

Work **Safe!** Bulletin

WORKING IN THE COLD

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Working outside during a Manitoba winter can be a very chilling experience. Most of us cope the best we can and carry on with our usual activities. But the cold can be a serious occupational hazard for many workers. Construction, oil and gas extraction, trucking, fire fighting, police work, farming/ranching, fishing, logging and other outdoor jobs are examples of occupations where the potential for serious cold injury exists. Workers need not be exposed to below zero temperatures to experience cold related conditions such as hypothermia. Indoor workers in refrigerated rooms or unheated buildings can also be at risk. Frostbite and hypothermia are two conditions of particular concern.

Frostbite is the actual freezing of tissue. Any exposed skin is subject to frostbite when the air temperature is below zero or when wind speeds are high. Frostbite can lead to scarring, tissue damage, possible amputation and may cause permanent disability. Symptoms of frostbite vary from swelling of the skin accompanied by slight pain in mild cases to tissue damage without pain or with burning pain or prickling in severe cases. Frostbitten skin is subject to infection and therefore must not be treated lightly. Affected area should be warmed slowly to normal temperatures. Medical attention should be received for severe cases.

Hypothermia occurs when the deep body or "core" temperature drops below 35°C. At this point the body loses its ability to prevent heat loss. The onset of hypothermia is a gradual process. Initially the victim has a sensation of cold, followed by pain. As exposure time or cold increase the sensation of pain is reduced and overall numbness develops. Additional symptoms include a decrease or absence of shivering, reduced memory and confusion, drowsiness, slurred speech, irritability, impaired coordination, dexterity and general muscular weakness. Hypothermia is a serious condition and can lead to coma and death if not treated quickly. Victims of mild hypothermia should be rewarmed in a warm bed or bath or with warming packs and blankets. Victims with severe hypothermia must receive immediate medical care from experienced medical personnel.

There are several factors that contribute to the risk of cold injury: temperature, wind speed, moisture (sweat or working near water), exposure duration, type of clothing, work/rest schedule, type of work performed, use of certain medications, degree of acclimatization (previous exposure to the cold) and age and physical state of the worker. Many of these factors can be controlled to reduce the potential for injuries - prevention is the key.

It is the employer's responsibility to ensure that appropriate clothing is worn. Clothing that matches heat loss to heat production is critical. Too much clothing can lead to sweating, and wet clothing causes greater heat loss and the chance of hypothermia. The solution is layered clothing with a windproof and waterproof outer shell. Table 1 (see reverse side) provides recommendations for protective clothing. These recommendations are based on the combination of temperature and wind speed, or wind chill. Collectively these two factors, measured in watts per metre squared, predict the rate of loss of heat from the body. Toes, fingers, ears and other parts of the face are highly susceptible to frostbite. Footwear, gloves/mittens and face protection must be selected to protect the worker and yet not make it impossible to perform the work.

It is obvious that the colder the temperature the greater the concern for proper winter clothing. Persons who must remain outdoors for extended periods must adjust their winter clothing for the "equivalent temperature" (temperature and wind chill). Table 2 (see reverse side) displays the "equivalent temperature" likely to be encountered in a Manitoba winter.

Workers who work for extended periods in cold environments should be provided with heated shelters and be provided with warm-up periods. Warm-up breaks are required even when appropriate winter clothing is used. Table 3 (see reverse side) provides recommendations on the length of work periods and the number of warm-up periods necessary during a 4-hour shift.

TABLE 1

WATTS/M² RECOMMENDED PROCEDURES

Under 900	Comfortable with normal winter clothing.
900 - 1400	Work and recreation becomes uncomfortable unless properly clothed. Hats, coats and gloves are recommended.
1400 - 1600	Outdoor work and travel are safe with quality winter clothing.
1600 - 1800	Frostbite can occur with prolonged exposure. Heavy outer clothing is essential. Your weather office will add the current wind chill to the public forecasts at this level.
1800 - 2000	Frostbite can occur in a few minutes. Multiple layers of clothing become essential. (May feel like minus 30°C)
2000 or more	Unprotected skin can freeze in one minute. Adequate face protection becomes important. Elementary school children require continuous adult supervision while outdoors. Work and travel alone is not advisable.
2200 or more	Adequate face protection becomes mandatory. Work and travel alone is hazardous. Special warm-up breaks are recommended for outside workers.
2300 or more	Outdoor conditions become dangerous. School closure should be considered. (May feel like minus 50°C).
2400 or more	Outdoor conditions are dangerous even for short periods of time. All non-emergency outdoor work should cease. Buddy system observation is mandatory. (May feel like minus 60°C).
2600 or more	These are rare wind chill values which will be experienced in some major blizzards. Danger to those exposed to the cold is extreme.

Source: Environment Canada

TABLE 2

Cooling Power of Wind on Exposed Flesh Expressed as EQUIVALENT TEMPERATURE*

Estimated Wind Speed (in kph)	Actual Temperature (°C)								
	4	-1	-7	-12	-18	-23	-29	-34	-40
0	4	-1	-7	-12	-18	-23	-29	-34	-40
8	3	-3	-9	-14	-21	-26	-32	-38	-44
16	-2	-9	-16	-23	-30	-35	-43	-50	-57
24	-6	-13	-20	-28	-36	-43	-50	-58	-65
32	-8	-16	-23	-32	-39	-47	-55	-61	-71
40	-9	-18	-26	-34	-42	-51	-59	-67	-76
48	-16	-19	-22	-36	-44	-53	-62	-70	-78
56	-11	-20	-29	-37	-46	-55	-63	-72	-81
64	-12	-21	-29	-38	-47	-56	-65	78	-82

Wind speed greater than 64 kph have little additional effect

LITTLE DANGER
In < 1 hr with dry skin
Maximum danger of false sense of security

INCREASING DANGER
Danger from freezing of Exposed skin within 1 minute.

GREATER DANGER
Flesh may freeze within 30 seconds.

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Adapted from American Conference of Governmental Industrial Hygienists (ACGIH). Threshold Limit Values for Chemical and Physical Agents and Biological Exposure Indices, 1996, p. 78.

TABLE 3

Work/Warm-up Schedule for Four Hour Shifts and Moderate to Heavy Work Activity*

Air Temperature °C (Sunny Skies)	No Noticeable Wind		8 kp/h Wind		16 kp/h Wind		24 kp/h Wind		32 kp/h Wind	
	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	Normal	1	Normal	1	75 mins.	2	55 mins.	3	40 mins.	4
-29 to -31	Normal	1	75 mins.	2	55 mins.	3	40 mins.	4	30 mins.	5
-32 to -34	75 mins.	2	55 mins.	3	40 mins.	4	30 mins.	5		
-35 to -37	55 mins.	3	40 mins.	4	30 mins.	5				
-38 to -39	40 mins.	4	30 mins.	5						
-40 to -42	30 mins.	5								
-43 and below										

In all shaded areas non-emergency work should cease.

This schedule applies to moderate-to-heavy work with breaks of 10 minutes in a warm location to allow workers to warm up. For light-to-moderate work (little physical movement), apply the schedule one step lower. For example, at - 35 °C with no noticeable wind, 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 shift instead of 55 minute work periods and 3 breaks.

* Adapted from Occupational Health & Safety, Saskatchewan Department of Labour