

# California State University Monterey Bay

Department of Marine Science



Standards for Scientific Diving Qualifications &  
Operations for Scientific Diving Programs



The American Academy of Underwater  
Sciences

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## Forward

From its inception twenty-five years ago, CSU *Monterey Bay* has shared a strong connection with its namesake. As the only CSU campus adjacent to the extraordinary living laboratory of the Bay, a campus that serves a wide variety of communities from the tri-county region and beyond, the faculty, staff, and students have felt a special obligation to honor the sense of place that proximity to the Bay confers.

Under the guidance of the University's first Diving Safety Officer, Mr. Frank Degnan, the campus quickly developed a robust and highly sought-after recreational dive program, offering students a chance to hone their skills at locations around the Monterey Peninsula and Carmel Bay. Beginning in 2007, plans were developed to launch a scientific diving program. That program became a reality in 2008, and has grown rapidly ever since. With the formalization of the Department of Marine Science, the core recreational dive courses now serve as the foundation of a four-course progression that culminates with Scientific Diving Techniques. With all four courses offered every semester, including multiple sections across all seven days in a week, CSUMB now issues hundreds of certifications per annum, necessitating unambiguous safety protocols at all levels of instruction. This revised CSUMB Diving Safety Manual, drawing on the guidance provided by the American Academy of Underwater Science, as well as the lessons learned by other dive programs across the state, is the embodiment of that emphasis on safety.

The Manual provides an administrative framework for the facilitation of safe diving operations conducted under the auspices of the University. But diver safety ultimately depends on the comprehensive preparation, adequate experience, and reasonable judgment of the individual diver. As such, the Manual should serve as a point of departure for safe diving operations, rather than an end in itself. Additional standards and regulations may be established by the CSUMB Diving Control Board as needed for particular projects. It is the responsibility of individual divers and the persons supervising them to comply with all CSUMB standards and to notify the DSO and DCB should modifications to any policy or procedure be required.

Additional information on the CSUMB Scientific Diving Program can be found at: [csumb.edu/diving](http://csumb.edu/diving).

## Volume 1

### Section 1.00 General Policy

#### 1.10 Scientific Diving Standards

##### Purpose – CSUMB Diving Standards

The purpose of these Scientific Diving Standards is to ensure that all scientific diving under the auspices of California State University Monterey Bay (CSUMB) and the California State University (CSU) is conducted in a manner that will maximize protection of scientific divers from accidental injury and/or illness, and to set forth standards for training and certification that will allow a working reciprocity between CSUMB and other organizational members. Fulfillment of the purposes shall be consistent with the furtherance of research and safety.

This manual sets minimum standards for the establishment of the American Academy of Underwater Sciences (AAUS) recognized scientific diving programs, the organization for the conduct of these programs, and the basic regulations and procedures for safety in scientific diving operations. It also establishes a framework for reciprocity between AAUS organizational members that adhere to these minimum standards.

##### Historical Perspective

This manual was developed and written by AAUS by compiling the policies set forth in the diving manuals of several university, private, and governmental scientific diving programs. The CSUMB Dive Safety Manual is based on the AAUS provided template with CSUMB-specific policies and procedures outlined to meet the specific needs of the CSUMB dive program.

These programs share a common heritage with the scientific diving program at the Scripps Institution of Oceanography (SIO). Adherence to the SIO standards has proven both feasible and effective in protecting the health and safety of scientific divers since 1954.

In 1982, OSHA exempted scientific diving from commercial diving regulations (29CFR1910, Subpart T) under certain conditions that are outlined below. The final guidelines for the exemption became effective in 1985 (Federal Register, Vol. 50, No.6, p.1046). AAUS is recognized by OSHA as the scientific diving standard setting organization.

Additional standards that extend this document may be adopted by each campus, according to local procedure.

##### Scientific Diving Definition

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

“Diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as:

Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.”

### Scientific Diving Exemption

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

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

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

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

### Liability

In adopting the policies set forth in this manual, the CSU assumes no liability not otherwise imposed by law. Outside of those university employees diving in the course and scope of their employment, each diver is assumed under this policy to be voluntarily performing activities for which they assume all risks, consequences and potential liability.

### Recommendations for Changes to AAUS Manual

As part of each organizational campus’ annual report, any recommendations for modifications of these standards shall be submitted to the AAUS and the Office of the Chancellor for consideration.

## 1.20 Operational Control

### The CSUMB Auspices Defined

For the purposes of these standards, “under the auspices of CSUMB” means any diving operation that involves the use of dive equipment or related safety equipment owned by CSUMB or the CSUMB Corporation, as well as any dive activity conducted by CSUMB students, staff, faculty, volunteers or auxiliary organizations in support of the educational/research mission of CSUMB, whether or not those activities use CSUMB equipment or take place on CSUMB property.

Examples of activities that fall under the auspices include CSUMB scuba diving classes, diving to collect data for CSUMB student research projects (undergraduate or graduate), diving to collect marine specimens or photographs for CSUMB courses, and diving for faculty research projects. Examples of activities that do not fall under the auspices include personal recreational dives by CSUMB students or employees who are not using CSUMB equipment and are not collecting specimens or data for CSUMB classes, projects, or research.

Ultimately, it is CSUMB’s responsibility to adhere to the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs. The administration of the local diving program will reside with the campus’ Diving Control Board (DCB). The regulations herein shall be observed at all locations where CSUMB diving is conducted.

### CSUMB’s Scientific Diving Standards and Safety Manual

CSUMB maintains a scientific diving safety manual that provides for the development and implementation of policies and procedures that will enable the university to meet requirements of local environments and conditions as well as to comply with the AAUS scientific diving standards. Matters of compliance with the scientific diving safety manual and general safety compliance cannot be waived. The campus’ scientific diving manual includes, but is not limited to:

1. AAUS standards may be used as a set of minimum guidelines for the development of an Organizational Member’s scientific diving safety manual. Volume 1, Section 1.00 through 6.00 and the Appendices are required for all manuals. Volume 2, Sections 6.00 through 13.00 are required only when the organizational member conducts that diving activity. Organizational members specific sections are placed in Volume 2.
2. Emergency evacuation and medical treatment procedures.
3. Criteria for diver training and certification.
4. Standards written or adopted by references for each diving mode utilized which includes the following:
  - a. Safety procedures for the diving operations.
  - b. Responsibilities of the dive team members.
  - c. Equipment use and maintenance procedures.
  - d. Emergency procedures.

## Diving Control Board

1. The Diving Control Board (DCB) must consist of a majority of active scientific divers. Voting members include the Diving Safety Officer (DSO) and other representatives of the diving program such as qualified divers and members selected by procedures established by CSUMB. A Chairperson and secretary may be chosen from the membership of the board according to local procedures.
2. Has autonomous and absolute authority over the scientific diving program's operation.
3. The DCB must:
  - a. Establish additional standards, protocols and operational procedures beyond the AAUS minimums to address CSUMB specific needs and concerns.
  - b. Approve and monitor diving projects.
  - c. Review and revise the diving safety manual.
  - d. Require and ensure compliance with the diving safety manual.
  - e. Approve the depth to which a diver has been authorized to dive.
  - f. Take disciplinary action for unsafe practices.
  - g. Ensure adherence to the buddy system for scientific diving.
  - h. Act as the official representative of CSUMB in matters concerning the scientific diving program.
  - i. Act as a board of appeals to consider diver-related problems.
  - j. Recommend the issue, re-issue or the revocation of diving authorizations.
  - k. Recommend changes in policy and amendments to AAUS and the CSUMB diving safety manual as the need arises.
  - l. Establish and/or approve training protocols of standards through which the applicants for authorization can satisfy the requirements of the CSUMB diving safety manual.
  - m. Suspend diving operations considered to be unsafe or unwise.
  - n. Establish criteria for equipment selection and use.
  - o. Recommend new equipment or techniques.
  - p. Establish and/or approve facilities for the inspection and maintenance of diving and associated equipment.
  - q. Ensure that the CSUMB air station(s) meet air quality standards.
  - r. Periodically review the DSO's performance and program.
  - s. Investigate diving incidents within the CSUMB diving program or policy violations of CSUMB's diving safety manual.
4. The DCB may delegate operational oversight for portions of the program to the DSO, however, the DCB may not abdicate responsibility for the safe conduct of the diving program.

## Diving Safety Officer

The Diving Safety Officer (DSO) serves as a voting member of the DCB and should be designated as one of CSUMB's representatives to the AAUS. This person should have broad technical expertise and experience in research related diving.



## Qualifications

1. Must be an active scuba instructor from an internationally recognized certifying agency.
2. Must be appointed by the responsible administrative officer or designee, with the advice and counsel of the DCB.
3. Must qualify as a Full Voting Member of the AAUS as defined by the AAUS Bylaws.
  - a. "Holds a diving certification from a recognized national certifying agency or equivalent, and
  - b. Has engaged in sustained or successive scientific diving activities during the past two years, or
  - c. Has completed a course in scientific diving that meets the requirements as specified by the most current edition of the AAUS Standards for Scientific Diving."
4. Must attend an AAUS DSO Orientation within one year of accepting a position at an AAUS approved OM, unless they have served as a DSO for another current AAUS OM within the last year.

## Duties and Responsibilities

1. Answer to the appropriate administrative officer or designee for the conduct of the CSUMB scientific diving program.
2. 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.
4. Must be guided in performance of the required duties by the advice of the DCB, but operational responsibility for the conduct of the scientific diving program will be retained by the DSO.
5. Must suspend diving operations determined to be unsafe or unwise.

## Instructional Personnel

### Qualifications

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

### Selection

Instructional personnel will be selected by the responsible administrative officer, or designee, and the DSO.

### Lead Diver

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

1. Coordination with other known activities in the vicinity that are likely to interfere with diving operations.

2. Ensuring all dive team members possess current certifications and are qualified for the type of diving operations.
3. Ensuring dives are conducted in accordance with Section 2.0.
4. Ensuring all required documents and safety and emergency equipment is in working order and at the dive site.
5. Briefing the dive team members on:
  - a. Dive objectives.
  - b. Unusual hazards or environmental conditions likely to affect the safety of the diving operation.
  - c. Modifications to diving or emergency procedures necessitated by the specific diving operation.
6. Suspending diving operations if in their opinion conditions are unsafe.
7. Reporting to the DSO any physical problems or adverse physiological effects including symptoms of pressure-related injuries.

#### Reciprocity and Visiting Scientific Divers

1. 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 Diving Control Boards to govern the joint dive project.
2. A Scientific Diver from an Organizational Member shall apply for permission to dive under the auspices of CSUMB by submitting to the Diving Safety Officer of CSUMB a document containing all the information described in Appendix 4, signed by the Diving Safety Officer or Chairperson of the home Diving Control Board.
3. A visiting Scientific Diver may be asked to demonstrate their knowledge and skills for the planned dive.
4. If a host CSU campus denies a visiting Scientific Diver permission to dive, the host Diving Control Board shall notify the visiting Scientific Diver and their Diving Control Board with an explanation of all reasons for the denial.

#### CSUMB Dive Team Composition

Each CSUMB diver should be paired with an active AAUS diver verified by an institutional Letter of Reciprocity (LOR). If the non-CSUMB diver cannot secure a LOR, approval to dive with a CSUMB diver must be obtained from the CSUMB Diving Control Board and Diving Safety Officer or their designee. The primary concern is that all dive buddies have appropriate training experience, medical and physical fitness to dive and recent diving activity in similar environments. The following steps outline how approval can be obtained when a LOR cannot be presented.

#### Definitions

CSUMB University Diver, Scientific Diver, Diving Instructor: Paid or volunteer CSUMB staff and/or student that will participate on a dive team. This person can be faculty, staff, graduate

or undergraduate student. This person will be covered under the CSUMB workers compensation program.

Collaborator: Non-paid, non-CSUMB diver that may be a participant on a dive team. This person will be diving under their home academic institution auspices and will not be covered under the CSUMB workers compensation program.

Unaffiliated Dive Buddy: Due to research constraints, the CSUMB diver needs to dive with the most qualified diver available in the area of operations. This person is not affiliated with an academic institution but shall have his/her own liability insurance and medical coverage.

Requirements for:

CSUMB University Diver, Scientific Diver, Diving Instructor

1. If they have active scientific diver status with an AAUS institution, a Letter of Reciprocity is required. A checkout dive may also be required.
2. If they were trained as a scientific diver at an AAUS institution but are currently unaffiliated with an AAUS institution, a Verification of Training is required. All documentation required to be a current CSUMB diver must be presented prior to a checkout dive with the CSUMB Diving Safety Officer or their designee.

Collaborators

1. If they have active scientific diver status with an AAUS institution, a Letter of Reciprocity is required.
2. If they were trained as a scientific diver at an AAUS institution but are currently unaffiliated with an AAUS institution, a Verification of Training is required. All documentation required to be a current CSUMB diver is required.
3. If they have scientific diving experience but no documented AAUS training, the diver will need to provide the following documentation:
  - a. Authorization from their home institution to do scientific diving on the project.
  - b. Coverage for diving medical emergencies, i.e. DAN insurance.
  - c. Medical approval to dive, i.e. letter from a physician
  - d. Copies of dive certification cards.
  - e. Documentation of diving first aid training.
  - f. Proof of equipment service within the last year.
  - g. Copy of last 12 dives logged.
4. If any aspect of the above section cannot be met, the DCB will need to review and approve the diver for the intended project.

Unaffiliated Dive Buddy

1. The CSUMB diver shall conduct dives through an established diving operation that is recognized by an international training agency or institution – this must be verified prior to start of project.
2. The unaffiliated dive buddy shall be a Divemaster (DM) or Dive Instructor affiliated with the diving operation or an independent and locally active DM or instructor. The dive

buddy must provide documentation of currency as a DM or instructor by emailing a copy of current certification card and dive log for last 6 months to the CSUMB DSO.

3. Lacking a locally active DM or instructor as the potential dive buddy will trigger a review and approval process conducted by the DCB and DSO for the intended project.
4. Unaffiliated dive buddies must show self-insurance in regards to medical and liability coverage before diving operations are approved.

## Waiver of Requirements

The CSUMB DCB may grant a waiver for specific requirements of training, examinations, depth authorizations and minimum activity to maintain certification. AAUS medical standards may not be waived.

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

Failure to comply with the regulations of the CSUMB diving safety manual may be cause for the revocation or restriction of the diver's scientific diving qualification by action of the CSUMB Diving Control Board.

### 1.40 Consequence of Violation of Regulations by Organizational Members

Failure to comply with the regulations of this standard may be cause for the revocation or restriction of the CSUMB campus diving program's recognition by AAUS.

### 1.50 Record Maintenance

The Diving Safety Officer or designee shall maintain permanent records for its diving program and for each participant. These records include but are not limited to: diving safety manual; equipment inspection, testing, and maintenance records; dive plans (project and/or individual); records of dive (project and/or individual); medical approval to dive; diver training records; diver authorization(s); individual dive log; dive incident reports; reports of disciplinary actions by the DCB; and other pertinent information deemed necessary by the CSUMB Diving Control Board.

Record retention must comply with CSU requirements where applicable.

## Availability of Records

1. Medical records shall be available to the attending physician of a diver or former diver when released in writing by the diver.
2. Records and documents required by this manual shall be retained by CSUMB for the following period:
  - a. Diving safety manual – Current document only

- b. Equipment inspection, testing and maintenance records – Minimum current entry or tag
- c. Records of dive – Minimum of 1 year, except 5 years where there has been an incident of pressure-related injury
- d. Medical approval to dive – Minimum of 1 year past the expiration of current document except 5 years where there has been an incident of pressure-related injury.
- e. Diver training records – Minimum of 1 year beyond the life of the diver's program participation
- f. Diver authorization(s) – Minimum 1 year beyond the life of the diver's program participation
- g. Pressure-related injury – 5 years
- h. Reports of disciplinary actions by the DCB – Minimum 1 year beyond the life of the diver's program participation
- i. Records of dive-related safety inspections, assessments and post-incident investigations - Minimum 3 years post date of report

## 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 the CSUMB scientific diving program unless they are authorized pursuant to the provisions of this manual.

### 2.20 Individual Accommodation

Divers that may need accommodation to perform scientific diving need approval by the DCB and DSO prior to commencing scientific diving under the auspices of CSUMB.

- The DCB shall review each individual accommodation that might be needed to perform scientific diving under the auspices of CSUMB.
- The DSO will review the diver's training, practical experience and incident history. The DSO will consult with the DCB and the divers attending physician for any accommodations related to health issues. This information would then be reviewed as it relates to dive team safety and national and community standards.
- If an accommodation is granted, the DSO will develop a specific protocol. The protocol will then be reviewed by the DCB (and the attending physician if needed) before being approved by the DCB.

### 2.30 Pre-Dive Procedures

#### Dive Plans

Before conducting any diving operations under the auspices of the CSUMB scientific diving program, a dive plan for the proposed project or dive must be formulated and submitted for approval by the DCB or designee. Dives should be planned around the competency of the least experienced diver. The dive plan (project or individual) should include the following:

- Diving mode(s) and gas(es) to be used
- Diver's authorizations
- Approximate number of proposed dives
- Location(s) of proposed dives
- Estimated depth(s) and bottom time(s) anticipated
- Decompression status and repetitive dive plans, if required
- Proposed work, equipment and boats to be employed
- A risk assessment to determine any hazardous conditions anticipated and mitigation strategies for each hazard.
- Emergency Action Plan
- In water details of the dive plan should include:
  - Dive buddy assignments and tasks
  - Goals and objectives

- Maximum depth(s) and bottom time
- Gas management plan
- Entry, exit, descent and ascent procedures
- Perceived environmental and operational hazards and mitigations
- Emergency and diver recall procedures

#### Diver Responsibility and Refusal to Dive

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

No dive team member will be required to be exposed to hyperbaric conditions against their will.

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

#### Pre-Dive Safety Checks

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

#### Pre-Dive Briefings

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

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

## 2.40 Diving Procedures

### Solo Diving Prohibition

All diving conducted under the auspices of the CSUMB shall be planned and executed in such a manner as to ensure that every diver maintains constant, effective communication with at least one certified and comparably equipped diver. This buddy system is based upon mutual assistance, especially in the case of an emergency. A diver shall not dive if they are not capable of rendering assistance to their dive buddy in the event of an emergency. If loss of effective communication occurs within the Dive Team, all divers shall surface as soon as it is safe to do so and re-establish contact within the dive team.

### Decompression Management

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

### Termination of the Dive

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

It is the responsibility of the diver to terminate the dive, 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.

### Emergencies and Deviations from Regulations

Any diver may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation that is likely to cause death, serious physical harm, or major environmental damage. A written report of such actions must be submitted to the Diving Control Board explaining the circumstances and justifications.

## 2.50 Post-Dive Procedures

### Post-Dive Safety Checks

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



When diving outside the no-decompression limits, the divers should remain awake for at least 1 hour after diving, and in the company of a dive team member who is prepared to transport them to a recompression chamber if necessary.

## 2.60 Emergency Procedures

Each dive project leader will develop emergency procedures, which follow outlined procedures in Appendix 6 of this manual, the standards of care of the community must include procedures and implementation criteria for emergency care, recompression, evacuation and incident reporting for each dive location.

## 2.70 Flying After Diving or Ascending to Altitude (Over 1000 feet)

Following a Single No-Decompression Dive: Divers should have a minimum preflight surface interval of 12 hours.

Following Multiple Dives per Day or Multiple Days of Diving: Divers should have a minimum preflight surface interval of 18 hours.

Following Dives Requiring Decompression Stops: Divers should have a minimum preflight surface interval of 24 hours.

Before ascending to Altitude above (1000 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.

## 2.80 Record Keeping Requirements

### Personal Diving Log

Each authorized scientific diver shall log every dive made under the auspices of the CSUMB scientific diving program, and is encouraged to log all other dives. All dives are logged in the online dive log and can be accessed from the CSUMB dive program website. Details of the submission procedures are left to the discretion of the Diving Safety Officer. The diving log shall be in a form specified by the organization and shall include at least the following:

1. Name of diver, buddy and Lead Diver
2. Date, time and location
3. Diving modes used
4. General nature of diving activities
5. Approximate surface and underwater conditions
6. Maximum depths, bottom time and surface interval time
7. Diving tables or computers used
8. Detailed report of any near or actual incidents

## Required Incident Reporting

All diving incidents shall be reported to the CSUMB DSO in a timely manner. All occupational injuries and illnesses should follow established CSUMB procedures for incident reporting, including those required by the AAUS and the appropriate Labor Code section. The report will specify the circumstances of the incident and the extent of any injuries or illnesses. The DSO, in conjunction with the DCB, shall investigate and document any incident of pressure related injury and prepare a report that is to be forwarded to the AAUS during the annual reporting cycle.

The below information must be gathered and retained in a written report by CSUMB, along with the record of dive, for a period of 5 years (or as required by CSU record retention policy):

1. Name, address and phone numbers of the principle parties involved
2. Summary of experience of divers involved
3. Location, description of dive site and description of conditions that led up to incident
4. Description of symptoms, including depth and time of onset
5. Description of results of treatment
6. Disposition of case
7. Recommendations to avoid repetition of incident.

The generated documentation and report must be submitted to the AAUS during their annual reporting cycle and forwarded to the CSUMB Risk Manager and CSU's Office of the Chancellor.

## Section 3.00 Diving Equipment

### 3.10 General Policy

All equipment shall meet standards as determined by the DSO and the DCB. All equipment shall be regularly examined by the person that the equipment is issued or owned by and be serviced according to the manufacturer recommendations. Annual inspection by the DSO does not take the place of the manufacturer's recommended serving intervals.

### 3.20 Equipment

The CSUMB DCB and DSO must establish minimum equipment configurations for all dives.

#### Regulators and Gauges

- Scuba regulators and gauges must be inspected and tested prior to each use and serviced, at a minimum, according to manufacturer's recommendations.
- Standard open circuit regulator configuration is:
  - First stage
  - Primary second stage
  - Alternate second stage
  - Submersible pressure gauge (SPG)
  - Inflator hose for Buoyancy Compensator Device (BCD)
- A Full Face Mask may be used in the place of the primary second stage according to manufacturer's recommendations and only if the diver is trained in the use of this equipment.

#### Equipment for Determination of Decompression Status

- Each member of the buddy team must have an underwater timing device and depth indicator OR dive computer.
- If dive tables are being used, a set must be available at the dive location.
- If a dive computer is used the diver must use the same computer on repetitive dives.
- In an aquarium or other manmade structure of a known maximum obtainable depth:
  - A depth indicator is not required, except when a diver's decompression status must be taken into consideration on repetitive dives.
  - Only one buddy must be equipped with a timing device.
  - The maximum obtainable depth of the aquarium must be used as the diving depth.

#### Scuba Cylinders

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

### Buoyancy Compensator Devices (BCD)

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

### 3.30 Use of Dive Computers

Dive computers may be allowed in lieu of using dive tables for dive profiling if authorized by the Diving Safety Officer and if these standards are followed:

1. A diver shall not use both a computer and dive tables to profile dives within a 24-hour period.
2. Only those makes and models of dive computers specifically approved by the Diving Safety Officer or their designee, may be used.
3. Any diver desiring to use dive computers must apply to the Diving Safety Officer or their designee, for training and an exam demonstrating understanding and proficiency in the use of the specific computer to be used.
4. Divers relying on dive computers to plan or profile a dive must use only their dive computer.
5. Divers in a Dive Team must follow the dive profiling required by the most conservative (shortest bottom time, shallowest maximum depth, longest safety/decompression stop and slowest ascent rate) computer in use.
6. If a dive computer fails or malfunctions at any time during a dive, the dive must be terminated, and appropriate surfacing procedures must immediately be initiated.
7. If the dive computer fails, further diving is prohibited for at least 24 hours after surfacing from the last dive.
8. A dive computer may not be initialized and used as the primary means of dive planning or determining decompression status by a diver who has made any dives or has been above 1000 feet above sea level within the past 24 hours.
9. When using a dive computer, all non-emergency ascents should be made in accordance with the manufacturer's recommendations for that unit.
10. When using a dive computer, all non-emergency ascents are to be at a rate specified for the make and model of dive computer being used.
11. Divers shall make a stop at 15-20 feet for 3-5 minutes when the dive is deeper than 30 feet and on all repetitive dives.
12. When possible, the deepest dives should be made first, with subsequent dives getting progressively shallower. Multiple deep dives (>60 feet) require special planning and approval.

13. All manufacturer's recommendations for dive computer usage shall be followed. If manufacturer's recommendations conflict with CSUMB standards, the Diving Safety Officer must pre-approve any non-emergency deviations from this standard.

### 3.40 Auxiliary Equipment

#### Handheld Underwater Power Tools

- Power tools and equipment used underwater must be specifically approved for this purpose.
- Users of power tools must have appropriate documented training for each tool prior to use.
- Tools and equipment supplied with power from the surface must be de-energized before being placed into or retrieved from the water.
- Handheld power tools must not be supplied with power from the dive location until requested by the diver.

### 3.50 Support Equipment

#### First Aid Supplies

- A first aid kit and emergency oxygen appropriate for the diving being conducted must be available at the dive site. AEDs, if available, are also recommended at the dive site.
- A current copy of the CSUMB Diving Emergency Management Procedures (Appendix 6) must also be present.

#### Dive Flag

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

#### CSUMB Controlled Compressor Systems

- Low pressure compressors used to supply air to the diver if equipped with a volume tank shall have a check valve on the inlet side, a relief valve and a drain valve.
- Compressed air systems over 500 psig shall have slow-opening shut off valves.
- All air compressor intakes shall be located away from areas containing exhaust of other contaminants.

### 3.60 Equipment Maintenance

#### Record Keeping

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:

- Regulators

- Submersible pressure gauges
- Depth gauges
- Scuba cylinders
- Cylinder valves
- Diving helmets
- Submersible breathing masks
- Compressors
- Gas control panels
- Air storage cylinders
- Air filtration systems
- Analytical instruments
- Buoyancy control devices
- Dry suits

### Compressor Operations and Air Test Results

Gas analyses and air tests shall be performed on each CSUMB-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.

### 3.70 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/m <sup>3</sup>
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 CSUMB, 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 must develop a protocol to mitigate risk to the diver.

## Section 4.00 CSUMB Diver Authorization

The DSO and DCB reserves the right to restrict or deny any application for diver Authorization or training if in the judgement of the DSO and DCB it is determined that the applicant's safety or the safety of the Dive Team cannot be protected while diving under the auspices of CSUMB.

### 4.10 Required Diver Authorization

No person shall engage in diving operations or diver training under the auspices of CSUMB unless they hold a current CSUMB diver authorization of correct designation for the specific type of diving and they are following all applicable provisions of this manual.

### 4.20 Types of CSUMB Diver Authorization

CSUMB has three types of diver authorizations: University Diver, Scientific Diver and Diving Instructor.

CSUMB University Diver Authorization (AAUS Scientific Diver-In-Training designation)

Includes divers conducting recreational, instructional or training dives under the auspices of CSUMB. Qualifications for this authorization is a prerequisite for all diving and authorizations under the CSUMB auspices.

Examples of CSUMB University Diver:

- Divers enrolled in any level of recreational dive training for degree program credit – MSCI 280 – NAUI Scuba Diver, MSCI 282 – Advanced and Rescue Diving Techniques, MSCI 283 – NAUI Master Diver.
- Divers who enter the program who receive express consent from the DSO and/or DCB to enter the training progression not at the basic level, i.e. entering the program already certified as an entry level scuba diver.
- Divers engaged in leadership level training which includes training assistants and leadership level training programs.

CSUMB Scientific Diver Authorization

Required authorization for all persons engaged in scientific diving under the auspices of CSUMB. This authorization requires the completion of a NAUI Master Diver certification (or equivalent advanced diver experience), additional specialized training specified in this manual or by the Diving Safety Officer and approval of the Diving Control Board, upon recommendation of the Diving Safety Officer. In addition, the authorization is only valid if the diving activities meet the Cal/OSHA Scientific Diving Exemption.

This authorization requires that all certifications, medical & physical fitness to dive, equipment inspections and dive log entries are current and up to date, as outline in the provisions of this manual.

Examples of CSUMB Scientific Diver:

- Diver who has completed and achieved certification in MSCI 280 – NAUI Scuba Diver, MSCI 282 – Advanced and Rescue Diving Techniques, MSCI 283 – Master Diver and MSCI 380 – Introduction to Scientific Diving Techniques.
- Diver who has completed an AAUS Scientific Diving course at an AAUS Organizational Member AND a verification of training is on file with the CSUMB DSO.

CSUMB Diving Instructor Authorization

CSUMB Diving Instructor authorization is required of all persons conducting diving instruction under the auspices of CSUMB. It requires that the instructor meets CSUMB diving standards and be approved by the DSO and the Diving Control Board.

Examples of CSUMB Diving Instructors:

1. Dive Instructor who is qualified to teach NAUI curriculum.

Temporary CSUMB Scientific Diver Authorization

Only a diver not under the auspices of an AAUS OM may be granted a Temporary Diver Authorization. The individual in question must demonstrate proficiency in diving and can contribute measurably to a planned dive. A Temporary CSUMB Scientific Diver Authorization constitutes a waiver of selected requirements of Section 4.00 & 5.00 and is valid only for a limited time, as approved by the DSO and DCB. A Temporary CSUMB Scientific Diver Authorization must be restricted to the planned diving operation and must comply with all other policies, regulations, and standards of this manual, including medical requirements. This authorization is not to be utilized as a repeated mechanism to circumvent existing standards set forth in this manual.

#### 4.30 Revocation of Authorization

An individual's diver authorization can be restricted or revoked for cause by the DCB. Authorizations associated with an individual's diver authorization may be restricted or suspended for cause by the DSO. Restrictions or suspensions issued by the DSO may be rescinded by the DSO; these issues will be reported to and reviewed by the DCB, and the outcomes or actions resulting from this review will be documented in the diver's CSUMB diver record. Violations of regulations set forth in this manual or other governmental subdivisions not in conflict with this manual, or demonstration of poor judgement, may be considered cause. The DCB or designee must inform the diver in writing of the reason(s) for revocation. The diver will be given the opportunity to present their case in writing to the DCB for reconsideration. Following revocation, the diver may be reauthorized after complying with conditions the DCB



may impose. All such written statements and requests, as identified in this section, are formal documents, and therefore part of the diver's file.

#### 4.40 Requalification of Authorization

If a diver's CSUMB diver authorization expires or is revoked, they may be re-authorized after complying with conditions the Diving Safety Officer and the Diving Control Board may impose. The diver shall be given an opportunity to present their case to the DSO and DCB before conditions for re-authorization are stipulated.

#### 4.50 Depth Authorizations

##### Depth Ratings and Progression to Next Depth Level

Indicates the maximum depth in which a diver can conduct science and may supervise other divers holding a lesser depth authorization. A scientific diver requires a valid depth authorization to be considered active.

A diver may be authorized to the next depth level after successfully completing the requirements for that level. A diver may exceed their depth authorization when accompanied and supervised by a dive buddy holding a depth authorization greater or equal to the intended depth. Dive must be planned and executed with the permission of the DCB and DSO.

In the event a diver within the CSUMB scientific diving program does not hold an authorization at the desired next level, the DCB may authorize a required progression or procedure for a diver to attain a deeper authorization. If local conditions do not conform to traditional AAUS depth progressions, the DCB may devise a reasonable accommodation. However, the total number of dives to obtain a given depth authorization must follow the cumulative number of dives listed below.

1. Authorization to 30 Foot Depth - Initial scientific diver depth authorization, approved upon the successful completion of training listed in Section 5.00. Cumulative minimum supervised dives: 12.
2. 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.
3. Authorization to 100 Foot Depth - A diver holding a 60-foot authorization may be authorized to a depth of 100 feet after successfully completing and logging 6 supervised dives to depths between 61 and 100 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 30.
4. Authorization to 130 Foot Depth - A diver holding a 100-foot authorization may be authorized to a depth of 130 feet after successfully completing and logging 6 supervised

dives to depths between 100 and 130 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate proficiency in the use of the appropriate decompression profiling method. Cumulative minimum supervised dives: 36.

5. Authorization to 150 Foot Depth - A diver holding a 130-foot authorization may be authorized to a depth of 150 feet after successfully completing and logging 6 supervised dives to depths between 130 and 150 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 42.
6. Authorization to 190 Foot Depth - A diver holding a 150-foot authorization may be authorized to a depth of 190 feet after successfully completing and logging 6 dives to depths between 150 and 190 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements. Cumulative minimum supervised dives: 48.

**Diving on air is not permitted beyond a depth of 190 feet. Dives beyond 190 feet require the use of mixed gas.**

7. Authorization to 250 Foot Depth - A diver holding a 190-foot authorization may be authorized to a depth of 250 feet after successfully completing and logging 6 supervised dives to depths between 190 and 250 feet under supervision of a dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
8. Authorization to 300 Foot Depth - A diver holding a 250-foot authorization may be authorized to a depth of 300 feet after successfully completing and logging 6 supervised dives to depths between 200 and 250 feet under supervision of dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.
9. Authorizations deeper than 300 Feet – Depth authorizations deeper than 300 feet progress in 50-foot depth/6 dive increments. A diver holding a 300 foot, or deeper authorization may be authorized to the next depth authorization increment after successfully completing and logging 6 supervised dives under supervision of dive buddy authorized by the DCB. The diver must also demonstrate knowledge of the special problems of deep diving and of special safety requirements.

## Section 5.00 CSUMB Diver Training Requirements

These requirements apply to all persons either in beginning diver training or previously certified divers seeking CSUMB University Diver, Scientific Diver or Diving Instructor authorizations. Previously certified divers must verify with the Diving Safety Officer that they have met these requirements.

### 5.10 CSUMB University Diver

These requirements and standards are applicable for all divers under the auspices of CSUMB.

#### Course Enrollment and Application

Participation in diving courses requires official enrollment in the course. During initial diver enrollment, divers must submit the outlined documentation to the Diving Safety Officer for review and approval.

#### Required Documentation

1. Diver Certification and Training Documentation (if entering program already certified)
2. CSUMB Diver Application
3. AAUS Medical Evaluation of Fitness for Scuba Diving Report
4. AAUS Diving Medical History Form
5. CSUMB and NAUI Waiver
6. Statement of Understanding of CSUMB Dive Manual
7. Swim Evaluation Form
8. Copies of CPR, First aid, DAN Emergency Oxygen Administration & Neurological Assessment certificates of training
  - Requirements for the above start at the MSCI 282 and above level. Entry level dive certification can be achieved without the above certifications.
9. Diver certifications (copies)
10. All additional required documents and examinations

### 5.20 Approval of Diver Authorization Application

Submission of documents and participation in knowledge or skill examinations does not automatically result in certification at any level. Applicants must convince the Diving Safety Officer or their designee that they are sufficiently skilled and proficient to dive safely before they receive a CSUMB diver authorization and/or a recreational dive certification. Any applicant who does not possess the necessary judgement, knowledge or skill required for the safety of the dive and the dive team, they may be denied CSUMB diving privileges and certification.

### 5.30 Waiver of Diver Authorization Requirements

If an applicant for authorization/certification can show evidence of qualifying experience, the Diving Safety Officer and the Diving Control Board may grant a written waiver for specific requirements of training and experience. Emergency response certification training may not be waived.

#### 5.40 Pre-Authorization and Training Evaluation

##### 1. Medical Evaluation

- a. An applicant for CSUMB diver authorization shall be certified by a licensed physician to be medically qualified and for diving before proceeding with any hyperbaric exposure while breathing compressed gas or engaging in any open water activities. The medical review standards specified in this manual shall be completed. The AAUS Medical Evaluation of Fitness for Scuba Diving Report and AAUS Diving Medical History Form must be used and are available from the Diving Safety Officer, CSUMB Diving Instructor and this manual. Periodic medical re-evaluation are required to maintain CSUMB diver authorizations.

##### 2. Swimming Evaluation

- a. At the start of each level of training, the applicant must demonstrate the following swim skills in the presence of the Diving Safety Officer or their designee. A record of the applicant's performance in this test shall be placed in the applicant's permanent CSUMB diver file. Swim aids may not be used during this evaluation.
  - i. Swim on the surface 400 yards in 12 minutes or less.
  - ii. Swim underwater 25 yards without surfacing.
  - iii. Tread water for 10 minutes using hands OR 2 minutes without the use of hands.
  - iv. Transport (tow) another person of equal size a distance of 25 yards.

#### 5.50 Minimum Scuba Training – Scuba Diver (Entry Level), Rescue Diver, Master Diver Certifications

The applicant must, at minimum, show documented proof of Diver Certification or equivalent from an internationally recognized training agency. OMs who wish to train and certify entry level divers may do so under the standards of the most current version of the RSTC/WRSTC and/or ISO entry-level diver standards. Entry level diver training is a prerequisite to scientific diver training and therefore no part of entry level training may be counted in any way toward scientific diver training.

<sup>1</sup> “Minimum Course Content for Open Water Diver Certification”- World Recreational Scuba Training Council (WRSTC), [www.wrstc.com](http://www.wrstc.com).

<sup>2</sup> “Safety related minimum requirements for the training of recreational scuba divers -- Part 2: Level 2 -- Autonomous diver”. ISO 24801-2:2007- International Organization for Standardization (ISO) - [www.iso.org](http://www.iso.org).

These three training courses (NAUI Scuba Diver, Rescue Diver, Master Diver) are the minimum training requirements for all persons in Scientific Diver training or certified for SCUBA diving under the auspices of CSUMB. The CSUMB Dive Instructor may and is encouraged to expand the training beyond these minimums. A record/copy of each of the diver's certifications are to be placed in their permanent CSUMB Diver File.

#### 5.60 CSUMB Scientific Diver

Divers engaged in scientific diving qualify for CSUMB Scientific Diver authorization if they meet the application requirements and receive approval from the Diving Safety Officer and the Diving Control Board. Before authorization is granted, the applicant must demonstrate to the satisfaction of the Diving Safety Officer and the Diving Control Board the ability to safely dive as a scientific diver under local conditions. This is a permit to dive, usable only while it is current and for the purpose intended.

#### General Policy

AAUS requires that no person shall engage in scientific diving unless that person is authorized by an organizational member pursuant to the provisions of this standard. Only persons diving under the auspices of the organizational member that subscribes to the practices of AAUS are eligible for a scientific diver authorization.

#### Pre-requisites

Successful completion of MSCI 380 – Introduction to Scientific Diving Techniques is the primary pathway for achieving a CSUMB Scientific Diver authorization. Additional pathways can be achieved through application to the Diving Safety Officer and the Diving Control Board with proof of successful completion of an AAUS Scientific Diving Course at an accredited AAUS Organizational Member and all other requisite documentation outlined in this manual.

#### CSUMB Scientific Diver Training Requirements & Outline

The candidate must 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 must include principles and activities appropriate to the intended area of scientific study. Formats for meeting the 100-hour training requirement include CSUMB 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, CSUMB 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 their buddy, may be denied CSUMB scientific diving privileges.

<b>Theoretical Training / Knowledge Development</b>	
<b>Required Topics:</b>	<b>Suggested Topics:</b>
Diving Emergency Care Training <ul style="list-style-type: none"> <li>● Cardiopulmonary Resuscitation (CPR)</li> <li>● AED</li> <li>● Standard or Basic First Aid</li> <li>● Recognition of DCS and AGE</li> <li>● Accident Management</li> <li>● Field Neurological Exam</li> <li>● Oxygen Administration</li> </ul>	Specific Dive Modes (methods of gas delivery) <ul style="list-style-type: none"> <li>● Open Circuit</li> <li>● Hookah</li> <li>● Surface Supplied diving</li> <li>● Rebreathers (closed and/or semi-closed)</li> </ul>
Dive Rescue <ul style="list-style-type: none"> <li>• To include procedures relevant to CSUMB specific protocols. (See water skills below)</li> </ul>	Specialized Breathing Gas <ul style="list-style-type: none"> <li>● Nitrox</li> <li>● Mixed Gas</li> </ul>
Scientific Method	Small Boat Operation
Data Gathering Techniques (Only items specific to area of study required) <ul style="list-style-type: none"> <li>● Transects and Quadrats</li> <li>● Mapping</li> <li>● Coring</li> <li>● Photography</li> <li>● Tagging</li> <li>● Collecting</li> <li>● Animal Handling</li> <li>● Archaeology</li> <li>● Common Biota</li> <li>● Organism Identification</li> <li>● Behavior</li> <li>● Ecology</li> <li>● Site Selection, Location, and Re-location</li> <li>● Specialized Data Gathering Equipment</li> </ul>	Specialized Environments and Conditions <ul style="list-style-type: none"> <li>● Blue Water Diving</li> <li>● Altitude</li> <li>● Ice and Polar Diving (Cold Water Diving)</li> <li>● Zero Visibility Diving</li> <li>● Polluted Water Diving</li> <li>● Saturation Diving</li> <li>● Decompression Diving</li> <li>● Overhead Environments</li> <li>● Aquarium Diving</li> <li>● Night Diving</li> <li>● Kelp Diving</li> <li>● Strong Current Diving</li> <li>● Potential Entanglement/Entrapment</li> <li>● Live boating</li> </ul>
<b>Required Topics:</b>	<b>Suggested Topics:</b>
Navigation	HazMat Training
HazMat Training <ul style="list-style-type: none"> <li>● HP Cylinders</li> </ul>	<ul style="list-style-type: none"> <li>• Chemical Hygiene, Laboratory Safety (Use of Chemicals)</li> </ul>
Decompression Management Tools	Specialized Diving Equipment

<ul style="list-style-type: none"> <li>● Dive Tables</li> <li>● Dive Computers</li> <li>● PC Based Software</li> </ul>	<ul style="list-style-type: none"> <li>● Full face mask</li> <li>● Dry Suit</li> <li>● Communications</li> <li>● Dive Propulsion Vehicle (DPV)</li> <li>● SMBs/Lift Bags</li> <li>● Line Reels</li> </ul>
AAUS Scientific Diving Regulations and History <ul style="list-style-type: none"> <li>● Scientific Dive Planning</li> <li>● Coordination with other Agencies</li> <li>● Appropriate Governmental Regulations</li> </ul>	
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	

<b>Practical Training / Skill Development</b>	
Confined Water	<p>At the completion of training, the trainee must 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"> <li>● Enter water fully equipped for diving</li> <li>● Clear fully flooded face mask</li> <li>● Demonstrate air sharing and ascent using an alternate air source, as both donor and recipient, with and without a face mask</li> <li>● Demonstrate buddy breathing as both donor and recipient, with and without a face mask</li> <li>● Demonstrate understanding of underwater signs and signals</li> <li>● Demonstrate ability to remove and replace equipment while submerged</li> <li>● Demonstrate acceptable watermanship skills for anticipated scientific diving conditions</li> </ul>
Open Water Skills	<p>The trainee must 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"> <li>● Surface dive to a depth of 10 feet (3 meters) without scuba*</li> <li>● Enter and exit water while wearing scuba gear* ^^</li> <li>● Kick on the surface 400 yards (366 meters) while wearing scuba gear, but not breathing from the scuba unit*</li> <li>● Demonstrate proficiency in air sharing ascent as both donor and receiver*</li> <li>● Demonstrate the ability to maneuver efficiently in the environment, at and below the surface* ^^</li> <li>● Complete a simulated emergency swimming ascent*</li> <li>● Demonstrate clearing of mask and regulator while submerged*</li> <li>● Underwater communications^^</li> <li>● Demonstrate ability to achieve and maintain neutral buoyancy while submerged*</li> <li>● Demonstrate techniques of self-rescue and buddy rescue*</li> <li>● Navigate underwater ^</li> </ul>

	<ul style="list-style-type: none"> <li>● Plan and execute a dive<sup>^</sup></li> <li>● Demonstrate judgment adequate for safe scientific diving* <sup>^^</sup></li> </ul>
	<p>Rescue Skills:</p> <ul style="list-style-type: none"> <li>● 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</li> <li>● Demonstrate simulated in-water mouth-to-mouth resuscitation</li> <li>● Removal of victim from water to shore or boat</li> <li>● Stressed and panicked diver scenarios</li> <li>● Recommendations For Rescue Of A Submerged Unresponsive Compressed-Gas Diver – Appendix 9</li> </ul>
	<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 must 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  <sup>^^</sup> Evaluated on all dives  <sup>^</sup> Evaluated at some point during the training cycle</p>

<b>Examinations</b>	
Equipment	<p>The trainee will be subject to examination/review of:</p> <ul style="list-style-type: none"> <li>● Personal diving equipment</li> <li>● Task specific equipment</li> <li>● Function and manipulation of decompression computer to be employed by the diver (if applicable)</li> </ul>
Written Exams	<p>The trainee must pass a written examination reviewed and approved by the CSUMB DCB that demonstrates knowledge of at least the following:</p> <ul style="list-style-type: none"> <li>● Function, care, use, and maintenance of diving equipment</li> <li>● Advanced physics and physiology of diving</li> <li>● Diving regulations</li> <li>● Applicable diving environments</li> <li>● Emergency procedures for CSUMB-specific dive mode(s) and environments, including buoyant ascent and ascent by air sharing</li> <li>● Currently accepted decompression theory and procedures</li> <li>● Proper use of dive tables</li> <li>● Hazards of breath-hold diving and ascents</li> <li>● Planning and supervision of diving operations</li> <li>● Navigation</li> <li>● Diving hazards &amp; mitigations</li> </ul>



	<ul style="list-style-type: none"> <li>● 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</li> <li>● Applicable theoretical training and knowledge development from the Required and Suggested Topics (above)</li> </ul>
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### 5.70 CSUMB Dive Instructor

This certification is required prior to presenting or supervising any diver training related activities under the CSUMB auspices as the Lead Diver. All personnel involved in diving instruction under the auspices of CSUMB shall be qualified for the type of instruction being given.

#### Application

In addition to completing all the CSUMB University Diver certification application requirements and all applicable standards in this manual, the DSO and DCB may require confined (pool) water and open water demonstration of diving and instructional skills by the applicant. The DSO will observe or conduct this skill demonstration and evaluate the applicant's performance for the DCB. Passing (>75%) of a written examination may be required to verify instructional and diving knowledge. Applicants must submit to the DSO and/or their designee:

1. Copy of current active status NAUI Scuba Instructor certification.
2. Copies of current CPR, First Aid, Oxygen Administration and Neurological Assessment certificates of training.
3. A written statement of educational, employment and diving experience, i.e. resume or CV
4. All required CSUMB employment forms.
5. Applicants will be subject to a background check.

### 5.80 Continuation of University Diver, Scientific Diver, Dive Instructor Authorizations

#### Terms of CSUMB Diver Authorization

All diving certifications shall expire:

1. One year from the date of issuance.
2. Six months from the date of the last logged open water dive.
3. Upon expiration of required certifications or examinations.

#### Renewal of CSUMB Diver Authorization

The Diving Safety Officer will renew CSUMB diver authorizations of the applicants for renewal have fully complied with the standards of this manual.

## Minimum required Dives to Maintain CSUMB Diver Authorization

During any 12-month period, each authorized CSUMB diver must make a minimum of twelve open water dives under the auspices of CSUMB and have submitted CSUMB dive logs for the diving activities. At least one dive must be logged near the maximum depth authorization during each 6-month period. Divers authorized to 150 feet or over may satisfy these requirements with dives to 130 feet or over. Failure to meet the above requirements may be cause for revocation or restriction of diver authorization.

## Required Periodic Medical Re-Examinations

All divers under the auspices of CSUMB shall pass a period medical re-examination. After each major illness or injury, a CSUMB authorized diver shall submit to a medical interview or examination before resuming diving activities and submit the documents specified in the medical section of this manual.

1. Medical re-examination is required every 5 years for divers age 39 and under.
2. Medical re-examination is required every 3 years for divers age 40-59.
3. Medical re-examination is required every year for divers age 60 and over.

## Emergency Care Training

CSUMB Scientific Divers and Dive Instructors must hold current training in the following (this requirement cannot be waived):

1. Adult CPR and AED
2. Emergency oxygen administration
3. First aid for diving accidents
4. Neurological assessment

## Section 6.00 Medical Standards

### 6.10 Medical Requirements

#### General

1. All medical evaluations required by this manual must be performed by, or under the direction of, a licensed physician of the applicant-diver's choice, preferably one trained in diving/undersea medicine.
2. The diver should be free of any chronic disabling disease and any conditions contained in the list of conditions for which restrictions from diving are generally recommended.
3. CSUMB must verify that divers have been declared by the examining medical authority to be fit to engage in diving activities.

### 6.20 Frequency of Medical Evaluations

<i>Medical evaluation must 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
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.		

### 6.30 Information Provided to Examining Physician

Medical examinations conducted initially and at the intervals specified in Section 6.20 must consist of the following:

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

### 6.40 Physician's Written Report

1. A Medical Evaluation of Fitness For Scuba Diving Report signed by the examining physician stating the individual's fitness to dive, including any recommended restrictions or limitations will be submitted to CSUMB's DSO for the diver's record after the examination is completed.

2. The Medical Evaluation of Fitness For Scuba Diving Report will be reviewed by the DSO or designee and the diver's record and authorizations will be updated accordingly.
3. A copy of any physician's written reports will be made available to the individual.
4. It is the diver's responsibility to provide to CSUMB 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 DSO or designee and the diver's record and authorizations will be updated accordingly.

## Volume 2

### Section 7.00 Nitrox Diving Guidelines

The following guidelines address the use of nitrox by scientific divers under the auspices of CSUMB.

#### 7.10 Requirements for Nitrox Authorization

##### Prerequisites

Only an authorized scientific diver or DIT diving under the auspices of CSUMB is eligible for authorization to use nitrox.

Applications for authorization to use nitrox must be made to the DSO. Submission of documents and participation in aptitude examinations does not automatically result in authorization to use nitrox. The applicant must convince the DSO that they are sufficiently knowledgeable, skilled and proficient in the theory and use of nitrox for diving.

##### Training

In lieu of writing/promulgating AAUS specific 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](http://www.wrstc.com).

“Recreational diving services – Requirements for training programs on enriched air nitrox (EAN) diving”. ISO 11107:2009 – International Organization for Standardization (ISO), [www.iso.org](http://www.iso.org)

##### Practical Evaluation

1. Oxygen analysis of nitrox mixture
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 and DSO.
4. Nitrox dive computer use may be included, as approved by the DCB and DSO.
5. A minimum of two supervised open water dives using nitrox is required for authorization.

## Written Evaluation

1. Function, care, use and maintenance of equipment cleared for nitrox use.
2. Physical and physiological considerations of nitrox diving.
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, pO<sub>2</sub> and other aspects of Nitrox diving as required by the DCB and DSO.

## 7.20 Minimum Activity to Maintain Authorization

The diver should log at least one nitrox dive per year. Failure to meet the minimum activity level may be cause for restrictions or revocations of nitrox authorization.

## 7.30 Operational Requirements

### 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.

### Calculation of Decompression Status

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

### Gas Mixture Requirements

1. Only nitrox mixtures and mixing methods approved by the DCB and DSO may be used.
2. CSUMB personnel mixing nitrox must be qualified and approved by the DSO 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 this manual, any air that may come into contact with oxygen concentrations greater than 40% (i.e. during mixing) must also have a hydrocarbon contaminant no greater than .01 mg/m<sup>3</sup>.
  - a) For remote site operations using compressors not controlled by CSUMB where this is not verifiable, the DSO and DCB must develop a protocol to mitigate risk to the diver.

### Analysis Verification by User

1. Prior to the dive, it is the responsibility of each diver to analyze the oxygen content of their scuba cylinder and acknowledge in writing the following information for each cylinder: fO<sub>2</sub>, MOD, cylinder pressure, date of analysis and user's name.
2. Individual dive log reporting forms should report fO<sub>2</sub> of nitrox used, if different than 21%.

### 7.40 Nitrox Diving Equipment

#### Required Equipment

All of the designated equipment and stated requirements regarding diving equipment required in this 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

#### Required 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, must be designed and maintained for oxygen service. Oxygen systems over 125 psig must have slow-opening shut off valves.

#### Compressor System

1. Compressor/filtration systems must 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 8.00 Surface Supplied Diving Technologies

Surface supplied diving technologies include any diving mode in which a diver at depth is supplied with breathing gas from the surface.

### 8.10 Prerequisites

All surface supplied and hookah divers must be authorized scientific divers in training and have completed system specific training as authorized by CSUMB.

### 8.20 Surface Supplied Diving

#### Surface Supply Definition

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 and communication line. The umbilical supplies a helmet or full-face mask, often with voice communications.

#### Procedures

- Each diver must be continuously tended while in the water.
- A diver must be stationed at the underwater point of entry when diving is conducted in enclosed or physically confined spaces.
- Each diving operation must have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.
- For dives deeper than 100ft (30m) or outside the no-decompression limits:
  - A separate dive team member must tend each diver in the water.
  - A standby diver must be available while a diver is in the water.
- A diver using surface supplied diving technologies may rely on surface personnel to keep the diver's depth, time and diving profile.
- Surface supplied air diving must not be conducted at depths deeper than 190 feet.
- The CSUMB DSO and DCB are responsible for developing additional operational protocols.

#### Staffing Requirements

The minimum number of personnel comprising a surface supplied dive team is three. They consist of: a Designated Person-In-Charge (DPIC), a Diver, and a Tender. Additional dive team members are required when a diving operation or dive site is considered complex, or when the task loading of a dive team member is deemed excessive. It is the CSUMB DCB's responsibility to define when the surface supplied dive team must be expanded beyond the minimum manning requirements.



## Equipment

- The diver will wear a positive buckling device on the safety harness to which the umbilical hose will be secured. The attachment be of sufficient strength to prevent any strain on the helmet/full face mask hose connections and equipment must be configured to allow retrieval of the diver by the surface tender without risk of interrupting air supply to the diver.
- Each diver must be equipped with a diver-carried independent reserve breathing gas supply containing sufficient volume to complete the ascent to the surface, including all required decompression and safety stops.
- Masks and Helmets
  - Surface supplied and mixed gas masks and helmets must have:
    - A non-return valve at the attachment point between the mask/helmet and hose which must be closed readily and positively; and
    - An exhaust valve.
  - Surface supplied masks and helmets must have a minimum ventilation rate capability of 4.5 actual cubic feet per minute at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below .02 atmospheres absolute when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.
  - Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment must be equipped with an exhaust valve.
- Air supplied to the diver must meet the air quality standards outlined in this manual.

## Surface Supplied in Aquariums

- In an aquarium habitat where the maximum depth is known, a pneumofathometer is not required.
- The maximum obtainable depth of the aquarium may be used as the diving depth.
- One tender may line-tend multiple divers, provided the tender is monitoring only one air source, there is mutual assistance between divers, there are no overhead obstructions or entanglements, or other restrictions defined by CSUMB.
- The CSUMB DSO and DCB is responsible for developing additional protocols for surface supplied diving specific to the aquarium environment.

## 8.30 Hookah Diving

### Hookah Definition

Hookah is an open circuit diving mode comprised of a remote gas supply, a long hose, and a standard scuba second stage or full face mask. Hookah is generally used in shallow water (30 feet or less), though the configuration has been used to supply breathing gas from a diving bell, habitat, or submersible/submarine.

## Equipment Requirements

- The air supply hose must be rated for a minimum operating pressure of 130 psi.
- Air supplied to the hookah diver must meet the air quality standards outlined in this manual.
- Hookah supply systems must be capable of supplying all divers breathing from the system with sufficient gas for comfortable breathing for the planned depth and workload.
- Hookah system second stage should be capable of being attached to the diver in a way to avoid pulling stress on the second stage mouthpiece and affords easy release of the diver must jettison the regulator and hose.
- An independent reserve breathing gas supplied will be carried by each hookah diver:
  - When the diver does not have direct access to the surface OR
  - At depths or distances from alternate breathing gas source determined by the DSO and DCB.

## Operational Requirements

- Hookah diving must not be conducted beyond depths or distances from alternate breathing gas source as determined by the DSO and DCB.
- A diver's independent reserve breathing gas supply, if worn, must contain sufficient volume to all the diver(s) to exit to the surface or alternate breathing gas source.
- Hookah divers not supported by diving bell or underwater habitat must not be exposed to dives that require staged decompression.
- The CSUMB DSO and DCB is responsible for developing additional operational protocols.

## Hookah Diving in Aquariums

- In an aquarium habitat where the maximum depth is known and planned for, a depth gauge is not required.
- The maximum obtainable depth of the aquarium may be used as the maximum diving depth.
- A hookah configured diver may operate without an in-water buddy in an aquarium provided the diver is tended from the surface; has visual contact, line pulls or voice communication with the tender; the diver carries an independent reserve breathing gas source containing sufficient volume to allow the diver to exit to the surface or alternate breathing gas source; and under other operational conditions determined by the CSJUMB DSO and DCB.
- The CSUMB DSO and DCB are responsible for developing additional operational protocols for hookah diving specific to the aquarium environment.

## Section 9.00 Staged Decompression Diving

Decompression diving is 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.

The following procedures must be observed when conducting dives requiring planned decompression stops.

### 9.10 Minimum Experience and Training Requirements

#### Prerequisites

1. Scientific Diver qualification
2. Minimum of 100 logged dives with experience in the depth range where decompression dives will be conducted.
3. Demonstration of the ability to safely plan and conduct dives deeper than 100 feet.
4. Nitrox certification/authorization according to this manual.

#### Training

Training must be appropriate for the conditions which dive operations are to be conducted.

Required Minimum Training must include the following:

1. A minimum of 6 hours of classroom training to ensure theoretical knowledge to include: physics and physiology of decompression, decompression planning and procedures, gas management, equipment configurations, decompression methods, emergency procedures and omitted decompression procedures.
2. It is recommended that at least one training session be conducted in a pool or sheltered water setting, to cover equipment handling and familiarization, swimming and buoyancy control, to estimate consumption rates and practice emergency procedures.
3. At least 6 open-water training dives simulating/requiring decompression must be conducted, emphasizing planning and execution of required decompression dives and review of emergency procedures.
4. Progression to greater depths must be by 6-dive increments at depth intervals as specified in this manual.
5. No training dives requiring decompression shall be conducted until the diver has demonstrated acceptable skills under simulated conditions.
6. The following are the minimum skills the diver must demonstrate proficiently during dives simulating and requiring decompression:
  - a) Buoyancy control
  - b) Proper ascent rates
  - c) Proper depth control
  - d) Equipment manipulation
  - e) Stage/decompression bottle use as pertinent to planned diving operations
  - f) Buddy skills
  - g) Gas management
  - h) Time management

- i) Task loading
  - j) Emergency skills
7. Divers must demonstrate to the satisfaction of the DSO or the DSO's qualified designee, proficiency in planning and executing required decompression dives appropriate to the conditions in which diving operations are to be conducted.

Upon completion of training, the diver must be authorized to conduct required decompression dives with DSO approval.

#### 9.20 Minimum Equipment Requirements

1. Valve and regulator systems for primary (bottom) gas supplies must be configured in a redundant manner that allows continuous breathing gas delivery in the event of failure of any one component of the regulator/valve system.
2. Cylinders with volume and configuration adequate for planned diving operations.
3. One of the second stages on the primary gas supply must be configured with a hose of adequate length to facilitate effective emergency gas sharing in the intended environment.
4. Minimum dive equipment should include:
  - a) Diver location devices adequate for the planned diving operations and environment.
  - b) Compass
5. Redundancy in the following components may be required at the discretion of the DSO:
  - a) Decompression schedules
  - b) Dive timing devices
  - c) Depth gauges
  - d) Buoyancy control device
  - e) Cutting device
  - f) Lift bags and line reels

#### 9.30 Minimum Operational Requirements

1. The maximum pO<sub>2</sub> to be used for planning required decompression dives is 1.6 for open circuit. It is recommended that a pO<sub>2</sub> of less than 1.6 be used during bottom exposure.
2. Decompression dives may be planned using dive tables, dive computers and/or PC software approved by the DSO and DCB.
3. Breathing gas used while performing in-water decompression must contain the same or greater oxygen content as that used during the bottom phase of the dive.
4. The dive team prior to each dive must review emergency decompression procedures appropriate for the planned dive.
5. If breathing gas mixtures other than air are used for required decompression, their must be in accordance with those regulations set forth in the appropriate sections of this manual.

6. Use of additional nitrox and/or high-oxygen fraction decompression mixtures as travel and decompression gases to decrease decompression obligations is recommended.
7. Use of alternate inert gas mixtures to limit narcosis is recommended for depths greater than 150 feet.
8. The maximum depth for required decompression using air as the bottom gas is 190 feet.
9. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DSO and the DCB to return the diver(s) to proficiency status prior to the start of a project where decompression diving are required.
10. Mission specific workup dives are recommended.

## Section 10.00 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.

### 10.10 Minimum Experience and Training Requirements

#### Prerequisites

1. Nitrox authorization
2. If the intended use entails required decompression stops, divers will be previously authorized in decompression diving.

Divers must demonstrate to the DSO and DCB satisfaction of skills, knowledge and attitude appropriate for training in the safe use of mixed gases.

#### Classroom Training Requirements

1. Review of topics and issues previously outlined in nitrox and required decompression diving training as pertinent to the planned operations.
2. The use of helium or other inert gasses and the use of multiple decompression gases.
3. Equipment configuration
4. Mixed gas decompression planning
5. Thermal considerations
6. END determinations
7. Mission planning and logistics
8. Emergency procedures
9. Mixed gas production methods
10. Methods of gas handling and cylinder filling
11. Oxygen exposure management
12. Gas analysis
13. Mixed gas physics and physiology

#### Practical Training Requirements

1. Confined water sessions(s) in which divers demonstrate proficiency in required skills and techniques for proposed diving operations.
2. A minimum of 6 open water training dives
3. At least one initial dive must be in 130 feet or less to practice equipment handling and emergency procedures.
4. Subsequent dives will gradually increase in depth, with a majority of the training dives being conducted between 130 feet and the planned operational depth.
5. Planned operational depths for initial training dives must not exceed 260 feet.
6. Diving operations beyond 260 feet require additional training dives.

## 10.20 Equipment and Gas Quality Requirements

1. Equipment requirements must be developed and approved by the DSO and DCB. Equipment must meet other pertinent requirements set forth elsewhere in this manual.
2. The quality of inert gas used to produce breathing mixtures must be of an acceptable grade for human consumption.

## 10.30 Minimum Operational Requirements

1. All applicable operational requirements for nitrox and decompression diving must be met.
2. The maximum pO<sub>2</sub> to be used for planning required open circuit decompression dives is 1.6. It is recommended that a pO<sub>2</sub> of less than 1.6 be used during bottom exposure.
3. Divers decompressing on high-oxygen concentrations mixtures must closely monitor one another for signs of acute oxygen toxicity.
4. If a period of more than 6 months has elapsed since the last decompression dive, a series of progressive workup dives defined by the DSO and DCB to return the diver(s) to proficiency status prior to the start of a project where decompression diving are required.
5. Mission specific workup dives are recommended.

## Section 11.00 Specialized Diving Environments

Certain types of diving, some of which are listed below, require equipment or procedures that require training. Supplementary guidelines for these technologies are in development by the AAUS. OM's using these, must have guidelines established by their Diving Control Board. Divers must comply with all scuba diving procedures in this *Manual* unless specified.

### 11.10 Blue Water Diving

Blue water diving is defined as diving in open water where the bottom is generally greater than 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).

### 11.20 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.

### 11.30 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. For the purposes of this *Manual*, Ice diving is a specialized overhead environment addressed in Section 11.20 and supplemented by requirements and protocols established by the CSUMB's DCB.

Cavern, Cave, or Flooded Mine Diving – See Section 13.00

It is the responsibility of the CSUMB's DCB to establish the requirements and protocol under which diving will be safely conducted in overhead environment portions of sunken shipwrecks and other manmade structures.

### 11.40 Saturation Diving

If conducting saturation diving operations, divers must comply with the saturation diving guidelines of CSUMB.



### 11.50 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 CSUMB's DCB to establish the requirements and protocol under which diving will be safely conducted.

## Section 12.00 Rebreathers

This section defines specific considerations regarding the following issues for the use of rebreathers:

- Training and/or experience verification requirements for authorization.
- Equipment requirements
- Operational requirements and additional safety protocols to be used.
- Application of this standard is in addition to pertinent requirements of all other sections of this manual.

For rebreather dives that also involve staged decompression and/or mixed gas diving, all requirements for each of the relevant diving modes must be met. The DCB reserves the authority to review each application of all specialized diving modes, and include any further requirements deemed necessary beyond those listed here on a case-by-case basis.

No diver shall conduct planned operations using rebreathers without prior review and approval of the DCB.

In all cases, trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by DSO and DCB.

### 12.10 Definitions

1. Rebreathers are defined as any device that recycles some or all of the exhaled gas in the breathing loop and returns it to the diver. Rebreathers maintain levels of oxygen and carbon dioxide that support life by metered injection of oxygen and chemical removal of carbon dioxide. These characteristics fundamentally distinguish rebreathers from open-circuit life support systems, in that the breathing gas composition is dynamic rather than fixed.
2. There are three classes of rebreathers:
  - a. Oxygen Rebreathers: Oxygen rebreathers recycle breathing gas, consisting of pure oxygen, replenishing the oxygen metabolized by the diver. Oxygen rebreathers are generally the least complicated design but are limited in depth of use due to the physiological limits associated with oxygen toxicity.
  - b. Semi-Closed Circuit Rebreathers: Semi-closed circuit rebreathers (SCR) recycle the majority of exhaled breathing gas, venting a portion into the water and replenishing it with a constant or variable amount of a single oxygen-enriched gas mixture. Gas addition and venting is balanced against diver metabolism to maintain safe oxygen levels.
  - c. Closed-Circuit Rebreathers: Closed-circuit mixed gas rebreathers (CCR) recycle all of the exhaled gas. Electronically controlled CCRs (eCCR) replace metabolized oxygen via an electronically controlled valve, governed by oxygen sensors. Manually controlled CCR (mCCR) rely on mechanical oxygen addition and diver monitoring to control oxygen partial pressure (ppO<sub>2</sub>). Depending on the design,

manual oxygen addition may be available on eCCR units as a diver override, in case of electronic system failure. Systems are equipped with two cylinders; one with oxygen, the other with a diluent gas source used to make up gas volume with depth increase and to dilute oxygen levels. CCR systems operate to maintain a constant ppO<sub>2</sub> during the dive, regardless of depth.

#### 12.20 Prerequisites for use of any Rebreather

1. Active scientific diver status, with depth authorization sufficient for the type, make, and model of rebreather, and planned application.
2. Completion of a minimum of 25 open-water dives on open circuit SCUBA. The DCB may require increased dive experience depending upon the intended use of the rebreather system for scientific diving.
3. For SCR or CCR, a minimum 60-foot-depth authorization is generally recommended, to ensure the diver is sufficiently conversant with the complications of deeper diving. If the sole expected application for use of rebreathers is shallower than this, a lesser depth authorization may be allowed with the approval of the DCB.
4. Nitrox training. Training in use of nitrox mixtures containing 25% to 40% oxygen is required. Training in use of mixtures containing 40% to 100% oxygen may be required, as needed for the planned application and rebreather system.

#### 12.30 Training

1. Specific training requirements for use of each rebreather model must be defined by DCB on a case-by-case basis. Training must include factory-recommended requirements, but may exceed this to prepare for the type of mission intended (e.g., staged decompression or heliox/trimix CCR diving). (See training section for details.)
2. Successful completion of training does not in itself authorize the diver to use rebreathers. The diver must demonstrate to the DCB or its designee that the diver possesses the proper attitude, judgment, and discipline to safely conduct rebreather diving in the context of planned operations.
3. Post training supervised dives are required before the Scientific rebreather diver is authorized to use rebreather for research dives.

## Individual Equipment Requirements

Individual Equipment Requirements			
Key: X = include, IA = If Applicable			
	O <sub>2</sub>	SCR	CC R
DCB approved rebreather make and model	X	X	X
Bottom timer, and depth gauge	X	X	X
Dive computer (separate from rebreather unit)		X	X
Approved dive tables		I A	I A
SMB (surface marker buoy) and line reel or spool with sufficient line to deploy an SMB from the bottom in the training environment	I A	I A	I A
Access to an oxygen analyzer	X	X	X
Cutting implement	X	X	X
BCD capable of floating a diver with a flooded loop and/or dry suit at the Surface	X	X	X
Bailout gas supply of sufficient volume for planned diving activities	X	X	X
Approved CO <sub>2</sub> absorbent and other consumables	X	X	X

### 12.40 Equipment Requirements

1. General
  - a. Only those models of rebreathers specifically approved by DCB shall be used.
  - b. Rebreathers should meet the quality control/quality assurance protocols of the International Organization for Standardization requirements: ISO 9004: 2009 or the most current version, AND successful completion of CE or DCB approved third party testing.
  - c. Rebreather modifications (including consumables and operational limits) that deviate from or are not covered by manufacturer documentation should be discussed with the manufacturer and approved by the DSO and DCB prior to implementation.
2. Equipment Maintenance Requirements
  - a. The DSO and DCB or their designee will establish policies for the maintenance of rebreathers and related equipment under their auspices. Rebreathers should be maintained in accordance with manufacturer serving recommendations.
  - b. Field repairs and replacement of components covered in rebreather divers training is not annual maintenance and may be performed by the rebreather diver in accordance with dive program policy.

- c. A maintenance log will be kept per the CSU records retention policy and will minimally include:
  - Dates of service
  - Service performed
  - Individuals or company performing the service

#### 12.50 Operational Requirements

1. Dive Plan – In addition to standard dive plan components, at a minimum all dive plans that include the use of rebreathers must include:
  - a. Information about the specific rebreather model(s) to be used
  - b. Type of CO<sub>2</sub> absorbent material
  - c. Composition and volume(s) of supply gases
  - d. Bailout procedures
  - e. Other specific details as required by the DSO and DCB
2. Particular attention should be paid to using rebreathers under conditions where vibration or pulsating water movement could affect electronics or control switches and systems.
3. Particular attention should be paid to using rebreathers under conditions where heavy physical exertion is anticipated.
4. Respired gas densities should be less than 5 g·L<sup>-1</sup>, and should not exceed 6 g·L<sup>-1</sup> under normal circumstances.
5. User replaceable consumable rebreather components should be replaced per manufacture recommendations or as defined by the DSO and DCB
6. If performed, periodic field validation of oxygen cells should be conducted per DCB designated procedure.
7. Diver carried off-board bailout is not required under conditions where the onboard reserves are adequate to return the diver to the surface while meeting proper ascent rate and stop requirements, and the system is configured to allow access to onboard gas. These calculations must take into consideration mixed mode operations where an open circuit diver could require assistance in an out of gas situation.
8. Use and reuse of CO<sub>2</sub> scrubber media should be per manufacture recommendations or as defined by the DSO and DCB.
9. Planned oxygen partial pressure in the breathing gas must not exceed 1.4 atmospheres at depths greater than 30 feet, or 1.6 at depths less than 30 feet.
10. Both CNS and Oxygen Tolerance Units (OTUs) should be tracked for each diver. Exposure limits should be established by the DSO and DCB.
11. The DCB or their designee will:
  - a. Establish policies for the use of checklists related to rebreather operations.
  - b. Establish policies for pre- and post- dive equipment checks to be conducted by their divers.
  - c. Establish policies for disinfection of rebreathers to be used by their divers.
  - d. Establish policies for pre-breathing of rebreathers used by their divers.

- e. Establish policies for the use of mixed mode and mixed rebreather platform dive teams under their auspices.
  - Mixed mode and/or mixed platform dive teams are permitted.
  - At minimum, divers must be cross briefed on basic system operations for establishing positive buoyancy, closing a rebreather diver's loop and procedures for gas sharing.
- f. Establish policies for the maximum depth of dives conducted using particular class of rebreathers within the auspices of their diving operations.
- g. Establish policies for depth authorizations and maintenance for divers using rebreathers.
- h. Establish policies for implementing workup dives within program
  - Pre-operation workup dives, including review and practice of emergency recognition and response skills and management of task loading are required for operations defined by the DSO and DCB as beyond the scope of normal operating conditions.
- i. Establish policies for reauthorization for the use of rebreathers if minimum proficiency requirements are not met.
  - Reestablishment of authorization to use rebreathers must require more than just performing a dive on a particular make or model of rebreather.
  - At a minimum demonstrated skills included in the required training elements for the level of rebreather operations must be performed and reevaluated.

## 12.60 Rebreather Training Outline

### Entry Level Training

1. The training area for O<sub>2</sub> Rebreather should not exceed 20 feet in depth.
2. Entry level CCR and SCR training is limited in depth of 130feet and shallower.
3. Entry level CCR and SCR training is limited to nitrogen/oxygen breathing media.
4. Divers at the CCR and SCR entry level may not log dives that require a single decompression stop longer than 10 minutes.
5. Who may teach: Individuals authorized as a CCR, SCR, or O<sub>2</sub> Rebreather Instructor by the DCB; in all cases, the individual authorized must have operational experience on the rebreather platform being taught, and where applicable the individual being authorized should be authorized as an instructor by the respective rebreather manufacturer or their designee.
6. Maximum Student/Instructor Ratio: 4 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
7. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.
8. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used

## Rebreather Entry Level Training Requirements

Key: X = include, IA = If Applicable, ISE = If So Equipped

	O <sub>2</sub>	SCR	CC R
<b>Required Training Topic</b>			
<b>Academic</b>			
<b>History of technology</b>	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Oxygen toxicity	X	X	X
Chemical burns & caustic cocktail	X	X	X
Hypoxia – insufficient O <sub>2</sub>	X	X	X
Hypercapnia – excessive CO <sub>2</sub>	X	X	X
Arterial gas embolism	X	X	X
Middle Ear Oxygen Absorption Syndrome (oxygen ear)	X	X	X
Hygienic concerns	X	X	X
Nitrogen absorption & decompression sickness		X	X
CO <sub>2</sub> retention	X	X	X
Hyperoxia-induced myopia	X	X	X
<b>System design, assembly, and operation, including:</b>			
Layout and design	X	X	X
Oxygen control systems	X	X	X
Diluent control systems		ISE	ISE
Use of checklists	X	X	X
Complete assembly and disassembly of the unit	X	X	X
Canister design & proper packing and handling of chemical absorbent	X	X	X
Decompression management and applicable tracking methods		ISE	X
Oxygen and high pressure gas handling and safety	X	X	X
Fire triangle	X	X	X
Filling of cylinders	X	X	X
Pre-dive testing & trouble shooting	X	X	X
Post-dive break-down and maintenance	X	X	X
Trouble shooting and manufacturer authorized field repairs	X	X	X
Required maintenance and intervals	X	X	X
Manufacturer supported additional items (ADV, temp stick, CO <sub>2</sub> monitor, etc.)	ISE	ISE	ISE
<b>Dive planning:</b>			
Operational planning	X	X	X
Gas requirements	X	X	X
Oxygen exposure and management	X	X	X
Gas density calculations		X	X

Oxygen metabolizing calculations	X	X	X
Scrubber limitations	X	X	X
Mixed mode diving (buddies using different dive modes)	X	X	X
Mixed platform diving (buddies using different rebreather platforms)	X	X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear elements	X	X	X
Loss of electronics	ISE	ISE	X
Partially flooded loop	X	X	X
Fully flooded loop	X	X	X
Cell warnings		ISE	X
Battery warnings	ISE	ISE	X
High O <sub>2</sub> warning	ISE	ISE	X
Low O <sub>2</sub> warning	ISE	ISE	X
High CO <sub>2</sub> warning	ISE	ISE	ISE
Recognizing issues as indicated by onboard scrubber monitors	ISE	ISE	ISE
Recognizing hypercapnia signs and symptoms in self or buddy	X	X	X
Excluded O <sub>2</sub> cell(s)	ISE	ISE	ISE
Loss of Heads Up Display (HUD)	ISE	ISE	ISE
Loss of buoyancy	X	X	X
Diluent manual add button not functioning		ISE	ISE
O <sub>2</sub> manual add button not functioning	ISE	ISE	ISE
Exhausted oxygen supply	X	X	X
Exhausted diluent supply		ISE	ISE
Lost or exhausted bailout	ISE	ISE	ISE
Handset not functioning	ISE	ISE	ISE
Solenoid stuck open	ISE	ISE	ISE
Solenoid stuck closed	ISE	ISE	ISE
ADV stuck open	ISE	ISE	ISE
ADV stuck closed	ISE	ISE	ISE
Isolator valve(s) not functioning	ISE	ISE	ISE
Oxygen sensor validation	ISE	ISE	X
CO <sub>2</sub> sensor validation	I A	I A	I A
Gas sharing	X	X	X
Diver assist and diver rescue	X	X	X
Other problem recognition and emergency procedures specific to the particular unit, environment, or diving conditions	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Use of checklists	X	X	X
Carbon dioxide absorbent canister packing	X	X	X
Supply gas cylinder analysis and pressure check	X	X	X



Test of one-way valves	X	X	X
System assembly and breathing loop leak testing	X	X	X
Oxygen control system calibration	ISE	ISE	X
Proper pre-breathe procedure	X	X	X
In-water bubble check	X	X	X
Proper buoyancy control during descent, dive operations, and ascent	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Unit removal and replacement on the surface	X	X	X
<b>Bailout and emergency procedures for self and buddy, including:</b>			
System malfunction recognition and solution	X	X	X
Manual system control	ISE	ISE	ISE
Flooded breathing loop recovery	I A	I A	I A
Absorbent canister failure	X	X	X
Alternate bailout options	X	X	X
Manipulation of onboard and off board cylinder valves	X	X	X
Manipulation of bailout cylinders (removal, replacement, passing and receiving while maintaining buoyancy control)	ISE	ISE	ISE
Manipulation of quick disconnects, isolator valves, and manual controls specific to the unit and gear configuration	ISE	ISE	ISE
<b>Proper system maintenance, including:</b>			
Breathing loop disassembly and disinfection	X	X	X
Oxygen sensor replacement	ISE	ISE	ISE
Battery removal and replacement or recharging	ISE	ISE	ISE
Other tasks as required by specific rebreather models	X	X	X
<b>Written Evaluation</b>	X	X	X
<b>Supervised Rebreather Dives</b>	X	X	X

## Entry Level Training – Minimum Underwater Requirements

	<b>Pool/Confined Water</b>	<b>Open water</b>	<b>Supervised Dives</b>
<b>O2</b>	1 Dive, 90 – 120 minutes	4 dives, 120 minute cumulative	2 Dives, 120 minute cumulative
<b>SC R</b>	1 Dive, 90 – 120 minutes	4 dives, 120 minute cumulative	4 dives, 120 minute cumulative
<b>CC R</b>	1 Dive, 90 – 120 minutes	8 dives, 380 minute cumulative	4 dives, 240 minute cumulative

## Rebreather Required Decompression, Normoxic and Hypoxic Mix Training

1. Required Decompression and Normoxic training may be taught separately or combined.
2. Prerequisites:
  - a. Required decompression: 25 rebreather dives for a minimum cumulative dive time of 25 hours.
  - b. Mixed Gas:
    - Normoxic mixes: 25 rebreather dives for a minimum cumulative dive time of 25 hours.
    - Hypoxic mixes – rebreather required decompression certification and normoxic certification and 25 decompression rebreather dives for a minimum cumulative dive time of 40 hours on dives requiring decompression
3. Who may teach: Individuals authorized as a CCR/SRC required decompression and/or Normoxic and/or Hypoxic Mix instructor by the DCB or their designee (this is in addition to the original authorization from [section A #5](#))
4. Maximum Student/Instructor Ratio: 2 to 1. This ratio is to be reduced as required by environmental conditions or operational constraints.
5. Upon completion of practical training, the diver must demonstrate proficiency in pre-dive, dive, and post-dive operational procedures for the particular model of rebreather to be used.
6. Supervised dives target activities associated with the planned science diving application. Supervisor for these dives is the DSO or designee, experienced with the make/model rebreather being used.

## Rebreather Required Decompression, Normoxic & Hypoxic Mix Training Requirements

Key: X = include, IA = If Applicable, ISE = If So Equipped

	Deco	Normoxic	Hypoxic Mixes
<b>Required Training Topic</b>			
<b>Academic</b>			
Review of applicable subject matter from previous training	X	X	X
<b>Medical &amp; physiological aspects of:</b>			
Hypercapnia, hypoxia, hyperoxia	X	X	X
Oxygen limitations	X	X	X

Nitrogen limitations	X	X	X
Helium absorption and elimination		X	X
High Pressure Nervous Syndrome (HPNS)			X
<b>System design, assembly, and operation, including:</b>			
Gear considerations and rigging	X	X	X
Gas switching	X	X	X
<b>Dive planning:</b>			
Decompression calculation	X	X	X
Gradient Factors	X	X	X
Scrubber duration and the effects of depth on scrubber function	X	X	X
Gas requirements including bailout scenarios	X	X	X
Bailout gas management – individual vs team bailout	X	X	X
Gas density calculations	X	X	X
Operational Planning	X	X	X
Equivalent narcosis depth theory		X	X
Gas selection, gas mixing and gas formulas		X	X
<b>Problem Recognition &amp; Emergency Procedures:</b>			
Applicable open circuit emergency procedures for common gear elements	X	X	X
Flooded loop	X	X	X
Cell warnings	X	X	X
Battery warnings	X	X	X
Hypercapnia, hypoxia, hyperoxia	X	X	X
<b>Practical Training and Evaluations</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
Proper demonstration of applicable skills from previous training	X	X	X
Proper manipulation of DSV and/or BOV	X	X	X
Proper descent and bubble check procedures	X	X	X
Proper monitoring of setpoint switching and pO2 levels	X	X	X
Proper interpretation and operation of system instrumentation	X	X	X
System monitoring & control during descent, dive operations, and ascent	X	X	X
Demonstrate the ability to manually change setpoint and electronics settings during the dive	ISE	ISE	ISE
Demonstrate buoyancy control; ability to hover at fixed position in water column without moving hands or feet	X	X	X
Demonstrate controlled ascent with an incapacitated diver including surface tow at least 30 meters / 100 feet with equipment removal on surface, in water too deep to stand	X	X	X
Onboard and off board valve manipulation for proper use, and reduction of gas loss	X	X	X

Diagnosis of and proper reactions for a flooded absorbent canister	X	X	X
Diagnosis of and proper reactions for CO2 breakthrough	X	X	X
Diagnosis of and proper response to Cell Errors	X	X	X
Diagnosis of and proper reactions for Low oxygen drills	X	X	X
Diagnosis of and proper reactions for Flooded Loop	X	X	X
Diagnosis of and proper reactions for High Oxygen Drills	X	X	X
Diagnosis of and proper reactions for electronics and battery failure	X	X	X
Operation in semi-closed mode	X	X	X
Properly execute the ascent procedures for an incapacitated dive buddy	X	X	X
Proper buddy contact and communication	X	X	X
Use of a line reel or spool to deploy an SMB from planned dive depth and while controlling buoyancy in the water column	X	X	X
Proper management of line reel or spool, and SMB during ascents and safety or required stops	X	X	X
Demonstrate the ability to maintain minimum loop volume	X	X	X
Demonstrate comfort swimming on surface and at depth carrying a single bailout/decompression cylinder/bailout rebreather	X		
Demonstrate ability to pass and retrieve a single bailout/decompression cylinder or bailout rebreather while maintaining position in the water column	X		
Demonstrate ability to pass and receive multiple bailout/decompression cylinders or bailout rebreather while maintaining position in the water column	I A	X	X
Demonstration of the ability to perform simulated decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstration of the ability to perform decompression stops at pre-determined depths for scheduled times	X	X	X
Demonstrate competence managing multiple bailout cylinders, including drop and recovery while maintaining position in the water column	I A	X	X
Demonstrate appropriate reaction to simulated free-flowing deco regulator	X	X	X
Gas share of deco gas for at least 1 minute	X	X	X
Demonstrate oxygen rebreather mode at appropriate stop depth		X	X
Complete bailout scenarios from depth to include decompression obligation on open circuit	X	X	X
<b>Written Evaluation</b>	X	X	X

Supervised Rebreather Dives		X	X	X
<b>Minimum Underwater Requirements</b>				
	<b>Pool/Confined Water</b>	<b>Openwater</b>	<b>Supervised Dives**</b>	
<b>Deco</b>	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.	
<b>Normoxic</b>	1 Dive / 60 min	7 Dives / 420 min	4 Dives / 240 min.	
<b>Deco/Normoxic Combined</b>	1 Dive / 60 min	7 Dives / 420 min 3 Normoxic Dives / 180 min	4 Dives / 240 min.	
<b>Hypoxic Mixes</b>		7 Dives / 420 min	4 Dives / 240 min.	
**A minimum of three supervised dives should comply with authorization parameters				

### Rebreather Crossover Training

1. Crossover training to a new rebreather platform requires a minimum of 4 training dives for a minimum cumulative dive time of 240 min.
2. Advanced level certification on a new rebreather platform may be awarded upon successful demonstration of required skills using the new platform.

## Section 13.00 Scientific Cave and Cavern Diving

This section defines specific considerations regarding the following issues for Scientific Cavern and Cave diving:

- Training and/or experience verification requirements for authorization
- Equipment requirements
- Operational requirements and additional safety protocols to be used

Application of this standard is in addition to pertinent requirements of all other sections of this Manual.

For cavern or cave dives that also involve staged decompression, rebreathers, and/or mixed gas diving, all requirements for each of the relevant diving techniques, modes, or gases must be met.

No diver must conduct planned operations in caverns, caves, or other overhead environments without prior review and approval of the DCB or designee. The diver must demonstrate that he/she possesses the proper attitude, judgment, and discipline to safely conduct cave and cavern diving in the context of planned operations.

If a conflict exists between this section and other sections in this Manual, the information set forth in this section only takes precedence when the scientific diving being conducted takes place wholly or partly within an underwater cave or cavern environment.

### 13.10 Definitions

A dive team must 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:

- The absence of natural light
- Current 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.
- The presence of silt, sand, clay, etc. that can cause visibility to be reduced to nothing in a very short time.
- Restrictions – Any passage through which two divers cannot easily pass side by side while sharing air, making sharing air difficult.
- Cave-Ins – A normal part of cave evolution; however, experiencing a cave-in during a diving operations is extremely unlikely.

### 13.20 Prerequisites

<b>Prerequisites</b>	<b>Cavern: OC or Rebreather</b>	<b>Cave</b>	<b>Rebreather Cave</b>
Active scientific diver status, with depth qualification sufficient for proposed training location(s)	X	X	X
Completion of a minimum of 25 dives.	X		
Cavern Diver Authorization		X	X

### 13.30 Training

<b>Training</b>	<b>Cavern: OC or Rebreather</b>	<b>Cave OC</b>	<b>Rebreather Cave</b>
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit			
Trainers must be qualified for the type of instruction to be provided. Training must be conducted by agencies or instructors approved by the DCB or their designee	X	X	X
<b>Academic</b>			
Policy for diving overhead environments	X	X	X
Environment and environmental hazards	X	X	X
Accident analysis	X	X	X
Psychological considerations	X	X	X
<b>Required equipment and equipment configuration</b>			
Single cylinder with H or Y Valve	IA	IA	
Doubles with Isolation Manifold	IA	IA	
Side Mount		IA	IA
No Mount		IA	IA
Stage Cylinder(s)		IA	IA
Off-board Bailout	IA		X
Communications	X	X	X
<b>Diving techniques</b>			
Body control	X	X	X
Navigation and guidelines	X	X	X
Entry and Exit Protocols (Right of Way)	X	R	R
Use of line arrows and cookies	X	X	X
Line Systems Applicable to the Area and/or Cave System	X	R	R
Line Jumps		X	X
Circuits		X	X
<b>Dive planning</b>			
Rule of Sixths	X	R	R
Rule of Thirds	X	R	R
Gas Matching	IA	X	X

Decompression Theory	R	R	R
Dive Tables	R	R	R
Mixed Mode Diving	IA	IA	IA
Cave geology	X	R	R
Cave hydrology	X	R	R
Cave biology	X	X	X
Emergency procedures	X	X	X
<b>Practical Training and Evaluation</b>			
<b>Land Drills</b>			
Line Reel Use	X	R	R
Techniques and Considerations for Laying a Guideline	X	X	X
Guideline Following	X	R	R
Buddy Communication	X	R	R
Team Positioning for Normal Entry and Exit	X	X	X
Zero Visibility Drills			
Line Reel Use	X	R	R
Line and Line Arrow Identification and Following	X	R	R
Bump and Go (Skills description)		X	X
Emergency Procedures			
How Far Can You Go Out Of Gas?(Skills description)	X	X	X
Team Positioning for Emergency Situations	X	X	X
<b>In-Water</b>			
<b>Demonstrated skills must include, at a minimum:</b>			
A minimum of four (4) cavern dives, preferably to be conducted in a minimum of two (2) different caverns	X		
A minimum of twelve (12) cave dives, preferably to be conducted in a minimum of four (4) different cave sites with differing conditions		X	X
Safety drill (S-drill) – Performed on every dive			
Review of Dive Plan and Turn Pressures	X	X	X
Essential Gear Identification, Positioning, and Function Check	X	X	X
Proper Valve Position Check	X	X	X
Bubble Check	X	X	X
Proper Buoyancy Compensator Use	X	X	X
Proper Trim and Body Positioning	X	X	X
Hovering and Buoyancy With Hand Tasks	X	X	X
Specialized Propulsion Techniques and Anti-Silting Techniques (modified flutter kick, modified frog kick, pull and glide, ceiling walk or shuffle)	X	X	X
Proper Light and Hand Signal Use	X	R	R
Proper Reel and Guideline Use	X	X	X
Ability to Deploy a Primary Reel and Tie Into a Main Line Under Different Conditions (Flow, Visibility, Bottom/Silt, etc.)	X	X	X
Proper Line Placement and Etiquette	X	X	X
Proper Use of Safety Reel		X	X
Proper Use of Jump/Gap Reel(s)		X	X



<b>Use of Drop/Stage Cylinders</b>			
Proper Placement and Retrieval of Cylinder(s) With Minimal Disturbance of Environment and Visibility		IA	IA
Ability to Deploy and Retrieve Cylinders With Minimal Loss of Forward Progress		IA	IA
Surveying	IA	IA	IA
Ability to Properly Critique Their Dives and Performance	X	X	X
Zero Visibility Drills	IA	X	X
Line Reel Use	X	R	R
Buddy Communication	X		
Line and Line Arrow Identification and Following	X	R	R
Bump and Go (Skills Description)		X	X
Emergency Procedures			
Team Positioning for Emergency Situations	X	X	X
Lost Line (Skills Description)		X	X
Lost Buddy	X	X	X
Gas Sharing While Following Guideline (Conducted with and without visibility, As Donor and Receiver)	X	X	X
Gas Sharing in a Minor Restriction Using a Single File Method As Donor and Receiver		X	X
Valve Manipulation	X	X	X
Proper Attitude, Judgment, and Discipline To Safely Conduct Dives In An Overhead Environment	X	X	X
<b>Written Examination</b>			
A written evaluation approved by the DCB with a predetermined passing score, covering concepts of both classroom and practical training	X	X	X

#### 13.40 Equipment Requirements

Equipment used for SCUBA in cave or cavern diving is based on the concept of redundancy. Redundant SCUBA equipment must be carried whenever the planned penetration distances are such that an emergency swimming ascent is not theoretically possible.

Minimum Equipment	Cavern OC	Rebreather Cavern	Cave OC	Rebreather Cave
Key: X = include, R = Review, IA = If Applicable, OC = Open Circuit				
At a minimum, a single cylinder with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy equipped with a "K" valve; standard OC regulator configuration ( <a href="#">Section 3.20</a> ); and BCD	X			
At minimum, a single cylinder equipped with an "H" or "Y" valve			IA	

Or an alternate gas supply with adequate volume and configured to allow divers to exit from farthest/deepest penetration while supporting self and dive buddy				
Off-board/bailout gas supply of sufficient volume and configured to allow diver to exit from farthest/deepest penetration	IA	X		X
A BCD capable of being inflated from the cylinder	X	X	X	X
Slate and pencil	X	X	X	X
A functioning primary light with sufficient burn time for the planned dive			X	X
Two functioning battery powered secondary lights	X	X	X	X
Two cutting devices	X	X	X	X
One primary reel of at least 350 feet (106 m) for each team	X	X	X	X
Safety reel with at least 150 feet (45.6 m) of line			X	X
Directional Line Markers			X	X
Cylinders with dual orifice isolation valve manifold Or independent SCUBA systems* with enough volume for the planned dive plus required reserve			X	
Two completely independent regulators, at least one of each having submersible tank pressure gauge and a low pressure inflator for the BCD			X	
One regulator to be configured with a five foot or longer second stage hose			X	
Rebreather		X		X
Off-board Bailout of sufficient capacity for the diver to exit to the surface		X		X
*Independent SCUBA systems must be configured to allow for monitoring of gas pressures in each cylinder				

### 13.50 Operational Requirements and Safety Protocols

<b>Operational Requirements and Safety Protocols</b>	<b>Cavern</b>	<b>Cave</b>
Diving must not be conducted at penetration distance into the overhead environment greater than 200 feet (60 m) from the water's surface, with a depth limit of 100 feet (30 m)	X	
Dive teams must perform a safety drill prior to each dive that includes equipment check, gas management, and dive objectives	X	X
Each team within the overhead zone must utilize a continuous guideline appropriate for the environment leading to a point from which an uninterrupted ascent to the surface may be made	X	X
Gas management must be appropriate for the planned dive with special considerations made for; DPV's, siphon diving, rebreathers, etc.	X	X

The entire dive team is to immediately terminate the dive whenever any dive team member calls (terminates) the dive	X	X
---	---	---

## Appendices

## 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 certification as a Scientific Diver for the \_\_\_\_\_ (Organizational Member). 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 **California State University Monterey Bay** standards. Thank you for your assistance. \_\_\_\_\_ Organizational Member

DSO Signature:	Date:
Printed Name: Andrew Morgan	Phone Number: 530-383-1564

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 but not limited to claustrophobia, suicidal ideation, psychosis, anxiety states, untreated depression and any other psychiatric disorder that impairs the ability to make safety related judgements for yourself and others. [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**

Available from Best Publishing Company, P.O. Box 30100, Flagstaff, AZ 86003-0100, the Divers Alert Network (DAN) or the Undersea and Hyperbaric Medical Society (UHMS), Durham, NC

- Elliott, D.H. ed. 1996. *Are Asthmatics Fit to Dive?* Kensington, MD: Undersea and Hyperbaric Medical Society.
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- Mitchell, S.J., and A.A. Bove. 2011. Medical screening of recreational divers for cardiovascular disease: Consensus discussion at the Divers Alert Network Fatality Workshop. *Undersea and Hyperbaric Medicine* 38(4): 289-296.
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- Bove, A.A. and Davis, J. 2003. *DIVING MEDICINE*, Fourth Edition. Philadelphia: W.B. Saunders Company.
- Edmonds, C., Lowry, C., Pennefather, J. and Walker, R. 2002. *DIVING AND SUBAQUATIC MEDICINE*, Fourth Edition. London: Hodder Arnold Publishers.
- Bove, A.A. ed. 1998. *MEDICAL EXAMINATION OF SPORT SCUBA DIVERS*, San Antonio, TX: Medical Seminars, Inc.
- NOAA DIVING MANUAL, NOAA. Superintendent of Documents. Washington, DC: U.S. Government Printing Office.
- U.S. NAVY DIVING MANUAL. Superintendent of Documents, Washington, DC: U.S. Government Printing Office, Washington, D.C.

## Appendix 2 AAUS Medical Evaluation of Fitness for Scuba Diving Report

Name of Applicant (Print or Type) \_\_\_\_\_

Date of Medical Evaluation \_\_\_\_\_

**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. 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:**

<b>DURING ALL INITIAL AND PERIODIC RE-EXAMS (UNDER AGE 40):</b>
• Medical history
• Complete physical exam, with emphasis on neurological and otological components
• Urinalysis
• Any further tests deemed necessary by the physician
<b>ADDITIONAL TESTS DURING FIRST EXAM OVER AGE 40 AND PERIODIC RE-EXAMS (OVER AGE 40):</b>
• Chest x-ray (Required only during first exam over age 40)
• Resting EKG
• Assessment of coronary artery disease using Multiple-Risk-Factor Assessment <sup>1</sup> (age, lipid profile, blood pressure, diabetic screening, smoking)
Note: Exercise stress testing may be indicated based on Multiple-Risk-Factor Assessment <sup>1</sup>

**PHYSICIAN'S STATEMENT:**

I have evaluated the above mentioned individual according to the tests listed above. 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.

01 I find no medical conditions that may be disqualifying for participation in scuba diving.

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.

\_\_\_\_\_ MD or DO \_\_\_\_\_

**SIGNATURE**

**DATE**

\_\_\_\_\_  
Name (Print or Type)

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone Number E-Mail Address

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

My familiarity with diving medicine is:  
\_\_\_\_\_

## Appendix 2b AAUS Medical Evaluation of Fitness for Scuba Diving Report

### APPLICANT'S RELEASE OF MEDICAL INFORMATION FORM

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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

<sup>1</sup>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 \_\_\_\_\_ DOB \_\_\_\_ 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 certification procedure.

This form must 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 must 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	
	<b>Yes</b>	<b>No</b>	<b>Please indicate whether or not the following apply to you</b>	<b>Comments</b>
23			Take tranquilizers	
24			Perforated ear drums	
25			Hay fever	
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	
	Yes	No	Please indicate whether or not the following apply to you	Comments
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	
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. A separate sheet can also be attached to accommodate explanations.

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

SignatureDate

Appendix 4 CSUMB/AAUS Request for Diving Reciprocity & 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 California State University Monterey Bay Diving Safety Manual, and has demonstrated competency in the indicated areas. California State University Monterey Bay 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 as of: (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 Certification \_\_\_\_\_ 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 Humboldt State University.

Diving Safety Officer:

\_\_\_\_\_  
(Signature) (Date)

\_\_\_\_\_  
(Print) Email/Phone

Appendix 5 CSUMB Diving Program Emergency Telephone Numbers

**In any life-threatening emergency, the correct procedure is to call 911. For a non-life-threatening diving emergency, call DAN as soon as is practical. The following is supplementary information only. It is subject to change so please check each institution’s website prior to filling out project proposals, dive plans and emergency actions plans for specific geographic locations.**

**Emergency Personnel – California State University Monterey Bay**

<b>Diving Safety Officer</b>	<b>C: 530-383-1564</b>	
Diving Control Board Chair	O: 831-582-4662 C: 831-915-5073	
Campus Health Center	O: 831-582-3965	
Coast Guard Station Monterey	Emergency: VHF Radio Ch. 16 OR 911	Non-Emergency: 831-647-7300

**Other References**

Divers Alert Network (DAN)	Emergency: 919-684-9111	Non-Emergency: 800-446-2671
Community Hospital of the Monterey Peninsula (CHOMP) - 23625 Holman Highway, Monterey	Emergency Dep.: 831-625-4900	
Pacific Grove Hyperbaric Chamber, Fire Station #4 - 600 Pine Ave., Pacific Grove	Initiate Through 911	Non-Emergency 831-2428733
Catalina Hyperbaric Chamber - USC Wrigley Institute, Two Harbors, Catalina Island	Emergency: 310-510-1053	Non-Emergency: 310-510-4020

## Appendix 6 CSUMB Diving Emergency Management Procedures

### Introduction

A diving accident victim could be any person who has been breathing compressed gas 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 OM 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
4. Administer 100% oxygen if appropriate (in case of decompression illness or near drowning).
5. Call local Emergency Medical Services (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 will understand why 100% oxygen may be required for the diving accident victim or that recompression treatment may be necessary.
6. Call appropriate Diving Accident Coordinator (i.e. DAN, LA County Medical Alert Network) for contact with diving physician and recompression chamber, etc.
7. Notify the Diving Safety Officer or designee according to the Emergency Action Plan for the diving location/area.
8. Complete and submit Incident Report Form ([www.aaus.org](http://www.aaus.org)) to the DSO and DCB.

### Procedures Necessary to Outline in Dive Plan

1. Emergency care procedures
2. Emergency contact information for each dive team member
3. Hazard identification and mitigation strategies
4. Nearest accessible hospital
5. Nearest Recompression Facility and how to access.
6. Evacuation plan, complete with contact information and procedure for initiation.
7. Available means of transportation



## Appendix 7 Research Diving Project Plan

Lead Diver Name: \_\_\_\_\_

Project Name: \_\_\_\_\_

*Sponsoring Research Faculty:*

Faculty and/or PI Signature: \_\_\_\_\_

Dive Site Location and Site Description (attach a map, if possible):

Summary of Dive Objectives and Activities (List any additional support equipment required such as dive flag/float, identification of anticipated hazards and mitigation strategies):

Diver Roles (describe in detail activities to be performed by each individual diver):

Science equipment to be used (note which items need to be checked out of the locker *and when you will pick them up*):

- Transect tapes \_\_\_\_ (quant)  Reel \_\_\_\_\_ (quant)
- Lights \_\_\_\_ (quant)
- Camera \_\_\_\_ (quant)  Camera strobe
- Other (describe below)

### Gas Management Plan

PSI at which gear retrieval begins \_\_\_\_\_

PSI at which the dive is terminated \_\_\_\_\_

PSI at which air sharing begins \_\_\_\_\_

Emergency Response Plan for Project's Specific Region (Must be reviewed with the dive team prior to all diving activities. Please note any additions to standard CSUMB diving emergency protocols):  
Means of Communication:

Emergency Care Procedures:

Nearest Accessible Hospital (include contact information):

Nearest operational Recompression Treatment Facility & How to Access (include contact information):

Evacuation Plan (include contact information):

Available Means of Transportation:

Dive Site Access:

- Shore
- Boat

Breathing gas:

- Air
- Nitrox
- Other

DSO Approval: \_\_\_\_\_ Date: \_\_\_\_\_

DIVE PLAN TRACKING ID: \_\_\_\_\_





## Appendix 8 Dive Plan Form

*It is the lead diver's responsibility to get DSO approval 48 hours in advance of diving activities then turn in completed form to DSO within 24 hours following diving activities.*

Lead Diver Name:

Project Name:

DIVE PLAN TRACKING ID (assigned at the bottom of your approved dive proposal) \_\_\_\_\_

Dive Date:

	Time In	Time Out	Max Depth
Dive 1			
Dive 2			

Dive site name:

Emergency shore contact name:

Phone:

### Dive Team

Name

Contact Number

Emergency Contact

(Name & Number)


Summary of Dive Objectives and Activities (List support equipment to be used, description of repetitive dive profile, identification of anticipated hazards and mitigation strategies – reference the Research Diving Proposal):

Gear Required from Dive Locker & To Whom Assigned:

Gear pick up AND drop off dates/times (1 hour window):

Comments (reminders, adjustments):

Emergency Response Plan (Must be reviewed with the dive team prior to all diving activities. Please note any additions to standard CSUMB diving emergency protocols – COPY AND PASTE FROM RESEARCH DIVING PROPOSAL):

Means of Communication:

Emergency Care Procedures:

Nearest Accessible Hospital (include contact information):

Nearest operational Recompression Treatment Facility & How to Access (include contact information):

Evacuation Plan (include contact information):

Available Means of Transportation:

DSO Approval: \_\_\_\_\_ Date: \_\_\_\_\_

## Field Checklist

Safety briefing (Must be reviewed with the dive team prior to all diving activities)

Access to

- DAN O2 kit
- Communications equip
- 1<sup>st</sup> aid
- Source and expected response time for EMS
- Nearest chamber location and contact info

Science briefing (reviewed with the dive team prior to diving activities)

Shore Contact notified (entry)

Shore Contact notified (exit)

Changes to dive plan or incidents (provide comments):

Equipment/Gear issues or comments (provide gear number):

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**General Emergency 911**

**Monterey County Sheriff Switchboard** (831) 647-7911

**Community Hospital of Monterey**  
General Information(831) 624-5311  
Emergency Department(831) 625-4900

**Pacific Grove Hyperbaric Facility**  
Non-Emergency (831) 648-3110  
Emergency911

**Catalina Hyperbaric Facility**  
Non-Emergency(310) 743-6793  
Emergency(310) 510-1053

**Divers Alert Network (DAN)**  
Non-Emergency(919) 684-2948  
Emergency(919) 684-8111

**CSU Monterey Bay DSO (Andrew Morgan)**  
Cell(530) 383-1564

## Appendix 9 Definitions of Terms

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

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

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

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

**Buddy Diver** - Second member of the dive team.

**Buddy System** - Two comparably equipped scuba divers in the water, maintaining the ability to effectively communicate with one another.

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

**Burst Pressure** - Pressure at which a pressure containment device would fail structurally.

**Certified Diver** - A diver who holds a recognized valid certification from an organizational member 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.

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

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

**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** - An individual in the water who uses apparatus, including snorkel, which supplies breathing gas at ambient pressure.

**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.

**Diver-Carried 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.

**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 (Section 1.24).

**Diving Safety Officer (DSO)** - Individual responsible for the safe conduct of the scientific diving program of the membership organization (Section 1.20).

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

**Emergency Ascent** - An ascent made under emergency conditions where the diver exceeds 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 7.00).  
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**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.

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

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

**FFW** - Feet or freshwater, or equivalent static head.

**FSW** - Feet of seawater, or equivalent static head.

**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.

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

**Maximum Working Pressure** - Maximum pressure to which a pressure vessel may be exposed under standard operating conditions.

**Organizational Member** - An organization which is a current member of the AAUS, and which has a program, which adheres to the standards of the AAUS as, set forth in the AAUS Standards for Scientific Diving Certification and Operation of Scientific Diving Programs.

**Mixed Gas** - MG

**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<sub>2</sub> for a given gas mixture reaches a predetermined maximum.

**MSW** - Meters of seawater or equivalent static head.

**Nitrox** - Any gas mixture comprised predominately of nitrogen and oxygen, most frequently containing between 21% and 40% oxygen. Also be referred to as Enriched Air Nitrox, abbreviated EAN.

**NOAA Diving Manual** - Refers to the *NOAA Diving Manual, Diving for Science and Technology*, 2001 edition. National Oceanic and Atmospheric Administration, Office of Undersea Research, US Department of Commerce.

**No-Decompression limits** - Depth-time limits of the “no-decompression limits and repetitive dive group designations table for no-decompression air dives” of the U.S. Navy Diving Manual or equivalent limits.

**Normal Ascent** - An ascent made with an adequate air supply at a rate of 60 feet per minute or less.

**Oxygen Clean** - All combustible contaminants have been removed.

**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 Unit** - OTU

**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.

**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.

**pN<sub>2</sub>** - Inspired partial pressure of nitrogen, usually expressed in units of atmospheres absolute.

**pO<sub>2</sub>** - Inspired partial pressure of oxygen, usually expressed in units of atmospheres absolute.

**Psi** - Unit of pressure, “pounds per square inch. 79

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

**Recompression Chamber** - see decompression chamber.

**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.

**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.

**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.

**Working Pressure** - Normal pressure at which the system is designed to operate.

## Appendix 10 AAUS Statistics Collection Criteria and Definitions

### 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 classifications
- Breathing gas
- Diving mode
- Decompression planning and calculations methods
- Depth ranges
- Specialized environments
- Incident types

Dive Time in Minutes is defined as the surface-to-surface time including any safety or required decompression stops.

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.

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.

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.

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 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.

#### Dive 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 masks. 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 their own depth, time and diving profile.
- Rebreather: 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 Environment:

- Required Decompression: Any dive where the diver exceeds the no-decompression limit of the decompression planning methods being employed.
- Overhead Environment: Any dive where the diver does not have direct access to the surface due to a physical obstruction.
- Blue Water Diving: Open water diving where the bottom is generally greater than 200 feet deep and requires the use of multiple tethered 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 purpose of specimen exhibit, education, husbandry or research (Not a Swimming Pool).

#### Incident Type:

- 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 compressed gas, but the person recovers.
- Hyperoxia/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 be exposed to an excess of carbon dioxide.
- Fatality: Any death occurring 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 consider being minor in nature. Examples of this classification of incident would include, but not limited to:
  - Mask squeeze that produces 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 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 serious in nature. Examples of this classification would include, but not limited to:
  - Arterial gas embolism
  - DCS symptoms requiring multiple hyperbaric treatment
  - Near drowning
  - Oxygen toxicity
  - Hypercapnea
  - Spinal injuries
  - Heart attack
  - Fatality