

### Health Effects of Heat Stress \*

Health Effect	Symptoms	Treatment
Heat Rash	Red bumpy rash with severe itching.	Change into dry clothes and avoid hot environments. Rinse skin with cool water. Wash regularly to keep skin clean and dry.
Fainting	Sudden fainting after at least two hours of work; cool moist skin; weak pulse.	<b>GET MEDICAL ATTENTION.</b> Assess need for CPR. Move to a cool area; loosen clothing; make person lie down; and if the person is conscious offer sips of cool water. Fainting may also be due to other illnesses.
Heat Cramps	Heat cramps are painful, involuntary muscle spasms that usually occur during heavy exercise in hot environments. Inadequate fluid intake often contributes to this problem. The spasms may be more intense and more prolonged than typical nocturnal leg cramps. Muscles most often affected include the calves, arms, abdomen and back, although the cramps may involve any muscle group involved in the exercise.	<b>If you suspect heat cramps:</b> Rest briefly and cool down. Drink water or an electrolyte-containing sports drink. Practice gentle, range-of-motion stretching and gently massage of the affected muscle group.
Heat Exhaustion	Signs and symptoms of heat exhaustion often begin suddenly, sometimes after excessive exercise, perspiration and inadequate fluid intake. Features resemble shock and include: feeling faint, nausea, ashen appearance, rapid heartbeat, low blood pressure, hot, red, dry or sweaty skin, low-grade fever, generally less than 40°C.	<b>If you suspect heat exhaustion:</b> Get the person out of the sun and into a shady or an air-conditioned location. Lay their person down and elevate the feet slightly. Loosen or remove the individual's clothing. Have the person drink cold water, not iced, or a sports drink containing electrolytes. Cool the person by spraying him or her with cool water and fanning. Monitor the person carefully. Heat exhaustion can quickly become heatstroke. <b>If fever - especially greater than 40°C - fainting, confusion or seizures occur, CALL FOR EMERGENCY MEDICAL ASSISTANCE.</b>
Heat Stroke	The main sign of heatstroke is a markedly elevated temperature - generally greater than 40°C - with hot, dry skin and changes in mental status ranging from personality changes to confusion and coma. Other signs may include: rapid heartbeat, rapid and shallow breathing, elevated or lowered blood pressure, cessation of sweating, irritability, confusion or unconsciousness, fainting, which can be the first sign in older adults.	<b>If you suspect heatstroke:</b> Move the person out of the sun and into a shady or an air-conditioned space. Dial 911 or <b>CALL FOR EMERGENCY MEDICAL ASSISTANCE.</b> Cool the person by covering him or her with damp sheets or by spraying with cool water. Direct air onto the person with a fan or newspaper.

\* The items regarding heat cramps, heat exhaustion, and heat stroke are copyright Mayo Foundation for Medical Education and Research. All Rights reserved. Used with permission from www.MayoClinic.com. Heat Rash and Fainting adapted from Ontario Ministry of Labour Heat Stress Guideline: [http://www.labour.gov.on.ca/english/hs/guidelines/gl\\_heat.html](http://www.labour.gov.on.ca/english/hs/guidelines/gl_heat.html)

**Rationale for Using Moderate Unacclimatized WBGT Category:** The Humidex-based heat response plan uses the ACGIH moderate unacclimatized workload category as the reference point for translating the WBGT into Humidex. The MOL heat stress guideline states that "hot spells in Ontario seldom last long enough for workers to acclimatize". Based on actual workplace measurements collected in the summer of 2002, we were able to confirm that workers performing work classified as "light" by ACGIH standards did not meet the criteria for assuming acclimatization (i.e. experiencing heat stress range temperatures for at least 5 days within any 7 consecutive day period). Similarly, workers performing "moderate" work (e.g. work with some pushing, lifting) would also not be assumed to be acclimatized by the same criteria, unless there is significant radiant heat associated with the work. Workers performing "heavy" work (e.g. shovelling dry sand), however, could probably be considered acclimatized once into the warm weather season. The acclimatized heavy work WBGT numbers are similar to the moderate unacclimatized. The reason for not selecting the light category is to be protective for all workers. People come in all shapes and sizes, along with different fitness levels and tolerances to heat. Since the TLV is based on data derived from 20 year old males weighing an average of 154 lbs., "real" workers probably burn up more calories than the TLV light category assumes. Selecting the "moderate" work category will account to some extent for workers who are somewhat dehydrated, older (e.g. over 40), not male, and somewhat heavier than 154 lbs.

**Every effort has been made to ensure the accuracy of the information in this document. OHCOW assumes no responsibility for how the information is used.**

### Humidex Based Heat Response Plan

**What is it?**

- The Humidex plan is a simplified way of protecting workers from heat stress which is based on the ACGIH Heat Stress TLV (used by the Ontario Ministry of Labour)
- Wet bulb globe temperatures (WBGT) were translated into Humidex based on the "moderate" work load category & assuming workers are unacclimatized (see rationale at the end of the document)

**Note:** in the translation process some simplifications and assumptions have been made, therefore, **the plan may not be applicable in all circumstances and/or workplaces** (follow steps #1-5 to ensure the Humidex plan is appropriate for your workplace).

#### Humidex Heat Stress Response Plan

Humidex	Response
25-29 °C	Supply water to workers on an "as needed" basis
30-33 °C	Post Heat Stress Alert notice; Encourage workers to drink extra water; Start recording hourly temperature and relative humidity
34-37 °C	Post Heat Stress Alert notice; Notify workers that they are drinking extra water; Ensure workers are trained to recognize symptoms
38-39 °C	Provide 15 minutes relief per hour; Provide adequate cool (10-15 °C ) water; At least 1 cup (240 mL) of water every 20 minutes; Workers with symptoms should seek medical attention
40-42 °C	Provide 30 minutes relief per hour in addition to the provisions listed previously;
43-44 °C	If feasible provide 45 minutes relief per hour in addition to the provisions listed above. If a 75% relief period is not feasible then stop work until the Humidex is 42 °C or less;
45 °C or over	Stop work until the Humidex is 44 °C or less

Humidex calculator: [http://www.ohcow.on.ca/menuweb/heat\\_stress\\_calculator.htm](http://www.ohcow.on.ca/menuweb/heat_stress_calculator.htm)

**Fans:**

Fans provide air movement which can increase the rate at which sweat evaporates (thus cooling the body). However, when relative humidity levels rise above 70%, very little evaporation occurs and increasing air movement has little benefit. If the air is the same temperature as the skin (36°C) or higher, moving air may actually heat up the body especially if the humidity is high.

**Vulnerability to Heat Stress:**

There are many permanent or temporary conditions (e.g. age, heart or lung conditions, dehydration, fatigue, some medications, etc.) that can make a person more vulnerable to heat strain. Despite their condition, they may be able to cope given adequate knowledge of the signs and symptoms of heat stress and if given the latitude to make the appropriate adjustments to their workplace or work routine. It is more often the young, fit workers who may think they are invincible who succumb to heat strain. Some workers may need medical advice about what accommodations would be right for them.



## Humidex Heat Stress Response Plan

**Limitations:** this table is based on moderate, unacclimatized work, with little or no radiant heat, assuming wearing regular summer clothing; if your conditions vary from these, see the steps listed below to make adjustments

Temp (in °C)	Relative Humidity (RH) (in %)																				
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	Temp (in °C)	
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**NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!!!**

**Humidex Action**

45+ stop work

43-44 45 min/hr relief

40-42 30 min / hr relief

38-39 15 min / hr relief

34-37 warning & more water

30-33 alert & water

25-29 water as needed

**Hamilton Clinic**  
848 Main St. E.,  
Hamilton L8M 1L9  
905-549-2552 or  
800-263-2129

**Sarnia Clinic**  
171 Kendall St.,  
Sarnia N7V 4G6  
519-337-4627

**Sudbury Clinic**  
84 Cedar St. 2nd Floor  
Sudbury P3E 1A5  
705-523-2330 or  
800-461-7120

**Toronto Clinic**  
970 Lawrence Ave. W., Suite #110  
Toronto M6A 3B6  
416-449-0009 or  
888-596-3800

**Windsor Clinic**  
3129 Marentette Ave., Unit #1  
Windsor N8X 4G1  
519-973-4800 or  
800-565-3185

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## Humidex Based Heat Response Plan

### Step #1: Clothing

- evaporating sweat is the primary way the body gets rid of excess heat build-up, therefore, the best clothing is the kind that makes it easiest for sweat to evaporate.
- the Humidex plan assumes workers are wearing regular summer clothes (light shirt & pants, underwear and socks and shoes).
- for workers who wear cotton overalls on top of summer clothes one should add 5°C Humidex (roughly equal to 3.5°C WBGT) to the workplace Humidex measurement.
- for different clothing configurations, estimate correction factor by comparing them with cotton overalls (e.g. gloves, hard hat, apron, protective sleeves might be equivalent to a little less than half the evaporation resistance as overalls so add 1°C or 2°C Humidex).

### Step #2: Training

- the Humidex plan by itself cannot guarantee that workers will not be affected by heat stress. It is absolutely essential that workers learn to recognize the early signs and symptoms of heat stress and know what to do to prevent them!
- if at all possible, workers need to be able to alter their pace of work, rest breaks, and fluid intake in response to early symptoms (240 mL every 20 minutes).
- the ideal heat stress response plan would let workers regulate their own pace by "listening to their body" without need for measurements.

### Step #3: Select a Measurement Location

- split the workplace into heat stress zones and put a thermal hygrometer in each zone.
- identify a representative location within the zone where measurements can be taken (if you want to base your actions on a single reading, select the highest heat stress zone).

**Note:** the Humidex Heat Stress Response Plan is **based on workplace measurements not weather station/media reports** (temperatures inside buildings do not necessarily correspond with outside temperatures)

### Step #4: Measure Workplace Humidex

- a thermal hygrometer (usually \$20-\$60 at hardware or office supply stores) is a simple way to measure the temperature and relative humidity in your workplace
- once you have the temperature and humidity, use the table above to determine the corresponding Humidex value and the appropriate heat stress prevention response
- measurements should be recorded at least hourly if the Humidex is above 30°C

**NEVER IGNORE ANYONE'S SYMPTOMS NO MATTER WHAT THE HUMIDEX!**

### Step #5: Adjusting for Radiant Heat

- for outdoor work in direct sunlight between the hours of 10 am and 4 pm, add 2-3°C (pro-rate according to percentage cloud cover) to your Humidex measurement
- for indoor radiant heat exposures, use common sense to judge whether the exposure of concern involves more or less radiant heat than direct sunlight and adjust the 2-3°C correction factor appropriately

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