



DIVE SAFETY MANUAL
STANDARDS FOR SCIENTIFIC DIVING

DIVING SAFETY PROGRAM
UNIVERSITY OF CALIFORNIA, SANTA BARBARA

FOREWARD

Since 1951 the scientific diving community had endeavored to promote safe, effective diving through self-imposed diver training and education programs. Over the years, manuals for diving safety have been circulated between organizations, revised and modified for local implementation, and have resulted in an enviable safety record. Scientific diving was exempted from the OSHA *Commercial Diving Regulations* upon the evidence of genuine self-control in the scientific community.

This document is drawn from the American Academy of Underwater Sciences (AAUS) Manual for Scientific Diving Certification and Operations of Scientific Diving Programs. The AAUS document represents the minimum safety standards for scientific diving at the present day.

The policies, procedures and standards set forth in this Diving Safety Manual are intended to govern the training and diving operations of all personnel participating in the Certified Scientific Diving Program at the University of California, Santa Barbara. It applies to all divers operating under University auspices, including visiting divers, and to those campus officers responsible for the administration of the SCUBA program.

CONTENTS

Volume I

Section 1.00 GENERAL POLICY

| | |
|---|---|
| 1.10 Purpose | 5 |
| 1.20 Operational Control | 5 |
| 1.30 Consequence of Violation of Regulations by Scientific Divers | 8 |
| 1.40 Consequences of Violation of Regulations by UCSB | 8 |

Section 2.00 DIVING REGULATIONS FOR SCUBA (Open Circuit, Compressed Air)

| | |
|----------------------------------|----|
| 2.10 Introduction | 9 |
| 2.20 Pre-Dive Procedures | 9 |
| 2.30 Diving Procedures | 10 |
| 2.40 Post-Dive Procedures | 11 |
| 2.50 Flying After Diving | 12 |
| 2.60 Record Keeping Requirements | 12 |

Section 3.00 DIVING EQUIPMENT

| | |
|----------------------------|----|
| 3.10 General Policy | 14 |
| 3.20 Equipment | 14 |
| 3.30 Equipment Maintenance | 15 |
| 3.40 Air Quality Standards | 16 |

Section 4.00 SCIENTIFIC DIVER AUTHORIZATION REQUIREMENTS

| | |
|---|----|
| 4.10 General Policy | 17 |
| 4.20 Prerequisites | 17 |
| 4.30 Training | 17 |
| 4.40 Types of Authorization | 20 |
| 4.50 Waiver of Requirements | 21 |
| 4.60 Depth Authorization and Progression | 21 |
| 4.70 Continuation of Scientific Authorization | 21 |
| 4.80 Revocation of Authorization | 22 |

Section 5.00 MEDICAL STANDARDS

| | |
|--|----|
| 5.10 Medical Requirements | 23 |
| 5.20 Frequency of Medical Evaluations | 23 |
| 5.30 Information Provided Examining Physicians | 23 |
| 5.40 Content of Medical Evaluations | 24 |
| 5.50 Physician's Written Report | 24 |

Volume II

Section 6.00 NITROX DIVING

| | |
|---|----|
| 6.10 Requirements for Nitrox Authorization | 25 |
| 6.20 Minimum Activity to Maintain Authorization | 26 |
| 6.30 Operational Requirements | 26 |
| 6.40 Nitrox Diving Equipment | 26 |

Section 7.00 OTHER DIVING TECHNOLOGY

| | |
|----------------------------------|----|
| 7.10 Blue Water Diving | 28 |
| 7.20 Ice and Polar Diving | 28 |
| 7.30 Overhead Environments | 28 |
| 7.40 Staged Decompression Diving | 28 |

| | |
|--------------------------------|----|
| 7.50 Hookah | 28 |
| 7.60 Surface Supplied Diving | 28 |
| 7.70 Mixed Gas Diving | 29 |
| 7.80 Drysuit Diving | 29 |
| 7.90 Dive Computers | 29 |
| 7.100 Altitude Diving | 29 |
| 7.110 Offshore Platform Diving | 29 |
| 7.120 Cave and Cavern Diving | 29 |
| 7.130 Rebreathers | 30 |
| 7.140 Saturation Diving | 30 |
| 7.150 Aquarium Diving | 30 |

APPENDICES

| | | |
|-------------|---|----|
| APPENDIX 1 | Diving Medical Exam Overview for the Examining Physician | 31 |
| APPENDIX 2 | AAUS/Medical Evaluation of Fitness for Scuba Diving Report | 33 |
| APPENDIX 2b | Applicant's Release of Medical Information Form | 34 |
| APPENDIX 3 | Diving Medical History Form | 35 |
| APPENDIX 4 | AAUS/CSB Request for Diving Reciprocity Form | 38 |
| APPENDIX 5 | Diving Emergency Management Procedures | 39 |
| APPENDIX 6 | Recommendations for Rescue of Submerged Unresponsive Compressed-Gas Diver | 40 |
| APPENDIX 7 | Definition of Terms | 41 |
| APPENDIX 8 | AAUS Statistic Collection Criteria and Definitions | 46 |

VOLUME I

SECTION 1.00 **General Policy**

1.10 PURPOSE

1.11 *The Diving Safety Program*

The purposes of a diving safety program are to insure that all diving under the auspices of the University of California, Santa Barbara (UCSB) is conducted in a manner most likely to minimize accidental injury or occupational illness, and to set forth rules, regulations and standards for training and authorization which will allow a working reciprocity between American Academy of Underwater Sciences (AAUS) member organizations.

1.12 *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.”

1.13 *The Diving Safety Manual*

The purpose of this Diving Safety Manual is to set forth the basic underwater diving safety policy, organization, regulations and procedures for UCSB’s diving operations and to meet OSHA’s guidelines to exempt our scientific diving activities from commercial diving regulations (29CFR1910 Subpart T and 29CFR1910.401). As part of UCSB’s annual report to AAUS, any recommendations for modifications of UCSB’s standards should be submitted to AAUS for consideration.

1.20 OPERATIONAL CONTROL

1.21 *University of California, Santa Barbara (UCSB) Auspices Defined:*

For the purposes of these standards the auspices of UCSB includes any scientific diving operation in which UCSB is connected because of ownership of any life support equipment used, locations selected, or relationship with the individual(s) concerned. This includes all cases involving the operations of employees of UCSB or employees of auxiliary organizations, where such employees are acting within the scope of their employment, and the operations of other persons who are engaged in scientific diving with UCSB or are diving as members of an organization recognized by UCSB.

It is UCSB's responsibility to adhere to the AAUS Standards for Scientific Diving Authorization and Operation of Scientific Diving Programs. The administration of the local diving program will reside with the UCSB Diving Control Board. The regulations herein shall be observed at all locations where scientific diving is conducted:

A. *Training and Authorization*

Any person diving under UCSB auspices is required to observe the provisions of this Manual. Individuals are not permitted to dive until they have met the requirements for diving pertinent to the level of the proposed activity.

B. *Equipment*

All diving under UCSB auspices shall be done with equipment, regardless of ownership, which conforms to the standards set in Section 3 of this Manual.

C. *Diving Rules*

The regulations herein shall be observed at all locations, whether or not owned by UCSB, where diving is carried out under UCSB auspices.

1.22 Authority and Responsibility

Maximum authority and operational responsibility for the conduct of the diving safety program on the Santa Barbara campus is vested in the Chancellor. He/she is responsible for providing surveillance of campus diving activities, interpreting University policies, and developing additional campus policies, regulations and standards consistent with University policies.

A. *Authority*

1. The Environmental Health and Safety Office has the authority to suspend diving operations of programs that are considered unsafe.
2. A representative of the Environmental Health and Safety Office shall meet with the DCB as an ex-officio member.

B. *Responsibilities (UCSB Policy 5400)*

1. The Vice Chancellors are responsible for ensuring that units under their authority comply with the campus environmental health and safety policy. Deans, unit heads, principal investigators, and supervisors are accountable for establishing and maintaining programs to ensure compliance within their areas and which will provide a safe and healthy environment.
2. All employees are responsible for knowing the applicable safety regulations governing the activities they carry out and are accountable for complying with them.

1.23 UCSB Scientific Diving Standards and Safety Manual

UCSB shall develop and maintain a scientific diving safety manual, which provides for the development and implementation of policies and procedures that will enable UCSB to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. UCSB scientific diving standards shall include, but not be limited to:

- A. The AAUS Standards may be used as a set of minimum guidelines for the development of the UCSB scientific diving safety manual.
- B. Emergency evacuation and medical treatment procedures.
- C. The criteria for diver training and authorization.
- D. Standards written or adopted by reference for diving modes utilized including the following:
 1. Safety procedures for the diving operation.
 2. Responsibilities of the dive team members.
 3. Equipment use and maintenance procedures.
 4. Emergency procedures.

1.24 The Diving Control Board

A. *Composition*

The Diving Control Board (DCB) shall consist of a majority of active scientific divers. Voting members shall include the Diving Safety Officer (DSO), the responsible administrative officer, or his/her designee, and should include other representatives of the diving program. A chairperson and a secretary may be chosen from the membership of the board according to DCB procedure. A representative of EH&S will be an ex-officio member.

B. *Authority*

The DCB shall have the autonomous authority over the UCSB Scientific Diving Program

C. Responsibilities

The DCB is responsible for setting policy and shall:

1. Shall act as a board of appeal to consider diver-related problems.
2. Shall periodically review the DSO's performance and program.
3. Shall sit as a board of investigation to inquire into the nature and cause of diving accidents or violations of UCSB diving manual.
4. Acting through the DSO, the DCB shall oversee the following:
 - i. *Establish additional standards, protocols, and operational procedures beyond the AAUS minimums to address OM specific needs and concerns.*
 - ii. *Approve and monitor diving projects.*
 - iii. *Review and revise the diving safety manual.*
 - iv. *Ensure compliance with the diving safety manual.*
 - v. *Approve the depth to which a diver has been authorized to dive.*
 - vi. *Take disciplinary action for unsafe practices.*
 - vii. *Ensure adherence to the buddy system for scientific diving.*
 - viii. *Act as the official representative of the OM in matters concerning the scientific diving program.*
 - ix. *Act as a board of appeal to consider diver-related problems.*
 - x. *Recommend the issue, reissue, or the revocation of diving authorizations.*
 - xi. *Recommend changes in policy and amendments to AAUS and the OM's diving safety manual as the need arises.*
 - xii. *Establish and/or approve training protocols or standards through which the applicants for authorization can satisfy the requirements of the OM's diving safety manual.*
 - xiii. *Suspend diving operations considered to be unsafe or unwise.*
 - xiv. *Establish criteria for equipment selection and use.*
 - xv. *Recommend new equipment or techniques.*
 - xvi. *Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.*
 - xvii. *Ensure that the OM's air station(s) meet air quality standards in this manual.*
 - xviii. *Periodically review the DSO's performance and program.*
 - xix. *Investigate diving incidents within the OM's diving program or violations of the OM's diving safety manual.*
5. 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.

1.25 The Diving Safety Officer

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

A. Qualifications

1. Shall be an active scuba instructor from an internationally recognized certifying agency.
2. Shall be appointed by the responsible administrative officer or designee, with the advice and counsel of the DCB.
3. Shall qualify as a Full Voting Member of AAUS as defined by AAUS Bylaws.
4. Shall attend an AAUS DSO Orientation within one year of accepting a position at an AAUS approved OM, unless he/she has served as a DSO for another current AAUS OM within the last year.

B. 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. Shall 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. Shall suspend diving operations determined to be unsafe or unwise.

1.27 Instructional Personnel

A. Qualifications

All personnel involved in diving instruction under the auspices of UCSB shall be qualified for the type of instruction being given.

B. Selection

The responsible administrative officer, or his/her designee, who will solicit the advice of the DCB in conducting preliminary screening of applicants for instructional positions, will select instructional personnel.

1.28 Reciprocity and Visiting Scientific Diver

- A. Two or more AAUS organizational members engaged jointly in diving activities, or engaged jointly in the use of diving resources, shall designate one of the participating DCBs to govern the joint dive project. However, responsibility for individual divers ultimately resides with the diver's home OM.
- B. A scientific diver from an organizational member shall apply for permission to dive under the auspices of another organizational member by submitting to the Diving Safety Officer of the host organizational member a document containing all the information described in Appendix 2, approved by the DSO or Chairperson of the home DCB.
- C. A visiting scientific diver may be asked to demonstrate his/her knowledge and skills for the planned diving.
- D. If a host organizational member denies a visiting scientific diver permission to dive, the host DCB shall notify the visiting scientific diver and their DCB with an explanation of all reasons for the denial.

1.29 Waiver of Requirements

The organizational DCB may grant a waiver for specific requirements of training, examinations, depth authorization, and minimum activity to maintain authorization.

1.30 CONSEQUENCES OF VIOLATION OF REGULATIONS BY SCIENTIFIC DIVERS

Failure to comply with the regulations of the UCSB diving manual may be cause for the revocation or restriction of the diver's scientific diving certificate by action of the UCSB DCB.

1.40 CONSEQUENCES OF VIOLATION OF REGULATIONS BY UCSB

Failure to comply with the regulations of this standard may be cause for the revocation or restriction of UCSB recognition by the AAUS.

SECTION 2.00
Diving Regulations for SCUBA (Open Circuit, Compressed Air)

2.10 INTRODUCTION

No person shall engage in scientific diving operations under the auspices of UCSB scientific diving program unless he/she holds a current authorization issued pursuant to the provisions of this manual.

2.20 PRE-DIVE PROCEDURES

2.21 Dive Plan

Dives should be planned around the competency of the least experienced diver. Before conducting any diving operations under the auspices of UCSB, the lead diver/dive manager for a proposed operation shall have the general dive plan approved by the DSO. The dive plan form is available on UCSB's Dive Safety website.

A. The dive plan should include the following:

1. Diving Mode(s) and Gas(es)
2. Divers' authorizations
3. Approximate number of proposed dives
4. Location(s) of proposed dives
5. Estimated depth(s) and bottom time(s) anticipated
6. Decompression status and repetitive dive plans, if required
7. Proposed work, equipment, and boats to be employed
8. Any hazardous conditions anticipated
9. Emergency Action Plan
10. In water details of the dive plan should include:
 - i. *Dive Buddy assignments and tasks*
 - ii. *Goals and objectives*
 - iii. *Maximum depth(s) and bottom time*
 - iv. *Gas management plan*
 - v. *Entry, exit, descent and ascent procedures*
 - vi. *Perceived environmental and operational hazards and mitigations*
 - vii. *Emergency and diver recall procedures*

2.22 Pre-dive Safety Checks

- A. Prior to commencing the dive, the team shall assure that every team member is healthy, fit, and trained for the type of dive that is being attempted.
- B. Scientific divers shall conduct a functional check of their diving equipment in the presence of the dive buddy or tender. They shall ensure the equipment is functioning properly and suitable for the type of diving operation being conducted.
- C. Each diver shall have the capability of achieving and maintaining positive buoyancy at the surface.
- D. Environmental conditions at the site will be evaluated prior to entering the water.
- E. Diver's Responsibility:
 1. Each scientific diver shall conduct a functional check of his or her diving equipment in the presence of the diving buddy or tender.
 2. 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 if, in his/her judgment, conditions are unfavorable, or if he/she would be violating the precepts of his/her training, or UCSB diving manual.

3. No dive team member shall be required to be exposed to hyperbaric condition against his or her will.
4. 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.

2.23 Emergency Procedures

Scientific diving shall not be conducted unless the emergency plan information is complete and has been approved by the DSO. The lead diver must ensure that first aid emergency, communication devices and oxygen administration equipment are in working order and available as described within the emergency plan.

2.30 DIVING PROCEDURES

2.31 Lead Diver/Diver-in Charge

For each dive, one individual shall be designated as the lead diver. This person shall be at the dive location during the entire diving operation. The lead diver shall be responsible for:

A. Coordination

Diving shall be coordinated with other known activities in the vicinity, which are likely to affect diving operations. The lead diver shall suspend diving operations if in his/her opinion conditions are not safe.

B. Briefing

The dive team members shall be briefed on:

1. Dive Buddy assignments and tasks
2. Dive objectives.
3. Maximum depth(s) and bottom time
4. Gas management plan
5. Entry, exit, descent and ascent procedures
6. Perceived environmental and operational hazards and mitigations
7. Emergency and diver recall procedures.

C. Dive Planning

Planning of a diving operation shall be in accordance with this manual and include the following considerations of the safety and health aspects of the divers.

1. Diving mode
2. Surface and underwater conditions and hazards
3. Breathing gas supply
4. Thermal protection
5. Diving equipment
6. Qualifications of all dive team members for the type of diving operations
7. Residual inert gas status of dive team members
8. Decompression schedules and altitude corrections
9. Emergency procedures.

D. Emergency Equipment.

The lead diver shall ensure that emergency equipment is present.

2.32 Buddy Diving Requirements and Solo Diving Prohibition

All diving activities shall assure adherence to the buddy system (two or three suitably equipped divers that shall be in effective communication throughout the dive). This buddy system is based upon mutual assistance, especially in the case of an emergency.

2.33 Termination of the Dive

- A. It is the responsibility of the diver to terminate the dive, without fear of penalty, whenever they feel it is unsafe to continue the dive, unless it compromises the safety of another diver already in the water.
- B. The dive shall 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.

2.34 Refusal to Dive

- A. The decision to dive is that of the diver. A diver may refuse to dive, without fear of penalty, whenever he/she feels it is unsafe for them to make the dive.
- B. The ultimate responsibility for safety rests with the individual diver. It is the diver's responsibility and duty to refuse to dive if, in their judgment, conditions are unsafe or unfavorable, or if he/she would be violating the precepts of his/her training or the regulations in this manual.

2.35 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, which is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions shall be submitted to the DCB explaining the circumstances and justifications.

2.36 Enclosed or Confined Spaces

Where an enclosed or confined space is not large enough for two divers, a diver shall be stationed at the underwater point of entry and an orientation line shall be used.

2.37 Dive Flags

A dive flag shall be displayed prominently over the dive site whenever diving is conducted.

2.38 Dive Computers and Dive Tables

The use of dive computers or dive tables as a means of determining decompression status is required for all dives conducted under the auspices of the UCSB. On any given dive, both divers in the buddy pair shall follow the most conservative dive profile.

2.39 Depth Limits

- A. Each scientific diver shall be authorized to a specific depth limit by the DSO.
- B. Each scientific diver diving under the auspices of the UCSB shall not exceed his/her depth authorization, unless accompanied by a diver certified to a greater depth. Under these circumstances the diver may not exceed his/her depth limit by more than one step.

2.40 POST-DIVE PROCEDURES

2.41 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.

2.42 Post-Dive Safety Checks

It is the responsibility of each buddy team member to inform the Lead Diver if they have any concerns with aspects of the dive operation as conducted during the dive. Operations will not continue until those concerns have been addressed to the satisfaction of the buddy team and Lead Diver. If needed, the team should contact the DSO for assistance in addressing any concern/s with the dive operation.

2.50 FLYING AFTER DIVING or ASCENDING TO ALTITUDE (Over 2200 feet)

- A. Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours
- B. Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.
- C. Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.
- D. Before ascending to Altitude (above 2200 feet) by land transport: Divers should follow the appropriate guideline for preflight surface intervals unless the decompression procedure used has accounted for the increase in elevation.

2.60 RECORDKEEPING AND REQUIREMENTS

2.61 Logging Dives

Each certified scientific diver shall log every dive made under the auspices of the UCSB program, and is encouraged to log all other dives. Dives should be logged at least monthly into the UCSB on-line dive log database. Details of the submission procedures are left to the discretion of the DSO. The diving log shall be in a form specified by the Diving Safety Office and shall include at least the following:

- A. Name of diver, buddy, and Lead Diver.
- B. Date, time, and location.
- C. Diving modes used.
- D. General nature of diving activities.
- E. Approximate surface and underwater conditions.
- F. Maximum depths, bottom time and surface interval time.
- G. Diving table or computer used.
- H. Detailed report of any near or actual incidents.

2.62 Record Maintenance

It is the responsibility of the individual diver to maintain his/her active scientific diver status. The DSO or his/her designee shall maintain permanent records for each individual scientific diver certified. The file shall include evidence of certifications, dive logs, results of current physical examination, waivers, reports of disciplinary actions by the DCB, and other pertinent information deemed necessary.

2.63 Required Incident Reporting

All diving incidents requiring recompression treatment, or resulting in moderate or serious injury, or death shall be reported to the UCSB DCB. UCSB's regular procedures for incident reporting, including those required by the AAUS shall be followed. The report will specify the circumstances of the incident and the extent of any injuries or illnesses. Additional information shall meet the following reporting requirements:

- A. UCSB shall record and report occupational injuries and illnesses in accordance with requirements of the appropriate Labor Code section.
- B. If pressure-related injuries are suspected, or if symptoms are evident, the following additional information shall be recorded and retained by UCSB, with the record of the dive, for a period of 5 years and a written descriptive report should include:

1. Name, address, and phone numbers of the principal parties involved
 2. Summary of experience of divers involved
 3. Location, description of dive sites and description of conditions that led up to incident
 4. Description of symptoms, including depth and time of onset
 5. Description and results of treatment
 6. Disposition of case
 7. Recommendations to avoid repetition of incident
- C. The DCB shall investigate and document any incident of pressure-related injury and prepare a report, which is to be forwarded to the AAUS during the annual reporting cycle. This report shall first be reviewed and released by the UCSB DCB.

SECTION 3.00 **Diving Equipment**

3.10 GENERAL POLICY

- A. All equipment shall meet standards as determined by the DSO and the DCB. Equipment that is subjected to extreme usage under adverse conditions should require more frequent testing and maintenance.
- B. It is the responsibility of the primary user (the diver) to regularly examine their equipment and verify that it is fit for use prior to each dive.

3.20 EQUIPMENT

3.21 Regulators and Gauges

- A. Scuba regulators and gauges shall be inspected by the diver prior to each use. Regulators and gauges should be functionally inspected/tested at intervals not to exceed 12 months. The regulator first and second stages should also be serviced at a minimum every two years, or per manufacturer's recommendations.
- B. Standard open circuit (OC) regulator configuration is:
 - 1. A first stage
 - 2. Primary 2nd stage
 - 3. Back up 2nd stage
 - 4. Submersible Pressure Gauge (SPG)
 - 5. Inflator hose for a Buoyancy Compensator Device
- C. A Full Face Mask may be used in place of the primary 2nd stage according to manufacturer's recommendations

3.22 Equipment for Determination of Decompression Status

- A. Each member of the buddy team shall have an underwater timing device and depth indicator, or dive computer.
- B. If dive tables are being used a set shall be available at the dive location.
- C. If a dive computer is used the diver shall use the same computer used on repetitive dives.
- D. Ascent should be initiated when the no-deco time displayed at depth is no less than 10 minutes (5 min at depths 100 ft or greater) without prior approval from the DSO.
- E. In an aquarium or other manmade structure of a known maximum obtainable depth:
 - 1. A depth indicator is not required, except when a diver's decompression status shall be taken into consideration on repetitive dives.
 - 2. Only one buddy shall be equipped with a timing device.
 - 3. The maximum obtainable depth of the aquarium shall be used as the diving depth.

3.23 Scuba Cylinders

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

D. Scuba cylinder valves shall be functionally tested at intervals not to exceed 12 months.

3.24 Buoyancy Compensation Devices (BCD)s

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

3.25 Hand held underwater power tools

Electrical tools and equipment used underwater shall be specifically approved for this purpose. Electrical tools and equipment supplied with power from the surface shall be de-energized before being placed into or retrieved from the water. Hand held power tools shall not be supplied with power to the dive location until requested by the diver.

3.26 First aid supplies

First aid kit and emergency oxygen appropriate for the diving being conducted shall be available.

3.27 Dive Flag

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

3.28 Compressor Systems - UCSB Controlled

The following will be considered in design and location of compressor systems:

- A. Volume tanks used in conjunction with a low pressure compressor to supply air to the diver shall have a check valve on the inlet side, a relief valve, and a drain valve
- B. Compressed air systems over 500 psig shall have slow-opening shut-off valves.
- C. All air compressor intakes shall be located away from areas containing exhaust or other contaminants.

3.30 EQUIPMENT MAINTENANCE

3.31 Recordkeeping

Each equipment modification, repair, test, calibration, or maintenance service shall be logged, including the date and nature of work performed, serial number of the item, and the name of the person performing the work for the following equipment:

- A. Regulators
- B. Submersible pressure gauges
- C. Depth gauges
- D. Scuba cylinders and valves
- E. Full Face Masks
- F. Compressors, air filtration systems, gas control panels, and storage banks
- G. Buoyancy control devices
- H. Dry suit.

- I. Surface supplied equipment
- J. Rebreather systems
- K. Additional equipment categories as determined by the DCB

3.32 Compressor Operation and Air Test Records

Gas analyses and air tests shall be performed on each OM-controlled breathing air compressor at regular intervals of no more than 100 hours of operation or 6 months, whichever occurs first. The results of these tests shall be entered in a formal log and be maintained.

3.40 AIR QUALITY STANDARDS

Breathing air for scuba shall meet the following specifications as set forth by the Compressed Gas Association (CGA Pamphlet G-7.1)

| CGA Grade E | |
|-------------------------------|----------------|
| Component | Maximum |
| Oxygen | 20 - 22%/v |
| Carbon Monoxide | 10 PPM/v |
| Carbon Dioxide | 1000 PPM/v |
| Condensed Hydrocarbons | 5 mg/m3 |
| Total Hydrocarbons as Methane | 25 PPM/v |
| Water Vapor ppm | (2) |
| Objectionable Odors | None |

For breathing air used in conjunction with self-contained breathing apparatus in extreme cold where moisture can condense and freeze, causing the breathing apparatus to malfunction, a dew point not to exceed -50°F (63 pm v/v) or 10 degrees lower than the coldest temperature expected in the area is required.

Remote Operations: For remote site operations using gas sources not controlled by the OM, every effort should be made to verify breathing gas meets the requirements of this standard. If CGA Grade E gas is not verifiable, the DCB shall develop a protocol to mitigate risk to the diver.

SECTION 4.00
Scientific Diver Authorization Requirements

4.10 GENERAL POLICY

Set forth below are the training requirements for UCSB Scientific Diver authorization. No person shall engage in scientific diving activities under the auspices of UCSB until the DSO, acting on behalf of the DCB, has issued a Scientific Diving Authorization and approved a submitted UCSB Dive Plan.

Submission of documents and participation in aptitude examinations does not automatically result in authorization. The applicant shall convince the DSO that he/she is sufficiently skilled and proficient to be authorized by the DCB. Any applicant who does not possess the necessary judgment, under diving conditions, for the safety of the diver and his/her partner, may be denied UCSB Scientific Diver privileges.

4.20 PREREQUISITES

4.21 Eligibility

- A. Only persons diving under UCSB auspices are eligible for UCSB Scientific Diver training and authorization. Generally, these people will be affiliated with UCSB however non-affiliated trainees may be admitted to the training program with the permission of the DCB.
- B. The applicant for training and authorization should be at least eighteen years of age, have at least entry level SCUBA training from an internationally recognized agency and at a minimum of 12 logged dives since the entry level training was completed.

4.22 Application

Application for authorization should be submitted to the DSO and the application form is available on UCSB's Dive Safety website.

4.23 Medical Evaluation

The candidate shall be medically qualified for diving as described by American Academy of Underwater Sciences medical standards and these may not be waived.

4.24 Swimming and Skin Diving Evaluation

The candidate shall demonstrate the following in the presence of the DSO or designee. All tests are to be performed without swim aids. However, where exposure protection is needed, the candidate shall be appropriately weighted to provide for neutral buoyancy

- 1. Swim underwater without fins for a distance of 25 yards without surfacing.
- 2. Swim 400 yards in less than 10 minutes without fins, demonstrating 2 strokes.
- 3. Tread water for 15 minutes without swim aids and for 5 of those minutes without hands.
- 4. Demonstrate swimming with snorkel and fins with and without facemask.
- 5. Surface dive without fins to a depth of 10-15 feet and recover a 10 lb weight.
- 6. Without fins, recover a swimmer and tow the swimmer 25 yards at the surface

4.30 TRAINING

The candidate shall successfully complete prerequisites, theoretical aspects, practical training, and examinations for a minimum cumulative time of 100 hours and a minimum of 12 open water dives. Theoretical aspects shall include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100-hour training requirement include OM developed formalized training course, or a combination of formalized and on the job training.

When a diver's resume provides clear evidence of significant scientific diving experience, the diver can be given credit for meeting portions of the 100-hour course requirements. The DCB will identify

specific overlap between on-the-job training, previous scientific diving training/experience and course requirements, and then determine how potential deficiencies will be resolved. However, OMs cannot “test-out” divers, regardless of experience, when they have no previous experience in scientific diving.

Any candidate who does not convince the DCB, through the DSO, that they possess the necessary judgment, under diving conditions, for the safety of the diver and his/her buddy, may be denied scientific diving privileges

| Theoretical Training / Knowledge Development | |
|---|--|
| Required Topics: | Suggested Topics: |
| Diving Emergency Care Training <ul style="list-style-type: none"> • Cardiopulmonary Resuscitation (CPR) • AED • Standard or Basic First Aid • Recognition of DCS and AGE • Accident Management • Field Neurological Exam • Oxygen Administration | Specific Dive Modes (methods of gas delivery) <ul style="list-style-type: none"> • Open Circuit • Hookah • Surface Supplied diving • Rebreathers (closed and/or semi-closed) |
| Dive Rescue <ul style="list-style-type: none"> • To include procedures relevant to OM specific protocols. (See water skills below) | Specialized Breathing Gas <ul style="list-style-type: none"> • Nitrox • Mixed Gas |
| Scientific Method | Small Boat Operation |
| Data Gathering Techniques (Only items specific to area of study required) <ul style="list-style-type: none"> • Transects and Quadrats • Mapping • Coring • Photography • Tagging • Collecting • Animal Handling • Archaeology • Common Biota • Organism Identification • Behavior • Ecology • Site Selection, Location, and Re-location • Specialized Data Gathering Equipment | Specialized Environments and Conditions <ul style="list-style-type: none"> • Blue Water Diving • Altitude • Ice and Polar Diving (Cold Water Diving) • Zero Visibility Diving • Polluted Water Diving • Saturation Diving • Decompression Diving • Overhead Environments • Aquarium Diving • Night Diving • Kelp Diving • Strong Current Diving • Potential Entanglement/Entrapment • Live boating |
| Required Topics: | Suggested Topics: |
| Navigation | HazMat Training <ul style="list-style-type: none"> • Chemical Hygiene, Laboratory Safety (Use of Chemicals) Specialized Diving Equipment <ul style="list-style-type: none"> • Full face mask • Dry Suit • Communications • Dive Propulsion Vehicle (DPV) • SMBs/Lift Bags • Line Reels |
| HazMat Training <ul style="list-style-type: none"> • HP Cylinders | |
| Decompression Management Tools <ul style="list-style-type: none"> • Dive Tables • Dive Computers • PC Based Software | |
| AAUS Scientific Diving Regulations and History <ul style="list-style-type: none"> • Scientific Dive Planning • Coordination with other Agencies • Appropriate Governmental Regulations | |
| Hazards of breath-hold diving and ascents | Other Topics and Techniques as Determined by the DCB |
| Dive Physics (Beyond entry level scuba) | |
| Dive Physiology (Beyond entry level scuba) | |
| Dive Environments | |
| Decompression Theory and its Application | |

| Practical Training / Skill Development | |
|---|--|
| Confined Water | <p>At the completion of training, the trainee shall satisfy the DSO or DCB-approved designee of their ability to perform the following, as a minimum, in a pool or in sheltered water:</p> <ul style="list-style-type: none"> • Enter water fully equipped for diving • Clear fully flooded face mask • Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask • Demonstrate buddy breathing as both donor and recipient, with and without a face mask • Demonstrate understanding of underwater signs and signals • Demonstrate ability to remove and replace equipment while submerged • Demonstrate acceptable watermanship skills for anticipated scientific diving conditions |
| Open Water Skills | <p>The trainee shall satisfy the DSO, or DCB-approved designee, of their ability to perform at least the following in open water:</p> <ul style="list-style-type: none"> • Surface dive to a depth of 10 feet (3 meters) without scuba* • Enter and exit water while wearing scuba gear* ^^ • Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit* • Demonstrate proficiency in air sharing ascent as both donor and receiver* • Demonstrate the ability to maneuver efficiently in the environment, at and below the surface*^^ • Complete a simulated emergency swimming ascent* • Demonstrate clearing of mask and regulator while submerged* • Underwater communications^^ • Demonstrate ability to achieve and maintain neutral buoyancy while submerged* • Demonstrate techniques of self-rescue and buddy rescue* • Navigate underwater ^ • Plan and execute a dive^ • Demonstrate judgment adequate for safe scientific diving* ^^ <p>Rescue Skills:</p> <ul style="list-style-type: none"> • Rescue from depth and transport 25 yards (23 meters), as a diver, a passive simulated victim of an accident: surface diver, establish buoyancy, stabilize victim • Demonstrate simulated in-water mouth-to-mouth resuscitation • Removal of victim from water to shore or boat • Stressed and panicked diver scenarios • Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – Appendix 9 <p>Successfully complete a minimum of one checkout dive and at least eleven additional open water dives in a variety of dive sites, for a cumulative surface to surface time of 6 hours. Dives following the checkout dive(s) may be supervised by an active Scientific Diver holding the necessary depth authorization experienced in the type of diving planned, and with the knowledge and permission of the DSO</p> <p>The eleven dives (minimum) following the initial checkout dive may be conducted over a variety of depth ranges as specified by the OM DCB. Depth progression shall proceed shallower to deeper after acceptable skills and judgement have been demonstrated, and are not to exceed 100 feet (30 m) during the initial 12 dive cycle</p> <p>* Checkout dive element ^^ Evaluated on all dives ^ Evaluated at some point during the training cycle</p> |

| Examinations | |
|---------------------|---|
| Equipment | <p>The trainee will be subject to examination/review of:</p> <ul style="list-style-type: none"> • Personal diving equipment • Task specific equipment • Function and manipulation of decompression computer to be employed by the diver (if applicable) |
| Written Exams | <p>The trainee shall pass a written examination reviewed and approved by the OM DCB that demonstrates knowledge of at least the following:</p> <ul style="list-style-type: none"> • Function, care, use, and maintenance of diving equipment • Advanced physics and physiology of diving • Diving regulations • Applicable diving environments • Emergency procedures for OM-specific dive mode(s) and environments, including buoyant ascent and ascent by air sharing • Currently accepted decompression theory and procedures • Proper use of dive tables • Hazards of breath-hold diving and ascents • Planning and supervision of diving operations • Navigation • Diving hazards & mitigations • Cause, symptoms, treatment, and prevention of the following: near drowning, air embolism, hypercapnia, squeezes, oxygen toxicity, nitrogen narcosis, exhaustion and panic, respiratory fatigue, motion sickness, decompression sickness, hypothermia, and hypoxia/anoxia • Applicable theoretical training and knowledge development from the Required and Suggested Topics (above) |

4.40 TYPES OF AUTHORIZATION

Only a person diving under UCSB auspices is eligible for Scientific Diver authorization from the University of California, Santa Barbara.

4.41 Scientific Diver-in-Training Authorization

This permit signifies the diver has completed an internationally recognized sport diving course and has met the requirements and has been approved by the DSO to participate with the training.

4.42 Scientific Diver Authorization

This is a permit to dive, issued by the DSO upon recommendation of the DCB, usable only while it is current and for the purpose intended.

4.43 Temporary Diver Authorization

This authorization is issued only following a demonstration of the required proficiency in diving and if the person in question can contribute measurably to a planned dive. It is granted by the DSO and is valid only for a specified time. Temporary diver authorizations shall be restricted to the planned diving operation under UCSB auspices and shall comply with all other policies, regulations, and standards of this manual, including medical requirements.

4.44 Scientific Diving Reciprocity Authorization

The DSO issues this authorization to an authorized Scientific Diver from an organization that operates, at a minimum, under scientific diving regulations that meet or exceed AAUS scientific diving regulations. The visiting diver shall, at a minimum, adhere to UCSB Manual for Diving Safety. Prior to arrival, a Scientific Diving Reciprocity form signed by the DSO or Chairman of the home organization's DCB shall be submitted to the UCSB's DSO for approval. The visiting diver may be asked to demonstrate their knowledge and skills for the planned dive.

4.45 Denial of Authorization

Submission of documents and participation in aptitude examinations does not automatically result in authorization. The applicant shall convince the DSO and members of the DCB that they are sufficiently skilled and proficient to be certified. Any applicant, who does not possess the necessary judgment for the safety of the diver and their partner, may be denied organizational member scientific diving privileges.

4.50 WAIVER OF REQUIREMENTS

The UCSB DCB may grant a waiver for specific requirements of training, examinations, depth authorization, and minimum activity to maintain authorization.

4.60 DEPTH AUTHORIZATIONS AND PROGRESSION

The UCSB Scientific Diver authorization will authorize the holder to dive to the depth indicated in his/her records. A diver shall not exceed his/her depth authorization, unless accompanied by a diver certified to a greater depth. Under these circumstances, the diver may not exceed his/her depth limit by more than one step.

4.61 Authorization to 30 Foot Depth

This is the initial authorization, approved upon successful completion of training listed in Section 4. Cumulative minimum supervised dives: 12.

4.62 Authorization to 60 Foot Depth

A diver holding a 30-foot authorization may be authorized to a depth of 60 feet after successfully completing and logging 12 supervised dives to depths between 31 and 60 feet under supervision of a diver authorized by the DCB, for a minimum total time of 4 hours. Cumulative minimum supervised dives: 24.

4.63 Authorization to 100 and 130 Foot Depth

A diver holding a 60 foot authorization may be certified to depths of 100 and 130 feet, respectively, by logging a minimum of 6 scientific dives near the maximum planned depth. The diver shall also demonstrate proficiency in the use of dive tables and computers. Cumulative minimum supervised dives: 30.

4.64 Authorization to 150 and 190 Foot Depth

A diver may be certified to depths of 150 and 190 feet, respectively, provided there is a scientific need, by logging 6 dives within each depth authorization range. The diver shall also demonstrate knowledge of the special problems of deep diving, and of special safety requirements. Cumulative minimum supervised dives: 42.

4.65 Authorization deeper than 190 Foot Depth or greater

Authorization to Depths over 190 feet shall be authorized by the DCB and meet current AAUS Standards.

4.66 Diving on air is not permitted beyond a depth of 190 feet.

Dives beyond 190 feet require the use of mixed gas.

4.70 CONTINUATION OF SCIENTIFIC DIVER AUTHORIZATION

4.71 Minimum Activity to Maintain Authorization

During any 12-month period, each certified scientific diver shall log a minimum of 12 dives. At least one dive should be logged near the maximum depth, as defined by the DCB, of the diver's authorization during each 6-month period. Divers certified to 150 feet or deeper may satisfy

these requirements with dives to 130 feet or over. Failure to meet these requirements may be cause for revocation or restriction of authorization.

4.72 Requalification of Depth Authorization

Once the initial requirements of this manual are met, divers whose depth authorization has lapsed due to lack of activity may be re-qualified by procedures adopted by UCSB's DCB.

4.73 Medical Examination

All certified scientific divers shall pass a medical examination at the intervals specified in this manual. After each major illness or injury, as described in Section 5, an authorized scientific diver shall receive clearance to return to diving from a physician before resuming diving activities.

4.74 Emergency Care Training.

The scientific diver shall hold current training in the following:

1. Adult CPR
2. Emergency oxygen administration
3. First aid for diving accidents

4.80 REVOCATION OF AUTHORIZATION

A diving certificate may be revoked or restricted for cause by the DSO or the DCB. Violations of regulations set forth in this manual, or other governmental subdivisions not in conflict with this manual, may be considered cause. The DSO shall inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present his/her case in writing for reconsideration and/or reauthorization. All such written statements and requests, as identified in this section, are formal documents, which will become part of the diver's file. Following revocation, the diver may be reauthorized after complying with conditions the DCB may impose.

SECTION 5.00
Medical Standards

5.10 MEDICAL REQUIREMENTS

5.11 General Policy

- A. The DCB shall determine that divers have passed a current diving physical examination and have been declared by the examining physician to be fit to engage in diving activities as may be limited or restricted in the medical evaluation report.
- B. All medical evaluations required by this standard shall be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.
- C. The diver should be free of any chronic disabling disease and be free of any conditions contained in the list of conditions (Section 5) for which restrictions from diving are generally recommended.
- D. If the DSO is unsure whether or not the medical history of a diver is a contraindication to diver training then the diver should be sent to a physician for an evaluation as required by the training agency and this physician should have a general understanding of diving medicine. Even if approved by a general physician the diver may be required to complete further consultation/evaluation by a board certified diving physician or a medical specialist with a general understanding of diving medicine if the DSO feels that diving is not in the individual's best interest or that their medical condition is likely to present a threat to others.

5.20 Frequency of Medical Evaluations

| <i>Medical evaluation shall be completed:</i> | | |
|--|--|--|
| Before Age 40 | After age 40 Before Age 60 | After Age 60 |
| Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 5 years | Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 3 years | Before a diver may begin diving, unless an equivalent initial medical evaluation has been given within the preceding 2 years |
| At 5-year intervals | At 3-year intervals | At 2-year intervals |
| <p>Clearance to return to diving must be obtained from a healthcare provider following a medically cleared diver experiencing any Conditions Which May Disqualify Candidates From Diving (Appendix 1), or following any major injury or illness, or any condition requiring chronic medication. If the condition is pressure related, the clearance to return to diving must come from a physician trained in diving medicine.</p> | | |

5.30 Information Provided Examining Physician

The OM shall provide a copy of the medical evaluation requirements of this *Manual* to the examining physician. (Appendices 1, 2, and 3).

5.40 Content of Medical Evaluations

Medical examinations conducted initially and at the intervals specified in Section 5 shall consist of the following:

1. Diving physical examination (Appendix 2). Modifications or omissions of required tests are not permitted
2. Applicant agreement for release of medical information to the Diving Safety Officer and the DCB (Appendix 2b)
3. Medical history (Appendix 3)

5.50 Physician's Written Report

- A. A Medical Evaluation of Fitness For Scuba Diving Report (or OM equivalent) signed by the examining physician stating the individual's fitness to dive, including any recommended restrictions or limitations will be submitted to the OM for the diver's record after the examination is completed.
- B. The Medical Evaluation of Fitness For Scuba Diving Report will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.
- C. A copy of any physician's written reports will be made available to the individual.
- D. It is the diver's responsibility to provide to the OM a written statement from the examining medical authority listing any restrictions, limitations, or clearances to dive resulting from medical examinations obtained by the individual outside of their normal diving medical examination cycle. These statements will be reviewed by the DCB or designee and the diver's record and authorizations will be updated accordingly.

VOLUME II

SECTION 6.00 **Nitrox Diving**

(This section describes the requirements for authorization and use of nitrox for Scientific Diving.)

6.10 REQUIREMENTS FOR NITROX AUTHORIZATION

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

6.11 Prerequisites

1. Only a certified Scientific Diver or DIT diving under the auspices of an OM is eligible for authorization to use nitrox.
2. Application for authorization to use nitrox shall be made to the DCB. Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant shall convince the DCB through the DSO that they are sufficiently knowledgeable, skilled and proficient in the theory and use of nitrox for diving.

6.12 Training

In lieu of writing/promulgating AAUS specific training standards for Nitrox divers, AAUS references the standards for Nitrox diver training as defined by the WRSTC and/or ISO. AAUS programs who wish to train Nitrox divers may do so using one of the following options:

1. Under the auspices and standards of an internationally recognized diver training agency.
2. Under the auspices of AAUS using the minimum guidelines presented by the most current version of the RSTC/WRSTC and/or ISO Nitrox diver training standards.

References:

"Minimum Course Content for Enriched Air Nitrox Certification" - World Recreational Scuba Training Council (WRSTC), www.wrstc.com.

"Recreational diving services- Requirements for training programs on enriches air nitrox (EAN) diving". ISO 11107:2009 - International Organization for Standardization (ISO), www.iso.org

6.13 Practical Evaluation

1. Oxygen analysis of nitrox mixtures.
2. Determination of MOD, oxygen partial pressure exposure, and oxygen toxicity time limits, for various nitrox mixtures at various depths.
3. Determination of nitrogen-based dive limits status by EAD method using air dive tables, and/or using nitrox dive tables, as approved by the DCB.
4. Nitrox dive computer use may be included, as approved by the DCB.
5. A minimum of two supervised open water dives using nitrox is required for authorization.

6.14 Written Evaluation

1. Function, care, use, and maintenance of equipment cleaned for nitrox use.
2. Physical and physiological considerations of nitrox diving (eg.: O₂ and CO₂ toxicity)
3. Diving regulations, procedures/operations, and dive planning as related to nitrox diving
4. Equipment marking and maintenance requirements
5. Dive table and/or dive computer usage
6. Calculation of: MOD, pO₂, and other aspects of Nitrox diving as required by the DCB

6.20 MINIMUM ACTIVITY TO MAINTAIN AUTHORIZATION

The diver should log at least one (1) nitrox dive in the past 12 months. If one nitrox dive has not been made in the past 12 months the diver should demonstrate O₂ analyzer use and review EANx procedures to the DSO or his/her designee. Failure to meet the minimum activity level may be cause for restriction or revocation of nitrox authorization.

6.30 OPERATIONAL REQUIRMENTS

6.31 *Oxygen Exposure Limits*

1. The inspired oxygen partial pressure experienced at depth should not exceed 1.6 ATA.
2. The maximum allowable exposure limit should be reduced in cases where cold or strenuous dive conditions, or extended exposure times are expected.

6.32 *Calculation of Decompression Status*

1. A set of DCB approved nitrox dive tables should be available at the dive site.
2. Dive computers may be used to compute decompression status during nitrox dives. Manufacturers' guidelines and operation instructions should be followed.
3. Dive computers capable of pO₂ limit and fO₂ adjustment should be checked by the diver prior to the start of each dive to ensure conformity with the mix being used.

6.33 *Gas Mixture Requirements*

1. Only nitrox mixtures and mixing methods approved by the DCB may be used.
2. OM personnel mixing nitrox shall be qualified and approved by the DCB for the method(s) used.
3. Oxygen used for mixing nitrox should meet the purity levels for "Medical Grade" (U.S.P.) or "Aviator Grade" standards.
4. In addition to the AAUS Air Purity Guidelines outlined in [Section 3.60](#), any air that may come in contact with oxygen concentrations greater than 40% (i.e.. during mixing), shall also have a hydrocarbon contaminant no greater than .01 mg/m³.
 - For remote site operations using compressors not controlled by the OM where this is not verifiable, the DCB shall develop a protocol to mitigate risk to the diver.

6.34 *Analysis Verification by User*

1. 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: fO₂, MOD, cylinder pressure, date of analysis, and user's name.
2. Individual dive log reporting forms should report fO₂ of nitrox used, if different than 21%.

6.40 NITROX DIVING EQUIPMENT

6.41 *Required Equipment*

All of the designated equipment and stated requirements regarding scuba equipment required in the *AAUS Manual* apply to nitrox operations. Additional minimal equipment necessary for nitrox diving operations includes:

1. Labeled SCUBA Cylinders in Accordance with Industry Standards
2. Oxygen Analyzers
3. Oxygen compatible equipment as applicable

6.42 Requirement for Oxygen Service

1. All equipment, which during the dive or cylinder filling process is exposed to concentrations greater than 40% oxygen, should be cleaned and maintained for oxygen service.
2. Any equipment used with oxygen or mixtures containing over 40% by volume oxygen shall be designed and maintained for oxygen service. Oxygen systems over 125 psig shall have slow-opening shut-off valves.

6.43 Compressor system

1. Compressor/filtration system shall produce oil-free air, or
2. An oil-lubricated compressor placed in service for a nitrox system should be checked for oil and hydrocarbon contamination at least quarterly.

SECTION 7.00

Other Diving Technology

Certain types of diving, some of which are listed below, require equipment or procedures, which require additional training. Supplementary guidelines for these technologies are in development by the AAUS. UCSB divers using these technologies shall follow the guidelines approved by the DCB. Divers shall comply with all scuba diving procedures in this manual unless specified otherwise.

7.10 BLUE WATER DIVING

No diver shall plan or conduct blue water dives without prior approval of the DCB. Blue water diving is defined as diving in open water where the bottom is generally >200 feet deep. It requires special training and the use of multiple-tethered diving techniques. Specific guidelines that should be followed are outlined in "Blue Water Diving Guidelines" (California Sea Grant Publ. No. T-CSGCP-014).

7.20 ICE AND POLAR DIVING

Divers planning to dive under ice or in polar conditions should use the following: "PESH-POL_2000.08 Standards for the Conduct of Scientific Diving", National Science Foundation, Division of Polar Programs, 2015.

7.30 OVERHEAD ENVIRONMENTS

Overhead environments include water filled Caverns, Caves, Flooded Mines and Ice diving, as well as portions of Sunken Shipwrecks and other manmade structures. No diver shall plan or conduct dives within overhead environments without meeting current AAUS standards and prior approval of the DCB. Where an enclosed or confined space is not large enough for two divers, a diver shall be stationed at the underwater point of entry and an orientation line shall be used.

7.40 STAGED DECOMPRESSION DIVING

Decompression diving shall be defined as any diving during which the diver cannot perform a direct return to the surface without performing a mandatory decompression stop to allow the release of inert gas from the diver's body. No diver shall plan or conduct staged decompression dives without meeting current AAUS standards and prior approval of the DCB.

7.50 HOOKAH

No diver shall plan or conduct hookah dives without prior approval of the DCB.

- A. Divers using the hookah mode shall be equipped with a diver-carried independent reserve breathing gas supply.
- B. Each hookah diver shall be hose-tended by a separate dive team member while in the water.
- C. The hookah breathing gas supply shall be sufficient to support all hookah divers in the water for the duration of the planned dive, including decompression.

7.60 SURFACE SUPPLIED DIVING

A mode of diving using open circuit, surface supplied, compressed gas delivered 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, often with voice communications. No diver shall plan or conduct surface supplied dives without prior approval of the DCB.

7.61 General Procedures for Surface Supplied Diving

- A. Each diver shall be continuously tended while in the water.
- B. A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces.
- C. Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- D. For dives deeper than 100fsw (30 m) or outside the no-decompression limits:
 - i. A separate dive team member shall tend each diver in the water;
 - ii. A standby diver shall be available while a diver is in the water;
- E. A diver using Surface Supply may rely on surface personnel to keep the diver's depth, time and diving profile
- F. Surface supplied air diving shall not be conducted at depths deeper than 190 fsw (57.9 m).

Additional Equipment & Manning Requirement will be determined by the DCB.

7.70 MIXED GAS DIVING

Mixed gas diving is defined as dives done while breathing gas mixes containing proportions greater than 1% by volume of an inert gas other than nitrogen. No diver shall plan or conduct mixed gas dives without meeting current AAUS standards and prior approval of the DCB.

7.80 DRY SUIT DIVING

All UCSB divers diving with drysuits under the auspices of UCSB shall demonstrate diving proficiency with a drysuit before diving in the ocean without direct supervision.

7.90 DIVE COMPUTERS

All UCSB divers using dive computers while diving under the auspices of UCSB shall be proficient with the use of their dive computer.

7.100 ALTITUDE DIVING

Divers planning to dive at sites with elevations greater than 1000ft shall have specialized training (see NOAA Dive Manual, Chapter 10) and prior approval of the DCB.

7.110 OFFSHORE PLATFORM DIVING

Divers planning around or near an offshore platform structure shall have prior approval of the DCB. Offshore platform diving recommendations are available on UCSB's Dive Safety website.

7.120 CAVE AND CAVERN DIVING

No diver shall plan or conduct dives within a cave and/or cavern without meeting current AAUS standards prior approval of the DCB.

A dive team shall be considered to be cave or cavern diving if at any time during the dive they find themselves in a position where they cannot complete a direct, unobstructed ascent to the surface because of rock formations. In addition to blocking direct access to surfacing, underwater caves have additional environmental hazards including but not limited to:

1. The absence of natural light.
2. Current or flow that vary in strength and direction. Of particular note is a condition known as siphoning. Siphoning caves have flow or current directed into the cave. This can cause poor visibility as a result of mud and silt being drawn into the cave entrance.
3. The presences of silt, sand, mud, clay, etc. that can cause visibility to be reduced to nothing in a very short time..
4. Restrictions –Any passage through which two divers cannot easily pass side by side while sharing air make air sharing difficult.
5. Cave-Ins –Cave-Ins are a normal part of cave evolution; however experiencing a cave-in during diving operations is extremely unlikely

7.130 REBREATHERS

No diver shall plan or conduct dives within a rebreather without meeting current AAUS standards and prior approval of the DCB.

7.140 SATURATION DIVING

No diver shall plan or conduct saturation dives without meeting current AAUS standards and prior approval of the DCB.

7.150 AQUARIUM DIVING

An aquarium is an artificial, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research.

It is recognized that within scientific aquarium diving there are environments and equipment that fall outside the scope of those addressed in this Manual. In those circumstances it is the responsibility of the OM's DCB to establish the requirements and protocol under which diving will be safely conducted.

APPENDIX 1
DIVING MEDICAL EXAM OVERVIEW FOR THE EXAMINING PHYSICIAN

TO THE EXAMINING PHYSICIAN:

This person, _____, requires a medical examination to assess their fitness for authorization as a Scientific Diver for the UC Santa Barbara. Their answers on the Diving Medical History Form (attached) may indicate potential health or safety risks as noted. Your evaluation is requested on the attached scuba Diving Fitness Medical Evaluation Report. If you have questions about diving medicine, you may wish to consult one of the references on the attached list or contact one of the physicians with expertise in diving medicine whose names and phone numbers appear on an attached list, the Undersea Hyperbaric and Medical Society, or the Divers Alert Network. Please contact the undersigned Diving Safety Officer if you have any questions or concerns about diving medicine or the UC Santa Barbara_ standards. Thank you for your assistance.

Eric Hessell
Diving Safety Officer

805 893-4559
Phone Number

Scuba and other modes of compressed-gas diving can be strenuous and hazardous. A special risk is present if the middle ear, sinuses, or lung segments do not readily equalize air pressure changes. The most common cause of distress is eustachian insufficiency. Recent deaths in the scientific diving community have been attributed to cardiovascular disease. Please consult the following list of conditions that usually restrict candidates from diving.

(Adapted from Bove, 1998: bracketed numbers are pages in Bove)

CONDITIONS WHICH MAY DISQUALIFY CANDIDATES FROM DIVING

1. Abnormalities of the tympanic membrane, such as perforation, presence of a monomeric membrane, or inability to autoinflate the middle ears. [5 ,7, 8, 9]
2. Vertigo, including Meniere's Disease. [13]
3. Stapedectomy or middle ear reconstructive surgery. [11]
4. Recent ocular surgery. [15, 18, 19]
5. Psychiatric disorders including claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression. [20 - 23]
6. Substance abuse, including alcohol. [24 - 25]
7. Episodic loss of consciousness. [1, 26, 27]
8. History of seizure. [27, 28]
9. History of stroke or a fixed neurological deficit. [29, 30]
10. Recurring neurologic disorders, including transient ischemic attacks. [29, 30]
11. History of intracranial aneurysm, other vascular malformation or intracranial hemorrhage. [31]
12. History of neurological decompression illness with residual deficit. [29, 30]
13. Head injury with sequelae. [26, 27]
14. Hematologic disorders including coagulopathies. [41, 42]
15. Evidence of coronary artery disease or high risk for coronary artery disease. [33 - 35]
16. Atrial septal defects. [39]
17. Significant valvular heart disease - isolated mitral valve prolapse is not disqualifying. [38]
18. Significant cardiac rhythm or conduction abnormalities. [36 - 37]
19. Implanted cardiac pacemakers and cardiac defibrillators (ICD). [39, 40]
20. Inadequate exercise tolerance. [34]
21. Severe hypertension. [35]
22. History of spontaneous or traumatic pneumothorax. [45]
23. Asthma. [42 - 44]
24. Chronic pulmonary disease, including radiographic evidence of pulmonary blebs, bullae, or cysts. [45,46]
25. Diabetes mellitus. [46 - 47]
26. Pregnancy. [56]

SELECTED REFERENCES IN DIVING MEDICINE

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APPENDIX 2
AAUS/ MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT

Name of Applicant (Print or Type)

Date of Medical Evaluation (Month/Day/Year)

To The Examining Physician: Scientific divers require periodic scuba diving medical examinations to assess their fitness to engage in diving with self-contained underwater breathing apparatus (scuba). Their answers on the Diving Medical History Form may indicate potential health or safety risks as noted. Scuba diving is an activity that puts unusual stress on the individual in several ways. Your evaluation is requested on this Medical Evaluation form. Your opinion on the applicant's medical fitness is requested. Scuba diving requires heavy exertion. The diver must be free of cardiovascular and respiratory disease (see references, following page). An absolute requirement is the ability of the lungs, middle ears and sinuses to equalize pressure. Any condition that risks the loss of consciousness should disqualify the applicant. Please proceed in accordance with the AAUS Medical Standards (Sec. 6.00). If you have questions about diving medicine, please consult with the Undersea Hyperbaric Medical Society or Divers Alert Network.

TESTS: THE FOLLOWING TESTS ARE REQUIRED:

DURING ALL INITIAL AND PERIODIC RE-EXAMS (UNDER AGE 40):

- Medical history
- Complete physical exam, with emphasis on neurological and ontological components
- Urinalysis
- Any further tests deemed necessary by the physician

ADDITIONAL TESTS DURING FIRST EXAM OVER AGE 40 AND PERIODIC RE-EXAMS (OVER AGE 40):

- Chest x-ray (Required only during first exam over age 40)
- Resting EKG
- Assessment of coronary artery disease using Multiple-Risk-Factor Assessment¹
(age, lipid profile, blood pressure, diabetic screening, smoking)

Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment²

PHYSICIAN'S STATEMENT:

_____ 01 Diver **IS** medically qualified to dive for: _____ 2 years (over age 60)
_____ 3 years (age 40-59)
_____ 5 years (under age 40)

_____ 02 Diver **IS NOT** medically qualified to dive: _____ Permanently _____ Temporarily.

I have evaluated the abovementioned individual according to the American Academy of Underwater Sciences medical standards and required tests for scientific diving (Sec. 6.00 and Appendix 1) and, in my opinion, find no medical conditions that may be disqualifying for participation in scuba diving. I have discussed with the patient any medical condition(s) that would not disqualify him/her from diving but which may seriously compromise subsequent health. The patient understands the nature of the hazards and the risks involved in diving with these conditions.

Signature

Date

Name (Print or Type)

My familiarity with applicant is: _____ This exam only _____ Regular physician for _____ years

My familiarity with diving medicine is: _____

APPENDIX 2b
AAUS/UCSB MEDICAL EVALUATION OF FITNESS FOR SCUBA DIVING REPORT
APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

Name of Applicant (Print or Type) _____

I authorize the release of this information and all medical information subsequently acquired in association with my diving to the _____ Diving Safety Officer and Diving Control Board or their designee at (place) _____ on (date) _____

Signature of Applicant _____

Date _____

REFERENCES

¹ Grundy, S.M., Pasternak, R., Greenland, P., Smith, S., and Fuster, V. 1999. Assessment of Cardiovascular Risk by Use of Multiple-Risk-Factor Assessment Equations. AHA/ACC Scientific Statement. *Journal of the American College of Cardiology*, 34: 1348-1359. <http://content.onlinejacc.org/cgi/content/short/34/4/1348>

**APPENDIX 3
DIVING MEDICAL HISTORY FORM**

(To Be Completed By Applicant-Diver)

Name _____ Sex ____ Age ____ Wt. ____ Ht. ____

Sponsor _____ Date ____/____/____
(Dept./Project/Program/School, etc.) (Mo/Day/Yr)

TO THE APPLICANT:

Scuba diving places considerable physical and mental demands on the diver. Certain medical and physical requirements must be met before beginning a diving or training program. Your accurate answers to the questions are more important, in many instances, in determining your fitness to dive than what the physician may see, hear or feel as part of the diving medical authorization procedure.

This form shall be kept confidential by the examining physician. If you believe any question amounts to invasion of your privacy, you may elect to omit an answer, provided that you shall subsequently discuss that matter with your own physician who must then indicate, in writing, that you have done so and that no health hazard exists.

Should your answers indicate a condition, which might make diving hazardous, you will be asked to review the matter with your physician. In such instances, their written authorization will be required in order for further consideration to be given to your application. If your physician concludes that diving would involve undue risk for you, remember that they are concerned only with your well-being and safety.

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|----|-----|----|---|----------|
| 1 | | | Convulsions, seizures, or epilepsy | |
| 2 | | | Fainting spells or dizziness | |
| 3 | | | Been addicted to drugs | |
| 4 | | | Diabetes | |
| 5 | | | Motion sickness or sea/air sickness | |
| 6 | | | Claustrophobia | |
| 7 | | | Mental disorder or nervous breakdown | |
| 8 | | | Are you pregnant? | |
| 9 | | | Do you suffer from menstrual problems? | |
| 10 | | | Anxiety spells or hyperventilation | |
| 11 | | | Frequent sour stomachs, nervous stomachs or vomiting spells | |
| 12 | | | Had a major operation | |
| 13 | | | Presently being treated by a physician | |
| 14 | | | Taking any medication regularly (even non-prescription) | |
| 15 | | | Been rejected or restricted from sports | |
| 16 | | | Headaches (frequent and severe) | |
| 17 | | | Wear dental plates | |
| 18 | | | Wear glasses or contact lenses | |
| 19 | | | Bleeding disorders | |
| 20 | | | Alcoholism | |
| 21 | | | Any problems related to diving | |
| 22 | | | Nervous tension or emotional problems | |
| 23 | | | Take tranquilizers | |
| 24 | | | Perforated ear drums | |
| 25 | | | Hay fever | |

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|----|-----|----|---|----------|
| 26 | | | Frequent sinus trouble, frequent drainage from the nose, post-nasal drip, or stuffy nose | |
| 27 | | | Frequent earaches | |
| 28 | | | Drainage from the ears | |
| 29 | | | Difficulty with your ears in airplanes or on mountains | |
| 30 | | | Ear surgery | |
| 31 | | | Ringing in your ears | |
| 32 | | | Frequent dizzy spells | |
| 33 | | | Hearing problems | |
| 34 | | | Trouble equalizing pressure in your ears | |
| 35 | | | Asthma | |
| 36 | | | Wheezing attacks | |
| 37 | | | Cough (chronic or recurrent) | |
| 38 | | | Frequently raise sputum | |
| 39 | | | Pleurisy | |
| 40 | | | Collapsed lung (pneumothorax) | |
| 41 | | | Lung cysts | |
| 42 | | | Pneumonia | |
| 43 | | | Tuberculosis | |
| 44 | | | Shortness of breath | |
| 45 | | | Lung problem or abnormality | |
| 46 | | | Spit blood | |
| 47 | | | Breathing difficulty after eating particular foods, after exposure to particular pollens or animals | |
| 48 | | | Are you subject to bronchitis | |
| 49 | | | Subcutaneous emphysema (air under the skin) | |
| 50 | | | Air embolism after diving | |
| 51 | | | Decompression sickness | |
| 52 | | | Rheumatic fever | |
| 53 | | | Scarlet fever | |
| 54 | | | Heart murmur | |
| 55 | | | Large heart | |
| 56 | | | High blood pressure | |
| 57 | | | Angina (heart pains or pressure in the chest) | |
| 58 | | | Heart attack | |
| 59 | | | Low blood pressure | |
| 60 | | | Recurrent or persistent swelling of the legs | |
| 61 | | | Pounding, rapid heartbeat or palpitations | |
| 62 | | | Easily fatigued or short of breath | |
| 63 | | | Abnormal EKG | |
| 64 | | | Joint problems, dislocations or arthritis | |
| 65 | | | Back trouble or back injuries | |
| 66 | | | Ruptured or slipped disk | |
| 67 | | | Limiting physical handicaps | |
| 68 | | | Muscle cramps | |
| 69 | | | Varicose veins | |

| | Yes | No | Please indicate whether or not the following apply to you | Comments |
|----|-----|----|--|----------|
| 70 | | | Amputations | |
| 71 | | | Head injury causing unconsciousness | |
| 72 | | | Paralysis | |
| 73 | | | Have you ever had an adverse reaction to medication? | |
| 74 | | | Do you smoke? | |
| 75 | | | Have you ever had any other medical problems not listed? If so, please list or describe below; | |
| 76 | | | Is there a family history of high cholesterol? | |
| 77 | | | Is there a family history of heart disease or stroke? | |
| 78 | | | Is there a family history of diabetes? | |
| 79 | | | Is there a family history of asthma? | |
| 80 | | | Date of last tetanus shot? Vaccination dates? | |

Please explain any "yes" answers to the above questions.

I certify that the above answers and information represent an accurate and complete description of my medical history.

Signature

Date

APPENDIX 4

**AAUS/UCSB REQUEST FOR DIVING RECIPROCITY FORM
VERIFICATION OF DIVER TRAINING AND EXPERIENCE**

Diver: _____

Date: _____

This letter serves to verify that the above listed person has met the training and pre-requisites as indicated below, and has completed all requirements necessary to be certified as a (Scientific Diver / Diver in Training) as established by the (Organizational Member) Diving Safety Manual, and has demonstrated competency in the indicated areas. (Organizational Member) is an AAUS OM and meets or exceeds all AAUS training requirements.

The following is a brief summary of this diver's personnel file regarding dive status at

(Date)

_____ Original diving authorization
_____ Written scientific diving examination
_____ Last diving medical examination Medical examination expiration date _____
_____ Most recent checkout dive
_____ Scuba regulator/equipment service/test
_____ CPR training (Agency) _____ CPR Exp. _____
_____ Oxygen administration (Agency) _____ O2 Exp. _____
_____ First aid for diving _____ F.A. Exp. _____
_____ Date of last dive _____ Depth _____
Number of dives completed within previous 12 months? _____ Depth Authorization _____ fsw
Total number of career dives? _____

Any restrictions? (Y/N) _____ if yes, explain:

Please indicate any pertinent specialty certifications or training:

Emergency Information:

Name: _____ Relationship: _____

Telephone: _____ (work) _____ (home) _____

Address: _____

This is to verify that the above individual is currently a certified scientific diver at _____

Diving Safety Officer:

(Signature)

(Date)

(Print)

APPENDIX 5
DIVING EMERGENCY MANAGEMENT PROCEDURES

Introduction

A diving accident victim could be any person who has been breathing air underwater regardless of depth. It is essential that emergency procedures are pre-planned and that medical treatment is initiated as soon as possible. It is the responsibility of each AAUS organizational member to develop procedures for diving emergencies including evacuation and medical treatment for each dive location.

General Procedures

Depending on and according to the nature of the diving accident:

1. Make appropriate contact with victim or rescue as required.
2. Establish (A)irway, (B)reathing, (C)irculation or (C)irculation (A)irway (B)reathing as appropriate
3. Stabilize the victim
3. Administer 100% oxygen, if appropriate (in cases of Decompression Illness, or Near Drowning).
4. Call local Emergency Medical System (EMS) for transport to nearest medical treatment facility. Explain the circumstances of the dive incident to the evacuation teams, medics and physicians.
Do not assume that they understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
5. Call appropriate Diving Accident Coordinator for contact with diving physician and decompression chamber. etc.
6. Notify DSO or designee according to the Emergency Action Plan of the organizational member.
7. Complete and submit Incident Report Form to the DCB of the organization and the AAUS as required.

List of Emergency Contact Numbers Appropriate For Dive Location

Available Procedures

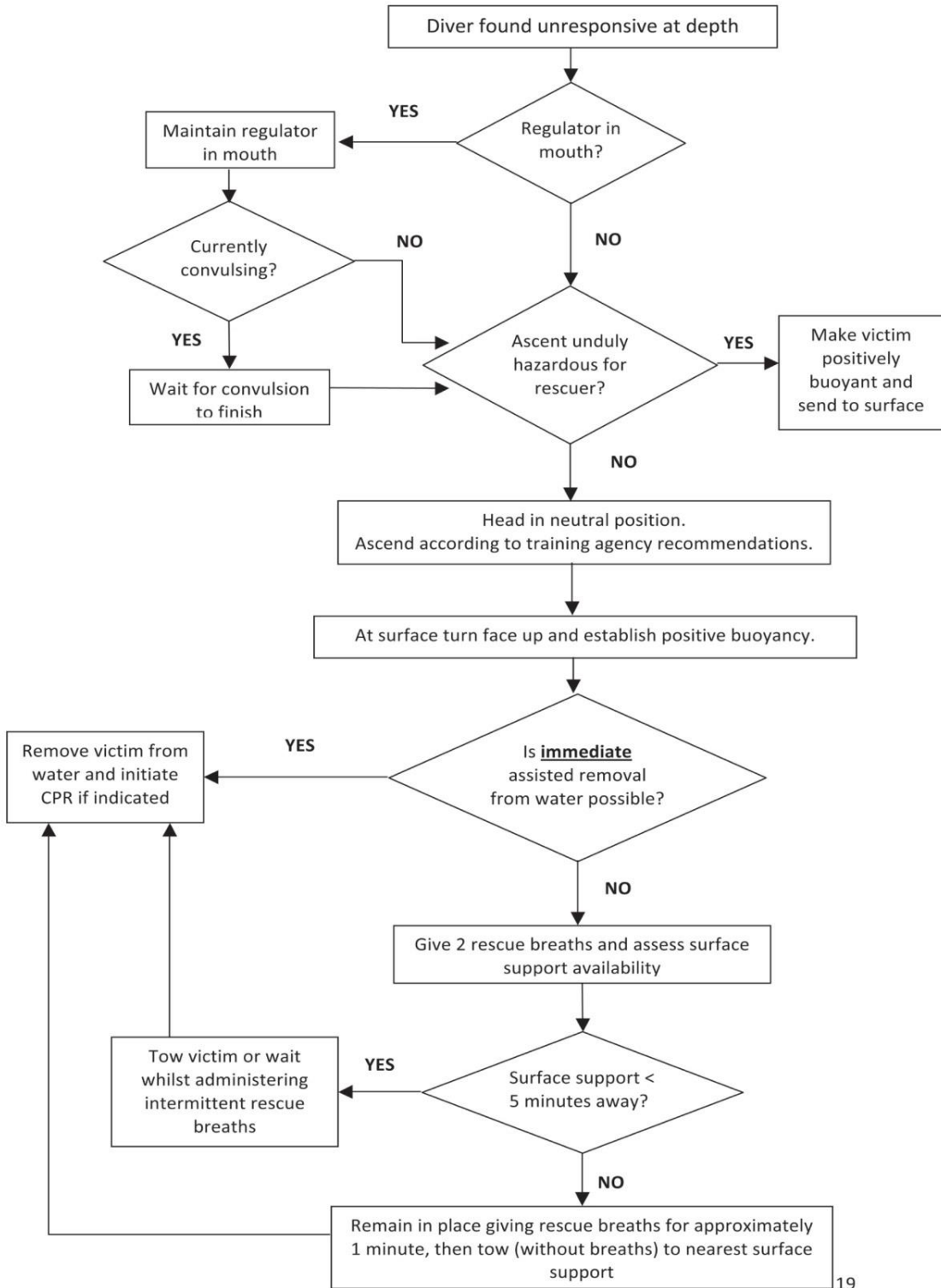
- Emergency care
- Recompression
- Evacuation
-

Emergency Plan Content

- Name, telephone number, and relationship of person to be contacted for each diver in the event of an emergency.
- Nearest operational decompression chamber.
- Nearest accessible hospital.
- Available means of transport.

Appendix 6

Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver
 From: S.J. Mitchell et al., Undersea and Hyperbaric Medicine 2012, Vol. 39, No. 6, pages 1099-1108



APPENDIX 7
DEFINITION OF TERMS (Updated terms)

| A | |
|---|--|
| 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 Authorization | Fully redundant system capable of providing a gas source to the diver should their primary gas supply fail The DCB authorizes divers to dive using specialized modes of diving, and the depth they may dive to. |
| (Scientific Diver) Authorization | A diver who holds a recognized valid authorization from an AAUS OM |
| B | |
| 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. |
| C | |
| 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 authorization from an AAUS OM or internationally recognized certifying agency. |
| 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 |
| D | |
| 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). |
| 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). |
| DPIC | See Designated Person-In-Charge |

E

| | |
|-----------------------------------|--|
| 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). |
| 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. |

F

| | |
|----------------------------|--|
| Flooded Mine Diving | Diving in the flooded portions of a man-made mine. Necessitates use of techniques detailed for cave diving |
| fO₂ - | Fraction of oxygen in a gas mixture, expressed as either a decimal or percentage, by volume. |
| FSW | Feet of seawater. |

G

| | |
|-------------------------|---|
| 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. |

H

| | |
|------------------------------|---|
| 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. |

I

| | |
|--|--|
| 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. |
|--|--|

J

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

L

| | |
|-------------------------------|--|
| Life Support Equipment | Underwater equipment necessary to sustain life |
| Lead Diver | Certified scientific diver with experience and training to conduct the diving operation. |

M

| | |
|-------------------------------------|---|
| 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 <i>AAUS Manual</i> . |
| 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 |

N

| | |
|----------------------|--|
| 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. |

O

| | |
|--------------------------|--|
| 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.

P

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.

pO₂ 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.

R

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.

S

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

T

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

U

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.

APPENDIX 8
AAUS STATISTICS COLLECTION CRITERIA AND DEFINITIONS (minor changes)

COLLECTION CRITERIA:

The "Dive Time in Minutes", The Number of Dives Logged", and the "Number of Divers Logging Dives" will be collected for the following categories.

- Dive Classification
- Breathing Gas
- Diving Mode
- Decompression Planning and Calculation Method
- Depth Ranges
- Specialized Environments
- Incident Types

- A. Dive Time in Minutes is defined as the surface-to-surface time including any safety or required decompression stops.
- B. A Dive is defined as a descent underwater utilizing compressed gas and subsequent ascent/return to the surface with a minimum surface interval of 10 minutes.
- C. Dives will not be differentiated as open water or confined water dives. But open water and confined water dives will be logged and submitted for AAUS statistics classified as either scientific or training/proficiency.
- D. A "Diver Logging a Dive" is defined as a person who is diving under the auspices of your scientific diving organization. Dives logged by divers from another AAUS Organization will be reported with the diver's home organization. Only a diver who has actually logged a dive during the reporting period is counted under this category.
- E. Incident(s) that occur during the collection cycle: Only incidents that occurred during, or resulting from, a dive where the diver is breathing a compressed gas will be submitted to AAUS.

DEFINITIONS:

Dive Classification:

- Scientific Dives: Dives that meet the scientific diving exemption as defined in 29 CFR 1910.402. Diving tasks traditionally associated with a specific scientific discipline are considered a scientific dive. Construction and trouble-shooting tasks traditionally associated with commercial diving are not considered a scientific dive.
- Training and Proficiency Dives: Dives performed as part of a scientific diver-training program, or dives performed in maintenance of a scientific diving certification/authorization.

Breathing Gas:

- Air: Dives where the bottom gas used for the dive is air.
- Nitrox: Dives where the bottom gas used for the dive is a combination of nitrogen and oxygen percentages different from those of air.
- Mixed Gas: Dives where the bottom gas used for the dive is a combination of oxygen, nitrogen, and helium (or other inert gas), or any other breathing gas combination not classified as air or nitrox.

Diving Mode:

- Open Circuit SCUBA: Dives where the breathing gas is inhaled from a self-contained underwater breathing apparatus and all of the exhaled gas leaves the breathing loop.
- 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 monitor the divers' depth, time and diving profile.
- 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 monitoring his/her own depth, time, and diving profile.

- Rebreathers: Dives where the breathing gas is repeatedly recycled in a breathing loop. The breathing loop may be fully closed or semi-closed. Note: A rebreather dive ending in an open circuit bailout is still logged as a rebreather dive.

Decompression Planning and Calculation Method:

- Dive Tables
- Dive Computer
- PC Based Decompression Software

Depth Ranges:

Depth ranges for sorting logged dives are: 0-30, 31-60, 61-100, 101-130, 131-150, 151-190, 191-250, 251-300, and 301->. Depths are in feet seawater (when measured in meters: 0-10, >10-30, >30-40, >40-45, >45-58, >58-76, >76-92, and >92->). A dive is logged to the maximum depth reached during the dive. Note: Only "The Number of Dives Logged" and "The Number of Divers Logging Dives" will be collected for this category.

Specialized Environments:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning method being employed.
- Overhead Environments: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Openwater diving where the bottom is generally greater than 200 feet deep and requires the use of multiple-tethers diving techniques.
- Ice and Polar Diving: Any dive conducted under ice or in polar conditions. Note: An Ice Dive would also be classified as an Overhead Environment dive.
- Saturation Diving: Excursion dives conducted as part of a saturation mission are to be logged by "classification", "mode", "gas", etc. The "surface" for these excursions is defined as leaving and surfacing within the Habitat. Time spent within the Habitat or chamber must not be logged by AAUS.
- Aquarium: An aquarium is a shallow, confined body of water, which is operated by or under the control of an institution and is used for the purposes of specimen exhibit, education, husbandry, or research (Not a swimming pool).

Incident Types:

- Hyperbaric: Decompression Sickness, AGE, or other barotrauma requiring recompression therapy.
- Barotrauma: Barotrauma requiring medical attention from a physician or medical facility, but not requiring recompression therapy.
- Injury: Any non-barotrauma injury occurring during a dive that requires medical attention from a physician or medical facility.
- Illness: Any illness requiring medical attention that can be attributed to diving.
- Near Drowning/ Hypoxia: An incident where a person asphyxiates to the minimum point of unconsciousness during a dive involving a compressed gas. But the person recovers.
- Hyperoxic/Oxygen Toxicity: An incident that can be attributed to the diver being exposed to too high a partial pressure of oxygen.
- Hypercapnea: An incident that can be attributed to the diver being exposed to an excess of carbon dioxide.
- Fatality: Any death accruing during a dive or resulting from the diving exposure.
- Other: An incident that does not fit one of the listed incident types

Incident Classification Rating Scale:

- Minor: Injuries that the OM considers being minor in nature. Examples of this classification of incident would include, but not be limited to:
 - Mask squeeze that produced discoloration of the eyes.
 - Lacerations requiring medical attention but not involving moderate or severe bleeding.
 - Other injuries that would not be expected to produce long term adverse effects on the diver's health or diving status.
- Moderate: Injuries that the OM considers being moderate in nature. Examples of this classification would include, but not be limited to:
 - DCS symptoms that resolved with the administration of oxygen, hyperbaric treatment given as a precaution.
 - DCS symptoms resolved with the first hyperbaric treatment.

- Broken bones.
- Torn ligaments or cartilage.
- Concussion.
- Ear barotrauma requiring surgical repair.
- Serious: Injuries that the OM considers being serious in nature. Examples of this classification would include, but not be limited to:
 - Arterial Gas Embolism.
 - DCS symptoms requiring multiple hyperbaric treatment.
 - Near drowning.
 - Oxygen Toxicity.
 - Hypercapnea.
 - Spinal injuries.
 - Heart attack.
 - Fatality.