

Canada's new wind chill index

Canada now has a new wind chill index! The new index is more accurate, easy to understand and reflects the needs of Canadians. It is based on new research, using human volunteers and advanced computer technology, combined with recent medical advances in the understanding of how the body loses heat when exposed to cold. As a result, the wind chill forecasts you hear will now be much closer to what you actually feel.

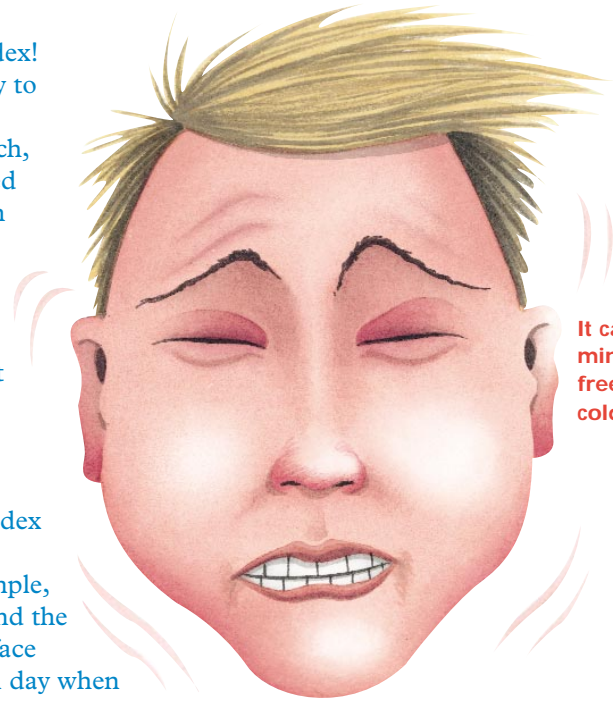
The new index is expressed in temperature-like units, the format preferred by most Canadians. The index likens the way your skin feels to the temperature on a calm day. For example, if the outside temperature is -10°C and the wind chill is -20 , it means that your face will feel as cold as it would on a calm day when the temperature is -20°C .

The new wind chill index enables Canadians to take action to avoid injuries from the cold, such as dressing warmly to avoid frostbite, and to make good decisions based on accurate information, such as whether school children should be let outdoors for recess.

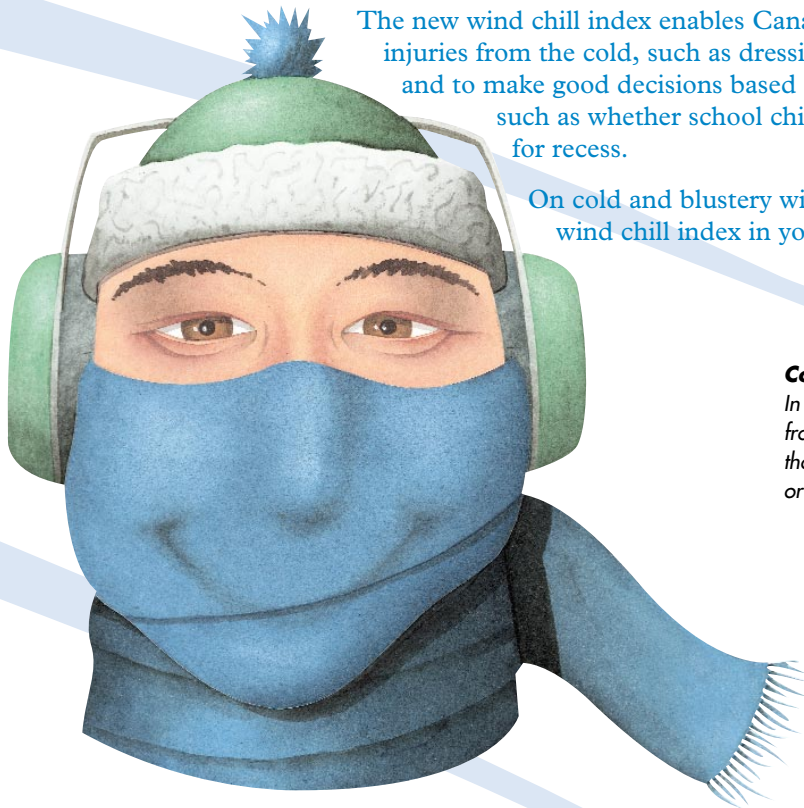
On cold and blustery winter days, listen for the new wind chill index in your local weather forecast!

Cold - A deadly weather hazard

In Canada, over 80 people die each year from over-exposure to the cold - more than those perishing from lightning, floods, or tornadoes - combined!



It can take only minutes to freeze at very cold wind chills



Saving face

WIND CHILL

The Chilling Facts



Environment
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What is Wind Chill?

Anyone who has ever waited at a bus stop or taken a walk on a blustery winter day knows that you feel colder when the wind blows. We call the cooling sensation caused by the combined effect of temperature and wind the wind chill.

On a calm day, our bodies insulate us somewhat from the outside temperature by warming up a thin layer of air close to our skin, known as the boundary layer. When the wind blows, it takes this protective layer away-exposing our skin to the outside air. It takes energy for our bodies to warm up a new layer, and if each one keeps getting blown away, our skin temperature will drop, and we will feel colder.

Wind also makes you feel colder by evaporating any moisture on your skin-a process that draws more heat away from your body. Studies show that when your skin is wet, it loses heat much faster than when it is dry.

How Wind Chill Affects You

Living in a cold country can be hazardous to your health. Each year, in Canada, more than 80 people die from over-exposure to the cold, and many more suffer injuries from hypothermia and frostbite. Wind chill can play a major role in such health hazards because it speeds up the rate at which your body loses heat.

How much heat you lose depends not only on the wind chill, but on other factors as well. Good quality clothing with high insulating properties traps air, creating a thicker boundary layer around the body which keeps in the heat. Wet clothing or footwear loses its insulated value, resulting in body-heat loss nearly equal to that of exposed skin. Your body type also determines how quickly you lose heat-people with a tall slim build become cold much faster than those that are shorter and heavier.

In addition, we can also gain heat by increasing our metabolism or soaking up the sun. Physical activity, such as walking or skiing, increases our metabolism and generates more body heat. Age and physical condition also play a part: elderly people and children have less muscle mass, so they generate less body heat. Sunshine, even on a cold winter day, can also make a difference. Bright sunshine can make you feel as much as ten degrees warmer.

Over time, our bodies can also adapt to the cold. People who live in a cold climate are often able to withstand cold better than those from warmer climates.

Where is the coldest wind chill in Canada?

The coldest wind chill on record occurred at Kugaaruk, Nunavut, on January 13, 1975. On that day, the air temperature was -51°C , and the winds were 56 km/h, producing a bone-chilling wind chill of -78.

City	Date	Wind Chill	Wind Speed (km/h)	Temperature ($^{\circ}\text{C}$)
Victoria	Dec. 16, 1964	-25	39	-13.3
Whitehorse	Jan. 9, 1963	-58	51	-36.1
Yellowknife	Jan. 26, 1960	-61	32	-41.7
Iqaluit, NU	Feb. 16, 1979	-66	61	-40.9
Alert, NU	Jan. 6, 1958	-65	58	-40.6
Edmonton	Dec. 15, 1964	-57	55	-35.6
Calgary	Dec. 15, 1964	-55	55	-33.9
Regina	Jan. 17, 1962	-59	39	-38.9
Saskatoon	Jan. 15, 1954	-59	32	-40
Winnipeg	Jan. 9, 1982	-54	56	-32.7
Thunder Bay	Jan. 10, 1982	-58	54	-36.3
Ottawa	Jan. 23, 1976	-48	35	-30.8
Toronto	Jan. 4, 1981	-44	30	-29.1
Quebec City	Feb. 12, 1967	-52	43	-33.3
Montreal	Jan. 23, 1976	-49	45	-30.6
Fredericton	Jan. 17, 1982	-43	37	-27.3
Halifax	Feb. 13, 1967	-41	48	-24.4
Charlottetown	Jan. 18, 1982	-50	37	-32.4
Goose Bay, Lab.	Jan. 21, 1975	-54	55	-33.3
Gander, Nfld.	Feb. 8, 1959	-43	72	-23.9

Canadians cope with a wide variety of wind chills. The Arctic is the wind chill capital of the country, while the mildest conditions are found in Vancouver and Victoria. The chart shows the highest recorded wind chill (over a 30 year period) for each site.

Wind Speed (km/h)	WHAT TO LOOK FOR	TEMPERATURE (°C)										WIND CHILL INDEX
		0	-5	-10	-15	-20	-25	-30	-35	-40	-45	
10	Wind felt on face; leaves rustle; wind vanes begin to move.	-3	-9	-15	-21	-27	-33	-39	-45	-51	-57	
20	Leaves & small twigs constantly moving; small flags extended.	-5	-12	-18	-24	-30	-37	-43	-49	-56	-62	
30	Dust, leaves, & loose paper lifted; large flags flap; small tree branches move.	-6	-13	-20	-26	-33	-39	-45	-52	-59	-65	
40	Small trees begin to sway; large flags extend and flap.	-7	-14	-21	-27	-34	-41	-48	-54	-61	-68	
50	Larger tree branches moving; whistling heard in power lines; large flags extend and flap more wildly.	-8	-15	-22	-29	-35	-42	-49	-56	-63	-69	
60	Whole trees moving; resistance felt in walking against wind; large flags extend fully and flap only at the end.	-9	-16	-23	-30	-36	-43	-50	-57	-64	-71	

Forecast-your-own wind chill: If you know the temperature outside, you can estimate the wind speed by observing the movement of trees and flags.

Beating the Chill

The best way to avoid the hazards of wind chill is to check the weather forecast before going outside, and be prepared by dressing warmly. As a guideline, keep in mind that the average person's skin begins to freeze at a wind chill of -25, and freezes in minutes at -35.

A simple way to avoid wind chill is to get out of the wind. Environment Canada's wind chill forecasts are based on the wind you would experience on open ground. Taking shelter from the wind can reduce or even eliminate the wind chill factor. However, you would still feel cold from the outside temperature alone.

A recent survey indicated that 82 per cent of Canadians use wind chill information to decide how to dress before going outside in the winter. Many groups and organizations also use the system to regulate their outdoor activities. Schools use wind chill information to decide whether it is safe for children to go outdoors at recess. Hockey clubs cancel outdoor practices when the wind chill is too cold. People who work outside for a living, such as construction workers and ski-lift operators, are required to take indoor breaks to warm up when the wind chill is very cold.

Try this!

Turn on a fan. Stand in front of it. You will feel colder because of the wind cooling your skin, but the temperature in the room has not changed. You cannot make the room any colder, no matter how high you turn up the fan. Similarly, no matter how strong the wind blows, the temperature of the air outside does not change. Now dab some water on your skin. Stand in front of the fan again. The wet skin will feel much colder. This demonstrates how important it is to stay dry when outdoors in high wind chills.

Towards a Better Wind Chill...

Wind chill describes a sensation, the way we feel as a result of the combined cooling effect of temperature and wind. This feeling can't be measured using an instrument, so scientists have developed a mathematical formula that relates air temperature and wind speed to the cooling sensation we feel on our skin.

The original wind chill formula was derived from experiments conducted in 1939 by Antarctic explorers, Paul Siple and Charles Passel. These hardy scientists measured how long it took for water to freeze in a small plastic cylinder when it was placed outside in the wind. Over the years, the formula was modified somewhat, but remained based on the Antarctic experiments.

The original formula was useful, but there was a need for improvement. There is a considerable difference between a human body and a plastic cylinder filled with water, most notably the fact that people produce body heat. As well, the wind speed used in the formula is measured ten metres above the ground, usually at airport weather stations. At this height, the winds are faster than those at 1.5 metres, the height of an average person. As a result, the method produced a colder wind chill than people actually experienced.

New Science and a New Standard

Canada took the lead in an international effort to develop a new wind chill formula. In April 2000, Environment Canada held the first global Internet workshop on wind chill, with more than 400 participants from 35 countries. Almost all agreed on the need for a new international standard for measuring and reporting wind chill that was more accurate, easy to understand, and incorporated recent advances in scientific knowledge.

During 2001, a team of scientists and medical experts from Canada and the U.S. worked together to develop a new wind chill index. The research agency of the Canadian Department of National Defence, with its knowledge of how troops are affected by cold weather, contributed to the effort by conducting experiments using human volunteers.

The new index is based on the loss of heat from the face—the part of the body that is most exposed to severe winter weather. Volunteers were exposed to a variety of temperatures and wind speeds inside a refrigerated wind tunnel.

They were dressed in winter clothing, with only their faces exposed directly to the cold. To simulate other factors affecting heat loss, they also walked on treadmills and were tested with both dry and wet faces.

To ensure the new wind chill index meets the needs of Canadians, Environment Canada conducted public surveys across the country. The new index is expressed in temperature-like units, the format preferred by most Canadians.

However, since the wind chill index represents the feeling of cold on your skin, it is not actually a real temperature, so it is given without the degree sign. For example, "Today the temperature is -10°C, and the wind chill is -20."

The new index is also being used in the U.S., so travelers will hear consistent information in both countries (although the U.S. index will be provided on a Fahrenheit scale).

Wind Chill	Description	Health Concern	What to do
0 to -9	Low	<ul style="list-style-type: none"> Slight increase in discomfort. 	<ul style="list-style-type: none"> Dress warmly, with the outside temperature in mind.
-10 to -24	Moderate	<ul style="list-style-type: none"> Uncomfortable. Exposed skin feels cold. Risk of hypothermia if outside for long periods without adequate protection. 	<ul style="list-style-type: none"> Dress in layers of warm clothing, with an outer layer that is wind resistant Wear a hat, mittens and scarf. Keep active.
-25 to -44	Cold	<ul style="list-style-type: none"> Risk of skin freezing (frostbite). Risk of hypothermia if outside for long periods without adequate protection. 	<ul style="list-style-type: none"> Check face, fingers, toes, ears and nose for numbness or whiteness. Dress in layers of warm clothing, with an outer layer that is wind resistant. Cover all exposed skin, particularly your face and hands. Wear a hat, mittens and a scarf, neck tube or face mask. Keep active.
-45 to -59	Extreme	<ul style="list-style-type: none"> Exposed skin may freeze in minutes. Serious risk of hypothermia if outside for long periods. 	<ul style="list-style-type: none"> Check face, fingers, toes, ears and nose for numbness or whiteness. Be careful. Dress very warmly in layers of clothing, with an outer layer that is wind resistant. Cover all exposed skin, particularly your face and hands. Wear a hat, mittens and a scarf, neck tube or face mask. Be ready to cut short or cancel outdoor activities. Keep active.
-60 and colder	Extreme	<p>DANGER!</p> <ul style="list-style-type: none"> Outdoor conditions are hazardous. Exposed skin may freeze in less than 2 minutes. 	<ul style="list-style-type: none"> Stay indoors.

Wind chill hazards.

Cold Injuries

Exposure to the cold can be hazardous, or even life-threatening. Your body's extremities, such as the ears, nose, fingers and toes, lose heat the fastest. Exposed skin may freeze, causing frostnip or frostbite. In extreme conditions or after prolonged exposure to the cold, the body core can also lose heat, resulting in hypothermia.

Hypothermia

- feeling cold over a prolonged period of time can cause a drop in body temperature (below the normal 37°C)
- shivering, confusion and loss of muscular control can occur
- can progress to a life-threatening condition where shivering stops, the person loses consciousness, and cardiac arrest may occur

What to do:

- get medical attention immediately
- lay the person down and avoid rough handling, particularly if the person is unconscious
- get the person indoors
- gently remove wet clothing
- warm the person gradually, using any available source of heat

Frostnip

- a mild form of frostbite, where only the skin freezes
- skin appears yellowish or white, but feels soft to the touch
- painful tingling or burning sensation

What to do:

- do not rub or massage the area
- warm the area gradually – use body heat (a warm hand), or warm water, avoid direct heat which can burn the skin
- once the affected area is warm, do not re-expose it to the cold

Frostbite

- a more severe condition, where both the skin and the underlying tissue (fat, muscle, bone) are frozen
- skin appears white and waxy, and is hard to the touch
- no sensation – the area is numb

What to do:

- frostbite can be serious, and can result in amputation. Get medical help.
- do not rub or massage the area
- do not warm the area until you can ensure it will stay warm
- warm the area gradually – use body heat, or warm water (40 to 42°C), avoid direct heat which can burn the skin

Seven Steps to Cold Weather Safety

1. Listen to the weather forecast

- check the Environment Canada weather forecast before going out in the cold
- if conditions are hazardous, a wind chill warning will be issued
- if the wind chill is very cold, exposed skin can freeze in minutes

2. Plan Ahead

Groups and organizations should develop a plan in advance, to ensure that safety concerns are addressed when the wind chill is high. For example, schools could hold recess indoors, outside workers could schedule warm-up breaks, and those involved in winter recreation could reduce the amount of time they spend outdoors.

3. Dress warmly

- wear layers of warm clothing, with an outer jacket that is wind-resistant. Mittens, boots and a hat are also important. (We lose a large portion of our body heat from the head.)
- when the wind chill is high, try to cover as much exposed skin as possible.
- wear a scarf, neck tube or face mask.
- check frequently for signs of frostbite

4. Seek shelter

- get out of the wind
- when wind chill is very cold, limit the time you spend outside

5. Stay dry

- wet clothing chills the body rapidly
- remove outer layers of clothing or open your coat if you are sweating

6. Keep Active

- walking or running will help keep you warm by generating body heat

7. Know your limits

- some people are more susceptible to the cold, particularly children, the elderly and those with circulation problems
- the use of alcohol, tobacco and certain medications will increase your susceptibility to cold

Source:

Defence R&D Canada, Defence and Civil Institute of Environmental Medicine – the research agency of the Canadian Department of National Defence.

Listen for Weather Forecasts and Warnings

Listen for the new wind chill index in Environment Canada's weather forecasts. In most of southern Canada, wind chill is included in the forecast when it reaches -25 , the point where frostbite becomes a risk. A wind chill warning is issued when conditions become more hazardous.

Environment Canada weather forecasts are available through radio and TV broadcasts, as well as on Weatheradio, recorded telephone messages, and on our web site at www.ec.gc.ca.

Wind Chill Quiz

1. Which of the following are affected by wind chill?

- a) your pet dog
- b) your car – when you first start it
- c) your car – when it is running
- d) your car – when it stops
- e) your house
- f) the mail box

Remember, any object that is warmer than the outside temperature is affected by wind chill.

a) Fido is definitely affected by wind chill. Pets and farm animals should not be left outside during high wind chills. b) When you first start your car in the morning, the engine is cold, so it is not affected by wind chill. However, if you use a block heater, the wind will reduce its efficiency by blowing away the heated air. Park the car so the heater is sheltered from the wind. c) When your car is running, the engine is producing heat. The movement of your car creates its own wind, and if outside temperatures are cold enough, your car may not produce enough heat to warm the passenger compartment. d) When your car has stopped, wind chill will cause it to cool off more rapidly, but once it has cooled down to the outside temperature, it will no longer be affected. e) Poorly insulated houses lose heat more quickly during high wind chills, and fuel consumption increases. f) Your mail box is not affected.

2. If the outside temperature is above 0°C , but the wind chill is -5 , will water freeze? What about the water pipes outside my house?

No matter how strong the wind blows, the outside temperature does not change. If the temperature is above zero, water will not freeze. However, if the outside temperature is below zero, water will freeze, and a strong wind will make your pipes freeze even faster.

3. What effect does wind chill have on plants? Will my garden freeze?

Wind does affect plants. Plants lose moisture through their leaves, and a strong wind can cause plants to dehydrate, particularly if the ground is frozen and their roots cannot absorb water. However, if the outside temperature is above zero, plants will not freeze. But, if the temperature is below zero, plants will freeze, and, just like your water pipes, a strong wind will make your plants freeze even faster.

4. You hear the following weather report on the radio:

"The temperature is -10°C , and the wind chill is -20 ."

- A) If the wind stops blowing, how cold is it outside?
- B) With the wind blowing, what is the temperature outside?

Both a) & b) have the same answer – the temperature outside is -10°C . The temperature does not change, no matter how hard the wind blows. Wind chill is a feeling – not a real temperature. The strong wind will make you feel very cold (as if you were in a room chilled to -20°C), but the outside temperature is still -10°C .

Further information:

Environment Canada, Inquiry Centre
Ottawa K1A 0H3

email: enviroinfo@ec.gc.ca

tel: 1-800-668-6767

weather forecasts: www.weatheroffice.ec.gc.ca

wind chill information site: www.windchill.ec.gc.ca

August 2001

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