

1.0 INTRODUCTION

This standard outlines the hazards associated with heat and cold stress, and the procedures and precautions that can reduce harm associated with the hazards.

2.0 SCOPE

This standard defines the mandatory activities or tasks to be executed to prevent illness, injury and reduce risk associated with thermal stress that may arise from environmental and/or working conditions. This is intended for use by all NBP employees and contractors.

3.0 REFERENCES

NB OHS General Regulation 91-191	New Brunswick Occupational Health and Safety Regulation 91-191 Part II: Section 4 – Drinking Water
NB OHS General Regulation 91-191	New Brunswick Occupational Health and Safety Regulation 91-191 Part III: Sections 22 and 23 – Extremes of Temperature
WorkSafe Alberta	Working Safely in the Heat and Cold, WorkSafe Alberta OHS Publication. Best Practice: Working Safely in the Heat and Cold (alberta.ca)
Occupational Health Clinics for Ontario Workers Inc	Humidex Based Heat Response Plan, Occupational Health Clinics for Ontario Workers Inc. Heat / Cold Extremes - OHCOW
Saskatchewan Labour	Cold Condition Guidelines for Working Outside, Saskatchewan Labour. http://ae.gov.sk.ca/cold-condition-guidelines-for-working-outside
Environment Canada	Environment Canada, Meteorological Service of Canada, Humidex Documentation, http://www.qc.ec.gc.ca/meteo/documentation/humidex_e.html
ACGIH	American Conference of Governmental Industrial Hygienists ACGIH works continuously to enhance the occupational, environmental, health, and safety fields. Our research provides you with the science and data you need to ensure the safety of your employees and community. Subscription support is crucial to the continued research and development of occupational science.

4.0 TERMS AND DEFINITIONS

Acclimatization	It is the increase in body's physiological adaptation and tolerance to the environmental temperature which occurs over time (ACGIH®).
Cold stress	The fall of body core temperature from 36 or 37°C as the body fails in maintaining body heat after being exposed to extremely cold, windy and/or wet conditions. It is associated with multiple cold related illnesses and injuries, some that may be fatal (ACGIH®).
Core temperature:	The temperature of the body in the region where the vital organs are present. It is a thermal shell surrounding the vital organs and maintaining their functionality by keeping the temperature around them constant (ACGIH®).

Heat strain	Physiological response of the body to prevent an increase of core body temperature from 36-37°C in extremely hot and/or humid conditions by removing excess heat (ACGIH®).
Heat stress	The "net [overall] heat load to which a worker may be exposed from the combined contributions of metabolic heat, environmental factors (i.e., air temperature, humidity, air movement, and radiant heat), and clothing requirements.
Relative humidity	It is the ratio of partial pressure of water vapor to the saturation pressure of water vapor at equal temperature and pressure
Dry bulb temperature	Temperature measured in ambient air in the absence of moisture (NIOSH).
TLVs®	Threshold Limit Values that give the maximum exposure limit for occupational hazards such as physical, chemical and biological hazards (ACGIH®).
Wet-bulb globe temperature (WBGT)	A heat stress index which represents a temperature that includes the total temperature effect or the heat load on humans due to air temperature, humidity, wind and radiation (Industrial Hygiene Bulletin and ACGIH®).

5.0 **ROLES AND RESPONSIBILITIES**

5.1 **Managers**

- Provide resources and means to prevent or reduce health effects related to thermal stress such as, but not limited to,
 - Engineering Controls
 - Breaks
 - Shelters
 - Clothing
 - PPE
 - Fluids

5.2 **Supervisor**

- Ensure workers adhere to the required work/rest requirements, when applicable.
- Schedule work such that thermal stress risk is reduced (e.g. avoid hot work during peak sunlight hours; or implement a work-warm up schedule when required
- Communicate thermal stress level to workers, as required.
- Provide workers with adequate means of hydration
- Ensure workers are provided with breaks in line with this document in a suitable location
- Permit workers to self-regulate work pace and rest where applicable.
- Ensure workers are aware of health effects and signs and symptoms of thermal stress



5.3 Employee

- Follow all requirements as per this instruction.
- Understand, recognize and report signs of thermal stress to supervisors immediately.
- If you experience any symptoms of heat or cold related illnesses, you are to report to your immediate supervisor on the day it occurs. Prompt, appropriate care will often reduce the severity of symptoms.
- Report any physical or medical conditions that could increase susceptibility to thermal stress to the applicable supervisor (e.g. medication, illness, etc)
- Take all necessary precautions to prevent or reduce impacts of thermal stress.

5.4 Total Health and Safety

- Perform thermal risk assessments, when requested, or when proactively identified through means such as JHA (Job Hazard Analysis) or other work planning tools
- Serve as Subject Matter Experts for thermal stress.

6.0 STANDARD

6.1 Thermal Stress

Thermal stress occurs when environmental conditions contribute to shifting core body temperature away from its normal operating range (36-38C). Occupational exposure to thermal stress can result in a variety of impacts ranging from increased risk of accidents and reduced productivity to potentially fatal disorders, such as hypothermia and heat stroke.

Thermal stress is highly complex and driven by a multitude of environmental, job specific and individual factors such as:

- Temperature
- Wind speed
- Humidity
- Radiant heat sources
- Amount of work being performed
- Amount and type of clothing worn
- Individual susceptibility

The largest variable is undoubtedly, individual susceptibility and can be impacted by

- Underlying medical conditions
- Age
- Physical condition
- Smoking habits
- Degree of acclimatization

Despite its complexity, there are environmental conditions that are generally known to increase risk of thermal stress and require mitigation. This standard outlines those conditions and the required mitigation to prevent thermal stress. It also identifies conditions that require additional analysis and control to ensure worker protection.

6.2 Cold Stress

Cold stress occurs when the body is cooled (via convection, evaporation and conduction) to levels that damage cells or reduce the core body temperature. Tissue cooling is directly related to, but not limited to, the following:

- Air temperature
- Wind speed
- Amount of work being done
- Type and amount of clothing

6.2.1 Symptoms and Hazards

The Threshold Limit Values (TLVs) in Appendix D are to prevent the deep body core temperature from falling below 36°C and to prevent cold injury to body extremities.

Core body temperature should never be allowed to reach 35°C.

	Symptoms	Treatment
Frostbite	A common injury caused by exposure to extreme cold or by contact with extremely cold objects (especially those made of metal). Frostbite occurs when tissue temperature falls below the freezing point (0°C/32°F), or when blood flow is obstructed. Blood vessels may be severely and permanently damaged, and blood circulation may stop in the affected tissue. In mild cases, the symptoms include inflammation of the skin in patches accompanied by slight pain. In severe cases, there could be tissue damage without pain, or there could be burning or prickling sensations resulting in blisters.	Treat frostbite by gently and quickly warming the affected area. Take caution not to rub or burn the affected area as the skin is less sensitive to temperature. Obtain immediate medical aid if there is no feeling of returning circulation.
Hypothermia	Pain in the extremities may be the first warning sign of hypothermia. Maximum shivering may develop when the body temperature has fallen to 35°C. In intense cold without adequate clothing, the body is unable to compensate for the heat loss and the body's core temperature starts to fall. The sensation of cold followed by pain in exposed parts of the body is one of the first signs of mild hypothermia. As the temperature continues to drop or as the exposure time increases, the feeling of cold and pain starts to diminish because of increasing numbness (loss of sensation). If no pain can be felt,	If hypothermia is suspected, obtain medical assistance immediately. Remove victim from all sources of cold (including wet clothing) and prevent further exposure. Handle the victim gently. Warm them up by wrapping them in blankets. Exposure to the cold should be terminated for any workers when severe shivering becomes evident. Limit physical and mental



	<p>serious injury can occur without the victim's noticing it. Next, muscular weakness and drowsiness are experienced. This condition is called hypothermia and usually occurs when body temperature falls below 33°C. Additional symptoms of hypothermia include shivering, diminished consciousness and dilated pupils. When body temperature reaches 27°C, coma (profound unconsciousness) sets in. Heart activity stops around 20°C and the brain stops functioning around 17°C.</p>	<p>work when severe shivering occurs. Do not suppress shivering, it is an effective way for the body to generate heat.</p>
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6.2.2 Prevention and Control

- The precautions and controls below must be considered at wind chill temperatures of -12°C or colder, but can be used freely at any time
 - Workers should drink warm sweet fluids and soups.
 - Workers should be encouraged to wear multiple layers of clothing. Multiple layers create insulating air pockets and allow a worker to more easily adapt to changing levels of physical exertion.
 - When entering the heated area, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation, or a change of dry work clothing should be changed into the prevent workers from returning to their work with wet clothing.
 - As the temperature or wind chill index gets more extreme, the number of breaks shall be increased. Break times should be taken in a warmer area. See Work/Warm Up Schedule in Appendix G.
 - Wind-chill factor should be considered when scheduling work and rest periods and when determining clothing needs for the job. Work areas shall be shielded from drafts or wind, as much as possible. See Wind Chill and Frostbite Chart in Appendix F.
 - Consider work requirements when planning work. Scheduling periods of inactivity after periods of exertion shall be avoided. Heavy work can cause sweating which can saturate clothing and lead to evaporative cooling. On the other hand, prolonged periods of limited physical activity can also result in excessive cooling due to lack of metabolic heat generation. Sitting or standing for long periods of time should be minimized. Provide wind shelter.
 - Workers should review this instruction to ensure they are aware of:
 - The proper rewarming procedures and appropriate first aid treatment.
 - Proper clothing practices.
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- Proper eating and drinking habits.
- Recognition of impending frostbite.
- Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.
- Safe work practices
- Workers with wet clothing should remove themselves from the cold environment immediately and change into dry clothes before re-entering the cold area.

6.3 Heat Stress

Heat stress disorders occur when our bodies cannot sweat fast enough to get rid of heat. High heat and humidity force our sweat glands to work harder and increase the chance of heat stress disorders. If these glands cannot handle the heat stress, body temperature will rise. If unchecked, this can cause vital organs to malfunction. Sickness and even death can result.

6.3.1 Symptoms and Hazards

	Symptoms	Treatment
Heat Syncope	Fainting while standing in a hot environment. A result of blood pooling in the dilated blood vessels of the legs	Move victim to a cool place and lay down. Recovery should be fast and complete
Heat Cramps	Painful cramps in the stomach, arms and legs can result if heavy sweating drains a person of salt. Cramps may occur suddenly at work or after hours. Cramps are a warning that more serious heat disorders may occur if the stress continues.	Move victim to a cool place. Give slightly salted fluids by mouth.
Heat Exhaustion	Heat exhaustion occurs when the body's cooling system cannot keep up with the heat stress. Sweat contains a balance of important fluids and salts. If lost water and salt are not replaced, the body becomes dehydrated. Signs of heat exhaustion include: <ul style="list-style-type: none"> ● Heavy sweating ● Cool, moist skin ● Body temperature greater than 38C ● Weak pulse ● Normal or low blood pressure 	Move victim to a cool place and lay down. Do not leave the worker alone. Give salted fluids by mouth. If unconscious or vomiting, refer to a doctor.



Heat Stroke	<p>Is a medical emergency. Signs of heat stroke include having a high body temperature (often greater than 40°C) and complete or partial loss of consciousness</p> <p>Victims may:</p> <ul style="list-style-type: none"> • Act strangely • Be weak or confused • Have a fast pulse rate or headache • Be dizzy <p>In later stages, victims may faint or have convulsions.</p> <p>Sweat is not a good indicator for heat stroke. Exertional heat stroke presents with sweat and traditional heat stress does not.</p>	<p>Obtain medical assistance immediately.</p> <p>Immediate, rapid cooling of victim is essential. Move victim to a cool place. Wrap in a wet blanket or sheet. Fan with cool air. If unconscious or not responding to first aid, transfer to a hospital.</p>
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6.3.2 Prevention and Control

Heavy work in hot and humid environments should be scheduled for the cooler part of the day (e.g. early mornings or night shift), whenever possible. Maintenance and repair work for hot areas should be scheduled for the cooler parts of the year, if possible.

- Installation of ventilation or air movement will help workers endure a hot environment. Air movement across the skin accelerates the evaporation of sweat, which is one of the cooling mechanisms of the body.
- Adequate fluid intake must be maintained. Often the thirst reflex is not enough to replenish fluids lost through sweating. A worker in a hot environment should drink 2 to 3 glasses of water per hour
- Regular rest breaks should be taken in an area cooler than the work environment. Rest breaks specifically to manage heat stress (outside of regularly scheduled breaks), do not need to occur in lunch or break areas.
- Radiant heat exposure shall be reduced. Barriers shall be used to deflect radiant heat and clothing to reduce the direct impact of radiant heat shall be considered
- Hot surfaces should be insulated, where possible, to minimize heat emission.
- If all other control mechanisms cannot sufficiently reduce the heat load, then PPE may be used as a last line of defense. Obtain guidance from Industrial Hygiene prior to implementing.

6.4 Hazard Assessment and Working Limits

6.4.1 Thermal working limits are regulated by WorkSafe New Brunswick, which refer to the 2016 ACGIH TLV limits (American Conference of Governmental Industrial Hygienists Threshold Limit Values). In order to assess risk in terms of these limits, special equipment and interpretation may be required.

However, there are several guidelines based on the ACGIH TLVs that are intended to facilitate assessing thermal risk. These guidelines use readily available, or attainable, information such as the Humidex and wind chill to evaluate thermal risk.

NB Power uses well established guidelines to assess thermal risk for all workers. Any situations or tasks involving chemical protective clothing, work inside confined spaces or work near sources of radiant heat require special assessment by a health and safety professional.

6.4.2 Humidex and Wind Chill values can be obtained by anyone with computer access from the Environment Canada webpage. Contact IH or Safety for help. Ideally, humidex values are obtained as close to the workers as possible using a hygrometer.

6.5 Heat Stress Measurement and Action

6.5.1 Humidex

NB Power uses the Humidex to evaluate the risk of thermal stress for some routine outdoor and indoor working conditions. Humidex values shall be considered during work planning outdoor work between May 15 – October. Where the humidex is projected to reach 30°C or more, it should be checked hourly so proper risk assessments can be made.

Humidex readings are:

- Intended to serve as general warnings and limits and are loosely comparable with the regulatory limits
- Basic in nature and do not incorporate wind speed, other sources of heat, work rate and more nuanced variables that the WBGT assessment uses.
- Best interpreted when taken at the worksite using a hygrometer

Humidex readings are not valid and must be replaced with WBGT readings where:

- There are sources of radiant heat
- Restrictive clothing such as dust suits and chemical suits are worn
- Confined spaces
- Heavy work is occurring

6.5.1.1 Humidex Action Plan

Humidex can be determined by using temperature and humidity readings to find the Humidex value on Appendix A. Ideally, humidex data is measured as close to the work as possible using a hygrometer which measures air temperature and humidity. Humidex data must be measured inside buildings as outside conditions are generally not indicative of indoor conditions. For outside work where worksite specific weather

data is not available, humidex values can be obtained by anyone with computer access from the Environment Canada webpage for the closest location to the worksite.

Once the humidex values are known, they must be applied to Appendix B to determine the required Actions to manage and prevent heat stress. It is important to note that to properly use Appendix B, the user must have knowledge of the work clothing being worn and the level of sun exposure.

6.5.2 Wet Bulb Globe Temperature (WBGT)

WBGT is a widely accepted method of measuring and assessing the potential impacts of heat stress to workers. It is more sophisticated than humidex and incorporates factors such as thermal temperature; radiant heat; humidity; wind speed; clothing and metabolic heat production. Where the humidex is broadly targeted at general work, the WBGT is only applicable to a specific work area and task.

All situations involving chemical clothing; work inside confined or constrained work spaces; work near sources of radiant heat; or work where the humidex no longer applies (Appendix B); require a health and safety professional to review WBGT data from the worksite and interpret the values using the instructions and work rest tables in Appendix C.

Work Rest Ratio

The purpose of a work rest ratio is to reduce the risk of heat related illness. By providing adequate rest the core body temperature has a chance to recover before returning to work. During a rest cycle, the workers should ensure they stay hydrated by drinking lots of fresh water. Rest can take place where the work occurs or in a cooler work environment which may reduce the required rest duration. Please see the WBGT Tables in Appendix E to see the differences in rest requirements for different rest environments. Work rest ratios are mandatory and must be diligently followed to manage and prevent heat stress.

6.6 Wind Chill

IOR uses the wind chill to evaluate potential thermal stress risk of outdoor conditions. Wind chill is a basic tool that does not incorporate

- Clothing
- Conditions inside buildings and structures
- Physical contact with cold surfaces

Wind Chill values can be obtained by anyone with computer access from the Environment Canada webpage for the closest location to the worksite. Contact IH or Safety for help obtaining or interpreting these values.

Wind Chill values shall be considered during work planning between December 1 – March 31. Where the wind chill is projected to be -26°C or less, it should be checked hourly so proper risk assessments can be made.

Health & Safety Standards



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New

Title:
Thermal Stress

Wind Chill Level	Wind Chill Reading	Mandatory Action
1	-12 to -32	Educate workers about symptoms of cold stress and implement elements of Section 5.3 as applicable
2	-32 to -43	+ implement work/rest schedule as per Appendix D;
3	-43 and colder	+ non-emergency work should cease

7.0 APPENDIX

Appendix A: Humidex Chart

Appendix B: Humidex Action Plan

Appendix C: WBGT Use and Interpretation

Appendix D: WBGT Procedure

Appendix E: WBGT Actions According to Clothing and Rest Area

Appendix F: Wind Chill Chart/Frost Bite Indication

Appendix G: Threshold Limit Values Work/Warm-Up Schedule

A handwritten signature in black ink, appearing to read "R. Roy".

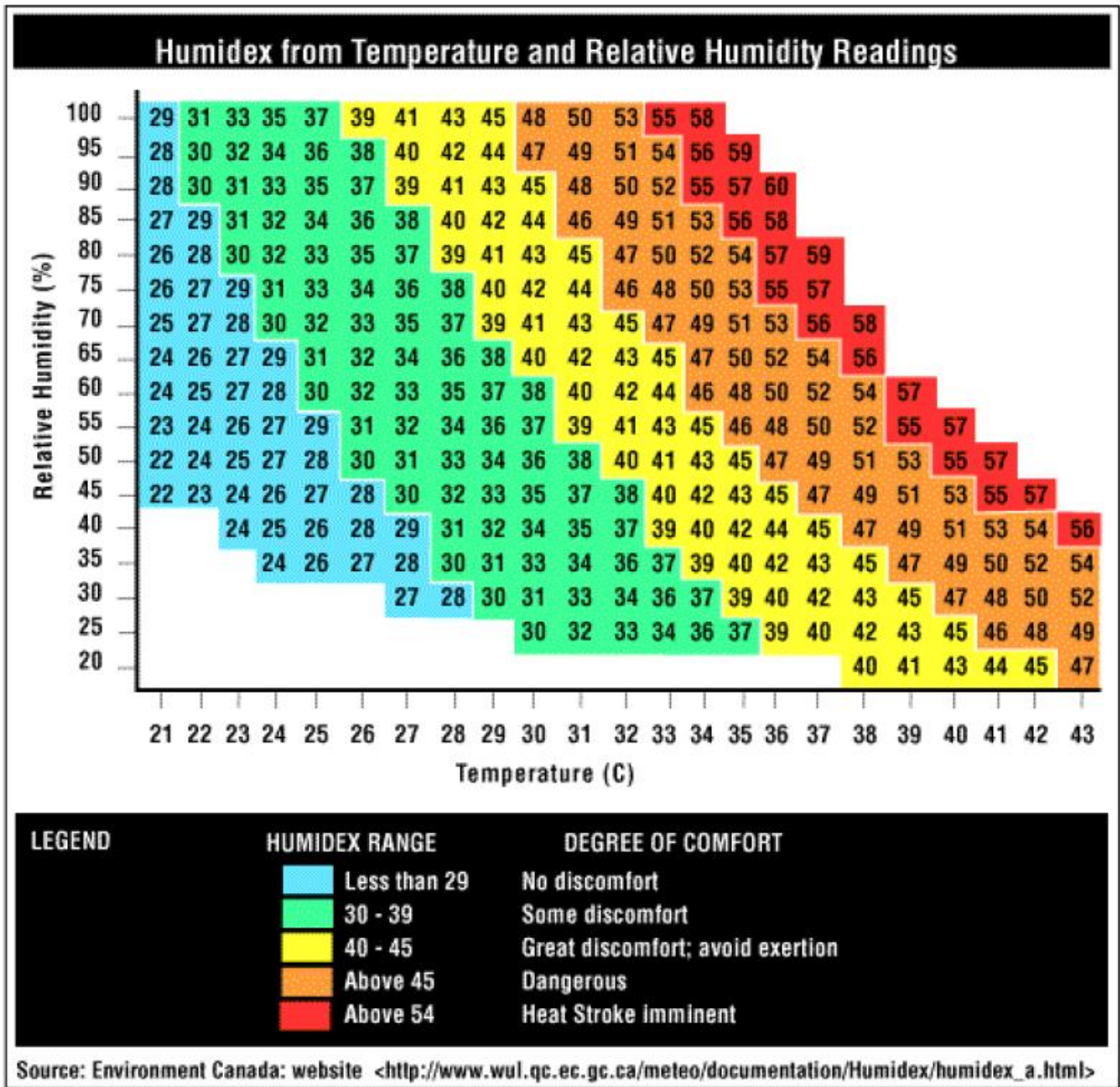
Director of Total
Health & Safety

DOCUMENT APPROVAL/REVISION RECORD

Revision #	Date	Revision Summary	Author	Reviewed By	Approved By
New		New	M. MacFarlane	H&S Team	R. Roy



Appendix A: Humidex Chart



- Adopted from environment Canada. These values represent the “thermal comfort” levels and are not to be directly interpreted as they do not incorporate clothing or working conditions.
- This table is solely intended to be used for determination of humidex when that information is unavailable.

Appendix B: Humidex Action Plan

Humidex Level	Actions based on Actual Work Conditions (Clothing and Sun Exposure)			
	Normal Work Clothes ¹ / No Sun Exposure	Cotton Coveralls ² / No Sun Exposure(+5)	Normal Work Clothes ¹ / Full Sun Exposure(+2)	Cotton Coveralls ² / Full Sun Exposure(+7)
27				Review HSEE-03-72 and provide extra water
28				Review HSEE-03-72 and provide extra water
29		Review HSEE-03-72 and provide extra water		Review HSEE-03-72 and provide extra water
30		Review HSEE-03-72 and provide extra water		Review HSEE-03-72 and provide extra water
31		Review HSEE-03-72 and provide extra water		15 min rest per hour
32		Review HSEE-03-72 and provide extra water	Review HSEE-03-72 and provide extra water	15 min rest per hour
33		15 min rest per hour	Review HSEE-03-72 and provide extra water	30 min rest per hour
34	Review HSEE-03-72 and provide extra water	15 min rest per hour	Review HSEE-03-72 and provide extra water	30 min rest per hour
35	Review HSEE-03-72 and provide extra water	30 min rest per hour	Review HSEE-03-72 and provide extra water	45 minutes rest per hour
36	Review HSEE-03-72 and provide extra water	30 min rest per hour	15 min rest per hour	45 minutes rest per hour
37	Review HSEE-03-72 and provide extra water	45 minutes rest per hour	15 min rest per hour	45 minutes rest per hour
38	15 min rest per hour	45 minutes rest per hour	30 min rest per hour	STOP WORK. Consult Safety.
39	15 min rest per hour	45 minutes rest per hour	30 min rest per hour	STOP WORK. Consult Safety.
40	30 min rest per hour	STOP WORK. Consult Safety.	45 minutes rest per hour	STOP WORK. Consult Safety.
41	30 min rest per hour	STOP WORK. Consult Safety.	45 minutes rest per hour	STOP WORK. Consult Safety.
42	45 minutes rest per hour	STOP WORK. Consult Safety.	45 minutes rest per hour	STOP WORK. Consult Safety.
43	45 minutes rest per hour	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.
44	45 minutes rest per hour	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.
45	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.	STOP WORK. Consult Safety.

¹ Normal Clothes - A worker wears modesty clothing, pants and shirt.

² Cotton Coveralls: A worker wears cotton coveralls over top of normal work clothes (see 1 above)

Appendix C: WBGT Use and Interpretation

Measurements

Readings must be taken in accordance with Appendix D. Readings must only be taken by competent individuals from exactly where work will occur to be representative of the work conditions. This may require multiple measurements to account for fans blowing on workers and other variables that can impact WBGT readings. The WBGT instrument must be used in accordance with manufacturers' specifications which includes stabilization period (see manufactures specification) for the instrument.

Clothing

Clothing can have a significant impact on the body's ability to dissipate heat. ACGIH has prescribed clothing adjustment factors that are to be incorporated into the WBGT readings. If Level A encapsulating suits are worn, the WBGT tables no longer apply and health and safety must be consulted.

Metabolic work rate

Metabolic work rate is the rate at which our body burns calories; the energy necessary to perform functions. Metabolic work rate effects the physiological tolerance time to ambient temperature; thus the harder you're working the less tolerance you have to heat. Metabolic work rate is explicitly linked to body mass and light work for one person can easily be moderate for another. Consideration should be given to modifying work rates for individuals above 200lbs. Use caution when applying work rates. If you need help determining metabolic work rates contact Total Health and Safety. Examples of metabolic rate categories are available in Table 1 below:

Table 1 – Examples of work at each level of metabolic work rate.

Light Work	Moderate Work	Heavy Work
Occasional walking and climbing	Walking with moderate lifting and pushing/pulling	Lifting, pushing and/or pulling heavy material without mechanical help
Stationary welding	Position welding/grinding	Prolonged overhead grinding
Performing light hand or arm work with small power tools	Using medium to large power tools	Repetitive manual work without power tools
Bench fabrication/grinding	Insulation removal or installation	Manual digging
Driving / Operating a vehicle	Impact guns on small bolts	Scaffold erection
Visual inspections / Supervising	Painting	Frequent ladder/stair/pole climbing

Appendix D: WBGT Procedure / Record Sheet

WBGT Measurement and interpretation must be performed by or under the guidance of someone who has competence in the use of the instrument and the data.

1. Take measurement
 - Instrument must have valid calibration certificate
 - Instrument must be self checked prior to use
 - Instrument must be prepared in accordance with manufacturer requirements (eg. Filled with distilled water and allowed to soak the wick or perform salt humidity check)
 - Instrument must be allowed to settle in the work location to be tested, for the duration recommended by the manufacturer, typically 8-20 minutes.
 - The measurement must be taken where work will occur.
 - Be wary of placing instrument near ventilation (e.g at mouth of vessel where air comes into the vessel, as it could cool the WBGT and give artificially low readings compared to a further area of the vessel where the workers will actually be located)
 - If workers are working near a radiant heat source, ensure the device location is representative of their radiant heat exposure.
 - WB_{Ti} vs WB_{To}

This factor allows the readings to account for the effects of sunlight on the body (WB_{To}) which is the most common application. As the sun only radiates on a small portion of the body the impact of the radiant heat is reduced. See equations below.

 - WB_{To} to be used when there is direct sunlight on the workers
 - $0.7 T_{nwb} + 0.2 T_g + 0.1 T_{db}$
 - WB_{Ti} to be used whenever there is not direct sunlight on the workers (eg. Cloudy day, working under a structure or in a vessel).
 - $0.7 T_{nwb} + 0.3 T_g$
 2. Document the work location, clothing used, the rest area and the work rate on the attached WBGT Record Sheet
 3. Apply the WBGT reading to the appropriate clothing / rest location in Appendix E
 4. Implement the work rest ratio (or no work)
 5. Options to improve work conditions (W/R ratio)
 - Cool work area, reduce PPE, lower work level to lower the heat stressors and lower the WBGT and therefore the requirements.
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WBGT Record Sheet

Must be used alongside WBGT Procedure (Appendix D) and WBGT Actions (Appendix E) of HSEE-03-72

Work Site: _____

Specific Work Location: _____

Working in Direct Sunlight?: No – use WBGT_i Yes – use WBGT_o

WBGT Device Information:

WBGT Device Serial Number: _____ WBGT Self Check Pass: Yes or No

WBGT Device Calibration: _____ WBGT Measurement : _____ WBGT_i /WBGT_o

WBGT Measurement Location Description: _____

WBGT Measurement Performed By: _____

Work Factors:

Clothing Used: Normal Work Clothing Dust Coveralls Chemical Covealls Other (Contact THS)

Rest Area: Same or similar WBGT to work Area or Cool Rest Area (confirmed to be <24C /19WBGT)

Work Being Performed: _____

Work Rate Best Match: Light Medium Heavy

*Work Rate is difficult to assess and varies widely from person to person. One assigned work rate may not be appropriate for the entire workgroup. Consider if individual work rate assessments are needed for heavier individuals to ensure the work rest ratios are sufficiently protective.

Work Rest Ratio (from Appendix E): Work _____ min / hr with normal breaks

Tips to Improve Working Conditions:

Cool Work Area, Reduce PPE through other controls, Lower the work level.

Appendix E: WBGT Actions According to Clothing and Rest Area

Rest in Work Area or similar environment

Rest in Cool Area (<24C/19WBGT)

Normal Work Clothing

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)	28	25	N/a
up to 45min/hr (75%)	28.5	26	24
up to 30min/hr (50%)	29.5	27	25.5
up to 15min/hr (25%)	30	29	28
No Work, Consult THS	31	30	29

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)	28	25	N/a
up to 45min/hr (75%)	31	28	25.5
up to 30min/hr (50%)	36	33	30
up to 15min/hr (25%)	40	37	34
No Work, Consult THS	42	39	36

Dust Coveralls (not airtight)

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)	27	24	N/a
up to 45min/hr (75%)	27.5	25	23
up to 30min/hr (50%)	28.5	26	24.5
up to 15min/hr (25%)	29	28	27
No Work, Consult THS	30	29	27

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)	27	24	N/a
up to 45min/hr (75%)	30	27	24.5
up to 30min/hr (50%)	35	32	29
up to 15min/hr (25%)	39	36	33
No Work, Consult THS	41	37	35

Chemical Coveralls (airtight)

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)	19	16	N/a
up to 45min/hr (75%)	20	17	15
up to 30min/hr (50%)	23	21	20
up to 15min/hr (25%)	27	26	25
No Work, Consult THS	28	27	26

Allocation of Work/hr	Perceived Work Load		
	L	M	H
up to 60min/hr (100%)			
up to 45min/hr (75%)	20	17	15
up to 30min/hr (50%)	28	24	21
up to 15min/hr (25%)	37	33	30
No Work, Consult THS	39	35	31



Appendix F: Wind Chill Chart/Frost Bite Indication

Wind Speed (km/hr)	Ambient Air Temperature (°C)									
	-12	-15	-18	-20	-23	-25	-29	-30	-34	-40
0	-12	-15	-18	-20	-23	-25	-29	-30	-34	-40
5	-15	-19	-22	-24	-28	-30	-34	-36	-40	-47
8	-17	-20	-24	-26	-30	-32	-37	-38	-43	-50
10	-18	-21	-25	-27	-31	-33	-38	-39	-44	-51
15	-19	-23	-27	-29	-33	-35	-40	-41	-46	-54
20	-20	-24	-28	-30	-34	-37	-42	-43	-48	-56
24	-21	-25	-29	-31	-35	-38	-43	-44	-49	-57
27	-22	-26	-29	-32	-36	-38	-44	-45	-50	-58
30	-22	-26	-30	-33	-36	-39	-44	-46	-51	-59
32	-22	-26	-30	-33	-37	-39	-45	-46	-51	-59
35	-23	-27	-31	-33	-37	-40	-45	-47	-52	-60
40	-23	-27	-31	-34	-38	-41	-46	-48	-53	-61
45	-24	-28	-32	-35	-39	-42	-47	-48	-54	-62
48	-24	-28	-32	-35	-39	-42	-47	-49	-54	-62
50	-24	-29	-33	-35	-39	-42	-48	-49	-54	-63
55	-25	-29	-33	-36	-40	-43	-48	-50	-55	-63
60	-25	-30	-34	-36	-41	-43	-49	-50	-56	-64

*Chart adapted from Environment and Climate Change Canada Wind Chill Calculator.

Legend

	Low risk of frostbite for most people
	Increasing risk of frostbite for most people within 30 minutes of exposure
	High risk for most people in 5 to 10 minutes of exposure
	High risk for most people in 2 to 5 minutes of exposure
	High risk for most people in 2 minutes of exposure or less




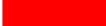
- This table is intended to be used to determine the wind chill and the risk of frost bite.
- Limiting exposed skin and wearing appropriate winter clothing can help prevent frostbite in the given temperature ranges. Additional insulating clothing should be worn as temperature decreases. Reduction in the duration of exposure may be required as per Attachment IV schedule.

Appendix G: TLV Work/Warm-up Schedules

Wind Speed (km/hr)	Ambient Air Temperature (°C)								
	-15	-18	-20	-23	-25	-29	-30	-34	-40
0	-15	-18	-20	-23	-25	-29	-30	-34	-40
5	-19	-22	-24	-28	-30	-34	-36	-40	-47
8	-20	-24	-26	-30	-32	-37	-38	-43	-50
10	-21	-25	-27	-31	-33	-38	-39	-44	-51
15	-23	-27	-29	-33	-35	-40	-41	-46	-54
20	-24	-28	-30	-34	-37	-42	-43	-48	-56
24	-25	-29	-31	-35	-38	-43	-44	-49	-57
27	-26	-29	-32	-36	-38	-44	-45	-50	-58
30	-26	-30	-33	-36	-39	-44	-46	-51	-59
32	-26	-30	-33	-37	-39	-45	-46	-51	-59
35	-27	-31	-33	-37	-40	-45	-47	-52	-60
40	-27	-31	-34	-38	-41	-46	-48	-53	-61
45	-28	-32	-35	-39	-42	-47	-48	-54	-62
48	-28	-32	-35	-39	-42	-47	-49	-54	-62
50	-29	-33	-35	-39	-42	-48	-49	-54	-63
55	-29	-33	-36	-40	-43	-48	-50	-55	-63
60	-30	-34	-36	-41	-43	-49	-50	-56	-64

*Chart adapted from Occupational & Safety Division, Saskatchewan Department of Labour.

Legend

	Normal breaks – 10 minute break after 2 hours of work
	55 min work – 10 minute break after each 55 min work period
	30 min work – 10 minute break after each 30 minute work period
	Non-emergency work should cease

- Continuous exposure should not be permitted when the air speed and temperature result in an equivalent chill temperature of -32°C.
- Chart applies to any 4 hour work period with moderate to heavy work, and assumes workers get normal 10 minute warm up periods (breaks) every 2 hours and an extended break (lunch) at the end of the work period.
- For light to moderate work, lower all criteria by one segment as the worker creates less metabolic heat and has a lower body temperature.
- Breaks must be taken in a warm location. If a worker has an onset of heavy shivering; frostnip; or the feeling of excessive fatigue, drowsiness, irritability, or euphoria, the worker should be immediately returned to the warm location.
- This chart assumes that the worker is acclimatized and is wearing appropriate winter clothing for the work and conditions.