Occupational Health Clinics for Ontario Workers

Centre de Santé des Travailleurs(ses) de l'Ontario

Addressing Heat Stress in Agricultural Workplaces: The Heat Stress Toolkit and Case Study

HEAT STRESS Toolkit

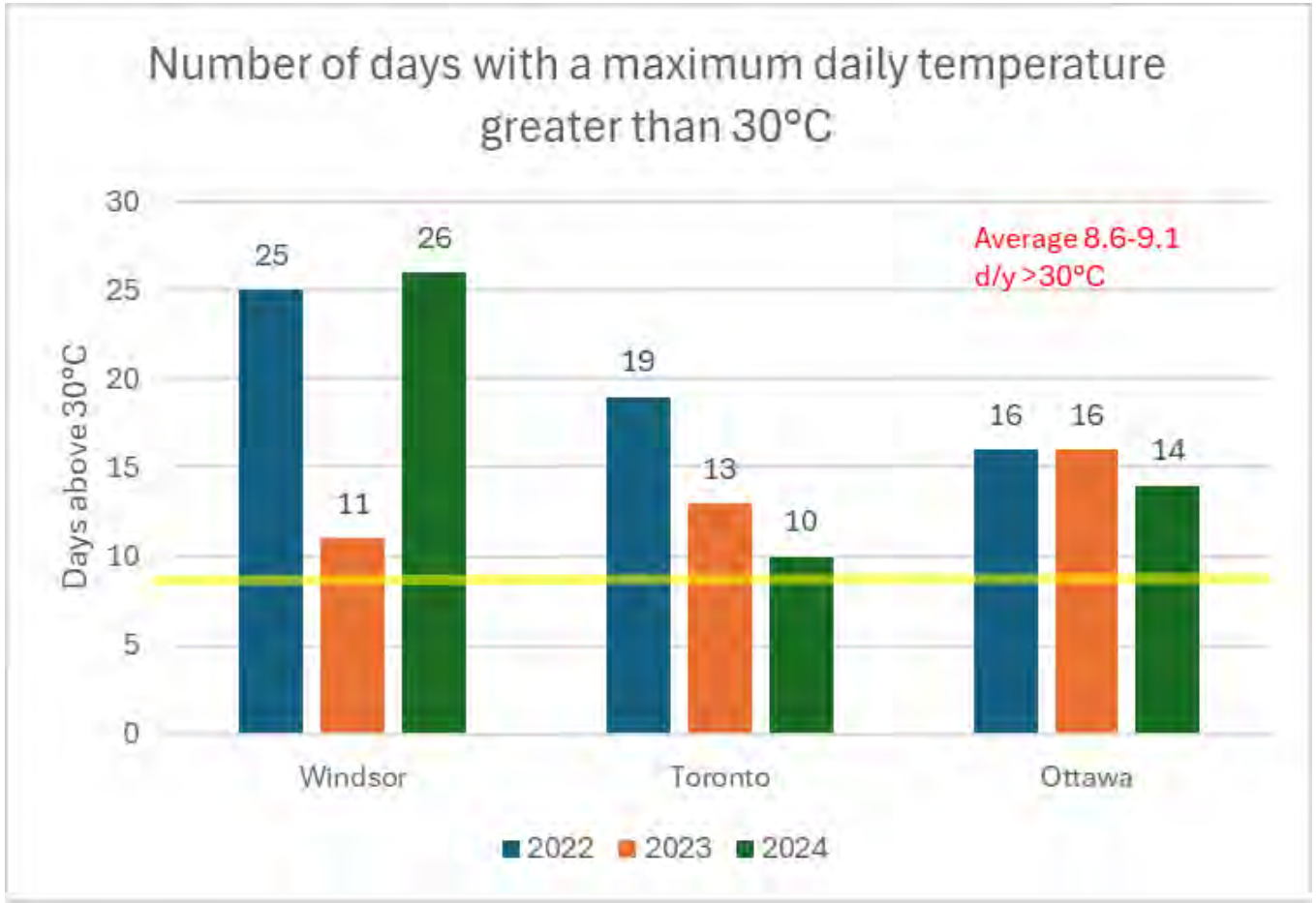
André Gauvin
Occupational Hygienist

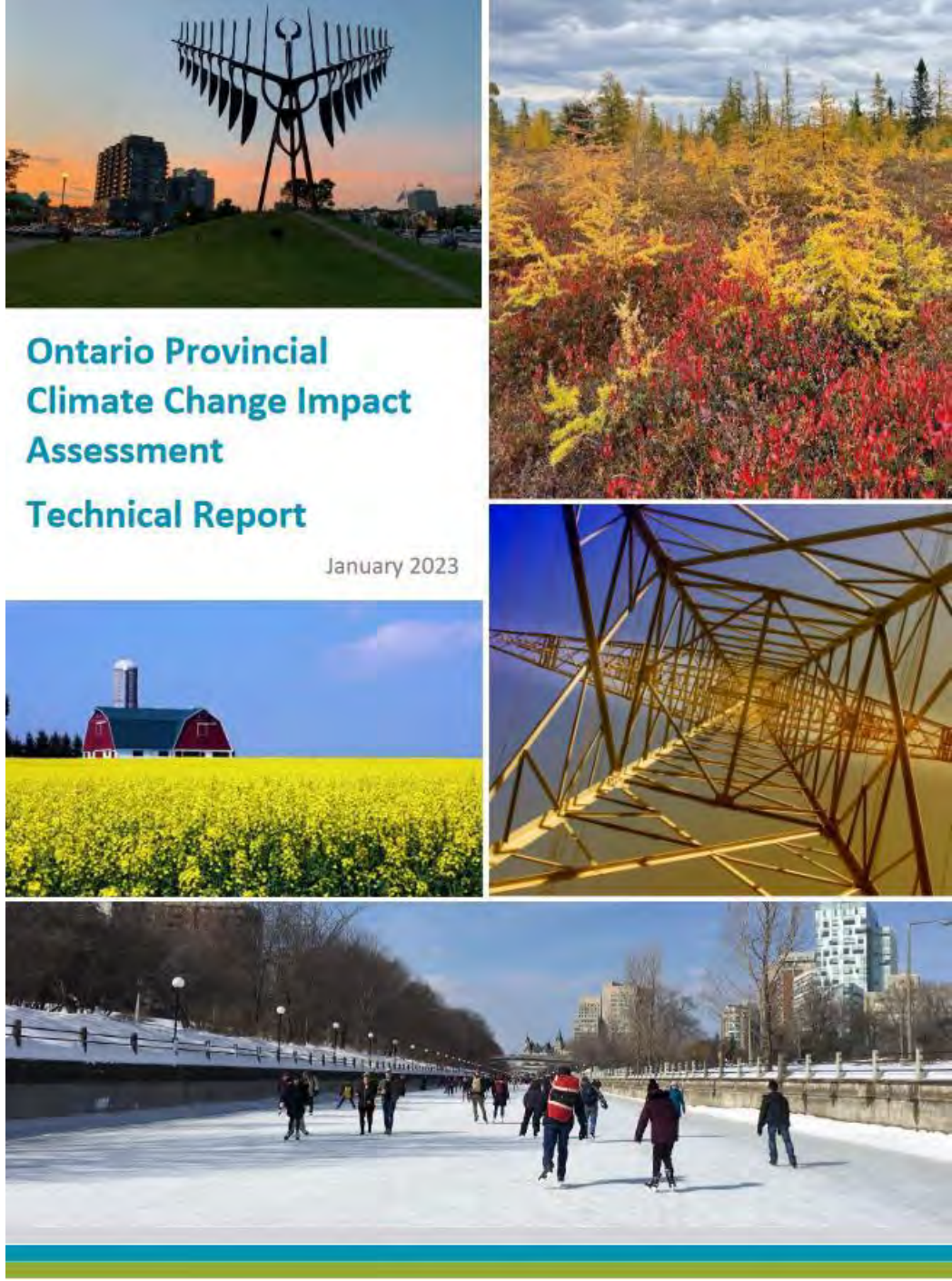
Eduardo Huesca
Project Manager

Current situation:

- MOL response to the **regulation proposal** and the **submissions provided** is to keep using **current legislation OHSA Section 25(2)(h),** (to take every precaution reasonable in the circumstances for protection of the worker.)
- **“new” challenges**: climate change awareness, wildfire smoke, temporary foreign workers exposure conditions
- **15-20 years experience** with OHSCO Heat stress tools
- Opportunity from **MOL project funding** to update
- **Evaluations of H&S interventions** (e.g., IWH scientific reviews, HSA’s field experience, union/employer workplace experiences)

Ontario government climate change report

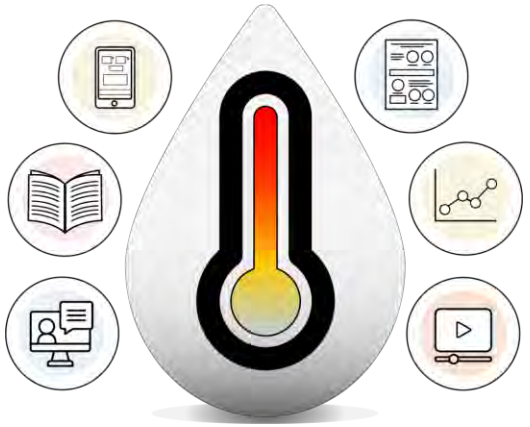




https://www.ontario.ca/files/2023-11/mecp-ontario-provincial-climate-change-impact-assessment-en-2023-11-21.pdf

Now Available! (2024)

- Heat Stress Toolkit – OHCOW



Target Audience:

- Who are we trying to reach and what do we want them **to do** (not just to know) (Prevention tools and Strategies guide) ?

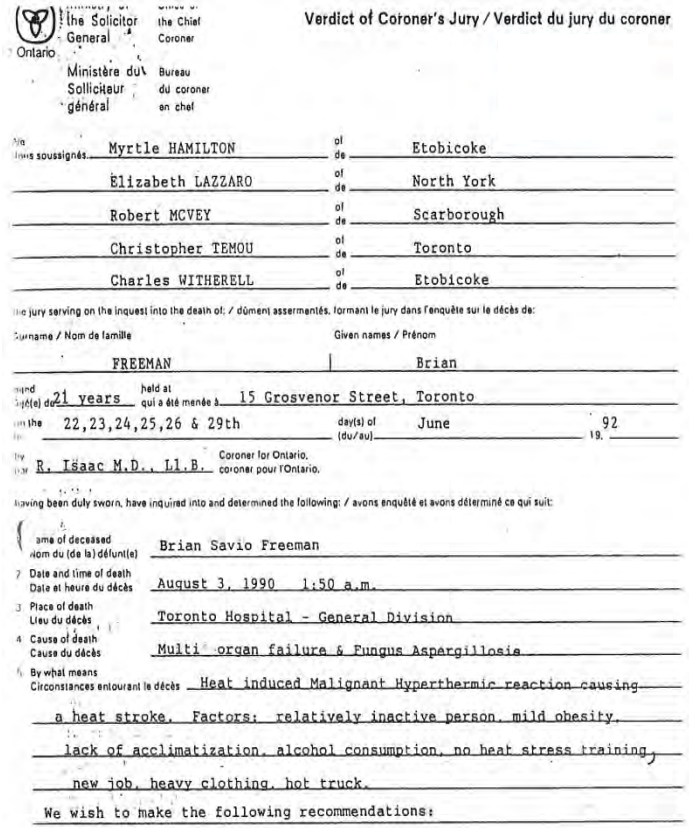
- Direct audience: **those supporting and protecting heat exposed workers**. This includes employers, managers, supervisors, fellow workers, Joint Health & Safety Committee (JHSC) members, health and safety representatives, and workplace union representatives.

- **Unions, employer associations, and health and safety professionals** may also find this information useful.

- 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,

Fundamental principles:

1. **De-technologize**: relying on expensive technical equipment to determine whether its too hot seems strange when everyone who listens to their body knows that already (in line with Brian Freeman's Coroner's Inquest recommendations)
2. **Supported Self-regulation**: ideally this would be the goal – workers able to detect signs and symptoms and have the resources/freedom to respond appropriately – although this is not always a practical option in many workplaces
3. Provide a **simplified TLV-based tools** so workplace don't need elaborate resources to manage heat stress – save the technical resources for difficult heat stress conditions
4. Recognize **self-calibration** – after a period of time of closely measuring, workers self-calibrate (unconsciously) and can accurately guess, based on how their feeling, what heat stress interventions are needed
5. **Medical monitoring**: last resort; realize this is collecting medical information require elaborate confidentiality arrangements



Ontario

the Solicitor General

Ministère du Solliciteur général

the Chief Coroner

Bureau du coroner en chef

Verdict of Coroner's Jury / Verdict du jury du coroner

We the undersigned / Nous soussignés

Myrtle HAMILTON of/de Etobicoke

Élizabeth LAZZARO of/de North York

Robert MCVEY of/de Scarborough

Christopher TEMOU of/de Toronto

Charles WITHERELL of/de Etobicoke

the jury serving on the inquest into the death of: / dûment assermentés, formant le jury dans l'enquête sur le décès de:

Surname / Nom de famille: FREEMAN

Given names / Prénom: Brian

aged 21 years / âgé(e) de — held at / qui a été menée à 15 Grosvenor Street, Toronto

on the 22,23,24,25,26 & 29th day(s) of / (du/au) June 19 92

by / par R. Isaac M.D., LL.B. Coroner for Ontario / coroner pour l'Ontario.

having been duly sworn, have inquired into and determined the following: / avons enquêté et avons déterminé ce qui suit:

1 Name of deceased / Nom du (de la) défunt(e): Brian Savio Freeman

2 Date and time of death / Date et heure du décès: August 3, 1990 1:50 a.m.

3 Place of death / Lieu du décès: Toronto Hospital - General Division

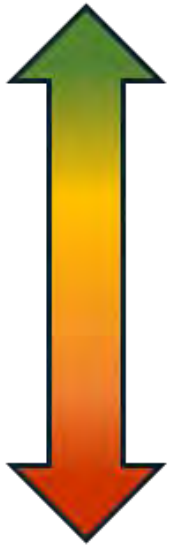
4 Cause of death / Cause du décès: Multi organ failure & Fungus Aspergillosis

5 By what means / Circonstances entourant le décès: Heat induced Malignant Hyperthermic reaction causing a heat stroke. Factors: relatively inactive person, mild obesity, lack of acclimatization, alcohol consumption, no heat stress training, new job, heavy clothing, hot truck.

We wish to make the following recommendations:

Prevention Tools and Strategies – Layered approach

Simpler/
More frequent



More complex/
Less frequent

Supported Self-management

Humidex/WBGT Estimate-based Heat Response Plan

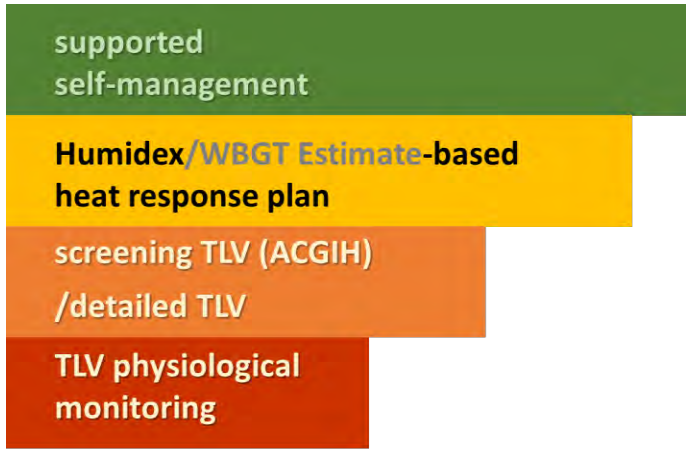
Screening TLV (ACGIH) / Detailed TLV

TLV Physiological Monitoring

- Layers are supposed blend together with the **optimal** being support self-management if feasible

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.**



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).

Supported Self-management

Caution!! This level of heat stress management cannot be followed without proper heat stress awareness and prevention training.

Training

- Train workers and supervisors to recognize early signs and symptoms of heat stress.
- Ensure workers can show demonstration of knowledge.
    - Practice (aware and skilled using HSMP)

Supported by supervisors/employers.

- Give workers access to a cool or shaded rest area
- Take breaks as needed
- Manage your own work rate and fluid intake
- Co-worker observation (buddy system) with verbal cues.
- Have a hot-weather plan (such as the Humidex).

Low tech tools: hydration urine colour chart

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

Supported Self-Management

Training

Health Effects and First Aid:

- Heat Edema
- Heat Rash
- Heat Syncope (fainting)
- Heat Cramps

Chapter 3

SUPPORTED SELF-MANAGEMENT OF HEAT STRAIN (Optimal Situation)

- supported self-management
- Humidex/WBGT Estimate-based heat response plan
- screening TLV (ACGIH) /detailed TLV
- TLV physiological monitoring

Health Effects (training essentials):

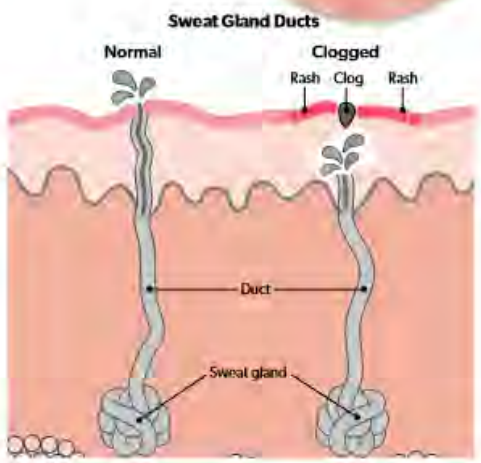
Heat Rash

Skin becomes reddened and may itch, feel prickly or hurt. Practice good personal hygiene; keep the skin clean and the pores unclogged, allow skin to dry, wear loose clothing, see doctor if rash persists. Often happens early in heat stress season (first heat wave) when skin is unacclimatized.

Supported self-management in heat stress management necessitates specific prerequisites to ensure workers' optimal performance and well-being under heat stress conditions. Here are the key requirements:

1. A solid understanding of heat strain symptoms and remedies is crucial to prevent health risks related to overheating. This knowledge helps individuals identify warning signs and address heat-related issues promptly.
2. **Supervisory support** in the ability to set your own work pace and take necessary breaks is essential for self-management, allowing individuals to recharge, rehydrate, and prevent heat strain.
3. Access to an ample water supply for hydration is fundamental for physical performance, and overall well-being.
4. Availability of other cooling options like air conditioning, shaded rest areas, and supporting effective self-management practices.

By meeting these key requirements and receiving leadership support, a workplace can implement supported self-management of heat strain.



Temperature

Taylor & Francis
Taylor & Francis Group

Temperature

Together, our findings indicate that strenuous work in the heat may compromise thermoregulatory function and elevate the risk of heat-illness in older workers on the next workday, particularly during moderate-to-high intensity work.

https://www.tandfonline.com/doi/full/10.1080/23328940.2018.1512830

ISSN: 2332-8940 (Print) 2332-8959 (Online) Journal homepage: www.tandfonline.com/journals/ktmp20

Cumulative effects of successive workdays in the heat on thermoregulatory function in the aging worker

Sean R. Notley, Robert D. Meade, Andrew W. D'Souza, Gregory W. McGarr & Glen P. Kenny

To cite this article: Sean R. Notley, Robert D. Meade, Andrew W. D'Souza, Gregory W. McGarr & Glen P. Kenny (2018) Cumulative effects of successive workdays in the heat on thermoregulatory function in the aging worker, Temperature, 5:4, 293-295, DOI:

What factors can we measure for heat stress?

What are you measuring?

- Humidex plan (Temp & RH%)
- ACGIH TLV ($WBGT_{eff}$)
- Physiological monitoring (HR, skin temp, core temp, complex heat stress program)

ACGIH Heat Stress & Strain TLV Documentation

HEAT STRESS AND STRAIN

the "Gold Standard"

TLV®

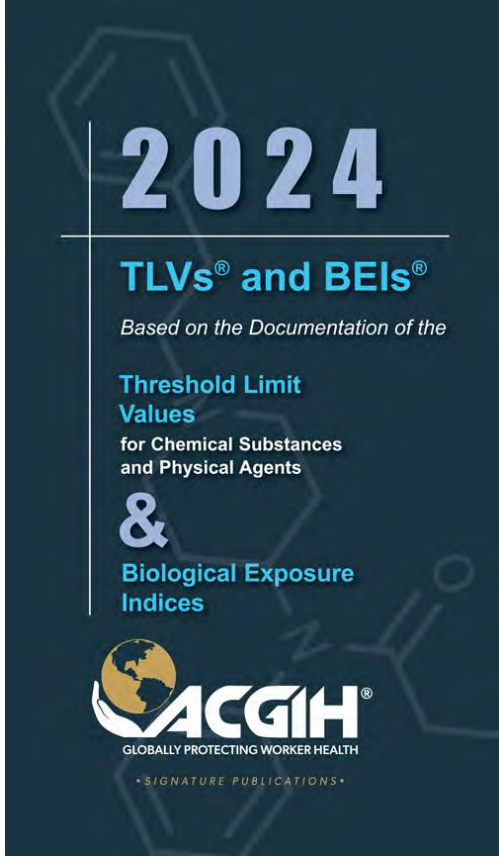
Warning: The TLV is based on the ability of most healthy hydrated acclimatized workers to sustain thermal equilibrium. The Action Limit (AL) is similarly prescribed for healthy hydrated unacclimatized workers. This TLV has a small margin of safety, and some workers may experience heat-related disorders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

excerpt from: ACGIH® © 2022 11DOC-658-NPA Heat Stress and Strain TLV p.1

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



HUMIDEX-BASED HEAT RESPONSE PLAN

Humidex Plan

removed Humidex2

supported self-management

Humidex/WBGT Estimate-based heat response plan

screening TLV (ACGIH) /detailed TLV

TLV physiological monitoring

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. The moderate unacclimatized WBGT's were translated into Humidex or WBGT estimate (see Appendix 1 for the Humidex-based Heat Response Plan). The following steps must be followed when using the Humidex based heat response plan. To use the WBGT estimate, see Appendix 1.

Step 1: Training

The Humidex plan by itself cannot guarantee that workers will not be affected by heat stress. It is important that all workers can recognize the early signs and symptoms of heat stress to prevent more serious heat illnesses. Workers need to adjust their work pace, take frequent breaks in shaded or cooler areas, and stay hydrated by drinking water regularly. Supervisors also need to be able to recognize when a worker is experiencing heat-related symptoms and know what to do to support them. 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 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. Therefore it important to identify a representative location within the zone where measurements can be taken, within 10m (30 ft) of the exposed worker

Step 3: Measure Workplace Humidex

For work areas where there is significant process radiant heat and/or humidity sources (steam, circulation of large quantities of water) the preferred measurements are Wet Bulb Globe Temperature (WBGT) measurements taken within 10m (30') of the exposure (the closer to the exposed worker the better). For workstations where weather conditions are the main source of external heat exposure temperature and relative humidity measurements taken within the work zone are sufficient. Measurements should be taken at least once per hour during heat stress conditions and be recorded. A thermal hygrometer a simple way to measure the temperature and relative humidity

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

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

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

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%	Temp (in °C)
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 %)

Acclimatization Argument

- The 2022 TLV® uses the following **measurable criteria**:

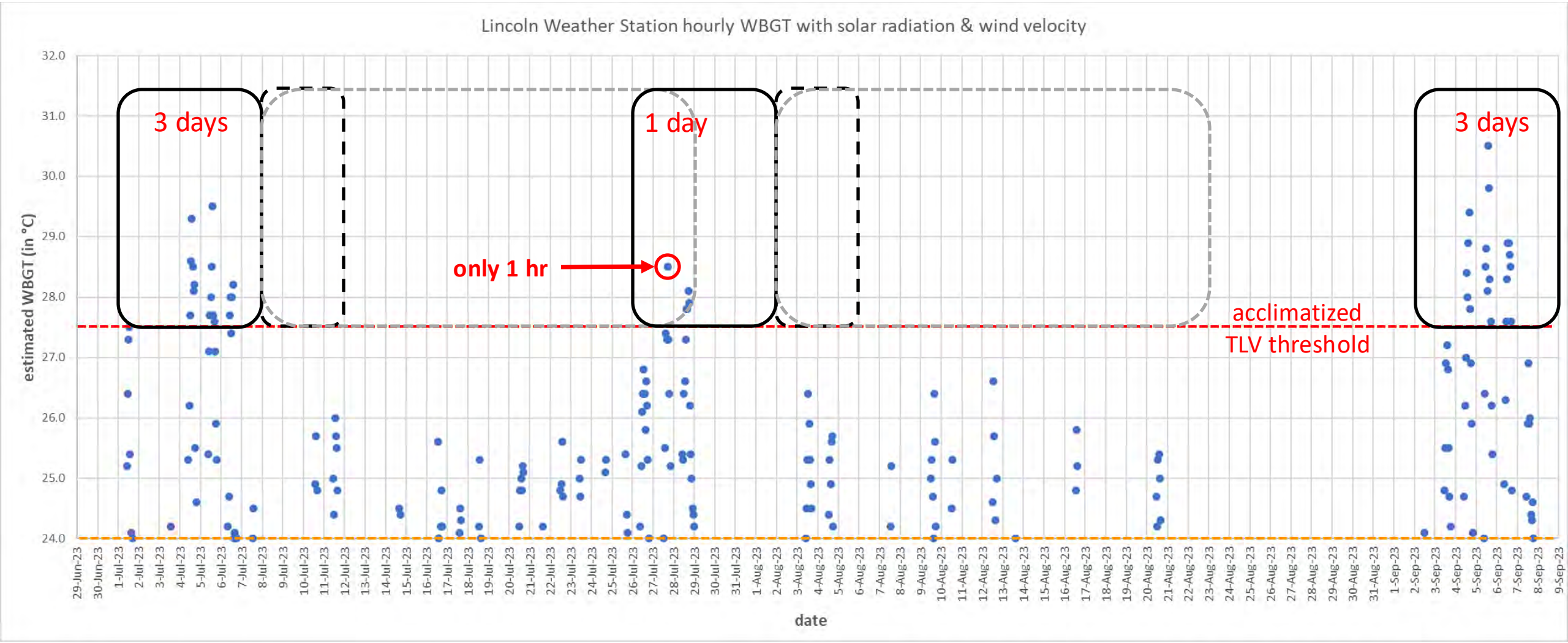
  ""Acclimatization requires physical activity under heat stress conditions like those anticipated for the work. With a recent history of heat stress exposures of at least **2 continuous hours for 5 of the last 7 days**, a worker may be considered acclimatized for the purposes of the TLV. Acclimatization 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)

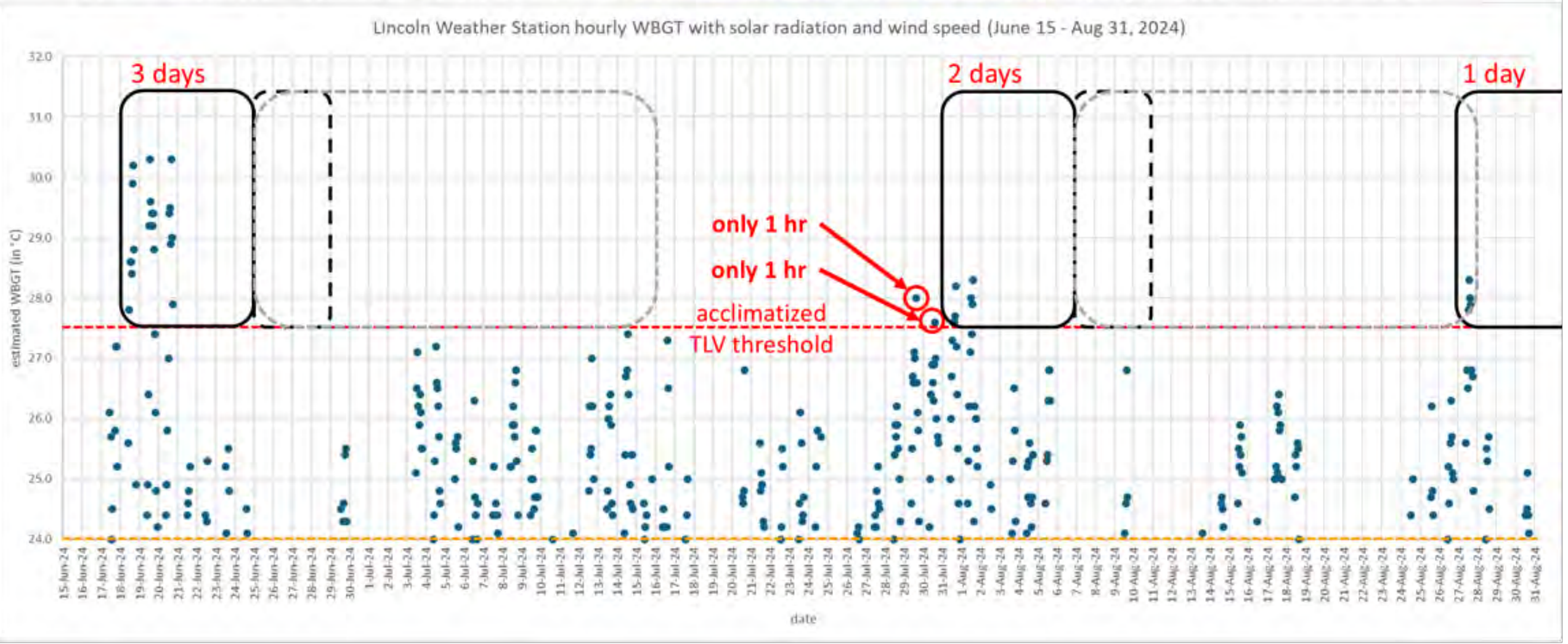
ACGIH acclimatization rule of thumb:

2 hr/day for 5 of 7 days window

after 4 days noticeable loss

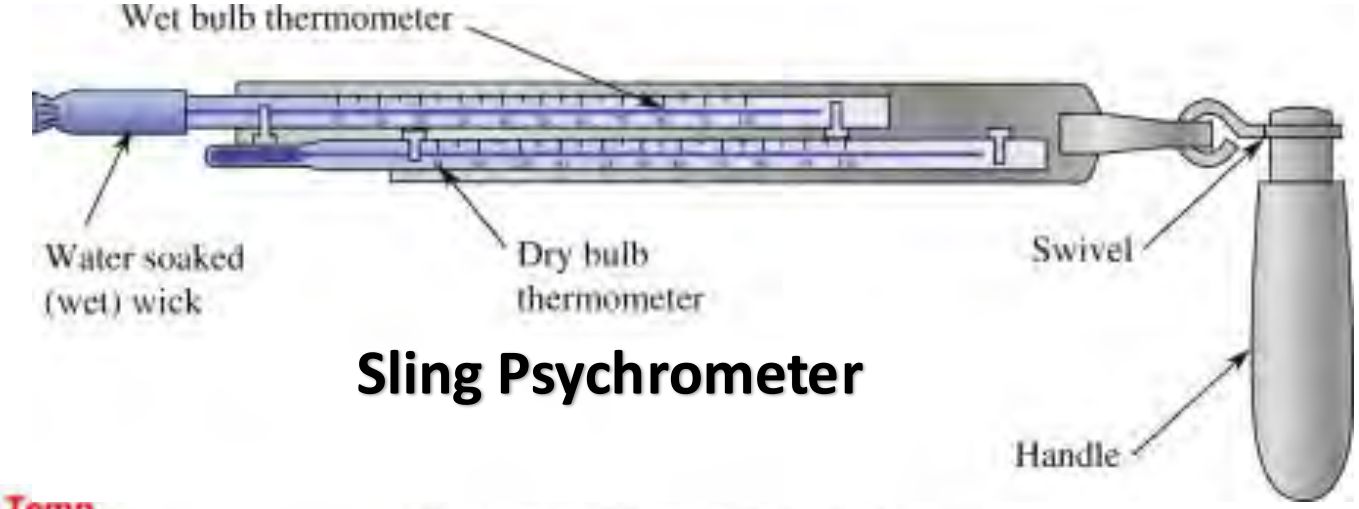
after 3 weeks complete loss

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



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

Can we estimate the WBGT from temperature and relative humidity (easily available)?

- Thomas Bernard has a table on a website ("Estimation of WBGT from Dry Bulb Temperature and Dew Point or Relative Humidity" https://health.usf.edu/-/media/v3/usf-health/COPH/Thomas-Bernard/Heat-Stress/Tables_WBGT_from_DP_or_RH21.ashx) where he provides **estimates of the WBGT based on temperature and relative humidity**. We used this table (converted to a set of equations) to estimate the indoor WBGT.
- For outdoor WBGT estimates, Bernard suggests **adding 2°C WBGT** to the table value to adjust for work in direct sunlight.
- Better yet, using a calculator available online (https://www.climatechip.org/excel-wbgt-calculator) the air temperature, **solar radiation**, relative humidity and **wind speed** were entered to supply an estimate of the outdoor WBGT

HUMIDEX-BASED HEAT RESPONSE PLAN

supported self-management

Humidex/WBGT Estimate-based heat response plan

screening TLV (ACGIH) /detailed TLV

TLV physiological monitoring

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. The moderate unacclimatized WBGT's were translated into Humidex or WBGT estimate (see Appendix 1 for the Humidex-based Heat Response Plan). The following steps must be followed when using the Humidex based heat response plan. To use the WBGT estimate, see Appendix 1.

Step 1: Training

The Humidex plan by itself cannot guarantee that workers will not be affected by heat stress. It is important that all workers can recognize the early signs and symptoms of heat stress to prevent more serious heat illnesses. Workers need to adjust their work pace, take frequent breaks in shaded or cooler areas, and stay hydrated by drinking water regularly. Supervisors also need to be able to recognize when a worker is experiencing heat-related symptoms and know what to do to support them. 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 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. Therefore it important to identify a representative location within the zone where measurements can be taken, within 10m (30 ft) of the exposed worker

Step 3: Measure Workplace Humidex

For work areas where there is significant process radiant heat and/or humidity sources (steam, circulation of large quantities of water) the preferred measurements are Wet Bulb Globe Temperature (WBGT) measurements taken within 10m (30') of the exposure (the closer to the exposed worker the better). For workstations where weather conditions are the main source of external heat exposure temperature and relative humidity measurements taken within the work zone are sufficient. Measurements should be taken at least once per hour during heat stress conditions and be recorded. A thermal hygrometer a simple way to measure the temperature and relative humidity

WBGT Estimate Plan

Estimated WBGT version (based on temp & RH)

Estimated Effective* WBGT	Action
29.1°C+ WBGT	only medically supervised work
27.1-29.0°C WBGT	75% relief
26.1-27.0°C WBGT	50% relief
25.1-26.0°C WBGT	25% relief
24.1-25.0°C WBGT	warning & double water
23.1-24.0°C WBGT	alert & water
≤23.0°C WBGT	water as needed

moderate metabolic rate, unacclimatized action limit

"Effective*" means adjusted for clothing

NEVER IGNORE ANYONE'S SYMPTOMS DESPITE YOUR MEASUREMENTS!

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																		30.1	29.0	45
44																	30.6	29.5	28.3	44
43																31.0	29.9	28.8	27.7	43
42															31.3	30.3	29.2	28.1	27.1	42
41														31.6	30.6	29.5	28.5	27.5	26.5	41
40														30.8	29.8	28.8	27.8	26.8	25.8	40
39													31.0	30.0	29.1	28.1	27.1	26.2	25.2	39
38												31.1	30.2	29.2	28.3	27.4	26.4	25.5	24.6	38
37											31.2	30.3	29.4	28.5	27.5	26.6	25.7	24.8	23.9	37
36										31.2	30.3	29.4	28.5	27.7	26.8	25.9	25.0	24.2	23.3	36
35									31.1	30.3	29.4	28.6	27.7	26.9	26.0	25.2	24.3	23.5	22.7	35
34								31.0	30.2	29.4	28.5	27.7	26.9	26.1	25.3	24.5	23.7	22.8		34
33						31.6	30.8	30.0	29.2	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	
	Relative Humidity (in%)																			

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

both units, side by side

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

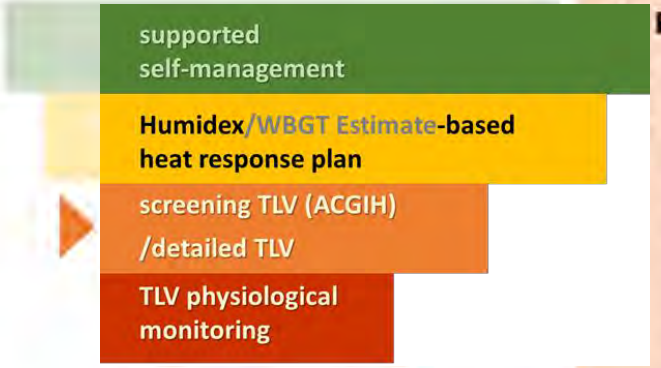
* "adjusted" means adjusted for additional clothing and radiant heat (see steps #4 & #5)
**at Humidex exposures above 45 (WBGT 29.1°C), heat stress should be managed as per the ACGIH TLV®

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

Chapter 4

SCREENING AND DETAILED TLV (ACGIH)

ACGIH Screening Criteria Based on WBGTeff



The ACGIH TLV for heat stress and strain is the "gold standard" for the evaluation and assessment of heat stress. If the simpler Humidex-based heat response plan does not allow for proper measurement of heat stress risk, the ACGIH TLV should be used.

The ACGIH TLV has 4 methods of heat stress assessment. Method 1 is the most commonly used and least complicated method. It consists of a table of TLV and Action Limit (AL) screening criteria based on the effective WBGT (WBGTeff). The screening criteria for heat stress exposure considers:

- **the contributions of environment (WBGT),**
- **metabolic work demands adjusted for weight as light, moderate, heavy, or very heavy, (follow table 1 of the ACGIH TLV)**
- **work-rest pattern, (follow table 2 of the ACGIH TLV)**
- **clothing; (Appendix 3 SOP)**
- **level of acclimatization.**

From Humidex to WBGT

Jamila works in a mid-sized factory producing shaped cardboard containers. The cardboard is shaped when wet and the dried in kilns, so the factory process emits both heat and humidity. At first the plant tried to use the Humidex plan, but heat stress conditions were more complicated than the Humidex plan assumes, so they decided to purchase machines that would measure the wet-bulb globe temperature (WBGT). The employer installed 4 fixed sets of sensors which were programmed to notify supervisors beginning when the conditions in these for areas exceed 20°C WBGT. There are also hand-held measuring units which can be used for following up specific heat stress concerns.

The Health & Safety department liked the simplicity of the Humidex plan so they worked out a correlation between Humidex and WBGT measurements so they could convert the Humidex table into WBGT units. The WBGT measurements take into consideration the radiant heat from the kilns and extra humidity from the wet processes in the plant. Jobs were classified by ergonomic consultants into "light" and "moderate" categories. It was also noted which jobs had access to air-conditioned break rooms for relief and which jobs did not. Engineering controls included ventilation with chillers to control the level of humidity in the plant (for the stability of the cardboard product), ergonomic changes were made to reduce the amount of energy workers have to expend to do their work, and evaporative cooling fans are placed strategically throughout the plant when things get really hot.

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.**

Detailed WBGT

Workplace are not implementing the TLV properly, so the online calculator will walk them through the TLV steps

- training
- metabolic correction for weight
- outdoor sun/indoor
- clothing adjustment factors
- acclimatization
- noting the difference in thermal regulation for those biologically female at birth

ACGIH TLV (WBGT)

Screening TLV (ACGIH) / Detailed TLV

Recommended if:

- You think you are acclimatized
- Working with process heat
- Heavy or very heavy work load

Detailed WBGT

Most workplace are not implementing the TLV properly, Our new online calculator will walk them through the steps:

- training
- metabolic correction for weight
- outdoor sun/indoor
- clothing adjustment factors
- acclimatization

ACGIH Method 1:
Screening Criteria Based on $WBGT_{eff}$

- requires:
  1. **measurement** of WBGT
  2. **clothing** adjustment cor
     or $WBGT_{eff}$)
  3. assign **metabolic work c**
  4. determine **acclimatizati**
  5. determine unadjusted w
- use criteria in **Table 3** to c
- based on **1 hour** time-we
- Assumes 8 hour days and

iT"

ls

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

	Metabolic Rate for Acclimatized Workers				Metabolic Rate for Unacclimatized Workers			
Allocation of Work in a Cycle of Work and Recovery	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
75 to 100%	31.0	28.0	–	–	28.0	25.0	–	–
50 to75%	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:

1. See Table 1 for metabolic work demand categories.
2. The thresholds are computed as a TWA Metabolic Rate where the metabolic rate for rest is taken as 115 W and work is the representative (midrange) value of Table 1. The time base is taken as the proportion of work at the upper limit of the percent work range (e.g., 50% for the range of 25% to 50%).
3. WBGT values are expressed to the nearest 0.5 °C.
4. If work and rest environments are different or work and rest are distributed over more than 1 location, hourly time-weighted averages (TWA) WBGT should be calculated and used. TWAs for work rates should also be used when the work demands vary within the hour. Note that the metabolic rate for rest is already factored into the screening limit.
5. Values in the table assume 8-hour workdays in a 5-day workweek with conventional breaks.
6. Because the physiological strain associated with Heavy and Very Heavy work among less fit workers regardless of WBGT may be unsustainable, screening criteria values are not provided for near continuous work and for up to 25% rest in an hour for Very Heavy. The screening criteria are not recommended, and, instead, a TWA analysis and/or physiological monitoring should be used.
7. Table 3 is intended as an initial screening tool to evaluate whether a heat stress situation may exist and thus the table is more protective than the TLV or AL. Because the values are more protective, they are not intended to prescribe work and recovery periods.

Metabolic category issue:

Note:

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

Moderate 235 to 360 W	...l 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).

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 N95 for the silica dust, earmuffs, etc., in addition to your overalls?

Article comparing the cooling rates of the different parts

Taylor and Machado-Moreira *Extreme Physiology & Medicine* 2013, 2:4
http://www.extremephysiolmed.com/content/2/1/4

Extreme Physiology & Medicine

REVIEW

Open Access

Regional variations in tra water loss, eccrine sweat gland den retion rates and electrolyte composi and exercising humans

Nigel AS Taylor* and Christiano A Machado-Moreira

Taylor & Machado-Moreira (2013)

Table 3 Regional contributions to evaporative heat loss (assuming 100% evaporation) from 14 body regions during thermal loading

Site	Rest heat loss (W)	Relative contribution (%)	Exercise heat loss (W)	Relative contribution (%)
Head (face)	27.81	10.2	91.30	13.8
Hand (palm)	4.33	1.6	12.88	1.9
Hand (dorsal)	9.63	23.5	27.36	4.1
Forearm	10.97	4.0	40.58	6.1
Upper arm	15.87	5.8	36.44	5.5
Axilla	2.48	0.9	6.75	1.0
Chest	22.00	8.1	50.60	7.7
Abdomen	21.71	8.0	45.68	6.9
Back	49.88	18.3	113.12	17.1
Buttocks	14.90	5.5	20.59	3.1
Thigh	42.06	15.4	102.59	15.5
Leg	37.89	13.9	88.56	13.4
Foot (sole)	3.75	1.4	6.83	1.0
Foot (dorsal)	9.75	3.6	17.43	2.6

The mean, whole-body sweat rates under these conditions would approximate 0.4 $L.h^{-1}$ (rest) and 1.0 $L.h^{-1}$ (light-moderate intensity exercise). Calculations were performed using the regional sweat rates from Figures 4 (resting states) and 5 (exercising states), an assumed heat loss of 2.43 $kJ.mL^{-1}$ and the surface area of each region (Table 1) based upon the morphological reference adult [116].

Derived CAV's

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

Physiological Monitoring

TLV Physiological Monitoring

- Can be a useful tool when working on hot environments with high physical activity
- Concerns about collection and confidentiality of medical information
- Self-monitoring can lead to Self-calibration (evolves into supported self-management)
- Reliability and validity of self-monitoring technology (these tools are relatively new and should be tested)
- See monitoring guide for more information

Calculator

ht
re
ca
ca

COVID-19 RESOURCES | About | Services | Referrals | Contact | MyOHCOW

OHCOW Occupational Health Clinics for Ontario Workers Inc.

OCCUPATIONAL ILLNESS | INJURY PREVENTION | WORKPLACE MENTAL HEALTH | WORKER PERSPECTIVE | Search

NEWS & EVENTS | APPS, TOOLS AND CALCULATORS | VIEW ALL RESOURCES

UPDATED 2024

First things first:

What type of data have you collected?

- ○ Temperature and relative humidity
- ◉ Detailed WBGT Method

WBGT – Wetbulb Globe Temperature

NEXT >

OR and RESPONSE PLAN

new Heat Stress Toolkit

an be hazardous to your health.
are no exception.

t 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:

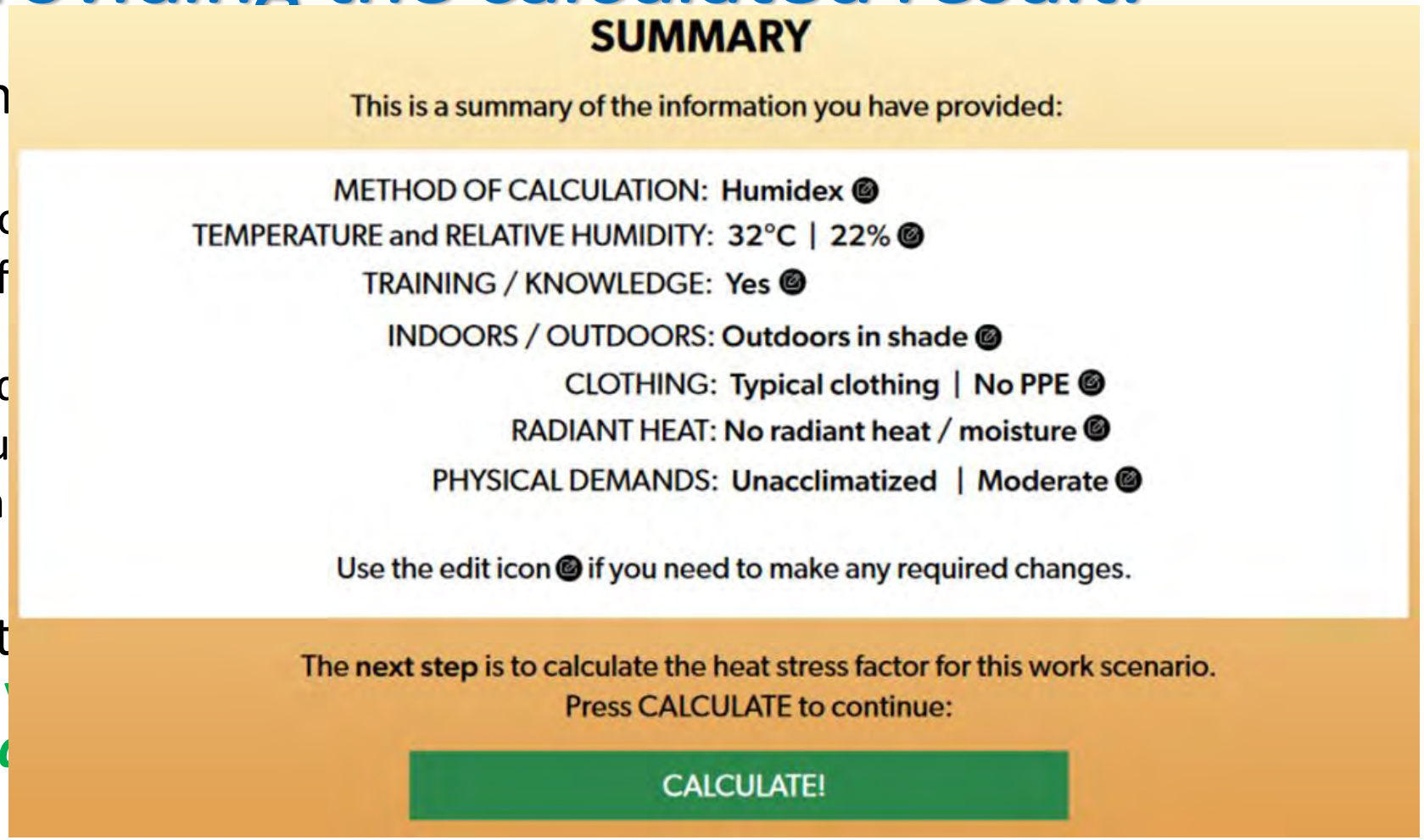
Humidex-based Method • WBGT Estimate Method • Detailed WBGT Method*

New Heat Stress Calculator – Prior to providing the calculated result:

Check status of 6 assun

1. adequate training
2. specify clothing in c
3. confirm absence of *detailed WBGT*)
4. specify indoor/outc
5. accept moderate/u
6. confirm measurem

Only after responding t temperature and relati *Bernard's **WBGT Estim***



Sample 10-page SOP

… for a Word version of this SOP please send a request to:
joudyk@ohcow.on.ca
agauvin@ohcow.on.ca

Heat Stress Prevention & Control Program

VERSION 1.0
05/28/2024

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	

1. NAME OF PROCEDURE

Heat Stress Prevention & Control Program

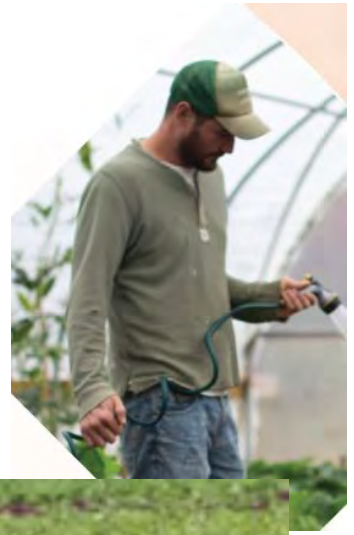
2. PURPOSE

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

Occupational Health Clinics for Ontario Workers

Centre de Santé des Travailleurs(ses) de l'Ontario

Addressing Heat Stress in Agricultural Workplaces



Eduardo Huesca, Project Manager, OHCOW

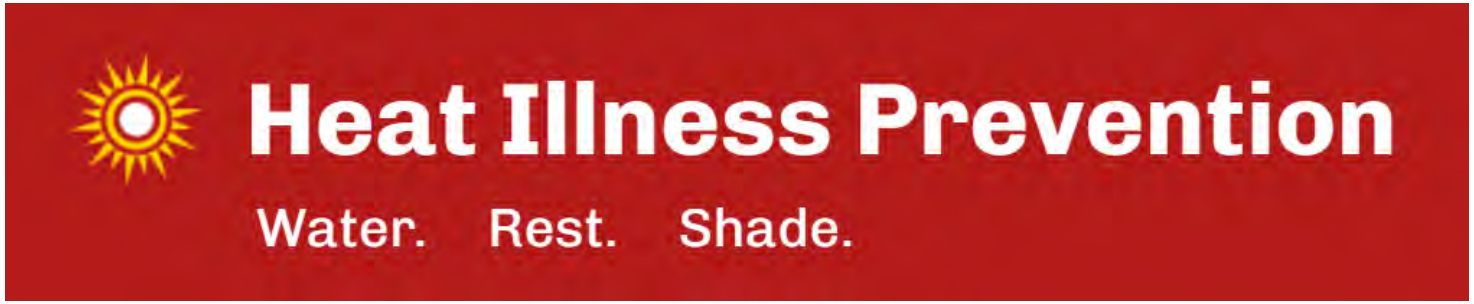
OHCOW's Migrant Agricultural Worker Program
Since 2006

A Gap in Ontario Heat Stress Prevention Education and Resources for Migrant Agricultural Workers

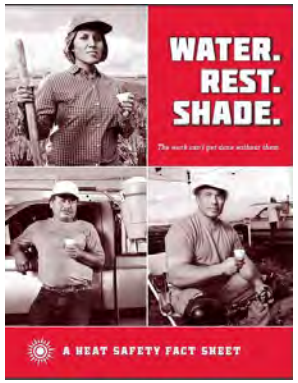
- We had difficulty finding Ontario based heat stress prevention related resources in accessible formats for these workers (language/ more visual formats), that also more closely considered their unique experiences.

- We were unable to find Ontario resources that included heat stress awareness and prevention information, that also provided information on what to do if workers had heat stress related concerns and where to get help.

U.S Heat Stress Resources for Migrant Agricultural Workers



STATE OF CALIFORNIA
CAL OSHA
DEPARTMENT OF INDUSTRIAL RELATIONS



https://www.99calor.org/english.html

Resources

Materials that promote heat illness prevention are available in multiple languages for print order and download.

Materials available for order:

*Email **heat@dir.ca.gov** to order copies of these materials at no cost.*

Pocket Guide (double-sided, English/Spanish, 3" X 4")

English/Spanish | English/Chinese

Illustrated Fact Sheets (4 pages, 8.5" X 11")

English | Spanish | Hmong | Punjabi | Chinese

Illustrated Poster (double-sided, 13" X 20")

Agriculture:

English | Spanish | Hmong | Punjabi

Construction:

English | Spanish

Community Training Guide (11" X 17")

An easy-to-follow illustrated 11 X 17 flipchart guide – leads the trainer through a heat awareness training, and provides visuals for workers.

- English
- Spanish (temporarily unavailable for print order)

Supervisor's Daily Checklist for the Worksite (1 page, 8.5" X 11")

English | Spanish

Materials Available for Download:

Community Posters

Post and distribute in your community:

English | Spanish | Hmong | Punjabi

How to Report a Problem to Cal/OSHA (4-Page Guide)

English | Spanish

Heat Illness Prevention Video (on YouTube, 9-minutes)

Videos:

English | Spanish | Mixteco | Hmong | Punjabi

Transcripts:

English | Spanish | Hmong | Punjabi

Video Guide:

Facilitate a discussion on heat illness prevention after watching the video.

English | Spanish | Punjabi

Training Guide

English | Spanish

Wall Graphics

Spanish | Punjabi | Hmong

Radio Ads

Audio:

Spanish Radio A | Spanish Radio B | Spanish Radio C

Hmong Radio A | Hmong Radio B | Hmong Radio C

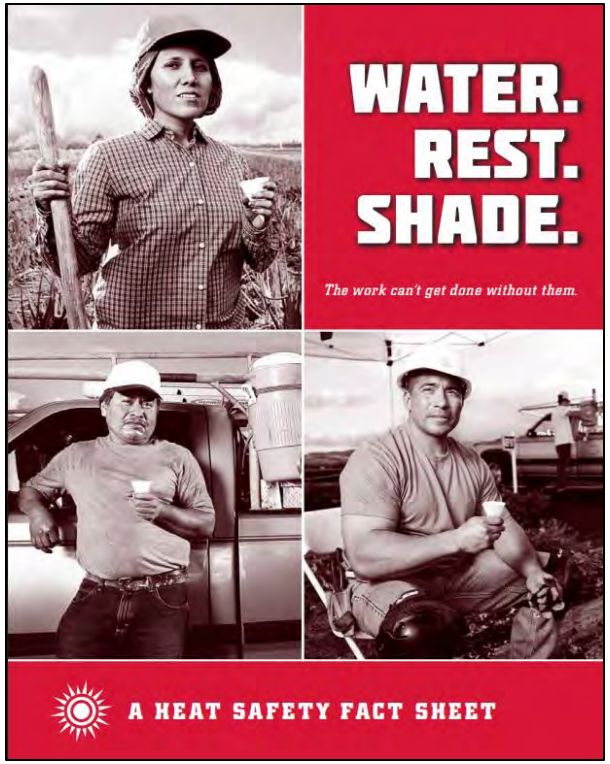
Punjabi Radio A | Punjabi Radio B | Punjabi Radio C

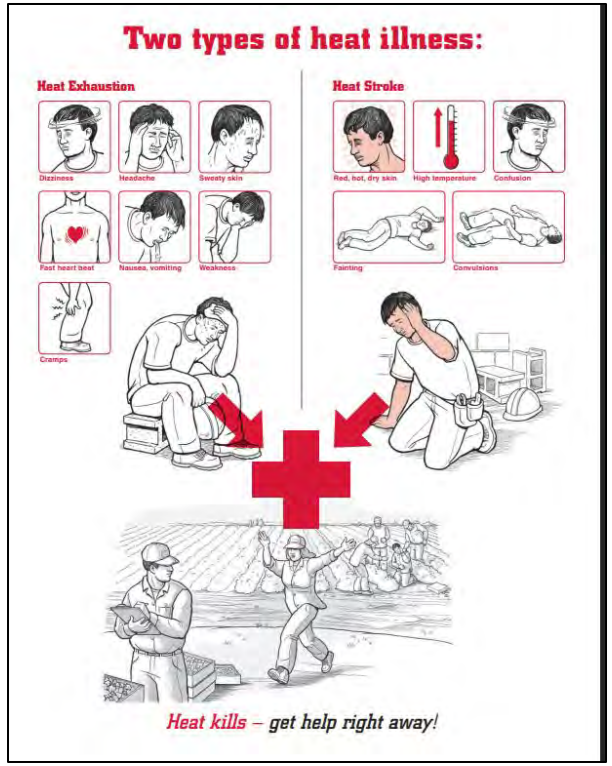
Heat Illness Prevention

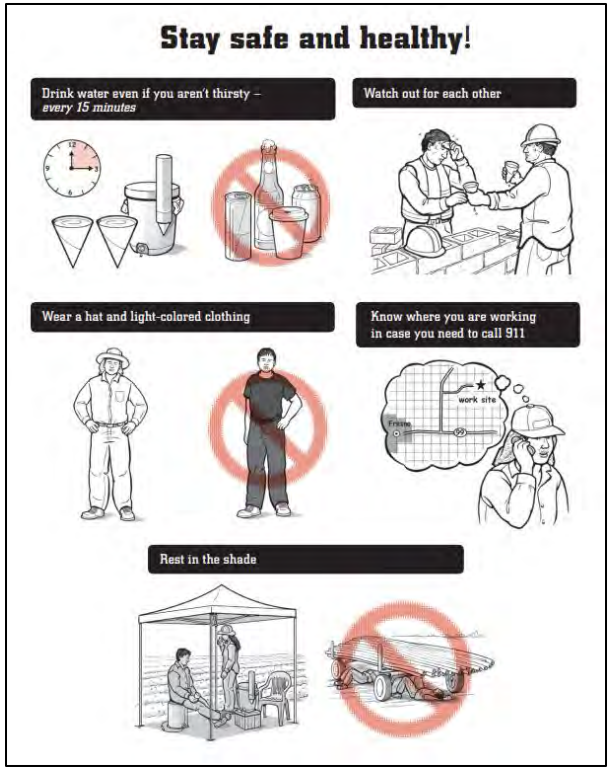
Water. Rest. Shade.

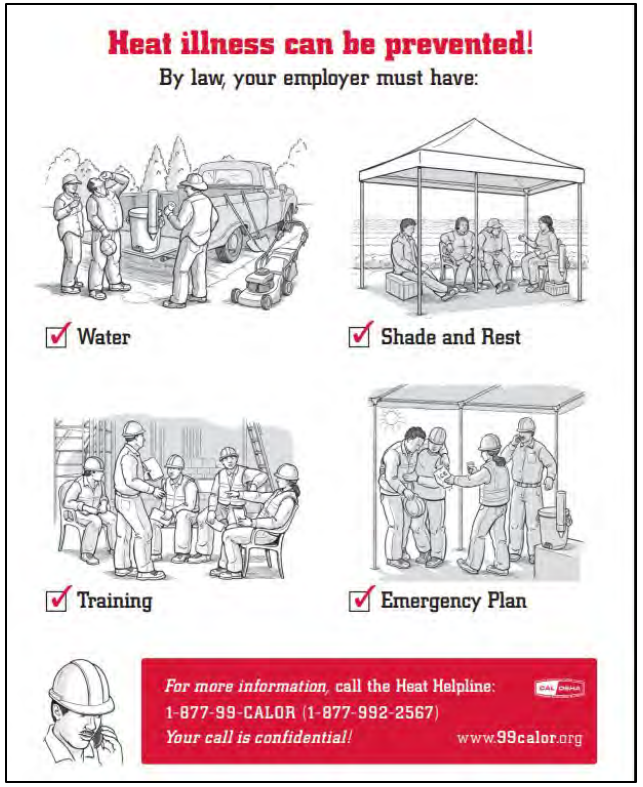
STATE OF CALIFORNIA
CAL OSHA
DEPARTMENT OF INDUSTRIAL RELATIONS

https://www.99calor.org/Resources.html



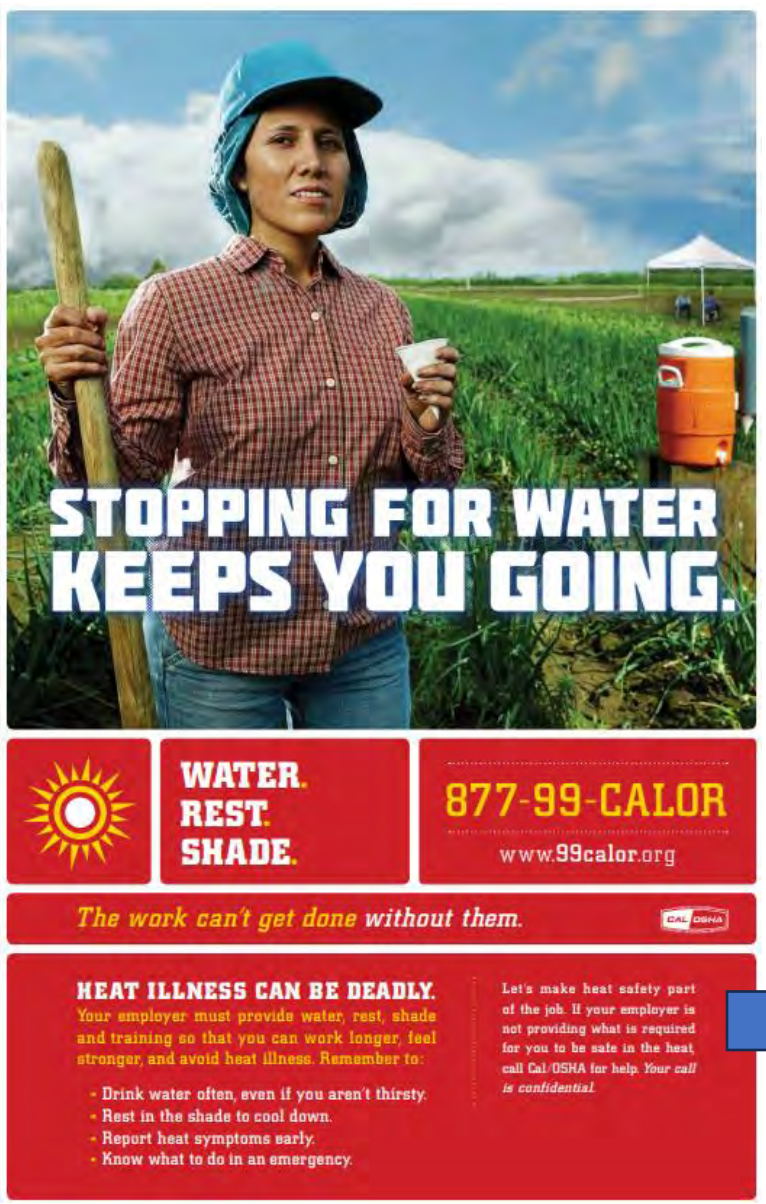






https://www.99calor.org/english.html

https://www.99calor.org/_downloads/factsheet.english.pdf

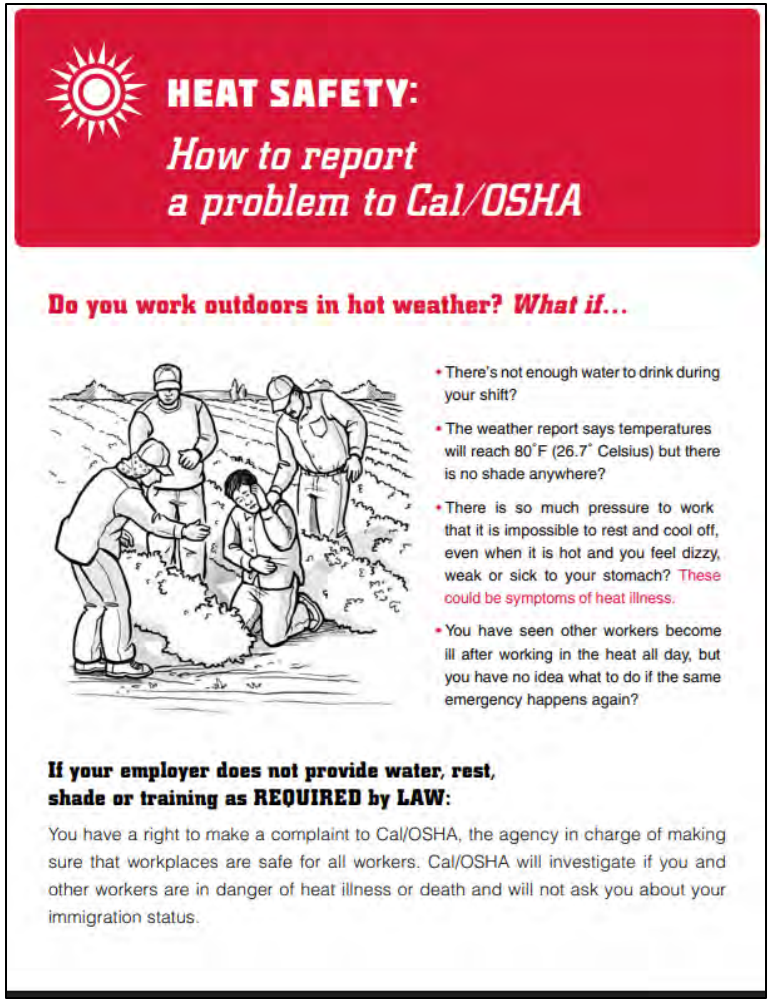


https://www.99calor.org/_downloads/poster.english.pdf

Let's make heat safety part of the job. If your employer is not providing what is required for you to be safe in the heat, call Cal/OSHA for help. *Your call is confidential.*

Heat Illness Prevention
Water. Rest. Shade.

STATE OF CALIFORNIA
CAL OSHA
DEPARTMENT OF INDUSTRIAL RELATIONS



HEAT SAFETY:
How to report a problem to Cal/OSHA

Do you work outdoors in hot weather? *What if...*

- There's not enough water to drink during your shift?
- The weather report says temperatures will reach 80°F (26.7° Celsius) but there is no shade anywhere?
- There is so much pressure to work that it is impossible to rest and cool off, even when it is hot and you feel dizzy, weak or sick to your stomach? These could be symptoms of heat illness.
- You have seen other workers become ill after working in the heat all day, but you have no idea what to do if the same emergency happens again?

If your employer does not provide water, rest, shade or training as REQUIRED by LAW:

You have a right to make a complaint to Cal/OSHA, the agency in charge of making sure that workplaces are safe for all workers. Cal/OSHA will investigate if you and other workers are in danger of heat illness or death and will not ask you about your immigration status.

https://www.99calor.org/_downloads/complaint.sheet_english.pdf

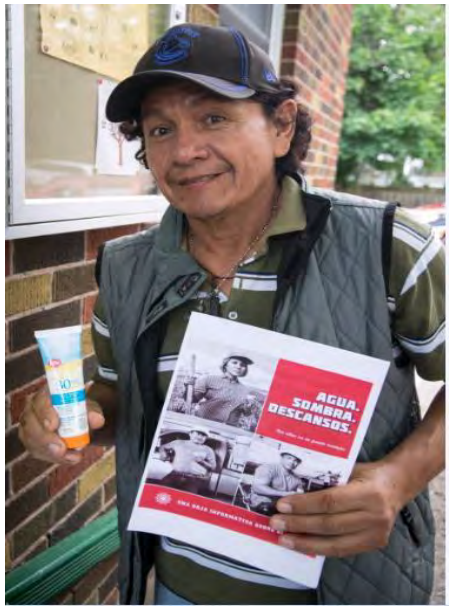
OHCOW Heat Stress and Sun Safety Workshops (2012-2014)

- 25 workshops were presented in English and in Spanish, to 500 Ontario migrant agricultural workers from Mexico and Caribbean countries. All of these were outdoor agricultural workers

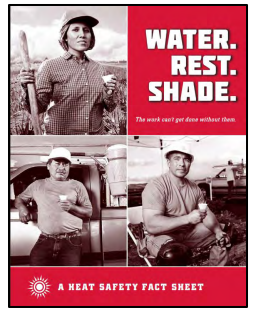
- Workshops were presented to these workers in the regions of Simcoe/Norfolk County, Niagara, Bradford, and Durham, Ontario.

- Workshops took place at the community level, at regional events and health and information fairs organized for these workers, as well at workplaces, at the invitation of employers.

- As part of these workshops, all workers were provided a print copy of CALOSHA's **Water.Rest.Shade** handout, which was reviewed with them in detail.



Picture of Mexican worker after participation in our workshop, Simcoe, Ontario



On farm workshop at Niagara region vineyard

Funded by the Prevention Office of the Ontario Ministry of Labour

OHCOW Heat Stress and Sun Safety Workshops (2012-2014)

- As part of these workshops, we asked workers about their work experiences, in relation to heat exposure, prevention measures, and health and safety practices taking place at their workplace.

- Their responses were recorded.

OHCOW Heat Stress and Sun Safety Workshop Findings (2012-2014)

- Most workers had not received prior training or information regarding heat stress or sun safety.
- Most workers identified that they did not know what to do in the case of a heat stroke emergency.
- Most workers noted they were able to access enough drinking water during work time.
- Several workers noted that they had experienced sun burn while working in Ontario. They described sunburns to the back of their neck, face, and arms.

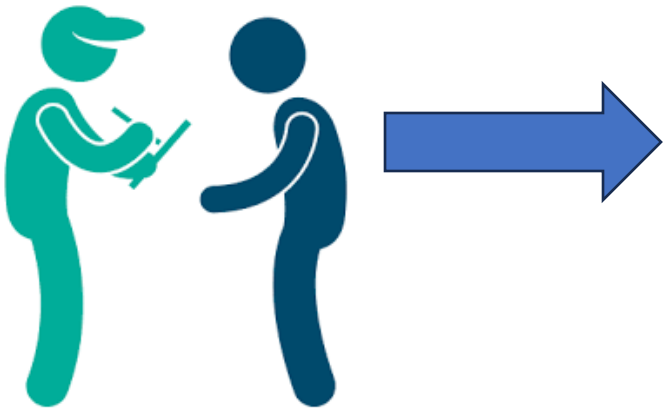
OHCOW Heat Stress and Sun Safety Workshop Findings (2012-2014)

- Workers noted that they did not feel comfortable asking to take breaks outside of their allocated break times in cases where they felt the heat and sun was negatively affecting them.

- Most workers noted that there was no easily accessible shade near to where they work to avoid the sun during breaks.

- Most workers noted that on particularly hot days supervisors would organize work during the cooler periods of the day, and stop work when temperatures were considered too hot.

Findings were included in a factsheet that was distributed to Ontario employers of migrant agricultural workers



Findings also informed ongoing heat stress workshops. Ex: We started providing workers with tubes of sunscreen and discussed its use.

Occupational Health Clinics for Ontario Workers Inc.

Heat stress and Sun safety

For Employers Hiring Migrant Farm Workers

Since 2006, OHCOW has provided occupational health support to more than a thousand migrant farm workers and their employers in Ontario through clinical consultations for individuals with occupational health concerns, and prevention-based occupational health and safety materials, tools and workshops. All our services are free of charge. This factsheet draws from our experience as well as from research conducted by other health and safety organizations working with migrant workers.

Why Heat Stress?

The physical nature of farm work creates heat from within muscles that can increase body temperature. When this internal heat is combined with the sun's effects as well as humidity there is a risk of workers experiencing heat stress, heat exhaustion, and if not addressed, heat stroke (which can be fatal). From speaking to migrant farm workers and seeing them clinically, many have identified experiencing mild symptoms of heat stress, while others report more severe symptoms including dizziness and nausea or knowing coworkers who have fainted.

Workshop Lessons and Suggestions

Adapted from research by the US National Center for Farmworker Health and from a heat and sun safety program designed by CAL OSHA, OHCOW staff have developed a workshop that provides information about heat stress, exhaustion and stroke, identifying the signs and symptoms, and steps to reduce the risk through proper hydration and sun protection. **From 2012-2014 we conducted 25 heat stress and sun safety workshops to a total of 500 migrant farm workers from Mexico and the Caribbean.** Below are some key findings from these workshops and corresponding suggestions that may be useful for developing or updating health and safety programs around this issue.

Heat Stress and Sun Safety Workshop findings and solutions

Findings	Solutions
• The majority of workers had not received prior training or information regarding heat stress or sun safety	• Given that this is a key risk, training should be done a number of times, particularly as temperatures are reaching 25C, and then touch base regularly once over 30C.
• Workers appreciated learning that heat stress, exhaustion and stroke are conditions that develop on a continuum, and need to be addressed early before they increase in severity and danger	• Make use of OHCOW or other materials and workshops in the language of the worker, and in graphic formats to promote comprehension.
• Most workers identified that they didn't know what to do in the case of a heat stroke emergency.	• Develop, equip and practice an Emergency Plan that includes response to heat illnesses (cooling with water), knowing work locations and communicating to 911

1

• The majority of workers noted they did not have difficulty accessing enough water during work time.	• Keep up the good work! Ensure potable water is easily available to workers throughout the day. Workers noted that having a centralized water dispenser to refill their individual water bottles helped a lot. • Clarify and demonstrate the best system of water storage and access that fits the work type and location. Encourage drinking beyond thirst.
• A substantial number of workers noted that they had experienced sun burn while working in Ontario. They described sunburns to the back of their neck, face, and arms. • Research in this area notes that often it is assumed that people with darker skin do not get sunburnt, but studies and feedback from workers confirm that some individuals do.	• Review the risks of sun protection, the importance of hats, skin covering work clothes, and the use of sunscreen. • Supply sweat-resistant sunscreen in quantities that allow timely re-application
• Workers noted that they did not feel confident asking to take breaks outside of their allocated time in cases where they felt the heat and sun was negatively affecting them	• Ask regularly how workers are feeling • Discuss what workers should do if they feel as though they need to take breaks during particularly hot days
• The majority of workers noted that there were no easily accessible shaded areas near to where they work to avoid the sun during breaks.	• Rest and Shade are key to recovering during breaks. Plan ahead to set up a tent or tarp, or find other simple ways to provide shade.
• Most workers noted that on particularly hot days supervisors would organize work during the cooler periods of the day, and stop work when temperatures were considered too hot.	• Use time shifting, pace reduction and other work practice control strategies to minimize sun and balance heat exposure. See Humidex-Based Heat Response Plan at www.ohcow.on.ca

For more information about the materials, services and workshops we offer on this topic or others contact

Occupational Health Clinics for Ontario Workers (OHCOW) Hamilton Clinic
1877-817-0336 or 905-549-2552: ex 2221
848 Main Street East Hamilton, Ontario
www.ohcow.on.ca

Occupational Health Clinics for Ontario Workers Inc.

2

Funded by the Prevention Office of the Ontario Ministry of Labour

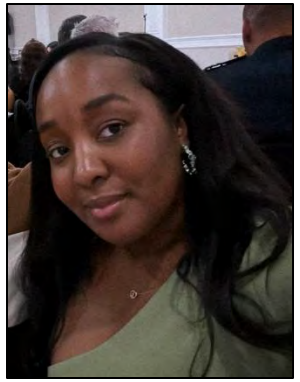
2022: The TeaMWork Project (Western Region)

- Funded by Employment and Social Development Canada's Migrant Worker Support Program (MWSP)
- The purpose of the project is to provide migrant workers with accurate information and access to available services and supports, and to assist them in learning about and exercising their rights while in Canada.
- The TeaMWork Project funds work in Essex County, Chatham-Kent, and Lambton County, alongside 9 other organizations.
- Administered by Workforce WindsorEssex and the Windsor-Essex Local Immigration Partnership (WE LIP)

Funded in part by the Government of Canada

Outreach Team

- Krizia Paylago-Project Coordinator and Filipino Community-Occupational Health & Safety Outreach Worker
- Andrea Steele-Project Coordinator and Caribbean Community-Occupational Health & Safety Outreach Worker
- Azuani Cano-Latinx Community-Occupational Health & Safety Outreach Worker:
- Kesinee Malakan-Thai Community-Occupational Health & Safety Outreach Worker:
- Toa Pierre-Thai Community-Occupational Health & Safety Outreach Worker:


Work within the catchment of OHCOW's Windsor and Sarnia Clinics (Southwestern Region)

TNO-The Neighborhood Organization's WSS Project

- Funded by Employment and Social Development Canada's Migrant Worker Support Program (MWSP)
- The purpose of the project is to provide migrant workers with accurate information and access to available services and supports, and to assist them in learning about and exercising their rights while in Canada
- TNO-The Neighborhood Organization's Worker Support Services (WSS) Project, funds our outreach workers working with TFAWs in the regions of:
  - Ottawa
  - Belleville, Prince Edward County, Cobourg
  - Simcoe/ Norfolk
  - Niagara Region

Funded in part by the Government of Canada | Canada

Worker Support Services (WSS)

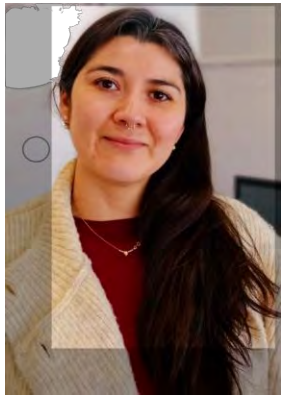
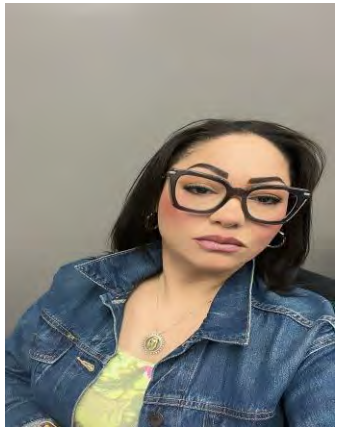
TNO - The Neighborhood Organization

TNO-Worker Support Services (WSS) Project

Outreach Teams

- Sara Castano, Outreach Worker, Eastern Team, Latinx Community, Belleville, Cobourg, Prince Edward County
- Elvira Cruz, Outreach Worker and Eastern Team Regional Coordinator, Latinx Community, Belleville, Cobourg, Prince Edward County
- Cynthia Mora, Outreach Worker and Central Team Regional Coordinator, Latinx Community, Simcoe Lead
- Daisy Rivadeneira, Outreach Worker, Latinx Community, Niagara Region Lead

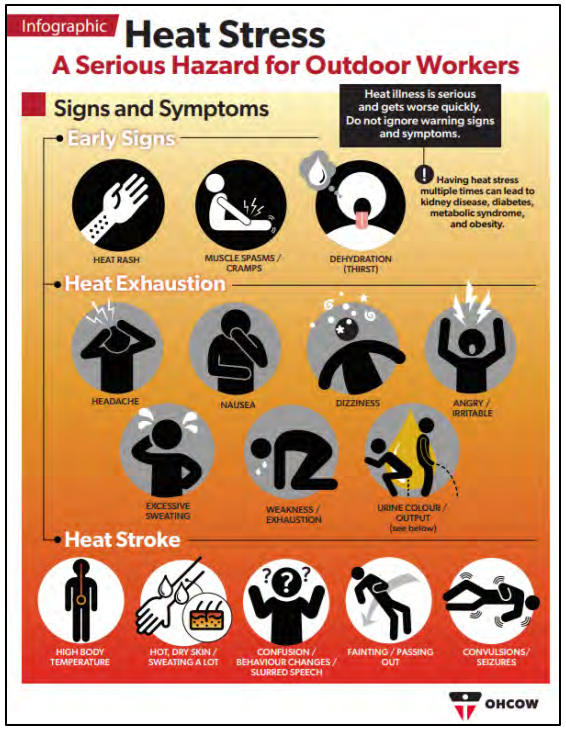


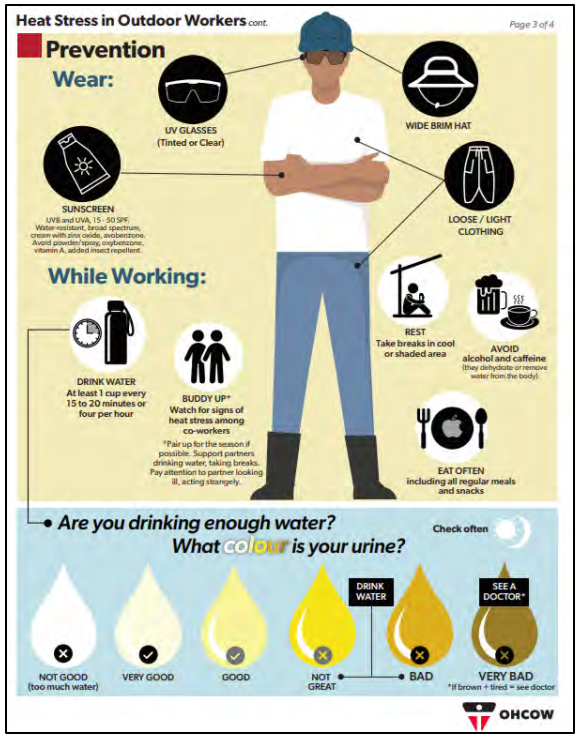



OHCOW's Heat Stress – A Serious Hazard for Outdoor Workers Infographic

- Created in 2023

https://www.ohcow.on.ca/posts/heat-stress-outdoor-workers/



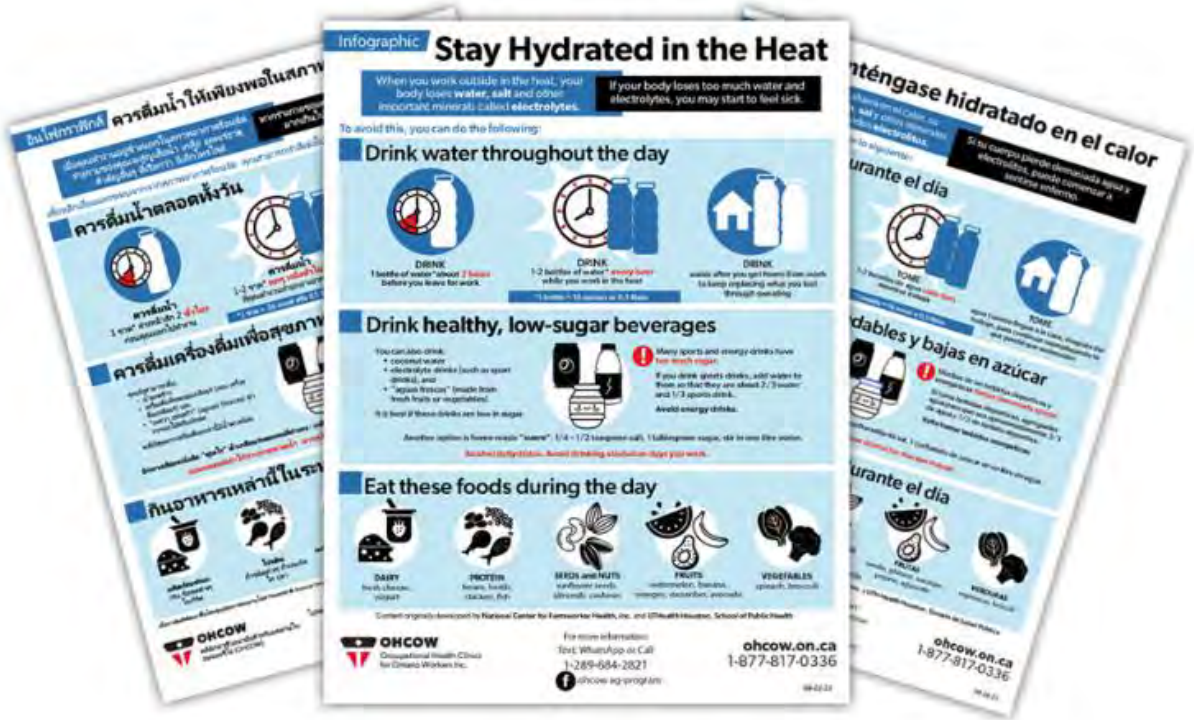


ENGLISH FRANÇAIS ESPAÑOL THAI TAGALOG

OHCOW's Stay Hydrated in the Heat Infographic

https://www.ohcow.on.ca/posts/stay-hydrated-in-the-heat/

- Created in 2023

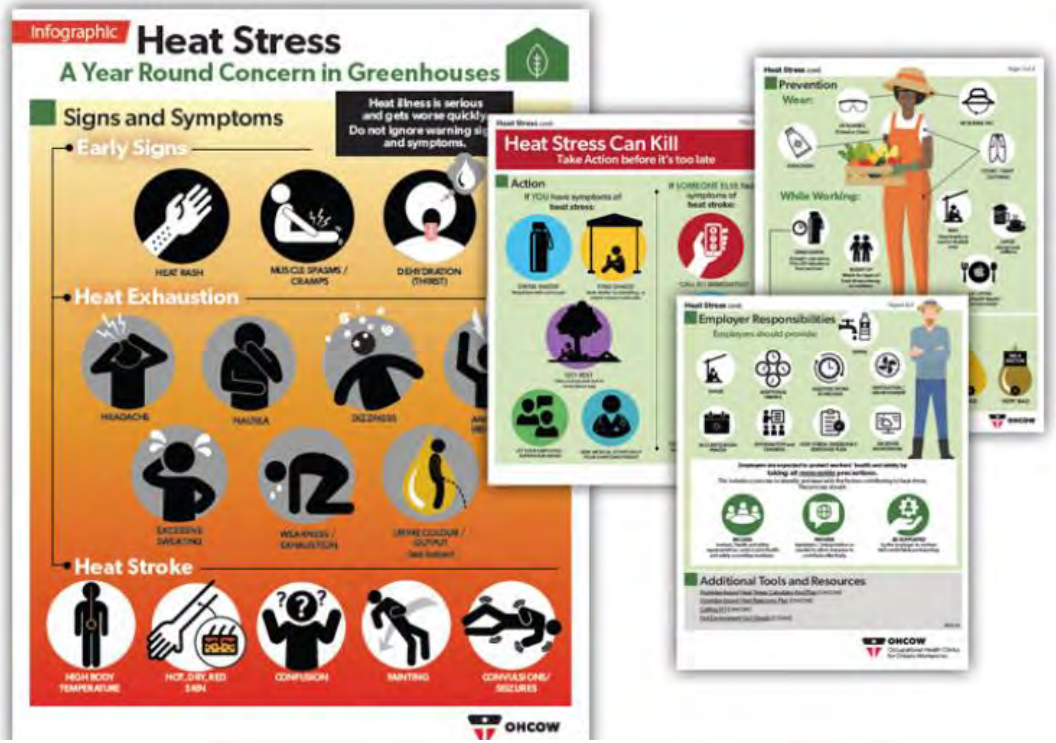


ENGLISH ESPAÑOL THAI TAGALOG

OHCOW's Heat Stress – A Year-Round Concern in Greenhouses Infographic

- Created in 2023

https://www.ohcow.on.ca/posts/heat-stress-greenhouses/

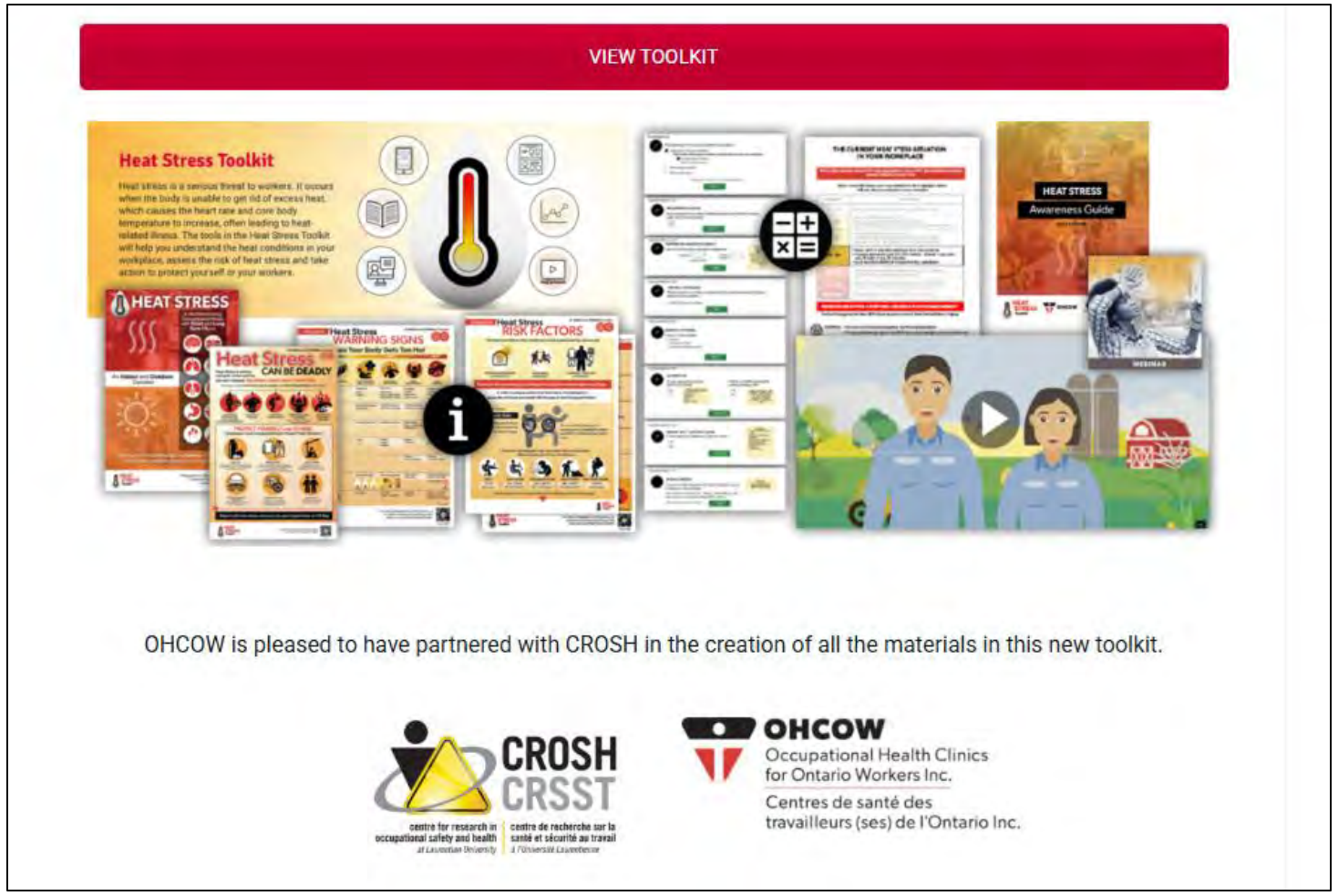


ENGLISH ESPAÑOL THAI TAGALOG

OHCOW's Heat Stress Toolkit

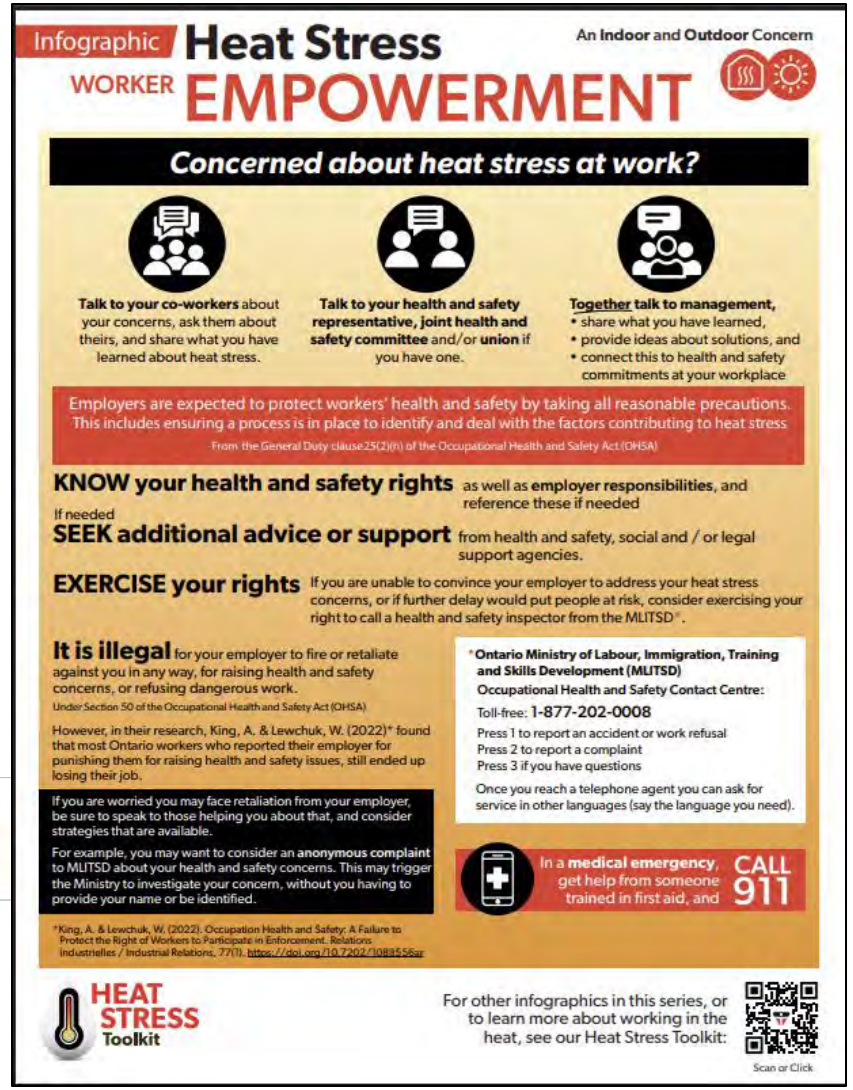
https://www.ohcow.on.ca/heat-stress-toolkit/

- Created in 2024



OHCOW's Heat Stress Toolkit

- Created in 2024



ENGLISH FRANÇAIS ESPAÑOL

https://www.ohcow.on.ca/wp-content/uploads/2024/03/heat-stress-empowerment.pdf

Some 2024 Achievements

OHCOW-TeaMWork Project

Activity Tracking

Prepared By (Name/Position):	Eduardo Huesca, Krizia Paylago, Andrea Steele, Azuani Cano, Kesinee Malakan, Toa Pierre
Reporting Period:	Q2 (July1-September 30, 2024)
Date of Submission:	October 9, 2024

- During this quarter our team participated in **(9) nine in person community events** where we set up information tables and distributed our OHS resources directly to temporary foreign agricultural workers
- In addition, during this quarter our team **delivered (6) six in-person OHS information sessions**, and **(3) three virtual information sessions**, directly to TFAWs in our TeaMWork project regions.
- As part of our OHS and worker rights resource distribution, during this quarter **we distributed 2586 print resources directly to MAWs** in our TeaMWork project regions
- **2064** print resources distributed directly to workers were related to heat stress safety
- In addition,
- **291** OHCOW reusable water bottles distributed directly to MAWs to promote regular hydration at work


OHCOW
Estrés por Calor
SEÑALES DE ADVERTENCIA
HEAT STRESS
ngase hidratado en el calor


work


& Services


OHCOW
Occupational
for Ontario Work
Prevention through
www.ohcow.on.ca


OHCOW
Occupational Health Clinics
for Ontario Workers Inc.


OHCOW


OCCUPATIONAL HEALTH CLINICS
FOR ONTARIO WORKERS


OCCUPATIONAL HEALTH CLINICS
FOR ONTARIO WORKERS


OHCOW
for Ontario Workers Inc.

Health Fair for MAWs hired by ConAgra , in Dresden, Ontario

- Friday, August 16, 2024, our team attended a health fair for migrant workers working at ConAgra, in Dresden, Ontario. Our team set up an information table at this event, and we focused on distributing and explaining our heat stress safety resources for migrant agricultural workers.

- At this event, our team engaged with 142 Caribbean migrant agricultural workers. We spoke to workers about recognizing early signs and symptoms of heat stress, and what workers can do. We also reviewed what employers and supervisors should be doing to prevent heat stress and protect workers.

- As part of this event, we distributed the following directly to these workers:
  - 130 copies of our Stay Hydrated in the Heat Infographic (English)
  - 130 copies of our Heat Stress-A Year-Round Concern in Greenhouses (English)
  - 130 copies of our Heat Stress can be Deadly Poster (English)
  - 130 OHCOW reusable water bottles to promote regular hydration at work

Heat Stress Resource Distribution to Project and Regional Partners

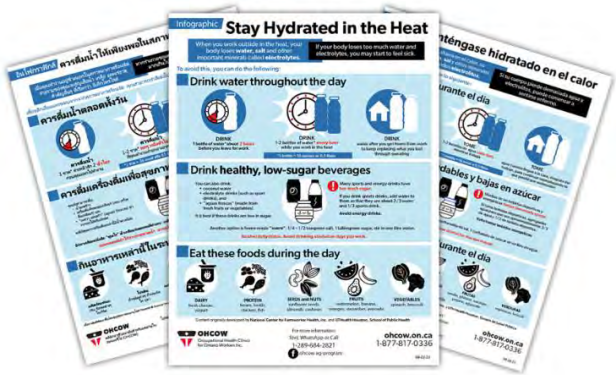
- On Tuesday, September 3, 2024, our team dropped off print copies of our heat stress resources to staff from the **Mexican Consulate in Leamington**, for their distribution to Mexican migrant workers working in a greenhouse they were visiting.

  - 27 copies of our Stay Hydrated in the Heat Infographic (Spanish)
  - 12 copies of our Heat Stress – A Serious Hazard for Outdoor Workers (Spanish)
  - 15 copies of our Heat Stress-A Year-Round Concern in Greenhouses (Spanish)
  - 27 copies of our Heat Stress can be Deadly Poster (Spanish)

This photo is of Ana Maria del Carmen Méndez Piña, Deputy Consul at the Mexican Consulate of Leamington, and a group of Mexican TFAWs holding up our heat stress prevention resources.

Upcoming 2025 Season

- We plan to deliver our heat stress prevention workshops to more Ontario migrant agricultural workers (including in the Ottawa region)
- We plan on distributing more copies of our heat stress infographics to these workers, their employers, and our project partners (both our agricultural specific resources, and those from OHCOW's heat stress toolkit).
- We plan on continuing to help translate OHCOW heat stress toolkit resources into more agricultural worker languages (including Thai and Tagalog).
- We hope to utilize the more technical guides and tools from OHCOW's heat stress toolkit with agricultural workers and employers.
- We plan on continuing to look at the accessibility of these resources and explore opportunities to get worker feedback on them.
- We would like to learn more about current experiences around heat exposure through way of a new worker survey and some workplace measurements



To be effective these resources and worker education cannot exist in a vacuum

- They must be part of continued work to ensure agricultural workplaces have effective heat stress prevention plans.
- They must be part of ongoing work to include and empower migrant/ TFAWs in the identification of workplace hazards, and in workplace hazard prevention, in a climate that is supportive of this and that is free of the fear of reprisals.

Indoor Temperatures in Migrant Agricultural Worker Housing

- In July 2023, a worker working in the Niagara region contacted our regional outreach workers and shared **concerns about the temperatures at their employer provided bunkhouse** where he and other workers were living. He mentioned the temperatures were high and the house had poor ventilation and hence poor air quality.

- Our outreach workers, met with this worker and **provided him with an Aranet4 Home monitor** and explained how to use it. Over several days the worker measured temperature and took pictures of the monitor at peak heat stress episodes and sent them to our OHCOW outreach team.

- Through ongoing engagement with migrant ag. workers on the issue of heat stress, we continued to hear about concerns with high temperatures in their employer provided housing.

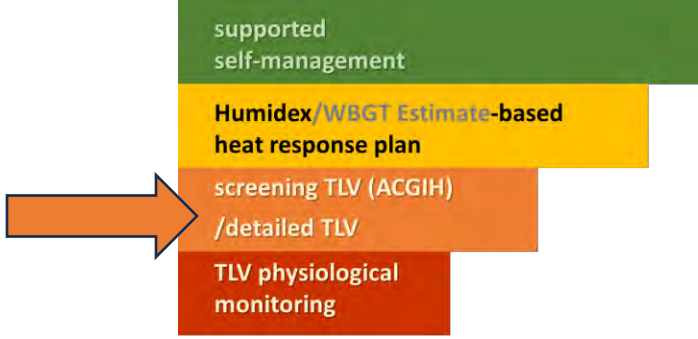
- Through research we identified other jurisdictions focusing on and regulating this issue.
  - Oregon OSHA's rule addressing high ambient temperatures in labor housing

- Based on this experience, we decided to engage more workers and use the Aranet4 monitors and **collect further data for the summer of 2024**.

2024 Pilot Project: Led by Cynthia Mora and Daisy Rivadeneira

- Our outreach teams reached out to more migrant agricultural workers in the regions of Niagara and Simcoe/ Norfolk County, about heat conditions in their bunkhouses and **offered to loan an Aranet4 Home** (set to capture temperature and humidity every 5-min) to monitor conditions in the bunkhouse over the summer
- When a worker accepted the Aranet, our outreach workers collected information about the worker themselves, and the bunkhouse
- Our outreach workers visited the bunkhouse or met the worker off site with the Aranet to download the information (**15 days of data** stored) – later **SwitchBot** thermo-hygrometers were also used instead (**60 days** of 1-min sampling rate data stored)
- **Further information about the bunkhouse** was collected and some **pictures and videos** were received from the workers
- We eventually recruited 11 worker houses that participated in the collection of data
- One of our OHCOW occupational hygienist organized and analyzed the data, and his report will be available soon.
- **We plan on expanding on this pilot in the 2025 season, including in the Ottawa region.**

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)
- **Heavy work and workers may be acclimatized (due to bunk house exposure)**

Measuring WBGT

- Using a calculator available online we can estimate the WBGT (https://www.climatechip.org/excel-wbgt-calculator) the air temperature, **solar radiation**, relative humidity and **wind speed** were entered to supply an estimate of the outdoor WBGT

- Outdoor weather data was collected online from the Lincoln weather station using a website called “Canada Weather Stats” (https://lincoln.weatherstats.ca/download.html) (closest weather station with solar radiation)

Calculation WBGT & UTCI

Version 2

https://www.climatechip.org/excel-wbgt-calculator

Input Data:

Ambient temperature(C)	30.0		
Globe temperature (C)		or Solar Radiation (w/m^2)	700
Dew point (C)		or Relative Humidity (%)	60
Wind Speed (m/s)	1.0		

Output:

UTCI	40.6	Needs ambient temperature, globe temperature OR solar radiation, dew point OR relative humidity and wind speed.
WBGT(outdoors)	29.7	Needs ambient temperature, globe temperature OR Solar radiation, dew point OR relative humidity and wind speed.
WBGT(indoors)	25.9	Needs ambient temperature, dew point OR relative humidity and wind speed.
Mean Radiant Temperature	68.0	

References:

Ramsey JD, Bernard TE (2000) Heat Stress in R Harris (ed) Patty's Industrial Hygiene and Toxicology vol 2 New York: John Wiley & Sons

Bernard TE, Pourmoghani M (1999) "Prediction of Workplace Wet Bulb Global Temperature." Applied Occupational and Environmental Hygiene 14: 126-134

Brice T, Hall T (2009) Wet-bulb calculator http://www.srh.noaa.gov/epz/?n=wxcalc

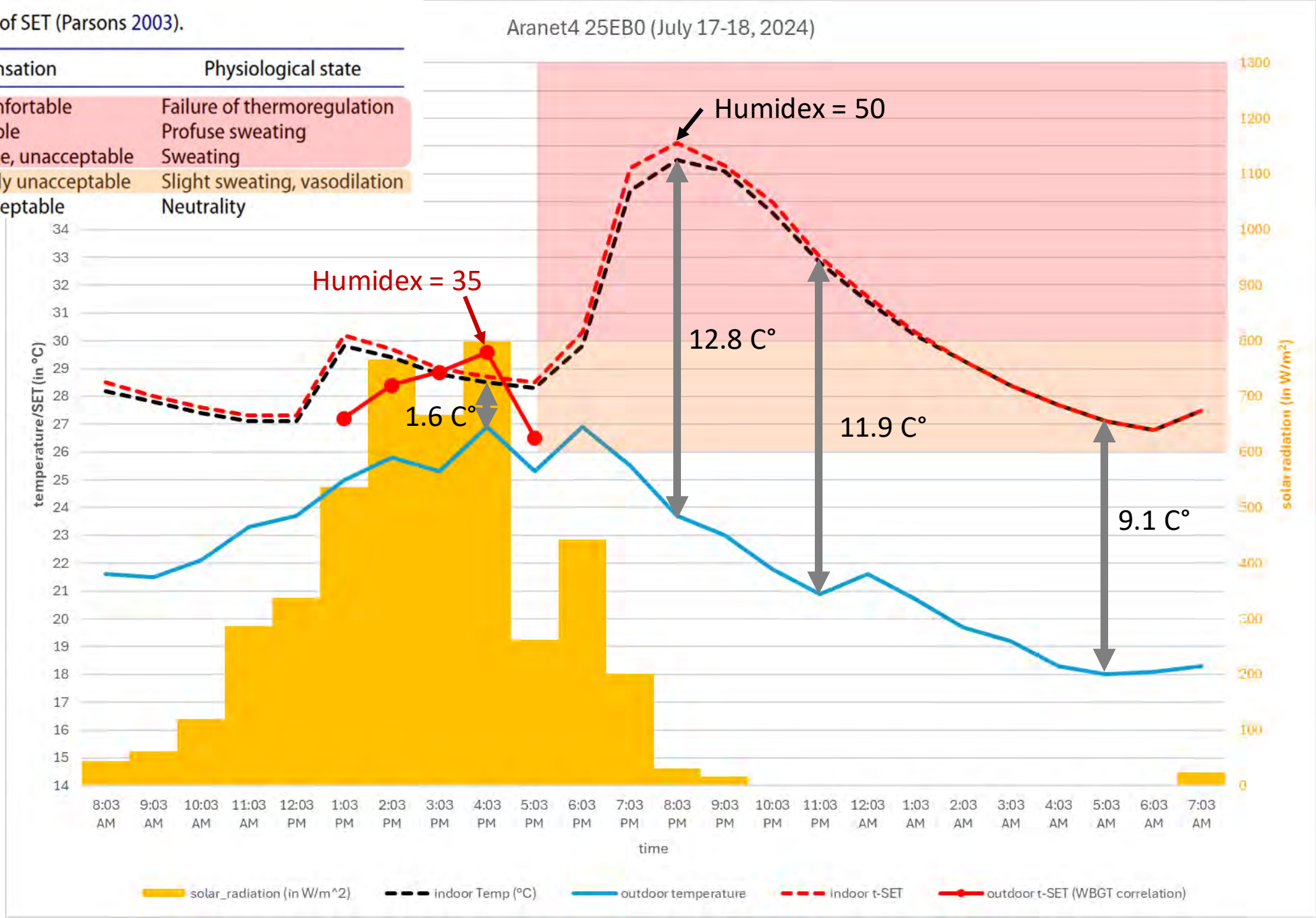
Liljegren J, Carhart R, Lawday P, Tschopp S, Sharp R (2008) "Modeling Wet Bulb Globe Temperature using Standard Meteorological Measurements" Journal of Occupational and Environmental Hygiene 5: 645-655

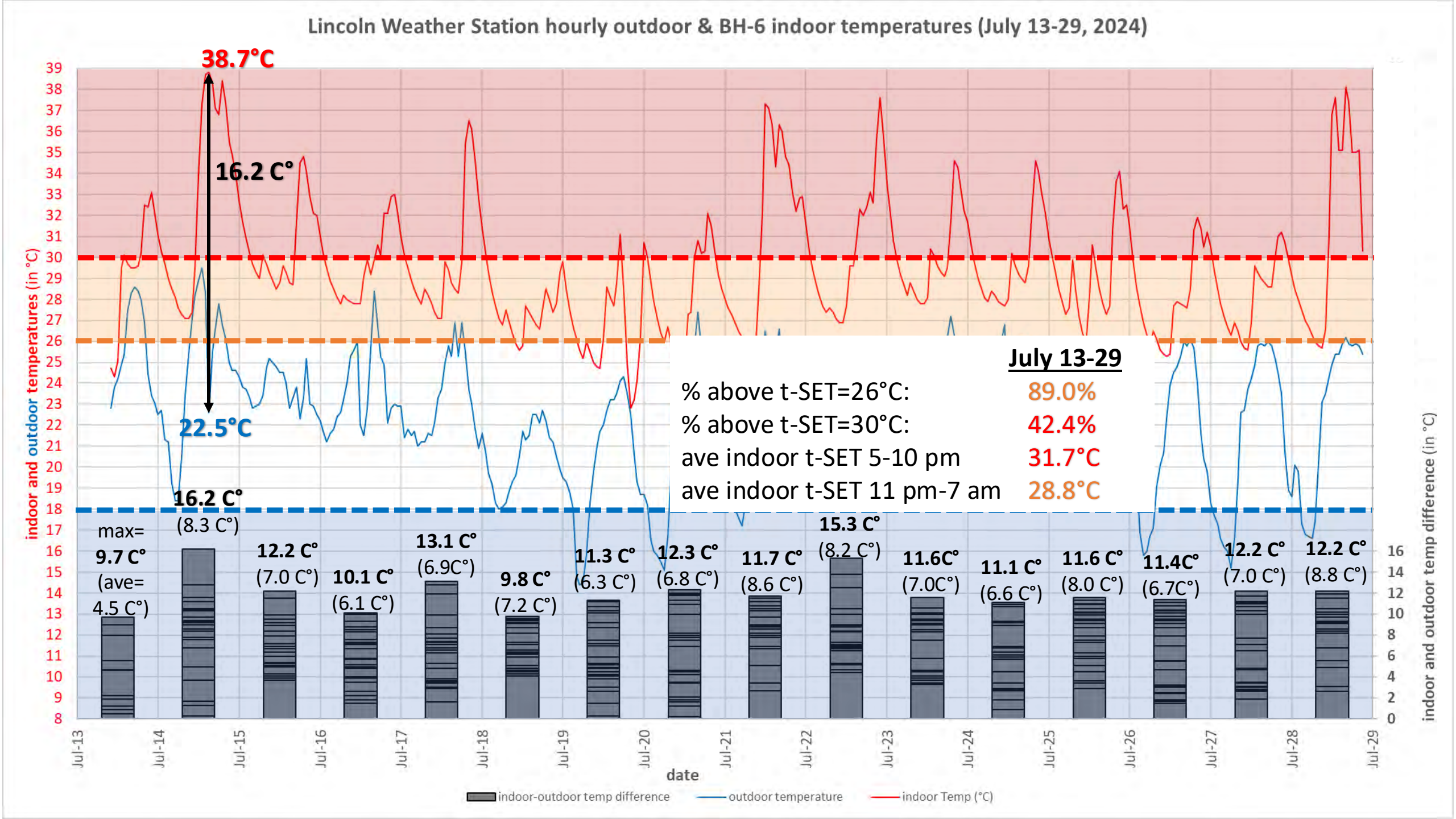
Thorsson S, Lindberg F, Eliasson I, Holmer B (2006) "MEASUREMENTS OF MEAN RADIANT TEMPERATURE IN DIFFERENT URBAN STRUCTURES" SIXTH INTERNATIONAL CONFERENCE ON URBAN CLIMATE p687

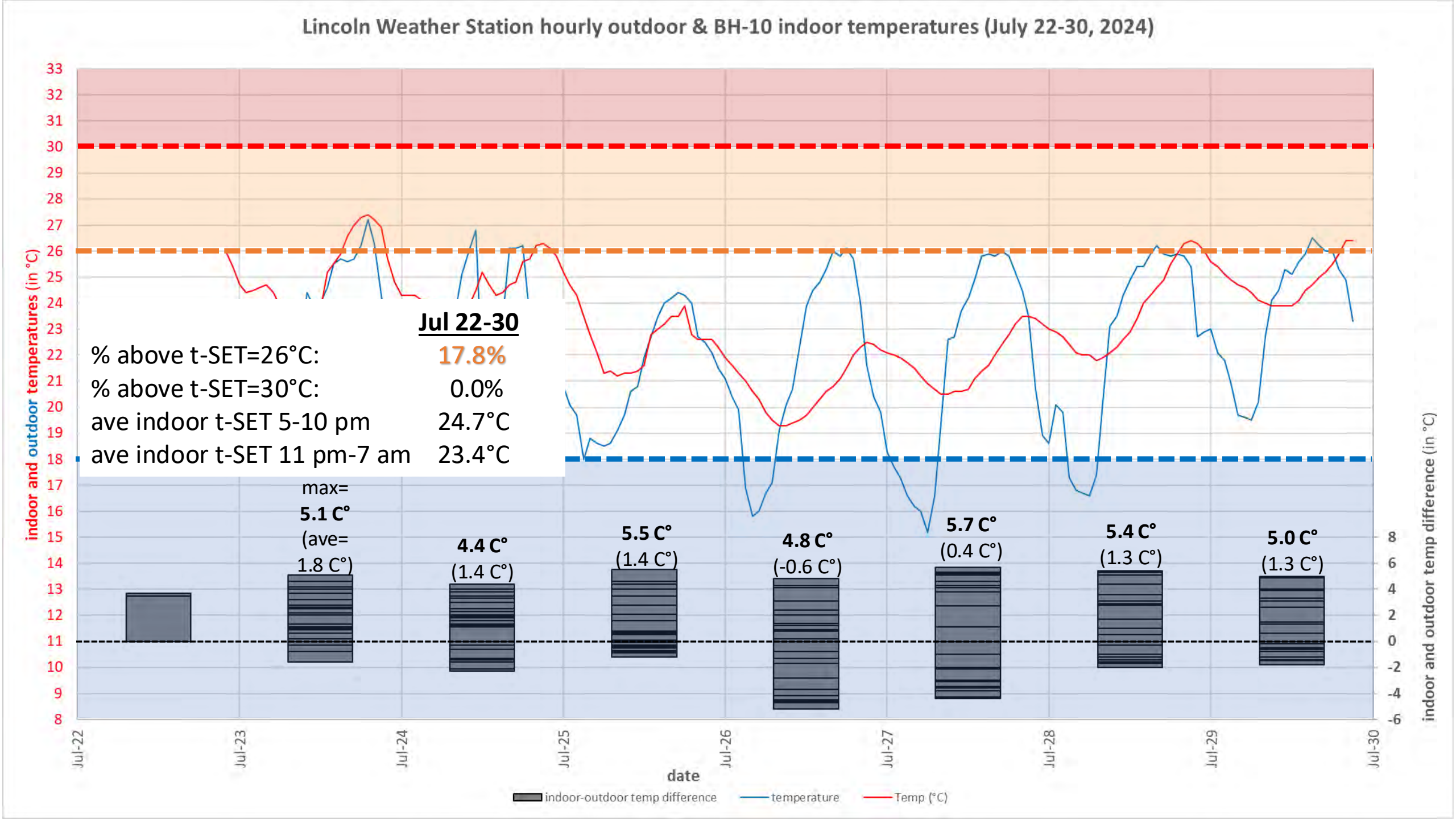
Table 2. Thermal sensation scale of SET (Parsons 2003).

SET (°C)	Thermal sensation	Physiological state
> 37.5	Very hot, very uncomfortable	Failure of thermoregulation
34.5 - 37.5	Hot, very unacceptable	Profuse sweating
30.0 - 34.5	Warm, uncomfortable, unacceptable	Sweating
25.6 - 30.0	Slightly warm, slightly unacceptable	Slight sweating, vasodilation
22.2 - 25.6	Comfortable and acceptable	Neutrality

daily graph example




Lincoln Weather Station hourly outdoor & BH-6 indoor temperatures (July 13-29, 2024)
38.7°C
16.2 C°
22.5°C
16.2 C°
(8.3 C°)
July 13-29
% above t-SET=26°C: 89.0%
% above t-SET=30°C: 42.4%
ave indoor t-SET 5-10 pm 31.7°C
ave indoor t-SET 11 pm-7 am 28.8°C
max= 9.7 C° (ave= 4.5 C°)
12.2 C° (7.0 C°)
10.1 C° (6.1 C°)
13.1 C° (6.9C°)
9.8 C° (7.2 C°)
11.3 C° (6.3 C°)
12.3 C° (6.8 C°)
11.7 C° (8.6 C°)
15.3 C° (8.2 C°)
11.6C° (7.0C°)
11.1 C° (6.6 C°)
11.6 C° (8.0 C°)
11.4C° (6.7C°)
12.2 C° (7.0 C°)
12.2 C° (8.8 C°)
indoor and outdoor temperatures (in °C)
indoor and outdoor temp difference (in °C)
Jul-13
Jul-14
Jul-15
Jul-16
Jul-17
Jul-18
Jul-19
Jul-20
Jul-21
Jul-22
Jul-23
Jul-24
Jul-25
Jul-26
Jul-27
Jul-28
Jul-29
date
indoor-outdoor temp difference
outdoor temperature
indoor Temp (°C)


Lincoln Weather Station hourly outdoor & BH-10 indoor temperatures (July 22-30, 2024)
indoor and outdoor temperatures (in °C)
indoor and outdoor temp difference (in °C)
Jul 22-30
% above t-SET=26°C: 17.8%
% above t-SET=30°C: 0.0%
ave indoor t-SET 5-10 pm 24.7°C
ave indoor t-SET 11 pm-7 am 23.4°C
max= 5.1 C° (ave= 1.8 C°)
4.4 C° (1.4 C°)
5.5 C° (1.4 C°)
4.8 C° (-0.6 C°)
5.7 C° (0.4 C°)
5.4 C° (1.3 C°)
5.0 C° (1.3 C°)
Jul-22
Jul-23
Jul-24
Jul-25
Jul-26
Jul-27
Jul-28
Jul-29
Jul-30
date
indoor-outdoor temp difference
temperature
Temp (°C)

Example of bunkhouse structure from the inside

SCHEDULE F
HOUSING INSPECTION REPORT
SEASONAL AGRICULTURAL WORKER PROGRAM AND AGRICULTURAL STREAM

Suggested addition:

HOUSING INTERIOR

3b. Is there a ventilation and/or cooling system that can maintain a temperature below 26 degrees Celsius (79 degrees Fahrenheit) in any living space within the housing?

Maintaining a room temperature no higher than 26 degrees Celsius (79 degrees Fahrenheit) as the maximum standard.

☐ Yes ☐ No ☐ Could not be verified during this inspection due to: _____

https://catalogue.servicecanada.gc.ca/content/EForms/en/Detail.html?Form=EMP5598

… in either one of these sections?

https://catalogue.servicecanada.gc.ca/content/EForms/en/CallForm.html?Lang=en&PDF=ESDC-EMP5598.pdf

3. Is a permanent heating system that can maintain a temperature ranging between 20 to 23.5 degrees Celsius (68 to 75 degrees Fahrenheit) available within the housing?

A room temperature ranging between 20 to 23.5 degrees Celsius (68 to 75 degrees Fahrenheit) is the minimum standard. Portable space heaters cannot be used as the primary source of heating for any living space within the housing.

☐ Yes ☐ No ☐ Could not be verified during this inspection due to:

5. Is there adequate ventilation by either natural or artificial means in the housing?

To prevent poor air quality, adequate ventilation by either natural means (e.g. windows) or artificial means (e.g. ceiling fans) is required.

☐ Yes ☐ No ☐ Could not be verified during this inspection due to:

What's Next?

- Looking to collect data in different worksites and different industries to measure workplace heat stress conditions and record what actions were taken to prevent heat stress
- This information can be used as a measure to see if "employers are doing the right thing" according to OHSA - S. 25 (2)(h).
- This can also "add pressure" to the implementation of a heat stress regulation.

HEAT STRESS Toolkit

Thank you!

HEAT STRESS Toolkit

agauvin@ohcow.on.ca

joudyk@ohcow.on.ca

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

Occupational Health Clinics for Ontario Workers Inc.

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	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