

Minimizing Effects of Cold on the Body:

1. Cold weather clothing systems are designed to change with the wearer's needs. Cold weather clothing protection is based on the **principles of insulation, layering and ventilation**. By understanding these principles, soldiers can vary their clothing to regulate protection and stay comfortable.

a. **Insulation** depends on the clothing thickness, properties of the garment material, and the amount of air trapped within the garment. When clothing is dirty the material tends to be packed down, which compromises insulation.

b. Wearing clothing ensembles in multiple **layers** allows the wearer to adjust the amount of insulation as changes in the environment, workload or individual preferences dictate. Wearing layered clothing is especially important for soldiers whose duties require them to frequently move in and out of heated shelters, or to periodically undertake vigorous physical activity.

c. Physically active people can sweat even in extremely cold weather. Sweat will be able to evaporate if clothing allows for **ventilation**. Proper clothing will be made of material that water vapor can pass through, and will allow the wearer to unzip and open the clothing periodically to increase ventilation. If sweat cannot evaporate, it will accumulate, wet the clothing, and compromise insulation. Additionally, sweat evaporation will be compromised when clothing is dirty.

2. Because cold weather clothing is heavy and cumbersome, it greatly increases the energy required for physical activity.

a. The increased effort can result in overheating and sweating especially during hard work, and can contribute to increased fatigue.

b. Perspiration buildup should be minimized by opening clothing and removing layers during heavy work and scheduling frequent short rest breaks.

3. Wind chill temperatures are widely reported by television and radio meteorologists, but they really only estimate the danger of cooling the **exposed** flesh of **inactive** persons. **Windproof clothing greatly reduces wind chill effects**. Rather than cancel outdoor training at some arbitrary temperature limit, training should be modified and safety surveillance should be increased as the weather becomes more severe, and the danger of tissue freezing increases, and indicated in Appendix B.

4. The U.S. Army has several heaters for use inside tents during cold weather.

a. The type of heater required depends on the size of the tent or shelter to be heated. Usually, the Yukon stove or the kerosene heater is used to heat the Arctic 10 Soldier Squad Tent, 5 soldier tents and GP small tents. The Squad stove M1950 is used in improvised shelters or small tents housing 2 to 5 soldiers. Larger capacity stoves are available for the bigger tents. All these stoves provide heat and can be used to melt ice and snow or to heat water.

b. Care must be used to prevent melting the frozen ground beneath or around the stove. By using a tent liner, removing loose snow and ice from the ground before setting up the tent, and preventing the tent from overheating melting can be minimized. If available, plywood tent flooring and metal trays under the stove can be used to reduce melting.

5. Shelter from weather is critical. The standard shelter is the tent, but improvised shelters (snow caves, snow trenches, lean-tos etc.) can be constructed from local materials.

6. The recommended sleeping system is the Extreme Cold Weather Sleeping Bag (NSN 8465-01-033-8057), on top of a polyfoam sleeping mat (NSN 8465-01-109-3367).

a. Layers of tree boughs or mats under the sleeping bag help prevent heat loss to the ground. The sleeping bag should be shaken out before using to add loft or air to the lining, which improves its insulation.

b. In tents, soldiers should sleep in long underwear and socks with all other clothing hung up to dry. In improvised shelters, only boots and the outermost clothing layer should be removed. Place clothing under the sleeping bag where it can add insulation without accumulating moisture from the body. Ice should be removed from vapor barrier boots; they should be wiped dry on the inside, and allowed to air out before putting them on again. In extreme cold, a balaclava or some other head cover should be worn while sleeping to protect the ears, neck, and face. The arctic mittens can be worn on the feet while inside the sleeping bag to help keep the feet warm. The head should not be put inside the sleeping bag, since moisture from breathing will accumulate in the bag.

c. Air out the sleeping bag as often as possible to evaporate moisture.

7. Feet, hands, and exposed skin must be kept dry. **Feet are particularly vulnerable and extra foot care is required for cold weather operations**. Feet should be washed and dusted with a dry, antifungal powder (NSN 6505-01-008-3054) daily. Socks must be changed whenever they become wet from exposure to rain, snow, or sweat. This may require changing socks at least 2-3 times daily. Extra socks can be air dried and then carried under BDUs to warm.

8. Humans protect themselves from cold primarily by avoiding or reducing cold exposure using clothing and shelter. When this protection proves inadequate, the body has biological defense mechanisms to help maintain correct body temperature. The body's internal mechanisms to defend its

temperature during cold exposure include vasoconstriction and shivering. When these responses are triggered, it is a signal that clothing and shelter are inadequate.

a. Vasoconstriction is the tightening of blood vessels in the skin when it is exposed to cold. The reduced skin blood flow conserves body heat, but, as described earlier, can lead to discomfort, numbness, loss of dexterity in hands and fingers, and eventually cold injuries.

b. Cold triggers shivering. Shivering increases internal heat production, which helps to offset the heat being lost. Internal heat production is also increased by physical activity, and the more vigorous the activity, the greater the heat production. In fact, heat production during intense exercise or strenuous work is usually sufficient to completely compensate for heat loss, even when it is extremely cold. However, high intensity exercise and hard physical work are fatiguing, can cause sweating and cannot be sustained indefinitely. Moreover, most military occupational activities are less vigorous than high intensity exercise, so internal heat production will probably not be adequate to offset heat loss.

c. Minimize the risk of cold injuries in fighting positions, sentry points and observation points by placing pads, sleeping bags, tree boughs, etc. inside these positions to allow occupants to insulate themselves from the ground or snow.

9. Humans do not acclimatize to cold weather nearly as well as they can acclimatize to hot weather, although repeated cold exposure does produce what is referred to as habituation. Proper training before deploying into cold weather regions is more important for prevention of cold injuries than repeatedly being exposed to cold temperatures.

Sun, Wind, Rain, Snow and Low Humidity

Besides cold temperatures, other environmental stressors will be encountered during cold weather operations. For example, winter operations in the coastal regions of the eastern United States may be conducted during periods of near freezing temperatures, rain and wind. Heavy snow may be encountered during winter operations in areas of northern Europe and America, and throughout the year in mountainous regions. In desert, arctic, and high altitude regions, very low temperatures are often accompanied by high winds, low humidity, very bright sun, or a combination of those conditions. The influence of wind and rain on the severity of cold stress has been discussed in the last section. However, sun, wind, snow, rain, and low humidity each present environmental health threats in and of themselves.