gas more efficiently, rebreathing it so that the oxygen content is used more fully. A rebreather using a nitrox mix containing, say, 32 or 36 percent oxygen will typically be equipped with a much smaller reservoir cylinder than an open-circuit aqualung set.

Among other benefits, such as compactness and low bubble production (in the case of semi-closed-circuit versions) or no bubble production (in the case of fully-closed units), rebreathers achieve major reductions in gas consumption. Against this must be weighed their currently high initial cost, and their need for considerably more care and attention than open-circuit equipment.

One significant handicap to progress is the fact that dive centres equipped to fill your dedicated nitrox cylinder with the appropriate gas mixture are still few and far between. This is only likely to change as a result of increased demand, because a fully-equipped mixed gas blending system requires a major investment on the part of the filling station.

What training is available for nitrox and technical diving?

If you are a BS-AC member, you will soon be offered skill development courses leading to BS-AC Nitrox Diver and BS-AC Advanced Nitrox Diver qualifications. An extended range diver course is also in hand.

An alternative is to go to one of the specialist agencies: IANTD (International Association of Nitrox and Technical Divers): TDI: (Technical Diving International); or ANDI (American Nitrox Divers International). They all offer a path to nitrox and trimix diving, eventually with rebreathers.

A good starting point for those interested is *An Introduction to Technical Diving*, by Rob Palmer, available from dive shops and the *DIVER* Bookshop at £17.95.

CMAS (the World Underwater Federation) should soon have international equivalents available which will allow member organisations to apply for equivalents to their certificates for issuing to their members.

Glossary

ANDI	American Nitrox Divers International.
EAD	Equivalent Air Depth.
EAN	Enriched Air Nitrox.
Heliox	A breathing gas mixture containing oxygen and helium.
IANTD	International Association of Nitrox and Technical Divers.
Nitrox	Any gas mixture (including air) containing nitrogen and oxygen, but commonly used to describe one where the oxygen content exceeds that of normal air. Known as Oxygen Enriched Air, Safe Air (registered to ANDI), and EAN.
PPO_2	Partial pressure of oxygen in the mixture breathed. The BS-AC recommended limit for this is 1.45 bar for in-water use.
PPN_2	Partial pressure of nitrogen in mixture breathed.
TDI	Technical Diving International.
Trimix	A breathing gas mixture containing oxygen, nitrogen and helium.

Key Words
Equipment, mixed gas, nitrox, physiology, reprint, safety, technical diving.

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KILLER FACTORS IN TECHNICAL DIVING

Killer factors in technical diving are complacency, attitude, oxygen toxicity, exceeding personal limits, ignorance and complexity.

Key Words
Reprint, safety, techical diving.

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COULD DO BETTER! BRITISH SUB-AQUA CLUB INCIDENTS IN 1995

Tim Parish

Nineteen-ninety-five was a good year for diving. Great weather, a 2,000 increase in BSAC membership and, probably as a result of both these factors, a rise in the number of “man-dives” carried out, estimated at over 3,000,000, half a million more than in 1994.

Even better was the drop in the number of incidents, from 389 in 1994, to 351 in 1995, despite the large increase in the number of dives carried out. This reduction has also

TABLE 1

BS-AC INCIDENTS IN 1995

Overseas	33
Miscellaneous	2
Equipment	22
Technique	14
Ascent	10
Boat or surface	113
Injury	28
Decompression illness	111
Fatalities	18

(Constructed from a bar graph with numbers)

been reflected in the data available from The Coastguard Agency, Diving Diseases Research Centre (DDRC) and the Royal National Lifeboat Institution (RNLI). Furthermore, the increased detail available from the Coastguard (our largest source of information) has enabled us to analyse more of the incidents more fully, leading to some surprising changes to some of our previous conclusions.

The breakdown of the data does not, however, bring any surprises. The number of fatalities in Britain rose to 18 last year, in 15 separate incidents. Nine involved BSAC members (despite the BSAC having an estimated two-thirds of the diving population as members). This is a 50 percent increase over 1994 and double the 1993 total, but before we get too despondent it is worth bearing in mind that statistically there is still only a 0.005 percent chance (or 1 in 200,000) of becoming involved in a fatal incident!

To put this further into perspective our records reveal that, while 1995 was not a particularly good year compared to 1994 and 1993, the picture is not as bad as it has been painted in the press. With a continuously

TABLE 3

FACTORS PRESENT IN 15 DIVING DEATH INCIDENTS

Separation	7
Buoyancy	4
Deep Dives	4
Narcosis	4
Panic	3
Free flow	2
Incorrect controlled buoyant lift	2
Out of air	1
Solo dive	1

(Table constructed from a pie chart)

TABLE 2

DEATHS AND BS-AC MEMBERSHIP

Year	Deaths		BS-AC
	BS-AC	Other	Membership
1986	5	8	34,000
1987	5	5	34,000
1988	10	7	33,000
1989	4	8	34,000
1990	3	7	36,000
1991	9	9	43,000
1992	9	8	45,626
1993	3	7	50,000
1994	6	8	50,000
1995	9	9	52,364

(Compiled from a small scale bar graph and the text of the article)

expanding BSAC membership (52,364 on Nov 1 1995) and with half a million more “man dives”, fatalities were no worse than in 1992. In that year there were 17 fatalities, 9 of which were BSAC members, with BSAC membership at 45,626.

1995 was also far better, statistically speaking, than 1988 (16 fatalities, 10 BSAC, with only 33,000 members). When you compare the ratios of number of members to fatalities, there was a 50 percent decrease in the relative number of fatalities in 1995 over 1988. While that should make us slightly more positive about the number of fatalities, this is obviously still too high.

Decompression incidents showed a welcome drop, with 111 incidents in 1995, compared to the 149 in 1994. Unfortunately, the British Hyperbaric Association’s recompression data was not made available to us last year. Had their figures been available, they would have boosted our total decompressions to around 130, but still a welcome reduction. It is also important to realise that the BHA information is sparse and its loss did not invalidate any of our analyses.

Injury and illness also showed a reduction, only 28 incidents compared to 47 in 1994, but boating and surface incidents apparently increased, though only by one! In reality, I believe that this category has probably actually reduced, for 1994 was the first year of the revised Coastguard reporting procedures and they could supply only 9 months of data. Last year we received the full 12 months’ information and could reasonably expect that difference to affect the figures.

Nevertheless, given that this was an area we were trying to target, the figures are relatively disappointing.

The number of divers missing on the surface has remained at 51 and, with engine failures at 46, these two categories make up the greatest proportion of the 113 incidents recorded.

Ascents accounted for 10 incidents, technique for 14, equipment problems for 22 and 2 were categorised as miscellaneous.

Last year, for the first time, we categorised the 33 overseas incidents separately and did not include them in our statistics. This was because the overseas figures we produce each year have always before been quoted as UK figures and this has been misleading. Overseas incidents are still included in the Incident Report which has been sent to every Branch Membership Secretary.

The main contributory factor in last year's fatal incidents was separation under water. Seven incidents stated this as a major cause and, when you consider that we have 3 incidents where the detail of the dive is not known, separation was involved in over half the UK fatalities. This is an area that we should be able to control and must improve.

Together with depth, and very much interrelated, buoyancy and narcosis were the second most common factors, each showing themselves as causes in 4 incidents (not all the same ones). Depth continued to be a major contributor in all incidents. Last year we saw 18 incidents occurring at depths below 50 metres, compared to 9 in 1994. I do not believe that it has become any more dangerous to dive to such depths than it was in 1994, therefore the conclusion we must draw is that *more* deep dives are being carried out.

One of the factors that must be borne in mind is that all the hype surrounding "technical diving" has made such depths appear to be far more normal than they used to be. That has, in part, led to people attempting dives that are far beyond their training, experience and capability. As a typical example, 2 divers died in 1994 attempting to break their own depth records, to get below 75 m on air! Their bodies were recovered by an ROV some days later, from nearly 90 m.

Panic, both underwater and on the surface, was the major cause in 3 incidents and free-flows and incorrectly handled controlled buoyant lifts contributed to 2 each.

The incorrectly controlled buoyant lifts were particularly disappointing. Both started with the casualty still alive, but the rescuers tried to carry out the lift using their own buoyancy instead of that of the casualties. On both occasions contact was lost during the ascent, with the result that the rescuer arrived on the surface out of control and the casualty sank to the seabed! The moral is clear: it must be the casualty who is made buoyant, not the rescuer, and if that means releasing the weightbelt then so be it. Get casualties to the surface by any means. They can be treated up there; they can't be helped on the bottom.

Moving to decompression, there is a better picture, with a drop in people treated, down to 111 from last year's 149. There have been significant areas of change. This has mostly been caused by the analysis of the more detailed Coastguard data, and it marks a significant improvement in our knowledge of what happened prior to the incidents. For instance, repeat diving leapt up last year, occurring in nearly 20 percent of incidents. The incidence of divers missing deco stops also increased. The most important and interesting changes, however, were the number of incidents within the tables or computer algorithms, and the number of rapid ascents.

For many years, the number of decompression incidents occurring within the tables has hovered around the 37-40 percent mark, calculated from the information available to us. Last year, that figure was only 20 percent, but the figures also show that rapid ascents apparently increased from 25 percent in 1994 to nearly 40 percent in 1995. An almost direct reversal in perentage occurrence.

If these figures are a truer reflection of what is happening, it gives us a far better chance to reduce the incident rate by ensuring that ascent rates can be controlled properly. This is a breakthrough. We could now be looking at a skill that we can train people properly to carry out and to practice. In contrast, DCI within the limits is relatively uncontrollable. I will be keeping an eye on this area to see if this is a real change, not just an anomaly. To do so properly, I do need the information from yourselves, DDRC and the Coastguard, so please keep providing it.

There are three main areas we need to address in 1996. The first is the Easter hump. Incident rates in April are always on a par with the busiest months, July and August, and the vast majority of April incidents occur over Easter. Most of these incidents are easily avoidable, so:

i We need to realise that the early season, particularly Easter, is an Incident Hot-spot.
ii We must take steps to ensure that we are practised in our core diving skills and that work-up dives are carried out.
iii One of the easiest actions is to make sure that all equipment, including club boats and engines, has been serviced and properly tested in safe conditions before the Easter dive trip.
iv Rescue skills should be practised regularly. It is no use learning the skill and then expecting to be able to carry it out properly for the first time several years later.
v Lastly, try to ensure that early dives are marshalled by your more experienced dive marshals. This part of the season can set the standard for the remainder of the year. Make sure the right example is set.

The second area I want to tackle is deeper diving. I have been tracking the trend towards deeper "average" dives and an analysis of 4 years of data shows that the trend is growing. There are two worrying factors. The first is that many divers carrying out these dives do not have the training necessary. The second is that their equipment is not always adequate. There are several things we can do to improve this:

i Less experienced divers must be educated about the realities of deep diving in British waters, and dismiss the myths regarding depth records and 80 m-plus air dives. Yes, they have been done, but not by recreational divers on a weekend trip.

ii Divers need to be trained in the techniques and practices required to carry out deep dives, the deployment of decompression stations, use of bottom lines, etc.

iii Inert gas narcosis is always a factor in incidents occurring on deeper dives and is probably a significant cause of underwater separation. Divers can work up their inert gas tolerance and, together with proper education, be taught how to deal with narcosis. By paying proper attention to their buddies, divers could also decrease the incidence of separation. Separation drills should always be part of the dive plan and we must ensure that divers realise the importance of following them. It only requires self discipline.

iv The equipment used on a deep dive is significantly different from that used on most club dives. Equipment redundancy and equipment layout are very important and the knowledge and experience in this area is generally gained from practice.

v Planning and marshalling deep dives is far more important than on shallower dives. Detailed plans need to be formulated for separation procedures, finding the shotline, air requirements, etc. The Dive Marshal must be aware of your dive plan so that he or she can effect an immediate rescue if required. When an incident happens at depth, time is critical and discipline is a key factor if safety is to be maintained.

vi Lastly, all these skills should be practised in safe conditions before they are tried for real. It is worth remembering that most of these skills can be learnt and practised on the BSAC Extended Range Diving skill development course.

Analysing incident reports throughout the year, several other things that could do with improvement came to my notice.

i The lack of buoyancy skills is a consistent offender in the incident database. We have taken steps to increase these skills in early training, but we must correct bad buoyancy in later diving as well. With the apparent increase in incidents caused by rapid ascents, this becomes even more important.

ii Dive planning and marshalling seem to be getting worse rather than better. The latest computer can still not plan your dive for you, nor tell the marshal what you are planning to do. These are critical skills and disciplines and we cannot afford to let them go to SEEDS, if you will excuse the pun.

iii Several incidents this year have ended up with casualties dead on the bottom, with weightbelts still firmly strapped around their waists. We need to reinforce the teaching of weightbelt dumping, a basic skill that can be a life-saver. It needs to be included in the buddy check before every dive, not taken for granted.

iv There has also been an increase in the number of near-incidents where controlled buoyant lifts have not been too successful, due to air leaking from the neck seal of the casualty's dry suit. We must make clear in our buddy checks how we can be lifted in an emergency. Make sure your buddy knows to use the BCD to gain adequate buoyancy in such a case.

v Generally it would seem that boatmanship and surface cover skills are in need of improvement in order to minimise the number of divers who end up missing on the surface. Accordingly, we must carry detection aids with us. The Coastguard reports are full of cases where divers could have been located hours earlier had they carried flares, strobes or even a torch. Orange smoke flares are available in waterproof versions and are excellent signalling aids.

vi Finally, let's make sure that both our equipment and ourselves are ready to go into the water.

Have a safe and happy 1996.

Key Words

Deaths, decompression illness, incidents, reprint, safety.

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