Cold Stress

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PDH: 1

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Module 1: Cold Stress Guide

Learning Objectives

By the end of this section, you will be able to:

- **Identify** environmental and physical risk factors that contribute to cold stress in various work settings.
- **Evaluate** the clinical symptoms of hypothermia, frostbite, and trench foot to determine appropriate first aid interventions.
- **Select** appropriate engineering controls, work practices, and personal protective equipment (PPE) to mitigate cold-related hazards.

Executive Summary: Cold stress is a critical occupational hazard where environmental conditions drive down skin and core body temperatures, potentially leading to tissue damage or death. Professionals must manage these risks through a combination of environmental monitoring, rigorous training, and the implementation of tiered protective strategies.

Design Fundamentals of Cold Stress

Anyone working in cold environments is at risk, particularly those required to work outdoors for extended periods such as emergency response personnel, sanitation workers, and snow cleanup crews. Cold stress occurs when the body can no longer maintain its normal internal temperature.

Environmental Assessment

The threshold for "extreme cold" varies by region; in areas unaccustomed to winter weather, temperatures near freezing are considered extreme.

Wind Chill Factors

Wind chill is the effective temperature felt by the body when air temperature and wind speed are combined. As wind speed increases, the body loses heat more rapidly.

Equation 1-1: LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

💡 **Design Tip:** Professional judgment is required to adjust work schedules based on local climate norms, as regions unfamiliar with cold will experience "extreme" effects at higher temperatures than northern regions.

Risk Factors and Physiological Response

Risk factors contributing to cold stress include:

- **Environmental conditions**: Wetness or dampness.
- **Physical state**: Exhaustion and poor physical conditioning.
- **Inappropriate PPE**: Dressing improperly for the conditions.

- **Predisposing health conditions**: Hypertension, hypothyroidism, diabetes, and cardiovascular disease.
- **Medications**: Certain drugs can impair the body's response to cold.

In cold environments, the body prioritizes the **internal core temperature** by shifting blood flow from the extremities (hands, feet, arms, and legs) and outer skin to the chest and abdomen. This physiological defense increases the risk of frostbite and hypothermia in the extremities.

Cold-Induced Illnesses and Injuries

Hypothermia (Medical Emergency)

Hypothermia occurs when the normal body temperature of 98.6 F drops to less than 95 F.

⚠️ **Safety Constraint:** If a worker is not breathing and has no pulse, check for 60 seconds before starting rescue breaths. Start chest compressions **only** under the direction of a 911 operator or if medical care is more than 3 hours away.

Frostbite

Frostbite involves the freezing of skin and underlying tissues. It typically affects fingers, toes, nose, and ears.

- **Symptoms include:**
    - Gray/white patches on reddened skin.
    - Skin that feels firm or hard.
    - Numbness.
    - Blisters in severe cases.

Trench Foot (Immersion Foot)

This injury is caused by prolonged exposure to wet and cold temperatures and can occur at temperatures as high as 60 F if feet are constantly wet. Wet feet lose heat **25 times faster** than dry feet.

Prevention and Protective Strategies

Engineering and Work Practice Controls

Employers must provide a workplace free from recognized hazards under the OSH Act. Recommended practices include:

Radiant Heaters: Use for warming workers in stationary outdoor positions.

- **Shielding**: Protect work areas from drafts and wind to reduce wind chill.
- **The Buddy System**: Assign workers in pairs to monitor for signs of distress.
- **Acclimatization**: Gradually increase workloads for new or returning workers.
- **Fluid Intake**: Provide warm, sweetened liquids; avoid alcohol and caffeine.

Personal Protective Equipment (PPE)

Dressing in layers is the primary defense against cold stress.

Layering Standards

- **Inner Layer**: Wool, silk, or synthetics (polypropylene) to wick moisture.
- **Middle Layer**: Wool or synthetic for insulation even when wet.
- **Outer Layer**: Wind and rain protection with ventilation to prevent overheating.

💡 **Design Tip:** Cotton should be avoided as it loses all insulation value when wet.

🧮 **Calculation Note:** When calculating survival time in water, assume that swimming or physical activity reduces survival time by approximately 50 percent due to heat loss.

Checkpoint Quiz

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1. **Which condition can occur at temperatures as high as 60 F if the environment is consistently wet?**
   a) Hypothermia
   b) Frostbite
   c) Trench Foot
   d) Hypertension

Answer: (c). Trench foot occurs due to prolonged wetness even at temperatures well above freezing.

2. **According to standard first aid for frostbite, which of the following actions is prohibited?**
   a) Moving the person to a dry area.
   b) Rubbing the affected area to stimulate blood flow.
   c) Loosely covering the affected part.
   d) Seeking medical attention immediately.

Answer: (b). Rubbing frostbitten tissue can cause severe skin and tissue damage.

3. **In an emergency where a hypothermic worker is unconscious and medical help is 4 hours away, when should a trained worker begin chest compressions?**
   a) Immediately upon finding the worker.
   b) Only if the worker is not breathing and has no pulse after a 60-second check.
   c) Only after 30 minutes of rescue breathing.
   d) Never; only medical professionals can perform compressions.

Answer: (b). Chest compressions are recommended if the patient will not receive medical care within 3 hours and lacks a pulse/breathing.

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