

André Gauvin

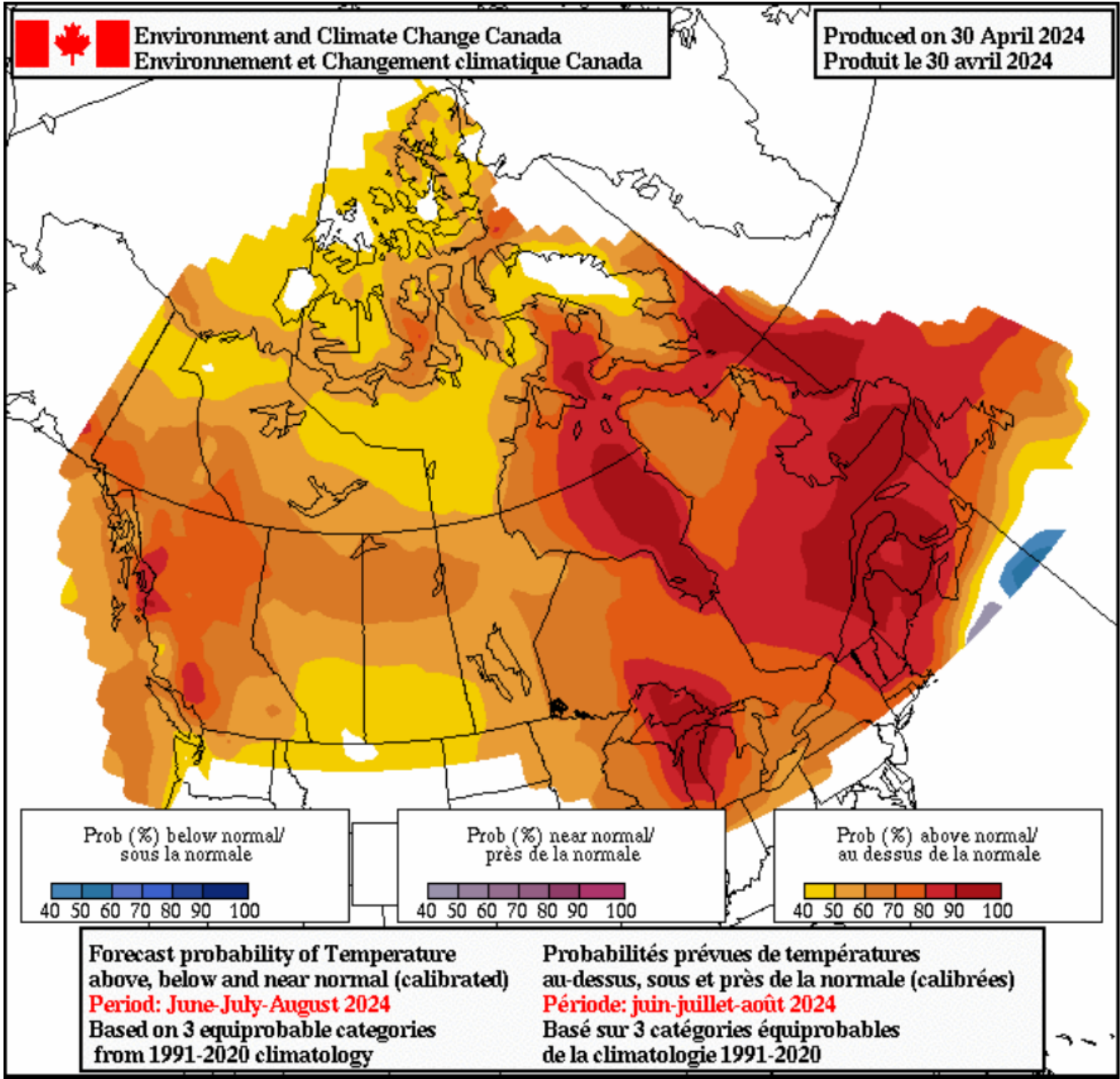
Occupational Hygienists

Oct 22, 2024

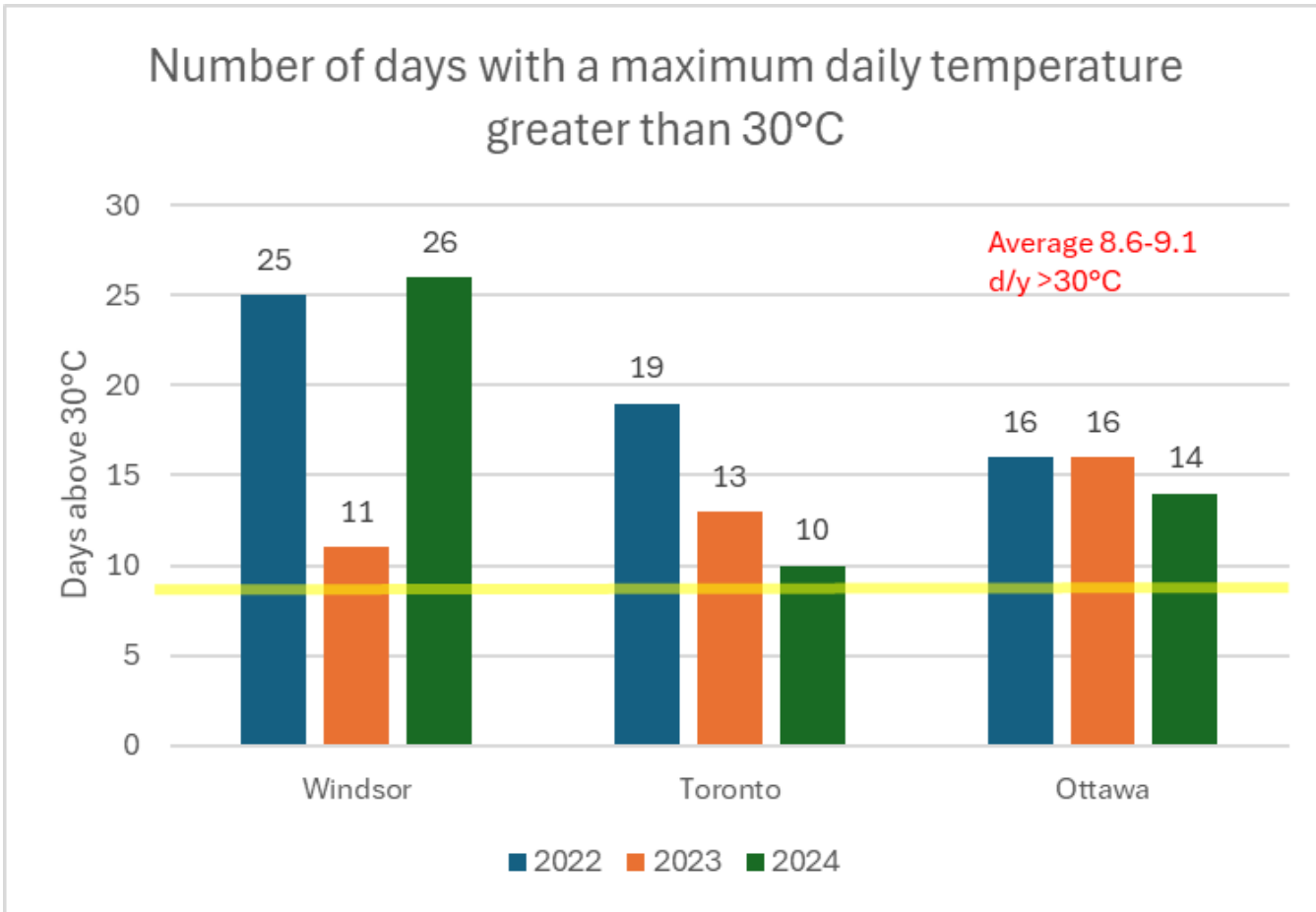


3-Month Seasonal Forecast Summer 2024:

https://weather.gc.ca/saisons/prob_e.html



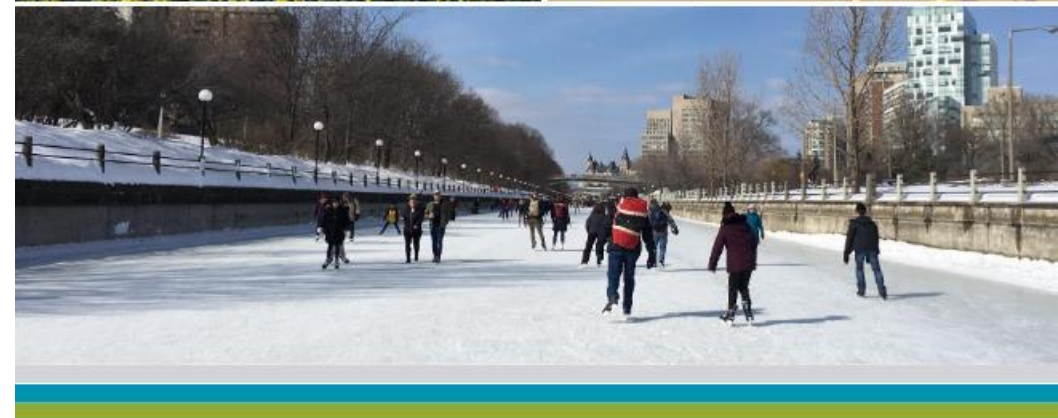
Ontario government climate change report



Ontario Provincial
Climate Change Impact
Assessment

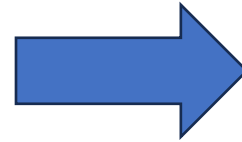
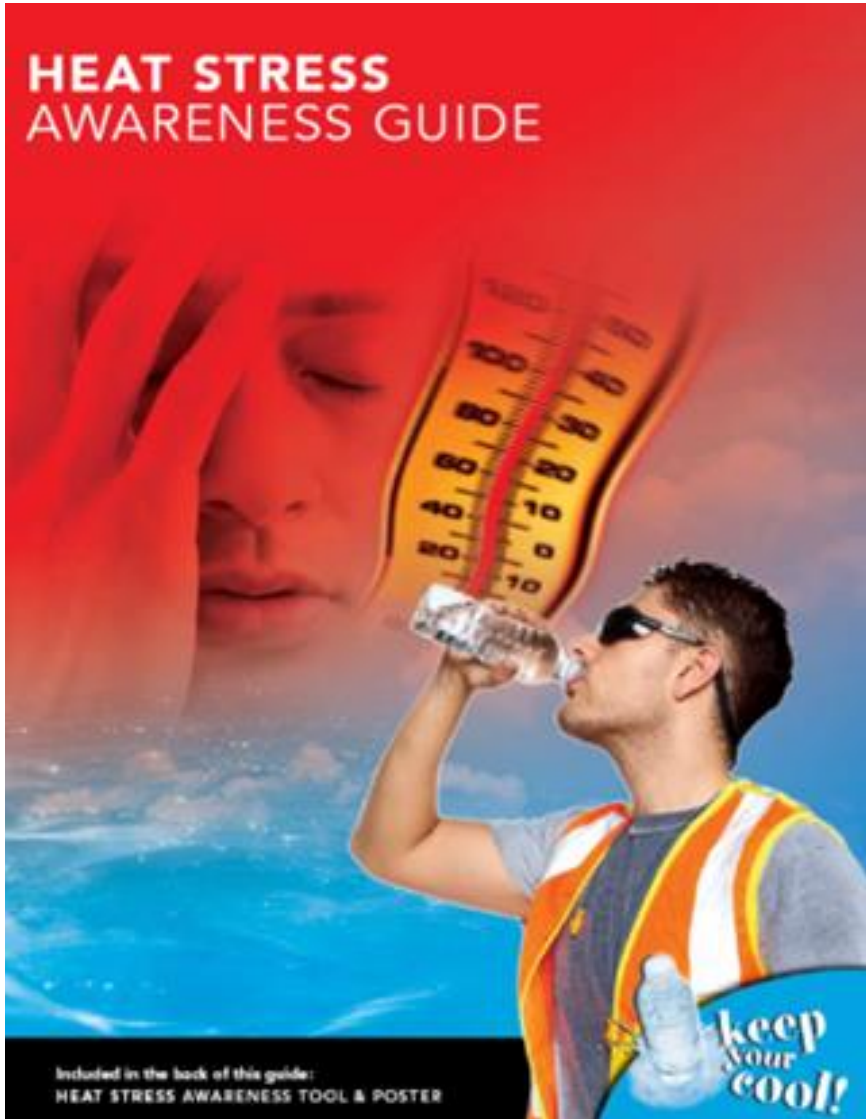
Technical Report

January 2023



<https://www.ontario.ca/files/2023-11/mecp-ontario-provincial-climate-change-impact-assessment-en-2023-11-21.pdf>



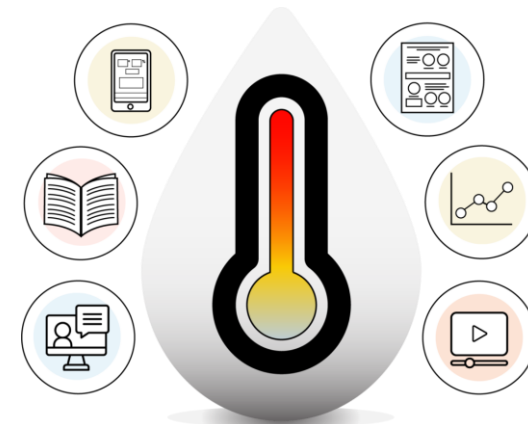


<https://www.ohcow.on.ca/wp-content/uploads/2024/05/hst-prevention-toolsandstrategies.pdf>



Available Now!

- [Heat Stress Toolkit – OHCOW](#)



Audience:

- Who are we trying to reach and what do we want them **to do** (not just to know)?
- Direct audience (Prevention tools and strategies): **heat stress exposed workers; H&S/JHSC reps and supervisors; H&S program professionals/managers; senior management**
- Since this originally was a project requested by unions and produced by the Prevention Partners (OHSCO), we thought it important to try to **re-engage everyone**
 - Ontario H&S system partners
 - MLITSD
 - Unions, OFL,



Over the hotter months your body's thermostat needed to change from heating to cooling

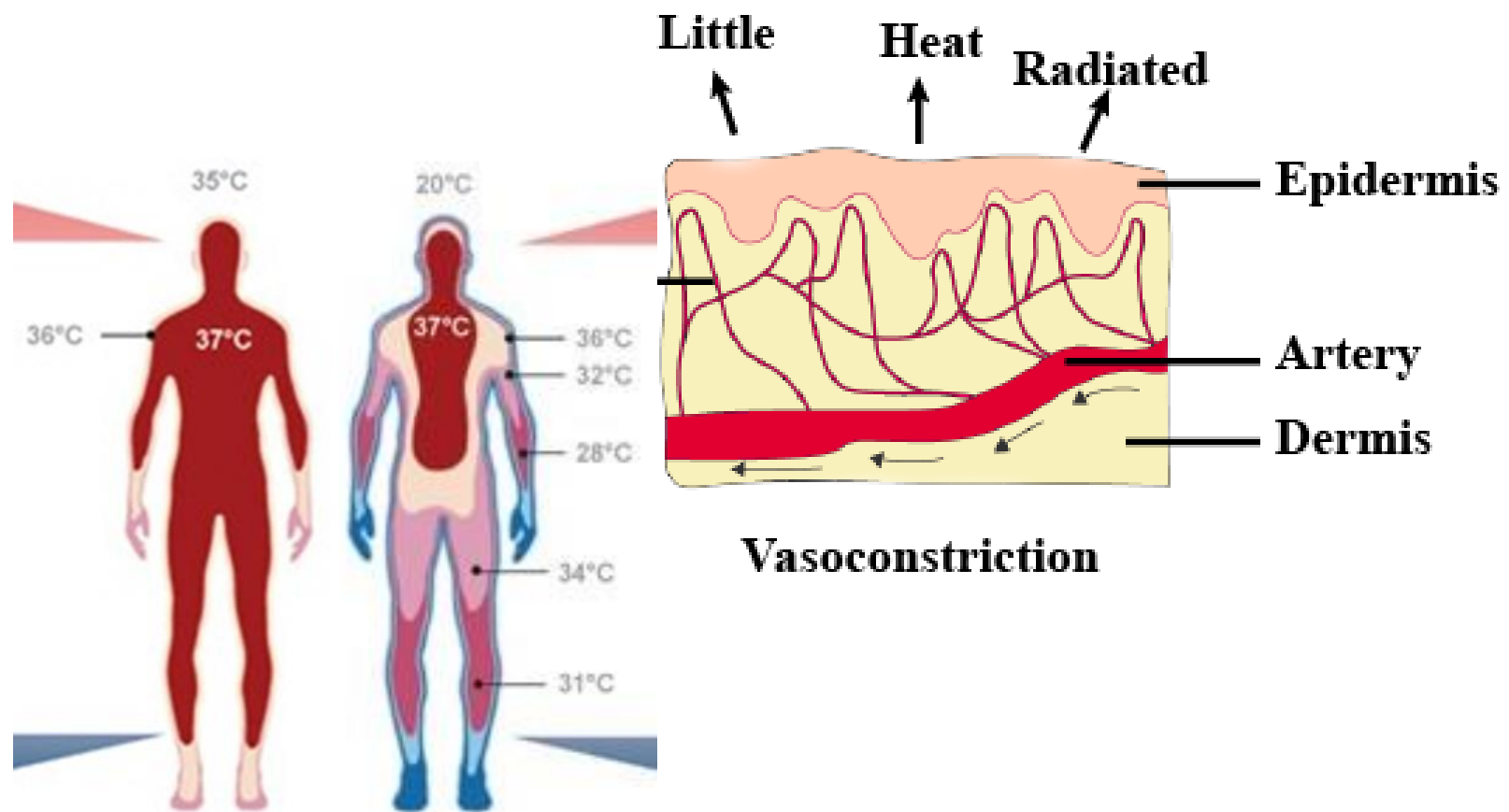


Regulating Temperature

- Thermoregulation
 - Despite variations in temperatures, humans can maintain a constant body temperature by balancing heat gain with heat loss.
- Humans can tolerate a decline in core temperature of 10°C but ONLY an increase of 5°C.



Capillaries and arteries/veins



How do you feel when you're exposed to heat?

- *what kind of symptoms have you experienced?*



Transient Heat Fatigue:

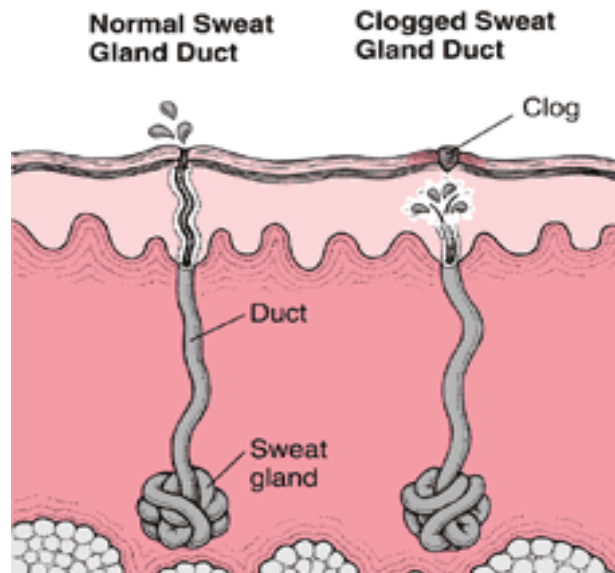
Symptoms: General feeling of tiredness or fatigue.

First Aid: Fluid replacement and rest.



Heat Rash

- Heat Rash is an irritation of the skin caused by excessive heat and sweating
- Rash develops as a result of plugged sweat glands (enhanced by hot, humid environment)
- Red, bumpy rash with severe itching.



Heat Syncope

Symptoms: Syncope means “fainting.” First signs are dizziness, feeling light-headed and perhaps nauseous, then the person may faint. Usually occurs in the beginning of heat stress season before the circulation system is adapted.



First Aid: Lay victim in a cool location in the prone position. If conscious, give fluids. Treatment the same as shock.



Heat Cramps:

Symptoms: Cramping of either active muscles (arms, legs) or involuntary (usually abdominal) muscles (or both).

First Aid: Replenish electrolytes through drinking of fluids such as Gator-Ade, Squincher, PowerAde, etc-Ade. Rest in a cool environment.



Heat Exhaustion:

Symptoms: Nausea, dizziness, weakness headache, blurred vision, profuse sweating, cold/wet (clammy) grayish skin, unconsciousness, coma and death.

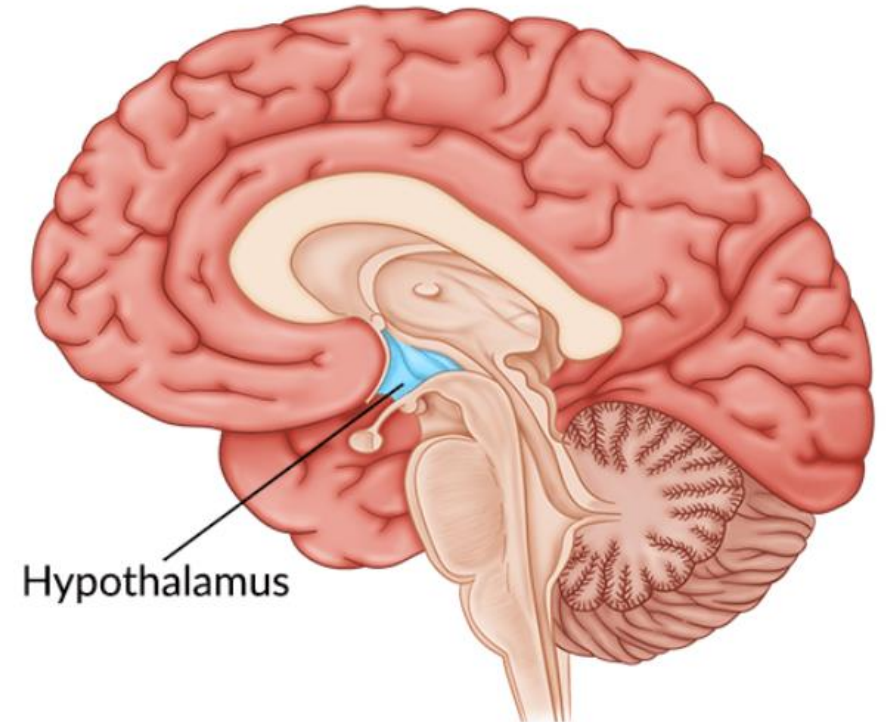
First Aid: Place victim in a prone position in a cool location, administer fluids if the victim is conscious. If unconscious, seek medical care or transport to a medical emergency room.



Which organ in the body is most susceptible to heat stress?

- Which part of the body do we need to be most worried about?

The brain functions best at a temperature between 36.4°C to 37.2°C (**normal = 37°C**)
Heat Stress programs are designed to keep the temperature **below 38°C**
At **40°C** the brain gives up trying to cool the body



Heat Stroke:



Symptoms: Chills, restlessness, irritability, euphoria, red face and skin, disorientation, hot/dry skin (not always), collapse, unconsciousness, convulsions and death.

First Aid: Immediate, aggressive cooling of the victim's body using wet cloths, immersion into cold water or alcohol wipes. **Transport to emergency medical facility ASAP!**



Watch out for each other!

- A worker heading into a heat stroke will no longer realize what's happening to him/her
- It is vital that co-workers be able to recognize what's happening and intervene
- Without quick attention, the co-worker may die!



Chronic (long-term) health effects:

- Chronic exposure to heat strain can result in long term illness affecting the **brain, heart, kidneys, liver, and muscles**.
- Also, both the **male and female reproductive systems** can be affected making it harder to conceive.
- Chronic heat strain can also **disturb sleep patterns** and affect **mental health**.
- **Consecutive days of heat stress** can lead to a **cumulative impact** on the body. Without enough **recovery time** away from the heat, the strain can accumulate. Instead of allowing the body to adapt to the heat, this build-up of strain may result in causing more harm particularly for older workers(Notley et al., 2018).



Who is most susceptible to heat stress?

- *Which of your co-workers are you most worried about when it gets hot?*



Risk Factors:

- very small body size
- overweight
- over 40 years old (the older the more sensitive)
- previous heat illness
- heart disease
- high blood pressure
- diabetes
- inactivity
- physical activity

... sooner or later we're all be at risk ...



... with all these vulnerabilities who typically gets heat stroke?



young physically fit males
and sick older people



Indirect Health Effects:

Reduced Work Performance: tired, fatigued workers perform with reduced accuracy/efficiency

Increased Accidents: tired, fatigued workers are more susceptible to accident and injury

Reproductive Problems: heat has been shown to reduce both male and female fertility and can be a problem for the fetus

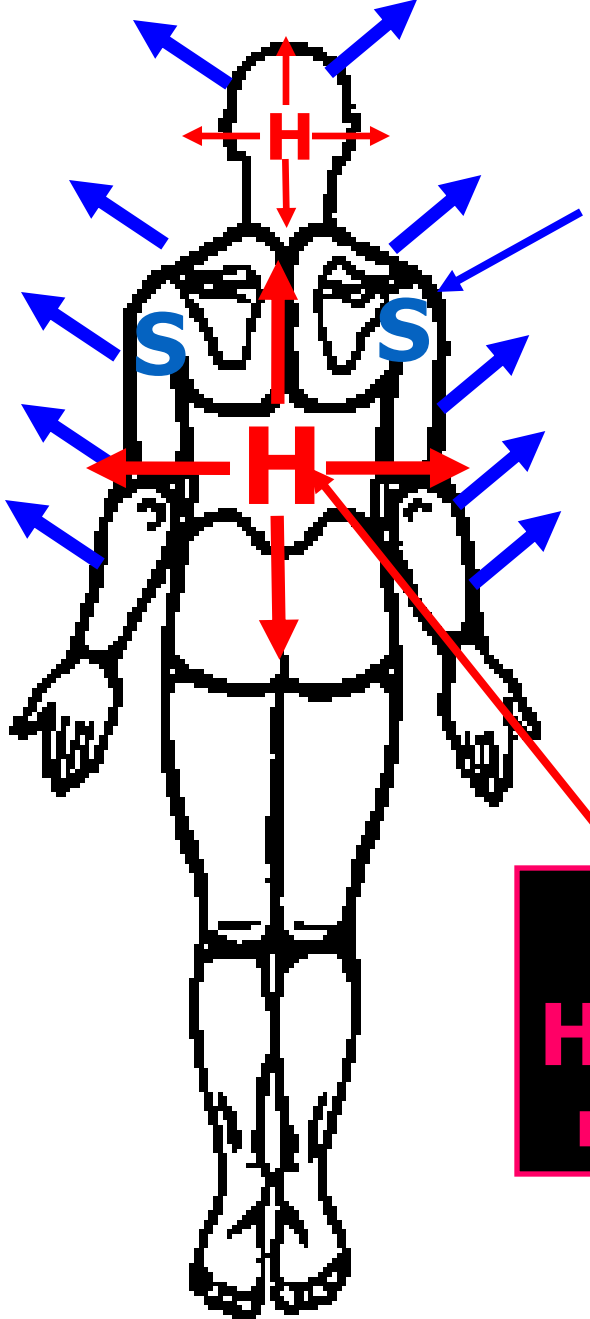
Heart/Lung Strain: if you already have heart, lung, kidney or circulatory problems; heat stress is an added strain on your body which in severe situation may precipitate serious episodes of acute problems

Poor Morale: working under heat stress conditions can aggravate pre-existing morale/labour relations problems



H

**External
Heat sources**
hot weather
radiant heat sources



**Cooling
evaporation
of sweat**

**Internal
Heat sources**
muscle activity



Internal heat sources: if I eat 1000 calories, where do they go?

300 calories used to work
700 calories wasted as heat

MEALS

Complete Your Meal
CHOOSE A BEVERAGE:
Brewed Coffee (M)
Tea
Water

CHOOSE A SIDE:
Potato Wedges
Donut*
Cookie

Adults and youth (ages 13 and older) need an average of 2,000 calories a day, and children (ages 4-12) need an average of 1,500 calories a day. However, individual needs may vary.

Turkey Bacon Club
8.79 MEAL 720-920 Cals

Roast Beef & Cheddar
8.79 MEAL 720-920 Cals

Caprese
7.59 MEAL 630-830 Cals

Ham & Cheddar
7.99 MEAL 670-870 Cals

BLT
7.99 MEAL 650-850 Cals

Bacon Grilled Cheese Melt
8.79 MEAL 800-1000 Cals



Heat Loss

Thermoregulation In Heat Stress

- The body has thermoregulatory mechanisms that primarily protect against overheating.
- The 4 Physical Processes Contribute to Heat Loss:
 - Radiation
 - Conduction
 - Convection
 - Evaporation



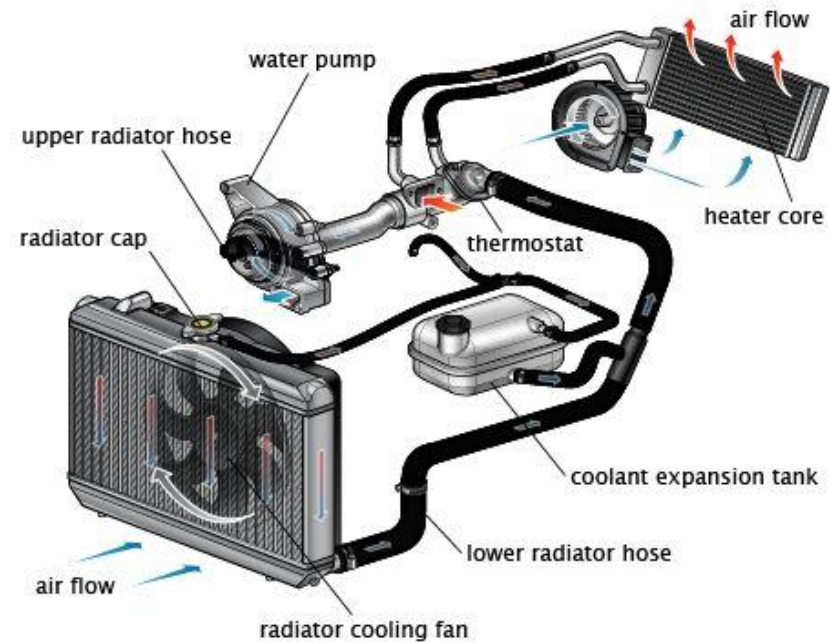
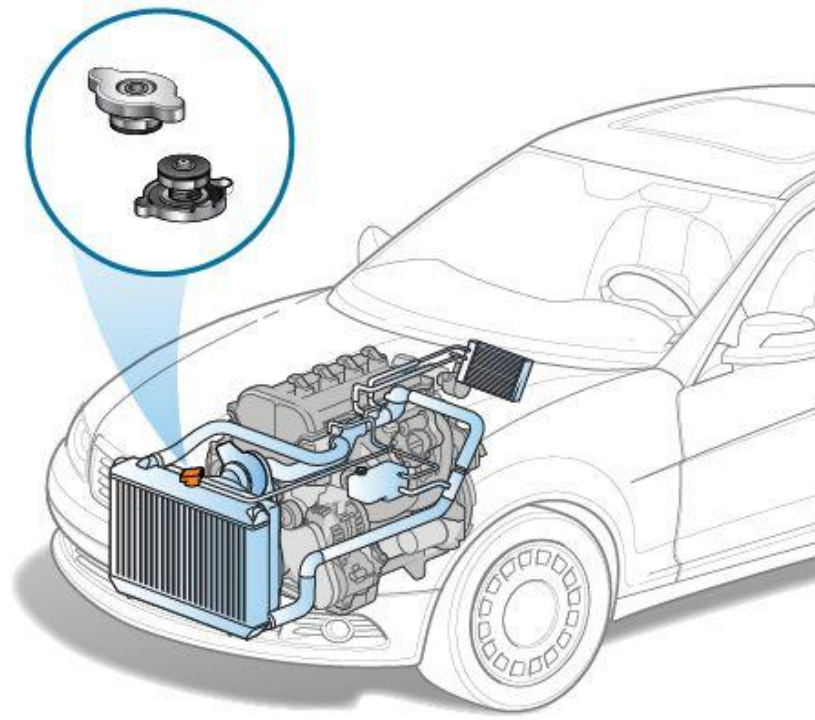
radiation



convection

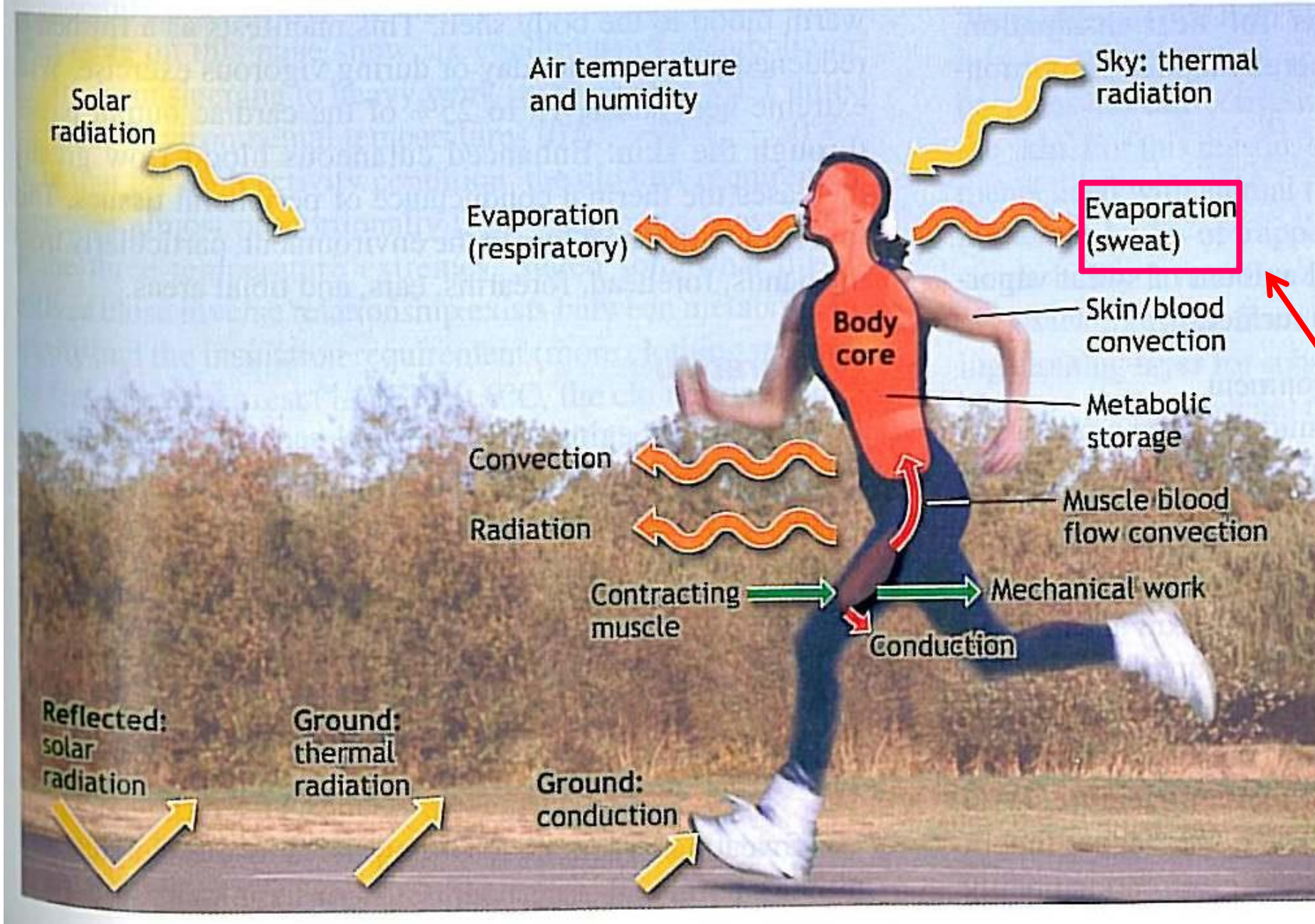


Your cooling system: radiator & convection



conduction



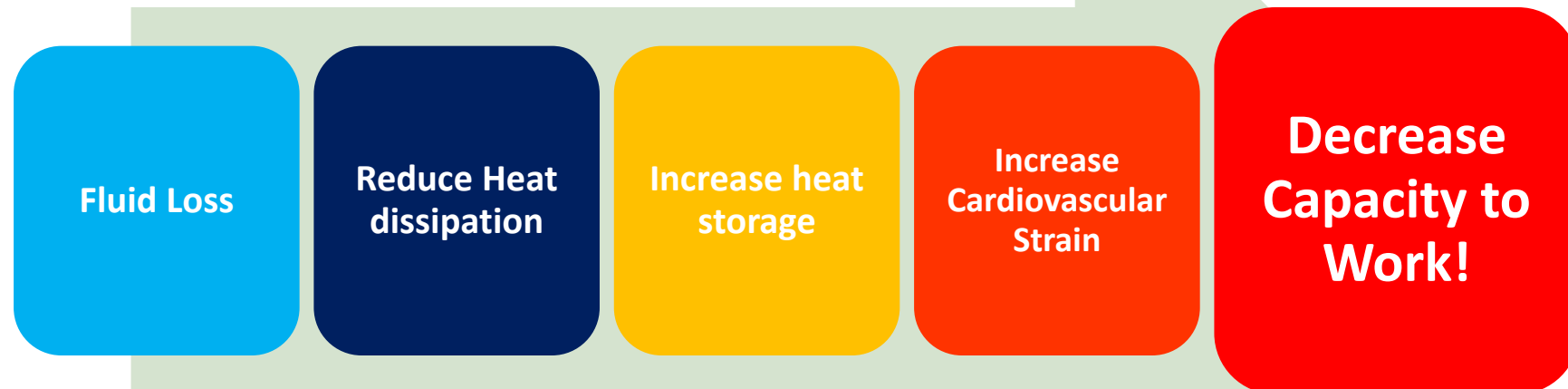


80%
 During Exercise
 or heavy work
 load



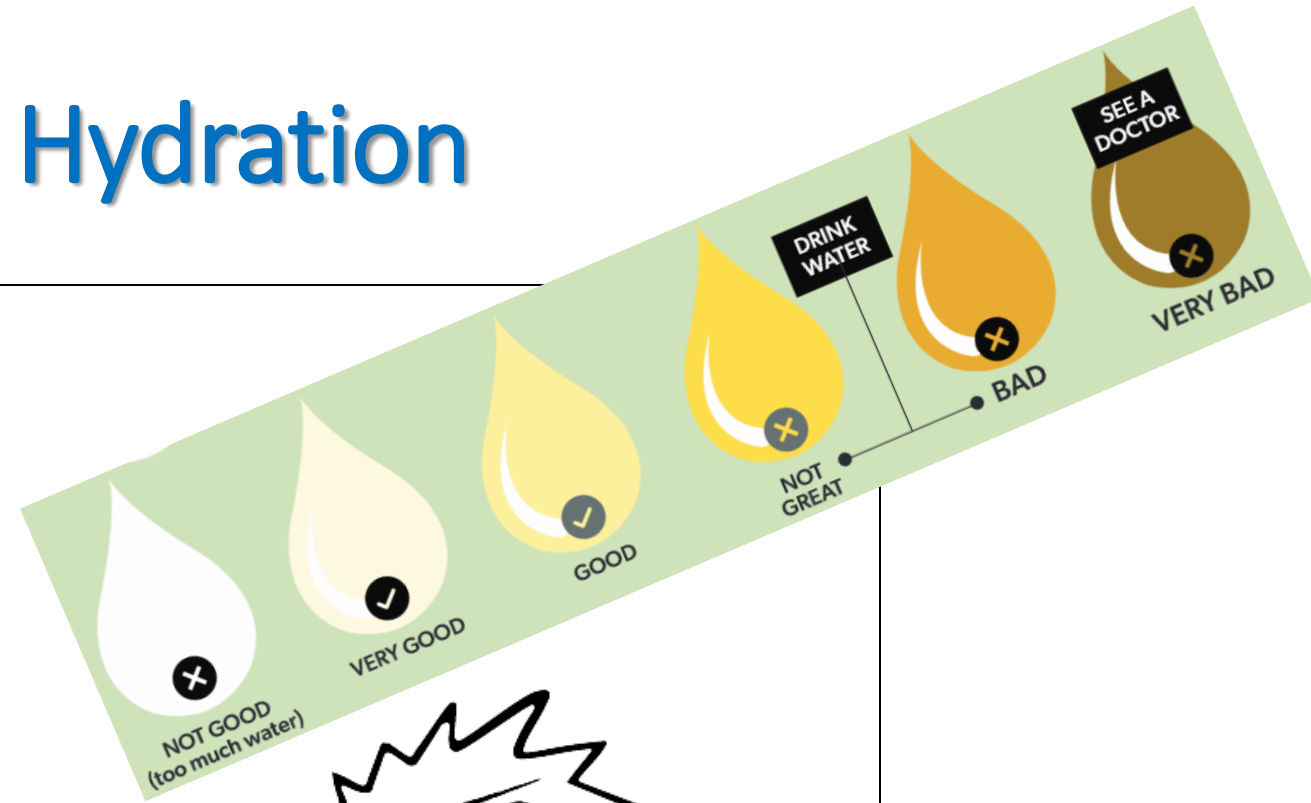
Fluid Loss in the Heat

- Dehydration = body water loss
- 1-hour moderate activity produces a sweat loss of 0.5 to 1 L (or more)



Signs of Hydration

- Inadequate Hydration
 - Infrequent urination
 - Excessive weight loss
 - Strong odour of urine
 - Urine **Colour**
- Adequate Hydration
 - Frequent urination
 - Urine **Colour**
 - Odourless



What to drink:



- Electrolyte drinks (e.g. Gatorade) are usually not needed for typical North American diet (can be used for first aid for cramps).
- Stay away from caffeinated carbonated, diet drinks and alcohol as they take water out of your body.
- Water is the best; juices and/or noncaffeine sport drinks are also good (juices contain energy restoring glucose).

How Much? A cup (250 mL) every 20 minutes (more than just satisfying your feelings of thirst – waiting for thirst is too late)



What can we measure to assess heat stress?

How are you measuring heat stress?



ACGIH Heat Stress & Strain TLV Documentation

HEAT STRESS AND STRAIN

the “Gold Standard”

TLV®

Warning: The TLV is based on the ability of most healthy hydrated acclimatized workers to sustain thermal equilibrium. The Action Limit (AL) is similarly prescribed for healthy hydrated unacclimatized workers. This TLV has a small margin of safety, and some workers may experience heat-related disorders below the TLV or AL.

Introduction: The goal of the TLV is to limit heat stress exposures to those that may be sustained for hours; that is, where healthy acclimatized individuals can achieve and maintain thermal equilibrium. The Action Limit (AL) describes conditions where most healthy unacclimatized workers can achieve thermal equilibrium. If thermal equilibrium cannot be sustained, there is an increasing likelihood of heat exhaustion or heat stroke. While not considered for the TLV, there is also an increased likelihood of errors in judgement, acute injury, and adverse incidents with increasing heat stress. Furthermore, the TLV assumes complete recovery from a previous heat stress exposure.



Evidence based:

- American Conference of Governmental Industrial Hygienist (**ACGIH**) Heat Stress/Heat Strain Threshold Limit Value (**TLV**[®]) Documentation (last updated 2022)
- Contains a **detailed literature summary**; explanation of derivation of TLV values; **instructions** on how to properly apply
- Considered **minimal** professional practice standard
- Been in use since 1974 and constantly updated – internationally referenced by regulations and in practice guides

2024

TLVs[®] and BEIs[®]

Based on the Documentation of the

Threshold Limit
Values

for Chemical Substances
and Physical Agents

&

Biological Exposure
Indices



GLOBALLY PROTECTING WORKER HEALTH

• SIGNATURE PUBLICATIONS •



What is a WBGT?

1. normal thermometer (dry-bulb)
2. wet-bulb thermometer
 - humidity
3. globe temperature
 - radiant heat

Wet **B**ulb **G**lobe **T**emp.



WBGT Formulas:

For indoor or shaded environments:

$$\text{WBGT} = 70\% T_{\text{nwb}} + 30\% T_{\text{g}}$$

T_{nwb} = natural wet-bulb temperature (70%)

T_{g} = globe temperature (30%)

For direct sunlight exposure:

$$\text{WBGT} = 70\% T_{\text{nwb}} + 20\% T_{\text{g}} + 10\% T_{\text{db}}$$

T_{db} = dry-bulb temperature



2022 ACGIH TLV

Table 3. Screening Criteria using $WBGT_{eff}$ (°C) for Acclimatized and Unacclimatized Workers

Allocation of Work in a Cycle of Work and Recovery	Metabolic Rate for Acclimatized Workers				Metabolic Rate for Unacclimatized Workers			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75 to 100%	31.0	28.0	–	–	28.0	25.0	–	–
50 to 75%	31.0	29.0	27.5	–	28.5	26.0	24.0	–
25 to 50%	32.0	30.0	29.0	28.0	29.5	27.0	25.5	24.5
0 to 25%	32.5	31.5	30.5	30.0	30.0	29.0	28.0	27.0

Notes:



Heat Stress Prevention Tools

**Simpler/
More frequent**



**More complex/
Less frequent**

supported
self-management

Humidex/WBGT Estimate-based
heat response plan

screening TLV (ACGIH)
/detailed TLV

TLV physiological
monitoring



Supported Self-Management

Knowledgeable workers who have demonstrated they are able to recognize early signs & symptoms and, supported by their supervisors, are provided the latitude to manage their work rate and their fluid intake. **Caution!! This level of heat stress management cannot be followed without proper heat stress awareness and prevention training.**

supported
self-management

Humidex/WBGT Estimate-based
heat response plan

screening TLV (ACGIH)
/detailed TLV

TLV physiological
monitoring

Humidex/WBGT Estimate Based Heat Respond Plan (Simplified TLV)

Humidex-based heat response plan a simplified version of the ACGIH TLV guidelines based on direct measurements of temperature and relative humidity. The measurements are converted to Humidex (or WBGT estimates) prescribing preventive actions. This approach is designed for workplaces without process heat/humidity sources and regular work clothing

Screening TLV / Detailed TLV (ACGIH)

Using the “official” **screening WBGT** measurements and appropriate application of work-rest regimens to prevent heat stress. For complex and unusual exposures there is also the option to follow the technically challenging “**TLV Analysis**” method outlined in the ACGIH TLV documentation. **A WBGT meter is needed for these methods.**

TLV Physiological Monitoring

may be required to manage exposures above the ACGIH TLV criteria (for tough to manage exposures). Physiological self-monitoring using smart watches or apps is another “unofficial” approach which should be viewed with caution (accuracy & validity problems).

Exposed Worker Training Elements:

- adapted to workers **language** and **learning patterns**.
- **signs and symptoms** of heat stress (try to have participants relate personal experiences)
- **what to do** in case of signs and symptoms; first aid responses for heat stress conditions; importance of listening to your body (how much to drink, when to take a break, etc.)
- **logistics for the supply of fluids**; how to **monitor hydration** (colour of urine), not waiting for thirst sensation, muscle cramps; knowing how much fluid to take in and when to drink electrolytes; knowing that alcohol & caffeine dehydrates the body; taking note of dripping sweat and knowing how to respond
- **watching out for co-workers** and supervisors looking out for their team members
- Review your **SOP** if there is one; videos; posters; info cards, etc., if available.
- **demonstration of training**: What would you do if ...? (asked while working in working environment)
- **H&S rights** and the internal procedures to exercise those rights
- Critical role of **supervisors**



Excerpt from ACGIH General Controls:

▪ “Training: Provide verbal and written instructions for pre-job and annual training programs with information about heat stress and strain, heat disorders, mitigation plan, and emergency response plan **in a language and format** that is understood by workers and supervisors.” (*emphasis added*)

... from **Table 5. Elements of a Heat Stress Management Program**

ACGIH® © 2022 11DOC-658-NPA Heat Stress and Strain TLV (p.7)



When a job involves working in the heat, it is imperative that workers / supervisors:

- are able to recognize heat stress signs and symptoms,
- know what to do to prevent them,
- know what to do in the event of a medical emergency.

This Checklist helps us to ensure that this requirement has been met.

Training/Reminders

- Over a year ago
- Within the last year
- Within last 6 months
- Within last 2 months

Training Length

- 10 minutes
- 10 – 30 minutes
- 30 – 60 minutes
- More than 1 hr

Training Type

- Video
- Online interactive
- In-person
- Workstation followup

Training Outcome

The worker(s) / supervisor:

- can explain what heat rash is and how to treat it
- knows the symptoms of heat syncope and how to respond
- are aware of the cause of muscle cramps and know what to drink to counter these symptoms
- can recognize the symptoms of heat exhaustion – realize need for immediate medical attention
- understands the danger of heat stroke and the need to watch others for unusual behaviour or collapse
- understand that heat stroke is a life-or-death medical emergency
- knows who is responsible to contact EMS in the event of a medical emergency
- knows the heat stress limit for body temperature
- understands that heart rate can also be monitored
- knows how much water to drink
- knows how to check the adequacy of their hydration status (colour of urine)
- knows where to get water when they need it
- understands the need to drink more than by thirst alone
- knows the amount of water to drink every 20 minutes
- are aware of the emergency procedures should someone faint, collapse or become confused
- understands that the body generates heat during activity and realize that slowing down/resting will control heat stress
- realize that personal cooling options are available and need to be customized to the individual
- know the physical and health conditions that pose risk factors for heat stress

The calculator algorithm scores the responses to the **delivery** and **outcomes** items into one of the **following categories:**

inadequate

minimal

sufficient

excellent

How is your
program
delivered?

Training Delivery Aspects:

Training/Reminders

- Over a year ago
- Within the last year
- Within last 6 months
- Within last 2 months

Training Length

- 10 minutes
- 10 – 30 minutes
- 30 – 60 minutes
- More than 1 hr

Training Type

- Video
- Online interactive
- In-person
- Workstation followup

Training Outcome Items (1 of 2):

What are your
program
outcomes?

Training Outcome

The worker(s) / supervisor:

- can explain what heat rash is and how to treat it
- knows the symptoms of heat syncope and how to respond
- are aware of the cause of muscle cramps and know what to drink to counter these symptoms
- can recognize the symptoms of heat exhaustion – realize need for immediate medical attention
- understands the danger of heat stroke and the need to watch others for unusual behaviour or collapse
- understand that heat stroke is a life-or-death medical emergency
- knows who is responsible to contact EMS in the event of a medical emergency
- knows the heat stress limit for body temperature
- understands that heart rate can also be monitored

Training Outcome Items (2 of 2):

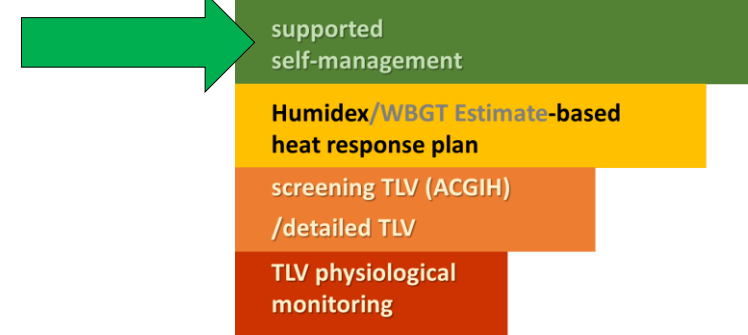
What are your
program
outcomes?

Training Outcome

The worker(s) / supervisor:

- knows how much water to drink
- knows how to check the adequacy of their hydration status (colour of urine)
- knows where to get water when they need it
- understands the need to drink more than by thirst alone
- knows the amount of water to drink every 20 minutes
- are aware of the emergency procedures should someone faint, collapse or become confused
- understands that the body generates heat during activity and realize that slowing down/resting will control heat stress
- realize that personal cooling options are available and need to be customized to the individual
- know the physical and health conditions that pose risk factors for heat stress

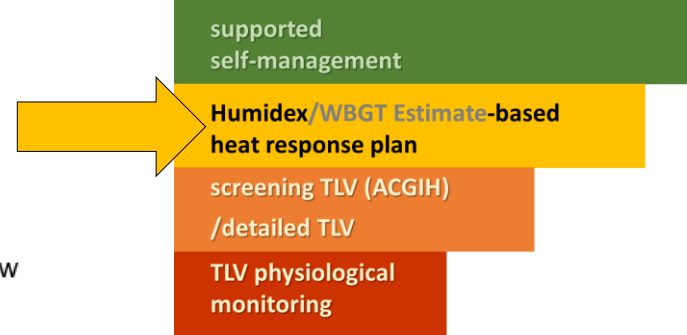
Low tech tools: hydration urine colour chart



1	Good
2	Good
3	Fair
4	Dehydrated
5	Dehydrated
6	Very dehydrated
7	Severely dehydrated



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 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 #3: 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 #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 (roughly equal to 3°C WBGT) 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 units (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

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

Step #1: Training

Training is probably the most crucial element of the plan – the knowledge gained and used could literally save someone's life!

- 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

The idea behind selecting a good measurement location is finding a place which is representative of the heat the worker is experiencing

- 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 the Workplace Humidex

The Humidex Plan is a simplification of the ACGIH WBGT method but the only things you need to measure are the workplace temperature and relative humidity

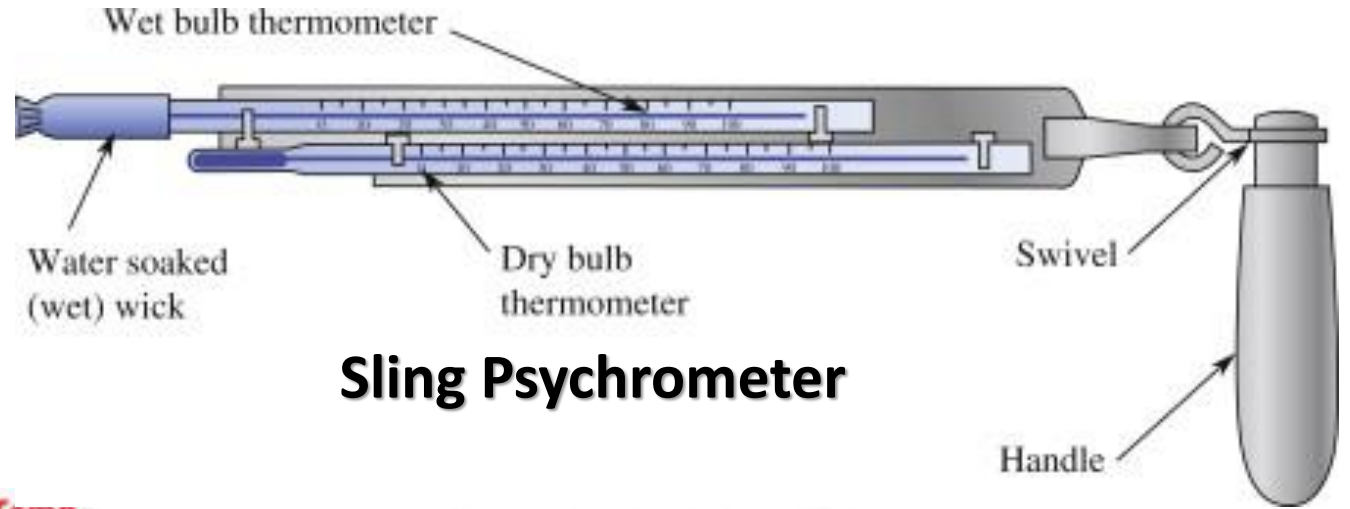
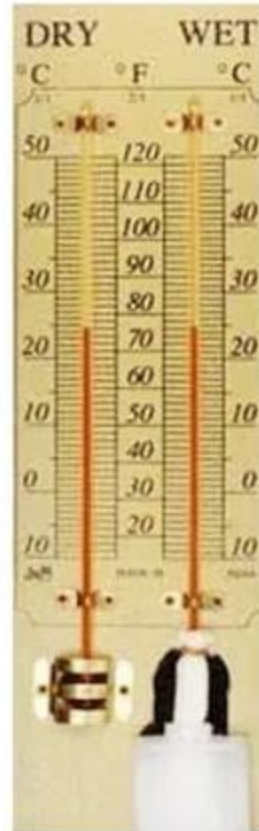
- a thermal hygrometer (usually \$10-\$50 at hardware or office supply stores – some even have free apps for your phone) is a simple way to measure the temperature and relative humidity in your workplace.
- once you have the temperature and humidity, use the table above to determine the corresponding 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!**



Measure the temperature & relative humidity

Thermal Hygrometer



Sling Psychrometer

Air Temp.
↓

Relative Humidity (%)

Dry-Bulb Temperature (°C)	Difference Between Wet-Bulb and Dry-Bulb Temperatures (°C)															
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
10	100	88	76	65	54	43	33	24	13	4						
12	100	88	78	67	57	48	38	28	19	10	2					
14	100	89	79	69	60	50	41	33	25	16	8	1				
16	100	90	80	71	62	54	45	37	29	21	14	7	1			
18	100	91	81	72	64	56	48	40	33	26	19	12	6			
20	100	91	82	74	66	58	51	44	36	30	23	17	11	5		
22	100	92	83	75	68	60	53	46	40	33	27	21	15	10	4	
24	100	92	84	76	69	62	55	49	42	36	30	25	20	14	9	4
26	100	92	85	77	70	64	57	51	45	39	34	28	23	18	13	9
28	100	93	86	78	71	65	59	53	47	42	36	31	26	21	17	12
30	100	93	86	79	72	66	61	55	49	44	39	34	29	25	20	16



Humidex-based Heat Response Plan (moderate, unacclimatized only)

supported
self-management

Humidex/WBGT Estimate-based
heat response plan

screening TLV (ACGIH)
/detailed TLV

TLV physiological
monitoring

Temp (in °C)	relative humidity (in %)																		Temp (in °C)																																																																																										
	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	Adjusted* Humidex	Action										NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!										50	47	47																																																																																					
46																						only medically supervised work										49	46	46																																																																											
45																																75% relief										50	47	45	45																																																																
44																																										50% relief										49	46	43	44																																																						
43																																																				25% relief										49	47	45	42	43																																											
42																																																														warning & double water										50	48	46	43	41	42																																
41																																																																								alert & water										48	46	44	42	40	41																						
40																																																																																		water as needed										49	47	45	43	41	39	40											
39																																																																																												* "adjusted" means adjusted for additional clothing and radiant heat (see steps 4 & 5)										49	47	45	43	41	39	37	39
38																																																																																																						** above a humidex of 45 use the ACGIH Heat Stress/Strain TLV							
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	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	27	30																																																																																								
30	48	47	46	44	43	42	41	40	39	37	36	35	34	33	31	30	29	28	27	26	29																																																																																								
29	46	45	43	42	41	40	39	38	37	36	35	33	32	31	30	29	28	27	26	25	28																																																																																								
28	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	27																																																																																								
27	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24			26																																																																																								
26	39	38	37	36	35	34	33	33	32	31	30	29	28	27	26	25	24				25																																																																																								
25	37	36	35	34	33	33	32	31	30	29	28	27	26	26	25	24					24																																																																																								
24	35	34	33	33	32	31	30	29	28	28	27	26	25	24							23																																																																																								
23	33	32	31	31	30	29	28	28	27	26	25	24	24								22																																																																																								
22	31	30	30	29	28	27	27	26	25	25	24										21																																																																																								
21	29	29	28	27	26	26	25	24	24												20																																																																																								
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%																																																																																										

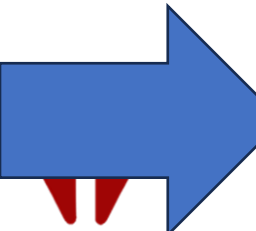
<https://www.ohcow.on.ca/wp-content/uploads/2023/09/Humidex-Based-Heat-Response-Plan-Apr-23-2024.pdf>



Let's try an example:

It's **30°C** in the workplace what's the Humidex?

Temp (in °C)	relative humidity (in %)																	Temp (in °C)																								
	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	Adjusted*	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Action only medically supervised work 75% relief 50% relief 25% relief warning & double water alert & water water as needed </div>																																		50	47	47				
46	Humidex																																				49	46	46			
45	45+**																																				50	47	45	45		
44	42-44																																				49	46	43	44		
43	40-41																																				49	47	45	42	43	
42	38-39																																				50	48	46	43	41	42
41	34-37																																				48	46	44	42	40	41
40	30-33																			49	47	45	43	41	39	40																
39	25-29																			49	47	45	43	41	39	37	39															
38	* "adjusted" means adjusted for additional clothing and radiant heat (see steps 4 & 5)																	49	47	45	43	42	40	38	36	38	38															
37	** above a humidex of 45 use the ACGIH Heat Stress/Strain TLV																	49	47	45	44	42	40	38	37	35	37	37														
36										50	49	47	45	44	42	40	39	37	35	34	36	34	33	35	36																	
35										50	48	47	45	43	42	40	39	37	36	34	33	32	30	33	35																	
34										49	48	46	45	43	42	40	39	37	36	34	33	32	30	31	34																	
33										50	48	47	46	44	43	41	40	39	37	36	34	33	32	30	33																	
32										50	49	48	47	46	45	44	42	41	40	39	38	37	36	34	33	32	30	29	32													
31										50	49	48	47	46	45	44	43	42	40	39	38	37	36	35	34	33	32	30	29	28	31											
30										50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	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	25	24	27	29										
28										43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	26	28										
27										41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	24	27										



NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!

Let's try an example:

It's 30°C in the workplace what's the Humidex?

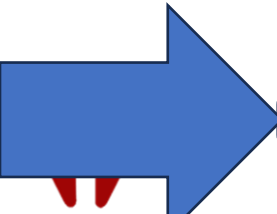
... opps forgot, the relative humidity is 50%, what's the Humidex?

Temp (in °C)	Relative Humidity (in %)															Temp (in °C)											
	100%	95%	90%	85%	80%	75%	70%	50%	45%	40%	35%	30%	25%	20%	15%		10%										
49																	50	49									
48																	49	48									
47	Adjusted*	Action																50	47	47							
46	Humidex																	49	46	46							
45	45+**	only medically supervised work																50	47	45	45						
44	42-44	75% relief																49	46	43	44						
43	40-41	50% relief																49	47	45	42	43					
42	38-39	25% relief																50	48	46	43	41	42				
41	34-37	warning & double water																48	46	44	42	40	41				
40	30-33	alert & water																49	47	45	43	41	39	40			
39	25-29	water as needed																49	47	45	43	41	39	37	39		
38	* "adjusted" means adjusted for additional clothing and radiant heat (see steps 4 & 5)																	49	47	45	43	42	40	38	36	38	
37	** above a humidex of 45 use the ACGIH Heat Stress/Strain TLV																	49	47	45	44	42	40	38	37	35	37
36								50	49	47	45	43	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	36	34	33	32	30	28	31	
30								50	48	47	46	44	43	42	41	40	39	37	36	35	34	33	32	31	30	28	31
29								46	45	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	29	
28								43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	28



NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!

Humidex = 36



Step #4: Adjust for Clothing

The ACGIH TLV requires an adjustment for clothing worn

- 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®)



Let's try an example:

It's 30°C in the workplace what's the Humidex?

... opps forgot, the relative humidity is 50%, what's the Humidex?

Humidex = 36

... opps forgot, the workers are wearing gloves, aprons, hard hats and earmuffs, what's the "adjusted" Humidex?

Humidex = 36 + 2? (in comparison, for overalls add +5 to +6) ≈ 38?



Official ACGIH Clothing Adjustment Values:

ACGIH clothing adjustment values	°C WBGT	Humidex
Short Sleeves and Pants of Woven Material	-1.0	-2
Work Clothes (Long Sleeve Shirt and Pants)	0.0	0
Cloth (woven material) Coveralls over underwear	0.0	0
thin disposable SMS Polypropylene Coveralls over underwear	+0.5	+1
disposable polyolefin (Tyvek) coveralls over underwear	+1.0	+2
Adding a Hood (Full Head and Neck Covering; not Face)	+1.0	+2
Double Layer Woven Clothing (e.g., coveralls over work clothes)	+3.0	+6
Limited-Use Vapor-Barrier Coveralls with Hood	+11.0	+22

... but what if you're required to wear leather gloves, a hard hat, an apron and earmuffs, in addition to your overalls?



Derived CAV's ... the alternative is "by guess and by golly"

derived clothing adjustment values	°C WBGT	Humidex
impervious gloves	+0.2	+0.4
impervious apron	+0.3	+0.6
additional protective sleeves	+0.2	+0.4
leather welding jacket	+1.5	+3.0
medical mask	+0.05	+0.1
N95 disposable respirator	+0.1	+0.2
half face piece elastomeric demand respirator	+0.2	+0.4
ear muffs	+0.1	+0.2
toque	+0.6	+1.2
hard hat	+0.2	+0.4
goggles	+0.1	+0.2
face shield	+0.1	+0.2
woven fabric hospital gown	+1.5	+3.0

0.4
+ 0.2
+ 0.6
+ 0.4
= 1.6
≈ +2



Step #5: Adjust for Radiant Heat

Because measuring the thermal hygrometer does not measure radiant heat, we need to adjust for this factor!

- 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.



Let's try an example:

It's 30°C in the workplace what's the Humidex?

... opps forgot, the relative humidity is 50%, what's the Humidex?

Humidex = 36

... opps forgot, the workers are wearing gloves, aprons, hard hats and earmuffs, what's the "adjusted" Humidex?

Humidex = 36 + 2? (in comparison, for overalls add +5 to +6) **≈ 38?**

... opps forgot, they're outdoors in the sunshine, what's the adjusted Humidex?

Humidex = 36 + 2? and then add +3 or +4 **≈ 41?**



= 36

≈ 38?

≈ 41?

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



Let's try an example:

... opps forgot, they're allowed to take their breaks indoors in a cafeteria that has a temperature of 25°C and a relative humidity of 60% – **What's the Humidex in the cafeteria (and why is that important?)**

Humidex (cafeteria) = 30



Time-Weighted Averages (TWA):

- Heat stress assessments are taken on an **hourly** time-weighted average (TWA) basis (most other occupational exposure levels (OELs) have an 8-hr TWA).
- So, you **take the average** of all your measurements over the hour – some expensive heat stress monitoring machines will do this for you, otherwise you have to do it for yourself.
- Example: calculate the TWA of these Humidex readings taken every 10 minutes over a 1-hour period: **36; 37; 35; 36; 34; 38**

$$\text{TWA Humidex} = (36 + 37 + 35 + 36 + 34 + 38)/6 = 36$$

(I fixed the numbers in this example 😊)



Time-Weighted Averages (TWA):

- But what if the workers took a **20-minute break** in a cafeteria (Humidex of **30** as you determined earlier):

Continuing our example: calculate the TWA of spending 20 minutes in the cafeteria (Humidex = 30) every hour and working at a workstation whose TWA Humidex is 36

$$\begin{aligned}\text{TWA Humidex} &= (20 \text{ min}/60 \text{ min}) \times \underline{30} &+ & (40 \text{ min}/60 \text{ min}) \times \underline{36} \\ &= &10 &+ & 24 \\ &= &\underline{34} &&\end{aligned}$$

(**don't forget:** we added the +2 adjustment for clothing, and the +3 adjustment for working outdoors in direct sunlight)

$$\begin{aligned}&= 34 + 2 \text{ (clothing)} + 3 \text{ (direct sunlight)} \\ &= \underline{\underline{39 \text{ TWA Humidex}}}\end{aligned}$$



= 36

≈ 38?

≈ 39?

≈ 41?

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



Thomas Bernard's temp & RH to WBGT-Estimate table:

supported self-management

Humidex/WBGT Estimate-based heat response plan

screening TLV (ACGIH) /detailed TLV

TLV physiological monitoring

T _{air} (in°C)	Relative Humidity (in%)																		T _{air} (in°C)	
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15		10
46																			29.6	46
45	Estimated Effective* WBGT		Action																29.0	45
44	29.1°C+ WBGT		only medically supervised work																28.3	44
43	27.1-29.0°C WBGT		75% relief																27.7	43
42	26.1-27.0°C WBGT		50% relief																27.1	42
41	25.1-26.0°C WBGT		25% relief																26.5	41
40	24.1-25.0°C WBGT		warning & double water																25.8	40
39	23.1-24.0°C WBGT		alert & water																25.2	39
38	≤23.0°C WBGT		water as needed																24.6	38
37	NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!																		23.9	37
36	moderate metabolic rate, unacclimatized action limit																		23.3	36
35	"Effective*" means adjusted for clothing																		22.7	35
34									31.1	30.3	29.4	28.6	27.7	26.9	26.0	25.2	24.3	23.5	22.8	34
33								31.0	30.2	29.4	28.5	27.7	26.9	26.1	25.3	24.5	23.7	23.0		33
32				31.6	31.2	30.6	29.8	29.1	28.3	27.5	26.8	26.0	25.3	24.5	23.8	23.0	22.3			32
31	31.0	31.0	30.9	30.5	30.1	29.5	28.8	28.1	27.4	26.6	25.9	25.2	24.5	23.7	23.0	22.3				31
30	30.0	30.0	29.8	29.5	29.1	28.5	27.8	27.1	26.4	25.7	25.0	24.4	23.7	23.0	22.3					30
29	29.0	29.0	28.8	28.5	28.1	27.5	26.8	26.2	25.5	24.8	24.2	23.5	22.8							29
28	28.0	28.0	27.8	27.5	27.0	26.5	25.8	25.2	24.6	23.9	23.3	22.7								28
27	27.0	27.0	26.8	26.4	26.0	25.4	24.8	24.2	23.6	23.0	22.4									27
26	26.0	26.0	25.8	25.4	24.9	24.4	23.8	23.3	22.7	22.1										26
25	25.0	25.0	24.8	24.4	23.9	23.4	22.8	22.3												25
	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	

<https://health.usf.edu/publichealth/tbernard/thermal>

For work in direct sunlight, add 2.2°C-WBGT to the estimated WBGT from the table.



both units, side by side

<https://www.ohcow.on.ca/wp-content/uploads/2023/09/Humidex-Based-Heat-Response-Plan-Apr-23-2024.pdf>

Adjusted* Humidex	Response	Effective** WBGT (°C)
25 - 29	supply water to workers on an "as needed" basis	← 23.0°C
30 - 33	post Heat Stress Alert notice; encourage workers to drink extra water; start recording hourly temperature and relative humidity	23.1 – 24.0°C
34 - 37	post Heat Stress Warning notice; notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms	24.1 – 25.0°C
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	25.1 – 26.0°C
40 - 41	work with 30 minutes relief per hour can continue in addition to the provisions listed previously	26.1 – 27.0°C
42 - 44	if feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above	27.1 – 29.0°C
45*** or over	only medically supervised work can continue	29.1°C*** or over

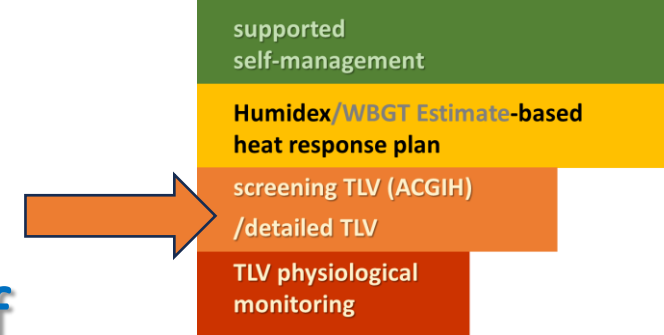
* "adjusted" means adjusted for additional clothing and radiant heat (see steps #4 & #5)

**at Humidex exposures above 45 (WBGT 29.1°C), heat stress should be managed as per the ACGIH TLV®

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



ACGIH Method: Screening Criteria Based on $WBGT_{eff}$



- requires:
 1. **measurement** of WBGT (need machine and knowledge/training)
 2. **clothing** adjustment consideration (which is why it is called “effective WBGT” or $WBGT_{eff}$)
 3. assign **metabolic work demands** category
 4. determine **acclimatization**
 5. determine unadjusted work-rest **time pattern**
- use criteria in **Table 3** to determine the need for, and types of controls
- based on **1 hour** time-weighted-average (TWA)



Acclimatization Argument

- The 2022 TLV[®] uses the following **measurable criteria**:
 - ““Acclimatization requires physical activity under heat stress conditions like those anticipated for the work. With a recent history of heat stress exposures of at least **2 continuous hours for 5 of the last 7 days**, a worker may be considered acclimatized for the purposes of the TLV. Acclimatization declines when activity under heat stress conditions is discontinued. A noticeable loss occurs after 4 days and may be completely lost in 3 weeks. A person may not be fully acclimatized to a sudden or episodic higher level of heat stress.” (*pages 3-4 emphasis added*)
- Our experience was that employers just assumed everyone was acclimatized, so we removed that option – **if heat stress conditions allow for acclimatization the workplace should follow the TLV[®]**

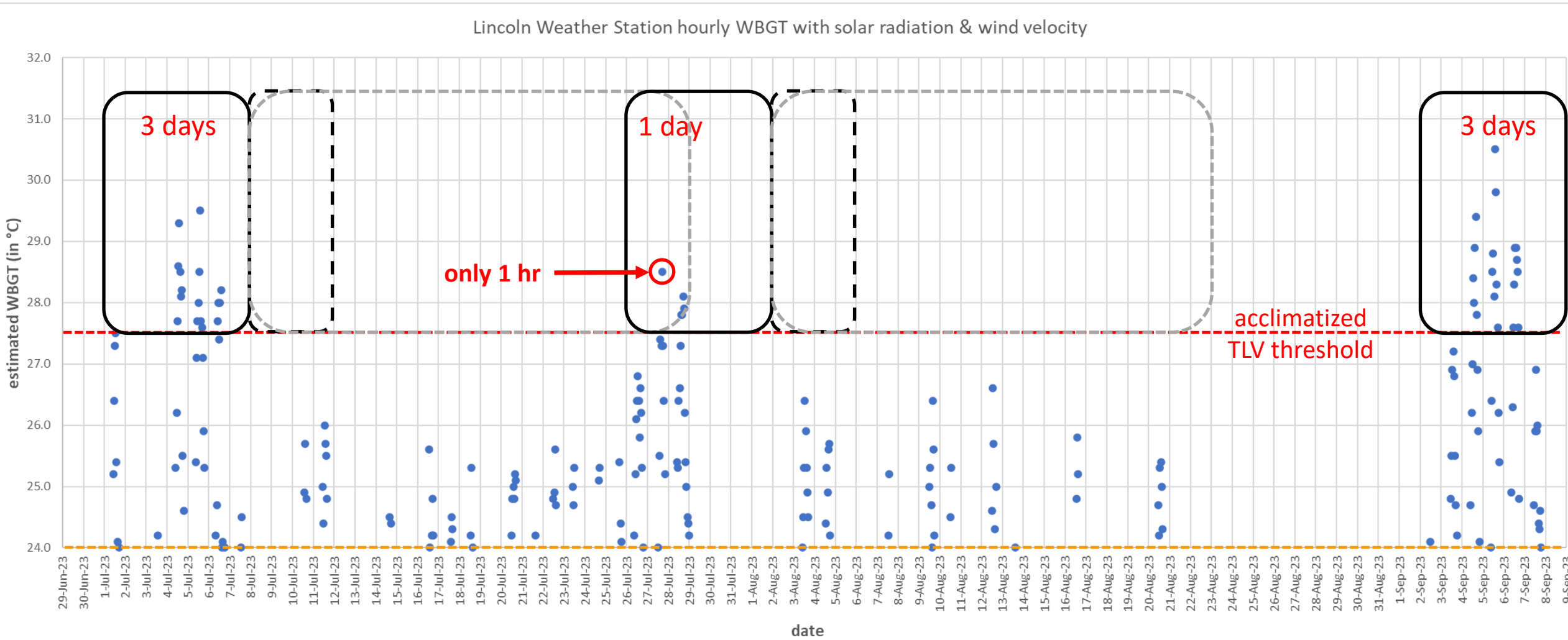


Acclimatization determination (with hourly solar radiation & wind data)

ACGIH acclimatization rule of thumb:

- 2 hr/day for 5 of 7 days window
- after 4 days noticeable loss
- after 3 weeks complete loss

Conclusion: no acclimatization even with solar radiation & wind velocity incorporated into the WBGT



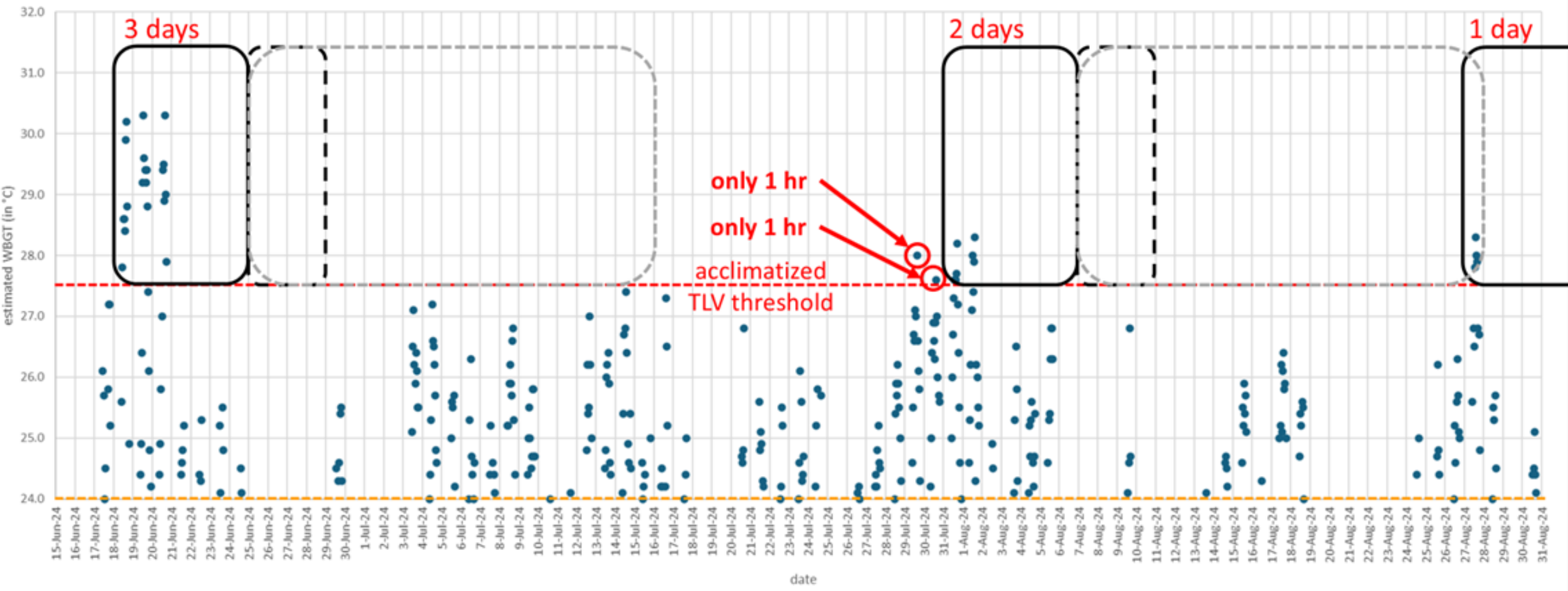
Acclimatization determination 2024 (with hourly solar radiation & wind data)

ACGIH acclimatization rule of thumb:

- 2 hr/day for 5 of 7 days window
- after 4 days noticeable loss
- after 3 weeks complete loss

Conclusion: no acclimatization even with solar radiation & wind velocity incorporated into the WBGT

Lincoln Weather Station hourly WBGT with solar radiation and wind speed (June 15 - Aug 31, 2024)



Metabolic category issue:

Note:

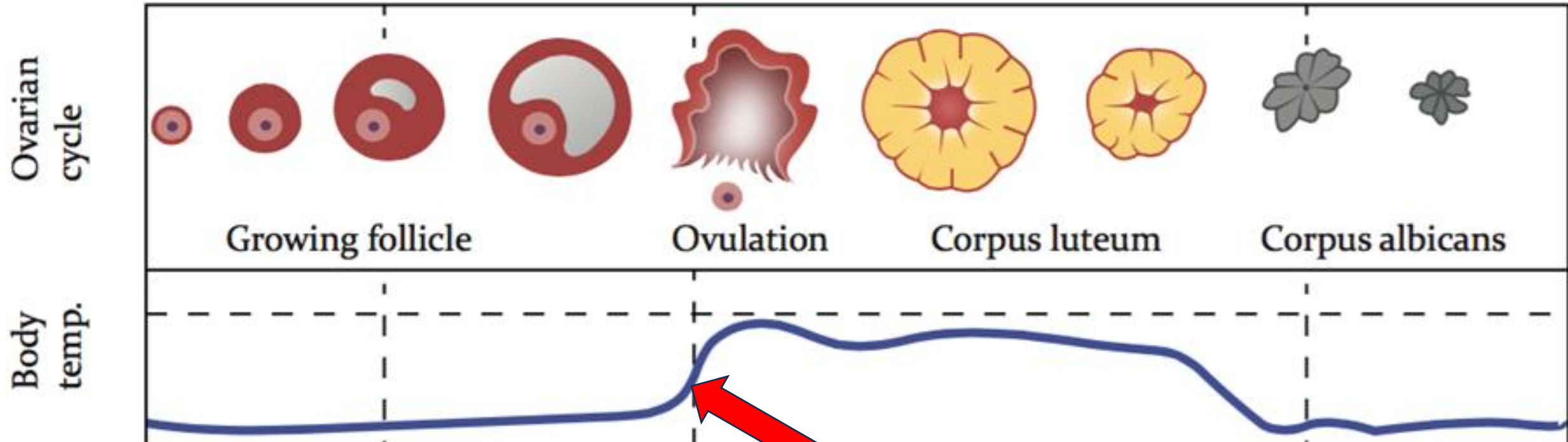
the 2022 TLV also specifies adjusting the metabolic rate for body weight

ACGIH® © 2022		Stress and Strain TLV – page 3
Moderate 235 to 360 W		and arm work, moderate ate arm and truck work, or Normal walking.
Heavy 360 to 470 W		rk, carrying, shoveling, and pulling heavy loads; e.
Very heavy > 470 W		st to maximum pace.

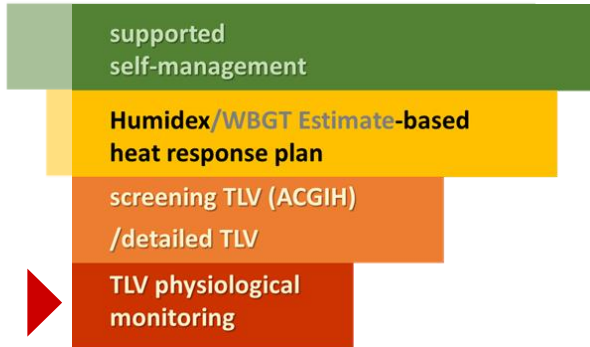
Note: The effect of body weight on the estimated metabolic rate can be accounted for by multiplying the estimated rate by the ratio of actual body weight divided by 70 kg (154 lb).

Source: (International Organization for Standardization (ISO) 2017).

Biological Sex Differences issue:



PHYSIOLOGIC MONITORING



Physiological monitoring for heat stress can be a useful tool to protect the health and safety of individuals working in hot environments especially if engaging in strenuous physical activities. Heat stress occurs when the body is unable to regulate its temperature, leading to symptoms ranging from mild discomfort to life-threatening conditions such as heat stroke. To prevent heat-related illnesses, monitoring tools including wearable technology equipped with heart rate monitors, and thermoregulatory devices can be utilized to track key physiological parameters like body temperature, heart rate, and hydration levels as well as raising awareness for the individual to self-monitor and take breaks when needed.

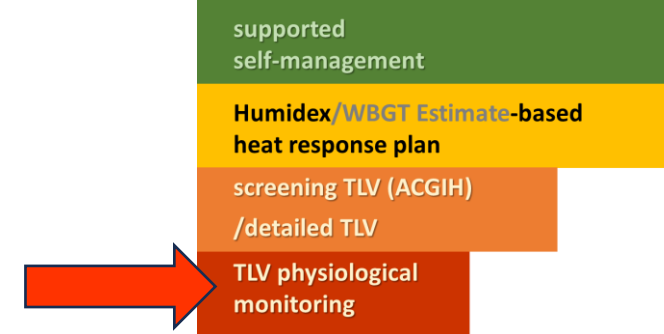
The integration of these tools can improve a comprehensive heat illness prevention plan, by proactively flagging early signs of heat strain and alerting a need for action to prevent its escalation. Monitoring can identify timely interventions including rest breaks, hydration status, recovery status, and can support self-calibration, particularly in inexperienced workers. Educational programs on heat stress awareness and prevention will enhance the effectiveness of physiological monitoring. In summary, integrating physiological monitoring into heat stress management strategies can be an effective tool in promoting a safe and healthy environment for individuals exposed to high temperatures and should be considered under conditions of high risk, and remote work.

Confidentiality

Data collected from monitoring devices used for personal information, belongs to the individual wearing the health monitoring device. The data can be shared with others, such as general practitioners, if the individual chooses to disclose the information, or if the device is being used to monitor a specific health/medical condition. However, personal devices should be differentiated from workplace provided health monitoring devices. Data output from physiological monitoring is considered private medical data, so stringent policies are required in workplaces that implement it related to: circumstances when monitoring is implemented; who has access to the data during monitoring; what the data can be used for; and whether the data is stored.

Self-Monitoring Reliability

The technologies for evaluating both physical and psychological health are at various stages of development and are constantly evolving. As new technology and devices are developed, it is important to test the device's ability to assess the intended feature compared to the



ACGIH TLV Physiological Monitoring

- Concerns about collection and confidentiality of medical information
- Self-calibration (evolves into supported self-management)
- Reliability and validity of self-monitoring technology (refer to Physiological Monitoring Guide)

<https://www.ohcow.on.ca/wp-content/uploads/2024/05/hst-Physiological-monitoring-guidev3.pdf>



Calculator

<https://www.ohcow.on.ca/resources/apps-tools-calculators/heat-stress-calculator/>

UPDATED 2024

HEAT STRESS CALCULATOR and RESPONSE PLAN

A key component of the new Heat Stress Toolkit

Working in extreme conditions can be hazardous to your health.
Heat and humidex are no exception.

Symptoms of heat stress include:



Weakness



Fatigue



Dizziness

Learn more about the symptoms of heat stress with our Heat Stress Symptoms infographic.

The Calculator

This calculator provides three methods of calculation based on the information you have access to:

Humidex-based Method • WBGT Estimate Method • Detailed WBGT Method*



Prior to providing the calculated result:

SUMMARY

This is a summary of the information you have provided:

METHOD OF CALCULATION: Humidex

TEMPERATURE and RELATIVE HUMIDITY: 32°C | 22%

TRAINING / KNOWLEDGE: Yes

INDOORS / OUTDOORS: Outdoors in shade

CLOTHING: Typical clothing | No PPE

RADIANT HEAT: No radiant heat / moisture

PHYSICAL DEMANDS: Unacclimatized | Moderate

Use the edit icon if you need to make any required changes.

The next step is to calculate the heat stress factor for this work scenario.

Press CALCULATE to continue:

CALCULATE!

Check

1.

2.

3.

4.

5.

6.

Only a

tempe

Berna



Heat Stress Prevention & Control Program

VERSION 1.0
05/28/2024

Sample 10-page SOP

VERSION HISTORY				
VERSION	APPROVED BY	REVISION DATE	DESCRIPTION OF CHANGE	AUTHOR
1.0				

PREPARED BY	OHCOW	TITLE	Occupational Hygienists	DATE	May 28, 2024
APPROVED BY		TITLE		DATE	

... for a Word version of this SOP please send a request to:

joudyk@ohcow.on.ca
agauvin@ohcow.on.ca

1. NAME OF PROCEDURE

Heat Stress Prevention & Control Program

2. PURPOSE

The goal of this document is to outline the responsibilities and procedures to protect workers from heat stress and prevent heat-related illnesses.





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 workplaces, if not, follow the ACGIH Heat Stress and Strain TLV[®]). This plan assumes moderate, unacclimatized work.

Adjusted [*] Humidex	Response	Effective ^{**} WBGT (°C)
25 – 29	supply water to workers on an "as needed" basis	≤ 23.0°C
30 – 33	post Heat Stress Alert notice; encourage workers to drink extra water; start recording hourly temperature and relative humidity	23.1 – 24.0°C
34 – 37	post Heat Stress Warning notice; notify workers that they need to drink extra water; ensure workers are trained to recognize symptoms	24.1 – 25.0°C
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	25.1 – 26.0°C
40 – 41	work with 30 minutes relief per hour can continue in addition to the provisions listed previously	26.1 – 27.0°C
42 – 44	if feasible, work with 45 minutes relief per hour can continue in addition to the provisions listed above	27.1 – 29.0°C
45 ^{***} or over	only medically supervised work can continue	29.1°C ^{***} or over

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

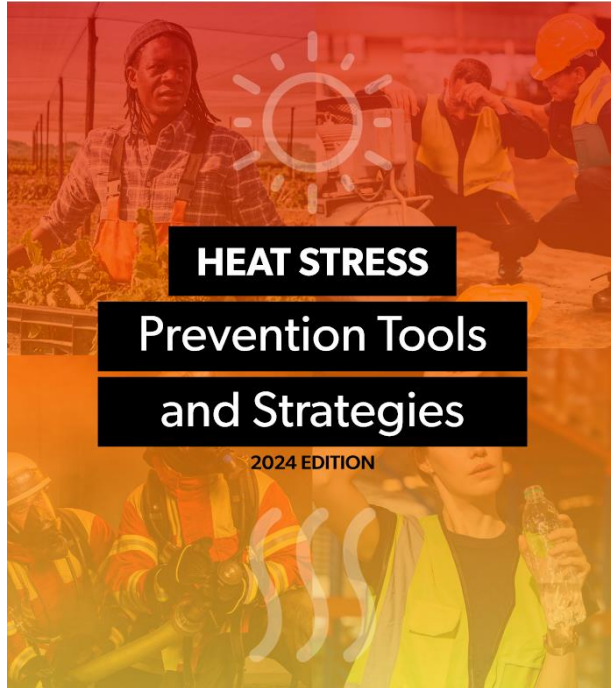
** "Effective" means adjusted for clothing (step #4) if the WBGT includes the globe temp

***at Humidex above 45 (29.0°C WBGT), 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.

April 2024



Thank you!



HEAT STRESS Toolkit

agauvin@ohcow.on.ca

joudyk@ohcow.on.ca

<https://www.ohcow.on.ca/heat-stress-toolkit/>

