HEALTH, SAFETY & ENVIRONMENTAL MANUAL	4.17 Safe Work Program – Thermal Hazards in Extreme Environments					
	Initial HIRA Score:	20	Residual HIRA Score:	5	Critical Task: **Yes**	
	Procedure(s): **5.4.17.1 (Heat), 5.4.17.2 (Cold)**					
	Revision Number: **R0**			Number of Pages: **10**		
	Revision Date:	Approval Date: 10/01/2024	Effective Date: 10/01/2024		SIGNATURE:	

SAFE WORK PROGRAM

Thermal Hazards

Significant external hazards on worksites are weather-related. Working in extreme heat, cold, active weather, and high UV days are all workplace hazards not often thought about. While some of these practices and policies are not explicitly legislated, the general duty clause applies.

Heat Stress

Heat stress is the challenge your body faces due to hot conditions. If your body is unable to cool itself, you can suffer heat related illnesses, which in some cases can lead to death. All workers need to recognize the early signs and symptoms of heat stress and know how to treat heat-related illnesses.

HEAT STRESS DISORDERS

ILLNESS	SIGNS AND SYMPTOMS	FIRST AID
Heat rash	Red, bumpy rash with severe itching.	Change into dry clothes and avoid hot environments. Rinse skin with cool water.
Heat cramps	Painful, involuntary cramps commonly in the most worked muscles which occur at work or later at home. They are serious because they are a warning of other more serious illnesses	Move to a cool area; loosen clothing; gently stretch affected muscles and drink an electrolyte sports beverage (i.e. Gatorade). If the cramps persist, get medical aid.
Fainting	Sudden fainting after at least two hours of work. Cool, moist skin. Weak pulse	**GET MEDICAL ATTENTION.** Assess the need for CPR. Move person to a cool area. Loosen clothing. Have the person lie down and if conscious, offer sips of cool water. Fainting may be caused by another illness.
Heat exhaustion	Heavy sweating; cool moist skin; body temperature over 38 degree C; weak pulse; normal or low blood pressure; person is tired and weak and has nausea and vomiting; is very thirsty; breathing rapidly or panting; vision may be blurred.	**GET MEDICAL ATTENTION.** This condition can lead to heat stroke, which can kill. Move person to a cool shaded area; loosen or remove excess clothing; provide cool water to drink; fan and spray with cool water. Do not leave affected person alone.
Heat stroke	High temperature (over 41 degree C) and any one of the following: person is weak, confused, upset or acting strangely; has hot dry, red skin; a fast pulse; headache or dizziness. In later stages a person may pass out and have convulsions.	**CALL AMBULANCE.** This condition can kill a person quickly. Move the person out of the sun and into shade or air-conditioning. Remove excess clothing. Fan and spray the person with cool water if they are conscious.

SAFE WORK PROGRAM

Personal Risk Factors

It is difficult to predict who will be affected by heat stress and when, because individuals vary. However, certain physical conditions reduce the body's natural ability to withstand high temperatures:

- Overweight
- Poor physical condition
- Previous heat illnesses
- Age (over 40)
- Heart disease or high blood pressure
- Recent illness
- Alcohol consumption (previous 24 hrs.)
- Certain medications
- Lack of acclimatization - the body will adapt when exposed to heat for a few days. It usually takes six or seven days. Although acclimatization may be lost in as little as three days.

Heavy physical work coupled with extra clothing or PPE in a humid environment can greatly affect a worker's ability to cope with the heat. This is especially true for an individual who is not acclimatized.

How Can Heat Stress be Controlled?

Management shall:

- Train and educate employees on the hazards, risks, symptoms, first aid measures and controls for heat stress and heat stress illnesses.
- Advise supervisors on the procedures for assessing and controlling heat stress hazards.
- Provide the necessary resources to control heat stress hazards (i.e., water).
- Allow sufficient time for workers to become acclimatized.
- Enforce this policy as needed.

Supervisors shall:

- Employ work procedures to help limit the risks of working in hot environments including giving workers extra breaks, cool water, and scheduling work for cooler parts of the day.
- Monitor workers for any heat stress symptoms and react accordingly when workers complain of heat stress. Job shutdown may be required.
- Advise management of any heat stress illnesses.

Workers shall:

- Follow instructions and training for controlling heat stress.
- Be alert to symptoms in yourself and others. Advise your supervisor of any heat stress.
- Get plenty of rest and drink small amounts of water regularly.

SAFE WORK PROGRAM

Assessing Heat Stress Hazards using the Humidex

The following four steps are designed to help determine whether conditions require action to reduce heat stress.

Supervisors will monitor their crews and follow these steps as needed

Step 1: Training

- Measurements alone cannot guarantee worker protection from heat stress. It is essential workers learn to recognize the early signs and symptoms.
- The ideal heat stress response plan would let workers regulate their own pace by "listening to their body".

Step 2: Workplace Humidex

- A thermal hygrometer is a simple way to measure the temperature and relative humidity, however these are rarely available to supervisors. In the case where a hygrometer is not available, use the local weather data.
- Once you have the temperature and humidity, use Table A to determine the humidex value.
- From Table B select *Humidex 1* or *Humidex 2* according to the amount of physical activity involved and the level of acclimatization. Although the Heat Stress Response (Table B) is based on workplace measurements not weather reports, it can be used where specific measurements are unavailable.

Step 3: Adjust for Clothing

- The humidex plan assumes workers are wearing regular summer clothes (light shirt, pants, underwear, socks, and work boots).
- If workers are wearing cotton overalls on top of clothing, add 5°C. to the workplace humidex measurement.
- Estimate the correction factor for other clothes or PPE.

Step 4: Adjust for Radiant Heat

- For outdoor work in direct sunlight between 10 am and 5 pm, add 1 - 2°C to your humidex measurement. Adjust for cloud cover.

The Heat Stress Plan is only a guide. Never ignore a person's signs and symptoms. Workers should always "listen to their body".

SAFE WORK PROGRAM

TABLE A- HUMIDEX: The Humidex value is where the temperature row and humidity column meet.

Humidex																			
	Relative Humidity (in %)																		
Temp (in °C)	100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	Temp (in °C)
49																			50	49
48	-																		49	48
47																		50	47	47
46			Never ignore someome's symptoms no matter what you measure!															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			27
26	39	38	37	36	35	34	33	33	32	31	30	29	28	27	26	25				26
25	37	36	35	34	33	33	32	31	30	29	28	27	26	26	25					25
24	35	34	33	33	32	31	30	29	28	28	27	26	25							24
23	33	32	31	31	30	29	28	28	27	26	25									23
22	31	30	30	29	28	27	27	26	25	25										22
21	29	29	28	27	26	26	25													21
	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	

SAFE WORK PROGRAM

Humidex 1 moderate unacclimatized and heavy acclimatized work	Response Never ignore someone's symptoms no matter what you measure!	Humidex 2 light unacclimatized work (sitting/standing doing light arm work)
30-37	**Low** • Alert workers to potential for heat stress. • Ensure access to water.	34-41
38-39	**Medium** • Reduce physical activity (e.g., slower pace, double up, breaks). • Drink a cup of water every 20-30 minutes.	42-43
40-42	**Moderate** • Reduce physical activity further. • Drink a cup of water every 15-20 minutes.	44-45
43-44	**High** • Ensure sufficient rest and recovery time. Severely curtail physical activity. • Drink a cup of water every 10-15 minutes.	46-48
45 or over	**Extreme** • It is hazardous to continue physical activity.	49 or over

Breaks (as a general guide)- guidelines indicate increasing work breaks for heavy physical activity with high humidex readings as follows: **38-39° C- 15 min /hour; 40-42° C- 30 min/hour; 43-44° C- 45 min/hour; 45+° C- stop work until humidex is 44 ° C or less.**

Light work - sitting with light manual work with hands or hands and arms; standing with some light arm work and occasional walking.

Moderate work - sustained moderate hand and arm work; arm and leg work or arm and trunk work; light pushing or pulling; normal walking.

Heavy work - intense arm and trunk work; carrying; shoveling; pushing and pulling heavy loads; walking quickly.

Acclimatization - a person becomes acclimatized when the body adjusts to long-term heat exposure. Workers performing "heavy work" could probably be considered acclimatized once we are well into the heat of summer.

Employees shall follow these guidelines

SAFE WORK PROGRAM

- Wear light, loose clothing
- Drink cool water - 8 oz.(250ml) – every ½ hour
  - Take rest breaks as required.
  - Avoid coffee, tea, alcohol, drugs.
  - Avoid eating hot, heavy meals.
  - Don't take salt tablets unless a doctor prescribes them.

Everyone reacts differently. Listen to your body and stop when you need to

COLD STRESS

Cold stress can affect workers who are not protected against cold. When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, leading to permanent tissue damage and even death.

Air temperature, wind speed and humidity are all challenges for a worker and must be counterbalanced with proper clothing, physical activity, and controlled exposure.

What is the wind-chill temperature?

At any temperature, you feel colder as the wind speed increases. It can be used as a general guideline for deciding clothing requirements and the possible health effects of cold.

WIND CHILL CHART

		Ambient Temperature (∞C)								
		4	-1	-7	-12	-18	-23	-29	-34	-40
Wind km/h	Velocity mph	Equivalent Chill Temperature (∞C)								
Calm										
0	0	4	-1	-7	-12	-18	-23	-29	-34	-40
8	5	3	-3	-9	-14	-21	-26	-32	-38	-44
16	10	-2	-9	-16	-23	-30	-35	-43	-50	-57
24	15	-6	-13	-20	-28	-36	-43	-50	-58	-65
32	20	-8	-16	-23	-32	-39	-47	-55	-63	-71
40	25	-9	-18	-26	-34	-42	-51	-59	-67	-76
48	30	-16	-19	-22	-36	-44	-53	-62	-70	-78
56	35	-11	-20	-29	-37	-46	-55	-63	-72	-81
64	40	-12	-21	-29	-38	-47	-56	-65	-73	-82

Adapted from: Threshold Limit Values (TLV™) and Biological Exposure Indeces (BEI™) booklet; published by ACGIH, Cincinnati, Ohio

Little danger in less than one hour exposure of dry skin

Maximum danger of false sense of security

DANGER – Exposed flesh freezes within one minute

GREAT DANGER – Flesh may freeze within 30 seconds

SAFE WORK PROGRAM

Exposure to cold causes 2 major health risks: ***hypothermia and frostbite.***

Hypothermia can affect workers not protected against the cold. When the body is unable to warm itself and maintain its core temperature, serious illnesses and injury can occur, leading to permanent tissue damage or even death.

HYPOTHERMIA STAGES	SIGNS AND SYMPTOMS
Mild	**Shivering, blue lips and fingers, poor coordination**
Moderate	**Mental impairment, confusion, disorientation, inability to take precautions from the cold, heart slowdown, slow breathing**
Severe	**Unconsciousness, pulse difficult to find or irregular, no shivering, no detectable breathing. In severe cases, hypothermia resembles death. Treat patients as though they are alive.**

First Aid:

- Carefully move person to shelter. Sudden movements can upset heart rhythm.
- Keep person awake.
- Remove wet clothing and wrap person in warm covers.
- Re-warm neck, chest, abdomen, and groin. Do not re-warm extremities.
- Apply direct body heat or use safe heating devices.
- Give warm, sweet drinks, but only if conscious.
- Administer CPR if necessary.
- Call for emergency medical help or transport person carefully to hospital.

SAFE WORK PROGRAM

FROSTBITE

Frostbite is a common injury caused by exposure to severe cold or contact with cold objects

It occurs more readily from touching cold metal than cold air

Body parts most affected include face, ears, fingers and toes

Symptoms vary, are not always painful, but often include a sharp prickling sensation

First indication is waxy looking skin that feels numb

Once tissues become hard, it becomes a severe medical emergency

Severe frostbite results in blistering that usually takes about 10 days to subside

Once damaged, tissues will be more susceptible in future

First Aid:

- Warm frostbitten area gradually with body heat. Do not rub.
- Don't thaw hands or feet unless medical aid is distant and there is no chance of refreezing. Parts are better thawed at hospital.
- Apply sterile dressings to blistered areas.
- Get medical attention.

How can Cold Stress be Controlled?

Management shall:

- Train and educate employees on the risk factors, signs, and symptoms, first aid measures and controls of cold stress and cold stress related health issues.
- Advise supervisors on the measures for controlling cold stress hazards.
- Provide the necessary resources to control cold stress hazards (i.e. heated shelters).
- Enforce this policy as needed.

Supervisors shall:

- Employ work procedures to help limit the risks of working in cold environments including giving workers sheltered breaks and backup as needed.
- Monitor the wind-chill and temperature readings at your jobsite. See Table 1
- Monitor workers for any cold stress symptoms and react accordingly.

SAFE WORK PROGRAM

- Advise management of any cold stress illnesses.

Workers shall:

- Follow instructions and training for controlling cold stress.
- Be alert to symptoms in yourself and others. Advise your supervisor of any cold related health issues.
- Select proper clothing to perform the job. Be prepared.

Employees shall follow these guidelines

- Work is to be paced to avoid excessive sweating.
- Clothing is recommended to be worn in multiple layers and kept dry and clean as possible.
- For work in wet conditions, utilizing waterproof material for outer layers is recommended.
- Almost 50 percent of body heat is lost through the head. A wool knit cap or a liner under a hard hat can reduce excessive heat loss.
- Gloves are recommended to be used below -7°C for moderate work. For work below -17°C, thin polyester gloves can be worn under protective gloves.
- Have extra socks available so you can dry your feet and change socks during the day.
- Face protection, a balaclava or hard hat liner is recommended to be used.
- Eat properly and frequently. Working in the cold requires more energy than in warm weather.
- Drink fluids often. Hot non-alcoholic beverages or soup are suggested. Caffeinated drinks such as coffee are recommended to be limited.
- Any worker shivering severely is to be brought out of the cold.
- If you get hot, open your jacket but keep hats and gloves on.
- Wear one thick or two thin pairs of socks. Don’t restrict blood flow with tight fitting footwear.

Exposure Limits

Ontario has no legislated limits for work in cold environments; however, Table 1 below was developed to indicate threshold limit values for properly clothed workers (dry clothing) in below freezing temperatures:

SAFE WORK PROGRAM

Air temperature (sunny sky)		No noticeable wind		8 km/h wind (5 mph)		16km/h wind (10 mph)		24 km/h wind (15mph)		32 km/h wind (20 mph)	
°C (approx.)	°F (approx.)	Max work period	No. of breaks	Max work period	No. of breaks	Max work period	No. of breaks	Max work period	No. of breaks	Max work period	No. of breaks
-26° to -28°	-15° to -19°	Normal breaks	1	Normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4
-29° to -31°	-20° to -24°	Normal breaks	1	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5
-32° to -34°	-25° to -29°	75 minutes	2	55 minutes	3	40 minutes	4	30 minutes	5	Non-emergency work should stop	
-35° to -37°	-30° to -34°	55 minutes	3	40 minutes	4	30 minutes	5	Non-emergency work should stop			
-38° to -39°	-35° to -39°	40 minutes	4	30 minutes	5	Non-emergency work should stop					
-40° to -42°	-40° to -44°	30 minutes	5	Non-emergency work should stop							
-43° and below	-45° and below	Non-emergency work should stop									

Source: Occupational Health and Safety Division, Saskatchewan Department of Labour

Notes

a) This table applies to any 4-hour work period of moderate-to-heavy work with warm-up periods of ten minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For light-to-moderate work (limited physical movement) apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (row 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (row 5).

Thunderstorms

If you are outdoors:

- If you hear thunder, then lightning is close enough to be dangerous. Move immediately to a place of shelter. Go to a well-constructed, enclosed building. Small, open structures do not provide protection from lightning.

- If no building is available, stay inside your vehicle or machine cab.
- Avoid water, high ground, isolated trees, and power lines.
- There isn't a place outside that is safe during a thunderstorm. Make every effort to get into a solid shelter or metal-topped vehicle. If neither is available, find a low-lying area away from tall, pointy, isolated objects, crouch down and put your feet together. Do not lie down. Cover your ears to reduce the threat of hearing damage from thunder.