Appendix B - The Humidex

Heat-related disorders are commonly caused by a combination of climate-related factors, work load, clothing and individual risk factors such as the worker's age, health, physical condition, medication and level of acclimatization. Due to the variance of individual susceptibility, effects of heat stress may be experienced by certain individuals earlier than expected. Supervisors should therefore begin to remind workers of heat-stress prevention strategies as the humidex level approaches 30°C.

The danger posed by heat and humidity has lead biometerologists to develop various discomfort indices in order to define the danger and alert the public. These indices are, to some degree, subjective. The level of discomfort or danger will depend on a person's age, health and physical condition, on the type of clothing worn and activity level. In addition to temperature and humidity, weather conditions such as the amount of sunshine and wind speed will also affect the "feel" of temperature and humidity.

The Canadian index, called **HUMIDEX,** combines the temperature and humidity into one number that is intended to reflect perceived temperature.

The following Humidex Heat Stress Response Plan, developed by the Occupational Health Clinics for Ontario Workers Inc. (OHCOW), is included as part of the Occupational Health and Safety Council of Ontario (OHSCO) Heat Stress Awareness Toolkit which is accessible online.

This resource can be used to determine humidex levels based on identified air temperature (°C) using a standard thermometer and % relative humidity using a hygrometer.

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 2022 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 prescribes an action limit (AL) based on the ability of "healthy hydrated unacclimatized workers to sustain thermal equilibrium". This limit "has a small margin of safety, and some workers may experience heat-related disorders below the AL."
- **Note:** in the translation process some simplifications and assumptions have been made, therefore, **the plan may not be applicable in workplaces with additional sources of heat and/or humidity** (follow steps #1-5 to ensure the Humidex plan is appropriate for your workplace, if not, follow the ACGIH Heat Stress and Strain TLV®). **This plan assumes moderate, unacclimatized work**.

Adjusted* Humidex	Response
25 – 29	supply water to workers on an "as needed" basis
30 – 33	post Heat Stress Alert notice; encourage workers to drink extra water; start recording hourly temperature and relative humidity
34 – 37	post Heat Stress Warning notice; notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms
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
40 – 41	work with 30 minutes relief per hour can continue in addition to the provisions listed previously
42 – 44	if feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above
45** or over	only medically supervised work can continue

*** "adjusted" means adjusted for additional clothing and radiant heat (see steps #4 & #5)**

****at Humidex above 45, heat stress to be managed as per the ACGIH TLV®**

General Controls: General controls apply to all 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 not considered acclimatized in Ontario unless they regularly work around significant heat and/or humidity sources (e.g., in foundries, around ovens, etc.).

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. Apply the hierarchy of controls.

Occupational Health Clinics for Ontario Workers Inc.

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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 Response Plan

NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!!!

adjusted* Humidex	Action
45+**	only medically supervised work
42-44	75% relief
40-41	50% relief
38-39	25% relief
34-37	warning & double water
30-33	alert & water
25-29	water as needed

* "adjusted" means adjusted for additional clothing and radiant heat (see steps 2 & 5)

** above a humidex of 45 use the ACGIH Heat Stress/Strain TLV

Temp (in ℃)	relative humidity (in %)																		Temp (in ℃)
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	
49																			50	49
48																			49	48
47																		50	47	47
46																		49	46	46
45																	50	47	45	45
44																	49	46	43	44
43																49	47	45	42	43
42															50	48	46	43	41	42
41															48	46	44	42	40	41
40														49	47	45	43	41	39	40
39													49	47	45	43	41	39	37	39
38												49	47	45	43	42	40	38	36	38
37											49	47	45	44	42	40	38	37	35	37
36									50	49	47	45	44	42	40	39	37	35	34	36
35								50	48	47	45	43	42	40	39	37	36	34	33	35
34							49	48	46	45	43	42	40	39	37	36	34	33	31	34
33						50	48	47	46	44	43	41	40	39	37	36	34	33	32	30	33
32					50	49	48	46	45	44	42	41	40	38	37	36	34	33	32	30	29	32
31	50	49	48	47	45	44	43	42	40	39	38	37	35	34	33	32	30	29	28	31
30	48	47	46	44	43	42	41	40	39	37	36	35	34	33	31	30	29	28	27	30
29	46	45	43	42	41	40	39	38	37	36	35	33	32	31	30	29	28	27	26	29
28	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	28
27	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24		27
26	39	38	37	36	35	34	33	33	32	31	30	29	28	27	26	25	24			26
25	37	36	35	34	33	33	32	31	30	29	28	27	26	26	25	24				25
24	35	34	33	33	32	31	30	29	28	28	27	26	25	24						24
23	33	32	31	31	30	29	28	28	27	26	25	24	24							23
22	31	30	30	29	28	27	27	26	25	25	24									22
21	29	29	28	27	26	26	25	24	24											21
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	

relative humidity (in %)

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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 know how 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 and supported in altering their pace of work, rest breaks, and fluid intake in response to any early symptoms (240 mL or a cup of water 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: Select a Measurement Location

- split the workplace into heat stress zones and put a thermal hygrometer in each zone (preferably within 10 m (30') of exposed worker(s)).
- 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 Response Plan is **based on workplace measurements not weather station or media reports**
(temperatures inside buildings **do not** usually correspond with outdoor temperatures)

Step #3: Measure Workplace Humidex

- a thermal hygrometer (usually $10-$50 at hardware or office supply stores – some even have free apps for your phone) 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 #4) and radiant heat (step #5)**)
- measurements should be recorded at least hourly if the Humidex reaches 30°.

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

Step #4: 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 (long-sleeved shirt & long pants, underwear, socks and shoes).
- for workers who wear cotton overalls on top of summer clothes one should add 5-6° Humidex to the workplace Humidex measurement.
- for different clothing configurations, estimate the clothing adjustment value 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 #5: Adjust for Radiant Heat

- for outdoor work **in direct sunlight** between the hours of 10 am and 5 pm, add 3-4° Humidex (pro-rate according to percentage cloud cover and/or shade) 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 Humidex measurement by adding the appropriate proportion of the 3-4° unit adjustment factor.