



Occupational Health Safety and Wellness

HEAT STRESS MANAGEMENT PROGRAM

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Introduction

In promoting a healthy workplace and complying with applicable legislation, Nova Scotia Health recognizes the need for a Heat Stress Management Program, as part of the Occupational Hygiene Program, to provide guidance and direction to Nova Scotia Health Team Members (“Team Member”) for the management of heat stress.

The Heat Stress Management Program includes:

- Task assessment
- Humidex measurements
- Wet bulb globe temperature (WBGT) measurements (where required)
- Team Member education
- Implementation of control measures

Given the variability between individual responses to elevated temperatures, education is available to allow Team Members to recognize signs and symptoms of heat stress, the factors that influence ability to dissipate heat, how to self-monitor for heat stress and when to increase the consumption of water. This applies to all areas and is provided to Team Members via the Nova Scotia Health SharePoint site with the LMS module “Heat Stress and Strain”.

The Heat Stress Management Program applies to:

- Any Team Member who is or may be exposed to conditions which could cause heat stress,
- Conditions which could result in a Team Member’s core body temperature exceeding 38°C (100°F), or
- Conditions which are in excess of the screening criteria values for heat stress exposure for unacclimatized Team Members as per the Nova Scotia Occupational Health and Safety Act and accepted guidelines.

What is Heat Stress?

Heat stress is the buildup of heat in the body to the point where the body has difficulty maintaining normal internal body temperature. When the body is not able to cool itself through sweating, there is a psychological response called heat strain. As heat stress increases, the heat strain on the body also increases resulting in heat-related disorders that can range from fatigue to heat stroke. Heat can also increase the risk of injuries as it can cause sweaty palms, fogged-up safety glasses, and dizziness. Workers who are exposed to hot conditions or work in hot environments may be at risk of heat stress. Caution should be taken when working in hot conditions and it is important to be able to recognize the symptoms of heat-related disorders and the actions to take in response. Refer to *Appendix A – Heat-Related Disorders* for the types,

symptoms and action response of heat-related disorders. Additional information can be found in the LMS module.

Risk Factors Contributing to Heat Stress

There are many risk factors that have the potential to expose Team Members to heat stress. These factors should be taken into consideration when assessing heat stress:

1. Job-related
2. Environmental
3. Personal

Job Related Factors

Team Members may be exposed to heat when working in any, or a combination of, the following conditions:

- Procedures or tasks that require the use of protective clothing, such as fluid resistant protective gowns/suits;
- Procedures or tasks that require physical exertion that can cause the body to generate heat.

Environmental Factors

Environmental factors (temperature, humidity, radiant heat and air velocity) can affect a Team Member's response to heat in the workplace. Examples of environmental factors are:

- Outdoor work during warmer months, especially when accompanied by high humidity and direct sunlight;
- Occupations where there are processes which generate radiant heat, such as in laundry or kitchen areas;
- Poorly ventilated buildings;
- Areas normally air conditioned where the systems are not functioning correctly.

Personal Factors

There are certain physical conditions that can reduce the body's natural ability to withstand elevated temperatures:

- Age
- Weight
- Fitness/physical condition
- Medical condition/medications
- Acclimatization to the heat

Legislation and Guidelines

In Nova Scotia, working in hot conditions is governed by the Workplace Health and Safety Regulations (WHSRs) made under Section 82 of the Nova Scotia Occupational Health and Safety Act (“The Act”). The WHSRs have adopted for use the occupational exposure limit values as per the “Threshold Limit Values and Biological Exposure Indices” booklet (to be referred as the “TLV Booklet”) published by the American Conference of Governmental Industrial Hygienists (ACGIH). The TLV Booklet is updated annually by the ACGIH, however, the WHSRs will identify the applicable version of the TLV Booklet that is authorized for use when referencing occupational exposure limits. These limits must be met at a minimum to be in compliance with The Act.

The ACGIH heat stress screening criteria Threshold Limit Values (TLV) and Action Limits (AL) for heat stress are based off of the Wet Bulb Globe Temperature (WBGT) index. These determined values are to be used in the evaluation and control of heat stress in all work areas with the exception of conventional office spaces. In addition to meeting these requirements, a Humidex based response plan, as per Environment Canada, can be followed to allow a more rapid response to concerns. The Humidex is a measure of how hot a person feels based on the temperature and humidity. The Humidex value can serve as an indicator of discomfort resulting from exposures to heat for both indoors and outdoors.

For office spaces, temperature ranges should be maintained as per the applicable standards and guidelines for those spaces (See Chapter on Indoor Air Quality). When temperature is in excess of the applicable guidelines, the Humidex can be used as a guideline to determine the actions to take to prevent heat stress.

An individual department may set more stringent heat stress guidelines than those referenced in this program if it is determined that there is a significant risk to patient or Team Members. This could be based on specific tasks and/or protective equipment worn that would significantly raise the heat stress on the body. In these cases, managers/supervisors are encouraged to contact Occupational Health, Safety and Wellness (OHSW) department for consultation.

ACGIH – Heat Stress Exposure Limits and Controls

The TLVs and ALs for heat stress, as per the applicable ACGIH TLV Booklet, is set to maintain body core temperature below 38°C (100°F) for the average person. The method of assessing heat stress risk is based on a WBGT index. The assessment for heat stress must be conducted by the Occupational Hygiene Team (with the OHSW department) to properly evaluate the risks to health and safety. The evaluation of heat stress concerns is conducted following the flow diagram in Appendix B.

The heat stress screening criteria TLVs represent conditions under which it is believed that nearly all heat acclimatized, adequately hydrated, unmedicated, health workers may be repeatedly exposed without adverse health effects. Acclimatization is the gradual physiological adaptation

that improves a Team Member's ability to tolerate heat stress. A Team Member is considered to be acclimatized if they have been exposed for a period of five of the last seven days to heat stress conditions that are similar to those that are expected for the work. When the exposure is discontinued, the Team Member's acclimatization begins to decline with a noticeable loss within four days. For unacclimatized Team Members, the screening criteria also details ALs.

The results of the heat stress assessment is used to determine the controls or monitoring that should be put into place to reduce heat stress on the body. *Appendix C – Heat Stress Evaluation, Exposure Limits, Monitoring and Action Control* details the heat stress assessment as per the applicable version of the ACGIH TLV Booklet.

Humidex Based Response Plan

Under certain workplace conditions, the Humidex value can serve as an indicator of discomfort resulting from occupational exposures to heat. For example, when workload, wind speed and radiant heat sources do not significantly contribute to the heat burden, the Humidex value may be used as a guideline. Offices are typical workplaces where Humidex values could be used.

The temperature and relative humidity readings at the workplace are compared to the Humidex Chart to determine the controls or monitoring that should be put into place to reduce heat stress on the body. *Appendix E – Humidex Based Response Plan* details the procedure and control actions.

Managing Heat Stress

Roles and Responsibilities

The Act assumes that the primary responsibility for creating and maintaining a safe and healthy workplace should be that of each of the workplace parties (e.g. employer, employees, contractors, etc.), to the extent of each party's authority and ability to do so. To provide greater clarity and direction, the following specific responsibilities to address heat stress in the workplace are provided:

The Employer:

- Identifies and assesses areas, tasks and occupations where there is the potential for heat stress;
- Implements and/or provides controls (engineering, administrative, or personal protective equipment (See *Appendix D –Control Measures to Prevent Heat Accumulation*) to minimize heat stress; and,
- Provides training and education regarding heat stress, including but not limited to:
 - Early signs and symptoms of heat-related disorders
 - Factors that enhance individual susceptibility to heat
 - Control measures for the prevention of heat-related disorders

- Actions to take if symptoms are experienced

The Manager:

- Implements the Heat Stress Management Program in their department and ensures Team Members are aware of the various components;
- Accesses available education to be able to recognize signs and symptoms of heat stress in Team Members;
- Supplies and implements the appropriate control measures to mitigate the risks associated with elevated temperatures (e.g water, additional ventilation, work/rest schedules, etc.); and,
- Reports to OHSW any area where elevated temperatures are a concern using the appropriate Nova Scotia Health zone reporting process (i.e report to SAFE Line or complete a Safety Improvement and Management System (SIMS)).

Team Member:

- Completes the education (*LMS Module "Heat Stress and Strain" and Brochure – "Dealing with Hot Weather"* – available from OHSW)
- Participates in monitoring programs to assess Team Member exposure to conditions that could cause heat stress;
- Self-monitors and monitors fellow Team Members when working in hot conditions;
- Adheres to all control measures or work procedures that have been implemented to reduce exposure to conditions that could cause heat stress; and
- Informs the Supervisor or Manager if signs or symptoms of a heat-related disorder appear. If the Supervisor or Manager is not available, leaves the hot work area and rests in the department designated cool location, such as an air-conditioned area.
- Reports any incident related to heat stress using the appropriate Nova Scotia Health zone reporting process (i.e report to SAFE Line or SIMS.)

Occupational Health, Safety, & Wellness:

- Administers and maintains the Heat Stress Management Program;
- Evaluates workplace areas for inclusion in the Heat Stress Management Program;
- Provides educational materials;
- Measures WBGT values, in some cases, in response to requests from Team Members, managers or Joint Occupational Health and Safety Committees (JOHSC) expressing a concern regarding recorded elevated temperatures; and,
- Identifies control measures to mitigate the effects of elevated temperatures.

Implementation

If conditions are found to be uncomfortable by Team Members who are not required to wear protective clothing and who have a light to moderate work demand, the departmental Manager or delegate:

- Measures the air temperature and relative humidity using a hygrometer (contact OHSW on how to obtain one) and takes action as per *Appendix E.1 – The Humidex Based Response Plan*.
- Records hourly measurements when the Humidex value is greater than 30°C (See *Appendix E.2 – Humidex Temperature Recording Form*).
- Implements control measures to reduce heat accumulation (See *Appendix D – Control Measures to Prevent Heat Accumulation*), as appropriate.
- Contacts OHSW with concerns as well as to request the measurement of the WBGT value (if deemed necessary by OHSW) and assistance in the identification of control measures.

In areas where Team Members are required to wear protective clothing, perform tasks that require high work demands, or work in areas with constant elevated temperatures and/or humidity (e.g., laundry, kitchen), the Manager or delegate:

- Evaluates the situation and implements appropriate control measures according to the flow diagram found in *Appendix B – Control Measures for the Evaluation of Heat Stress Concerns*.
- Contacts OHSW for assistance in the evaluation and measurement of the WBGT value and the identification of control measures.
- When the measurement of the WBGT is requested:
 - Provides notice to the appropriate JOHSC, and/or the requesting JOHSC member, as soon as possible to give them opportunity to observe the measurements.
 - Post notices to inform staff that monitoring will be conducted.

Observation of the measurement by a JOHSC member may not always be possible; however, the WBGT values are documented and made available to the JOHSC.

The Occupational Hygiene Team maintains a record of WBGT values (when measured) and provides this information to Managers and JOHSC members, upon request.

Definitions

Acclimatized Member:	Team	A Team Member is considered to be acclimatized if they have been exposed for a period of 5 of the last 7 days to heat-stress conditions that are similar to those expected for the work. When the exposure is discontinued, the staff member’s acclimatization begins to decline with a noticeable loss within 4 days.
Nova Scotia Health Member:	Team	All employees, physicians, learners, volunteers, board members, contractors, contract workers, franchise employees, and those with affiliated appointments and other individuals performing activities within Nova Scotia Health. Referred to as Team Members throughout the document.
Heat Stress:		The net heat load to which a Team Member can be exposed from the combination of workload, environmental factors (air temperature, humidity, radiant heat and air movement) and clothing requirements.
Heat Strain:		Overall physiological response to heat stress, for the dissipation of excess heat from the body.
Humidex:		A value combining the air temperature and the relative humidity into one number, used to indicate how hot weather feels to the average person.
Hygrometer		A device used to measure ambient temperature and percent relative humidity.
Joint Occupational Health and Safety Committee (JOHSC):		A committee established under Nova Scotia Occupational Health and Safety Act with an established Terms of Reference.
Percent Relative Humidity (%R.H.):		The moisture content of air expressed as a percentage of the maximum it can hold at a given temperature; the optimum %RH is 30 to 60%
Wet Bulb Globe Temperature (WBGT):		An index used to quantify the level of heat stress on Team Members from the combined effects of air temperature, relative humidity and radiant heat. The ACGIH work-rest regimen is based on WBGT values.

Forms, Templates and Additional Information

- Humidex Temperature Recordings (Appendix E.2)
- Dealing with Hot Weather (brochure)
- LMS Module – Heat Stress and Strain

References

ACGIH (American Conference of Governmental Industrial Hygienists). TLVs & BEIs. Cincinnati, OH: Signature Publications; 2020.

CCOHS (Canadian Centre for Occupational Health and Safety). Humidex Rating and Work. Retrieved from: https://www.ccohs.ca/oshanswers/phys_agents/humidex.html

Province of Nova Scotia. Heat Stress Guidelines Document. Retrieved from: <https://novascotia.ca/lae/healthandsafety/documents/HeatStressGuidelines.pdf>

Province of Nova Scotia. Workplace Health and Safety Regulations made under section 82 of the Occupational Health and Safety Act, effective October 1, 2014.

APPENDIX A

HEAT-RELATED DISORDERS

Appendix A - Heat-Related Disorders - The Effects of Heat and Possible Influencing Factors

When the body produces energy by physical exertion and/or receives energy from an external heat source, the body temperature will start to rise. To offset the rise in body temperature, the body's cooling mechanisms will be initiated. These include perspiration (less efficient in humid conditions) and dilation of the blood vessels with increased blood flow to the surface of the skin so the blood can be cooled by the surrounding air (why the skin becomes flushed when a person is hot).

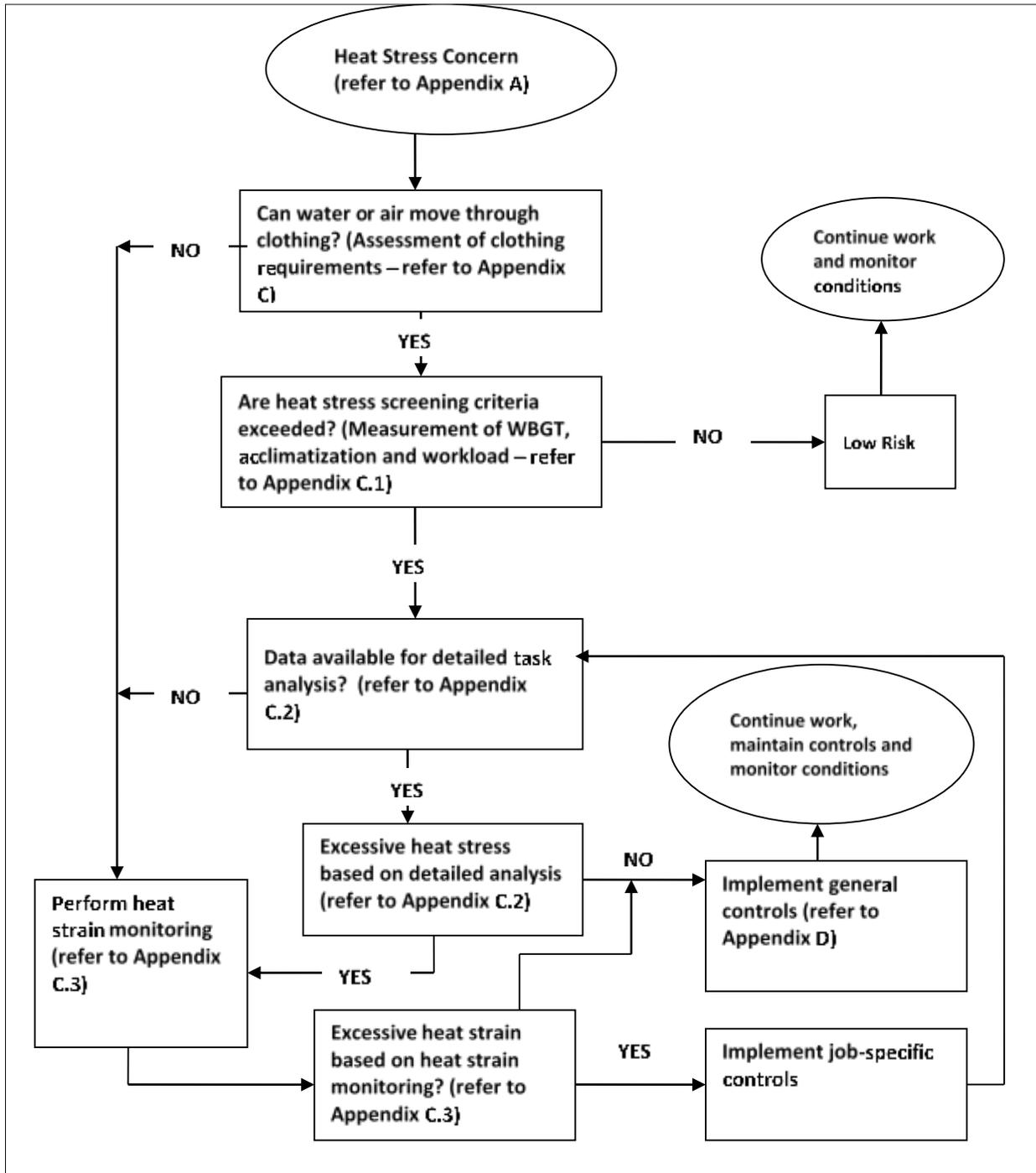
When environmental conditions, the use of protective clothing and/or the level of physical activity interrupt the body's cooling mechanisms the potential for a heat-related disorder increases.

The following is a list of heat-related disorders, the health effects caused by each and the actions to take if they occur. If you are at work, you should notify your supervisor immediately if you or a co-worker develops any of these symptoms.

Heat Stress Disorder	Health Effects	Action
Heat Fatigue	Impaired performance, mental concentration or vigilance.	Remove the person from the heat and provide cool water to drink.
Heat Rashes	Red bumps where clothing is restrictive or chafes. Bumps begin to feel prickly when sweating increases.	Heat rash will normally disappear when individual returns to a cooler environment.
Heat Collapse	Loss of consciousness. In a faint or collapse, the brain does not receive enough oxygen because blood pools in the extremities.	Move the individual to a cooler area, loosen clothing and give fluids.
Heat Cramps	Caused by lack of water, cramps usually occur when performing hard physical labour in a hot environment.	Water must be taken every 15 to 20 minutes in hot environments.
Heat Exhaustion	Headache, nausea, dizziness, blurred vision, weakness or fatigue, giddiness and/or thirst. Skin is damp and looks muddy or flushed, similar to the symptoms of heat stroke.	Remove the individual from the hot environment, give fluids, loosen clothing, shower or sponge bath with cool water and allow to rest in a cool place.
Heat Stroke	Confusion, irrational behaviour, loss of consciousness, convulsions, hot dry skin that may be red, mottled or bluish, lack of sweating (usually) and abnormally high body temperature. This is a medical emergency.	Immediate emergency medical attention is required.

APPENDIX B
FLOW DIAGRAM FOR THE EVALUATION OF
HEAT STRESS CONCERNS

Appendix B – Flow Diagram for the Evaluation of Heat Stress Concerns



APPENDIX C
**ACGIH - HEAT STRESS EVALUATION,
EXPOSURE LIMITS, MONITORING AND
ACTION CONTROL**

Appendix C.1 – Heat Stress Evaluation, Exposure Limits and Action Controls

The threshold limit values (TLV) and Action Limits (AL) for heat stress, as per the version of ACGIH TLV Booklet authorized for use by The Act, is set to maintain body core temperature below 38°C (100°F) for the average person. The assessment for heat stress must be conducted by the Occupational Hygiene Team to properly evaluate the risks to health and safety. The evaluation of heat stress concerns is conducted following the flow diagram in *Appendix B*.

The heat stress screening criteria TLVs represent conditions under which it is believed that nearly all heat acclimatized, adequately hydrated, unmedicated, health workers may be repeatedly exposed without adverse health effects. Acclimatization is the gradual physiological adaptation that improves a Team Member's ability to tolerate heat stress. A Team Member is considered to be acclimatized if they have been exposed for a period of five of the last seven days to heat stress conditions that are similar to those that are expected for the work. When the exposure is discontinued, the Team Member's acclimatization begins to decline with a noticeable loss within four days. For unacclimatized Team Members, the screening criteria also details the ALs.

Evaluating Risk Factors for Heat Stress

The heat stress screening criteria for the determination of the appropriate TLV or AL is based on the Wet Bulb Globe Temperature (WBGT) calculation (thermal environment) and involves adjusting for the type of type of clothing being worn, work demand, and to determine the proportion of work and rest within an hour.

Thermal Environment

The WBGT measurements for the thermal environment is collected using a heat stress monitor that consists of a dry bulb thermometer (air temperature), black bulb globe thermometer (radiant heat), and a wet bulb thermometer (evaporation cooling). The measurements are also dependant on whether sunlight is direct (outdoors) or not (indoors).

Type of Clothing

The body's main heat removal mechanism is the evaporation of sweat from the skin, therefore, the clothing worn by Team Members may affect the body's ability to remove heat. As the WBGT is only an index of the thermal environment, it does not indicate what the Team Member is experiencing inside their clothing. The screening criteria is based on fully clothed staff wearing summer work garments of lightweight pants and long sleeved shirt. Therefore, the measured WBGT must be adjusted for the type of clothing worn (See Table Below). If the clothing type is not represented in the table, then it is important that there is monitoring for signs and symptoms

of heat-related disorders (*Appendix A*) and Heat Strain (See *Appendix C-3 –Heat Strain Monitoring*).

Adjustments for Clothing Type	
Clothing Type	Addition to WBGT(°C)
Work clothes(long sleeve shirt and pants)	0
Cloth (woven material) overalls	0
Double-layer woven clothing	3
SMS polypropylene coveralls	0.5
Polyolefin coveralls	1
Limited-use vapor-barrier coveralls	11
**Values as per the 2020 publication of the ACGIH TLV Booklet	

Work Demand

As work demands increase, the body’s metabolic rate increases which causes a rise in core body temperature. The work demand must be determined to be able to compare the WBGT to the TLV screening criteria. The TLVs are based off of light, moderate, heavy and very heavy work demands (See table below).

Table 2 – Work Demand	
Demand	Activity Examples
Light Work	<ul style="list-style-type: none"> • Sitting with moderate arm and leg movement • Standing with light work at machine or bench while using mostly arms • Using a table saw • Standing with light or moderate work at machine or bench and some walking about
Moderate Work	<ul style="list-style-type: none"> • Scrubbing in a standing position or mopping • Walking about with moderate lifting or pushing • Walking on level ground at 6 km/hour while carrying a 3 kg. weight load
Heavy Work	<ul style="list-style-type: none"> • Carpenter sawing by hand • Shoveling dry sand • Heavy assembly work on a non-continuous basis • Intermittent heavy lifting with pushing or pulling (e.g., pick & shovel work)
Very Heavy Work	<ul style="list-style-type: none"> • Shoveling wet sand • Very intense activities at fast to maximum pace

Screening Criteria TLV and ALs

Once the work demand and the acclimatization status of the Team member (s) is determined, the WBGT value (including clothing adjustments) is compared to the screening criteria TLVs and ALs (See table below) to determine if additional monitoring and controls are required to reduce heat stress.

Allocation of work in a cycle of work and recovery	Threshold Limit Value (Acclimatized)				Action Limit (Unacclimatized)			
	Light	Moderate	Heavy	Very heavy	Light	Moderate	Heavy	Very heavy
75% to 100%	31	28		-	28	25		-
50% to 75%	31	29	27.5	-	28.5	26	24	-
25% to 50%	32	30	29	28	29.5	27	25.5	24.5
0 to 25%	32.5	31.5	30.5	30	30	29	28	27
**Values as per the 2020 publication of the ACGIH TLV Booklet								

The following actions are to be taken depending on where the measured WBGT falls on the screening criteria table for the TLVs and ALs:

- If the measured WBGT value falls within the applicable TLV/AL ranges for work demands then the corresponding allocation of work in a work/recovery cycle within each hour of work, is to be applied to control heat stress. In addition to work/recovery cycles for heat stress control, other control measures should be used in conjunction to prevent heat accumulation. Appendix E details other control measures to be taken into consideration and applied, where necessary.
- If the measured WBGT is less than the applicable screening criteria values then work can continue. Although there is little risk to of exposures to heat stress, it is important to continue to monitor conditions for signs of heat stress (*Appendix A*).

If the measured WBGT is equal to or higher than the applicable screening criteria values then further detailed task analysis must be considered (*Appendix C.2 – Detailed Task Analysis*).

Appendix C.2 - Detailed Task Analysis

If the measured Wet Bulb Globe Temperature (WBGT) is higher than the screening criteria threshold limit values (TLV) and Action Limits (AL) values, it may be necessary to perform a detailed task analysis to determine if the actual work demand for a one-hour period actually exceeds the screening criteria. If there is no availability of data for the detailed work analysis, then Heat Strain Monitoring (*Appendix C.3*) must be conducted to assess the degree of heat strain.

If a staff member is assigned different tasks within a one-hour period, it is necessary to determine a time-weighted average (TWA) for the work demands. This can be done by assigning a metabolic rate to each task that will be performed in the hour and multiply it by the duration of the task. The product of work demand and duration for each task (See table below) is then added up, and the sum is divided by the total duration of all tasks performed during the averaging period.

Metabolic Rates for Work Tasks		
Activity or work task	Average kcal/min	Average kcal/hr
<i>Body position and movement:</i>		
Sitting	0.3	18
Standing	0.6	36
Walking on a level surface	2.0 to 3.0	150
Walking uphill	To 2.5, add 0.8 for every meter of rise	To 150, add 48 for every meter of rise
<i>Type of work:</i>		
Hand work:		
Light	0.4	24
Heavy	0.9	54
One-arm work:		
Light	1.0	60
Heavy	1.7	102
Two-arm work:		
Light	1.5	90
Heavy	2.5	150
Whole-body work:		
Light	3.5	210
Moderate	5.0	300
Heavy	7.0	420
Very Heavy	9.0	540
Basal Metabolism	1.0	60

Note: The metabolic rates are for a standard staff member with a body weight of 70 kg (154 lb.) and a body surface area of 1.8 m² (19.4 ft²).

Once the TWA for the work demand is calculated, the metabolic rate category (light, moderate, heavy, and very heavy) is selected from the table below.

Metabolic Rate Categories and the representative metabolic rate with example activities (as per the 2018 edition of the ACGIH TLVs and BEIs)		
Category	Metabolic Rate (W)	Examples
Rest	115	Sitting
Light	180	Sitting with light manual work with hands or hands and arms, and driving. Standing with some light arm work and occasional walking.
Moderate	300	Sustained moderate hand and arm work, moderate arm and leg work, moderate arm and trunk work or light pushing and pulling. Normal walking.
Heavy	415	Intense arm and trunk work, carrying, shoveling, manual sawing; pushing and pulling heavy loads; and walking at a fast pace.
Very Heavy	520	Very intense activity at fast to maximum pace.

Example of a calculated work demand (TWA):

A nurse will perform three tasks over an hour period – turn a patient, write reports and distribute medications. What is the work demand for the one-hour period?

The metabolic rate must be calculated for each task

- turn a patient which requires 15 minutes
 - o standing – 0.6 kcal/min
 - o working both arms (heavy) and heavy work of the body – 5.0 kcal/min. (intermediate value)
 - o basal metabolism – 1.0 kcal/min

Total for Task 1: 6.6 kcal. /min x 15 minutes = 99 kcal

- writing reports for 15 minutes
 - o sitting – 0.3 kcal./min
 - o heavy handwork – 0.9 kcal/min
 - o basal metabolism – 1.0 kcal/min

Total for Task 2: 2.2 kcal/min x 15 minutes = 33 kcal

- distributing medication for 30 minutes
 - o walking – 2.0 kcal/min
 - o working both arms (light) – 1.5 kcal/min
 - o basal metabolism – 1.0 kcal/min

Total for Task 3: 4.5 kcal/min x 30 minutes = 135 kcal

The metabolic rate for the three tasks over an hour period is 267 kcal, which corresponds to a moderate work demand.

Once the actual work demand and the acclimatization status of the Team Member(s) is determined, the WBGT value (including clothing adjustments) is compared to the screening criteria TLVs and ALs to determine if additional monitoring and controls are required.

If the WBGT from the analysis does not exceed the applicable TLV/AL ranges for work demands then control measures should be used to prevent heat accumulation (See **Appendix D**) along with continued monitoring for signs of heat stress (**Appendix A**).

If the measured WBGT is equal to or higher than the applicable screening criteria values then Heat Strain Monitoring (See **Appendix C.3**) must be conducted to demonstrate that adequate protection is provided.

Appendix C.3: Heat Strain Monitoring

As evaporation is the most significant heat removal mechanism, the wearing of protective clothing that is water–vapour impermeable or air–impermeable and/or several layers of clothing will severely restrict heat removal. The occurrence of a heat stress disorder is possible even when the ambient conditions are considered cool. When this type of protective clothing must be worn, the measurement of the WBGT would not represent the actual exposure conditions of the staff member. Therefore, the use of heat strain monitoring (physiological monitoring) is required to ensure safe body temperatures have not been exceeded.

In accordance with the 2020 ACGIH publication "Threshold Limit Values and Biological Exposure Indices", excessive heat strain may be marked by one of the following:

- Sustained (several minutes) heart rate is in excess of 180 bpm (beats per minute) minus the individual's age in years (e.g., 180–age), for individuals with assessed normal cardiac performance; or
- Body core temperature is greater than 38.5°C (101.3 °F) for medically selected and acclimatized Team Members; or greater than 38°C (100.4 °F) in unselected and unacclimatized Team Members; or
- Recovery heart rate at one minute after a peak work effort is greater than 120 bpm; or
- There are symptoms of sudden and severe fatigue, nausea, dizziness or lightheadedness.

If one of the listed conditions applies, the Team Member should be relocated to a cool location with rapidly circulating air and allowed to rest. Observation of the Team Member is necessary to initiate emergency care if needed.

APPENDIX D

CONTROL MEASURES TO PREVENT HEAT ACCUMULATION

Appendix D – Control Measures to Prevent Heat Accumulation

There are three types of control measures that can be taken to reduce exposure conditions that could cause heat stress. The most effective of the control measures are engineering controls, followed by administrative controls and the least effective, personal protective equipment. It is the responsibility of management to provide and implement the appropriate control measures to reduce heat stress on Team Members. The following table provides a summary of the control measures that could be implemented.

Table 5 – Summary of Control Measures	
Method of Control	Action
Engineering Controls	
Reduce body heat production	Automate and/or mechanize tasks to reduce heavy physical work
Reduce exposure to radiant heat from hot objects	Insulate hot surfaces, use reflective shields or remote controls
Reduce heat gain from surrounding air	Lower air temperature, increase air speed if air temperature below 35°C, increase ventilation
Increase sweat evaporation	Reduce humidity, use a fan to increase air speed
Administrative Controls	
Acclimatization	Allow sufficient acclimatization period (5 out of 7 days at the exposure conditions) before full workload
Duration of work	Shorten exposure time and use frequent rest breaks
Rest area	Provide cool (air-conditioned) rest-areas
Water	Provide cool drinking water and encourage staff to drink small amounts frequently
Pace of Work	Allow staff to set their own pace of work and promote self-monitoring
Education	Training of staff, including symptoms associated with heat stress, factors increasing susceptibility, safe work procedures, monitoring programs, and safe use of protective clothing
Signage	Posting of heat stress hazard warning signs
Protective Clothing	
Anti-radiant heat or reflective clothing	Used when there is excessive radiant heat from a hot surface that cannot be covered or shielded

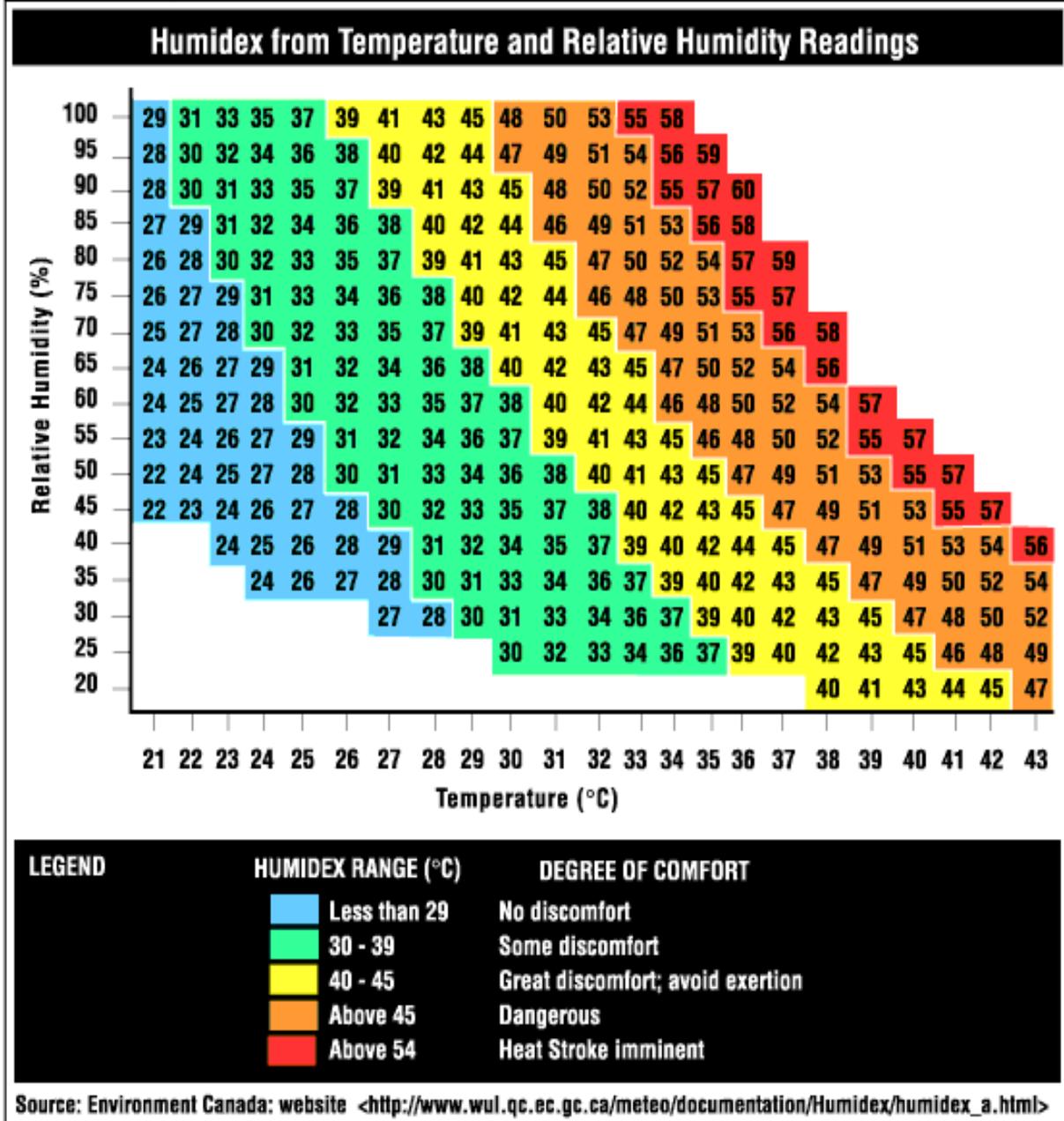
Temperature-controlled suits	Use of ice pack vests, wetted overclothing (bandanna, wrist bands, head bands), air-cooled suits
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APPENDIX E

HUMIDEX BASED RESPONSE PLAN

Appendix E.1 – Humidex Based Response Plan

Under certain workplace conditions, the Humidex value can serve as an indicator of discomfort resulting from occupational exposures to heat. For example, when workload, wind speed and radiant heat sources do not significantly contribute to the heat burden, the Humidex value may be used as a guideline. Offices are typical workplaces where Humidex values could be used.



When the Humidex Value is:	Action to take:
25–29°C	Not required, but staff are encouraged to stay hydrated.
30–33°C	Heat Stress Alert is in effect. Staff members are encouraged to drink extra water and information is provided by managers/supervisor (via this program) about recognizing the signs and symptoms of heat stress. As long as the Humidex value exceeds 30°C, measurements of temperature and relative humidity are recorded on at least an hourly basis
34–37°C	Heat Stress Warning is in effect; Staff members are instructed to drink extra water and information is provided about recognizing the signs and symptoms of heat stress.
38–39°C	Staff members receive 15 minutes rest relief per hour in addition to the provisions listed for a Humidex of 33–37°C. Any staff member with symptoms is instructed to seek medical attention
40–41°C	Staff members receive 30 minutes relief per hour in addition to the provisions listed for a Humidex of 38–39°C
42–44°C	If feasible, staff members receive 45 minutes relief per hour in addition to the provisions listed for a Humidex of 38–39°C.
>45°C	Only medically supervised work may continue

