Working in Hot Environments: Health & Safety Guide

Canadian Centre for Occupational Health and Safety
Working in Hot Environments: A Health and Safety Guide

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Working in Hot Environments: A Health and Safety Guide

Objectives

The guide will help health and safety committee members and representatives as well as supervisors, managers, engineers and other health and safety professionals to:

2. Identify risk factors for work in hot environments.
3. Develop prevention programs and practices to reduce injury and illness.
5. Develop hazard controls based on the most current knowledge in the field of occupational health and safety.
6. Comply with legal requirements.

Scope

The guide provides:

- Practical guidance for the identification, assessment and control of the health and safety hazards related to working in hot environments; and
- Applicable legislation, standards and guidelines addressing heat stress.

Detailed information on specific workplace hazards can be obtained from the Inquiries Service of the Canadian Centre for Occupational Health and Safety (CCOHS).
**Target Audience**

The guide is intended to serve as a handy reference for health and safety committee members, health and safety representatives, employees, supervisors and managers.

For training sessions, the guide can serve as a practical handout for future reference.

**Summary**

Heat stress is the net heat load on the body from the combined effect of hot environmental conditions (air temperature, radiant heat, humidity and air movement), internal body heat due to physical activity, and clothing requirements. Workplaces and occupations associated with excessive heat exposure include: foundries, steel mills, bakeries, construction sites, kitchens, grounds maintenance, dishwashing and steaming.

Heat strain is the overall response of the body resulting from heat stress. It can cause a wide variety of health disorders. Heat stroke is the most serious health risk, which can be fatal if medical attention is not available promptly. People doing heavy physical work in hot and humid conditions are affected more than those doing light work.

Heat stress is largely preventable by engineering and administrative control methods. As a last resort or in extreme conditions, the use of personal protection is warranted. Engineering controls are designed to eliminate or minimize the level of heat exposure at the source of the hazard. Administrative controls reduce heat exposure at the worker. These measures include establishing procedures for acclimatization of new workers, training in safe work practices, reducing the duration of work in hot environments and providing plenty of drinking water. Workers and supervisors must receive adequate training and education to be able to recognize early symptoms of health disorders and seek timely medical help.
Under excessively hot working conditions, personal protective equipment such as cooling vests, hats and other body cooling equipment may be necessary. It might be necessary to stop work in extremely hot conditions.

Employers can prevent or minimize heat stress hazards by implementing appropriate policies and programs. A workplace heat stress policy must include clearly defined procedures for working safely in hot environments and for providing care to potential heat stroke victims.
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   heat exposure
Introduction

Everyone likes warm weather. However, when it becomes too hot we feel discomfort. Working under very hot conditions can cause serious adverse health effects. Examples of hot working conditions include:

- Working in foundries, steel mills, smelters and glass factories.
- Working near furnaces and extremely hot or molten metals.
- Outdoor work such as construction, road repair, open-pit mining and farming in summer months.
- Working in laundries, restaurant kitchens, bakeries and canneries.

In a hot working environment, how hot we feel depends on the following factors:

- air temperature;
- relative humidity (moisture content of the air);
- air movement;
- physical exertion (heavy workload produces more body heat than light work); and,
- clothing.

The combined effect of the environmental factors (air temperature, relative humidity and air movement) are expressed as the wet bulb globe temperature index, commonly known as WBGT. For occupational exposures WBGT is used as an overall measure of heat exposure.

In this guide we frequently use the terms heat stress, heat strain and heat-related illnesses. Heat Stress is the overall heat load on the body, including environmental heat and inner body heat production due to heavy workload. Heat Strain refers to the body’s response to heat stress. Heat-Related Illnesses refers to adverse health effects due to heat stress.
The body’s defense mechanisms make adjustments to deal with moderate excess heat exposure. In extremely hot working conditions, the risk of heat-related illnesses increases. Heat stroke is the most severe adverse health effect related to heat exposure. It can be fatal unless medical attention is provided immediately.

In a particular hot environment, everyone is not affected equally. Some individuals are more susceptible than others to extreme heat and may be at greater risk. Personal factors such as body weight, diet, level of acclimatization, medications and alcohol consumption contribute to how an individual responds to hot working conditions. It is important to consider individual susceptibility when developing safe work practices.

The guide provides information to assist workers and their supervisors with the recognition and prevention of heat-related illnesses. The main purpose of the guide is to emphasize the importance of developing safe work practices and implementing preventive measures to prevent (or minimize) worker exposure to extreme heat.
Section 1

Legal Responsibilities to Prevent Heat Stress

1. Responsibilities as set out in Health and Safety legislation.

2. Ways of meeting responsibilities: being prepared.
Employers are obliged to prevent heat-related illnesses and fatalities. Such responsibilities are the same as those for other occupational hazards such as noise, chemicals and radiation.

1. Responsibilities as set out in Health and Safety legislation.

Some jurisdictions may not have health and safety regulations specifying occupational heat exposure limits. This does not mean that employers do not have obligations to protect employees from harmful heat exposures.

Under the general duty clause of the Occupational Health and Safety Act (Canada Labour Code Part II for federal jurisdiction), employers are responsible to protect the health and safety of employees. For example, the Canada Labour Code Part II states:

“Every employer shall ensure that the health and safety at work of every person employed by the employer is protected.” Canada Labour Code Part II, section 124.

All provincial and territorial OSH acts have similar provisions. Therefore, employers have a legal responsibility to protect employees from harmful heat exposure.
2. Ways of meeting OHS responsibilities: being prepared.

The purpose of being prepared to meet OHS responsibilities is to prevent heat-related illnesses from occurring and reduce the impact of potentially harmful heat exposure situations.

In order to meet their health and safety responsibilities, employers must:

1. Identify conditions that pose a risk of heat-related illness;
2. Evaluate the risk of adverse health effects;
3. Develop and implement a prevention program in consultation with the health and safety committee;
4. Evaluate the effectiveness of the program; and,
5. Periodically review the heat stress policy and program and make continuous improvements in consultation with the health and safety committee.

Supervisors have legal responsibilities to ensure that employees work safely. In order to meet their responsibilities, supervisors must:

1. Identify potential heat stress situations in their workplace;
2. Ensure that employees follow safety procedures required by the employer;
3. Take every precaution reasonable in the circumstances for the protection of employees; and,
4. Ensure that changes of equipment or process are done only after evaluation of their impact on employee health and safety.

Workers are responsible too. They must:

1. Follow safe work practices established by the employer; and,
2. Report unsafe conditions to their supervisor.
A heat stress policy and program is a systematic plan of action designed to prevent heat stress and related adverse health effects. Because needs differ from one workplace to another, a prevention program developed for one workplace may not serve the needs of others. It is vital to develop and implement a workplace-specific prevention program in consultation with the workplace health and safety committee.

Following are the basic elements of a heat stress prevention program.

- Conformity with the company health and safety policy.
- Conformity with the occupational health and safety legislation.
- Conformity with the overall workplace health and safety policy and program.
- A time frame for implementation and completion.
- Provision for regular monitoring and review.
- Procedures for keeping records of the successes and problems of the program.
- Clearly defined roles and responsibilities.
- Employee orientation.
- Job specific training.
- Reporting and investigating incidents.
- Emergency procedures.
- Medical and first aid procedures.
All persons working in hot conditions must receive adequate training and education so that they are able to recognize early warning signs and symptoms of heat-related illnesses, especially heat stroke. Individuals affected by heat stroke are usually unable to recognize their own symptoms. The survival of heat stroke victims depends on the coworkers’ ability to identify the signs and symptoms of heat stroke and take timely action.

Provide prompt medical attention to heat stroke victims
Section 2

The Body’s Response to Hot Environments.

1. The body’s heat balance.
2. Heat exchange between the body and the environment.
3. Effect of clothing.
4. Other contributing factors.
1. The body’s heat balance.

A healthy human body maintains its internal temperature (core temperature) around 37°C. Variations, usually of less than 1°C, may occur with the time of the day, level of physical activity or emotional state.

In order to maintain a constant body temperature, the body must continuously lose as much heat as it gains. This implies that when it is hot, our body must lose more heat compared to the heat loss in a cool environment.

---

**High Temperature + High Humidity + Physical Work = Heat Stress**
The body gains heat in two ways:

1. Metabolic (inner body) heat production.
2. Heat gain from the environment.

Metabolic heat is the heat produced within the body. It is a result of the physical and chemical processes that take place within the body for continued growth, functioning and movement. Even when we are sitting quietly, the body’s internal processes are active and produce some amount of metabolic heat. The metabolic heat production increases with increase in the physical activity.

Heat gain from the environment occurs from contact with the surrounding hot air and from hot objects in the vicinity. As the environment warms-up, the body tends to warm-up as well. The body's internal “thermostat” maintains constant inner body temperature by increasing the body heat loss to offset increased heat gain from the environment.
2. Heat exchange between the body and the environment

There are three main ways the body exchanges heat with its surroundings:

- Radiation
- Convection
- Sweat evaporation

**Radiation** is the direct heat exchange between the body and an object without direct contact with the object.

- The body gains heat from surrounding hot objects, such as hot metal, furnaces or steam pipes.
- The body loses heat to cold objects, such as chilled metallic surfaces.
- No radiant heat gain or loss occurs when the temperature of surrounding objects is the same as the skin temperature (about 35°C).

When we stand in the sun, we feel warm because our body receives heat from the sun by the radiation process.

Radiant heat is the main concern when working near hot objects or outdoors on a hot and sunny summer day. Radiant heat can come directly from hot objects and also as reflection from nearby surfaces.

**Convection** is the process by which the body exchanges heat by contact with the surrounding air.

- The body gains heat from the hot air that comes in contact with the body; for example, hot air coming from heating vents.
- The body looses heat to cold air that comes in contact with the skin; for example, cold draft from leaky outside doors.
Convective heat exchange increases when:
- Air speed increases; and/or
- The difference between air temperature and skin temperature increases.

**Sweat Evaporation** cools the body. Cooling by sweat evaporation increases when:
- Wind speed increases; and
- Relative humidity (the moisture content of the air) decreases.

Besides radiation, convection and sweat evaporation, a small amount of heat is lost through conduction and respiration.
Conduction is the process in which the body exchanges heat with an object that comes in contact with the body. Usually, body’s heat gain or loss by conduction process is very small compared to the heat exchange by radiation, convection and sweat evaporation processes.

Respiration contributes to a very small amount of heat exchange between the body and the inhaled hot air. The amount of heat exchanged through breathing is very small and can be ignored in assessing heat stress.

### Normal Cooling Mechanisms

1. When body core temperature rises
   - Blood flow to skin increases
   - Sweating increases
   - Heart rate increases to move blood to the skin

2. When this works well
   - Core temperature drops or stabilizes at a safe level

### Heat Stress

1. Heat exhaustion and heat stroke occur when the body is subjected to more heat than it can cope with
1. The body becomes unable to control its inner body temperature

2. Death or permanent damage may occur if medical treatment is not given promptly

3. Symptoms
   - No sweating
   - Red, hot, dry skin
   - Throbbing headache
   - Dizziness
   - Nausea

Heat Stroke
3. Effect of Clothing

Clothing affects heat exchange between the body and the environment. Heavy clothing that fails to “breathe” does not allow the body to cool off by air circulation and sweat evaporation processes.

4. Other contributing factors

In addition to high temperature and humidity, the effect of heat stress on the body depends on several individual factors such as general health and lack of acclimatization. Certain medications such as antihistamines, cold remedies, diuretics, tranquilizers, etc. may cause heat intolerance by decreasing sweating or increasing urination. People taking such medications must consult their doctor about their ability to work in hot environments.
Section 3

Safety and Health Concerns.

1. Safety Concerns

2. Health Concerns

   (a) Heat Strain

   (b) Heat-related illnesses
1. Safety concerns

Heat stress can cause safety problems by impairing a worker’s ability to work safely. Heat can lead to accidents resulting from the slipperiness of sweaty palms and to accidental contact with hot surfaces. Heat causes dizziness. Heat may also affect mental alertness and physical ability to work increasing the risk of incidents. As a worker moves from a cold to a hot environment, fogging of eyeglasses can briefly obscure vision, presenting a safety hazard.

2. Health Concerns

(a) Heat Strain

Heat strain is the response of the body to heat exposure. It is a series of physiological responses to heat stress. Excessive and prolonged heat strain can cause heat-related illnesses. An early recognition of heat strain signs and symptoms will help in preventing potentially serious health disorders.

The severity of heat strain varies greatly from one person to another. Some highly susceptible individuals are affected sooner than others. However, as the level of exposure and/or the exposure duration increases more and more people are likely to be affected. The signs and symptoms of heat strain include:

- Sweating
- Discontinued sweating
- Increased heart rate
- Increased inner body temperature
- Urinating less frequently than normal
- Small volume of dark-colored urine
- Irritability
- Lack of coordination
- Lack of judgement
Sweating:

The presence of sweat on the skin, or sweat-soaked clothing, is a sign of heat strain.

Sweat evaporation cools the body. Commonly used methods to increase the sweat evaporation rate are:

- Increasing the air flow rate over skin and clothing surfaces.
- Lowering the ambient temperature and relative humidity.
- Reducing radiant heat gain from the sun and hot objects in the vicinity.
- Reducing the level of physical activity (metabolic heat production).

Discontinued sweating:

Absence of sweating in a very hot environment can be a sign of potential heat stroke. Affected persons require immediate first aid and medical attention.

Increased heart rate:

An increase in the heart rate is an indication that the body has to work harder than normal to cope with the increased heat load.

Increased inner body temperature:

When the body is unable to cope with the hot environment, the body’s heat gain exceeds the body’s capability to lose heat. As a result, the inner body temperature rises increasing the risk of heat-related illnesses.
Decreased frequency and volume of urination and change in the colour of urine:

In hot environments the volume of urine and the frequency of urination decrease because of loss of body fluids through sweating. These are warning signs of dehydration. People need to develop a habit of drinking adequate volumes of water at frequent intervals to maintain their normal frequency of urination, urine colour and urine volume.

(b) Heat-Related illnesses

Prolonged exposure to hot working conditions can cause a wide range of adverse health effects. Commonly known heat illnesses are:

- Heat rash
- Heat edema
- Heat cramp
- Heat exhaustion
- Heat syncope (fainting)
- Heat stroke

Signs and symptoms of heat illnesses include:

- Excessive sweating
- Rapid breathing
- Weakness or fainting
- Tiredness
- Headache
- Confusion

Heat Rash, also called prickly heat or miliaria, is a condition in which areas of the skin itch intensely and often feel prickly, or sting. Heat rash looks like tiny bumps surrounded by a zone of red skin. It usually occurs on clothed parts of the body, such as the back, abdomen, neck, upper chest, groin, or armpits and goes away within a few days.
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 cramps are painful muscle cramps, which result from excessive loss of salt from the body. Muscles of the extremities and the abdominal wall are usually involved. Heat cramps are promptly relieved when the individual takes drinks that replace the body electrolytes, and rests in a cool environment.

Heat exhaustion occurs as a result of excessive loss of water and salt from the body. The symptoms include heavy perspiration, flushed skin and low blood pressure. Prompt recovery occurs when the affected individual moves to a cool environment, takes rest and drinks water or beverages with adequate water and electrolyte content.

Heat Syncope is a sudden dizziness experienced after physical exertion in a hot environment. The skin appears pale and sweaty but is generally moist and cool. The pulse may be weakened, and the heart rate is usually rapid. Body temperature is normal.

Heat Stroke

Heat stroke is a medical emergency, which can be fatal unless first aid and medical help is promptly provided. If you or someone you are with becomes ill, has difficulty in breathing, or feels confused or disoriented, SEEK MEDICAL ATTENTION IMMEDIATELY.
Heat stroke signs and symptoms include:

- Extremely high body temperatures (above 41°C).
- Mental confusion, delirium, or coma.
- Absence of sweating.
- Complete or partial loss of consciousness.
- Red, hot, and dry skin (no sweating).
- Rapid, strong pulse.
- Throbbing headache.
- Dizziness.

The following actions are basic elements of a first response:

- **TAKE** the affected person to a cooler area (for example, an air-conditioned shed or air-conditioned vehicle).
- **REMOVE** excess clothing (hard hat, boots, shirt).
- **GIVE** the person water to drink, if conscious.
- **ALLOW** the person to rest.
- **COOL** the person’s body with cool water, cold compresses, and/or rapid fanning.
- **TAKE** the person to medical facility for proper medical care.

Risk of heat stroke is higher than normal if a person is:

- Not fully acclimatized;
- Not in good physical health;
- Ill as a result of pre-existing diarrhea or fever; or,
- Recovering from a heat-related illness.

A case of heat stroke should be taken as a warning. It indicates a possibility that other workers could be affected. It is important to take immediate remedial action to prevent future recurrence of heat strokes in similar environments.
Illnesses caused by long-term (chronic) heat exposure

Some researchers have reported that certain disorders of the kidney, liver, heart, digestive system, central nervous system and skin may be linked to long-term heat exposure. Other probable effects include: chronic heat exhaustion, sleep disturbances and susceptibility to minor injuries. There is no conclusive scientific evidence linking such effects and long-term exposure to heat.

Effect on the eye due to long-term (chronic) heat exposure

The eye has no heat sensors and no blood vessels to carry heat away. The lens of the eye is particularly vulnerable to radiant heat from red-hot objects (infrared radiation). Following are some examples of sources of radiant heat exposure:

- Glass products manufacturing plants.
- Iron, steel and nonferrous foundries.
- Brick-firing and ceramics operations.
- Bakeries.

Glass blowers and furnace-men may develop cataracts after many years of exposure to radiant heat from hot objects. Foundry workers, blacksmiths and oven operators are also exposed to potentially harmful levels of infrared radiation.

Medications that may affect heat illnesses

Certain medications can affect heat tolerance. People taking medications must ask their doctor if they need to be extra careful when working in hot environments.

The following table summarizes the symptoms, treatment and preventive actions for common heat-related illnesses.
## Recognition and Prevention of Heat Related Illnesses

<table>
<thead>
<tr>
<th>Heat related illness</th>
<th>Symptoms</th>
<th>Treatments</th>
<th>Prevention</th>
</tr>
</thead>
</table>
| Heat Rash            | - Red bumpy rash with severe itching | - Change into dry clothes  
- Avoid hot environments  
- Rinse skin with cool water | - Wash regularly to keep skin clean and dry |
| Heat Cramps          | - Painful cramps in arms, legs or stomach  
- Can occur suddenly at work or later at home  
- Cramps can be a warning of other more dangerous heat induced illness | - Move to a cool area  
- Loosen clothing  
- Drink cool salted water (1tsp. salt per gallon of water) or commercial fluid replacement beverage  
- Seek medical aid if cramps are serious | - Use salt in food (if on a low salt diet, discuss with a doctor)  
- Salt in food will give the body all the salt the body needs |
<table>
<thead>
<tr>
<th>Heat related illness</th>
<th>Symptoms</th>
<th>Treatments</th>
<th>Prevention</th>
</tr>
</thead>
</table>
| Fainting (heat syncope) | - Sudden fainting  
- Cool moist skin  
- Weak pulse | - Fainting may be due to a heart attack  
- Get Medical aid  
- Assess need for CPR  
- Move to a cool area  
- Loosen Clothing  
- Make the person lie down  
- Offer sips of cool water if person is conscious | - Reduce physical activity levels and/or heat exposure  
- Drink fluids regularly  
- Check on each other to help spot the signs and symptoms that often precede heat stroke |
| Heat Exhaustion | - Heavy sweating  
- Cool moist skin  
- Body temperature over 38°C  
- Weak pulse  
- Normal or low blood pressure  
- Person is tired, weak, clumsy, upset or confused  
- Person is very thirsty  
- Person is panting or breathing rapidly  
- Person’s vision is 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 physical activity levels and/or heat exposure  
- Drink fluids regularly  
- Check on each other to help spot the symptoms that often precede heat stroke |
# Heat-related Illness: Heat Stroke

## Symptoms

<table>
<thead>
<tr>
<th>Condition</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Stroke</td>
<td>High body temperature (over 41°C)</td>
</tr>
<tr>
<td></td>
<td>Person is weak</td>
</tr>
<tr>
<td></td>
<td>Confused, upset or acting strangely</td>
</tr>
<tr>
<td></td>
<td>Person has hot, dry skin, a fast pulse, or a headache or dizziness</td>
</tr>
<tr>
<td></td>
<td>In later stages, a person passes out and has convulsions</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Prevention

- Reduce physical activity levels and/or heat exposure
- Drink fluids regularly
- Check on each other to help spot the symptoms that often precede heat stroke
- Learn to recognize warning signs of a heat stroke

## Treatments

- 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

## Source

Ontario Ministry of Labour, Occupational Health and Safety Division, Guide to Heat Stress

Section 4

Measures of Heat Exposure

1. Measures of Occupational Heat Exposure: The WBGT index

2. Environmental Measures of Heat Exposure

How hot we feel depends on the combined effect of the following environmental and workload factors:

- Temperature of the surrounding air.
- Radiant heat from the sun and other hot objects in the vicinity.
- Relative humidity (moisture content of the surrounding air).
- Speed of air movement.
- Level of physical activity.

**WBGT (Wet Bulb Globe Temperature) index**

The Wet Bulb Globe Temperature (WBGT) index takes into account all the environmental factors, i.e., air temperature, radiant heat, humidity and air movement speed, and gives a single number measure of the perceived heat.

WBGT is calculated by using one of the following two formulas:

1. With direct exposure to sunlight:
   
   \[ \text{WBGT}_{\text{out}} = 0.7 \ T_{\text{nw}} + 0.2 \ T_{\text{g}} + 0.1 \ T_{\text{db}} \]

2. Without direct exposure to the sun:
   
   \[ \text{WBGT}_{\text{in}} = 0.7 \ T_{\text{nw}} + 0.3 \ T_{\text{g}} \]

Abbreviations used in the above formula are as follows:

- \( T_{\text{nw}} \) = natural wet-bulb temperature (accounts for cooling due to sweat evaporation).
- \( T_{\text{g}} \) = globe temperature (accounts for the radiant heat exposure).
- \( T_{\text{db}} \) = dry-bulb (accounts for air temperature).

Occupational exposure limits are generally given in WBGT units.
Instrumentation for measuring WBGT

A WBGT monitoring instrument consists of:

1. A dry-bulb thermometer to measure air temperature (Tdb).
2. A natural (static) wet-bulb thermometer to measure evaporative temperature (Tnwb).
3. A black globe thermometer to measure radiant temperature (Tg).

A **Dry bulb thermometer** is an ordinary thermometer commonly used to measure the air temperature. The bulb of the thermometer must be shielded from the sun and other hot objects in the vicinity to prevent radiant heat from reaching the thermometer bulb. However, the shield should not interfere with the airflow around the bulb.

A **Natural wet bulb thermometer** has a wet wick covering its bulb.

- The wick must be wetted by direct application of water from a syringe one-half hour before each reading.
- The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb.
- The wick must be replaced periodically to avoid salt and dirt accumulation.
A *Globe thermometer* consists of a 15 cm (6 inch) in diameter hollow copper sphere painted on the outside with a matte black finish. The thermometer bulb or another temperature sensor is fixed in the center of the interior of the sphere.

The following diagram illustrates the components of a WBGT monitoring instrument.

### Helpful tips for using a WBGT monitor

- **FOLLOW** operating instructions provided by the equipment manufacturer.
- **PLACE** the monitor as close as possible to the position of the worker involved.
- **AVOID** placing the monitor close to a hot surface or in a draft unless this represents an actual condition of the worker’s environment.
ENSURE that the wick is damp at all times. Use only distilled water.

ALLOW about 25 minutes for the unit to stabilize after it has been set up.

**Personal Heat Stress Monitors**

Personal heat stress monitors are commercially available. These are convenient to use to monitor the worker exposure during a work shift. Personal monitors are generally equipped with a data logging system, which stores and displays temperature data and warns the worker when pre-set temperature thresholds are reached.
2. Environmental measures of heat exposure

Environmental measures are generally based on air temperature and relative humidity but do not take into account the effect of radiant heat and air movement in the workplace. Therefore, such measures cannot be used to determine occupational heat stress in the industry.

Two commonly used environmental measures are:

1. The Humidex; and,
2. The Heat Index.

The Humidex

Environment Canada’s Weather Service uses the humidex as a measure of how hot people feel in outdoor environmental conditions. The humidex gives a combined effect of air temperature and relative humidity as a single number that is intended to reflect perceived heat (see Appendix B). Humidex levels can be obtained on the Environment Canada website: http://www.weatheroffice.ec.gc.ca/canada_e.html.

Heat Index

The US National Weather Service has developed a Heat Index Chart to express perceived heat for different environmental conditions of temperature and humidity. A heat index chart is available from the National Weather Service (NWS), the US National Oceanic and Atmospheric Administration (NOAA). Website:http://www.srh.noaa.gov/lzk/images/hindex1.gif.
Section 5

Heat Exposure Standards and Guidelines.

1. Occupational exposure limits.

2. Thermal comfort guidelines for offices.
1. Occupational exposure limits

The purpose of occupational exposure limits is to eliminate or minimize the risk of heat-related illnesses. Exposure limits are set by provincial, territorial and federal jurisdictions responsible for workplace health and safety. Many regulatory agencies use the exposure guidelines recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). For further details please refer to the most recent version of the ACGIH publication “Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices”. The occupational exposure limits are generally given as work/rest regimen for working in hot environments.

An Example of Heat Stress Exposure Limits

Saskatchewan (Canada) “Hot Conditions Guidelines” and Saskatchewan Labour publication "http://www.labour.gov.sk.ca/safety/thermal/hot/index.htm" Working Under Hot Conditions” recommend the following rest break schedule for working in hot environments. For exposure limits applicable to your workplace, please consult your health and safety regulations.
Recommended Rest Break Schedules for Acclimatized Workers

<table>
<thead>
<tr>
<th>Wet Bulb Globe Temperature (WBGT) Index</th>
<th>Work Load</th>
<th>Work Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continuous work</td>
<td>15 minutes rest per hour</td>
</tr>
<tr>
<td>Heavy</td>
<td>up to 25.0°C</td>
<td>25.0°C to 26.0°C</td>
</tr>
<tr>
<td>Moderate</td>
<td>up to 27.0°C</td>
<td>27.0°C to 28.0°C</td>
</tr>
<tr>
<td>Light</td>
<td>up to 30.0°C</td>
<td>30.0°C to 30.6°C</td>
</tr>
</tbody>
</table>
Notes and definitions for the above table

The WBGT index in the above tables is based on American Conference of Governmental Industrial Hygienists (ACGIH) TLV Documentation.

These indices are not equivalent to regular thermometer readings. The tables apply only to acclimatized workers without special needs who are wearing lightweight, light coloured, loose-fitting cotton clothing. Adjustments must be made to these indices for workers with special needs.

- **Heavy work** – Intermittent lifting, pushing or pulling (such as pick and shovel work) or hard sustained work, such as assembly line activities where workers are paced by machines and cannot stop.

- **Moderate work** – (1) Work done in a sitting position, but requiring heavy arm and leg motions; or (2) work done while standing and involving moderate work at a machine or bench; or (3) work done while walking about and involving moderate lifting or pushing activities.

- **Light work** – Sitting or standing; work at a machine or bench that requires mostly arm work.

- **Continuous work** – Assumes that there are short morning and afternoon breaks and a longer lunch break in an eight hour day.

- **Rest breaks** – This includes all breaks, such as regular work breaks and unscheduled pauses during work. If rest breaks occur in an area that is significantly cooler than the work position, the WBGT is modified.
Applying the Recommended Rest Break Schedule

The recommended rest break schedule applies to workers who are fully acclimatized. New workers and workers returning from more than two weeks vacation or sick leave should be allowed a week to acclimatize. Start with a short exposure to hot work—twenty percent of the time on the first day. Another twenty percent should be added each day after that.

The recommended rest break schedule assumes that the WBGT index of the resting place is the same or similar to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time weighted average should be used. The weighted average should not exceed a WBGT of 30°C for light work, 27°C for moderate work and 25°C for heavy work for any one hour of continuous work. The weighted average is determined by the equation:

\[
\frac{\text{WBGT}_1 \times t_1 + \text{WBGT}_2 \times t_2}{t_1 + t_2} = \text{weighted average}
\]

Where:

- \(\text{WBGT}_1\) is the work area index
- \(\text{WBGT}_2\) is the rest area index
- \(t_1\) is the time worked every hour
- \(t_2\) is the length of the rest period every hour
Special Situations

If a job requires specialized clothing such as heavy coveralls, "turn out gear" for firefighters or chemical-resistant clothing, the WBGT index must be adjusted down. The WBGT index should also be adjusted down for special needs workers, such as:

- persons over 40
- the obese
- alcohol abusers
- unconditioned or unacclimatized workers who are likely more susceptible to heat stress disorders

In these situations, obtain advice from a competent person or a physician if needed.
When WBGT Indices Exceed the Table Guidelines

Higher heat exposures than shown in the table should only be permitted where:

- A competent person will determine the maximum length of work exposure to extreme heat that is safe, based on past experience in similar conditions.
- Each worker will pace the speed of work and will be able to terminate any particular heat exposure because of strain or discomfort.
- A doctor will determine the fitness of each worker for work in extreme heat.
- Workers will be watched by a trained supervisor or worker who can recognize signs of heat effects.
- Appropriate protective clothing or equipment will be provided to reduce the intensity of heat exposure.
- An emergency plan will be in place to rescue and treat workers who become ill.
Canadian Regulations

The following table summarizes requirements for the thermal conditions in the workplace.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Wet Bulb Globe Temperature Index (WBGT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada, Federal</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>British Columbia</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>Alberta</td>
<td>Similar to ACGIH TLVs</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>Hot Conditions Guidelines in WBGT units</td>
</tr>
<tr>
<td>Manitoba</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>Ontario</td>
<td>Heat Stress (Health and Safety Guidelines) April 2003 ACGIH TLVs</td>
</tr>
<tr>
<td>Quebec</td>
<td>Safety in mines: Occupational exposure limits WBGT similar to ACGIH TLVs</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>ACGIH TLVs</td>
</tr>
<tr>
<td>Newfoundland</td>
<td>ACGIH TLVs</td>
</tr>
</tbody>
</table>

ACGIH TLVs: Threshold Limit Values (TLVs) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH TLV booklet is updated annually.
The Occupational Health Clinics for Ontario Workers (OH Cow) has developed a simplified screening to assess workplace heat stress using humidex as a measure of the environmental heat. The following table summarizes the “Humidex Based Heat Response Plan”.

<table>
<thead>
<tr>
<th>Humidex</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-29C</td>
<td>- supply water to workers on an “as needed” basis</td>
</tr>
<tr>
<td>30-33C</td>
<td>- post Heat Stress Alert notice.</td>
</tr>
<tr>
<td></td>
<td>- encourage workers to drink extra water.</td>
</tr>
<tr>
<td></td>
<td>- start recording hourly temperature and relative humidity.</td>
</tr>
<tr>
<td>34-37C</td>
<td>- post Heat Stress Warning notice.</td>
</tr>
<tr>
<td></td>
<td>- notify workers that they are drinking extra water.</td>
</tr>
<tr>
<td></td>
<td>- ensure workers are trained to recognize symptoms.</td>
</tr>
<tr>
<td>38-39C</td>
<td>- provide 15 minutes relief per hour.</td>
</tr>
<tr>
<td></td>
<td>- provide adequate cool (10–15C) water, at least 1 cup (240 mL) of water every 20 minutes.</td>
</tr>
<tr>
<td></td>
<td>- workers with symptoms should seek medical attention.</td>
</tr>
<tr>
<td>40-42C</td>
<td>- provide 30 minutes relief per hour in addition to the provisions listed previously.</td>
</tr>
<tr>
<td>43-44C</td>
<td>- if feasible provide 45 minutes relief per hour in addition to the provisions listed above.</td>
</tr>
<tr>
<td></td>
<td>- if a 75% relief period is not feasible then stop work until the Humidex is 42C or less.</td>
</tr>
<tr>
<td>45C or over</td>
<td>- stop work until the Humidex is 44C or less</td>
</tr>
</tbody>
</table>

2. Thermal comfort guidelines for offices

The occupational heat exposure limits are not applicable to office work. There are no regulations specific to office work. However, there are guidelines for thermal comfort in offices.

The following table shows the temperature and relative humidity ranges recommended by the Canadian Standard Association's Standard CAN/CSA Z412-00 - "Office Ergonomics".

| Temperature and Humidity of an Office Environment taken from CSA Z412-00 |
|------------------------|----------------------------------|
| **Temperature**       | **% Relative Humidity**           |
| Heating Season        | 20–23.5°C 68–75°F               | 50%                              |
| Cooling Season        | 23–26°C 73–79°F                 | 50%                              |
Section 6

Control Measures

1. Engineering Controls
2. Administrative Controls
3. Personal Protective Equipment
4. Sample Safe Work Practices
1. Engineering Controls

Engineering controls are the most effective means of reducing heat exposure in industrial work environments. Following are some examples of commonly used engineering controls:

**Automation and mechanization of tasks**

Automation and mechanization of tasks reduces the need for heavy physical work. Reducing heavy physical effort reduces the inner body heat production rate, and hence, the risk of heat stress.

**Use of mechanical aids**

Mechanical aids such as carts, turn tables, etc. reduce the amount of physical effort needed to perform a task and hence reduce metabolic heat production.

**Location of work stations away from hot objects and processes**

Increasing distance from hot surfaces reduces radiant heat exposure.

**Insulating hot surfaces**

Insulation reduces the surface temperature of a radiant heat source and hence reduces the radiant heat exposure of workers.
Shielding

Shields stop radiated heat from reaching the worker. Two types of shields can be used.

- **Shieldsthat reflect heat:** Stainless steel, aluminum or other bright metal surfaces reflect heat back towards the source.
- **Shieldsthat absorb heat:** Absorbent shields, such as water-cooled jackets made of black-surfaced aluminum, can absorb heat.

Ventilation and air conditioning

Ventilation, localized air conditioning and cooled observation booths are commonly used to provide cool work stations. Cooled observation booths allow workers to cool down after brief periods of intense heat exposure while still allowing them to monitor equipment.

Using local exhausts

Local exhaust systems remove the hot air and steam produced by a process before it mixes with the ambient air in the work area.

Reducing the relative humidity

Air conditioning, dehumidification, and elimination of open hot water baths, drains, and leaky steam valves help reduce relative humidity.

Increasing air movement

If the air temperature is less than the skin temperature (35°C or 95°F), a fan can increase air movement. Brisk air movement causes body cooling by convection and increased sweat evaporation.
Using fans to cool off

Fans don't cool the air — they just move air around. Fans keep you cool by increasing the rate of sweat evaporation. Following are some helpful tips for using fans.

✔️ USE your fan in or next to a window, box fans are the best.

USE a fan to bring cool air in from outside.

USE your fan by plugging it directly into the wall outlet. If you need an extension cord, it should be CSA approved and should not present a trip hazard.

❌ DO NOT use fans if the room is closed and filled with hot air. Blowing hot air on the body will increase the risk of adverse health effects.

DO NOT use a fan to blow extremely hot air on yourself. This can cause heat exhaustion to happen faster.
2. Administrative Controls

The purpose of administrative controls is to minimize heat stress risks by controlling work schedules, work locations and work procedures. Administrative controls include the following:

- Acclimatization
- Safe work practices
- Training
- Exposure time reduction
- Prevention strategies for workers

Acclimatization

Acclimatization is the most important administrative control. The concept of acclimatization is based on the fact that the longer people work in hot environments, the more tolerant they become. People who are not used to working in hot environments should be given a week or two to get acclimatized to the heat. Some individuals may need longer than others. Also, persons with poor health may need more time to acclimate.

Helpful tips for the acclimatization of employees:

- ACCLIMATIZE new employees before assigning a full workload. It is advisable to assign about half of the normal workload to a new employee on the first day of work and gradually increase on subsequent days.

- INCREASE the duration of work gradually when a new or transferred employee starts working in a hot environment.

- INCREASE the level of physical activity gradually — start with light work on the first day and gradually increase the work-load on subsequent days.

- MONITOR heat strain symptoms during the acclimatization period. If an individual shows symptoms of excessive strain, reduce the duration of exposure and/or the level of activity.
ADVISE employees who are on medication to consult their doctor and inquire if the medication will affect their heat tolerance ability.

**Loss of acclimatization**

Loss of acclimatization occurs gradually when a person is moved permanently away from a hot environment or after several days of absence from work.

**Safe Work Practices**

- REDUCE physical effort needed for performing a task.
- PROVIDE an appropriate work-rest regimen as recommended in the health and safety legislation. The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended a work-rest regimen which can be found in the current version of the ACGIH publication Threshold Limits (TLVs) for Chemical Substances and Physical Agents & Biological Exposure Indices.
- SCHEDULE jobs to minimize heat stress.
- SCHEDULE outdoor jobs so that people perform physically demanding jobs during cooler periods of the day.
- PAY attention to employees with special needs. Advise and encourage pregnant workers and workers with a medical condition to discuss any limitations and special precautions needed for working in hot environments with their doctor.
- PROVIDE appropriate training and education to enable employees to:
  - Develop a high degree of awareness about the potential hazards of working in hot environments; and
  - Ways of preventing adverse health effects due to such hazards.
Provide appropriate training and education

A training program should include the following topics:

- Employer’s responsibilities in providing a safe workplace and establishing safe work practices;
- Hazards and potential health effects of heat stress;
- Use of WBGT monitor and interpretation of results;
- Principles of work-rest regimen design;
- Predisposing factors, danger signs and symptoms of heat-related illnesses;
- First-aid procedures for heat-related disorders;
- Possible side effects of certain medications when taken in a hot environments;
- Proper use and maintenance of protective clothing and equipment.
ALLOW adequate recovery time. Provide adequate rest periods to reduce the risk of adverse health effects.

USE the Buddy System. In hot working environments the buddy system is a must. Individuals are less likely to notice their own symptoms. The survival of the affected person depends on the co-worker’s ability to recognize the symptoms and seek timely medical help.

MINIMIZE metabolic heat production by:

• Reducing work pace;
• Reducing work duration;
• Reducing the physical exertion required to perform a task;
• Increasing the frequency and duration of rest breaks;
• Substituting light tasks for heavy ones;
• Increasing assigned staff so that more workers share the workload;
• Reducing the use of heat generating devices; and,
• Reducing the time and frequency of working with or near heat sources.

Prevention Strategies for Workers

In hot environments, workers can use certain preventive strategies to minimize the risk of adverse health effects. Such strategies include:

REPORT discomfort and early symptoms of heat-related illnesses to your supervisor.

DRINK plenty of water even if you do not feel thirsty. Sweating results in the loss of body fluids. Excessive water loss may cause dehydration. Thirst is not a reliable indication of body’s need for fluid replacement. A person should drink approximately 250 millilitres (one cup) of cool water every 20 minutes. Coffee, sweet beverages and alcohol must be avoided.
MAINTAIN a healthy diet. On hot days, eat light foods such as fruits and vegetables, and avoid heavy foods such as proteins which increase body heat.

LIMIT non-work heat stress exposures.

REPORT any changes in health status to your supervisor. Pregnant workers and those with medical conditions should consult their physician about their occupational exposures to heat stress. Older workers should be particularly cautious due to a decreased ability to sweat.

CONSULT your doctor if you are taking medications that may cause heat intolerance or inhibited sweating. Certain antibiotics will cause photosensitivity. People taking such drugs should avoid strong mid-day sunlight.

Alcohol Consumption increases the risk of heart related illness
3. Personal Protection

Engineering controls are the most desirable method of controlling heat exposure. Personal protective equipment (PPE) should be used as an interim measure while engineering controls are being explored.

Eye protection

Eye protection that absorbs infrared radiation (heat rays), may be needed when working near very hot objects, such as molten metals and red-hot objects.

Clothing

Ordinary clothing provides some protection from heat radiated by surrounding hot surfaces. Light clothing allows maximum skin exposure and efficient body cooling by sweat evaporation.

Cotton clothing is cooler than polyester clothing. However, cotton will absorb water and wet clothing tends to be uncomfortable.

When selecting clothing, heat stress prevention should be balanced with other health and safety risks. For example, for outdoor workers, a balance must be achieved between heat stress prevention and the ultraviolet exposure.

Cooling Vest
**Impermeable clothing**

Work that requires the use of impermeable clothing presents an added heat burden. Impermeable clothing reduces the body's ability to dissipate heat. Therefore, it is necessary to provide a cooler working environment than that recommended for workers wearing light clothing.

**Protective clothing**

The selection of protective clothing depends on the specific circumstance. Working in certain hot environments may require insulated gloves, insulated suits, reflective clothing, infrared-reflecting face shields and safety footwear (e.g., foundry boots, welder's boots). For extremely hot conditions, thermally conditioned clothing is available. Examples of such protective clothing are:

- A self-contained air conditioner in a backpack.
- A compressed air source which feeds cool air into the jacket or coveralls through a vortex tube.
- A jacket which has pockets that can be filled with containers of ice.

Check with your local safety equipment supplier regarding the types of personal protective equipment available and the degree of protection such clothing is expected to provide.

In a high radiant heat situation, people generally use reflective clothing. However, this advantage may be nullified if the clothes interfere with the sweat evaporation. For very hot environments air, water or ice-cooled insulated clothing may be used.

Workers who move back and forth between very hot, dry indoor environments and cold, winter outdoor environments find that long underwear moderates the extremes in temperatures.
### Table 3 - Summary of Heat Stress Control Measures

<table>
<thead>
<tr>
<th>Method of Control</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Engineering controls</strong></td>
<td></td>
</tr>
<tr>
<td>Reduce body heat production</td>
<td>Mechanize tasks</td>
</tr>
<tr>
<td>Stop exposure to radiated heat from hot objects</td>
<td>Insulate hot surfaces. Use reflective shields, aprons, remote controls</td>
</tr>
<tr>
<td>Reduce convective heat gain</td>
<td>Lower air temperature. Increase air speed if air temperature below 35°C. Increase ventilation. Provide cool observation booths</td>
</tr>
<tr>
<td>Increase ventilation</td>
<td>Reduce humidity. Use a fan to increase air speed (movement)</td>
</tr>
<tr>
<td>Clothing</td>
<td>Wear loose clothing that permits sweat evaporation but stops radiant heat. Use cooled protective clothing for extreme conditions</td>
</tr>
<tr>
<td><strong>Administrative controls</strong></td>
<td></td>
</tr>
<tr>
<td>Acclimatization</td>
<td>Allow sufficient acclimatization period for new workers</td>
</tr>
<tr>
<td>Duration of work</td>
<td>Shorten exposure time and use frequent rest breaks</td>
</tr>
<tr>
<td>Rest area</td>
<td>Provide cool (air-conditioned) rest-areas</td>
</tr>
<tr>
<td>Water</td>
<td>Provide cool drinking water</td>
</tr>
<tr>
<td>Pace of work</td>
<td>If practical, allow workers to set their own pace of work</td>
</tr>
<tr>
<td>First aid and medical care</td>
<td>Establish emergency procedures. Assign one person trained in first aid to each work shift. Train workers in recognition of signs and symptoms of heat stroke</td>
</tr>
</tbody>
</table>
4. Sample safe work practices

The following are some examples of safe work practices for preventing heat stress.

(a) Working outdoors during prolonged heat spells

In the summer months, outdoor workers are simultaneously exposed to two main health hazards:

i. Heat stress as air temperature and/or humidity increases; and,

ii. UV rays from sunlight.

Preventing health effects of heat Stress

AVOID unnecessary or unusual stressful activity.

PERFORM stressful tasks during the cooler parts of the day (early morning or at night).

AVOID double shifts and overtime whenever possible. Employers must not permit double shift or overtime to workers in hot environments.

ADOPT a recommended work-rest regimen to recover from the heat stress.

DRINK plenty of water in frequent small portions. Employers are required to provide plenty of drinking water in hot workplaces.

AVOID alcohol consumption. The consumption of alcoholic drinks increases the risk of dehydration and other heat-related illnesses.

CONSULT your doctor about potential side effects if you are taking blood pressure control medication, diuretics or water pills.

TAKE sufficient sleep and good nutrition for maintaining a high level of heat tolerance.
Preventing health effects of UV exposure

During outdoor work, the safety measures for UV protection depend on the intensity of UV rays in the sunlight.

The weather service of Environment Canada expresses the intensity of UV rays in the units of UV index. The UV index is the highest during noon hours in the summer months and lowest in the mornings and evenings of winter days. Appendix C gives safety tips for different levels of UV index.

(b) Working near extremely hot objects

People who work near extremely hot objects are at a high risk of heat stress. The main source of heat exposure is radiant heat from hot surfaces such as furnaces and molten metals. Examples of such workplaces include:

- Iron, steel and nonferrous foundries
- Brick-firing and ceramics operations
- Glass products manufacturing plants
- Rubber products manufacturing plants
- Bakeries
- Restaurant kitchens
- Smelters

You must pay special attention if:

- You are unacclimatized;
- You have a history of heat intolerance;
- You are recovering from a fever;
- You are dehydrated;
- You have circulatory disorders;
- You are taking medication; or,
- You are in overall poor health.
Basic Safety tips

PROVIDE adequate ventilation and air movement.

INSTALL shields to reduce radiant heat exposure from hot surfaces.

PROVIDE cool work stations.

PROVIDE adequate protective clothing and equipment including gloves, safety footwear and eye protection. When selecting protective clothing, consider the following important factors:

- Protection from radiant heat; and
- Allowance for sweat evaporation.

ENSURE that all new and transferred employees are acclimatized before assigning them a full work-load. Acclimatization may also be needed for employees who return to work after several days of vacation.

PLAN job rotation to reduce duration of heat exposure.

PROVIDE cool drinking water and make sure that employees understand the importance of drinking water at frequent intervals.

PROVIDE adequate rest breaks. Work-rest periods recommended in the ACGIH TLV booklet may be used as a guideline to develop a company policy.

Drink plenty of water
Hands free water system provides ready access to drinking water
Section 7

Occupational Health and Safety Legislation

1. Canadian Legislation

2. US Legislation
1. Canadian Legislation

The purpose of Occupational Health and Safety (OH&S) legislation is to protect you, the employee, against any hazards on the job. The occupational health and safety act outlines the rights and responsibilities of employers, supervisors and employees in ensuring workplace health and safety.

The Canadian health and safety legislation is based on the internal responsibility system. In this system, everyone in the workplace is responsible for health and safety. Employers have legal responsibility to provide a safe workplace and ensure that work is carried out in a safe manner.

**Employer’s responsibilities**

Employers must provide a safe workplace to prevent risk of injury and illness. Therefore, it is the employer’s responsibility to protect employees from harmful heat exposure.

In some Canadian jurisdictions, there are no regulations with respect to heat stress. However, the general duty clause in the health and safety act holds the employer responsible for the overall health and safety of employees. Therefore, employers are responsible for implementing an adequate heat stress prevention program.
Employee responsibilities

In general, employees must take all reasonable and necessary precautions to ensure their own health and safety and that of other employees and any persons who might be affected by their activities. Following are some examples of employee responsibilities:

- Follow safe work practices established by the employer.
- Use safety equipment required by the employer.
- Report any unsafe conditions or practices to the employer.
- Report every accident or incident (near miss).

Employees’ Rights

Employees have the following three basic rights:

Right to know: The employer must provide information about any actual or potential hazards, and train employees in safe work practices.

Right to participate: Employees have the right to participate in workplace health and safety activities through health and safety committees or an employee health and safety representative.

Right to refuse unsafe work: Employees have the right to refuse performing work that poses a danger to their health and safety. Health and safety legislation outlines procedures to be followed in resolving work refusals. The following chart summarizes steps involved in resolution of work refusals. Please consult your appropriate health and safety act for details. The steps involved in the resolution process may vary from one jurisdiction to another.

In Ontario, certified members of the health and safety committee have the right to stop work following the procedure outlined in the Ontario Health and Safety Act.
Work Refusal Chart

Worker OH&S Concern (Work Refusal) Reports to Supervisor

Supervisor and Worker attempt to resolve problem

RESOLVED

UNRESOLVED

Supervisor
Union/H&S Rep
H&S Comm. Member
Investigate

RESOLVED

UNRESOLVED

Call Government Inspector
Assign reasonable alternative work
Assign work being refused to another worker

Decision of the Inspector

RESOLVED

Further Government Action
Further Employer Action or Appeal of Government Directives

RESOLVED

BACK TO WORK
2. U.S. Legislation

In the United States of America (USA) the Occupational Safety and Health Act is popularly known as the OSH Act. The Occupational Safety and Health Administration (OSHA) is responsible for administering the OSH Act.

The OSH Act does not cover the following four categories of employees:

- Self-employed persons;
- Farms which employ only immediate family members of the farm employer;
- Workers covered by other legislation; and
- State and local government employees.

Regulations dealing with OSHA are published in Title 29 of the Code of Federal Regulations as:

- 29 CFR Part 1910 Occupational Safety and Health Standards; and

These standards define exposure limits, exposure monitoring methods, medical surveillance and protective measures.

Duties of Employer

The OSH Act sets out two main duties for employers:

- Employers must provide a workplace which is free from hazards that are known to cause or likely to cause death or serious physical harm to employees.
- Employers must comply with occupational safety and health standards under the Act.
Duties of Employees

Employees must comply with occupational safety and health standards, rules, regulations and orders which are applicable to their own conduct and actions.

Key Provisions

Some key provisions of the OSH Act:

- To assure, insofar as possible, that every employee has safe and healthy working conditions.
- To require employers to maintain accurate records of exposures to potentially toxic materials or harmful physical agents and inform employees of the monitoring results.
- To allow at least one employee representative to be present during the walkthrough inspection.
- To encourage free and open exchange of information between employees and the inspector.
- To implement procedures for investigating alleged violations, at the request of any employee or employee representatives, issuing citations and assessing monetary penalties against employers.
Section 8

Information Sources

1. Canadian Government Departments with Responsibility for Occupational Health and Safety

2. US Federal Safety and Health Agencies
1. Canadian Government Departments Responsible for Occupational Health and Safety

Canadian Centre for Occupational Health and Safety (CCOHS)

Inquiries & Client Services
(free answers to your OH&S questions)
135 Hunter Street East
Hamilton, ON L8N 1M5
Phone: 905-570-8094
(8:30 AM to 5:00 PM EST Time)
Toll-free: 1-800-668-4284 (Canada and US only)
Fax: 905-572-4500
E-mail: clientservices@ccohs.ca
OSH Answers Web Site: www.ccohs.ca/oshanswers
Web Site: www.ccohs.ca

General Contact
Phone: 905-572-2981
Fax: 905-572-2206

Federal Jurisdiction

Workplace Health and Safety
Human Resources and Social Development Canada
1-800-641-4049
Ottawa ON K1A 0J2
workplace_health/index.shtml

Regional and District Offices:
Web Site: http://www1.servicecanada.gc.ca/en/
gateways/where_you_live/menu.shtml
Provincial Jurisdictions

Alberta

Workplace Health and Safety
Alberta Employment, Immigration and Industry
10030-107 Street
Edmonton, AB T5J 3E4
(Edmonton and surrounding area)
Phone: (780) 415-8690
Toll-free in Alberta: 1-866-415-8690
Fax: (780) 422-3730
E-mail: whs@gov.ab.ca
Web Site: http://employment.alberta.ca/cps/rde/xchg/hre/hs.xsl/53.html

British Columbia

WorkSafeBC (Workers' Compensation Board of British Columbia)
6951 Westminster Highway (Richmond, BC)
PO Box 5350 Stn Terminal
Vancouver, BC V6B 5L5
Workplace Safety and Health Inquiries
Phone: (604) 276-3100
Toll-free in B.C.: 1-888-621-7233 (SAFE)
Fax: (604) 244-6490
Emergency and Accident Reporting
Toll-free in B.C.: 1-888-621-7233 (SAFE)
After hours: 1-866-922-4357 (WCB-HELP)
Web Site: www.worksafebc.com

Manitoba

Workplace Safety and Health Division
Manitoba Labour and Immigration
200-401 York Avenue
Winnipeg, MB R3C 0P8
General Inquiries: (204) 945-3446
Toll free in Manitoba: 1-800-282-8069
After hours: (204) 945-0581
Fax: (204) 945-4556
E-mail: wshcompl@gov.mb.ca
Web Site: www.gov.mb.ca/labour/safety/
New Brunswick

Workplace Health, Safety and Compensation Commission of New Brunswick

1 Portland Street
PO Box 160
Saint John, NB E2L 3X9
Phone: (506) 632-2200
Toll free: 1-800-222-9775
Fax: (506) 642-0718
E-mail: prevention@whscc.nb.ca
Web Site: www.whscc.nb.ca

Newfoundland and Labrador

Occupational Health and Safety Branch
Department of Government Services

15 Dundee Avenue
Mount Pearl, NL A1N 4R6
General Inquiries: (709) 729-2706
Toll-free in NL: 1-800-563-5471
Fax: (709) 729-3445
Serious Workplace Accident Reports
Phone: (709) 729-4444 (24 Hours)
Web Site: www.gs.gov.nl.ca/ohs/

Northwest Territories and Nunavut

Workers' Safety and Compensation Commission of Northwest Territories and Nunavut

PO Box 8888
Yellowknife, NT X1A 2R3
General Inquiries: (867) 920-3888
Toll free: 1-800-661-0792
Fax: (867) 873-4596
Toll Free Fax: 1-866-277-3677
E-mail: yellowknife@wcb.nt.ca
Web Site: www.wcb.nt.ca
Iqaluit

PO Box 669
Iqaluit, NU X0A 0H0
Phone: (867) 979-8500
Fax: (867) 979-8501
Toll-free: 1-877-404-4407
Toll Free Fax: 1-866-979-8501
E-mail: iqaluit@wcb.nt.ca
Website: www.wcb.nt.ca

Nova Scotia

Occupational Health and Safety Division Nova Scotia
Department of Environment and Labour and Workforce Development
5151 Terminal Rd., 6th Floor
PO Box 697
Halifax, NS B3J 2T8
General Inquiries: (902) 424-5400
Toll free in NS: 1-800-952-2687
Fax: (902) 424-5640
E-mail: webster@gov.ns.ca
Web Site: http://www.gov.ns.ca/enla/ohs/

Ontario

Ministry of Labour
Occupational Health and Safety Branch
505 University Avenue, 19th Floor
Toronto ON M7A 1T7
416-326-3835
Fax 416-326-7761
1-800-268-8013 (province-wide)
E-mail: webohs@mol.gov.on.ca
Web Site: www.labour.gov.on.ca/english/hs/index.html
Prince Edward Island

Workers’ Compensation Board of PEI
Occupational Health and Safety
PO Box 757, 14 Weymouth Street
Charlottetown, PE C1A 7L7
General Inquiries: (902) 368-5680
Toll-free (in Atlantic Canada): 1-800-237-5049
Occupational Health & Safety
24 Hr Emergency Tel: (902) 628-7513
Customer Liaison Service: 1-866-460-3074
Fax: (902) 368-5705
Web Site: www.wcb.pe.ca

Québec

Commission de la santé et de la sécurité du travail du Québec (CSST) (Occupational Health & Safety Commission)
1199, rue de Bleury
C.P. 6056, Succursale «centre-ville»
Montréal QC H3C 4E1
Tel: 514-906-3780/514 906-3061, poste 2214
1-866-302-2778
Fax: 514-906-3781/514 906-3016
www.csst.qc.ca
(514) 906-2911 Urgence 24 h – Services de prévention-inspection
Web Site: http://www.csst.qc.ca/portail/fr/

Saskatchewan

Advanced Education, Employment and Labour
Occupational Health and Safety Division
400 - 1870 Albert Street
Regina, SK S4P 4W1
Phone: (306) 787-4496
Toll-free in SK: 1-800-567-7233
Fax: (306) 787-2208
Web Site: www.labour.gov.sk.ca/
Saskatoon Office:
122-3rd Avenue North
Saskatoon, SK S7K 2H6
Phone: (306) 933-5052
Toll-free: 1-800-667-5023
Fax: (306) 933-7339

Yukon Territory

Yukon Workers' Compensation, Health and Safety Board Occupational Health and Safety Branch
401 Strickland Street
Whitehorse, YT Y1A 5N8
General Inquiries: (867) 667-5645
24-hour Emergency Line for Reporting Serious Workplace Accidents and Injuries: (867) 667-5450
Toll free across Canada: 1-800-661-0443
Fax: (867) 393-6279
E-mail: worksafe@gov.yk.ca
Web Site: www.wcb.yk.ca

For an up-to-date listing of information sources visit
http://www.ccohs.ca/oshanswers/information/govt.html
2. US Federal Safety and Health Agencies

US Environmental Protection Agency (EPA)
Ariel Rios Building
1200 Pennsylvania Avenue NW,
Washington, DC 20460
Phone: (202) 272-0167
Web Site: www.epa.gov

National Institute for Occupational Safety and Health (NIOSH)
Education and Information Division (EID)
4676 Columbia Parkway
Cincinnati, OH 45226
1-800-CDC-INFO (1-800-232-4636)
Outside the US: (513) 533-8328
Fax: 1-513-533-8347
E-mail: eidtechinfo@cdc.gov
Web Site: www.cdc.gov/NIOSH/

Occupational Safety & Health Administration (OSHA)
200 Constitution Ave., NW
Washington, DC 20210
Phone: (202) 693-2000
Emergency reporting or if you have workplace safety and health related questions
Toll Free: 1-800-321-OSHA (6742)
Web Site: www.osha.gov
Bibliography and Internet Links

**Environment Canada Fact Sheet: Summer Severe Weather**

**Environment Canada Humidex Calculator**
http://lavoieverte.qc.ec.gc.ca/meteo/Documentation/Humidex_e.html

**Environment Canada Weather Office**
http://www.weatheroffice.ec.gc.ca/canada_e.html

**Province of Ontario Heat Stress Guideline**
http://www.labour.gov.on.ca/english/hs/guidelines/gl_heat.html

**US Dept. of Labour – Heat Stress**
http://www.osha.gov/SLTC/heatstress/

**OSHA Heat Stress Card**
http://www.cdc.gov/niosh/topics/heatstress/

**Extreme Heat**
http://emergency.cdc.gov/disasters/extremeheat/index.asp

**FEMA Federal Emergency Management Agency Extreme Heat**
http://www.fema.gov/hazard/heat/index.shtm

**The Australian Council of Trade Unions ACTU Guidelines for Working in Seasonal Heat**
http://www.actu.asn.au/Archive/Papers/ACTUGuidelinesForWorkingInSeasonalHeat.aspx

**Prevent Heat Stress**
http://www.wsib.on.ca/wsib/wsibsitemeasure.nsf/public/PreventHeatStress

**Heat Stress in Construction**
http://www.cpwr.com/search.php?zoom_query=heat+stress&zoom_per_page=100&zoom_and=0&zoom_sort=0

**OR-OSHA: The Heat Equations**
http://www.cbs.state.or.us/external/osha/pdf/pubs/3333.pdf

**Working Outdoors Factsheet**
http://www.twcc.state.tx.us/information/videoresources/s_working_outdoorspdf
Ultra violet radiation from the sun
http://www.cdc.gov/elcosh/docs/d0100/d000146/D000146.html

Hot Environments – Health Effects
http://www.ccohs.ca/oshanswers/phys_agents/heat_health.html

Hot Environments – Control Measures
http://www.ccohs.ca/oshanswers/phys_agents/heat_control.html

US Department of Labour – Confined space Hazards
http://www.osha.gov/SLTC/smallbusiness/sec12.html: This document on confined space hazards has a section on thermal hazards.

MNOSHA heat-stress guide
http://www.doli.state.mn.us/heatstrs.html

1. CDC. Illness and death due to environmental heat--Georgia and St. Louis, Missouri, 1983. MMWR 1984;33:325-6.


7. Criteria for a recommended Standard; Occupational Exposure to Hot Environments, National Institute for Occupational Safety and Health. DHHS (NIOSH) publication No. 72-10269, 1972
Section 10

Appendices

A. A summary of health hazards and preventive measures

B. The Humidex

C. Safety tips for different levels of the UV index

D. Glossary

E. Abbreviations

F. Sample heat stress policy and checklist

G. Case histories: fatalities from occupational heat exposure
## APPENDIX A

A summary of health hazards and preventive measures.

### Health Hazards and Preventive Measures

<table>
<thead>
<tr>
<th>Type of work</th>
<th>Health and Safety Concerns</th>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working near extremely hot objects such as foundries, furnaces, red hot metals, bakery ovens</td>
<td>Heat-related illnesses and heat stroke due to:</td>
<td>Reduce radiant heat emission from hot objects by shielding the object</td>
</tr>
<tr>
<td></td>
<td>1. Radiant heat emission from hot objects</td>
<td>Reduce heat reaching the worker by using adequate shielding</td>
</tr>
<tr>
<td></td>
<td>2. Temperature and humidity of the working environment</td>
<td>Provide cool air</td>
</tr>
<tr>
<td></td>
<td>3. Dehydration due to excessive sweating</td>
<td>Provide plenty of drinking water</td>
</tr>
<tr>
<td></td>
<td>4. Excessive inner body heat production due to heavy workload</td>
<td>Use mechanical aids to reduce physical exertion</td>
</tr>
<tr>
<td></td>
<td>5. Risk of cataracts due to infrared radiation exposure of the eyes</td>
<td>Provide appropriate eye protection</td>
</tr>
<tr>
<td>Working outdoors on hot summer days such as construction work, road repair, farming and grounds keeping</td>
<td>1. Radiant heat from the sun</td>
<td>Wear wide brim hats, full sleeve shirts and long pants</td>
</tr>
<tr>
<td></td>
<td>2. Hot environmental temperature and relative humidity</td>
<td>Wear loose cotton clothing</td>
</tr>
<tr>
<td></td>
<td>3. Heavy work load</td>
<td>Drink plenty of water at frequent intervals</td>
</tr>
<tr>
<td></td>
<td>Risk of skin cancer and eye disorders due to UV (sunlight) exposure</td>
<td>Perform heavy work during cooler parts of the day.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Avoid skin and eye exposure to direct sunlight by using wide brim hats, full sleeve shirts and long pants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sunglasses with UV protection</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sun blocking cream with at least SPF 15</td>
</tr>
</tbody>
</table>
The Humidex

The Weather Service of Environment Canada uses the humidex to provide the public with a sense of how hot it feels when we are outdoors. At a given temperature, the humidex increases as relative humidity increases.

Environment Canada has provided the following relationship between humidex and perceived heat:

In addition to temperature and humidity, weather conditions such as the amount of sunshine and wind speed will also affect the how hot a person feels.

Determining the Humidex

The following chart can be used to determine the humidex. For example, if the temperature is 30°C and the relative humidity is 70%, the humidex is 41°C. This is considered a level of great discomfort. For 50% relative humidity and 30°C temperature, the humidex is 36°C, which is a condition of some discomfort.
Humidex from Temperature and Relative Humidity Readings

Legend

Humidex Range:
- Less than 29
- 30 - 39
- 40 - 45
- Above 45
- Above 54

Degree of Comfort:
- No discomfort
- Some discomfort
- Great discomfort; avoid exertion
- Dangerous
- Heat Stroke imminent
## APPENDIX C

Safety tips for different levels of UV Index

<table>
<thead>
<tr>
<th>UV Index</th>
<th>Description</th>
<th>Sun Protection Actions</th>
</tr>
</thead>
</table>
| 0–2      | Low         | • Minimal sun protection required for normal activity  
|          |             | • Wear sunglasses on bright days. If outside for more than one hour, cover up and use sunscreen  
|          |             | • Reflection off snow can nearly double UV strength. Wear sunglasses and apply sunscreen |
| 3–5      | Moderate    | • Take precautions - cover up, wear a hat, sunglasses and sunscreen, especially if you will be outside for 30 minutes or more  
|          |             | • Look for shade near midday when the sun is strongest |
| 6–7      | High        | • Protection required — UV damages the skin and can cause sunburn  
|          |             | • Reduce time in the sun between 11 a.m. and 4 p.m. and take full precautions — seek shade, cover up, wear a hat, sunglasses and sunscreen |
| 8–10     | Very High   | • Extra precautions required — unprotected skin will be damaged and can burn quickly  
|          |             | • Avoid the sun between 11 a.m. and 4 p.m. and take full precautions — seek shade, cover up, wear a hat, sunglasses and sunscreen |
| 11+      | Extreme     | • Values of 11 or more are very rare in Canada. However, the UV Index can reach 14 or more in the tropics and southern U.S.  
|          |             | • Take full precautions. Unprotected skin will be damaged and can burn in minutes. Avoid the sun between 11 a.m. and 4 p.m., cover up, wear a hat, sunglasses and sunscreen  
|          |             | • White sand and other bright surfaces reflect UV and increase UV exposure |

Source: Environment Canada, UV Index Program, March 2004  
http://www.msc-smc.ec.gc.ca/topics/uv/present_detail_table_e.html
UV Rays can harm your eyes
Glossary

**Acclimatization**
Becoming accustomed to working in hot environments. New workers are acclimatized to hot working conditions by slowly increasing the duration and the level of heat exposure.

**Convection**
Heat exchange between the body and the surrounding air. Heat exchange by convection occurs when the body comes in contact with the air.

**Dehydration**
Loss or deficiency of water in the body. Dehydration can occur as a result of sweating, vomiting or diarrhea. In hot environments, dehydration can occur due to excessive sweating.

**Heat cramps**
Muscle pain due to loss of body fluids as a result of heavy sweating.

**Heat edema (swelling)**
Swollen hands or feet and ankles when people sit or stand for a long time in a hot environment. Heat causes the blood vessels to expand (dilate), so body fluid moves into the hands or legs.

**Heat rash (prickly heat or milliaria)**
An itchy rash of small raised red spots on the face, neck, back, chest and thighs caused by a hot and moist environment.

**Heat strain**
Body’s responses to excessive heat exposure.
Heat stroke
Acute illness caused by overexposure to heat. Symptoms are dry, hot skin, high body temperature and mental dysfunction. Heat stroke can be fatal unless immediate medical aid is available.

Heat syncope
Temporary loss of consciousness due to insufficient blood flow to the brain. Recovery is normally prompt and without any long-term ill effects.

Metabolic rate
Rate of energy (heat) production of the body. Metabolic heat production increases as the level of activity increases. For example, people doing office work produce less body heat than a person who is digging or shovelling.

Natural Wet Bulb Temperature
Air temperature measured using a thermometer in which the bulb is covered with a wet wick.

Radiant (heat)
Heat that comes directly from a hot object. When we stand near a furnace or in bright sunlight, we feel warm even when the surrounding air is cold.

Relative humidity
The ratio of the water vapour content of air to the maximum possible water vapour content of air at the same temperature and barometric pressure.
APPENDIX E

Abbreviations

ACGIH

American Conference of Governmental Industrial Hygienists. ACGIH is a professional society of government workers and educators who work to promote occupational safety and health. The organization publishes recommendations on ventilation, air sampling and airborne chemical concentration guideline (threshold limit values or TLVs) designed to limit and control exposure of workers to airborne chemicals in the workplace.

ANSI

American National Standards Institute, an American organization that produces the ANSI standards.

ASHRAE

American Society of Heating, Refrigeration and Air Conditioning Engineers – sets ventilation and other standards related to the indoor environment.

CCOHS

Canadian Centre for Occupational Health and Safety, Canada's national organization for promotion of workplace health and safety by providing information, advice, training and research.

CSA

Canadian National Standards Association, a national organization that produces CSA standards.

IAPA

Industrial Accident Prevention Association, Ontario.

ISO

International Organization for Standardization, an international organization that produces the ISO standards.
MSDS
Material Safety Data Sheet; provides information about toxicity and safe work practices for chemicals

NFPA
National Fire Protection Association (USA), publishes the Fire Code.

NIOSH
U.S. National Institute for Occupational Safety and Health. NIOSH, part of the Centers for Disease Control, conducts research on worker safety and health and recommends standards for worker protection to OSHA.

OSHA
U.S. Occupational Safety and Health Administration, develops and enforces health and safety legislation.

PPE
Personal protective equipment: hard hat, ear plugs, safety boots, gloves, etc.

TLVs
Threshold Limit Values recommended by ACGIH – often used as guidelines to set occupational exposure limits.

UV
Ultraviolet radiation.

WBGT

WCB
Workers' Compensation Board.

WSIB
Workplace Safety and Insurance Board (Ontario).
APPENDIX F

Sample Heat Stress Policy and Checklist

Source: Adopted from Heat Stress Policy of the City of Toronto; by permission.

Purpose and Application

This policy is intended to protect workers from potential adverse effects of overexposure to heat. It applies to all City of Toronto employees who work in high temperature conditions for significant time periods.

Definitions

Heat rash: A heat-induced condition characterized by a red, bumpy rash with severe itching

Heat cramps: A heat-induced condition characterized by painful cramps in the arms, legs or stomach which can occur at work or later at home. This condition can be a warning of other more serious heat-induced illnesses

Heat exhaustion: A heat-induced condition characterized by sweating, cool moist skin, body temperature over 38EC, weak pulse, and normal or low blood pressure

Heat stroke: A heat-induced condition characterized by high body temperature (>41EC) and any one of the following:

- weakness, confusion, emotional upset and strange behaviour
- hot, dry, red skin
- fast pulse headaches and dizziness

In the later stages, a person may pass out and have convulsions. If not recognized and addressed, this condition can result in death
Responsibilities

Departments/divisions will:

- identify jobs with a potential risk of heat stress and develop job-specific safe work procedures (based on the City of Toronto Interim Guidelines for the Prevention of Heat-Related Disorders) which address this hazard
- inform workers and their supervisors where their work involves potential risk of heat stress
- develop a process to ensure supervisors and workers are advised of:
  - factors which can predispose them to heat stress
  - the warning signs and symptoms of heat stress conditions (heat rash, heat cramps, heat exhaustion and heat stroke), and
  - the measures to be taken to protect against this hazard (eg. having water available to drink during work shift, wearing appropriate clothing and pacing oneself while working)
- post information on heat stress in the workplaces of employees potentially exposed to this hazard
- ensure workers have access to a drinking water source for filling personal containers at the beginning of the shift, if water is not accessible throughout the shift
- if uniforms or clothing are being provided by the department, ensure that clothing specifications reduce the risk of heat stress (while providing appropriate protection from other hazards, where necessary)
- allow a gradual period of acclimatization to work in hot environments for new and other non-accli- matized workers [Note: Even workers who work outside on an ongoing basis may not be
acclimatized if temperatures rise steeply within a short time period early in the spring or summer.]

- re-schedule work on hot days to cooler times of the day, when feasible
- where feasible and necessary, reduce temperature and humidity through air cooling and conditioning of enclosed work environments or shading of open areas

Those with supervisory responsibilities will:

- schedule information sessions for employees whose workplaces them at risk of heat stress
- on days where environmental conditions have reached designated threshold levels according to the attached guideline:
  - implement safe work procedures established to prevent heat-induced illness
  - determine any additional rest breaks that may be required as a result of workload and local conditions
  - advise workers to:
    - drink enough fluids to replace those lost through sweating and breathing
    - take breaks in the shade or a cool area, as needed to avoid heat exhaustion or collapse
    - report to their supervisor heat stress-related symptoms in themselves or their co-workers
    - adhere to the recommended rest break schedule, established to avoid heat exhaustion or collapse.
Workers will:

- be familiar with heat stress hazards, predisposing factors and preventative measures
- follow safe work practices established to prevent heat related illness
- drink enough fluids to replace those lost through sweating and breathing
- report to their supervisor heat stress-related symptoms in themselves or their co-workers
- follow recommended schedule of rest breaks, as advised by supervisors, to avoid heat exhaustion or collapse

Occupational health and safety staff, in conjunction with supervisory staff, will:

- prepare information related to heat stress
- develop safe work procedures
- address heat stress concerns of employees
- assist in provision of information sessions
Heat Stress Evaluation Checklist

Workplace Description

Work area / department / section / unit: ______________________

Heat-producing equipment or processes used: ______________________

Previous heat-related problems:

<table>
<thead>
<tr>
<th>Frequency</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severity</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
</tr>
</tbody>
</table>

Number of employees exposed: ______________________

Exposure duration: ______________________

Thermal environment data (if available)

Has best practices typical of this industry used to maintain adequate:

- Temperature
- Humidity
- Air velocity
- Heat-Reducing Engineering Controls
- Ventilation
- Ventilation operating
- Fans
- Shields or insulation between sources and employees

Does the heat stress prevention policy and program has the following elements:

- Roles and responsibilities of employees at all levels
- Training program
- Liquid replacement program
- Acclimatization program
- Scheduling of work to minimize exposure level and duration
- Work/rest schedule
- Cool rest areas
- Heat stress monitoring
- Personal Protective Equipment
- First Aid
- Trained personnel
- Procedures for getting medical attention
- Transportation to medical facilities readily available for heat stroke victims
- Medical Screening and Surveillance Program
- Procedures for incident reporting, investigation and follow-up
APPENDIX G

Case Histories: Fatalities from Occupational Heat Exposure

The following cases are some examples of conditions that caused heat stroke, and resulted in fatalities.

Case 1

A bakery worker, whose duties included unloading baked goods from an oven, was found collapsed by a co-worker. The worker was taken to a nearby hospital, where the worker was pronounced dead a short time later. On that day, the air temperature at the bakery was 36° C. The worker’s death was attributed to heat stroke.

Source: Ontario Ministry of Labour, News Release February 18, 2004

Case 2

A 24-year-old worker, who was employed at a surface coal mine, collapsed and later died after performing heavy labor in a hot environment. On the day of the reported incident, he was assigned to load 40 pound bags of explosives into vertically drilled holes in preparation for blasting the material overlying the coal seam. He began work at 6:00 a.m., and at 3:40 p.m., informed a co-worker that he did not feel well. He walked about 50 yards to a shady area and collapsed. The outdoor dry bulb temperature was 39.4°C (103°F).

Source: http://www.cdc.gov/mmwr/preview/mmwrhtml/00000376.htm
Case 3

A 39-year-old worker was employed as a furnace attendant at an aluminum foundry. He had worked at the foundry for 2 weeks and was responsible for turning on and attending a furnace used to melt aluminum. On the afternoon of the reported incident, he had pressed the wrong button and accidentally spilled molten aluminum on the floor. He spent about 15 minutes removing the spill and wore a silver reflective suit for protection against the radiant heat emanating from the metal. The outdoor dry bulb temperature was 28.3°C (83°F), and the worksite temperature was about 29.4°C (84°F); the estimated temperature of the molten aluminum in the furnace was 982°C (1,800°F).

He died the next day at 9:30 a.m. in cardiac arrest. The autopsy report listed the causes of death as hyperthermia, disseminated intravascular coagulation, and coronary arteriosclerosis. The worker had a history of treatment for alcoholism and reportedly had been drinking heavily in the days before his death. However, at the time of hospitalization, he had no alcohol in his blood. Four days before the heat stroke, he had severely lacerated his toes in a lawnmower accident and was treated with antibiotics and tetanus toxoid.

Source: http://www.cdc.gov/mmwr/preview/mmwrhtml/00000376.htm
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Accident Investigation
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- OSH References [CISILO (English/French), HSELINE, Canadiana, OSHTLINE® with NIOSHTIC®, INRS Bibliographic]

Regulatory information

- Canadian enviroOSH Legislation
- Canadian enviroOSH Legislation *plus* Standards
- National Labour Operations Resources*

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clientservices@ccohs.ca

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