Over past summer's diving season there were at least eight fatalities and a number of injuries in the U.S. involving "technical-level" exposures and reportedly even more in Europe. Unfortunately in most of these cases, experienced divers violated one or more basic safety principles and died as a result. According to a recent study of diving accidents conducted by Mano and Shibayama1, over 45% of the sport diving fatalities investigated were due to "lack of technique" or "reckless diving." Their conclusion is probably even more applicable to technical diving where there is little margin for error.With today's technologies and the complex diving environments that are accessible, it's easy for people to get in over their heads. Safety is always the primary objective in technical diving.We offer the following information in the hopes that others will be able to learn from these tragedies and events.

Fatalities:

***Alachua Sink,* Florida**

1992July. A newly trained cave diver got lost in the cavern zone after being separated from the team's line in zero visibility conditions at Alachua Sink and drowned. His partner survived. Instead of following the permanent line which begins at a log in the basin, the team ran a reel during the evening dive in order to make their way down through the sloping cavern zone to the main tunnel. The basin had near zero visibility conditions due to the seasonal algae bloom which usually clears up at about 130 fsw at the upstream/ downstream tunnel junction. About 60-80 feet into the dive, the team realized they had missed the main tunnel. After searching for the tunnel for several minutes in 3-4 foot visibility they decided to turn the dive and lost visual and physical contact of each other. The surviving partner reeled in believing his partner was ahead of him on the line. Reaching the surface alone and realizing his partner was still in the water, he attempted numerous line searches in order to locate the diver without success and went for help. Though the lost diver had several hours of gas in his double 95's he was unable to find his way up and out of the funnel shaped cavern zone. *A contributing factor may have been that he was only carrying a 50 foot "jump reel "rather than a 150 foot "safety reel" recommended by the cave diving training agencies.* Ironically, if the dive had been conducted during the day observers speculate that it should have been easy to find a way out.

Alachua Sink is considered an advanced dive by experienced cave divers due to low visibility conditions, depth and the arduous climb out of the water. Most divers wait for winter season to make the dive because of the low visibility in the basin during the spring and summer. Due to the poor conditions, it took three and half days for teams to recover the body which was found wedged in the ceiling of the cavern.

***Andrea Doria,* New York**

1)1992July**.** An experienced diver wearing double overpressurized 72's *"ran out of gas"* while making his eleventh penetration dive on the Andrea Doria (240 fsw) . His partner who entered the water with a "half-filled" set of steel 120s -*insufficient gas to safely make the dive*- survived.

Both were breathing trimix though neither was formally trained in its use. The team was separated during a penetration in the wreck. When the surviving partner exited at 220 fsw with only *several hundred psi remaining in his doubles* and found his stage bottles clipped off near the anchorline, his partner was no where to be found. The body was later recovered. A close friend who had trained with the diver reported that he had had problems "managing his gas" on several prior occasions. What's more is that the diver was *using trimix as a suit inflation gas in the chill 45°F water* which was possibly a contributing factor in the accident that could have impaired the diver's judgement.

2)1992July Two weeks later another trained, experienced diver drowned after getting separated from the mainline during a wreck penetration on the *Doria* while the team worked as planned at two different places within the wreck. Though the trimix used to conduct the operation was a big safety factor, analysts on site believe the diver left the line to explore just a little further for artifacts before making his planned exit-*contrary to the dive plan.* He wasn't running a *"gap reel.*

" In addition his primary light apparently failed leaving only a single *"dim"* secondary light to exit the silted wreck. This probably added to his confusion. Lost in the wreck he ran out of gas and drowned before the team was able to locate him. His body was later recovered at 230 fsw. Though he was a cave-trained police diver who regularly dived solo and had been trained in mix, he did not have extensive wreck penetration experience and had gotten slightly disoriented on their previous dive. Sadly, the diver apparently told his partner prior to the trip that he just "had" to bring home a *Doria* artifact for his pregnant wife.

***Arundo*, New Jersey**

1992July. A very experienced deep wreck diver *knowingly* dived beyond the NOAA oxygen limits while conducting an enriched air dive on the *Arundo* (135 fsw), suffered an oxygen seizure and drowned. The diver was breathing an EAN 40 (40% O2, balance nitrogen). This mix has a rated "Maximum Operating Depth" or MOD of 87 fsw (at a partial pressure of oxygen or PO2 of 1.45). However, the *deck of the wreck is at 110 fsw with a maximum depth of 135 fsw*, resulting in a *PO2 of 1.7-2.0 atm* which is well above the CNS toxicity threshold.

The diver had told others in the past that he didn't follow the NOAA guidelines as he believed they were too conservative. An individual who knew the diver well believed he was probably diving the USN's "extreme exposure" limits for oxygen which are generally not considered conservative enough. In one case, the diver recommended that another follow his example *(After all diving air at 250 fsw is a PO2 of 1.8 atm. No problem!)* . The problem is that CNS toxicity is a function of both PO2, time and other factors, many of which are not well understood. His body was found approximately 45-50 minutes into the dive with regulator out of his mouth and 1500 psi in his doubles. Maximum depth on his computer was 132 fsw.

Chester Polling, Massachusetts

1992July. An experienced 45 year old wreck diver suddenly lost consciousness during a 170 fsw air dive on the *Chester Polling* and drowned in the arms of his partner. The exact cause of his death is unknown. The team descended on the "near virgin" wreck at 140-170 fsw for what planned to be a short first dive of the day leaving their inflatable boat unattended but anchored into the wreck. Conditions were good and there was no current. About 10-15 minutes into the dive, the surviving partner called the dive and begin to ascend to the bow at 140 fsw to free their anchor.

The diver drifted back down to the bottom briefly for one more sweep of the area. When he returned to their ascent line he didn't look right to his partner who signaled, "OK?" The diver signaled, "NO- Not OK," but didn't indicate what was wrong. His partner grabbed him by the harness to maintain contact during their ascent. As they ascended the diver began moving his arms and legs and then his legs went limp at about 90 fsw. At 80 fsw his regulator fell out of his

mouth and the diver lost consciousness. The surviving partner was "freaked" and tried to resuscitate the diver without success. At 15 fsw the surviving partner elected to complete a portion of his decompression before surfacing, removed the diver's weightbelt, inflated his BC and pushed him to the surface. *There was no surface support person or anyone on their boat.* The surviving partner completed about 5 minutes of air decompression, surfaced and went on oxygen. A nearby sailboat had picked up the drowned diver and had radioed the Coast Guard station which was only a few minutes away. CPR was applied to no avail. There were no life signs. The diver was evacuated to the hospital and pronounced dead. The autopsy stated the cause of death was drowning. It is highly unlikely that the event was an oxygen convulsion (a PO2 of 1.26 atm at low to moderate work levels). The diver had no previous history of cardiac problems and was reportedly in great shape.

***Devil's Eye*, Florida**

1992July. A trained cave diver lost consciousness and drowned while making an enriched air stage dive at Devil's Eye cave system. His partner survived. The multilevel dive was conducted using air as a travel mix and a bottom mix of EAN 40. The maximum depth of the dive was 104 fsw. The dive team staged into the system on an aluminum 80cf air stage which was breathed for approximately 15 minutes into the dive before the switch to EAN 40. After about 60 minutes into the dive the surviving partner turned to see the diver stop and begin shaking before losing consciousness and spitting the regulator out of his mouth. His partner tried unsuccessfully resuscitate the diver and then attempted to swim the unconscious diver out of the cave. Soon realizing that his efforts were futile, the surviving diver exited the cave to get help. The body was recovered a short time later by a recovery team.

Investigators believe that an oxygen seizure was the cause of death. Though PO2s for most of the multilevel dive were at or below 1.4 atm (83 fsw on EAN 40), due to the configuration of the cave there were multi-minute portions of the dive with PO2s as high as 1.5-1.7 atm (95-105 fsw) *placing the profile outside of the NOAA Oxygen Limits (a maximum PO2 of 1.6 atm)* which are based on "moderate" diver work levels. The team was reported to be swimming hard in the "upstream" system which would have resulted in CO2 build-up and possibly increased the diver's sensitivity to convulsion. The family refused an autopsy.

La Jolla Canyon, California

1992July. Two "untrained" recreational divers reportedly died in La Jolla Canyon attempting to beat their *"personal best"* depth records of 200 fsw which they made in the Canyon the week before *using recreational scuba equipment*. Their goal was to hit 250 fsw. Apparently neither of the divers had *training or experience at these depths* and had *not done prior work up dives.* According to newspaper reports, when questioned by friends about their "record" dive the previous weekend one of the team said they got narked *"big time,"* and rather than dangerous or stupid believed their continuing push for depth was*"cool."* Both of the divers were recreational divemasters, one of the divers had just received his divemaster certification earlier that month. La Jolla Canyon begins about 150 yards off shore in 45 fsw of water and quickly drops through a series of slopes and ledges to about 300 fsw. The team apparently swam out alone sometime in the afternoon covering probably about 600-800 yards on the surface (probably building up CO2 levels) before dropping into the canyon. *They were conducting the dive on single aluminum 80's* without a stage or pony bottle and there was *no descent/ascent line or surface support personnel.* (Assuming a conservative surface consumption rate of 0.75- 1 cf/min. the transit to and from depth would have required between 30-40 cf. for each diver not including time on the bottom, decompression requirements, their surface swim or *reserves in the event of an emergency.)* Since their bodies were never recovered and their were no witnesses, we can only speculate as to their dive and the exact events that led to their deaths.

Other fatalities:

Apparently numerous fatalities occurred this summer in the UK and Europe involving technical level exposures. The majority of these accidents reportedly involved deep air diving in overhead environments. As of this writing we have been unable to get sufficient details to include these in this report.

Injuries:

***U-"Who" Boat*, New Jersey**

1992June. An east coast wreck diver "blew up" to the surface as a result of operational problems while diving trimix on the newly discovered, unidentified New Jersey U-boat, the "U-Who" (215 fsw), omitted about 30 minutes of decompression and suffered decompression illness during his evacuation. According to on site observers, the diver, who had completed a trimix course, was "*grossly overweighted and was diving new equipment including stage bottles that he was not well practiced with."* On descent, the diver missed the anchor line separating from his partner and sank straight to the bottom at about 215 fsw missing the wreck. Rather than trying to surface immediately or send up a lift bag indicating "diver in distress," the diver searched for the wreck on the bottom under low visibility conditions and burned through approximately 200 cf of gas in less than 10 minutes. Out of bottom mix, lost, overweighted with no ascent line and unable to gain sufficient buoyancy with his drysuit or back mounted wings, the diver elected to ditch his weightbelt and blew to the surface switching to his EAN 50 decompression gas at 150 fsw on the way up.

The diver showed no symptoms of decompression sickness upon surfacing and was immediately put on surface oxygen. He was evacuated by a Coast Guard chopper which did *not have any oxygen onboard.* Unfortunately, he wasn't packed with an O2 cylinder and manifested symptoms in flight. Upon landing he was successfully treated with a single Table 6. Clearly this incident was a "blow up" and cannot be counted as a traditional DCI case. To date there appears to have been only one known incident of decompression illness involving trimix in approximately 400-500 recent U.S. "technical" dives.

***Andrea Doria,* New York**

3)1992August. A very experienced cave diver omitted approximately 68 minutes of decompression rather than executing a "free floating" hang while conducting a solo air dive on the *Andrea Doria* and suffered a severe case of decompression illness. The diver was wearing double 104 pumped with air and an oxygen stage bottle for decompression and there was a surface-supplied O2 system on board. Apparently the dive had gone near "picture perfect" in the 10-12 ft. visibility water when the diver's guideline broke at his "turn" and he was swept off the wreck by the heavy current. After spending precious minutes swimming hard at about 190 fsw to regain the wreck and find the anchor line, the diver was forced to begin his ascent due to his dwindling gas supplies. *In the resulting confusion, he neglected to deploy the reel and lift bag that he was carrying.* He ascended without a line and completed his 50 fsw stop and ascended to 40 fsw at which point he had minimal air in his doubles.

At that point, the diver reported he did not think of using his upline and bag and elected to surface rather than to ascend and pull his oxygen decompression "free floating" in the current and risk getting separated from the boat. Upon surfacing his computer showed 31 minutes of runtime. The onset of symptoms was immediate and severe and progressed to include nausea, vomiting and vertigo. Oxygen and fluids were administered immediately by a fellow diver and RN and the diver was evacuated for treatment by helicopter. Reportedly he spent nearly 40 hours in the chamber and was released with a slight deficit in his left leg.

Lake Jocasee, North Carolina

1992July. An experienced cave diver suffered an oxygen seizure during decompression following a special mix open water dive to 300 fsw in Lake Jocasee, N.C. was treated for fresh water drowning and luckily survived *due to excellent top-side support.*

Utilizing a pair of large inflatables for surface support , safety divers and an continuous ascent/decompression line system, the eight minute planned jump to 300 fsw was conducted on trimix 14/33 (14% oxygen, 33% HE, balance N2. Max. working PO2 = 1.41 atm) with two intermediate mixes, an EAN 32 (@130 fsw) and an EAN 60 (@ 60 fsw) to be followed by surface supplied oxygen at 20 fsw. Back up oxygen bottles were carried by team members. Total planned decompression time was 61 minutes. Prior to reaching the 20 fsw oxygen stop, PO2's on the dive were at or below about 1.4 atm with the exception of two minutes at 120-130 fsw (PO2= 1.5-1.6 atm), and 6 minutes at 50-60 fsw (PO2=1.5-1.7) during the intermediate gas switches. The dive team discussed and dismissed the need for "air breaks" (the practice of breathing air for 5 minutes every 20-25 minutes during oxygen decompression which greatly reduces sensitivity to convulsions) as unnecessary during the oxygen decompression phase of the dive due to the short time (36 minutes) involved .

The dive proceeded as planned without incident until about 20 minutes into the oxygen decompression. The diver unclipped from the decompression line switching to his oxygen stage in order to swim over and check on a second team on a nearby decompression line on the second support boat. He did not communicate what he was doing to his partner who lost visual contact with the diver as soon as he swam off. Swimming slowly the diver lost some buoyancy, drifted down to about 35 fsw (PO2=2.06) and he believes he dozed off for several moments due to his excessive fatigue. He startled awake when his breathing became abnormal and quickly checked his depth as the onslaught of oxygen toxicity began. Fortunately experience took over. Holding his regulator in his mouth with one hand he hit his power inflator with the other as the seizure began. His actions saved his life. As he ascended uncontrolled, he was aware of losing his regulator at about 10 feet and hit the surface convulsing, face down and helpless before losing consciousness. The diver was rescued within moments of surfacing by the team's support personnel. His breathing had stopped. CPR was applied and the diver was resuscitated. He was soon evacuated to a nearby hospital, treated for fresh water drowning and recovered.

Though the diver's profile would normally be considered "light" from an oxygen tolerance perspective *the short spike to 35 fsw coupled with the lack of an "air break" apparently led to trouble.* Extenuating circumstances appear to be his condition before making the dive. A paramedic by profession, the diver had just come off of a 24 hour shift and had *less than 2 hours of sleep the night before the dive.* Fluid intake had been minimal and little food had been consumed over the previous 14 hours. Diver fatigue was believed to be the main cause of the accident.

Accident Analysis

About twelve to fifteen years ago in response to the then growing number of accidents, the cave diving community developed a set of safety principles based on the then new tool of "accident analysis." Later refined by pioneer Sheck Exley and elucidated in his book, *"Basic Cave Diving: A Blueprint For Survival 2,"* accident analysis is a means to rigorously dissect an accident into it's constituent parts with the goal of determining *"what went wrong."* Applying this tool to cave diving it was found that most diving accidents could usually be attributed to a primary causal factor and typically one or more contributing factors. What's more is that these factors could be "boiled down" into five basic cave diving safety principles; *be trained, utilize a continuous guideline to the surface, manage your gas according to a third's rule or better, don't dive deep (on air)3, and carry at least three lights*. Accident analysis and these resulting safety principles have become the cornerstone of cave diving safety ever since.

As shown in Table 1. below, the predominant causal factor in the accidents above was ***the lack of a "continuous guideline" (line system) to the surface*** that serves as a critical navigation device in the overhead environment of a cave or wreck and an important staging tool during open water staged decompression. Even in the absence of rough sea conditions executing a five to ten stage open water hang in the absence of a decompression line is hazardous and tricky particularly when using hyperoxic mixtures for decompression where depth control is critical.

Though the use of a continuous guideline is one of the fundamental safety tenets in cave diving, the use of lines is still not accepted among many of the hardcore wreck diving community *though its absence has resulted in many wreck diving deaths, near misses and injuries.* Fortunately this mindset is changing. In the accidents discussed above **getting separated from the line and or not carrying/running a reel was the primary factor responsible for the death at Alachua, the second death and decompression incident on the *Andrea Doria* and was a contributing factor in the La Jolla deaths and the U-Who "blow up."**

The second most predominant factor responsible for at least three of incidents above was ***"inadequate gas management,"*** including the lack of pre-planning and violation of gas management rules, for example conducting the dive according to the "Rule of Thirds,"("turning the dive" when the first member consumed one third of his or her gas supply leaving two thirds for the return transit and a reserve). **"Out-of-gas" emergencies are the single greatest risk factor in self-contained diving.** The practice of burning down one's gas supplies to 500 psi or less at depth, and or relying on a pony bottle to exit a wreck and ascend to a decompression gas stage is dangerous and irresponsible. It not only endangers the life of the diver in question but jeopardizes the safety of the entire team.

In at least two of the cases above, the first fatality on the *Andrea Doria* and the La Jolla deaths, the dive team entered the water with *insufficient gas to conduct the dive safely and handle an emergency.* They were in effect conducting "suicide missions."

Though "special mix" was used in six of the cases discussed above, four involving helium mixes, the important issues appear to be operational problems of running out of gas, blow ups and depth control and in the cases of the two enriched air diving accidents: oxygen management. Helium was not the problem. Reducing nitrogen levels (i.e. nitrogen narcosis) at depth by using a helium mixture is clearly a major safety factor and *the failure to use trimix in the deep dives above would have made things worse.*

Clearly, the most critical factor in special mix diving for technical divers is oxygen management. Inadequate oxygen management was the primary factor responsible for death on the *Arundo* where oxygen tolerance limits were knowingly pushed to an extreme. In the case of the death at Devil's Eye, oxygen levels *were outside of the recommended NOAA limits* (PO2s not to exceed 1.6 atm) and involved "high" work levels though there may have been other contributing factors which in the absence of an autopsy will never be known. *Given the depth profile of the system and high work levels, an EAN 32 or 36 mix (max PO2=1.2-1.5 at the max depth of 105 fsw) would have been a wiser, more conservative choice of gas mix.*

Gas mix choices were not an issue in the case of Lake Jocasee convulsion. Rather the problems were that the diver *lost depth control* during decompression resulting in a PO2 spike,*"air breaks" were not utilized* and there were known extenuating circumstances being *extreme diver fatigue* which is believed to have been a major contributing factor to the incident. *This dive should probably have been "called" before it began*.

These incidents highlight the caution and respect that must be used in managing oxygen tolerances and underscore the need for "conservatism" in utilizing hyperoxic mixtures *(including air beyond about 190-200 fsw.)*.

Today there are numerous groups that are running "high" PO2 levels during the working phase of their dives, and there seems to be considerable misunderstanding about oxygen tolerance and some misapplication of management tools such as the NOAA Oxygen Limits which were never designed for technical diving exposures and don't take into account multilevel profiles or varying diver work levels. What's more is that there are still major gaps in our understanding about oxygen tolerance, considerable individual and daily variability exists, and there is scant hard empirical data particularly as it relates to CNS toxicity involving multilevel exposures. As a result, the trend in oxygen management over the years across many different communities, including both commercial and military divers, has been to reduce excessive PO2 exposures (of 1.6 atm or more) in order to avoid oxygen convulsions4. What was thought to be "safe" ten to twenty years ago is now viewed to involve unacceptable risks.

This trend seems to be continuing in technical diving and the emerging community "consensus" seems to be directed at conservatism; **running PO2s below about 1.2-1.45 atm during the working phase of the dive, boosting oxygen levels to a maximum of 1.6 atm during decompression and taking regular "air breaks" during the twenty and ten foot oxygen stops** (see "Rethinking Oxygen Limits" by Dr. R.W. Bill Hamilton on pg. 16). In addition, EAN mixtures such as EAN 50 are being used in place of pure oxygen for decompression in some applications offering the advantage of greater operational flexibility. The potential danger of an inwater seizure is also spurring the development and use of full face mask and block systems which act to prevent drowning in the event that a diver loses consciousness and will facilitate the use of needed underwater communication systems.

As a result many people believe that full face masks and blocks will become the standard equipment for technical diving much as it has in commercial and professional communities.

Note that in the accidents presented above, the *resulting narcosis from the* ***use of air beyond about 190- 200 fsw*** was likely a major contributing factor in the La Jolla fatalities and possibly an issue in the case of the diver failing to employ his reel and lift bag on the *Doria (incident #3)* which resulted in him taking a hit. It also appears to have been a major factor in a number of this summer's deep diving deaths in Europe according to informed sources.

Lack of proper equipment was probably a contributing factor in the second fatality on the *Doria* in which the diver was only carrying a single arguably "inadequate" back up" light. The cave diving community recommends that divers carry a primary and two back up lights. That way in the event of a primary light failure the diver still has a secondary light and a back up. The wreck diving community seems to have taken this principle one step further. The thinking today is that divers should carry two primary lights or at least a "substantial" secondary light. Switching to a one to two watt back up in a silt out or low visibility situation after running a 50-75 watt primary is likely to add to the distressed diver's confusion.

Clearly improper equipment was also the major contributing factor to the La Jolla deaths. The diver's were not equipped to conduct the dive they intended to do. ***It can be easily argued that the typical recreational diving "set" is inadequate for conducting dives beyond about 130-150 fsw and for decompression dives,*** the major problem being inadequate gas volumes (*to handle emergencies*), the lack of self-contained redundancy, a "long hose" on the back up regulator and lines. That is not to say that these dives can't be done; in fact they are done regularly in some communities. ***The point is that these dives cannot be conducted "safely" using recreational equipment and methods.*** Unfortunately many recreational divers seem to be unaware of this fact as evidenced by "beyond the limit" dives regularly conducted at warm water resorts and on home waters.

Though it can be argued that the lack of training is almost always a causal factor in diving accidents, particularly as the term is used in athletic sports i.e."continual work and practice," formal training seems to have played only a contributing role in all but one of the accidents

presented above. With the exception of the La Jolla fatalities and the U-Who incident in which the diver had not "trained" on the equipment he was diving, all of the incidents involved "trained" and "experienced" divers. The point is we need to be careful in assigning accident causality and not treat training courses as an automatic panacea.

It is doubtful whether a formal "nitrox certification" would have prevented the death of the very experienced "self-taught" enriched air diver on the *Arundo* who chose to disregard recognized oxygen limits. Similarly, though it can be argued that the dive team involved the first Doria fatality were not "formally" trained in the use of trimix, that's not what killed the diver in question or nearly killed his partner; poor gas management did. In fact the divers had made previous mix dives, worked with other divers who were "trained" in its use, and were "experienced" by any diving standards.

The fact is that with the exception of enriched air training5, there is presently no formal "standardized" special mix training programs or recognized safety standards in technical diving and only a handful of individuals (and few instructors!) have much experience at all. That's not to say that some of the existing training programs and instructors aren't excellent and that the efforts to set up and build a certification system aren't to be applauded. Rather the facts suggest that simply "getting a card," which is only just a starting point (a carry over from recreational diving?), is not enough and should not be promoted nor treated as a one-stop license that in itself will make a diver drown proof, better qualified, or more of an "expert" than others. What's more is that training is very much *"task and environment specific"* and experience in one environment (ex. caves or wrecks) does not necessarily qualify a diver for another without additional work. Under these circumstances it makes good sense for divers to take responsibility for their own safety, continually seek out the best training available for the dives they plan to conduct and to build up their experience base slowly through practice. ***The bottom line is that technical diving involves a lot of hard dedicated work, continual practice, expense and represents an ongoing learning process.***

Several final factors that contributed to more than one of the incidents above is the ***lack of adequate surface support*** and apparent **"macho" attitudes** which are a theme in this issue of *technicalDiver.* The emerging community consensus is that adequate surface and diver support is essential for the safety of the dive team for many if not most technical level exposures. In this, technical diving is similar to its commercial counterpart. Adequate support might have made a difference in the *Chester Polling* incident and was certainly responsible for saving the lives of the divers on the *Doria* (incident #3) and at Lake Jocasee.

Macho attitudes don't seem to have a place in any kind of diving, particularly those involving technical level exposures. Of course given enough time, the forces of natural selection will eventually take care of the problem and empirically it's much cheaper and more effective than government. Fortunately, as we have learned from the cave diving community there is a better way. As a technical community, we'd be wise to follow their example. Safety first. M2

Box: *Please send any reports or information regarding accidents involving technical-level exposures to aquaCorps: PO Box 4243, Key West, FL 33041. Fax: 305-294-7612.*
Special thanks to Capt. Billy Deans, Terry DeRouin, Dr. R.W. Bill Hamilton, Lamar Hires, Dr. Mark Modano, Bart Malone, Ted Masotti, Karl Shreeves, Wings Stocks, Frans Vandermolen and Dr. Richard Vann for their help in compiling this information.
1. Y. Mano and M. Shibayama "Aspects of Recent Scuba Diving Accidents," Marine Technology Society Journal, Vol. 23, Number 4,"Diving Safety", Dec. 1989 . For information write: MTS, 1825 K St. N.W., Washington, DC 20006.
2. Basic Cave Diving: A Blueprint For Survival can be obtained from the National Speleology Society-Cave Diving Section, PO Box 950, Branford, Florida 32008-0950. ***(This book should be required reading for all technical divers -Ed.)***
3. As explained in "Basic Cave Diving," the original deep diving reccomendation stemmed from the hazards of deep diving on air. Today it is generally recognized that that deep air diving is hazardous. As a

result, the emerging community standard is to discourage air dives beyond about 180-200 fsw depending on the operation and environment.
4. The US Navy is reportedly cutting back their oxygen exposure limits as are others. For example, the new DCIEM Nitrogen/Oxygen (EAN) tables classify working PO2s of 1.5-1.6 atm an "exceptional exposure."
5. Agreements are still needed between the two enriched air training agencies, ANDI and the IAND, if there is to be a consistent set of national training and pumping standards promised at the "Enriched Air workshop" held in Houston, 1992 January (*See* technicalDiver 3.1*, 1992July, for details)*.