

Source: Canadian Centre for Occupational Health & Safety

Extreme Hot or Cold Temperature Conditions

Is there a temperature at which work becomes dangerous and should be stopped?

The short answer is yes. Both very cold and very hot temperatures could be dangerous to your health.

Excessive exposure to heat is referred to as heat stress and excessive exposure to cold is referred to as cold stress.

In a very hot environment, the most serious concern is heat stroke. In absence of immediate medical attention, heat stroke could be fatal. Heat stroke fatalities do occur every summer. Heat exhaustion, and fainting (syncope) are less serious types illnesses which are not fatal but interfere with a person's ability to work.

At very cold temperatures, the most serious concern is the risk of hypothermia or dangerous overcooling of the body. Another serious effect of cold exposure is frostbite or freezing of the exposed extremities such as fingers, toes, nose and ear lobes. Hypothermia could be fatal in absence of immediate medical attention.

What are the warning signs of heat stroke and hypothermia?

The victims of heat stroke and hypothermia are unable to notice the symptoms, and therefore, their survival depends on co-workers' ability to identify symptoms and to seek medical help.

While symptoms can vary from person to person, the warning signs of heat stroke can include complaints of sudden and severe fatigue, nausea, dizziness, lightheadedness, and profuse and prolonged sweating. If a co-worker appears to be disorientated or confused (including euphoria), or has unaccountable irritability, malaise or flu-like symptoms, the worker should be moved to a cool location and seek medical advice.

Warning signs of hypothermia can include complaints of nausea, fatigue, dizziness, irritability or euphoria. Workers can also experience pain in their extremities (hands, feet, ears, etc), and severe shivering. Workers should be moved to a heated shelter and seek medical advice when appropriate.

What are the exposure limits for working in hot environments?

Two types of exposure limits are often used: occupational exposure limits and thermal comfort limits. Occupational exposure limits are to protect industrial workers from heat-related illness. Thermal comfort limits are for office work to ensure productivity and quality of work.

ASHRAE Standard 55-1992 Thermal Environmental Conditions for Human Occupancy,

recommends the following acceptable temperature ranges at relative humidity (RH) of 50% and air speed less than 0.15 m/sec. (30 fpm).

Table 1 Acceptable Temperatures		
Season	Clothing	Temperature
Winter	Heavy slacks, long sleeve shirt and/or sweater	20-23.5°C (68-75°F)
Summer	Light slacks and short sleeveshirt	23-26°C (73-79°F)

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends Threshold Limit Values (TLVs) for working in hot environments. These limits are given in units of WBGT (wet bulb globe temperature) degrees Celsius (°C). The WBGT unit takes into account environmental factors namely, air temperature, humidity and air movement, which contribute to perception of hotness by people. In some workplace situations, solar load (heat from radiant sources) is also considered in determining the WBGT. Some Canadian jurisdictions have adopted these TLVs as occupational exposure limits and others use them as guidelines to control heat stress in the workplace.

The ACGIH publication "2000 TLVs and BEIs" provides recommended screening criteria for heat stress exposure for workers acclimatized to heat and for workers who are not acclimatized to heat (Table 2). The publications "2000 TLVs and BEIs" and "Documentation of TLVs and BEIs" should be consulted for more detailed information on these screening criteria, categories of work demands, guidelines for limiting heat strain and heat strain management.

Table 2 Screening Criteria for Heat Stress Exposure (WBGT values in °C) for 8 hour work day five days per week with conventional breaks								
	Acclimatized				Unacclimatized			
Work Demands	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% work	29.5	27.5	26		27.5	25	22.5	
75% Work; 25% Rest	30.5	28.5	27.5		29	26.5	24.5	
50% Work; 50% Rest	31.5	29.5	28.5	27.5	30	28	26.5	25
25% Work; 75% Rest	32.5	31	30	29.5	31	29	28	26.5

Source: 2000 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati : American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 183.

Many Canadian occupational health and safety regulations specify upper and lower temperature limits for work performed inside buildings which are normally heated (see Table 4).

The weather broadcast service of Environment Canada uses the humidex scale to inform the public about hot weather conditions. The humidex scale quantifies human discomfort due to perceived heat taking into account the effect of air temperature and relative humidity. For a given temperature, the humidex increases as the relative humidity (moisture content) of the air becomes higher. The following table gives ranges of humidex for various degrees of thermal effect on people.

**Table 3
Humidex and Thermal Comfort**

Humidex Range (°C)	Degrees of Comfort
20 - 29	Comfortable
30 - 39	Varying degrees of discomfort
40 - 45	Uncomfortable
46 and Over	Many types of labour must be restricted

The Treasury Board Secretariat (TBS) of Canada uses humidex as measure of thermal conditions in office accommodations. "An unsatisfactory condition is deemed to exist when the humidex reading exceeds 40°C [inside the building - not based on "weather information" or outdoor air temperatures] or when the air temperature (dry bulb) falls below 17°C. In these cases, operations shall be stopped and employees released from the workplace if relocation is not practicable." Direct comparison between WBGT and humidex is not possible - there are no standard conversion tables or mathematical formulas to do such conversions.

**Table 4
Canadian health and safety regulations with respect to
thermal conditions in the workplace**

Jurisdiction	Regulation	Temperature
Canada, Federal	Personal service food preparation area Materials handling: operators' compartment First aid room	18°C min./29°C max. 27°C max. 21°C - 24°C ACGIH TLVs for heat stress, cold stress
Treasury Board Guidelines	Thermal conditions in office work	20-26°C Humidex 41°C max.
British Columbia	Heat Stress Regulations Indoor Air Quality Regulation, ASHRAE 55-1992 Standard	Limits in WBGT units similar to ACGIH TLV
	Summer Indoor Winter Indoor	23.3 - 27.2°C or 74 - 81°F 20.5 - 24.4°C or 69 - 76°F
Alberta	(Guidelines only)	similar to ACGIH TLVs for heat stress and cold stress
Saskatchewan	Thermal environment	Reasonable and appropriate to nature of work
Manitoba	Thermal environment	ACGIH TLVs for heat stress, cold stress
Ontario	Construction projects:	
	Change room for underground workers Work chamber Medical locks	27°C min. 38°C max. 18°C min./27°C max.
	Enclosed workplace, Industrial Establishment Regulations	18°C min.
Quebec	Safety in mines: Dryhouse temperature Occupational exposure limits	22°C min. WBGT similar to ACGIH TLVs
New Brunswick	Enclosed place of employment:	
	Light work while sitting, mental work	20°C min.
	Light work while sitting, work with small machine tools	18°C min
	Moderate physical work, standing	16°C
	Heavy physical work	12°C min.
	Work conditions	1991-92 ACGIH TLVs for heat stress and cold stress
Nova Scotia	Construction safety regulations: Working chamber	80°F max. (27°C) ACGIH TLVs for heat stress and cold stress
Prince Edward	Enclosed workplace:	

Island	Light work while sitting, mental work	20°C min.
	Light work while sitting, work with small machine tools	19°C
	Light work, standing	17°C
	Moderate work standing	16°C
	Heavy work	12°C min.
	Occupational exposure limit	ACGIH TLVs for heat and cold exposure
Newfoundland	Occupational exposure limit	ACGIH TLVs for hot and cold environment
Northwest Territories	Overnight minimum temperature only, Camp Sanitation Regulation	18°C min
Yukon Territory	Thermal environment	Heat Stress limits similar to ACGIH TLVs

What are exposure limits for working in the cold?

Some Canadian occupational health and safety regulations specify a minimum temperature for indoor work environments in buildings that are normally heated (see Table 4). No such limits are specified for outdoor work in cold weather.

The ACGIH has adopted the guidelines developed by the Saskatchewan Labour for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time (Table 5). The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The warm-up break periods are of 10 minute duration in a warm location. The schedule assumes that "normal breaks" are taken once every two hours. At the end of a 4-hour period, an extended break (e.g. lunch break) in a warm location is recommended. More information is available in the ACGIH publications "2000 TLVs and BEIs" and "Documentation of TLVs and BEIs" and on the Saskatchewan Labour web page "[Cold Conditions Guidelines for Outside Workers](#)".

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx)	°F (approx)	Max. work Period	No. of Breaks**	Max. Work Period	No. of Breaks						
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease		Non-emergency work should cease			
-40° to -42°	-40° to -44°	30 min.	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

*2000 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati : American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 176. Adopted from Saskatchewan Labour "[Cold Conditions Guidelines for Outside Workers](#)"

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