



Boat Crew Seamanship Manual

Chapter 3: Crew Efficiency Factors

Introduction

This chapter specifies physical fitness issues that all Boat Crew Members should keep in mind. It also describes some of the hazards and unique discomforts boat crews cope with when operating boats in the maritime environment. The combination of many factors such as extreme hot or cold weather, fatigue, and seasickness are all factors that can impair crew performance. Understanding these factors will help crewmembers remain at the highest level of efficiency while underway.

NOTE: Specific treatment procedures for the conditions described in this chapter are covered in *Chapter 5, First Aid* of this Manual.

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Section A. Physical Fitness Issues

Introduction

Operating or being a Boat Crew Member on a Division Rescue Vessel can be physically demanding and can take a toll on one's body. [This is even truer on Great Salt Lake due to the density and high salinity of the lake as well as the wave height and characteristics encountered here.](#) Crewmember should have sufficient strength, flexibility, and endurance to safely perform duties during normal and adverse conditions. Each crewmember should be able to accurately gauge their level of fitness and make improvements where necessary.

Section B. Crew Fatigue

Introduction

The crew's physiological well-being plays an important role in the safe and successful accomplishment of each mission. A crewmember will assist people during the worst conditions. At times, they may feel like they have reached the limits of their physical and mental endurance.

B.1. Fatigue

Mental and physical fatigues are among the greatest dangers during rough weather operations. The hazard of fatigue dramatically reduces the powers of observation, concentration, and judgment. This reduces the ability to exert the effort necessary, and increases the probability that chances will be taken and prescribed safety precautions may be discarded. The following are examples of situations that may cause fatigue:

- Operating in extreme hot or cold weather conditions.
- Eye strain from hours of looking through sea-spray blurred windshields.
- The effort of holding and maintaining balance
- Stress
- Exposure to noise
- Exposure to sun
- Poor physical conditioning
- Lack of sleep
- Boredom

The safety of the crew and other passengers should always be the foremost concern.

B.2. Crew Responsibility

The crew's safety and welfare are the VO's primary responsibility. VO's must be constantly aware of stress signs evident in their crews, learn to recognize fatigue, and take corrective action. Crewmembers must watch each other's condition to prevent excessive fatigue from taking its toll. The ability of each member to respond to normal conversation and to complete routine tasks should be observed.

B.3. Symptoms

The primary symptoms of fatigue are:

- Inability to focus on concentrate/narrowed attention span.
- Mental confusion or judgment error.
- Decreased coordination of motor skills and sensory ability (hearing, seeing).
- Increased irritability.
- Decreased performance.
- Decreased concern for safety.

Any one of these symptoms can cause mistakes in judgment or cause taking shortcuts that could threaten the safety of the mission and crew. It is important to ward off the effects of fatigue before it gets too great. Fatigue can lead to faulty decisions and a “don’t care” type of attitude.

B.4. Prevention

VO’s must be aware of the dangers that exist when crewmembers push themselves beyond reasonable limits of performance. They should help eliminate mistakes caused by fatigue. VO’s must not hesitate to call for assistance when fatigue begins to impair the efficiency of their crew.

Some preventive measures are:

- Adequate rest.
- Appropriate dress for weather conditions.
- Rotate crew duties.
- Provide food and refreshments suitable for conditions.
- Observe other crewmembers for signs of fatigue.

B.4.a. Environmental Conditions

Despite the normal operating climate in a particular area, all crewmembers must dress (or have clothing available) for unexpected weather. Keeping warm in cold weather and cool in hot weather helps prevent fatigue. Some other environmental conditions that also promote fatigue are:

- Motion sickness.
- Glare from the sun.
- Wind and rough sea conditions.
- Rain or snow.
- Vibration (boat engine).

Section C. Motion Sickness

Introduction

Motion sickness, or seasickness, is nausea and/or vomiting caused by an imbalance between visual images and portion of the middle ear that senses motion. This section discusses the causes and symptoms of motion sickness, as well as the methods of prevention.

C.1. Causes of Motion Sickness

Mental and physical stress, as well as the rolling or pitching motion of a boat, contributes to motion sickness. Reading chart work, or other tasks that require close attention, will aggravate motion sickness.

C.2. Symptoms

The motion of the boat, especially when the boat's heading produces a wallowing or rolling motion, can cause the typical symptoms of nausea and vomiting. The primary symptoms of seasickness are:

- Nausea and vomiting.
- Increased salivation.
- Unusual paleness.
- Sweating.
- Drowsiness.
- Overall weakness.
- Stomach discomfort.

CAUTION! Some anti-motion sickness medications may cause drowsiness. Consult a medical professional to determine if other alternatives are available.

C.3. Prevention / Medication

Besides taking medication, there are other things that can be done to help prevent seasickness:

- Stay out of confined spaces.
- Stay above deck in the fresh air.
- Avoid concentrating on the movement of the boat by looking out over the water toward the horizon or shoreline.
- Avoid smoking.

Motion sickness can often be prevented or made less severe with different kinds of anti-motion medication, including the use of Scopolamine patches. Crewmembers who are especially susceptible to motion discomfort should take anti-motion medication throughout their watch since they never know when they will be dispatched on a mission. Medication taken just before getting underway may not have its maximum effect during the mission.

C.4. Medication Restrictions

Restrict medication in the following circumstances:

- Without medical supervision
- Within 12 hours of alcohol consumption
- To pregnant crewmembers.

Section D. Lethal Fumes

Introduction

Crewmembers are constantly at risk of injury or death from exposure to lethal fumes. Carbon monoxide (CO) is a colorless and odorless gas. It is the most common lethal gas encountered during boat operations.

D.1. Conditions Where CO may be Present

The following conditions are associated with CO poisoning:

- Fuel-burning devices.
- Enclosed areas.
- Underway.
- Fires.

D.1.a. Fuel-Burning Devices

Operating any of the following fuel-burning devices produces CO fumes

- Gasoline or diesel engines.
- Portable dewatering pumps
- Propane or alcohol stoves.
- Kerosene heaters.

D.1.b. Enclosed Areas

Personnel can be quickly affected by CO fumes in areas such as closed cockpits or unventilated spaces below decks and under the following conditions:

- Sleeping in a closed cabin while using certain types of catalytic and/or flame producing heaters.
- Working around the engines with the engines operating
- Working a defective exhaust system has allowed fumes to accumulate in a confined space.

NOTE: When located in a compartment that may be affected by lethal fumes, breathable air may be found near the deck. Crouch or crawl on the deck to reach an exit.

D.1.c. Underway

The boat does not need to be stationary for a problem with CO fumes to occur. For example, a following wind can circulate exhaust gases throughout the cockpit of a slow-moving boat.

The construction of some cockpits or cabins can cause eddies from a wind current to draw fumes back aboard.

D.1.d. Fires

Breathing the by-products of a fire is another source of dangerous fumes. Even a recently extinguished fire is still dangerous. Fires can also create other highly lethal fumes such as cyanide gases. This happens when different types of plastics, upholstery, cushions, or electronics insulation burn.

D.2. Symptoms

Symptoms of lethal fume poisoning can include one or more of the following:

- Throbbing temples
- Dizziness.
- Ears ringing.
- Watering and itching eyes.
- Headache.
- Cherry-pink skin color.

D.3. Prevention

Crewmembers should always ensure adequate circulation of fresh air throughout the vessel. Minimizing the effect of exhaust fumes on the vessel is key and may be as simple as:

- Making a minor course change.
- Increasing speed.
- Opening a window.
- Cracking open a door, etc.

D.4. Response to Victims

The first senses affected by poisonous gases are those that control a person's judgment and decision-making ability. Once dangerous fumes affect a person, they may not be able to help themselves. The following responses should be conducted as appropriate:

- If CO or any other type of poisoning is suspected, remove the conscious victim to fresh air and get medical help immediately
- If the victim is unconscious, do not try to assist them alone. Needless casualties occur from people trying to help someone overcome by lethal fumes, only to become victims themselves. See if the victim is responsive by calling out to them. If there is no response, immediately call for assistance and wait in a clean atmosphere until help arrives.

Section E. Noise

Introduction

Any continual noise at the same pitch can distract, lull, or aggravate to the point where it adversely affects temperament and the ability to perform properly.

E.1. Noise as a Fatigue Factor

Loud noise can cause hearing loss and contribute to excessive fatigue. VO's should be aware of the effect noise may be having on the crew.

E.2. Noise Management

The following are a few measures to help manage noise:

- Make minor changes to engine speed.
- Adjust radio controls so they produce a minimum amount of static.
- Use single hearing protection whenever noise levels exceed 85 decibels and double hearing protection for noise levels of 104 decibels. (see **Figure 3-1** for decibel scale)

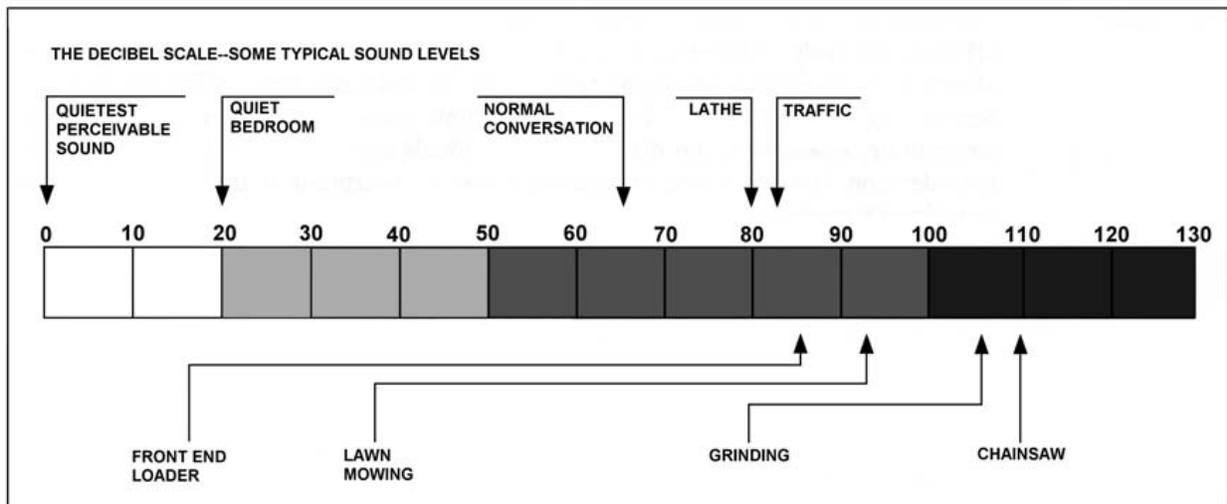


Figure 3-1
Decibel Scale

Section F. Drugs and Alcohol

Introduction

Alcohol and drug use causes slower reaction time, lack of coordination, slurred speech, drowsiness, or an overconfident attitude. Hangovers also cause irritability, drowsiness, sea-sickness, and a lack of concentration. Crewmembers who knowingly get underway for a mission while under the influence are violating Division policy and put themselves and others at risk.

F.1. Prescription Drugs

Prescription drugs have the ability to adversely affect or incapacitate crewmembers. Certain medications can be as incapacitating as alcohol. In addition, many medications, if taken with alcohol, accentuate the action of both. Crewmembers should always notify the VO while taking prescription drugs which may affect performance or prevent performance of duties.

F.2. Alcohol

Alcohol is a well-recognized central nervous system depressant. It is one of the most frequently used and abused drugs in our society. Even small amounts of alcohol in the blood can seriously impair judgment, reflexes, muscular control and reduce the restorative effects of sleep.

The level of alcohol in the body varies with the frequency and amount of alcohol intake, the length of time following cessation of drinking and an individual's body weight. A zero alcohol level is essential for boat crew personnel to meet the rigorous demands of boat operations.

Detectable blood alcohol or symptomatic hangovers are causes for restricting boat crew personnel from operations. Although some personnel metabolize alcohol quicker than others, at least eight hours is required for up to two drinks and twelve hours after three or more. This time span allows an adequate margin of safety before resuming operations.

F.3. Tobacco

The nicotine contained in tobacco is a quick-acting poison. Excessive smoking causes depression of the nervous system and impairment of vision. The carbon monoxide resulting from the combustion of tobacco is absorbed by the bloodstream in preference to oxygen, resulting in a lowering of altitude tolerance. Tobacco smoke also irritates the respiratory system.

F.4. Caffeine

The drug caffeine, contained in coffee, tea and many soft drinks, can produce an adverse effect on the body. The amount of caffeine contained in just two cups of coffee appreciably affects the rate of blood-flow and respiration. In small amounts, coffee can be considered a nervous system stimulant. Excessive amounts may produce nervousness, inability to concentrate, headaches, and dizziness. Individuals accustomed to daily intake of caffeine may develop headaches, and experience a loss of sharpness if daily intake is stopped or significantly curtailed.

Section G. Cold Related Issues

Introduction

The purpose of this section is to briefly describe the precautions to take while operating in cold weather. Cold, rain, snow, ice storms, and high winds can develop with very little warning on the Great Salt Lake. Preparation before encountering these kinds of conditions and understanding the effects of cold on personnel safety is vital.

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Effects of Cold Weather

WARNING: Excessive loss of body heat, which can occur even in mild weather conditions, may lead to hypothermia

G.1. Operating in a Cold Climate

Operating in a cold climate presents the challenge of keeping warm while effectively carrying on the mission. As the temperature drops or clothing becomes wet, more insulation is required to keep the body from losing heat.

WARNING: Prolonged exposure to the wind may lead to hypothermia and/or frostbite

G.2. Wind

Wind affects body temperature. Those parts of the body exposed directly to the wind will lose heat quickly, a condition referred to as “wind chill”. On bare skin, wind will significantly reduce skin temperature, through evaporation, to below the actual air temperature.

G.3. Crew Fatigue

The combination of rough seas, cold temperatures, and wet conditions can quickly cause the crew to become less effective. Crew fatigue will occur more quickly when these conditions are present. Many accidents occur when cold induced fatigue sets in because the mid loses attentiveness and physical coordination diminishes. Even a crew that is moderately cold and damp will exhibit a decrease in reaction time which is also a symptom of the onset of hypothermia.

Hypothermia

G.4. Body Temperature

Hypothermia is the loss of internal body temperature. Normal internal body temperature is 98.6° Fahrenheit and is automatically regulated by our bodies to remain very close to this temperature at all times. A minor deviation either up or down interferes with the bodily processes. Being too cold will adversely affect the body. Even a minor loss of internal body temperature may cause incapacitation.

Hypothermia Chart

Water Temp (degrees)	Hypothermia Index	Exhaustion/Unconsciousness	Expected Survival Time
20° to 32°	EXTREME	Under 7 minutes	Under 7-22 minutes
32.5°	EXTREME	Under 15 minutes	Under 15 to 45 minutes
32.5° - 40°	SEVERE	15 to 30 minutes	30 to 90 minutes
40° - 50°	HIGH	30 to 60 minutes	30 to 90 minutes
50° - 60°	CAUTION	1 to 2 hours	1 to 6 hours
60° - 70°	MEDIUM	2 to 7 hours	2 to 40 hours
70° - 80°	LOW	3 to 12 hours	3 hours to indefinite
Over 80°	NONE	Indefinite	Indefinite

WARNING: Great Salt Lake water temperatures during the winter actually go off the USCG Hypothermia charts.

WARNING: Never give hypothermia victims anything by mouth, especially alcohol.

G.5. Symptoms

Signs that a person may be suffering from hypothermia include:

- Pale appearance
- Skin cold to the touch.
- Pupils are dilated and will not adjust properly when exposed to light
- Poor coordination
- Slurred speech / appears to be intoxicated
- Incoherent thinking
- Unconsciousness
- Muscle rigidity
- Weak pulse
- Very slow and labored breathing
- Irregular heartbeat

A hypothermic person will tremble and shiver, however, these symptoms may not always be present. When a person stops shivering, their hypothermia may have advanced beyond the initial stages.

G.6. Prevention

Cold and hypothermia affect crew safety and mission performance, and prevention must be a top priority. Proper protective clothing which is designed to prolong boat crew member's exposure to the elements making them more effective should be worn anytime there is a risk to exposure to conditions that could lead to hypothermia. Clothing should be worn properly and maintained in accordance with its maintenance schedule in order for it to maintain its effectiveness.

G.7. Should I Go?

On missions where hypothermic environments may be encountered, if a Boat Crew Member does not have proper PPE, and proper PPE that would fit the Boat Crew Member is not available, that Boat Crew Member should be excluded from that mission.

G.8. Treatment

Treatment for hypothermia is covered in *Chapter 5, First Aid*.

Frostbite

G.9. Development Factors

Frostbite is the development of ice crystals within the body tissues. Frostbite is most likely to develop in air temperatures less than 20° F. The following factors contribute to frostbite development:

- Cold stressors (wind, air temperature, and exposure to water).
- Any restrictions of blood-flow
- Lack of appropriate protection
- Skin exposure.

G.10. Symptoms

A frostbite victim will complain of painful cold and numbness in the affected area. Waxy white or yellow-white, hard, cold, and insensitive areas will develop. As the area begins to thaw, it will be extremely painful and swelling (reddish-purple) or blisters may appear. Areas prone to frostbite include all extremities where the blood has traveled farthest from the heart, such as the hands, feet, face, and ear lobes. A patient suffering from frostbite should also be treated for hypothermia.

WARNING: Any person who has had frostbite previously is at increased risk for cold exposure injury in that same area of the body.

G.11. Prevention

Cold weather clothing and equipment is essential to preventing cold-related injuries and fatigue. Such items include thermal boots, woolen socks, watch caps, gloves, and thermal undergarments (polypropylene) made of fleece or pile. During cold conditions, VO's should discuss the possibilities of frostbite with the crew before getting underway.

Layering Clothing

G.12. First Layer – Wicking

Staying dry is an essential factor to maintaining body temperature. Clothing worn next to the skin must carry or “wick” moisture away from the body. Cotton clothing can pose particular problems. They absorb and retain moisture, which will rob the body heat through evaporation. Wool has good insulating properties even when wet, but it is less than ideal because it stays wet. Modern synthetic wicking fibers such as polypropylene do not retain moisture. They will actually draw moisture from the skin and transport it to an absorbent outer layer. This clothing works well by itself, or it can be combined with a second layer for extreme cold.

G.13. Second Layer – Insulation

The insulating effect of a fabric is related to how much air it can trap. This is why a loose-knit or fuzzy material is better than one that is tightly knit. It is also why two thin layers of a given material are better than one thick one. The second layer traps air, which retains body heat, while the absorbing excess moisture from the first layer. Wool or cotton thermals are an acceptable second layer if worn over a wicking layer, but a number of synthetic fleece or pile garments do a much better job. An example of this is the fleece coverall.

G.14. Third Layer – Moisture Barrier

The outer layer should stop wind and water, so the inner layers can work as designed. Choices include the anti-exposure coverall dry suit, or rain gear. The dry suits and rain gear have no insulating properties and will require extra insulation for cold weather. Also, as most dry suits do not “breathe,” an absorbent second layer is needed so that perspiration has a place to go.

G.15. Extremities

Most heat loss occurs through the extremities, especially the head. It is particularly important to cover these areas well. It is still important to layer properly, but thinner, or all-in-one materials must be used to reduce bulk. For the head, a wool cap may work, but a heavy wicking hood or cap worn alone or under a wool cap will keep you drier and warmer. A rain hat/hood/sou’wester should be considered for wet weather. Gloves should be waterproof, and a wicking liner glove will work better than wool. High top rubber boots are the only option for wet weather. A wicking liner sock under a wool, cotton, or fleece outer sock will provide the best warmth. Insoles should be non-absorbent. A perforated foam insole also works well.

Section H. Sun and Heat-Related Factors

Introduction

Crewmembers must be aware of the dangers of too much exposure to the sun and take preventive measures to guard against a decrease in performance. Intense sunlight and extreme heat can increase crew fatigue and reduce effectiveness. This section discusses the various sun and heat-related factors that crewmembers may encounter during their activities.

NOTE: Detailed treatment information on all heat related injuries can be found in *Chapter 5, First Aid*.

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Sunburn

H.1. Description

Continuous exposure to the sun can cause sunburn and other complications such as heat stroke, dehydration, etc. Unprotected exposed skin will suffer from premature aging and an increased chance of skin cancer.

H.2. Symptoms

Sunburn appears as redness, swelling, or blistering of the skin. Other effects of overexposure to the sun are fever, gastrointestinal symptoms, malaise, and pigment changes in the skin.

H.3. Prevention

If exposed to the sun for prolonged periods of time, crewmembers must take precautions. Staying in the shade when possible is a start. However, just getting out of direct sunlight is not always enough since sun can be just as harmful when reflected off a bright surface, such as sand or water. Sunscreen lotion with a sun protection factor (SPF) of 15 or higher should be used. Protective clothing such as a hat with a brim and sunglasses with UV protection for eyes should be worn.

H.4 Treatment

Most sunburns do not appear fully until exposure to the sun for several hours. Treatment consists of applying cool wet towels to the affected area. Cooling the skin temperature is very important. Keeping the skin moist but being wary of what product is applied is also essential. Many lotions contain perfumes, alcohol, or wax that will only aggravate the burn. Several types of first aid sprays give fast but short-lived relief.

Dehydration

WARNING: Do not use salt tablets unless prescribed by a physician. The use of salt tablets does not improve wellbeing despite the amount of perspiration of salt/electrolyte loss.

H.5. Description

An adequate fluid intake is essential to remain hydrated while underway. Fluids are lost from the body in several ways. The most obvious loss is through the kidneys. The less obvious loss of body fluid occurs

through perspiration from the skin and respiration through the lungs. As a result, an average, healthy adult requires two or three liters of fluid a day to replace these losses. Extremely warm weather significantly increases the loss of fluids. Staying away from liquids such as tea, alcohol, coffee, and soft drinks is advisable as these liquids speed up fluid loss.

One vital element of body fluids must be maintained is electrolytes. "Electrolyte" is a medical/scientific term for salts, specifically ions. Electrolytes are important because the body uses them to maintain voltage across cell membranes and to carry electrical impulses for moving the muscles. The body loses electrolytes mostly through perspiration. In most cases, a normal diet and drinking plenty of fluids will maintain an adequate electrolyte level.

H.6. Symptoms

Healthy adults must satisfy their water and electrolyte requirements. When water and electrolytes are not replaced, the body experiences dehydration. Drinking alcohol and caffeine increases dehydration. At first there is thirst and general discomfort, followed by an inclination to slow physical movement, and a loss of appetite. As more water is lost, an individual becomes sleepy and experiences a rise in body temperature. By the time the body loses 5% of body weight in fluids, the individual begins to feel nauseated. When 6 to 10% of body fluids are lost, symptoms increase in this order

- Dry mouth
- Dizziness
- Headache
- Difficulty in breathing
- Tingling in the arms and legs
- Skin color turns bluish
- Inability to walk
- Cramping legs and stomach

H.7. Prevention

Drinking fresh clean water is the best and easiest method to replace fluid loss and prevent dehydration. Almost all fluids are suitable including fruit juices, soups, and water. Drinks that do not contain sodium (salt) are recommended. Crewmembers should drink plenty of fluids throughout the day, especially in warm, dry climates. Taking along an ample supply of water is a must during prolonged periods away from a water source.

WARNING: Never force fluid by mouth to a person who is unconscious or semiconscious.

H.8. Treatment

The signs of dehydration can be subtle and therefore, crewmembers should be particularly watchful of each other under extreme conditions of sun and heat. The crew should be encouraged to drink fluids throughout the mission. Rotating crews between tasks where they are exposed to the sun and shade will help prevent dehydration. If a crewmember becomes dehydrated, the person should be immediately removed from further exposure to heat and/or sun and should receive prompt medical attention. Mild dehydration cases will become serious if the level of activity and environmental conditions do not change.

Heat Rash (Prickly Heat)

H.9. Description

Heat rash is prevalent among those living and working in warm, humid climates or in hot spaces ashore or aboard boats. It may occur in cool weather if a person overdresses.

H.10 Symptoms

Heat rash is caused by:

- Breakdown of the body's ability to perspire
- Decreased evaporative cooling of the skin

Heat rash interferes with sleep, resulting in decreased efficiency and increased cumulative fatigue, making the individual susceptible to more serious heat disorders. Heat rash also accelerates the onset of heat stroke. Symptoms are:

- Pink or red minutes lesions
- Skin irritation (prickling)
- Frequent, severe itching

H.11 Prevention

DVI's and crewmembers must be aware of negative effects brought on by heat rash, and be alert for symptoms when operating in a hot environment. Rotating crews between heat-related tasks and those jobs in a cooler environment would help prevent heat rash from occurring.

H.12 Treatment

If heat rash occurs, the crewmember should be removed from further exposure to excessive heat immediately. Positive action should be taken to prevent the onset of more serious disorders. Cool, wet towels should be applied to the affected areas.

Heat Cramps

H.13. Description

Heat cramps are painful contractions caused by excessive salt and water depletion. Heat cramps may occur as an isolated occurrence with normal body temperature or during heat exhaustion. Recently stressed muscles are prone to heat cramps, particularly those muscles in the extremities and abdomen.

H.14. Symptoms

The victim's legs will be drawn up into the fetal position and excessive sweating will occur. The victim may grimace and cry out in pain.

H.15. Prevention

The guidelines discussed previously for other heat-related illnesses should be followed.

H.16 Treatment

Heat cramps can be treated by placing the victim in a cool place and encouraging the victim to lie down in a comfortable position. Cool drinks should be offered to replace fluid loss. Solutions containing

electrolytes, like a sports drink, are also useful, however, the ingestion of excessive salt should not be allowed. Cramped muscles must not be treated with heat packs or massage. Prompt medical assistance is recommended for severe or persistent conditions.

Heat Exhaustion

H.17. Description

Heat exhaustion typically occurs when people exercise heavily or work in a warm, humid environment where body fluids are lost through heavy sweating. Fluid loss can result in a decrease of blood flow to vital organs. In heat exhaustion, sweat does not evaporate as it should, possibly because of high humidity or too many layers of clothing. As a result, the body is not cooled effectively.

H.18. Symptoms

When suffering from heat exhaustion, a person collapses and sweats profusely. The victim has pale skin, a pounding heart, nausea, headache, and acts restless.

H.19 Prevention

The guidelines discussed previously for other heat related illnesses should be followed.

H.20 Treatment

First aid treatment should be provided immediately followed by rapid removal (in a litter, if possible) for the patient to a location that can provide proper medical care.

Heat Stroke

H.21 Description

Heat stroke is a major medical emergency and results from the complete breakdown of the body's sweating and heat regulatory mechanisms. Heat stroke or "sun stroke" is caused by operating in bright sun or working in a hot environment, such as in the cabin of a Division vessel. The onset of heat stroke is very rapid.

H.22. Symptoms

The major symptoms of heat stroke are:

- Red skin, hot and dry to the touch (cessation of sweating)
- Characteristic body temperature above 105°
- Headache
- Weak and rapid pulse
- Confusion, violence, lack of coordination, delirium and/or unconsciousness
- Brain damage (if immediate medical treatment is not given)

H.23. Prevention

The guidelines discussed previously for other heat-related illnesses should be followed

WARNING: No matter which type of operation or assigned mission is being conducted, all incidents of heat stroke must be considered as medical emergencies.

Susceptibility to Heat Problems

H.25 Description

Personnel who are not accustomed to strenuous physical activity in hot and humid environments are particularly susceptible to heat injuries. Excess body weight contributes to this susceptibility.

H.26. Clothing and Equipment

Impermeable clothing does not “breathe” and thus greatly increases an individual’s susceptibility to heat related illnesses. Clothing acts as a barrier that prevents evaporative cooling. Many synthetic fabrics reduce the absorption and dispersal of sweat needed to achieve optimum heat loss by evaporation.

Clothing and equipment should be worn so that there is free circulation of air between the uniform and the body surface. Wearing shirt collars, shirt cuffs, and trouser bottoms open will aid in ventilation. However, this practice may not be permissible in those areas where loose fitting or open clothing would present a safety hazard (e.g., around machinery with moving parts).

In full sunlight or a high radiant heat source (e.g., machinery spaces), keeping the body covered with permeable clothing reduces the radiant heat load upon the body. When not working in these areas, removal of the outer layer of clothing will help reduce body temperature. Impermeable clothing must be worn, precautions should be taken to avoid the rapid buildup of body heat. Heat illnesses may be manifested in minutes if impermeable clothing is worn.

H.27. Fever

Febrile illnesses (fever) increase the chance of rapid heat buildup within the body. The presence of fever before heat stress exposure reduces the allowable exposure times.

H.28. Fatigue

Cumulative fatigue may develop slowly. Failure to recognize this slow development increases an individual’s susceptibility to heat-related problems.

H.29. Prior Heat Illnesses

Prior heat illnesses lead to heat illnesses of greater severity with each incidence. There are two major preventive measures:

- Water
- Salt

H.29.a. Water

The body needs water only in quantities sufficient to prevent dehydration and electrolyte imbalances that result from losses in sweat, urine, etc. Under conditions of profuse sweating, each person will require one pint or more of fluid intake per hour. Water should be taken in small quantities at frequent intervals, such as every 20 to 30 minutes.

H.29.b. Salt

The average diet provides from 15 – 20 grams of salt daily. This amount of salt is adequate for the prevention of most heat-related illnesses. It is not recommended to take salt or 'electrolyte' drinks under normal conditions.