# *EMERGENCY PROCEDURES - AN EXPANDING DILEMMA*

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*The successful use of emergency procedures requires that the techniques involved are overlearned to the point where they can be executed with minimal problem-solving behavior. Expanding diving technology and the current trend toward the use of increasingly complex life support systems and protective equipment is creating a significant challenge to diving safety officers and instructors. The specific nature of the effective response to an emergency will depend on many variables, not the least of which will be equipment configurations. This presentation will explore some of the major problems and offer suggestions for consideration.*

## INTRODUCTION

The discussion of emergency procedures for current diving practices must be prefaced by the reiteration of some relatively well known but generally not well implemented "lessons-learned-the-hard-way".

1. Specificity of training means that an effective training program must contain the identical psycho-motor elements that are present in the desired end behavior. This requires that an analysis of the skill components of any procedure must be undertaken before the training program for that procedure is developed. The analysis is then used to develop the training program.
2. Training programs should progress from the simple to the complex elements of the skill procedure. Achieving proficiency with the procedures under ideal conditions before training for proficiency under simulated emergency conditions is fundamental to good progression.
3. Never assume that telling your divers about a change in a procedure brought about by an equipment configuration change will result in a change in the specific adaptation that they have developed as a result of the original training program. Effective changes in behavior are best developed by retraining using the new configuration.
4. Periodic reinforcement of the emergency procedures is necessary to retain a high level of proficiency in the effective execution of the procedure.

The successful use of emergency procedures requires that the techniques involved be overlearned to the point where they can be executed with the need for minimal problem-solving behavior. Problem-solving behavior under conditions of high stress is likely to be degraded even to the point of complete failure to cope with the problem. The more complex problem-solving behaviors are most likely to fail under high stress states.

## BACKGROUND

The early days of diver training were marked by the presence of "the bible" in the form of the U.S. Navy Diving Manual which provided the definitive word on diver training and emergency procedures. The equipment consisted of a two-hose regulator, tank and backpack, mask, fins, snorkel, weights and often, but not always, a small, oral-inflation only, front mounted life jacket. The emergency procedures were found in "the bible" and variation from the procedures was out of the question. There was, quite literally, only one way to do any procedure and it was described in detail in the manual.

The growth of the ancillary use of SCUBA in commercial, scientific, and recreational venues resulted in the further development of the equipment. The development of the single-hose regulator, for example, led to some relatively minor but significant changes in the buddy breathing procedure. Instead of facing directly into the face of the donor, the recipient was placed to the donor's left side for easy delivery of the mouthpiece. Again the procedure was standardized and easily executed because there was little variation in the basic configuration of the equipment. The training organizations were all in agreement with regard to the procedures and the Diving Equipment Manufacturer's Association (DEMA) had appointed a group of committees that were charged with the standardization of the various pieces of life support equipment. These committees worked for several years but were not able to reach consensus perhaps due to a concern that standardization might stifle innovation in product development. Since the functional characteristics of most of the equipment remained essentially the same until the 1980's there was still a consistency in the various emergency protocols. The work on the standardization issues for the equipment became bogged down in the face of a rapidly expanding marketplace and the efforts of innovators who developed equipment items such as the octopus regulator, power inflators with and without breathing capabilities, weighting systems, multi-faceted buoyancy control devices, dive computers and a variety of other auxiliary air sources that required additional variations in the emergency procedures. Each variation requires a specific adaptation on the part of the diver and the buddy. While it is possible to identify a procedural pattern that will adapt to most of the equipment configurations, the reality is that each configuration requires specific skills and understandings in order to reach a comfort level with regard to proficiency. As a direct result of the proliferation of diving equipment configurations we are facing an increasing dilemma in training safe, effective divers.

## CONSIDERATIONS

1. Regulators typically have four or five hoses dedicated to primary life support, alternate air source, low pressure inflation to the buoyancy compensator and/or a dry suit and a tank pressure gauge and console. Although the primary regulator consistently (but not absolutely) comes over the right shoulder, any semblance of standardization stops there. Any of the remaining hoses are basically up for grabs (no pun intended).
2. Alternate air sources are available in dozens of configurations.
3. Buoyancy compensators are available in dozens of configurations and variations in controls and location are often not consistent within a given manufacturer.
4. Weighting may be integrated or non-integrated. In either case there are a number of variations for weight-release in an emergency and some are position dependent.
5. While wet suits are still somewhat traditional there are significant variations in buoyancy with variant materials. Dry suits, on the other hand, have assorted controls that vary with manufacturer and/or personal preference.
6. Basic diver training courses have been redefined according to the specific training organizations' philosophies. They are generally in agreement with the Recreational Scuba Training Council (RSTC) guidelines but are not focused upon the complexities of the various skills. Modular approaches are beginning to have an impact on instruction but the emphasis on problem solving found in many earlier courses has been relegated to advanced experiences.
7. Most scientific diving programs find themselves faced with novice divers from a variety of programs using a wide assortment of equipment.

## REQUISITE TRAINING

Scientific diving safety programs must now consider training these individuals so that they can operate safely and effectively in the field under a variety of highly specific environmental conditions using a wide array of instrumentation. The nature of the calculated risk at this level rarely involves consideration of the issues previously identified since the divers are already "trained" and are usually project-oriented, not training-oriented. The concept of reciprocity is based upon a qualitative level of training in both institutions so that the divers can be expected to dive safely together. This agreement usually does not take into account such details as training conditions, equipment used during the training on emergency procedures and what, if any, reinforcement has taken place with regard to the training. The dilemma resides in the reality that unless the diving team receives current training on the establishment of standardized emergency procedures for the project, any encounter with an emergency situation is likely to require advanced problem-solving skills in the absence of appropriate overlearned emergency procedures. It has been widely demonstrated that confusion that arises during an emergency can result in minor errors which quickly avalanche into panic-producing, life-threatening behaviors. The excellent safety record for the scientific diving community can be credited, in part, to traditional training programs that were effective because they took the time to pass on training to insure the overlearning of critical skills used for avoiding or resolving problems.

The issues raised above are representative of a specificity-of-training problem that is increasing in complexity with each passing season. It seems obvious that scientific diving training programs should take into account the functional variability of diving equipment and establish criteria that would standardize procedures as well as the functional requirements for equipment configurations used in the programs. Either the procedures must be customized to the equipment or the equipment must be customized to the procedures.

## ALTERNATE BREATHING SOURCES

Bachrach and Egstrom (1987) made an early attempt to develop an air-sharing procedure that would be compatible with a number of alternate air sources, *i.e.*, octopus regulator, pony bottle, SPARE-AIR, buddy breathing, and integrated power-inflator breathing devices. The reliability and effectiveness of the procedure was dependent upon locating the alternate air source mouthpiece within a triangle on the diver's chest so that the mouthpiece would always be moved easily from the same visible general location *en route* to the recipient's mouth. While the procedure utilizes similar movement patterns and responses for the various devices, there are differences in the actual utilization of some of the devices. For example, there is a difference of opinion regarding which mouthpiece is given to the recipient. Some believe in breaking the primary life support link of the donor, who gives up the primary air source to the recipient, and others, including the author, believe that a viable alternate air source mouthpiece be presented to the recipient. There are valid arguments for either approach but importantly, the latter approach does not involve the retrieval of the alternate air source by the donor. Additional differences are built in as a result of design variations. An ideal alternate air source would not have any position dependency for use by a recipient. Up, down or sideways positioning of the mouthpiece would result in easy, dry breathing. Currently, those second stages that have the exhaust valves under the mouthpiece are continuing to be inserted improperly during emergencies, often due to a lack of appropriate training.

## BUOYANCY CONTROL

The proliferation of buoyancy control devices (bcd) follows a similar pattern of variation but to a much greater degree than that found in regulators. Location of basic controls for inflation and deflation are varied sufficiently to create confusion with many of the devices. As an example, there are two similar appearing power-inflator/alternate air sources with the oral inflation function accomplished through the mouthpiece on one device and through a round orifice located on the underside of the second. Both devices have the advantage of breathing in any position but one requires that the breath of compressed air be taken, lips disengaged from the mouthpiece and resealed on a round plastic part before the valve is opened permitting air to go into the bladder. Either device is easily used when proper training has taken place but confusion can occur as a result of the differences when either is presented to someone trained on the variant device. Additionally, power-inflators vary with regard to control placement as well as the technique necessary for release of air through the manual dump valve, *i.e.*, the manual valve may be on the shoulder or on the manual inflator. A secondary manual dump valve may also be located somewhere on the back or side of the bcd.

By way of example, assume that there are 10 variations involving alternate air sources, 10 variations involving locations, controls and dump valves on a bcd, 5 variations on weight ditching procedures. This conservative number of variations results in the potential for 500 different configurations that can affect training for basic diving as well as emergency procedures. Any given diving program can resolve a number of the issues by severely limiting the type of equipment permitted in the program. This approach has a significant potential effect on reciprocity and diving safety.

## CONCLUSION

Since it is unlikely that anything can be done with regard to the expanding universe of diving equipment, it appears that several challenges exist.

1. Train the divers so thoroughly that they are able to solve any problems that are presented by the equipment variations found in their programs.
2. Establish a training module for all divers who come into your program and replace equipment that is not compatible with your procedures.
3. Develop standardized training and emergency procedures for the scientific community and eliminate any equipment that is not compatible with the procedures.
4. Provide specific skills retraining for all divers who will be working together on a given project before the project gets underway.
5. Provide retraining on procedures, including new variations, with the advent of recertification.
6. Develop a bullet-proof informed consent and waiver of liability document. Good luck!

The certainty is that none of these challenges will be met nor will the problem get any less complicated in the future. This paper has addressed the problem at the most basic level and has not elaborated on issues raised by customized diving equipment where multi-variant configurations further complicate emergency procedures. The realistic challenge may well require the scientific diver to focus on the elimination of diving emergencies. Most diving emergencies are the result of lapses in judgment or diver error which causes a loss of control. A lack of appreciation for the nature of the calculated risk a diver must face on each and every dive cannot be overcome once a minor crisis begins to avalanche into panic behavior. Hard corps training for comfort and control is quite probably the reasonable means of minimizing the impact of widely varied equipment configurations on safe, effective diving procedures.

## LITERATURE CITED

Bachrach, A. and G. Egstrom. 1987. Stress and Performance in Diving. Best Publishing Company, Flagstaff, AZ. p. 129-138.