

PURPOSE/APPLICATION

Canadian Plains Energy Services (CPES) shall attempt to minimize risks to personnel, equipment and property by conducting operations during safe and tolerable working weather conditions. In extreme conditions workers will be provided with an adequate supply of cool potable water and work/rest schedules appropriate to the conditions will be implemented. When temperature conditions are extreme, the following safe work practice and exposure plan will be adhered to.

CPES shall attempt to minimize risks to personnel, equipment and property by conducting operations during safe and tolerable working weather conditions. However, when conditions are extreme, the following safe work practice will be followed.

PPE

- CPES minimum requirements

TRAINING

HAZARDS & CONCERNS

- Heat Stress
- Heat Stroke
- Heat Rash

PRECAUTIONS

1) The Body's Response to Temperature

Your body works best when it has an internal "core" temperature of 37°C. 37°C might seem warm, but this is your internal temperature (not the air temperature). This temperature is necessary for your vital organs to function normally. During a regular day, your body temperature may vary by about 1°C depending on the time of day, your level of physical activity and how you are feeling (emotional reactions). The body's metabolic processes produce the right amount of heat you need when you digest your food and when you perform physical activity.

2) Maintaining Balance

When you work in extreme temperatures, your body has to adapt. To maintain a constant inner body temperature, the body must continually keep or gain heat in cold environments and lose heat in hot environments.

To stay cool in hot environments, the body sweats because evaporating sweat cools the body. The body also increases blood flow to the skin to speed up the loss of heat from the skin by radiating away the excess heat if the outside air is cooler.

By sweating, shivering, and changing the rate of blood flow, the body can adapt to a fairly wide range of temperatures. However, there are limits to what the body can adapt to and its ability to maintain its core temperature can fail.

3) Acclimatization

People can adapt to hotter temperatures through a process called "acclimatization." At the workplace acclimatization is important because it allows you to work more safely and efficiently. However, becoming acclimatized takes time. When working in hot conditions, people need at least 4 to 7 working days to become fully acclimatized, but the process may take up to three weeks. Each person must be monitored to ensure that he or she is adapting to working in the heat.

4) Factors Affecting How You Feel

How hot or cold you feel depends on these factors:

- **Air Temperature** is what can be measured with a thermometer, however in situations where there is a lot of radiant heat such as sunlight, heat generating machinery or open flames, it is not always an accurate indication of how hot or cold you feel. Over time on a hot day, these sources can radiate heat into the air and add to a worker's body temperature.
- **Relative Humidity** is the amount of moisture in the air. The warmer the air, the more moisture it can hold. High humidity makes people feel hotter because sweat does not evaporate off the skin as easily; it is the evaporation of sweat that makes you feel cooler.
- **Air Movement** usually cools a person. This cooling provides relief in a hot environment if the moving air is cooler than the person.
- **Physical Exertion** or how hard the body is working also influences how hot or cold you feel. Moving around or working generates heat. When working on a very hot day, this movement increases your heat stress.
- **Clothing** selection affects the body's ability to expel heat and how hot a person feels.
- **General Health** also influences how well the person adapts to heat and cold. Those with extra weight often have trouble in both cold and hot situations due to the body having difficulty maintaining a good heat balance. Age (particularly for people about 45 years and older), poor general health, and a low level of fitness will make people more susceptible to feeling the extremes of heat and cold.
- **Medical conditions** can also increase how susceptible the body is to heat and cold. People with heart disease, high blood pressure, respiratory disease and uncontrolled diabetes may need to take special precautions.
- **Substances** – both prescription or otherwise – can also have an impact on how people react to heat and cold.

Substances that can affect a person's tolerance to heat include:

- Alcohol
- Amphetamines
- Anaesthetics
- Anticholinergics (e.g. atropine)
- Antidepressants
- Cannabis (marijuana)
- Cocaine
- Hypnotics (e.g. barbiturates)
- Morphine
- Psychotropic drugs

5) Health Effects of Extremes Heat

Heat stress is the overall heat load on the body, including environmental heat and inner body heat production due to working hard. Mild or moderate heat stress may be uncomfortable and may affect performance and safety, but it is not usually harmful to your health.

When heat stress is more extreme, the possible health effects include:

- **Heat edema** is swelling which generally occurs among people who are not acclimatized to working in hot conditions. Swelling is often most noticeable in the ankles.
- **Heat rashes** are tiny red spots on the skin, which cause a prickling sensation. The spots are the result of inflammation caused when sweat glands become plugged.
- **Heat cramps** are sharp pains in the muscles that may occur alone or be combined with one of the other heat stress disorders. The cause is salt imbalance resulting from the failure to replace salt lost

with sweat. Cramps most often occur when people drink large amounts of water without sufficient salt (electrolyte) replacement.

- **Heat exhaustion** is caused by excessive loss of water and salt. Symptoms include heavy sweating, weakness, dizziness, nausea, headache, diarrhea, muscle cramps, and more (see table 4).
- **Heat syncope** is heat-induced giddiness and fainting induced by temporarily insufficient flow of blood to the brain while a person is standing. It occurs mostly among unacclimatized people. It is caused by the loss of body fluids through sweating, and by lowered blood pressure due to pooling of blood in the legs.
- **Heat stroke and hyperpyrexia** (elevated body temperature) are the most serious types of heat illnesses. Signs of heat stroke include body temperature often greater than 41°C, and complete or partial loss of consciousness. The signs of heat hyperpyrexia are similar except that the skin remains moist. Sweating is not a good symptom of heat stress as there are two types of heat stroke – “classical” where there is little or no sweating (usually occurs in children, persons who are chronically ill, and the elderly), and “exertional” where body temperature rises because of strenuous exercise or work and sweating is usually present.

6) Signs and Symptoms of Heat Exposure (Hyperthermia)

Early Warning Signs

- Headache
- Dizziness / faintness
- Irritability / anger / mood change
- Fatigue
- Heavy sweating
- Prickly heat (heat rash)
- Muscle cramps (especially after several days of exposure)
- Changes to breathing and pulse rate
- Dehydration

As Heat Stress Worsens...

- Breathlessness (having trouble catching your breath)
- A strong rapid pulse changes to a weak rapid pulse
- Severe headache
- Severe muscle cramps
- Confusion
- Skin goes from feeling cold and clammy to hot and dry
- Severe dehydration
- Sweating may stop
- Exhaustion
- Coma and possible death

7) Treatment and Prevention

Being aware of the signs of heat stress is the first step for prevention. Remember that lack of acclimatization, poor levels of physical fitness, and conditions such as diarrhea or fever increase susceptibility to heat stress because the body is already in a weakened state. Certain drugs such as tranquilizers and diuretics can also increase susceptibility. Heat stroke occurs more easily when the body has suffered a previous heat disorder.

Heat stroke and hyperpyrexia require **immediate** first aid and medical attention. Delayed treatment may result in damage to the brain, kidneys and heart.

A heat stroke victim is usually unable to recognize the heat stroke signs and symptoms. His or her survival depends on a co-worker's ability to recognize the symptoms and seek immediate medical help.

If one person is showing signs of heat stress, take it as a sign that other workers may also be affected. Workers should report to a cool area and be assessed individually before work continues.

8) First Aid for Heat Stress

- Move the person to a cooler area where they can rest (such as an air-conditioned building or vehicle, or into the shade).
- Take off excess clothing (hard hat, boots, shirt, coveralls, etc.).
- Give the person water to drink but only if they are able to drink it on their own.
- Cool the person with cold compresses and rapid fanning.

For heat cramps/heat exhaustion, take the person to a cooler place and have them rest in a comfortable position. Give a half glass of cool water every 15 minutes. Do not let the person drink too quickly. Do not give liquids with alcohol or caffeine as these ingredients can make conditions worse. Remove or loosen tight clothing and apply cool, wet cloths such as towels or wet sheets.

9) First Aid for Heat Stroke

- Call 911 and get medical help. **Heat stroke is a medical emergency.**
- Move the person to a cooler place. Keep the person lying down.
- If the person is conscious, have them drink cool water slowly but regularly.
- If possible, help the person's body cool faster by wrapping wet sheets around the body and then fanning the body.
- If ice packs or cold packs are available, wrap the packs in a cloth and place them on each of the victim's wrists and ankles, in the armpits, and on the neck to cool the large blood vessels.
- Watch for signals of breathing problems and make sure the airway is clear.

NOTE: Immersing the victim in cold water more efficiently cools the body but it can result in harmful overcooling. This can interfere with vital brain functions, so it must only be done under close medical supervision. Do not use rubbing alcohol because it closes the skin's pores and prevents heat loss.

10) What and When to Drink

Being dehydrated is a serious issue. Since you cannot rely on "feeling thirsty", watch for signs of fatigue, irritability, headaches, nausea, and giddiness. The clinical (medical) signs are not passing urine and changes to a person's personality or mental state. When dehydrated, urine will be dark yellow to orange in colour and there will be far less of it.

Unacclimatized workers can lose up to 5 or 6 litres of fluid in an 8-hour shift. While working, drink about 250 ml (1 cup) of water every 15-20 minutes. Workers should be well hydrated before work in the heat

begins. A person working in a hot environment loses water and salt through sweat. On average, about one litre of water each hour must be drunk to replace lost fluid.

Workers in hot environments should be encouraged to drink water even if they do not feel thirsty. A person is adequately hydrated when the person has to urinate slightly more often than usual. Make sure plenty of cool (10-15°C) or room temperature (20°C) drinking water is available at the worksite.

11) Salt Supplements

An acclimatized worker loses relatively little salt in their sweat and, therefore, salt in the normal diet is usually enough to maintain the electrolyte balance in body fluids. For unacclimatized workers who may sweat continuously and repeatedly, additional salt in the food may be used.

In most cases, people will eat enough salt to maintain their electrolyte balance. Salt tablets are not recommended because the salt does not enter the body system as fast as water or other fluids. Too much salt can cause higher body temperatures, increased thirst and nausea. Workers on salt-restricted diets should discuss their job tasks and the need for supplementary salt with their doctor.

12) Sport Drinks, Fruit Juice, etc.

Drinks specially designed to replace body fluids and electrolytes may be taken but for most people, they should be used in moderation. They may be of benefit for workers who have very physically active occupations but keep in mind they may add unnecessary sugar or salt to your diet. Fruit juice or sport and electrolyte drinks, diluted to half the strength with water, is an option. Drinks with alcohol or caffeine should never be taken, as they dehydrate the body. For most people water is the most efficient fluid for re-hydration.

13) Clothing

Evaporation of perspiration from the skin is the main way the body cools itself. Clothing such as water-vapour impermeable, air-impermeable, thermal insulation or layered clothing will greatly restrict this heat removal process. The result can be excessive heat strain even when environmental conditions are not hot.

Worker's should put careful thought into ensuring their clothing is appropriate for all weather conditions they may face in each day.

14) Measuring Hot Conditions

There are two common methods for determining heat stress:

- Wet Bulb Globe Temperature (WBGT) Index
- Environment Canada's Weather Service's Humidex values.

a) Wet Bulb Globe Temperature (WBGT) Index

The WBGT Index is an indicator of workplace heat stress that factors in the effects of air temperature, humidity, air movement and radiant energy. It provides a single number measure of "perceived heat". The index can be calculated automatically using a portable instrument called a wet-bulb globe temperature meter often referred to as a heat stress monitor. This device is essentially a combination of three thermometers:

- A conventional thermometer (called a "dry bulb") that measures air temperature and is shielded from heat radiation.

- A black bulb globe thermometer (a hollow 150 mm diameter copper ball painted black, with a conventional thermometer located at the center) which measures the combined effects of radiant heat and wind.
- A wet bulb thermometer (a conventional thermometer with the bulb wrapped in a wet cotton wick moistened with distilled water from a reservoir) which measures the cooling effects of movement and evaporation.

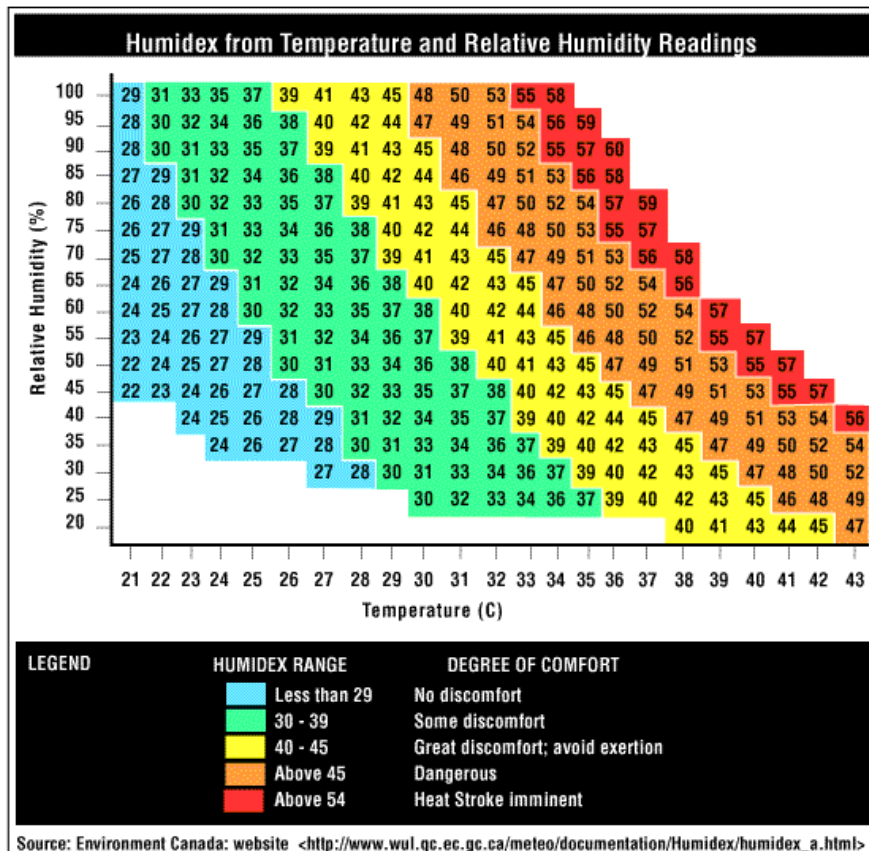
b) Humidex

The humidex is an index number used by Environment Canada to describe how hot the weather feels to the average person by combining the effect of heat and humidity. Humidity is a major factor because as the humidity increases sweat does not evaporate as readily which can contribute to body heat rising. When the humidity reaches 90% sweat will not evaporate at all. The humidex value is especially important when its value exceeds 30.

Portable instruments for measuring temperature and relative humidity to calculate humidex are inexpensive and easy to use. They allow for an on-site assessment of humidex value.

Some important factors to consider when using the humidex as an indicator are:

- Humidex is an indication of physiological reactions, not an absolute measure. It does not account for personal factors, acclimatization, or clothing.
- Outdoor humidex readings may not accurately reflect conditions at an indoor workplace. Humidex readings do not account for workplace-specific factors such as air movement and the presence of radiant heat sources.



15) Humidex as a Guide for Heat Stress

As previously discussed, Environment Canada uses a humidex scale to inform the public about hot weather conditions. For a given temperature, the humidex increases as the relative humidity (moisture content) of the air becomes greater.

The Occupational Health Clinics for Ontario Workers Inc. (OHCOW) created a “Humidex-based response plan” which translated TLVs® WBGTs into humidex values and developed recommended responses for each humidex range. This plan was developed as a tool to help workplaces as most workplaces find using the WBGT complicated and expensive.

Recommended Actions Based on the Humidex Reading		
Humidex Reading		Action
Moderate physical work, unacclimatized worker, OR Heavy physical work, acclimatized worker	Moderate physical work, acclimatized worker, OR Light physical work, unacclimatized worker	
45+	50+	Workers must be under medical supervision during work
42-44	47-49	Work with 45 min/hour rest
40-41	45-46	Work with 30 min/hr rest
38-39	43-44	Work with 15 min/hr rest
34-37	40-42	Warn workers of symptoms and provide extra water
30-33	36-39	Alert workers of symptoms and provide extra water
25-29	32-35	Provide water as needed

Environment Canada describes the degree of comfort from humidex ranges slightly differently but their “calculations” of comfort do not discuss being physically active or working outdoors.

CONTROLLING HEAT EXPOSURE

Engineering Controls

- Reduce the level of physical activity required. Reducing heavy physical activity will lower the body’s metabolic heat production and thus the risk of heat stress. Some examples include using carts, conveyors, or mechanical lifting devices.
- Where possible, change the location of the work to a cooler work area. Determine if some or all of the work can be done in the shade, or better, in a ventilated or air-conditioned space. Examples would be to load vehicles inside a cooled warehouse or to fabricate in a well-ventilated shop as opposed to in a yard.
- Establish a cooling station where workers can rest in a ventilated and air-conditioned space, either a booth or vehicle. For example, workers can take breaks in an air-conditioned vehicle or provide shade (tarps, tents, etc.).
- Use fans to increase air movement and help encourage sweat evaporation. **NOTE:** This control method is only effective when the air temperature is less than the skin temperature (about 35°C). When extremely hot air is blown on a person, heat exhaustion can happen faster.
- Indoor environments may also be able to insulate or shield objects that give off radiated heat, use local exhaust to remove hot air or steam produced by processes, or use air conditioning to control the temperature and amount of humidity in the workspace.

Administrative Controls

- Reduce the physical effort needed for the task by:
- Lowering the pace of work (how fast) or the intensity (how "hard" the job is).
- Shortening the duration of the work (how long).
- Increasing the number and/or length of rest breaks.
- Substituting light tasks for heavy ones.
- Increasing the number of staff so that more workers share the workload.
- Allow time for acclimatization. Acclimatization is an important control step.
- Use a work-rest schedule. This schedule reduces the amount of time spent at physical activities and allows for a rest period for the body to recover and cool. Recommendations for how long the work and rest periods are will depend on the temperature, humidity, acclimatization, and company policy. Rest breaks allow the body time to cool (rid itself of excess heat), reduce the production of internal body heat, and provide greater blood circulation to the skin.
- If practical, workers in hot environments should be encouraged to set their own work and rest schedules. Experienced workers can often judge heat stress and limit their exposure accordingly. Inexperienced workers may need special attention as they may continue to work beyond the point at which signs of heat stress begin to appear.
- Schedule physically demanding jobs for cooler periods of the day (usually early morning or evening).
- Carefully monitor infrequent or irregular tasks such as emergency repairs or working near hot process equipment as these tasks often result in heat stress.
- Provide appropriate training and education to increase workers' awareness of the potential hazards and what to do when they recognize warning signs in themselves or others.
- Pay attention to workers with special needs, including those with medical conditions or pregnant workers. Workers should discuss limitations and precautions with their doctor.
- If workers are routinely expected to work in hot conditions, the employer should prepare safe work practices regarding working in hot conditions.
- Provide training and education. Create awareness about the hazards of working in hot conditions.
- Establish how you will determine when work should be reduced, or when it is too hot to do certain types of work.
- Know what steps to take to prevent health effects.
- Establish a buddy system; everyone should be able to recognize early warning signs of health effects in themselves and their co-workers and be able to respond appropriately.
- Always provide enough drinking water for all workers. Each worker should drink about 250 ml or 1 cup of water every 15-20 minutes when working in hot conditions.

Reminder: Staying hydrated is essential. Level of acclimatization and personal factors also play a significant role in how we adapt to heat and cold.

Personal Protective Equipment (PPE)

When selecting clothing to help prevent heat stress, the type selected should be balanced against other health and safety needs. Types of protective equipment (hard hats, coveralls, impermeable clothing, gloves, etc.) may be necessary to protect from other hazards but this clothing or equipment will increase the heat stress burden experienced by an individual.

REFERENCES / ADDITIONAL INFORMATION

Canadian Center for Occupational Health and Safety – Humidex Rating and Work

https://www.ccohs.ca/oshanswers/phys_agents/humidex.html

Canadian Center for Occupational Health and Safety – Hot Environments – Health Effects and First Aid

https://www.ccohs.ca/oshanswers/phys_agents/heat_health.html

REGULATIONS

Alberta OHS Code

None

Saskatchewan OHS Regulation - PART VI General Health Requirements

Thermal conditions

70(1) Subject to subsection (3), in an indoor place of employment, an employer, contractor or owner shall provide and maintain thermal conditions, including air temperature, radiant temperature, humidity and air movement, that:

- a) are appropriate to the nature of the work performed;*
- b) provide effective protection for the health and safety of workers; and*
- c) provide reasonable thermal comfort for workers.*

(2) At an indoor place of employment where the thermal environment is likely to be a health or safety concern to the workers, an employer, contractor or owner shall provide and maintain an appropriate and suitably located instrument for measuring the thermal conditions.

(3) Where it is not reasonably practicable to control thermal conditions or where work is being performed outdoors, an employer, contractor or owner shall provide and maintain measures for:

- a) the effective protection of the health and safety of workers; and*
- b) the reasonable thermal comfort of workers.*

(4) Measures for the purposes set out in subsection (3) may include, but are not limited to, the following:

- a) frequent monitoring of thermal conditions;*
- b) the provision of special or temporary equipment, including screens, shelters and temporary heating or cooling equipment;*
- c) the provision of suitable clothing or personal protective equipment;*
- d) the provision of hot or cold drinks;*
- e) the use of acclimatization or other physiological procedures;*
- f) the use of limited work schedules with rest and recovery periods, changes in workloads, changes in hours or other arrangements for work;*
- g) frequent observation of workers by a person who is trained to recognize the symptoms of physiological stress resulting from extreme temperatures;*

- h) the provision of emergency supplies for use when travelling under extremely cold or inclement weather conditions.*
- (5) Where a worker is required to work in thermal conditions that are different from those associated with the worker's normal duties, an employer or contractor shall provide, and require the worker to use, any suitable clothing or other personal protective equipment that is necessary to protect the health and safety of the worker.*

British Columbia OHS Regulation - Part 7 Noise, Vibration, Radiation and Temperature

Heat Exposure

7.28 Exposure limits

- (1) A worker must not be exposed to levels that exceed those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.*
- (2) Clothing corrections must be applied in accordance with the heat stress and strain section of the ACGIH Standard.*

7.29 Heat stress assessment and exposure control plan

- (1) If a worker is or may be exposed to the conditions specified in section 7.27, the employer must
 - (a) conduct a heat stress assessment to determine the potential for hazardous exposure of workers, using measures and methods that are acceptable to the Board, and*
 - (b) develop and implement a heat stress exposure control plan meeting the requirements of section 5.54(2).**

7.30 Heat stress controls

- (1) If a worker is or may be exposed to the conditions specified in section 7.27, the employer must implement engineering controls to reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard.*
- (2) If the action described in subsection (1) is not practicable, the employer must reduce the exposure of workers to levels below those listed in the screening criteria for heat stress exposure in the heat stress and strain section of the ACGIH Standard by providing
 - (a) administrative controls, including a work-rest cycle, acceptable to the Board, or*
 - (b) personal protective equipment, if the equipment provides protection equally effective as administrative controls.**

7.31 Provision of water

If a worker is or may be exposed to the conditions specified in section 7.27, the employer must provide and maintain an adequate supply of cool potable water close to the work area for the use of a heat exposed worker.

7.32 Removal from and treatment for heat exposure

If a worker shows signs or reports symptoms of heat stress or strain, the worker must be removed from the hot environment and treated by an appropriate first aid attendant, if available, or by a physician.



SAFE WORK PRACTICE
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SWP-68
WORKING IN HEAT

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Last Revised by: 1. Ryan Obleman 2. _____ Date: April 18, 2018
