



Cold Weather Stresses

A Fact Sheet prepared by the National Telecommunications Safety Panel

Introduction

This Fact Sheet is prepared to provide guidelines to follow when personnel are exposed to cold temperatures. The cold can pose a risk for employees who are working outside or inside where cold temperatures exist.

Factors that Contribute to Cold Stress

The ambient temperature and the velocity of the wind (wind chill) are the major factors in the development of cold weather injuries. Additional risk factors include: exhaustion, use of alcohol or other substances that could impair judgment, inadequate or wet clothing, and predisposition to the effects of cold due to certain medications and/or medical conditions.

Different Types of Cold-related Injuries and Methods of First Aid Treatments

Frostbite

Frostbite occurs when there is actual freezing of body tissues. The effects are more severe if the injured area thaws and then re-freezes. Commonly affected areas are the nose, cheeks, ears, fingers or toes. Just before the icing (frostbite) occurs, the skin may be slightly flushed. When the skin turns white or grayish-yellow, frostbite has set in. Often there is no pain. The following treatment is recommended:

- Warm affected area quickly and maintain respiration.
- Give the victim a warm, non-alcoholic drink. Alcohol dilates the blood vessels near the skin surface, which increases heat loss and lowers body temperature.
- Place the frostbitten area in warm (NEVER HOT) water. Water should be between 100° and 105°F (38° and 41°C). If water is not available, wrap area gently in a sheet or warm blanket. Never apply heat. Burning can occur because the affected area will have no feeling.
- Never rub the affected areas.
- Once the affected area is warm, have the victim exercise the area. If the feet are involved, do not allow the victim to walk.
- If fingers and toes are involved, place dry gauze between them to keep them apart.
- Elevate the frostbitten parts. Give fluids.
- Obtain medical assistance as soon as possible.

Hypothermia

Hypothermia results when the body loses heat faster than it can produce it. When this situation first occurs, blood vessels in the skin constrict in an attempt to conserve vital internal heat. If clothing becomes wet, either from contact with water or due to sweating during intensive physical work, the body's ability to insulate from the cold will be greatly diminished. A relatively small temperature drop in the body core of about 3°F (2°C) produces shivering. Shivering is the body's way of attempting to produce more heat, and it's usually the first warning sign of hypothermia. As the body core temperature continues to drop, the brain becomes less efficient, causing speech difficulty, forgetfulness, loss of manual dexterity, collapse, and finally death. Hands and feet are affected first. The temperature of the hands and feet can drop as much as 40°F (23° to 28°C) below normal body temperature without lasting harm. Additional symptoms occur when body temperature drops between 92° and 96°F (33° to 36°C). Symptoms before complete collapse are: memory lapses, uncontrollable fits of shivering, vague - slow - slurred speech, incoherence, drowsiness, cool skin, slow irregular breathing, low blood pressure, apparent exhaustion and an inability to get up after a rest.

Severe shaking or rigid muscles are caused by bursts of body energy and changes in body chemistry. Even with the most severe symptoms, it is still not too late to help the victim revive. The following is recommended first:

- a. Get the victim to medical help immediately, if possible. If medical help is not available, first get the victim out of the wind, snow or rain. Keep their use of energy to a minimum, but keep them awake if possible.
- b. Strip off wet clothes and give warm, sweet drinks, but NOT alcohol.
- c. Re-warm the victim gradually, but rapidly enough to cause them to adjust to the warmer environment. For example, get the person into dry clothes and wrap them in a blanket. If possible, increase the room temperature.
- d. It's very important for all victims of hypothermia to be checked by a physician as soon as possible because the effects of the cold may have caused other injuries or illnesses, such as frostbite or pneumonia.
- e. Stay dry. Use body energy wisely. If outdoor temperatures are extremely cold, do only those things that are necessary for survival.

Suggestions for Preventing Accidental Hypothermia

- a. Avoid prolonged exposure to the cold without proper protection for the work activity.
- b. If you're on medication, check with your physician to make sure the medication does not change your body's response to the cold.
- c. Eat heat-producing foods (fats and carbohydrates). Follow a nutritious diet, including warm liquids. Drink plenty of liquids, but not alcoholic beverages because they lower the body temperature.
- d. Wear adequate clothing, protecting critical body areas such as the head, neck, sides of the chest, and groin. Several layers of clothing give an insulating effect. Clothing made of material that "breathes" is best: wool, sheepskin, or fluffy wool down. Wool is the only natural material that continues to serve as insulation when wet.

Wind Chill Factor

The wind chill factor is the cooling effect of any combination of temperature and wind. The wind chill "temperatures" have no significance other than the effect on exposed body surfaces. Although the wind chill temperature may be below the freezing point of water, it is not hazardous unless the air temperature is also below freezing. The body's sense of cold is a relative factor. The thermometer may read above 40°F (4°C) and the possibility of hypothermia might seem remote, but many cases of exposure have occurred in temperatures well above freezing. How cold the body gets depends on many factors, not just the air temperature. Heat loss from convection is probably the greatest and most deceptive factor in loss of body heat. When the air is still and the temperature is 30°F (-1°C), the body will feel cold. Given the same temperature and a wind of 25 mph (40 km/h), it will feel bitterly cold. In essence, the wind blows away the thin layer of air that acts as an insulator between the skin and the outside air.

Control Measures

No one type of clothing is best for all weather conditions. Denim is relatively loose woven, which not only allows water to penetrate, but permits wind to blow away the body heat that should remain trapped between the body and clothing. Duck or goose down is good for stopping wind, but is of little use when wet. Consider using clothing made of a wicking fabric that draws moisture away from your skin. Clear plastic or closely woven nylon is good protection from wind and rain, but offers very little insulation against cold. The dead air space between the warm body, clothing, and the outside air is essential. Many layers of relatively light clothing with an outer shell of wind-proof material maintain body temperature much better than a single heavy outer garment worn over ordinary indoor clothing. The more air cells each of these clothing layers have, the more efficiently it insulates against body heat loss.

- Make sure clothing allows some wicking or venting of perspiration.
- Because wet skin will freeze more rapidly than dry skin, use all feasible means to keep as dry as possible.
- Make full use of windbreaks and avoid exposing skin directly to the wind.
- Because metal will conduct heat away from the body quite rapidly, be very careful of skin contact with metal objects such as tools.
- If possible, use tools that have non-metallic handles.

Does Wind Chill Only Apply to People and Animals?

Yes. The only effect wind chill has on inanimate objects, such as vehicles and water pipes, is to more quickly cool the object to the current air temperature. Objects will not cool below the actual air temperature. If the temperature outside is -3°F (-19°C) and the wind chill temperature is -30°F (-34°C), then the car or the water pipes temperature will not drop lower than -3°F (-19°C).

Stranded During a Winter Storm in a Vehicle

When stranded during a winter storm in a vehicle, it is better to stay with the vehicle. The engine can furnish heat, while the vehicle itself can act as a shelter from outside elements. **Care should be taken, however, to prevent a buildup of carbon monoxide gas in the closed vehicle.**

Additional Information:

National Oceanic & Atmospheric Administration

<http://www.noaa.gov>

National Weather Service

<http://www.nws.noaa.gov>

Meteorological Calculators

<http://www.srh.noaa.gov/ffc/html/metcalc.shtml>

		Temperature (°F)																		
		40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	
Wind (mph)	Cal/m	40	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	5	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72	
	10	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77	
	15	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81	
	20	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84	
	25	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87	
	30	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89	
	35	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91	
	40	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93	
	45	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95	
	50	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97	
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97		
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98		

Frostbite Times: ■ 30 minutes ■ 10 minutes ■ 5 minutes

Wind Chill (°F) = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

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