

# Guide for Cold Water Survival

- 1 The Maritime Safety Committee, at its eighty-first session (10 to 19 May 2006), with a view to providing enhanced guidance for passenger ships operating in cold water areas, approved the Guide to cold water survival, prepared by the Sub-Committee on Radiocommunications and Search and Rescue, at its tenth session (6 to 10 March 2006), as set out in the annex.
- 2 Member Governments and international organizations are invited to bring the annexed Guide to the attention of all concerned.

## Annex: Guide For Cold Water Survival

### 1 Introduction

- 1.1 The purpose of this guide is to examine the hazards of cold exposure that may endanger your life, and to provide you with advice on how to prevent or minimize those dangers. A thorough understanding of the information contained in this booklet may some day save your life.
- 1.2 The sinking of the *Titanic* in 1912 provided a dramatic example of the effects of cold water immersion. Partially due to a lack of preparedness with protective clothing, of adequate flotation equipment, and of knowledge of survival procedures, none of the 1,489 persons immersed in the 0°C water was obviously alive when rescue vessels arrived one hour and 50 minutes after the sinking.
- 1.3 Countless lives could have been saved had the survivors and the rescuers known more of how to cope with cold water: almost all of the people in the lifeboats were alive.
- 1.4 During the Second World War the Royal Navy of the United Kingdom alone lost about 45,000 men at sea, of whom it is estimated 30,000 died from drowning and hypothermia. Many of those who drowned did so because of incapacitation due to cold. Even today the pattern is similar.
- 1.5 It is important to realize that you are not helpless to effect your own survival in cold water. Body heat loss is a gradual process, and research shows that in calm water at 5°C a normally dressed person has a 50% chance of surviving three hours. Simple self-help techniques can extend this time, particularly if the person is wearing a lifejacket. You can make the difference; this guide is intended to show you how.

### 2 Your body

- 2.1 An understanding of how your body reacts to cold air or water exposure, and knowing the steps you can take to help your body delay the damaging effects of cold stress, will help you in your struggle to stay alive in the event of cold water exposure.
- 2.2 Imagine your body to consist of an inner core and an outer layer. Your body produces a great deal of heat as a result of normal body functions, such as physical exercise and digesting your food.
- 2.3 Nature requires that your body core be kept to an ideal temperature of 37°C. A network of blood vessels running through the core and the outer layer of your body picks up the heat produced, and distributes it throughout the body. Nature also gives your body a very accurate system to regulate automatically the core temperature at 37°C. For example, if the temperature around you is high, as on a warm day or in a hot boiler room, the blood vessels near the skin of your body will enlarge, allowing more blood to flow to the outer layer and increase body heat loss. This will keep you comfortable and keep the core temperature from rising. If the surroundings are cool, your body will narrow the blood vessels in the outer layer and keep that valuable body heat from being lost too rapidly.
- 2.4 This regulatory system strives to keep the core temperature of the body constant despite variations in ambient temperature around you. The body can only do this within certain limits. There are levels of cold exposure when the body must have help in maintaining the core temperature at nature's choice of 37°C. You must give your body that help by taking correct actions and wearing protective clothing.

### 3 Body heat loss and insulation

**3.1** The body usually loses heat to the surroundings in the following ways:

- 1** Transfer of heat by direct contact with cold water or other materials. Heat passes from your body, which is at a relatively high temperature, to a substance which is lower in temperature. Certain substances are better conductors of heat than others. Water conducts heat more than twenty times faster than air.
- 2** Transfer of heat by air or water currents: moving air is far cooler to the body than still air. Cooling by wind is known as the 'wind-chill' effect. Similarly disturbed or moving water around your body is more chilling than still water at the same temperature.

**3.2** In almost all parts of the world, man cannot survive without the aid of clothes. Clothes by themselves do not warm the body; the body is actually warmed by its own heat production. The body heat warms the layer of air trapped between the skin and clothing. It is this layer of air that provides insulation. If the layer of air is lost, then the insulation is diminished. This layer of trapped air between skin and clothing may be disturbed by movement or displaced by water. In either case, valuable warm air is displaced and skin temperature will fall. Heat from the body core will then be used in an endeavour to maintain skin temperature. If heat loss from the skin remains unchecked, the body core temperature will fall.

### 4 Hypothermia

**4.1** The loss of body heat is one of the greatest hazards to the survival of a person at sea. The rate of body heat loss depends on the:

- 1** water and air temperature;
- 2** wind speed;
- 3** sea conditions;
- 4** length of time spent in the water;
- 5** protective clothing worn;
- 6** body type of the survivor;
- 7** mental and health status of the survivor;
- 8** level of alcohol and certain drugs in the survivor's body; and
- 9** manner in which the survivor conducts himself.

**4.2** An abnormally low body core temperature can be recognized by a variety of symptoms. Very early during exposure, the body tries to combat the excessive heat loss both by narrowing its surface blood vessels (to reduce heat transfer by blood to surface) and by shivering (to produce more body heat). However, if the exposure is severe, the body is unable to conserve or produce enough heat. Body core temperature begins to fall. When the body core temperature is below 35°C, the person is suffering from 'hypothermia'.

**4.3** By then, discomfort, tiredness, poor coordination, numbness, impaired speech, disorientation, and mental confusion are well established. As the internal temperature falls further, unconsciousness may occur, shivering is replaced by muscle stiffness, and the pupils of the eyes may be enlarged. The heartbeat becomes irregular, slow and weak and the pulse is barely detectable. Although death may occur at any stage of hypothermia, when a person's temperature is very low it is difficult to understand, if the person is alive or dead. Death by hypothermia is then defined as a failure to revive on re-warming.



## 5 Ship abandonment

- 5.1** Ships may sink in less than 15 minutes. This affords little time to formulate a plan of action, so careful planning is essential to be ready in an emergency. Here are some sound pointers for you to remember when abandoning a ship (see also appendix 1):
- 1** Put on as many layers of warm clothing as possible, including foot protection, making sure to cover head, face, neck, hands and feet. Fasten, close and/or button up clothing to prevent cold water flushing through the clothing.
  - 2** If an immersion suit is available, put it on over the warm clothing.
  - 3** If the immersion suit does not have inherent flotation, put on a lifejacket and be sure to secure it correctly before immersion. In cold water you will lose full use of your fingers immediately.
  - 4** If time permits all persons should, before boarding the survival craft or in any case immediately after boarding, take some recommended anti-seasickness medicine. Seasickness will interfere with your survival chances as vomiting removes precious body fluid, and seasickness in general makes you more prone to hypothermia and impairs your will to survive.
  - 5** Avoid entering the water if possible, e.g. board davit-launched survival craft on the embarkation deck or by the marine escape system. If davit-launched survival craft, a marine escape system or other means of dry-shod embarkation are not available, use over-side ladders or, if necessary, lower yourself by means of a rope or fire hose.
  - 6** Stay out of the water as long as possible! Try to minimize the shock of sudden cold immersion. A sudden plunge into cold water can cause rapid death, or an uncontrollable rise in breathing rate may result in an intake of water into the lungs. If jumping into the water is unavoidable, you should try to keep your elbows to your side and cover your nose and mouth with one hand while holding the wrist or elbow firmly with the other hand. Avoid jumping onto the liferaft canopy or jumping into the water astern of a liferaft, in case the ship has some remaining headway.
  - 7** Once in the water, whether accidentally or by ship abandonment, orient yourself and try to locate the ship, lifeboats, liferafts, other survivors, or other floating objects. If you were unable to prepare yourself before entering the water, button up clothing now. In cold water, you may experience violent shivering and great pain. These are natural body reflexes that are not dangerous. You do, however, need to take action as quickly as possible before you lose full use of your hands: button up clothing, turn on signal lights, locate whistle, etc.
  - 8** While afloat in the water, do not attempt to swim unless it is to reach a nearby craft, a fellow survivor, or a floating object on which you can lean or climb. Unnecessary swimming will 'pump' out any warm water between your body and the layers of clothing, thereby increasing the rate of body heat loss. In addition, unnecessary movements of your arms and legs send warm blood from the inner core to the extremities (arms and legs) and thus to the outer parts of the body. This can result in very rapid heat loss. Stay calm and take up a good position to prevent drowning.
  - 9** The body position you assume in the water is also very important in conserving heat. Try to float as still as possible - with your legs together, elbows close to your side, and arms folded across the front of your lifejacket. This position minimizes the exposure of the body surface to the cold water. Try to keep your head and neck out of the water.
  - 10** Try to board a lifeboat, raft, or other floating platform or object as soon as possible in order to shorten the immersion time. Remember: you lose body heat many times faster in water than in air. Since the effectiveness of your insulation has been seriously reduced by water soaking, you must now try to shield yourself from wind to avoid a wind-chill effect. If you manage to climb aboard a lifeboat, shielding can be accomplished with the aid of a canvas cover, a tarpaulin, or an unused garment. Huddling close to the other occupants of the lifeboat or raft will also conserve body heat.
  - 11** Keep a positive attitude of mind about your survival and rescue. This will improve your chances of extending your survival time until rescue comes. Your will to live does make a difference!



## 6 Treatment of the immersion survivor

- 6.1** The treatment for hypothermia will of course depend on both the condition of the survivor and the facilities available. Generally speaking, survivors who are rational and capable of recounting their experiences, although shivering dramatically, merely require removal of all wet clothes and replacement with dry clothes or blankets. If possible, they should be taken from the water horizontally and carried this way, or else be returned to the horizontal (or, better still, to the unconscious position) as quickly as possible and kept this way. Hot sweet drinks should be given but only if the victim is fully conscious with gag and cough reflexes. Rest in a warm environment not exceeding 25°C (normal room temperature) is also recommended. Do not allow alcohol or smoking, or massaging or rubbing of the cold skin. However, always bear in mind that even conscious survivors can collapse and become unconscious shortly after rescue. They should therefore be kept resting horizontally, with their legs slightly elevated (the 'shock position'), and be watched until core rectal temperature has exceeded 35°C (see also appendix 2).
- 6.2** In more serious cases, where the survivor is not shivering and is semi-conscious, unconscious, or apparently dead, immediate first-aid measures will be necessary to preserve life while awaiting medical advice on more detailed management procedures. This advice should be sought as soon as possible and first-aid measures should not be delayed while advice is being sought. The recommended first-aid measures for such an immersion survivor are as follows:
- 1** On rescue, always check the survivor's breathing and carotid pulse for one minute each side of the neck.
  - 2** If the survivor is not breathing, make sure the airway is clear (remove dentures, if any), tilt the head back, lift the chin and start artificial respiration immediately (mouth-to-mouth or mouth-to-nose). If the heart appears to have stopped beating then cardiac compressions may be applied. However, you should be certain that there is no pulse at all (remember that hypothermia slows and weakens the pulse greatly) and, once started, it must be continued properly until the patient is either fully re-warmed or delivered to a hospital.
  - 3** If the survivor is breathing but unconscious, lay him in the unconscious position. This is necessary to ensure that the person's breathing is not obstructed by his tongue or by vomit.
  - 4** Avoid all manhandling which is not necessary to determine whether there are any serious injuries; do not even remove wet clothes; do not massage.
  - 5** Prevent further heat loss through evaporation and from exposure to the wind. Carefully wrap the patient in blankets and/or a casualty bag or large plastic bag and transfer immediately to a (wind-) sheltered area or below decks to a compartment at normal room temperature, keeping him horizontal, slightly head down.
  - 6** Advice on re-warming and decisions regarding further treatment should normally be given only by a doctor. If no medical advice is immediately available, continue to apply the essential life-saving procedures given in subparagraphs .1 to .5 above. In addition, even if the rescued person is cold and appears dead, or if he deteriorates and/or the pulse and breathing are lost, resuscitation attempts should not be ended before patient has been re-warmed. In a sheltered warm room the person's clothing can be cut and removed with a minimum of disturbance. Then wrap the person in blankets to reduce further heat loss. The best method of 'active' re-warming is the use of forced warm air (maximum 40°C), which has to be blown under the blankets covering the rescued person. Alternatively use heated blankets or sheets (about 40°C, but not hotter). Never use a hot bath or hot shower!
  - 7** 'Passive' methods of warming are not very effective. Do not attempt to warm the person by vigorous actions. Apply heating pads or hot water bottles under the blanket, to the person's head, neck, chest and groin - but never place these warm objects against the bare skin as cold skin is easily burned.
- 6.3** If the above-mentioned methods of warming are not available then apply body warmth by direct body-to-body contact with the rescued person. In addition, wrap a blanket around both the rescued person and the person or persons supplying the warmth. In all cases try to monitor the pulse and breathing.
- 6.4** The above basic guidelines on first aid treatment for the unconscious person could be illustrated diagrammatically.



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## START

(Recover in a more or less horizontal position whenever possible)

### IS PERSON BREATHING?

#### YES

1. Insulate to prevent further heat loss through evaporation and exposure to wind. Avoid unnecessary manhandling - leave wet clothes on and enclose in blankets and/or plastic bag. Move to sheltered location.
2. Lay down in the unconscious position whenever possible.
3. Oxygen should be given if available.
4. If water was inhaled, encourage deep breathing and coughing.
5. Request medical assistance.
6. Watch person closely until shivering starts. In the absence of medical advice re-warm the person by either the 'active' or 'passive' method described in paragraph 6.

#### NO

1. Clear airway, check carotid pulse.
2. Start artificial respiration immediately (mouth-to-mouth, mouth-to-nose). If a pulse cannot be detected, commence cardiac resuscitation.
3. Insulate to prevent further heat loss through exposure to wind. Avoid unnecessary manhandling - leave wet clothes on and enclose in blankets and/or plastic bag. Monitor pulse, breathing and consciousness of victim and actively re-warm if the person appears dead or if the person's condition deteriorates.
4. Seek medical advice. If medical advice is not available, continue resuscitation until the patient is either fully re-warmed\* or delivered to a hospital.

\* **Note:** In the context of hypothermia a person cannot be presumed dead until he is re-warmed and shows no bodily functions.

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A person with cardiac arrest caused by severe hypothermia has a very good chance of surviving if artificial respiration and cardiac resuscitation is carried out until re-warming is finished. Mouth-to-mouth ventilation over a long period of time is very difficult and exhausting. Doing conventional cardiac resuscitation is a hard physical activity. As soon as possible use medical aids to make resuscitation more bearable for the helper and more effective for the brain and the heart of the rescued person, who is lacking oxygen: use a ventilation bag, Guedel-airway, oxygen-delivery device, Combitube-airway (which enables the helper to do rescue breathing directly into a pipe positioned in or at the entrance of the trachea), etc. The chest and the muscles of a hypothermic person are stiff. The pumping effect of chest compression can be improved by using a handheld medical device equipped with a suction cup to actively lift the anterior chest during decompression. Instruction in advance is necessary to use these mechanical devices more effectively in basic life support.



## 7 Summing up

**7.1** We have briefly explained how your body responds to cold, what you can do to help ward off the harmful effects of cold and, finally, how to administer aid to an immersion survivor. We will now sum up the story with a number of important reminders. Follow them for your life may depend on them.

- 1. Plan your emergency moves in advance!** Ask yourself what you would do if an emergency arose. Where is your nearest exit to the deck for escape? Where is the nearest available immersion suit, lifejacket, lifeboat, or raft? How would you quickly get to your foul weather gear, insulated clothing, insulated gloves?
- 2. Know how your survival equipment works.** The time of the emergency is not the time to learn.
- 3.** Even in the tropics, before abandoning ship, **wear many layers of clothing** to offset the effects of cold. Wear an immersion suit if available.
- 4. Put on a lifejacket** as soon as possible in an emergency situation.
- 5.** When abandoning ship, **try to board the lifeboat or raft dry** without entering the water. Take anti-seasickness medicine as soon as possible.
- 6.** If immersion in water is necessary, **try to enter the water gradually.**
- 7.** Swimming increases body heat loss. **Swim only to a safe refuge nearby.**
- 8.** To reduce your body heat loss, **try to float in the water with your legs together, elbows to your side, and arms across your chest.**
- 9.** In a survival situation, you must **force yourself to have the will to survive.** This will make the difference between life and death.

**7.2** In conclusion, advance planning, preparation and thought on your part can be the most significant factors in your struggle with cold water immersion and in your survival. Familiarize yourself with the contents of this guide.\*

## Appendix 1: Checklist for Cold Water Survival

What can I do for surviving a longer stay in cold water, even for several hours?

### Preparation in advance:

- Hardy to cold.
- Fitness.
- Emergency rescue training.
- Knowledge of cold water survival.
- Have a plan!

### In a distress alert situation:

- Put on as many layers as possible, alternating thin/close-meshed and thick/wide-meshed! The outer layer should be as watertight as possible. Fasten, close and/or button-up clothing to prevent cold water flushing through the clothing.
- Cover head, neck and face.
- Wear robust, laced boots (better than Wellingtons)!
- Put an immersion suit over the warm clothing!
- Drink a lot (warm tea is best, no alcohol: that reduces chances of survival in cold water!)
- Take anti-seasickness tablets as soon as possible.
- Be sure that all your clothing, life jacket and lifebelt are secured correctly! In cold water you will lose full use of your fingers immediately. Check each other!

### Ship abandonment:

- Avoid entering the water for as long as possible!
- Automatic life vests should be manually activated before you enter the water and after you leave the interior of your ship.
- Enter the water as late as possible and as slowly (step by step) as possible to prevent cold shock!
- Do not jump into the water (danger of cold shock)!
- If falling into the water, keep your elbows to your sides and cover your nose and mouth with one hand, holding the wrist or elbow firmly with the other hand!
- Be prepared that the first contact with the cold water will stress your circulation, breathing and nervous system.
- Within a few minutes of minimum movement the "pain" of your skin will become more tolerable.



### **In the water:**

- Float on your back with a minimum of leg movement!
- Stay calm. Float as still as possible, legs together, elbows close to your side, and arms folded across the front of your lifejacket.
- Keep as much skin as possible out of the water!
- Huddling close to others will conserve body heat.
- Keep a positive attitude of mind. You will be the lucky one to be rescued! You can survive a long time in cold water, even in deep hypothermia, even when unconscious. Rescuers are searching for you! This positive attitude helps your body to keep its core temperature.
- Do not drink or inhale seawater!

## **Appendix 2: Checklist for Rescuers First Aid After Cold Water Immersion:**

- Do search long enough! Survival is possible, even after many hours in cold water. Ask MRCC for advice; whether to give up or not.
- Do not expect any kind of assistance from a person in need of rescue! A full and coordinated use of fingers and arms will be not possible. Lifting an arm for taking hold of a rope can induce the sinking and drowning of the victim.
- If circumstances allow, the rescued person should always be transferred in a horizontal body position including when being lifted from the water.
- A person with hypothermia should lie down and be kept still (immobile).
- Cover the person thoroughly with blankets or plastic sheets/bags against risk of further cooling down, including head, neck and as much face as possible!
- Remove wet clothing once the person is in a warm room (20-25°C). Use scissors to ensure minimum movement of the body!
- Prevent the person from standing up, unless the rectal temperature is more than 36°C.
- Give warm sweet drinks - no alcohol - no caffeine.
- Keep continuous watch over the victim.
- Ask for telemedical consultation.
- Give oxygen, if available.

### **Person is unconscious:**

- Put into the recovery position. Observe breathing and pulse!
- Observe for vomiting and be prepared to clear airway.
- Be prepared for a sudden cardiac and breathing arrest.
- Give Cardiopulmonary Resuscitation (CPR) only if you do not feel any pulse or breathing for more than two minutes. Remember that in hypothermia blood pressure is very low. Pulse and breathing are very slow. Any mechanical irritation of the body in that stage can cause cardiac arrest.

### **Person is not breathing and has no pulse for more than two minutes:**

- If you are not sure that the person has been in cardiac arrest for more than one hour and if there are no signs of irreversible death (injuries, decomposition), a successful resuscitation could be possible.
- Bring oxygen to the brain! Immediately start with rhythmic cardiac compression. If available use a chest suction device for more efficiency.
- Blow air into the lungs. Use an artificial airway device, if available (e.g. combitube), otherwise ventilation bag/mask or mouth-to-mouth.
- Follow the guidelines you have learned in your CPR training. Do not stop until you get medical advice to do so.

### **What you need to be prepared:**

- You attend training in the theory of hypothermia/drowning, First aid and CPR and update this regularly to include the latest operation procedures!
- You know the procedures and the equipment on board for rescuing a person from the water!