



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 2009 ACGIH Heat Stress TLV[®] (Threshold Limit Value[®]) which uses wet bulb globe temperatures (WBGT) to estimate heat strain. These WBGT's were translated into Humidex.
- The ACGIH specifies an action limit and a TLV[®] to prevent workers' body temperature from exceeding 38°C (38.5°C for acclimatized workers). Below the action limit (Humidex 1 for work of moderate physical activity) most workers will not experience heat stress. Most healthy, well-hydrated, acclimatized workers not on medications, will be able to tolerate heat stress up to the TLV[®] (Humidex 2 for moderate physical activity). Between Humidex 1 and Humidex 2, general heat stress controls are needed and above Humidex 2 job-specific controls are needed.
- **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 1	Response	Humidex 2
25 – 29	supply water to workers on an “as needed” basis	32 – 35
30 – 33	post Heat Stress Alert notice; encourage workers to drink extra water; start recording hourly temperature and relative humidity	36 – 39
34 – 37	post Heat Stress Warning notice; notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms	40 – 42
38 – 39	work with 15 minutes relief per hour can continue; provide adequate cool (10-15°C) water; at least 1 cup (240 mL) of water every 20 minutes worker with symptoms should seek medical attention	43 – 44
40 – 41	work with 30 minutes relief per hour can continue in addition to the provisions listed previously;	45 – 46*
42 – 44	if feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above.	47 – 49*
45 or over	only medically supervised work can continue	50* or over

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

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

Humidex 1, General Controls: General controls apply to unacclimatized workers and include providing annual heat stress training, encouraging adequate fluid replacement, permitting self-limitation of exposure, encouraging watching out for symptoms in co-workers, and adjusting expectations for workers coming back to work after an absence. Workers doing moderate work are considered acclimatized in Ontario only if they regularly work around heat sources (e.g. in foundries, around ovens, etc.). NOTE: clothing and radiant heat must also be taken into account when using this guideline (see steps #1-5 outlined on page 3).

Humidex 2, Job-Specific Controls: Job-specific controls include (in addition to general controls) engineering controls to reduce physical job demands, shielding of radiant heat, increased air movement, reduction of heat and moisture emissions at the source, adjusting exposure times to allow sufficient recovery, and personal protective equipment that provides for body cooling.



Limitations: this table is based on work with **little or no radiant heat**, assuming wearing **regular summer clothing**; if your specific working conditions vary from these assumptions, see the steps 1-5 listed below to make adjustments

Humidex Heat Stress Response Plan

Temp (in °C)	Relative Humidity (in %)																													
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%											
49																		50												
48	NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!!!																													
47	Moderate Unacclimatized & Heavy Acclimatized							Moderate Acclimatized & Light Unacclimatized												50	47									
46																				49	46									
45																				50	47	45								
44		Action																		49	46	43								
43		45+		only medically supervised work						50+ *													49	47	45	42				
42		42-44		work with 45 min/hr relief						47-49*													50	48	46	43	41			
41		40-41		work with 30 min/hr relief						45-46*													48	46	44	42	40			
40		38-39		work with 15 min/hr relief						43-44													49	47	45	43	41	39		
39	34-37		warn for symptoms & extra water						40-42													49	47	45	43	41	39	37		
38	30-33		alert for symptoms & extra water						36-39													49	47	45	43	42	40	38	36	
37	25-29		water as needed						32-35													49	47	45	44	42	40	38	37	35
36	*for Humidex 45+, heat stress should be managed as per the ACGIH TLV®								50	49	47	45	44	42	40	39	37	35	34											
35									50	48	47	45	43	42	40	39	37	36	34	33										
34									49	48	46	45	43	42	40	39	37	36	34	33	31									
33									50	48	47	46	44	43	41	40	39	37	36	34	33	32	30							
32									50	49	48	46	45	44	42	41	40	38	37	36	34	33	32	30	29					
31	50	49	48	47	45	44	43	42	40	39	38	37	35	34	33	32	30	29	28											
30	48	47	46	44	43	42	41	40	39	37	36	35	34	33	31	30	29	28	27											
29	46	45	43	42	41	40	39	38	37	36	35	33	32	31	30	29	28	27	26											
28	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25											
27	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25													
26	39	38	37	36	35	34	33	33	32	31	30	29	28	27	26	25														
25	37	36	35	34	33	33	32	31	30	29	28	27	26	26	25															
24	35	34	33	33	32	31	30	29	28	28	27	26	25																	
23	33	32	31	31	30	29	28	28	27	26	25																			
22	31	30	30	29	28	27	27	26	25	25																				
21	29	29	28	27	26	26	25																							
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%											

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Humidex Based Heat Response Plan

Step #1: 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 #2: Adjust for 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 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° Humidex (roughly equal to 3°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° or 2° Humidex).
- If clothes do not allow sweat evaporation (encapsulated suits) heat stress should be managed by monitoring vital signs (see ACGIH TLV®)

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 or media reports** (temperatures inside buildings **do not** usually correspond with outdoor temperatures)

Step #4: Measure Workplace Humidex

- a thermal hygrometer (usually \$10-\$50 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 (remember to adjust for clothing (step #2) and radiant heat (step #5))
- measurements should be recorded at least hourly if the Humidex is above 30° or temperature above 26°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 5 pm, add 2-3° (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° correction factor appropriately

**Health Effects of Heat Stress***

Health Effect	Symptoms	Treatment
Heat Rash	Red bumpy rash with severe itching.	Change into dry clothes often 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.	GET MEDICAL ATTENTION. 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.	If you suspect heat cramps: Rest briefly and cool down. Drink water or an electrolyte-containing sports drink. Practice gentle, range-of-motion stretching and gentle 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.	If you suspect heat exhaustion: Get the person out of the sun and into a shady or an air-conditioned location. Lay the 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. If fever — especially greater than 40°C — fainting, confusion or seizures occur, CALL FOR EMERGENCY MEDICAL ASSISTANCE.
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.	If you suspect heatstroke: Move the person out of the sun and into a shady or an air-conditioned space. Dial 911 or CALL FOR EMERGENCY MEDICAL ASSISTANCE. 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.org. Heat Rash and Fainting adapted from Ontario Ministry of Labour Heat Stress Guideline: http://www.labour.gov.on.ca/english/hs/pubs/gl_heat.php (accessed Jun/17).

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 these conditions, workers may be able to cope given adequate knowledge of the signs and symptoms of heat stress and, given the latitude to make the appropriate adjustments to their pace of work. 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.

Acclimatization: The MOL heat stress guideline states that "hot spells in Ontario seldom last long enough for workers to acclimatize". 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. 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.
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