



**Maritime Archeological Society**

**STANDARDS FOR SCIENTIFIC DIVING  
MANUAL**

### Revision History

Date	Rev #	Approver	Description
1/13/2019	1	Bill Zanke	Initial Release
8/21/2019	2	Bill Zanke	Updates to Include Safety Diver Requirement

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# Volume 1

## Section 1.00 GENERAL POLICY

### 1.10 Scientific Diving Standards

#### **Purpose**

The Maritime Archeological Society (MAS), a volunteer non-profit organization, maintains the following Scientific Diving Standards to ensure that all diving activity is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness, and to conform to applicable rules and regulations of the Washington State Department of Labor and Industries. These diving standards are adapted from the American Academy of Underwater Sciences (AAUS) and sets forth standards for diver certification, training, equipment and procedures that will maintain safety while enabling MAS to forward its mission to seek out, investigate, and document shipwrecks and other maritime archaeological sites.

This Diving Safety manual provides general and specific regulations for all MAS sponsored research diving and training. Any diving activity conducted by MAS members outside of MAS sponsored events is the responsibility of the individuals involved in that activity.

#### **Scientific Diving Definition**

Scientific diving is defined (29CFR1910.402) as:

“Diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.”

#### **Scientific Diving Exemption**

In 1982, OSHA exempted scientific diving from commercial diving regulations (29 CFR 1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046).

The two elements that a diving program must contain as defined by OSHA in 29 CFR 1910 Subpart T 1910.401(a)(2)(iii) are:

- a) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.
- b) Diving control (safety) board, with the majority of its members being active divers, which must at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices;

and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

OSHA has granted an exemption for scientific diving from commercial diving regulations under the following guidelines (Appendix B to 29 CFR 1910 Subpart T):

- The Diving Control Board consists of a majority of active scientific divers and has autonomous and absolute authority over the scientific diving program's operation.
- The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are non-proprietary.
- The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.
- Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and therefore, are scientists or scientists-in-training.

Washington State Administrative Code (WAC) Chapter 296-37 describes the standards for commercial diving operations. Appendix B to Chapter 296-37 WAC lists the guidelines for scientific diving. It is the intent of this Diving Safety Manual to meet or exceed all relevant Federal and State Standards.

## 1.20 Operational Control

### Diving Control Board

- The Diving Control Board (DCB) must consist of a majority of active scientific divers. Voting members include the Diving Safety Officer (DSO), and other representatives of the diving program such as qualified divers and members selected by procedures established by each OM. A chairperson and a secretary may be chosen from the membership of the board according to local procedure.
- Has autonomous and absolute authority over the scientific diving program's operation.
- Meets, either in person or by web conference, bi-annually to review/modify the MAS diving standards, discuss any diving related issues and schedule diving activities
- The DCB must:
  - Establish additional standards, protocols, and operational procedures beyond the AAUS minimums to address specific needs and concerns.
  - Approve and monitor diving projects.
  - Review and revise the diving safety manual.
  - Ensure compliance with the diving safety manual.
  - Approve the depth to which a diver has been authorized to dive.
  - Take disciplinary action for unsafe practices.
  - Ensure adherence to the buddy system for scientific diving.
  - Act as the official MAS representative concerning the scientific diving program.
  - Act as a board of appeal to consider diver-related problems.
  - Recommend the issue, reissue, or the revocation of diving authorizations.
  - Recommend changes in policy and amendments the MAS diving safety manual as the need arises.
  - Establish and/or approve training protocols or standards
  - Suspend diving operations considered to be unsafe or unwise.
  - Establish criteria for equipment selection and use.
  - Recommend new equipment or techniques.

- Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
- Periodically review the DSO's performance and program.
- Investigate diving incidents within the OM's diving program or violations of the OM's diving safety manual.
- The DCB may delegate operational oversight for portions of the program to the DSO; however, the DCB may not abdicate responsibility for the safe conduct of the diving program.

### **Diving Safety Officer**

The Diving Safety Officer (DSO) serves as a voting member of the DCB and board member of MAS. This person should have broad technical expertise and experience in research related diving.

#### **Qualifications:**

1. Must be an active scuba instructor or Divemaster from an internationally recognized certifying agency.
2. Must be appointed by the responsible administrative officer or designee, with the advice and counsel of the DCB.
  - (b) Has engaged in sustained or successive scientific diving activities during the past two years, or
  - (c) Has completed a course in scientific diving that meets the requirements of MAS.

#### **Duties and Responsibilities**

1. Answers, through the DCB, to the appropriate administrative officer or designee, for the conduct of the scientific diving program of the OM.
2. If delegated by the DCB, the routine operational authority for this program rests with the DSO. This oversight includes, but is not limited to: training, diver authorizations, approval of dive plans, maintenance of diving records, and ensuring compliance with this Manual.
3. May permit some duties and responsibilities to be carried out by a qualified delegate, with the approval of the DCB.
4. Must be guided in the performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the scientific diving program will be retained by the DSO.
5. Must suspend diving operations determined to be unsafe or unwise.

### **Waiver of Requirements**

MAS and the DCB may grant a waiver for specific requirements of training, examinations, depth authorizations, and minimum activity to maintain authorizations.

### **1.30 Consequence of Violation of Regulations by Scientific Divers**

Failure to comply with the regulations of MAS diving safety manual may be cause for the restriction or revocation of the diver's authorization by action of the MAS DCB.

## **1.40 Record Maintenance**

The DSB or designee shall maintain permanent records for each Scientific Diver certified. The file shall include evidence of certification level, log sheets, dive plans (project and/or individual), liability waivers, reports of disciplinary actions by the DCB, and other pertinent information deemed necessary.

### **Availability of Records:**

- Records and documents required by this Manual must be retained by the OM for the following period:
  1. Diving safety manual – Current document only.
  2. Equipment inspection, testing, and maintenance records – Minimum current entry or tag.
  3. Records of Dive – minimum of 1 year, except 5 years where there has been an incident of pressure-related injury.
  4. Diver training records – Minimum of 1 year beyond the life of the diver's program participation.
  5. Liability Waiver(s) – Minimum of 1 year beyond the life of the diver's program participation.
  6. Pressure-related injury assessment - 5 years.
  7. Reports of disciplinary actions by the DCB – Minimum of 1 year beyond the life of the diver's program participation.

## **1.**

# **SECTION 2.00 DIVING REGULATIONS**

## **2.10 Introduction**

No person shall engage in scientific diving operations under the auspices of the MAS scientific diving program unless they are authorized pursuant to the provisions of this *Manual*.

## **2.20 Diver Certification**

All divers must show documented proof of Diver Certification or equivalent from an internationally recognized training agency. The minimum level of certification for a MAS divers is advanced open water or equivalent.

## **2.30 Dive Insurance**

All MAS divers are required to have, at a minimum, DAN Master level Dive Accident Insurance coverage.

## 2.40 Pre-Dive Procedures

### Lead Diver

For each dive, one individual will be designated as the Lead Diver who shall be at the dive location during the diving operation. The Lead Diver shall be responsible for:

- A. Making certain all required paperwork is completed and signed, including liability waivers and the MAS dive plan worksheet
- B. Ensuring dives are conducted in accordance with MAS Standards
- C. Ensuring all dive team members possess current authorization and are qualified for the type of diving operation.
- D. Coordination with other known activities in the vicinity that are likely to interfere with diving operations.
- E. Ensuring safety and emergency equipment is in working order and at the dive site.
- F. Suspending diving operations if in their opinion conditions are not safe.
- G. Reporting to the DCB, through the DSO, any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

### Dive Plans

Dives should be planned around the competency of the least experienced diver in a team. Before conducting any diving operations, the lead diver for a proposed project or dive must formulate a dive plan that should include the following:

- Diving Mode(s) and Gas(es)
- Divers' authorizations
- Approximate number of proposed dives
- Location(s) of proposed dives
- Estimated depth(s) and bottom time(s) anticipated
- Decompression status and repetitive dive plans, if required
- Proposed work, equipment, and boats to be employed
- Any hazardous conditions anticipated
- Emergency Action Plan (Appendix 7)
- In water details of the dive plan should include:
  - Dive Buddy assignments and tasks
  - Goals and objectives
  - Maximum depth(s) and bottom time
  - Gas management plan
  - Entry, exit, descent and ascent procedures
  - Perceived environmental and operational hazards and mitigations
  - Emergency and diver recall procedures

### Diver Responsibility and Refusal to Dive

The decision to dive is that of the diver. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive, without fear of penalty, if in his/her judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of regulations in this *Manual*.

No dive team member will be required to be exposed to hyperbaric conditions against his/her will.



No dive team member may dive for the duration of any known condition, which is likely to adversely affect the safety and health of the diver or other dive team members.

### **Pre-dive Safety Checks**

- Prior to commencing the dive, the team must assure that every team member is healthy, fit, and trained for the type of dive that is being attempted.
- Scientific divers must conduct a functional check of their diving equipment in the presence of the dive buddy or tender. They must ensure the equipment is functioning properly and suitable for the type of diving operation being conducted.
- Each diver must have the capability of achieving and maintaining positive buoyancy at the surface.
- Environmental conditions at the site will be evaluated prior to entering the water.

### **Pre-dive Briefings**

Before conducting any diving operations under the auspices of the OM, the dive team members must be briefed on:

- Dive Buddy assignments and tasks
- Dive objectives.
- Maximum depth(s) and bottom time
- Turn around pressure and required surfacing pressure
- Entry, exit, descent and ascent procedures
- Perceived environmental and operational hazards and mitigations
- Emergency and diver recall procedures

## **2.50 Diving Procedures**

### **Solo Diving Prohibition**

All diving activities must assure adherence to the buddy system. This buddy system is based upon mutual assistance, especially in the case of an emergency.

### **Safety Diver**

A safety diver shall be present for all dives conducted by MAS. The role of the safety diver is to observe the diving activities from shore or the boat and be available to lend assistance to the dive team in the water. The safety diver will have all his/her dive equipment readily available and be wearing the appropriate exposure equipment necessary for the diving environment.

### **Decompression Management**

- On any given dive, both divers in the buddy pair must follow the most conservative dive profile
- A safety stop performed during the ascent phase of the dive should be conducted on any dive that exceeds 30fsw (9.14m).

## **Termination of the Dive**

Any dive must be terminated while there is still sufficient cylinder pressure to permit the diver to safely reach the surface, including decompression time, or to safely reach an additional air source at the decompression station.

It is the responsibility of the diver to terminate the dive that he/she considers unsafe, without fear of reprisal, in a way that does not compromise the safety of another diver already in the water.

## **Emergencies and Deviations from Regulations**

Any diver may deviate from the requirements of this *Manual* to the extent necessary to prevent or minimize a situation likely to cause death, serious physical harm, or major environmental damage. A written report must be submitted to the DCB explaining the circumstances and justifications.

## **2.60 Post-Dive Procedures**

### **Post-Dive Safety Checks**

After the completion of a dive, each diver must report any physical problems, symptoms of decompression sickness, or equipment malfunctions to the Lead Diver, DSO, and/or DCB.

## **2.70 Emergency Procedures**

Each OM will develop emergency procedures which follow the standards of care of the community and must include procedures and implementation criteria for emergency care, recompression, evacuation, and incident reporting.

## **2.80 Flying After Diving or Ascending to Altitude (Over 1000 feet/304 meters)**

- Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.
- Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.
- Before Ascending to Altitude Above 1000 feet (304 meters): Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

## **2.90 Record Keeping Requirements**

### **Personal Diving Log**

Each authorized scientific diver must log every dive made under the auspices of the OM's program and is encouraged to log all other dives. The dive log shall be submitted to the dive safety officer or dive leader as soon as logistically possible after the dive is conducted. The dive log must include at least the following:

- Name of diver and buddy
- Date, time, and location
- Diving modes and gas used
- General nature of diving activities

- Maximum depth and dive time
- Diving tables or computers used
- Detailed report of any near or actual incidents

### **Required Incident Reporting**

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death must be reported to the OM's DCB and AAUS in a timely manner. OMs must record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section. OMs must investigate and document any incident of pressure-related injury and prepare a report that is to be forwarded to AAUS during the annual reporting cycle.

- If pressure-related injuries are suspected, or if symptoms are evident, the following additional information must be recorded and retained by the OM-MAS, with the record of the dive, for a period of 5 years:
  - Written descriptive report shall include:
    - Name, address, phone numbers of the principal parties involved.
    - Summary of experience of divers involved.
    - Location, description of dive site, and description of conditions that led up to incident.
    - The circumstances of the incident and the extent of any injuries or illnesses.
    - Description of symptoms, including depth and time of onset.
    - Description and results of treatment.
    - Disposition of case.
    - Recommendations to avoid repetition of incident.

## **Section 3.00 NITROX DIVING**

### **3.1 Requirements for Nitrox Authorization**

Prior to authorization to use nitrox, the following minimum requirements must be met:

All divers utilizing Nitrox must present Nitrox certification from an internationally recognized training agency.

### **3.2 Oxygen Exposure Limits**

- The inspired oxygen partial pressure experienced at depth should not exceed 1.4ATA.
- All dives utilizing Nitrox will be conducted using 32% Oxygen, +/- 2%.
- The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected.

### **3.3 Calculation of Decompression Status**

- All dives conducted using Nitrox shall be carried out using air tables or with the individuals dive computer set to calculate decompression based on air.

### **3.4 Analysis Verification by User**

- Prior to the dive, it is the responsibility of each diver to analyze the oxygen content of his/her scuba cylinder and acknowledge in writing the following information for each cylinder: fO<sub>2</sub>, MOD, cylinder pressure, date of analysis, and user's name. This information shall be clearly labeled on the divers tank and verified by the dive leader.
- Individual dive log reporting forms should report fO<sub>2</sub> of nitrox used, if different than 21%.

### **3.5 Nitrox Diving Equipment**

#### **Required Equipment**

All of the designated equipment and stated requirements regarding scuba equipment required in section 4 of this manual apply to nitrox operations. Additional minimal equipment necessary for nitrox diving operations includes:

- Labeled SCUBA Cylinders in Accordance with Industry Standards
- Oxygen Analyzers
- Oxygen compatible equipment as applicable

## **SECTION 4.00 DIVING EQUIPMENT**

### **4.10 General Policy**

All equipment must be regularly examined by the person using it and serviced according to manufacturer recommendations. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance. It is the responsibility of each MAS diver to ensure his/her dive gear has been serviced and is in good working order. The DSO or dive leader may refuse to allow a diver to conduct a dive if they observe that a divers gear appears to be defective or does not meet minimum MAS dive gear standards.

### **4.20 Equipment**

The minimum gear configuration is as follows:

#### **Regulators and Gauges**

- Scuba regulators and gauges must be inspected and tested prior to each use and serviced, at a minimum, according to manufacturer's recommendations
- Standard open circuit (OC) regulator configuration is:
  - A first stage
  - Primary 2<sup>nd</sup> stage
  - Back up 2<sup>nd</sup> stage
  - Submersible Pressure Gauge (SPG)
  - Inflator hose for a Buoyancy Compensator Device

### **Equipment for Determination of Decompression Status**

- Each member of the buddy team must have an underwater timing device and depth indicator, or dive computer
- If dive tables are being used a set must be available at the dive location
- If a dive computer is used the diver must use the same computer used on repetitive dives.

### **Scuba Cylinders**

- Scuba cylinders must be designed, constructed, and maintained in accordance with the applicable provisions of the Unfired Pressure Vessel Safety Orders.
- Scuba cylinders must be hydrostatically tested in accordance with DOT standards.
- Scuba cylinders must have an internal and external inspection at intervals not to exceed 12 months.
- Scuba cylinder valves must be functionally tested at intervals not to exceed 12 months.

### **Buoyancy Compensation Devices (BCD)**

- Each diver must have the capability of achieving and maintaining neutral buoyancy underwater and positive buoyancy at the surface.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must be equipped with an exhaust valve and shall have enough buoyancy to keep a diver afloat at the surface.
- These devices must be functionally inspected and tested at intervals not to exceed 12 months.
- BCDs, dry suits, or other variable volume buoyancy compensation devices must not be used as a lifting device in lieu of lift bags.

## **4.30 Support Equipment**

### **First Aid Supplies**

- A first aid kit and emergency oxygen appropriate for the diving being conducted must be available at the dive site.

### **Diver's Flag**

- A diver's flag must be displayed prominently whenever diving is conducted under circumstances where required or where water traffic is probable.

# Volume 2

## APPENDIX 1 DEFINITION OF TERMS

*Air sharing* - Sharing of an air supply between divers.

*ATA(s)* - “Atmospheres Absolute”, Total pressure exerted on an object, by a gas or mixture of gases, at a specific depth or elevation, including normal atmospheric pressure.

*Alternate Gas Supply* - Fully redundant system capable of providing a gas source to the diver should their primary gas supply fail.

*Authorization*-The DCB authorizes divers to dive using specialized modes of diving, and the depth they may dive to.

*Breath-hold Diving* - A diving mode in which the diver uses no self-contained or surface-supplied air or oxygen supply.

*Bubble Check* - Visual examination by the dive team of their diving systems, looking for O-ring leaks or other air leaks conducted in the water prior to entering a cave. Usually included in the "S" Drill.

*Buddy Breathing* - Sharing of a single air source between divers.

*Buddy System* -Two comparably equipped scuba divers in the water in constant communication.

*Buoyant Ascent* - An ascent made using some form of positive buoyancy.

*Cave Dive* - A dive, which takes place partially or wholly underground, in which one or more of the environmental parameters defining a cavern dive are exceeded.

*Cavern Dive* - A dive which takes place partially or wholly underground, in which natural sunlight is continuously visible from the entrance.

*Certified Diver* - A diver who holds a recognized valid certification from an AAUS OM or internationally recognized certifying agency.

*(Scientific Diver) Certification*- A diver who holds a recognized valid certification from an AAUS OM

*Controlled Ascent* - Any one of several kinds of ascents including normal, swimming, and air sharing ascents where the diver(s) maintain control so a pause or stop can be made during the ascent.

*Cylinder* - A pressure vessel for the storage of gases.

*Decompression Sickness* - A condition with a variety of symptoms, which may result from gas, and bubbles in the tissues of divers after pressure reduction.

*Designated Person-In-Charge* – Surface Supplied diving mode manning requirement. An individual designated by the OM DCB or designee with the experience or training necessary to direct, and oversee in the surface supplied diving operation being conducted.

*Dive* - A descent into the water, an underwater diving activity utilizing compressed gas, an ascent, and return to the surface.

*Dive Computer* - A microprocessor based device which computes a diver's theoretical decompression status, in real time, by using pressure (depth) and time as input to a decompression model, or set of decompression tables, programmed into the device.

*Dive Location* - A surface or vessel from which a diving operation is conducted.

*Dive Site* - Physical location of a diver during a dive.

*Dive Table* - A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.

*Diver* – A person who stays underwater for long periods by having compressed gas supplied from the surface or by carrying a supply of compressed gas.

*Diver-In-Training* - An individual gaining experience and training in additional diving activities under the supervision of a dive team member experienced in those activities.

*Diving Mode* - A type of diving required specific equipment, procedures, and techniques, for example, snorkel, scuba, surface-supplied air, or mixed gas.

*Diving Control Board (DCB)* - Group of individuals who act as the official representative of the membership organization in matters concerning the scientific diving program (See Diving Control Board under Section 1.0).

*Diving Safety Officer (DSO)* - Individual responsible for the safe conduct of the scientific diving program of the membership organization (See Diving Safety Officer under Section 1.0).

*DPIC* – See Designated Person-In-Charge.

*EAD* - Equivalent Air Depth (see below).

*Emergency Swimming Ascent* - An ascent made under emergency conditions where the diver may exceed the normal ascent rate.

*Enriched Air (EANx)* - A name for a breathing mixture of air and oxygen when the percent of oxygen exceeds 21%. This term is considered synonymous with the term “nitrox” (Section 6.00).

*Equivalent Air Depth (EAD)* - Depth at which air will have the same nitrogen partial pressure as the nitrox mixture being used. This number, expressed in units of feet seawater or saltwater, will always be less than the actual depth for any enriched air mixture.

*Flooded Mine Diving* - Diving in the flooded portions of a man-made mine. Necessitates use of techniques detailed for cave diving.

*fO<sub>2</sub>* - Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume.

*FSW* - Feet of seawater.

*Gas Management* - Gas planning rule which is used in cave diving environments in which the diver reserves a portion of their available breathing gas for anticipated emergencies (See Rule of Thirds, Sixths).

*Gas Matching* – The technique of calculating breathing gas reserves and turn pressures for divers using different volume cylinders. Divers outfitted with the same volume cylinders may employ the Rule of Thirds for gas management purposes. Divers outfitted with different volume cylinders will not observe the same gauge readings when their cylinders contain the same gas volume, therefore the Rule of Thirds will not guarantee adequate reserve if both divers must breathe from a single gas volume at a Rule of Thirds turn pressure. Gas Matching is based on individual consumption rates in volume consumed per minute. It allows divers to calculate turn pressures based on combined consumption rates and to convert the required reserve to a gauge based turn pressure specific to each diver’s cylinder configuration.

*Guideline* - Continuous line used as a navigational reference during a dive leading from the team position to a point where a direct vertical ascent may be made to the surface.

*Hookah* - While similar to Surface Supplied in that the breathing gas is supplied from the surface by means of a pressurized hose, the supply hose does not require a strength member, pneumofathometer hose, or communication line. Hookah equipment may be as simple as a long hose attached to a standard scuba cylinder supplying a standard scuba second stage. The diver is responsible for the monitoring his/her own depth, time, and diving profile.



*Hyperbaric Chamber* - See decompression chamber.

*Hyperbaric Conditions* - Pressure conditions in excess of normal atmospheric pressure at the dive location.

*Independent Reserve Breathing Gas* - A diver-carried independent supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by another diver.

*Jump/Gap Reel* - Spool or reel used to connect one guide line to another thus ensuring a continuous line to the exit.

*Life Support Equipment* – Underwater equipment necessary to sustain life.

*Lead Diver* - Certified scientific diver with experience and training to conduct the diving operation.

*Organizational Member (OM)* - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the *AAUS Manual*.

*Manifold with Isolator Valve* - A manifold joining two diving cylinders, that allows the use of two completely independent regulators. If either regulator fails, it may be shut off, allowing the remaining regulator access to the gas in both of the diving cylinders.

*Mixed Gas* - Breathing gas containing proportions of inert gas other than nitrogen greater than 1% by volume.

*Mixed Gas Diving* - A diving mode in which the diver is supplied in the water with a breathing gas other than air.

*MOD* - Maximum Operating Depth, usually determined as the depth at which the  $pO_2$  for a given gas mixture reaches a predetermined maximum.

*Nitrox* - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 22% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.

*Normal Ascent* - An ascent made with an adequate air supply at a rate of 30 feet per minute or less.

*OTU* - Oxygen Toxicity Unit

*Oxygen Compatible* - A gas delivery system that has components (O-rings, valve seats, diaphragms, etc.) that are compatible with oxygen at a stated pressure and temperature.

*Oxygen Service* - A gas delivery system that is both oxygen clean and oxygen compatible.

*Oxygen Toxicity* - Any adverse reaction of the central nervous system (“acute” or “CNS” oxygen toxicity) or lungs (“chronic”, “whole-body”, or “pulmonary” oxygen toxicity) brought on by exposure to an increased (above atmospheric levels) partial pressure of oxygen.

*Penetration Distance* - Linear distance from the entrance intended or reached by a dive team during a dive at a dive site.

*Pressure-Related Injury* - An injury resulting from pressure disequilibrium within the body as the result of hyperbaric exposure. Examples include: decompression sickness, pneumothorax, mediastinal emphysema, air embolism, subcutaneous emphysema, or ruptured eardrum.

*Pressure Vessel* - See cylinder.

$pO_2$  - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

*Primary Reel* - Initial guideline used by the dive team from open water to maximum penetration or a permanently installed guideline.

*Psi* - Unit of pressure, “pounds per square inch.

*Psig* - Unit of pressure, “pounds per square inch gauge.

*Recompression Chamber* - A pressure vessel for human occupancy. Also called a hyperbaric chamber or decompression chamber.

*Restriction* - Any passage through which two divers cannot easily pass side by side while sharing air.

*Rule of Thirds* - Gas planning rule which is used in cave diving environments in which the diver reserves 2/3's of their breathing gas supply for exiting the cave or cavern.

*Rule of Sixths* - Air planning rule which is used in cave or other confined diving environments in which the diver reserves 5/6's of their breathing gas supply (for DPV use, siphon diving, etc.) for exiting the cave or cavern.

*Safety Drill* - ("S" Drill) - Short gas sharing, equipment evaluation, dive plan, and communication exercise carried out prior to entering a cave or cavern dive by the dive team.

*Safety Reel* - Secondary reel used as a backup to the primary reel, usually containing 150 feet of guideline that is used in an emergency.

*Scientific Diving* - Scientific diving is defined (29CFR1910.402) as diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks.

*Scuba Diving* - A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

*Side Mount* - A diving mode utilizing two independent SCUBA systems carried along the sides of the diver's body; either of which always has sufficient air to allow the diver to reach the surface unassisted.

*Siphon* - Cave into which water flows with a generally continuous in-current.

*Standby Diver* - A diver at the dive location capable of rendering assistance to a diver in the water.

*Surface Supplied Diving* - Surface Supplied: Dives where the breathing gas is supplied from the surface by means of a pressurized umbilical hose. The umbilical generally consists of a gas supply hose, strength member, pneumofathometer hose, and communication line. The umbilical supplies a helmet or full-face mask. The diver may rely on the tender at the surface to keep up with the divers' depth, time and diving profile.

*Swimming Ascent* - An ascent, which can be done under normal or emergency conditions accomplished by simply swimming to the surface.

*Tender* - Used in Surface supplied and tethered diving. The tender comprises the topsides buddy for the in-water diver on the other end of the tether. The tender must have the experience or training to perform the assigned tasks in a safe and healthful manner.

*Turn Pressure* – The gauge reading of a diver's open circuit scuba system designating the gas limit for terminating the dive and beginning the exit from the water.

*Umbilical* - Composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies a diver or bell with breathing gas, communications, power, or heat, as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.