

**T**housands of Texan's jobs require long hours outside in the cold.

Employees in construction, snow removal, oil and gas, utility repair, policing, and postal services are among those exposed to extreme cold. The risks of cold are not only for outdoor workers. People working in cold stores, refrigerated warehouses, and the frozen food sections of supermarkets can all suffer from cold stress.

## What is cold stress?

According to the National Institute for Occupational Safety and Health, cold stress is a condition that occurs when the body can no longer maintain its normal temperature. The results can include serious injuries resulting in permanent tissue damage or death.

The body works hard to maintain its temperature in the cold. As the surrounding cold air draws heat away, the body works to keep the internal core -- the chest and abdomen -- warm. This shifts blood flow away from the skin, hands, arms, feet, and legs. These areas quickly cool, and the risk for hypothermia, frostbite, and trench foot (if exposed to moisture) can begin.

## What are the symptoms of cold stress?

Cold stress can lead to serious conditions such as hypothermia, frostbite, and trench foot.



## Hypothermia

Hypothermia results when the body temperature drops too low. Symptoms may include fatigue, confusion, disorientation, excessive shivering, and loss of coordination. In the later stages, the skin turns blue, pupils dilate, the pulse and breathing slows, and unconsciousness and coma may follow.

## Frostbite

If exposed to cold environments for long periods, ice begins to form inside and around skin cells. The ice blocks the movement of blood through capillaries, depriving body tissue of oxygen and nutrients. Early warning signs of frostbite are numbness, the feeling of pins and needles, blue and blotchy skin, and aches in the affected area. Later, blisters or black scabs may form. If untreated, in the most severe cases, amputation of the damaged tissue is the only solution.

## Trench Foot

Trench foot, also called immersion foot syndrome, is a serious and painful condition of the feet caused by standing in cold water or mud for long periods. Unlike frostbite, trench foot can occur at temperatures as high as 60°F, because wet feet lose heat twenty-five-times faster than dry feet. To prevent heat loss, the body constricts the blood vessels to shut down circulation in the feet. As this happens, skin tissue begins to die due to lack of oxygen and nutrients. Blisters, blotchy skin, redness, prickliness, and numbness may occur. Skin tissue that dies will fall off or may need removal.

## How can employees respond to cold-related symptoms?

The following chart provides valuable information in responding to and treating cold stress conditions.

Condition	Causes and Symptoms	Response
<p><b>Hypothermia</b>-a medical emergency caused by the drop in normal body temperature to 95°F or less.</p>	<p><b>Causes:</b></p> <ul style="list-style-type: none"><li>• the body loses heat faster than it can be replaced;</li><li>• happens most often at very cold temperatures;</li><li>• can occur at cool temperatures above 40°F if a person is chilled from rain, sweat, or cold water;</li><li>• continued exposure uses up a person's stored energy; and</li><li>• a body temperature that is too low affects the brain and keeps the victim from moving well or thinking clearly.</li></ul> <p><b>Mild symptoms:</b></p> <ul style="list-style-type: none"><li>• alertness with uncontrollable shivering, which is a sign the body is trying to warm itself; and</li><li>• shivering stops as symptoms worsen and the body's temperature falls.</li></ul> <p>Moderate and severe symptoms:</p>	<ul style="list-style-type: none"><li>• call 9-1-1 immediately;</li><li>• move the worker to a warm, dry place;</li><li>• remove any wet clothing and replace with dry clothing; and</li><li>• wrap the body, including the head and neck (but not the face), in layers of blankets and with a vapor barrier, like a tarp or garbage bag.</li></ul> <p><b>If medical help is more than 30 minutes away:</b></p> <ul style="list-style-type: none"><li>• give warm, sweetened drinks if alert -- no alcohol or caffeine -- to help raise the body temperature;</li><li>• never give a drink to an unconscious person;</li><li>• place warm bottles or hot packs in armpits, sides of chest, and groin; and</li><li>• call 9-1-1 for more rewarming instructions.</li></ul>

Condition	Causes and Symptoms	Response
<p><b>Hypothermia-</b> (continued)</p>	<p><b>Causes:</b></p> <p><b>Moderate and severe symptoms:</b></p> <ul style="list-style-type: none"> <li>• loss of coordination;</li> <li>• inability to stand up;</li> <li>• dilated pupils;</li> <li>• confusion;</li> <li>• slurred speech;</li> <li>• slow heart rate or breathing;</li> <li>• loss of consciousness; and</li> <li>• death.</li> </ul>	<p><b>If the person is not breathing or has no pulse:</b></p> <ul style="list-style-type: none"> <li>• call 9-1-1 immediately;</li> <li>• check for signs of breathing or a pulse every 60 seconds;</li> <li>• if after 60 seconds the affected worker is not breathing and does not have a pulse, workers trained in CPR may start rescue breaths for three minutes;</li> <li>• recheck for breathing and pulse every 60 seconds;</li> <li>• if the worker is still not breathing and has no pulse, continue rescue breathing;</li> <li>• start chest compressions only upon the advice of the 9-1-1 operator or emergency medical services*; and</li> <li>• continue to check the patient.</li> </ul> <p>*OSHA does not recommend chest compressions unless the patient will not receive medical care within three hours.</p>
<p><b>Frostbite-</b>freezing in the deep layers of the skin and body tissue.</p>	<p><b>Causes:</b></p> <ul style="list-style-type: none"> <li>• exposure to cold-weather conditions;</li> <li>• direct contact with ice, frozen metal or very cold liquids; and</li> <li>• increased risk in people with lower blood circulation and in those not dressed properly for the extreme cold.</li> </ul>	<p>Follow the response for hypothermia:</p> <ul style="list-style-type: none"> <li>• move the person to a warm, dry area;</li> <li>• do not leave the person alone;</li> <li>• loosely cover the frostbitten area with a dry cloth to protect it from contact until medical help arrives;</li> </ul>

Condition	Causes and Symptoms	Response
<p><b>Frostbite-</b> (continued)</p>	<p><b>Symptoms:</b></p> <ul style="list-style-type: none"> <li>• numbness</li> <li>• red, white, bluish-white or grayish-yellow skin;</li> <li>• hard or waxy-looking skin;</li> <li>• clumsiness due to joint and muscle stiffness; and</li> <li>• blistering after rewarming, in severe cases.</li> </ul> <p><b>Stages of frostbite:</b></p> <ul style="list-style-type: none"> <li>• <b>Frostnip.</b> Frostnip is a mild form of frostbite. Continued exposure leads to numbness in the affected area. As skin warms, people may feel pain and tingling. Frostnip does not permanently damage skin.</li> <li>• <b>Superficial frostbite.</b> Superficial frostbite appears as reddened skin that turns white or pale. Skin may begin to feel warm – a sign of serious skin freezing. If frostbite is rewarmed at this stage, the surface of skin may appear blotchy. Stinging, burning, and swelling will begin. A fluid-filled blister may appear in 12 to 36 hours after rewarming the skin.</li> <li>• <b>Deep (severe) frostbite.</b> As frostbite progresses, it affects all layers of the skin, including the tissues that lie below. Skin turns white or bluish gray. People may experience numbness and the loss of all sensation of cold, pain, or discomfort in the affected area.</li> </ul>	<ul style="list-style-type: none"> <li>• remove any tight or wet clothing that might cut off blood flow to the affected area;</li> <li>• do not rub the affected area, which can further damage skin and tissue;</li> <li>• do not apply snow or water;</li> <li>• do not break blisters;</li> <li>• do not try to re-warm the frostbitten area;</li> <li>• wait for medical professionals;</li> <li>• do not use heating pads or place the area in warm water; and</li> <li>• give warm sweetened drinks (no alcohol) if the person is alert.</li> </ul>

Condition	Causes and Symptoms	Response
<p><b>Frostbite-</b> (continued)</p>	<p>Joints or muscles may no longer work. Large blisters form 24 to 48 hours after rewarming. Afterward, the area turns black and hard as the tissue dies.</p>	
<p><b>Trench foot-</b> also known as immersion foot, is a nonfreezing injury to feet.</p>	<p><b>Causes:</b></p> <ul style="list-style-type: none"> <li>• ongoing exposure to wet conditions and cold temperatures;</li> <li>• can happen at temperatures as high as 60° F if the feet are constantly wet;</li> <li>• the body squeezes the blood vessels to shut down blood flow in the feet to prevent heat loss; and</li> <li>• skin tissue starts to die from the lack of oxygen and nutrients and the buildup of toxic products.</li> </ul> <p><b>Symptoms:</b></p> <ul style="list-style-type: none"> <li>• skin redness;</li> <li>• swelling;</li> <li>• numbness; and</li> <li>• blisters.</li> </ul>	<ul style="list-style-type: none"> <li>• call 9-1-1 right away in an emergency;</li> <li>• in a non-emergency, seek medical attention as soon as possible;</li> <li>• remove shoes or boots and wet socks; and</li> <li>• dry the feet.</li> </ul>



## How can employers and employees prevent cold-related injuries?

Prevention is the key to success.

### Employers should train workers

Before working in the cold, **train employees** about:

- the environmental and workplace conditions that lead to cold stress;
- the causes of cold-related injuries and how to limit risks;
- the need to watch for symptoms and respond;
- how to report, give first aid, and reach emergency medical services;
- how factors outside of work -- such as age, poor physical health, or opioids -- can make it harder for the body to fight or recover from work-related cold stress;
- how to choose the proper clothing for cold, wet, or windy conditions;
- how to care for and use heat-protective clothing and personal protective equipment; and
- the importance of slowly getting used to cold conditions.

Before scheduling employees to work in the cold, **train supervisors** to:

- gradually introduce workers to the cold;
- create healthy work schedules that include frequent breaks in warm, dry areas;
- save outdoor tasks for the warmest part of the day;
- use relief workers for demanding jobs, or use other means to make physical work easier;
- monitor workers' physical health, especially those at risk of cold stress, like returning workers, older workers, those with health conditions like heart disease, hypertension, hypothyroidism, or diabetes, and those taking certain medications;
- respond when a worker shows signs of a cold-related illness, and follow emergency response procedures;
- give workers warm liquids to drink, but avoid caffeine (coffee, tea, or hot chocolate);
- check the National Weather Service daily for wind chill watches, warnings, and advisories in your area, and respond accordingly;
- have employees work in pairs (the buddy system) to lower fatigue and make it easy for workers to monitor each other's well-being; and
- recommend that workers eat warm, balanced meals and get plenty of rest to keep their energy up.

### Ensure Proper Clothing

Layered clothing insulates body heat. Tight clothing restricts blood from reaching the extremities. Advise workers to wear at least three layers of loose clothing, including:

- an inner layer made of wool, silk, or a synthetic fabric to keep moisture away from the body;
- a middle layer made of wool or a synthetic to insulate when wet; and
- a larger, outer layer with some ventilation to protect from wind and rain.

Dressing properly is extremely important to prevent cold stress. The following are recommendations for working in cold environments:

- Choose wool, silk, or synthetic fibers, which stay warm when wet.
- Avoid cotton clothing, which gets and stays wet easily.
- Wear clean clothing. Dirt fills the air cells in clothing, hindering insulation.
- Wear clothing for cold, wet, windy conditions. This includes:
  - \* a hat to covers ears;
  - \* a knit cap or liner underneath a hard hat to retain heat;
  - \* a knit mask to cover the face and mouth (if needed);
  - \* mittens, not gloves, unless the work requires fine manual coordination;
  - \* socks and underwear in polypropylene or polyester to keep water away from skin; and
  - \* waterproof, insulated boots with rubber soles, removeable felt insoles, and leather tops.

## How does the wind chill temperature affect working conditions?

Both air temperature and wind speed affect how cold outdoor workers feel. The **wind chill temperature** refers to the rate the human body loses heat due to low air temperature and wind speed. For example, when the air temperature is 40°F and the wind speed is 35 mph, the wind chill temperature is 28°F. This measurement is the actual effect of the environmental cold on the exposed skin.

It is important for employers to know the wind chill temperature to gauge worker's exposure risks. Wind chill information is available through The National Oceanic and Atmospheric Administration ([NOAA Weather Radio](#)) and [Wind Chill Calculators](#) available on the internet. These tools can help employers and employees plan to safely work in the cold.

The American Conference of Governmental Industrial Hygienists developed the following Work/Warm-up Schedule for 4-hour shifts to help employers decrease cold stress on employees. Based on both air temperature and wind speed, it provides employers recommendations on when to schedule work breaks and stop non-emergency work.

**Work/Warm-up Schedule for a 4-Hour Shift**

Air Temperature--Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°F (approximate)	°C (approximate)	Maximum Work Period	Number of Breaks								
-26 to -28	-15 to -19	(Normal Breaks ) 1		(Normal Breaks ) 1		75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	(Normal 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					
-40 to -42	-40 to -44	30 min	5	Non-emergency work should cease							
-43 & below	-45 & below	Non-emergency work should cease									

Schedule applies to any 4-hour work period with moderate to heavy work activity; with warm-up periods of ten (10) 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.

*Adapted from ACGIH 2012 TLVs*

The Occupational Safety and Health Administration (OSHA) does not have a specific standard that covers working in cold environments, but the OSHA Act of 1970 states that employers have a duty to protect workers from hazards that are recognized. This includes cold stress hazards that cause or are likely to cause serious physical harm or death in the workplace. Always remain watchful of the physical conditions of your workers and provide the training needed to ensure a safe and healthy workplace.



*Safety Violations Hotline*

**1-800-452-9595**

[safetyhotline@tdi.texas.gov](mailto:safetyhotline@tdi.texas.gov)

The Texas Department of Insurance,  
Division of Workers' Compensation (DWC)  
E-mail [resourcecenter@tdi.texas.gov](mailto:resourcecenter@tdi.texas.gov)  
or call 1-800-687-7080 for more information.

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