2 PERSONAL SAFETY

Overview

All SAR personnel are individually responsible for personal safety — for their own, and for that of their team members.

'Safety first' must be the adopted culture to minimise the risk of personal injury.

Coastguard's regular contact with the public and its public education courses mean that it is vital that SAR personnel maintain, and be seen to maintain a high standard of safety. This will ensure that this safety image is seen as the norm, and will ultimately enhance general public safety standards.

Physical Considerations

Before SAR Operations

Personal safety starts well before you get anywhere near a CRV, CAP or Operations room. Alcohol, bad health, use of some medications, and lack of sleep, will all impair judgment. Anything affecting the physical or mental abilities of a person on land will only be increased in the harsher marine environment.

A crew member has a responsibility to remain in a physical and mental state appropriate for the period of duty.

Any personal physical conditions that may affect your health or performance must be declared at the start of duty, to the person in command.

Some forms of medication contain ingredients that suppress normal reactions, and display symptoms similar to the effects of alcohol. Many are of a sedative nature and cause tiredness.

During SAR Operations

Prolonged exposure to cold and the stresses of poor weather conditions will cause a decline in crew capabilities. The nature of a SAR incident should not be underestimated, and may adversely affect the emotional state of those involved.

Without being aware of it, crew member's awareness, judgement, and reaction times will deteriorate during long cold duties. Exposure to rough conditions, minimal physical movement, increased wind-chill, fatigue, hunger, and seasickness can all strongly influence the ability of an otherwise healthy and competent crew.

All of these effects are generally increased at night.

Effects of Heat

Prolonged work in a hot environment can lead to dehydration, heat exhaustion and even heatstroke. This can be prevented by regular intake of water and wearing appropriate clothing.

New Zealand has one of the highest rates of skin cancer per person in the world. The potentially damaging effects of the sun are increased if skin is also exposed to the wind, which dries the skin's natural oils. Waterproof sun block should be applied liberally to exposed skin even in overcast conditions. The reflection of sunlight from the water increases the risk of sunburn at sea.

Effects of Cold

Mental and physical capabilities are adversely affected by the cold. Even if your body temperature remains normal, efficiency may drop as cold affects the extremities.

Wind-chill factor is a measurement of the effect of wind on exposed parts of the body. The table below gives the air temperature adjusted for wind speed.

Actual Temp ℃	10	5	-0	-5
Wind speed				
10 Kts	7.5	1.3	-5.0	-11.3
15 Kts	6.5	0.0	-6.2	-12.7
20 Kts	6.0	-0.5	-7.2	-13.8
25 Kts	5.5	-1.0	-8.0	-14.7
30 Kts	5.0	-1.6	-8.5	-15.4
	Equivalent Temp ℃			

As can be seen from the table above, increased wind speed can have a marked effect on temperature. Overnight temperatures below freezing are not uncommon in New Zealand, so you must be equipped with suitable clothing.

Exposure to cold will lead to a loss of sensation in your hands, and the inability to carry out otherwise simple tasks. Concentration and vision are also affected by cold. Night vision takes longer to acquire in cold temperatures. Mental responses sharpen in the early stages of cold exposure but decline with the onset of hypothermia.

Hypothermia is when your body core temperature begins to fall below its normal 36.5° – 37.5° C.

Being wet will dramatically increase the risk of hypothermia – ***water will conduct heat away from the skin approx 25 times faster than air.***

Recognition of Hypothermia

The physical and mental deterioration associated with hypothermia can be slow and not always easy to recognise. Progressive symptoms include:

Mild Hypothermia (approx 33 - 35°C)

- Quietness.
- Shivering.
- Numbness.
- Clumsiness.
- Physical weakness.
- Irritableness (Denial of any problem).

Moderate Hypothermia (approx 30 - 33°C)

- Slurred speech.
- Shivering stops (at approx 32 °).
- Muscle stiffness.
- Disturbed vision.

Severe Hypothermia (approx 25 - 30°C)

- Collapse.
- Dilated pupils.
- Unconsciousness.

Shivering commences early, but the sudden cessation of shivering is an important sign of moderate to severe hypothermia, and the victim is unlikely to accept the fact that anything is wrong at this stage. Correct treatment should be commenced at the first sign. Death can result if correct treatment is not initiated promptly. Treatment for hypothermia is essentially not allowing the patient to get any colder, and to re warm them slowly. (Refer approved First Aid course)

Motion Sickness

This is a disorder that afflicts people to varying degrees. It can be experienced afloat or flying, and it occurs because of excessive stimulation of a pair of minute organs located within the inner ears. Changes in body position are normally recorded in this area and transmitted to the brain.

It is a highly unpleasant affliction, and motion sickness can have severe physical and emotional effects on the sufferer, who quickly becomes a liability to both themselves and others.

Motion sickness can be minimised by;

- Riding on the centre line and towards the stern of a vessel (the area of least motion).
- Being in a place where there is a flow of fresh air.
- Keeping occupied.
- Being able to see the horizon.

A number of drugs and other preventative measures can be effective in preventing motion sickness when taken before the experience, although drowsiness may be a side effect of some medication.

To combat motion sickness and its effects, try to:

- Commence duty in good physical and mental condition.
- Wear suitable personal clothing.
- Consume drinks and snacks regularly.
- Take regular short breaks from ‘watch’ and exercise the body.

Personal Clothing and Equipment

Every crew member must be appropriately equipped for their designated role whilst on duty. Some items are mandatory and others recommended.

Clothing

All clothing traps a thin layer of air, which is a good insulator. Several layers of thin clothing are more effective than one thick layer, as each layer of clothing traps a separate layer of air. This also allows you to add or remove some layers if required. When clothing becomes wet these layers of insulating air are replaced by water which conducts heat away from the body.

In high wind-chill conditions, more clothing is required to maintain body temperature, but excessive clothing can have an adverse effect. Being too warm can lead to drowsiness and seasickness. Bulky clothing can also be very physically restrictive.

The type of clothing material is a personal preference, but some points should be considered.

- Wool versus polypropylene — both give equivalent warmth, but polypropylene is lighter and more easily dried. It is however more flammable than wool.
- Heavy cotton or denim should be avoided as it becomes very restrictive when wet, and offers little heat retention.
- A large percentage of body heat is lost from the neck and head (approx 30% from the head alone) so a warm scarf and hat are essential items.
- Footwear is a necessity on a CRV. Bare feet expose a crew member to all manner of injuries when working on a vessel. A pair of good quality sea boots is ideal; otherwise a pair of boat shoes or trainers will protect your feet. Jandals should never be worn on a CRV.
- A wind / waterproof outer layer is essential to prevent heat loss from the wind and or spray / rain.

Personal Flotation Devices (PFD's)

'PFD' is a generic term to describe various types of buoyancy garments ranging from a lifejacket to a wetsuit. A life jacket is designed to keep an unconscious wearer floating in an upright (face up) position with their head supported and clear of the water. Any other type of PFD that is not specifically designed to do just that, is a buoyancy aid not a lifejacket.

Lifejackets

There are two main types of marine lifejacket, fixed flotation & inflatable.

Fixed Flotation

These have permanent solid flotation, are simple, robust and require little maintenance. They are, however bulky and generally unsuitable as a working lifejacket.

Gas Inflatable

Although not as robust (as there is the risk of puncture), and requiring a little more care and maintenance, this type of lifejacket is compact and does not restrict a wearer's movement. All inflatable lifejackets can be inflated orally, but there are three quite different methods of gas inflation.

- Manual gas-inflatable lifejackets — a toggle needs to be pulled to puncture a Co2 cylinder and hence inflate the lifejacket.
- Automatic inflatable lifejackets — In addition to being able to inflate manually by the toggle, an auto inflate lifejacket will deploy in contact with the water. A water soluble pill or collar dissolves allowing the lifejacket to inflate automatically. This type of lifejacket can be prone to accidental inflation by spray, or if stored in damp conditions.
- Hydrostatic inflatable — Can be inflated using the pull toggle, but unlike the auto inflate it will deploy automatically only at a given depth due to water pressure. This type will not accidentally inflate due to waves / spray or being stored wet.

When wearing inflatable lifejackets care must be taken to guard against accidental activation, but If the pull-toggle is stowed inside the jacket it must be easily accessible.

Every lifejacket should have retro-reflective tape and a whistle attached. Lifejackets may be fitted with a light (either strobe or fixed).

Additional fittings may include webbing straps for lifting and crotch or thigh straps. When tightened they pull the inflated lifejacket down, thus pulling the wearer up. This can raise the wearers face another 50 – 70 mm from the water. This may not sound like much – but it makes a lot of difference when you're in the water.

Some lifejackets are fitted with spray hoods which will protect the wearer from spray inhalation in rough weather. The natural tendency is for persons in the water wearing a life jacket to end up facing the wind and waves.

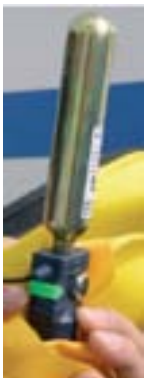
Never wear anything over the top of an inflatable lifejacket. When the jacket inflates inside a layer of clothing it will compress the chest and restrict breathing.

- As with other emergency equipment you must be thoroughly familiar with your lifejacket – how to inflate (orally and manually), deflate and operate any equipment on the jacket such as strobe lights, crotch straps etc.

Being thoroughly familiar with emergency equipment means being able to operate the equipment with your eyes shut. Trying to read the instructions on how to activate the light on your lifejacket once you are in the water, in the dark, in driving rain and 3m seas is unlikely to be successful.

Inflatable lifejackets should be regularly inspected to check that;

- Co2 cylinder is not corroded or pitted (opposite).
- Co2 cylinder is firmly screwed in (if loose by 1 or 2 threads the firing pin may not be able to puncture the cylinder).
- The indicator tag on the firing mechanism (usually red or green) is still in place (opposite below).



- The webbing is in good condition.
- That lights if fitted are working.
- The lifejacket still retains air and has no punctures or leaks – the jacket should be checked periodically by fully inflating, and being left for a few hours(its preferable to inflate using a pump if possible to avoid the build up of moisture within the bladder).

All CRV lifejackets are also subject to periodic inspection / maintenance by approved service agents. These inspections are part of the Units Standard Operating Procedures (SOPs) and Safe Ship Management. (See Module Legal Considerations)

Other Flotation Devices

Buoyancy Vests

A buoyancy vest is a device that will help a conscious person to float. The buoyancy provided is much less than that of a lifejacket, and will not turn an unconscious person face up in the water. They are suitable for water sports such a waterskiing.

Fixed Floatation Suits

These are suits either one or two piece suits that have floatation throughout. They not only provide floatation but have a high degree of insulation. Floatation suits are not generally designed to be lifejackets, and should not be seen as a replacement for one. The suits do not concentrate the floatation in one area to help turn a person face up. As a consequence a person can float just as easily face down.

The added floatation in the suit also means that it takes a far larger lifejacket to turn the wearer face up. The typical buoyancy of most 'offshore' inflatable lifejackets is 150 Newton's (15kg of buoyancy). Many floatation suits need lifejackets of 250 – 275 Newton's to turn a person face up in the water.

The area you operate in, vessel type, prevailing weather and sea conditions, will dictate the type of PFD you wear. This will be detailed in the Unit SOPs.

As a minimum requirement, it is mandatory for all Skippers and crew, when underway in a CRV, to wear approved PFDs at all times.

Personal Equipment

Personal Grab Bag

A ready access bag should be kept by all CRV crew at home, in the car, or at the Unit base / boat shed. This bag should contain personal items and its contents could include:

- Change of dry clothes.
- Wet weather gear.
- Hat, gloves & scarf.
- Towel.
- Knife.
- Water bottle.
- Sun glasses.
- Sun block.
- Snack food.
- Waterproof torch.

A multi tool knife is useful, but a robust blade in a sheath is more suitable for emergency use.

Vessels Grab Bag

Emergency / survival items may be stowed in a 'grab bag' on board. A grab bag is designed to float, and can include emergency equipment that would be taken in the event of having to abandon the vessel. Certain equipment may be added to a grab bag as part of the vessels abandon ship procedures. Given that Coastguard generally operate close to shore, the primary equipment to be carried in any grab bag will be signalling equipment.
Its contents could include but not be limited to;

- Hand held VHF Radio.
- Hand held GPS.
- EPIRB.
- Distress flares.
- Waterproof Torch.
- Cylume (chemical light) sticks.
- Length of line or lanyards (to secure crew to each other).

The contents of the grab bag should also be secured in some way. It would be unfortunate to open the grab bag in the water, and then have your emergency equipment float away in the dark.

The storage and accessibility of emergency items on board is very important. There are no hard-and-fast rules regarding location or distribution of emergency / survival gear on a vessel.

All Coastguard crews should regularly practice emergency and abandon ship procedures. As with all emergency drills / training (fire, man overboard etc) they should be documented in the CRV log. (See Module Legal Considerations)

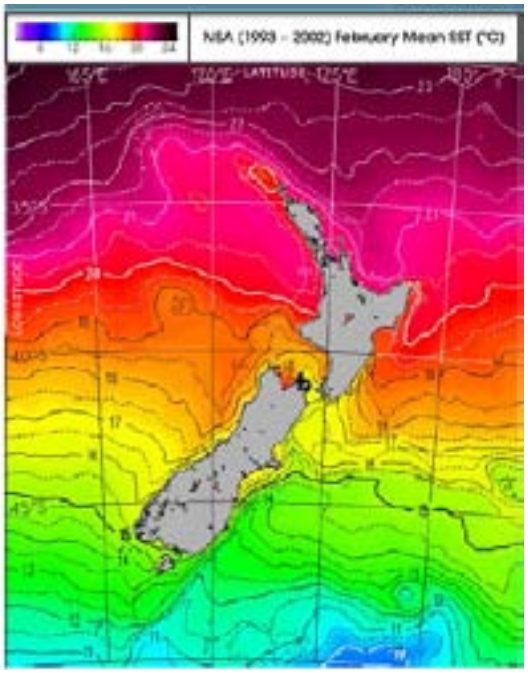
Remember - for or your own safety, and that of other crew members, know where all emergency equipment is stored and how to use it. CRV crew should know how to find and operate emergency equipment such as flares and EPIRB with their eyes shut.

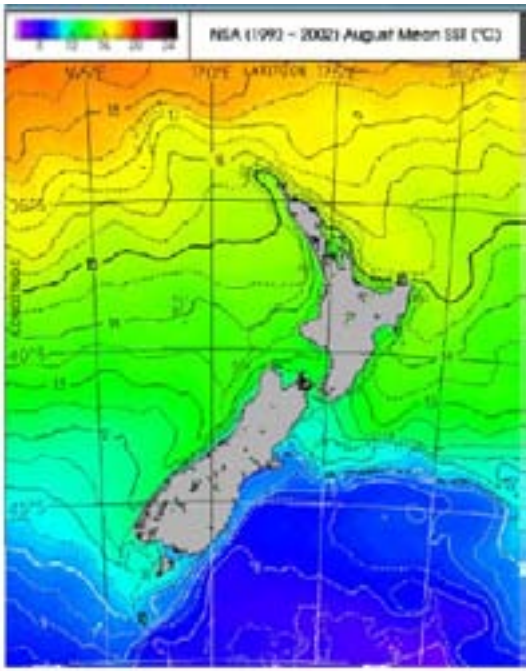
Sea Survival

Cold Water Immersion – the 4 stages

To understand the reasoning behind sea survival techniques, and the risks involved in a survival situation you must appreciate the 4 stages of cold water immersion.

'Cold water' for the purposes of this section is water below approx 25°C. The colder the water is, the more rapid and severe the reaction to immersion. The risks inherent in the first stage of cold water immersion are present in water below 20 - 25°C, and particularly significant in water of 15°C or less.





As can be seen on the example sea temperature charts (above) for the New Zealand coast, 15°C or less is not uncommon, and inland waterways & lakes can often be considerably colder.

The times in the table opposite are approximations, and actual times will depend on many factors including a persons clothing, physical fitness, body mass etc

Water	Exhaustion / Unconscious	Survival Time
21–27° C	3–12 hours	3 hours – indefinitely
16–21° C	2–7 hours	2–40 hours
10–16° C	1–2 hours	1–6 hours
4–10° C	30–60 minutes	1–3 hours
0–4° C	15–30 minutes	30–90 minutes

Stage 1 Cold Water Shock (first 3 – 5 mins)

On initial immersion in water below approx 20 – 25 °C the body's reaction is to make a large involuntary gasp, followed by an increase in heart beat and breathing by up to 4 times the normal rate. The colder the water is, the more severe the reaction.

- The initial gasp and rise in breathing rate greatly increases the risk of water inhalation, and makes holding your breath underwater for more than just a few seconds almost impossible.
- The huge increase in breathing rate (hyperventilation) can cause dizziness or fainting.
- The huge increase in heart rate and blood pressure can result in cardiac arrest. This can occur with even young healthy persons, and is a significant risk in older or unfit persons, and those with existing cardiac problems.

Unless a person regularly swims in 'cold' water and has effectively trained the body to suppress cold water shock, this reaction will occur regardless of a persons size, shape, or body mass. To counteract cold water shock you must try to remain calm and control your breathing – it will pass.

Stage 2 Swimming Failure (5 – 30 mins)

The effect of short term immersion in cold water is the cooling of the body's surface & extremities, this cooling of the muscles and nerves leads to;

- Loss of coordination.
- Loss of physical strength.

This combination can lead to drowning even in very strong swimmers, and simple physical tasks such as operating flares or a hand held radio will become increasingly difficult.

Stage 3 Hypothermia (30mins plus)

Hypothermia (the lowering of the body's core temperature) only starts to occur after around 30mins or more. As the core temperature falls, so does the heart rate and blood pressure. In this stage death can occur due the continuing effects of stage 2, and to;

- Loss of consciousness (and subsequent drowning).
- Cardiac arrest (due to loss of blood pressure).

In water of 15°C death will occur in 50% of lightly clothed persons in 6 hrs or less.

The first 2 stages of cold water immersion account for over 50% of immersion deaths. Post (after) or Circum (around / during) Rescue Collapse accounts for up to a further 20% of immersion deaths.

Stage 4 Post / Circum Rescue Collapse

While immersed, water pressure helps to reduce blood flow to the extremities. When the casualty is taken from the water this pressure is removed, and blood from the core flows to the skin surface and extremities. This leads to a loss of blood pressure and can result in loss of consciousness / cardiac arrest. If this is coupled with the effect of gravity draining blood from the body's core to the legs, as in a prolonged vertical lift, the risk is even greater. (See Module Victim Recovery)

Any physical exertion will also increase the risk of loss of consciousness / cardiac arrest as blood circulation in the core is diverted to the exterior muscles.

Basic rules of Sea Survival

If you do end up in the water there are a few basic but essential rules to follow.

Primarily - Conserve heat and energy

If you have the opportunity (or there is a very good reason not to) – enter the water with your lifejacket already inflated. Try to stay calm and control your breathing. Do not attempt to swim. Only swim for the shore if it is within very easy reach. If you do have to swim use your legs only as you will tire and loose body heat quicker if the upper body and arms are used.

Any exertion will result in loss of body heat as energy is being expended in activity rather than maintaining warmth. Movement also displaces water that has been trapped between layers of clothing (and has been heated slightly by the body) and replaces it with cooler water from the surrounding sea.

If you can get out of (or partially out of) the water onto a floating object for example, then do so. Remember water will conduct heat from the body approx 25 times faster than air.

You will live a lot longer if you can keep still!

HELP (Heat Escape Lessing Posture)

- Keep head out of the water.
- Arms crossed in front of chest.
- Lower legs crossed.
- Knees together and raised as high as possible.

If there is a group in the water it is vital to stay together – the larger the target you make the easier it is to be found. A group will help maintain morale and can provide shared warmth (minimal effect – but it all helps). A method of securing everyone together (such as lanyards with spring clips) should be employed.

Huddle

- Arms hugging each other.
- Maximum body contact.
- Legs intertwined.

If you have to swim in a group, a recommended method is to form a 'crocodile' – a chain swimming on your back, using legs only if possible.

Remember the basic rules for sea survival;

- **Keep calm.**
- **Keep out of the water.**
- **Keep together.**
- **Keep still.**

Safety on Board

Safety on board is not only the responsibility of the Skipper but of each and every crew member. Safety must be planned and maintained — it does not just happen. Every member of a Coastguard unit has a collective and individual responsibility to;

'Take all practical steps to identify, minimise, isolate or eliminate the inherent hazards in any SAR operation'. (See Module Legal Considerations)

Common Types & Areas of Risk

- The most common type if injuries sustained in Coastguard crews are impact injuries, incurred by falling over or being thrown against parts of the vessel. CRV's often operate at high speed and in rough conditions.
- It is essential that crew try to maintain as secure a position as they can (preferably with three points of contact at all times) when underway.
- Because of the motion, uneven and often wet surfaces on a boat, thought must be given to body stance when performing even a basic task. Kneeling down rather than trying to remain standing may often minimise the risk of injury.

Any significant changes in course or speed should be communicated to all crew prior to the event. The helmsman should ensure that any alterations of course and speed should be done as smoothly and gradually as is practical.

All objects / equipment on the CRV should be secure. In rough conditions any unsecured object can turn into a missile.

- Another common cause of injury is during 'rope work' – using lines when towing or coming alongside. Comprehensive practical training and good communication on board the CRV are essential to avoid injury.
- Recovering objects or persons from the water can risk falling overboard. Tethers or safety harnesses can provide extra support, and security to CRV crew engaged in the task.
- Crush injuries can occur when vessels come alongside, particularly at sea. 'Knee-jerk' reactions often cause crew members to attempt to fend off other vessels, underestimating the forces involved. If required to board another vessel at sea, extreme care must be taken.
- Working around any moving machinery or engine parts is dangerous in all conditions, particularly with loose clothing. All moving mechanical parts should be avoided.
- Fuel, especially petrol, gives off vapour, particularly when agitated. Care must be taken to remove this vapour, for example by venting engine spaces, before starting engines.
- Batteries while being charged (and for a short time after charging) give off hydrogen gas which is extremely flammable. Care must be taken to prevent any source of ignition around charging batteries.

Safety is Paramount

The role of Coastguard SAR personnel is preservation of life. This must be our own lives first. If we are injured or incapacitated then we have greatly reduced the effectiveness of the rest of the team and possibly jeopardised the operation itself.

Ongoing hazard identification and risk assessment must be made whenever participating in a SAROP or in regular training, to ensure the safety of vessel and crew.