

*In construction, municipal, agricultural and many other kinds of businesses, working outdoors during cold weather is just part of the job. To prevent temperature-related injuries such as hypothermia and frostbite, workers should be aware of how extremely cold temperatures and windchill indices affect their health and what they can do to protect themselves.*

### Temperature and Windchill

As temperatures decrease and wind speeds increase, it becomes less comfortable to work outdoors. The following table from the National Weather Service illustrates the relationship between outdoor temperature, wind speed and windchill temperature.

Table 1: Wind Chill Temperature Index Chart

**NWS Windchill Chart**

		Temperature (°F)																	
		40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Wind (mph)	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93	
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95	
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97	
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98	

Frostbite Times: 30 minutes (light blue), 10 minutes (medium blue), 5 minutes (dark blue)

Wind Chill (°F) =  $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$   
 Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

### Frostbite

Frostbite occurs when skin tissue freezes, causing ice crystals to form between cells, which leads to cellular dehydration. As Table 1 shows, frostbite can occur in as little as 30 minutes at windchill indices below -18°F, and as little as 5 minutes at wind chill indices below -48°F. The most susceptible parts of the body are the extremities, such as fingers, toes, ear lobes and the tip of the nose. Symptoms include a loss of feeling in the extremity and a white or pale appearance. A victim is often unaware of frostbite because the frozen tissue is numb. Frostbite can permanently damage the body, and severe cases can lead to amputation. The risk of frostbite is greater for people with poor blood circulation.

If a person is suspected of having frostbite:

- Get the victim out of the cold and into a warm, dry area.
- Remove any wet or tight clothing that may cut off blood flow to the affected area.
- Do not rub the affected area because this may damage the skin and tissue.
- Slowly warm frostbitten areas. Don't use a heat lamp or pour hot water on the affected area. Instead, place the victim in a warm bath (105°F) for 20 to 40 minutes.
- Dry and wrap the affected area after warming.
- Seek medical attention as soon as possible.



### Hypothermia

Hypothermia occurs when the body loses more heat than it can produce, and the internal body temperature (normally 98.6°F) drops to 95°F or lower. Low body temperature can affect the brain, causing confusion and/or poor physical movement.

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Some other symptoms of hypothermia include uncontrollable shivering; slurred speech; cool bluish skin; confused or irrational behavior; and fatigue or drowsiness. Hypothermia usually happens at very cold temperatures, but can occur even at temperatures above 40°F, if a person becomes chilled from rain, sweat or submersion in cold water. Hypothermia is particularly dangerous for older adults and young children, as well as those with medical conditions such as diabetes.

If a person shows symptoms of hypothermia, conserve their remaining body heat and provide additional heat sources until medical attention is available. This can be accomplished by:

- Getting the victim out of the cold and seeking shelter immediately
- Removing wet clothing
- Adding layers of dry clothing or blankets
- Getting the victim to move his/her arms and legs to create muscle heat; if the victim is unable to do this, place warm bottles or hot packs in the arm pits, and on the groin, neck, and head
- Giving the victim warm, sweet beverages to drink, such as sports drinks without caffeine or alcohol

### Protecting Workers

Workers should avoid exposure to extremely cold temperatures when possible. When cold environments or temperatures can't be avoided, follow these recommendations to help prevent cold-temperature injuries:

- Recognize dangerous environmental and workplace conditions
- Train workers about cold-induced illnesses and injuries
- Encourage workers to wear proper clothing for cold, wet and windy conditions, including layers that can be adjusted to changing conditions

- Use an on-site source of heat, such as radiant heaters
- Include a thermometer and chemical hot packs in all first aid kits
- Be sure workers in extreme conditions take frequent, short breaks in warm, dry shelters
- Schedule work for the warmest part of the day
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm
- Use the buddy system—work in pairs so that one worker can recognize danger signs

Personal protective clothing is the most important defense for workers exposed to cold temperatures.

Follow these recommendations:

- Wear layers of loose-fitting clothing; trapped air between layers provides insulation
- Wear tightly woven, water repellent, and hooded outer garments
- Wear a hat; 40% of a person's body heat can be lost from the head
- Wear mittens, snug at the wrist, instead of gloves
- Wear insulated and waterproof footwear
- Make dry clothing available in case work clothing becomes wet

### For Additional Information

#### Occupational Safety & Health Administration:

[www.osha.gov](http://www.osha.gov)

- Cold Stress Card

#### Centers for Disease Control and Prevention:

[www.cdc.gov](http://www.cdc.gov)

- Extreme Cold Guide

#### National Weather Service: [www.weather.gov](http://www.weather.gov)

- Windchill Chart