SURVIVAL SUIT MYTHS

The Performance of "Approved" Marine Immersion Suits may not be what You Expect

by Darren Williams, BSc. LLb.

This month's *Legal Desk* debunks two myths commonly held by commercial fishermen regarding the effectiveness of their survival suits. A critical review of Transport Canada's study, *Survival in Cold Waters: Staying Alive*, and the current regulatory standard for the development, testing and performance of these suits reveals points of concern and room for improvement. Changes to these standards may be in progress, but will the wheels of bureaucracy turn quickly enough to avert future loss of life?

Myth #1 – Donning a Survival Suit Wet

It is a myth that donning a wet survival suit at sea will provide an adequate degree of protection to ensure survival. In realistic conditions, the chance that a fisherman, donning a survival suit wet, will perish before being rescued is 50% or more. "Realistic conditions" in this case might include a moderately fit individual, 10 degree Celcius water, a 4 foot chop, 20 knot wind, and rescue at 3 to 6 hours from immersion.

Before becoming a lawyer I worked on draggers, deep-sea trawlers for 14 seasons. I used to think it was possible to survive an accident after donning a survival suit in the water. I saw some mates practice it at the dock, they seemed fine. Since then I have learned much, and in retrospect, this was like watching someone rehearse for their funeral.

In a study commissioned by Transport Canada and published in early 2003 entitled, *Survival in Cold Waters: Staying Alive,* the authors reviewed over 100 studies and reported on the effects of cold water immersion and the effectiveness of survival suit systems. In a conclusion that would surprise many fishermen, Transport Canada found that introducing as little as ½ litre of water into the survival suit will reduce the insulation value of the suit by 30 percent.

While this figure may not be important to fishermen who find themselves rescued within a short time of entering the water, current restraints on coastal rescue resources, and the trend for fisheries to be conducted in more remote areas (and perhaps in worse weather), means that we cannot, and should not, count on being plucked from the water within a reasonable period of time. Water conducts heat 25 times more effectively that air – keeping it away from our skin is critical. Staying dry in a survival suit is the key to staying alive.

The *Survival in Cold Waters* study made another important finding, and that is: a wave height of one metre will reduce the insular effect of a survival suit by 15 percent. It is unclear what the relationship between wave height and

insular effect is when the wave height is greater than one metre. It is noteworthy, however, that one study reviewed by Transport Canada found that survival suit insulation was reduced by 80 percent (tested on a manikin) in a wave height of 60cm (about two feet). In light of this study, it is not apparent that Transport Canada is adopting a precautionary approach to estimating the potential effects of wave action on the effectiveness of survival suits.

Assume, for example, you are forced to abandon your vessel in moderate weather in Queen Charlotte Sound. Not a remote area, but rescue could conservatively be two hours away, assuming they can find you. Winds are gusting 35 knots, a five-foot chop, blowing rain. Donning your immersion suit in the slanting deck behind the wheelhouse you are wetted by wave and spray. Getting into the water you're not soaked, but wet all the same. The net effect is that insular value of your suit, which is intended to protect you for approximately six hours, may now have been reduced by as much as 45 percent, perhaps more. This leaves little, if any, margin for survival.

Myth #2 – A Universal Size Suit is "Universal"

The second myth I wish to debunk is that all fishermen can rely on a "universal" size survival suit to protect them from the effects of cold water.

It is the *Canada Shipping Act*, and the *B.C. Occupational Health and Safety Regulations* that require a vessel to carry an "approved" immersion suit for each member of the vessel's complement. The regulatory standard for the development, testing and performance of survival suits typically relied on (*Canadian General Standards Board, Standard CAN/CGSB-65.16-M89*) was developed in the 1980s. Although republished in 1999, the Standard changed little, despite advances in technology.

The Standard maintains that adult survival suits will be manufactured in small, universal, jumbo and custom sizes. The Standard sets out that "small" is meant for persons up to 330 pounds, "universal" is for 110 to 330 pounds, and "jumbo" is for 110 pounds or greater. The "universal" size is most commonly found on vessels. In the fishing industry this is likely because crew members, who come in all shapes and sizes, may move from vessel to vessel and not own their own suit. Hence, the vessel must accommodate these crew fluctuations by providing a suit that, allegedly, fits all persons who might come aboard. The alternatives are either custom suits for anyone who might step aboard, or providing a suit of every size for each potential crew member (for a four man crew, that would mean carrying 12 suits). Neither alternative is terribly realistic.

So what of the Standard for "universal" size survival suits like the one that is probably in your foc'sle? The problem relates back to myth #1 and the importance of keeping water out of the suit, particularly the watertight integrity of the neck and wrist seals. Transport Canada's *Survival in Cold Waters* found that continuous latex rubber seals (as opposed to the more common neoprene seals) are the best way to ensure a watertight seal around the neck and wrists. Despite this, the current Standard sets no requirements for the use of latex rubber seals

instead of neoprene. This may be in part because advances in the availability, durability, or costs of this latex rubber did not arise until after the Standard was developed in the 1980s. However, the Standard was not amended in 1999 to account for the use of the best available technology.

A simple way to demonstrate this issue is to drag out your survival suit, dust it off, and have your 225 friend try it on. Probably fits well. Then have your 150 pound in-breaker try it on. Or your wife, daughter or son. If the seals are neoprene, you will likely find that persons with an average or smaller wrist or neck diameter cannot maintain a consistent seal. Sealing of the wrists may be helped by putting the gloves on, but it is prudent that they seal regardless. In many cases bodies are recovered in survival suits with the gloves off. Moreover, many survival suits have an integrated neoprene hood which seals around the face, but provides no seal around the neck. Flexing the face, having facial hair (a common condition of fishermen), pulling at the restrictive hood, or taking a wave directly into the face will compromise the seal and allow water into the suit. This danger increases as the weather gets worse and wearers often have their heads under a passing wave. Again, as little as two cups of water can reduce the insular effect of the suit by 30 percent.

Ideally, the solution would be to have custom suits for all wearers. This would avoid reliance on a “universal” suit size. However, in an industry where fishermen move from vessel to vessel, few have their own suits, and the vessel must provide the suit, custom suits may not be possible without shifting the responsibility for the suit from vessels to crew and providing subsidies for career fishermen.

All seamen, but particularly career fishermen, are well advised in my opinion not to rely on a “universal” size suit unless they have once personally and vigorously tested the suit’s leakage, and once satisfied you remain dry (remember, two cups can kill) then stow it, maintain it not less than twice per year and whenever the suit is moved from its inspected place on the vessel (movement increases the risk the suit may be damaged before it is needed).

Changing the Standards to Reflect Reality

Transport Canada’s *Survival in Cold Waters* concluded that the current regulations regarding ship abandonment suits (survival suits) “require modifications”. The regulations referred to are those that require an approved immersion suit; “approved” being an endorsement by the Board of Steamship Inspection and the Workers Compensation Board as meeting the Standard referred to above.

A primary purpose of the Standard is to set requirements for the testing of prototype suits. Ironically, the authors of *Survival in Cold Waters* recommend that “testing [of prototype suits] should be as realistic as possible to avoid disappointment with the function of the final product in the survival situation”. I say, nothing like death to make for a “disappointment”.

What is the current Standard's definition of reality in testing then? Although a full critique is beyond the scope of this article and the author's expertise, here is a good example of where the Standard is inadequate.

Each prototype suit is tested for water ingress. The water ingress of the suit is tested in a two-part procedure. First, a subject wearing the prototype suit is made to jump from a height of 10 feet into a pool and remain still in the water for one minute ("jump test"). The subject is then weighed to determine how much water entered the suit. Secondly, three subjects are made to swim on their backs for one kilometer in a pool ("swim test"). The subjects are then weighed to determine water ingress, and the average (multiplied by a factor of three) is added to the jump test result to provide a total ingress result. The Standard states "a minimum of three subjects shall participate in the [swim] test together in order to achieve adequate wave motion in the pool". Don't laugh! That's what is says.

There is no expectation in the Standard that the suit should be watertight, only waterproof. The Standard does not set any limit for how much water ingress is too much. It only provides that the amount of water from the ingress test is added to the suit before the suit is tested for thermal protection. In the thermal protection test a subject must wear the suit in two degree (Celsius) water for up to six hours, "unless [the test] is terminated sooner". The Standard sets no expectation of how long a suit is to protect a subject in order for it to be "approved", only that the test ends at six hours or sooner.

The Standard's water ingress swim test only requires that there be 10 subjects having a height in the range between the 5th and 95th percentile of the population – it does not require that any of the 3 subjects who suits are actually tested for leaks come from the lower percentiles (average wrist size or smaller). I suggest that the results of the ingress test may not realistically reflect the water entering the suit worn by someone who does not have larger than average wrists. Moreover, does a wave height created by three people back-stroking in a pool realistically reflect the effects that wave height at sea would have on water making its way into the suit? Is having a Standard that does not set a limit for how much water ingress is too much, prudent?

The current standards for the testing and performance of survival suits are not acceptable as they do not reflect the reality of the situation for which they are intended. What makes matters worse is that because these suits are "approved" by the government, crew members expect that properly maintained and inspected suits are effective for the purposes intended. Do not rely on this "approval", it could be fatal. Test your suit vigorously to ensure it will be watertight in realistic condition (two cups can kill), store it safely, maintain it regularly and pray to God you never have to use it.

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