Dive Safety: It’s No Accident

Divers Alert Network (DAN) takes great pride in being by your side, and for 30 years we have been conducting research to help make diving safer. Recently, DAN researchers reviewed our accumulated fatality data and conducted a root cause analysis of nearly 1,000 recreational diving fatalities to determine what circumstances and events lead to diver deaths. In this analysis, DAN researchers identified four different phases in the cascade of events leading to a fatality: the trigger, the disabling agent, the disabling injury and the cause of death. As the earliest identifiable root causes that transform dives into emergencies, the triggers merit special attention. Identifying these triggers is essential so divers can avoid or manage them during dives.

In the fatality analysis, the triggers were identified as follows:

1. Running out of breathing gas 41%
2. Entrapment 21%
3. Equipment problems 15%
4. Rough water 10%
5. Trauma 6%
6. Buoyancy 4%
7. Inappropriate gas 3%

RUNNING OUT OF BREATHING GAS

The most significant trigger was running out of breathing gas. To put this in context, approximately 400 divers from the cases studied might be alive today had they managed their gas supply correctly. Because of the equipment standard in diving today, running out of breathing gas underwater, especially before any other problems occur, should simply never happen.

Be “air aware.” Always begin dives with a full cylinder of breathing gas, and end dives (standing on the boat, dock or shore) with gas remaining. Before starting a dive, you and your fellow divers should decide how you will communicate information about your remaining gas supplies during the dive. Establish a point at which you will begin making your way to the exit. That may be when the first diver reaches half of his breathing gas supply, but it may be sooner than that.

Many cave divers use the rule of thirds, which has divers using the first third of their gas supply for the dive, the second third for the exit from the cave or the ascent, and the final third set aside for contingencies. This may seem conservative for open-water diving, but the idea of leaving a significant reserve for emergencies or other unexpected circumstances is absolutely relevant. Anything short of total management of your breathing gas puts you, your buddy and every diver in the vicinity at risk.

ENTRAPMENT

The next most common trigger in dive fatalities is entrapment. Approximately 200 divers in the DAN fatality records, or 21 percent, found themselves trapped in an overhead environment and unable to get back to open water. An overhead environment is any in which a diver does not have direct, vertical access to the surface — such as a cave, cavern, wreck or under ice. Every training organization warns divers about the dangers of entering such environments without appropriate training, experience, planning and equipment. The way to mitigate the hazard of this trigger is very simple: Don’t enter overhead environments without being qualified and prepared to do so. When in doubt, stay out.

EQUIPMENT PROBLEMS

The third most common trigger identified in the fatality analysis was equipment problems. This trigger caused 15 percent, or about 150, of the fatalities studied. Notably, this does not mean the equipment failed or its design was flawed. Rather, the problems were most often a result of user error. These errors included improper use, failure to ensure correct configuration, lack of maintenance and insufficient familiarity with the equipment. Dr. George Harpur, an experienced investigator of dive fatalities , states, “We are not able to document a single case in which equipment malfunction directly caused a diver’s death or injury. It has been the diver’s response to the problem that results in the pathology.” It’s important to remember that dive equipment is life-support equipment. Learn about all its features and functions, practice with it, and maintain it; take care of your gear so it can take care of you.

Knowing how divers get into serious trouble only advances the discussion so far. For diving to be safer, we must apply the lessons that can be taken from these tragic events. How can we, as divers, reduce the likelihood that these triggers will cause problems for us?

EDUCATION

Take full advantage of every opportunity to learn. Read dive magazines, spend time with experienced divers, attend dive club meetings, and check out dive safety lectures or seminars online. More knowledgeable divers are safer divers. Get trained in the type of diving you want to do, but don’t stop learning when you leave the classroom — treat every dive as an educational experience. Use any unexpected incidents that occur while diving as opportunities to brainstorm and discuss response options, contingencies and prevention strategies with your buddies.

PRACTICE

Dive skills and emergency-management skills require constant practice and reinforcement. Refresh your skills often, especially when you haven’t been diving in a while. Take time to familiarize yourself with new equipment in a controlled environment before using it in open water. Although practice may not make you perfect, it will help you make the correct decisions and manage problems appropriately rather than trying to escape to the surface.

EXPERIENCE

The value of experience cannot be overstated. Divers with limited experience, including those returning to the sport after a long absence, are at greatest risk. According to the DAN fatality data, 88 percent of the divers died on the first dive of their dive series. Consider that the number of dives in your logbook or the date on your certification card do not automatically qualify you for greater challenges. To truly be prepared for more advanced diving, slowly and methodically increase the complexity and task loading of your dives. Expand your horizons gradually, making sure you don’t outpace your training and your level of comfort. Certification is not the same thing as proficiency. Don’t dive your C-card, dive your experience.

HEALTH

Approximately one-fourth of the fatalities studied involved cardiac problems. Amazingly, in 60 percent of the cases with cardiac involvement the divers had symptoms such as shortness of breath, chest pain or fatigue but proceeded to dive anyway. Most divers are aware of the importance of good general health and fitness for diving, but comfort and well-being at the time of the dive are also important. If you’re not

feeling up to a dive, don't dive; wait and see how you feel later.

The majority of these cardiac cases were associated with a pre-existing condition or age greater than 40. It's a good idea for everyone older than 35, whether or not they dive, to have an annual physical. A physical is also recommended following any change in an individual's health status. Divers might benefit from having their physical exam performed by a physician trained in dive medicine. If you don't know a physician in your area who is familiar with dive medicine, send DAN an email: medical@daneurope.org.

PREDIVE PREPARATION

As you prepare to dive, it's a good idea for you and your buddy to configure and assemble your equipment together so you can identify anything that looks odd or out of place. This also provides an opportunity to familiarize yourselves with each other's equipment. If boat diving, it may be helpful to set up your gear before the boat leaves the dock. This is especially true if you are subject to seasickness, since it minimizes the amount of time you'll spend on the rocking boat deck. Hastily assembling your equipment in rolling seas while feeling nauseated increases the likelihood of potentially hazardous errors.

Before diving, review your dive plan with your buddy to ensure you have a shared understanding of the dive's goals. You'll also want to agree on the route you'll take and possible alternatives to your primary dive plan. It's much easier to communicate the switch to plan B if you decided what plan B was before you descended. Establish the fact that anyone can terminate a dive at any time for any reason, even before the dive begins, without repercussions. Creating an environment in which divers feel comfortable making such calls builds a culture of safety.

Develop and continually reinforce a predive ritual. It should involve equipment checks, dive plan review, hand signal review, diver separation protocol review and out-of-breathing-gas procedure review. This may seem unnecessary if you dive with the same people regularly, but these rituals are time well spent if they give you confidence and reduce the likelihood that you are unprepared to dive. The use of a checklist to assist in this ritual is highly recommended. Never say, "Don't worry, I'll take care of you." That means one of the divers is not as qualified or prepared for the dive as he should be — a formula for disaster. Anyone making a dive should do so only if he is fully prepared and wants to dive, not because someone else wants him to.

THE DIVE

Once in the water, check each other to make sure all equipment is secure and in place, there are no leaks and that buoyancy is properly calibrated. Give and receive the OK signal, initiate your preparatory ear-clearing procedures, and begin a controlled descent. Descending feet first using a fixed line makes it easy to stop the descent should the need arise and may be advisable if a current is present. If there is any doubt about your preparation for the dive, make a short stop 4,5 to 6 metres below the surface to give and receive the OK sign before proceeding to the bottom. Maintain constant awareness of your environment during dives, and know when to call off a dive. It's always wise to plan your dive and dive your plan, but you can modify your dive plan if conditions call for a more conservative approach. If you are working harder during the dive than anticipated, you may want to watch your air consumption more closely and possibly limit the time you spend at depth.

As you move underwater, your pace should be dictated by the slowest diver in you group. Never assume another diver can keep up with you. If a recreational dive starts to feel like work, slow down — you or a member of your dive group may be doing it wrong. If you're diving in a group of three and one diver

decides to return to the surface, either end the dive as a group or escort the diver back to the exit point and make sure he is safely out of the water before continuing the dive.

Does this examination of diving fatalities indicate that recreational diving is inherently dangerous? No. There are millions of certified divers who have made tens of millions of safe, enjoyable dives without incident. But consider that there is risk in anything you do. Is this risk we divers subject ourselves to unreasonable? I firmly believe the answer is no. A degree of risk will always be part of scuba diving, but it is a risk we can identify and learn to manage.

Scuba diving is a fantastic sport enjoyed by young and old alike. The focus should always be to maximize enjoyment while minimizing risk. You overcome challenges in and under the water by thorough preparation, physical capability and the effective application of knowledge and skill.