

## **HEAT AND COLD STRESS**

### **1.0 INTRODUCTION**

Field personnel may work under conditions of hot or cold temperature extremes. Regulation of body temperature, which is an important physiological function, can be impaired under temperature extremes and result in heat- or cold-related illness. Therefore, it is important that field personnel understand the nature of heat and cold stress-related disorders, know the necessary measures to prevent these problems, and be able to identify and respond to these situations if they do occur.

#### **Learning Objectives**

At the end of this module you will be able to:

- Recognize potential heat and cold stress environments and situations
- Identify symptoms and appropriate treatment for heat- and cold-related illness
- Take appropriate action to minimize the effects of heat and cold stress.

### **2.0 HEAT STRESS**

Heat stress is the total heat load imposed on the body, consisting of both environmental and physical work factors. Heat can be transferred whenever temperature differences exist between two or more bodies. Net heat transfer is always from the body of higher temperature to the body of lower temperature and occurs by one or more of the following mechanisms:

- **Conduction.** The transfer of heat from one point to another within a body, or from one body to another when both bodies are in physical contact. Although conduction can be a localized source of discomfort from direct physical contact with a hot or cold surface, it normally is not a significant factor to total heat stress.
- **Convection.** The transfer of heat from one place to another by moving gas or liquid. Convection results from differences in density caused by temperature differences. (Warm air is less dense than cool air. Warm air rises relative to the cool air and vice versa.)
- **Radiation.** The process by which energy, electromagnetic (visible and infrared), is transmitted through space without the presence or movement of matter in or through this space.

The net heat exchange between a person and the ambient environment can be expressed by:

$$H = M+R+C-E$$

where: H=body heat storage load  
M=metabolic heat gain  
R=radiant or infrared heat load  
C=convection heat load  
E=evaporative heat loss

The body tries to maintain a balance between the heat gained by work, radiant and converted heat imposed on the body, and the heat lost by sweating (evaporation). Heat stress disorders result when the body can no longer maintain that balance.

## **2.1 Heat Sources and Contribution Stress Factors**

Environmental heat is important because it influences the rate at which body heat can be exchanged with the environment and consequently the ease with which the body can regulate and maintain a normal temperature. Environmental factors contributing to heat stress are:

- Air temperature
- Humidity
- Air movement (wind)
- Radiant heat (e.g., sun, blacktop road, generator engine)

Physical factors contributing to heat stress are:

- Metabolic heat (i.e., internal body heat from work)
- Clothing.

Other factors that may contribute to heat stress are:

- Intensity of work being performed
- Physical fitness of individual worker (e.g., obese)
- Inadequate acclimatization
- Effects of alcohol consumption (e.g., dehydration resulting in less water to form sweat)
- Effects of caffeine consumption (e.g., acts as a diuretic increasing urine and electrolyte excretion)
- Fatigue
- Cardiac and respiratory conditions
- Chemical exposure
- Medications
- Age of individual worker
- Gender
- Altitude.

## **2.2 Heat Stress Disorders and Symptoms**

Heat stress disorders result when the body's normal functions cannot reduce the internal body heat. This often occurs when the air temperature is higher or nearly the same as the body temperature. If it is also humid or there is little or no air movement, the evaporative cooling mechanism of sweating can be lost. PPE can also contribute to heat stress. For example, when wearing Level A or Level B fully encapsulating suits, the risk of heat stress increases because the protective clothing interferes with the body's evaporative cooling mechanism. The body temperature then begins to rise and there is a danger of heat stress disorders. The following heat stress disorders range from life-threatening emergencies, such as heat stroke, to less serious problems, such as sunburn.

### ***2.2.1 Heat Stroke***

Heat stroke is a severe illness caused by exposure to excessively high temperatures and is characterized by severe headaches, high fever with dry, hot skin, rapid heartbeat, and in serious cases, collapse and coma. It is caused by a breakdown in the body's cooling mechanism and may result from untreated heat exhaustion symptoms. This failure to sweat results in the loss of evaporative cooling (i.e., system shutdown).

Symptoms - any or all of these symptoms may be present:

- Red or flushed skin (may also be cyanotic)
- Hot, dry skin
- Extremely high body temperature (up to 106°F).

These symptoms may also be accompanied by:

- Dizziness
- Nausea
- Seizures
- Headache
- Unconsciousness.

Treatment:

- Obtain immediate medical attention
- Get individual wet immediately (e.g., loosen/remove clothing, cover with wet towels or sheets, or sponge the victim's bare skin with cool water)
- Move the individual to a shaded, cool location
- Provide fluids if individual is conscious and capable of sipping; do not force fluids
- Monitor temperature (stop process of cooling down when body temperature reaches 102°F or shock may result).

### ***2.2.2 Heat Exhaustion***

Heat exhaustion is a reaction to excessive heat, marked by prostration, weakness, and collapse resulting from dehydration. If treated properly, recovery is assured. However, if untreated, heat exhaustion may progress into heat stroke.

Symptoms - any or all of these symptoms may be present:

- Clammy, moist skin
- Profuse sweating
- Body temperature remains approximately normal.

These symptoms may also be accompanied by:

- Fatigue
- Headache
- Nausea.

Treatment:

- Move the victim to a cooler area, loosen clothing, and have him/her lie down
- Administer fluids by mouth (gradually); stop fluids if vomiting occurs
- Place cool cloth on back of neck and inside wrists
- Get medical aid if symptoms are severe, become worse, or last longer than an hour.

### ***2.2.3 Heat Fainting***

Heat fainting is caused by the pooling of blood in dilated vessels of the skin and lower body. The inadequate cardiac function results from the failure of the circulatory system to compensate for increased blood flow demands imposed by the need to cool the body. Heat fainting may accompany heat exhaustion.

Symptoms:

- Fainting
- Dizziness.

Treatment:

- Remove the victim to a cooler area, and have him/her lie down
- Elevate the victim's feet 8 to 12 inches
- Loosen victim's clothing
- Get medical aid if symptoms are severe, become worse, or last longer than 1 hour.

### **2.2.4 Heat Cramps**

Heat cramps are muscle pains and spasms caused by loss of electrolytes from the body caused by heavy sweating. A person with heat cramps should be checked for symptoms of heat exhaustion.

Symptoms - any or all of these symptoms may be present:

- Painful muscle cramping and spasms
- Heavy sweating
- Vomiting
- Convulsions
- Normal pulse and blood pressure.

Treatment:

- Remove the victim to a cooler area
- Loosen the victim's clothing
- Apply hand pressure to the affected area or gently massage the cramped muscle
- Administer electrolyte replacement solution (e.g., Gatorade™) gradually
- If the symptoms are not relieved by drinking electrolyte replacement solution, transport the victim to the nearest medical facility for treatment.

### **2.2.5 Heat Rash**

Heat rash results when the sweat glands become clogged and inflamed. This is often caused by wearing protective clothing, because sweat is restricted from evaporating from the skin.

Symptoms - any or all of these symptoms may be present:

- Rash
- Red, itchy skin
- Inflammation.

Treatment:

- Cleanse affected area of skin with cool water
- Apply mild drying lotions or powders.

### **2.2.6 Sunburn**

Working in the sun for long periods can result in sunburn if precautions are not taken. Although generally not as serious as other heat stress disorders, sunburn can still be a painful and sometimes disabling problem associated with working outdoors.

Symptoms - any or all of these symptoms may be present:

- Redness
- Pain
- Mild swelling
- In severe cases, blisters and considerable swelling.

Sunburn is usually a first-degree burn of the skin (injury only to the outside layer of the skin); however, prolonged exposures to the sun can lead to a second-degree burn (injury to the layers of skin beneath the surface).

Treatment:

- Put cold water or cold wet cloths on the burned area
- Do not rub the skin
- Do not break blisters
- Apply aloe gel, ointments, sprays as appropriate
- If sunburn is severe, seek medical attention.

### **2.3 Measures to Prevent or Reduce Heat Stress**

Prior to engaging in field activities, an assessment should be made of:

- Heat sources
  - Assess potential sources of heat at the field site, including radiation, conduction, and convection sources
- Environmental conditions (e.g., weather)
  - Assess the weather conditions at the field site (hot/cold, humid/dry, windy/calm)
- Human factors
  - Assess the degree of acclimatization of team members
  - Assign nonacclimatized team members to shorter lengths of time in the heat. Do this for at least 1 week
  - Monitor workers for symptoms of heat stress, especially during adverse conditions
- Ways in which heat stress can be reduced
  - Be aware of the environmental conditions and know your limitations (e.g., do not overwork)
  - Break the workday into short work-rest periods. Take frequent rest breaks away from heat and high humidity
  - Drink electrolyte replacement solution frequently to replace fluids and salt lost by sweating
  - Eat lightly salted foods during periods of high risk when heat and sweating are greater than normal. Do not take salt tablets
  - If you are on a low salt diet or are taking diuretics, consult your physician in advance of field activities about the replacement of salts
  - Protect your body from radiant heat

- Wear light-colored loose clothing that allows sweat to evaporate
  - Avoid wearing tight clothing that inhibits or impairs sweating
  - Shower after working in heat and dry the skin thoroughly
  - Take protective measures *before* your skin is red and painful. Use sunscreen and sunblock before exposure to the sun
  - Wear hats with visors or long sleeves to shield your skin from exposure
  - Limit your exposure to sun, especially when your skin has not had a chance to tan gradually
  - Be aware that you can become sunburned on overcast days from nonvisible ultra-violet (UV) rays
  - If near an industrial site, assess the availability of a cool or air-conditioned room for the field personnel to take breaks
  - If in a remote location, locate shady trees or provide a shelter by using a tarp
  - Make sure there is adequate ventilation
- Availability and location of emergency facilities and services
    - Know how to obtain medical assistance quickly, including ambulance service
    - Know the exact location of your work site in order to direct emergency vehicles
    - Know the name, address, and telephone number of the nearest medical treatment facility. Know the travel time and their arrangements for accepting patients
    - Know the location of a water source (or bring water with you)
    - Know if any of the crew have special medical conditions or are allergic to medications
    - Make sure at least one crew member knows first-aid for heat stress.

Advance preparation for working in hot conditions should include:

- Training/retraining personnel on symptoms and precautions
  - Ensure that all crew members have received the appropriate training.
- Scheduling of work, including work-rest cycles
  - If possible, arrange to work during relatively cool periods of the day or in cool seasons of the year
  - Lifting and hauling of equipment and supplies (activities that generate considerable metabolic heat) should be scheduled for the cool hours of the day
  - If work must be done during the heat of the day or during the hottest months of the year, be sure to include time for adequate rest periods when estimating the amount of work to be done each day
  - If you will need to sample near heat sources in an industrial plant, try to schedule work when the equipment is not operating
  - If respiratory equipment or protective clothing will be worn without cooling vests, consult an industrial hygienist to establish appropriate work-rest regime.
- It is generally recommended that personnel wearing impervious protective garments should institute a formal heat stress monitoring program, including a work-rest regimen, at temperatures of 70°F and greater.
- Provision of appropriate equipment, supplies, and replacement fluids

- Obtain a reliable ambient temperature thermometer or wet bulb globe thermometer to check the air temperature at the beginning of each workday and during the day
  - If your sampling involves moving heavy tools and equipment, especially to heights, provide a block-and-tackle for hoisting. This will make the work less strenuous and will reduce metabolic heat production in crew members
  - If you will be working near sources of intense heat in an industrial plant or in the direct sun, plan to use protective heat shields, insulating materials, and reflectors to reduce the heat load
  - Take electric fans for cooling and tarps to provide shade, if appropriate
  - Plan to provide crew members with sufficient electrolyte replacement solution
  - Provide emergency communication equipment for use between ground crews and those working in the heat, at heights, or in remote locations.
- Clothing recommendations
    - Plan to have crew members wear head coverings and clothing that will reduce the heat load
    - Clothing should be light in color, absorbent, and reflective. When the ambient temperature is below 100°F, loose-fitting clothing or a limited amount of clothing should be worn. If the ambient temperature is above 100°F, crew members should cover their bodies as much as possible
    - Cooling vests are also available, generally for personnel wearing PPE while working in hot environments.
- Preparation for the emergency treatment of heat stress.
    - Personnel should know the symptoms of the major heat stress disorders, understand how to prevent them, and know how to provide emergency treatment and seek medical help if they occur
    - More than one, if not all, personnel should be trained in first aid and emergency treatment of heat stress disorders, especially if you will be more than 3 miles or 10 minutes from medical treatment
    - Keep the following information in a prominent place in your vehicle: information on medical facilities and emergency medical services, a good description of any directions to your exact location, concise directions for treating heat stress disorders in the field, and medical information on personnel that would affect treatment
    - Prepare a plan for medical treatment and evacuation of any personnel working at heights or in a remote location.

During the workday, employees should be checked periodically for signs of heat stress and reminded to take rest breaks and replace fluids. For extreme situations, oral temperatures should be taken at breaks to detect the onset of heat stress problems, and workers should be weighed at the beginning and end of each workday to detect dehydration.



A heat stress checklist, included as Appendix A, contains general guidelines that can be used to help prevent or minimize heat stress situations.

### **3.0 COLD STRESS**

The human body is designed to function normally within a relatively narrow range of internal body temperatures. Because humans are warm-blooded, we must maintain our body heat. Cold stress is the cumulative effect on the body resulting from a number of ways the body loses heat.

#### **3.1 Causes of Loss of Body Heat and Contributing Factors**

The body can lose heat through the following processes:

- Radiation (i.e., radiant energy emitted by exposed skin to the surrounding cooler air)
- Conduction (i.e., heat loss to water during swimming and diving)
- Convection (i.e., wind)
- Evaporation (i.e., moisture from perspiration, rain, snow).

Heat loss from convection (i.e., wind) is probably the greatest and most deceptive factor in loss of body heat. In essence, the wind blows away the thin layer of air that acts as an insulator between the skin and the outside air temperature.

Other factors that may contribute to body heat loss are:

- Inadequate food, water, or sleep
- Lack of acclimatization
- Alcohol consumption (e.g., causes vasodilation, the dilation of blood vessels near the skin surface, resulting in increased heat loss)
- Fatigue
- Medications (e.g., sedative drugs, which interfere with the transmission of impulses to the brain)
- Cardiac and respiratory conditions (e.g., more difficult to maintain increased metabolic rate)
- Physical fitness of individual worker
- Age.

#### **3.2 Cold Stress Disorders and Symptoms**

Cold stress disorders result when the body cannot maintain an adequate internal temperature. The body maintains its internal temperature by gaining heat from food and muscular work, or by losing heat through the factors previously mentioned. Cold first affects the skin by cooling the blood in the peripheral capillaries. Blood vessels of the skin restrict, which reduces heat loss, and glucose is produced to provide additional fuel. The extremities are generally the first areas affected by cold stress disorders. Shivering is

the body's reflexive attempt to produce heat by rapid contractions of the muscles, raising the body's metabolic rate. Following the onset of these symptoms, if the body continues to lose heat, hypothermia will occur. Frostbite is a separate condition, although it may accompany hypothermia.

Field personnel who are required to perform diving or other in-water activities should wear thermal underwear under dry suits. After leaving the water, personnel should dry off and change into warm clothes as soon as possible. Consult diving manuals for temperature-related specifics.

### ***3.2.1 Hypothermia***

Hypothermia is the progressive lowering of body temperature accompanied by rapid, progressive mental and physical collapse. Hypothermia may occur on land or following submersion in even moderately cold water (65°F or below).

The first symptoms of hypothermia are:

- Sensation of cold
- Uncontrollable shivering
- Heartbeat slows and sometimes becomes irregular
- Blood pressure changes.

Other symptoms that can occur before complete collapse include:

- Severe shaking or rigid muscles
- Vague or slow slurred speech
- Memory lapses or incoherence
- Drowsiness
- Low blood pressure
- Slow, irregular breathing
- Apparent exhaustion and fatigue after rest.

Treatment:

For mild cases:

- Move victim to shelter and warmth as rapidly as possible
- Remove all wet clothing and replace it with dry clothing
- Give the victim something warm to drink (e.g., non-caffeinated beverage).

More severe cases should be considered medical emergencies and help should be obtained as soon as possible. Even persons with mild hypothermia should see a doctor.

For severe cases:

- Provide external heat (e.g., a warm bath or wrap warm moist towels around the victim's head, neck, sides, and groin; use hot water bottles, heated blankets, heating pads, human sandwich)
- Do not wrap a hypothermia victim in a blanket without an auxiliary source of heat unless it is to protect against any further heat loss before treatment can begin
- Do not leave the person in a sleeping bag without heat before going for help
- Give warm liquids and nourishing food
- Handle the patient gently and do not allow him/her to walk

**Caution:** Exertion can route cold stagnant blood away from extremities to the central body and cause "after-drop," in which the patient's core body temperature may drop below the level that will sustain life.

### ***3.2.2 Frostbite***

Frostbite is the freezing of some part of the body as a result of exposure to very low temperatures. The face, hands, and feet are most commonly affected by frostbite. Severity can range from incipient frostbite (frostnip) which affects the skin, to superficial frostbite, which involves the skin and the tissues immediately beneath it, to deep frostbite, a much more serious injury with damage that may affect deeper tissue and even bone.

Symptoms - symptoms for each of the three stages of frostbite include:

Frostnip:

- Skin first turns red, later becomes pale or waxy white
- May be tingling, stinging, aching, or uncomfortable sensation of coldness, followed by numbness; symptoms may go unnoticed by the victim.

Superficial frostbite:

- Skin is white or gray-white or waxy in appearance
- Skin is firm to the touch, does not move easily
- Tissue beneath the skin is soft and resilient
- Lack of sensation in the area.

Deep frostbite:

- Tissues are pale, cold, and solid
- Usually affects hands and feet
- Blisters and swelling may occur.

Treatment:

- Thaw frozen spots immediately by applying body heat. **Caution:** Do not rub or massage affected area
- Do not use snow to thaw frostbite; this can make the injury more serious
- Give victim warm, noncaffeinated drinks
- Have victim exercise fingers or toes as soon as they are warmed
- Do not allow a person with frostbitten feet to walk because it may cause additional damage
- For deep frostbite, IMMEDIATE MEDICAL CARE IS URGENT. Remove person to a heated shelter to avoid further frostbite. Remove all constricting items if it can be done without danger of further frostbite. Warm extremities in a carefully controlled warm water bath, if available.

### 3.3 Measures to Prevent or Reduce Cold Stress

Cold stress can be reduced or prevented by planning ahead and following the appropriate steps, such as:

- Never go into the field in cold weather without adequate clothing, including a windproof, water-resistant outer jacket
- Wear enough layered clothing to protect yourself against cold and wind
- Wear warm gloves, socks, boots, and a hat
- Exercise face, fingers, and toes from time to time to keep them warm and to detect any areas that may have become numb
- Watch others for signs of frostbite.
- Stay dry. If clothing becomes wet from perspiration, rain, snow, or immersion, clothing should be changed as soon as possible
- If you start to shiver in a prolonged or violent way, seek warm shelter at once.

Prior to engaging in field activities, an assessment should be made of:

- Weather conditions, including typical wind conditions
  - Assess the weather conditions to determine adequate preparation and length of time the crew can work outside
  - Determine the typical wind conditions for the period in which you will be working.
- Whether areas in which work will be performed are sheltered or open to the wind
  - Identify if the areas in which you will be working are sheltered or open to the wind and determine a means of providing shelter, if needed
- Availability of a warm shelter, warm food, and drinks
  - Determine the need for scheduling enough crew members to allow alternate personnel to continue the activity while others warm themselves
  - If you will be using a vehicle for a warming area or if you will use a heater in a closed room, determine how you can ensure there will be adequate ventilation to prevent carbon monoxide poisoning

- Availability and location of emergency facilities and services.
  - Know how to obtain medical assistance quickly, including ambulance service
  - Know the exact location of your work site in order to direct emergency vehicles
  - Know the name, address, and telephone number of the nearest medical treatment facility. Know the travel time and their arrangements for accepting patients
  - Know if any of the crew have special medical conditions or are allergic to medications
  - Make sure at least one crew member knows first-aid for cold stress.

Advance preparation for working in cold conditions should include:

- Training/retraining personnel on symptoms and precautions
  - Ensure that all crew members have received the appropriate training.
- Scheduling of work, including warming breaks
  - Try to schedule work in the least severe weather
  - Plan to rotate crew members to keep cold exposures short
  - Allow sufficient time for frequent warming breaks
  - Remember that workers in heavy clothing may need more time to complete tasks and may become fatigued more easily
  - Be aware that you may have to discontinue operations if winds increase or the temperature drops
  - Remember that winter days are short. Scheduling should allow time for taking care of equipment and supplies before nightfall, when it is more difficult to gauge terrain and when temperatures are more likely to drop.
- Provision of appropriate equipment and supplies
  - Cover/metal handles of tools and control bars with thermal insulating material at temperatures below 30.2°F (-1°C)
  - Take a reliable ambient temperature thermometer, a wind gauge, and a wind chill chart
  - If the site is very windy, try to provide some means of shelter from the wind
  - If a source for hot food and beverages is not available, carry food and beverages (including water) and provide a means for warming them
  - Provide emergency communication equipment for use between ground crews and those working in the cold, at heights, or in remote locations
  - Carry several blankets and at least one sleeping bag for use in treatment of cold stress disorders.
- Clothing recommendations
  - Clothing should be selected keeping three factors in mind: insulation value, absorption ability, and wind resistance
  - Multiple layers of clothing have more insulating volume than single, thick layers of equal thickness. Multiple layers also have the advantage of being removable,

- one at a time, as weather conditions or workload dictates. Inner layers should be porous and outer layers should be nonporous, wind resistance, and waterproof
- Heat loss from the head can be as much as 40 percent. Head coverings should be well lined and loose fitting with a means of protecting the ears. Some means of securing the protection to the head should be considered
  - Well insulated, but loose-fitting materials should be selected for the hands and feet. Fur-lined mittens with water-resistant coverings are the best, although gloves may be required for greater dexterity. Fur-lined insulating boots in a size larger than normally worn will allow for air space insulation and multiple layers of socks. Boots should be made of waterproof material, such as rubber or leather, and treated with waterproofing. In some instances, steel-toed boots will be required. Soles should be designed for sure footing on slippery surfaces or snow. Extra pairs of socks and gloves should be carried. Socks should be changed as necessary to keep feet dry.
- Preparation for the emergency treatment of cold stress.
    - Personnel should know the symptoms of the major cold stress disorders, understand how to prevent them, and know how to provide emergency treatment and seek medical help if they occur
    - More than one, if not all, personnel should be trained in first aid and emergency treatment of cold stress disorders, especially if you will be more than 3 miles or 10 minutes from medical treatment
    - Keep the following information in a prominent place in your vehicle: information on medical facilities and emergency medical services, a good description of any directions to your exact location, concise directions for treating cold stress disorders in the field, and medical information on personnel that would affect treatment
    - Prepare a plan for medical treatment and evacuation of any personnel working at heights or in a remote location.

Continuing assessment should be made throughout the field activity. During each workday, employees should be periodically checked for signs of cold stress and given frequent warming breaks. Clothing should be worn in layers, with the inner layer being insulating and porous and the outer layer being nonporous and wind and water resistant.

A cold stress checklist, included as Appendix B, contains general guidelines that can be used to help prevent or minimize cold stress situations.

#### **4.0 HEAT AND COLD EXPOSURE LIMITS**

Several methods have been developed to assess/predict the level of heat or cold stress workers may experience. The Wet Bulb Globe Temperature (WBGT) index, which incorporates important environmental factors, is a commonly used method that is sanctioned by both the American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH). Once

the WBGT index is known, it can be applied to tables of threshold limit values to determine appropriate work-rest regimens. Consult ACGIH's most current Threshold Limit Values booklet for additional information. [NOTE: Work-rest regimens should be determined only by qualified industrial hygienists or health and safety professionals. Refer to Emergency Response Team SOSGs for EPA-specific requirements.]

## **5.0 MONITORING EQUIPMENT**

Heat and cold stress situations are generally monitored by measuring the ambient conditions and correlating them to the potential stress experienced by the workers. However, in some extreme cases, it may be necessary to monitor the individual workers.

The following equipment can be used for monitoring the ambient conditions contributing to heat stress situations:

- Ambient temperature thermometer
- Wet bulb globe thermometer.

The following equipment can be used for monitoring individual workers for heat stress:

- Oral thermometer
- Reliable bathroom scale
- Personal heat stress monitors (core body temperature).

The following equipment can be used for monitoring the ambient conditions contributing to cold stress situations:

- Ambient temperature thermometer
- Wind gauge and a wind chill chart.

The following equipment can be used for monitoring individual workers for cold stress:

- Personal cold stress monitors (core body temperature).

## **6.0 ADDITIONAL RESOURCES OF INFORMATION**

For additional information on heat/cold stress, consult the following sources:

- "Community First Aid & Safety," American Red Cross. October 1993, ISBN 0-8016-7064-0, stock number 652030
- "Occupational Exposure to Hot Environments," NIOSH, Revised Criteria 1986
- "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," NIOSH/OSHA/USCG/USEPA, 1985.

## 7.0 SUMMARY

The ease with which the regulation of body temperature can be accomplished is dependent on workers':

- Ambient environment
- Intensity of work
- Type of clothing
- Individual susceptibility (age, health, fitness).

The following factors are fundamental to preventing or reducing heat and cold stress:

- Water and electrolyte replacement
- Acclimatization
- Proper work clothing
- Appropriate work-rest regimens
- Training and education
- Medical screening.

Prior to engaging in field activities, you should be able to:

- Recognize signs and symptoms of heat and cold stress disorders in yourself and others
- Perform the appropriate emergency treatment
- Identify where and how medical attention can be obtained
- Identify the type of assessment and steps that need to be taken before work begins in temperature extremes.
- Prevent or reduce the effects of heat and cold stress



## EXERCISE

Read the following questions and circle the correct response, true or false.

1. A symptom of heat stroke is heavy sweating T    F
2. Heat and cold stress can be reduced by acclimatization. T    F
3. To treat frostbite, you should rub the affected area vigorously. T    F
4. One way to prevent heat cramps is to drink an electrolyte solution periodically throughout the workday. T    F
5. The onset of heat stress problems can be detected by weighing workers before and after each workday. T    F
6. The loss of body heat can be increased by alcohol consumption. T    F
7. Drowsiness and slow, slurred speech are symptoms of hypothermia. T    F
8. For severe hypothermia, wrap the victim in a blanket, sleeping bag, or extra coat and immediately go get help. T    F
9. Heat exhaustion is a common problem experienced by many workers in hot environments and does not require medical treatment. T    F
10. Sunscreen is not needed on cloudy, overcast days. T    F

## **EXERCISE KEY**

Read the following questions and circle the correct response, true or false.

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8. For severe hypothermia, wrap the victim in a blanket, sleeping bag, or extra coat and immediately go get help. T    F
9. Heat exhaustion is a common problem experienced by many workers in hot environments and does not require medical treatment. T    F
10. Sunscreen is not needed on cloudy, overcast days. T    F

## **APPENDIX A: HEAT STRESS CHECKLIST**

### **PREVENTION**

Good judgement is essential! Know your own limitations! Pace yourself. Don't over exert. You are the best heat stress monitor! When in doubt, get out.

Drink a lot of cool water or electrolyte solutions (e.g., GATORADE, QUICK KICK). Vary your intake of both fluids. When on the job, drink one (1) cup of replacement fluid every 15 to 20 minutes, if possible. Drink even if you do not want to.

Stop work, notify on-site supervisor, Health & Safety, etc., and rest in cool and/or shaded area at the first sign of symptoms.

Eat regularly and properly! Increase salt intake (VIA FOOD) during the hot season and hot spells. Consult a physician for other suggestions if you are on a salt- restrictive diet.

Do not take salt tablets.

If you anticipate field work, get acclimated and conditioned prior to working in high temperatures (takes 4 to 7 days to acclimate).

Obtain American Red Cross First Aid and CPR Certification.

When wearing protective clothing, remove it or open it when on break.

Maintain good physical condition (e.g., nonsmoker, proper weight). Control blood pressure.

Participate in a yearly medical surveillance program.

Regulate alcohol intake if you are going to be working in hot environments.

Watch out for your "Buddy" and fellow workers. Look for signs and symptoms of heat-related disorders. Working in hot environments may cause physical or physiological problems. Workers may do unsafe things, make faulty decisions, or act hastily, because of heat.

If you are on medication, or have some medical restriction, consult a physician prior to working in hot environments.

## **APPENDIX B: COLD STRESS CHECKLIST**

### **PREVENTION**

Preplanning is essential! Have the appropriate clothing, equipment, supplies, and training before working in cold environments.

If areas of your body become numb or you start to shiver in a prolonged or violent way, seek warm shelter at once!

Keep your head covered (i.e., hat, hood)! As much as 40 percent of body heat can be lost when the head is exposed.

Protect your hands and feet. These extremities are farthest from the heart and become cooled most easily.

Exercise face, fingers, and toes from time to time to keep them warm and to detect any areas that may have become numb.

Do not work alone in cold environments! Ensure that you have some means of contact/communication with a "Buddy."

Watch out for your "Buddy" and fellow workers. Check periodically for signs of frostbite.

Wear loose-fitting, layered clothing with breathable inner-layers and wind/waterproof outer-layers.

Always carry extra pairs of socks and gloves!

Drink warm, sweet, caffeine-free, nonalcoholic drinks for fluid replacement and caloric energy.

If you have high blood pressure or are on a restricted salt diet, consult your physician for advice on salt intake.

Regulate your alcohol intake if you are going to be working in cold environments.

Participate in a yearly medical surveillance program.

Maintain good physical condition (e.g., nonsmoker, proper weight, good fitness level. Control blood pressure.