New Jersey Public Employee Occupational Safety and Health (PEOSH) Program’s Cold Weather Safety Initiative

Cold is an occupational health hazard for many types of workers. Currently there is no specific regulation that addresses the protection of workers from environmental cold, although the Occupational Safety and Health Administration (OSHA) and the New Jersey Public Employees Occupational Safety and Health (PEOSH) General Duty Clauses may apply in severe cases. The information presented on this page provides an overview of the health hazards of working in cold environments and contains guidelines and resources on how workers can be protected.

Like all occupational diseases, cold-related health problems, including the indirect toll on exposed workers, are under-recognized and under-reported. Few employers report workers missed work as a direct result of exposure to environmental cold. Some jobs at risk are listed in the box at right.

**Types of Jobs at Risk for Cold Exposure:**

- Airport ground personnel
- Athletes, especially on sidelines
- Auto repair and fueling
- Bus and taxi driving
- Construction and demolition
- Crossing guards
- Dairy farming
- Fishing and diving
- Ice making
- Logging
- Maritime
- Meat packing, fresh and frozen food
- Mining, oil, and gas drilling
- Police, fire, and emergency responders
- Postal and other delivery
- Pulp and paper
- Railroad and trucking
- Road repair
- Ski resorts and other outdoor recreation
- Snow and trash removal
- Utility repair
- Warehousing
**Direct Cold-Related Health Problems**

**Hypothermia:** Hypothermia, a drop in the body's internal temperature below 95 degrees Fahrenheit, is a threat in frigid weather but can also strike at moderate temperatures. Hypothermia is a medical emergency with a high fatality rate.

**Frostbite:** Skin, muscle, blood vessels, and nerves freeze and form ice crystals. Blood vessels become blocked with tissue debris that causes more damage. Frostbite is often irreversible and amputation is sometimes required. If the injured site heals, the victim may suffer chronic pain or numbness, excessive sweating, abnormal skin color, and joint pain. The feet, hands, ears, nose, cheeks, and penis are the most frequently injured sites.

**Immersion foot:** If part of the body is covered with water or wet mud that is just above freezing, the area may become chronically swollen, weak, and sensitive to the cold.

**Chilblain:** Red, swollen skin, usually on hands and feet that feels hot, tender, and itchy after cold exposure.

**Indirect Cold-Related Health Problems**

**Disease flare-ups:** Conditions like arthritis and asthma can be made worse in cold environments.

**Increase in injuries:** Cold weather can decrease dexterity, mental skills, coordination, and cause a general decline in performance that could create safety risks.

**Strains and sprains:** Working in cold weather can increase the risk of injuries to muscles and tendons, for example, back strain.

**Other health effects:** Sinus irritation, viral infections, chronic lung disease, arthritis.

**Factors that Increase Danger from the Cold**

**Air movement:** High wind exposure, strong ventilation, moving through air -- as in an open vehicle.

**Wetness:** Wet skin, clothing or shoes from being wet with water, gasoline, alcohol, solvent, or other liquid that evaporates.

**Sweating:** Wet skin, clothing, or shoes from sweating.

**Under-dressing:** Exposed fingers, cheeks, nose, ears; uncovered head.
**Over-dressing:** Too-thick clothing rather than layers; tight-fitting belt, clothing or shoes that restrict circulation; waterproof clothing that restricts evaporation.

**Low activity level:** Standing or sitting still, driving.

**Contact with cold objects:** These take the heat out of the body.

**Being tired, hungry or thirsty:** These keep the body from replacing lost heat.

**Medical conditions:** Especially those affecting circulation, such as diabetes, an underactive thyroid, heart disease, history of frostbite.

**Medications:** Some medications such as tranquillizers and beta-blockers cause drowsiness or affect vasoconstriction.

**Alcohol, caffeine, nicotine:** Alcohol impairs judgment and reduces shivering and caffeine increases urine production and blood circulation; both lead to a loss of body heat. Nicotine decreases blood flow to the extremities and raises the risk of cold injury.

**Control Measures to Prevent Cold-Related Injuries**

1. **Raise the Temperature**
   - **Indoors:** Readings of temperature and air movement should be taken in all cold work areas at the start, middle, and end of each shift, or at least every four hours.
   - **Outdoors:** The weather report can be used.
   - **Wind Chill Chart:** Where there is air movement from wind, ventilation, or travel in an open vehicle like a forklift, the wind chill index should be used to evaluate the hazard, rather than the air temperature lost by the body alone. The wind chill index takes into account the wind blowing the heat away from the body. If you know the temperature and speed of air movement, the wind chill can be obtained from Table 1:
2. **Raise the Temperature**

The first line of defense against cold is to warm things up. A refrigerated room can be kept at the maximum allowable temperature. Outdoor work can be postponed to a warmer day, using weather forecasts for planning. Warm air jets, radiant heaters, and contact warm plates can be provided for spot heating. Infrared radiant heaters warm people and objects but not the air and therefore may be cost-effective in warehouses, loading docks, and other large, unheated indoor spaces.

3. **Use Warming Shelters**

Heated tents, cabins, break rooms, etc. should be available to workers. The colder the temperature and the higher the wind speed, the more often special warm-up breaks should be taken in these shelters. Breaks should be at least 20 minutes to allow for re-warming. The onset of heavy shivering, frostnip or minor frostbite, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the warming shelter. The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended the work/warm up schedules in Table 2. For example, at -20 to -24 degrees Fahrenheit (°F) with a wind speed of five miles per hour (mph) [440 feet per minute (fpm)], the ACGIH recommends two warm-up breaks in a 4-hour period, with a maximum work period of 75 minutes. Note that the table also gives several
ACGIH recommendations on when non-emergency work should cease -- for example, below -35°F with a 10-mph (880 fpm) wind speed.

### Table 2

<table>
<thead>
<tr>
<th>Air Temp. (°F)</th>
<th>No wind</th>
<th>5-mph wind</th>
<th>10-mph wind</th>
<th>15-mph wind</th>
<th>20-mph wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Fahrenheit (°F)</td>
<td>max. work period</td>
<td># of breaks</td>
<td>max. work period</td>
<td># of breaks</td>
<td>max. work period</td>
</tr>
<tr>
<td>-15 to 19 °F</td>
<td>(normal breaks)</td>
<td>1</td>
<td>1</td>
<td>75 min.</td>
<td>2</td>
</tr>
<tr>
<td>-20 to 24 °F</td>
<td>(normal breaks)</td>
<td>1</td>
<td>75 min.</td>
<td>2</td>
<td>55 min.</td>
</tr>
<tr>
<td>-25 to 29 °F</td>
<td>75 min.</td>
<td>2</td>
<td>75 min.</td>
<td>2</td>
<td>55 min.</td>
</tr>
<tr>
<td>-30 to 34 °F</td>
<td>55 min.</td>
<td>3</td>
<td>40 min.</td>
<td>4</td>
<td>30 min.</td>
</tr>
<tr>
<td>-35 to 39 °F</td>
<td>40 min.</td>
<td>4</td>
<td>30 min.</td>
<td>5</td>
<td>Non-emergency work should cease</td>
</tr>
<tr>
<td>-40 to 44 °F</td>
<td>30 min.</td>
<td>5</td>
<td>Non-emergency work should cease</td>
<td>Non-emergency work should cease</td>
<td></td>
</tr>
<tr>
<td>-45 °F and below</td>
<td>Non-emergency work should cease</td>
<td>Non-emergency work should cease</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table applies only if workers are wearing dry clothing and doing moderate to heavy work activity, for light to moderate work activity, move down one line to decrease maximum work period and increase the number of breaks.

Source: Thermal Stress, Cold Stress, 2008 TLVs® and BEIs®, pages 208-216, ACGIH, Cincinnati, OH.

### 4. Control Effects of Air Movement

An increase of just one mph (88 fpm) in wind speed can double the chance of cold injury. Wind can be blocked by wind shields. In refrigerated rooms, air speed can be minimized as much as possible by properly designed air distribution systems and should not exceed 2.3 mph (200 fpm). Special wind-protective clothing can be provided.

### 5. Stay Dry

Heavy sweating will result in wet clothing. The work rate should be fast enough to keep warm, but not so fast as to cause heavy sweating. Clothing that has become wet either from sweating, rain, snow, or other moisture source should be changed. When entering a heated shelter, snow or frost on clothing should be brushed off before it melts, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation. Snow should be kept out of clothing, boots, and gloves.

### 6. Wear Loose-fitting, Layered Protective Clothing

Selection of cold weather protection should be done in compliance with OSHA and PEOSH standards on personal protective equipment (PPE). These are 1910.132 for general requirements, 1910.136 for foot protection, and 1910.138 for hand protection. A hazard assessment is a key requirement of the standards. There are separate PPE standards for
construction, maritime, and agriculture. Resources on the PPE Standards are provided at the end of last section.

### Three layers of body, hand, foot, and hand protection should be used!

Protection should be loose-fitting with at least three layers so as to trap air and provide insulation. At the same time, it is important that protection be permeable to perspiration. Only if very light work is involved should the outer layer of body protection be waterproof. Desirable features in cold weather clothing include hand-warmer pockets, hoods, adjustable cuffs, removable linings, and easy control of openings at neck, underarms, and wrists to regulate ventilation of interior space.

- **Inner wicking layer:** An inner layer of protection made of a wicking material, such as polypropylene, will help to draw moisture away from the skin.

- **Middle insulating layer:** Wool, down, fleece or other material with loft will hold the body’s heat without adding weight. Protective clothing has improved with the introduction of synthetic fabrics that are lighter, more insulating, and faster-drying than wool, for example, polyester fleece like Polartec®.

- **Outer layer for wind and water protection:** Water-repellent outer fabrics will let air pass through them and can be changed as they become too wet. Waterproof fabrics are available that are also breathable, for example, Gore-Tex®. Depending on the nature of the work, this layer may also need to be resistant to oil, fire, chemicals, or abrasion.

### Hand protection

Protection of the hands is important not only to prevent cold injury while maintaining the dexterity needed to prevent accidents. Layer with glove liners, gloves, then mittens. For jobs requiring dexterity, there are fingerless gloves with attached mittens that can be temporarily folded back. The ACGIH recommends gloves if the air temperature falls below 60.8°F for sedentary, 39.2°F for light, and 19.4°F for moderate work. If fine work is to be performed with bare hands for more than 10-20 minutes, special provisions such as warm air jets, radiant heaters, or contact warm plates should be provided. Below 0°F, the ACGIH recommends mittens, which protect better than gloves. Machine controls and tools for use in cold conditions should be selected or designed so they can be handled without removing the mittens. Metal handles should be covered by thermal insulating material at temperatures below 30.2°F. Warning signs should be placed on cold surfaces below 20°F.
Foot protection: The feet and toes are highly susceptible to cold injury. Layer with sock liners, woolen or polyester socks, then waterproof insulated boots. Military vapor-barrier boots and Native Alaskan-inspired mukluk boots are examples of effective foot protection. Removable felt liners should be used in boots and removed daily for complete drying. Socks should be changed if damp. Boots may need to have a steel-toe if crushing hazards are present. Tight-fitting shoes should be avoided because they restrict blood circulation and do not allow for air to be trapped in socks for insulation.

Hat and face protection: Hats, hoods, and masks not only prevent frostbite to the cheeks, ears, and nose but also conserve heat loss from the head. Forty percent of heat loss is through the head. Removing headgear is an effective way to decrease body temperature when overheated.

7. Have a Change of Clothing for an Emergency

In case of wetness or excessive sweating, a complete change of clothing (shoes, hat, gloves, etc.), should be available.

8. Eat and Drink Well

Workers can prepare for work in the cold by eating a high calorie diet to maintain a larger reserve of stored energy. Dehydration or the loss of body fluids can be a problem in the cold. Warm, sweet drinks, and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee, tea, and cola should be limited.

9. Use a Buddy System

The ACGIH recommends that below 10.4°F workers should be under constant protective observation by a co-worker or supervisor. New employees should not be required to work full-time in the cold during the first days on the job until they become accustomed to the working conditions and required protective clothing.

10. Prepare for Vehicle Breakdowns

Workers who must travel in cold weather should be supplied with extra warm clothing, gloves, and blankets, as well as normal vehicle emergency supplies.

11. Worker Education

Workers exposed to cold should receive initial and annual training regarding the health effects of cold exposure, proper re-warming procedures, recognition of and first aid for frostbite and hypothermia, required protective clothing, proper use of warming shelters, the buddy system, vehicle breakdown procedures, and proper eating and drinking habits for working in the cold.
NOTE: The PPE Standard requires that employers certify in writing that training on PPE use, care, and limitations has been provided and that employees understand what they have been taught.

12. **Medical Checkups**

Workers should be checked by a physician to ensure that they are not suffering from diseases or taking medications which interfere with normal body temperature regulation or reduce tolerance for cold environments.

13. **Proper Medical Treatment**

Treatment of cold-related health problems in a medical facility can make the difference between full recovery and lifelong problems. Treatment for frostbite involves rapid re-warming of the affected parts in \(104-108^\circ F\) water and oral and topical therapy to limit inflammation. Treatment for hypothermia involves whole body re-warming from the inside out, not immersion or exercise. Because internal organs, including the heart, are cold, people suffering from hypothermia are at increased risk of heart attacks. Helpful measures (until transport to a medical facility) include moving the worker to a warm, dry location, drinking warm liquids, removing wet clothing, adding layers of dry clothing, placing the victim in a pre-warmed sleeping bag, preferably with a warm person, applying, and heat packs in the armpits, neck, chest, and groin. Severe hypothermia can mimic death. Victims should receive medical care even if they show no signs of life.