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CITY OF KAMLOOPS

# SP15 – Heat Stress



## Supplementary Program – Document Version Control

DOCUMENT TITLE:	SP15 – HEAT STRESS			
DOCUMENT TYPE:	SUPPLEMENTARY PROGRAM			
ORIGINATING AUTHOR:	CALEB MIERAU			
DATE ORIGINATED:				
REVIEW AND REVISION HISTORY / PROGRESS				
DOCUMENT EVENT	DATE:	REVIEWED BY:	MODIFIED? (YES/NO)	COMMENTS / SUMMARY OF CHANGES
REVIEW COMPREHENSIVE REVISION	SEPT 2020	CALEB MIERAU	YES	COMPLETE PROGRAM REWRITE ADDITION OF HUMIDEX
JHSC CONSULT DATE: OCT 2020		STAKEHOLDERS CONSULTED: JHSC / SUPERVISORS / MANAGERS		
DOCUMENT EVENT	DATE:	REVIEWED BY:	MODIFIED? (YES/NO)	COMMENTS / SUMMARY OF CHANGES
REVIEW COMPREHENSIVE REVISION	JUNE 23 2021	CALEB MIERAU	NO	NO CHANGES
JHSC CONSULT DATE:		STAKEHOLDERS CONSULTED:		
DOCUMENT EVENT	DATE:	REVIEWED BY:	MODIFIED? (YES/NO)	COMMENTS / SUMMARY OF CHANGES
REVIEW COMPREHENSIVE REVISION				
JHSC CONSULT DATE:		STAKEHOLDERS CONSULTED:		
DOCUMENT EVENT	DATE:	REVIEWED BY:	MODIFIED? (YES/NO)	COMMENTS / SUMMARY OF CHANGES
REVIEW COMPREHENSIVE REVISION				
JHSC CONSULT DATE:		STAKEHOLDERS CONSULTED:		
DOCUMENT EVENT	DATE:	REVIEWED BY:	MODIFIED? (YES/NO)	COMMENTS / SUMMARY OF CHANGES
REVIEW COMPREHENSIVE REVISION				
JHSC CONSULT DATE:		STAKEHOLDERS CONSULTED:		

# SP15 – Heat Stress

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## PURPOSE

This program is designed to prevent heat exposure and, if not practicable, minimize workers' heat exposure to eliminate the risk of heat disorders while performing work tasks. Heat stress is a general name for several medical conditions such as heat exhaustion, heat cramps (muscle pain or spasms) and heat stroke, caused by working in hot areas.

## SCOPE

This program applies to all City of Kamloops workers and visitors, including contractors, who may be exposed to heat stress conditions in the workplace. All City of Kamloops workers, especially those who work outdoors or in vehicles during the summer months, should be knowledgeable about the Heat Stress Exposure Plan.

## DEFINITIONS

(For purposes of this program and as defined by WorkSafeBC regulation)

Acclimatization	A process by which the body modifies its own functions to cope more effectively and efficiently with heat stress. Typically 5 to 15 days.
Administrative Controls	Methods of changing the way that work in a job is assigned or scheduled to reduce exposure to various hazards.
Calorie (=kilocalorie / kcal)	The amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C). This measure is used to categorize activities into light, moderate and heavy.
Conduction	The transfer of heat between materials in contact with each other. Heat passes from the warmer material to the cooler material.
Convection	The transfer of heat by the bulk movement of a fluid such as water or air from a hot region to a cold region.
Dry Bulb Temperature	Temperature measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, shielded from direct radiant energy
Engineering Controls	Methods and equipment designed and installed into a plant or process to prevent development of a hazardous condition by eliminating contact of the worker with the hazard.
Evaporative Cooling	Takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

Globe Temperature	Temperature measured by a thermometer with its sensor inside a matte black globe, exposed to radiant heat.
Heat Cramp	A condition usually caused by performing hard physical labour in a hot environment. Cramps may be attributed to an electrolyte imbalance caused by sweating.
Heat Exhaustion	A condition preceding heat stroke that may include headache, nausea, vertigo, weakness, thirst and giddiness. Although not as serious as heat stroke, it is treated as a medical emergency.
Heat Stress	The process in which a person's body gains heat faster than it removes heat resulting in a rise in body temperature. Health problems resulting from heat stress are known as heat disorders including heat cramps, heat exhaustion and heat stroke.
Heat Stroke	This occurs when the body's system of temperature regulation fails and body temperature rises to critical levels (over 41°C). This is the final stage of heat stress and may be fatal if signs and symptoms are not recognized early enough and medical aid is delayed.
Humidex	Combines the effect of air temperature and relative humidity to describe the body's perception of a hot environment (i.e. how hot the weather feels).
Natural Wet Bulb Temperature	Temperature measured by a thermometer that has its sensor covered by a wetted cotton wick for measurement of the effects of evaporation and convection. The term "natural" refers to the movement of air around the sensor.
Radiant Heat	The transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.
Reflective Clothing	A type of clothing that protects workers from radiant heat, also known as Anti-Radiant Heat Clothing.
Ultraviolet Light (UV light)	Electromagnetic radiation with a wavelength from 10 nm to 400 nm, shorter than that of visible light but longer than X-rays.
Unacclimatized Worker	A worker who is not accustomed to working in a hot environment or who has been out of a hot environment for seven consecutive days.
WBGT°C	Wet Bulb Globe Temperature in Celsius, this unique temperature measurement unit combines air temperature, humidity, airflow and radiant heat into a single value. This measurement is used to

assess the risk of heat stress disorders. A special Heat Stress instrument is required to take the measurement.

## RESPONSIBILITIES

### Employer

- Ensure compliance with applicable WorkSafeBC regulations related to Thermal Exposure (Part 7 Division 4)
- Ensure program information is in place to protect workers from the hazards of heat stress
- Provide appropriate resources to protect workers from heat stress
- Ensure heat stress risk assessments are completed and controls implemented

### Managers and Supervisors

- Identify and assess areas, tasks, and occupations where there is the potential for heat stress.
- Complete heat stress hazard identification and risk assessment documentation, according to procedures specified in this program, for jobs and tasks that may pose a risk of heat stress.
- Provide resources, equipment and controls (engineering, administrative, or personal protective equipment) to minimize heat stress and ensure their implementation.
- Provide training and education regarding heat stress and sun safety, including early signs and symptoms of heat-related disorders.
- Ensure that there is adequate supervision and first aid coverage; and establish emergency procedures to deal with serious conditions such as heat exhaustion and heat stroke.
- Inform workers of the outcome of the heat stress hazard identification and risk assessment for the jobs and areas in which they are working.
- Ensure that workers who are at risk of heat-related disorders are adequately educated and trained in the recognition of signs and symptoms of heat-related disorders and applicable treatment options.
- Provide adequate instruction and direction (safe work procedure) to workers who may be at risk of heat stress.
- Ensure, through adequate supervision, that workers follow all applicable safe work practices and ensure proper application of controls
- Address worker concern about heat stress and investigate any heat stress related incidents

## Workers

- Participate in environmental monitoring program to assess worker exposure to conditions that could cause heat stress.
- Adhere to all control measures and safe work procedures that have been designed and implemented to reduce exposure to conditions that could cause heat stress.
- If signs or symptoms of a heat-related disorder appear, inform your supervisor and take precautions to lower core temperature (drink cool liquids, seek shade, reduce physical effort, etc.).
- Watch for early signs and symptoms of heat stress in themselves and their co-workers, and respond appropriately.
- Notify your supervisor if you have any medical conditions or take any medications that may affect your body's ability to respond to heat stress.
- Be aware of and follow applicable program requirements including safe work procedures and heat stress controls.
- Participate in all required training.
- Use or wear personal protective equipment that is provided.
- Report unsafe acts and conditions to the supervisor.
- Protect themselves from UV exposure

## Safety Division

- Review and maintain the heat stress program
- Assist Managers and Supervisors in meeting their responsibilities under this program
- Monitor the program effectiveness to ensure ongoing compliance
- Maintain records of the heat stress assessments and worker training

## Joint Health and Safety Committee

- Review procedures and effective systems to deal with hot environments.
- Promote worker concerns regarding heat stress.
- Assist in investigating heat stress incidents and inspection of worksites that may pose risk of heat stress.
- Assess the effectiveness of the Heat Stress Program and Exposure Control Plan through ongoing and annual review

## PROGRAM DETAILS

This program intends to prevent or minimize exposure to heat stress conditions by requiring a systematic process of hazard identification, risk assessment, implementation of appropriate control measures, training, documentation and annual program review.

## HEAT STRESS EXPOSURE CONTROL PLAN

An exposure control plan intended to protect the health and safety of workers who may be exposed to heat stress conditions and prevent exposure to heat conditions at levels above the WorkSafeBC action limit will be implemented by City of Kamloops in accordance with the requirements of WorkSafeBC OHS Regulation 5.54(2) and 7.29(1).

According to the Regulation, the required elements of an exposure control plan include the following:

- a statement of purpose and responsibilities;
- risk identification, assessment and control;
- education and training;
- written work procedures, when required;
- hygiene facilities and decontamination procedures, when required;
- health monitoring, when required;
- documentation where required

## HEAT STRESS EXPOSURE CONTROL

Whenever a risk of heat stress is identified measures will be implemented to control the risk to employees' health. The City of Kamloops is committed to reducing workers' exposures below the heat exposure limits. A combination of control measures may be required to effectively mitigate the risk of heat stress and ensure exposure is below the WorkSafeBC limit for heat stress.

The preferred method for controlling the risk of heat stress is to eliminate the hazard or substitute it with a less hazardous one. When this is not practicable, engineering controls will be developed and implemented. If engineering controls are not sufficient on their own to reduce exposures below the heat exposure limits, then the City of Kamloops will provide additional administrative and/or personal protective equipment controls. The various control measures to mitigate the risk of heat stress are discussed below.

## Elimination and Substitution

Whenever possible, the hazard that poses a risk of heat stress will be eliminated or replaced with one that generates less heat. For example,

- Eliminate hot work from a job
- Remove unnecessary heat sources
- Replace a hot process / material with a cooler one

## Engineering Controls

### Air Conditioning

Air conditioning reduces both the air temperature and relative humidity. During the hot summer months, choose mobile equipment that have air conditioning and use the air conditioning.

### Increased Air Movement

Moving air across the worker's body with the use of a fan produces a cooling effect by increasing the convective heat exchange and sweat evaporation rate. The faster the air motion, the greater the cooling effect experienced. However, at air temperature over 40 °C, increasing air motion may actually increase heat stress.

### Ventilation

Local and/or general exhaust ventilation can be employed to draw hot air and steam away from the work area. For example, range hoods over kitchen stoves draws hot steam and vapours away from the work area.

### Reduced Humidity

Use of dehumidifier and elimination of open water baths and steam leaks reduces relative humidity and thus reduces the risk of heat stress.

### Reduced Work Rate / Load

Reducing the effort required reduces the metabolic heat load. Mechanization or automation can be used to minimize physical effort required. For example, power tools, hoists, lifts, hydrovac trucks and other equipment can be used to reduce manual physical labour.

### Shielding

Radiant heat load from external sources such as boilers and furnaces can be reduced through shielding or insulating exterior surfaces.

Canopies or tents can be provided to provide shade from the sun. These structures could be over outdoor work, rest areas, or for open-top mobile equipment. Examples include canopy over an outdoor guard chair, portable rest tent for paving or construction crew with water.

## Administrative Controls

Administrative controls attempt to minimize risks through work practices. Administrative controls may be used when engineering controls are not feasible or to supplement engineering controls. Administrative controls for reducing heat stress risk include the following:

### Training

Awareness and knowledge gained through a program of training and education is a key component in controlling the risk of heat stress. Training will be provided to workers and their supervisors about the hazards of heat stress and their prevention and cover the following broad areas:

- Heat stress hazard recognition and risk assessment
- Heat related disorders, how to recognize symptoms and treatment options
- Measures for controlling the risk of heat stress
- Safe work procedures for minimizing risk of heat stress
- Use and limitations of protective clothing and equipment

Training should be regularly reviewed.

### Safe Work Procedures

Whenever a risk of heat stress exists, safe work procedures will be provided to affected employees by their supervisor. The safe work procedure must document the results of the risk assessment, the control measures to be implemented and step by step instructions to ensure the safety of the workers.

### Acclimatization

Acclimatization provides opportunity to gradually build up the body's capacity for heat stress and increases the ability to remove excess body heat. Acclimatized workers tolerate hot environments better as a result of improved cardiovascular fitness, enhanced sweating and lower salt content in sweat. Acclimatization is only achieved by continuous days of gradual exposure to the hot environment and may take up to two weeks depending on personal risk factors and physical demands of the job. It is generally recommended that workers unaccustomed to working in hot environments start at 20% of the workload and increase 10 – 20 % each day.

Workers returning to work in hot environments after an absence of more than seven days may need to work at 50% of their expected workload. Workload should increase by 10 – 20 % each day.

Where workers work outside during summer months and continue to reside in the region it is generally considered that those workers will remain acclimatized to the normal outdoor environment.

## **Buddy System**

Consider pairing up employees when the risk assessment indicates a high risk of heat stress and train them to recognize the signs and symptoms of heat stress in themselves and their co-workers. Workers also need to be trained and capable of providing first aid treatment to employees exhibiting symptoms of heat stress.

## **Removal of Workers**

Workers have the responsibility and the right to leave a hot environment once they notice signs and symptoms of heat stress. Workers also have a responsibility to watch for signs and symptoms of heat illness in their co-workers and ensure that co-workers exhibiting these signs and symptoms leave the hot environment. Supervisors and managers are also responsible for removing workers exhibiting signs and symptoms of heat illness from the hot environment. Workers leaving or being removed from a hot environment as a result of symptoms of heat stress will be provided first aid and/or professional medical treatment.

## **Work Scheduling**

Work schedules can be adjusted to avoid periods and places where a hot environment may be present. The following guidelines are recommended for adjusting work schedules to avoid heat stress exposure:

- Schedule hot and physically demanding tasks for early mornings or evenings.
- Plan or schedule work for times when trees, buildings or other structures shade the work area.
- Rotate workers between hot and cool tasks in a job.
- Schedule regular maintenance work that poses a risk of heat stress for cooler seasons of the year.
- Perform work on or near heat sources such as boilers and furnaces when they are not operational.
- Where possible do not schedule physically demanding outdoor work during summer hot spells.
- Reschedule work if appropriate control measures are unavailable or cannot be implemented when a risk of heat stress is present.

## **Recovery, Rest or Cooling Breaks**

Periods of recovery or rest away from the hot environment during a shift allows the body to dissipate excess heat and return to normal temperature. It is important to not allow a worker to spend too long in a hot environment before taking a cooling break. Allow adequate time for the body to cool down following a period of work in hot environment.

Refer to Appendix 2 Table B3 (Humidex method) or Appendix C Table C1 (WBGT method), following a risk assessment as outlined above, to determine the appropriate work-rest cycle.

If necessary, rotate workers to minimize time spent in a hot environment. A cool shaded area must be provided for rest breaks. If possible ventilated or an air-conditioned area is more effective.

Supervisors and/or their designates are responsible for scheduling and implementing the appropriate work-rest cycle whenever work in a hot environment presents a risk of heat stress.

### **Provide Water**

Work in hot environments result in loss of water and salt through sweating and, without adequate replacement, can result in dehydration. This increases susceptibility to heat stress disorders.

Provide sufficient amounts of cool drinking water and/or fruit juices close to the work site when work is being performed in a hot environment.

The following guidelines are recommended for fluid and salt replacement when working in a hot environment.

- Drink water (~ 2 cups) before starting work in a hot environment.
- Drink one cup every 20 minutes throughout the work shift.
- Do not wait until you are thirsty before you drink water.
- Avoid caffeinated drinks and energy drinks.
- Eat salty foods and snacks. Avoid salt tablets.

Supervisors and workers must ensure that workers have sufficient cool water to get them through the work day. During high heat situations 1 cup or 240ml of water is required every 15 to 20 minutes. Workers should have up to 6 to 8 litres of water per person for an 8 hour work shift.

It is generally accepted that workers should fill up personal water containers at the beginning of their shift to take to their respective work sites. Where there are situations such as prolonged shifts or unanticipated heat exposure supervisors shall ensure sufficient water for workers.

### **Self-Paced Work**

Allowing self-paced work for the environmental conditions helps to minimize heat stress injuries. A reduced work pace decreases the metabolic heat load and enhances the body's ability to maintain a normal temperature. Workers should regularly consult with their immediate supervisor regarding work pacing and work activities.

### **Cool Clothing**

Workers should be reminded to wear

When working outdoors in high heat it is recommended to wear clothing that covers skin such as long sleeves and pants that are light weight, light coloured and loose fitting to prevent exposure to UV radiation and to provide skin shade and allow sweat to evaporate.

Thick or tight clothing inhibits evaporation of sweat and increases the risk of heat stress. Workers should not remove or wear less clothing when working outdoors during high heat.

Light weight clothing includes cotton fabric or moisture wicking synthetic fabrics that allow air to pass through and enhances evaporation of sweat. In hot, sunny weather light colored clothes help reflect radiant heat away from the body.

Wide brimmed hats shade the head, face and neck area from direct sunlight. Similarly, attaching a piece of light colored cloth to the back and side rims of hardhats provide shade to the neck area.

### **Supervision**

Adequate supervision of workers in hot environments ensure that heat stress hazard, risk factors and symptoms are promptly identified and controlled or treated. Supervisors must ensure that workers are made aware of heat stress hazard and implement necessary control measures including first aid and emergency procedures.

Supervisors need to remind workers to drink water and ensure their workers have access to cool water.

### **Signage**

Heat stress warning signs will be posted in work areas and at entrances to work areas where a risk of heat stress has been identified. See Appendix D for sample signage.

### **Personal Protective Equipment**

Personal protective equipment is the least preferred means of controlling hazardous exposures. It is generally not anticipated that personal protective equipment will be required to control exposure to heat stress at City of Kamloops work sites.

PPE such as chill-it bands or cooling cloths may be available through City stores to enhance worker comfort but these are not considered to be required PPE.

Required PPE can be considered where engineering or administrative controls are not practicable or not sufficient to control the heat stress exposure. Examples of other personal protective equipment that may be provided for controlling heat stress exposure include anti-radiant heat or reflective clothing and temperature controlled suits.

A proper assessment of the heat source is required to determine which personal protective clothing, if required, is suitable for controlling the risk of heat stress at the work site. Workers must be trained in the proper use, maintenance and limitations of any personal protective equipment they are required to use.

## HEAT STRESS HAZARD IDENTIFICATION

The City of Kamloops will conduct a heat stress hazard identification process to identify hazards associated with the environment, type of task being performed, and clothing/equipment required for the task that may expose the worker to a risk of heat stress.

The Heat Stress Hazard Identification form located in **Appendix A** will be used to record the results of the hazard identification process.

Hazard identification should consider work conditions, work areas and jobs/tasks will be identified that may put workers at risk. These will include:

- Environmental temperature conditions: areas with temperatures above 23°C or high humidity (>60%).
- Areas or occupations that have been identified through accident investigation reports, first aid treatment books, and records of injury and disease.
- Jobs or tasks that require medium to high exertion or strength.
- Areas or occupations about which workers have expressed concern.

Occupations that have been identified as at risk for heat stress will be entered into the DATS training tracking software. Employees will receive education and training as to the awareness of heat stress and their responsibilities.

Other considerations when performing heat stress hazard identification and risk assessment should include:

### Heat Sources

Body temperature can be increased by the heat generated internally or gained from external sources. It is therefore important to identify the level of physical exertion involved in the job task as well as external sources of heat. Strenuous work activities involving heavy physical exertion can result in heat stress even when the air temperature is relatively low.

Moderate physical exertion includes (but not limited to):

- Brisk walking or normal pace walking for prolonged period,
- Sitting with continuous arm and leg movement,
- Pushing, pulling or lifting moderately heavy loads etc.

Heavy physical exertion includes (but not limited to):

- Shovelling, digging, sledge hammering,
- Climbing stairs or ladder with heavy gear
- Pushing, pulling or lifting heavy loads etc.

External radiant heat sources also contribute to the risk of heat stress and needs to be identified. These include (but not limited to) items such as:

- Boilers, heaters, ovens,
- Hot asphalt,
- Heavy machinery,
- Sun

## Environmental Conditions

Environmental conditions presenting a hazard of heat stress include:

- Air temperature: High air temperature increases the potential for heat related disorders.
- Relative humidity: High relative humidity hinders the body's ability to dissipate heat by sweating and hence increases potential for developing heat related disorders
- Air movement: Areas or environmental conditions where there is little or no air movement increases potential for heat related disorders.

## Occupation

Certain occupations and jobs/tasks may put workers at risk of heat stress either because of the level of physical exertion involved, the area in which the job is performed, or materials and equipment involved in the job. Some examples of these jobs include (but not limited to):

- Outdoor occupations (especially in the summer) such as construction, arborist, landscapers, parking enforcement, park rangers etc.
- Occupations that involve work with hot materials or radiant heat sources such as welding, road paving, kitchen workers, plumbing & gas inspectors (boilers) etc.
- Jobs that require workers to wear full personal protective equipment ensemble such as hazardous materials remediation.
- Jobs or tasks that require medium to high exertion or strength such as construction or labourers.
- Occupations or jobs that are performed in areas with high air temperature and relative humidity such as kitchens and aquatic facilities.
- Occupations, tasks or areas that have been identified through incident investigation reports, first aid treatment records, and records of injury and disease as potentially presenting a risk of heat stress.
- Occupations, tasks or areas about which workers have expressed concern

## Clothing Requirements

The type of clothing and personal protective equipment required for the job can significantly influence the risk of heat stress posed to workers. Impervious (non-breathable) and semi-impervious clothing prevents easy evaporation of sweat from skin, for example Tyvek suits. This

inhibits the cooling effect of sweat evaporation, which can result in elevation of core body temperature and increases the possibility of developing heat stress disorders.

Personal protective equipment such as hard hats, coveralls, safety boots, and respirators can trap hot air next to the skin and increase the risk of heat stress disorders. Workers wearing full PPE ensemble, such as a chemical suit, are at an increased risk of heat stress and require special precautions and regular monitoring especially during the hot summer months.

## Heat Related Disorders

Early recognition and treatment of heat related disorders is critical to prevention of long term and more serious health effects. If not recognized and treated early, heat related disorders can progress to debilitating or even fatal consequences. This section discusses the various heat related disorders, including signs and symptoms as well as treatment.

### Heat Rash

Clusters of tiny bumps appear on the skin as a result of excessive sweating during hot, humid weather. Sweat glands become blocked causing inflammation of the skin.

*Signs and Symptoms:* pimple-like bumps on skin; itchy feeling.

*Treatment:* Keep area of skin cool and dry; powders may relieve discomfort.

### Heat Cramps

Painful muscle spasms occur as a result of loss of water and salt through heavy sweating; usually occurs in the muscles of the arms, legs and abdomen. Heat cramps are a warning sign that more serious heat related illness could occur if precautions are not taken.

*Signs and Symptoms:* Excessive sweating; muscle pain or spasms.

*Treatment:* Lay affected worker down in a cool area and remove or loosen tight clothing. Cool worker by fanning or applying wet towels to skin. Provide cold drinks (water, juice, sports drink) for worker. Caffeinated drinks (pop, soft drinks) should be avoided.

Massage cramped muscles gently.

Patient should be coached not to consume alcohol after shift to properly recover.

### Heat Syncope

Heat syncope is a fainting that occurs when blood vessels dilate and blood pools in the extremities in an attempt to cool the body thus reducing blood flow to the brain. Heat syncope is very common among workers standing or sitting in one spot for a long period of time in a hot environment.

*Signs and Symptoms:* Fainting, dizziness, light headedness.

*Treatment:* Lay affected worker down in a cool area and remove or loosen tight clothing. Cool worker by fanning or applying wet towels to skin. Provide cold drinks (water, juice, sports drink) for worker. Caffeinated drinks (pop, soft drinks) should be avoided.

## Heat Exhaustion

Heat exhaustion is a more serious heat related disorder than heat cramps and is caused by depletion of water and salt that occurs as a result of heavy sweating over a prolonged period of physical exertion.

*Signs and Symptoms:* In addition to symptoms of heat cramp, a worker suffering from heat exhaustion may experience rapid heart rate, shallow breathing, loss of consciousness, headache, nausea, pale skin, weakness and fatigue.

*Treatment:* Lay affected worker down in a cool area and remove or loosen tight clothing. Cool worker by fanning or applying wet towels to skin. Provide cold drinks (water, juice, sports drink) for worker. Caffeinated drinks (pop, soft drinks) should be avoided. Worker should seek medical treatment (i.e. transport affected worker to a medical clinic) even if symptoms have improved. Complete required claims and investigation documentation.

## Heat Stroke

Heat stroke is a life threatening condition in which the body's ability to cool has failed; body temperature continues to rise beyond 41 °C and sweating has stopped. If not treated immediately, heat stroke can result in loss of consciousness, permanent brain damage or death.

*Signs and Symptoms:* In addition to symptoms of heat exhaustion, a worker suffering from heat stroke may experience lack of sweat, elevated body temperatures, seizures, coma, confused mental state, slurred speech, shock and cardiac arrest.

*Treatment:* Call 911 right away. Lay affected worker on their back or side in a cool area and remove or loosen tight clothing. Cool worker by fanning and applying wet towels to skin or soak clothing with cool water. Maintain breathing and circulation as required. Worker should seek medical treatment (i.e. transport affected worker to a medical clinic) even if symptoms have improved. Complete required claims and investigation documentation.

## HEAT STRESS RISK ASSESSMENTS

Once it is determined which occupations, tasks, or areas should be assessed, the risk of developing a heat-related disorder should be evaluated using a risk assessment meeting the requirements of WSBC regulation 7.29(1)(a). WSBC identifies a number of acceptable methods for assessing heat stress including

- Measurement of **environmental parameters**, such as air temperature, air velocity, air humidity, and infrared radiation (see OHS Guidelines G7.29-2 and G7.29-4). Environmental parameters are the most practicable for measurement in the field.

- Direct measurement of **body temperature** (see OHS Guideline G7.29-3) where the core body temperature is maintained between 36°C – 38°C
- Measurement of other **physiological responses**, such as heart rate (see OHS Guideline G7.29-3)

### Action Levels and Exposure Limits

The Action Levels and Exposure Limits Table (Table 1 below) provides an overview of the exposure limits and action levels for workers exposed to heat stress in the workplace. If the Hazard Identification results show that a worker is or may be regularly exposed to an environment in excess of the heat action levels/exposure limits, The City of Kamloops will complete a risk assessment and implement the controls required.

TABLE 1 – ACTION LEVELS AND EXPOSURE LIMITS		
WORKLOAD	ACTION LEVEL FOR UNACCLIMATIZED WORKERS (2-HOUR TIME WEIGHTED AVERAGE)	EXPOSURE LIMIT FOR ACCLIMATIZED WORKERS (2-HOUR TWA)
LIGHT	28 WBGT°C	30 WBGT°C
MODERATE	24.7 WBGT°C	26.7 WBGT°C
HEAVY	23 WBGT°C	25 WBGT°C

### Environmental Parameters

When assessing using **environmental parameters** the most common and widely used heat stress index is the wet bulb globe temperature (WBGT). The WBGT combines the effect of humidity and air velocity (natural wet bulb) ambient air temperature, velocity, and radiant energy (globe temperature), and air temperature (dry bulb temperature) into a single value. The values listed in screening criteria for heat stress exposure are WBGT in °C. (See OHS Guideline G7.28(1) for the table of screening criteria.) **The City of Kamloops will use this method where it is not possible or practicable to use other methods such as the Humidex or Dry Bulb methods.**

Other heat stress indices are available to measure heat stress, including the wet globe temperature (WGT), or Botsball, and ISO 7933 Hot Environments - Analytical Determination and Interpretation of Thermal Stress Using Calculation of Required Sweat Rate. Under certain circumstances, the Botsball may be used instead of the WBGT. For example, a Botsball may be used as a screening tool, or for conditions of moderate radiant heat and humidity such as in general construction work. It is not likely that this method will be used at the City of Kamloops as there are other more effective methods.

### Body Temperature & Physiological Response Methods

These methods are not used for general heat stress risk assessments at the City of Kamloops. They may be incorporated into assessments where workers may need to wear significant protective clothing such as hazmat response or firefighting or where other means of assessment are not considered appropriate. Consult with the Safety Division prior to considering these methods.

Temperature, measured under the tongue, must be within a range of 36 – 38°C while heart rate must remain below 90 beats per minute by the third minute of a rest period. If these conditions are not met at any time, additional controls must be implemented before the work can continue and the situation reassessed.

### Heat Stress Assessments using Humidex Index

The **Humidex-based method** will generally be used at the City of Kamloops as our workers are not typically exposed to sources of direct heat emanating from industrial equipment or from other hot surfaces, high humidity levels or high temperature steam.

The Humidex involves the measuring of environmental parameters such as air temperature and air humidity. The Humidex Method will be used to assess the risk of developing a heat-related disorder based on the workload (i.e. light, moderate, heavy) of the tasks being performed. The Humidex value will also be adjusted for their clothing and exposure to direct sunlight.

Results of the heat stress risk assessment will be documented using the heat stress risk assessment worksheet in Appendix B. The steps involved in this approach are as follows:

1. Determine air temperature and relative humidity at the work location using a digital temperature and relative humidity instrument. Do not use air temperature or relative humidity values from weather stations, media reports or other locations.
2. From Table B1, find the air temperature (left column) and relative humidity (top row). Read across both of these values to determine the humidex value.
3. Adjust the humidex value for clothing and PPE as outlined in the risk assessment worksheet (Appendix B).
4. Determine whether worker is acclimatized or unacclimatized to heat. An unacclimatized worker is a worker who is not accustomed to working in a hot environment or who has been away from a hot environment for seven consecutive days.
5. Determine the work rate (level of physical exertion involved in work). Refer to the guideline in Table B2 for assistance determining the work rate.
6. From Table B3 (Appendix B), identify the appropriate column for acclimatized or unacclimatized worker and find the adjusted humidex value under the appropriate column.

7. Ensure that the work rate (level of physical exertion involved) is equal to or less than that recommended for the adjusted humidex value.
8. Identify and implement the response plan corresponding to the humidex value and work rate.

Supervisors or their designates are responsible for conducting heat stress risk assessments for **each worksite** according to the procedures outlined above. The Safety Division can be consulted for assistance with this risk assessment. The forms located in Appendix A (Heat Stress Hazard Identification) and Appendix B (Heat Stress Risk Assessment Worksheet) will be used to document results of the hazard identification and risk assessment.

The Heat Stress Risk assessment will be required to be completed, by those occupations who have been identified as at risk, when the temperature exceeds 30°C or greater and workers will be exposed for greater than 15 minutes without returning to an acclimatized environment such as a vehicle or building.

### Table 1: Humidex Table

#### Humidex Method – as per WSBC guideline

The Humidex Based Heat Response Plan is a simplified method of protecting workers from heat stress, (developed by the Occupational Health Clinics for Ontario Workers (OHCOW)). The method is based on the American Conference of Governmental Industrial Hygienists (ACGIH) heat stress/strain TLVs<sup>®</sup> (Threshold Limit Values) and is a translation of wet bulb globe temperatures (WBGT) into Humidex values. Other factors - air movement, workload, radiant heat sources, and acclimatization - also need to be considered when assessing heat stress. Humidex values are obtained by measuring temperature (dry bulb) and relative humidity and factoring them into the *Humidex* table below (Table 1). For example the Humidex value for a temperature of 37°C (read across from the left side of the Table) and a relative humidity of 50 percent (read down from the top of the Table) is 49°C. Temperature and relative humidity can be measured by a digital hygrometer (available at most hardware stores) or a sling psychrometer (a wet/dry bulb thermometer for determining relative humidity). It is important that a reading be taken at the actual workplace as Humidex values can vary substantially from location to location.

Heat stress reference chart

TEMPERATURE (°C)	RELATIVE HUMIDITY (%)																			
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	
49																			50	49
48																			50	49
47																			50	47
46																			49	46
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28																			48	45
27																			49	47
26																			49	45
25																			49	47
24																			49	45
23																			49	47
22																			49	45
21																			49	47

The following must also be considered (added) when calculating a Humidex value:

- The *Humidex method* assumes that workers are wearing regular summer clothing (light shirt, pants, underwear, socks and shoes). If workers wear coveralls (e.g., cotton coveralls) over summer clothes, then 5°C should be added to the workplace Humidex value. Gloves and/or hard hat would each add 1°C and an apron (or vest) would add 2°C to the Humidex value. For workers who wear encapsulating suits, do not use the *Humidex method*.
- To adjust for radiant heat in direct sunlight (between 10 am and 4 pm), add 2 - 3°C to the Humidex value (pro-rate according to percentage cloud cover).
- For indoor radiant heat exposures, use training, knowledge, and experience to adjust the 2 - 3°C sunlight correction factor by estimating whether the exposure is more or less than the heat exposure to direct sunlight. Workplaces with significant process-related heat load (e.g. from boilers, furnaces, steam lines, etc.) should measure the WBGT.
- Humidex values should be measured at several locations in the work area (safe work procedures should be based on the highest reading).
- Do not base Humidex values on weather station or media reports. Use measurements taken at the worksite.
- Measurement should be recorded hourly if the Humidex is above 30°C.

- Never ignore anyone's symptoms regardless of the measurements.

### Heat Stress Assessments using Dry Bulb Thermometer

Under the WorkSafeBC OHS Regulation Section 7.29 and accompanying guidelines, air temperature measured using a regular thermometer, dry bulb or digital thermometer is an acceptable method of heat stress risk assessment if all of the following conditions apply:

- Air temperature measured in the immediate work area does not exceed 35°C (95°F). Do not use media reports or weather forecasts for this purpose.
- External radiant heat sources, such as boilers, furnaces, engines, or process related heat, are not present.
- The work being done, if classified as "heavy", as described in Table B2 of Appendix B, does not exceed 2 hours in duration
- Worker(s) are not wearing impervious or semi-impervious protective clothing.
- At air temperature of 30°C (86°F) or higher, appropriate control measures, as outlined in this plan, are implemented.

If any of the above conditions are not met, more precise measurements such as Humidex or WBGT method are required to determine the risk of heat stress

### Heat Stress Assessments using Wet Bulb Globe Thermometer

For work activities involving significant process related radiant heat load or high relative humidity directly from industrial equipment, such as boilers and furnaces, the Wet Bulb Globe Temperature (WBGT) method will be used for heat stress risk assessment in accordance with WorkSafeBC Guideline G7.29.

Consult with the Safety Division for your business unit or work area if your specific job or task requires WBGT measurement instrument to assess the risk of heat stress. Examples of the type of work this may apply to are maintenance workers working on a furnace that must stay on or workers doing paving work in the summer months.

Results of the WBGT measurement will be used to determine appropriate work-rest cycle to mitigate the risk. **Table C1 in Appendix C** will be used. Table C1 also represents the WorkSafeBC exposure limit for heat. The Action Limit in Table C1 determines work-rest cycle for unacclimatized workers while the TLV<sup>®</sup> determines the work-rest cycle for acclimatized workers.

## EDUCATION AND TRAINING REQUIREMENTS

To ensure that City of Kamloops workers at risk of heat stress are aware of the dangers of heat exposure and the measures to mitigate the risk the following is a general guideline of heat stress awareness training that will provided to all at-risk workers

Workers should be able to:

- Identify hazards associated with a hot work environment.
- Identify environmental, job and personal risk factors that contribute to heat stress.
- Complete a heat stress risk assessment.
- Determine and implement appropriate heat stress control measures.
- Recognize the signs and symptoms of heat stress disorders.
- Know the procedures to follow when someone shows signs and symptoms of heat stress disorders

The heat stress awareness training includes, but is not limited to, the following topics:

- Heat sources (including the significance of external and internal sources)
- Effect of environmental factors on heat stress; air temperature, relative humidity, air velocity, radiant heat from the sun or heat sources
- Mechanisms by which the body controls its temperature (thermoregulation)
- Health effects of excessive heat exposure (heat related disorders)
- Signs and symptoms of heat-related disorders and treatment options
- Personal factors that may contribute to the risk of heat stress including:
  - lack of acclimatization
  - 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)
  - alcohol abuse and recreational drugs
  - previous heat illness
- Heat stress risk assessment methods (humidex, dry bulb and WBGT methods)
- Effect of clothing (e.g. protective clothing) on the risk of heat stress
- Control measures for mitigating the risk of heat stress
- Importance of and how to ensure adequate hydration (fluid replacement)
- Job specific step by step instructions (safe work procedure) to be followed to minimize the risk of heat stress including procedures for reporting signs and symptoms of heat related disorders
- Proper use and limitations of personal protective equipment for controlling heat stress, if required.

Refresher training will be provided annually to all workers exposed to environments that could cause heat stress.

All heat stress awareness training will be recorded DATS for City of Kamloops employees.

## PROGRAM MAINTENANCE

Programs within the Safety Management System are reviewed periodically by the Joint Health and Safety Committees. The Heat Stress Program will be reviewed annually and updated as necessary, in consultation with the Central Joint Health and Safety Committee.

The following elements will be included in the review:

- Responsibilities
- Hazard identification and risk assessment
- Exposure control measures
- Education and training
- Safe work procedures
- Heat related incidents
- Documentation

## DOCUMENTATION

The City of Kamloops will maintain records of the following:

- Heat Stress Program & Exposure Control Plan
- Heat Stress Hazard Identification & Risk Assessments
- Worker Education and Training
- Safe Work Procedures
- Heat Stress Hazard Warning Signs
- Heat Stress Incident Investigations
- Heat Stress Program Review

## REFERENCES AND APPLICABLE OH&S LAW

WorkSafeBC OHS Regulation Part 7, Sections 7.26 to 7.32. Available at:  
<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-07-noise-vibration-radiation-and-temperature>

WorkSafeBC OHS Guidelines G7.27(1) – G7.30-3. Available at:  
<https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-guidelines/guidelines-part-07>

WorkSafeBC Booklet *Preventing Heat Stress at Work* (2007). Available at:  
<https://www.worksafebc.com/en/resources/health-safety/books-guides/preventing-heat-stress-at-work>

NIOSH Heat Stress Website: <https://www.cdc.gov/niosh/topics/heatstress/>

NIOSH [2016]. NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication 2016-106. Available at: <https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf>

Employment and Social Development Canada – Thermal Stress in the Workplace Guideline – Oct 17, 2018 <https://www.canada.ca/en/employment-social-development/services/health-safety/reports/thermal-stress-work-place.html>

## APPENDICES

Appendix A – Heat Stress Hazard Identification Worksheets

Appendix B – Heat Stress Risk Assessment Worksheet

Appendix C – Screening Criteria for Heat Exposure - WBGT

Appendix D – Signage (Sample)

Appendix E – Summary Table of Heat-Related Disorders

Appendix F – Sun Exposure Safety Talk

## APPENDIX A – HEAT STRESS HAZARD IDENTIFICATION

### *Instructions*

- Complete Section A. This section includes general information about the worksite and affected workers.
- Complete Section B. This section involves identifying hazards associated with the environment, type of tasks being performed and clothing/equipment required for the task.

SECTION A – WORKSITE INFORMATION	
Location of Work Site:	
Date:	Time:
Weather Conditions (description only):	Job Titles/Occupations of Workers at Risk:
Activities of Workers at Risk:	
Duration of Task:	First Aid Attendant On-Site? Yes          No
Other Remarks:	
Name of Assessor:	Signature of Assessor:
Others in Attendance:	Signatures of Others in Attendance:

<b>SECTION B: HAZARD IDENTIFICATION</b>			
<b>Workload of Activities:</b> Check boxes that are relevant to the type of work activity being undertaken by workers			
<b>Hazard</b>	<b>Present in Work Area</b>	<b>Absent in Work Area</b>	<b>Details of Hazard</b>
Jobs/tasks requiring medium exertion/strength	<input type="checkbox"/>	<input type="checkbox"/>	
Jobs/tasks requiring heavy exertion/strength	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Environmental Conditions:</b> Check boxes if conditions are present. Provide brief details of the hazard if appropriate			
Areas with temperatures above 23°C	<input type="checkbox"/>	<input type="checkbox"/>	
Outdoor job site	<input type="checkbox"/>	<input type="checkbox"/>	
Workers exposed to radiant heat e.g. sunlight	<input type="checkbox"/>	<input type="checkbox"/>	
Indoor job site	<input type="checkbox"/>	<input type="checkbox"/>	
Heat is a problem for the entire work shift	<input type="checkbox"/>	<input type="checkbox"/>	
Areas with high humidity (> 50%)	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Clothing Requirements:</b> Check boxes that are relevant to the type of clothing required for the job/task.			
Jobs/tasks require winter work clothing	<input type="checkbox"/>	<input type="checkbox"/>	
Jobs/tasks require semi-impervious clothing	<input type="checkbox"/>	<input type="checkbox"/>	
Jobs/tasks require impervious clothing	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Review of Records/Statistics:</b> Check boxes as appropriate			
Work area and/or occupation previously identified as hazardous	<input type="checkbox"/>	<input type="checkbox"/>	
Workers have previously expressed concern regarding the work area/activity	<input type="checkbox"/>	<input type="checkbox"/>	

Determine whether you need to conduct a Heat Stress Risk Assessment based on the information you have just gathered:

- Yes, risk factor(s) identified: continue with a risk assessment.
- No risk factor identified. Repeat the hazard identification procedure if/when conditions (environmental or worker) change that may present a new risk of heat stress.

## APPENDIX B – HEAT STRESS ASSESSMENT WORKSHEET

- First Complete the Heat Stress Risk Assessment chart below
- After, determine the appropriate response plan from Table B3 using your adjusted humidex value.



Heat Stress Risk Assessment - Humidex	
Air Temperature	
Relative Humidity	
Calculated Humidex Value (from Table B1)	
Additions to Humidex Value	
Coveralls worn over regular clothes:	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 5 °C)
Hardhats worn:	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 1 °C)
Gloves worn:	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 1 °C)
Apron / Vest worn:	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 1 °C)
Direct sunlight (between 10 am to 4 pm):	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 2 - 3 °C)
Indoor heat source:	<input type="checkbox"/> No <input type="checkbox"/> Yes (add 2 - 3 °C)
Adjusted Humidex Value (Initial Humidex value plus additions)	<b>TOTAL</b>
Worker Acclimatized?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Work Rate (physical exertion) (refer to Table B2)	<input type="checkbox"/> Heavy <input type="checkbox"/> Moderate <input type="checkbox"/> Light

Table B1: Humidex Value Calculator

**Heat stress reference chart**

TEMPERATURE (°C)	RELATIVE HUMIDITY (%)																														
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%												
49																			50	49											
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33																49	48	46	45	43	42	40	39	37	36	34	34				
32																50	49	47	46	44	43	41	40	39	37	36	33	33			
31																50	49	48	46	45	44	42	41	40	39	37	36	32	32		
30																50	49	48	46	45	44	42	41	40	39	37	36	34	31	31	
29																48	47	46	44	43	42	40	39	38	37	36	34	33	30	29	29
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27																48	47	46	44	43	42	40	39	38	37	36	34	33	30	27	27
26																48	47	46	44	43	42	40	39	38	37	36	34	33	30	26	26
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24																48	47	46	44	43	42	40	39	38	37	36	34	33	30	24	24
23																48	47	46	44	43	42	40	39	38	37	36	34	33	30	23	23
22																48	47	46	44	43	42	40	39	38	37	36	34	33	30	22	22
21																48	47	46	44	43	42	40	39	38	37	36	34	33	30	21	21

**Table B2: Guidelines for Determining Work Rate**

Section 1 – Determine Workload of Work Activities			
Classification of Workload	Types of Activity	Examples of Activity	
<b>Light</b> Work that generates a metabolic rate of less than 200 kcal/hr	Sitting, with moderate movement of arms and legs Standing doing light work, with mostly arm movement Casual walking	Desk work; typing; Driving in traffic Traffic Control Supervising a worksite, bylaw inspections	<input type="checkbox"/>
<b>Moderate</b> Work that generates a metabolic rate of between 200 and 350 kcal/hr	Normal to brisk walking Sitting, with vigorous arm and leg movements, standing, doing light to moderate work, Moderate lifting or pushing	Driving heavy machinery Tending shrub beds Warehouse work; loading and unloading of trucks	<input type="checkbox"/>
<b>Heavy</b> Work that generates a metabolic rate of greater than 350 kcal/hr	Construction tasks Intermittent heavy lifting, pushing or pulling Climbing stairs with heavy gear	Sawing; planting; digging; shoveling; sledgehammer work; roofing Asphalt crew	<input type="checkbox"/>

**Table B3. Humidex Based Heat Response Plan**

Work Rate	Humidex		Response (Apply at lower level controls cumulatively)
	Acclimatized	Unacclimatized	
Heavy	25 - 29		Supply water to workers on an "as needed" basis
Moderate	32 - 35	25 - 29	
Light		32 - 35	
Heavy	30 - 33		Post heat stress alert, encourage workers to drink extra water; start recording the hourly temperature and relative humidity (Humidex Value) in the table below.
Moderate	36 - 39	30 - 33	
Light		36 - 39	
Heavy	34 - 37		Post heat stress alert, notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms
Moderate	40 - 42	34 - 37	
Light		40 - 42	
Heavy	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
Moderate	43 - 44	38 - 39	
Light		43 - 44	
Heavy	40 - 41		Work with 30 minutes relief per hour can continue in addition to the provisions listed previously
Moderate	45 - 46*	40 - 41	
Light		45 - 46*	
Heavy	42 - 44		If feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above
Moderate	47 - 49*	42 - 44	
Light		47 - 49*	
Heavy	45* or over		Only medically supervised work can continue
Moderate	50* or over	45* or over	
Light		50* or over	

**HEAT STRESS ALERT**

Hourly Humidex Log							
Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8

## APPENDIX C - SCREENING CRITERIA FOR HEAT EXPOSURE - WBGT

Table C1. Screening Criteria for Heat Exposure - WBGT

	TLV® (Acclimatized worker)				Action Limit (Unacclimatized Worker)			
	WBGT (°C)							
Work-Rest Cycle (each hour)	Light Work	Moderate Work	Heavy Work	Very Heavy Work	Light Work	Moderate Work	Heavy Work	Very Heavy Work
75 – 100% Work	31	28	-	-	28	25	-	-
50 - 75% Work	31	29	27.5	-	28.5	26	24	-
25 - 50% Work	32	30	29	24.5	29.5	27	25.5	24.5
0 - 25% Work	32.5	31.5	30.5	27	30	29	28	27

## APPENDIX D – SIGNAGE

City of Kamloops



Canada's Tournament Capital

# HEAT STRESS ALERT

**Working in a hot environment can be hazardous to your health.**

**Know the symptoms of heat stress:**

1. **Feeling faint or dizzy**
2. **Excessive Sweating**
3. **Nausea / vomiting**
4. **Muscle cramps**
5. **Pale clammy skin**

**Protect yourself by:**

1. **Acclimatize – Gradually expose yourself to the environment.**
2. **Drink plenty of water**
3. **Take regular rest breaks**
4. **Slow down**
5. **Wear loose light-coloured clothing**
6. **Seek shade**
7. **Wear a wide brim hat in the sun**
8. **Use fans or air conditioning**
9. **Schedule work for cooler parts of the day**
10. **Report symptoms of heat stress**

Human Resources and Safety: 105 Seymour Street, Kamloops, BC, V2C 2C6  
P: 250-828-3439 | F: 250-828-3635 | E: hr@kamloops.ca | Kamloops.ca



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## APPENDIX E – SUN SAFETY

### Sun Safety

The sun is a workplace [hazard](#) for workers that work outside.

Sun exposure can cause the following:

- Health conditions of the skin and eye from over-exposure to [solar ultraviolet \(UV\) radiation](#), including [skin cancer](#), [sunburn](#), and cataracts, among others.
- [Heat stress](#) caused by [exposure](#) to the sun.

Ways to reduce sun exposure should be in order of the hierarchy of controls.

#### **Elimination**

Re-scheduled or postponed the task until a day or time when it is not as sunny (eg. another day or evening).

#### **Engineering:**

Where possible, workers should work in the shade or take breaks in the shade.

Shade can either be human-made (for example, permanent and temporary shade structures) or natural shade from trees.

In addition to direct exposure to solar UV radiation from the sun, worker exposure is also determined by the amount of reflected solar UV they receive. Reducing reflected solar UV by making surfaces less reflective is particularly important for eye exposure.

Window glass generally provides good protection against UVB radiation, but can transmit substantial amounts of UVA radiation. For workers who spend a lot of their time in vehicles, driving with the windows closed provides good protection from solar UV. Clear and tinted window films can be applied to windows for additional protection.

#### **Administrative**

[Signs and posters](#) that list sun-safe [practices](#) are posted to raise worker awareness of the hazard and remind workers about how to stay sun safe.

Supervisors whose workers have work outdoors provide Safety talks on Sun Safety to their workers.

All incidents of negative health effects from sun exposure (for example, sunburn, photokeratitis, heat stress) are to be reported;

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

All identified required sun safe personal protection needs to be worn or used at all times.

Personal protection for sun exposure will provide coverage to as much of the workers body as possible, yet still allowing workers to stay cool during hot weather. Sun safe personal protection measures include:

- **Clothing:** This is the most effective form of personal protection. Worker will wear long sleeved shirts with collars and long pants made of breathable fabrics with a high [ultraviolet protection factor \(UPF\)](#).
- **Hats and hard hats:** Workers will wear broad brimmed hats and legionnaire style hats for the most protection. Baseball style caps are to be avoided as they provide good protection to the nose, but little protection to the cheek and chin, and no protection to the ears or neck. If a hard hat is required then a sun shade should be added.
- **Sunglasses and [protective eyewear](#):** The eyes are very sensitive to UV radiation. All outdoor workers should wear eye protection all year round. For workers who do not require 'protective eyewear' as described in [CSA Z94.3.1-09](#), good quality sunglasses will provide excellent UV protection, particularly if they are close-fitting and wrap-around in design.
- **[Sunscreen](#):** Wear a broad spectrum, water resistant sun screen with a minimum [sun protection factor \(SPF\)](#) of 30. Sunscreen is the least favorable of the personal protection measures for outdoor workers. A list of sunscreens recognized by the Canadian Dermatology Association are available on their [website](#).

**Cooling wear:** Cooling wear if required by a risk assessment, can be purchased to provide additional cooling for workers. Cooling wear includes vests, neck shades, towels, headwear and bandanas which either work on the principle of evaporative cooling or use built in replaceable ice/cooling packs. Some of these are designed to be used with hard hats.

## APPENDIX F - SUMMARY TABLE OF HEAT-RELATED DISORDERS AND INDICATORS

After just three hours of moderate work on a warm-to-hot job site, performance can be drastically affected by the symptoms of heat stress. The U.S. National Institute for Occupational Safety & Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommend drinking five to seven ounces of cool fluid every 15 - 20 minutes to replenish the necessary fluids in the body.

### Heat Stress Indicators

Dehydration Levels	Percentage of Body Weight Loss	Fluid Loss in Pounds and Litres	Effects and Symptoms	How Soon This Can Happen Without Drinking*
Minor	1%	1.5 lbs 0.75 litres	Unnoticed	1 hour
Initial stage	2%	3.0 lbs 1.5 litres	Loss of endurance, thirsty, feel hot, less comfortable	2 - 3 hours

Performance loss	3%	4.5 lbs 2.25 litres	Loss of strength, loss of energy, moderate discomfort	3 - 4 hours
Heat cramps	4%	6.0 lbs 3.0 litres	Cramps, headaches, extreme discomfort	4 - 5 hours
Heat exhaustion	5 - 6%	7.5 - 9 lbs 3.5 - 4 litres	Heat exhaustion; nausea, faint	5 - 6 hours
Heat stroke	7%+	11+ lbs 5+ litres	Heat stroke, collapse, unconsciousness	7+ hours
Source: CamelBak© Products <span style="float: right;">Rough guidelines only. Depends on rate of water loss.</span>				

#### Heat Related Disorders

CONDITION	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.
Sunburn	Too much exposure to the sun	Red, painful or blistering and peeling skin.	If the skin blisters, seek medical aid. Use skin lotions (avoid topical anesthetics) and work in the shade.	Work in the shade; cover skin with clothing; wear sunscreen lotions with a sun protection factor of a least 15. People with fair skin should be especially cautious.
Heat Cramps	Heavy sweating drains a person body of salt, which cannot be replaced just by drinking water.	Painful cramps in arms, legs or stomach which occur suddenly at work or later at home. Cramps are serious because they can be a warning of other more dangerous heat-induced illnesses.	Move to a cool area, loosen clothing and drink cool, salted water (1 Tbsp salt per gallon of water) or commercial fluid replacement beverage. If the cramps are severe or don't go away, seek medical aid.	When working in the heat, workers should put salt on their food (if on a low salt diet, this should be discussed with a Doctor). This will give the body all the salt it needs. Do not take salt tablets.
Fainting	Not enough blood flowing to the head, causing loss of consciousness.	Sudden fainting after at least two hours of work, cool moist skin, weak pulse.	Fainting may be due to a heart attack or other illness. GET MEDICAL ATTENTION. Assess need for CPR. Move to a cool area; loosen clothing; make person lie	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms

			down and if the person is conscious, offer sips of cool water.	which often precede heat stroke.
Heat Exhaustion	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 38C; weak pulse; normal or low blood pressure; person is tired, weak, clumsy, upset or confused; is very thirsty or is panting or breathing rapidly; vision may be blurred.	GET MEDICAL AID. This condition can lead to heat stroke, which can kill. Move the person to a cool shaded area; loosen or remove excess clothing; provide cool water to drink (salted if possible); fan and spray with cool water.	Reduce activity levels and/or heat exposure. Drink fluids regularly. Workers should check on each other to help spot the symptoms which often precede heat stroke.
Heat Stroke	If a person's body has used up all its water and salt, it will stop sweating. This can cause body temperature to rise.	High body temperature (over 40C) and any one of the following: the person is weak, confused, upset or acting strangely; has hot, dry, red skin; a faint pulse; a 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 which often precede heat stroke.

## APPENDIX G – SAFE WORK PROCEDURES