



Cold Stress

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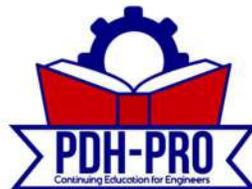
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Cold Stress Guide

NOTE:

The Occupational Safety and Health Act (OSH Act) requires employers to comply with hazard-specific safety and health standards. In addition, pursuant to Section 5(a)(1) of the OSH Act, employers must provide their employees with a workplace free from recognized hazards likely to cause death or serious physical harm. Emergency Preparedness Guides do not and cannot enlarge or diminish an employer's obligations under the OSH Act.

Emergency Preparedness Guides are based on presently available information, as well as current occupational safety and health provisions and standards. The procedures and practices discussed in Emergency Preparedness Guides may need to be modified when additional, relevant information becomes available or when OSH Act standards are promulgated or modified.

Anyone working in a cold environment may be at risk of cold stress. Some workers may be required to work outdoors in cold environments and for extended periods, for example, snow cleanup crews, sanitation workers, police officers and emergency response and recovery personnel, like firefighters, and emergency medical technicians. Cold stress can be encountered in these types of work environment. The following frequently asked questions will help workers understand what cold stress is, how it may affect their health and safety, and how it can be prevented.

How cold is too cold?

What constitutes extreme cold and its effects can vary across different areas of the country. In regions that are not used to winter weather, near freezing temperatures are considered "extreme cold." A cold environment forces the body to work harder to maintain its temperature. Whenever temperatures drop below normal and wind speed increases, heat can leave your body more rapidly.

Wind chill is the temperature your body feels when air temperature and wind speed are combined. For example, when the air temperature is 40°F, and the wind speed is 35 mph, the effect on the exposed skin is as if the air temperature was 28°F.

Cold stress occurs by driving down the skin temperature and eventually the internal body temperature (core temperature). This may lead to serious health problems, and may cause tissue damage, and possibly death.

What are the risk factors that contribute to cold stress?

Some of the risk factors that contribute to cold stress are:

- Wetness/dampness, dressing improperly, and exhaustion
- Predisposing health conditions such as hypertension, hypothyroidism, and diabetes
- Poor physical conditioning

How does the body react to cold conditions?

In a cold environment, most of the body's energy is used to keep the internal core temperature warm. Over time, the body will begin to shift blood flow from the extremities (hands, feet, arms, and legs) and

outer skin to the core (chest and abdomen). This shift allows the exposed skin and the extremities to cool rapidly and increases the risk of frostbite and hypothermia. Combine this scenario with exposure to a wet environment, and trench foot may also be a problem.

What are the most common cold induced illnesses/injuries?

- Hypothermia
- Frostbite
- Trench Foot

What is hypothermia?

Hypothermia occurs when body heat is lost faster than it can be replaced and the normal body temperature (98.6°F) drops to less than 95°F. Hypothermia is most likely at very cold temperatures, but it can occur even at cool temperatures (above 40°F), if a person becomes chilled from rain, sweat, or submersion in cold water.

What are the symptoms of hypothermia?

- Mild symptoms:
 - An exposed worker is alert.
 - He or she may begin to shiver and stomp the feet in order to generate heat.
- Moderate to Severe symptoms:
 - As the body temperature continues to fall, symptoms will worsen and shivering will stop.
 - The worker may lose coordination and fumble with items in the hand, become confused and disoriented
 - He or she may be unable to walk or stand, pupils become dilated, pulse and breathing become slowed, and loss of consciousness can occur. A person could die if help is not received immediately.

What can be done for a person suffering from hypothermia?

- Call 911 immediately in an emergency; otherwise seek medical assistance as soon as possible.
- Move the person to a warm, dry area.
- Remove wet clothes and replace with dry clothes, cover the body (including the head and neck) with layers of blankets; and with a vapor barrier (e.g. tarp, garbage bag). Do **not** cover the face.
- If medical help is more than 30 minutes away:
 - Give warm sweetened drinks if alert (no alcohol), to help increase the body temperature. Never try to give a drink to an unconscious person.
 - Place warm bottles or hot packs in armpits, sides of chest, and groin. Call 911 for additional rewarming instructions.
- If a person is not breathing or has no pulse:
 - Call 911 for emergency medical assistance immediately.
 - Treat the worker as per instructions for hypothermia, but be very careful and do not try to give an unconscious person fluids.

- Check him/her for signs of breathing and for a pulse. Check for 60 seconds.
- If after 60 seconds the affected worker is not breathing and does not have a pulse, trained workers may start rescue breaths for 3 minutes.
- Recheck for breathing and pulse, check for 60 seconds.
- If the worker is still not breathing and has no pulse, continue rescue breathing.
- Only start chest compressions per the direction of the 911 operator or emergency medical services`
- Reassess patient's physical status periodically.

`Chest compression are recommended only if the patient will not receive medical care within 3 hours.

What is frostbite?

Frostbite is an injury to the body that is caused by freezing of the skin and underlying tissues. The lower the temperature, the more quickly frostbite will occur. Frostbite typically affects the extremities, particularly the feet and hands. Amputation may be required in severe cases.

What are the symptoms of frostbite?

- Reddened skin develops gray/white patches.
- Numbness in the affected part.
- Feels firm or hard.
- Blisters may occur in the affected part, in severe cases.

What can be done for a person suffering from frostbite?

- Follow the recommendations described above for hypothermia.
- Do not rub the affected area to warm it because this action can cause more damage.
- Do not apply snow/water. Do not break blisters.
- Loosely cover and protect the area from contact.
- Do not try to rewarm the frostbitten area before getting medical help; for example, do not place in warm water. If a frostbitten area is rewarmed and gets frozen again, more tissue damage will occur. It is safer for the frostbitten area to be rewarmed by medical professionals.
- Give warm sweetened drinks, if the person is alert. Avoid drinks with alcohol.

What is immersion/trench foot?

Trench Foot or immersion foot is caused by prolonged exposure to wet and cold temperatures. It can occur at temperatures as high as 60°F if the feet are constantly wet. Non-freezing injury occurs because wet feet lose heat 25-times faster than dry feet. To prevent heat loss, the body constricts the blood vessels to shut down circulation in the feet. The skin tissue begins to die because of a lack of oxygen and nutrients and due to the buildup of toxic products.

What are the symptoms of trench foot?

- Redness of the skin, swelling, numbness, blisters

What can be done for a person suffering from immersion foot?

- Call 911 immediately in an emergency; otherwise seek medical assistance as soon as possible.
- Remove the shoes, or boots, and wet socks.
- Dry the feet.

How can cold stress be prevented?

Although OSHA does not have a specific standard that covers working in cold environments, employers have a responsibility to provide workers with employment and a place of employment which are free from recognized hazards, including cold stress, which are causing or are likely to cause death or serious physical harm to them (Section 5(a)(1) of the Occupational Safety and Health Act of 1970). Employers should, therefore, train workers on the hazards of the job and safety measures to use, such as engineering controls and safe work practices, that will protect workers' safety and health.

Employers should train workers on how to prevent and recognize cold stress illnesses and injuries and how to apply first aid treatment. Workers should be trained on the appropriate engineering controls, personal protective equipment and work practices to reduce the risk of cold stress.

Employers should provide engineering controls. For example, radiant heaters may be used to warm workers in outdoor security stations. If possible, shield work areas from drafts or wind to reduce wind chill.

Employers should use safe work practices. For example, it is easy to become dehydrated in cold weather. Employers therefore, can provide plenty of warm sweetened liquids to workers. Avoid alcoholic drinks. If possible, employers can schedule heavy work during the warmer part of the day. Employers can assign workers to tasks in pairs (buddy system), so that they can monitor each other for signs of cold stress. Workers can be allowed to interrupt their work, if they are extremely uncomfortable. Employers should give workers frequent breaks in warm areas. Acclimatize new workers and those returning after time away from work, by gradually increasing their workload, and allowing more frequent breaks in warm areas, as they build up a tolerance for working in the cold environment. Safety measures, such as these, should be incorporated into the relevant health and safety plan for the workplace.

Dressing properly is extremely important to preventing cold stress. The type of fabric worn also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, silk and most synthetics, on the other hand, retain their insulation even when wet. The following are recommendations for working in cold environments:

- Wear at least three layers of loose fitting clothing. Layering provides better insulation. Do not wear tight fitting clothing.
 - An inner layer of wool, silk or synthetic to keep moisture away from the body.
 - A middle layer of wool or synthetic to provide insulation even when wet.
 - An outer wind and rain protection layer that allows some ventilation to prevent overheating.
- Wear a hat or hood to help keep your whole body warmer. Hats reduce the amount of body heat that escapes from your head.
- Use a knit mask to cover the face and mouth (if needed).

- Use insulated gloves to protect the hands (water resistant if necessary).
- Wear insulated and waterproof boots (or other footwear).

Safety Tips for Workers

- Your employer should ensure that you know the symptoms of cold stress.
- Monitor your physical condition and that of your coworkers.
- Dress properly for the cold.
- Stay dry in the cold because moisture or dampness, e.g. from sweating, can increase the rate of heat loss from the body.
- Keep extra clothing (including underwear) handy in case you get wet and need to change.
- Drink warm sweetened fluids (no alcohol).
- Use proper engineering controls, safe work practices, and personal protective equipment (PPE) provided by your employer.

Additional Resources

Cold Stress. National Institute for Occupational Safety and Health (NIOSH).

The Cold Stress Equation

<http://www.osha.gov/Publications/coldcard/coldcard.html>

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA 3156

1998

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold related illnesses and injuries may occur, and permanent tissue damage and death may result.

Hypothermia can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/ 37°C.

Cold related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.

		Wind Speed (MPH)				
		0	10	20	30	40
30° F/-1.1° C -						
						Little Danger
20° F/-6.7° C -						(Caution)
10° F/-12.2° C -						Freezing to Exposed Flesh
0° F/-17.8° C -						within 1 Hour
10° F/-23.3° C -						
20° F/-28.9° C -						
30° F/-34.4° C -						Danger
50° F/-45.6° C -						Freezing to Exposed Flesh
-40° F/-40° C -						within 1 Minute
						
						Extreme Danger
						Freezing to Exposed Flesh
						within 30 Seconds
						Adapted from: ACGIH Threshold Limit Values, Chemical Substances and

FROST BITE

What Happens to the Body:

FREEZING IN DEEP LAYERS OF SKIN AND TISSUE; PALE, WAXY-WHITE SKIN COLOR; SKIN BECOMES HARD and NUMB; USUALLY AFFECTS THE FINGERS, HANDS, TOES, FEET, EARS, and NOSE.

What Should Be Done: (land temperatures)

- Move the person to a warm dry area. Don't leave the person alone.
- Remove any wet or tight clothing that may cut off blood flow to the affected area.
- **DO NOT** rub the affected area, because rubbing causes damage to the skin and tissue.
- **Gently** place the affected area in a warm (105°F) water bath and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast causing tissue damage. Warming takes about 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm. **NOTE:** If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

HYPOTHERMIA - (Medical Emergency)

What Happens to the Body:

NORMAL BODY TEMPERATURE (98.6° F/37°C) DROPS TO OR BELOW 95°F (35° C); FATIGUE OR DROWSINESS; UNCONTROLLED SHIVERING; COOL BLUISH SKIN; SLURRED SPEECH; CLUMSY MOVEMENTS; IRRITABLE, IRRATIONAL OR CONFUSED BEHAVIOR.

What Should Be Done: (land temperatures)

- Call for emergency help (i.e., Ambulance or Call 911).
- Move the person to a warm, dry area. Don't leave the person alone. Remove any wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if they are alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) or alcohol.

- Have the person move their arms and legs to create muscle heat. If they are unable to do this, place warm bottles or hot packs in the arm pits, groin, neck, and head areas. **DO NOT** rub the person's body or place them in warm water bath. This may stop their heart.

What Should Be Done: (water temperatures)

- Call for emergency help (Ambulance or Call 911). Body heat is lost up to 25 times faster in water.
- **DO NOT** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **DO NOT** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses the body's heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

How to Protect Workers

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during 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).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol.
- Eat warm, high-calorie foods like hot pasta dishes.

Workers Are at Increased Risk When...

- They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
- They take certain medication (check with your doctor, nurse, or pharmacy and ask if any medicines you are taking affect you while working in cold environments).
- They are in poor physical condition, have a poor diet, or are older.