work that involves strenuous physical labour.
- Even lower temperatures with high humidity conditions can present a heat stress condition, depending on a worker's individual susceptibility or the physical demands of a job.

It is important to recognize the signs and symptoms of heat stress disorders and to take appropriate immediate action.

DEVELOPING A HEAT STRESS CONTROL PLAN

Employers must assess the heat stress of the work environment prior to developing a heat stress control plan. If the WBGT readings or the humidex levels require action, the plan must be put into place to reduce the risk of heat stress. A heat stress control plan must include training for employers, supervisors, and workers on the effects of heat on the body, the signs and symptoms of heat-related illness, and the control measures the workplace has in place to help prevent heat-related illness.

Training should include the following information:

- How heat stress develops.
- Personal risk factors and acclimatization.
- Controls to prevent heat stress.
- How to recognize signs and symptoms.
- What a worker should do if they, or a co-worker, develops a heat disorder.

Personal Risk Factors

Personal risk factors for heat stress include being new to the job, prior history of heat stroke, repeated heat exhaustion, cardiac or kidney disease, pregnancy, obesity, older age, and certain medications. It is recommended that workers with personal risk factors consult a health care provider prior to working in a hot environment.

Control Measures

Engineering Controls

The most effective control measure an employer can provide is an engineering control to reduce the risk of heat stress. Engineering control isolates people from the hazards. The following are some examples of engineering controls for hot work environments.

- Providing air conditioning or ventilation to remove hot air.
→ Do not use fans when a thermometer reads 35°C as it can increase the heat load.
- Reducing humidity.
- Installing spot cooling in hot work areas.
- Insulating or shielding hot surfaces to reduce radiant heat.
- Eliminating heavy work or the physical demands of the job by using alternative equipment or methods.

Administrative Controls

When engineering controls are not practicable, like when work is done outdoors during the summer months, administrative controls must be considered. Administrative control changes the way that people work. A combination of engineering and administrative controls are often needed to effectively protect workers from heat stress. The following are some common administrative controls used to reduce the risk of heat stress.



Acclimatization

Acclimatization is the improvement in heat tolerance that comes from gradually increasing the intensity or duration of work performed in a hot setting. Deaths from heat stress often occur during the first few days on the job and among new or less experienced workers who are not acclimatized. A sudden increase in temperature, like during a heat wave, also leaves workers at greater risks of heat-related illness. A heat stress control plan that accounts for acclimatization can reduce the risks.

Introducing workers to physical activity for 1 to 2 hours during heat-stress conditions is a way to acclimatize a worker. A worker is considered acclimatized when their recent work history has included at least 2 continuous hours of work within the hot condition for 5 of the last 7 days, or for 10 of the last 14 days. More strenuous or longer tasks require more acclimatization.

- Acclimatized workers will sweat more, eliminate less salt in their sweat, and overall be able to better withstand heat stress conditions.

Other Administrative Controls

- Schedule the hardest physical tasks for the coolest part of the day and the slower-paced work during the hottest parts of the day. Supervisors can also rotate work activities or use additional workers to reduce heat exposure for each member of the work crew.
- Supervise workers. Create a buddy system and train workers to watch for the first signs and symptoms of heat stress.
- Set up a check-in or monitoring procedure for workers in heat stress conditions. Monitoring could include measuring core body temperature and heart rates.
- Provide an air-conditioned area for workers during rest breaks.
- Provide shaded work areas and/or shaded break areas for workers.
- Provide water and encourage workers to drink it. As a starting point, workers should drink about two glasses (500 ml) of water before starting work in a hot environment and one glass (250 ml) every 20 minutes throughout the workday. Workers should not wait until they are thirsty to replace fluids.
- Encourage workers to consume food and drinks that contain electrolytes.
 - Salt tablets are NOT recommended because they take a long time to be absorbed by the body.
 - Fluids that contain caffeine or alcohol are not suitable because they increase dehydration.

Personal Protective Equipment (PPE) and Clothing

There is specialized clothing and PPE designed for work in heat conditions - heat shielding and cooling clothing. Heat shielding clothing may be necessary where there is excessive heat from a hot process or surface like welding gloves, arc flash protective equipment, aprons to work nearby kilns, etc. Clothing can be used to help cool a worker in a heat stress condition too. Examples of this would be air-cooled suits, water-cooled suits, or ice vests.

There are some practical limitations when using heat shielding and cooling clothing. These options should be considered on a case-by-case basis.

Any heat retention caused by PPE required for a job should be reviewed when planning for work under heat stress conditions. It is important to note that adjustment must be made to the WBGT reading or humidex values used for assessing heat conditions for workers wearing for waterproof clothing.

For working outside in the sun, wear clean, light coloured, loose-fitting clothing made of breathable fabric. Large-brimmed hats that provide shade for the head, face, and neck area are great options but must not affect the integrity of a hard hat, where necessary.

See the WCB's [Prevention Update on Solar Radiation \(Sun Exposure\)](#) for more information.

HEAT STRESS SIGNS AND SYMPTOMS

It is important for workers to recognize the early signs and symptoms of heat stress and to understand the first aid required for heat-related illnesses. If workers can 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 signs and 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.



Heat Stroke

It is particularly important to watch for the signs and symptoms of heat stroke. If a worker has a body temperature above 41°C and any of the following they may be experiencing heat stroke: the person is weak, confused, upset, or acting strangely; has hot, dry, red skin; has a fast pulse; has a headache or dizziness; passes out or has convulsions. The worker should be removed from the hot environment and made to rest in a cool location with rapidly circulating air and kept under constant observation.

**Heat stroke is a medical emergency. Call 9-1-1.
Taking immediate action may save the person's life.**

As you wait for medical help to arrive, cool the person by whatever means available. For example:

- Take the affected worker to a cooler area in the shade, in an air-conditioned space or have fans blow directly on the worker.
- If the person is conscious, offer chilled water, or a sports drink containing electrolytes.
- Take off excess clothing like hard hats, boots, shirts, coveralls, etc.
- Place ice or cold wet towels on the head, neck, trunk, armpits, and groin.

Other Heat-Related Illnesses

Never ignore signs or symptoms of heat-related disorders as shown in Table 3, on the next page.



Table 3 - Heat-related illnesses, causes, signs and symptoms, and treatment

Heat-related illness	Causes	Signs and Symptoms	Treatment
Heat Fatigue	Generally due to the individual not being used to working in heat	Impaired performance of skills, of mental concentration, or vigilance	Rest in a cool place, drink cool fluids, and loosen clothing
Heat Rashes	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
Sunburn	Too much exposure to the sun	Red, painful, or blistering and peeling skin	If the skin blisters, seek medical attention, use skin lotions but avoid topical anesthetics, and work in the shade
Heat Cramps	Heavy sweating drains a person's body of salt which cannot be replaced just by drinking water	Painful cramps in arms, legs or stomach that occur suddenly at work or later at home. Heat cramps are serious because they can be a warning sign of other more dangerous heat-related illnesses	Move to a cool area, loosen clothing and drink an electrolyte replacement beverage. If the cramps are severe or don't go away, seek medical attention.
Fainting	Fluid loss and inadequate water intake	Sudden fainting after at least two hours of work, cool moist skin, weak pulse	GET MEDICAL ATTENTION Assess the need for CPR, move to a cool area, loosen clothing, make the person lie down, and when the person is conscious, offer sips of cool water. Fainting may also be due to other illnesses.
Heat Exhaustion	Fluid loss and inadequate salt and water intake causes the body's cooling system to start to break down	Heavy sweating, cool, moist skin, body temperature above 38°C, weak pulse, normal or low blood pressure, tired and weak, nausea and vomiting, very thirsty, panting or breathing rapidly, blurred vision	GET MEDICAL ATTENTION This condition can lead to heat stroke, which can lead to death. Move the person to a cool shaded area, loosen or remove excess clothing, provide cool water to drink, fan and spray with cool water.
Heat Stroke CALL 911 This is a medical emergency	If a person's body has used up all its water and salt reserves, it will stop sweating, which can cause body temperature to rise. Heat stroke may develop suddenly or may follow from heat exhaustion	Body temperature above 41°C and any of the following: the person is weak, confused, upset, or acting strangely; has hot, dry, red skin; has a fast pulse; has a headache or dizziness; and in later stages, a person may pass out and have convulsions.	CALL 911 This condition can quickly lead to death. Remove excess clothing, fan and spray the person with cool water, offer sips of cool water, if the person is conscious.

Appendix A – Heat Stress Poster

Poster can be downloaded and printed from the QR code below or from our website wcb.pe.ca

HEAT STRESS

Heat Exhaustion	Heat Stroke
Faint or dizzy	Throbbing headache
Excessive sweating	No sweating
Cool, pale, clammy skin	Body temperature above 39°C Red, hot, dry skin
Nausea or vomiting	Nausea or vomiting
Rapid and weak pulse	Rapid and strong pulse
Muscle cramps	May lose consciousness

Get to a cooler, air conditioned place

- Get to a cooler, air conditioned place
- Drink water if fully conscious
- Take a cool shower or use cold compresses

Call 9-1-1

- Take immediate action to cool the person until help arrives

Download our Heat Stress Prevention Guide



LEARN MORE AT WCB.PE.CA



To report a serious workplace injury, call the 24/7 Occupational Health and Safety Emergency Line at 902-628-7513

June 2023

Appendix B – Heat Stress Self-Audit Checklist

A self-audit can determine what mechanisms and practices your workplace has in place to address heat stress. It also indicates which programs or practices may be deficient and require attention.

Areas of the workplace	Items
Leadership See the following section(s) of the guide: Legislative Requirements	Written heat stress policy and control plan
	Responsibilities and accountabilities identified for the: <input type="checkbox"/> Employer <input type="checkbox"/> Supervisor <input type="checkbox"/> Safety Committee or Safety Representative
	Accident or incident reports
	Absentee rate, employee complaints, medical records
	Evaluation of overall program effectiveness
	Compliance with standards and procedures
Employee Training What is heat stress Primary factors contributing to heat stress Heat-related illnesses, causes, signs and symptoms and treatment Control measures Leadership (see above)	What is heat stress
	Signs, symptoms and health effects
	Personal risk factors
	Monitoring heat stress signs and symptoms
	Providing first aid treatment for heat stroke
	Actions to be taken for controlling heat stress
	Heat stress policy and control plan
	Controls as established—engineering, administrative, works practices, personal protective equipment (PPE)
Reporting procedures	
Monitoring How is heat stress measured Can workplaces use humidex values	Identification of potential heat hazards and jobs at risk
	Weather as a trigger
	Type of testing (WGBT/Humidex/Other)
	Testing frequency
	Workload categories for jobs
	Clothing insulation values
Comparison of monitoring results to acceptable standards	
Controls Preventing heat stress Control measures Heat-related illnesses are preventable	Controls—like shielding heat sources, ventilation, fans, air conditioning, reducing metabolic workload, acclimatization, work scheduling, rotation, work/rest regimen, water, PPE, etc.
	Consider additional measures of core body temperature and heart rate