

# UNDERSTANDING & PREVENTING COLD STRESS

By Paula Glover

**Working in the cold is physically difficult and psychologically demanding. On those miserable days when Mother Nature mixes in a bit of wind or rain, the effects of cold stress take hold, and the work can become downright dangerous.**

**While OSHA has not** set specific standards for cold stress or cold-related hazards, employers have an obligation to make their work environments and jobsites safe for workers. To guard against debilitating illness and injury from cold stress, employers must first understand its causes and consequences. Then, they must address those areas of risk with policies, training and outfitting that give employees proper protection from the cold.

## What Is Cold Stress?

Cold stress is a condition in which the body responds to cold environmental conditions by drawing blood away from the extremities and into the core to maintain a sufficient internal temperature. As the skin cools and blood retreats farther from the hands, feet and limbs, the risk of more serious or even life-threatening cold-related illness and injury increases.

## Who Is at Risk for Cold Stress?

Anyone who is exposed to cold is at risk of experiencing cold stress. Most especially, people in outdoor work environments with cold, wet, or windy weather and those working at higher altitudes are at the most significant risk for cold stress. Weather patterns can change without much warning, and conditions can deteriorate quickly. Construction workers, utility workers and tower climbers, ground crews at airports, public works employees, and agricultural workers must face all manner of weather challenges year-round, but working in the cold winter months is particularly risky.

People working in temperature-controlled indoor environments are also at risk for cold stress. For example, order selectors in refrigerated warehouses and cold storage facilities, food processors in blast chillers, and scientists working in deep freezers for manufacturing pharmaceuticals or storing biological materials are at risk for cold stress due to the extreme cold temperatures of the work area and their prolonged exposure to cold during a typical workday.

People with preexisting health conditions such as high blood pressure,

diabetes or hypothyroidism experience even greater risk for cold stress when working in these cold environments.

## What Are the Signs of Cold Stress?

It does not have to be extremely cold for a person to experience cold stress. Workers can experience the effects of cold stress even when temperatures are around 50 °F, especially in wind or rain (University of Iowa, n.d.).

Warning signs and symptoms of cold stress that managers and employers should watch for include:

- shivering
- fatigue or drowsiness
- tingling sensation followed by numbness
- disorientation or confusion
- slurred speech
- changes in skin color, such as turning from red to purple to white
- changes in skin texture, such as a waxy appearance

Without proper treatment, these symptoms of cold stress can advance into much more severe conditions such as hypothermia, frostbite and trench foot. These conditions can lead to permanent injuries, loss of limbs and possibly loss of life.

## Hypothermia

The average person has a body temperature of 98.6 °F. With prolonged exposure to cold, the body begins to lose heat faster than it can be produced, resulting in hypothermia. Hypothermia becomes a medical emergency when the body temperature drops below 95 °F (Mayo Clinic, 2024a). Functions of the heart, nervous system and other vital organs become dangerously impaired, and, if left untreated, hypothermia leads to respiratory failure and death.

If milder winters are more common in the area, employers may be tempted to shrug off the risks of hypothermia. However, it is important to understand that hypothermia is not restricted to subfreezing temperatures. It can occur in temperatures well above freezing, even above 40 °F (CDC, 2024), and becomes more likely when workers are exposed to rain, sleet, snow, submersion in cold water or excessive sweat.

## Frostbite

The effects of frostbite are visible externally on exposed skin. Frostbite occurs when areas of the skin and underlying tissues freeze. The skin may feel very cold, then numb, and then change colors



to red, white, blue, gray, purple or brown. Skin and tissues affected by frostbite may also become hard and take on a wax-like appearance (Mayo Clinic, 2024b).

Frostbite can occur at any temperature below 32 °F and usually affects small areas of exposed skin such as fingers, toes, ears and noses (Cleveland Clinic, 2023). Milder cases can be treated by rewarming and protecting the affected area from further damage. More severe cases will result in swelling and blistering after rewarming. More serious cases of frostbite cause necrosis, an irreversible tissue damage that requires surgery to remove.

## Trench Foot

Trench foot is a nonfreezing cold injury that usually occurs in cool, damp and sometimes unsanitary conditions that are above freezing, even as high as 60 °F (Bush et al., 2023). Trench foot can develop in as little time as 10 hours and is caused by standing in water or working in wet or excessively sweaty socks and shoes.

Prolonged exposure to cool, damp conditions can reduce blood flow in the feet, causing the skin and underlying tissues to break down and develop blisters or open sores that increase the risk of fungal and bacterial infections. Without prompt and proper treatment, trench foot can progress to skin sloughing and serious infection or sepsis that may require surgery or amputation.

## Increased Risk of Incidents & Injuries

The U.S. Bureau of Labor Statistics (2022) reports 53 on-the-job fatalities in 2020 where weather and atmospheric conditions such as high winds, snow and ice were considered a source of injury. Workers who experience cold stress from these sources may not even know anything is wrong. Even though their reaction times are slower and their coordination is impaired, they may still keep working. Without intervention from a coworker or manager who recognizes the signs of cold stress, everyone on the jobsite could be at risk for incidents or injuries.

## What Should Employers Do to Prevent Cold Stress on the Job?

Whether employees are working outdoors in cold winter weather or indoors in a refrigerated warehouse, employers must provide a safe working environment. Employers should establish policies regarding cold stress prevention, provide training to help employees



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## Policies for Cold Stress Prevention

First, create policies that empower managers to adjust staffing and scheduling when conditions will be extremely cold. NIOSH (2024) recommends scheduling relief workers or assigning additional workers to jobs that are particularly demanding, or that require peak concentration and high levels of dexterity or precision.

Policies that affect work in cold conditions should also provide adequate time and a designated area for warming breaks. The latter can be a heated room outside a cold storage warehouse or simply a heated construction trailer on a jobsite. The American Conference of Governmental Industrial Hygienists suggests 10-minute warming breaks between short work periods. The work periods and frequency of recommended warming breaks vary based on ambient temperature, wind speed, and work intensity (University of Iowa, n.d.). Essentially, as conditions become colder and windier, the work periods should become shorter and the warming breaks more frequent.

## Training for Cold Temperatures

Employees who have never experienced cold stress may not understand that their own lives and limbs may be at

stake, not to mention the danger to their colleagues if cold stress impairs their performance to the point that an incident occurs. Employers should provide annual training to prepare employees for working in the cold.

Training sessions should include information on cold stress prevention, recognizing the signs and symptoms of cold stress, and more severe conditions like hypothermia, frostbite and trench foot. Explain that these conditions are considered medical emergencies and ensure that employees know how to handle medical emergencies at work.

## Proper Outfitting for Cold Weather Work

Whether employers supply a uniform that includes insulated PPE for the cold, provide a stipend for employees to purchase insulated PPE, or require employees to obtain protective gear at their own expense, employers should set clear expectations about the proper outfitting for cold weather work.

## Cold Stress Culprits for Stealing Body Heat

Ensure that employees understand the five main ways the body loses heat: radiation, convection, evaporation, respiration and conduction. Then, make sure they understand how to mitigate heat loss.

The human body generates enough heat in mild conditions to maintain a stable body temperature. In colder temperatures, body heat rises to the skin's surface, then radiates away quickly (Young et al., 1996), especially in the head and neck areas where the skin is more likely to be exposed. The better the skin is covered, the warmer the body will feel and the lower the risk of cold stress.

In addition to heat loss by radiation, cold conditions siphon warmth away from the body through convection. More commonly referred to as windchill, convection amplifies the effects of heat loss and makes the body feel even colder. Windproof outer layers protect against cold stress induced by windchill.

Working up a sweat in the cold might sound like a good idea for keeping warm, but the process of evaporating sweat actually cools the body. Sweating too much makes the body feel significantly colder. Wearing multiple layers of clothing allows adjustments as the activity level changes. Wearing a noncotton, moisture-wicking layer close to the skin will also help keep the skin dry and feeling warmer.



When conditions are cold, the simple act of breathing can be dangerous due to heat loss from respiration. Long exposure to breathing cold air can lower the body's core temperature, making it even more challenging to keep the extremities warm. Covering the nose and mouth with a gaiter or face mask can mitigate the effects of cold stress from respiration.

Lastly, contact with cold surfaces or materials can steal away body heat through conduction. In a cold environment, everything a worker touches—from tools or equipment to the floor or surface they are standing on and products or supplies they are handling—can transfer cold. Wearing insulated gloves and work boots with composite safety toes, rather than cold-conducting steel or aluminum toes, guards against transferring cold via conduction.

### Cold Stress Cures for Keeping Warm at Work

Insulated PPE is a requirement for fighting against loss of body heat while working in the cold. Following are recommendations for guarding against heat loss and the risks of cold stress.

First, employees should dress for the environment and their personal activity level. Insulated PPE is available in varying levels of warmth and insulation. If workers are very active, less insulation is needed because they generate more body heat. Employees working in less active positions will need more insulation from the cold.

Carefully consider the type of insulation as well. Natural down insulation is warm but settles into clumps with prolonged use, leaving cold spots in the garment. Natural down is also heavier when it gets wet. Synthetic insulation such as polyester or plant-based materials is more durable and can be sewn into the garment to avoid shifting and settling, even after long use. Synthetic insulation also offers greater water resistance and weighs less than natural down insulation.

Workers in outdoor environments should choose water-repellent outerwear that keeps rain and snow from creeping in. People working indoors in refrigerated environments must still consider the effects of ice and condensation, so water-repellent outerwear is recommended for them as well.

Remember that getting wet means getting cold. Employees should take a moment at each warming break to check for sweat or moisture buildup inside their

insulated PPE and change into dry clothing or socks as needed.

Dress in multiple layers for adjustable full-body coverage. A good rule of thumb is to start with a moisture-wicking base layer. Avoid cotton base layers and thermal underwear because cotton absorbs sweat and holds it near the skin, making the body feel colder. Synthetic layers with hollow fibers that wick moisture away from the skin keep workers drier and warmer.

Next, choose an insulated mid-layer such as a quilted sweatshirt or thermal fleece. This layer adds a pocket of warmth to trap escaping body heat. Then, choose a weatherproof outer layer such as an insulated jacket, bib overalls or coveralls.

Protect employees' feet from cold-related injury with moisture-wicking socks and waterproof work boots. In extreme cold, a pac boot with a removable insulated liner may be easier to keep dry and fresh. Workers can change their socks and liners during a warming break, allow them to dry, put on a fresh pair and get back to work.

Pair insulated work gloves with moisture-wicking glove liners to protect employees' hands. Add a neck gaiter or a full-face mask to protect vulnerable skin of the neck, ears and face. Workers who must wear a hard hat should consider wearing a balaclava that is specially designed to fit over a hard hat to protect their neck, ears and face from the cold.

Remember to cover all areas exposed to cold, wet or windy conditions. Add or remove layers as needed when the activity level or environment changes.

Workers should avoid tight clothing, especially clothing that is too tight around the waist, at the top of sock bands and the wrists. Proper blood flow and adequate circulation are vital to keeping the core and extremities warm (NIOSH, 2024). It is also a good idea to look for insulated PPE that provides added flexibility at major joints such as shoulders, elbows and knees so that workers can move, bend, reach and react quickly on the job.

Employees in cold environments will burn more energy to maintain a stable temperature, so they may need more calories and water than usual. Warm, noncaffeinated drinks, water and energy-dense snacks are good ways to fuel up during a warming break. Alcohol and nicotine should be avoided when working in the cold because these substances affect the body's ability to regulate temperature and retain body heat, especially in the extremities.

Employees should check in with co-workers in a buddy system. Cold stress can set in quickly, so regularly timed check-ins can help employees notice declines in coordination or focus. If an employee is experiencing drowsiness, loss of balance, extreme shivering or changes in breathing, seek help immediately.

### Conclusion

Working through cold, wet and windy conditions takes determination and dedication. By implementing policies that prioritize worker warmth and safety, delivering cold-stress training and helping workers understand how to dress correctly for cold conditions, employers can effectively prepare their teams to take on the cold without getting taken out by cold stress. **PSJ**

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