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## Preventing Cold-Related Illnesses in Agricultural Workers<sup>1</sup>

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During the winter months many agricultural workers and commercial fishermen face an additional occupational hazard - exposure to the cold. Some health problems can arise including frostbite, trench foot, and hypothermia. This sheet is designed to provide readers with basic information on how to prevent cold-related illnesses.

### THE COLD ENVIRONMENT

**How the body responds to cold.** An individual gains body heat from food and muscular work, and loses it through convection, conduction, radiation, and sweating to maintain a constant body temperature of approximately 98.6°F. The body's first response to a cold environment is constriction of the blood vessels of the skin, that reduces heat loss from the surface of the skin by decreasing peripheral blood flow; and/or shivering, that generates heat by increasing the body's metabolic rate.

**Environmental conditions** that cause cold-related stresses are low temperature, cool high winds, dampness, and cold water. Wind chill (temperature and wind velocity) is an important factor to evaluate when working outside. For example, when the actual air temperature of the wind is 40°F and its velocity is 35 mph, the exposed skin would perceive these conditions as if the equivalent still air temperature were 11°F. A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures.

### OTHER MAJOR RISK FACTORS FOR COLD-RELATED STRESSES

In addition to the cold environment, other major risk factors contributing to cold-related stresses include:

- Inadequate clothing or wet clothing (the actual effects of cold on the body depend on how well the skin is insulated from the environment);
- Drug use or certain medications may inhibit the body's response to cold or impair judgment (examples include beta blocks, neuroleptic drugs, alcohol, and cigarettes);
- A cold or other disease, such as diabetes, atherosclerosis and hypothyroidism, may increase risk;
- Gender: male death rates due to cold exposure are greater than the rates for females; perhaps because of inherent risk-taking activities, body fat composition, or other physiological differences;
- Susceptibility increases with age;
- Exhaustion or immobilization, especially through injury or entrapment.

### HARMFUL EFFECTS OF COLD

Common harmful effects of cold include **frostbite**, **trench foot**, and **general hypothermia**.

Frostbite occurs when skin tissue actually freezes and cell damage results. The freezing point of skin is approximately 30°F and windchill can be a significant

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factor in accelerating the process. Fingers, toes, cheeks, nose, and ears are primarily affected. The symptoms of frostbite include uncomfortable sensations of coldness; there may be a tingling, stinging, or aching feeling followed by numbness. Initially the frostbitten area appears white and is cold to the touch. This is followed by heat, redness, and swelling. Occasionally a victim may not be aware of the frostbite.

Tissue damage can be mild and reversible or severe, resulting in scarring and tissue death. Amputation or loss of function can be an unfortunate result. First aid includes treating affected areas with warm water at 102° to 110°F. Be careful to avoid rubbing frostbitten areas because this can lead to greater tissue injury. If there is a chance for refreezing, do not rewarm the affected areas.

**Trench foot** may be caused by long, continuous exposure to a wet and cold environment, or actual immersion in water. This may be a special concern of commercial fishermen. The condition is characterized by vascular damage. Symptoms include a tingling and/or itching sensation, pain, and swelling. Blisters may form and be followed by death of skin tissue and ulceration.

First aid treatment for trench foot is similar to the treatment for frostbite, and includes: moving the victim to a warm area; treating the affected part with warm water (102°-110°F) or warm packs; arranging bed rested in a warm environment; and obtaining medical assistance as soon as possible.

**General hypothermia** is the progressive loss of body heat with prolonged exposure to cold. Body heat loss is accelerated more rapidly when a person is wet because of sweat or working in a damp environment. Most cases of hypothermia develop in air temperatures between 30° & 50°F, but significant hypothermia can occur with air temperatures as high as 65°F (particularly when clothing is wet), or in the water at 72°F.

The first symptoms of hypothermia are uncontrollable shivering and feeling of cold. As the body's temperature continues to drop, an individual can become confused, careless, and disoriented. At this point a person may make little or no effort to avoid further exposure to the cold. For those working around machinery or animals, accidental injury is an additional risk. When the core body temperature falls below 86°F, the body's adaptive mechanisms for reducing heat loss become ineffective and death can occur.

Individuals experiencing mild hypothermia should be immediately moved to a warm, dry shelter. Further heat loss is minimized by removing wet clothing and applying warm blankets for insulation. Warm, nonalcoholic, caffeine-free drinks may be offered. More severe cases of hypothermia require intensive medical care.

## PREVENTING COLD-RELATED DISORDERS

The following recommendations may help to reduce the number of cold-related disorders that agricultural workers experience during the winter months.

### Personal Protective Clothing

1. Dress appropriately. Wear at least three layers: an outer layer to break the wind and allow some ventilation (like gortex or nylon); a middle layer of wool, down, or synthetic pile to absorb sweat and retain insulating properties when wet; and an inner layer of cotton or synthetic weave to allow ventilation and escape of perspiration (1).
2. Layer clothing to create air pockets that help retain body heat. Layering also makes adapting to changes in weather and level of physical exertion easier.
3. Keep available a change of clothing, if work garments become wet.
4. Pay special attention to protecting feet, hands, head, and face. Keep the head covered (up to 40 percent of body heat can be lost when the head is exposed). Fingers and hands lose their dexterity at temperatures below 59°F.
5. Wear footgear that protects against cold and dampness. Footgear should be insulated and fit comfortably when socks are layered.
6. Avoid wearing dirty or greasy clothing because such garments have poor insulating properties.

### Environmental Protection

1. Protect hands, face, and feet from frostbite with an on-site source of heat. Air jets, radiant heaters, or contact warm plates may be employed.
2. Provide a heated shelter for workers who experience prolonged exposure to the equivalent wind-chill temperature of 20°F or less.
3. Shield work areas from drafty or windy conditions.
4. Use thermal insulating material on the handles of equipment when temperatures drop below 30°F. Do not sit or kneel on cold unprotected surfaces.

### Safe Work Practices

1. Allow individuals to set their own pace and take extra work breaks when needed.
2. Avoid activities, whenever possible, that lead to heavy perspiration.
3. Shift as many outdoor activities to the inside as feasible, and when working outside, select the warmest hours of the day.
4. Minimize activities that reduce circulation, such as sitting or standing in a cold environment for prolonged periods of time.
5. Keep energy levels up and prevent dehydration by consuming warm, sweet, caffeine-free, nonalcoholic drinks and soup.
6. Allow a period of adjustment to the cold before embarking on a full work schedule.
7. Avoid working alone in very cold weather use a buddy system.
8. Seek warm shelter immediately following these symptoms: heavy shivering, an uncomfortable sensation of coldness, severe fatigue, drowsiness, or euphoria.

### WORKER HEALTH AND EDUCATION

1. Older workers, or those with certain medical problems, need to be extra alert about the effects of cold stress. Check with a doctor about special needs and precautions.
2. Avoid using alcohol or drugs which may impair judgment while working in a cold environment. Hypothermia commonly occurs in association with alcohol abuse. In addition to its effects on judgment, alcohol increases heat loss through vasodilation and may impair shivering.
3. Educate new workers on the hazards of working in a cold environment.
4. Prevent chapped skin by the frequent application of protective lotions.
5. Stay in good physical condition.

### REFERENCE

1. Delaney K A: "Hot and Cold Environments", in Rom W N (ed): *Environmental and Occupational Medicine*. 1992. Little Brown and Company, Boston, MA.
2. National Safety Council. *Pocket Guide to Cold Stress*. 1986. Chicago, IL.

### ADDITIONAL READING

1. Alpaugh E L: "Temperature Extremes", in Plog B A (ed): *Fundamentals of Industrial Hygiene*. 1988. National Safety Council, Chicago, IL.
2. APHA: "Cold-Related Disorders", in Weeks J L, Levy B S, Wagner G R (Eds): *Preventing Occupational Disease and Injury*. 1991. Washington, DC.
3. Hu H: "Other Physical Hazards and Their Effects", in Levy B S, Wegman D H (eds): *Occupational Health Recognizing and Preventing Work-Related Disease*. 1992. Little Brown and Company, Boston, MA.
4. Kilburne E M: "Illness Due to Thermal Extremes", in Last J M, Wallace R B: *Public Health and Preventive Medicine*. 1992. Appleton and Lange, Norwalk, CT / San Mateo CA.