
Why Divers Die

Failure to control buoyancy can be fatal

Current American reporting on diver errors leading to fatalities falls short of what we divers need to know to dive more safely. Although John McAniff, of the University of Rhode Island Underwater Research Institute, made an effort to get at diver error, he no longer has government funding. DAN is the only other source of such information; as you would expect, it emphasizes the medical elements of fatalities.

If we turn to the U.K., Australia, and New Zealand, however, we can often find useful analyses. In a recently published New Zealand study of 1,000 diving incidents, 154 involved buoyancy jacket use, misuse, and malfunction. Nearly one-third (48) led to serious injury, including 17 DCS cases, 12 embolisms, and 10 pulmonary barotraumas.

Because so many errors occurred among experienced divers, we have decided to provide a synopsis of the study to help divers understand what can go wrong. The original report, prepared by Dr. Criss Acott of the Hyperbaric Medicine unit at the Royal Adelaide Hospital in Australia, appeared in the South Pacific Underwater Medicine Society Journal.

Power inflation mechanisms can change a diver's buoyancy and depth very rapidly. Consequently, it's not surprising that BC problems are a cause of both injury

and death. In fact, in one study of 100 Australian and New Zealand diver deaths, overinflation or the failure of the inflation mechanism were major contributors.

Diver Error or Design?

inflaters. In a study done by Bob Halstead on the live-aboard *Telita*, 28 percent of 265 divers who filled out his questionnaire reported having experienced BC failure through leakage or continuous inflation. Of course, we hope that we would have the presence of mind simply to disconnect the inflator hose from the power inflator.

Better yet, service the inflator when you service your regulator, always rinse it in fresh water after a dive, and make sure it works during your pre-dive check. I called three dive stores; all reported numerous BC failures and suggested annual service.

What the study doesn't address at all is the design of the equipment. I've always thought that BC inflator design could use an overhaul. In 1989 we gave our annual tongue-in-cheek Urchin award to the now-defunct manufacturer Tekna for its BC design. The inflate and deflate buttons were located within a quarter of an inch of each other, were identical in size and shape, and were both operated by pushing down with the thumb. Not to worry, said Tekna: "One button is light blue, the other darker blue." J. Q.

While most of us think that these errors are someone else's and not ours, we should at least be troubled by the 15 incidents of spontaneous jacket inflation and the 5 jammed

In our Diving Incident Monitoring Study, two common factors in BC incidents were the failure of divers to deflate their BCs (89 incidents, including 79 certified divers, 27 of whom held advanced or higher certification) and not knowing how to use them (71 incidents, including 59 certified divers, 17 of whom were advanced or higher).

The inability to exhaust air from a BC and the consequent rapid ascent was the main cause of injury. Some incidents occurred when a diver was unable to adjust his buoyancy adequately at a decompression or safety stop.

Of the 154 incidents, 39 could have been prevented if divers had simply checked their BCs before diving.

Of the 79 incidents analyzed (see table) where there were problems with the power inflator, in 31 cases the inflation mechanism failed, in 26 the diver pressed the wrong button, and in 15 the power inflator activated spontaneously because of either poor design by the manufacturer or poor maintenance by the diver.

Eight incidents involved inadequate buoyancy on the surface; all resulted in injury. None of the divers removed their weight belts, and four did not know how to orally inflate their BC.

Most power inflation failure incidents could have been avoided by securing the inflator in an accessible position and making a thorough pre-dive check. However, the highest rate of injury arising from power inflation failures was associated with being either low on air or out of air, situations that appropriate air-supply management would have prevented.

Incidents in which the diver overused the power inflator to

maintain buoyancy and in which divers were unable to control their ascent after their weight belt became dislodged are indicative of divers using their BC as the main or sole means of buoyancy control. This is poor diving technique and can be avoided by better training.

On most BCs, the inflating and deflating buttons are too close together — a hazard illustrated by the number of incidents caused by divers failing to distinguish between them. In many emergencies, neither the diver nor his buddy was able to activate either mechanism. They should be separated and secured on different sides of the jacket, standardized to reduce the risk of error. This would make them accessible during an emergency and would improve the ability of divers to control their buoyancy, particularly during an emergency air-sharing ascent — especially if the second stage of the donor's spare regulator were part of, or attached to, the BC's power-inflator hose.

To dive safely, divers need to be prepared to decrease the rate on an uncontrolled ascent and should be particularly aware of the ascent changes that occur in the last 15 feet of a dive.

Ben Davison

Contributing Factors and Deaths Associated with 89 Incidents Involving Inadequate BC Deflation

Contributing Factors	Number	Deaths
Diver was not familiar with the BC's functions	40	20
Insufficient time to activate deflation mechanism	26	12
Diver's buddy was unable to activate the deflation mechanism due to its inaccessible position	9	6
Maximum deflation rate was inadequate	6	1
Deflation mechanism was inaccessible to the diver	5	1
Deflation mechanism was faulty	3	1
Totals	89	41

Contributing Factors in 16 Incidents Where the BC Provided Inadequate Buoyancy

Contributing Factors*	Number	Deaths
Low-air situation	5	3
Diver didn't know how to orally inflate the BC**	4	2
The power inflator was not connected**	4	2
The dump valve malfunctioned**	2	0
Out-of-air situation	1	1
The diver was unable to locate the inflator**	1	1
The inflator hose was leaking**	1	1
BC provided inadequate buoyancy while retrieving the anchor	1	1
BC leaking**	1	0

* These contributing factors are not mutually exclusive.

** Could have been prevented by a pre-dive check.

Tipping the Boat

How to reward friends and make enemies

In February I asked readers how much they tipped on a dive trip. The question struck a chord. Confusion, aversion, and just plain bad feelings were common responses. These are just a few of the comments.

Subscriber C. McClure (Atlanta) wrote: "No matter how I approach tipping, after a dive trip I wind up with a sick feeling in my stomach. If I tip what I think is fair and this doesn't match with the percentage they demand,

then I'm a jerk. If I tip the recommended percentage but think it's too much, I also feel like a jerk. If I tip the recommended percentage and other passengers don't, the crew doesn't know the difference. They think we're all jerks.

"I don't mind showing my appreciation, but tipping ceases to be voluntary when you are told in no uncertain terms how much to tip. My suggestion: add it to the