

WHAT IS 'COLD WATER'?

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EXECUTIVE SUMMARY

1. Cold water (below 68°F) predominates in North American oceans, lakes and rivers. Merchant vessels sailing these cold waters need to provide adequate protection for their crews in case of accidental immersion. The selection of a critical water temperature for carriage of personal protective equipment requires a consideration of the science of hypothermia, as well as the economic costs of such equipment.
2. The facts about the dangers of immersion in cold water are as follows:
 - (a) There are four clear stages of immersion in which death can occur. These are:
 1. Cold shock (kills within 3-5 minutes after immersion).
 2. Swimming failure (kills within 30 minutes after immersion).
 3. Hypothermia (kills after 30 minutes of immersion).
 4. Post rescue collapse (kills at the point of rescue or up to several hours afterward).
 - (b) The cause of death associated with each stage respectively is:
 1. Drowning, heart (circulatory) and respiratory problems.
 2. Impaired physical performance leading to inability to self-help, swimming failure and drowning.
 3. Deep body cooling leading to hypothermia and drowning.
 4. Collapse of arterial blood pressure leading to cardiac arrest.
3. Up until 5-8 years ago, the problems associated with stages 1-2 and 4 have largely been considered of academic interest only. Stages 1, 2 and 4 can have a profound influence on survival probability as the water temperature falls and the sea state worsens. With regard to the condition of hypothermia, for a normally clothed "typical passenger" this is accelerated if whole body exercise is performed in the water (i.e. swimming).

4. Historically, there has been a preoccupation with hypothermia. This has been reflected in the predictive survival curves based on the time to reach hypothermia. Thus, excellent teaching and training programs, standards and equipment have been developed aimed at reducing this specific threat. However, it is now considered that the early responses to immersion (stages 1 and 2) probably account for the majority of open water immersion deaths. What has been overlooked is the significance of the first two stages - cold shock and swimming failure as a cause of death.
5. Survival prediction curves are of limited value only. This is because they do not take into account that death may occur from cold shock, swimming failure and drowning during early hypothermia. The curves should be revised to include these factors.
6. The initial responses (stage 1) peak in water between 50-60°F, but still occurs in warmer water (e.g. <75 °F). Swimming failure (stage 2) occurs much sooner in cold water than in warm water, even in proficient swimmers. As a consequence, humans tend to grossly over-estimate their swimming capability in cold water. This is a little known, but central factor in the cause of death.
7. From all the combined research on cold water accidents and scientific research, it has become clear that sudden immersion in cold water, (below 68°F) is very dangerous. It should be avoided if at all possible. Furthermore, a conscious decision to swim (and rescue oneself) or stay floating still in the water should not be taken lightly without assessing the pros and cons. It has now been shown that a person's swimming ability in warm water bears no relationship to that in cold water.
8. These scientific findings lead to practical advice regarding the regulations requiring the carriage of liferafts and survival suits and training of operators of passenger carrying vessels.
 - (a) Wherever possible entry into water below 68°F should be avoided. Direct entry into a life raft should be the objective.
 - (b) The Coast Guard should use this philosophy in the design, development and implementation of all regulations and/or new legislation. All vessels operating on all waters less than 68°F (oceans, lakes and rivers in North America) should carry liferafts that can be easily launched and boarded by the entire crew. Immersion suits should also be carried on all vessels operating in cold water.
 - (c) The only exception to this should be where it is physically or practically impossible to stow a liferaft or immersion suit. Under such conditions the passengers must wear appropriate lifejackets when on board.
 - (d) Closeness to the shore or the carriage of EPIRB are not a reason for waiving this requirement because death from cold shock will occur within 3-5 minutes, and

swimming failure in under 30 minutes. EPIRB alerts average between 90 minutes and 2 hours.

- (e) Emergency medical training curricula should be amended to include the concepts of cold shock, swimming failure, hypothermia and post-rescue collapse.
- (f) Even though there are well established teaching programs, regulations and much improved life saving equipment, there are still far too many open water deaths each year. What has been overlooked is the significance of the first two stages - cold shock and swimming failure as a cause of death.

Modified from *Survival in Cold Water*, by Dr. C.J. Brooks, Survival Systems Limited, Dartmouth, Nova Scotia