

USAG Humphreys

Cold Weather

Winter Safety Guide



1. The seriousness of cold weather is often underestimated. Cold weather injuries always involve considerable, long lasting pain and frequently involve the loss of fingers, ears, toes, and even an entire hand or foot. It is not a pretty or minor injury. Many cold weather injuries have occurred because personnel removed or failed to have the required items of winter wear. Often fingers get frozen when personnel remove mittens or gloves to perform work. Working on cold metal without gloves is particularly dangerous. Minor cold weather injuries generally result in the flesh becoming red, swollen, hot, and dry. Some superficial peeling of the skin may occur. In a severe cold weather injury, the hands, feet, or facial features are often frozen, including the bone. These tissues are in fact destroyed, necessitating amputation to avoid gangrene. The following information is not a substitute for specific training or experience. Before traveling/working in cold conditions found in Korea, personnel need to be briefed on cold weather injury prevention measures.

2. **Prevention of Cold Weather Injury:** Prevention of cold weather injury involves *avoiding unnecessary exposure* to cold, proper use of winter wear, and avoiding wetness, moisture, and wind. Each individual must avoid exposure to cold that is not part of his or her mission, tasking, or work performance.

3. Four Types of Cold Weather Injuries:

- a. Chilblains – Occur at temperatures ranging from 32°F to 50°F in connection with high humidity. Results in painful redness of exposed skin, and may lead to peeling of the skin and underlying flesh in very serious cases.
- b. Trenchfoot – Caused by prolonged exposure to cold at temperatures from just above freezing to 50°F and involving dampness of the feet.
- c. Immersion Foot – Caused by prolonged exposure of the feet in water at temperatures usually below 50°F.
- d. Frostbite – The most common and often the most serious cold weather injury, which it involves actual freezing with crystallization of body fluids and destruction of body tissues.

4. **Prevention Measures - Clothing:** The basic principle on which cold weather clothing works is the layer system. Several layers of clothes are used to trap body heat and provide insulation from the cold. It is important that each person have a complete, properly fitting (not too tight) set of winter wear. It is equally important to wear this clothing properly. Keep in mind the word “COLD”.

- a. Keep your winter wear **C**LEAN. Dirt degrades the ability of the clothing to insulate you from the cold.
- b. Do not allow yourself to **O**VERHEAT. Sweat will reduce the insulation capabilities of your clothing and reduce its effectiveness. Remove layers as you work or as the temperature rises and add them when immobile or temperatures drop.
- c. Use the **L**AYER system properly. Don't tailor or alter winter clothing to make it tighter or less baggy. You will reduce its effectiveness. Remove clothing layers when hot, add layers when cold.

- d. Keep **D**ry. Keep your clothes, particularly your socks dry. Wet clothing will not insulate properly and hastens cold injury.

NOTE: Cotton clothes (especially underwear and socks) get damp from sweat, are hard to dry and get cold. Garments made from wool, polar fleece or polypropylene is better.

Dress in layers - loose, layered clothes trap body heat and provide the best insulation.

5. Have the following as a minimum:

- a. Insulated or polypro underwear (lined or wind pants if not wearing long underwear).
- b. Loose trousers or insulated bib overalls.
- c. Warm gloves or mittens (mittens are preferable and keep your fingers from freezing)
- d. Hat that covers the ears or a balaclava with face mask that covers ears and nose.
- e. Flannel or other warm shirt.
- f. Fleece pullover or sweater.
- g. Winter weight coat - parka type that is long and loose with a hood.
- h. Boots - Pack boots with felt liners and aggressive tread for walking on ice are best (Do not wear tennis shoes or leather dress shoes with leather soles).
- i. Heavy socks.

6. General Precautionary Information:

- a. **Avoid the wind.** The wind is a major factor in many cold weather injuries. By passing large amounts of cold air over exposed portions of the body, the wind will rapidly cool and freeze the flesh. For example, when the thermometer reads 10° above zero, a wind of only 20 mph will create the same danger of freezing as a calm day at 25° below zero. Avoid direct exposure to the wind whenever possible.
- b. **Avoid fatigue.** Maintain your physical stamina and get adequate rest. Fatigue, mental and physical, can increase susceptibility to cold weather injury.
- c. **Be doubly alert.** If you are from a climate that is warm year-round, use extra caution. Statistics show you are more likely to suffer a cold weather injury because of unfamiliarity with winter conditions.
- d. **If you have previously suffered cold weather injury, consult your doctor** regarding the proper course of action. You are twice as vulnerable to cold weather injury as the person who has never been injured.
- e. **Avoid alcohol and tobacco (smoking) use before outdoor duty.** Use of alcohol increases susceptibility to cold weather injury by reducing blood flow to the skin and by inducing carelessness regarding cold weather injury prevention measures. Alcohol and cold DON'T MIX. Drink lots of water or fruit juice. Also avoid smoking. Nicotine contracts blood vessels and inhibits flow of warm blood to the extremities.
- f. **Protect eyes on days of bright sunshine when snow is on the ground.** Long hours of observation duty can result in painful snow blindness.

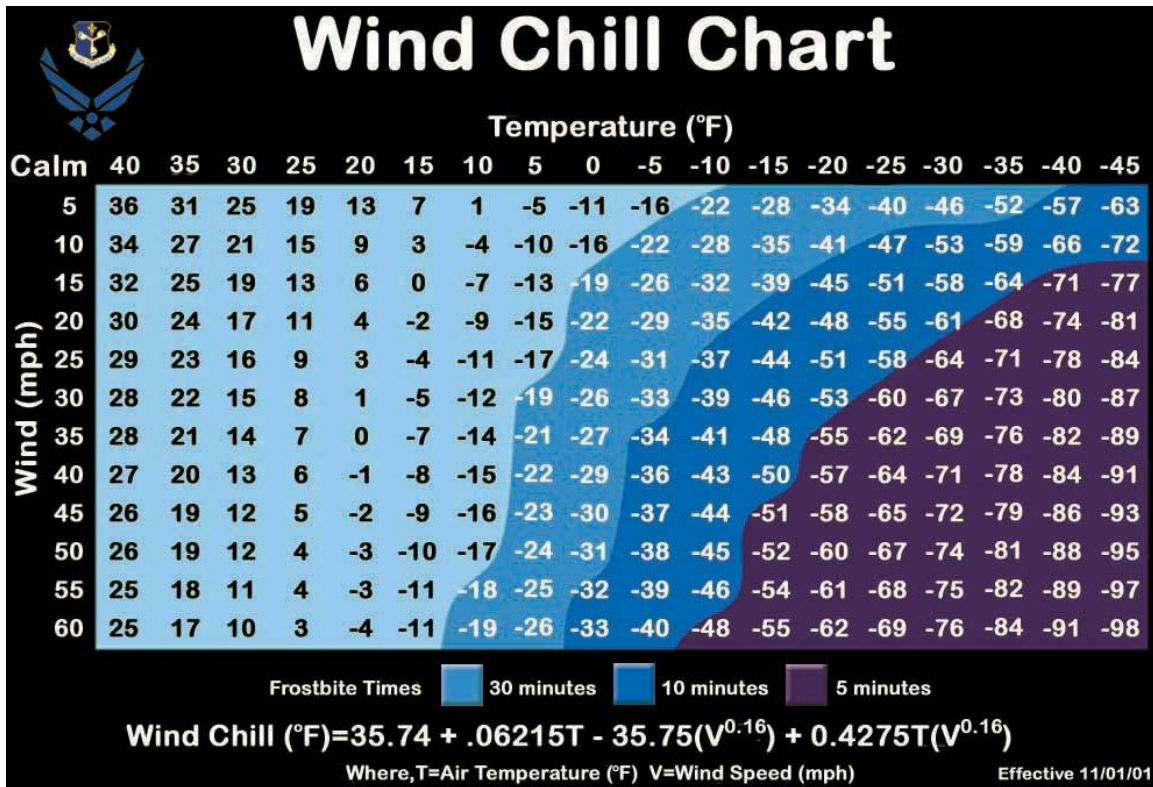
g. **Use the buddy system to detect early cold injury.** Make sure someone knows where you are, where you're going, and when you should arrive or return. In addition, although the onset of frostbite is often accompanied by an uncomfortable sensation of coldness and numbness, usually with some pain, in many cases there is no pain or the pain is ignored under the pressure of work or other activity. On cold or windy days when the likelihood of cold weather injury is high, use the buddy system to watch each other for the redness of early frostbite or the pale waxy appearance of the skin as it develops. Susceptible areas to keep in mind are the fingers, toes, ears, nose, and other facial areas.

h. If you plan to travel a long distance in Korea or back in the states, and your car breaks down, you and your family may be in a life-threatening situation within minutes.

Ensure you carry a Travel Survival kit that includes:

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|-------------------|---|
| 1. Fuel | 2. Jumper Cables |
| 3. Knife | 4. Tow Rope or Strap |
| 5. Water | 6. Windshield Scraper |
| 7. Flares | 8. Can with Tissue Paper |
| 9. Shovel | 10. Blanket/Sleeping Bags |
| 11. Matches | 12. Notebook/Pencil or Pen |
| 13. Whistle | 14. Flashlight and Batteries |
| 15. Tool Kit | 16. Chemical Lights (Red), 4 ea |
| 17. Heat Packs | 18. Sand for Traction |
| 19. Medication | 20. Non-perishable Food (Energy Bars, etc) |
| 21. First Aid Kit | 22. Extra Clothing (Parka, Boots, Hat, Gloves, etc) |
| 23. Cell Phone | 24. Candles |

7. **Wind Chill Chart:** To use this chart, first find the wind speed on the vertical column at the left of the chart, and then find the actual thermometer reading on the horizontal column at the top. Trace across and down from the appropriate numbers and find your equivalent temperature in the main body of the chart. For example, at estimated wind speed of 20 mph and an actual thermometer reading of 10°F, the freezing effect of the combined cold and wind is equivalent to 9° below zero. Note that the chart is divided into three parts, which indicate the overall threat posed by weather conditions. In our example above, we are in the increasing danger area and should take additional cold injury prevention precautions.



8. **Brief Synopsis of Cold Weather Medical Concerns:**

a. **Hypothermia** is a decrease in the core body temperature to a level at which normal muscular and cerebral functions are impaired. Conditions leading to hypothermia include:

- Cold temperatures
- Improper clothing and equipment
- Wetness
- Fatigue, exhaustion
- Dehydration
- Poor food intake
- Alcohol intake - leads to increased heat loss

Signs and Symptoms of Hypothermia:

- Stumbles, mumbles, fumbles, and grumbles which show changes in motor coordination and levels of consciousness.
- Mild Hypothermia involves shivering, not under voluntary control. Can't perform complex motor functions (ice climbing or skiing) can still walk & talk.
- Moderate Hypothermia involves dazed consciousness; loss of fine motor coordination (particularly in hands - can't zip up parka). Slurred speech, violent shivering, irrational behavior (Paradoxical Undressing - person starts to take off clothing), and unaware of cold are other signs.
- Severe Hypothermia involves shivering in waves, violent then pause, pauses get longer until shivering finally ceases. Person falls to the ground, can't walk, curls up into a fetal position. Muscle rigidity develops, skin is pale, pupils dilate, and pulse rate decreases - reducing breathing and heart rates. Person looks dead but is still alive.
- How to Assess if someone is Hypothermic:
 - If shivering can be stopped voluntarily = mild hypothermia
 - If a person is hypothermic they can't answer a question that requires higher reasoning (e.g. count backward from 100 by 9's)
 - If shivering cannot be stopped voluntarily = moderate to severe hypothermia
 - If you can't get a pulse at the wrist it indicates a core temp below 90 - 86 degrees
 - If person is curled up in a fetal position, try to open their arm up. If arm curls back up, the person is alive. Dead muscles won't contract.

Treating Hypothermia requires rewarming to conserve the heat they have and replacing the body fuel they are burning to generate that heat.

- Mild to Moderate Hypothermia:
 - Reduce heat loss
 - Add layers of dry clothing
 - Increase physical activity
 - Provide shelter
 - Add fuel and fluids - carbohydrates are best for quick energy
 - Add heat from fire or other external heat source and/or body to body contact (e.g. get person into a sleeping bag, in dry clothing with a person in lightweight dry clothing)

- Severe Hypothermia:

Reduce heat loss by providing a shell of total insulation. No matter how cold, a person internally re-warm themselves much more efficiently than from external re-warming. Make sure the person is dry, and has a polypropylene layer to minimize sweating. Person must be protected from any moisture in the environment.

Use multiple sleeping bags, wool blankets, wool clothing, and insulation pads to create a minimum of 4" of insulation all the way around the person, especially between patient and ground. Include an aluminum "space" blanket to help prevent radiant heat loss, and wrap the entire ensemble in plastic to protect from wind and water. If someone is truly hypothermic, don't place them in a sleeping bag with another person.

- Add Fuel & Fluids:

In severe hypothermia, the stomach has shut down and will not digest solid food, but can absorb water and sugars. Give a dilute mixture of warm water with sugar every 15 minutes. Dilute Jell-O works best, since its part sugar and part protein will be absorbed directly into the blood stream. Do not give full strength Jell-O even in liquid form, since it is too concentrated and will not be absorbed.

The kidneys pull off excess fluid to reduce the increased pressure in the blood stream. A full bladder results in body heat being used to keep urine warm rather than vital organs. You will need to help the person urinate. Open up the Hypothermia Wrap enough to do this and then cover them back up.

- Add Heat:

Heat can be applied to transfer heat to major arteries - at the neck, armpits, groin, and/or palms. Chemical heat packs, hot water bottles, warm rocks, towels and compresses may be used. For a severely hypothermic person, rescue breathing can increase oxygen and provide internal heat.

Do not expose a severely hypothermic victim to heat extremes. This sends cold, stagnate blood from the periphery of the body to the core and could lead to death.

- A person in severe hypothermia may demonstrate clinical signs of death:

Cold

Blue skin

Fixed and dilated pupils

No discernable pulse

No discernable breathing

Comatose & unresponsive to any stimuli

Rigid muscles

But, they still may be alive in a "metabolic icebox" and can be revived. Your job as a rescuer is to re-warm the person and do CPR, if indicated and needed. Severe mechanical stimulation (such as CPR or moving them) may result in fibrillation leading to death. As a result CPR should not be performed for some hypothermia situations: **(IF NOT CPR CERTIFIED AND TRAINED YOU CAN CAUSE MORE DAMAGE TO THE INDIVIDUAL. DO NOT DO CPR UNLESS QUALIFIED AND TRAINED.)**

- a. Do a complete heart rate assessment before beginning CPR. The heart rate may be 2-3/minute and the breathing rate 1/30 seconds. Instituting cardiac compressions at this point may be life-threatening. Check the carotid pulse for up to a minute to ascertain if there is a slow heartbeat. External cardiac compressions are only 20-30% effective. Thus, with severely decreased demands, the body may satisfy its circulatory needs with only 2-3 beats/minute. Be sure pulse is absent before beginning CPR. You will need to continue CPR as you re-warm the person.
- b. Ventilation may have stopped but respiration may continue. Oxygen demands for the body have been so diminished with hypothermia that the body may survive for some time using only oxygen already in the body. If ventilation has stopped, artificial ventilation may increase available oxygen. In addition, blowing warm air into the person's lungs may assist in internal re-warming.

c. CPR Procedures - Check radial pulse, between 91.4 and 86 degrees F this pulse disappears. Check for carotid pulse - wait at least a full minute to check for very slow heartbeat. If pulse, but no breathing or slow breathing, give rescue breathing (also adds heat). If no discernible heartbeat begins, then start CPR. Be prepared to continue - persons with hypothermia have been given CPR for up to 3.5 hours and have recovered with no neurological damage. Begin active re-warming.

(DO NOT DO CPR UNLESS QUALIFIED AND TRAINED.)

Cold Injuries described below are related to the degree of peripheral circulation. Tissue temperature in cold weather is regulated by external temperature and internal heat flow. As peripheral circulation is reduced to prevent heat loss to the core, these conditions are more likely to occur.

- Factors influencing cold injuries include:

Low ambient temperature

Wind chill - increases rate of freezing dramatically

Moisture - wet skin freezes at a higher temp than dry

Insulation

Contact with metal or super cooled liquids (white gas)

Exposed skin

Vasodilatation (Widening of the blood vessels)

Vasoconstriction (Narrowing of the blood vessels)

Previous cold injuries

Constricting garments

Local pressure

Cramped position

Body type

Dehydration

Caloric intake

Diabetes, some medications

Alcohol, caffeine, nicotine

- Cold-induced Vasodilatation - When a hand or foot is cooled to 59 degrees F, maximal vasoconstriction and minimal blood flow occur. If cooling continues to 50 degrees, vasoconstriction is interrupted by periods of vasodilatation with an increase in blood and heat flow. This "hunting" response recurs in 5-10 minute cycles to provide some protection from cold. Prolonged, repeated exposure increases this response and offers some degree of acclimatization.

- Pathophysiology of Tissue Freezing - As tissue begins to freeze, ice crystals are formed within the cells. As intracellular fluids freeze, extracellular fluid enters the cell and there is an increase in the levels of extracellular salts due to the water transfer. Cells may rupture due to the increased water and/or from tearing by ice crystals. Do not rub tissue; it causes cell tearing from the ice crystals. As the ice melts there is an influx of salts into the tissue further damaging the cell membranes. Cell destruction results in tissue death and loss of tissue. Tissue can't freeze if the temperature is above 32 degrees F.

- Surface frostbite generally involves destruction of skin layers resulting in blistering and minor tissue loss. Blisters are formed from the cellular fluid released when cells rupture. Deep frostbite can involve muscle and bone

- Cold Response
 - Circulation is reduced to the area to prevent heat loss
 - Area may be pale, cold
 - Area may have sensation or be numb

- Frostnip
 - Freezing of top layers of skin tissue
 - Generally reversible
 - White, waxy skin, top layer feels hard, rubbery but deeper tissue is still soft

Numbness

Most typically seen on cheeks, earlobes, fingers, and toes

Treat by re-warming area gently, generally by blowing warm air on it or placing area against a warm body part (partner's stomach or armpit). Do not rub the area - this can damage the effected tissue.

- Frostbite

Skin is white and "wooden" feeling all the way through

Superficial frostbite includes all layers of skin

Numbness, possible anesthesia - loss of sensation with or without loss of consciousness

Deep frostbite may freeze muscle and/or bone. Difficult to re-warm the appendage without some damage occurring.

Treat superficial frostbite by re-warming as frostnip in only a small area.

Re-warming deep frostbite is accomplished by immersing the effected part into a water bath of 105 - 110 degrees F (temperature, which is warm to your skin) for 25 – 40 minutes. Using hotter water will result in additional damage. Remove constricting clothing, place appendage in the water and monitor water temperature. As temperature drops, add warm water to maintain 105 - 110 degrees. Do not add warm water directly to the injury. Circulate water fairly constantly to maintain even temperature. Thawing is complete when the part is pliable and color and sensation return. Once the area is re-warmed, there can be significant pain. Discontinue warm water bath when thawing is complete

Do not use dry heat to re-warm. It cannot be effectively maintained at 105 - 110 degrees and can cause burns further damaging the tissues.

Once re-warming is complete, the injured area should be wrapped in sterile gauze and protected from movement and further cold.

Once a body part has been re-warmed it cannot be used for anything. Also it is essential that the part be kept from refreezing. Refreezing after re-warming causes extensive tissue damage and may result in loss of tissue. If you cannot guarantee that the tissue will stay warm, do not re-warm it. Mountaineers have walked out on frozen feet to have them re-warmed after getting out with no tissue loss. Once the tissue is frozen the major harm has been done. Keeping it frozen will not cause significant additional damage.

- Special Considerations for Frostbite

If the person is hypothermic and frostbitten, the first concern is core re-warming. Do not re-warm frostbitten areas until the body core temp approaches 96 degrees F.

No alcohol - may increase fluid buildup

No smoking - nicotine may increase chances for developing frostbite

Liquids such as white gas can "super cool" in the winter (drop below their freezing point but not freeze). Spilling super cooled white gas on exposed skin leads to instant frostbite from evaporative cooling. Always wear gloves when handling fuel.

Touching metal with bare skin can cause the moisture on your skin to freeze to the metal (in really cold conditions, metal glasses frames can be a problem). When you pull away, you may leave a layer of skin behind. Don't touch metal with bare skin.

- Trench Foot - Immersion Foot

Trench Foot, a process similar to chilblains, is caused by prolonged exposure of the feet to cool, wet conditions. This can occur at temperatures as high as 60 degrees F if the feet are constantly wet. This can happen with wet feet in winter conditions or wet feet in much warmer conditions (ex. sea kayaking). Wet feet lose heat 25 times faster than dry; therefore the body shuts down peripheral circulation in the foot to prevent heat loss. Skin tissue begins to die from lack of oxygen and nutrients and buildup of toxic products. The skin is initially reddened with numbness, tingling pain, and itching then becomes pale and mottled and finally dark purple, gray or blue. The affected tissue generally dies and sluffs off. In severe cases trench foot can involve the toes, heels, or the entire foot. If circulation is impaired for > 6 hours there will be permanent tissue damage. If circulation is impaired for > 24 hours the victim may lose the entire foot. Trench Foot causes permanent damage to the circulatory system making the person more prone to cold related injuries in that area. A similar phenomenon can occur when hands are kept wet for long periods of time such as kayaking with wet gloves. The damage to the circulatory system is known as Reynaud's Phenomenon.

Treatment and prevention of Trench Foot include careful washing and drying of the feet, gentle re-warming and slight elevation. Since the tissue is not frozen, as in severe frostbite, it is more susceptible to damage by walking. Trench foot victims should not walk; they should be evacuated by litter. Pain and itching are common complaints. Give Ibuprofen or other pain medication.

Prevent trench foot by keeping feet dry by wearing appropriate footwear. Check your feet regularly to see if they are wet. If your feet get wet (through sweating or immersion) stop and dry your feet and put on dry socks. Periodic air-drying, elevation, and massage will also help. Change socks at least once a day and do not sleep with wet socks. Be careful of tight socks, which can further impair peripheral circulation. Foot powder with aluminum hydroxide can help. Vapor barrier socks may increase the possibility of trench foot.

- Avoiding Frostbite and Cold related Injuries

Use "Buddy system" to watch faces, cheeks and ears for signs of frostnip/frostbite. Regularly self check" for cold areas, wet feet, numbness or anesthesia.

If a cold injury is discovered, re-warm the area (unless doing so causes greater risk).

- Eye Injuries

Cornea may freeze by forcing eyes open during strong winds without goggles. Treatment is controlled, rapid re-warming e.g. placing warm hand or compress over closed eye.

After re-warming, eyes must be covered with patches for 24 - 48 hours.

Eyelashes freezing together

Place hand over eye until ice melts, then open the eye

- Snow blindness

Sunburn of the eyes - prevent by wearing good sunglasses with side shields or goggles.

Eye protection from sun is as necessary on cloudy or overcast days as in full sunlight when you are on snow.

Snow blindness can even occur during a snowstorm if the cloud cover is thin.

Symptoms occur 8-12 hours after exposure. Eyes feel dry and irritated, and then feel as if they are full of sand. Moving or blinking becomes extremely painful, exposure to light hurts the eyes, eyelids may swell, eye redness may occur, and excessive tearing.

Treat with cold compresses and dark environment. Do not rub eyes

9. First aid for cold weather injury. Frostbite is a serious injury. Delaying treatment at a medical facility can make it even worse. If an individual suspect he or she is suffering from frostbite, he must immediately obtain release from duty and report to a medical facility. Do not attempt to rub snow on the injured part. Do not walk on frozen toes or feet and do not attempt to thaw frozen flesh by massaging it. Remove all constricting clothing from the site of the injury, and report immediately to a medical facility. While enroute, attempt to warm the frozen area with a warm hand, without rubbing. Maintain general body warmth. Above all, **seek medical assistance** as soon as possible

10. Summary/Review:

Cold weather injuries are painful and often very serious. The results may be amputations of toes, fingers, hands, and feet. We have found out that cold, dampness, and wind are key factors causing cold weather injury. We have also learned that careless individuals contribute to their own cold weather injury by unnecessarily exposing themselves to cold or by failing to properly wear their winter clothing. We were introduced to first aid measures and the importance of seeking medical aid. We have found that the buddy system is an important prevention technique and that cold injury has no cure. **It must be prevented.**